WANG

Independent Sales
Organization

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PRICE INCREASES
EFFECTIVE
FEBRUARY 1, 1984
by ISO Marketing

Effective February 1, 1984, Wang Laboratories will increase the price of selected products. These selective price increases are the result of a recent review of Wang's pricing and competitive positioning, and an analysis of the effect of Wang's new product announcements. In making these price increases, Wang has maintained the objective having its systems price competitive. There is only a minor impact on typical configurations.

All Wang product lines have been reviewed. Wang's product mix strategy, industry trends and product costs were analyzed very carefully in making these adjustments. The pricing adjustments made are fully justified and they will have no impact on Wang's continued marketplace leadership.

Price changes effective February 1, 1984, for the 2200, VS, and Wang PC product lines are listed in detail on the following pages. ISOs should apply the applicable discount schedules reflected in their individual agreements with Wang to the prices listed.

Current 8-pack VS workstation pricing, which applies to the 2256C, is discontinued effective February 1. There is no installation charge for initial installation of systems. For add-on equipment or upgrades that are not designated as customer-installable, there is an installation charge of 3% of the purchase price with a minimum charge of $100 per order, effective February 1, 1984.

2200 PRODUCT LINE

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE

2200 LVP CENTRAL PROCESSING UNITS

All 2200 LVP CPUs include a 3 I/O slot chassis and a 1MB industry compatible DSDD diskette drive. User memory is available in 32, 64, 128 and 256K sizes. Fixed disk options of 2, 4, and 8 MB are available.

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
2200LVP-8X	32K Memory & Diskette	$ 7,600	$ 80
2200LVP-8B	32K Memory Diskette & 2MB Fixed Disk	9,800	110
2200LVP-8C	32K Memory Diskette & 4MB Fixed Disk	10,600	122
2200LVP-8D	32K Memory Diskette & 8MB Fixed Disk	12,100	137
2200LVP-16X	64K Memory & Diskette	8,800	108
2200LVP-16B	64K Memory Diskette & 2MB Fixed Disk	11,000	138
2200LVP-16C	64K Memory Diskette & 4MB Fixed Disk	11,800	150
2200LVP-16D	64K Memory Diskette & 8MB Fixed Disk	13,300	165
2200LVP-32X	128K Memory & Diskette	10,000	170
2200LVP-32B	128K Memory Diskette & 2MB Fixed Disk	12,200	200
2200LVP-32C	128K Memory Diskette & 4MB Fixed Disk	13,000	212
2200LVP-32D	128K Memory Diskette & 8MB Fixed Disk	14,500	227
2200LVP-64X	256K Memory & Diskette	12,400	267
2200LVP-64B	256K Memory Diskette & 2MB Fixed Disk	14,600	297
2200LVP-64C	256K Memory Diskette & 4MB Fixed Disk	15,400	309
2200LVP-64D	256K Memory Diskette & 8MB Fixed Disk	16,900	324

2200 LVPC CENTRAL PROCESSING UNITS

All 2200 LVPC CPUs include a 7 I/O slot chassis and a single 1MB industry compatible DSDD diskette drive. Fixed disks are available in 2, 4, 8, 16 or 32 MB sizes. These CPUs are equipped with the Expanded Language Option. User memory is available in 64, 128, 256, 384, and 512K sizes.

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
2200LVPC-16X	64K Memory Diskette	$ 9,300	$ 124
2200LVPC-16B	64K Memory Diskette & 2MB Fixed Disk	11,500	154
2200LVPC-16C	64K Memory Diskette & 4MB Fixed Disk	12,300	166
2200LVPC-16D	64K Memory Diskette & 8MB Fixed Disk	13,800	181
2200LVPC-16E	64K Memory Diskette & 16MB Fixed Disk	15,800	183
2200LVPC-16F	64K Memory Diskette & 32MB Fixed Disk	17,800	186
2200LVPC-32X	128K Memory & Diskette	10,500	139
2200LVPC-32B	128K Memory Diskette & 2MB Fixed Disk	12,700	169
2200LVPC-32C	128K Memory Diskette & 4MB Fixed Disk	13,500	181
2200LVPC-32D	128K Memory Diskette & 8MB Fixed Disk	15,000	196
2200LVPC-32E	128K Memory Diskette & 16MB Fixed Disk	17,000	198
2200LVPC-32F	128K Memory Diskette & 32 MB Fixed Disk	19,000	201
2200LVPC-64X	256K Memory & Diskette	12,900	169
2200LVPC-64B	256K Memory Diskette & 2MB Fixed Disk	15,100	199
2200LVPC-64C	256K Memory Diskette & 4MB Fixed Disk	15,900	211
2200LVPC-64D	256K Memory Diskette & 8MB Fixed Disk	17,400	226
2200LVPC-64E	256K Memory Diskette & 16 MB Fixed Disk	19,400	228
2200LVPC-64F	256K Memory Diskette & 32 MB Fixed Disk	21,400	231
2200LVPC-96X	384K Memory & Diskette	15,300	199
2200LVPC-96C	384K Memory Diskette & 4MB Fixed Disk	18,300	241
2200LVPC-96D	384K Memory Diskette & 8MB Fixed Disk	19,800	256
2200LVPC-96E	384K Memory Diskette & 16MB Fixed Disk	21,800	258
2200LVPC-96F	384K Memory Diskette & 32MB Fixed Disk	23,800	261
2200LVPC-128X	512K Memory & Diskette	17,700	229
2200LVPC-128C	512K Memory Diskette & 4MB Fixed Disk	20,700	271
2200LVPC-128D	512K Memory Diskette & 8MB Fixed Disk	22,200	286
2200LVPC-128E	512K Memory Diskette & 16MB Fixed Disk	24,200	288
2200LVPC-128F	512K Memory Diskette & 32MB Fixed Disk	26,200	291

WORKSTATIONS

2336DE	Interactive DP Ergo Workstation	$ 2,100	$ 22
2336DW	Integrated DP/WP Ergo Workstation	2,100	22
2326DW	Integrated DP/WP Wkstn. & Expanded Keybd.	2,100	22

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE

Installation charges are included in the purchase price of all 2200 upgrades.

2200 CENTRAL PROCESSING UNIT UPGRADES

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE
UJ-900	VP to MVP CPU Conversion	$ 1,650
UJ-5026	VP to MVPC	2,200
UJ-5027	MVP to MVPC	1,650
UJ-5028	LVP to LVPC	1,650
UJ-5031	VP/SVP/MVP/LVP Security	440
UJ-5043	Multi-Processing Option (SVP)	1,100

The following CPU upgrades involve an exchange of serialized equipment. These upgrades include 2336DW Workstation, 2236MXD Terminal Controller and 22C02 Printer Controller.

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE
UJ-6009*	SVP-8X to LVPC-16C (SVP/LVPC)	$ 14,500
UJ-6010	SVP-8A to LVPC-16C (SVP/LVPC)	13,300
UJ-6011	SVP-8B to LVPC-16C (SVP/LVPC)	12,200
UJ-6012	SVP-8C to LVPC-16C (SVP/LVPC)	11,550
UJ-6013	SVP-16X to LVPC-16C (SVP/LVPC)	12,900
UJ-6014	SVP-16A to LVPC-16C (SVP/LVPC)	12,200
UJ-6015	SVP-16B to LVPC-16C (SVP/LVPC)	10,700
UJ-6016	SVP-16C to LVPC-16C (SVP/LVPC)	10,100
UJ-6017	SVP-8D to LVPC-16D (SVP/LVPC)	10,700
UJ-6018	SVP-16D to LVPC-16D (SVP/LVPC)	9,000
UJ-6019	SVP-32A to LVPC-32C (SVP/LVPC)	12,650
UJ-6020	SVP-32B to LVPC-32C (SVP/LVPC)	9,900
UJ-6021	SVP-32C to LVPC-32C (SVP/LVPC)	9,350
UJ-6022	SVP-32D to LVPC-32D (SVP/LVPC)	8,800
UJ-6009E*	SVP-8X to LVPC-16C (SVP/LVPC)	14,500
UJ-6010E	SVP-8A to LVPC-16C (SVP/LVPC)	13,300
UJ-6011E	SVP-8B to LVPC-16C (SVP/LVPC)	12,200
UJ-6012E	SVP-8C to LVPC-16C (SVP/LVPC)	11,500
UJ-6013E	SVP-16X to LVPC-16C (SVP/LVPC)	12,900
UJ-6014E	SVP-16A to LVPC-16C (SVP/LVPC)	12,200
UJ-6015E	SVP-16B to LVPC-16C (SVP/LVPC)	10,700
UJ-6016E	SVP-16C to LVPC-16C (SVP/LVPC)	10,100
UJ-6017E	SVP-8D to LVPC-16D (SVP/LVPC)	10,700
UJ-6018E	SVP-16D to LVPC-16D (SVP/LVPC)	9,000
UJ-6019E	SVP-32A to LVPC-32C (SVP/LVPC)	12,650
UJ-6020E	SVP-32B to LVPC-32C (SVP/LVPC)	9,900
UJ-6021E	SVP-32C to LVPC-32C (SVP/LVPC)	9,350
UJ-6022E	SVP-32D to LVPC-32D (SVP/LVPC)	8,800

* When ordering UJ-6009(E) if SVP OPTION-W was included with the returned SVP:
A. List Serial Number of the OPTION-W Board (include on contract)
B. Deduct $200 from specified price

2200 CRT CONSOLE UPGRADES

List serial numbers of all 2236s being converted.

UJ-915	2236MXD BAUD Conversion to 19,200	$ 220
UJ-5020	2236DE to 2236DW	770
UJ-5046	Ergo Upgrade DE to DW with Std Keyboard	990

2200 PRINTER UPGRADES

UJ 980	2231W-1 to 2231W-2	$ 330
UJ 1196	TSF & EF Upgrade for all DW 20	275
UJ-1226	Paper Tensioner for FT-1	125

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE

2200 FIXED DISK UPGRADES

Upgrades to 16MB and 32MB disk options require that the CPU be equipped with a MVP/LVP C-option.

UJ-5007	SVP-X to SVP-A	$ 1,925
UJ-5022	SVP-X to SVP-B (2 MB DR)	3,300
UJ-5023	SVP-X to SVP-C (4MB DR)	4,400
UJ-5042	SVP-X to SVP-D (8MB DR)	5,500
UJ-5008	LVP-X to LVP-B (2MB DR)	2,400
UJ-5009	LVP-X to LVP-C (4MB DR)	3,300
UJ-5010	LVP-X to LVP-D (8MB DR)	5,000
UJ-5032	LVP-X to LVP-E (16MB DR)	7,200
UJ-5033	LVP-X to LVP-F (32MB DR)	9,400
UJ-6007	SVP-A to SVP-B (Dual Diskette to 2MB)	3,300
UJ-6008	SVP-A to SVP-C (Dual Diskette to 4MB	4,400
UJ-5041	SVP-A to SVP-D (Dual Diskette to 8MB	5,500
UJ-5001	SVP/LVP-B to SVP/LVP-C (2MB to 4MB DR)	1,100
UJ-6003	SVP/LVP-B to SVP/LVP-D (2MB to 8MB DR)	2,750
UJ-6005	SVP/LVP-C to SVP/LVP-D (4MB to 8MB DR)	2,750
UJ-5034	LVP-B to LVP-E (2MB to 16MB DR)	5,100
UJ-5035	LVP-B to LVP-F (2MB to 32MB DR)	7,300
UJ-5036	LVP-C to LVP-E (4MB to 16MB DR)	4,400
UJ-5037	LVP-C to LVP-F (4MB to 32MB DR)	6,600
UJ-5038	LVP-D to LVP-E (8MB to 16MB DR)	3,900
UJ-5039	LVP-D to LVP-F (8MB to 32MB DR)	6,100
UJ-5040	LVP-E to LVP-F (16MB to 32MB DR)	4,400

2200 DISK UPGRADES

UJ-930	2260B-1/4 to 2260B-1/2	$ 1,100
UJ-931	2260B-1/4 to 2260B	1,650
UJ-932	2260B-1/2 to 2260B	550
UJ-933	2260C-1/4 to 2260C 1/2	1,100
UJ-934	2260C-1/4 to 2260C	1,650
UJ-935	2260C-1/4 to 2260C 2	11,200
UJ-936	2260C-1/2 to 2260C	550
UJ-937	2260C-1/2 to 2260C-2	10,100
UJ-938	2260C to 2260C-2	9,600
UJ-939	2260BC-1/4 to 2260BC-1/2	1,100
UJ-940	2260BC-1/4 to 2260BC	1,650
UJ-941	2260BC-1/4 to 2260BC-2	11,200
UJ-942	2260BC-1/2 to 2260BC	550
UJ-943	2260BC-1/2 to 2260BC-2	10,100
UJ-944	2260BC to 2260BC-2	9,600
UJ-945	2260C to 2260BC	1,100
UJ-946	2270-1 to 2270-2	1,650
UJ-947	2270-1 to 2270-3	3,300
UJ-948	2270-2 to 2270-3	1,650
UJ-949	2270A-1 to 2270A-2	1,650
UJ-950	2270A-1 to 2270A-3	3,300
UJ-951	2270A-2 to 2270A-3	1,650
UJ-952	2270 to 2270A	440
UJ-953	2280-1 to 2280-2 2280N-1 to 2280N-2	1,100
UJ-954	2280-1 to 2280 3 2280N-1 to 2280N-3	2,200
UJ-955	2280-2 to 2280 3 2280N 2 to 2280N 3	1,100

2200 MISCELLANEOUS UPGRADES

UJ 5025	2281W Envelope Feeder Electronics Only	$ 275
UJ 5051	Expanded Control Memory Option	440

2200 COMMUNICATIONS UPGRADES

UJ-5021	2228B to 2228C	$ 440
UJ-5049	2228D 4E/4X to 2228D 8E/8X or OP28D 4E/4X to OP28D 8E/8X (64K to 128K)	1,100

PROFESSIONAL COMPUTER PRODUCT LINE

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
PC-AC001	Monitor Arm	$ 200	N/A
PC-AC002	Desk Clamp	125	N/A
PC-SS020	PC Async Communications Options (Includes 2236DW Emulation)	$ 100	N/A

VS PRODUCT LINE

Maximum distance of a communications line from the CPU (IOP) is 50 feet. A 25 foot cable with a RS-232 interface is provided at no charge, for each port available on a 22V06, 22V26 IOP or 25V76-1. The maximum length is 50 feet, available as a substitute for the standard 25 foot cable. Cable lengths must be submitted with the system/peripheral order.

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE

VS25/45 SYSTEMS

VS25/VS45 DATA COMMUNICATIONS DEVICE CONTROLLER

25V76-1	VS25/45 Single Port Data Communications Device Controller with 1 DLP	$ 1,650	$ 14

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE

VS25/45 CPU UPGRADE

UJ-3139	VS25 to VS45	$ 8,800

VS45 DISK DEVICE CONTROLLER UPGRADES

UJ-3164	25V50-1 to 25V50-2	$ 1,650
UJ-3165	25V50-1 to 25V50-3	2,500
UJ-3166	25V50-1 to 25V50-4	3,500
UJ-3167	25V50-2 to 25V50-3	1,650
UJ-3168	25V50-2 to 25V50-4	2,750

VS25/45 DISK UPGRADES

UJ-3140	VS25/45-A to VS25/45-C (34MB to 68MB Fixed Disk)	$ 8,500
UJ-3142	VS45-X to VS45-A (No Fixed Disk to 34MB Fixed Disk. Includes Fixed Disk Controller)	8,250
UJ-3141	VS45-X to VS45-C (No Fixed Disk to 68MB Fixed Disk. Includes Fixed Disk Controller)	15,500
UJ-3246	VS45-X to VS45-N (No Fixed Disk to 76MB Fixed Disk. Includes Fixed Disk Controller)	15,500
UJ-3247	VS25/45-A to VS25/45-N (34MB Fixed Disk to 76MB Fixed Disk. Includes Fixed Disk Controller)	13,000
UJ-3248	VS25/45-C to VS25/45-N (68MB Fixed Disk to 76MB Fixed Disk. Includes Fixed Disk Controller)	11,000

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE

VS 80 SYSTEMS

VS 80 CENTRAL PROCESSING UNITS

Consists of main memory, one 300 KB diskette drive and its input/output processor (IOP), a 16 Port Serial IOP, and a chassis capable of accommodating a total of eight (8) IOPs. Operating System and assembler are standard.

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
VS-8C	256KB Main Memory	$ 20,000	$ 330
VS-12C	384KB Main Memory	26,000	380
VS-16C	512KB Main Memory	30,000	430

VS 80 DATA COMMUNICATIONS

When a VS 80 is traded in for to a VS 85/90/100 the IOPs for the VS 85/90/100 must be ordered with the CPU. When an IOP is being returned with the VS 80 there will be no charge for the same IOP on the VS 85/90/100. Reference must be made to the work order(s) on which the original IOPs were ordered.

22V06-1	VS 80 Data Communications IOP with one Data Link Processor	$ 3,000	$ 44
22V06-2	VS 80 Data Communications IOP with two Data Link Processors	3,800	55
22V06-3	VS 80 Data Communications IOP with three Data Link Processors	4,600	66

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE

VS 80 TAPE DRIVE

22V05-2	VS-80 IOP for up to four 2209, 2209V-2 or 2209V-3 magnetic tape drives	$ 3,500	$ 17
22V15-1	VS-80 IOP for 2219V series tape drives	4,500	27

VS 85/90/100 SYSTEMS

VS 85 CENTRAL PROCESSING UNITS

Consists of main memory, a 16 port serial IOP, one serial archiving workstation with hard sector/soft sector controller, and one bus adapter. Operating system and Assembler are standard. Only serial devices may be attached to the system through an appropriate IOP.

VS85-1	1024KB Main Memory	$ 64,000	$ 294
VS85-2	2048KB Main Memory	74,000	344
VS85-4	4096KB Main Memory	92,000	444

VS 85 PACKAGED SYSTEMS

85-CACHE	32KB Cache Memory for VS85	$ 7,500	$ 60
VS85E	VS85-1, 90MB Fixed/Removable Disk, 4 Port Disk IOP, 3 Port Data Communications IOP, Disk Cables, Compiler*	79,000	596
VS85F	VS85-1, 288MB Removable Disk, 4 Port Disk IOP, 3 Port Data Communications IOP, Disk Cables, Compiler*	84,000	665
VS85G	VS85-1, (2) 75MB Removable Disks, 4 Port Disk IOP, 3 Port Data Communications IOP, Disk Cables, Compiler*	94,000	730

* Compiler may be VS COBOL, RPGII, BASIC or PL/1.

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE

VS 90 CENTRAL PROCESSING UNITS

Consists of main memory, a 16 port serial IOP, one serial archiving workstation with hard/soft sector controller, and one bus adapter. Operating system and assembler are standard. Only serial devices may be attached to the system through an appropriate IOP.

VS90-1A	1024KB Main Memory	$ 76,000	$ 338
VS90-2A	2048KB Main Memory	86,000	388
VS90-3A	3072KB Main Memory	95,000	438
VS90-4A	4096KB Main Memory	104,000	488

VS 100 CENTRAL PROCESSING UNITS

Consists of main memory, cache memory, and a chassis capable of accommodating Sixteen (16) IOPs. One Bus Adapter which provides an interface for eight (8) IOPs is standard. One additional Bus Adapter is optional at extra cost. Operating system and assembler are standard. All systems include one serial archiving workstation with hard/soft sector controller and a 16 port serial IOP. Only serial devices may be attached to the system through an appropriate IOP.

VS-32G	1024KB Main Memory	$ 85,000	$ 776
VS-64G	2048KB Main Memory	95,000	826
VS-96G	3072KB Main Memory	104,000	876
VS-128G	4096KB Main Memory	113,000	926
VS-160G	5120KB Main Memory	121,000	976
VS-192G	6144KB Main Memory	129,000	1,026
VS-224G	7168KB Main Memory	137,000	1,076
VS-256G	8192KB Main Memory	145,000	1,126

VS 100 SYSTEM EXPANSION

For Bus Adapter PCA type 210-7911, order CO-1001. Order CO-1002 for PCA type 210-7611.

CO-1001	Additional Bus Adapter to support up to 8 more IOPs (VS 100 only)	$ 9,000	$ 50
CO-1002	Additional Bus Adapter to support up to 8 more IOPs (VS 100 only)	9,000	50

VS 85/90/100 IOPS

22V27-1	VS 85/90/100 IOP for serial devices Provides up to eight (8) serial ports	$ 3,000	$ 18
22V27-2	VS 85/90/100 IOP for serial devices Provides up to sixteen (16) serial ports	3,500	30

VS 85/90/100 DATA COMMUNICATIONS IOPS

22V26-1	VS 85/90/100 Data Communications IOP with one Data Link Processor	$ 3,000	$ 44
22V26-2	VS 85/90/100 Data Communications IOP with two Data Link Processors	3,800	55
22V26-3	VS 85/90/100 Data Communications IOP with three Data Link Processors	4,600	66

VS 85/90/100 TAPE DRIVE IOPS

22V25-2	VS 85/90/100 IOP for up to four 2209, 2209V-2 or 2209V-3 magnetic tape drives	$ 3,500	$ 17
22V15-2	VS 85/90/100 IOP for 2219V series tape drives. Requires cache option on VS 85.	4,500	27

MODEL NUMBER	DESCRIPTION	INITIAL LICENSE FEE	MONTHLY LICENSE FEE
	VS SOFTWARE		
IIS-LISTMGMT-X	List Management (Requires WP 195-2078-x)	$ 2,000	$ 9
195-2121-X	Key Entry software	2,500	13
MAPL-1-X	Mathplanner Modeling & Package	3,000	17
VS-ALLIANCE-X	VS-Alliance Base Level *	11,000	84

*VS Alliance requires: VS45, 85, 90 or 100, minimum 1 Megabyte Main Memory, minimum 75MB Disk Drive for the Alliance software (It is recommended that this not be the system drive), 64K C Workstations, and 64K Printers. See Alliance upgrade section for upgrading printers to 64K. See VS upgrade charts for upgrading workstation to 64K. Alliance on a VS45 requires a 64K Archiving workstation that supports hard sector (2276C-1 or 2276C-3).

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
	VS COMMUNICATIONS PROCESSORS AND OPTIONS		

Specify required components individually, i.e., a front panel and connector must be ordered for each DLP board required for the external chassis. It is necessary that there be an available port for each DLP board installed in the chassis.

VS-6554	External chassis for VS	$ 2,500	$ 50
VS-TC	64K Communications Controller	2,000	25
VS-TC1	128K Communications Controller	2,500	30
VS-FP6554	Front panel/external chassis	200	N/A
TCP-RS232	Connector for RS-232/CCITTV.24 support	200	N/A
TCP-RS366	Connector for RS366/CCITTV.25 support	200	N/A
TCP-X21	Connector for X.21 support	200	N/A

VS WORKSTATIONS

All workstations are upper/lower case 12 inch (80 Character by 24 lines). The maximum distance for a serial device from the CPU is 2000 feet. A 25-foot cable is shipped with each serial peripheral device. Cables cannot be interconnected or spliced. Cable lengths must be submitted with the system/peripheral order.

4200 SERIES WORKSTATIONS

4200 Series Workstations consist of three components. The Display Monitor includes the CRT only. The Electronics Package consists of all the workstation boards, power supply and packaging. The Keyboard includes a specific Wang keyboard, all are standard with numeric keypad. 4200 Series Workstations can be upgraded to a Wang Professional Computer.

Remote workstations include communications controllers allowing operation as a remote standalone workstation. A parallel printer may be attached directly to any Wang Remote workstation.

A 25 foot/7.6 meter modem cable is provided with each unit (please refer to cable section). Maximum distance from the modem is 50 feet/15.2 meters, if a 2247V-4 Modem Sharing Unit (MSU) is used then the maximum distance is 2000 feet/609 meters from the MSU.

4205-VS	VS DP Workstation.	$ 2,750	$ 20
4210-VS	64K VS WP/GPH Workstation	3,400	20
4230-VS	VS DP/WP/GPH Workstation	3,800	24
4220-VS	Remote VS Workstation	2,500	18
4200-AC001	4200 Series Monitor Arm & 8-foot cable	225	N/A

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
	5300 ERGONOMIC WORKSTATIONS (ERGO 3)		

Ergo 3 terminals are three piece terminals, one display monitor, one electronics package and one keyboard to complete a proper configuration. 5300/VS-DP Electronics Packages must be booked with the 5300KBD/DP-STD keyboard. All other Electronics packages must be accompanied by an order for a 5300KBD/IIS-STD keyboard. Memory size requirements for IIS applications apply to the 5300 Series workstations also. Electronics packages may be configured with any Display Monitor. The 5300 Series workstations use the compatible language options as Ergo 2 terminals.

	DISPLAY MONITOR		
5310	Green Display Audio (Alliance only)	$ 1,150	$ 20
5320	Green Display	1,050	20
5330	Black/White Audio (Alliance only)	1,250	20
5340	Black on White Display	1,150	20
	ELECTRONICS PACKAGE		
5300/VS-IIS64	64K Combined Wkstn. Electronics for WP/DP application	$ 3,050	$ 15
5300W/VS	64K Combined Wkstn. Electronics for WP/DP application with WangNet Interface (Peripheral Band)	3,650	20
	KEYBOARD		
5300KBD/DP-STD	VS-DP Standard Keyboard	$ 525	N/A
5300KBD/IIS-STD	Combined WP/DP (for WangNet Ergos)	525	N/A

6300 SERIES GRAPHIC WORKSTATIONS

6300 Series Workstations consist of three components. The Display Monitor includes the CRT only. The Electronics Package consists of all the workstation boards, power supply and packaging. The Keyboard includes a specific Wang Keyboard, all are standard with numeric keypad. The 6300 Graphics Workstation can be attached to an OIS, VS or VS/IIS system. The printer for Graphics is the 5577 high-density Matrix Printer.

	DISPLAY MONITOR		
6340	Black and White Graphic Display	$ 1,350	$ 20
	ELECTRONICS PACKAGE		
6300/VS-64	64K VS Graphic Electronics	$ 3,900	$ 20
	KEYBOARD		
UNI/KBD-US	US Low Profile Serial Keyboard	$ 525	N/A

WORKSTATION SWITCHES

SW16	Serial Device Switch for switching up to 32 serial devices between two VS systems (16 on each system)	$ 3,500	$ 20

COMBINED WP/DP WORKSTATIONS

Combined Workstations are capable of alternately performing WP or DP functions. These workstations connect to an appropriate IOP for local use only via coaxial cable. Workstations with 64K memory are required for some IIS applications, Wang Typesetter 5548Z, and for Remote WangNet operations to other systems.

2256C	Combined WP/DP 64K VS Workstation	$ 4,200	$ 24

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE	MONTHLY MAINTENANCE
	VS DISK SWITCHES		
SW04	Disk Switch Option for 2265V-1 for secondary access of disk resource (price is per disk).	$ 4,500	$ 25
SW04-1	Disk Switch Option on 2265V-2 for secondary access of disk resource (price is per disk).	4,500	25
SW04-3	Disk Switch Option for 2265V-3 for secondary access of disk resource (price is per disk)	4,500	25
	6250 BPI MAGNETIC TAPE DRIVES WITHOUT IOPS		
2219V-1	Dual Density (1600/6250 bpi) Tape Subsystem with tape transport mechanism and formatter	$ 50,900	$ 427
2219V-1B	Dual Density Add-on Drive (up to three can be attached to 2219V-1)	25,500	209
2219V-3	Tridensity Tape Subsystem (800/ 1600/6250 BPI) with tape transport mechanism and formatter	56,000	444
2219V-3B	Tridensity Add-on Drive (up to three can be attached to 2219V-3)	31,000	227
	VS PARALLEL PRINTERS		

Parallel Printers are available for attachment to Remote Workstation ONLY

2273V-1	Remote W/S Low Speed Band Printer with one Utility B Print Band.	$ 9,500	$ 103
	VS SERIAL PRINTERS		

The maximum distance for serial device from the CPU is 2000 feet/609 meters. A 25 foot/7.6 meter cable is shipped with each serial peripheral device. Cables cannot be interconnected or spliced. Cable lengths must be submitted with the system/peripheral order. Printers required for VS Alliance must be 64K Printers.

'5573	Low Speed Band Printer with one Utility B Print Band.	$ 9,500	$ 103
5574	Medium Speed Band Printer with one Utility C Print Band.	13,250	145
5575	High Speed Band Printer with Powered Paper Stacker and one print band.	29,500	330

UPGRADE JOB #	DESCRIPTION	PURCHASE PRICE
	VS WORKSTATION UPGRADES	
UJ-500	5526 to 2246C	$ 4,750
UJ-501	5536-1 to 2246C	1,100
UJ-3039	2246S to 2246C	2,050
UJ-503	5536-2 to 2246C	550
UJ-3011	2246S to 2256C	2,700
UJ-3012	2246C to 2256C	1,150
UJ-3013	5536-4 to 2256C	725
UJ-3020	5536-1 to 2256C	1,700
UJ-3021	5536-2 to 2256C	1,375
UJ-3022	5536-3 to 2256C	1,050
UJ-3127	2246S to 2246S-1	550
UJ-3128	2246S to 2246S-2	550
UJ-3129	2246S to 2246S-3	550
UJ-3138	2246S 2-board to 32K Memory	825
UJ-3162	2246S 3-board to 32K Memory	825
	ARCHIVING WORKSTATION UPGRADES	
UJ-3038	2266S-3 to 2266C-3	$ 275
UJ-3096	2266S-2 to 2266C-3	1,450
UJ-3095	2266S-1 to 2266C-3	1,450
UJ-3041	2266C(S)-1 to 2266C(S)-3 or 2276C-1 to 2276C-3	1,450
UJ-3042	2266S-2 to 2266S-3	1,450
UJ-3094	2266S-1 to 2266C-1	275
UJ-3135	2266C-1 to 2276C-1	825
UJ-3136	2266C-1 to 2276C-3	1,750
UJ-3137	2266C-3 to 2276C-3	825
	VS IOP UPGRADES	
UJ-504	22V06-1 to 22V06-2	$ 1,050
UJ-505	22V06-1 to 22V06-3	1,950
UJ-506	22V06-2 to 22V06-3	1,050
UJ-507	22V07-1 to 22V07-2	725
UJ-3043	22V07-1 to 22V17-1	150
UJ-3044	22V07-1 to 22V17-2	725
UJ-3045	22V07-2 to 22V17-2	175
UJ-3067	22V17-1 to 22V17-2	650
UJ-3062	22V27-1 to 22V27-2	725
	VS PRINTER UPGRADES	
UJ-3049	2273-1/2273V-1 to 5573	$ 2,200
UJ-3050	2273-2 to 5574	2,200
	VS DATA COMMUNICATIONS PROCESSOR UPGRADES	
UJ-3088	6554-1 to 6554 2	$ 2,375
UJ-3089	6554 1 to 6554 3	4,675
UJ 3090	6554 1 to 6554 4	6,975
UJ-3091	6554 2 to 6554 3	2,375
UJ 3092	6554-2 to 6654 4	4,675
UJ-3093	6554-3 to 6554 4	2,575

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE

VS DISK CABLES

When configuring VS disk cables, two types of cables are required: "A" cables for data transfer and "B" cables for disk status. An "A" CPU to disk cable connects the first drive to the disk IOP while the "A" daisy chain cables link the first through fourth drives. "B" disk to CPU cables connect a drive to a port on the disk IOP. Both "A" and "B" cables are required for disk interfacing to the disk IOP. A dual-ported disk drive must be "A" and "B" cabled to both CPUs. VS system and drive type must be considered when selecting the appropriate cables.

VS 80 DISK CABLES

"A" CABLES - CPU TO DISK

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3041-6	15ft.	2280V-1,2,3	$ 315
220-3041-14	25ft.	2280V-1,2,3	410
220-3041-15	50ft.	2280V-1,2,3	540
220-3041-3	15ft.	2265V-1	315
220-3041-10	25ft.	2265V-1	410
220-3041-11	50ft.	2265V-1	540
220-3041-4	15ft.	2265V-2A, 2A1	315
220-3041-12	25ft.	2265V-2A, 2A1	410
220-3041-13	50ft.	2265V-2A, 2A1	540
220-3041-26	15ft.	2265V-3	315
220-3041-27	25ft.	2265V-3	410
220-3041-28	50ft.	2265V-3	540

"B" CABLES - DISK TO CPU

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3033-18	15ft.	2280V-1,2,3,	$ 315
220-3033-19	25ft.	2280V-1,2,3	410
220-3033-30	50ft.	2280V-1,2,3,	540
220-3033-12	15ft.	2265V-1	315
220-3033-13	24ft.	2265V-1	410
220-3033-32	50ft.	2265V-1	540
220-3033-14	15ft.	2265V-2A, 2A1, 2B	315
220-3033-15	25ft.	2265V-2A, 2A1, 2B	410
220-3033-31	50ft.	2265V-2A, 2A1, 2B	540
220-3033-40	15ft.	2265V-3	315
220-3033-41	24ft.	2265V-3	410
220-3033-42	50ft.	2265V-3	540

"A" CABLES - DAISY CHAIN

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3031-1	10ft.	2280V's	$ 220
220-3031-2	10ft.	2265V-2's	220
220-3031-3	10ft.	2265V-1's	220
220-3031-4	10ft.	2265V-1 & 2265V-2's	220
220-3031-5	10ft.	2280V's & 2265V-2's	220
220-3031-6	10ft.	2265V-1 & 2280V's	220
220-3031-10	10ft.	2265V-3 to 2265V-1	220
220-3031-11	10ft.	2265V-3 to 2265V 2	220
220-3031-12	10ft.	2265V-3 to 2280V's	220
220-3031-13	10ft.	2265V-3 to 2265V-3	220

VS 45/85/90/100 DISK CABLES

"A" CABLES - CPU TO DISK

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3039-7	15ft.	2280V-1,2,3,	$ 315
220-3039-20	25ft.	2280V-1,2,3	410
220-3039-21	50ft.	2280V-1,2,3	540
220-3041-9	15ft.	2265V-1	315
220-3041-16	25ft.	2265V-1	410
220-3041-17	50ft.	2265V-1	540
220-3041-8	15ft.	2265V-2A, 2A1	315
220-3041-18	25ft.	2265V-2A, 2A1	410
220-3041-19	50ft.	2265V-2A, 2A1	540
220-3041-23	15ft.	2265V-3	315
220-3041-24	25ft.	2265V-3	410
220-3041-25	50ft.	2265V-3	540

"B" CABLES - DISK TO CPU

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3038-21	15ft.	2280V-1,2,3	$ 315
220-3038-22	24ft.	2280V-1,2,3	410
220-3033-33	50ft.	2280V-1,2,3	540
220-3033-25	15ft.	2265V-1	315
220-3033-26	25ft.	2265V-1	410
220-3033-35	50ft.	2265V-1	540
220-3033-23	15ft.	2265V-2A, 2A1, 2B	315
220-3033-24	25ft.	2265V-2A, 2A1, 2B	410
220-3033-34	50ft.	2265V-2A, 2A1, 2B	540
220-3033-37	15ft.	2265V-3	315
220-3033-38	24ft.	2265V-3	410
220-3033-39	50ft.	2265V-3	540

"A" CABLES - DAISY CHAIN

PART NUMBER	CABLE LENGTH	DESCRIPTION	PRICE
220-3031-1	10ft.	2280V's	$ 220
220-3031-2	10ft.	2265V-2's	220
220-3031-3	10ft.	2265V-1's	220
220-3031-4	10ft.	2265V-1 & 2265V-2's	220
220-3031-5	10ft.	2280V's & 2265V-2's	220
220-3031-6	10ft.	2265V-1 & 2280V's	220
220-3031-10	10ft.	2265V-3 to 2265V-1	220
220-3031-11	10ft.	2265V-3 to 2265V-2	220
220-3031-12	10ft.	2265V-3 to 2280V's	220
220-3031-13	10ft.	2265V-3 to 2265V-3	220

REFURBISHED
VS AND 2200
AVAILABILITY
by Financed
    Systems
    Marketing

Wang's Financed Systems Marketing group announces the avail-
ability of three refurbished equipment packages to ISOs:

1. A VS80Z2R Package
2. A 2200MVP Package
3. A 2236-DE Workstation 4-Pack Package

Refurbished VS 80 "Z" Equipment
Due to an increase in remanufacturing's inventory of VS 80s
and 90MB disk drives, the refurbished VS-80Z2R package is
being made available to ISOs for purchase at their
appropriate discount.

Effective January 1, 1984, the VS-80Z2R has been reduced by
$6,000 and the VS-80Z1R discontinued. In addition, the
monthly maintenance on the VS-80Z2R package has been
reduced by $100 to $566 per month, for the first year
maintenance contract booked during Q3 and Q4 FY'84. ISO
discounts apply to the package system price listed below.

Model Number	Description	Refurb. Price	Monthly Maint.
VS-80Z2R	Remanufactured VS 80 (512 KB), Operating System & compiler, 300KB diskette drive, 16 port serial IOP, 4-port disk IOP and 90MB fixed/removable disk drive	$26,850	$566

No refurbished workstations or printers are available;
peripherals should be ordered as new equipment at the time
the order is placed through normal order processing
channels, using the model number given above. Estimated
delivery is six weeks from the time the order is booked.

Inventories of 75MB and 288MB disk drives are not high
enough to allow release of the VS-80Y2R package and the new
VS-80X2R package to ISOs at this time. We expect this
situation to change in the near future and will keep you
informed. Wang is pleased to be able to bring this
refurbished VS 80 package to you. Now ISOs will be able to
close price-sensitive business using the proven VS-80Z2R.

Refurbished 2200 Packages
Financed Systems Marketing announces the availability of a
refurbished 2200MVP package with a 10MB Hawk Drive and
Triple Controller. This package is priced competitively
with the MVP-P3 package, but allows 5MB more backup than the
"P" packages. In addition, we are introducing a four pack
of 2236-DE workstations with a 4-port terminal multiplexer,
available with the refurbished 2200MVP package.

REFURBISHED
VS AND 2200
AVAILABILITY
(continued)

Both of the 2200 packages are being offered at 40% off new list price, and ISO discounts apply to the prices given below. With these two refurbished 2200 packages, ISOs will be able to appeal to price-sensitive customers who need more backup than the "P" packages allow. Act today -- quantities are limited.

Model Number	Description	Refurb. Price	Monthly Maint.
MVP-R	Remanufactured 2200MVP (256 KB memory), new 22C32 Triple Controller, remanufactured 10MB Hawk Drive (5MB fixed/5MB removable includes 22C12 disk controller and stand)	$12,500	$400
2236-4R	Four remanufactured 2236-DE terminals and a new 2236-MXD 4-port Terminal Multiplexer	5,500	98

The four pack of refurbished workstations (2236-4R) can only be ordered with the refurbished 2200 package (MVP-R). Orders will be accepted on a "first come, first serve" basis, beginning February 1, 1984. Any additional equipment needed must be ordered new and can be put on the same order. Delivery is approximately 6 weeks from the time the order is booked.

The above systems can be ordered through normal order processing channels, using the indicated model numbers. If you have additional questions, call Wang Laboratories in Lowell at (617) 459-5000 and ask for Lawrence Crooks (x.4540) or Wayne Lucier (x.2468).

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A SIMPLE HASHED FILE ACCESS TECHNIQUE FOR WANG 2200 SYSTEMS

by Joseph Reach, Director of Technical Services
Minicomputer Consultants, Inc.

INTRODUCTION -- REQUIREMENTS FOR ACCESS METHOD

Minicomputer Consultants, Inc. found, in creating business software for the Wang 2200, the need for a random file access technique. This article describes the file access method developed and how it is suited to the 2200 system. It is assumed that the reader has an understanding of both hashing techniques and the Wang 2200/BASIC-2 programming language.

In creating this technique, several important features were required:

1. The data structure must be kept simple; there must be only one file (both physically and logically). The data is to be created in DC mode, allowing the programmer to process the information using all DC commands (OPEN, LIMITS, LOAD/SAVE DC, etc.)

2. The technique must be efficient--it must locate records rapidly and occupy a small amount of memory.

3. Space occupied by deleted records must be automatically re-used without maintaining a file (list) of available space. The application programmer need not be concerned about re-using deleted space.

4. Both blocked records (array-type blocking) and multi-sector records must be supported.

With these needs in mind, a technique based on hashing algorithms was developed. No new principles were developed--old concepts were applied to the 2200, taking into account its strengths and weaknesses.

THE ALGORITHMS THEMSELVES

The two basic functions required--initial address determination and collision handling--were treated as follows:

Initial address determination: For the initial address, a_0, a division method was used. The alphanumeric key was converted to an integer. Since the 2200 has a capacity of 13 significant digits for its numeric variables, the entire key could not be treated as a binary value. Therefore, each set of 4 bytes (beginning with the least significant) were converted to an integer, multiplied by a scalar and added to the values for the other 4-byte sets to create an integer which corresponds to the key.

(continued)

For example, for a 14-byte key, the sum of the following items produced the integer:

$$1 * \text{binary equivalent of bytes } 11\text{-}14$$
$$3 * \text{binary equivalent of bytes } 7\text{-}10$$
$$5 * \text{binary equivalent of bytes } 3\text{-} 6$$
$$\underline{+ 7 * \text{binary equivalent of bytes } 1\text{-} 2}$$
$$\text{Sum} = \text{ Integer used for initial address}$$

Let j = the integer calculated from the key and let f = the number of entries in the hashed table (file). Then $a_0 = j \bmod f$. The scalars used in the key transformation are the odd numbers, in sequence, for each set of 4 bytes.

Collision handling: An open addressing system, which involves quadratic probing, was used to handle collisions. When a key is to be inserted, the initial address, a_0, is calculated. If the entry at location a_0 is already occupied, successive addresses are tried based on an index (i) as follows:

$$a_i = (a_0 + i^2) \bmod f$$

Hence,
$$a_1 = (a_0 + 1) \bmod f$$
$$a_2 = (a_0 + 4) \bmod f$$
$$a_3 = (a_0 + 9) \bmod f$$

and so on. Successive entries are tested in this manner until an unused entry is found, in which case the key may be inserted. The quadratic probing avoids the problem known as "pile up" associated with linear probing, but does not avoid "secondary clustering."

One feature of quadratic probing is that if f is prime only half of the entries in the file will be tested during an insertion (or location). This implies that it is possible that a key may not be inserted when, in fact, there is space available. This may be shown as follows:

Consider j and k such that $0 \leq j \leq f$ and $0 \leq k \leq f$, j and k are not equal and that $a_j = a_k$. Using $\equiv$ to indicate congruence, this implies that

$$(a_0 + j^2) \equiv (a_0 + k^2) \bmod f$$

which implies

$$(a_0 + j^2) - (a_0 + k^2) \equiv 0 \bmod f$$

which implies

$$j^2 - k^2 \equiv 0 \bmod f$$

which implies

$$(j + k)(j - k) \equiv 0 \bmod f$$

Since f is prime this implies that either $(j+k) \equiv 0 \bmod f$ or $(j-k) \equiv 0 \bmod f$. The latter is not true since it would imply that $j=k$; therefore $(j+k) \equiv 0 \bmod f$. Since j and k are not equal, either $j > f/2$ or $k > f/2$. Therefore only $f/2$ entries need to be scanned.

(continued)

ADAPTATION TO THE WANG 2200

A completely empty hashed table must be filled with all unused entries and a value must be chosen to indicate an unused entry. The high value, HEX(FF), was selected for this role--in an empty file, the entire key must be filled with ALL(FF). The reason for this is to aid in the re-use of deleted record space and will be discussed later. Therefore, a file created using this system will always appear full since it must begin with a file filled with "dummy" records with keys set to ALL(FF). Unfortunately, then, a LIMITS statement may not be used to determine how full a file is.

In adapting these techniques, single- and multi-sector records were considered to be an entry (or block); a block of records (in a file of array-type blocked records) was also considered to be an entry. During the quadratic probing, all records in a block are checked.

On the 2200 system, the record structure is totally at the programmer's discretion. Because the hashing system inserts and locates based on the actual data (as opposed to a separate file maintained by the hashing system), several restrictions must be placed on the record structures:

    . The key must be alphanumeric, at least 2 bytes long and must occupy
      contiguous bytes in the record.

    . The sentinel value, HEX(FF), must not be used in the first 2 bytes
      of the key.

    . The key must be located in the first variable in the record. For
      example, if the file uses array type blocking (3 records per sector)
      and the block structure is N7$(3)40,B2(3),L$(3)6, then the keys for
      the 3 records must be in N7$(1), N7$(2) and N7$(3) respectively.

    . As mentioned earlier, all record access is done using DC mode.

The MAT REDIM statement may be used when loading keys from the file. Let $k = 1$ for single- and multi-sector records and $k = \#$ records per block for blocked records. Let $p =$ the byte position of the key in the first variable (i.e., $p = 1,2,\ldots,n$ where $n =$ length of the first variable) and let $m =$ the length of the key. Given a single-dimension array, A$(), which is large enough, it may be restructured as follows:

$$MAT\ REDIM\ A\$(k)p+m-1$$

This array is all that needs to be loaded in order to scan a block of keys located at a given entry (for example, using MAT SEARCH)--the remainder of the block may be ignored. A$() may be used to accommodate several files, if necessary, as long as its original size is at least as large as the worst case.

(continued)

RE-USE OF DELETED RECORD SPACE
As mentioned earlier, one of the important features required for this system
was the automatic re-use of deleted space without another file. Deleted space
must be re-used without effort on the part of the application programmer.

In adapting these techniques to the 2200, several restrictions were made on
the application programmer. Among these were the following: the key must be
at least 2 bytes long and an empty file must be filled with dummy records each
of which has a key of ALL(FF).

When a record is to be deleted, it is located and then the first byte of the
key is set to HEX(FF). The locate, insert and delete algorithms (using the
quadratic probing discussed earlier) take this into consideration and are as
follows (f = # blocks capacity of file):

Locate: 1. i=0
          2. Calculate a_i
          3. Load block at address a_i
          4. If key to be located is in block then exit (KEY FOUND at a_i)
          5. If HEX(FFFF) found in first 2 bytes of key of any record in
              block, then exit (KEY NOT FOUND)
          6. i=i+1
          7. If i < f/2 then goto 2

Insert: 1. Locate key (using above)--if key found, then exit (KEY IS A
              DUPLICATE)
          2. i=0
          3. Calculate a_i
          4. Load block at address a_i
          5. If HEX(FF) found in first byte of key of any record in block,
              then exit (INSERT KEY AT a_i)
          6. i=i+1
          7. If i < f/2 then goto 3
          8. Exit (FILE IS FULL)

Delete: 1. Locate key (using above)--if key not found, then exit (KEY MAY
              NOT BE DELETED)
          2. Set first byte of key to HEX(FF)

An Example: Suppose that key "1234" is to be inserted and at the addresses
calculated for this key, the following contents were found:

Location	Contents
a_0	"WXYZ"
a_1	HEX(FF)&"987"
a_2	"4321"
a_3	ALL(FF)

(continued)

In order to insert the key, the first thing to do is to locate the key to
ensure that it is not a duplicate. During the locate function, the search
will end at i=3 instead of i=1 since at a_3 the first two bytes of the key
are both HEX(FF) whereas at a_1 only the first byte is HEX(FF). The space at
a_1 did contain a record but the item was deleted. During the second part of
the insert function, the procedure will stop at i=1 since the insert portion
stops when it finds a key with the first byte being HEX(FF). The contents of
the above addresses will now be as follows:

Location	Contents
a_0	"WXYZ"
a_1	"1234"
a_2	"4321"
a_3	ALL(FF)

If another key is to be inserted for which the initial address is the same as
above, it would be inserted at a_3, since it would be the first entry with
the first byte = HEX(FF).

Performance/Analysis:
The access time (as measured in the number of disk reads) required to locate an
item is not dependent upon the # of records in the file--a block in a 100 block
file may be located as fast as a block in a 10,000 block file. The access time
required is, however, dependent upon how full the file is (i.e., the # of blocks
in the file / the # blocks of capacity), as the table below shows:

% full	Avg. # probes *
10	1.05
25	1.15
50	1.39
75	1.85
90	2.56
95	3.15
99	4.66

Thus the average # of probes required for a file 90% full is 2.56. Given a
file with 9,000 blocks with a capacity of 10,000 blocks, this number is
dramatic. "Padding" the file capacity is, therefore, almost necessary. Given
a file with 9,000 blocks, a binary search would take as many as 14 probes
(since $2^{13} < 9,000 < 2^{14}$). These values cannot be compared to the # of
probes required in a KFAM file with 9,000 entries, because the access time in
a KFAM key file depends upon the length of the key. Given a key of length 4,
three levels of a KFAM key file structure (hence, 3 probes) are required for
slightly more than 1100 records.

(continued)

* Niklaus Wirth, Algorithms + Data Structures = Programs (Englewood Cliffs,
          NJ: Prentice-Hall, Inc., 1976), p. 273.

The three subroutines required for routine maintenance (locate, insert and delete) occupy (in total) approximately 2.75K which fits nicely in a universal global partition.

One major disadvantage is the inability to locate the "next" logical key (as in KFAM's function '237) unless a separate key or index file was also created. This would defeat the requirement that the file structure be kept simple and that there is only one (logical) file. However, the file may be sorted as is (using ISS utilities, for example), as long as records with HEX(FF) in the first byte of the key are ignored.

An analysis of the performance, advantages and disadvantages of the techniques used in this system would indicate that the system would best be applied to files which remain relatively static, for which rapid insertion and location by key is required and for which a "find next key" routine is not required on an immediate basis.

FOR MORE INFORMATION
Many other programming aids have been developed by Minicomputer Consultants, Inc. for the Wang 2200 and other systems. For more information on this and other utilities contact us at:

Minicomputer Consultants, Inc.

Two Glenhardie Corporate Center   - or -   157 Goose Lane
1285 Drummers Lane, Suite #100   Guilford, CT 04637
Wayne, PA 19087   (203) 453-0606
(215) 964-1142

References:

Wirth, Niklaus Algorithms + Data Structures = Programs, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1976.

Maurer, Ward Douglas Programming: An Introduction to Computer Techniques, San Francisco, CA: Holden-Day, Inc., 1972.

VS 25/45 REMOTE   The VS 25 and VS 45 are the first systems developed by Wang
DIAGNOSTICS   with remote diagnostic capability. The remote diagnostics
PROCEDURES   logic, known as the "diagnostic core", is contained on one
by Customer   printed circuit board. This diagnostic core consists of
   Engineering   highly-reliable components which allow troubleshooting even
                  in the absence of system functionality.

                  Physically located on the Bus Processor and within the
                  diagnostic core are 2K bytes of memory, made non-volatile
                  by a small lithium battery. The primary purpose of this
                  non-volatile memory (NVRAM) is to provide a compact "snap-
                  shot" status under remote diagnostic test conditions. This
                  snapshot status consists of power-up diagnostic results,
                  configuration description, service log, a cumulative error
                  count for individual devices, and customer information.

                  Through control of all data, address, status and interrupt
                  lines, the Bus Processor both tests and integrates portions
                  of the VS 25/45 CPU hardware. During a remote diagnostics
                  session, results of these tests are relayed through the
                  diagnostic core to the Wang Remote Maintenance Center (RMC)
                  in Lowell, for diagnosis.

                  Remote Diagnostics Usage
                  To provide the customer with system security, all diagnostic
                  sessions are run in stand-alone mode with the system
                  off-line. A remote diagnostic session can be initiated
                  only from the customer location, by switching the system
                  key from the "Local" to the "Remote" position.

                  Remote Diagnostics Are Useful When:
                     . A VS 25 or VS 45 fails to complete its Initial Program
                       Load (IPL) sequence
                     . Error codes appear on front panel display
                     . A VS 25 or VS 45 fails to pass its power-up diagnostics
                     . A system drops into control mode during operation

                  Remote Diagnostics May Help When:
                     . Repeated machine faults occur
                     . A system is exhibiting hardware performance problems
                     . A system hangs while executing normal application
                       programs

                  Remote Diagnostics Are Unlikely To Help When:
                     . A workstation on the system will not function
                     . Printers on the system do not function properly
                     . An application program fails to run properly
                     . A system experiences AC power problems

                                  (continued)

VS 25/45 REMOTE
DIAGNOSTICS
PROCEDURES
(continued)

Site Preparation for Remote Diagnostics
When planning a VS 25 or 45 installation, it is important
to adhere to the following distance requirements:
  . Place Workstation 0 within 25 feet of the VS 25/45 CPU.
  . A Wang-supplied remote diagnostic modem should be
    located within 10 feet of the VS 25 or VS 45 CPU.
  . A touch-tone phone should be placed next to the remote
    diagnostic modem, with the telephone connection located
    within 10 feet of workstation 0.

No expensive communication links have to be installed by
the customer; only a touch-tone phone and common jack are
required to complete the communication link between the
system and Wang Remote Maintenance Center (RMC). Federal
Communications Commission (FCC) regulations (part 68)
specify that prior to connecting a device such as the
Wang-supplied WA3451 remote diagnostics modem to a switched
telephone network, users must provide the local telephone
company with the name of the manufacturer of the device to
be attached, and the model number, FCC registration number,
and ringer equivalence number of the device to be connected.
For the WA3451, the information is listed on the bottom of
the modem, as follows:

    Model Number: Wang WA3451
    Manufactured for Wang Labs, Inc. by Racal-Vadic, Inc.
    FCC Registration Number: AJ 496M-67213-DM-N
    Ringer Equivalence Number: 0.9B

Since the WA3451 modem is FCC-registered as a permissive
device for direct connection to a switched telephone line,
a Data Access Arrangement (DAA) is not needed.

Specifications of the WA3451 remote diagnostic modem are:

    Power Requirements   Physical Data
      115 VAC + 10%   Height -- 2.55 inches
      47 to 63 Hz   Width -- 7 inches
      12 watts maximum   Depth -- 12 inches

The WA3451 modem has a direct-connect cable terminating in
a miniature 6-pin modular plug. This plug is compatible
with several voice and data jacks provided by a local
common carrier. To connect a WA3451 modem to a public
switched telephone network, an RJ11C Voice Jack (also
available for flush wall connection as RJ11W) should be
ordered from the local telephone company. This device is
commonly known as a modular connecting block and is
primarily used for connecting standard extension telephones.

<u>VS 25/45 REMOTE
DIAGNOSTICS
PROCEDURES</u>
  (continued)

<u>Installing Remote Diagnostics</u>
At the time remote diagnostics capability is installed on a
VS 25 or 45 system by Wang Customer Engineering, NVRAM will
be initialized, the remote modem will be connected, and a
"remote link verification" will be performed. A copy of
the remote diagnostics diskette and accompanying documenta-
tion will be left at the customer site.

Warning: Do not copy files from the remote diagnostics
diskette onto the system disk. The diagnostics diskette
contains software that may not be compatible with the VS
operating system, meaning that the system will not pass
diagnostics in normal power-up procedures.

<u>Customer Procedure for Initiating Remote Diagnostics</u>
If remote diagnostics may be needed when a problem occurs
with your VS 25 or VS 45, do the following:

1. Ensure that the following items are available:
     a. Remote Diagnostic Diskette number 732-0021.

     b. The system key, used to switch to "Remote" when
        prompted to do so by the Remote Maintenance Center.

2. If an error is present on the workstation or the VS
   25/45 front panel, make a note of the error code, the
   test that failed and/or the events preceding the error.

3. Place a service call to your local Wang Call Control
   Center (CCC) using the phone which is attached to the
   remote maintenance modem. The CCC will request the
   following information: customer name, on-site contact,
   and problem description. If remote diagnostics are
   determined to be appropriate, the CCC will contact the
   Wang Remote Maintenance Center (RMC) in Lowell.

4. When the RMC calls you back, you will be asked some
   further information and then requested to perform the
   following steps.
     a. If the system is running, make sure all users are
        logged off.
     b. Insert the remote diagnostics diskette into the
        diskette drive.
     c. Place the diskette bootstrap switch, located on the
        front panel, in the UP position.
     d. Insert the system key into the keyslot on the front
        panel, and turn it to the "Remote" position.
     e. Press the "Control Mode" button.
     f. Press the "Initialize" button.

(continued)

VS 25/45 REMOTE
DIAGNOSTICS
PROCEDURES
 (continued)

5. When the LED display on the front panel flashes on and off with code 4500, the RMC will transfer the phone to the diagnostic system, instructing the user to switch the modem to "Data" when the carrier tone is heard.

6. At the completion of the diagnostics, a message will appear at workstation 0 prompting the user to return all switches back to their normal position. Results of the remote diagnostics will be relayed from RMC to the Call Control Center.

2200 IDEAS I,
VERSION 1.6
by 2200 R&D

DESCRIPTION
2200 IDEAS (Inquiry Data Entry Access System) Release I,
Version 1.6, is now available. This version corrects a
problem in which records were occasionally skipped or
printed twice during sequential access.

HARDWARE PRE-REQUISITES
Any 2200 VP, SVP, LVP, LVPC, MVP, or MVPC with 32K or more.

SOFTWARE PRE-REQUISITES
None

ALERTS
None

ORDERING INFORMATION
2200 IDEAS I, Version 1.6, is available through normal
order processing channels, on three types of media, as
follows. DSDD mini-diskette media is for use with 2275-10
diskette drives.

System	Model #	Media
VP,MVP(C),LVP(C)	195-2115-3	3 SSSD Diskettes (701-2644E, 701-2645E, and 701-2651E)
VP,MVP(C),LVP(C)	195-2115-9	3 DSDD Mini-Diskettes (731-0088A, 731-0089A, and 731-0090A)
SVP,LVP(C)	195-2115-5	1 DSDD Diskette (731-0022C)

INSTALLATION INSTRUCTIONS
The recommended installation procedure is to use ISS COPY
with the Add/Replace option.

PROBLEMS CORRECTED
A problem in IDEAS Release I, Version 1.5, has been
corrected to enable a sequential access (i.e., printing a
report) and random access (i.e., doing file maintenance)
of the same data file simultaneously on different
terminals without the sequential process skipping a record
or printing the same record twice.

KNOWN ANOMALIES
None

REFERENCES
2200 IDEAS Familiarization Guide (700-5939A)
2200 IDEAS User Manual (700-5778B)

2200 ASYNC,
VERSION 7.0
by 2200 R&D

DESCRIPTION
Version 7.0 of Wang 2200 Asynchronous Communications soft-
ware for the 2236MXE Controller, as well as the 2227B/2228B/
2228C and OP-27B/28B/28C Communications Controllers, is now
available. In addition to support of asynchronous communi-
cations on the MXE controller, 2200 Asynch 7.0 contains new
configuration options. The TTY and 2741 configuration
modules have been modified to ask for the telecommunications
(TC) board type and the TC port on an MXE.

HARDWARE PRE-REQUISITES
1. Wang 2200 VP, SVP, LVP, LVPC, MVP, or MVPC
2. 8K minimum memory in the active partition
3. Communications controller: 2236MXE* or 2227B/2228B/2228C
   or OP-27B/28B/28C
4. Terminal controllers: 2236MXE* or 2236MXD or 22C32
   Triple Controller for terminal, disk, and printer
5. Optional devices supported are system printers, 2236-DE
   and 2236-DW terminals.

 * Because async communications are now supported on the
   2236MXE, the MXE can be used for a communications port
   as well as a terminal interface. Without a 2236MXE, it
   is necessary to have both a communications controller
   and a terminal controller.

SOFTWARE PRE-REQUISITES
With the 2236MXE, Multi-User Operating System Release 2.5
or later should be used. Otherwise, any Release 2.0 or
later 2200 Operating System may be used.

ALERTS
None

ORDERING INFORMATION
2200 Asynchronous Communications software, Version 7.0, is
available through normal order processing channels, on
three types of media, as follows:

System	Model #	Media
VP,MVP(C),LVP(C)	195-2056-3	1 SSSD Diskette (701-2358C)
VP,MVP(C),LVP(C)	195-2056-9	1 DSDD Mini-Diskette (731-0110A)
SVP,LVP(C)	195-2056-5	1 DSDD Diskette (731-0024C)

The 2200 Async software consists of 32 files.

INSTALLATION INSTRUCTIONS
The recommended installation procedure is to use ISS COPY
with the Add/Replace option.

(continued)

2200 ASYNC,
VERSION 7.0
(continued)

PROBLEMS CORRECTED
1. Buffer overrun on TTY when no CR (carriage return) was
   received for 255 characters
2. Non-support of async communications on MXE controller
3. Some obscure keys (such as COS, PI, etc., found on
   earlier keyboards) were corrected for 2741 terminals.
4. A function was added to TTY so that CLEAR key will send
   HEX(7F) rub-out.

KNOWN ANOMALIES
None

REFERENCES
2200 Asynchronous 1 Communications User Guide (700-7122)
2200 Asynchronous Communications Guide for Model 2236MXE
        and Option W (700-8098)

WANG PC
SERIAL INTERFACE
PIN ASSIGNMENTS
by the Technical
   Support Center

One of the most common reasons for non-Wang serial printers not operating on the Wang PC is incompatible serial interface connectors between the printer and the Wang PC. Both the Wang PC and each serial printer are equipped with a 25-pin, RS-232-C serial interface connector. Not all printers adhere to the standard pin assignments, and even those printers which adhere to pin assignment standards may have incompatible values across the pins. For example, a pin may have the standard functional assignment, yet may require the opposite binary state to the Wang PC.

The first step in trying to resolve the issue of an incompatible serial interface connector is to know what the Wang PC connector requires, and what the serial printer is providing. In discussing data and control circuit interfaces, the following terminology is used:

Terminology	Possible States
Voltage	Negative or Positive
Binary State	One or Zero
Signal Condition	Mark or Space

NOTE: Voltages adhere to American National Standards Institute (ANSI) standards, where positive voltage is +3 to +25 volts and negative voltage is -3 to -25 volts. Typically, the output from the Wang PC is between ± 8 volts and ± 12 volts.

The chart on the following page provides a list of each pin that the Wang PC serial interface uses, its input/output state, its function, and a description of that function.

If an incompatibility exists between the Wang PC and the serial printer pin assignments, the problem can often be solved by providing an asynchronous null modem to perform the function of switching the signals to the correct pin assignments. Alternatively, the user can obtain a device to perform the same functions as a null modem, or build a cable that will connect the wires to the appropriate pins on the connectors at either end of the cable.

WANG PC
SERIAL INTERFACE
PIN ASSIGNMENTS
(continued)

Wang PC serial interface connector pin assignments are as follows:

Pin	I/O	Signal	Description
1	--	--	Not connected.
2	O	TxD	Transmit Data - Serial data out of CPU. Value of one or "mark" is negative and value of zero or "space" is positive.
3	I	RxD	Receive Data - Serial data into the CPU. "Mark" is negative and "space" is positive.
4	O	RTS	Request To Send - When positive, tells modem that the CPU is ready to transmit data.
5	I	CTS	Clear To Send - When positive, CPU may begin data transmission.
6	I	DSR	Data Set Ready - When positive, says modem or printer is ready to communicate with CPU.
7	--	± 0v	± 0 volts. Signal ground.
8	I	DCD	Data Carrier Detect - When positive, modem has detected the carrier from the remote location, and CPU can expect to receive data.
9 to 19	--	--	Not connected.
20	O	DTR	Data Terminal Ready - When positive, CPU is operational and ready to communicate with modem or printer.
21 to 25	--	--	Not connected.

MICRO FOCUS
LEVEL II COBOL
ANNOUNCED
FOR WANG PC
by Wang PC
    Product
    Marketing

DESCRIPTION
Wang Laboratories is pleased to announce the availability of
the Micro Focus Level II COBOL programming environment on
the Wang Professional Computer. Level II COBOL consists of
a single-pass COBOL compiler together with a run-time system.
Once an application has been developed and compiled, the per-
formance can be enhanced by invoking a Native Code Generator
to optimize the code for high-speed execution. This approach
affords the best combination of fast program development
with high program performance.

Sold and distributed by Wang Laboratories, the Micro Focus
Level II COBOL package is well suited to the development of
new applications for the Professional Computer environment.
Because Level II COBOL is a mainframe-level compiler, it
enables the Wang PC to compile and run programs written in
full ANSI'74 COBOL with minimal source code modification.
Customers and prospects with large investments in existing
COBOL programs will benefit by the ability to maintain and
execute them on the PC. The Micro Focus Level II program-
ming environment consists of the following three modules:

Level II COBOL Compiler
Level II COBOL implements ANSI X3.23 1974 COBOL and includes
features that address the needs of interactive program devel-
opment. The compiler provides features additional to the
ANSI'74 standard, in the form of language extensions for:

    . Interactive screen handling
    . Line sequential file handling
    . Run-time specification of external file & program names

Micro Focus Level II COBOL meets the federal government's
"High Level" rating, the highest level of COBOL implemen-
tation defined by the U.S. Government's Federal Compiler
Testing Center. Level II COBOL is certified "without
errors" by the General Services Administration (GSA). Of
the other 10 COBOL compilers currently certified as High
Level without errors, all are mainframe compilers.

ANIMATOR™
ANIMATOR is a unique programming tool which allows the
programmer to observe the logical path of program execution
at the source code level. Program execution can be
suspended at any point, giving access to a full range of
debugging commands. This tool, similar in function to the
VS DEBUG facility, makes the entire process of analyzing
and debugging during program development more effective.

™ ANIMATOR and FORMS-2 are trademarks of Micro Focus

MICRO FOCUS
LEVEL II COBOL
ANNOUNCED
FOR WANG PC
  (continued)

FORMS-2™
FORMS-2 is a visual programming tool to speed the creation
of interactive screen handling programs. The operation of
FORMS-2 allows the programmer to create an interactive form
on the CRT screen exactly as it is to appear at run-time,
and FORMS-2 will generate the error-free COBOL code to
handle the screen. FORMS-2 works only with Level II COBOL.

There is no object code compatibility between VS COBOL
(195-2105-x), Microsoft COBOL (PC-SS013), and Micro Focus
Level II COBOL. Each implementation is different, and
migrating source code between these different COBOL
implementations will require re-editing and recompiling.
Micro Focus Level II COBOL is integrated with Wang PC
applications software only to the extent that text files
generated by a COBOL program can be used by Wang PC Word
Processing, and possibly Multiplan, if formatted in the
SYLK (Symbolic Link Language) file format first.

MARKETING STRATEGY
COBOL is the most widely-used language in mainframe and
minicomputer environments. The total investment in COBOL
programs in the U.S. exceeds 100 billion dollars. Level II
COBOL allows the full facilities of mainframe/minicomputer
COBOL on the Wang PC, and is the ideal choice for developing
applications in a corporate environment where COBOL software
and expertise are already present.

While being sold and distributed by Wang, the Micro Focus
Level II COBOL compiler, ANIMATOR and FORMS-2 programming
tools will be supported by Micro Focus. The support
offered by Micro Focus is in addition to the standard
entitled support offered for the Professional Computer.

Wang PC entitled support offers the PC customer full
documentation on the PC and 90 days access to the Wang PC
hotline (1-800-343-1098). The Wang PC Hotline will handle
questions of a general nature concerning Micro Focus Level
II COBOL, but customers should contact Micro Focus for
detailed support and service, at the following address:

                        MICRO FOCUS
                        1601 Civic Center Drive
                        Santa Clara, CA 95050
                        (415) 856-4161
                        Telex: 278704MFCISUR

MICRO FOCUS
LEVEL II COBOL
ANNOUNCED
FOR WANG PC
 (continued)

ORDERING INFORMATION

Micro Focus Level II COBOL requires a Wang PC with at least 256KB main memory and two diskette drives. Level II COBOL may be ordered through normal order processing channels and is expected to be available during the third quarter of fiscal year '84.

Wang Laboratories offers the Level II COBOL compiler, ANIMA-TOR, and FORMS-2 modules for one bundled price as well as individually. Each software module comes complete with full user documentation. A general overview data sheet may be ordered from the Wang Supplies Division as publication #700-8654. Wang end-users or software vendors who develop applications with Level II COBOL do not need to pay run-time fees when their applications are sold.

Model Number	Description	License Fee Initial	Monthly
PC-SS022	Level II COBOL Compiler	$ 1,500	N/A
PC-SS023	FORMS-2 *	150	N/A
PC-SS024	ANIMATOR *	500	N/A
PC-CS003	Bundled Version; includes Level II COBOL Compiler, FORMS-2 & ANIMATOR	1,750	N/A

* Requires Level II COBOL Compiler, PC-SS022.
  The Native Code Generator is included with the compiler.

PC SOFTWARE RELEASE LEVELS

Currently-released core software for the Wang Professional Computer is listed below. Although an attempt has been made to list hardware and software requirements of each software release, this list of requirements may not be complete. Newly-released software is indicated by an underscored version number.

MODEL #	I/U*	DESCRIPTION	PKG. #	VERSION	HARDWARE REQUIREMENTS**	SOFTWARE REQUIREMENTS
System Software						
PC-SS001	U	System Software Diskette	195-2326-9	V1.21	128K RAM, 1,2,3+,4 or 5	(Has MS-DOS V2.01 & BIOS V1.21)
PC-PM050	I	CP/M-80 Emul. Card & Sft.	195-2738-9	V1.00	128K RAM, 1,2,3+,4 or 5, 6 or 7	System Software V1.00 or later
PC-SS005	I	CP/M-80 Emul. Sftware Only	195-2738-9	V1.00	128K RAM, 1,2,3+,4 or 5, 6 or 7	System Software V1.00 or later
Languages						
PC-SS010	I	MS-Compiled BASIC	195-2327-9	V1.00	128K RAM, 1,2,3+,4 or 5	System Software V1.00 or later
PC-SS012	I	MS-FORTRAN	195-2329-9	V3.04	256K RAM, 1,2,3+,4 or 5	System Software V1.00 or later
PC-SS011	I	MS-Pascal	195-2328-9	V3.04	256K RAM, 1,2,3+,4 or 5	System Software V1.00 or later
PC-SS013	I	MS-COBOL	195-2330-9	V1.07	256K RAM, 1,2,3+,4 or 5	System Software V1.00 or later
Productivity						
PC-AS001	U	PC Multiplan	195-2338-9	V1.06.05	128K RAM, 1,2,3,4 or 5	System Software V1.10 or later
PC-AS002	U	PC Word Processing	195-2339-9	V1.11	128K RAM, 1,2,3+,4 or 5	System Software V1.10 or later
PC-AS005	I	PC Notebook	195-2621-9	V1.0	128K RAM, 1,2,3R,4 or 5	System Software V1.10 or later
PC-CS001	I	Productivity I (Multiplan/WP/Async.)	196-0002-9	N/A	128K RAM, 1,2,3+,4 or 5	System Software V1.10 or later
Telecommunications						
PC-SS020	I	PC Async.Comm. (inc.2200)	195-2331-9	V1.00	128K RAM, 1,2,3,4 or 5	System Software V1.00 or later
PC-PM041	I	PC Local Communications	195-2647-9	V1.01	128K RAM, 1,2,3,4,6	System Software V1.10 or later
PC-SS063	I	3276 SNA/SDLC Emulation	195-2605-9	V1.08E	128K RAM, 1,2,3,4 or 5, 8	System Software V1.10 or later
PC-WSNT-MS	I	PC Multipoint Secondary***	195-2803-9	V2.1	128K RAM, 1,2,3,4 or 5, 9	System Software V1.10 or later
PC-WSNT-BSS	I	BSS File Trans./Term.Em.***	195-2806-9	V2.1	128K RAM, 1,2,3,4 or 5, 9	System Software V1.10 or later
PC-SS060	I	Batch 2780/3280/WPS Option	195-2337-9	V2.01	128K RAM, 1,2,3,4 or 5, 9	System Software V1.10 or later

* I = Initial Release; U = Updated Version

** Hardware Requirements:
    1 - Wang PC CPU Board #210-8221, with V1.00 Boot EPROMs (ECO 26344)
    2 - Wang PC Keyboard
    3 - One 5.25" DSDD diskette drive
    3+- Two 5.25" DSDD diskette drives preferred
    3R- Two 5.25" DSDD diskette drives or one 10 MB Winchester drive required
    4 - PC-PM004 Wang Monochrome Monitor with PC-PM001 character resolution board #210-8243
    5 - Industry-standard monitor (RGB or B&W) with PC-PM003 character/graphics board #210-8222 using 80-column mode only
    6 - PC-PM041 Wang PC Local Communications Option Card Set (Data Link Board #210-8245 and CPU Board #210-8246)
    7 - PC-PM050 Wang PC CP/M 80 Emulation Card #210-8248
    8 - PC-PM042 Wang PC Multiport Controller Card #210-8251
    9 - PC-PM040 Wang PC Remote Telecommunications Card #210-8232

*** Wang Systems Networking (WSN) software formerly bundled as Remote WangNet with the PC-PM040 Remote Communications Option.
     Orders for PC Remote WangNet must now specify a Transport (such as PC-WSNT-MS), a Service (PC-WSNS-BSS Basic Support Service,
     containing File Transfer and VS Terminal Emulation), and the Wang PC Remote Telecommunications card (PC-PM040). The three
     items were formerly bundled in PC-PM040. Color (RGB) monitors do not function with these Wang PC WSN software packages.

WANG PC
SYSTEM SOFTWARE,
VERSION 1.21
by Wang PC R&D

DESCRIPTION

Wang PC System Software Release 1.21 is now available. This
release contains the following enhancements:

Generalized Printer Drivers

Release 1.21 includes generalized printer drivers and
accompanying printer table editors (the Printer Index Table
Editor, the Printer Function Table Editor, and the Character
Translate Table Editor). It is expected that the general-
ized printer drivers will support most of the printers
available for microcomputers. See pages 220-229 for a
discussion of 1.21 generalized printer driver usage.

Menu Revisions

Wang PC System Software Release 1.21 includes a new menu
entitled Printer Support. The purpose of this menu is to
enable the user to conveniently direct printed output to
either parallel port #1 (device = PRN), serial port #1
(device = PRN1), or to the console (device = CON). This
menu also provides access to the generalized printer driver
tables, as discussed on pages 221-226. Wang PC System Soft-
ware Release 1.21 no longer includes the Conversion Aids
Menu. Those selections have been moved to the Application
Menu as they are generally used with Word Processing and
other applications integrating WP documents as text files.

RAMDISK Device Driver

Also included in Wang PC System Software Release 1.21 is a
version of the Wang PC RAMDISK software. RAMDISK is an
installable device driver (RAMDISK.COM) which allows the
allocation of a portion of main memory to be used as a
high-speed MS-DOS volume. Either a fixed amount or a
percentage of available main memory may be specified for
RAMDISK use. To direct a system to use RAMDISK, CONFIG.SYS
must be modified as described under Installation Procedures
on page 218. Then, each time the system is started,
RAMDISK will be automatically loaded.

Once the RAMDISK has been established, it may be accessed
by the same commands and utilities as a regular disk drive,
with the exception that DISK COPY cannot be used with
RAMDISK. The RAMDISK drive designation is the next letter
in the alphabet after the one the system last used as a
drive designation. RAMDISK, however, never uses a "B"
drive designation. With a single- or dual-drive system,
RAMDISK space would be referenced by "C." On a system with
a Winchester drive (Drive C), RAMDISK space would be "D".

Other 1.21 Enhancements

   . New File Display Utility - functionally equivalent to
     the MS-DOS TYPE command.

(continued)

WANG PC
SYSTEM SOFTWARE,
VERSION 1.21
(continued)

Other 1.21 Enhancements (continued)

. Set Keyboard Options - enables the user to adjust the
  volume of the keyboard speaker and keyboard clicker.

. Winchester BACKUP - allows the user to backup
  selected portions of a Winchester disk to 5.25" DSDD
  diskettes. For further information concerning the
  Wang PC Winchester BACKUP Utility, refer to the Wang
  PC Utility Programs User Guide (700-8389).

. Winchester RESTORE - enables the user to reconstruct
  the contents of a Winchester disk following the
  inadvertent loss of information. The 5.25" DSDD
  diskettes produced by the Wang PC Winchester BACKUP
  Utility are used as input by this utility, as
  described in the Wang PC Utility Programs User Guide.

. The Wang PC Editor Menu supports interactive help
  text editing, path processing, and parameter passing.
  The user may now specify both the directory in which
  the selected program resides and the parameters that
  are passed to the selected program.

. A Microsoft Background Print facility has been added,
  which supports MS-DOS V2.00 file specifications.

. Version 1.03 of the Microsoft GW BASIC Interpreter is
  included in Release 1.21. This version is token
  compatible with IBM Advanced (or Disk) BASIC, but not
  with BASIC Interpreter versions included in previous
  Wang PC System Software releases.

. High Resolution monitor support.

HARDWARE PRE-REQUISITES
1. Wang PC CPU card #210-8221 with V1.00 Boot EPROMs.

2. A minimum of 128 KB standard RAM. Expanded memory
    (more than 128K) is required for use of RAMDISK, and
    for systems running Word Processing with more than one
    generalized printer driver.

3. One (preferably two) 5.25" DSDD diskette drives.

4. A Wang PC Monochrome Monitor (PC-PM004) with an
    attached Character Display Card #210-8243 (PC-PM001),
    or an industry standard monitor or television (color or
    B&W) with an attached Wang PC Color/Graphics Display
    Card #210-8222 (PC-PM003).

WANG PC
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  (continued)

SOFTWARE PRE-REQUISITES
Release 1.21 of Wang PC System Software contains MS-DOS
V2.01 and BIOS V1.21. Many of the components included with
this release require MS-DOS V2.01 and BIOS V1.21.

ALERTS
1. Because of token incompatibility, Interpretive BASIC
   programs written and saved under releases prior to BASIC
   V1.03 will not execute properly under V1.03 and later
   releases, unless they have been saved in ASCII format.
   BASIC programs that have not been saved in ASCII format
   should be loaded into the Interpreter with which they
   were created, and then resaved in ASCII format via the
   ",A" option of the SAVE command. Programs in ASCII
   format will run under any version of the Wang PC BASIC
   Interpreter. NOTE: "Tokens" are the numeric values with
   which the text of BASIC commands is replaced when
   programs are saved in formats other than ASCII.

2. Interpretive BASIC programs with protected source-code
   files created prior to V1.03 will not run under BASIC
   V1.03, which is included in Systems Software Release
   1.21. To "copy protect" a file using Interpretive BASIC
   V1.03, load the ASCII format of the file into memory and
   issue a SAVE command with the ",P" protect option.

3. When using the RAMDISK option, all files on the RAMDISK
   are lost when you turn off the system. Therefore, to
   save the files on RAMDISK, copy them to diskette before
   turning off the system.

4. If you are copying the system diskettes onto a Winchester
   disk that already contains modified system files, be
   aware that the FILE COPY utility replaces those files
   with the system files from the diskette. Therefore, if
   your Winchester already contains a copy of CONFIG.SYS
   that you have modified, do not copy the CONFIG.SYS file
   from the diskette. Also, if you have customized the
   system menus on the Winchester disk, note all changes;
   you must make these changes again after the new system
   menus have been copied.

5. When passing control to a device which cannot pass
   control back to the main system's keyboard (e.g., a
   printer or monitor without a separate keyboard), use a
   batch file. Within the batch file, include the CTTY
   commands to switch from the main system's keyboard to a
   device and back again. Then, the system executes these
   commands even if the auxiliary device does not have the
   capability to return control to the main system's
   keyboard independently.

WANG PC
SYSTEM SOFTWARE,
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  (continued)

ALERTS (continued)

6. If the File ID field is left blank in the Winchester
   RESTORE utility, all of the files will be restored.

7. For the PC-PM012 daisy printer to function correctly,
   its baud rate must be set at 1200 (i.e. dip switch
   selections for positions 1, 2, and 8 should be set ON).

ORDERING INFORMATION
Wang PC Systems Software 1.21 is available as an upgrade
for existing Wang PC systems as model number UJ-3199 at a
cost of $100. Release 1.21 or later software will be
shipped with all new Wang PC systems hereafter.

To order this upgrade, ISOs should send a standard customer
order form directly to Wang Software Distribution for
processing and invoicing. Be sure to include CPU SERIAL
NUMBER and CUSTOMER NUMBER on the order form. Return cus-
tomer order forms to Wang Laboratories Inc., 836 North St.,
Tewksbury, Ma. 01876, Attn: Mynna Wexler, Mail Stop 2625.
The following Wang PC Systems diskettes are included in
package number 195-2326-9 (upgrade model UJ-3199):

Description	Media Number	Volume ID
System Diskette I	734-0008B	PCSYSD1V121
System Diskette II	734-0015A	PCSYSD2V121
System Diskette III	734-0059	PCSYSD3V121

Release 1.21 of the Wang PC System Software is stored on
three 5.25" 360 KB MS-DOS volumes. Wang PC System Diskette
I contains all of the files necessary to boot the system,
to invoke all of the selections appearing on the Main
System Menu, and to manage the tables and commands
associated with the Generalized Printer Drivers. Wang PC
System Diskette II contains the balance of the system
software, with the exception of the BASIC Interpreter,
Winchester Backup, and Winchester Restore. The latter
software is contained on PC System Diskette III.

INSTALLATION INSTRUCTIONS
If device drivers such as RAMDISK or the generalized
printer drivers are to be used with Systems Software
Release 1.21, they must be specified in CONFIG.SYS.
RAMDISK installation instructions are given below. For
printer driver installation instructions, refer to the
section entitled "Specifying the Printer Driver File Name
in CONFIG.SYS" on page 222 of this issue.

(continued)

WANG PC
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  (continued)

On systems with two diskette drives, it may be convenient to modify the system menus so that System Diskette I can always remain in Drive A and System Diskette II can remain in Drive B. Procedures for doing this are described in the General Comments section of Wang PC Documentation Update #2 (700-8020A.02). This avoids removing System Diskette I from Drive A and replacing it with System Diskette II every time you want to access a program on System Diskette II.

Installing the RAMDISK Option
To specify the RAMDISK option, enter DEVICE = RAMDISK.COM as the last line of CONFIG.SYS, followed by either the absolute amount of memory or the percentage of available memory that should be used. For example, if you want to always allocate 156 KB of memory to RAMDISK, the line within CONFIG.SYS should read DEVICE = RAMDISK.COM F156. The minimum amount of RAMDISK space that can be reserved is 32 KB.

To designate a percentage of memory as RAMDISK, specify DEVICE = RAMDISK.COM, followed by the letter R and the amount of reserved memory (in KB) to be used as a RAMDISK, followed by the letter P and the percentage of the remaining memory you want to use as RAMDISK. For example, if you want to reserve 128KB of memory and use 60 percent of the remaining memory as a RAMDISK, add the following line to CONFIG.SYS: DEVICE = RAMDISK.COM R128 P60. The default value for the PERCENT parameter is 70.31%; the default value for the RESERVED parameter is 128KB. If you enter the line DEVICE = RAMDISK.COM without parameters, the system assumes a percentage calculation with the default values for the PERCENT and RESERVED parameters.

KNOWN ANOMALIES
1. Text to Document Conversion: Word Processing cannot combine converted document pages into a single page.

2. If the serial port is assigned for printer output, and the user enters the MS-DOS Command Processor and runs the Printer Redirection utility specifying the parallel port, the printer output assignment will be reset to the serial port when the user exits from MS-DOS to the Wang PC menu structure. To bypass this problem, run the Printer Redirection utility from the Printer Support menu, shown on page 221, rather than from MS-DOS.

REFERENCES
The Wang PC Introductory Package (700-7590) is shipped with System Software Release 1.21. This package consists of:
    . Wang PC Introductory Guide (700-8020A)
    . Wang PC Utility Programs User Guide (700-8389)
    . Wang PC Documentation Update #2.(700-8020A.02)
    . Wang PC Utilities Reference Card (700-8658)

WANG PC
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   (continued)

REFERENCES (continued)
Items in the Wang PC Introductory Package are not orderable
separately; all are included under order number 700-7590.
The revised Interpretive BASIC Language Guide text
(700-8019A) is scheduled for release in February 1984.

Wang PC V1.21 System Software Memory Requirements
The following memory requirements were obtained for Wang PC
System Software Release 1.21 using the Microsoft CHKDSK
Utility executed from the System Utilities Menu:

Hardware Configuration		** Based on 128KB RAM ** Required Memory	Available Memory
Single Diskette Drive System			
With 210-8343 Med. Res. Character Board		43,840	87,232
With 210-8343 Med Res Char Board, 210-8233 Graphic Board		43,840	87,232
With 210-8222 Low Res. Character Board		51,600	79,472
With 210-8343 Med Res Char Board, 210-8233 Graphic Board, and 210-8222 Low Res. Char Board		51,696	79,376
Dual Diskette Drive System			
With 210-8343 Med. Res. Character Board		43,840	87,232
With 210-8343 Med Res Char Board, 210-8233 Graphic Board		43,840	87,232
With 210-8222 Low Res. Character Board		51,600	79,472
With 210-8343 Med Res Char Board, 210-8233 Graphic Board, and 210-8222 Low Res. Char Board		51,696	79,376
Single Diskette and 10MB Winchester Drive			
With 210-8343 Med. Res. Character Board		45,360	85,712
With 210-8343 Med Res Char Board, 210-8233 Graphic Board		45,360	85,712
With 210-8290 High Res. TXT/IMAGE/Graphic Board		47,152	83,920
With 210-8222 Low Res. Character Board		53,120	77,952
With 210-8343 Med Res Char Board, 210-8233 Graphic Board, and 210-822 Low jRes. Char Board		53,216	77,856
Single Diskette and 10MB Winchester Drive With 210-8343 and 8233 Boards			
With PAR1DRVR Installed	7,312 plus	45,360	78,400
With SER1DRVR Installed	7,664 plus	45,360	78,048
With PAR1DRVR & SER1DRVR Installed	14,976 plus	45,360	70,736
With PRINT.COM Resident Portion Installed	2,768 plus	45,360	82,944
With GW-BASIC Interpreter Resident	58,662 plus	45,360	27,050

Note: Configuration file "SHELL = /MENUDRVR.COM" was used for above figures.
        If "SHELL = /COMMAND.COM" is used and CHKDSK is invoked from the command
        level, add 960 bytes to all available memory figures above.

USING WANG PC
GENERALIZED
PRINTER DRIVERS
by Wang Technical
   Publications

The following article is an overview of Wang PC generalized
printer driver usage. For more details, refer to the
Appendix I revision included in Wang PC Documentation
Update #2 (700-8020A.02), shipped with Wang PC System
Software Release 1.21.

Generalized serial and parallel printer drivers are included
in Wang PC System Software Release 1.21. These table-driven
generalized printer drivers support any ASCII printer that
meets the following requirements:

1. The printer must support a Centronics type parallel
   or serial RS-232C hardware interface.

2. If the printer is a serial device, it must support
   DC1/DC3(XON/XOFF) protocol.

3. The printer must support control codes for line feed
   (LF), form feed (FF), and carriage return (CR).

4. The printer must have a dip switch which disables
   automatic line feed.

5. If the printer is to be used for word processing, it
   needs a 24 lines-per-inch (lpi) increment for correct
   printing of the subscript, superscript, and double
   underscore attributes. The double underscore defaults
   to a 1/48 inch increment, if available.

Generalized Printer Driver Tables
The Wang PC generalized printer driver software uses the
following tables: (1) printer function tables, which list
the specifications for each printer to be used, (2) char-
acter translate tables, indicating font positions and
special character access for each printer, and (3) a printer
index table containing the file names of the printer tables
and the character translate tables.*

Wang PC System Software Release 1.21 includes printer
function tables and character translate tables for the
Epson MX80 printer (PC-PM010) and the Diablo 620 printer
(PC-PM012). These tables can be used as examples for devel-
oping tables for non-Wang printers. Because the DW-20
printer (PC-PM011) is being replaced in the Wang PC product
line by the PC-PM012 printer, the DW-20 is not supported by
the generalized printer drivers. Therefore, DW-20 printer
usage will still require the installation of the specific
device driver DW20DRVR.COM.

* The file names for the printer function tables and the character translate
  tables include a version number, such as v1. As the printer function and
  character translate tables are updated, the version number, and hence the
  file name, changes.

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(continued)

Wang PC System Software Release 1.21 includes a new Printer Support menu, accessible from the Main System Menu. The Printer Support menu allows access to the Printer Function Table Editor, the Character Translate Table Editor, and the Printer Index Table Editor, as shown in Figure 1. Also, the Printer Support menu enables users to conveniently direct printed output to either parallel port #1 (device = PRN), serial port #1 (device = PRN1), or to the console (device = CON). In order to direct printed output to parallel port #1 or to serial port #1, the user must have specified in CONFIG.SYS the generalized printer drivers PAR1DRVR.COM and SER1DRVR.COM respectively.

```
mm/dd/yy                    Wang Professional Computer              hh:mm:ss
                       P R I N T E R   S U P P O R T   M E N U
                                  Release 1.20


         Select an Item and Proceed




                            _  Character Translate Table Editor
                            _  Printer Function Table Editor
                            _  Printer Index Table Editor
                            _  Redirect to Console
                            _  Redirect to Parallel Port #1
                            _  Redirect to Serial Port #1
                            _  System Utilities
                            _  Other




                                         SPACE BAR - Item Select
                                         EXECUTE   - Proceed
                                         CANCEL    - Previous Menu
```
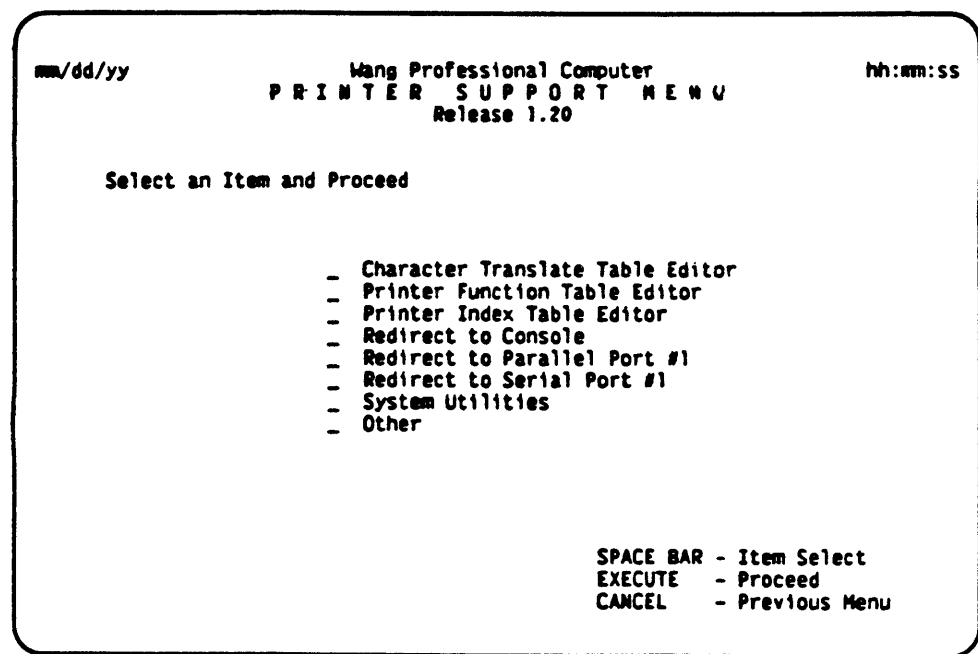
FIGURE 1.   The New Printer Support Menu

For printers to operate correctly under Wang PC System Software Release 1.21, three steps must be performed:

1. The correct printer driver file name(s) must be included in the file CONFIG.SYS.

2. The correct printer function table(s), and character translate table(s) for the printer(s) must be available within the system software.

3. The file PRNXLT.COM, which is automatically loaded by the generalized printer drivers, must specify the correct printer table and character translate table file names.

(continued)

USING WANG PC
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(continued)

These three steps are described in more detail below, and are fully documented in the revised Appendix I included in Wang PC Documentation Update #2 (700-8020A.02).

Specifying the Printer Driver File Name in CONFIG.SYS
The correct printer driver file name(s) must be included in the file CONFIG.SYS when the system is initialized. To do this, the following steps should be performed:

1. Insert Wang PC System Software Release 1.21 Diskette I in Drive A. Start up your system.

2. If you have not done so already, make a backup copy of System Diskette I using the DISK COPY utility, available from the System Utilities Menu.

3. Return to the Main System Menu. Select the Program Development option.

4. Replace System Diskette I with System Diskette II.

5. Select the Editor option from the Program Development Menu.

6. If you have a dual-diskette drive system, type A:CONFIG.SYS on the line provided for the file name. If you have a single-diskette drive system, you also enter A:CONFIG.SYS, but you must also replace System Diskette II with System Diskette I. Press EXEC.

7. The commands you use to specify the printer drivers should appear as the last lines within the CONFIG.SYS file. Use the South cursor key to move the highlighted line to the last line of the CONFIG.SYS file, which should be SHELL = /MENUDRVR.COM -NO01 -P/BIN. Press EXEC to create a blank line below this line and to move the cursor to the beginning of the blank line.

8. If you are using a parallel printer, enter DEVICE = /PAR1DRVR.COM. If you are using a serial printer, enter DEVICE = /SER1DRVR.COM. If you are using both printers, enter both commands on separate lines. For the DW-20 printer, enter DEVICE = /DW20DRVR.COM. If a specialized printer driver is used, only <u>one</u> printer driver may be specified in CONFIG.SYS. To use a DW-20 printer, the DW20DRVR.COM and DAISY06 files must be available on Systems Diskette I. (The DAISY06 table is used by DW20DRVR.COM; both files are included on Diskette II of Wang PC Systems Software Release 1.21.)

(continued)

USING WANG PC
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(continued)

NOTE: If you are using your system for Word Processing, and it is not an expanded system (i.e., it does not have more than 128KB of memory) then you can specify only one printer driver program in CONFIG.SYS. If more than one printer driver is specified, there will be insufficient memory to load Word Processing.

9. Press SHIFT and CANCEL keys simultaneously to indicate that you have finished editing CONFIG.SYS. Press EXEC to save your changes. The system will return to the Program Development Menu.

10. Restart your system. The system automatically loads the parallel and/or serial printer driver program(s) specified in CONFIG.SYS and displays the program name(s) on the screen.

11. Make a backup copy of the new CONFIG.SYS file.

Printer Function Tables
The printer function tables include the specifications for each printer, such as hardware interface functions and escape codes. The printer function table provides for a maximum of 15 form lengths. These form length values may range from 1 to 15 inches, and may be specified in 1-inch increments. For printer tables that support a serial driver, parameters such as baud rate, parity, data bits, and number of stop bits can be specified. Each function table is a file on System Diskette I. Every function table file has the extension ".PDT". Wang PC System Software Release 1.21 provides the following tables:

  PM010v2.PDT for PC-PM010 80-cps matrix printers (parallel)
  PM012v2.PDT for PC-PM012 20-cps daisy printers (serial)**

If you have either of the two printers listed above, you do not have to create a printer function table. Otherwise, unless a specific printer driver such as DW20DRVR.COM is to be used, a table must be created using the Printer Function Table Editor.

**
  The PM012v2.PDT function table transmits data between the system and the
  PC-PM012 daisy printer as follows: 1200 baud rate, 8 data bits, no parity,
  and 1 stop bit. Of particular importance is the baud rate. Before using
  your PC-PM012 daisy printer, check to see that the dip switch is set at
  1200 (dip switch selections for positions 1, 2, and 8 should be set ON for
  1200 baud).

USING WANG PC   The Printer Function Table Editor is a separate utility
GENERALIZED   provided with System Software Release 1.21, accessible from
PRINTER DRIVERS   the Printer Support selection on the Main System Menu. The
   (continued)   Printer Function Table Editor allows you to edit an existing
                         printer function table or to create a new table. To access
                         this utility, select the Printer Function Table Editor
                         option from the Printer Support Menu. The process of
                         editing or creating a printer table consists of the
                         following steps:

                         . Prefill the new table with information from an existing
                           printer table by selecting the "Prefill" (load into
                           memory) option from the Printer Function Table Editor
                           menu. Once the new printer table has been prefilled,
                           only items which differ from those in the existing
                           printer table need to be entered.

                         . Specify the hardware interface functions your printer
                           supports.

                         . Enter escape codes for your printer (not required if
                           your printer supports the Transparent Mode function).

                         . Save the new printer table file on System Diskette I and
                           enter this table name in PRNXLT.COM using the Printer
                           Index Table Editor utility as described on pages 225-226.

                         Character Translate Tables
                         The character translate table for a particular printer
                         specifies the location of PC WISCII character positions in
                         that printer's font table. Character translate tables also
                         specify single and double overstrike characters as well as
                         ESC (escape) code characters and SO/SI (shift out)/(shift
                         in) character access.

                         The character translate table file, if specified, is loaded
                         along with the printer function table by the printer
                         driver. All character translate tables must have the file
                         extension ".CTT". The character translate tables included
                         with Wang PC System Software Release 1.21 are the following:

                         . PM010v1.CTT for PC-PM010 80-cps matrix printers (parallel)
                         . PM012v2.CTT for PC-PM012 20-cps daisy printers (serial)

                         If you plan to use either of the generalized printer
                         drivers with a printer other than the PC-PM010 or the
                         PC-PM012, you will need to create a character translate
                         table using the Character Translate Table Editor. The
                         Character Translate Table Editor utility is a selection
                         from the Printer Support Menu.

                                        (continued)

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(continued)

The process of editing or creating a character translate
table consists of the following steps:

. Select the "Prefill" option from the Character Translate
  Table Editor menu in order to prefill (load into memory)
  information from an existing character translate table.
  Once the new character table has been prefilled, only
  items which differ from those in the existing character
  translate table need to be entered.

. Select the Edit Special Characters option from the
  Character Translate Table Editor menu. Then specify the
  hex values of up to 15 first overstrike characters and
  15 second overstrike characters, and the hex values of
  the escape code characters. Indicate also whether Shift
  Out/Shift In (SO/SI) character access is supported.

. Using the Edit Character Table option from the Character
  Translate Table Editor menu, specify the hex code
  corresponding to the font positions on your printer for
  each character in the WISCII character set.

. After saving the new character translate table on disk,
  enter the name of this table in PRNXLT.COM, using the
  Printer Index Table Editor described below. You can
  also specify that this table will be loaded automatically
  during system start-up.

The Printer Index Table
The PRNXLT.COM file contains the names of printer tables
and character translate tables. This file can also specify
that the system automatically load a character translate
table during start-up. With Release 1.21, only two printer
tables and two character translate tables can be specified;
the last two of the four entries for each table are ignored.

For the parallel printer driver, PRNXLT.COM uses by default
the printer function table and character translate table
for the Wang PC-PM010 printer. For the serial printer
driver, PRNXLT.COM uses by default the printer function
table and character translate table for the PC-PM012
printer. If you are using these printers, you do not have
to modify PRNXLT.COM. If you are using any other printer
with the generalized printer drivers, then PRNXLT.COM must
be modified to load the appropriate tables.

To modify PRNXLT.COM, use the Printer Index Table Editor
utility. After selecting the Printer Support option from
the Main System Menu, Remove System Diskette I and insert
System Diskette II. Then, select the Printer Index Table
Editor option from the Printer Support Menu.

(continued)

USING WANG PC
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  (continued)

The Printer Index Table screen includes a prompt that requests you to enter the drive that the printer index file will reside on. Enter a valid drive letter and press EXEC. The prompts that then appear on the bottom portion of the screen contain by default the names of the printer tables that Wang supplies: PM010v2.PDT for the PC-PM010 parallel printer and PM012v2.PDT for the PC-PM012 serial printer.

Enter the file names (ending in .PDT) of any printer tables you have developed for printers other than the above. For a parallel printer, you should enter the new printer table name in field #1, over the default PM010v2.PDT name. For a serial printer, enter the new printer table in field #2 over the default PM012v2.PDT name. It is not necessary to delete the default printer table names that are not being used.

After you enter all the desired items on this screen, press EXEC. A second Printer Index Table Editor screen appears, on which character translate table names other than the defaults of PM010v1.CTT and PM012v2.CTT can be entered.

Transparent Mode
The generalized printer drivers can be put into a transparent mode of operation where all input is passed directly through the driver, without translation, to the peripheral device. Transparent mode is required to change software-loadable fonts and to print items such as graphics, which the generalized printer drivers do not support.

Transparent mode is supported in three ways: the driver can default to transparent mode when it is loaded; transparent mode can be set by running the Transparent Mode utility; and transparent mode can be enabled and disabled dynamically by a user-created applications program.

To have transparent mode selected as the default, complete the procedure described below.

1. Select Printer Support from the Main System Menu.

2. Select Printer Function Table Editor from the Printer Support Menu.

3. Select Prefill Function Tables from the Printer Function Table Editor Menu and load the printer function table for your printer.

(continued)

USING WANG PC
GENERALIZED
PRINTER DRIVERS
(continued)

4. After you have loaded the printer function table, return
   to the Printer Function Table Editor and select Supported
   Functions. From the Supported Functions Menu, select
   Transparent Mode. Press EXEC until the Printer Driver
   Editor menu appears.

5. Select Write to Disk from the Printer Function Table
   Editor Menu to save the printer function table that now
   designates the default transparent mode.

To use the Transparent Mode utility, follow the procedure
described below. When you run an application that requires
transparent mode, first enter transparent mode, run the
application, then exit transparent mode. The printer
driver is then available for use by other applications.

The best procedure for accessing the Transparent Mode
utility, which is located on System Diskette I, is to
create and execute a batch command file to enter or exit
transparent mode. The file must contain the line
PRNMODE.COM 1 to enter transparent mode, and the line
PRNMODE.COM 0 to exit transparent mode. The batch command
file and the file COMMAND.COM must reside on the same disk
as the utility and batch file.

Entries for entering and exiting Transparent Mode can also
be added to the Applications Menu. To do this, modify the
Applications Menu data file APPMENU.DAT by using the MODIFY
SYSTEM MENUS utility. The procedure listed below describes
how to modify the Applications Menu assuming that your
system has two diskette drives. Instructions for other
configurations are given in the Wang Professional Computer
Utility Programs User Guide (700-8389).

1. Select Modify System Menus from the System Utilities Menu.

2. When the initial utility screen appears, position the
   acceptance block next to the Edit Existing Menu option.
   Enter APPMENU.DAT in the Menu File Id field. Enter the
   letter A in the On Drive field. Press EXEC twice.

3. Add an entry to the Applications Menu for turning
   Transparency mode on. To do this, press RETURN to move
   the acceptance block to the function selections. Select
   the Add New Entry option and press EXEC. Enter the line
                 Enter Transparent Mode
   in the menu display. Press RETURN, enter the following
   responses to the prompts, and then press EXEC:

   File Name: PRNMODE   File Extension: COM   Parameters: 1
   Module type: (position acceptance block next to Program)

(continued)

USING WANG PC
GENERALIZED
PRINTER DRIVERS
 (continued)

4. Add an entry to the Applications Menu for turning
   Transparency mode off. To do this, press RETURN to move
   the acceptance block to the function selections. Select
   the Add New Entry option and press EXEC. Enter the line
                  Exit Transparent Mode
   in the menu display. Press RETURN, enter the following
   responses to the prompts, and then press EXEC:

   File Name: PRNMODE   File Extension: COM   Parameters: 0
   Module type: (position acceptance block next to Program)

5. Press CANCEL. When this message appears, press EXEC:

       Press EXECUTE to update the menu definition file
       or CANCEL to return to menu without updating file.
       WARNING: FAILURE TO UPDATE MAY DAMAGE THE INTEGRITY
       BETWEEN THE MENU DEFINITION AND HELP TEXT FILES.

The process of adding these entries to the Applications Menu
is then complete.

In order for the Transparent Mode utility to be functional,
a printer driver must be installed in the file CONFIG.SYS.
If you attempt to turn transparent mode on in a system that
does not have a printer driver installed, the message
"Function was not completed" appears on the screen, and the
system returns to the Applications Menu.

Applications programmers should consider the option of
selecting transparent mode dynamically. To do so, create
an assembly language applications program which executes an
interrupt type 21h (function request). Prior to executing
the interrupt type 21h, registers must be set as follows:

       AH   44h (function number)
       AL   03h (subfunction code)
       BX   04h (file handle)
       CX   01h (count)
       DS:DX   buffer address of transparent mode command byte:
                     FCh – enter transparent mode
                     FBh – exit transparent mode

Printer Redirection Utility
Release 1.21 of the Wang PC System Software automatically
directs printed output to serial port #1 (device = PRN1) if
the serial printer driver SER1DRVR.COM is installed (i.e.
specified in CONFIG.SYS) during system initialization.
Otherwise, printed output is directed to parallel port #1
(device = PRN).

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  (continued)

The Printer Redirection utility is used to select a
particular printer port. On the Printer Support Menu
(accessed from the Main System Menu), there are three
Printer Redirection options, each of which directs printed
output to a different port:

> . Redirect to Console
> . Redirect to Parallel Port #1
> . Redirect to Serial Port #1

It will be necessary to run the Printer Redirection utility
if you have specified both PAR1DRVR.COM and SER1DRVR.COM in
CONFIG.SYS, and you want to use both the parallel and the
serial printers during one session. At that time, to use
the parallel printer for the first time, you would have to
run the Redirect to Parallel Port #1 option. If you wanted
to use the serial printer after using the parallel printer,
you would have to run the Redirect to Serial Port #1 option.

To run the Printer Redirection utility, position the cursor
by the desired option and press EXEC. The message
"Redirection Complete" appears on the screen after the
system runs the redirection program.

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VIA WANG PC BIOS
by Wang PC R&D

The Wang PC software BIOS interface allows a number of
specific system events to be trapped so that when one of
these events occurs, control may be passed to a routine
that performs special processing based upon the trapped
event. When setting a trap, the program must supply an
event index, a count, and the address of the routine to be
executed when the trap occurs. The event index specifies
which type of event (10ms timer, serial I/O, etc.) to trap.
The count specifies how many times the event must occur
before calling the special processing routine. Normally,
the BIOS will perform its regular processing for an event
before transferring control to the special processing rou-
tine. Specifying a count of zero tells the trap handler to
go directly to the special processing routine, bypassing
normal BIOS processing.

Upon completion, the set trap function returns a queue
identification (QID) number. Once the trap has been set,
it will continue trapping until it is cleared. A trap is
cleared using the clear trap function, which requires the
user to supply the QID of the trap to be cleared. It is
important for an application program that sets traps to
clear them before exiting the application. If the program
exits without clearing traps, undesirable results will occur
the next time the trapped event occurs, since control will
be passed to the address where the trap routine was located.

The BIOS interface can be used to trap input/output from
the Wang PC serial communications controller I/O ports.
When an input trap is set and a character is available for
input, an interrupt is generated and control is passed to a
routine whose address is specified when the trap is set.
This routine is responsible for inputting the character
from the serial input port and performing any associated
error checking, XON/XOFF checking, etc.

When the clear to send (CTS) signal is active and the
transmitter is not currently sending a character, enabling
the transmitter (by setting the transmit enable bit in the
communications controller's command register) generates an
interrupt. If an output trap is set, the transmit interrupt
causes control to be passed to a routine whose address is
specified when the trap is set. This routine is responsible
for sending the character out to the serial output port if
one is available and shutting off the transmitter if no
character is available. The transmitter must always be
disabled when there are no characters to be sent. Not
disabling the transmitter can effectively hang the system,
since the transmit interrupt is generated over and over
again while the transmitter is enabled.

(continued)

ASYNCHRONOUS
COMMUNICATIONS
VIA WANG PC BIOS
  (continued)

To send a break, the break bit in the command register must
be set to one and the transmitter must be turned on and
left on for the duration of the break. A break is detected
when the serial input port contains a zero and the status
register indicates that a framing error has occurred.

Note: The communications controller requires two RS-232
signals to communicate with other devices: clear to send
(CTS) is required for the PC to transmit data and data
carrier detect (DCD) is required to receive data.

There are no function calls at either the BIOS or the
MS-DOS level that allow the setting or modification of
communications protocol and data transfer speed. These may
be set by writing directly to the communications
controller's mode registers.

For more detailed information on accessing the serial
communications controller, refer to Chapter 5 of the Wang
Professional Computer Technical Reference Manual (700-8332)
and Appendix D of the Wang Professional Computer Program
Development Guide, included in package 700-8335.

For illustrative purposes, a code segment is given on the
following pages.

ASYNCHRONOUS
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(continued)

```
data            segment
out$byte                db   1 dup (?)      ; byte to be transmitted
more$bytes              db   1 dup (?)      ; flag used by serial output routine

ser$input$qid          dw   1 dup (?)      ; serial input trap queue id
ser$output$qid         dw   1 dup (?)      ; serial output trap queue id
data            ends

stack           segment stack
                dw   128 dup (?)
stack           ends

code            segment
assume          cs:code,ds:data,ss:stack

set$traps       proc near
; --------------------------------------------------------------
; code to set serial port input character ready trap

        mov   cx,0                ; set count to zero
        mov   bx,01H              ; choose serial input as event to trap
        push  ds                  ;
        mov   ax,cs               ;      make ds:dx point to the
        mov   ds,ax               ;      serial input routine
        mov   dx,offset ser$input    ;
        mov   al,02H              ; choose set event trap function
        int   088H                ; set the trap
        pop   ds
        mov   ser$input$qid,bx    ; save trap QID


; --------------------------------------------------------------
; code to set serial port output character ready trap

        mov   cx,0                ; set count to zero
        mov   bx,02H              ; choose serial output as event to trap
        push  ds                  ;
        mov   ax,cs               ;      make ds:dx point to the
        mov   ds,ax               ;      serial output routine
        mov   dx,offset ser$output   ;
        mov   al,02H              ; choose set event trap function
        int   088H                ; set the trap
        pop   ds
        mov   ser$output$qid,bx   ; save trap QID
        ret
set$traps       endp
```

(continued)

ASYNCHRONOUS
COMMUNICATIONS
VIA WANG PC BIOS
  (continued)

```
        clear$traps   proc near
; ------------------------------------------------------------------
; code to clear serial port input character ready trap

        mov  al,03H              ; choose clear event trap function
        mov  bx,ser$input$qid    ; serial input trap qid --> bx
        int  88H                 ; clear trap
; ------------------------------------------------------------------
; code to clear serial port output character ready trap

        mov  al,03H              ; choose clear event trap function
        mov  bx,ser$output$qid   ; serial output trap qid --> bx
        int  88H                 ; clear trap
        ret
        clear$traps   endp


; ------------------------------------------------------------------
; serial input routine

ser$input     proc far

        mov  dx,1080H            ; address of serial input port --> dx
        in   al,dx               ; get the input character

;  error processing, xon/xoff processing, etc. can be added here


        ret
ser$input     endp


; ------------------------------------------------------------------
; serial output routine
; This routine will be called whenever a transmit interrupt occurs.  The
; routine checks a flag (more$bytes).  If the flag is not zero, it sends the
; character in out$byte to the serial output port and zeros the flag.  When
; the application program wants to send a byte, it should first check the
; more$bytes flag.  If the flag is zero, the program should place the output
; character in out$byte and enable the transmitter.  If the flag is not zero,
; it means that the previous character has not yet been sent; therefore, the
; application program should wait until more$bytes is zero before attempting
; to send another character.

ser$output    proc far

        test more$bytes,0FFH  ; turn off transmitter if there
        jz   xmit$off         ;  are no characters to send
        mov  dx,1088H         ; address of serial output port --> dx
        mov  al,out$byte      ; byte to be transmitted --> al
        out  dx,al            ; send the byte to the port
        mov  more$bytes,0     ; reset flag
        jmp  done             ; exit routine
xmit$off:
        mov  dx,1086H         ; addr. of command register input port --> dx
        in   al,dx           ; get command register data
        and  al,11111110B    ; reset transmit enable bit to zero
        mov  dx,108EH        ; addr. of command register output port -> dx
        out  dx,al           ; turn off transmitter
done:   ret
ser$output    endp
```

(continued)

ASYNCHRONOUS
COMMUNICATIONS
VIA WANG PC BIOS
(continued)

```
;   ------------------------------------------------------------------
; set protocol and baud rate and initialize command register

set$protocol  proc near

; The communications controller's two mode registers are written through
; the same port.  The first write to the mode register port accesses mode
; register 1, the second write accesses mode register 2.  Reading the
; command register assures that the next write to the mode register port
; will access mode register 1, so this is done for initialization purposes.

        mov   dx,1086H        ; load read command register
                              ;   port address
        in    al,dx           ; read the command register

; The following code programs the mode registers and the command register
; with sample values.  See tables in chapter 5 of WPC Technical Reference
; Manual for complete list of possible register values

        mov   dx,108CH        ; load write mode register
                              ;   port address
        xor   al,al           ; clear al register
        or    al,00000001B    ; bits 1,0 determine clock rate
                              ; '01' -- > async. communications at
                              ; clock rate
        or    al,00001000B    ; bits 3,2 determine # of data bits
                              ; '10' ---> 7 data bits
        or    al,00010000B    ; bit 4 controls parity checking
                              ; '1'  --> parity checking on
        or    al,00100000B    ; bit 5 determines even/odd parity
                              ; '1'  --> even parity
        or    al,01000000B    ; bits 7,6 determine # of stop bits
                              ; '01' --> one stop bit
        out   dx,al           ; program mode register 1

        xor   al,al           ; clear al register
        or    al,00000111B    ; bits 3,2,1,0 determine baud rate
                              ; '0111' ---> 1200 baud
        or    al,0001000B     ; bit 4 determines which clock to use
                              ; '1'  --> use internal clock
                              ; '0'  --> use external receiver clock
        or    al,00100000B    ; bit 5 determines which clock to use
                              ;   for transmitter
                              ; '1'  --> use internal transmit clock
                              ; '0'  --> use external transmit clock
                              ; bits 7,6 are unassigned
        out   dx,al           ; program mode register 2

        mov   dx,108EH        ; load write command register
                              ;   port address
        xor   al,al           ; clear al register
        or    al,00000110B    ; enable receiver and set /DTR to 1
        out   dx,al           ; program command register
        ret

set$protocol  endp
code          ends
              end
```

CUMULATIVE INDEX

(continued)

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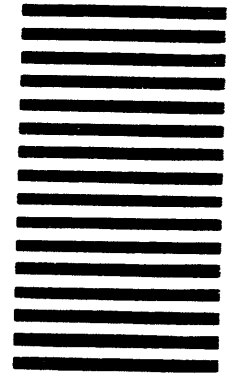
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