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VOLUME VIII ISSUE III • Devoted to the 68XX User • March 1986

"Small Computers Doing Big Things"

SERVING THE 68XX USER WORLDWIDE

YSS 1
NM 2
IRQ 3
FIRQ 4
BS 5
SA 6
VCC 7
A0 8
A1 9
A2 10
A3 11
A4 12
A5 13
A6 14
A7 15
A8 16
A9 17
A10 18
A11 19
A12 20

40 XTAL
39 XTAL
38 RESET
37 VMA
36 VMA
35 IO
34 IO
33 BUSY
32 BUSY
31 BUSY
30 BUSY
29 BUSY
28 BUSY
27 BUSY
26 BUSY
25 BUSY
24 BUSY
23 BUSY
22 BUSY
21 BUSY

MC68095 CPU

D4 1
D3 2
D2 3
D1 4
D0 5
AS 6
UD 7
LD 8
B 9
DYACK 10
BG 11
BGACK 12
BR 13
VCC 14
CE 15
GND 16
HAB 17
RESET 18
VMA 19
EC 20
VMA 21
BERR 22
FV 23
IR 24
FV 25
FC 26
FC 27
FC 28
A1 29
A2 30
A3 31
A4 32

64 D6
63 D6
62 D7
61 D8
60 D9
59 D10
58 D11
57 D12
56 D13
55 D14
54 D15
53 D16
52 A9
51 A9
50 A9
49 VCC
48 A0
47 A9
46 A9
45 A7
44 A9
43 A15
42 A14
41 A13
40 A12
39 A11
38 A10
37 A9
36 A9
35 A7
34 A8
33 A6

MC68000 CPU

YSS 1
NM 2
IRQ 3
FIRQ 4
BS 5
SA 6
VCC 7
A0 8
A1 9
A2 10
A3 11
A4 12
A5 13
A6 14
A7 15
A8 16
A9 17
A10 18
A11 19
A12 20

40 XTAL
39 XTAL
38 RESET
37 VMA
36 VMA
35 IO
34 IO
33 BUSY
32 BUSY
31 BUSY
30 BUSY
29 BUSY
28 BUSY
27 BUSY
26 BUSY
25 BUSY
24 BUSY
23 BUSY
22 BUSY
21 BUSY

MC6809 CPU

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MUSTANG-020 Super SBC™



We Proudly Announce the **MUSTANG-020 Super SBC***
"The one with the **REAL KICK!**"
Only from DATA-COMP



MUSTANG-020 System Prices Effective November 1985

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...

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This is the NCC, world beater GMX SBC, in a super configuration. Data-Comp has mated it to a power plus power supply/stylish cabinet and your choice of floppy and/or hard disk drives. Available in several different configurations. (1) single board. (2) single board and regulators for your cabinet or mainframe and power supply. (3) single board - power supply and cabinet - your disk drives. (4) single board - power supply/cabinet - our drives configured to your specs, and ready to run. OS9 68K will be available as well as several other popular operating systems. Also all the popular OS9 68K software and Motorola 020-BUG will be available at a very reasonable price.



This system is the state-of-the-art star-ship. It runs **rings** around any other 68XXX SBC, and most mainframes. The speed and expanded RAM make this the "best buy" by a far stretch! A **true** multi-user, multi-tasking computer. So far advanced that even the experts don't call it a micro. Compared to the others, it isn't even a "horse race." And the price is certainly right. You can bet on this one!

So, will it be Turtle or Thoroughbred?



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Discounts Available**



* Mustang-020 is trademark of Data-Comp-CPI

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FOREIGN ADD 5%
MIN. \$2.50

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For Ordering
TELEX 5106006630

MUSTANG-020 Super SBC™

Mustang 020 Features

- 12.5 Mhz MC68020 full 32-bit wide path Processor
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 - Enhanced instruction set - Coprocessor interface
- Optional 68881 Floating point Coprocessor (12.5 Mhz)
 - Direct extension of 68020 instruction set
 - Full support of IEEE P754, draft 10.0
 - Transcendentals and other math functions
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- Up to 256K bytes of EPROM (64K X 32-bits)
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 - Software programmable baud rates to 19.2K
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 - Optional network interface on one port
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- Expansion Connector for Additional I/O Devices
 - 16-bit data path
 - 256 byte address space
 - 2 interrupt inputs
 - Clock and Control Signals
- Time-of-Day Clock/Calendar w/battery backup
- Controller for up to Two 5 1/4" Floppy Disk Drives
 - Single or double sided
 - Single or double density
 - 48 or 96 tracks per inch (40/80 Track)
- Mounts Directly to a Standard 5 1/4" Disk Drive
- SASI Interface for Intelligent Hard Disk Controllers
- Programmable Periodic Interrupt Generator
 - For time-slicing and real-time applications
 - Interrupt rates from microseconds to seconds
 - Highly Accurate timebase (5 PPM)
- 5-bit sense switch, readable by the processor
- Hardware single-step capability

MUSTANG-020 Benchmarks **

Type System	32 bit Int. Loop	Register Long Loop
IBM AT 7300 Xenix Sys 3	9.7	No Registers
AT&T 7300 UNIX PC 68010	7.2	4.3
DEC VAX 11/780 UNIX Berkley 4.2	3.6	3.2
DEC VAX 11/750 " " "	5.1	3.2
68008 OS9 68K 8 Mhz	18.0	9.0
68000 " " 10 Mhz	6.5	4.0
MUSTANG-020 68020 MC68881 OS9 16 Mhz	2.2	0.88
MUSTANG-020 68020 MC68881 UNIFLEX "	1.8	1.22

```

** Loop: Main()
{
    register long i;
    for (i=0; i < 999999; ++i);
}

```

Estimated MIPS - MUSTANG-020 - 2.5 MIPS
Motorola Specs: Burst up to 7 - 8 MIPS - 16 Mhz

(615)842-4600
Telex 5106006630

For a limited time we will offer \$400 Trade-In on your old Q--- 68008 or 68000 SBC, must be working properly and complete with all software and cables. Call for more information!

** ACTION PROVEN **

The MUSTANG-020 is already on the job! And winning acclaim in industry, commerce, business and several government agencies. The delivery times were close to schedule. We are hearing back nothing but praise (and more orders). If you are considering the purchase of a Mustang-020, be advised that the price will increase in the second quarter of this year.

Experienced users are awed at the tremendous power and speed of the Mustang-020, from Data-Comp. Especially when compared with other 68XXX systems. Not only is it more practical than all the others, but it is much more cost efficient. Compare it to any other 68XXX and you will see why!

Dual 5" 80 trk. Floppy No Winchester

Winchester & 1 Floppy

020 Board	\$2750.00		\$2750.00
Cabinet	269.95		269.95
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Total System	\$3949.80	Winchester cable	39.95
Less 5%	-197.49	Winchester controller	395.00
	\$3752.31	10 MegByte Winchester	695.00
S/H UPS	20.00	Total System	\$4809.80
Total	\$3772.31	Less 5%	-240.49
		S/H UPS	\$4569.31
		Total	\$4589.31
		With 20 MegByte Winchester Add:	200.00
NOTE: 68881 Co-Processor	Add \$495.00		
UnifLEX	\$450.00		
less \$350.00 (OS-9)	Add \$100.00		
			\$4789.31

Prices and Specifications subject to change.

Mustang-020 Software

OS-9

OS-9.....	\$350.00
Basic09.....	300.00
C Compiler.....	400.00
Fortran 77.....	*400.00
Pascal Compiler.....	400.00
OMEGASOFT-PASCAL.....	900.00
Style-Graph.....	495.00
Style-Spell.....	195.00
Style-Merge.....	175.00
SCULPTOR+.....	*Call
COM.....	*Call

** See discount below

UnifLEX

UnifLEX.....	\$450.00
Screen Editor.....	150.00
Sort-Merge.....	200.00
BASIC/PreCompiler.....	300.00
C Compiler.....	350.00
COBOL.....	750.00
Fortran 77.....	450.00
SCULPTOR+.....	*Call

** See discount below

* New items

Standard system shipped 12.5 Mhz
Add for 16 Mhz..68020....\$400.00
Add for 16 Mhz..68881....\$400.00
8 Port expansion board use two total of 20 RS232 ports wired & Tested.....each....\$498.00

SCULPTOR+..We are USA distributors for SCULPTOR+. Call or write for site license or multiple discounts.

** Software Discounts

Call for software discounts from 10-70% for buyers of these systems, from Data-Comp. Limited offer. Call!



```

ELSE
  target:=""
ENDIF
(*
(* Open the file, read in lines from the text
(* and process them.
number:=0
characters:=0
words:=0
OPEN #path,pathname:READ
WHILE NOT(EOF(#path)) DO
  READ #path,line
  number:=number+1 \REM Count lines
  characters:=characters+LEN(line)
  inword:=FALSE \REM count words
  FOR i:=1 TO LEN(line)
    IF MID$(line,i,1)="" THEN
      inword:=FALSE

```

```

ELSE
  IF inword=FALSE THEN
    inword:=TRUE
    words:=words+1
  ENDIF
NEXT i
IF search THEN \REM Print target lines
  IF SUBSTR(target,line)<>"" THEN
    IF numberit THEN
      PRINT USING "IS",s,number," ";
    ENDIF
    PRINT line
  ENDIF
ELSE \REM or print all lines
  IF numberit THEN
    PRINT USING "IS",s,number," ";
  ENDIF

```

```

PRINT line
ENDIF
ENDWHILE
CLOSE #path
(*
(* Finish with necessary line, word and
(* character counts
PRINT
IF linecount THEN
  PRINT USING "Lines read: ",linecount,number
ENDIF
IF wordcount THEN
  PRINT USING "Words read: ",wordcount,words
ENDIF
IF charcount THEN
  PRINT USING "Characters read: ",charcount,characters
ENDIF
END

```

MUSTANG - 020

"C" "Real" Life Test



For the past few months you might have noticed that I have not said a lot concerning our **MUSTANG-020 68020** system. Despite it being the fastest system for anywhere near the money of **ANYTHING** presently available.

Also you will be seeing a lot of "benchmarks" of this system as opposed to others. Every day we run all sorts of neat testing routines. However, of all those we have used or published, I have yet to include one in any programming I have done. They are just **not** "real life" type procedures. They are fine for comparison, but what I (and you) really want to know is - how does it evaluate to "daily" usage? In other words, "what does it really do, doing the things you and I do daily with a computer? So, just for you and me, I conducted the following, very unscientific "benchmark" series.

The K & R Benchmark (sorta)

I extracted from K&R the "list" program. The changes I made were to replace the "printf" function with "puts", see listing below. Also for the 68020 I declared 'c' to be "register", but not "long", I wanted to give the others fair "shake" on this test. Otherwise it is fairly "stock K&R".

The times indicated below are pretty well what I expected. The more I/O you do, the slower the operation. Note that the floppy times for both the level II 6809 and floppy 68020 are very close. Surprised? Well you shouldn't be, practically all the time is spent reading and writing to the disk. So, it make little difference how rapidly the CPU handled the code, it still sat around a relatively long time waiting for disk reads and writes.

This is very pronounced for short source programs and compilers. The compiler must load and unload the same data for floppy or ramdisk operations. However, as the code gets longer (or more complex) the differences in speed becomes more apparent.

For a source program of 240 lines as opposed to our very simple list program, the difference gets real one-

**As more time
is spent
computing code
and less time
doing I/O,
the real advantage
of the 68020
becomes very
apparent !!**

sided. As more time is spent computing code and less time doing I/O, the real advantage of the 68020 (or any more efficient CPU) becomes very apparent!

... if you do anything
beyond the very
simple,
the Mustang -020 ...
is far
Superior !!!

**** Three New Options ****

For example the 240 line program (no fancy math) mentioned above still compiles, on the MUSTANG-020 68020 system, in RamDisk, in about 4.3 seconds. Less than twice the time but about 12 times more code and work. The point being, "the larger and more complex the task, the more efficient the better CPU". The spread continues to expand as the task becomes larger or more complex.

So here are my results, done in a very unscientific manner. But they do reflect what I and most of you do, reasonable things, not too simple and not overly complex (on the surface, that, is).

6809 1 mhz OS9 level I floppy 2 milsec step 3 min 28 sec	
" 2 " " " II " " " " 1 min 49 sec	
" " " " HardDisk	44.2 seconds
" " " " RamDisk	28.4 seconds
68020 12.5 mhz OS9 68K floppy 2 milsec step 1 min 03 sec	
" " " " HardDisk	18.6 seconds
" " " " RamDisk	2.8 seconds

The systems used:

6809 Level I OS9	Sardis SBC (CoCo OS9)
6809 Level II OS9	GIMIX III
68020 Level 1 OS9 68K	MUSTANG-020

All three systems were running the latest (we have) of the Microware 'C' compiler. The source was unchanged from system to system.

The Level I's much slower times are not completely a fault of the compiler or the CPU. Because of memory constraints, the compiler, in this version is in two parts. Actually this (Sardis) is a more efficient Level I than most other Level I systems (more RAM available). Also more temporary files are required to be built (and deleted) by all Level I systems. Actual CPU times were much closer. But nevertheless, it still took far more 'real time'. And that is what **REALLY** counts - **REAL TIME!!**

So if you do anything beyond the very simple, the MUSTANG-020 68020, with a full 2,000,000 plus bytes of RAM is far superior.

Compared to several 68008 and 68000 systems we have tested, the MUSTANG-020 is still as much as 18-20 times faster. Which means that your 6809 will even 'whip-up' on them (68008/68000) in many applications. But for real 68XXX power, the 68020 is, by far, **KING OF THE HILL!**

Some More New Stuff

By the time this gets to you, we should be fairly well into our port expansion options. As of now there will be three options, not including the standard pre-wired 4 serial port card and cable, which is included with all Mustang-020 systems.

The first is an additional 8 port expansion pre-wired, standard DB25 connectors. This consists of the main board adaptor, cable and two additional pre-wired four port serial cards. You can install more than one of these. As all options - no soldering or wiring - everything pre-wired, burned-in and ready to plug on.

Also coming in the next 60 or so days is an expansion card containing DB9 serial connectors, pre-wired with adaptor connector, dc-dc converter and all necessary hardware. The pin-outs are identical to the IBM AT. This means that if you want to hook up a "local computer store" serial anything (that works on the IBM AT) you can buy IBM AT cables, and say a modem, for instance, simply plug them into the MUSTANG-020 DB9 connectors, and go.

We have tried to take all the hassle out of bringing up or using this system. We (CPI, Data-Comp) listen to what you tell us! That is why we have packaged up for you our readers, the most powerful system available, and at prices others can't touch! **The MUSTANG-020, from Data-Comp, is the most powerful, and least expensive system available -ANYWHERE!!!!!!!!!!!!!!**

Because of the various options, we will be delivering several different cabinet configurations. Each designed to accept additional ports, boards (expansion RAM, CAD, etc.) allowing future expansion of the system.

The basic system, consisting of the main board, hard disk controller board, winchester (1), floppy (1) and all cables and power supply (switching), and standard cabinet (MO20 cabinet). IF you think that you will be expanding the system after delivery, then I suggest you consider starting out with one of the larger cabinets. The price difference between smallest to largest presently available cabinets will be less than \$100. Just though you might like to know.

And of course, as is the Data-Comp promise to try to make it the best they can for our readers - you can buy any or all parts as you need them.

DMW

- - -

```
/* A C listing program - very simple and basic */
#include <stdio.h>
main (argc,argv)
int argc;
char *argv[];
{
    register char c;
    FILE *fl, *fopen();

    if (argc !=2){
        puts("\n Usage:  $ list filename");
        exit (1);
    }

    if (<<fl = fopen(argv[1], "r")>> == NULL){
        puts("Can't open called file");
        exit (1);
    }

    while (<<c =getc(fl)>> != EOF)
        putchar(c);

    fclose(fl);
}
```