SOUTH AUSTRALIAN

MICROPROCESSOR GROUP

P.O. BOX 113,
PLYMPTON, S.A. 5038
TEL. 278 7288

Meetings held at
THEBARTON HIGH SCHOOL
ASHLEY ST., THEBARTON

NEWSLETTER

Vol. 1. No. 1.
April/may 1979 Newsletter. *Mail Box*, ...P.O. BOX 113, PLYMPTON S.A.

Welcome to the first issue of the proposed bi-monthly newsletter. We hope to keep you up to date on group events coming up and short articles on Microprocessors and associated goodies.

Firstly, I am sure you will all join me in thanking Clive Pearson and John Moffatt for their past efforts in running the group and I hope we can maintain the same high standard in the meetings to come.

The questionnaire completed at the March meeting was a thorough success, we have compiled a list of popular group activities, and hopefully we will be covering them all this year. Anybody wishing to fill in one of the forms can pick one up from any committee member at the next meeting.

In the newsletter, we are going to start columns on the various micro-systems e.g. S.W.T.P., TRS 80, Apple, &etc. To do this we would like to hear from anyone who could perhaps submit an article or two on their system and software. The sort of things we would like could include construction problems, or lack of, I/O requirements, monitor configuration, and stuff like that.

We also plan a "Wanted to buy/sell/exchange", column so anyone wishing to advertise their unwanted equipment, or buy second hand gear, can give the details to any committee member or write to S.A.M.G. *mail box*.

Our next meeting on the 20th of April at 7.30pm. is a "bring your own system", evening. To make this event a success, we would like to see as many systems brought along as possible, working or not. At the start of the April meet we will also start the arrangements for a small elementary Logic, Software/Hardware instruction group. Anyone interested in joining this group can see Bob Stunell or Eric Clarke at the beginning of the evening, or drop a line to S.A.M.G. *mail box*.

Lastly if you know of anyone who may be interested in joining the group then by all means, bring them along to the next meeting, or give them our mailing address. If they are not able to attend meeting because of travelling distance etc. then a $5 member fee will entitle them to group facilities, newsletters, etc. So , see you at the April meeting.

THIS NEWSLETTER IS PRINTED, FREE OF CHARGE
WITH COMPLIMENTS OF: THE MICRO SHOP, BOX 207, GAWLER.

1. YOUR COMMITTEE FOR 1979

CHAIRMAN: Eric Clarke Work phone 278 7288
SECRETARY/TREASURER: Bob Stunell Work phone 3525811

COMMITTEE MEMBERS:

Tony Beresford
Bob Daniells
Howie Harvey
Rick Matthews

2. THE GROUP V.D.U.

An order on behalf of the group has been placed for a V.D.U. board and parts. When this arrives we will be looking for volunteers to construct this project. When combined with the 2650 C.P.U. board already owned by the group we will have a system that will enable members who do not own one to gain experience in microprocessor fundamentals.

3. INCORPORATION OF THE GROUP

This procedure still grinds on slowly. Progress is being made through the many forms which must be typed and then completed.

4. NEW MEMBERS

At the last meeting there were 12 new members. We welcome you to the group and assure you that the receipt book will be at the next meeting. Seriously though, the group is for you, please let us know what you want of the meetings and the news-letter.

P.S. If you are not financial, new member or old, bring $5 to the next meeting and go home with a clear conscience.

5. HEY-YOU!!!!!!

Ever heard that at one of the meetings? I hope not, but it can happen as a group has new members. Lets get to know each other by name. You can help by wearing a name-tag. It does not have to be as elaborate as Eric's engraved special, but a simple piece of cardboard held on by a pin will ensure that members will not have to say .....HEY-YOU!!!!!!

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**************************************
*                                    *
*  I am _____                        *
*                                    *
*                                    *
*    a member of                     *
*                                    *
* The S.A. Microprocessor Group.     *
*                                    *
*                                    *
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THE CP/M SYSTEM

by Tony Beresford

CP/M is a portable operating system written for 8080 based Microcomputers with one or more floppy disk drives. It is probably the most common disk operating system for such systems.

The system has been written so that the parts of the programme which actually use your input-output devices are quite separate from the rest of the program, and are in a known location. You have to provide subroutines to input and output single characters to your console device (crt keyboard or telytype) and also to do the primitive functions for your disk system such as selecting a given drive , moving the head to a given track, reading or writing a particular sector.

The rest of the program has a standard way of accessing the primtive functions, and a simple and uniform way is provided for user programs to get at the primitive functions and some other basic facilities the program provides such as display a string of characters in a given memory location ending in a '$' .

CP/M is made up of three distinct parts. The section called the CCP is the section which responds to commands from the console and provides input buffering and some editing facilties for command lines. The second section is called BDOS, it provides a means of dividing the available space on the floppy disks in a manner which removes worries about sectors and tracks. Instead the disk is divided up into files which are known by name, and you can read and write to a file randomly or sequentially without knowing the position of the block of information on the disk, just its logical location in the file. The third section is called BIOS and is the part provided by the user for the particular system. I have already discussed it above. Bios can be easily changed when you change your system. I have had three different ones already and am just working on a fourth to use the eti 640 video board as output instead of the eme-1 which is what i am using for a video display at the moment.

The biggest factor which induced me to buy CP/M for my NORTH STAR disk system was the large range of software alreaedy available in the CP/M format. I intend buying an 8" disk system now because i have found CP/M so useful, but i find the limitations on available space on the mini-floppy irksome. I think other members of the group who have the sd sales version of CP/M may also run into space limitations if they use either large assembly langauge programs or moderate size BASIC programs.

There is a large range of system software available. I have three BASICs ,tarbell BASIC, CBASIC-1, and BASIC-e. I also have a Fortran compiler, which includes an assembler which produces relocatable object code and the necesaary linking loader and library manager . For the data processing types I know of 2 COBOL compilers and there is a variety of assemblers with differing functions and expense!

The largest provider of such system software in both variety and differing formats would have to be Life Boat Associates. they do not write software themselves but they certainly advertise the widest selection , and they provide it in CP/M format for all the most common personal computer disk systems. I suggest you see their advertisement in 'byte' for march 79 (page 30).

Most applications programs that are advertised nowadays that are not for packaged systems (e.g. trs80 or exidy) will sell a version on at least 8" CP/M disk if not in the other formats. I have for example a mailing list system NAD and the TEX text formating program (from originators of CP/M, Digital research) ,other examples that spring to mind are the text formater from Technical Systems Consultants, and the data base program 'whatsit' , of which i have the North Star basic version, but there is a CBASIC version as well. Their are now advertised several sets of business programs on CP/M to do accounting and payroll functions for small bussiness's. If any of you are thinking of using such things , I suggest you read 'interface age' for the last 6 months about the pitfalls involved.

The CP/M users group is an organization of users of CP/M which provide , on subscription access to 33 standard IBM formated disks with many programs on them that are both useful and interesting. Bob daniels and myself have bought quite a few. I was basically looking at some of the new languages and compilers on them , such as the FORTH like language STOIC and the Algol like compiler ALGOL/M.A very good feature of these disks is that they all include the documentation on the disk itself, so much easier than sending an ordinary manual if one has a printer.

I must apologize for the lack of right hand justification in this article but I do not know TEX well enough yet to use it properly so i have just used CP/M editor Ed to write and correct this text. The listing was then transferred to my KSR43 using the Peripheral Interchange Package , PIP for short, with the command LST:=newsl.txt[t8} .

LST: indicates the printer logical device
newsl.txt is the name of this file
[t8} passes a message to PIP to expand tab's every 8 columns.

FOR SALE Spare s-100 boards

1 imsai 4k eprom board for 1702a eproms with 2 eproms
$100

1 imsai PIC-8 priority interrupt and timer board
hardware programable for time interrupt
also has single bit output line which can be used to generate audio tones under program control.
$120

1 eti 640 video board assembled and working
original manual and assembly listing of i/o routine supplied (true assembly listing)
$100

A Beresford 79 2936 after hours

Diskettes, Disk Jockeys, and Dynamic RAMs.

By Bob Daniells

Although audio cassettes are a relatively cheap and reliable mass storage media for short programs in machine code, their lack of random-access capabilities and slow data transfer rate make them generally unsuited for storing files. For example, if you use cassettes as a file storage device for an assembly language program development system, you can handle source files that are larger than the available RAM in your computer, but remember that each source file must be scanned twice by the assembler. Waiting for the start of a source file to be found on tape, scanned once, manually rewound, and scanned again soon becomes very tedious to the extent that it is easy to lose concentration, and to forget just what it is you are trying to achieve.

By adding one or more floppy disk drives to your computer, together with a suitable controller, and appropriate operating system software, you can make it much more convenient to use for a variety of applications, and it will behave more like the fun machine that it should be. A double-sided, 8" floppy holds over 600 kilobytes in the standard IBM soft-sectored format; about the same amount as both sides of a C90 cassette. Finding the start of a file on the diskette takes typically less than one second in random access, compared with anything up to one and a half hours with the cassette. Once the file is located, data is transferred from the diskette at a rate of more than 200 times that of a cassette running at 1200 Bauds! Double-density floppies give you an even greater capacity and data rate.

The floppy disk system that I eventually selected for my computer consists of one Shugart SA851, 8", double-sided drive, and a Thinker Toys "Disk Jockey" controller and, of course, the CP/M diskette operating system.

The SA851 drive has a pair of heads that load onto both sides of a diskette simultaneously. It can be set up to handle a variety of data formats, including a choice of hard or soft sectoring, and single or double density. (At present I am using the IBM 3740 soft-sectored single-density format.)
The head carriage on the SA851 is driven by a split steel band attached to a stepper motor spindle. Each half of the steel band wraps in the opposite direction to the other on the spindle so there is no resultant spring tension in one direction or the other. This "Fastflex" actuator permits a track-to-track access delay of about 3 mS compared to 10 mS for the earlier lead screw arrangement.

The DJ controller is a kit version of the one that is used in the Discus 1 package sold by George Morrow under the Thinker Toys brand. It will cater for up to four 8" or 5.25" drives, using soft-sectored media.
The DJ controller is a little unusual in that it uses processor wait states to synchronize data transfers to and from disk rather than DMA techniques. Since 16k of RAM in my computer was of the dynamic type at the time I ordered the controller, I was keen to avoid DMA if possible.

Using DMA principles with dynamic RAMs can cause problems due to clashes between DMA data transfers and refresh cycles. When I purchased my IMSAI kit there were not many 16k cards available, and static types were in short supply, so I had to settle for a Dynabyte card which is one of the "transparent refresh" dynamic types. Although the Dynabyte RAM appears to be specifically designed for DMA operation, the documentation that comes with it lists known incompatabilities with at least one diskette system.

Why is it necessary to resort to DMA techniques or wait states for diskette data transfers? Well, diskettes are just too fast to use with conventional I/O methods whereby the processor runs in a loop and repeatedly checks to see if the peripheral device is ready. Consecutive data bits on a single-density 8" diskette are spaced at intervals of only 4 microseconds.

The wait state synchronization method used by the DJ controller is delightfully simple in principle, and it works well in practice. The DJ uses 1k of the computer's memory map nominally based at E000 hex. (This area can be moved by changing a PROM if necessary). Half of this area is used for controller routines in an on-card PROM, and the remainder is split into two, 256 byte pages, one of which is used as a data buffer (RAM), and the other is used for memory-mapped I/O registers. There are four readable I/O registers, and four others are write-only. The readable registers cater for reading data bytes, detecting marks that indicate the start of each sector, reading the diskette drive status (ready, head loaded, track zero, etc.), and loading the head. One bit of the read status register is used as the input leg of a 1200 Baud serial port for a VDU or similar terminal. The write-only register functions include writing data bytes, writing sector marks, drive control functions such as drive select, step heads, etc., and the output leg of the serial I/O port.

As an example of how these hardware registers are used, assume that the heads have been loaded onto the diskette surface, and are positioned over a previously selected track and sector, such that all is ready for a data read operation. To read a byte of data it is necessary only to execute a memory read instruction from location E300H, which is the address of the "read-data" hardware register. For example, we could load H,L register pair with E300H, and then execute a MOV A,M instruction. This causes logic associated with the read-data register to pull the CPU ready line low, thus putting it into a wait state. The read-data register is actually an 8-bit shift register that accepts the data bits from the diskette (after they have been separated from the associated clock bits), and when the register is full, logic attached to the disk data register takes the ready line high again, thus terminating the wait state. At this time the data is available on the data bus, and completion of the instruction cycle puts it in the accumulator. Note that, as far as the CPU is concerned, the diskette looks the same as any other memory location, except for a relatively slow access time of about 32 microseconds per byte. Of course, it is not necessary to work at the level of the individual hardware registers in a typical diskette operating system, as more powerful routines are provided in the DJ's PROM firmware, and these can all be accessed by a common entry point and specified function numbers if CP/M is used.

Getting the system going was not all plain sailing. At first, the system would not perform any read or write operations, and after spending several hours checking the controller, I began to (reluctantly) suspect the drive. Close inspection showed that one of the heads had been shattered. The damaged one was on the side nearest the chassis, where it is not readily visible, so that I did not notice this when I took delivery. Fortunately, the local distributor supplied a replacement drive at

no charge, despite the fact that I had had the original unit for several weeks while waiting for the controller kit to arrive. With the replacement drive, data from the diskette as viewed on a CRO looked much healther, but I could still not boot in CP/M. Further analysis with the CRO showed that the controller was finding the correct track and sector, and the mark that indicates the start of the sector, but was not recovering from the wait state triggered by the first byte of data until about half way through the sector. Following this point it was reading only every second byte spread over several sectors! I tried copying some of the DJ's firmware into RAM and inserting appropriate breakpoints, but this only confirmed the CRO picture and gave me no clue as to the cause. At this stage I returned the assembled controller to the supplier, who quickly advised that there was nothing wrong with it.

Eventually the problem turned out to be associated with a "Bytesaver" PROM card that normally sits in my computer at E000H, the same address as the DJ firmware ROM. I had removed a PROM from this slot, but overlooked the fact that the Bytesaver generates wait states as part of its PROM programming function and these were interfering with the DJ. Why hadn't I removed the Bytesaver card altogether before this? Well, the monitor that I was using to help me debug the system sits on this card at E400H! A classic case of the corollary to Murphy's Law which states that "any debugging system will always introduce more bugs than it helps to locate."

Once the Bytesaver card was removed, CP/M booted in first time, and I was sure that my problems were over. Not so. The system was terribly unreliable. Diskettes would get overwritten for no apparent reason, and data in files changed unexpectedly. You will recall that I wanted to avoid DMA principles due to possible incompatibilities with dynamic RAM. Would you beleive it? The Dynabyte RAMs don't maintain refresh during wait states, despite claims of no known problems with devices using wait states!! The refresh logic looked fairly complex, and the Dynabyte is supplied in assembled form without a circuit diagram, so I gave up on attempts to modify it and substituted a static card instead. If you are contemplating adding memory to your system, I would strongly recommend that you avoid dynamic types. Fortunately, statics are now readily available, and dynamics offer no cost or power dissipation advantage as they once did. (A "Superram" kit now costs only $299, compared with $550 for the assembled Dynabyte, and it runs much cooler).

Was the effort of adding a diskette system worth it? Well, I certainly think so. The general increase in speed of communication between the computer and me has made it more fun to use. I still use cassettes for keeping backup copies of files, and to enable me to copy diskettes in a one drive system. When I can afford it I might add another drive, but my next priority must be a faster printer.
My poor old Model 15 Teletype would take about 38 hours to dump the contents of one full diskette!

HEX TO DEC CONVERSION

HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC
00	00000	000	34	13312	052	68	26624	104	9C	39936	156	D0	53248	208
01	00256	001	35	13568	053	69	26880	105	9D	40192	157	D1	53504	209
02	00512	002	36	13824	054	6A	27136	106	9E	40448	158	D2	53760	210
03	00768	003	37	14080	055	6B	27392	107	9F	40704	159	D3	54016	211
04	01024	004	38	14336	056	6C	27648	108	A0	40960	160	D4	54272	212
05	01280	005	39	14592	057	6D	27904	109	A1	41216	161	D5	54528	213
06	01536	006	3A	14848	058	6E	28160	110	A2	41472	162	D6	54784	214
07	01792	007	3B	15104	059	6F	28416	111	A3	41728	163	D7	55040	215
08	02048	008	3C	15360	060	70	28672	112	A4	41984	164	D8	55296	216
09	02304	009	3D	15616	061	71	28928	113	A5	42240	165	D9	55552	217
0A	02560	010	3E	15872	062	72	29184	114	A6	42496	166	DA	55808	218
0B	02816	011	3F	16128	063	73	29440	115	A7	42752	167	DB	56064	219
0C	03072	012	40	16384	064	74	29696	116	A8	43008	168	DC	56320	220
0D	03328	013	41	16640	065	75	29952	117	A9	43264	169	DD	56576	221
0E	03584	014	42	16896	066	76	30208	118	AA	43520	170	DE	56832	222
0F	03840	015	43	17152	067	77	30464	119	AB	43776	171	DF	57088	223
10	04096	016	44	17408	068	78	30720	120	AC	44032	172	E0	57344	224
11	04352	017	45	17664	069	79	30976	121	AD	44288	173	E1	57600	225
12	04608	018	46	17920	070	7A	31232	122	AE	44544	174	E2	57856	226
13	04864	019	47	18176	071	7B	31488	123	AF	44800	175	E3	58112	227
14	05120	020	48	18432	072	7C	31744	124	B0	45056	176	E4	58368	228
15	05376	021	49	18688	073	7D	32000	125	B1	45312	177	E5	58624	229
16	05632	022	4A	18944	074	7E	32256	126	B2	45568	178	E6	58880	230
17	05888	023	4B	19200	075	7F	32512	127	B3	45824	179	E7	59136	231
18	06144	024	4C	19456	076	80	32768	128	B4	46080	180	E8	59392	232
19	06400	025	4D	19712	077	81	33024	129	B5	46336	181	E9	59648	233
1A	06656	026	4E	19968	078	82	33280	130	B6	46592	182	EA	59904	234
1B	06912	027	4F	20224	079	83	33536	131	B7	46848	183	EB	60160	235
1C	07168	028	50	20480	080	84	33792	132	B8	47104	184	EC	60416	236
1D	07424	029	51	20736	081	85	34048	133	B9	47360	185	ED	60672	237
1E	07680	030	52	20992	082	86	34304	134	BA	47616	186	EE	60928	238
1F	07936	031	53	21248	083	87	34560	135	BB	47872	187	EF	61184	239
20	08192	032	54	21504	084	88	34816	136	BC	48128	188	F0	61440	240
21	08448	033	55	21760	085	89	35072	137	BD	48384	189	F1	61696	241
22	08704	034	56	22016	086	8A	35328	138	BE	48640	190	F2	61952	242
23	08960	035	57	22272	087	8B	35584	139	BF	48896	191	F3	62208	243
24	09216	036	58	22528	088	8C	35840	140	C0	49152	192	F4	62464	244
25	09472	037	59	22784	089	8D	36096	141	C1	49408	193	F5	62720	245
26	09728	038	5A	23040	090	8E	36352	142	C2	49664	194	F6	62976	246
27	09984	039	5B	23296	091	8F	36608	143	C3	49920	195	F7	63232	247
28	10240	040	5C	23552	092	90	36864	144	C4	50176	196	F8	63488	248
29	10496	041	5D	23808	093	91	37120	145	C5	50432	197	F9	63744	249
2A	10752	042	5E	24064	094	92	37376	146	C6	50688	198	FA	64000	250
2B	11008	043	5F	24320	095	93	37632	147	C7	50944	199	FB	64256	251
2C	11264	044	60	24576	096	94	37888	148	C8	51200	200	FC	64512	252
2D	11520	045	61	24832	097	95	38144	149	C9	51456	201	FD	64768	253
2E	11776	046	62	25088	098	96	38400	150	CA	51712	202	FE	65024	254
2F	12032	047	63	25344	099	97	38656	151	CB	51968	203	FF	65280	255
30	12288	048	64	25600	100	98	38912	152	CC	52224	204			
31	12544	049	65	25856	101	99	39168	153	CD	52480	205			
32	12800	050	66	26112	102	9A	39424	154	CE	52736	206			
33	13056	051	67	26368	103	9B	39680	155	CF	52992	207			