Dear 2650 Computer Circuit Board Customer:

Below are several changes that you can make to the en-'
closed circuit board. These changes are reflected in our
2650 Computer System Manual, but Radio-Electronics arti-
cles do not include them.

1) In the cassette interface, there used to be two one-
shots in the demodulator. It was learned that by using
only one, the circuit was much more stable. In order to
disconnect the second one-shot you must cut the line from
pin 10 at IC76 to pin 12 of IC73. This also means that
C13 (.056 uf) and R20 (68K) are no longer needed.

2) Also to improve cassette reliability, IC25 should be
a 74132 rather than a 7400. This schmitt trigger cleans
up the output of the op-amp considerably - getting rid of
the need for C4 (.01 uf).

3) With certain slow RAM chips, it is necessary to make
a modification in the circuit which generates DISPMEM.
This involves removing pin 11 of IC61 from ₮5 (probably
by clipping the pin on the top of the board) and hooking
the pin to OPREQ (pin 11 of IC6).

4) Due the some timing problems it may be necessary to make
the following modifications:

    a) cut the lines which feed clock signals into pin
       2 of IC's 50, 51 and 55.
    b) hook pin 2 of IC50 to pin 4 of IC53
    c) hook pin 2 of IC51 to pin 6 of IC53
    d) hook pin 2 of IC55 to pin 5 of IC53

Central data

Dear Customer:

We are glad to announce the availability of a 16K RAM board
for our 2650 System. It is laid out for the S-100 bus, so
that all you need to do to use it is plug it into your S-100
bus board.

The board comes completely assembled and it is tested for
the 2650 System. It is warranteed for one full year. The
power dissapation is less than 11 watts - quite a savings
over static boards.

The price for the 16K board is $289.00. The price for the
24K board (which will fill up your 2650 system) is $395.00.

Because of your past orders, Central Data is offering you
a chance to get these boards at a lower cost - if you order
by January 31, 1978. The special prices are: $265.00 for
16K, $380.00 for 24K. Please note on your order that it is
for a 2650 System and enclose this letter to get the special
price.

Sincerely,

Jeff Roloff

JR:jl

S-100 Extender Board

The Central Data S-100 extender board allows you to hook any static S-100 RAM board (with access time of less than 500ns) or any I/0 board to the 2650 computer system. The board contains five edge connectors which are used to plug in S-100 boards, four 16 pin sockets which are used to connect the S-100 extender to the 2650 computer system board, and three TTL IC's to change the 2650's signals to S-100 signals.

The signals generated by the S-100 extender are:

WRITE	RESET	R/W	OUTPUT
INPUT	MEMORY READ	MEMORY WRT	

Because the 2650 is so much simpler than its 8080 counter-part, the signals coming from the 2650 cannot derive all of the signals the 8080 puts onto the S-100 bus.

The only signals that the board does not generate which are of any actual value are $\phi1$, $\phi2$, and SYNC. If these signals are needed on a S-100 board that you want to use, the board will have to be modified so that it generates these signals by itself. Virtually no static RAM board requires these signals, and all truly static RAM boards can be easily made to operate without them. Some I/0 boards do require the signals for clocking, and you can generally use the CLOCK line (pin 49) as such a clock.

Note that most dynamic RAM boards do require the use of the above three signals, and it would be a major task to try to get them to operate with the 2650 system.

There are several lines from the 2650 which don't fit into the definition of any of the S-100 lines. These lines are run down the bus on pins not normally used by the S-100 bus structure (pins marked T.B.D. in the definitions) and corres-pond to the following table:

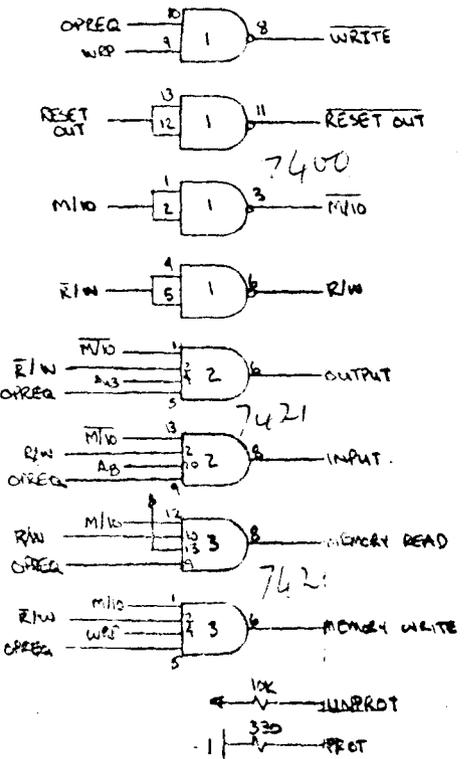| Line Name	2650 plug-pin	S-100 pin
PAUSE	81-6	13
OPREQ	85-15	14
STOP CLOCK	81-8	15
INTAK	81-16	16

Note that the line INTAK (interrupt acknowledge) does not
normally come out of the 2650 computer system board. If you
wish to use interrupts, you must hook pin 34 of the pro-
cessor to pin 16 of plug 81. This is then taken to the S-100
board and run down line 16. Also, the interrupt line of
the 2650 is normally tied high on the processor board and
this too must be changed to allow for interrupts. The line
must be disconnected from the +5 line (by cutting the path
running to it on the bottom side of the board) and connected
up to plug 85, pin 12. This completes the modification for
interrupts.

To allow the use of the OPAK line of the processor (to slow
down the processor for slow memory or other reasons), you
must also hook up a jumper wire. On the standard 2650
computer board, OPAK is tied low--telling the processor that
the memory or I/0 data will be ready 500ns after the address
bus is stable. Note that OPAK is the opposite sense of the
READY line running down the S-100 bus (READY is high to indi-
cate the ready condition, while OPAK is low to do the same).
For this reason, you must hook the READY line from the S-100
bus to the input of an inverter and then send it to the OPAK
pin (36) of the 2650 chip. A convenient inverter is on the
processor board, IC12 where pin 5 is the input and pin 6 is
the output. The READY line comes into the board on pin 4 of
plug 81. Note that the path from ground to pin 36 on the
processor (which holds OPAK low) must be cut for this option
to work. This path is on the bottom of the board.

For both the READY line and the INTREQ line, you should put
some 10K pullup resistors on the S-100 board to keep the
lines from just floating to the high state. These resistors
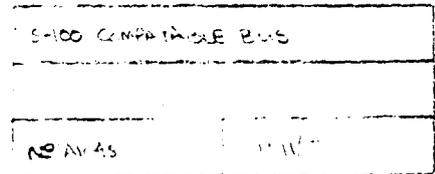could also be put on the actual S-100 boards which use the
signal lines.

The pin on the S-100 bus which READY is sampled from is pin
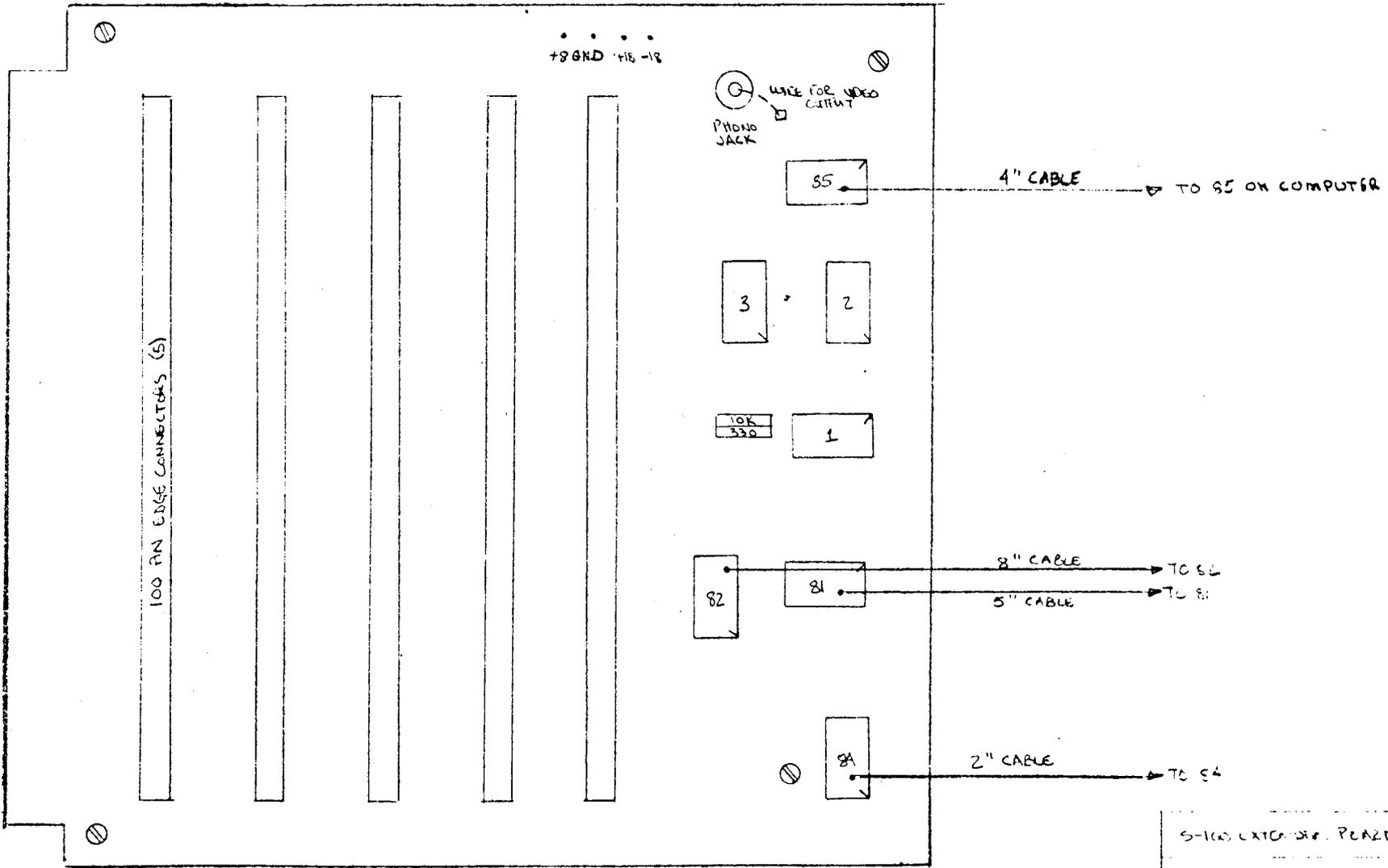12, defined as XRDY2.

3CSO BUS TO 2650 PLUG CONNECTIONS

Left-side logic (hand-drawn gates):

- OPREQ (10), WRP (9) → gate 1 → (8) WRITE
- RESET OUT (13, 12) → gate 1 → (11) RESET OUT
- 7400
- M/IO (1, 2) → gate 1 → (3) $\overline{M/IO}$
- R/W (4, 5) → gate 1 → (6) R/W
- $\overline{M/IO}$, R/W, A13, OPREQ → gate 2 → (6) OUTPUT
- 7421
- $\overline{M/IO}$, R/W, A8, OPREQ → gate 2 → INPUT
- R/W, M/IO, OPREQ → gate 3 → (8) MEMORY READ
- 7421
- R/W, M/IO, WRP, OPREQ → gate 3 → (6) MEMORY WRITE
- 10K → +UNPROT
- 330 → +PROT

S-100 PIN	2650 PIN	NAME	S-100 PIN	2650 PIN	NAME	S-100 PIN	2650 PIN	NAME
1	EXT.CONN.	+8 V.	35	P4-7	DO1	69	N.A	PS
2	EXT.CONN.	+18V.	36	P4-6	D.8	70	*PROT	PROT
3	N.A.	XRDY	37	P2-4	A0	71	P-5	RUN
4		VI0	38	P4-10	DO4	72	N.A	PRDY
5		VI1	39	P4-11	DO5	73	OPREQ P5-12	PINT
6		VI2	40	P4-5	DO6	74	N.A	HOLD
7		VI3	41	P4-8	DI2	75	*RESET OUT	RESET
8		VI4	42	P4-9	DI3	76	N.A	PSYNC
9		VI5	43	P4-4	DI7	77	*WRITE	PWR
10		VI6	44	N A	SM1	78	*I/W	PDBIN
11	N.A.	VI7	45	*OUTPUT	SOUT	79	P1-5	A0
12	P1-4	XRDY2	46	*INPUT	SINP	80	P5-5	A1
13	PAUSE P1-6	T.B.D.	47	*MEM.READ	SMEMR	81	P5-11	A2
14	OPREQ P5-15		48	N.A.	SHLTA	82	P5-6	A6
15	STOP CLK. P1-8		49	P1-13	CLOCK	83	P2-5	A7
16	INTAK P1-16		50	GND	GND	84	P2-9	A8
17	N.A	T.B.D.	51	EXT.CONN.	+5V.	85	P5-11	A13
18	P1-2	STAT DISB	52	EXT.CONN.	-18V	86	P5-2	A14
19	P1-2	CTC DISB	53	N.A.	$\overline{SSW1}$	87	P2-1	A11
20	*UNPROT	UNPROT	54	RESET OUT	EXT CLR	88	P4-3	DO2
21	N.A.	SS	55	N.A.	RTC	89	P4-9	DO3
22	P1-1	ADD DISB	56		STSTB	90	P4-4	DO7
23	P1-7	DO DISB	57		DIG1	91	P4-10	DI4
24	N.A.	P2	58		FRDY	92	P4-11	DI5
25	N.A.	Ø1	59		T.B.D.	93	P4-5	DI6
26	N.A.	PHLDA	60			94	P4-	DI1
27	N.A.	PWAIT	61			95	P4-	DI0
28	N.A.	PINTE	62			96	N A	SWTA
29	P2-7	A5	63			97	*R/W	SWO
30	P2-13	A4	64			98	N A	SSTACK
31	P2-16	A3	65			99	*RESET OUT	POC
32	GROUND	A6	66			100	GROUND	GND
33	P5-6	A12	67	N.A	T.B.D.			
34	P2-15	A9	68	*MEM.WRITE	MWRTE			

(X) INDICATES DERIVED SIGNAL (SEE CIRCUITRY ON THIS PG)

+8 GND +18 -18

WIRE FOR VIDEO OUTPUT

PHONO JACK

100 PIN EDGE CONNECTORS (S)

B5 — 4" CABLE → TO B5 ON COMPUTER

3   2

10K
330   1

B2   B1 — 8" CABLE → TO B2
5" CABLE → TO B1

BA — 2" CABLE → TO BA

S-100 EXTENDER BOARD

PARTS PLACEMENT

J ROLOFF   10/17/77

A1052

CENTRAL DATA, cont.

at high speed. I'm guessing. We'll hear more from Dave, I'm sure.

Software for the 2650 includes one of the best editors we've seen anywhere, Basic and assembler. The editor comes with both Basic and assembler, each of which is $20.

An obvious application for this capable video system is to supply that wierd APL character set.

For more information, see the April-June '77 Radio-Electronics. It was cover story.

New products expand capability

A video board, first we've seen in S50, 6502 and Z80 CPU board, "Number Cruncher" harware math, real-time clock and Basic compiler are some of the new SwTP-compatible products that have made S50 machines much more versatile.

As most readers knew, F & D Associates (box 183, New Plymouth OH 45654) offers the 6502, Number Cruncher board, video and two EPROM programmers (1702 & 2704/8). We have press releases and photos these products, which we will run, but we are most interested in reader experiences with them.

The 6502 board will allow S50 users to use the high-speed MicroSoft Basic available for KIM ($98), and used in PET. (No, you can't trick PET into dumping Basic, from a Basic program. MicroSoft trapped it. We understand it can be 'dumped via machine instructions, but it might not do anybody any good, if it did not use the TIM monitor (I don't know if it does).

One of the most interesting Basics is the compiler by Microware Systems (box 954, Des Moines IO 50304).

Being a true compiler, your program is compiled into machine code. You can then throw the compiler out the window, if you wish, and run the program on the machine bare. Excellent for writing text editors, control programs, 90 per cent of the things done on computers, Microware estimates.

We want to hear more about this amazing bargain–just $50.

S 50 BUS USER NOTES:

Lots potential this newsletter

What have we planned for S50 hackers?

Much of what we've said in regard to the S100 User Notes is a ditto here, including video problems (except they are worse in S50).

All TCH publications are dedicated to saving subscribers' money. You know you can save $100 or so on your SwTP by buying bare boards, and stuffing them yourself. You won't get a notebook that has SwTP silkscreened on it, but who cares? Neither will you get the obsolete Motorola books, but you'd be better off with ones by Adam Osborne and any of the Dilithium Press books we've seen.

With each bare board, you do get full documentation for that board. You can't skip the mother board, and hope to patch things together yourself, because they won't tell you how to do it. You must buy their $40 mother, unless a subscriber has a good idea to share.

Many people buy the kit because they don't think they can make a good-looking case with hammer and thumbs. We slapped together a case of Masonite, covered with vinyl, and with a Formica front panel. Looks real spiffy. Maybe we'll have room for a picture some time. Bought white vinyl letters and put "6800" on the side.

Is this type too small?

One of the criticisms I've aimed at a lot of newsletters is too-small type.

But after trying to hold the 1:3 2650 User Notes inside of 13¢ postage (it started out as 16 pages "firm"), we accidentally reduced one of the pages this size. It was readable. How remarkable!

Of course if we had unlimited resources, we'd be "Life" size, but you know where "Life" is today, and even "Fortune" had to retreat from that size.

Hint: the narrow columns viewing through magnifyer feasible.

super - graphics style.

Hey, there is a picture of it on the cover, but with Z-80 on its side.

S50 subscribers particularly should feed us lots of information they think we already know, since neither SwTP nor Smoke Screen have respended-to any of our requests for material for the newsletter. Could it be they are unhappy we are starting this publication? Maybe readers can fill us in on that question. We just don't know.

(It is very silly for a manufacturer to fail to pour-on the information when a publication requests it. If we want to write about the Smoke SwTP we'll do it, putting together what information we have available. If it all comes from critics, dissidents and competitors, what do we care? It should make a difference to them, however.)

S100 on SwTP? 80 char. video

Granted, many will see this as unwanted and unnecessary, but wouldn't it be nice to interface S50 to S100?

The first Processor Technology "Access" newsletter (are they still publishing?) showed how to connect PT static memory boards to 6800 systems. We think that probably gives most of the clues needed for a limited interface, allowing you to use most S100 static memory boards, most universal I/O cards.

Instead of making their recommended changes to the S100 memory board, perhaps it could be done to the S100 mother boad and interconnect.

Another promising scheme is to buy the $40 6-slot Central Data S100 interface board. That circuit is meant for interfacing the company's 2650 machine, but I suspect it would not be too difficult to adapt to 6800. We've queried Central Data on this (box 2484, station A, Champaign IL 6120), but not received a reply.

Want 80 character/line video for the SwTP? Use the Central Data 2650 machine as a TV typewriter ($40 bare board, $275 assembled, tested, guaranteed 1 year). Sorry to make this read like a Central Data ad, but there is a lot of capability in their little (8.5" sq.) boards.

CHALLENGE TO READERS:

Here's our interactive publications for S50, S100 bus computer users

Welcome to the unusual world of interactive publishing, a portion of print medium which we think popular computers will not only make increasingly necessary, but more feasible.

For about half a year now, three issues, Central Data 2650 computer users and TCH have been hammering together (never mind the blueprints, I'm on DEADLINE) our concept of an interactive publication.

Rejected was the established formula of "typeset your own article". Our editor gets the shakes at the thought of trying to con everyone into using a 37-space pica line, and changing the ribbon, etc. We established only one requirement for editorial contributions: that they be legible.

The result has been that a small number of 2650 users (yes, Virginia, there really is a 2650!) have gotten going, in six short months, one of the best user-group publications in hobby computing.

An interactive publication is no good if you have all subscribers and no contributors. Of course at some point between 2K and 10K circulation you could buy enough articles to satisfy everybody. But then it wouldn't be what we set out to be–an interactive publication. It would be a magazine, without ads. Something way down low in the publishing pecking order.

What is an interactive pub-

lication?

Since I've got this page (you'll notice readers left me just one two-line corner in the 2650 1:3, just enough space to note that I am a $5/yr editor), I guess I have to answer that, although the readers have done a better job, on the 24 pages of the 1:3 edition (4 pages deleted to meet postal technicalities).

An interactive publication is a post office box to which you can write your interests, solutions and problems, any or all of those. They can be either thoughtfully put together and carefully articulated, or scratched out. An editor takes it and sets it in type, usually not in one piece.

Why do we break people's letters into little pieces? Supposing someone makes a good point about voltage regulators, or Basic programs, or keyboads, or all of the above. Supposing, some months later, you want to refer to what he (continued)
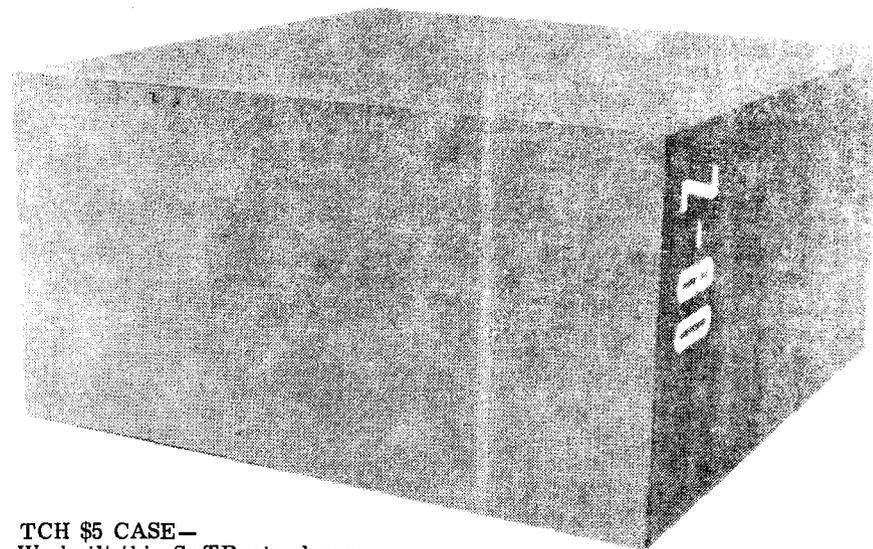
TCH $5 CASE—
We built this SwTP-sized case of Masonite, covered with adhesive-backed vinyl, with Formica front panel. "Z-80" was formed of pre-cut vinyl letters, bought in a paint store.

said about one of the items. If it were all mixed together, what chance would there be you could find it? So we take things apart, and departmentalize the publication.

Why bother? What good is such a publication?

When we started out, that was a good question. When you buy a new tool, you buy solutions, not problems. Everything is shiny and celophane packed. There are directions. You have bought answers. Who, except maybe a quiz show, ever bought questions?

Once you have the thing home, however, or have part of it, the questions start coming to mind.

In the case of the 2650 computer, everyone started asking, "what kind of keyboard should I get?" The computer's designer answered that any ASCII keyboard would do, why not the inexpensive Radio Shack!

Turned out that unfortunately, in several vital respects, the Radio Shack isn't ASCII. Yes, the catalog says it is ASCII. The packaging is professional, and says ASCII. What do the 3,000 people who bought Radio Shack keyboards do? Write Radio Shack? We did, and got nothing but a couple phone calls explaining the history of the keyboard, and how the new model, when it comes out, will overcome problems they ran into with the old one.

Radio Shack grossed maybe $150,000 on their keyboard, yet feels it has no responsibility to the people who bought it. The firm simply wants to avoid similar difficulties with the new model.

If Radio Shack isn't concerned about the people who bought its defective keyboard, who is?

Certainly the people who got stuck with the turkeys do, and the editor of their interactive computer publication. We've carried about ten pages of material on the subject.

What is the point? Simply that the merchants are really only interested in the sale of merchandise. The magazines want polished articles that do not anger either their advertisers, or their potential advertisers. The interactive publication serves only its subscribers. It has no advertisers. And, coupled with a fast-turnaround time, it serves these needs while it still matters. Some year you may still read a magazine article about how the Radio Shack keyboard can be

YOU ASK:

Do manufactuers all hate us

Maybe you think the manufacturers all dislike what we are setting out to do. We don't think so.

This society is so institutionalized, that people feel they need have an advocate bring a consumer complaint to the attention of a manufacturer or retailer. Of the people who wrote to us about the Radio Shack keyboard, probably none wrote to Radio Shack.

So what do we do, air the industry's dirty linnen?

Hardly! When we, or a reader, mentions a manufacturer or other vendor, and this is not something we have previously called to their attention, we write them a letter or send a proof. If after two weeks we receive no response, we assume there will be no response.

There already has been an instance where we were going to say something negative, but were convinced it was wrong. In a phone conversation, a subscriber said he had bought a keyboard and the keyswitches were weak. He returned it. What keyboard was that? We batted that one around quite a while and decided it was GRI. I reported it to the manufacturer, who told us that out

of 3,000 early-model kits shipped, they replaced a total of three keyswitches, all of which were damaged by improper soldering. Switches have been laboratory evaluated to in excess of 100 million operations without failure.

We wrote another keyboard kit manufacturer, telling him it is our feeling his keyboard is "junk". He replied with a few lines of sarcasm, which ed". We agree that maybe there are some positive points that could be mentioned in regard to his product, but he failed to give them to us and we don't know what they are. We toned down our criticism, slightly.

No manufacturer should hate us, unless they really want to put something over on people. If they are advertising something which they are not shipping, if there are bugs or other problems, people have a right to know this. We plan to spread the word.

Mostly, our job is going to be constructive. We're going to be writing about how you can do neat things with equipment and software available today. Our primary message is going to be "you can get there from here."

S100 USER NOTES:

Project would be better left to a computer manufacturer?

I was a little confused to hear of your plans for an S100 newsletter.

That bus is a real can of worms.

Even if you feel there's a need in this area, it might be better left to a manufacturer who has access to the mountains of data, schematics, and test systems involved in S100 use.
—Leonard Crane,
Forethought Products

Let's kick that one around a little bit, Leonard.

In order to put out a creditable user notes publication, a manufacturer would have to hire about $20,000 worth(?) of editor (question mark inserted by firm's accountant). Put that down as a $25,000 cost if you wish, but you are under-stating your overhead. Note that under almost no foreseeable circumstances can we expect to

coaxed to emit ASCII code. But by then anyone who had bought one of the things will have gotten something else, and the vendor long since will have cleared them out and replaced them with the new model, which has 10 fewer keys.

Are we saying that an interactive publication is better than magazines? Not at all. We do not need to explain the need of magazines.

S100 BUS USER NOTES:

What does your editor see for this publication?

Repeatedly at computer clubs I have met people who were going to build IMSAIs, but who could not afford it.

I have nothing against IMSAI. It is just that if someone is interested in computing, I would rather see them build something they can afford—actually build it—instead of going on forever about the computer they are going to build.

I suggested the Ithaca Audio Z80 ($110 from Base2) and Vector motherboard ($29), and inexpensive memory (Base2 and Jade have it for about $130).

They all replied that they are just beginners and could not build a computer unless all the parts came in one box,

LEAVE TO MFR., cont.

sell more than 2,000 subscriptions first year, even at a low $5 rate, so start figuring your deficit from $15,000, a point that does not consider promotional, postal, production or other costs. Color that manufacturer philanthropic!

In order to establish any publication, you need to set up the following departments:
art, bookkeeping/accounting, circulation, detail, editorial, photography (probably under editorial), production (including engraving, mailing, pasteup, printing, stereotyping, and typesetting), promotion.
You don't just set them up once (unless you have Almighty powers), but often (continually?), always seeking a little bit of efficiency.

After doing all that, in order to lose all that money, someone in that manufacturing firm is going to question the whole operation: "We are in manufacturing, not publishing", our critic will say, and subscribers will be treated to a $5-off coupon. Our $20,000/yr. journalist? Don't pity him. He will have spent most of his time establishing contacts in other firms, and will be able to change horses gracefully.

If done independently, the manufacturer is unencumbered by any of the problems of publishing, but is free to comment in the publication any time he wishes. He's got it made there!

from the same company, with very comprehensive manual.

I've written TDL and asked them specifically, for the record: "will your neat Z80 software work with the Ithaca Audio board?" I have no real doubts that it will, but wanted their reply for the record. They said they had not had a chance to try it.

The purpose of this newsletter is to get users together, and let them tell each other what works and what does not work.

Another example: Digital Group has some nice equipment, but it is expensive. It also has some interesting software—and it is cheap. Wouldn't it be nice to know how to have Digital Group software reside happily in the $110 Ithica Audio Z80?

Word - processing frieks are not too impressed with 32 and 64 - character / line video. Yet there is not much available in the 80-character-and-larger line format, except at great cost. You can get one from TDL for $369, assembled. Or you can get a computer-on-a-board with 80-character video, parallel and serial ports, 2K RAM, tape interface-all that for $275, assembled. How do you hook that to your IMSAI or other computer? Through either the serial or parallel ports! That computer bargain, incidentally, is the Central Data 2650, which the accompanying newsletter supports. It has available for it an excellent editor, assembler, and Basic ($40 takes all).

Why get into multiprocessing, when you can stay with one computer?

Why not turn that question around: why struggle with trying to get everything through just one computer, when for less money you can have two?

Whenever the subject of printers comes up, the first (and only) question usually is "how fast is it". Not "how well does it print", or how reliable, but how fast.

Why? Because with our primitive operating systems, we tell the printer to do something, and have to wait for it to finish before we can do something

ourselves at the video. Either we go to sophisticated multitasking, or pick up additional processing capability. It used to be that the software approach was cheaper, but probably not any more.

These are the things we want to bat around in S100 User Notes. We're not going to get very far into word processing, since we have a whole newsletter about that ($12.95/12 issues), or about printers (Word Processing Letter has series started on building your own Selectric or Olivetti Lexikon 82 interface for about $50, for interfacing any electric typewriter for about $100, and for picking up Friden machines for $25 or so, and making them work).

Let's kick some of this around in S100 User Notes 1:1.

CENTRAL DATA 2650:

Keep pushing 80 char. video

Several times in this supplement we mention the 80-character video available on the inexpensive Central Data 2650. Here is a rundown on that machine.

On one 8.5" square board it gives you:
—Sixteen lines of 80-character video display, expandable with lowercase,
—Cassette interface, Kansas City standard,
—Serial port,
—Latched parallel I/O port,
—Keyboard port,
—2K bytes RAM,
—1K bytes ROM, expandable to 4K, containing system executive.

In our user notes, we hopefully are developing the potential for putting the character generator in RAM, so that the CRT will be totally under program control. This means not only upper and lowercase letters, but in any style, any alphabet (Greek, Russian, etc.), or maybe logic symbols, electronic design symbols, symbols for pipe fittings, whatever.

Secret of the character-generator RAM, according to Dave Maciorowski, is either 90ns RAM, or tricking the system into thinking it has some. That probably means a tricky little device between character-generator RAM and video generator that is capable of storing one character, and outputting dots
(continued)