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00.00.00

WANG LABORATORIES INC.  
PROBLEM TRACKING AND REPORTING  
CUSTOMER COMPLETE DETAIL REPORT  
HEADER INFO  
CUSTOMER PROBLEM NUMBER C900004346

PAGE: 1  
26 SEP 1991  
08:44:01

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PROBLEM NUMBER: C900004346      CUST NAME: CTC  
PRIORITY P1      CUST NUMBER: HJ 90000000000  
  
PROBLEM TYPE: INFW      CUST CONTACT: MANABU FUKAMACHI  
LINK TO PROB NO: NOT LINKED      CUST CONT PHONE: 01-813-770-9748 NONE  
CUST ADDRESS 1: 25 KOWA BLDG.  
CUST ADDRESS 2: 3-8-7 CHIYODA-KU  
CUST ADDRESS 3: TOKYO 102  
CUST CITY: JAPAN  
SYSTEM MODEL NO: CS386      CUST ST/PROV:  
GEN SYST MODEL: 2200 CS CPU      CUST ZIP: -      CUST RDB: H9919  
O. S. VERSION: 1 17  
HW MODEL NUMBER: CS386      CUST COUNTRY:  
SW MODEL NUMBER: OS  
SW VERSION: 1 17  
  
RDB ASSIGNED: 8760  
PERSON ASSIGNED: BAHIA MICHAEL E  
PART NUMBER:      ORIG NAME: FUKAMACHI MANABU  
PART NUM REV:      ORIG EMPL NO: HJ-99405  
SERIAL NUMBER:      ORIG PHONE: - - -  
ORIG RDB: H9919  
  
CALL TRKG DATE: 00/00/00 00:00      NETWORKED: N  
CALL TRKG NO:      RES DEPLOYED:  
  
ORG ACT/SYM/ACN:      DATE ENTER PTR: 11/29/90  
STATUS DATE: 11/29/90      DATE TO R&D: 019901212  
STATUS CODE: H 0 318      WKDAYS IN R&D: 205.38  
STATUS ABBREV: INFORMATON      TOT WKDAYS OPEN: 214.39  
STATUS DESC: INFORMATION PROVIDED

PROBLEM SUMMARY :FUKAMACHI MANABU DATE: 11/29/90 TIME: 22:19  
The system was upgraded from CS, LVP, MVP to CS386 without changing any peripherals (e.g. I/F etc.). After the change, there have been various kind of problem happening on I/F and devices. I need to find out what the above problem are based on. I've sent a list of the devices to Ms. Ada Yeung via WANG OFFICE. Pls check the list and provide us the information. Thanks.  
Initial Escalation To ASC. By WANG CTC.

RESOLUTION TEXT :BAHIA MICHAEL E DATE: 09/26/91 TIME: 08:42  
HC142. Customer problem resolved by installing correct e-rev 2228B boards. 210-7223 should be e-rev 5. The 210-7224 should be e-rev 2. Failing boards had undocumented ECOs changing the e-revs to 6 & 3 respectively. TSB will be written to warn of problem & a check has been done to verify all boards in stock are at proper e-rev.

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ASSIGNED: WONG TAK LAM            DATE: 09/25/91    TIME: 03:12  
To H.O.: Please transfer this call back to H9936 for closure. Thanks!

ASSIGNED: BAHIA MICHAEL E        DATE: 09/13/91    TIME: 08:58  
Received Wang Office from Manabu this AM. Problem occurs immediately with customer application but only with the 386. We can close this call if agreeable. A TSB will be written to make the field aware of the potential problem, a purge of stock will be done, & a MJB will need to be done to remove the ECO. Can we close this call?

ASSIGNED: FUKAMACHI MANABU        DATE: 09/13/91    TIME: 04:04  
This problem occurs on CS386 only. It does fail immediately, using customer applications. Thanks.

ASSIGNED: BAHIA MICHAEL E        DATE: 09/12/91    TIME: 11:18  
On frequency of failure need more specific info. Does it fail immediately on this command or intermittently. How long does it usually take before a failure occurs, a minute 5 minutes, within a half-hour?  
Also, do we know if this problem occurs on VLSI or non-386 CPUs?

ASSIGNED: BAHIA MICHAEL E        DATE: 09/12/91    TIME: 11:14  
Japan unable to update PTR for as yet an undetermined reason. Recvd Wang Office from Manabu concerning problem as follows:  
2228B used to communicate w/ a Plotter (Async) using a customer application.  
Problem occurs with every version tested of O/S.  
The error I92 occurs frequently with the following GIO command:  
4409 1020 02FF 03FF 1223 C620 DATA ...

ASSIGNED: FUKAMACHI MANABU        DATE: 09/11/91    TIME: 02:45

ASSIGNED: BAHIA MICHAEL E        DATE: 09/06/91    TIME: 15:09  
Have tested the 2 boards you sent using the CE Diagnostic loopback tests & both boards pass without errors. Can you provide some information on what these boards were being used to communicate with, what emulation or software package was being used, what kind of errors & how often a failure occurred? Will write a TSB and want to indicate as specifically as possible what kind of errors might be seen and whatever information you can provide.

ASSIGNED: CHUI SIMON              DATE: 08/23/91    TIME: 23:59  
Michael, Ack'd update, will wait for your test result then. Thanks.

ASSIGNED: BAHIA MICHAEL E        DATE: 08/22/91    TIME: 08:41  
Have not had opportunity to check out boards yet due to cutback in staff & trying to get things done required to get the new 2200 Turbo system out the door. I will get to this in the next few days. Sorry for the delay.

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W A N G   L A B O R A T O R I E S   I N C .  
PROBLEM TRACKING AND REPORTING  
CUSTOMER COMPLETE DETAIL REPORT  
P R O B L E M   D E T A I L  
CUSTOMER PROBLEM NUMBER C900004346

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08:44:01

ASSIGNED: WONG TAK LAM                   DATE: 08/20/91    TIME: 22:38  
Michael, Pls update status of the checking,thanks.

(Simon Chui)

ASSIGNED: FUKAMACHI MANABU            DATE: 07/29/91    TIME: 19:17  
Update acknowledged.

ASSIGNED: BAHIA MICHAEL E             DATE: 07/29/91    TIME: 12:21  
Boards have been received. Will check them out & get back to you.

ASSIGNED: FUKAMACHI MANABU            DATE: 07/22/91    TIME: 04:02  
Air Bill Number is 15388564.  
2 sets boards were arrived USA customhouse at July 15.

ASSIGNED: OKADA MARIKO                 DATE: 07/17/91    TIME: 00:52  
To Peter:  
Manabu will give you the information which is required in the prev. comment  
after he comes back from vacation which is 7/22.  
Regards.  
Mariko

ASSIGNED: WONG TAK LAM                 DATE: 07/15/91    TIME: 02:18  
Japan: Manabu, could you please check status of your shipment to Michael  
Bahia & advice the shipment details ?

ASSIGNED: BAHIA MICHAEL E             DATE: 07/11/91    TIME: 17:26  
Still have not received boards. On vacation for 2 weeks starting July 13th.  
Please check status with shipper.

ASSIGNED: BAHIA MICHAEL E             DATE: 06/28/91    TIME: 15:18  
Update acknowledged.

ASSIGNED: FUKAMACHI MANABU            DATE: 06/28/91    TIME: 01:28  
We had send TWO sets of boards on June 10 by KINTETSU EXPRESS (Carrier).  
We checked with them, But in some how, it has not been shipped yet. It will  
be shipped in next week.

ASSIGNED: BAHIA MICHAEL E             DATE: 06/25/91    TIME: 09:03  
Update acknowledged. Do you have any shipping information such as the carrier  
& the Air Bill # and the date shipped should we need to track it down?

ASSIGNED: FUKAMACHI MANABU            DATE: 06/24/91    TIME: 19:31  
We have already shipped. Pls wait a little more. Thanks.

ASSIGNED: BAHIA MICHAEL E             DATE: 06/21/91    TIME: 10:15  
Still waiting for boards. Have they been shipped yet.

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ASSIGNED: BAHIA MICHAEL E      DATE: 06/06/91      TIME: 08:51  
Let me know when the boards are shipped. Thanks.

ASSIGNED: FUKAMACHI MANABU      DATE: 06/05/91      TIME: 20:36  
TO H.O.: Mike, I see, I send more than 1 board. You will receive 2 210-7223  
and 2 210-7224 boards. Thanks.

ASSIGNED: BAHIA MICHAEL E      DATE: 06/05/91      TIME: 14:54  
Want 2 fully assembled 2228B or 2228C boards, each consisting of 1 210-7223 &  
1 210-7224 board connected together with completed Repair Tag attached. If  
the failure has to do with an improper ECO, I need to verify that and I would  
like to have more than 1 board to insure the problem isn't just a bad board.

ASSIGNED: FUKAMACHI MANABU      DATE: 06/04/91      TIME: 20:08  
To H.O.: Mike, you need TWO sets boards? Today, I send a bad e-rev boards  
(ONE set) to you. Pls clearly. Thanks.

ASSIGNED: WONG TAK LAM      DATE: 06/03/91      TIME: 01:41  
To Japan: Manabu, you need to send TWO sets of 2228B to Michael Bahia at H.O.  
mailstop MS/014-A3A. The other THREE sets of wrong E-Rev 2228B boards should  
be returned back to H.O. originator. You should fill out all the repair tags  
to indicate the failing symptom & wrong E-Rev on these boards.

ASSIGNED: BAHIA MICHAEL E      DATE: 05/31/91      TIME: 10:48  
Yes, send them to me directly. My address is:  
Wang Laboratories  
1 Industrial Ave  
Lowell, Ma 01824  
Attn: Mike Bahia  
M/S 014-A3A

My RDB is 8760 if you need it.

ASSIGNED: FUKAMACHI MANABU      DATE: 05/30/91      TIME: 19:32  
1) We have got the 2 sets boards of them. I have to send 1 set to Mike as  
you know, can I send it to Mike directry?  
2) The rest of 4 sets boards will be returned all together, but whom should  
I send them to? Because the boards were came from Joan E. Hanley at H.O.  
Should I send them to him or you?  
I send a avobe the mail to Donna, Mike and Peter, but no reply from Donna.  
Do you read this Wang Office mail from me? I'm waiting for reply. Thanks.

ASSIGNED: BAHIA MICHAEL E      DATE: 05/30/91      TIME: 12:08  
Still have not received boards. Have they been shipped yet? Need 2 complete  
2228Bs.

ASSIGNED: WONG TAK LAM      DATE: 05/08/91      TIME: 01:15

ASSIGNED: WONG TAK LAM DATE: 05/08/91 TIME: 01:15  
To Japan: Manabu, please try to ship TWO sets of PCBs (as stated in 4/17 comment) to Michael Bahia for problem evaluation. Regards.

ASSIGNED: BAHIA MICHAEL E DATE: 05/07/91 TIME: 17:52  
Sounds good. Let me know when they are shipped and how. Thanks.

ASSIGNED: FUKAMACHI MANABU DATE: 05/07/91 TIME: 03:47  
I've received 5 sets of boards today (May 07, 1991). Now, CTC is exchanging them at customersite. I'll send a first 1 sets of boards to Mike (H.O.), After I get replacement the boards. Thanks.

ASSIGNED: WONG TAK LAM DATE: 05/07/91 TIME: 01:16  
To Japan: Any delivery status from Donna Johns ? Please update status.

ASSIGNED: BAHIA MICHAEL E DATE: 04/16/91 TIME: 10:27  
Please send me 2 of the 2228B or 2228C controllers, each controller consistin g of a 7223 & a 7224 so that I will have 2 7223s & 2 7224s. Need 2 boards so that I can verify the changes and symptoms are consistent when I test them are an accurate reflection of the problem. Please have completed repair tags attached which accurately state the symptoms seen when using. Thanks.

ASSIGNED: WONG TAK LAM DATE: 04/16/91 TIME: 04:48  
Donna Johns of H.O. logistics will ship 5 sets of boards (of proper E-Rev) 210-7223-A (E-Rev 5) & 210-7224-A (E-Rev 2) to Japan directly. Then, Japan will ship one set of the board (of wrong E-Rev) to Michael Bahia for further problem evaluation.

\* Donna Johns indicated that future requests such as this SHOULD FIRST be worked with Yangmei/Taiwan (Area Logistics).

ASSIGNED: BAHIA MICHAEL E DATE: 04/08/91 TIME: 10:11  
After you get replacements with the correct e-revs, send me 2 of these boards with the incorrect e-revs.

ASSIGNED: FUKAMACHI MANABU DATE: 04/05/91 TIME: 01:08  
To H.O.: This problem occurs on CS386 (Three systems on different customer). No problem on the other 2200 system. I can not send these boards, Because 15 boards are all user at customer site and other wise the customers system will be not operational for a while.

ASSIGNED: BAHIA MICHAEL E DATE: 04/04/91 TIME: 13:07  
Please send me 2 of these boards. When the boards are sent back make sure there is a clear memo attached describing the problem and to please call me if there are any questions. Sent a Wang Office to Manabu on this matter this morning. We have checked Home Office inventory and none of the 2228B & 2228C in stock were of the higher problem e-revs. Does the customer have working

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ASSIGNED: BAHIA MICHAEL E      DATE: 04/04/91      TIME: 13:07  
boards? Indication in the Wang Office was the customer needed boards. Would like to verify customer has working boards on site before de-escalating.

ASSIGNED: WONG TAK LAM      DATE: 04/04/91      TIME: 02:19  
To H.O.: Michael, I wonder whether it's possible to downgrade the ECOs if there is no paperwork for the ECOs. Anyway, Japan CSO will return all these wrong ECO boards back to repair center in H.O. (15 of them). Please alert the repair center about this also. You may de-escalate call to us for closure.

ASSIGNED: BAHIA MICHAEL E      DATE: 03/28/91      TIME: 16:11  
Answer we received from Taiwan was they are not involved. At this time we can find no logical reason why we are seeing the higher e-rev boards that are causing you problems. We have a possible theory. These boards were being fixed in Puerto Rico before that plant was closed & at times they wrote ECOs and installed them before sending us the paperwork. Just before closing the Puerto Rico plant was badly damaged in a storm & possibly the paperwork for these changes was lost. Right now I am in the process of checking our home office inventory to purge all the e-rev 6 210-7223 and e-rev 3 210-7224 brds to have them downgraded as we know no reason for these ECOs, with these ECOs the boards fail, and without they work. Will also write a TSB for the field to warn them of the potential problem and existence of these undocumented changes.

ASSIGNED: WONG TAK LAM      DATE: 03/28/91      TIME: 00:40  
To H.O.: Is there any feedback from Taiwan board repair yet ?

ASSIGNED: BAHIA MICHAEL E      DATE: 03/18/91      TIME: 13:21  
Our Repair Center has come back to me and indicated their MUBs used to check the ECO history indicate the 210-7223 at e-rev 5 and the 210-7224 at e-rev 2. Some board repair is done in Taiwan and we are now checking with people there to see if that is where the problem is. Have received the XEROX copies of the boards.

ASSIGNED: FUKAMACHI MANABU      DATE: 03/15/91      TIME: 01:05  
CTC could not duplicate the problem of Error I90 on 2270A. (Same as C9-3678) I think this call's problem is 210-7223, 7224 E-Rev only.

ASSIGNED: BAHIA MICHAEL E      DATE: 03/14/91      TIME: 11:28  
Yes, I received your Wang Office & as you indicate there was a problem. While I'm waiting to receive your package have called Board Repair to see what information on E-revs for these boards they may have. Is the 2270A problem resolved here? I have had a little difficulty getting 2 different 2270A units running. Had to order 4 210-7218C boards to get 2 good ones. The bad boards would get intermittent I90s. Now have 2 7218 boards which run error free.

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ASSIGNED: FUKAMACHI MANABU      DATE: 03/14/91      TIME: 00:28  
To H.O.: Michael, I have tried to FAX copy of boards to you several times  
but it didn't go through. I don't know why. So I decided to send it via  
Federal Express. Thanks.

ASSIGNED: FUKAMACHI MANABU      DATE: 03/13/91      TIME: 21:15  
To H.O.: Michael, Cleary this problem.  
2236MXD is solve for your information.  
Only one problem.  
Does the 210-7223 of E-Rev 6, 210-7224 of E-Rev 3 are correct?  
CTC had ordered these boards 4 times ('89 - 3 times, '90 - 1 times).  
That boards from BOSTON. About 15 boards are all used customer site.  
No problem on other system, it happens only on " CS386 " (3 boards).  
I'll send photo copy of boards via FAX.  
Pls check.

ASSIGNED: BAHIA MICHAEL E      DATE: 03/11/91      TIME: 15:29  
Still waiting for feedback on this call. Have you duplicated my test config-  
uration to try to reproduce the problem? Can you provide me with a program  
to duplicate the problem under a limited configuration. Have you gone back &  
replaced the hardware. Have 2 2270A units & having difficulty getting a 2nd  
210-7218C board. Have got 1 7218C working perfectly but the 2 new 7218C  
ordered for the 2nd unit both get intermittent I90s. Please recheck  
hardware. Have still not received any info from you on the 7223 & 7224 e-rev  
matter. Do you have documentation indicating the 210-7223 is E-rev 6 & the  
7224 E-Rev 3? If so send it to me via FAX if possible.  
FAX # is 508-458-0620.

ASSIGNED: WONG TAK LAM      DATE: 03/07/91      TIME: 02:10  
To Japan: If problem still occurs under 1.1B or 1.1C, please update with  
detail duplication procedures.

ASSIGNED: BAHIA MICHAEL E      DATE: 02/25/91      TIME: 15:20  
Update acknowledged. Please provide us with specific details on configuratio  
n & program to duplicate problem if still failing. We cannot reproduce  
problem with 2270A at this time.

ASSIGNED: FUKAMACHI MANABU      DATE: 02/25/91      TIME: 04:10  
I received S/W 1.1C. CTC testing now. Pls wait my update. Thanks.

ASSIGNED: BAHIA MICHAEL E      DATE: 02/22/91      TIME: 10:04  
CS/386 Maint Rel 1.1C has no positive changes to it that would effect the I90  
with the 2270A and possibly may be worse. However, will send you a copy via  
Wang Office. Right now we need to have information on how to duplicate the  
problem. Have had a 2270A running in my cube for over a week now without  
failure. Please insure a hardware problem does not exist by testing with

ASSIGNED: BAHIA MICHAEL E DATE: 02/22/91 TIME: 10:04  
another 2270A or replacing the 210-7218C, the controller, & drive. Again please give me details on how to duplicate problem if at all possible.

ASSIGNED: FUKAMACHI MANABU DATE: 02/21/91 TIME: 22:22  
Same problem happend and same duprication on 1.1B.  
Have you version 1.1C? If you have, pls send us.

ASSIGNED: BAHIA MICHAEL E DATE: 02/21/91 TIME: 16:52  
The MXD board is supported on the 386. If you are having problems the MXD you are using may be bad or solmething is interfering with it, possible from a terminal or cable or a board in the CPU. Make sure all cables are legal & properly connected. Reconfigured so the MXD in question is connected to different terminals. Move controller up closer to the power supply. Have not received any documentation from you on the 7223 & 7224. All my informati on so far indicates the boards are e-rev 5 and 2 respectively. Have you test ed the 1.1C against more than 1 2270A? Can you give me information on how you are currently duplicating the problem. Right now we cannot reproduce a problem. My 210-7218C board is also e-rev 7.

ASSIGNED: FUKAMACHI MANABU DATE: 02/21/91 TIME: 02:14  
I mistake other PTR No. This problem not solve.  
Use the Mother board 210-7218C E-Rev 7, P-Rom 2256,2257.  
Is the 2236MXD support on CS 386?  
Pls information to us a 210-7223 E-Rev 6, 210-7224 E-Rev 3.

ASSIGNED: FUKAMACHI MANABU DATE: 02/21/91 TIME: 01:15  
Tested succesful. Error I90 on 2270A. I've two question.  
1) Is the 2236MXD supported on CS386?  
2) Pls information to us 210-7223 E-Rev 6, 210-7224 E-Rev 3.  
To ASC: Do you received my photo copy (210-7223, 210-7224) via air mail?

ASSIGNED: BAHIA MICHAEL E DATE: 02/12/91 TIME: 09:40  
Update acknowledged.

ASSIGNED: FUKAMACHI MANABU DATE: 02/11/91 TIME: 21:20  
I've received CS386/Rel 1.1B. Pls wait my update. Thanks.

ASSIGNED: WONG TAK LAM DATE: 02/11/91 TIME: 04:09  
To Japan: CS386/Rel 1.1B sent to you via WO today. Please update with test result on I90 error in 2270A. Thanks!

ASSIGNED: BAHIA MICHAEL E DATE: 02/08/91 TIME: 09:49  
Have been doing some additional testing with the 2270A and we found a hardware problem. After correcting the problem retested against the last 2 CS/386 Maint Releases, 1.1B & 1.1B. Cannot reproduce the problem with 1.1B.

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ASSIGNED: BAHIA MICHAEL E DATE: 02/08/91 TIME: 09:49  
However 1.1C does not work with the 2270A. Get immediate I92 errors doing a LIST or SCRATCH. Will send you 1.1B via Wang Office today for the 2270A problem. 1.1B does have a problem involving SELECT H ON, platter hogging which is fixed with 1.1C. To prevent confusion, only 1.1B will be sent at this time.

ASSIGNED: BAHIA MICHAEL E DATE: 02/07/91 TIME: 16:46  
Don't understand last update. Please explain?

ASSIGNED: FUKAMACHI MANABU DATE: 02/06/91 TIME: 21:07  
It make a board (Notch up).

ASSIGNED: WONG TAK LAM DATE: 02/06/91 TIME: 03:53  
To Japan: Manabu, HOW you determine that 210-7223 is E-Rev 6 & 210-7224 is of E-Rev 3 ?? I check on the latest MUB (the Mandatory Update Bulletin that has all the ECO history on Wang PCBs) dated Jan 4, 1991 & find that LATEST E-Rev of 210-7223 is 5 while that of 210-7224 is 2. H.O. updates on 1/31/91 has the info of how to determine the PCB E-Rev. It is possible that you have faulty PCBs that caused the problem.

ASSIGNED: FUKAMACHI MANABU DATE: 02/05/91 TIME: 21:41  
CTC orders or repairs the 210-7223, 7224, they are returned as the E-Rev 6 E-Rev 3. We check the ECO (Dec. 04, 1990) and can't find this version. Pls more information to us. Thanks.

ASSIGNED: BAHIA MICHAEL E DATE: 02/05/91 TIME: 18:28  
Tested 2270A against new Maint Rel just received, 1.1C. Problems seem worse as now getting I92 with SCRATCH and intermittently on LIST & MOVE. Problems have been reported.

ASSIGNED: BAHIA MICHAEL E DATE: 02/04/91 TIME: 19:17  
We looked at the ECO History by Model Number distributed via Wang Office by John Proulx, ECO Support Manager. We also got a copy of the prints for the 210-7223, title - Bi-Sync B-Version Motherboard, and the 210-7224, title - Schematic Logibloc Transmitter/Receiver & Memory Board.

ASSIGNED: CHUI SIMON DATE: 01/31/91 TIME: 02:49  
Manabu, Thought they are refering to MUB and ECO history by model #. Pls check.

ASSIGNED: FUKAMACHI MANABU DATE: 01/30/91 TIME: 22:09  
What DOCUMENTATION are you referring? Pls tell me the name and P/N. Thanks.

ASSIGNED: BAHIA MICHAEL E DATE: 01/30/91 TIME: 18:09  
Have been doing research on thew 2228B board concerning E-Rev. According to

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ASSIGNED: BAHIA MICHAEL E DATE: 01/30/91 TIME: 18:09  
all documentation here at the home office and the prints used to build the board, the latest E-rev are:

210-7223 E-rev 5 & 210-7224 E-rev 2

There is no E-rev 6 210-7223 or E-rev 3 210-7224 that I can find documented. Could someone be confusing the E-rev with the Artwork. The E-rev is normally marked on the etch side of the board with a small white sticker on most older boards or a round black sticker on newer boards or is marked inside a scratched square on the etch side. Prom L6 on the 210-7223 board has 4 variations for 4 variations of the board:

210-7223C L6 - 378-4001 used for the 2228C  
210-7223A L6 - 378-2060R3 used for the 2228B  
210-7223D L6 - 378-4167R2 used for a particular model 2228D  
210-7223? L6 - removed for the 2227B

Possibly you may have had the wrong prom or board or a bad prom or board. The MXD board should definitely have the R7 prom. The R7 prom fixes problems with cursor control. We expect to receive a new Maint Rel tomorrow. If so will test your problem against it & get back to you with the results.

ASSIGNED: FUKAMACHI MANABU DATE: 01/29/91 TIME: 03:57

PROBLEM NOW:

ERROR I92 --- 2228B I/F Version 210-7223 E-6, 210-7224 E-3, P-ROM 2060R3  
No Problem - 2228B I/F Version 210-7223 E-5, 210-7224 E-2, P-ROM 2060R2  
HANGUP --- 2236MXD P-ROM Version 2140R6 to 2143R6  
No Problem - 2236MXD P-ROM Version 2140R7 to 2143R7  
ERROR I90 --- 2270A

Pls advise the good H/W version and OS version and something. Thanks.

ASSIGNED: CHUI SIMON DATE: 01/28/91 TIME: 22:48  
To Japan:Manabu/Okada, pls update whether TC problem is still occurred?

ASSIGNED: BAHIA MICHAEL E DATE: 01/22/91 TIME: 16:24  
We have a new maint rel, 1.1B which fixes a TC problem with the MXE board, but it does not correct the I90 problem with the 2270A. We are still expecting to get a new release any day now to address the 2270A problem. Taiwan R&D has had some equipment problems that have slowed things up. Do we have any details yet on the TC problem or have they been corrected?

ASSIGNED: BAHIA MICHAEL E DATE: 01/09/91 TIME: 19:02  
Tested new release against this problem today & this problem is not fixed. Have updated R&D that 1.1B does not fix problem and a fix is still needed. Sorry for the delay.

ASSIGNED: WONG TAK LAM DATE: 01/09/91 TIME: 02:15  
To H.O.: Michael, is the maintenance release OK to be sent? What is the version of it?

ASSIGNED: BAHIA MICHAEL E DATE: 01/02/91 TIME: 12:55  
We have a new maintenance release which has a fix for this problem. It is being tested today. If good should be able to send out by Friday.

ASSIGNED: CHUI SIMON DATE: 12/27/90 TIME: 22:39  
To H.O.: Michael, pls forward a copy to us via office when it is available.  
To Japan: Manabu, do you still encounter any Telecommunication problem as mentioned in prevoius updates?

ASSIGNED: BAHIA MICHAEL E DATE: 12/21/90 TIME: 18:22  
R&D has the fix for this which will be in the next maintenance release. It may have been completed today but we are now off until Jan 2. We should be able to get it to you that week if no problems found in testing.

ASSIGNED: BAHIA MICHAEL E DATE: 12/12/90 TIME: 13:15  
There are existing problems using the 2270A with the 386 which result in I90. See PTR C900003678. R&D is currently working on this problem & we hope to have a fix shortly. MVPs and LVPs cannot be upgraded to 386 boards. Only CPUs built with just a single CPU board slot are supported. Extended etches on MVP/LVP motherboards appear to be problem. What is I/F? What kind of TC problems are there? Should be using minimum O/S 1.1. Remember boards that appear to work perfectly with the older CPUs may fail with the 386 board cause the clock is so much faster. Please refer to TSBs HWT 9373 from 12/12/89, SWT 9225 from 12/26/89, & SWG 9176 from 3/27/90 for additional technical information.

ASSIGNED: WONG TAK LAM DATE: 12/11/90 TIME: 05:15  
To H.O.: Asking for proper trouble-shooting procedures to the problem. We don't quite familiar with this system. Regards.

ASSIGNED: FUKAMACHI MANABU DATE: 12/09/90 TIME: 21:08  
Simon, Error is "I90". 2270A P/N 210-7218C e-rev 7.  
210-7342 0.  
210-9746 0.

Same ERROR appeared.

ASSIGNED: CHUI SIMON DATE: 12/06/90 TIME: 06:19  
Manabu, What error is shown in diagnostic, such as I90 or I91 etc.  
Is there any problem in other peripherals?  
Pls confirm whether it is a model 2270 or 2270A disk drive?  
What is the p/n for disk controller and e-rev level of that?

ASSIGNED: FUKAMACHI MANABU DATE: 12/04/90 TIME: 04:34  
Run the 2200 diagnostics, No error CPU. 2270 disk - Many errors appear.

ASSIGNED: WONG TAK LAM DATE: 12/03/90 TIME: 00:26

XA0291S  
00.00.00

W A N G L A B O R A T O R I E S I N C .  
PROBLEM TRACKING AND REPORTING  
CUSTOMER COMPLETE DETAIL REPORT  
P R O B L E M D E T A I L  
CUSTOMER PROBLEM NUMBER C900004346

PAGE: 14  
26 SEP 1991  
08:44:01

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ASSIGNED: WONG TAK LAM                      DATE: 12/03/90    TIME: 00:26  
To Japan: Have you run the 2200 diagnostics for CPU & peripherals ? HWT9373  
has some troubleshooting info when using the 386 CPU board.

ASSIGNED: FUKAMACHI MANABU                DATE: 11/30/90    TIME: 05:00  
SYSTEM hang, Can't telecommunication, Many problems by I/F and devices.  
Pls information. Thanks.

ASSIGNED: WONG TAK LAM                      DATE: 11/30/90    TIME: 04:16  
To Japan: WHAT are the problems ? Could you list them out one by one ?

ASSIGNED: YEUNG ADA                         DATE: 11/30/90    TIME: 02:43  
To: CSO/Japan, PTR is accepted in ASC at Nov 30, 90.

MIKE BAHIA

TELECOMMUNICATIONS

SEMINAR

M

MATT ZABOY  
EXT 6152

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## Terminology

### Asynchronous

Asynchronous transmission is often called "Start/Stop" transmission. Usually used for low volume, low speed requirements, asynchronous is characterized by transmission of one character at a time. Each character is "framed" by the sending equipment with signals telling where the character's bits begin and end. These signals are called "Start" and "Stop" bits. The 22V06 IOP does not presently support asynchronous transmission but it is being investigated. Asynchronous transmission is used in the following protocols: TTY1, TTY2, IBM I, and IBM III.

### Synchronous

Synchronous transmission, used for high volume, high speed requirements, is characterized by transmitting a "block" of data at a time. At the start of each block is a pattern which allows the receiving equipment to synchronize on the bit stream. This method implies a buffer in the terminal to be used for collection of characters to form a block. The buffer also allows retransmission should an error occur. BSC, HDLC, and SDLC protocols use synchronous transmission.

### Full Duplex

This is a method of transmission where data can be sent in either direction simultaneously. Full duplex usually requires "four wire" service however, some modems are capable of full duplex over "two wire" service. The 22V06 does not support full duplex operation but for certain point-to-point applications, full duplex modems can be used to eliminate delays in turn-around.

### Half Duplex

This method of transmission allows data to be sent in either direction, but not simultaneously. Half Duplex uses "two wire" service, however, "four wire" service can be used under certain applications using multidrop leased lines. The host will be "four wire" while the remotes will be "two wire". The 22V06 and 2246R are half duplex units. In half duplex transmission there is a delay each time the line is reversed called line turnaround or Clear-to-Send delay. This time is needed for the modems to reverse the signal direction and allow the lines to settle.

### Simplex

This is a communications facility capable of transferring data in one direction only, or a mode of circuit operation which permits communication in one direction only, even though the circuit may be designed for half duplex operation.

### Four Wire Service

This service allows full duplex operation at any common speed. Four wires (two pairs) are attached to the modem. One pair is for inbound traffic and one pair is for outbound. The 208A is a typical four wire modem.

NOT  
SUPPORTED  
AT THIS  
TIME

IN  
USE

### Two Wire Service

This service allows half duplex operation at medium to high speed. Two wires (one pair) are attached to the modem and handle both inbound and outbound traffic. At speeds of 1200 bps and below, some modems are capable of full duplex operation over two wires by simultaneously transmitting different frequencies in either direction.

### Modem

The modem is a device used to interface with communications facilities which then allow terminals and computers to communicate over any distance. The modem is used to convert the digital signals present on the computer/terminal output to analog signals for use on the carrier system. This conversion is known as modulation. The conversion of signals back to digital is called demodulation, hence the term modem. The following is a list of the most common types of modems supported by the 22V06 where the Bell numbers are for reference and not for endorsement:

- 201A - 2000 bps, half or full duplex
- 201C - 2400 bps, half duplex leased or switched line or full duplex leased line.
- 208A - 4800 bps, half or full duplex on leased line.
- 208B - 4800 bps, half duplex on switched line
- 212A - 1200 bps, full duplex on switched line
- 209A - 9600 bps, leased line

### Baud and BPS      BAUD & BPS ONLY EQUAL IF CLOCK FOR EA DATA BIT.

Baud is a unit of signalling speed equal to one second divided by the time duration of the shortest unit or pulse in any one character. BPS is the abbreviation for "bits per second". In computer systems, the bit rate equals the baud rate if all bits have the same duration.

### Multiplexing

This is the process of combining two or more channels of information for simultaneous transmission over the same line(s). Multiplexing effectively replaces a number of lines with one line of greater capacity.

### Switching

This is the process of establishing temporary interconnections between two or more stations of a communications system. The facility is connected each time before use by dialing the destination's telephone number, thus providing one network subscriber access to all others on the communications system. Types of switching include circuit, message, and packet switching.

### Switched Lines

Switched lines (or DDD: Direct Distance Dialing) are used for connections established for the duration of the communications session. The physical connection facilities are probably different each time because of the call's routing, hence the disadvantage of switched lines is that line quality cannot be assured and therefore the user is restricted to the lower speeds (2400 bps recommended/4800 maximum).



### Leased Lines

A leased line is a point to point or multi-point circuit reserved for the sole use of the leasing subscriber. This communications facility is permanently connected between two or more transmitting/receiving devices. Leased lines can be conditioned to provide for higher speeds and less errors.

### Multipoint

This is a mode of communications circuit operation in which signals within the circuit are received by all stations connected to the circuit. Multipoint is a method of sharing one physical line to the host system among several terminals. This method implies polling facilities in the host software.

### Point to Point

This is a method of attaching a single terminal to a central host system. The line is not shared with any other terminal and in this method of connection the host software sees a one-to-one correspondence with the terminal. Point-to-point can be implemented using either leased or switched lines.

### Protocols

When data is transferred from one location to another in a computer system, it is usually necessary to add additional information to specify the ultimate destination of the information, detect and correct errors that may occur during the transfer, and arbitrate use of the communications path between users requesting simultaneous access. This information is referred to as "protocol". A protocol is the agreed upon procedure defining how the terminal and the host will communicate. A protocol specifies:

- Definition of line control characters
- Message layout; how control characters are used
- How to begin and terminate transmission
- Dialog on the line
- How to detect errors
- What to do when an error is detected

There are several different protocols, each with its own unique characteristics, for example:

- TTY1 - Asynchronous, Baudot code used on TTY28 and WU115A
- TTY2 - Asynchronous, TWX code used on Teletype 33 and 35
- IBM I - Asynchronous, PTTC code used on IBM 2740
- IBM III - Asynchronous, USASCI-8 code used on IBM 2848/2845
- BSC - Synchronous, EBCDIC/USASCI codes used on 3270/3780
- SDLC - Synchronous, any code, used on 3270/3650/3600/3790

At present, the 22V06 supports only the BSC (BISYNC) protocol to communicate with the 2246R, VSCOPY, TCCOPY, and 3270 emulation.

## Networks

The fundamental purpose of a computer network is to provide access to the resources of other computers in the network. This is done by providing a network operating system which oversees access to resources on other nodes. A part of the network provides a transport mechanism, the purpose of which is to transport data quickly and unchanged to any part of the computer network. This mechanism is much easier to implement than a complete network and many "value added common carriers" provide only this service to their subscribers: Telenet, Tymenet, SBS, and COMSAT, for example.

Networks fall into two broad categories: general purpose and specialized. A general purpose network provides an interface for the attachment of computers of different manufacturers and provides a set of "network services" to the subscriber: e.g. ARPANET, ACS, SNA. A specialized network exists to provide a special function such as electronic mail, on-line banking, or ticket reservations. Typically, these networks interface to the equipment of a single manufacturer.

## Network Terminology

### Circuit Switching

Switching is performed in the telephone network where communication is along a circuit established for the duration of the call. This arrangement is suitable when transporting data in large quantities. The disadvantage is the costly set-up time needed to establish a connection.

### Message Switching

This is a method of operating a communications network in which messages are moved from node to node. The message switch at a node must be capable of storing a message but need not necessarily wait for the whole message to be received before starting the onward transmission. This type of switching is suitable in applications not requiring end to end interaction: electronic funds transfer, electronic checking, and electronic mail, for example. The advantage of this arrangement is increased utilization of line capacity. The major disadvantage occurs when the system is heavily loaded and the message queues extend into auxiliary storage; this can introduce a delay that can range from a few minutes to several hours.

### Packet Switching

This is a method of network operation involving the formatting of messages into "packets", each of a fixed maximum size. Consequently, a message may have to be carried as several "packets". This message is similar to message switching when the size of each message is limited to, say 1000 bits; this is to guarantee that no message will cause the system to operate at capacity. By doing so, packet switching systems can provide service close to circuit switching response times and at an attractive cost. Packet switching almost always utilizes private lines and performs multiplexing by interleaving packets from different streams according to their demand for channel capacity. This economy is offset by the overhead required for packet headers and other control packets. It produces an economy where the use of the circuit would be intermittent or sparse - the case in most data communications and in most kinds of terminal interaction.

## Modem Terminology

<sup>RS232</sup>  
DTR - Data Terminal Ready (CD - pin 20)

DTR is supplied by the terminal or host computer. This is the first condition which must be on to start up the modem. The "ON" condition prepares the modem to be connected to the communications channel, when a line connection is established via the telephone set. The "OFF" condition causes the modem to be switched off. In the 2246R, DTR is up when power is applied and in the 22V06, DTR is activated by the microcode. The 2228N Null Modem applies DTR to pin 6 on the terminal end (normally DSR) which effectively tells the terminal that the host and the modem are up and ready. Leased line modems do not use DTR on point-to point connections because the transmitter and receiver are always turned "ON".

<sup>RS232</sup>  
DSR - Data Set Ready (CC - pin 6) or MR

DSR is supplied by the modem. The "ON" condition indicates that the modem is connected to a communications line (OFF HOOK in switched service) and is ready for data transmission. DSR also means that the modem is not in "talk" or "dial" mode nor in "test" mode. On the 2228N null modem, DSR is tied to DTR so that as soon as the terminal or host is ready (DTR) the other end is notified that the modem is ready (DSR).

RTS - Request to Send (CA - pin 4)

RTS is supplied by the terminal/host to notify the modem that it requires the communications line. When RTS is received from the terminal, the modem's modulator is turned on and the modem enters the transmit mode and starts generating and sending a carrier wave onto the communications line. When RTS is turned off, the modem stops transmitting and goes back into receive mode after all data received from the terminal has been transmitted. In the 2228N null modem, RTS is tied to the sending unit's CTS (Clear to Send) and the receiving unit's "received line signal detector" (Carrier Detect).

CTS - Clear to Send (CB - pin 5)

CTS is provided by the modem and is the modem's response to RTS. CTS will respond after some delay, which is necessary to allow the modem's transmit circuits to establish the carrier and to allow the receiver circuits of the remote modem to synchronize with the carrier of the transmitting modem. In the 2228N null modem, CTS is tied to RTS at the transmitting end and to Carrier Detect at the receiving end. This way RTS, CTS, and Carrier Detect come up instantaneously.

TX Data - Transmitted Data (BA - pin 2)

TX Data is supplied by the terminal/host in the form of serial data and is applied to the modulator circuitry of the modem after CTS. This serial digital data is then converted to an analog modulated signal and transferred to the receiving terminal/host. The TX Data line is held in the marking condition (logical "1") during intervals between characters or words and at all times when no data is being transmitted. A positive voltage denotes the spacing state (binary "0") and a negative voltage denotes the marking state (binary "1"). In the 2228N null modem TX from the host is tied to RCV Data to the terminal and vice versa.

### RS232

#### TX Clock - Transmit Clock (DB - pin 15)

TX Clock is supplied by the modem. For the transmission of synchronous binary data, timing information is provided to the terminal's/host's transmit circuit to denote every new bit location in the binary data stream. TX Clock must be up before TX Data. If the modem does not have an internal clock, the timing information is provided by the terminal or host. In the 2228N null modem, TX Clock is tied to RCV Clock on both ends. When using the null modem, the 22V06 provides the clock, hence the polarity of the 2228N. For asynchronous transmission of data, the TX Clock is not required. The asynchronous character delimiters "START" and "STOP" bits are used for synchronization of the TX Data.

### RS232

#### DCD - Data Carrier Detect (CF - pin 8)

DCD is supplied by the modem when the demodulator detects a received carrier. DCD informs the terminal/host of incoming data. To bring up DCD, the modem must be in receive mode which means RTS is off, the modulator is off and the demodulator is on. In this state, the modem waits for a carrier from the remote site. In the 2228N null modem, DCD is tied to RTS and CTS on the other side.

### RS232

#### RX Data - Received Data (BB - pin 3)

RX Data is supplied by the modem in the form of digital serial data. RX Data is developed from the analog signals received from the remote terminal/host via the remote modem's modulator circuit. In normal applications, the host/terminal will only accept signals on this line when DCD is present. In the 2228N null modem, RX Data is tied to TX Data on the other end.

#### RX Clock - Receive Clock (DD - pin 17)

RX Clock is supplied by the modem, for synchronous data only, to denote to the terminal the bit locations of the received data stream. RX Clock must be up before RX Data. In the 2228N null modem, RX Clock and TX Clock are tied together at each end and to each end.

#### Four Wire Operation

In a four wire communications environment there are two permanent wires available for the transmit circuit and two for the receive circuit. It is obvious that when the TX modulators and the RX demodulators are kept ON continuously, the following advantages will be available:

Full Duplex transmission - transmit and receive  
at the same time

For Half Duplex transmission there will be no line  
turnaround time.

Note that in a four wire operation, the switching signals RTS and CTS are not active and are hardware strapped in the modem and constant in the terminal/host.

#### Null Modem (WLI# 177-2228N)

The null modem is used to connect two pieces of RS-232-C terminal equipment without using modulating/demodulating devices. The null modem can be used for short distances only (100 ft max).

## Modem Indicators and Test Buttons

Bell model 212A

### Status Lamps

MB - Make Busy - The ON condition of this lamp indicates that the internal make busy circuit is activated and/or the data set is ready for an analog loop test.

TR - Terminal Ready - The ON condition of this lamp indicates that the customer terminal equipment is applying an ON condition to the CD interface circuit. NOTE - CD is EIA pin 20, DTR.

MR - Modem Ready - The ON condition of this lamp indicates that the data set has turned ON the CC interface (EIA pin 6, DSR) circuit except when the dataset is in the self test or digital loop modes. In these modes the MR lamp monitors the status of the internal modem ready circuit.

SD - Send Data - This lamp indicates the state of the customer interface circuit BA (EIA pin 2, TX Data) whenever the data set is conditioned to transmit data. The lamp is on when the BA circuit is positive (space).

RD - Received Data - This lamp indicates the state of the data set interface circuit BB (EIA pin 3, RX Data) except when the data set is in self test, digital loop, or in the low speed mode with the speed mode HIGH option installed. During these modes, the lamp displays the state of the internal received data. The lamp is ON when the received data is positive (space).

HS - High Speed - This lamp monitors the status of the speed mode detection circuit. The lamp is ON whenever the data set is transmitting and receiving at 1200 bps, including the high speed analog loop test mode.

MC - Modem Check - This lamp provides indications for two distinct conditions. In the data mode, whenever the receiver carrier energy is below the carrier detect threshold, the lamp will be ON. When the data set is in the self test mode, and the self test receiver circuit detects an error in the received data pattern, this lamp blinks ON for 300ms. The modem check lamp is ON whenever the data set is in the idle condition, or talk mode.

TM - Test Mode - This lamp is ON whenever the data set is put in a test mode, either locally or remotely.

### Test Buttons

Four of the five front panel pushbuttons are for system testing. The

fifth (HS) button is an operational control.

AL - Analog Loop - This button conditions the data set to permit local testing by customer terminal equipment through the customer interface.

ST - Self Test - This button overrides the customer interface BA circuit forcing the transmission of a test pattern. The button also activates the error detection circuit which monitors the received data, and provides an indication of bit errors.

RDL - Remote Digital Loop - This button allows testing of local and remote data sets in the high speed mode and the intervening channels with the local customer terminal equipment. the remote data set is automatically put in the digital loop mode when the local RDL button is depressed.

DL - Digital Loop - This button allows testing of the local data set from a remote location such as a data test center without local customer terminal equipment.

HS - Speed Mode - The 212A data set is capable of communication at two distinct bit rates which are nominally called 300 bps and 1200 bps. Both directions of communication are at the same bit rate.

The bit rate of a given communications link between 212A data sets is completely controlled by the data station that originates the connection. At the originating (calling) station, the speed mode is controlled by the speed select button (HS) on the front panel. The speed mode must be selected before the data mode is entered, and cannot be changed once the data set is in the data mode. The speed mode of the answering station is automatically determined from the received line signal, and the local customer speed selection circuits are ignored.

When the speed mode HIGH option is selected, the speed select control of the data set is still functional, and the data set will enter the appropriate speed mode when the data mode is entered. If the low speed mode is entered, however, the transmission and reception of customer data are blocked at the customer interface. When the high speed mode is entered, the interface acts normally.

The speed mode of a data call can be changed by simultaneously transferring both data sets to the talk mode, changing the originating speed selector to the new speed, and re-entering the data mode. This method can be used only when there are attendants at both stations.

## Bell Model 201C

### Status Lamps

ON - Power On - The ON lamp will light when AC power is applied to the data set.

TR - Terminal Ready - The TR lamp will light when the DTR from the customer interface goes ON (CD - pin 20).

MR - Modem Ready - The MR lamp indicates that DSR (CC - pin 6) is active.

RS - Request to Send - The RS lamp indicates that RTS (CA - pin 4) is active on the interface.

CS - Clear to Send - The CS lamp indicates that CTS (CB - pin 5) is active.

CO - Carrier On - The CO lamp indicates that DCD (CF - pin 8) is active, also known as Received Line Signal Detector.

MC - Modem Check - The MC lamp indicates the absence of Receive Signal Element Timing (RX Clock) (DD - pin 17) signal at the customer interface. In normal operation the lamp will be on when the CO lamp is off. It will off when the CO lamp and the interface circuit DCD (CF - pin 8) are on (when receiving a signal). When using the self test feature, the MC lamp is, again, on whenever CO is off. However, when CO is on during self test, the MC lamp flashes on whenever an error occurs on the RX Data (BB - pin 3) lead. This provides a positive indication of any malfunction in the data set or errors due to transmission impairments on the channel when the self test is made.

TM - Test Mode - The TM lamp will light when the data set is placed in the TEST mode by use of the AL, ST, RT, or DL test switches (but not the RO switch). The lamp will go off only if the data set is removed from the TEST mode by releasing the appropriate test switch(es).

#### Test Switches

The 201 C has five pushbutton test switches accessible at the front cover which permit comprehensive local and remote testing of the data set and facilities. The buttons are push-to-operate and push-to-release type. All buttons must be released to the out position for normal operation.

RO - Receive Only - Used to condition the data set as a receiver when self testing the data set over switched network or two wire non-switched private line facilities. When depressed, the switch turns the RTS signal within the data set off regardless of the state of RTS at the customer interface or any other test switches.

AL - Analog Loopback - Used to connect the transmitter output to the receiver input on both two- and four-wire services. For switched network service, operation of the AL switch will prevent the data set from entering the data mode manually and will inhibit automatic answer. While the talk mode is not inhibited, any attempt to transfer to the data mode will result in the call being dropped.

ST - Self Test - Used to condition the data set to operate with a built in word generator and word comparator to check for errors. This switch internally turns the RTS and DTR signals on.

RT - Remote Test - used only for switched network data sets to condition the data set for switched network testing from a telephone company test center.

DL - Digital Loopback - Used only for four wire data sets to connect together the RX Data and TX Data circuits, the RX Clock and the TX Clock circuits, and the DCD and the RTS circuits. This permits a four-wire data set to operate as a regenerator for testing from a remote location.

Bell model 208A

Status Lamps

ON - Power On - The ON lamp will light when AC power is supplied to the data set. If for any reason the power supply voltages in the data set rise excessively, the ON lamp will extinguish. When this occurs, the power unit can be reset by unplugging and replugging the power cord in the AC outlet. If the condition persists, the customer should verify that the correct AC voltage is being supplied to the data set and, if such is the case, notify the telephone company repair service for correction of this problem.

MR - Modem Ready - The MR lamp indicates that DSR (CC - pin 6) is active in the modem.

RS - Request to Send - The RS lamp indicates that RTS (CA - pin 4) is active on the interface.

CS - Clear to Send - The CS lamp indicates that CTS (CB - pin 5) is active on the interface.

CO - Carrier On - The CO lamp indicates that DCD (CF - pin 8) is on in the modem (also known as Received Line Signal Detector).

ER - Equalizer Retrain in normal mode or Error Indication in self test mode - The ER lamp indicates the mode of the adaptive equalizer when the data set is in the data mode. It is normally on when CO is off. When the CO lamp is on and the ER lamp is flashing, the automatic adaptive equalizer is retraining. After retraining, the ER lamp will go off. If ER continually flashes when the CO lamp is on, marginal performance is indicated (i.e., channel impairments are excessive or the data set is faulty). If this condition should arise, testing procedures should be employed. The ER lamp is also used when the data set is in one of three self test modes (analog loopback, end-to-end, or digital loopback). The ER lamp will flash whenever errors are detected in the received data signal during these tests.

In the present version of the 208A, indication that a test is in progress is given by the depressed pushbuttons.



## Test Switches

LP - Lamp Test - This is a non-locking button which when held depressed will light all of the status lamps except the ON lamp (which is lit whenever the data set is powered on) to check that they are working. Depressing this button does not affect data set operation.

AL - Analog Loopback - The AL button is used to connect the transmitter output to the receiver input through an internal attenuation network. This permits the testing of the local data set with either self contained test circuitry activated by the ST button or with external test equipment or the data terminal equipment through the data set interface.

ST - Self Test - The ST button is used to condition the data set to operate with a built in test word generator and word comparator to check for errors. This switch internally turns the RTS signal on and lights the RS lamp. The DSR circuit and the MR lamp are both turned off. The ER lamp will blink on to indicate the presence of errors.

DL - Digital Loopback - The DL button is used to internally connect together the RX Data and the TX Data circuits, the RX Clock and the TX Clock, and the Signal Quality (CG - pin 21) and the RTS circuits at the customer interface. This permits a round trip test of the facilities and the two data sets with either the self-contained test circuitry activated by the ST button or with external test equipment or the data terminal equipment through the data set interface. It also permits a loop-around test to be made from a telephone company test center.

NOTE - the DL button will not function properly unless the AL button is released.

The four test switches permit the following types of tests to be made:

1. Analog loopback self-test (data set alone).
2. End-to-End self test (one data set transmitter, one data set receiver, and the interconnecting private line facilities).
3. Digital loopback self-test (two data sets plus the four wire private line facilities).
4. Analog loopback test (data terminal equipment and local data set; requires full duplex DTE operation).
5. Digital loopback test (data terminal equipment, two data sets and four wire facilities; requires full duplex DTE operation).
6. Telephone company remote tests (local data set and four wire facilities to the telephone company test center).

Any of the first three self-tests can be made by the customer, prior to calling the telephone company repair service, without any auxiliary test equipment. Tests 4 and 5 permit testing through the data set interface with external test equipment as well as with the data terminal.

The original version of the 208A had a slide switch for testing instead of push buttons, and the ST and LP functions were not available.

EIA RS-232-C Interface

<u>Pin#</u>	<u>Circuit</u>	<u>Label</u>	<u>Name</u>	<u>Description</u>
1	AA	---	Protective ground	Attached to equipment frame for grounding
2	BA	TD	Transmitted Data	Serial bits being sent
3	BB	RD	Received Data	Serial bits being received
4	CA	RTS	Request to Send	Terminal tells modem it wants to send
5	CB	CTS	Clear to Send	Modem tells terminal it's ready to send
6	CC	DSR	Data Set Ready	Modem has power on, not in test, line connected
7	AB	---	Signal ground	Common ground reference potential
8	CF	DCD	Carrier Detect	Modem is receiving carrier from other modem
9	--	---	Test	Reserved for modem testing
10	--	---	Test	Reserved for modem testing
11	--	---	Unassigned	Not presently used on RS-232-C interface
12	SCF	---	Secondary Carrier Detect	Same as DCD for secondary channel
13	--	---	Secondary Clear to Send	Same as CTS for secondary channel
14	SBA	---	Secondary TX Data	Same as TD for secondary channel
15	DB	SCT	TX Clock	Modem gives clock to DTE to send data
16	SBB	---	Secondary RX Data	Same as RD for secondary channel
17	DD	SCR	RX Clock	Modem gives clock to DTE for received data
18	--	---	Unassigned	Not presently used on RS-232-C interface
19	SCA	---	Secondary RTS	Same as RTS for secondary channel
20	CD	DTR (MR)	Terminal Ready	Terminal tells modem it is ready
21	CG	---	Signal Quality detector	Modem sets OFF if high probability of error
22	CE	RI	Ring Indicator	Modem tells it's receiving ring signal
23	CH/CI	---	Data Signal Rate Selector	Used to select speeds if dual speed
24	DA	---	TX Clock	Terminal gives clock signal to modem
25	--	---	Unassigned	Not presently used on RS-232-C interface

## Protocol

At the present time, the 22V06 IOP supports only the BSC (Binary Synchronous Communications) protocol and therefore this section will be limited to the discussion of BSC. For information on other types of protocol, refer to Data Communications Concepts Training Manual, Section II, for an outline.

### BSC Protocol

When the communications data link hardware components are available and when a line connection is established, the CPU and terminal are ready for conversations. It is obvious that a conversational problem would occur if every terminal used a different language. Therefore, in order to allow many different terminals to communicate with the host CPU without compatibility problems, a special TC language was developed by IBM for the orderly transfer of data transmitted in synchronous mode. This is called BSC or BISYNC communications procedure, which is a half duplex procedure.

BSC is capable of accomodating a broad range of medium and high speed equipment. The code sets used in the BISYNC procedure are as follows:

WANG USES - EBCDIC: Extended Binary Coded Decimal Interchange Code  
                  which has 256 code assignments  
          USASCII: United States of America Standard Code for Information  
                  Interchange which has 256 code assignments  
          Six Bit Transcode: Has 64 code assignments

Any one of the code sets can be used with the transparent mode where all possible bit configurations are treated as data only within transparent text.

With normal transmission under BSC, the text block may not contain the bit representation of control characters. This does not allow the transmission of all 256 characters as data. Transparency is a method to allow all 256 character combinations in the text, by preceding each control character by the DLE character. Example: DLE STX initiates transparent mode for the text that follows.

### BSC Line Control Characters

The BSC protocol uses control sequences to maintain line control. These are usually shown by acronyms that refer to either one or two characters. The HEX representation of an acronym may differ between ABCDIC and USASCII; these representations are shown on the following page.

<u>Acronym</u>	<u>Name</u>	<u>EBCDIC</u>	<u>ASCII</u>	<u>Description of Use</u>
SYN	Synchronous Idle	32	16	Establishes and maintains modem synchronization
SOH	Start of Heading	01	01	Puts terminal in text mode. Starts accumulation of new BCC
STX	Start of Text	02	02	Puts terminal in text mode. Starts accumulation of new BCC
ITB	Intermediate Text Block	1F	1F	End of intermediate block, check parity but do not reset
ETB	End Text Block	26	17	End of text, check BCC and respond. Another block will follow
ETX	End Text	03	03	End of Text, check BCC and respond. This is last block
EOT	End of Transmission	37	04	Puts terminals and line in control mode. Negative response to poll
ENQ	Enquiry	2D	05	With point-to-point this asks "can you accept transmission?" With multipoint, ENQ is part of polling and selection.
<b>DLE</b>	Data Link Escape	10	10	Used with other control characters to create special 2 character sequences.
ACK0		1070	1030	Positive reply to even blocks
ACK1		1061	1031	Positive reply to odd blocks
RVI	Reverse Interrupt	107C	103C	Notifies sending station to stop transmitting.
WACK	Wait Positive Acknowledgment	106B	103B	"Received last block OK, but wait before transmitting next."
NAK	Negative Acknowledgment	3D	15	Notifies transmitting station last block was received with error.
TTD	Temporary Text Delay	022D	0205	Transmitting station wants to return control of line but cannot xmit now.
PAD	Pad Character	FFFF	FFFF	Follows each text block to allow time lapse before turnaround. Either all ones, alternate 1/0, or SYN char.

*PROCEEDS TO CONTROL IT AS SUCH*

The SYN is transmitted by the sending equipment to allow synchronization. At least three SYN characters are needed and are generated by the sending equipment. These are deleted by the receiving equipment, so never appear in the receiver's buffer.

The PAD character follows each block and allows for possible disturbances due to transmission terminations. It has no other function.

## Remote Workstation Activation

### Leased Line or Null Modem

1. Power-On Remote workstations(s) and MSU, if present.
2. Verify that R/WS Power-Up-Diagnostic has completed on each workstation. The screen should display:  
    "WS # NN RDLP:2.0.0:041180" in upper left corner and  
    "2246R POWER-UP REV 2.4" in center of screen.  
NOTE: The above specific information may change as revisions are made to the Remote Workstation firmware and P.U.P..
3. Verify that the modems have power applied to them.
4. At the operator's console, depress PF7 (Control DEVICE STATUS) and then PF9 (Control REMOTE DEVICES).
5. Move cursor to the CLUSTER column of the device # GEN'd for and connected to the Remote Workstation to be activated. Insert in the CLUSTER column the number, corresponding to the address switch setting in the R/WS, of the Workstation to be activated.
6. Move cursor to PORT column and enter 00. The PORT column is not used at present and must be set to 00.
7. Move cursor to DEVICE-ON-PORT column and enter 00.  
NOTE: 00 for workstation, 01 for printer.
8. Reposition cursor (with BACK TAB) to the line being activated.
9. Depress PF8 (ACTIVATE). In a short time, the message DEVICE RESERVED should appear in the status column. At this time the VS is loading microcode to the 2246R and if operational the message "WS # NN LOADING" will appear on the upper left corner of the screen after a few seconds, depending on line speed. After another delay, the LOGON screen will appear.
10. If the message "ASSISTANCE REQUIRED FOR WORKSTAT NN" flashes on the operators's console sometime after activation, verify the following:
  - a. If upper left corner on screen displays "LOAD FAILURE" (irrecoverable problem during loading) or "SYSTEM FAIL" (irrecoverable S/W problem during running or loading).
  - b. Steps 1, 2, and 3 above.
  - c. Proper connections on modem. MR lamp on modems should be on.
  - d. Proper connections on 22V06, 2246R, and MSU.
  - e. External SIO on 2246R and Loop-Back test on 22V06.
  - f. Phone lines.

If all of above verify, troubleshoot.

### Switched Lines

Switched lines are activated as above except that after PF8 (ACTIVATE) the phone line must be connected by dialing. The message "ASSISTANCE REQUIRED AT WORKSTAT NN" may come up but will go away when line is established. If the message does not disappear after a few moments follow above procedure (Step 10).

## Remote Printer Activation

1. Verify steps 1, 2, and 3 of Remote Workstation Activation procedure.
2. Power-On the remote printer and select.
3. Activate the Remote Workstation per previous page.
4. In "Control REMOTE DEVICES" screen:
  - a. Move cursor to the TYPE column of the device # selected for the remote printer.
  - b. Enter 2221V into TYPE column.
  - c. Move cursor to CLUSTER column and enter the number of the Remote Workstation that the printer is attached to.
  - d. Move cursor to the PORT column and enter 00.
  - e. Move cursor to the DEVICE-ON-PORT column and enter 01.
  - f. With BACK TAB put cursor on the line being activated.
  - g. Depress PF8 (ACTIVATE). In a short time (1 sec. max.) the word ATTACHED should appear in the status column.

The printer and workstation should now be ready for use. If you only want to use the printer, it is not necessary to LOGON on the workstation. The printer will act independently of what is being done on the workstation. All that is required is activation of workstation and printer, in that order.

NOTE: DO NOT deactivate the remotes while they are loading or in operation and do not deactivate the printer when in use unless a hang situation absolutely requires the deactivation. Most R/WS hang problems can be reset with power-off/power-on. The 22V06 will usually reload the 2246R if the line is connected.

## Deactivation of 2246R and Printers

1. Ensure that the printer is inactive and the R/WS is Logged Off. Do Not power the units off at this time.
2. Depress PF7 then PF9 to bring up the "Control REMOTE DEVICES" screen.
3. Move cursor to the printer line, if attached, then press PF9 (DEACTIVATE).
4. Move cursor to selected 2246R line and press PF9.
5. The remote equipment may now be powered off.

You may find that after Activating and Deactivating many times that you can ignore some of the steps and notes. In order to minimize operational problems, have the customer adhere to a firm set of procedures.

In some instances, especially on dialup lines, the DTR on the 22V06 will not go inactive at deactivation time. This means that the phone line is still in use and connected. This is a known problem and is being investigated. Should you have this problem, just run TCTEST to that port and then end it after it samples the port. This can be prevented by making all line connections by calling from the remote site to the host.

## System Generation of Telecommunications

Refer to the Release 4.02 SYSGEN Procedure Manual (WLI# 800-8201SP-03) for the generating procedure (see pages 17 - 19).

As many 22V06-3 IOP's as are slots available can be installed into the 2200VS. The 22V06 can be set to 32, 64, 96, 128, 160, 192, and/or 224. Each IOP to be used must be specified in the GEN and each port on the IOP that will be used must be specified.

### IOP TYPE=TC

This statement must precede the PP and LINE macros for lines on this IOP. This statement is used to set "programmable IOP" parameters. The word TYPE states the programmable IOP type and presently, only the TC type is supported.

### PP n,MCCLASS=TC,MCTYPE=name

This statement must be one of a group of PP and LINE macros following an IOP macro. This statement is used to generate the peripheral processor generation parameters. The three operands within the macro are described as follows:

n - the number (0, 1, or 2) of the peripheral processor within the IOP.

MCCLASS - the class of microcode that can be loaded to the peripheral processor.

MCTYPE - the name of the micro code type (compatible with MCCLASS) which will be loaded in response to the first occurring PP-CODE-NOT-LOADED error completion in an IO operation directed through this PP. This parameter is for documentation only and does not restrict the PP to the use of the MCTYPE name. The names that can be entered here presently are 2780, 3780, 3271, and REMWS.

### LINE n,DEVICES=nnn-~~nnn~~,NAME=name

This statement must be one of a group of LINE macros following a PP macro. The statement is used to set the TC line generation parameters. The operands within the LINE macro are described as follows:

LINE n - The TC line number within the PP. At present, use 0 for all configurations.

DEVICES=nnn-~~nnn~~ - The range of device numbers connected to this line. The range is from 1 to 32. A single device address line can be used for 2780 or 3780 emulation or one Remote Workstation. A two device address line can be used for 2780, 3780, or 3271 emulation, or one R/WS and printer, or two R/WS with MSU or multidrop leased line. An eight device address line can be used with 2780, 3780, or 3271 emulation, or four R/WS's with printers with MSU or multidrop leased line. The total number of TC devices specified plus the total number of other DEVICE statements cannot exceed 64.

NOTE: For 3271 emulation, two devices must be entered starting with an even numbered device.

NAME=name - The symbolic name given to a TC line. This name, one to eight characters in length, is for documentation only. The name does not restrict usage of the line in any way. The name entered here is what is displayed in the "DEVICE LINE" column at the operator's console when activating/deactivating (Control REMOTE DEVICES). If no name is desired, the NAME operand can be omitted

The following is an example of TC IOP Generation

```
IOP  TYPE=TC
  PP  0,MCCLASS=TC,MCTYPE=2780
      LINE 0,DEVICES=64-65,NAME=PORT00
  PP  1,MCCLASS=TC,MCTYPE=3271
      LINE 0,DEVICES=66-67,NAME=PORT01
  PP  2,MCCLASS=TC,MCTYPE=REMWS
      LINE 0,DEVICES=68-71,NAME=PORT02
IOP  TYPE=TC
  PP  0,MCCLASS=TC,MCTYPE=3780
      LINE 0,DEVICES=96-97,NAME=PORT03
  PP  1,MCCLASS=TC,MCTYPE=2780
      LINE 0,DEVICE=98,NAME=TC'TEST
  PP  2,MCCLASS=TC,MCTYPE=3271
      LINE 0,DEVICES=100-101
IOP  TYPE=TC
  PP  0,MCCLASS=TC,MCTYPE=2780
      LINE 0,DEVICES=128-129,NAME=BATCH
  PP  1,MCCLASS=TC,MCTYPE=3780
      LINE 0,DEVICES=130-131,NAME=PORT07
  PP  2,MCCLASS=TC,MCTYPE=REMWS
      LINE 0,DEVICES=132-139,NAME=REMOTIEWS
GENERATE
```



## BIBLIOGRAPHY

Model 2247V-4 Modem Sharing Unit P.M.M. (WLI# 03-0098)

Model 2246R Remote Standalone Workstation P.H.M. (WLI# 03-0089)

Data Communications Concepts Training Manual, Section I (WLI# 700-5550)

Data Communications Concepts Training Manual, Section II (WLI# 700-5551)

Data Communications User's Guide (WLI# 800-1302DC-02)

Data Communications Reference Guide (WLI# 700-5552)

Release 4.02 SYSGEN Procedure (WLI# 800-8201SP-03)

TC Self-Study AV Workbook (WLI# 03-0078)

Modem Decisions (May 13, 1980) by Software Support Group

"The Significance of X.25" article from MINI-MICRO SYSTEMS magazine

Mailway Seminar: "Introduction to Computer Networks" by Software Support Group

DATA SET 201C Interface Specification (4/73) (PUB 41210)

DATA SET 208A Interface Specification (11/73) (PUB 41209)

DATA SET 212A Interface Specification (10/76) (PUB 41214 prelim)

Assorted notes and memoranda



To: Distribution  
From: Matt Zaboy, VS Systems Support Group  
Date: 03/04/80  
Subj: Telecommunications Information.

These notes contain basic telecommunications information that will be helpful to the field. All information in these notes was obtained from some of the publications listed at the end of this memo. Please distribute this information to all VS field service people for their use as reference.

#### 22V06 Communications IOP

The model 22V06 IOP is designed to support a wide range of communications capabilities. This IOP is available in three versions: the 22V06-1, the 22V06-2, and the 22V06-3. The dash number indicates the number of synchronous communications lines supported on the IOP. In addition, each line can support an automatic calling unit (ACU).

With multiple lines, the 22V06 IOP can concurrently handle the same or different types of communication linking the VS to several remote sites. More than one 22V06 IOP can be used in the system when more than three communications lines are required, as long as there are IOP slots available in the VS chassis.

At present, the 22V06 IOP must be at E-Rev 5 (ECN 13403) to run properly on O/S 4.1.8.

#### 2247V-4 Modem Sharing Unit (MSU)

The Model 2247V-4 MSU allows up to four 2246R Workstations (with optional parallel printers) to share a single modem and data communications line. It eliminates the need for separate modems at remote sites where more than one 2246R workstation is

used. Only four workstation ports are active in the 2247V-4; the remaining connectors are not used. The MSU can be located up to fifty feet from the modem. The maximum allowable cable length from the MSU to the 2246R workstation is 2000 feet.

Circuitry within the MSU is designed to scan the attached 2246R workstations, one at a time. When a request-to-send (RTS) signal is received from one of the workstations, the MSU stops scanning and makes the data communications line available to that workstation. During this time, other workstations connected to the MSU do not have access to the communications line.

A model 2247V-8, with eight active workstation ports, will be released at some future time. This version is physically identical to the 2247V-4, and it will have software to support eight 2246R workstations.

The 2247V-4 MSU's must have the following ECN's installed for proper operation: ECN 13540 (E-Rev 1) on 7512 PCB, ECN 13749 (E-Rev 2) on PCB 7512, ECN 13943 (no E-Rev change) on 7512 PCB, and ECN 13994 (replace 210-7513-R1 MB PCB with 210-7513-R2).

#### 2246R Remote Workstation.

The 2246R Remote Workstation consists of a CRT screen and a typewriter-like keyboard with associated electronic circuits, together with a built-in telecommunications controller enabling it to function as a remote standalone workstation for single site applications. The controller electronics also support a parallel printer, which can be directly connected to the back of the remote workstation. The remote workstation is packaged in a standard Wang workstation cabinet that may be located for operator convenience in a variety of user applications.

Along with the standard Power Supply, CRT assembly and Keyboard assembly, the 2246R has two PCB's. The TC Memory PCB (TC Data Link Processor) WLI# 210-7478, contains the input/output control circuits through which the VS host system and the remaining workstation/printer electronics communicate with each other. This PCB contains a row of normal-operation PROM's which contain the DLP operating system's firmware.

The CRT/CPU PCB (enhanced workstation CPU) WLI# 210-7479, contains a microprocessor, an 8K RAM storage area, and CRT control logic. This PCB also contains keyboard input circuitry and interface circuitry for an optional parallel printer that can be connected to the 2246R.

For proper operation, the following ECN's must be installed into the 2246R workstations: ECN 13177 and 13550 (no E-Rev) on the 7479 PCB, ECN 12609 (E-Rev 1) on the 7478 PCB, ECN 13437 (E-Rev 2) on 7478 PCB, and ECN 13764 (E-Rev 3) on the 7478 PCB.

### MODEM's

A suitable modem is required for each communication line from a 22V06 IOP. A modem (modulator-demodulator) is needed as an interface between an IOP port and a leased or switched telephone line. The modem modulates the IOP's digital signals into a range of frequencies suitable for transmission over telephone lines and demodulates received signals before their transfer to the 22V06 IOP.

For point-to-point or multidrop telephone lines, any RS-232-C or CCITT V.24 compatible synchronous modem can be used. However modems at both ends of a communications link must be compatible with each other.

For local connections up to 100 feet over coaxial cables, a model 2228N "null modem" (available from Wang) can be used. For connections up to 25 miles over private lines, short-haul modems can be used.

Modems may be rented from telephone companies serving the localities where the 22V06 IOP and the remote devices are installed. The ordering of a modem is not the responsibility of a Wang salesperson or customer engineer; also, modem installation is not the responsibility of a Wang CE.

Various configurations require somewhat different modems. Listed below are the Bell modems and their options necessary for use on the 22V06 IOP. The Bell modems are listed only as a standard for comparison and are in no way the only recommended modems.

Bell Model 201A - 2000 bps, half/full duplex.

Options - A1, B3, C6, D7.

Bell Model 201C - 2400 bps, half duplex leased or switched line;  
full duplex leased line.

Options - (leased line) - A1, B3, C6, D8, E9, F12.

(switched line) - A1, B4, C5, D8, E9, F11.

Bell Model 208A - 4800 bps, half/full duplex, leased line.

Options - A1, B3, C6, D7, E10, F11.

Bell Model 208B - 4800 bps, half duplex, switched line.

Options - A1, B3, C6, D8, E9.

Bell Model 212A - 1200 bps, full duplex, switched line.

Options - A1, B3, C5, D8, E10.

Bell Model 209A - 9600 bps, leased line.

Options - A1, B3, C6, D8, E9, F12.

#### Automatic Calling Units (ACU)

Although a modem is required for each communications line from a 22V06 IOP, the use of an ACU is optional. Each port on a 22V06 IOP is uniquely addressable and has two connectors. The RS-232-C connector accepts the cable from a modem. The RS-366/V.11 connector accepts the cable from an ACU. Both of these connectors are identical 25 pin connectors but their use is marked on the IOP under the connector.

Listed below are the Bell ACU's and the options necessary for use on the 22V06 IOP. Again, Bell equipment is listed only as a standard for comparison, not an endorsement.

Bell Model 801A - for rotary dialer.

Options - A1, B4, C5, D8, E9.

Bell Model 801C - for Touch-Tone dialer.

Options - A1, B4, C5, D8, E9, F12.

## Data Access Arrangement (DAA)

Telephone companies require a DAA installed between the modem and the line when the modem is not supplied by the telephone company. The DAA provides protective circuitry to circumvent harm to the telephone lines due to "foriegn" device connection. The DAA usually consists of a telephone handset and a modem interface rented from the telephone company.

Listed below are the Bell DAA's and their options necessary for use with the 22V06 IOP.

Bell Model 1000A (CDT) - Manual only operation.

Options - No customer options.

Bell Model 1001A and 1001F (CBS) - auto operation, voltage interface.

Options - A2, B4, C5, D8, E10.

Bell Model 1001B and 1001D (CBT) - auto operation, contact closure interface.

Options - A1, B4, C6, D8.

## Wang Published Technical Publications on Telecommunications

<u>Item</u>	<u>WLI Stock #</u>	<u>Publication Title</u>
1.	700-3830	2227B Buffered Asynchronous TC Data Sheet.
2.	700-4086	TC Support Utilities User Manual.
3.	700-4086-1	TC Support Utilities User Manual Addendum.
4.	700-4114	2227B Buffered Asynchronous TC User Manual.
5.	700-4143	2228B Bisynchronous TC Data Sheet.
6.	700-4412	TC Marketing Guide.
7.	700-4703	TC Sales Guide.
8.	700-4704	Teletype Emulator Data Sheet.
9.	700-4705	Burroughs Emulator Data Sheet.
10.	700-4706	2741 Emulator Data Sheet.

- 11. 700-4707 HASP Multileaving Data Sheet.
- 12. 700-4708 3741 Software Utilities Data Sheet.
- 13. 700-4709 2780/3780 Software Utilities Data Sheet.
- 14. 700-4718 Asynchronous I Manual (mktg pub).
- \*15. Product Service TC Guide (CE pub) Service Bulletin #77.
- \*16. 03-0078 TC Self-Teaching Manual (CE pub)
- \*17. 03-0098 Model 2247V-4 MSU Preliminary Maintenance Manual (CE pub).
- \*18. WPNL #48 Bisynchronous Communications
- \*19. ~~03-0101~~ Preliminary 22V06 Manual
- \*20. 03-0089 2246R Preliminary Hardware Manual
- \*21. 13-3955 TC Handbook.
- \*22. 700-5550 Data Communications Concepts Training Manual I.
- \*23. 700-5551 Data Communications Concepts Training Manual II.
- \*24. 700-5552 Data Communications Reference Guide.

\* Recommended reading for VS Customer Engineers who have an interest in or may get involved with TC.

ONE SECOND HOLDOVER - OFF AT SENDER (HOST), ON AT REMOTE TERMINAL

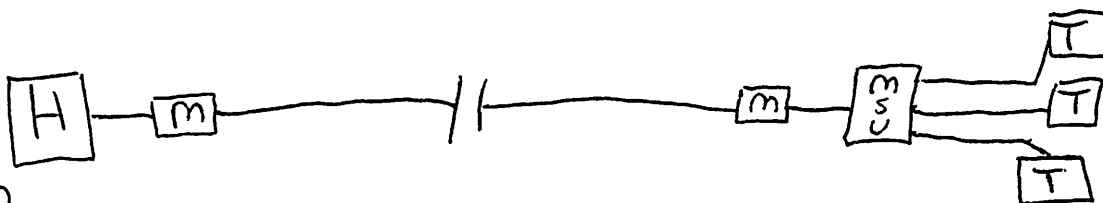
POINT TO POINT - SINGLE TERMINAL TO 1 CENTRAL HOST SYSTEM

208A MODEM

- A1 INTERNAL TIMING
- B3 CONTINUOUS CARRIER
- C6 CONTINUOUS CLEAR TO SEND
- D7 ONE SECOND HOLDOVER ON
- F11 (C) DATA SET READY, LEAD IS ON
- E10 NEW SYNC NOT USED

4 WIRE LINE, ONLY USING 2 WIRES AT A TIME (HALF DUPLEX)

MULTIPOINT



208A MODEM

- INTERNAL TIMING
- CONTINUOUS CARRIER
- CONTINUOUS CLEAR TO SEND
- ONE SECOND HOLDOVER OFF
- NEW SYNC (ABILITY TO RESYNC ON NEW CLK)
- DATA SET READY, LEAD IS ON

- SAME
- SWITCHED CARRIER
- SWITCHED CLR. TO SEND
- USE ONE SEC. HOLDOVER
- NEW SYNC. NOT USED
- 3 SAME

USE SWITCHED CARRIER + SWITCHED CLR. TO SEND WHEN EVER HAVE MORE THAN 1 TERMINAL EITHER ON A MSU OR WITH MULTIPLE MODEMS ON THAT END ONLY

ONLY 4 TERMINAL MAY BE ON AT ANY ONE TIME ALTHOUGH MORE THAN 4 TERMINALS MAY BE CONNECTED. SOFTWARE RESTRICTED.

- ASYN - SENDS ONE CHAR AT A TIME WITH A CLK BIT FOR EA. DATA BIT
- BISYN - SENDS BLOCKS OF DATA AT A TIME

BAUD CLOCK DRIVER OF NULL MODEM - CONNECT TO V06, DOES NOT MATTER w/ 2 CPU'S

AT PRESENT 22V06 ONLY SUPPORTS BSC



Modem to Terminal - 50' max

Modem to MSU - 50' max

MSU to Terminal - 2000'

Null Modem - 100'

STAND	ALONG	
220-0219	25'	STANDARD
220-0113	12'	SIGNAL
220-0220	50'	CABLES
FOR LONGER DISTANCE USE * w/ 2247-0_		
* 220-0247	25'	MALE/MALE
220-2247-01	50'	MALE/FEMALE
120-2247-02	100'	MALE/FEMALE
-03	200'	
-04	300'	
-05	400'	
-06	500'	

### BREAKOUT BOX

#### POPBACK JUMPERS

PIN 2 - PIN 3 (RD)

PIN 4 - PIN 5 (CTS)

PIN 11 - PIN 17 (RC) TO PIN 15 (TC)

#### MONITORING

HOST

SOLID

DATA SET READY

RECV CLK

TRANSMIT CLK

#### LITES

SIDE (SENDER)

BLANKING (DURING XMIT)

RECV CARRIER DETECT

RECV DATA

#### REMOTE

DATA TRANSMIT READY

REQUEST TO SEND DATA

# TELECOMMUNICATION HANDBOOK

Prepared by Customer Engineering

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## INTRODUCTION

This Handbook is designed as a quick field reference for pertinent telecommunications data. This data is divided into four major categories:

- (1) General Telecommunications;
- (2) 2200 Telecommunications;
- (3) Wang Word Processing Telecommunications;
- (4) Optical Character Recognition Telecommunications.

This document identifies important related documentation for both hardware and software as well as diagnostics, code sets, control characters, specifications, modem information, important pin assignments and special operating keys.

# WANG TC DOCUMENTATION AND SOFTWARE

## DOCUMENTATION

### GENERAL

- PRODUCT SERVICE TELEPROCESSING GUIDE
- MODEMS (#700-4703)

### 2200 SYSTEMS

- SERVICE BULLETIN #77.XX - GENERAL 2200 TELECOMMUNICATIONS INFORMATION
- TELECOMMUNICATIONS SALES GUIDE (#700-4703)
- 2227B BUFFERED ASYNCHRONOUS COMMUNICATIONS CONTROLLER USER MANUAL (#700-4114)
- 2227B/OPTION 62 DATA SHEET (#700-3830C)
- 2228B SYNCHRONOUS/ASYNCHRONOUS COMMUNICATIONS CONTROLLER USER MANUAL (#700-4670)
- 2228B/OPTION 62B DATA SHEET (#700-4143B)
- ASYNCHRONOUS I PACKAGE OPERATOR'S GUIDE (INTERIM) - RELEASE 4.0 (#700-4718)
- 2741 EMULATION DATA SHEET (#700-4706)
- TELETYPE EMULATION DATA SHEET (#700-4704)
- BINARY SYNCHRONOUS I (BSC) TELECOMMUNICATIONS PACKAGE OPERATOR'S GUIDE (INTERIM) - RELEASE 4.0 (#700-4719)
- 2780/3780 EMULATION DATA SHEET (#700-4709)
- 3741 EMULATION DATA SHEET (#700-4708)
- HASP EMULATION DATA SHEET (#700-4707)

- BURROUGHS EMULATION PACKAGE PROGRAMMER/OPERATOR'S GUIDE (INTERIM) - RELEASE 2.2 (#700-4746)
- BURROUGHS EMULATION DATA SHEET (#700-4705)
- TC SUPPORT UTILITIES 1 USER MANUAL - RELEASE 2.0 (#700-4086)
- TC SUPPORT UTILITIES 1 USER MANUAL ADDENDUM (#700-4086.01)

### WORD PROCESSING SYSTEMS

- WORD PROCESSING NEWSLETTER #48.XX - MODEL 5528 BINARY SYNCHRONOUS COMMUNICATIONS OPTION
- MODEL 5528 DATA SHEET (#700-4382)
- WORD PROCESSING NEWSLETTER #50.XX - OPTICAL CHARACTER RECOGNITION (OCR)
- WORD PROCESSING NEWSLETTER #51.XX - MODEL 5595-4 ASYNCHRONOUS COMMUNICATIONS OPTION
- MODEL 5595-4 ASYNCHRONOUS COMMUNICATIONS OPTION DATA SHEET (#700-4733)
- WPS SYSTEM 5 USERS MANUAL (#700-6295)

### SOFTWARE

#### 2200 SYSTEMS

- 2200 PERIPHERAL DIAGNOSTIC DISKETTE (#701-2180B)
- 2200 PERIPHERAL DIAGNOSTIC MINIDISKETTE (#701-8001A)
- ASYNC I TELECOMMUNICATIONS REL 4.0 (TTY & 2741) DISKETTE (#701-2358)
- ASYNC I TELECOMMUNICATIONS REL 4.0 (TTY & 2741) MINIDISKETTE (#701-8112)
- BSC I TELECOMMUNICATIONS REL 4.0 (2780 & 3780, 3741, HASP, 2200-2200) DISKETTE (#701-2357)
- BSC I TELECOMMUNICATIONS REL 4.0 (2780 & 3780) MINIDISKETTE (#701-8109)

- BSC I TELECOMMUNICATIONS REL 4.0 (3741) MINIDISKETTE (#701-8110)
- BSC I TELECOMMUNICATIONS REL 4.0 (HASP & 2200-2200) MINIDISKETTE (#701-8111)
- TC SUPPORT UTILITIES DISKETTE (#701-2110)

#### WORD PROCESSING SYSTEMS

- SYSTEM CHECKOUT DISKETTE E13.10
- COM 20 15.4T5 DISKETTE
- COM 30 5.4T5 DISKETTE

## RECOMMENDED BELL SYSTEM TECHNICAL REFERENCE PUBLICATIONS

- BELL PUB. TECHNICAL REFERENCE CATALOG.  
#40000
- BELL PUB. TECHNICAL REFERENCE  
#40001 RING BINDER.
- BELL PUB. COMPLETE SET OF DATA  
#41001 COMMUNICATION TECHNICAL  
REFERENCES.
- BELL PUB. DATA COMMUNICATIONS USING  
#41004 VOICEBAND PRIVATE LINE  
CHANNELS.
- BELL PUB. DATA COMMUNICATIONS USING  
#41005 SWITCHED TELECOMMUNICATIONS  
NETWORK
- BELL PUB. TRANSMISSION PARAMETERS  
#41008 AFFECTING VOICEBAND DATA  
TRANSMISSION — DESCRIPTION  
OF PARAMETERS.
- BELL PUB. TRANSMISSION PARAMETERS  
#41009 AFFECTING VOICEBAND DATA  
TRANSMISSION — MEASURING  
TECHNIQUES.
- BELL PUB. DIGITAL DATA SYSTEM-CHANNEL  
#41021 INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 103A INTERFACE  
#41101 SPECIFICATION.
- BELL PUB. DATA SET 103A3,  
#41102 DATA SET 103E,  
DATA SET 103G,  
DATA SET 103H,  
INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 103F,  
#41103 INTERFACE SPECIFICATION.
- BELL PUB. 113 TYPE DATA STATION  
#41105 INTERFACE SPECIFICATION.
- BELL PUB. DATA SETS 201A and 201B.  
#41201
- BELL PUB. DATA SETS 202C and 202D  
#41202 INTERFACE SPECIFICATION.

- BELL PUB. DATA SET 208A  
#41209 INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 201C  
#41210 INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 208B  
#41211 INTERFACE SPECIFICATION.
- BELL PUB. DATA SETS 202S AND 202T  
#41212 INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 209A  
#41213 INTERFACE SPECIFICATION.
- BELL PUB. DATA SET 212A  
#41214 INTERFACE SPECIFICATION.
- BELL PUB. DIGITAL DATA SYSTEM  
#41450 DATA SERVICE UNIT  
INTERFACE SPECIFICATIONS.
- BELL PUB. DATA AUXILIARY SET 801A  
#41601 (AUTOMATIC CALLING UNIT)  
INTERFACE SPECIFICATION.
- BELL PUB. DATA AUXILIARY SET 801C  
#41602 (AUTOMATIC CALLING UNIT)  
INTERFACE SPECIFICATION.
- BELL PUB. 801C-L1/2 DATA AUXILIARY  
#41603 SET INTERFACE SPECIFICATION.
- BELL PUB. DATA COUPLERS CBS AND  
#41802 CBT FOR AUTOMATIC TERMINALS.

## RS232 (V24) MODEM/TERMINAL 25 PIN CONNECTOR ASSIGNMENTS

PIN NUMBER	CIRCUIT	DESCRIPTION	TO MODEM	FROM MODEM
1	RS232 (V24) (NOTE) AA (101) (1)	PROTECTIVE GROUND	X	X
2	BA (103) (2)	TRANS. DATA	X	
3	BB (104) (2)	RECEIVE DATA		X
4	CA (105) (3)	REQUEST TO SEND	X	
5	CB (106) (3)	CLEAR TO SEND		X
6	CC (107) (3)	DATA SET READY		X
7	AB (102) (1)	SIGNAL GROUND	X	
8	CF (109) (3)	CARRIER DETECT		X
9		MODEM TEST		
10		MODEM TEST		
11	SCA (120) (3)	2nd CA (NO EIA) (NO V24)		
12	SCF (122) (3)	2nd CF		X
13	SCB (121) (3)	2nd CB		X
14	SBA (118) (2)	2nd BA	X	
15	DB (114) (4)	XMIT CLOCK		X
16	SBB (119) (2)	2nd BB		X
17	DD (115) (4)	RCV. CLOCK		X
18		NOT USED		
19	SCA (120) (3)	2ND CA	X	
20	CD (108) (3)	DATA TERM. RDY	X	
21	CG (110) (3)	MOD. DETECT		X
22	CE (125) (3)	RING		X
23	CH/ CI (111/ 112) (3)	SPEED SELECT	X	X
24	DA (113) (4)	XMIT CLOCK	X	
25		NOT USED		

**NOTE:**

- (1) = GROUND
- (2) = DATA
- (3) = CONTROL
- (4) = CLOCK

**NOTE:**

INQUIRIES RELATED TO THESE TECHNICAL REFERENCES

SHOULD BE REFERRED IN WRITING TO:

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
INFORMATION DISTRIBUTION CENTER, ROOM C190

ATTN: TECHNICAL REFERENCES

P.O. BOX 3513

NEW BRUNSWICK

NEW JERSEY 08903

# ASCII CODE SET

	HIGH ORDER HEX DIGIT							
	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P		p
1	SOH	DC1 XON	!	1	A	Q	a	q
2	STX	DC2 PN	"	2	B	R	b	r
3	ETX	DC3 XOF	#	3	C	S	c	s
4	EOT	DC4 PF	\$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K		k	
C	FF	FS	,		L		l	
D	CR	GS	-	=	M		m	
E	SO	RS	.		N		n	
F	SI	US	/	?	O		o	DEL

# ASCII DATA LINK CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
ACK	06	POSITIVE ACKNOWLEDGEMENT
DLE	10	DATA LINK ESCAPE
ENQ	05	ENQUIRY
EOT	04	END OF TRANSMISSION
ETB	17	END OF TEXT BLOCK
ETX	03	END OF TEXT
NAK	15	NEGATIVE ACKNOWLEDGEMENT
SOH	01	START OF HEADER
STX	02	START OF TEXT
SYN	16	SYNCHRONOUS IDLE

# ASCII FUNCTION CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
BEL	07	BELL
BS	08	BACKSPACE
CAN	18	CANCEL
CR	0D	CARRIAGE RETURN
DC1	11	DEVICE CONTROL 1
DC2	12	DEVICE CONTROL 2
DC3	13	DEVICE CONTROL 3
DC4	14	DEVICE CONTROL 4
EM	19	END OF MEDIUM
ESC	1B	ESCAPE
FF	0C	FORM FEED
FS	1C	FIELD SEPARATOR
GS	1D	GROUP SEPARATOR
HT	09	HORIZONTAL TAB
LF	0A	LINE FEED (NEW LINE)
NUL	00	NULL
PF	14	PUNCH OFF
PN	12	PUNCH ON
RS	1E	RECORD SEPARATOR
SO	0E	SHIFT OUT
SI	0F	SHIFT IN
SUB	1A	SUBSTITUTE
US	1F	UNIT SEPARATOR
VT	0B	VERTICAL TAB
XOF	13	PAPER TAPE READER OFF
XON	11	PAPER TAPE READER ON



# IBM 2741 CORRESPONDENCE CODE SET

Lower Case

Upper Case

		HIGH ORDER HEX DIGIT			
		0	1	2	3
L O W O R D E R H E X D I G I T	0	SP	2	1	3
	1	!	.	m	v
	2	t	n	x	u
	3	j	=	g	f
	4	4	z	0	9 EOA
	5	o		s	w
	6	l		h	b
	7	/		y	-
	8	5	6	7	8
	9	'	i	r	a
	A	e	k	d	c
	B	p	q	;	,
	C		UC		EOT
	D		BS	NL	IL
	E			LF	
	F		LC	HT	

# 2741 DATA LINK CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
EOA	34	END OF ADDRESS
EOT	3C	END OF TRANSMISSION

# 2741 FUNCTION CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
BS	1D	BACKSPACE
HT	2F	HORIZONTAL TAB
IL	3D	IDLE
LC	1F	LOWERCASE SHIFT
LF	2E	LINE FEED
NL	2D	NEW LINE (CR LF)
SP	00	SPACE
UC	1C	UPPERCASE SHIFT

# EBCDIC CODE \*

High-order 4-bits Low-order 4-bits	4-bits hex-digit	4-bits hex-digit							
		0000	0001	0010	0011	0100	0101	0110	
		0	1	2	3	4	5	6	
0000	0	NUL 0	SOH 1	STX 2	ETX 3	PF 4	HT 5	LC 6	
0001	1	DLE 16	DC1 17	DC2 18	DC3 19	RES 20	NL 21	BS 22	
0010	2	DS 32	SOS 33	FS 34		BYP 36	LF 37	ETB 38	
0011	3			SYN 50		PN 52	RS 53	UC 54	
0100	4	Spacs 64							
0101	5	& 80							
0110	6	(dash) 96	/ 97						
0111	7								
1000	8		a 128	b 129	c 130	d 131	e 132	f 133	
1001	9		j 144	k 145	l 146	m 147	n 148	o 149	
1010	A		~ 160	s 161	t 162	u 163	v 164	w 165	
1011	B								
1100	C	{ 192	A 193	B 194	C 195	D 196	E 197	F 198	
1101	D	{ 208	J 209	K 210	L 211	M 212	N 213	O 214	
1110	E	\ 224		S 226	T 227	U 228	V 229	W 230	
1111	F	0 240	1 241	2 242	3 243	4 244	5 245	6 246	

\*Numbers on the lower right corner of each box represent the decimal equivalent of the binary and the hexadecimal code for

# EBCDIC CODE

		0111	1000	1001	1010	1011	1100	1101	1110	1111
		7	8	9	A	B	C	D	E	F
DEL 71			RLF 8	SMM 9	VT 10	FF 11	CR 12	SO 13	SI 14	
IL 23	CAN 24	EM 25	CC 26		IFS 27	IGS 28	IRS 29	IUS 30		
ESC 39			SM 42			ENG 44	ACK 45	BEL 46		
EOT 55						DC4 60	NAK 61	SUB 62		
				(period) 74	< 75	( 77	+ 78	 79		
			! 89	\$ 91	· 92	) 93	: 94	~ 95		
			! 103	(comma) 104	% 107	(under line) 108	> 110	? 111		
			grave accent 120	: 121	# 122	@ 123	(spot) 124	= 126	.. 127	
g 135	h 136	i 137								
p 151	q 152	r 153								
x 167	y 168	z 169								
G 199	H 200	I 201								
P 215	Q 216	R 217								
X 231	Y 232	Z 233								
7 247	8 248	9 249								

the character shown in the box, e.g., A = (C1)<sub>16</sub> = (11000001)<sub>2</sub> = (193)<sub>10</sub>

## BSC DATA LINK CHARACTERS

CHARACTER	HEX CODE	NAME
BEL	2F	BELL
CR	0D	CARRIAGE RETURN
DLE	10	DATA LINK ESCAPE
ENQ	2D	ENQUIRY
EOT	37	END OF TRANSMISSION
ESC	27	ESCAPE
ETB	26	END OF TEXT BLOCK
ETX	03	END OF TEXT
HT	05	HORIZONTAL TAB
ITB (IUS)	1F	INTERMEDIATE TEXT BLOCK
NAK	3D	NEGATIVE ACKNOWLEDGEMENT
NUL	00	NULL
PAD	FF	TRAILING PAD CHARACTER
SOH	01	START OF HEADER
STX	02	START OF TEXT
SYN	32	SYNCHRONOUS IDLE

## BSC DATA LINK CONTROL SEQUENCES

CHARACTER	HEX CODE	NAME
ACK 0	1070	POSITIVE ACKNOWLEDGEMENT 0 (DLE X '70')
ACK1	1061	POSITIVE ACKNOWLEDGEMENT 1 (DLE /)
DLE EOT	1037	DISCONNECT SEQUENCE FOR A SWITCHED LINE
RVI	107C	REVERSE INTERRUPT (DLE @)

TTD	022D	TEMPORARY TEXT DELAY (STX ENQ)
WACK	106B	WAIT-BEFORE- TRANSMIT POSITIVE ACKNOWLEDGEMENT (DLE.)

## IBM 2780 CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
EM	19	END OF MEDIA
SP	40	SPACE

## IBM 3780 CONTROL CHARACTERS

CHARACTER	HEX CODE	NAME
DC1	11	DEVICE SELECT PRINTER
DC2	12	DEVICE SELECT PUNCH
DC3	13	DEVICE SELECT PUNCH
FF	0C	FORM FEED
IGS	1D	INTERCHANGE GROUP SEPARATOR
IRS	1E	INTERCHANGE RECORD SEPARATOR
LF	25	LINE FEED
NL	15	NEW LINE
SP	40	SPACE
VT	0B	VERTICAL TAB

WWPS DOCUMENT CODE SET  
Standard Version  
HIGH ORDER HEX DIGIT

	0	1	2	3	4	5	6
L		a	SP	0	@	P	
O	1	CTR	e !	1	A	Q	a
R	2	HT	i "	2	B	R	b
D	3	CR	o #	3	C	S	c
E	4	IT	u \$	4	D	T	d
X	5	DAL	a %	5	E	U	e
D	6	FMT	e &	6	F	V	f
I	7		i ' 7	G	W	g	
G	8		o ( 8	H	X	h	
I	9		u ) 9	I	Y	i	
T	A		a * :	J	Z	j	
	B	STP	e + ;	K		k	
	C	NOT	u ,	L		l	
	D	MG	A - =	M		m	
	E	SPS	O .	N		n	
	F	SBS	U / ?	O		o	

WANG WP CONTROL CHARACTERS  
HEX

CHARACTER	CODE	NAME
CR	03	Carriage Return
CTR	01	Center
DAL	05	Decimal Align
DMG	8D	Don't Merge
FMT	06	Format
HT	02	Horizontal Tab
IT	04	Indent Tab

WWPS DOCUMENT CODE SET  
Standard Version

	7	8	9	A	B	C	D	E	F
p		a	-	0	@	P	-	p	
q		e	!	1	A	Q	a	q	
r		i	"	2	B	R	b	r	
s		o	#	3	C	S	c	s	
t		u	\$	4	D	T	d	t	
u		a	%	5	E	U	e	u	
v	PG	e	&	6	F	V	f	v	
w		i	'	7	G	W	g	w	
x		o	(	8	H	X	h	x	
y		u	)	9	I	Y	i	y	
z		a	*	:	J	Z	j	z	
		e	+	;	K		k		
		u	,		L		l		
e	DMG	A	-	=	M		m	e	
		O	.		N		n		
¢		U	/	?	O		o	¢	

WANG WP CONTROL CHARACTERS  
HEX

CHARACTER	CODE	NAME
MG	0D	Merge
NOT	0C	Note
PG	86	Page
SBS	0F	Subscript
SPS	0E	Superscript
SP	20	Space
STP	0B	Stop

WWPS INTERMEDIATE CODE SET\*  
Standard Version

HIGH ORDER BIT DIGIT

	0	1	2	3	4	5	6	7
L								
O	DMG	a	S?	0	e	P		p
W		e	l	1	A	Q	a	q
O								
R	HT	i	"	2	B	R	b	r
D								
E		o	#	3	C	S	c	s
R								
H		u	\$	4	D	T	d	t
E								
X		a	%	5	E	U	e	u
H								
E	-	e	&	5	F	V	f	v
D								
I		i	'	7	G	W	g	w
G								
I		o	(	3	E	X	h	x
T								
A		u	)	3	I	Y	i	y
A		a	*	:	J	Z	j	z
B	STP	e	+	;	K		k	
C	NOT	u	,		L		l	
D	MG	A	-	=	M		m	e
E	SPS	O	.		N		n	
F	SBS	U	/	?	O		o	¢

\*Only the codes represented by the 7 low-order bits are shown. In addition, the high-order bit denotes underscoring of graphics.

**EBCDIC-DP TO WWPS STANDARD/  
INTERMEDIATE CODE  
Code Translation Table**

		EBCDIC HIGH ORDER HEX DIGIT						
		0	1	2	3	4	5	6
E B C D I C	0	80	C0	01	20	20	26	2D
	1	C0	C1	0B	06	8D	C0	2F
	2	C0	C2	0C	C0	C0	C0	C0
	3	C0	C3	C0	C0	C0	C0	C0
	4	C0	C0	05	C0	C0	C0	C0
	5	CE	CD	C0	C0	C0	C0	C0
	6	C0	C0	C0	C0	C0	C0	C0
	7	C0	C0	C6	C0	C0	C0	C0
H E X	8	C0	C0	C0	0F	C0	C0	C0
	9	0E	20	C0	04	C0	C0	C0
D I G I T	A	C0	C0	0D	86	7F	21	7C
	B	C7	C0	C0	C0	2E	24	2C
	C	C7	C0	C0	C0	3C	2A	25
	D	CD	CF	C0	C0	28	29	A0
E	C0	CD	C0	C0	2B	3B	3E	
F	C0	C0	03	C0	5B	5D	3F	

**EBCDIC-DP TO WWPS STANDARD/  
INTERMEDIATE CODE  
Code Translation Table**

7	8	9	A	B	C	D	E	F
C0	C0	C0	C0	C0	7B	7D	5C	30
C0	61	6A	7E	C0	41	4A	20	31
C0	62	6B	73	C0	42	4B	53	32
C0	63	6C	74	C0	43	4C	54	33
C0	64	6D	75	C0	44	4D	55	34
C0	65	6E	76	C0	45	4E	56	35
C0	66	6F	77	C0	46	4F	57	36
C0	67	70	78	C0	47	50	58	37
C0	68	71	79	C0	48	51	59	38
09	69	72	7A	C0	49	52	5A	39
3A	C0	C0	C0	C0	C0	C0	C0	C0
23	C0	C0	C0	C0	C0	C0	C0	C0
40	C0	C0	C0	C0	C0	C0	C0	C0
27	C0	C0	C0	C0	C0	C0	C0	C0
3D	C0	C0	C0	C0	C0	C0	C0	C0
22	C0	C0	C0	C0	C0	C0	C0	C0

WWPS STANDARD/INTERMEDIATE  
CODE TO EBCDIC-DP

Code Translation Table

		WWPS HIGH ORDER HEX DIGIT						
		0	1	2	3	4	5	6
W W P S	0	0C	81	40	F0	7C	D7	3F
	1	20	85	5A	F1	C1	D8	81
L O W	2	05	89	7F	F2	C2	D9	82
	3	0D	96	7B	F3	C3	E2	83
O R D E R	4	39	A4	5B	F4	C4	E3	84
	5	24	81	6C	F5	C5	E4	85
H E X	6	31	85	50	F6	C6	E5	86
	7	3F	89	7D	F7	C7	E6	87
D I G I T	8	3F	96	4D	F8	C8	E7	88
	9	79	A4	5D	F9	C9	E8	89
A	B	3F	81	5C	7A	D1	E9	91
	C	2F	85	4E	5E	D2	4F	92
D	E	22	A4	6B	4C	D3	E0	93
	F	2A	C1	60	7E	D4	5F	94
E		09	D6	4B	6E	D5	3F	95
		38	E4	61	6F	D6	3F	96

WWPS STANDARD/INTERMEDIATE  
CODE TO EBCDIC-DP

Code Translation Table

7	8	9	A	B	C	D	E	F
97	3F	81	6D	F0	7C	D7	3F	97
98	3F	85	5A	F1	C1	D8	81	98
99	3F	89	7F	F2	C2	D9	82	99
A2	3F	96	7B	F3	C3	E2	83	A2
A3	3F	A4	5B	F4	C4	E3	84	A3
A4	3F	81	6C	F5	C5	E4	85	A4
A5	3A	85	50	F6	C6	E5	86	A5
A6	3F	89	7D	F7	C7	E6	87	A6
A7	3F	96	4D	F8	C8	E7	88	A7
A8	79	A4	5D	F9	C9	E8	89	A8
A9	3F	81	5C	7A	D1	E9	91	A9
CO	3F	85	4E	5E	D2	4F	92	CO
6A	3F	A4	6B	4C	D3	E0	93	6A
DO	03	C1	60	7E	D4	5F	94	DO
A1	3F	D6	4B	6E	D5	3F	95	A1
4A	3F	E4	61	6F	D6	3F	96	4A

## BI-SYNC PROTOCOL

Each transmission begins with a sync pattern of three consecutive SYN characters. A receiving terminal must receive at least two consecutive SYN characters to obtain synchronization (or character phase). A terminal, ready to transmit, must first determine that the remote unit is able to receive. This request to transmit is made by the transmission of an ENQ. On receipt of the ENQ, a remote unit will respond with ACK 0 if it is ready to receive data, or with NAK if it is not ready to receive data.

### EXAMPLE: SIMPLE POINT-TO-POINT OPERATION

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION:	SYN
	STX
	TEXT A (odd)
	ETB
RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	STX
	TEXT B (Even)
	ETX
RECV STATION	SYN
	ACK 0
TRANS STATION	SYN
	EOT

### EXAMPLE: POINT-TO-POINT LINE CONTROL SEQUENCE

	E	E	S	E	E	A	A
PRIMARY	N (1 sec)	N	T Test	T	O	CO	C1
	Q	Q	X	X	T	K	K
			(Odd)				
SECONDARY	E	A	A	E	S	E	E
	N	CO	C1	N	T Text	T	O
	Q	K	K	Q	X	X	T
					(Odd)		

## FORMAT: RESPONDING TO TRANSMISSION OF TEXT

### POSITIVE RESPONSE

TRANS STATION	SYN
	STX
	TEXT
	ETB
	bcc
	bcc
RECV STATION	SYN
	ACK 0 or ACK 1
TRANS STATION	SYN
	STX
	TEXT A
	ETB
	bcc
	bcc

### NEGATIVE RESPONSE

TRANS STATION	SYN
	STX
	TEXT A
	ETB
	bcc
	bcc
RECV STATION	SYN
	NAK
TRANS STATION	SYN
	STX
	TEXT A (Retransmission)

### INVALID OR NO RESPONSE

TRANS STATION	SYN
	STX
	TEXT
	ETB
	bcc
	bcc
RECV STATION	NO RESPONSE
TRANS STATION	SYN
	ENQ
RECV STATION	NO RESPONSE



TRANS STATION	SYN
	ENQ
RECV STATION	NO RESPONSE
TRANS STATION	SYN
	ENQ
RECV STATION	NO RESPONSE
TRANS STATION	SYN
	EOT

**FORMAT: EOT RESPONSE OR INCOMPLETE TRANSMISSION**

**EOT RESPONSE**

TRANS STATION	SYN
	STX
	TEXT
	ETB
	bcc
	bcc
RECV STATION	SYN
	EOT
TRANS STATION	(Re-establish communication)

**INCOMPLETE TRANSMISSION**

TRANS STATION	SYN
	STX
	TEXT
	ENQ
RECV STATION	SYN
	NAK
TRANS STATION	SYN
	EOT (Re-establish communication)

**FORMAT: ERROR CONDITIONS**

**Line Failure**

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION:	SYN
	STX

	TEXT A (odd)
	ETB
	bcc
	bcc
RECV STATION:	SYN
	ACK 0 (Line failure during response; character 1 changed to 0)
TRANS STATION:	SYN
	ENQ

RECV STATION	0
	ACK 1
TRANS STATION	0
	STX
	TEXT

**OUT OF STEP**

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION	SYN
	STX
	TEXT A (Odd)
	ETB
	bcc
	bcc
RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	STX
	TEXT B (Even)
	ETB
	bcc
	bcc
RECV STATION	SYN
	ACK 1 (Response should have been ACK 0)
TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	ENQ

RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	EOT

**FORMAT: RETRANSMISSION**

**NEGATIVE RESPONSE**

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION	SYN
	STX
	TEXT A
	ETB
	bcc
	bcc
RECV STATION	SYN
	NAK
TRANS STATION	SYN
	STX
	TEXT A
	ETB
	bcc
	bcc
RECV STATION	SYN
	ACK 1
TRANS STATION	SYN
	STX
	TEST B

**NOTE:**

Text will be retransmitted three times before stop condition when operating terminal-to-terminal.

**NO RESPONSE**

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION	SYN
	STX
	TEXT
	ETB
	bcc
	bcc
RECV STATION	NO RESPONSE
TRANS STATION	TIME OUT
TRANS STATION	SYN
	ENQ
RECV STATION	NO RESPONSE
TRANS STATION	SYN
	TIME OUT
TRANS STATION	SYN
	ENQ
RECV STATION	NO RESPONSE
TRANS STATION	TIME OUT
TRANS STATION	SYN
	EOT

**STX MISSED (OUT-OF-STEP CONDITION)**

TRANS STATION	SYN
	ENQ
RECV STATION	SYN
	ACK 0
TRANS STATION	TEST A
	ETB
	bcc
	bcc
RECV STATION	NO RESPONSE
TRANS STATION	TIME OUT
	SYN
	ENQ
RECV STATION	SYN
	ACK 0

TRANS STATION    SYN  
                   STX  
                   TEXT A  
                   ETB  
                   bcc  
 RECV STATION    bcc  
                   SYN  
                   ACK 1  
 TRANS STATION    SYN  
                   STX  
                   TEXT B

## ASYNCRONOUS ON-LINE DIAGNOSTICS

The suggested method of on-line system checkout (when applicable) for any of the communication controller boards is a telephone hook-up with WYLBUR (IBM 370/158) at the Wang Data Center in Burlington, MA. Basically, WYLBUR is an interactive type host computer. WYLBUR is programmed to communicate using either Teletype or IBM 2741 protocol; therefore, either emulation program may be used. (Refer to Section 3 of S.B. #77) The required parameters are:

Teletype    —    NO ECHO  
                           EVEN PARITY  
                           7 DATA BITS  
  
 2741        —    CORRESPONDENCE CODE OR  
                           BCD CODE  
                           134.5 BAUD

The other parameters are optional. These parameters must be set and the emulator program loaded before going on-line with WYLBUR.

WYLBUR's telephone numbers are:

0-300 baud — (617) 272-8120 103 Type  
                           Modem  
 1200 baud — (617) 272-7420 202 Type  
                           Modem

### TEST:

- 1) Dial WYLBUR. (See above telephone numbers.)
- 2a) If using a model 103 or 202 modem (or 103 or 202 equivalent), wait for carrier tone and then press "data" button.
- b) If using acoustic coupler, wait for high pitch sound from telephone and place receiver down into cups located on coupler. A light will illuminate on coupler when carrier tone is established. If not, redial WYLBUR.

### NOTE:

The coupler should be set for full duplex operation.

EXAMPLE: On OMNITECH coupler, both switches located at rear of coupler must be out.

3) Enter the word below and then RETURN(EXEC).

"2741" if 2741 emulator program is used  
or  
"GTWX" if 0-300 baud Teletype emulator  
program is used  
or  
"TWX" if 1200 baud Teletype emulator  
program is used

- 4) The computer will respond with "Wang Data Center." (If this does not occur, repeat steps 1 thru 3)
- 5) The computer will respond with "TERMINAL?" ENTER "W33", then RETURN(EXEC).
- 6) The computer will respond with "INITIALS?" ENTER "FES", then RETURN(EXEC).
- 7) The computer will respond with "ACCOUNT?" ENTER "FS", then RETURN(EXEC).
- 8) The computer will respond with "KEYWORD?" Enter keyword (obtained from Customer Engineering Home Office), then RETURN(EXEC).
- 9) The computer will respond with "COMMAND?".

You are signed on to the computer system. If you want to play out the program which is already in the computer, follow procedure in steps 10-14.

- 10) ENTER "USE 2200 ON W33002", then RETURN(EXEC).
- 11) The computer will respond with "COMMAND?" ENTER "LIST UNN", then RETURN(EXEC).
- 12) The computer will then send the test and it will be displayed on CRT:

1. THIS IS A 2200 T.C. TEST
2. THE 2200 CAN OPERATE AT 110, 150, 300, 600, and 1200 BAUD RATE DEPENDING ON MODEM.
3. THE BELL 103A OR COMPATIBLE CAN OPERATE UP TO 300 BAUD WHILE BELL 202C UP TO 1200 BAUD

4. THE 2200 SYSTEM CAN BE SELECTED FOR 5 TO 8 DATA BITS PER CHARACTER.
5. THE EVEN OR ODD OR NO PARITY IS SWITCH SELECTABLE. ALSO 1 OR 2 STOP BITS ARE SWITCH SELECTED.
6. THE 2200 T.C. USES HALF DUPLEX MODE WHICH MEANS IT CANNOT RECEIVE AND TRANSMIT AT THE SAME TIME.
7. YOU MUST HAVE RECEIVED SEVEN LINES AND THIS IS THE END OF TRANSMISSION.

- 13) When the test is completed the computer will respond with "COMMAND?" ENTER "CLR ACT", RETURN(EXEC).
- 14) The computer will respond with "COMMAND?"
- 15) ENTER "SIGNOFF", then RETURN(EXEC).
- 16) The computer will respond with "OK TO CLEAR?" (Optional)
- 17) ENTER "CLEAR", then RETURN(EXEC).
- 18) The computer will give statistics on how long the terminal has been signed on, etc.
- 19) The computer will send "END OF SESSION"; this concludes the test.

## BI-SYNC ON-LINE SYSTEM CHECKOUT

The suggested method of on-line system checkout (when applicable) for the Communications Controfer is a telephone hook-up with a Remote Job Entry (RJE) port with the IBM 370/158 host computer at the Wang Data Center in Burlington, MA (business telephone number (617) 272-8550). The Data Center supports both IBM 2780 and 3780 protocol (connections = 2780, 3780, or 3780c) but will NOT support the protocol used in a WPS connection. An alternate method of on-line checkout is to arrange a test with the Home Office.

### NOTE:

These methods are only to be used if the on-line checkout with the customer's remote site fails.

## RULES FOR USING DATA CENTER FACILITIES

1. The sign-on procedures and keywords are strictly for customer engineering personnel use only.
2. Under no circumstances will the sign-on or keyword be given to a customer. This is done to ensure protection of the data base at the Wang Data Center. Please remember that the IBM 370 at the Wang Data Center is a time-sharing system.
3. Please limit your on-line checkout time to a maximum of 15 minutes at a time as you may tie up the line for other data center customers.
4. Before calling Home Office for assistance, the on-line check must be performed.
5. Successful checkout indicates that hardware, software and modem are functioning. The routines do not checkout any variations in protocols or sign-on procedures a customer may encounter when using other remote host computers.

### PROCEDURE:

#### A. METHOD 1 (QUICK TEST)

1. Prepare two test documents before going on-line with the Data Center. The first document required is a SIGN-ON document which is prepared as follows:

```
For 2780: /*SIGNON  REMOTE53  SEVXMTKL
           !         !         !
           column 1  column 16  column 28
For 3780: /*SIGNON  REMOTE46  TBKLDVXA
```

The SIGN-ON document must be prepared exactly as above and must have a /\* in the documents comment field (refer to section 3.5.1 of WPNL #48).

The second test document is as follows:

```
/*$ DA
!
column 1
```

2. Schedule a TC session using either the 2780, 3780, or 3780c connection and enter first the document ID number of the SIGN-ON document, and then the document ID number of the other document (refer to section 3.5.2 of WPNL #48).
3. Dial one of the following telephone numbers of the Data Center, depending upon which type of modem the customer has:

#### MODEM

TYPE	SPEED	TELEPHONE NUMBER
201A	2000	(617) 272-9460
201C	2400	(617) 272-6224
208B	4800	(617) 272-4060

4. After the connection is dialed, the modem at the Data Center will automatically answer and present a high-pitched answer tone, after which you must press the modem's DATA button to enter into the data mode (refer to section 3.5.5 of WPNL #48).
5. Data transmission takes place after entering data mode. Observe that RS, CS and CO lamp indicators reflect transmission activity.
6. After the two documents have been successfully transmitted, the computer will transmit to your system a listing of the computer's JOB queue. The reception of this file indicates that your system, including modem, is functional. An example is the following file:

\$11.28.42 JOB 4460 WOS5KMNM ON RM14.RD1 PRIO 15  
 \$11.28.42 JOB 4466 WN@5KMQL ON INTRDR1 PRIO 15  
 \$11.28.42 JOB 4379 WN@5KLFH ON RM14.PR1 PRIO 15  
 \$11.28.42 JOB 4374 DT#5KLDM ON PRINTER1 PRIO 15  
 \$11.28.42 JOB 4406 KES5KLWB ON RM33.PR1 PRIO 15  
 \$11.28.42 JOB 4381 BE@5KLGW ON RM7.PR1 PRIO 15  
 \$11.28.42 JOB 4408 UD@5KLWJ ON PRINTER2 PRIO 9  
 \$11.28.42 JOB 4313 WN@5KKL7 EXECUTING E PRIO 8  
 \$11.28.42 JOB 4341 WN@5KK3J EXECUTING E PRIO 8  
 \$11.28.42 JOB 4363 WC@5KLAY EXECUTING D PRIO 6  
 \$11.28.42 JOB 4450 MS@5KMJA EXECUTING D PRIO 6  
 \$11.28.42 JOB 4242 CR@5KJGL EXECUTING B PRIO 2  
 \$11.28.42 JOB 4413 HD@5KLX4 EXECUTING A PRIO 2  
 \$11.28.42 JOB 4431 WC@5KL98 EXECUTING D PRIO 2

7. Check the communication session summary if no file is received within a few minutes. If it indicates session is ABORTED, then disconnect the line and re-start the procedure at step 2. Call Home Office to perform an on-line check if you are not successful after several retries.

#### B. METHOD 2 (LONG TEST)

1. Prepare SIGN-ON document as shown in step 1 of Method 1.
2. The second document must be prepared using the following JCL (Job Card Language) data.

```

Column 1           29
//W33  JOB RAV,PRTY=8,CLASS=A
/* ROUTE PRINT REMOTE53 (or REMOTE 46)
// EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD SYSOUT=A
//SYSUT1 DD *
  
```

3. The third document must be your test document. (It can be any one of the short documents on WP system.)
4. Schedule a TC session and enter the document ID of SIGNON document, then JCL document ID, and finally, your test document ID.

5. Follow instructions in steps 3, 4, and 5 of section A.

6. Within 10 minutes after the three documents have been successfully transmitted, the computer will transmit to the system the test document prepared in step 3. Along with this document, the computer will send job statistics as well as notices for users. Reception of these documents indicates that the hardware, modem, and telephone lines are functional.

During periods of heavy usage it may take longer than 10 minutes for the computer to process the job request. Rather than remain on-line, it is possible to disconnect from the computer and re-dial at a later time, but another session must be scheduled with SIGN-ON document ID specified. If computer has completed job request, test document will be sent.

#### NOTE:

It is possible that someone dialing the computer and using the same SIGN-ON ID will receive your test document while you are signed off.

#### TROUBLESHOOTING CHECKLIST

- 1) Check the entire system by running all possible diagnostics available and checking all voltages.
- 2) Check the telecommunications controller for correct address; visually inspect the card(s) for any broken components, short etches, etc. Make sure the card(s) are seated properly in connectors.
- 3) Run the off-line diagnostic if available. Most hardware functions are checked by this diagnostic.
- 4) Check the TC cable for bad contacts. Do a continuity check on the cable, making sure all required signal wires are connected at both ends of the cable.
- 5) Call the Telephone Data Service Center and have the modem checked. If possible, be present when the modem service representative arrives and show him the problem.

- 6) Make sure the host computer can, in fact, support the Wang system. For example, if the host computer can support only single record blocks, a change in the Wang software is necessary to accommodate the host computer.
- 7) Contact data processing personnel at the host computer and explain the nature of the problem. Almost all sign-on type problems can be resolved this way. If possible, determine how other similar systems are being used.
- 8) Most importantly, contact the Area or Home Office to obtain assistance.

### MODEM CONTROL SIGNALS CHECKOUT

The following control signals can be checked using a DVM or the EIA Interface Test Set if trouble is suspected in the modem (the modem must be in the Data mode when checking these signals).

- 1) Place the RS-232 Interface PCB on an extender or use the EIA Interface Test Set to give access to signals used by the RS-232 connector (25 pin Cannon connector). Signal pin numbers given below are in reference to 25 pin Cannon connector.
- 2) Pins 1 and 7 are chassis and reference ground, respectively. Check for any noise on ground circuit.
- 3) Pin 2 TRANSMITTED DATA (TO data set).

Signals on this circuit are generated by data terminal equipment. Check to see if terminal is transmitting data when in Transmit mode. The data terminal will not transmit data unless clear-to-send signal (+3v to +25v) is present on pin 5, data terminal ready signal (+3v to +25v) is present on pin 20, and data set terminal ready signal (+3v to +25v) is present on pin 6.

- 4) Pin 3 RECEIVED DATA (FROM data set).

Signals on this circuit are generated by the receiving set in response to signals from a remote data set. This circuit is always held in the MARK state (-3v to -25v) when the received line signal detector (pin 8) is OFF (-3v to -25v).

- 5) Pin 4 REQUEST-TO-SEND (TO data set).

Data terminal presents ON signal (+3v to +25v) on this circuit when terminal intends to transmit data. Once this signal is present, data terminal must wait for clear-to-send signal (pin 5) before starting data transmission.

- 6) Pin 5 CLEAR-TO-SEND (FROM data set).

A signal on this circuit indicates whether or not data set is ready to transmit. This circuit is turned ON (+3v to +25v) in response to request-to-send signal on pin 4 which is delayed from 50 to 200 ms, depending on type of modem and customer options selected.

- 7) Pin 6 DATA SET READY (FROM data set).

An ON condition (+3v to +25v) in this circuit indicates that the data set is in Data mode and is capable of receiving and transmitting data. The data-terminal-ready signal on pin 20 must be ON (+3v to +25v) during the Data mode. The OFF condition (-3v to -25v) indicates that the data set is in Talk, Test, or On-Hook mode.

- 8) Pin 8 RECEIVED LINE SIGNAL DETECTOR (carrier) (FROM data set).

The ON condition (+3v to +25v) on this circuit indicates the presence of the data carrier signal above the receiver threshold for at least 47 ( $\pm 3$ ) milliseconds. This circuit is ON during Receive mode and will turn OFF (-3v to -25v) and disable receiver when data terminal is in Transmit mode, or when request-to-send signal is turned ON.

9) Pin 15 TRANSMITTER SIGNAL ELEMENT TIMING (FROM data set).

The square wave signals on this circuit (2000 HZ for 2000 baud modem; 2400 HZ for 2400 baud modem; 4800 HZ for 4800 baud modem) are used to provide the data terminal equipment with signal element timing information for the transmitted data circuit. A timing signal will be present on this circuit whenever power is on in the data set.

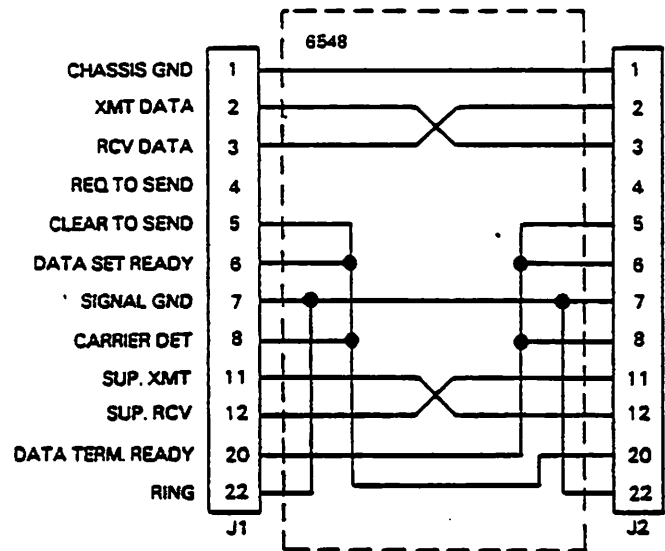
10) Pin 17 RECEIVER SIGNAL ELEMENT TIMING (FROM data set).

The square wave signals on this circuit (2000 HZ for 2000 baud modem; 2400 HZ for 2400 baud modem; 4800 HZ for 4800 baud modem) are used to provide the data terminal equipment with receiver signal element timing information. The transition from ON to OFF normally indicates the center of each signal element on the received data circuit. A timing signal will be present on this circuit when CARRIER (pin 8) is ON for data sets 201A and 201C.

11) Pin 20 DATA TERMINAL READY (TO data set).

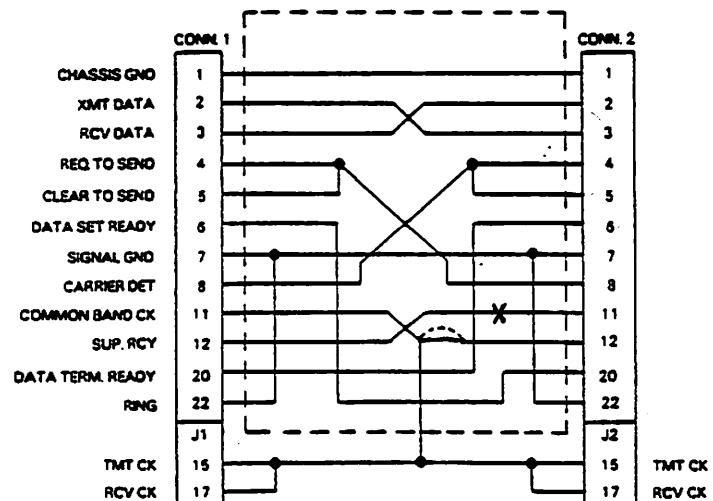
The data terminal must apply an ON condition (+3v to +25v) to this circuit at all times to go into the Data mode. An OFF signal on this line will not allow data set to go to the Data mode. An OFF signal on this line during data reception or transmission will make the data set drop the communication line.

2227N NULL MODEM CORRECT FOR 2200  
177-2227N



2228N NULL MODEM CORRECT FOR 2200

177-2228N





## 2227B, 2228, OR 2228B

Set the device address switches located on the 6723/7223 P.C. Board to Hex 1C, as specified on the controller's mounting bracket (set switches 3, 4, 5 ON, and all others OFF) before installing the communications controller into the local 2200 CPU.

	1	2	3	4	5	6	7	8
ON			•••					
OFF	••			•••				

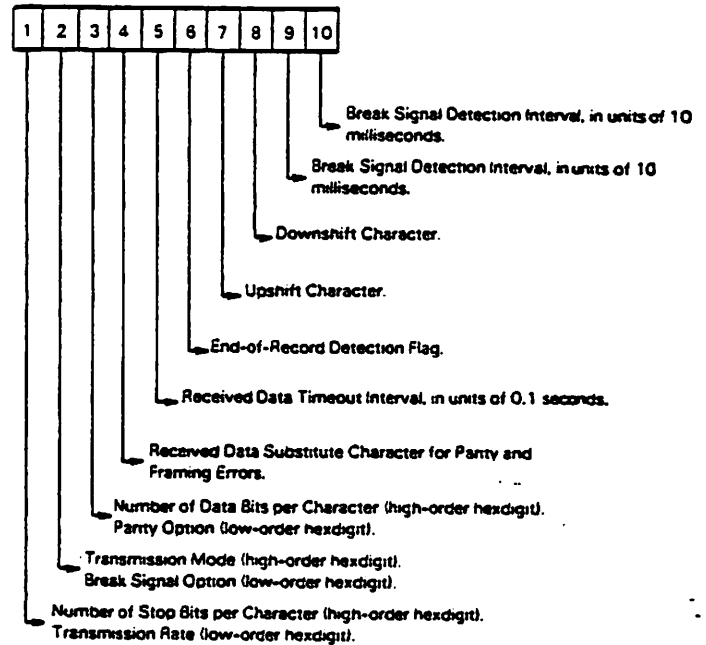
## OPTION 62 OR 62B

Set the device address switches to Hex 1C (set switches 4, 5 and 6 ON, and all others OFF) before installing either the 7153 board (Option 62) or 7153-1 board (Option 62B)

	1	2	3	4	5	6	7	8
ON			•••					
OFF	•••				••			

## 2200 COMMUNICATIONS CONTROL VECTOR FORMAT

### COMMUNICATIONS CONTROL VECTOR BYTES



## 2200 VALID COMMUNICATIONS CONTROL VECTOR SPECIFICATIONS

Byte	High-order Hexdigit	Low-order Hexdigit
1	0 = Illegal value	0 = 50 bps (bits per seconds)
	1 = 1 Stop bit 2 = 1.5 Stop bits 3 = 2 Stop bits	1 = 75 bps 2 = 100 bps 3 = 110 bps 4 = 134.5 bps 5 = 150 bps 6 = 200 bps 7 = 300 bps 8 = 600 bps 9 = 1200 bps A = 1800 bps B = 2400 bps C = 3600 bps D = 4800 bps E = 7200 bps F = 9600 bps
2	0 = Half duplex 1 = Half duplex with deletion of received null characters	0 = Break disabled 1 = Break enabled on transmit/receive 2 = Break enabled on Secondary Req. to Send & Sec. Rec. Line Sig. Det.
	2 = Full duplex 3 = Full duplex with deletion of received null characters	3 = Same as 2 with inverted polarity
3	0 = 5 Data bits per character 1 = 6 Data bits 2 = 7 Data bits 3 = 8 Data bits	0 = No parity 1 = Even parity 2 = No parity 3 = Odd parity

## 2200 VALID COMMUNICATIONS CONTROL VECTOR SPECIFICATIONS (CONTINUED)

Byte	Hexadecimal Notation*	Remarks
4	xy = Substitute character for parity/framing errors.	Each received character having a or framing error is replaced by the designated character (replacement occurs prior to code translation if translation tables are being used).
5	xy = Timeout interval in units of 0.1 seconds.	The specification, in hexadecimal notation represents the timeout interval in units of 0.1 seconds; e.g., (24) <sub>16</sub> = (36) <sub>10</sub> specifies an interval of 3.6 seconds.
6	00 = Disable end-of-record detection. 01 = Enable end-of-record detection.	If enabled, the end-of-record characters must be defined via the receive code translation table by setting the high-order bit to 1 for each code corresponding to an incoming end-of-record character.
7	xy = Upshift character.	To enable shift code insertion/deletion, the high-order hexdigit in byte 3 of the control vector must be 0 or 1 (i.e., the number of data bits per character must be 5 or 6). Also, the transmit code translation table must identify all downshifted, upshifted, and "don't care" characters by setting the two high-order bits to 00, 01 and either 10 or 11 as described in Section 3.6. The Receive Code Translation Table must allow for the controller's automatic setting (before translation of the high-order bit 1 for all incoming upshifted characters.
8	xy = Downshift character.	

\*x and y denote any hexdigit from 0 through F. If a feature is not desired and the communications control vector has been initiated to binary zero, the byte positions associated with the feature can be ignored.

## 2200 VALID COMMUNICATIONS CONTROL VECTOR SPECIFICATIONS (CONTINUED)

Byte	Hexadecimal Notation*	Remarks
9	xy = Break signal transmit interval in units of 10 ms.	To enable break signal transmission/detection, the low-order hexdigit in byte 2 of the control vector must specify the polarity and the modem signals. If bytes 9 and 10 are both HEX (00), the low-order hexdigit in byte 2 should be 0. The byte
10	xy = Break signal detection interval in units of 10 ms.	9 and 10 specifications in hexadecimal notation represent break signal transmit and receive intervals in units of 10 milliseconds; e.g. $(12)_{16} = (18)_{10}$ specifies a 180 ms interval.

\*x and y denote any hexdigit from 0 through F. If a feature is not desired and the communications control vector has been initiated to binary zero, the byte positions associated with the feature can be ignored.

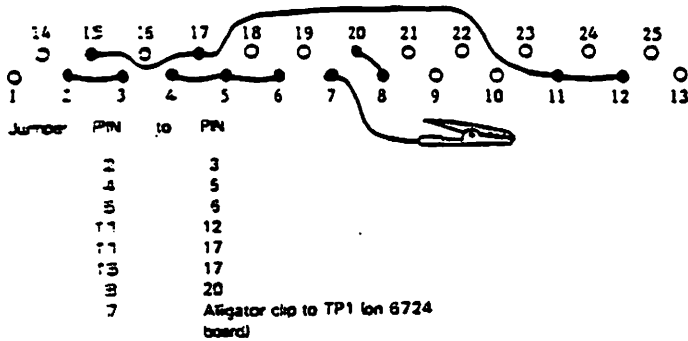
## 2200 COMMUNICATIONS STATUS VECTOR INFORMATION

Byte	Bit*	Meaning
1	1	1 = Break signal received.
2	1	1 = Received Line Signal Detector On.
	2	1 = Sec. Rec'd Line Sig. Det. On.
	3	1 = Data Set Ready modem signal On.
3	1	1 = Receive parity error detected.
	2	1 = Receive buffer overrun error detected.
	3	1 = Receive framing error detected.
4	all	Binary count of the number of characters in the receive buffer.
5	all	Binary count of the number of end-of-record characters in the receive buffer.
6	all	Received data timeout countdown.
7	all	Binary count of the number of characters in the transmit buffer.

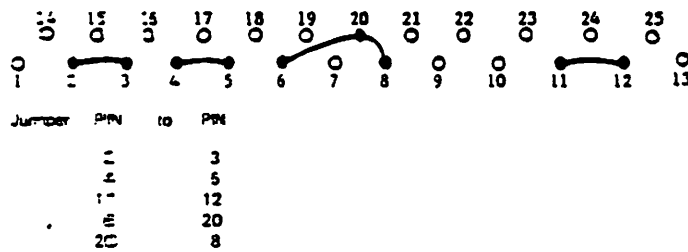
\*Bit positions in each byte are numbered from 1 (low-order) to 8 (high-order).

## CONNECTOR JUMPER FOR 2228

For Model 2228 only:



For Models 2227B, 2228B, Option 62, and Option 62B:



## MODEL 5528 COMMUNICATIONS CONTROLLER SPECIFICATIONS

TC Controller Model No. 5528 (W.L. #177-9303)

P.C. Board Numbers:

210-7353	Data Link TC
210-7354	Memory
210-7355	CPU
210-7356	Modem/ACU Interface (RS-232)
210-7357	TCP Current Loop (replaces 7356 PCB)
210-7358	Voltage Regulator
210-7359	Motherboard (Chassis)

### 5528 DC VOLTAGES

ADJUST POT ON 7358 PCB	REGULATED VOLTAGE	LOCATION	ADJUSTED VOLTAGE RANGE
R5	+ 5 Volts	7335 PCB Pin Y, Conn. 4	+ 4.9 to + 5.1
R16	+ 12 Volts	7335 PCB Pin S, Conn. 2	+ 11.75 to + 12.25
R29	- 5 Volts	7335 PCB Pin X, Conn. 4	- 4.9 to - 5.1
R32	- 12 Volts	7356 PCB Pin 14, Conn. 2 OR L4 (75150 IC) Pin 5	- 11.75 to - 12.25

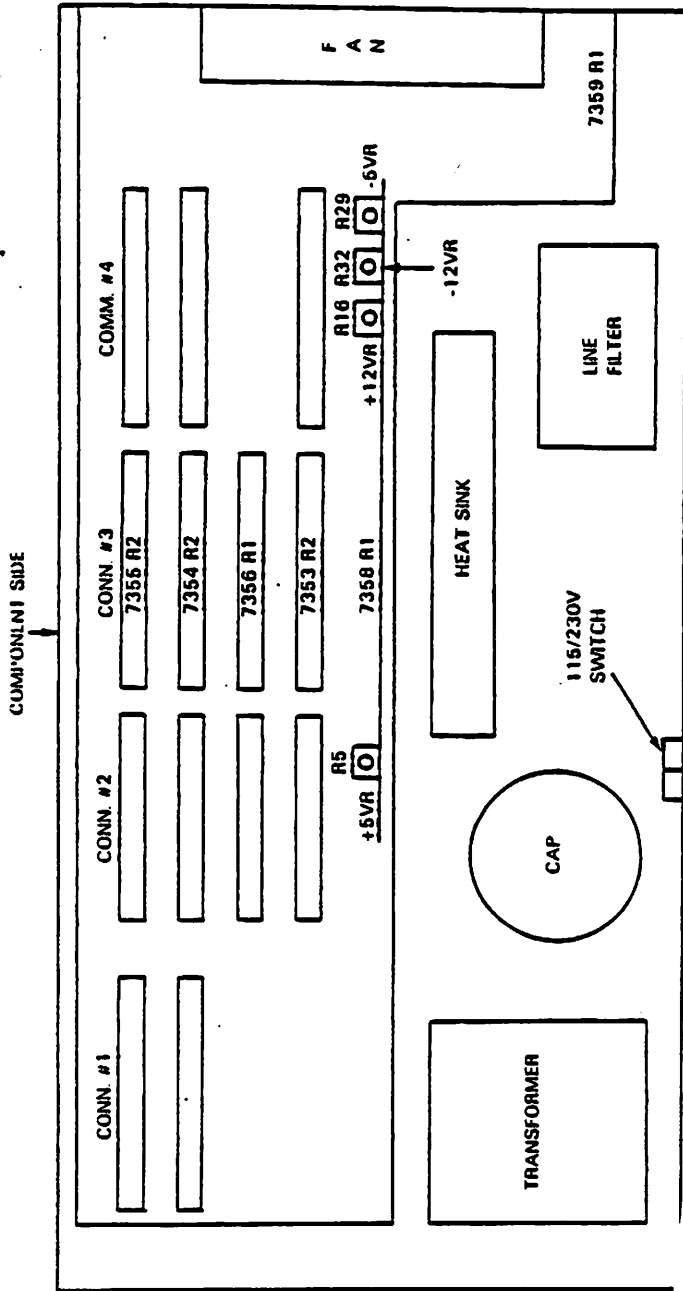
### ADDRESS SWITCH SETTINGS

PCB 7353 has a bank of five Device Type microswitches to be set as specified below. These settings indicate to the Master CPU that a Model 5528 (Device Type = HEX 08) is connected to it.

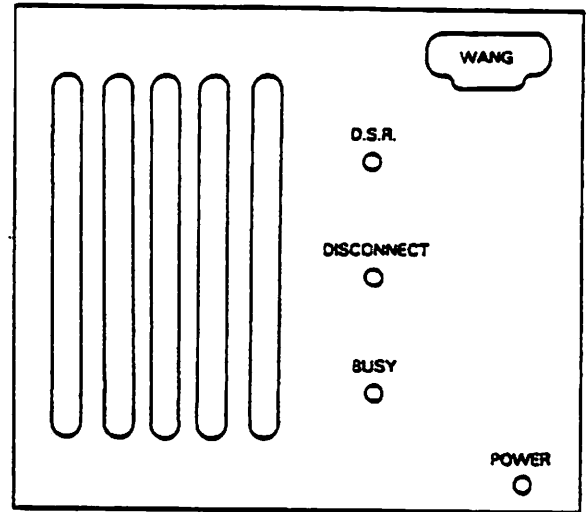
	1	2	3	4	5
ON	.	.	.	.	.
OFF				.	

Set port ID switches on PCB 7355 as follows: 1 through 5 to the ON position, switches 6 and 7 to the OFF position. The Model 5528 hardware is designed so that more than one Model 5528 can be connected to the Master CPU. In this case, each TC Channel must have its unique address set by the bank of 8 Channel ID microswitches on PCB 7355. At this time, only one Model 5528 can be attached to the WP system so only address switch No. 1 must be set to "ON."

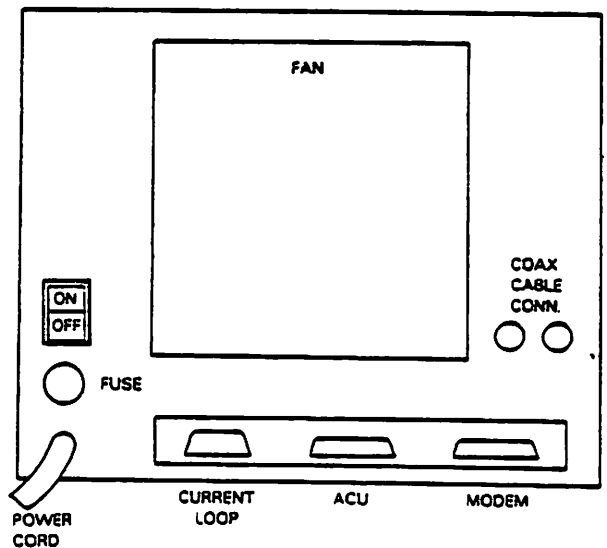
# MODEL 5528 COMMUNICATIONS CONTROLLER



# MODEL 5528 COMMUNICATIONS CONTROLLER FRONT PANEL



# MODEL 5528 COMMUNICATIONS CONTROLLER BACK PANEL



## MODEL 5526 WORKSTATION (OPTION 5595-4) SPECIFICATIONS

TC Workstation (80 column) (W.L. #177-9303)

### P.C. Board Numbers:

210-7067	Power Supply Regulator Board
210-7227	Data Link Board (Device Type = Hex '1')
210-7230	TC Option Board (RS-232-C)
210-7236	24K Memory Board
210-7328	Motherboard (Chassis)
210-7425	CPU/CRT Control Board

TC Workstation with Horizontal Scroll Option (160 column) (W.L. #177-9303H)

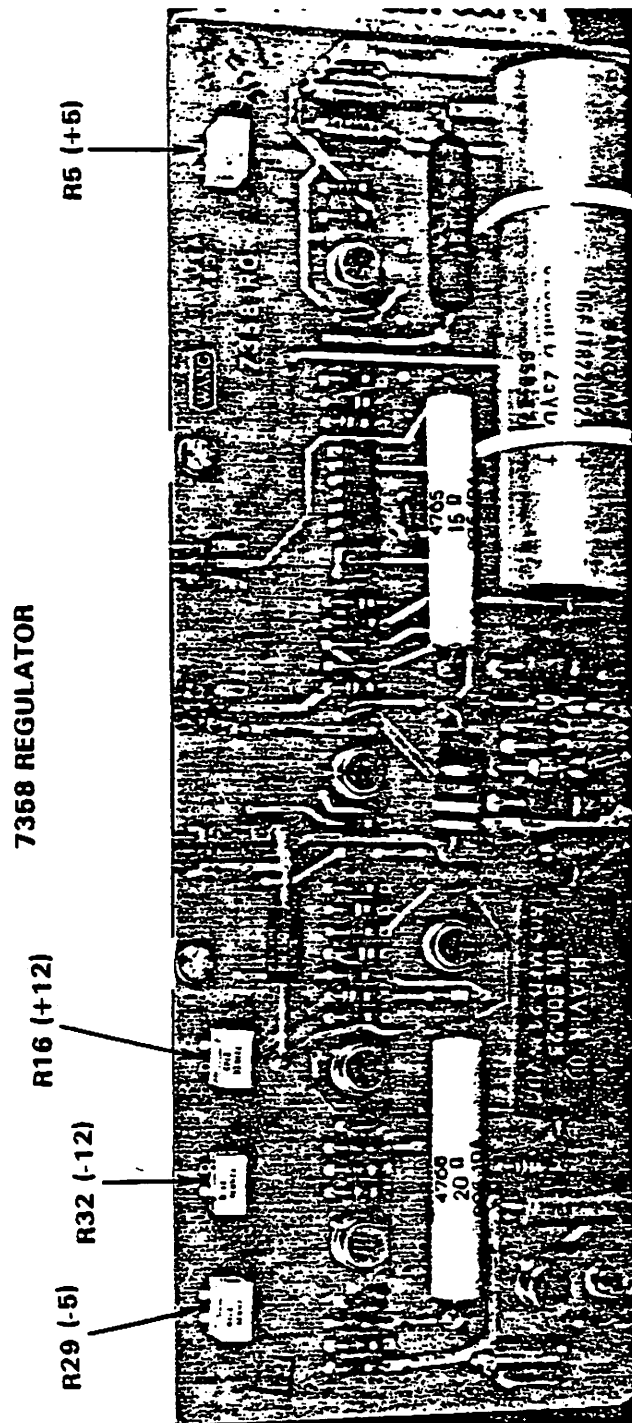
### P.C. Board Numbers:

210-7067	Power Supply Regulator Board
210-7227	Data Link Board (Device Type = Hex '2')
210-7230	TC Option Board (RS-232-C)
210-7236	24K Memory Board
210-7328	Motherboard (Chassis)
210-7425	Horizontal Scroll CPU/CRT Control Board

## D.C. VOLTAGE ADJUSTMENTS ON REGULATOR BOARD

Before operating the Model 5528, the regulated D.C. voltages must be checked or adjusted as required. Refer to Figure for pot locations on the 7358 regulator board for various regulated voltages.

ADJUST POT ON 7358 PCB	REGULATED VOLTAGE	LOCATION	ADJUSTED VOLTAGE RANGE
R4	+ 5 Volts	7227 PCB Test Point	+ 4.9 to + 5.1
R10	+ 12 Volts	7227 PCB Test Point	+ 11.8 to + 12.2
R19	- 5 Volts	7227 PCB Test Point	- 4.9 to - 5.1
R16	- 12 Volts	7356 PCB Pin 14, Conn. 2	- 11.8 to - 12.2

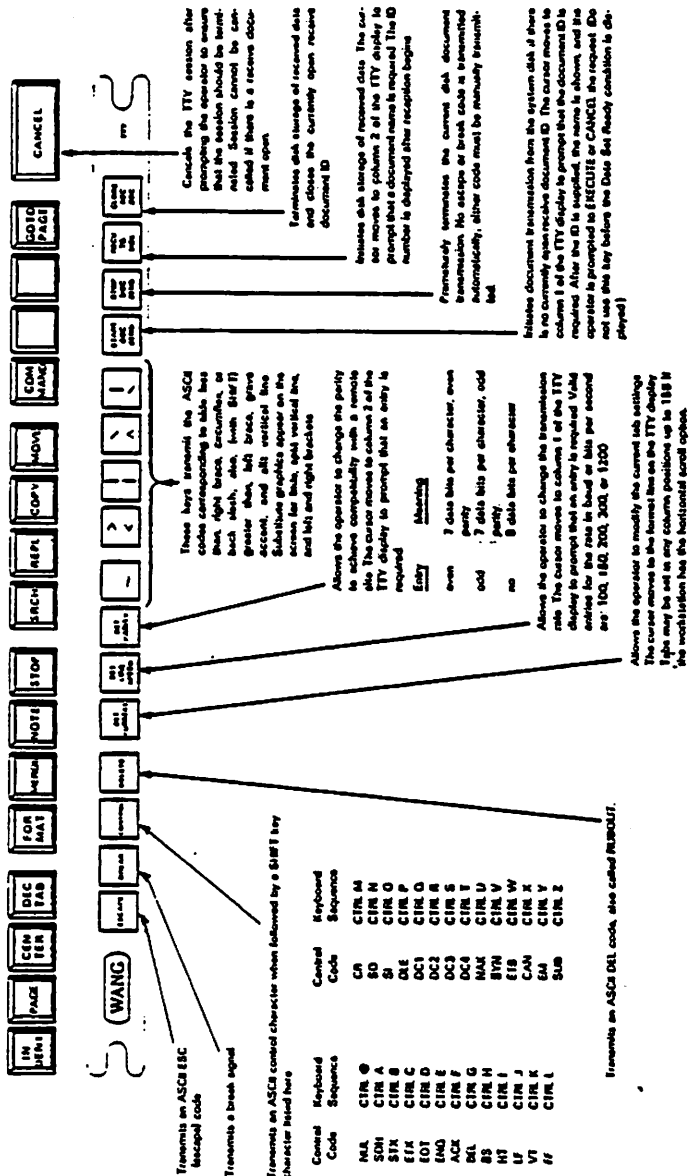


# PORT ID SWITCH SETTINGS

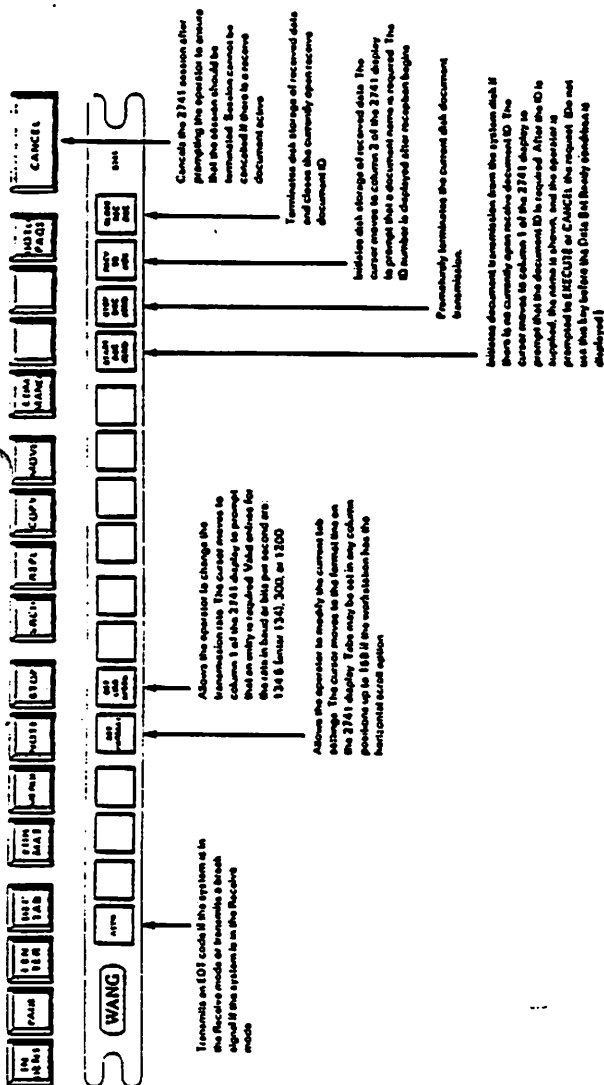
PCB 7230 has a bank of five Port ID microswitches to be set as specified below. Their interpretation is a function of software, which uses them to identify a set of parameters stored on the system disk which defines the type of modem and line connected to the TC Workstation.

	1	2	3	4	5
ON	.	.	.	.	.
OFF	.	.	.	.	.

# SPECIAL TTY KEYS



## SPECIAL 2741 KEYS



## WANG HARDWARE (FOR OCR CONNECTION)

- 1 5528 unit
- 1 Null Modem (2227N or 2228N)
- 1 co-axial cable (WL#220-0148)
- 2 TC cables (WL#220-0113)

### OCR Character Format and Speed

OCR unit must be strapped to operate at AYNC, 1200 Baud, 7 bit even parity ASCII code.

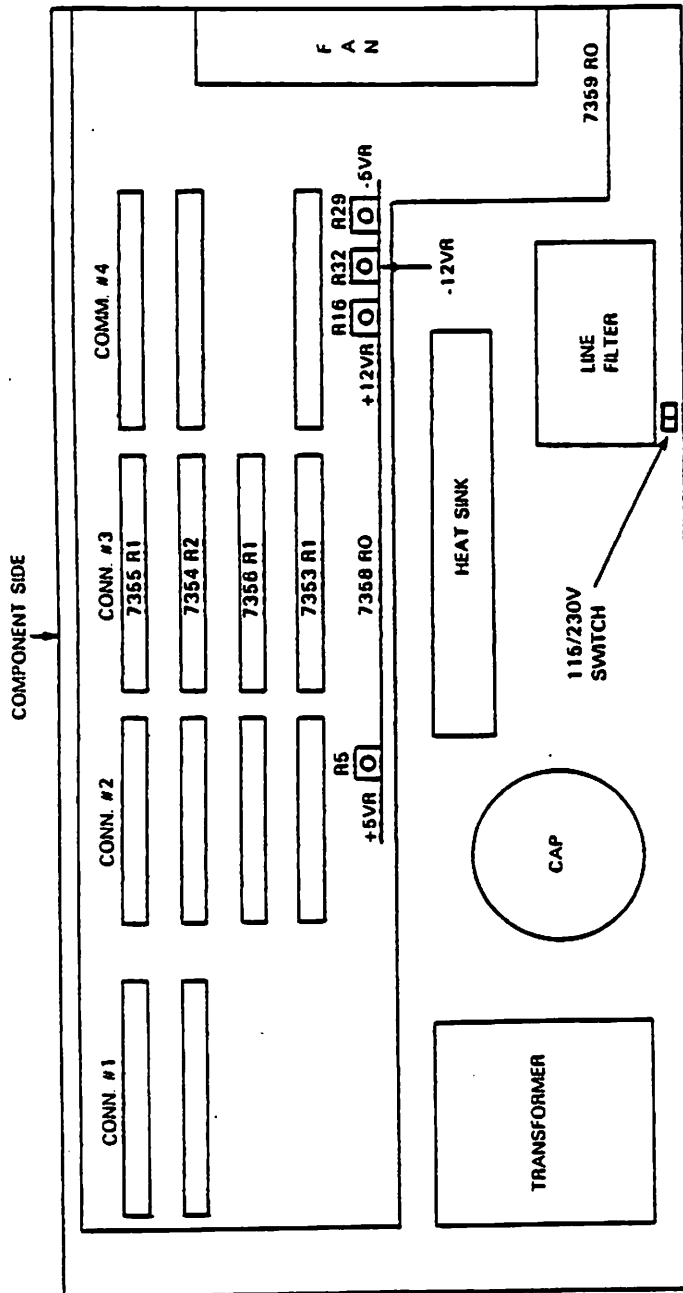
### D.C. Voltage Adjustments on Regulator Board

Before operating the Model 5528, D.C. regulated voltages must be checked or adjusted as required. Refer to Figure 6 for potentiometer locations on the 7358 regulator board for various regulated voltages.

ADJUST POT ON 7358 PCB	REGULATED VOLTAGE	LOCATION	ADJUSTED VOLTAGE RANGE
R5	+ 5 Volts	7335 PCB Pin Y, Conn. 4	+ 4.9 to + 5.1
R16	+ 12 Volts	7335 PCB Pin S, Conn. 2	+ 11.75 to + 12.25
R29	- 5 Volts	7335 PCB Pin X, Conn. 4	- 4.9 to - 5.1
R32	- 12 Volts	7358 PCB Pin 14, Conn. 2 OR L4 (75150 IC) Pin 5	- 11.75 to - 12.25



## WANG OCR HARDWARE INTERFACE UNIT



## BELL AND BELL COMPATIBLE MODEM SUMMARY

This summary is an attempt to dispell some of the confusion concerning the variety of telecommunications modems now being manufactured. The primary modem manufacturer is Western Electric, a subsidiary of Bell Telephone. There are many other manufacturers of modems. Most of these modems are compatible with and may be used as a direct replacement for Bell modems. The following summary lists the modems by manufacturer and includes model number, type (synchronous or asynchronous) and mode (half duplex or full duplex) of operation, line speed in bits per second, type of line required and what model Bell modem it replaces. In the case of Bell modems, a list of options necessary for operation with a Wang TC controller is presented. Although specifics are not available, other manufacturers' modems should be optioned similiar to Bell modems. Also presented is a listing of modems that are compatible with Wang systems and TC controllers.

## MODEM SUMMARY

MANF	MODEL	STATUS	OPERATION	MODE	SPEED	LINE TYPE	MODEM OPTIONS	BELL MATCH
Bell	103A	Obsolete	ASYNC	A B	300	Switched 2 Wire		Replaced by 103J
Bell	103J	In Use	ASYNC	A B	300	Switched 2 Wire	6,7,8,9, 10,11	
Bell	113A	Obsolete	ASYNC Originate Only	A B	300	Switched 2 Wire		Replaced by 113C
Bell	113C	In Use	ASYNC Originate Only	A B	300	Switched 2 Wire		
Bell	113B	Obsolete	ASYNC Answer Only	A B	300	Switched 2 Wire		Replaced by 113D
Bell	113D	In Use	ASYNC Answer Only	A B	300	Switched 2 Wire		
Bell	2018	Obsolete	SYNC	A B	2400	Leased 2 4 Wire	1,2,3,5, 10,37,40	Replaced by 201C
Bell	201A	Obsolete		A B	2000	Leased 2 Wire	1,2,3,5, 10, 37	Replaced by 201C
Bell	201C	In Use	SYNC	A B	2400	Switched 2 Wire Leased 2 4Wire	1,15,30, 31,32,33	
Bell	202C	Obsolete	ASYNC	A B	1200 1800	Switched 2 Wire Leased 2 4 Wire		Replaced by 202S
Bell	202D	Obsolete	ASYNC	A B	1900	Leased 2 4 Wire		Replaced 202T
Bell	202R	Obsolete	ASYNC	A B	1200 1800	Switched 2 Wire Leased 4 Wire		Replaced by 202S 202T
Bell	202S	In Use	ASYNC	A	1200	Switched 2 Wire	1,4,10, 12,15	
Bell	202T	In Use	ASYNC	A B	1900	Leased 2 4 Wire	4,16-25	
Bell	208A	In Use	SYNC	A B	4800	Leased 4 Wire	1,3,4,3 38,37,38,42	
Bell	208B	In Use	SYNC	A	4800	Switched 2 Wire	1,10,15, 39	
Bell	209A	In Use	SYNC	A B	9600	Leased 4 Wire	1,14,15 34,35,41 ...	
Bell	212A	In Use	ASYNC	B	300	Switched 2 Wire	10,26,27, 28,29	
Bell	212A	In Use	ASYNC	B	1200	Switched 2 Wire	10,26,27 29	
			SYNC	B	1200	Switched 2 Wire	10,26,28 29	

## MODEM SUMMARY

MANF	MODEL	STATUS	OPERATION	MODE	SPEED	LINE TYPE	MODEM OPTIONS	BELL MATCH
A/J*	AD342		ASYNC	A B	300	Acoustic DAA	Note 1 Page 6	103A
A/J*	MU1291		ASYNC	B	1200	DAA 2 4 Wire	" "	202C, 202D
Asl**	103		ASYNC	A B	300	Switched 2 Wire	" "	103
Asl**	120		ASYNC	B	1200 1800	Switched 2 Wire Leased 4 Wire	" "	202
Asl**	324		SYNC	A B	2400	Switched 2 Wire Leased 2 4 Wire	" "	201B 201C
Codes Corp							" "	None
Collins Radio	TE1200		ASYNC	A B	1800	Leased 2 4 Wire	" "	202D 202T
Collins Radio	TE2400		SYNC	A B	2400	Leased 2 4 Wire	" "	201B
General Data Comm	100		ASYNC	A B	300	Switched 2 Wire Leased 4 Wire	" "	103A 113A 113B
General Data Comm	202		ASYNC	A B	1200 1800	Switched 2 Wire Leased 2 4 Wire	" "	202C 202D
General Data Comm	201		SYNC	A B	2400	Switched 2 Wire Leased 2 4 Wire	" "	201B 201C
General Data Comm	208		SYNC	A B	4800	Leased 2 4 Wire	" "	208A
General Data Comm	9601		SYNC	B	9600	Leased 4 Wire	" "	None
G.T.E.	262A		SYNC	A B	4800	Leased 2 4 Wire	" "	208A
G.T.E.	262B		SYNC	B	4800	Leased 4 Wire	" "	208B
IBM								None
ICC Milgo	96		SYNC	B	9600	Leased 4 Wire	" "	None

\* A/J = Anderson, Jacobson  
\*\* Asl = Astrocom

## MODEM SUMMARY

MANF	MODEL	STATUS	OPERATION	MODE	SPEED	LINE TYPE	MODEM OPTIONS	BELL MATCH
ICC Migo	24LSI		SYNC	A/B	2400	Switched 2 Wire Leased 2/4 Wire	Note 1 Page 6	2018/C
Inter- tel	MCS 1200		SYNC ASYN	A/B	1800	Switched 2 Wire Leased 2/4 Wire	--	202C 202D 202S 202T
Inter- tel	MCS 2400		SYNC	A/B	2400	Leased 2/4 Wire	--	2018
Inter- tel	MCS 9600		SYNC	A/B	9600	Leased 2/4 Wire	--	None
Liver- more	412		ASYN	A/B	1200	Switched 2 Wire Leased 2/4 Wire	--	202S 202T
Liver- more	424		SYNC	A/B	2400	Switched 2 Wire Leased 2/4 Wire	--	2018 201C
Hew- lett	202		ASYN	A/B	1200 1800	Switched 2 Wire Leased 2/4 Wire	--	202C 202D
Omnitac	1202		ASYN	A	1200	DAA/ 4 Wire	--	202C
Prin- tice	P202		ASYN	A/B	1200	Switched 2 Wire Leased 2/4 Wire	--	202C 202D
Prin- tice	P201 B/C		SYNC	A/B	2400	Switched 2 Wire Leased 2/4 Wire	--	2018 201C
Rizon	T202S		ASYN	A/B	1200	Switched 2 Wire	--	202S
Rizon	T202T		ASYN	A/B	1800	Leased 2/4 Wire	--	202T
Rizon	T208A		SYNC	B	4800	Leased 4 Wire	--	208A
Rizon	T208B		SYNC	A	4800	Switched 2 Wire	--	208B
Rizon	T201 A/B		SYNC	A/B	2000  2400	Switched 2 Wire Leased 4 Wire Leased 2/4 Wire	--	201A 201B

## MODEM SUMMARY

MANF	MODEL	STATUS	OPERATION	MODE	SPEED	LINE TYPE	MODEM OPTIONS	BELL MATCH
Tele- dynamic	7201 A/B		SYNC	A/B	2000 2400	Switched 2 Wire Leased 4 Wire Leased 2/4 Wire	Note 1 Page 6	201A 201B
Tele- dynamic	7202 D/E		ASYN	A/B	1800	Leased 2/4 Wire	--	202D 202E
Tele- dynamic	7208A		SYNC	A/B	4800	Leased 4 Wire	--	208A
Vadic	VA300		ASYN	B	300	Switched 2 Wire	--	103 113
Vadic	VA3406		SYNC	A/B	2400	Switched 2 Wire Leased 2/4 Wire	--	2018 201C

### Notes

A = Half Duplex

B = Full duplex

DAA = Data Access Arrangement

Acoustic = Acoustic Coupler

Modem system/controller compatibility:

Modem Type	System	Controller
Asynchronous	2200	2227B/2228B
Asynchronous	PCS II	Option 62 (210-7153)
Asynchronous	WPS	5596-4 (210-7230)
Synchronous	2200	2228B
Synchronous	2200VS	22V06-1,2
Synchronous	PCS II	Option 62B (210-7153-11)
Synchronous	WPS	5596-5 (5528)

## Summary of Bell Modem Options For Wang Systems

1. Transmitter internally timed.
2. Half duplex operation.
3. Carrier controlled by request to send.
4. 150 to 200 millisecond clear to send. (For long distance transmissions).
5. EIA interface.
6. Send space disconnect.
7. Receive space disconnect.
8. Loss of carrier disconnect.
9. Fail safe state of CN circuit "off."
10. Auto answer.
  1. Factory supplied EIA interface.
  2. No local copy on primary channel.
  3. No local copy on reverse channel.
  4. DSR lead "on" in analog loopback test.
  5. Signal and frame ground connected.
  6. Point-to-point circuit application. (Not for multi-point application.)
  7. Two wire operation. (Not for full duplex operation.)
  8. No local copy on primary channel. (2 wire application only.)
  9. Master station or continuous carrier operation. (4 wire application only.)
  10. Remote station or carrier controlled by RTS. (2 wire application only.)
  11. No local copy on reverse channel. (2 wire application only.)
  12. Fast turnaround operation. (4 wire application only.)
  13. Normal turnaround operation. (2 wire application only.)
  14. Telco engineered customer options.
  15. Operation at 1200 BPS or less.
  16. Factory supplied disconnect options.
  17. Factory supplied dual 300/1200 BPS asynchronous mode. (See note 2.)
  18. Factory supplied dual 300 BPS asynchronous/1200 BPS synchronous mode. (Specify Telco sub-options a2,c1,d2,e1)
  19. Interface controlled make-busy/analog loop-in.
30. Auto-answer controlled by DTR only.
31. Ring indicator on EIA interface pin 22.
32. Continuous receiver bit clock-out. (Not for Direct Distance Dialing over satellite link.)
33. Receive Symbol Clock provided on EIA interface pin 18.
34. Continuous carrier. (Not for multi-point operation.)
35. Continuous request-to-send. (Not for multi-point operation.)
36. One second delay holdover used.
37. New sync not used.
38. Data-set-ready lead "on" in analog loopback test.
39. CC "on" when AL pressed.
40. With alternate voice.
41. Elastic store out.
42. Switched Request-to-Send.

Note 1. Modem should be optioned similar to Bell Modem.

Note 2. Modem is restricted to either a 9 or 10 bit character format (including start and stop bits) in the 1200 BPS asynchronous mode. It is not clear at present if this modem will support the 2236 interactive terminal (8 data bits, parity and start/stop) character format. Contact the local Bell representative for further information.

# ORDERING BELL MODEM DAA AND ACU WITH OPTIONS COMPATIBLE TO WANG SYSTEMS

## BELL MODEL 103J

TYPE: Asynchronous, full-duplex

SPEED: Up to 300 BPS

NETWORK: For low speed, point-to-point, SWITCHED networks

- WANG SYSTEMS:
- For 2236 Remote Terminal connection to 2200MVP with 2236MXD
  - For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C
  - For Wang Word Processors using 5595-4

### Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Send space disconnect
	2. No send space disconnect
B	3. Receive space disconnect
	4. No receive space disconnect
C	5. Loss of carrier disconnect
	6. No loss of carrier disconnect
D	7. Fail safe state of CN circuit on
	8. Fail safe state of CN circuit off
E	9. Automatic answer yes
	10. Automatic answer no
F	11. Factory supplied EIA interface
	12. Customer selected EIA interface

### STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS	COMMENTS
A1	
B3	
C5	
D8	
E9	
F11	

## BELL MODEL 201A

**TYPE:** Synchronous, half-duplex

**SPEED:** 2000 BPS

**NETWORK:** For medium speed, point-to-point,  
SWITCHED networks

**WANG SYSTEMS:**

- For Wang Computers using 2228B/OP62 or 2228C
- For Wang Word Processors using 5595-5

### Bell Telephone Company Modem Options

DECISION	OPTION
A	1. EIA interface 2. Contact interface
B	3. With alternate voice 4. Without alternate voice
C	5. With new sync 6. Without new sync
D	7. Half-duplex (2-wire) 8. Full-duplex (4-wire)
E	9. 4-wire continuous carrier 10. 4-wire carrier controlled by request-to-send

### STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

	COMMENTS
A1	
B3	This option is required for operation with the dial-up network (allows for voice communications).
C6	
D7	This option is required for operation with the dial-up network
E9	If D7 was chosen, no E decision is made. E9 is the normal option for point-to-point, 4-wire connections. For E9, indicate a clear-to-send delay of either 0 or 7 ms.

## BELL MODEL 201C

TYPE: Synchronous, half-duplex

SPEED: 2400 BPS

NETWORK: For medium speed, point-to-point,  
SWITCHED networks

- WANG SYSTEMS:
- For Wang Computers using 2228B/OP62B or 2228C
  - For Wang Word Processors using 5595-5

Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Transmitter timing internal 2. Transmitter timing external
B	3. Automatic answer not provided 4. Automatic answer controlled by DTR only
C	5. Ring indicator on EIA interface pin 22 6. Ring indicator contact closure on pins 22 and 23
D	7. Continuous receiver bit Clock-in 8. Continuous receiver bit clock-out

## STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

	COMMENTS
A1	
B4	
C5	
D8	Select D7 if direct distance dialing over satellite link, otherwise D8.

BELL MODEL 201C (Cont'd)

DECISION	OPTION
E	9. EIA interface pin 18 includes local analog loopback
	10. EIA interface pin 18 provides receive symbol clock
F	11. Signal and frame ground connected
	12. Signal and frame ground not connected

STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS

COMMENTS

E10

F11



## BELL MODEL 202S

TYPE: Asynchronous, half-duplex

SPEED: Up to 1200 BPS

NETWORK: For medium speed, point-to-point,  
SWITCHED networks

- WANG SYSTEMS:
- For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C
  - For Wang Word Processors using 5595-4

Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Local copy on primary channel 2. No local copy on primary channel
B	3. Local copy on reverse channel 4. No local copy on reverse channel
C	5. Telco engineered timing option 6. Customer engineered timing option
D	7. DSR lead-on in analog loopback test 8. DSR lead-off in analog loopback test
E	9. Automatic answer in 10. Automatic answer out
F	11. Signal and frame ground connected 12. Signal and frame ground not connected

## STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

COMMENTS

A2

B4

C5

D7

E9

F11

## BELL MODEL 202T

**TYPE:** Asynchronous, half-duplex or full-duplex

**SPEED:** Up to 1800 BPS

**NETWORK:** For medium speed, PRIVATE line, point-to-point or multi-point networks

- WANG SYSTEMS:**
- For 2236 Remote Terminal connection to 2200MVP with 2236MXD (for point-to-point connections only)
  - For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C (multi-point operation only with Burroughs emulator)
  - For Wang Word Processors using 5595-4

Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Multi-point circuit application 2. Point-to-point circuit application
B	3. Two-wire operation 4. four-wire operation
C (2-Wire)	5. Local copy on primary channel 6. No local copy on primary channel

## STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

	COMMENTS
A2	Select A1 for multi-point application.
B3	Select B4 if full-duplex is required.
C6	

BELL MODEL 202T (Cont'd)

DECISION	OPTION
C (4-Wire)	5. Master station or continuous carrier operation
	6. remote station or carrier controlled by RTS
D (2-Wire)	7. No local copy on reverse channel
	8. Local copy on reverse channel
D (4-Wire)	7. Fast turnaround
	8. Normal turnaround operation
E	9. Telco engineered customer options
	10. Customer engineered customer options
F	11. Operation at 1200 BPS or less
	12. Operation at more than 1200 BPS

STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS

COMMENTS

D7

Select C5 (4W)  
if B4 was selected,  
otherwise C6 (4W).

Select D7 (4W) if  
B4 was selected,  
otherwise D8 (4W).

E9

F11

## BELL MODEL 208A

TYPE: Synchronous, half-duplex

SPEED: 4800 BPS

NETWORK: For high speed, PRIVATE line, point-to-point or multi-point networks

WANG SYSTEMS:

- For Wang Computers using 2228B/OP62B or 2228C (multi-point operation with Burroughs emulation)
- For Wang Word Processors using 5595-5 (point-to-point operation only)

### Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Transmitter internally timed 2. Transmitter externally timed
B	3. Continuous carrier 4. Switched carrier
C	5. Switched request-to-send 6. Continuous request-to-send
D	7. One second holdover used 8. One second holdover not used
E	9. New sync used 10. New sync not used

### STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

	COMMENTS
A1	
B3	Normal option for point-to-point connection. Use B4 if multi-point.
C6	If B4 was selected, C5 must be selected for proper operation.
D7	
E10	

BELL MODEL 208A (Cont'd)

DECISION	OPTION
F	11. Data set ready lead ON in analog loopback test
	12. Data set ready lead OFF in analog loopback test

STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS

COMMENTS

F11

## BELL MODEL 208B

TYPE: Synchronous, half-duplex

SPEED: 4800 BPS

NETWORK: For high speed, point-to-point,  
SWITCHED networks

WANG SYSTEMS: ● For Wang Computers using  
2228B/OP62B or 2228C  
● For Wang Word Processors  
using 5595-5

Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Transmitter internally timed 2. Transmitter externally timed
B	3. Without 801 auto-calling unit 4. With 801 auto-calling unit
C	5. CC off when AL pressed 6. CC on when AL pressed
D	7. Without automatic answer 8. With automatic answer
E	9. Desk mounting 10. Rack or cabinet mounting

## STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

A1

B3

C6

D8

E9

## COMMENTS

Select B4 if  
auto-calling is required.

## BELL MODEL 209A

TYPE: Synchronous, half-duplex

SPEED: 9600 BPS

NETWORK: For high speed, PRIVATE line, point-to-point or multi-point networks

WANG SYSTEMS: For Wang Word Processors using 5595-5

Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Transmitter timing by data set 2. Transmitter timing by data terminal
B	3. Data set ready interface lead ON in analog loopback mode 4. Data set ready interface lead OFF in analog loopback mode
C	5. Transmit timing slaved to receive timing 6. Transmit timing not slaved to receive timing
D	7. Elastic stores in 8. Elastic stores out

## STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

	COMMENTS
A1	
B3	
C6	Normal option for point-to-point connection.
D8	Normal option for point-to-point connection.

BELL MODEM 209A (Cont'd)

DECISION	OPTION
E	9. Continuous carrier (decision F required)
	10. Switched carrier (decision F Not required)
F	11. Switched request-to-send
	12. Continuous request-to-send

STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS

	COMMENTS
E9	Normal option for 4-wire, point-to-point connection.
F12	If E10 was selected, then F11 will be automatically selected.



## BELL MODEL 212A

- TYPE:** Asynchronous, full-duplex  
Synchronous, full-duplex
- SPEED:** 300/1200 BPS dual mode —  
Asynchronous operation  
1200 BPS — Synchronous operation
- NETWORK:** For low or medium speed, point-to-point,  
SWITCHED networks
- WANG SYSTEMS:**
- For 2236 Remote Terminal connection to 2200MVP with 2236MXD (selected asynchronous option)
  - For Wang Computers using 2227B/OP62, 2228B/OP62B, or 2228C
  - For Wang Word Processors using 5595-4 (use 5595-5 if synchronous option is selected)

### Bell Telephone Company Modem Options

DECISION	OPTION
A	1. Factory supplied disconnect options 2. Customer selected disconnect options
B	3. Automatic answer — yes 4. Automatic answer — no
C	5. Factory supplied EIA interface 6. Customer selected EIA interface

### STANDARD MODEM OPTIONS FOR COMPATIBILITY WITH WANG SYSTEMS

A1

B3

C5

### COMMENTS

BELL MODEL 212A (Cont'd)

DECISION	OPTION
D	7. Factory supplied dual mode
	8. For 1200 BPS synchronous mode
E	9. Interface controlled make busy/analog loop-in
	10. Interface controlled make busy/analog loop-out

NOTE: At 1200 BPS, the 212A is not compatible with Bell 202 type modems.

STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS

	COMMENTS
D7	This option will enable Dual 300/1200 ASYNC Mode.
	Select D8 and the below listed sub-options for dual mode 1200 synchronous and 300 asynchronous operation.
	D8a2
	D8c1
	D8d2
	D8e1

E9

**BELL 801A ROTARY DIALER AUTOMATIC  
CALLING UNIT (ACU)**

<b>DECISION</b>	<b>OPTION</b>
A	1. EIA voltage interface 2. Contact interface
B	3. Call terminated through ACU after data set status (DSS) ON 4. Call terminated through data set after data set status (DSS) ON
C	5. Abandon call and retry (ACR) timer stopped after DSS ON 6. Abandon call and retry (ACR) timer NOT stopped after DSS ON
D	7. End-of-number signal from customer terminal 8. No end-of-number signal from customer terminal
E	9. ACU answer-tone detection 10. Data set answer-tone detection

**STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS**

<b>OPTION</b>	<b>COMMENTS</b>
A1	
B4	
C5	
D8	If D7 option is used, no E decision is needed.
E9	

**BELL 801C TOUCH TONE DIALER AUTOMATIC  
CALLING UNIT (ACU)**

<b>DECISION</b>	<b>OPTION</b>
A	1. 2-wire
	2. 4-wire
B	3. Call terminated through ACU
	4. Call terminated through data set after data set status (DSS) ON
C	5. Abandon call and retry (ACR) timer stopped after data set status ON
	6. Abandon call and retry (ACR) timer not stopped after data set status ON
D	7. End-of-number signal (EON) from customer terminal
	8. No end-of-number signal from customer terminal
E	9. ACU answer-tone detection
	10. Data set answer-tone detection without end-of-number
F	11. Loop start
	12. Ground start

**STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS**

	<b>COMMENTS</b>
A1	Normal option for switched telephone network.
B4	
C5	
D8	If D7 option is used, E decision is 9.
E9	
F12	

**BELL 1000A (CDT) DATA ACCESS ARRANGEMENT****NO CUSTOMER OPTIONS****BELL 1001A AND 1001F (CBS) DATA  
ACCESS ARRANGEMENT**

<b>DECISION</b>	<b>OPTION</b>
A	1. With customer provided power
	2. With Telephone Company provided power
B	3. EIA — RS-232-B interface
	4. EIA — RS-232-C interface
C	5. With associate telephone set
	6. Without associate telephone set
D	7. Coupler controls line
	8. Telephone set controls line
E	9. Ringer connected on telephone set side of exclusion key
	10. Ringer connected on line side of exclusion key

**STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS**

	<b>COMMENTS</b>
A2	Option A1 is provided only with 1001F.
B4	Option B4 is provided only with 1001F.
C5	Option C5 is used with switched telephone network. If C6 is used, no further decisions are required.
D8	Option D7 is for automatic operation; option D8 is for manual operation.
E10	With option E9 no audible ring is heard; with option E10 an audible ring is heard until the modem answers the call

**BELL 1000B and 1001D (CBT) DATA  
ACCESS ARRANGEMENT**

**DECISION**

**OPTION**

- |   |  |
|---|--|
| A | <ol style="list-style-type: none"> <li>1. With telephone</li> <li>2. Without telephone</li> </ol>  |
| B | <ol style="list-style-type: none"> <li>3. DAA controls line</li> <li>4. Telephone set controls line</li> </ol>   |
| C | <ol style="list-style-type: none"> <li>5. Ringer connected on telephone set side of exclusion key, only DAA (ring indicator) rings</li> <li>6. Ringer connected on line side of exclusion key, both DAA (ring indicator) and telephone ring</li> </ol>   |
| D | <ol style="list-style-type: none"> <li>7. Ringer connected on telephone set side of exclusion key, if exclusion key is down, only telephone rings; if exclusion key is up, only DAA (Ring Indicator) rings</li> <li>8. Ringer connected on line side of exclusion key, if exclusion key is down, only telephone rings; if exclusion key is up, both DAA (ring indicator) and telephone set ring</li> </ol> |

**STANDARD MODEM OPTIONS  
FOR COMPATIBILITY WITH  
WANG SYSTEMS**

**COMMENTS**

- |    |  |
|----|--|
| A1 | Option A1 is used with switched telephone network. If A2 is used, no further decisions are required. |
| B4 | Option B4 is for manual operation and option B3 is for automatic operation.                          |
| C6 | -  |
| D8 |  |

Notes

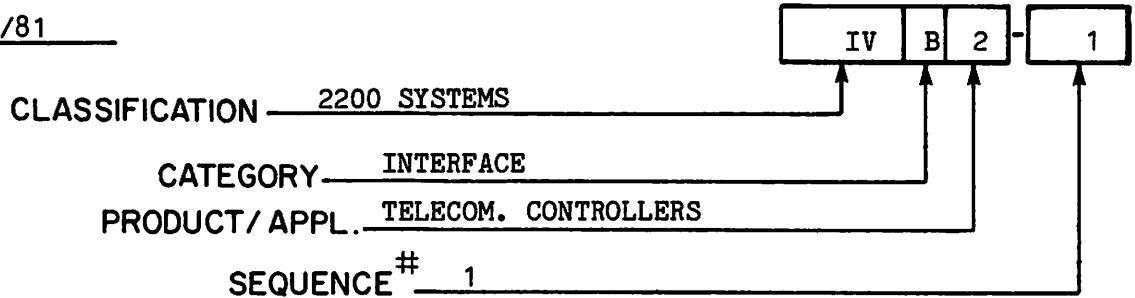
Notes



CUSTOMER ENGINEERING

# PRODUCT SERVICE NOTICE

DATE : 7/15/81



TITLE :

2228D TC CONTROLLER MANUAL UPDATE

The Product Maintenance Manual (PMM) entitled "2228D Telecommunications Controller" (IV.B.2-M), dated February 1981, contained errors with respect to RS449 Loopback Connector wiring diagram, located in Appendix E. Replace the existing RS449 wiring diagram in Appendix E (page E-1) with the wiring diagram attached to this PSN.

**WANG**

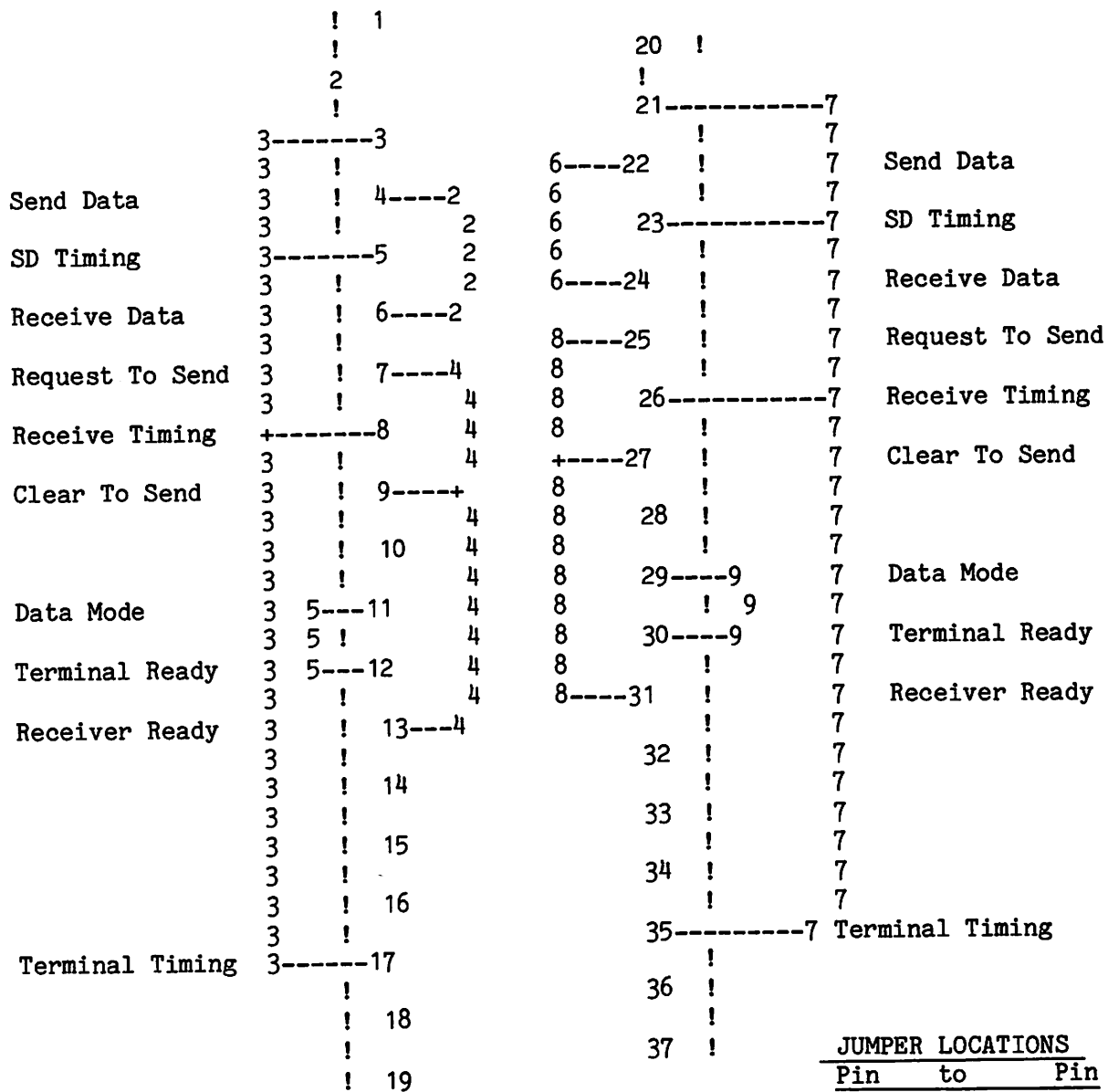
LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL. (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

PRINTED IN U.S.A.  
REORDER NO.  
729-0972

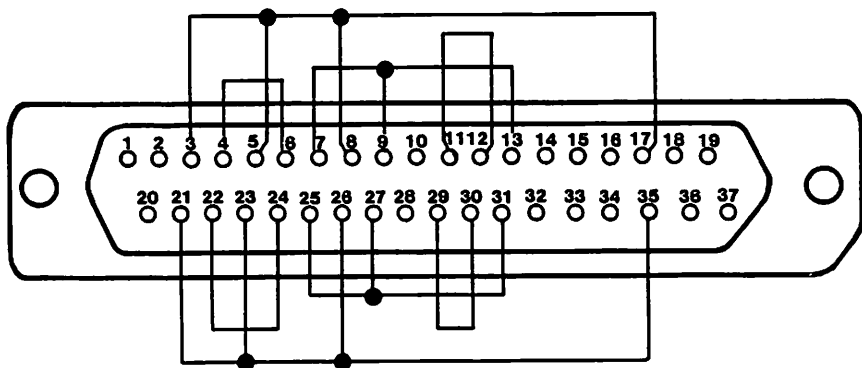


RS449 LOOP BACK CONNECTOR, WIRING DIAGRAM



JUMPER LOCATIONS		
Pin	to	Pin
3		5
4		6
5		8
7		9
8		17
9		13
11		12
21		23
22		24
23		26
25		27
26		35
27		31
29		30

RS449 LOOP BACK CONNECTOR





TECHNICAL SERVICE BULLETIN  
SECTION: HardWare Technical

NUMBER: HWT 5125      REPLACES: HWT 5105      DATE: 07/02/85      PAGE 1 OF 3 2  
MATRIX ID. 7301      PRODUCT/RELEASE# 2228D/E/F TC Controllers  
TITLE: 2200 Data Communication Controller Options

PURPOSE:

To publish to the Field an up-to-date listing of Model 2228D data communications controllers available, what each controller can be used for and the part numbers.

EXPLANATION:

There has been some confusion about the uses of the Model 2228D and Option 28D Data Communications Controllers used in the 2200 systems. The model numbers for the controllers are in themselves confusing, in that previously released hardware and software documents may refer to the 2228E and the 2228F:

The 2228E refers to the 2228D-4E  
2228D-4A  
2228D-4X                      and

The 2228F refers to the 2228D-8E  
2228D-8A  
2228D-8X

The following is a chart of Model numbers, Modem interfaces (M.B.), Ram size (D.B.), type of support and part numbers.

<u>Model Numbers</u>		<u>Interface</u>	<u>Ram Size</u>		<u>Type of Support</u>
<u>LVP-VP-MVP</u>	<u>SVP</u>	<u>M.B.</u>	<u>D.B.</u>		
2228D-4E	OP28D-4E	RS232/366	64K		ICS, 2780/3780 RWN, ASYNC
2228D-4X	OP28D-4X	X.21	64K		International
2228D-4A	OP28D-4A	RS449/366	64K		Special order only
2228D-8E	OP28D-8E	RS232/366	128K		SNA, 3274, RWN

GROUP: Telecommunications Networking Support Group      MAIL STOP: 0115A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

WANG

**TECHNICAL SERVICE BULLETIN**  
**SECTION: HardWare Technical**

NUMBER: HWT 5125      REPLACES: HWT 5105      DATE: 07/02/85      PAGE 2 OF 32  
 MATRIX ID. 7301      PRODUCT/RELEASE# 2228D/E/F TC Controllers  
 TITLE: 2200 Data Communication Controller Options

EXPLANATION (cont'):

<u>Model Numbers</u>		<u>Interface</u>	<u>Ram Size</u>		<u>Type of Support</u>
<u>LVP-VP-MVP</u>	<u>SVP</u>	<u>M.B.</u>	<u>D.B.</u>		
2228D-8X	OP28D-8X	X.21	128K		International
2228D-8A	OP28D-8A	RS449/366	128K		Special order only
2228D-4	OP28D-4	RS232	64K		IBM 3271 BSC Only. No RWN, 2780 or 3780

PART NUMBERS

<u>Model Numbers</u>	<u>Controller</u>	<u>Mother Board</u>	<u>Daughter Board</u>
2228D-4E	212-2228DE *	210-7858-A	210-7659-3C
2228D-4X	212-2228DG	210-7859-A	210-7659-3C
2228D-4A	212-2228DF	210-7857-A	210-7659-3C
2228D-8E	212-2228DH *	210-7858-A	210-7855-A
2228D-8X	212-2228DK	210-7859-A	210-7855-A
2228D-8A	212-2228DJ	210-7857-A	210-7855-A
OP28D-4E	212-2228DE *	210-7858-A =232/ACU SVP Ext.	210-7659-3C
OP28D-4X	212-2228DG	210-7859-A =X.21 SVP Ext.	210-7659-3C
OP28D-4A	212-2228DF	210-7857-A =449/ACU SVP Ext.	210-7659-3C
OP28D-8E	212-2228DH *	210-7858-A =232/ACU SVP Ext.	210-7855-A
OP28D-8X	212-2228DK	210-7859-A =X.21 SVP Ext.	210-7855-A
OP28D-8A	212-2228DJ	210-7857-A =449/ACU SVP Ext.	210-7855-A
2228D-4	212-2228D1 *	210-7658-A	210-7659-3A

NOTE: 210-7658-A is the old mother board  
 210-7858-A is the new mother board

The old mother board cannot be used with the 128K daughter board.

M.B. = Mother Board  
 D.B. = Daughter Board

\* Are the only boards in stock. Use the 212-xxxxxx number when ordering any of these boards.



TECHNICAL SERVICE BULLETIN  
SECTION: HardWare Technical

NUMBER: HWT 5105 REPLACES: \_\_\_\_\_ DATE: 05/14/85 PAGE 1 OF 2

MATRIX ID. 7301 PRODUCT/RELEASE# 2228D/E/F TC Controllers

TITLE: 2200 Data Communication Controller Options

PURPOSE:

To publish to the Field an up-to-date listing of Model 2228D data communications controllers available, what each controller can be used for and the part numbers.

EXPLANATION:

There has been some confusion about the uses of the Model 2228D and Option 28D Data Communications Controllers used in the 2200 systems. The model numbers for the controllers are in themselves confusing, in that previously released hardware and software documents may refer to the 2228E and the 2228F:

The 2228E refers to the 2228D-4E  
2228D-4A  
2228D-4X and

The 2228F refers to the 2228D-8E  
2228D-8A  
2228D-8X

The following is a chart of Model numbers, Modem interfaces (M.B.), Ram size (D.B.), type of support and part numbers.

<u>Model Numbers</u>		<u>Interface</u>	<u>Ram Size</u>		<u>Type of Support</u>
<u>LVP-VP-MVP</u>	<u>SVP</u>	<u>M.B.</u>	<u>D.B.</u>		
2228D-4E	OP28D-4E	RS232/366	64K		ICS, 2780/3780 RWN, ASYNC
2228D-4X	OP28D-4X	X.21	64K		International
2228D-4A	OP28D-4A	RS449/366	64K		Special order only
2228D-8E	OP28D-8E	RS232/366	128K		SNA, 3274, RWN

GROUP: Telecommunications Networking Support Group MAIL STOP: 0115A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

MATRIX ID. 7301PRODUCT/RELEASE# 2228D/E/F TC ControllersTITLE: 2200 Data Communication Controller Options

## EXPLANATION (cont'):

<u>Model Numbers</u>		<u>Interface</u>	<u>Ram Size</u>		<u>Type of Support</u>
<u>LVP-VP-MVP</u>	<u>SVP</u>	<u>M.B.</u>	<u>D.B.</u>		
2228D-8X	OP28D-8X	X.21	128K		International
2228D-8A	OP28D-8A	RS449/366	128K		Special order only
2228D-4	OP28D-4	RS232	64K		IBM 3271 BSC Only. No RWN, 2780 or 3780

PART NUMBERS

<u>Model Numbers</u>	<u>Controller</u>	<u>Mother Board</u>	<u>Daughter Board</u>
2228D-4E	212-2228DE *	210-7858-A	210-7659-3C
2228D-4X	212-2228DG	210-7859-A	210-7659-3C
2228D-4A	212-2228DF	210-7857-A	210-7659-3C
2228D-8E	212-2228DH *	210-7858-A	210-7855-A
2228D-8X	212-2228DK	210-7859-A	210-7855-A
2228D-8A	212-2228DJ	210-7857-A	210-7855-A
OP28D-4E	212-2228DE *	210-7858-A =232/ACU SVP Ext.	210-7659-3C
OP28D-4X	212-2228DG	210-7859-A =X.21 SVP Ext.	210-7659-3C
OP28D-4A	212-2228DF	210-7857-A =449/ACU SVP Ext.	210-7659-3C
OP28D-8E	212-2228DH *	210-7858-A =232/ACU SVP Ext.	210-7855-A
OP28D-8X	212-2228DK	210-7859-A =X.21 SVP Ext.	210-7855-A
OP28D-8A	212-2228DJ	210-7857-A =449/ACU SVP Ext.	210-7855-A
2228D-4	212-2228DI *	210-7658-A	210-7659-3A

NOTE: 210-7658-A is the old mother board  
210-7858-A is the new mother board

The old mother board cannot be used with the 128K daughter board.

M.B. = Mother Board  
D.B. = Daughter Board

\* Are the only boards in stock. Use the 212-xxxxxx number when ordering any of these boards.

TECHNICAL SERVICE BULLETIN  
SECTION: HardWare Technical

NUMBER: HWT 5069 REPLACES: \_\_\_\_\_ DATE: 04/12/85 PAGE 1 OF 1

MATRIX ID. 7301 PRODUCT/RELEASE# 2200

TITLE: Jumpers J5, J6, J7 on 2228D1 PCB

PURPOSE:

To define jumpers J5, J6, and J7 on the 209-7658 PCB (2228D1 TC controller).

EXPLANATION:

1. The jumper J6 is for power on reset and must be installed on the board to operate.
2. The jumper J5 is for master clock and must be installed on the board to operate.
3. The jumper J7, when jumpered, connects Pin #19 "secondary request to send" and Pin #11 "clock" together on the RS232 connector. This jumper must not be installed to insure proper operation of the TC controller.

GROUP: Telecommunications Networking Support Group MAIL STOP: 0127

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WANG Laboratories, Inc.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20914

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

IDEIC: 2228D COMMUNICATION CONTROLLER TROUBLESHOOTING  
PROCEDURES (CONTINUED)

- d. Availability of explanatory documentation, which accompanies the above mentioned diagnostic disks, would be helpful even though the diagnostic disks are self prompted.
4. Currently, in the field, there are only two (2) acceptable numbers for the PROM located on the memory board of the 2228D Communications Controller. They are #4219 and #4381.

The following information is specifically for Northwestern Mutual Life (NML).

1. Perform all procedures listed above and on previous page.
2. Be sure system and switch box are configured properly. There are five (5) different configurations for this account. They may all be found in the National Accounts Alert Notice #19-2 dated January 27, 1982. NOTE: If you are having problems bringing the system up when loading TC software, you may bypass the switch box by running the cable directly from the 2228D controller into the modem.
3. Interpretation is not always available for all error codes. One of these is 4D1520. This code is peculiar to NML's operating system and appears quite often. History of the 4D1520 error code indicates that the 2228D microcode did not load properly. This may result from bad or disconnected modem, A/B switch box bad or switch in wrong position, bad or disconnected cable, and possibly a defective 2228D board. A variety of other error codes: 540220, P48, P34, etc., may indicate some equipment, usually a printer, is powered down and/or configured incorrectly. Do not overlook the possibility that the customers software may be at fault.
4. Modem considerations for NML's Async operation: Black and yellow wires should be disconnected from Telco line.

All feedback is welcomed and will be highly appreciated. Its' use will be invaluable for future updates.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20914

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

TOPIC: 2228D COMMUNICATION CONTROLLER TROUBLESHOOTING PROCEDURES

The following recommendations for troubleshooting communication problems on 2200 systems utilizing the 2228D controller are to be performed prior to escalation or referral.

1. C.E. should first try "power-up self test" diagnostic. By using a RS232 loop back connector (WLI #420-1040) and turning SW2-1 ON prior to power-up, the 2228D will run an additional self test routine called "SIO Bisync External Test." (Switch 2 is located on the motherboard near RS232 connector.) The red LED will be on for approximately 10 seconds and then should go off. If LED stays on or blinks, it is an indication that the 2228D may be defective. (This is documented in the 2228D Maintenance Manual #729-0858, pages 4-2 and 6-17.) Once this test has passed successfully, the following information should be used to run more extensive tests. DO NOT FORGET TO TURN SW2-1 OFF!!!
2. Use a Wang Operating System Software (Rel. 2.3), other than customers, configured with a device address table which includes 2228D primary address (01C) and secondary address (09C). NOTE: Secondary address must be hex 80 higher than primary. Also, configure a partition for a minimum of 56K. (These prerequisites are a must in order to run the following diagnostics.)
3. Field Level Diagnostics
  - a. All 2228D controllers in the field should be "Rev 2 or Higher" with the exception of a limited quantity of Rev 1's originally installed at Mutual Benefit Life.
  - b. Single sided single density (usually MVP and VP systems)  
Disk #702-0097C 2228D TC Field Level Diagnostics Rev 2.
  - c. Dual sided double density (usually LVP and SVP systems)  
Disk #732-0002B LVP/SVP System Exerciser (which includes TC)

Run "Telecommunications" and "2228D Field Service Diagnostics Rev 2"



CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20803

IV.C.1

2200 SYSTEMS-SOFTWARE-DIAGNOSTICS.

TOPIC: 2228D DIAGNOSTICS REQUIREMENTS

The field has over 225 212-2228D TC Controllers in use and most of them are at two National Accounts' Northwest Mutual and Mutual Benefit Life. Both of these accounts require a speedy resolution to their TC problems. The 2228D has a Field Level Diagnostic that should be run on the controller before any replacement parts are ordered. Therefore, it is requested that all branches serving either Northwest Mutual and/or Mutual Benefit Life acquire a copy of the 2228D TC Field Level Diagnostic.

For LVP'S, the order number is\*

732-0002B LVP/SVP SYSTEM EXERCISER

For MVP'S, the order number is\*

702-0097A 2228D TC Field Level Diagnostic  
Motherboard Artwork Rev. 1

702-0097C 2228D TC Field Level Diagnostic  
Motherboard Artwork Rev. 2 and up.

# 2228D TC BRD PROB

Hello Alan,

We investigated a recently by the repair reported problem concerning the 2200 TC controllers 212-2228DE & 212-2228D1 wich have DMA failures while running the TC diagnostics. We concluded the following.

The DMA controller devices used on the 212-2228DE & 212-2228D1 are labeled :  
AM9517APC or AM9517-xPC  
(c)19xxx (c)19xxx

The DMA devices with date higher than 1981 are not reliable. Some have intermittent failures most have direct constant failures.

Using a different 2200 CPU and different TC controllers sometimes changed the error but DMA FAILURES remained at all times with devices above date 1981.

## TEST RESULTS:

CPU: 2200 MVP  
O.S: MVP BASIC-2(rev 3.00)  
DIAGS: 2200 diag package(rev 179E) WPN 195-2956-0  
select:- Field Service Diagnostic/  
- 2228 E/F RS232,RS449,& X.21  
- DMA/SIO test  
TC ctr: 212-2228D1 = 210-7658(Erev 4) + 210-7659(Erev 2)  
212-2228DE = 210-7858(Erev 1) + 210-7659(Erev 2)  
DMA ctr: AM9517A-1PC (1979) Test OK.  
AM9517A-1PC (1981) Test OK.  
AM9517A-1PC (1982) Test failed (only when warm)  
AM9517A-1PC (1982) Test failed (see note)  
AM9517APC (1982) Test failed (see note)  
AM95174PC (1983) Test failed (see note)

## NOTE:failures can be one of the following:

- \*\* CPU timed out before receiving an IBStrobe.
- \*\* Failed to get TC on both channels 0 & 1 of DMA.
- \*\* Failed to get EOP on both channels 0 & 1 of DMA.
- \*\* TC failed to decrement CTC channel 0 downcounter.

We consulted ECO's TSB's and PROBE ,but nowhere was this problem mentioned .

Can you give us any feedback about this ?

If you are not responsible, can you pass the question to the right person and let me know about it ?

Best Regards,  
Van Hoecke William.  
E.L.S.O.

M-E-M-O-R-A-N-D-U-M

Mike  
**WANG**

Bill A  
Mike B  
2200 CES -13  
BM'S FYI  
PNC

TO: D.T.S.M.'s  
FROM: John Forbes  
DATE: September 30, 1983  
SUBJECT: 2228D TC Boards

-----

Product Support has requested our assistance in collecting information on the 2228D TC Controller. This particular board is one of our highest repaired items but is also one of our highest no problem found items. Of the 28, 2228D boards repaired last month, 78% were found to have no problem.

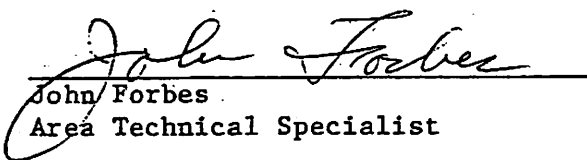
The information requested is 4 simple questions that can be easily answered prior to replacing a 2228D. If the Customer Engineer would please call me with these answers, it may save a lot of time and trouble. The questions are:

1. Why was the 2228D replaced?
2. Was diagnostics run first before the controller was replaced? (DSDD Disk Diag. 732-0002B, SSSD Disk Diag. 702-0097C)
3. Did customer have microcode down load problem?
4. Did problem go away after IPLing or resetting the controller?

If I cannot be contacted, please have the Customer Engineer mail the answers to me. I have also attached some information on assisting Customer Engineers in troubleshooting the 2228D.

Thank you in advance for your cooperation.

Regards,

  
John Forbes  
Area Technical Specialist

Attachment:

cc: Ken Baroni

JF:0197L

MEMORANDUM

TO: DISTRIBUTION

CC: SCOTT JOHNSON  
MATT ZABOY

FROM: WILLIAM FRENCH/  
JOHN R. KRIKORIAN  
COMMUNICATIONS  
PRODUCT SUPPORT GROUP/  
NEW PRODUCT GROUP  
M/S 8250 X6815/X6812  
DATE: AUGUST 31, 1982  
DOC #: 257 (0026j)

SUBJECT: 2228D COMMUNICATION CONTROLLER TROUBLESHOOTING PROCEDURES

The following recommendations for troubleshooting communication problems on 2200 systems utilizing the 2228D controller are to be performed prior to escalation or referral.

1. C.E. should first try "power-up self test" diagnostic. By using a RS232 loop back connector (WLI #420-1040) and turning SW2-1 ON prior to power-up, the 2228D will run an additional self test routine called "SIO Bisync External Test." (Switch 2 is located on the motherboard near RS232 connector.) The red LED will be on for approximately 10 seconds and then should go off. If LED stays on or blinks, it is an indication that the 2228D may be defective. (This is documented in the 2228D Maintenance Manual #729-0858, pages 4-2 and 6-17.) Once this test has passed successfully, the following information should be used to run more extensive tests. DO NOT FORGET TO TURN SW2-1 OFF!!!
2. Use a Wang Operating System Software (Rel. 2.3), other than customers, configured with a device address table which includes 2228D primary address (Ø1C) and secondary address (Ø9C). NOTE: Secondary address must be hex 80 higher than primary. Also, configure a partition for a minimum of 56K. (These prerequisites are a must in order to run the following diagnostics.)
3. Field Level Diagnostics
  - a. All 2228D controllers in the field should be "Rev 2 or Higher" with the exception of a limited quantity of Rev 1's originally installed at Mutual Benefit Life.
  - b. Single sided single density (usually MVP and VP systems)  
Disk #702-0097C 2228D TC Field Level Diagnostics Rev 2.
  - c. Dual sided double density (usually LVP and SVP systems)  
Disk #732-0002B LVP/SVP System Exerciser (which includes TC)  
Run "Telecommunications" and "2228D Field Service Diagnostics Rev 2"
  - d. Availability of explanatory documentation, which accompanies the above mentioned diagnostic disks, would be helpful even though the diagnostic disks are self prompted.
4. Currently, in the field, there are only two (2) acceptable numbers for the PROM located on the memory board of the 2228D Communications Controller. They are #4219 and #4381.

The following information is specifically for Northwestern Mutual Life (NML).

1. Perform all procedures listed on Page 1.
2. Be sure system and switch box are configured properly. There are five (5) different configurations for this account. They may all be found in the National Accounts Alert Notice #19-2 dated January 27, 1982.  
NOTE: If you are having problems bringing system up when loading TC software, you may bypass switch box by running cable directly from 2228D controller into modem.
3. Interpretation is not always available for all error codes. One of these is 4D1520. This code is peculiar to NML's operating system and appears quite often. History of the 4D1520 error code indicates that the 2228D microcode did not load properly. This may result from: bad or disconnected modem, A/B switch box bad or switch in wrong position, bad or disconnected cable, and possibly a defective 2228D board. A variety of other error codes: 540220, P48, P34, etc., may indicate some equipment, usually a printer, is powered down and/or configured incorrectly. Do not overlook the possibility that customers software may be at fault.
4. Modem considerations for NML's Async operation: Black and yellow wires should be disconnected from Telco line.

All feedback is welcomed and will be highly appreciated. Its use will be invaluable for future updates.

Regards,

*William French*  
William French

*John R. Krikorian*  
John R. Krikorian

WF/JRK:kat

Distribution: ATOMs -  
Frank Andreano MS 8236A  
Frank Haggarty MS 8239T  
Harry Hegg MS 8239  
Joe Kramer MS 8239B  
Rich Lascelles MS 8110  
Gary McMann MS 8239T  
Erv Nork MS 8239  
Gary Smith MS 1209

**IMMEDIATE  
SERVICE  
NOTICE**

**NO.** 46

**DATE:** 1/16/75

ITEM(S) / PRODUCT(S):

MODEL 2252A INFORMATION

The Model 2252A (6592 PC) controller board is similar to the 2252 controller (Reference: Service Bulletin #55).

*Added Features:*

- (a) The number of BCD digits to be read at one time are switch selectable, from 1 to 10 digits.
- (b) A *scanning* mode capability when using the KEYIN statement of the 2200 B, C, or S.

*Pushbutton Switches:*

- (a) DATA Switch

UP if input data Logic "1" (active signal level) is HIGH.

DOWN if input data Logic "1" (active signal level) is LOW.

- (b) IS Switch

UP if input strobe (ACK on pin 18; see schematic) active level is HIGH.

DOWN if input strobe active level is LOW.

- (c) SIGN Switch

UP if the + sign active level is HIGH and the - sign is LOW.

DOWN if the + sign active level is LOW and the - sign is HIGH.

- (d) EXEC Switch

UP if the active signal level requirement for "EXECUTE is HIGH.

DOWN if the active EXECUTE signal is LOW.

- (e) TRANS Switch

UP if active signal level requirement for "Transmission in Progress" is HIGH.

**WANG**

LABORATORIES, INC

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DOWN if active signal level requirement for "Transmission in Progress" is LOW.

(f) EOT Switch

UP if active signal level requirement for "End of Transmission" is HIGH.

DOWN if active signal level requirement for "End of Transmission" is LOW.

(g) Digits Selected

Four pushbutton switches marked 1, 2, 4, and 8 (BCD) are used for selecting one to ten digits per read. For example, to read 5 digits, switches 4 and 1 are DOWN, and switches 8 and 2 are UP.

*Connector Pin Assignments:*

Same as 2252 controller (Reference: Service Bulletin #55), except pin 32 (PRMS), which is PRIME (Reset) from the keyboard, is available as an output.

*Address Switch Setting:*

Same as 2252; i.e., Hex address code 25A (switch setting 5A) can be used.

*Installation:*

Same as 2252, except set number of digits being read = 10 (8 and 2 DOWN, 4 and 1 UP), and at step (g) (S.B. #55, paragraph 2) also set number of digits to be read per customer requirement.

*Additional Diagnostic:*

Enter the following program with 2252 test connector attached to the 2252A controller:

```
10 SELECT INPUT 25A
20 INPUT A$
30 GO TO 10
```

1) Select for 10 input digits, RUN, EXECUTE.

DATA and sign switches up: +0000000000 (ten digits plus a sign)  
DATA and sign switches down: -??????????

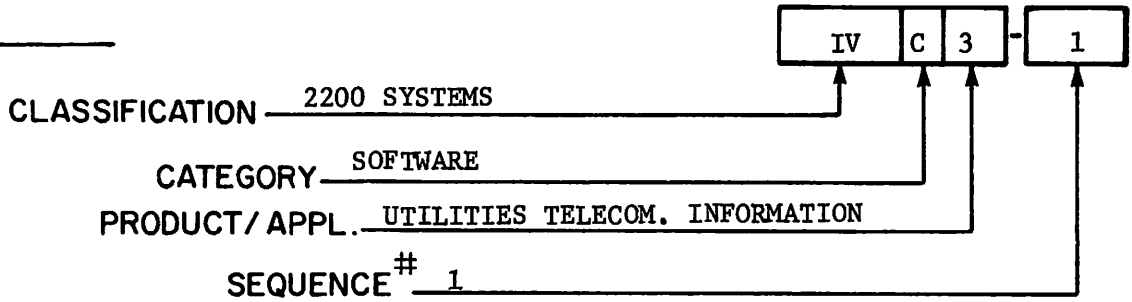
2) Select for 1 to 9 digits in a similar manner with the 2252A push-button switches. The CRT will display the number of digits selected. For example, if switches are selected for 5 digits, display will show a sign plus only 5 digits.

*Logic Operation:*

See 6592 schematic in Schematic Manual.

# PRODUCT SERVICE NOTICE

DATE : 1/27/81



TITLE:

INTERACT REPLACEMENT FOR WYLBUR ASYNC ON-LINE DIAGNOSTIC

The WANG Data Center in Burlington has replaced WYLBUR with another ASYNC on-line diagnostic editor called INTERACT. This product Service Notice (PSN) describes the procedure for implementing the INTERACT diagnostic.

### RELATED DOCUMENTATION

A note referencing this PSN and citing the fact that INTERACT replaces WYLBUR should be made in each of the following documents:

<u>Document</u>	<u>Page</u>
Telecommunications Handbook (729-0830)	31
Service Bulletin No. 77	85





## INTERACT ON-LINE DIAGNOSTIC TEST

The suggested method of on-line system checkout (when applicable) for any of the communication controller boards is a telephone hook-up with INTERACT (IBM 370/158) at the Wang Data Center in Burlington, MA. Basically, INTERACT is an interactive host computer programmed to communicate using either Teletype or IBM 2741 protocol; therefore, either emulation program may be used. The required parameters are:

Teletype - NO ECHO  
          EVEN PARITY  
          7 DATA BITS

2741 - CORRESPONDENCE CODE OR  
      BCD CODE  
      134.5 BAUD

Other parameters are optional. These parameters must be sent and the emulator program loaded before going on-line with INTERACT.

INTERACT's telephone numbers are:

0-300 baud - (617) 272-8120 103, 113 or  
            212A type Modem

1200 baud - (617) 272-7420/ 21 202 type  
            Modem

### TEST PROCEDURE

- 1) Dial INTERACT. (See above telephone numbers)
- 2a) If using one of the modems listed above (or equivalent type modem), wait for carrier tone and then press the "data" button.

- b) If using an acoustic coupler, wait for high pitched sound from telephone and place receiver down into cups located on coupler. A light will illuminate on coupler when carrier tone is established. If not, redial INTERACT.

NOTE:

The coupler should be set for full duplex operation.

EXAMPLE: On OMNITECH coupler, both switches located at rear of coupler must be out.

- 3) Enter the signon code below and then RETURN (EXEC).

2741 - For 2741 test.

OADM - For TTY test. (This may have to be entered more than once without restarting).

OTTY - For TTY test. (This signon is used if a timing problem exists (e.g. character overlay). It allows additional idle characters to be transmitted causing a delay between carriage return and next line transmission.

- 4) INTERACT will respond with:

INTERACT, LINE #, TIME and DATE.

INITIALS

- 5) Enter FES (CR)

INTERACT responds with: GROUP?

6) Enter FS (CR)

INTERACT responds with: KEYWORD? GGGGGGGG

7) Enter Keyword obtained from H.O. 2200 Product Support. (CR)

INTERACT responds with: ACCOUNT-FS? (or ACCOUNT-W33?)

8) Enter W33 (CR)

INTERACT responds with: EXEC END COMMAND

9) Enter USE 2200 ON W33002 (CR)

INTERACT responds with: COMMAND?

10) Enter LIST UNN (CR)

INTERACT responds with:

1. THIS IS A 2200 TELECOMMUNICATIONS TEST.
2. THE 2200 CAN OPERATE AT 110, 150, 300, 600 AND 1200 BAUD RATE ASYNC, DEPENDING ON MODEM.
3. THE BELL 103A OR COMPATIBLE CAN OPERATE UP TO 300 BAUD WHILE BELL 202C UP TO 1200 BAUD.
4. THE 2200 SYSTEM CAN BE SELECTED FOR 5 TO 8 DATA BITS PER CHARACTER.
5. THE EVEN OR ODD PARITY IS PROGRAM SELECTABLE ALSO. 1 or 2 STOP BITS ARE PROGRAM SELECTED.
6. THE 2200 T.C. USED HALF DUPLEX MODE WHICH MEANS IT CANNOT RECEIVE AND TRANSMIT AT THE SAME TIME.
7. YOU MUST HAVE RECEIVED SEVEN LINES AND THIS IS THE END OF TRANSMISSION.

COMMAND?

11) Enter CLR ACT (CR)

INTERACT responds with: COMMAND?

12) Enter SIGNOFF (CR)

INTERACT responds with: OK TO CLEAR?

13) Enter YES (CR)

INTERACT responds with;

### SECONDS EDITING TIME

# PAGE READS, ## PAGE WRITES

# DISK READS, ## DISK WRITES

ESAPSED TIME = ##:##:##

END OF SESSION

This concludes the INTERACT on-line diagnostic test.



MIKE BARRA

M E M O R A N D U M

TO: Distribution  
FROM: Gail Stanwyck  
DATE: April 16, 1981  
SUBJECT: Recent Diagnostic Release

-----

The 2228D Power Up Error Code Interpreter Diagnostic, 2228D TC Field Service Diagnostics for Rev. 1 only and 2228D TC Field Service Diagnostics for Rev. 2 are ready for release.

The part numbers for these diagnostics are 702-0121, Rev. 3124, 702-0097A, Rev. 1121, and 702-0097B, Rev. 1121.

The 2228D Power Up Error Code Interpreter Diagnostic has been revised to incorporate the following changes:

Corrected to allow for more device address inputs.

Key Return Statement on screen corrected to read Press 'RETURN' to Continue.

The 2228D TC Field Service Diagnostics for Rev. 1 only and 2228D TC Field Service Diagnostics for Rev. 2 have been revised to include the following changes.

2228D Field Service Diagnostic for Rev. 1, 2228D Field Service Diagnostic for Rev. 2 and up affects Basic Monitor Program only.

Bug corrected to allow all device address testing - previous release would not load micro code into any controller that did not have device address 01C.

Corrected to allow for more addresses other than 01C and 01F.

Key-RETURN to Continue screen statements changed to read Press RETURN to Continue.

If you should have any problems or questions concerning these diagnostics, please contact Lynda Derby at Wang Corporate Headquarters extension 2314.

1.0 TITLE

2228D TC Field Service Diagnostics for Rev. 1 only

2.0 REVISION/DATE

Date: April 9, 1981 Documentation Release: Rev. 9111 Software Release: Rev. 1121 Part Number: 702-0097A
--

3.0 REFERENCE DOCUMENTS

- Z80 - Assembly Language Programming Manual
- Z80 - PIO Technical Manual
- Z80 - CTC Technical Manual
- Z80 - SIO Technical Manual
- Am9517 - Technical Information Sheet
- MOSTEK 1979 Memory Data Book and Designers Guide
- 2228D Telecommunications Controller Hardware Specification 1/8/80
- Addendum to 2228D Telecommunications Controller Hardware Spec. 6/11/80
- WANG BASIC 2 Language Reference Manual

4.0 CONFIGURATION REQUIREMENTS

4.1 Hardware

Minimum required configuration

- 2200 VP or MVP with 2236MXD or equivalent and 80 X 24 Terminal
- 2228D Rev. 1 Telecommunications Controller Board with 378 - 4219 Power-Up Prom
- RS232 Loop Back Connector
- RS449 Loop Back Connector
- Requires 56K bytes of user Memory

4.2 Software

MVP BASIC 2 Rev. 2.1 or VP BASIC 2 Rev. 2.3  
 When using the MVP software the device table must have the secondary address of the TC Controller defined as listed below:

2228D Address	Secondary Address
019	099
01A	09A
01B	09B
01C	09C
01D	09D
01E	09E
01F	09F

## 5.0 PROGRAM DESCRIPTION

Monitor Program and Microcode Diagnostics are stored on a Floppy Diskette under file names 28DFSRI and FSDIAGS respectively.

The Monitor Program handles all screening, test control, and error reporting. Following is a description of the normal screens (shown in Appendix D) that will be encountered when using this diagnostic.

SCREEN 1 - This is a warning screen identifying the intended use of this diagnostic.

SCREEN 2 - This screen requests operator input of the correct device address for the controller, (default is 01C). After the operator depresses RETURN the Monitor program checks the device for a Ready/Busy condition. The result is displayed to the operator. NOTE: a Busy response indicates either the device address is wrong or the controller will be unable to respond to any future requests from the Monitor program.

SCREEN 3 - This screen requests operator input of the condition the controller is in, (LED ON or OFF). If the LED is OFF the operator will answer Y. The monitor will immediately enter a communications test between the controller and the 2200. NOTE: the communications test is only run upon initial entry of this diagnostic or upon a restart request by the operator from the menu.

If the LED is ON or Flashing the operator will answer N. The next question that will appear asks the operator if the LED is Flashing. If the operator answers N, indicating the LED is ON solid an error screen will be displayed and no further testing will take place. If the answer is Y, indicating the LED is Flashing the monitor will check the controller's power up diagnostic error reporting routine for the error that was detected. If a RAM failure of some type exists an error screen will be displayed and no further testing will take place. If any other type of error exists, the controller will be forced into the operating system firmware portion of the prom and the communications test will be invoked. NOTE: if the communications test is invoked after determining no RAM errors exist, the LED may remain ON or OFF, ignore this condition.

SCREEN 4 - This screen displays the conditions of the DMA/PIO Test (the first communications test). Any errors will be reported on this screen and no error looping will be used. If a CPU Time Out error IBS occurs, no further testing will take place. If a failure to get an IBS from the controller occurs, no further testing can take place. Both failures indicate a fault in either the DMA or PIO.

SCREEN 5 - This screen displays the conditions of the DMA Multiplexer Test (the second communications test). Any errors will be reported on this screen and error looping will be automatically invoked.

SCREEN 6 - This screen requests testing parameter inputs from the operator. The parameters are Loop or Halt On Error, Display or no Display of instruction/information screens, and the number of passes each test is to make.

SCREEN 7 - This screen displays the conditions encountered by the controller after successful completion of the communications tests. It is at this time that the microcode diagnostic program file is downline loaded from the disk to the controller memory, starting at location 0900.

SCREEN 8 - This is the menu screen and indicates that the microcode was successfully loaded into the controllers memory and that the controller has been sent to this program and is awaiting test requests from the monitor.

The remaining screens are test screens and are self-explanatory. Each test will provide the operator with error information indicating the cause of failure.

The following is a brief description of each test that will or can be performed using this diagnostic. These tests are more exhaustive checks of the various capabilities of the controller not performed in the power up diagnostic.

Automatic Testing - These two tests check the communications capability of the controller utilizing the firmware microcode portion of the prom. The tests check the ability of the controller and 2200 to communicate utilizing the PIO and DMA chips.

The DMA/PIO Test transfers a 256 byte incremental data pattern to the controller memory starting at address 0900. It then reads back and compares the data sent with the expected data. Successful functioning of this test will result in advancement to the next communications test.

The DMA Multiplexer Test is designed to check the high order address bit multiplexer for the DMA chip. A unique byte is placed in each of the memory locations shown below. Then each unique byte is read at the specific address and checked with the expected byte. Successful completion of this test will result in advancement to the parameter inputs by the operator and eventual loading of the microcode diagnostic program.

ADDRESS AND BYTE = 8000 (00), 8100 (01), 8200 (02), 8400 (04), 8800 (08)  
9000 (10), A000 (20), C000 (40)

The remaining tests are invoked by the operator from the menu of the Monitor program.

RE-KEY INPUT PARAMETERS SFO - This routine allows the operator to re-input the Loop On Error or Halt On Error, Instruction/Information Display, and Number of Passes parameters. After reentry the microcode program is again downline loaded into controller memory.



MOVING INVERSIONS MEMORY TEST SF1 - This test program performs a more exhaustive RAM memory check using the moving inversions test procedure with a AA/55 test pattern. NOTE: If all banks are to be tested, the number of passes must be set to 4 and chain mode requested. Otherwise, the test requests which bank you desire to test and will test only this bank for the number of passes requested during the input parameters screen. NOTE: If an error is detected it will display the address of failure, the expected and actual data patterns. If the data patterns are equal this indicates a Parity RAM failure has occurred.

SIO EXTERNAL LOOP SF2 - This test requires that the RS232 Loop Back connector be installed. The test runs a more extensive test of the SIO and associated circuitry utilizing Async, Bisync, and SDLC modes of operation. Error messages are more detailed than the SIO External Loop Test for the power up diagnostic. No option switch setting is required.

SIO/DMA TEST SF3 - The RS232 Loop Back Connector is required for this test. The test performs a interaction check between the SIO, DMA, and CTC utilizing the Async mode of operation. Transfers of 256 bytes, 512 bytes, 1K, 2K, 4K, 8K, and 16K are performed with error checking after each transfer completion. A time out feature is also incorporated in case no transfer operation takes place as expected, indicating an SIO DMA problem exists.

CONTROL CHARACTER RAM TEST SF4 - The RS232 Loop Back Connector is required for this test. The test operates in two modes. First the Control Character RAM is flooded not to recognize any characters. With the SIO and DMA (Receive channel only) activated 256 characters 00 to FF are transmitted and received. The CTC is monitored, as well as the DMA, checking each character that did not cause a downcount of CTC channel 0 after completion of each transfer. The Control Character RAM is then flooded to recognize all characters as control characters. The CTC channel 0 is monitored after each transfer to insure a downcount occurred indicating a control character was recognized.

PRIORITY INTERRUPT TEST SF5 - The RS232 Loop Back Connector is required for this test. The test will check the IEI/IEO line connected between the SIO, CTC, and PIO to see if it is functioning properly. It also insures the priority scheme with the SIO having the highest and the PIO the lowest is maintained.

RS449 LOOP BACK TEST SF6 - The RS449 Loop Back Connector is required for this test, also the switch on the rail must be in the RS449 position. The tests performed are the same as those performed by the SIO EXTERNAL LOOP Test.

OPTION SWITCH TEST SF7 - This test allows the operator to test SW2 on the controller motherboard. After test entry the screen will display the current switch setting. The operator need only change the setting of the switch at will and the screen display will automatically reflect the new setting. To exit the test the operator must depress RETURN.

CHAIN MODE SF8 - This test invokes the tests associated with Special Function Keys 1, 2, 3, 4, and 5. This program will invoke each test one at a time for the number of passes entered during parameter entry. The bank number for the Moving Inversions Test will automatically be incremented. If a minimum of 4 passes was selected by the operator, each bank of memory will be tested once by Moving Inversions.

RESTART SF9 - This entry forces a software reset of the controller to location 0000 of the prom. The Monitor program is also reset to the first screen. NOTE: If an error existed during the power up diagnostic and if bank number 4 of the moving inversions test was not run, the operator will have to wait for the power up diagnostic to complete before proceeding. However, if neither of these conditions mentioned exist, the operator may begin immediately.

#### 6.0 LOAD PROCEDURE

The operator must request the loading of file 28DFSR1 using the LOAD RUN DC F or R and " 28DFSR1 " RETURN procedure.

#### 7.0 OPERATING INSTRUCTIONS

All operating instructions are screen prompted and require no detailed explanation.

#### 8.0 REVISION HISTORY

2228D Field Service Diagnostic for Rev. 1 Boards affects Basic Monitor Program only.

Bug corrected to allow all device address testing - previous release would not load micro code into any controller that did not have device address 01C.

Corrected to allow for more addresses other than 01C and 01F.

Key-RETURN to Continue screen statements changed to read Press RETURN to Continue.

#### 9.0 MISCELLANEOUS

SF Key 16 Is reserved for use with a menu driven diagnostic package currently not available. Use of this key will result in the user having to reload the diagnostic program and may yield unpredictable results.

APPENDIX A  
TEST AND ERROR INFORMATION TABLE

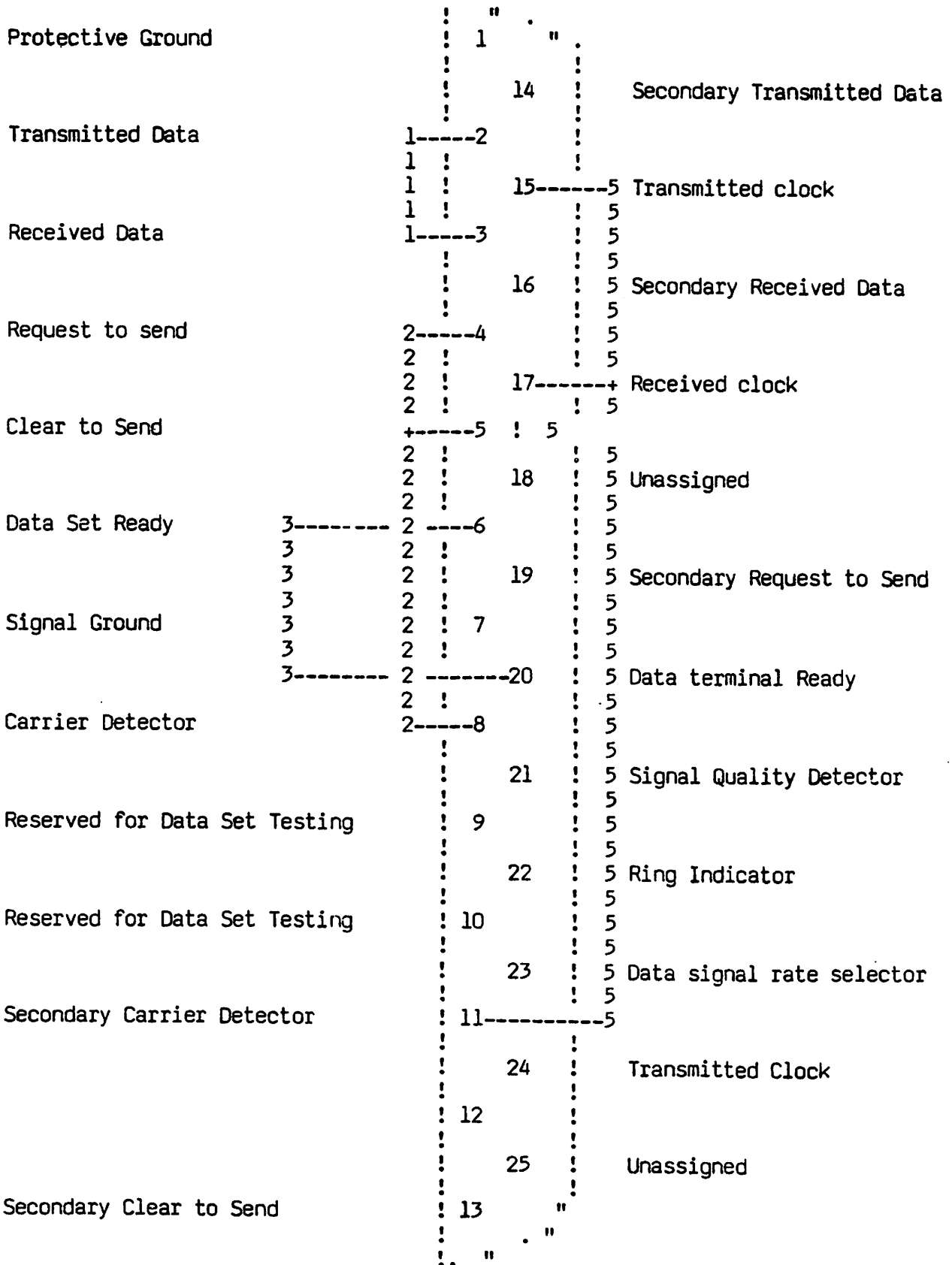
<u>TEST NO.</u>	<u>TEST NAME</u>	<u>ERROR CODE</u>	<u>FAILING MODULE or DESCRIPTION</u>
1	DMA/PIO	NONE	Screen display of the expected data and actual data.
2	DMA MULTIPLEXER TEST	NONE	Screen display of the failing address, expected data and actual data.
3	MOVING INVERSIONS	NONE	Screen display of the failing address, expected data and actual data.
4	SIO EXTERNAL LOOP	F0	Receiver failed to enter hunt mode in either Bisync or SDLC mode of testing. Display will give mode of testing.
		F1	Transmitter failing to send sync or flag characters during Bisync or SDLC mode of testing. Display will give mode of testing.
		F2	Receiver failed to receive sync or flag character and exit hunt mode. Display will give mode of testing.
		F3	Transmitter failing to transmit data characters. Display will give mode of testing.
		F4	Receiver failed to receive transmitted character. Display will give mode of testing.
		F5	Data error between transmitted and received character. Display will give mode of testing, expected and actual character.
		F6	Transmit interrupt failed to occur during Bisync mode of testing.
		F7	Receive interrupt failed to occur during Bisync mode of testing.
		F8	Overrun interrupt failed to occur during Bisync mode of testing.
		F9	CTS interrupt failed to occur during Bisync mode of testing.
		FA	DCD interrupt failed to occur during Bisync mode of testing.
		FB	DCD interrupt occurred when DCD was supposed to be turned off during Bisync mode of testing.

<u>TEST NO.</u>	<u>TEST NAME</u>	<u>ERROR CODE</u>	<u>FAILING MODULE or DESCRIPTION</u>
5	SIO/DMA	F0	CTC channel 2 downcounter failed to decrement as a result of EOP from the DMA.
		F1	Data error between transmitted and received data. Display give expected and actual data.
		F2	Parity error occurred during DMA transfer.
		F3	Timed out waiting for Transfer to complete.
6	CC RAM	F0	Character was recognized during non-recognition test. Display gives character that caused failure which equivocates to the RAM address.
		F1	Character failed to recognized during recognition test. Display gives character that caused failure which equivocates to the RAM address.
7	PRIORTY	F0	CTC interrupt failed to occur in allotted time.
		F1	SIO interrupt failed to occur after CTC interrupt had occurred and before a return from interrupt was executed.
		F2	PIO interrupt occurred before completion of service to the CTC interrupt i.e. a return from interrupt has not been executed.
		F3	PIO interrupt failed to occur within the allotted time.
8	RS449 LOOP BACK TEST		SAME ERRORS AS SIO EXTERNAL LOOP

APPENDIX B  
MODULE DESCRIPTIONS

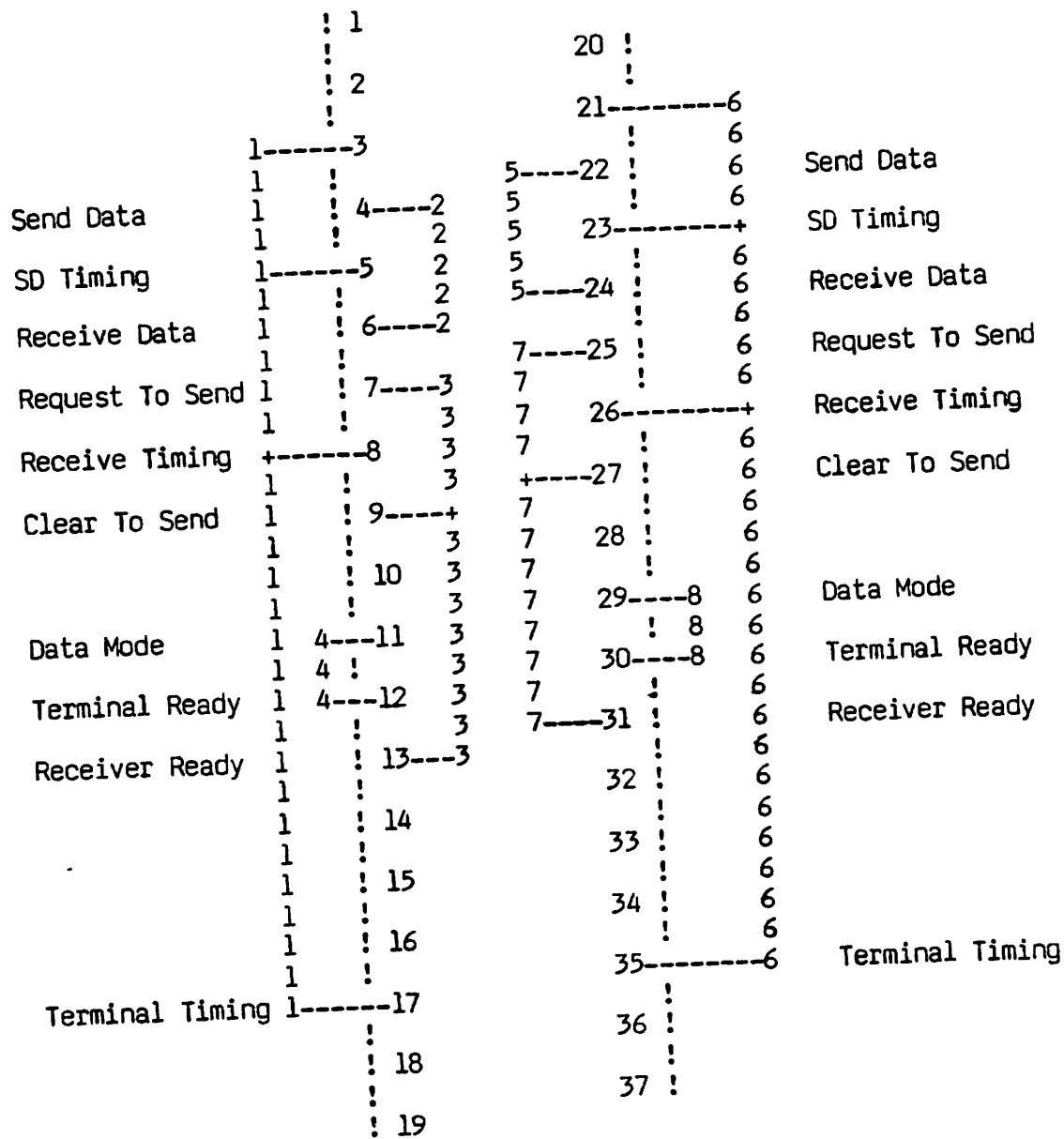
APPENDIX C  
RS232 AND RS449  
LOOP BACK CONNECTOR  
WIRING DIAGRAMS

RS232 LOOP BACK CONNECTOR





# RS449 LOOP BACK CONNECTOR



APPENDIX D  
SAMPLE SCREENS

**APPENDIX B**  
**MODULE DESCRIPTIONS**

```

      Stmt File
      No.  Line  Source  Statement
0000      2      2  TEST1 MODULE
FFFF      3      3      KOLIST
0000     152     152      LIST
     153     153 .....
     154     154 .....
     155     155 .....
     156     156 .....
     157     157 .....
     158     158 .....
     159     159 .....
     160     160 .....
                2200: FIELD SERVICE POST ROUTINE
                .....
                This routine will communicate with the 2200 to interpret commands
                .....
                requesting various tests be executed and/or various error reporting,
                .....
                echo responses, etc. be returned properly to the 2200.
                .....

```

Start File	Line	Source Statement	Value	Locs	Code
	162		FFFF		
	163		0000		
	325				
	326				
	337				
	338				
	339				
	340				
	341				
	342				
	343				
	344				
	345				
	346				
	347				
	348				
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	361				
	362				
	363				
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	370				
	371				

NOIIST  
LIST

SIO EXTERNAL LOOP BACK TEST

Testing of the SIO chip is done in three distinct phases. The SIO is tested using ASYNC, BSYNC, and SDLC. The CTC Channel 1 is set to clock at 9600 baud. Clocks are provided externally via the loop back.

ASYNC MODE: In this mode the SIO chip is initialized to transmit and receive characters in the ASYNC mode using 1 stop bit. An incremental data pattern of 00 to FF is used with the exclusion of a hex 32. The 32 is excluded because BHSYNC testing uses this same routine.

BHSYNC MODE: In this mode the SIO chip is initialized to transmit and receive characters in the BHSYNC mode. An incremental data pattern is again used excluding the sync byte Hex 32. Several error reportable checks are made here that are not made in the ASYNC mode. The status of the receiver is checked to see that it entered the Hunt mode from a command given during initialization. The transmitter is then enabled and checks are made to determine if it is sending Sync characters. The receiver is then checked to determine if it is receiving Sync characters after completion character transmission and reception with checking begins. After character transmission and reception is completed the testing of interrupts begin. Transmit, receive, and overrun interrupts are checked for both internal and external loop back. If you are running external loop back two additional interrupts are checked, they are CTS and DTP.

SDLC MODE: In this mode tests are made on the flag character transmission and reception and also transmission and reception to two data patterns AA and 55. Except for interrupts some of the same checks as BHSYNC mode are made prior to transmission of the two data patterns.

All errors will be reported via the 22C0 basic test monitor program and should be easily understood by the user.

Start File  
Value NO. Line SOURCE\_Statement

```

FFFF 373 41      NOLIST
C000 816 484      LIST
      817 485
      818 486
      819 487
      820 488
      821 489
      822 490
      823 491
      824 492
      825 493
      826 494
      827 495
      828 496
      829 497
      830 498

```

.....  
: IC / LMA TEST  
.....  
This test is designed to load data from disk into controller memory and  
runs starting at location 0x00. The function of this test is to check  
the ability of the SIO to transfer bytes out of memory and receive them  
via loop back and put the received characters into memory. The inter-  
-action between the LMA and SIO is tested here. Data is transferred from  
memory locations 4000 to 4100 in the BIOS mode. After completion of  
the data transfer from and to memory the data is checked by the 280 for  
validity and the pass or fail parameters are passed onto the 2200 via  
the firm resident test routine.
.....

EE	Loc. Code	Value	Stat File	Line	Source_Statement
----	-----------	-------	-----------	------	------------------

FF1F	832	500			NOLIST
0000	1000	678			LIT
	1001	670			.....
	1002	670			CONTROL CHARACTER RECOGNITION RAM TEST
	1003	671			.....
	1004	672			This test is downline loaded from disk into controller memory and
	1005	673			runs starting at location 0900. The function of this test is to check
	1006	674			the ability of Control Character Recognition Ram to detect control char-
	1007	675			acters during an SIO/DMA transfer. The output of the ram will trigger the
	1008	676			CTC channel 2. On the first pass the ram will be set to not recognize
	1009	677			any characters by flooding it with all ones using an OUT 31 command and
	1010	678			a 256 byte incremental data pattern to accomplish this. Then using an
	1011	679			OUT 30 command and the same data pattern the ram will be set to recognize
	1012	680			all characters of control characters. The end result will a down count
	1013	681			of the CTC channel 2 after the transfer of each character. Any failure
	1014	682			will be reported to the 22CC monitor program.
	1015	683			.....

Stm File  
NO. LINE SOURCE LABEL

EE Locs Code

FFFF	1017	684	NOIIT	.....
0000	1122	7	LIT	.....
	1123	3		.....
	1124	4		.....
	1125	5		.....
	1126	6		.....
	1127	7		.....
	1128	8		.....
	1129	9		.....
	1130	10		.....
	1131	11		.....
	1132	12		.....
	1133	13		.....
	1134	14		.....
	1135	15		.....
	1136	16		.....
	1137	17		.....
	1138	18		.....
	1139	19		.....

PRIORITY INTERRUPT LINE TEST FOR SIO/CTC/PIO

The function of this test is to check the priority scheme of the I/O line that runs between the SIO/CTC/PIO chips is functioning. The test will allow an interrupt from the CTC then while in the service routine will create an interrupt from the SIO. When this interrupt is received the SIO service routine should be entered verifying the SIO has a higher priority than the CTC. The 2200 will then be informed to send a character which will cause a PIC interrupt, once enabled. A return from interrupt will be executed thus the routine should exit the SIO routine and return to the CTC routine. After verification of entry into the CTC routine is completed another Return from interrupt will be performed which then should allow the I/O interrupt to occur signifying successful test completion. Any errors will be reported to the 2200 for display on the monitor.



Ex	LOC	Code	Value	Line	Source Statement
			FFFF	1141	21
			0000	1276	156
				1277	157
				1278	158
				1279	159
				1280	160
				1281	161
				1282	162
				1283	163
				1284	164
				1285	165
				1286	166
				1287	167
				1288	168
				1289	169
				1290	170
				1291	171
				1292	172
				1293	173
				1294	174
				1295	175
			FFFF	1297	177
			0000	1502	382
				1503	383
				1504	384
				1505	385
				1506	386
				1507	387
				1508	388
				1509	389
				1510	390
				1511	391
				1512	392
				1513	393
				1514	394
				1515	395
				1516	396
				1517	397
				1518	398
				1519	399
				1520	400
				1521	401

```

MOVING INVERSIONS RAM TEST FOR BANK 1
.....
The MOVING INVERSIONS RAM Test is used to check the functionality of
the 16K RAM chips. This test should be run only after the RAM Test has
passed since this test is downline loaded into memory. This test will
find the bad RAM's not detected by the RAM test which should catch most
common RAM failures. MOVING INVERSIONS should find the flakey failures
that a cheap and dirty RAM test like the MARCHING 1's and 0's won't.
The error reporting is done via the 220C monitor. The expected data,
actual data read and the address of the failure will be displayed on the
screen.
.....
This MOVING INVERSIONS test uses all increment values for 16K RAM chips.
The test uses only two patterns ('AA'+'.5'), because the RAMS are single
bit.
.....
TIME TO RUN : APPROX = 45 SECONDS
.....
MOVING INVERSIONS RAM TEST FOR BANKS 2,3,4
.....
The MOVING INVERSIONS RAM Test is used to check the functionality of
the 16K RAM chips. This test should be run only after the RAM Test has
passed since this test is downline loaded into memory. This test will
find the bad RAM's not detected by the RAM test which should catch most
common RAM failures. MOVING INVERSIONS should find the flakey failures
that a cheap and dirty RAM test like the MARCHING 1's and 0's won't.
The error reporting is done via the 220C monitor. The expected data,
actual data read and the address of the failure will be displayed on the
screen.
.....
This MOVING INVERSIONS test uses all increment values for 16K RAM chips.
The test uses only two patterns ('AA'+'.5'), because the RAMS are single
bit.
.....
TIME TO RUN : APPROX = 45 SECONDS
.....

```

IR LOC. Code	Value	Stat File	Line	Source-Statement
1523	FFFF	403		
1732	0000	612		
1733		613		
1734		614		
1735		615		
1736		616		
1737		617		
1738		618		
1739		619		
1740		620		
1741		621		
1742		622		
1743		623		

NOI:ST  
 I:ST

OPTION SWITCH TEST

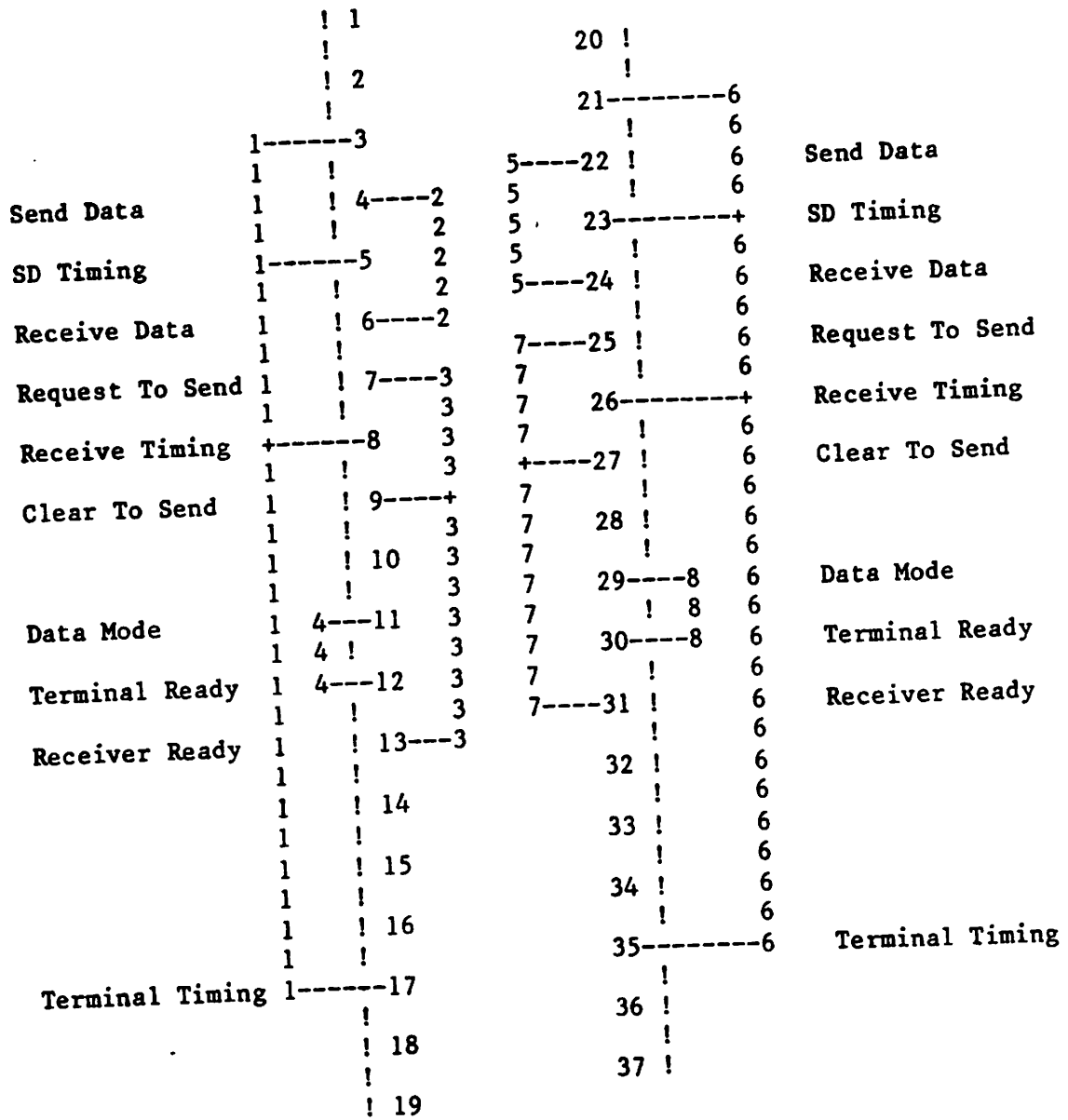
This test is designed to test the option switch (SW2) on the 7658 board of the controller. Upon entry into this test the 2200 will be notified of the current switch setting. The user will have the opportunity to change the switch and have the setting displayed by the 2200. This test will terminate when instructed to do so by the 2200 monitor.

**APPENDIX C**  
**RS232 AND RS449**  
**LOOP BACK CONNECTOR**  
**WIRING DIAGRAMS**

RS232 LOOP BACK CONNECTOR

Protective Ground	!	"	.	
	!	1	"	!
	!			!
	!	14	!	Secondary Transmitted Data
	!		!	!
Transmitted Data	1-----2		!	!
	1 !		!	!
	1 !	15-----5	!	Transmitted clock
	1 !		!	5
Received Data	1-----3		!	5
	!		!	5
	!	16	!	5 Secondary Received Data
	!		!	5
Request to send	2-----4		!	5
	2 !		!	5
	2 !	17-----+	!	Received clock
	2 !		!	5
Clear to Send	+-----5	!	5	
	2 !		!	5
	2 !	18	!	5 Unassigned
	2 !		!	5
Data Set Ready	3-----2	2-----6	!	5
	3	2 !	!	5
	3	2 !	!	5
	3	2 !	!	5
	3	2 !	!	5
Signal Ground	3	2 !	!	5
	3	2 !	!	5
	3-----2	2-----20	!	5 Data terminal Ready
	2 !		!	5
Carrier Detector	2-----8		!	5
	!		!	5
	!	21	!	5 Signal Quality Detector
	!		!	5
Reserved for Data Set Testing	!	9	!	5
	!		!	5
	!	22	!	5 Ring Indicator
	!		!	5
Reserved for Data Set Testing	!	10	!	5
	!		!	5
	!	23	!	5 Data signal rate selector
	!		!	5
Secondary Carrier Detector	!	11-----5	!	5
	!		!	!
	!	24	!	Transmitted Clock
	!		!	!
	!	12	!	!
	!		!	!
	!	25	!	Unassigned
	!		!	!
Secondary Clear to Send	!	13	!"	
	!		!"	
	!	!"	!"	

### RS449 LOOP BACK CONNECTOR



**APPENDIX D**  
**SAMPLE SCREENS**

WARNING FIELD SERVICE DIAGNOSTIC FOR 2228D REV 1 ONLY

KEY 'RETURN' TO CONTINUE

2228D TC FIELD SERVICE DIAGNOSTICS REV 1121

Requires VP BASIC Rev. 2.3 or MVP BASIC Rev. 2.1

Available device addresses are:

019 01A 01B 01C 01D 01E 01F

What is the device address ? 01C

DEVICE IS READY

PRESS 'RETURN' TO CONTINUE



Device address '01C' will be used for all tests

Is the LED OFF ? 'Y' or 'N'\*Y

#### CHECKING DMA/PIO

SENDING 256 BYTES OF DATA TO CONTROLLER MEMORY

READING & COMPARING 256 BYTES OF DATA FROM CONTROLLER MEMORY

! DMA/PIO TEST PASSED

#### DMA MULTIPLEXER TEST

SENDING UNIQUE ADDRESS PATTERNS

! READING AND COMPARING UNIQUE ADDRESS PATTERNS

! DMA ADDRESS MULTIPLEXER TEST PASSED

Device address '01C' will be used for all tests

Do you want to loop on error 'Y' or 'N' N

\* The program will STOP on error

Do you want to display instructions 'Y' or 'N' Y

\* Instructions will be displayed

How many passes do you wish to make (less than 10000)? 4

\* All tests will make 4 pass(es)

KEY 'RETURN' TO CONTINUE

SENDING MICROCODE TEST PROGRAMS TO CONTROLLER MEMORY

TRANSFER OF MICROCODE SUCCESSFUL

FORCING CONTROLLER INTO MICROCODE TEST PROGRAM

## TEST SELECTION MENU

- SF 0 - RE-KEY INPUT PARAMETERS
- SF 1 - MOVING INVERSIONS MEMORY TEST
- SF 2 - SIO EXTERNAL LOOP
- SF 3 - SIO/DMA TEST
- SF 4 - CONTROL CHARACTER RAM TEST
- SF 5 - PRIORITY INTERRUPT TEST
- SF 6 - RS449 LOOP BACK TEST
- SF 7 - OPTION SWITCH TEST
- SF 8 - CHAIN MODE
- SF 9 - RESTART
- SF 16 - RETURN TO MAIN MENU

STRIKE THE SPECIAL FUNCTION KEY ASSOCIATED WITH THE DESIRED TEST  
WHICH TEST DO YOU DESIRE?

## MOVING INVERSIONS TEST

This test will run a more complete RAM check and is bank selective. In the Chain Mode bank selection will be an automatic function.

KEY 'RETURN' TO CONTINUE

MOVING INVERSIONS TEST

RAM MEMORY WILL ONLY BE TESTED ON 1 BANK AT A TIME

ENTER 1 FOR BANK 1 ADDRESS 2000 TO 3FFF  
ENTER 2 FOR BANK 2 ADDRESS 4000 TO 7FFF  
ENTER 3 FOR BANK 3 ADDRESS 8000 TO BFFF  
ENTER 4 FOR BANK 4 ADDRESS C000 TO FFFF

ENTER THE NUMBER OF THE BANK YOU WISH TO TEST ? 3

PASS# 1

MOVING INVERSIONS TEST

WAITING FOR CONTROLLER TO COMPLETE TESTS

CURRENTLY TESTING BANK # 3

PASS# 1

MOVING INVERSIONS TEST

MOVING INVERSIONS TEST PASSED

**SIO EXTERNAL LOOP**

This program tests the controller's SIO external loop back circuitry. The tests are conducted in all 3 modes ie Async, Bisync and SDLC. In addition 3 vectored interrupt tests are performed, Transmit, Receive, Overrun, CTS, & DCD.

KEY 'RETURN' TO CONTINUE

PASS# 1

SIO EXTERNAL LOOP

WAITING FOR CONTROLLER TO COMPLETE TESTS

PASS# 1

SIO EXTERNAL LOOP

SIO EXTERNAL LOOP PASSED

FR IS BACK IN HOST

SIO/DMA TEST

This test requires the RS232 LOOP BACK Plug. The test checks the ability to transfer data from one section of memory to another. The test is run in the Async mode.

This test checks transfers of 256 bytes, 512 bytes, 1k, 2k, 4k, 8k, and 16k.

KEY 'RETURN' TO CONTINUE

PASS# 1

SIO/DMA TEST

WAITING FOR CONTROLLER TO COMPLETE TESTS

PASS# 1

SIO/DMA TEST

SIO/DMA TEST PASSED

CONTROLLER IS BACK IN HOST

CONTROL CHARACTER RECOGNITION RAM TEST

This program checks the static ram using the SIO in Async mode. The failing character is interpreted as the RAM address. INSTALL RS232 LOOP BACK

KEY 'RETURN' TO CONTINUE

PASS# 1

CONTROL CHARACTER RECOGNITION RAM TEST

WAITING FOR CONTROLLER TO COMPLETE TESTS

PASS# 1

CONTROL CHARACTER RECOGNITION RAM TEST

CHARACTER RAM TEST PASSED

CONTROLLER IS BACK IN HOST

PRIORITY INTERRUPT TEST

This test checks the IEI and IEO line between the SID, CTC, and PIO chips. The test insures also that higher priority is observed. INSTALL RS232 LOOP BACK

KEY 'RETURN' TO CONTINUE

PASS# 1

PRIORITY INTERRUPT TEST

WAITING FOR CONTROLLER TO COMPLETE TESTS

PASS# 1

PRIORITY INTERRUPT TEST

PRIORITY INTERRUPT TEST PASSED

CONTROLLER IS BACK IN HOST



RS449 LOOP BACK

This program tests the controller's SIO external loop back circuitry for the RS449 plug. The RS449 LOOP BACK must be INSTALLED and the Toggle switch switched. Testing is the same as for the SIO External Loop Test.

KEY 'RETURN' TO CONTINUE

PASS# 1

RS449 LOOP BACK

WAITING FOR CONTROLLER TO COMPLETE TESTS

PASS# 1

RS449 LOOP BACK

RS449 LOOP BACK PASSED

CONTROLLER IS BACK IN HOST

## OPTION SWITCH TEST

This program tests the user option switch on the daughter board. The user sets the switch to the desired switch setting which will automatically be updated on the screen. To exit the routine the user must key RETURN.

KEY 'RETURN' TO CONTINUE

## OPTION SWITCH TEST

	1	2	3	4	5	6	7	8
O	O	O	O	O	O	O	O	O
N	F	F	F	F	F	F	F	F
↑	F	F	F	F	F	F	F	F

USER OPTION SWITCH (SW2)

KEY RETURN TO EXIT TEST

TEST SELECTION MENU

- SF 0 - RE-KEY INPUT PARAMETERS
- SF 1 - MOVING INVERSIONS MEMORY TEST \*
- SF 2 - SIO EXTERNAL LOOP \*
- SF 3 - SIO/DMA TEST \*
- SF 4 - CONTROL CHARACTER RAM TEST \*
- SF 5 - PRIORITY INTERRUPT TEST \*
- SF 6 - RS449 LOOP BACK TEST
- SF 7 - OPTION SWITCH TEST
- SF 8 - CHAIN MODE
- SF 9 - RESTART
- SF 16 - RETURN TO MAIN MENU

STRIKE THE SPECIAL FUNCTION KEY ASSOCIATED WITH THE DESIRED TEST  
WHICH TEST DO YOU DESIRE?

CHAIN MODE TEST ROUTINE

THIS TEST WILL CALL AND EXECUTE ALL MARKED (\*) TESTS  
THE ENTIRE TEST WILL BE EXECUTED 4 TIME(S)

KEY 'RETURN' TO CONTINUE

## 1.0 TITLE

2228D Power Up Error Code Interpreter. Which will interpret the error codes supplied by the 2228D TC Controller Power Up Diagnostic Program. The Diagnostic program is resident in the 2716 prom located on the 2228D TC Daughter Board.

## 2.0 REVISION/DATE

Release Date: April 9, 1981
Documentation Release: 9120
Part Number: 702-0121, Rev. 3124 (BASIC 2)

## 3.0 REFERENCE DOCUMENTS

Specifications of 2228D TC Controller Power Up Diagnostic. Rev. 01.01, 06/20/80

Basic 2 Language Reference Manual

## 4.0 PROGRAM DESCRIPTION

This program is designed to request and interpret the error codes which can be provided by the 2228D TC Controller Power Up Diagnostic when the LED is Flashing.

## 5.0 ROUTINES IN THIS PROGRAM

1. Request Device address for 2228D TC Controller
2. Request Error Code from 2228D TC Controller.
3. Interpret Error Code and Display appropriate information.

See Appendix A for module descriptions.

## 6.0 OPERATING INSTRUCTIONS

- A. Load Diskett into Floppy Disk.
- B. Select that Disk drive with SELECT DISK statement.
- C. Depress 'LOAD'
- D. Depress 'RUN'
- E. Depress 'T' and enter in " " the name 28DEIRO

## 7.0 ERROR CODES

In Appendix A the error codes and their interpretations are given.

8.0 REVISION HISTORY

Corrected to allow for more device address inputs.

Key Return Statement on screen corrected to read Press 'RETURN' to Continue.

APPENDIX A

## ROUTINES AND SCREEN DISCRIPTIONS

### 1.0 INITIAL SCREEN

Screen Display:

ERROR CODE INTERPRETER FOR THE 2228D POWER UP DIAGNOSTIC

REVISION 3124

This program is used to interpret error codes from the 2228D, ONLY if the LED is FLASHING. DO NOT use for any other purpose the results will be unpredictable.

PRESS RETURN TO CONTINUE

### 2.0 PROGRAM NAME SCREEN AND CONTINUE ENTRY REQUEST

This routine is entered after the correct address has been entered and the operator has keyed return to continue. This routine identifies the program that is about to be used by the operator and requests a return entry to continue.

Screen Display:

ERROR CODE INTERPRETER FOR THE 2228D POWER UP DIAGNOSTIC

KEY RETURN TO CONTINUE

### 3.0 ADDRESS ENTRY ROUTINE AND SCREEN DISPLAY

Screen Display:

```
ERROR CODE INTERPRETER FOR THE 2228D POWER UP DIAGNOSTIC
REVISION 3124
AVAILABLE ADDRESSES ARE - 019 01A 01B 01C 01D 01E 01F
PLEASE ENTER THE CORRECT ADDRESS FOR THIS CONTROLLER
WHAT IS THE ADDRESS OF THIS CONTROLLER ? 01C
```

### 4.0 SELECTING DEVICE ADDRESS

This routine selects the device address entered during the first screen display. It reports to the user whether the device is ready or busy. The user is asked if he desires to continue using the message PRESS RETURN TO CONTINUE at the bottom of the screen.

Screen Display:

```
SELECTING DEVICE ADDRESS 01C
DEVICE IS READY
PRESS RETURN TO CONTINUE
```



## 5.0 REQUESTING ERROR STATUS ROUTINE

This routine is entered from the Press Return of the previous screen. During this routine a interrim screen is displayed while the 2200 requests the error code from the 2228D and then uses the error code to find the appropriate screen for display to the operator.

Screen Display:

```
REQUESTING STATUS WORD FROM 2228D CONTROLLER
```

THE REMAINING ROUTINES ARE SCREEN DISPLAYS OF THE ERROR CODE INTERPRETER  
ERROR CODE 01 :

```
WRITE BAD PARITY/PARITY GENERATOR TEST ERROR  
ERROR CODE RECEIVED = 01
```

```
PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S
```

ERROR CODE 02:

```
BANK DECODER TEST ERROR  
ERROR CODE RECEIVED = 02
```

```
PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S
```

ERROR CODE 03:

This is the Ram Data Error and the controller can supply additional information for screening. Ergo upon detection of this error code the program enters an additional request routine to get more pertinent information from the controller.

! MEMORY ERROR !

FAILING MEMORY ADDRESS =           !

EXPECTED DATA =       !      ACTUAL DATA =       !

LINES 2 AND 3 MAY BE REPEATED TWO ADDITIONAL TIMES IF THE CONTROLLER  
GIVES ERROR INFORMATION FOR THESE POSITIONS.

PRESS RETURN FOR BOARD DISPLAY OF ERROR

SCREEN DISPLAY OF BOARD IS A GRAPHIC RAM CHIP LAY OUT WITH  
THE BAD RAM OR RAMS POSITIONS IDENTIFIED.

80	40	20	10	8	4	2	1	P	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	B A D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BANK # 1 (0800 TO 3FFF)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BANK # 3 (8000 TO BFFF)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BANK # 2 (4000 TO 7FFF)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BANK # 4 (C000 TO FFFF)

ERROR CODE 04:

CONTROLLER FAILED DMA POWER UP TEST  
ERROR CODE RECEIVED = 04

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 05:

CONTROLLER FAILED DMA CURRENT AND WORD COUNT REGISTERS TEST  
ERROR CODE RECEIVE = 05

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 06:

CONTROLLER FAILED CTC GO/NO GO POWER UP TEST  
ERROR CODE RECEIVED = 06

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 07:

CONTROLLER FAILED CTC CHANNEL INTERRUPT TEST  
ERROR CODE RECEIVED = 07

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 10:

CONTROLLER FAILED SIO BISYNC EXTERNAL LOOP BACK TRANSMIT/RECEIVE TEST  
ERROR CODE RECEIVED = 10

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 11:

CONTROLLER FAILED SIO BISYNC INTERNAL LOOP BACK TRANSMIT/RECEIVE TEST  
ERROR CODE RECEIVED = 11

PRESS RETURN TO TEST PIO & 2200 OB'S AND IB'S

ERROR CODE 08:

NMI OCCURRED DURING POWER UP DIAGNOSTIC  
ON A TEST OTHER THAN PARITY, BANK DECODER, OR MARCHING RAM TEST  
ERROR CODE RECEIVED = 08

PRESS RETURN TO TEST PIO & 2200 0B'S AND IB'S

ERROR CODE 09:

NMI OCCURRED DURING NORMAL OPERATION FROM BOOTSTRAP  
ALL POWER UP DIAGNOSTICS PASSED UPON RETRY  
ERROR CODE RECEIVED = 09

PRESS RETURN TO TEST PIO & 2200 0B'S AND IB'S

ADDITIONAL SCREENS THAT MAY BE DISPLAYED

A.(screen display)

INVALID STATUS ERROR CODE RECEIVED FROM CONTROLLER  
ERROR CODE RECEIVED = XX

PRESS RETURN TO TEST PIO & 2200 0B'S AND IB'S

B.(screen display)

UNABLE TO COMMUNICATE WITH CONTROLLER

C.(screen display) PIO & 2200 OB'S / IB'S ROUTINE

INPUT THE HEX CHARACTER TO BE TRANSMITTED XX

RECEIVED BYTE XX

PRESS RETURN TO CONTINUE

NOTE: When using the OB's IB's test above do not use a HEX 'FF'. This code will be used for further testing of the controller using another diagnostic package. At present the results will be one of two possibilities. If error codes 01, 02 or 03 exist then the previous pattern entered will be returned and the controller will remain in the error reporting routine. The board is considered untestable until the present memory problem is corrected. If any error code other than the ones mentioned above exists the result will be a return of the previous pattern entered. The controller will go to the Bootstrap Firmware Program to enable additional micro code diagnostics to be entered via another diagnostic package.

1.0 TITLE

2228D TC Field Service Diagnostics for Rev. 2.

2.0 REVISION/DATE

Date: April 9, 1981 Documentation Release: Rev. 9111 Software Release: Rev. 1121 Part Number: 702-0097B
--

3.0 REFERENCE DOCUMENTS

Z80 - Assembly Language Programming Manual  
Z80 - PIO Technical Manual  
Z80 - CTC Technical Manual  
Z80 - SIO Technical Manual  
Am9517 - Technical Information Sheet  
MOSTEK 1979 Memory Data Book and Designer's Guide  
2228D Telecommunications Controller Hardware Specification 1/8/80  
Addendum to 2228D Telecommunications Controller Hardware Spec. 6/11/80  
WANG BASIC 2 Language Reference Manual

4.0 CONFIGURATION REQUIREMENTS

## 4.1 Hardware

Minimum required configuration

2200 VP or MVP with 2236MXD or equivalent and 80 X 24 Terminal  
2228D Rev. 2 Telecommunications Controller Board with 378-4219 Prom  
RS232 Loop Back Connector  
RS449 Loop Back Connector  
Requires 56K bytes of user Memory

## 4.2 Software

MVP BASIC 2 Rev. 2.1 or VP BASIC 2 Rev. 2.3

When using the MVP software the device table must have the secondary address of the TC Controller defined as listed below:

2228D Address	Secondary Address
019	099
01A	09A
01B	09B
01C	09C
01D	09D
01E	09E
01F	09F

## 5.0 PROGRAM DESCRIPTION

The Field Service Monitor Program and Microcode Diagnostics are stored on a Floppy Diskette under file names 28DFSR2 and FSDIAGS respectively.

The Monitor Program handles all screening, test control, and error reporting. Following is a description of the normal screens (shown in appendix D) that will be encountered when using this diagnostic.

SCREEN 1 - This is a warning screen identifying the intended use of this diagnostic. Also the Revision level is displayed.

SCREEN 2 - This screen requests operator input of the correct device address for the controller, (default is 01C). After the operator depresses return the Monitor program checks the device for a Ready/Busy condition. The result is displayed to the operator. Note: a Busy response indicates either the device address is wrong or the controller will be unable to respond to any future requests from the Monitor program.

SCREEN 3 - This screen requests operator input of the condition the controller is in, LED ON or OFF. If the LED is OFF the operator will answer Y. The monitor will immediately enter a communications test between the controller and the 2200. Note: the communications test is only run upon initial entry of this diagnostic or upon a restart request by the operator from the menu.

If the LED is ON or Flashing the operator will answer N. The next question will appear which asks the operator if the LED is Flashing. If the operator answers N, indicating the LED is ON solid an error screen will be displayed and no further testing will take place. If the answer is Y, indicating the LED is Flashing the monitor will check the controllers power up diagnostic error reporting routine for the error that was detected. If a RAM failure of some type exists, an error screen will be displayed and no further testing will take place. If any other type of error exists, the controller will be forced into the operating system firmware portion of the prom and the communications test will be invoked. Note: if the communications test is invoked after determining no RAM errors exist the LED may remain on or off ignore this condition.

SCREEN 4 - This screen displays the conditions of the DMA/PIO Test (the first communications test.) Any errors will be reported on this screen and no error looping will be used. If a CPU Time Out error occurs, no further testing will take place. If a failure to get an IBS from the controller occurs, no further testing can take place. Both failures indicate a fault in either the DMA or PIO.

SCREEN 5 - This screen displays the conditions of the DMA Multiplexer Test (the second communications test.) Any errors will be reported on this screen and error looping will be automatically invoked.



SCREEN 6 - This screen requests testing parameter inputs from the operator. The parameters are Loop or Halt On Error, Display or no Display of instruction/information screens, and the number of passes each test is to make.

SCREEN 7 - This screen displays the conditions encountered by the controller after successful completion of the communications tests. It is at this time the microcode diagnostic program file is downline loaded from the disk to the controller memory, starting at location 0900.

SCREEN 8 - This is the menu screen and indicates that the microcode was successfully loaded into the controllers memory and that the controller has been sent to this program and is awaiting test requests from the monitor.

The remaining screens are test screens and are self-explanatory. Each test will provide the operator with error information indicating the cause of the failure.

The following is a brief description of each test that will or can be performed using this diagnostic. These tests are more exhaustive checks of the various capabilities of the controller not performed in the power up diagnostic.

Automatic Testing - These two tests check the communications capability of the controller utilizing the firmware microcode portion of the prom. The tests check the ability of the controller and 2200 to communicate utilizing the PIO and DMA chips.

The DMA/PIO Test transfers a 256 byte incremental data pattern to the controller memory starting at address 0900. It then reads back and compares the data sent with the expected data. Successful functioning of this test will result in advancement to the next communications test.

The DMA Multiplexer Test is designed to check the high order address bit multiplexer for the DMA chip. A unique byte is placed in each of the memory locations shown below. Then each unique byte is read at the specific address and checked with the expected byte. Successful completion of this test will result in advancement to the parameter inputs by the operator and eventual loading of the microcode diagnostic program.

ADDRESS AND BYTE = 8000 (00), 8100 (01), 8200 (02), 8400 (04), 8800 (08)  
9000 (10), A000 (20), C000 (40)

The remaining tests are invoked by the operator from the menu of the Monitor program.

RE-KEY INPUT PARAMETERS SFO - This routine allows the operator to reinput the Loop On Error or Halt On Error, Instruction / Information Display, and Number of Passes parameters. After reentry the microcode program is again downline loaded into controller memory.

MOVING INVERSIONS MEMORY TEST SF1 - This test program performs a more exhaustive RAM memory check using the moving inversions test procedure with a AA/55 test pattern. This test routine has been enhanced to allow the user to select all banks. Chain mode will automatically select all banks ergo every bank will be tested on one pass rather than requiring four passes as is required for the Rev. 1 controller. Screening is enhanced to keep the user informed as each bank is completed in the ALL mode of testing. Note: if an error is detected it will display the address of failure, the expected and actual data patterns. If the data patterns are equal, this indicates a Parity RAM failure has occurred.

SIO EXTERNAL LOOP SF2 - This test requires the RS232 Loop Back connector be installed. The test runs a more extensive test of the SIO and associated circuitry utilizing Async, Bisync, and SDLC modes of operation. Error messages are more in detail than for the power up diagnostic. No option switch setting is required.

SIO/DMA TEST SF3 - The RS232 Loop Back Connector is required for this test. The test performs an interaction check between the SIO, DMA, and CTC utilizing the Bisync mode of operation. Transfers of 256 bytes, 512 bytes, 1K, 2K, 4K, 8K, and 16K are performed with error checking after each transfer completion. A time out feature is also incorporated in case no transfer operation takes place indicating an SIO DMA problem exists. The screening has been enhanced to provide the user with the current transfer size in progress.

CONTROL CHARACTER RAM TEST SF4 - The RS232 Loop Back Connector is required for this test. The test operates in two modes. First the Control Character RAM is flooded not to recognize any characters. With the SIO and DMA (Receive channel only) activated 256 characters 00 to FF are transmitted and received. The CTC is monitored as well as the DMA checking each character did not cause a downcount of CTC channel 2 after completion of each transfer. The Control Character RAM is then flooded to recognize all characters as control characters. The CTC channel 2 is monitored after each transfer to insure a downcount occurred indicating a control character was recognized.

PRIORITY INTERRUPT TEST SF5 - The RS232 Loop Back Connector is required for this test. The test will check the IEI/IEO line connected between the SIO, CTC, and PIO is functioning properly. It also insures the priority scheme with the SIO having the highest and the PIO the lowest is maintained.

RS449 LOOP BACK TEST SF6 - The RS449 Loop Back Connector is required for this test, also the Switch on the rail must be in the RS449 position. The tests performed are the same as those performed by the SIO EXTERNAL LOOP Test.

OPTION SWITCH TEST SF7 - This test allows the operator to test SW2 on the controller motherboard. After test entry the screen will display the current switch setting. The operator need only change the setting of the switch at will and the screen display will automatically reflect the new setting. To exit the test the operator must depress RETURN.

CHAIN MODE SF8 - This test invokes the tests associated with Special Function Keys 1, 2, 3, 4, and 5. This program will invoke each test one at a time for the number of passes entered during parameter entry. All banks are tested during the Moving Inversions Test.

RESTART SF9 - This entry forces a software reset of the controller to location 0000 of the prom. The Monitor program is also reset to the first screen. Note: if an error existed during the power up diagnostic and if bank number 4 of the moving inversions test was not run the operator will have to wait for the power up diagnostic to complete before proceeding. However, if neither of these conditions mentioned exist, the operator may begin immediately.

#### 6.0 LOAD PROCEDURE

The operator must request the Loading of file 28DFSR2 using the LOAD RUN DCF and "28DFSR2" RETURN procedure.

#### 7.0 OPERATING INSTRUCTIONS

All operating instruction are screen prompted and require no detailed explanation.

#### 8.0 REVISION HISTORY

2228D Field Service Diagnostic for Rev. 2 and up affects Basic Monitor Program only.

Bug corrected to allow all device address testing - previous release would not load micro code into any controller that did not have device address 01C.

Corrected to allow for more addresses other than 01C and 01F.

Key-RETURN to Continue screen statements changed to read Press RETURN to Continue.

#### 9.0 MISCELLANEOUS

SF Key 16 Is reserved for use with a menu driven diagnostic package currently not available. Use of this key will result in the user having to reload the diagnostic program and may yield unpredictable results.

APPENDIX A  
TEST AND ERROR INFORMATION TABLE

<u>TEST NO.</u>	<u>TEST NAME</u>	<u>ERROR CODE</u>	<u>FAILING MODULE or DESCRIPTION</u>
1	DMA/PIO	NONE	Screen display of the expected data and actual data.
2	DMA MULTIPLEXER TEST	NONE	Screen display of the failing address, expected data and actual data.
3	MOVING INVERSIONS	NONE	Screen display of the failing address, expected data and actual data.
4	SIO EXTERNAL LOOP	F0	Receiver failed to enter hunt mode in either Bisync or SDLC mode of testing. Display will give mode of testing.
		F1	Transmitter failing to send sync or flag characters during Bisync or SDLC mode of testing. Display will give mode of testing.
		F2	Receiver failed to receive sync or flag character and exit hunt mode. Display will give mode of testing.
		F3	Transmitter failing to transmit data characters. Display will give mode of testing.
		F4	Receiver failed to receive transmitted character. Display will give mode of testing.
		F5	Data error between transmitted and received character. Display will give mode of testing, expected and actual character.
		F6	Transmit interrupt failed to occur during Bisync mode of testing.
		F7	Receive interrupt failed to occur during Bisync mode of testing.
		F8	Overrun interrupt failed to occur during Bisync mode of testing.
		F9	CTS interrupt failed to occur during Bisync mode of testing.
		FA	DCD interrupt failed to occur during Bisync mode of testing.
		FB	DCD interrupt occurred when DCD was supposed to be turned off during Bisync mode of testing.

<u>TEST NO.</u>	<u>TEST NAME</u>	<u>ERROR CODE</u>	<u>FAILING MODULE or DESCRIPTION</u>
5	SIO/DMA	F0	SIO failed to enter hunt mode after initialization.
		F1	SIO failed to transmit sync characters after transmitter initialization.
		F2	SIO failed to receive sync characters and exit hunt mode.
		F3	Timed out waiting for transfer complete on channels 0 and 1 of the DMA chip.
		F4	CTC channel 0 downcounter failed to decrement as a result of EOP from the DMA.
		F5	Data error between transmitted and received data. Display give expected and actual data.
6	CC RAM	F6	Parity error occurred during DMA transfer.
		F0	Character was recognized during non recognition test. Display gives character that caused failure which equivocates to the RAM address.
7	PRIORITY	F1	Character failed to recognized during recognition test. Display gives character that caused failure which equivocates to the RAM address.
		F0	CTC interrupt failed to occur in allotted time.
		F1	SIO interrupt failed to occur after CTC interrupt had occurred and before a return from interrupt was executed.
8	RS449 LOOP BACK TEST	F2	PIO interrupt occurred before completion of service to the CTC interrupt i.e. a return from interrupt has not been executed.
		F3	PIO interrupt failed to occur within the allotted time.
			SAME ERRORS AS SIO EXTERNAL LOOP

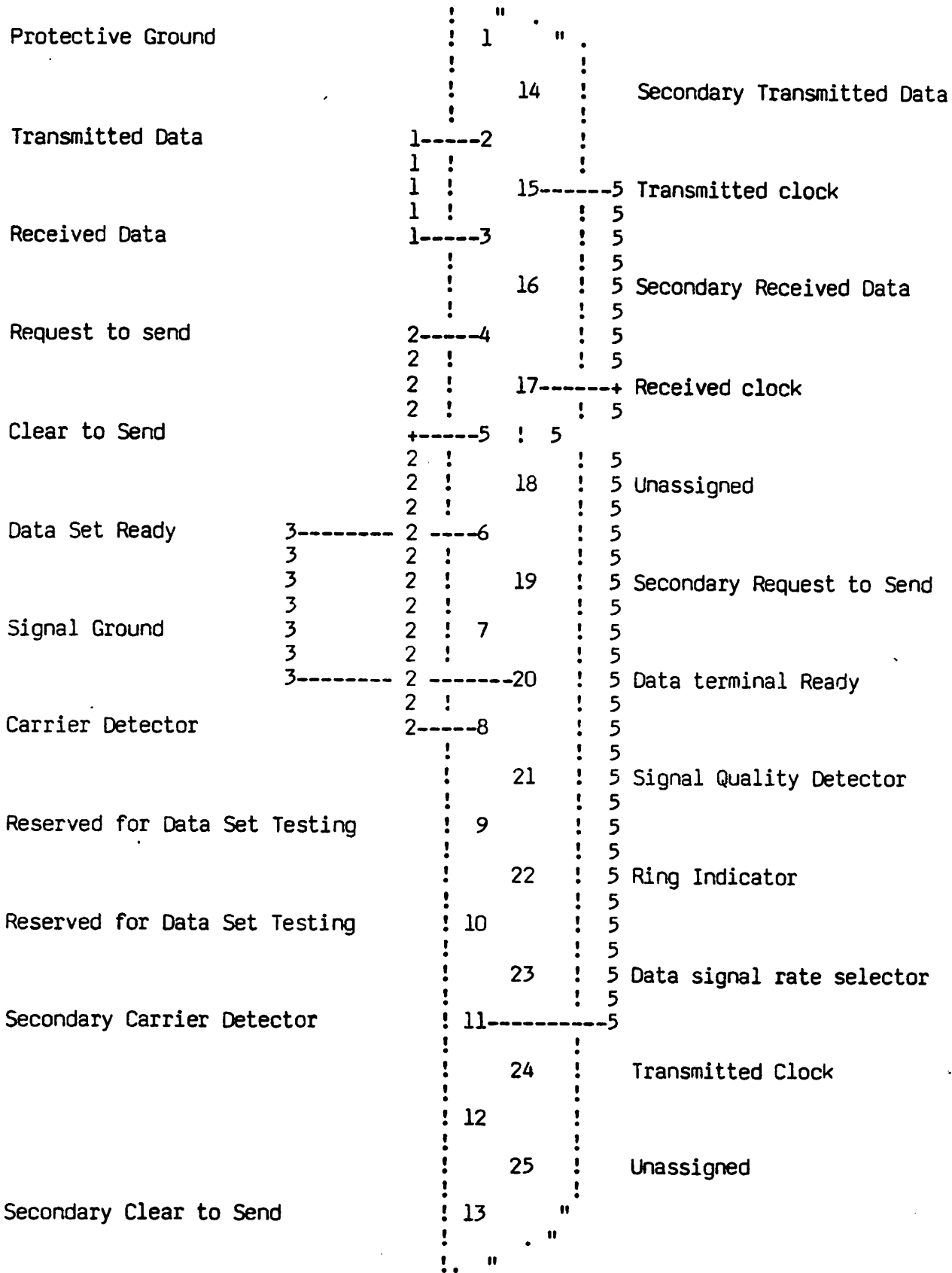
APPENDIX B  
MODULE DESCRIPTIONS

APPENDIX C

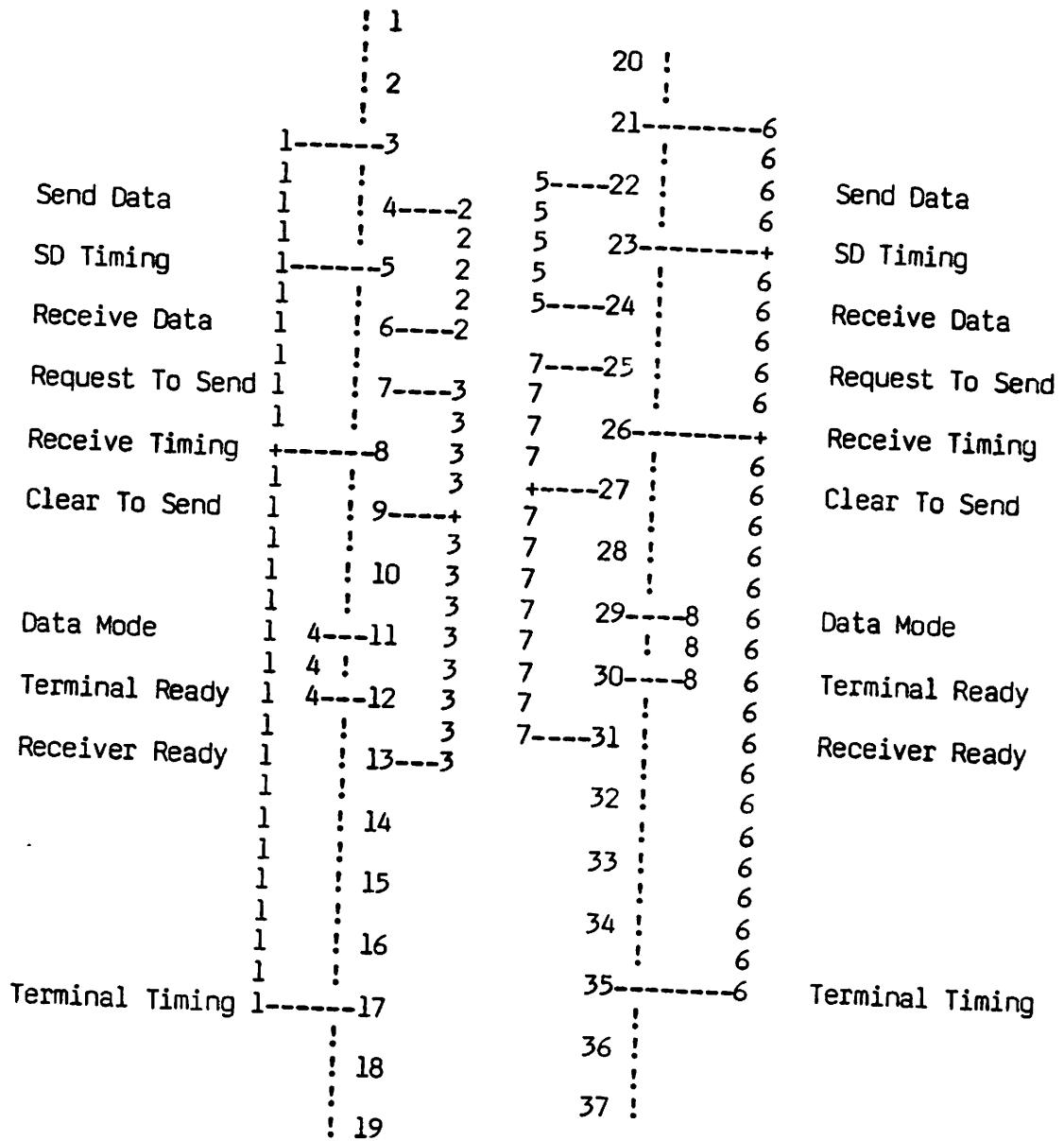
RS232 & RS449 LOOP BACK CONNECTOR WIRING DIAGRAM



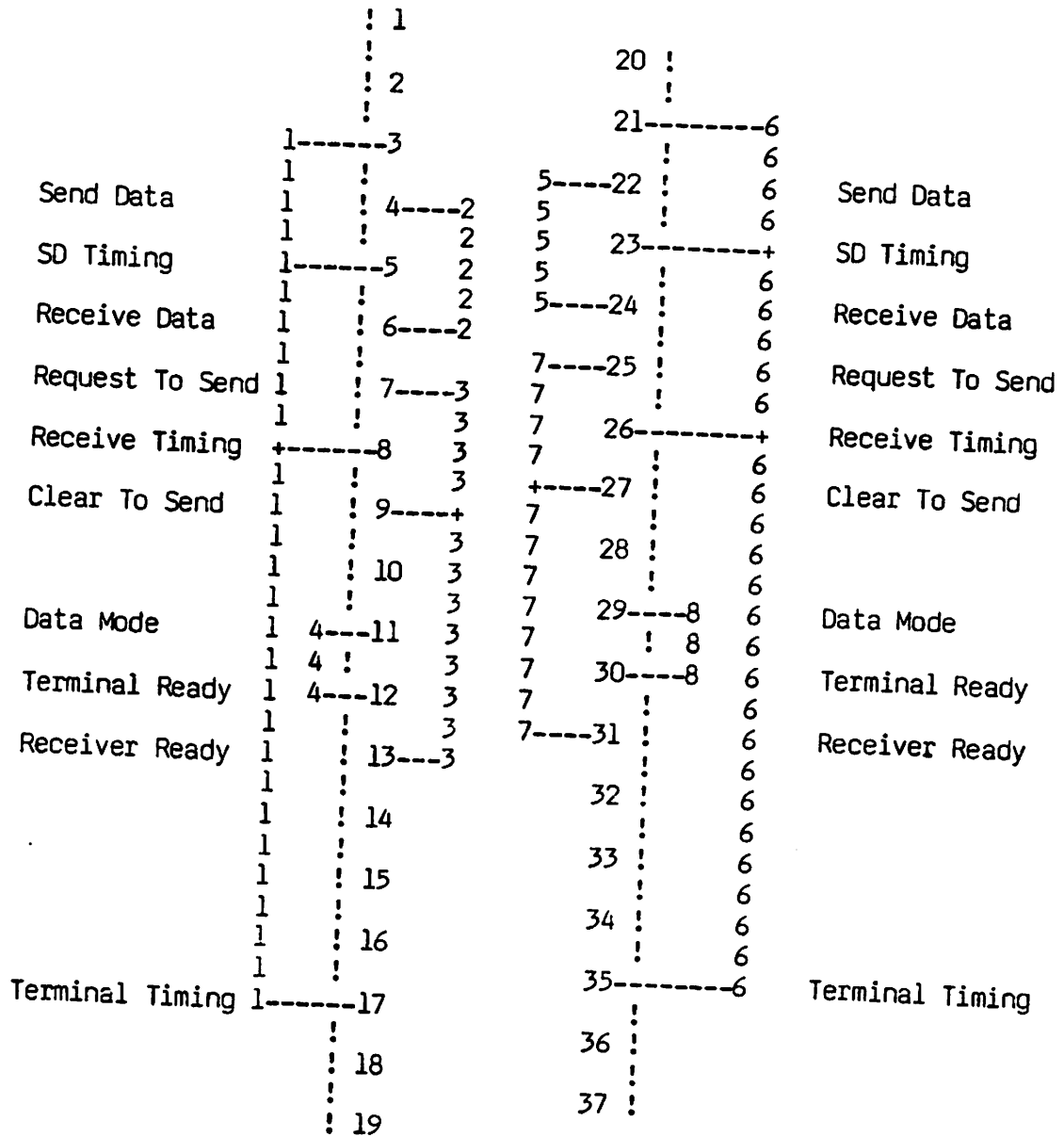
RS232 LOOP BACK CONNECTOR



# RS449 LOOP BACK CONNECTOR



# RS449 LOOP BACK CONNECTOR



APPENDIX D  
SCREEN SAMPLES

**APPENDIX B**  
**MODULE DESCRIPTIONS**

```

EI  L2C1 CODE
Stat File
Value NO. Line SOURCE-Statement
0000 2 2 FSTEST2 MODULE
FFFF 3 3 NOLIST
0000 152 152 LIST
153 153 .....
154 154 * 2223D FIELD SERVICE HOST ROUTINE
155 155 *
156 156 * This routine will communicate with the 2200 to interpret commands
157 157 * requesting various facts be executed and/or various error reporting,
158 158 * echo responses,etc. be returned properly to the 2200.
159 159 *
160 160 .....

```

Eq	Loc. Code	Value	Line	Source_Statement
----	-----------	-------	------	------------------

FFFF	1219	22		NOLIST
0000	1408	211		LIST
	1409	212	*	*****
	1410	213	*	MOVING INVERSIONS RAM TEST FOR BANK 1
	1411	214	*	*****
	1412	215	*	The MOVING INVERSIONS RAM Test is used to check the functionality of
	1413	216	*	the 16K RAM chips. This test should be run only after the RAM Test has
	1414	217	*	passed since this test is downline loaded into memory. This test will
	1415	218	*	find the bad RAM's not detected by the RAM test which should catch most
	1416	219	*	common RAM failures. MOVING INVERSIONS should find the flakey failures
	1417	220	*	that a cheap and dirty RAM test like the MARCHING 1's and 0's won't.
	1418	221	*	The error reporting is done via the 2200 monitor. The expected data,
	1419	222	*	actual data read and the address of the failure will be displayed on the
	1420	223	*	screen.
	1421	224	*	*****
	1422	225	*	This MOVING INVERSIONS test uses all increment values for 16K RAM chips.
	1423	226	*	The test uses only two patterns ('AA','55'),because the RAMS are single
	1424	227	*	bit.
	1425	228	*	*****
	1426	229	*	TIME TO RUN : APPROX = 45 SECONDS
	1427	230	*	*****

FFFF	1420	232		NOLIST
0000	1634	437		LIST
	1635	438	*	*****
	1636	439	*	MOVING INVERSIONS RAM TEST FOR BANKS 2,3,4
	1637	440	*	*****
	1638	441	*	The MOVING INVERSIONS RAM Test is used to check the functionality of
	1639	442	*	the 16K RAM chips. This test should be run only after the RAM Test has
	1640	443	*	passed since this test is downline loaded into memory. This test will
	1641	444	*	find the bad RAM's not detected by the RAM test which should catch most
	1642	445	*	common RAM failures. MOVING INVERSIONS should find the flakey failures
	1643	446	*	that a cheap and dirty RAM test like the MARCHING 1's and 0's won't.
	1644	447	*	The error reporting is done via the 2200 monitor. The expected data,
	1645	448	*	actual data read and the address of the failure will be displayed on the
	1646	449	*	screen.
	1647	450	*	*****
	1648	451	*	This MOVING INVERSIONS test uses all increment values for 16K RAM chips.
	1649	452	*	The test uses only two patterns ('AA','55'),because the RAMS are single
	1650	453	*	bit.
	1651	454	*	*****
	1652	455	*	TIME TO RUN : APPROX = 45 SECONDS
	1653	456	*	*****

EE	Label	Code	Value	Line	Source Statement	Start File
152			FFFF	162		
336			0000	2		
337				3	***** NOLIST *****	
338				4	***** LIST *****	
339				5		
340				6	***** SIO EXTERNAL LOOP BACK TEST *****	
341				7		
342				8	Testing of the SIO chip is done in three distinct phases. The SIO is	
343				9	tested using ASYNC, BISYNC, and SDLC. The CTC Channel 1 is set to clock	
344				10	at 9600 baud, clocks are provided externally via the loop back.	
345				11		
346				12	ASYNC MODE: In this mode the SIO chip is initialized to transmit and	
347				13	receive characters in the ASync mode using 1 stop bit. An incremental	
348				14	data pattern of 00 to FF is used with the exclusion of a Hex 32. The	
349				15	32 is excluded because bisync testing uses this same routine.	
350				16		
351				17	BISYNC MODE: In this mode the SIO chip is initialized to transmit and	
352				18	receive characters in the Bisync mode. An incremental data pattern is	
353				19	again used excluding the sync byte Hex 32. Several error reportable	
354				20	checks are made here that are not made in the ASync mode. The status	
355				21	of the receiver is checked to see that it entered the Hunt mode from	
356				22	a command given during initialization. The transmitter is then enabled	
357				23	and checks are made to determine if it is sending Sync characters. The	
358				24	receiver is then checked to determine if it is receiving Sync characters	
359				25	after completion character transmission and reception with checking	
360				26	begins. After character transmission and reception is completed the	
361				27	testing of interrupt: begin. Transmit, receive, overrun, CTS, and DTR	
362				28	interrupts are tested.	
363				29		
364				30	SDLC MODE: In this mode tests are made on the flag character transmission	
365				31	and reception and also transmission and reception of two data patterns	
366				32	AA and 55. Except for interrupts some of the same checks as Bisync mode	
367				33	are made prior to transmission of the two data patterns.	
368				34		
369				35	All errors will be reported via the 2200 basic test monitor program	
370				36	and should be easily understood by the user.	
371				37	*****	



```

      Stmt File
      No.  Line  Value  Code  Source_Statement
-----
      373  30    FFFF
      484  484    0000
      485  485
      486  486
      487  487
      488  488
      489  489
      490  490
      491  491
      492  492
      493  493
      494  494
      495  495
      496  496
      497  497
      498  498
      499  499
      500  500
      501  501
      502  502
      503  503
      504  504
      505  505

```

NOLIST  
 LIST  
 \*\*\*\*\*  
 SIO / DMA TEST  
 \*\*\*\*\*  
 The function of this test is to check the ability of the SIO to transfer  
 bytes out of memory and receive them via loop back, and put the received  
 characters into another location of memory. The interaction between the  
 DMA and SIO is tested here. Data transfers from / to memory are shown in  
 the table below. After completion of each data transfer the data is read  
 and compared on a location by location basis.

Size	Source	Destination
256 Byte Transfer	4000 to 40FF	TC 4100 to 41FF
512 Byte Transfer	4000 to 41FF	TC 4200 to 43FF
1k Byte Transfer	4000 to 43FF	TC 4400 to 47FF
2k Byte Transfer	4000 to 47FF	TC 4800 to 4FFF
4k Byte Transfer	4000 to 4FFF	TC 5000 to 5FFF
8k Byte Transfer	4000 to 5FFF	TC 6000 to 7FFF
16k Byte Transfer	4000 to 7FFF	TC 8000 to BFFF

EL	Label Code	Value	stmt No.	Line	Source_Statement
		FFFF	841	507	NOLIST
		0000	1079	745	LIST
			1080	746	.....
			1081	747	.....
			1082	748	.....
			1083	749	.....
			1084	750	.....
			1085	751	.....
			1086	752	.....
			1087	753	.....
			1088	754	.....
			1089	755	.....
			1090	756	.....
			1091	757	.....
			1092	758	.....
			1093	759	.....
			1094	760	.....
					CONTROL CHARACTER RECOGNITION RAM TEST
					.....
					The function of this test is to check the ability of the Control
					Character Recognition Ram to detect control characters during an
					SIO/DMA transfer. The output of the RAM will trigger channel 2 of
					the CTC. On the first pass the RAM will be set to not recognize any
					characters by flooding it with all 1's using an OUT 31, and a 256
					byte incremental data pattern. Then using an OUT 30, and the same
					data pattern the RAM will be set to recognize all characters as
					control characters. The end result will be a down count of channel 2
					of the CTC, after the transfer of each character. Any failure will
					be reported to the 2200 monitor program.
					.....

EC	12C4 Code	VALUE	Start File No. Line	SOURCE_Statement
		FFFF	1096	NOLIST
		0000	1199	LIST
			1200	*****
			1201	PRIORITY INTERRUPT LINE TEST FOR SIO/CTC/PIO
			1202	*****
			1203	
			1204	The function of this test is to check the priority scheme of the
			1205	IEI /IEO line that runs between the SIO/CTC/PIO chips is functioning.
			1206	The test will allow an interrupt from the CTC then while in the service
			1207	routine will create an interrupt from the SIO. When this interrupt is
			1208	received the SIO service routine should be entered verifying the SIO
			1209	has a higher priority than the CTC. The 2200 will then be informed to
			1210	send a character which will cause a PIO interrupt, once enabled. A
			1211	Return from Interrupt will be executed thus the routine should exit the
			1212	SIO routine and return to the CTC routine. After verification of entry
			1213	into the CTC routine is completed another Return from Interrupt will be
			1214	performed which should allow the PIO interrupt to occur signifying
			1215	successful test completion. Any errors will be reported to the 2200 for
			1216	display on the monitor.
			1217	*****
			1218	*****
			1219	*****
			1220	*****

EC	Loc. Code	Value	Stat. No.	File Line	Source Statement
		FFFF	1655	458	NOLIST
		0000	1P57	660	LIST
			1858	661	*****
			1859	662	*****
			1860	663	*****
			1861	664	*****
			1862	665	*****
			1863	656	*****
			1864	667	*****
			1865	668	*****
			1P66	669	*****
			1867	670	*****
			1868	671	*****
					OPTION SWITCH TEST
					This test is designed to test the option switch (SW2) on the 7658
					board of the controller. Upon entry into this test the 2200 will
					be notified of the current switch setting. The user will have the
					opportunity to change the switch and have the setting displayed
					by the 2200. This test will terminate when instructed to do so by
					the 2200 monitor.

APPENDIX C

RS232 & RS449 LOOP BACK CONNECTOR WIRING DIAGRAM

### RS232 LOOP BACK CONNECTOR

Protective Ground	!	1	"	.	
	!				
	!		14	!	Secondary Transmitted Data
	!				
Transmitted Data	1-----2	!		!	
	1 !	!		!	
	1 !	!	15-----5	!	Transmitted clock
	1 !	!		!	5
Received Data	1-----3	!		!	5
	!	!		!	5
	!	!	16	!	5 Secondary Received Data
	!	!		!	5
Request to send	2-----4	!		!	5
	2 !	!		!	5
	2 !	!	17-----5	!	Received clock
	2 !	!		!	5
Clear to Send	+-----5	!	5	!	5
	2 !	!		!	5
	2 !	!	18	!	5 Unassigned
	2 !	!		!	5
Data Set Ready	3-----2	!	6	!	5
	3	!		!	5
	3	!	19	!	5 Secondary Request to Send
	3	!		!	5
Signal Ground	3	!	7	!	5
	3	!		!	5
	3-----2	!	20	!	5 Data terminal Ready
	2 !	!		!	5
Carrier Detector	2-----8	!		!	5
	!	!		!	5
	!	!	21	!	5 Signal Quality Detector
	!	!		!	5
Reserved for Data Set Testing	!	!	9	!	5
	!	!		!	5
	!	!	22	!	5 Ring Indicator
	!	!		!	5
Reserved for Data Set Testing	!	!	10	!	5
	!	!		!	5
	!	!	23	!	5 Data signal rate selector
	!	!		!	5
Secondary Carrier Detector	!	!	11-----5	!	5
	!	!		!	5
	!	!	24	!	5 Transmitted Clock
	!	!		!	5
	!	!	12	!	5
	!	!		!	5
	!	!	25	!	5 Unassigned
	!	!		!	5
Secondary Clear to Send	!	!	13	!	5 "
	!	!		!	5 "
	!	!	1.	!	5 "



**APPENDIX D**  
**SCREEN SAMPLES**



REVISION: 1121

WARNING FIELD SERVICE DIAGNOSTIC FOR 2228D REV 2 & UP

PRESS 'RETURN' TO CONTINUE

2228D TC FIELD SERVICE DIAGNOSTICS REV 1121

Requires VP BASIC Rev. 2.3 or MVP BASIC Rev. 2.1

Available device addresses are:

019 01A 01B 01C 01D 01E 01F

What is the device address ? 01C

DEVICE IS READY

PRESS 'RETURN' TO CONTINUE

Device address '01C' will be used for all tests

Is the LED OFF ? 'Y' or 'N'\*Y

## DMA/PIO TEST

Sending 256 Bytes of data to controller memory

Reading & comparing 256 Bytes of data from controller memory

DMA/PIO test passed

:

## DMA MULTIPLEXER TEST

Sending unique address patterns

Reading and comparing unique address patterns

DMA address multiplexer test passed

:

Device address '01C' will be used for all tests

Do you want to loop on error 'Y' or 'N' N

\* The program will STOP on error

Do you want to display instructions 'Y' or 'N' Y

\* Instructions will be displayed

How many passes do you wish to make (less than 10000)? 1

\* All tests will make 1 pass(es)

KEY 'RETURN' TO CONTINUE

Sending microcode test programs to controller memory  
Transfer of microcode successful  
Forcing controller into microcode test program

:

#### TEST SELECTION MENU

SF 0 - RE-KEY INPUT PARAMETERS  
SF 1 - MOVING INVERSIONS MEMORY TEST  
SF 2 - SIO EXTERNAL LOOP  
SF 3 - SIO/DMA TEST  
SF 4 - CONTROL CHARACTER RAM TEST  
SF 5 - PRIORITY INTERRUPT TEST  
SF 6 - RS449 LOOP BACK TEST  
SF 7 - OPTION SWITCH TEST  
SF 8 - CHAIN MODE  
SF 9 - RESTART  
SF 16 - RETURN TO MAIN MENU

STRIKE THE SPECIAL FUNCTION KEY ASSOCIATED WITH THE DESIRED TEST

WHICH TEST DO YOU DESIRE?

## MOVING INVERSIONS TEST

This test will run a more complete RAM check and is bank selective. In the Chain Mode bank selection will be all.

KEY 'RETURN' TO CONTINUE

## MOVING INVERSIONS TEST

Enter 1 for bank 1 address 2000 TO 3FFF  
Enter 2 for bank 2 address 4000 TO 7FFF  
Enter 3 for bank 3 address 8000 TO BFFF  
Enter 4 for bank 4 address C000 TO FFFF  
Enter 5 for all of the above

Enter the number of the bank you wish to test ? 5

PASS# 1

MOVING INVERSIONS TEST

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)

Bank 1 (2000 to 3FFF) OK  
Bank 2 (4000 to 7FFF) OK  
Bank 3 (8000 to BFFF)  
Bank 4 (C000 to FFFF)

PASS# 1

MOVING INVERSIONS TEST

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
Moving Inversions test passed ....Controller is back in host  
Bank 1 (2000 to 3FFF) OK  
Bank 2 (4000 to 7FFF) OK  
Bank 3 (8000 to BFFF) OK  
Bank 4 (C000 to FFFF) OK

## SIO EXTERNAL LOOP

This program tests the controller's SIO external loop back circuitry. The tests are conducted in all 3 modes ie Async, Bisync and SDLC. In addition 3 vectored interrupt tests are performed, Transmit, Receive, Overrun, CTS, & DCD.

KEY 'RETURN' TO CONTINUE

PASS# 1

## SIO EXTERNAL LOOP

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
SIO external loop passed .....Controller is back in host

:

## SIO/DMA TEST

This test requires the RS232 LOOP BACK Plug. The test checks the ability to transfer data from one section of memory to another. The test is run in the Bisync mode.

This test checks transfers of 256 bytes, 512 bytes, 1k, 2k, 4k, 8k, and 16k.

KEY 'RETURN' TO CONTINUE

PASS# 1

## SIO/DMA TEST

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
SIO/DMA test passed .....Controller is back in host  
256 Byte transfer OK  
512 Byte transfer OK  
1k transfer OK  
2k transfer OK  
4k transfer OK  
8k transfer OK  
16k transfer OK



CONTROL CHARACTER RECOGNITION RAM TEST

This program checks the static ram using the SIO in Async mode. The failing character is interpreted as the RAM address. INSTALL RS232 LOOP BACK

KEY 'RETURN' TO CONTINUE

PASS# 1

CONTROL CHARACTER RECOGNITION RAM TEST

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
Character RAM test passed .....Controller is back in host

:

PRIORITY INTERRUPT TEST

This test checks the IEI and IEO line between the SIO, CTC, and P10 chips. The test insures also that higher priority is observed. INSTALL RS232 LOOP BACK

KEY 'RETURN' TO CONTINUE

PASS# 1

PRIORITY INTERRUPT TEST

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
Priority Interrupt test passed .....Controller is back in host

:

RS449 LOOP BACK

This program tests the controller's SIO external loop back circuitry for the RS449 plug. The RS449 LOOP BACK must be INSTALLED and the Toggle switch switched . Testing is the same as for the SIO External Loop Test.

KEY 'RETURN' TO CONTINUE

PASS# 1

RS449 LOOP BACK

Forcing controller out of host....  
Controller entered selected test(s)  
Waiting for controller to complete selected test(s)  
RS449 loop back passed                   ....Controller is back in host

:

## OPTION SWITCH TEST

This program tests the user option switch on the mother board. The user sets the switch to the desired switch setting which will automatically be updated on the screen. To exit the routine the user must key RETURN.

KEY 'RETURN' TO CONTINUE

## OPTION SWITCH TEST

	1	2	3	4	5	6	7	8
O	O	O	O	O	O	O	O	O
N	N	F	F	F	F	F	F	F
↑		F	F	F	F	F	F	F

USER OPTION SWITCH (SW2)

KEY RETURN TO EXIT TEST

## TEST SELECTION MENU

- SF 0 - RE-KEY INPUT PARAMETERS
- SF 1 - MOVING INVERSIONS MEMORY TEST \*
- SF 2 - SIO EXTERNAL LOOP \*
- SF 3 - SIO/DMA TEST \*
- SF 4 - CONTROL CHARACTER RAM TEST \*
- SF 5 - PRIORITY INTERRUPT TEST \*
- SF 6 - RS449 LOOP BACK TEST
- SF 7 - OPTION SWITCH TEST
- SF 8 - CHAIN MODE
- SF 9 - RESTART
- SF 16 - RETURN TO MAIN MENU

STRIKE THE SPECIAL FUNCTION KEY ASSOCIATED WITH THE DESIRED TEST  
WHICH TEST DO YOU DESIRE?

## CHAIN MODE TEST ROUTINE

THIS TEST WILL CALL AND EXECUTE ALL MARKED (\*) TESTS  
THE ENTIRE TEST WILL BE EXECUTED 1 TIME(S)

KEY 'RETURN' TO CONTINUE

TECHNICAL SERVICE BULLETIN  
SECTION: HardWare General

NUMBER: HWG 7008 REPLACES: \_\_\_\_\_ DATE: 03/24/87 PAGE 1 OF 2  
MATRIX ID. 7401 PRODUCT/RELEASE# Telecommunications  
TITLE: TelCo Services for Modem Connections

PURPOSE:

To provide field personnel with a very basic overview of the different types and quality of TelCo Services (lines) for modem connections.

EXPLANATION:

There are basically two types of phone line connections for modem data services. They are called Switched and Leased line services.

The most common line connection is the Switched or 3002 Unconditioned Voice Grade Line. This is the same type and quality of line over which voice conversations occur. The 3002 Unconditioned Voice Grade Line has a frequency range of 300 to 3300 MHZ. This type of line provides good data communications at rates of 0 to 4800 BPS.

The second type of line connection is the Leased line. There are two types of leased lines to be considered. The first is the Loaded Line connection. The Loaded Line uses the same 3002 Voice Grade Line as Switched services except that 2 or 4 wire connections are used and there are two types of line conditioning available. The line conditioning types are C or D. C conditioning limits the amount of envelop delay distortion while the D conditioning is for high performance channels and limits C-notched noise and is normally used with data rates of 4800 to 9600 BPS. The Loaded Line uses small inductors of 88 mHenry placed in line at 6000 foot intervals to reduce attenuation. The second type of Leased Line connection is the Un-Loaded line. Un-Loaded lines are leased lines that allow for higher data rates of up to 19.2K BPS. The Un-Loaded line has a higher bandwidth of frequency range and the loading coils are removed. There lines are referred to as 3010 type, 11000 type or metallic twisted pair. Specifications and characteristics for this type of line can be found in the Bell System Technical Reference #43401.

GROUP: Telecommunications Software Support-New Products MAIL STOP: 001-11A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

WANG

TECHNICAL SERVICE BULLETIN  
SECTION: HardWare General

NUMBER: HWG 7008 REPLACES: \_\_\_\_\_ DATE: 03/24/87 PAGE 2 OF 2  
MATRIX ID. 7401 PRODUCT/RELEASE# Telecommunications  
TITLE: TelCo Services for Modem Connections

CORRECTIVE ACTION:

When recommending data service lines to a customer, use the data rate required for the application, the type of modem (ie. Switched vs. Leased), and the above supplied information to recommend the type of service that a customer should order.

ADDITIONAL INFORMATION:

LDSU or Local Distribution Service Units by characteristic use broad ranges of frequencies for communication. For this reason, it is suggested that LDSU's be connected to Un-Loaded lines for proper operation at higher data rates.

If you plan to connect an LDSU to a leased Loaded line then data rates should be kept to 4800 BPS or less.

GROUP: Telecommunications Software Support-New Products MAIL STOP: 001-11A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

# PRODUCT BULLETIN

# NO. 137

Table 1. Compatible Modems for Wang's 2780, 3780 or 3741 Emulation Software

Bell Data Set (or equivalent)	Line Speed (bits/sec.)	Decision*	Required Options**
201A (Send & Receive)	2000	A B C D	1. EIA Interface 3. With Alternate Voice 6. Without New Sync 7. Half-duplex (2-wire)
201C (Dial Service) (Send Receive)	2400	A B C D F	1. Transmitter Internally Timed 3. Without 801 ACU 5. EIA Ring Indicator 8. With Automatic Answer 10. Automatic Answer (Selective)
208B (Send & Receive)	4800	A B C D E	1. Transmitter Internally Timed 3. Without 801 Automatic Calling Unit 6. CC on when AL pressed (CC=Data set ready) 8. With Automatic Answer-- Permanent 9. Desk Mounting

\* When the Bell Telephone System is contacted by a customer or a vendor to discuss compatible modems, a Bell representative identifies desired options by asking the customer if he wants Decision A, for example. If so, the customer replies "yes, I want Option 1."

\*\* All options listed in Column 4 for a particular data set should be selected.

**WANG**

LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 851-4111, TWX 710 343-6769, TELEX 94-7421



Table 2. Compatible Modems for Wang's Teletype Emulation Software

Bell Data Set* (or equivalent)	Transmission Mode and Rate
103A or 103J 202C or 202S	Full duplex up to 300 baud Half duplex up to 1200 baud

- \* If a 103A or 103J type modem is used, it should be ordered with optional features which provide an originate and an answer capability (also, a receive long space disconnect feature is desirable). If a 202C or 202S type modem is used, optional features should include originate, answer, and receive long space disconnect capabilities. To use a break signal, the reverse channel option should be included.

TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#00805

VI.B.4

VS SYSTEMS-INTERFACE-TELECOM I/O PROCESSORS.

TOPIC: 22V05 TELECOMMUNICATIONS IOP, MODEM OPTIONS

When using 208A type modems with 2 or more remote drops on the line, ensure the following strapping in the modems:

Host Modem           A1 - Transmitter timing internal  
                      B3 - Continuous carrier  
                      C6 - Continuous CTS  
                      D8 - One second holdover not used  
                      E10 - New Sync not used  
                      F11 - DSR (CC) lead on

Remote Modem        A1 - Transmitter timing internal  
                      B4 - Switched Carrier  
                      C5 - Switched CTS  
                      D7 - One second holdover is used  
                      E10 - New Sync not used  
                      F11 - DSR (CC) lead on

Remote drops is defined as either 2 or more remote modems or one or more remote modems with MSU's attached.

For point to point (one remote modem with no MSU attached), use the options specified above under Host Modem for both modems.

If you are operating correctly with different options than stated above, please contact Matt Zaboy/MS 8236A/X6152 with the options you are using. Please double check to verify different options.

TC

202T

Cable 220-0113

Other keys should appear as:

SF '27 A2 - No local copy on Primary channel  
 '28 B4 - No local copy on reverse channel  
 C5 - telephone CO engineer tuning options  
 '29 D7 - " " " "

'30 E10 reverse channel not installed

'31 F11 signal  $\equiv$  to frame  $\equiv$

RUN

4 wire operation (needed)

LOAD

indicate FULL DUPLEX X

CLEAR

Continuous carrier

ERASE

HALT

CONTINUE

EDIT

FN (lower case)

FN (upper case)

# 1979

## Trade Show Exhibit Schedule

### April

- 4 - 6 Word Processing Exposium '79 Lake Geneva, WI
- 9 - 12 Interface '79 (National) Chicago, IL

### Sept.

- 6 - 8 Graphic Arts '79/The Charlotte Show Charlotte, NC

## Modems

### INTRODUCTION/DEFINITION

The computer industry manufactures data processing equipment that utilizes DIGITAL signals to represent binary coded information internally. The communications industry provides networks and communications equipment that supports voice information which is carried or transmitted using ANALOG signals.

For data communications it is necessary to provide a means of connecting or interfacing the analog designed communications network to the digital pulse requirements of the data processing equipment. Devices used to make this connection are called MODEMS. The term modem is a contraction of the words modulator/demodulator. A modem, therefore, is an electronic device for the conversion of signals between a business machine and a communications line. When in the send mode, it modulates digital pulses to analog form. When in the receive mode, it demodulates the analog form back into the original digital pulses. The data link consists of two modems, one at each end of the telephone line, to provide for this signal conversion. The modems must be matched; that is, they must be identical or electrically equivalent in operation.

### MODEM TYPES

There are many types of modems available from Bell Telephone and from other independent companies. Modems can best be grouped according to operating speeds and by identifying a special function group.

### GROUPED BY SPEED

Type	Speed	Use with Wang Equipment
1. Low Speed	0 - 600 BPS*	2227B or 2228B
2. Medium Speed	1200 - 2400 BPS	2227B or 2228B
3. High Speed	3600 - 9600 BPS	2227B or 2228B (2228B or 7200 BPS only)
4. Wideband	19,200 - 230,400 BPS	not supported

\*BPS - Bits Per Second - Modem speed is specified in Bits Per Second.

### Low-Speed Modems

Low-speed modems most commonly support speeds of 50, 75, 110, 300 and 600 BPS. These modems are used primarily in the interactive communications environment supporting teleprinters and display terminals.

### Medium-Speed Modems

Medium-speed modems support transmission speeds from 1200 to 2400 BPS. They are utilized for interactive or low speed batch operations.

### High-Speed Modems

High-speed modems operate in the 3600 to 9600 BPS range. Most common speed is at 4800 BPS on dial-up lines. Leased lines are usually required for 7200 and 9600 BPS. This modem type is used for high speed remote batch data transmissions.

### Wideband Modems

Wideband modems support transmission speeds greater than 9600 BPS. Use of these modems is small and requires special leased lines.

The following is a list of special-purpose modems. They are listed apart from the standard modem types because of their uniqueness and special purpose. Except for the null modem, they serve the same purpose as the standard modem (i.e., signal conversion).

### GROUPED BY SPECIAL FUNCTION

Type	Speed	Use with Wang Equipment
Acoustic Couplers	up to 1200 BPS	2227B or 2228B
Short Haul Modems	up to 9600 BPS	2227B or 2228B
Wang Null Modem	up to 9600 BPS	2227B or 2228B

### Acoustic Couplers

Acoustic Couplers do essentially the same thing as modems. The modem is hard-wired connected to the telephone line and electrically transfers data. The acoustic coupler is portable and transfers data acoustically via an ordinary telephone. Acoustic couplers support transmission speeds up to 1200 BPS maximum.

### Short Haul Modems

Short Haul Modems, also referred to as Limited Distance Modems, are designed for data communications ranging from a few hundred feet to about ten miles. They are non-Bell compatible and are used mostly for private line hard-wired links. Some can operate over Bell voice grade telephone lines.

### Wang Null Modems

The Wang Null Modem is simply a connector that provides for the local connection of a Wang 2200 System to a terminal, a host computer, or another Wang System. The null modem replaces standard modems providing for local connections and makes the pin assignments compatible between the two devices being connected.

There are two versions of the null modem; they are the 2227N and the 2228N. As their names imply, the 2227N is used with the 2227B controller and the 2228N is used with the 2228B controller.

The 2227N has no polarity; that is, it makes no difference how it is connected. It is used only with the 2227B (or OP62). The 2228N has polarity. In other words, one end of the null modem must receive the cable from the 2228B (or OP62B). The other end will receive the cable from the other device being connected. The null modem is used with the 2228B controller and will support the synchronous mode of communications. The 2228N null modem can be used with the 2228B in asynchronous mode and with the 2227B. However, the reverse channel capability becomes disabled.

### AVAILABILITY

Wang Laboratories does not manufacture or supply modems or acoustic couplers. This equipment must be obtained from Bell Telephone or from other suppliers. Modems may be rented from Bell in your locality or they may be purchased from any one of several modem manufacturers.

Ordering of a modem for a Wang Customer is not the responsibility of a Wang salesman nor is the installation of a modem the responsibility of a Wang serviceman. However, as a service to your customer you can assist in this area by referring him to the Data Service Representative of Bell Telephone in your local area. Or, you can provide him with a list of various suppliers as given in this article. The listing of

these suppliers is for convenience only. Wang Laboratories is not affiliated with or endorsing any of those listed companies.

### BELL MODEMS

Just as IBM is the giant in the computer industry, Bell is the dominating force in the modem marketplace. Because of sheer size and total number of modems installed, Bell modems have become the "standard" and are used to measure or compare modems of other vendors for compatibility. As mentioned earlier, two modems are required in the data link and they must be matched.

In other words, it must be identical in operation to that of the Bell modem it will be communicating with. Bell Modems compatible for use with Wang 2200 Series Systems:

Bell Modem	Speed
103A/103J	300 BPS
212A	300/1200
202C	1200
202S	1200
202T	1800
201A	2000
201C	2400
208A	4800
208B	4800

### MODEM OPTIONS

Bell System Modem Options to be used with Wang 2227B/2228B Controllers.

### REQUIRED OPTIONS

#### Bell 103A Series 300 BPS

Without Auto-Dialer  
Loss of Carrier Disconnect  
Send Space Disconnect  
Receive Space Disconnect

#### Bell 102J Series 300 BPS

Request Standard Bell  
Factory Furnished Options  
Without Auto-Dialer  
Common Grounds

#### Bell 202C or 202S Series 1200 and 1800 BPS

No Local Copy or Primary Channel  
Bell Engineered Timing Options  
Without Auto-Dialer  
Signal and Frame Ground Connected

**Bell 201A Series 2000 BPS**

EIA Interface  
With Alternate Voice  
Without New Sync  
Half-duplex (2-Wire)

**Bell 2201C Series 2400 BPS**

Transmitter Internally Timed  
EIA Ring Indicator  
Without New Sync

**Bell 208B Series 4800 BPS**

Transmitter Internally Timed

Rixon, Inc.  
2120 Industrial Parkway  
Silver Spring, MD 20904  
(301) 621-2121

Syntech Corporation  
11810 Parklawn Drive  
Rockville, MD 20852  
(301) 770-0550

Vadic Corporation  
505 East Middlefield Road  
Mountain View, CA 94043  
(415) 965-1620

**SUPPLIERS**

**Low-Speed Modems**

Anderson Jacobson, Inc.  
1065 Morse Avenue  
Sunnyvale, CA 94086  
(408) 263-8520

Omnitec Data Corporation  
2405 South 20th Street  
Phoenix, AZ 85034  
(602) 258-8244

Rixon, Inc.  
2120 Industrial Parkway  
Silver Spring, MD 29004  
(301) 622-2121

Vadic Corporation  
505 East Middlefield Road  
Mountain View, CA 94043  
(415) 965-1620

**Medium-Speed Modems**

International Communications Corp.  
8600 Northwest 41st Street  
Miami, FL 33166  
(305) 592-7654

Intertel, Inc.  
6 Vine Brook Park  
Burlington, MA 01803  
(617) 273-0950

Penril Data Communications Corp.  
5520 Randolph Road  
Rockville, MD 20852  
(301) 881-8151

**High-Speed Modems**

GTE Lenkurt, Inc.  
1105 County Road  
San Carlos, CA 94070  
(415) 591-8461

Rixon, Inc.  
2120 Industrial Parkway  
Silver Spring, MD  
(301) 621-2121

**Acoustic Couplers**

Anderson Jacobson, Inc.  
1065 Morse Avenue  
Sunnyvale, CA 94086  
(408) 263-8520

Data Access Systems, Inc.  
100 Route A6  
Mountain Lakes, NJ 07046  
(201) 335-3322

Livermore Data Systems Inc.  
2050 Research Drive  
Livermore, CA 94550  
(415) 447-2252

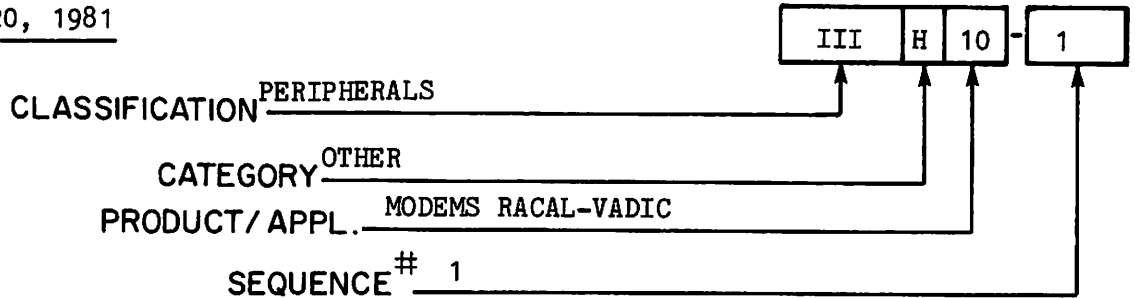
Omnitec Data Corporation  
2405 South 20th Street  
Phoenix, AZ 85034  
(602) 258-8244

**Short Haul Modems**

Computer Transmissions  
2352 Utah Avenue  
El Segundo, CA 90245  
(213) 973-2222

# PRODUCT SERVICE NOTICE

DATE : August 20, 1981



TITLE:

RACAL-VADIC MODEM VA3450 MANUAL CHANGES

NOTE

This PSN applies to Board Number 81164, Rev. G (board number and revision level located on component side of printed circuit board).

Wang has added the Racal-Vadic model VA3450 modem to its telecommunications product line. The Wang version (WA3451) of the VA3450 is slightly different than the Racal-Vadic version. These differences are outlined in this PSN.

To understand the changes to the VA3450 use this PSN in conjunction with the Customer Engineering reprint for the Racal-Vadic Model VA3450 Manual. This manual can be found under the class code III.H.10M-1 and can be reordered by the part number 729-0997.

This PSN is organized into the following paragraphs:

- 1.0 Introduction
- 2.0 Racal-Vadic Manual Changes
- 3.0 Wang Switch and Strap Options
- 4.0 Wang External Switches
- 5.0 Operational Differences
- 6.0 Additional Installation Information



## 1.0 INTRODUCTION

The WA3451 series modem has been revised to include an integral line-connect (DATA/AANS/OFFL) switch on the front of the unit. Seven internal option straps (straps x, y, aa, ab, ac, ad, and ae) have been also added to the printed circuit board. The DATA/AANS/OFFL switch and strap "x" permits the modem to be used for manual operation with a standard voice telephone. The MA position of the switch disables the automatic answering functions of the modem and allows the TelCo line to be used as a normal telephone circuit. (Straps "aa" through "ac" provide optional user programming of EIA pins 18 and 25; and straps "ad" and "ae" are used for factory selection of microprocessor memory size. Strap "y" selects microprocessor internal ROM if IN, and external ROM if OUT. The changes required to update the reprinted Racal-Vadic manual are specified below.)

## 2.0 RACAL-VADIC MANUAL CHANGES

- A. Page 2-3 - For use with a standard telephone, follow the installation procedure on page 2-3 of the Racal-Vadic manual. Connect the modem as shown in the PSN figure 1, instead of figure 2-1 as shown in the Racal-Vadic reprint.
- B. Page 3-1 - The updated front view presented in the PSN figure 2 should be referred to instead of the version shown on Page 3-1 of the Racal-Vadic manual. On all subsequent front views, refer to the PSN updated figure.
- C. Page 3-4 and 3-5 - The operating procedures presented on pages 3-4 and 3-5 remain essentially unchanged when using the DATA/AANS/OFFL switch except for the following considerations:
  1. For automatic modes of operation, leave the DATA/AANS/OFFL switch in the AANS position when the modem is not in use.



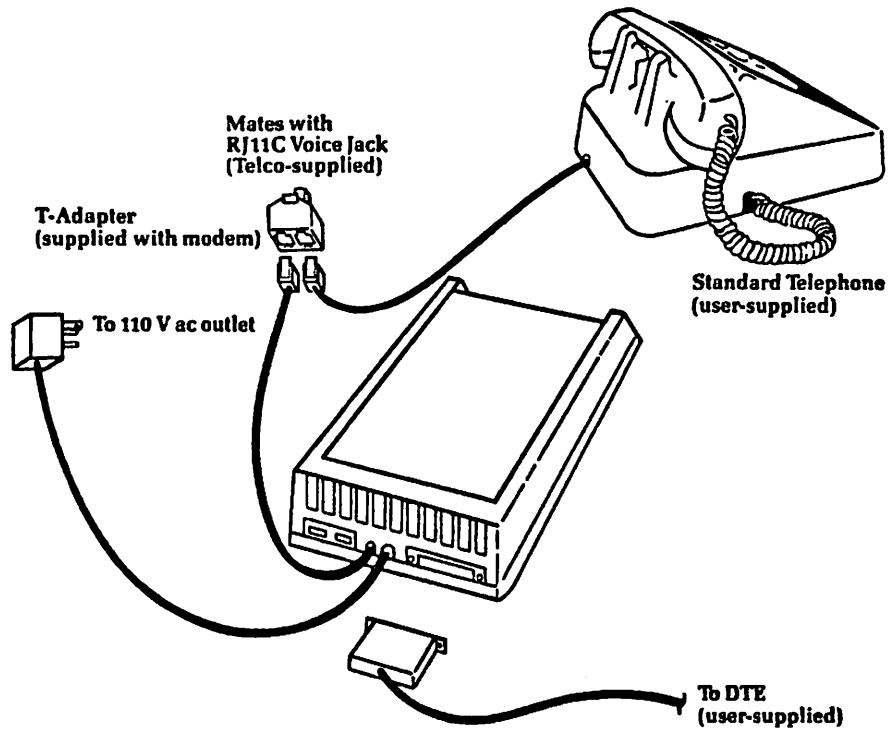


FIGURE 1 - CONNECTION TO DATA JACK

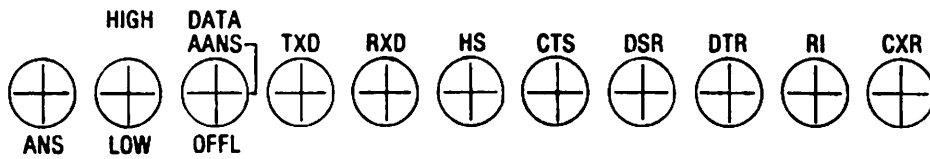


FIGURE 2 - CONTROLS AND INDICATORS

2. For manual modes of operation, leave the DATA/AANS/OFFL switch in the OFFL position when the modem is not in use.
3. For, Manual Originate/Manual-Answer operation, hang up the telephone handset when modem enters data communication mode (step 4 of Manual Originate, step 2 of Manual-Answer).
4. Be sure to return the DATA/AANS/OFFL switch to the AANS or OFFL position when data communication is complete to avoid unnecessary telephone charges.

D. Page 5-3 - Add the following information to appropriate columns in Table 5-1 (page 5-2) of the Racal-Vadic manual:

Strap	Function	Enabled Position	Normal Position
x	Enable Line Connect switch	In	In
y	Internal Memory Access	In	Out
aa	Test Indication on J3/25	In	Out
ab	Busy-Out Control on J3/25	In	In
ac	Busy-Out Control on J3/18	In	Out
ad	Select 4K ROM	In	Out
ae	Select 2K ROM	In	In

E. Page 5-7 - Add the following information to the option strap list:

- x. When IN;
  1. Line-connect (DATA/AANS/OFFL) switch on front of unit connects modem to telephone line when the switch is placed in DATA position.

2. Allows the modem to automatically connect to line when the switch is placed in the AANS position, and disables the automatic line-connect functions when placed in the OFFL position. When OUT, line connect switch is not operational.
- 
- aa. When IN, modem will generate a logic HIGH on pin 25 of RS232C connector J3 during test. (Strap ab must be OUT.)  
When OUT, pin 25 does not provide test indication.
  - ab. When IN, modem will busy-out the telephone line when a logic HIGH is applied to pin 25 of RS232C interface connector J3.  
(Strap aa must be OUT.)  
When OUT, pin 25 does not control busy-out.
  - ac. When IN, modem will busy-out the telephone line when a logic HIGH is applied to pin 18 of RS232C interface connector J3.  
When OUT, pin 18 does not control busy-out.
  - ad. When IN, modem internal program memory (ROM) is set to 4K.  
This is a factory-set option, not for field use.  
When OUT, strap ae must be IN.
  - ae. When IN, modem internal program memory (ROM) is set to 2K.  
This is a factory-set option, not for field use.  
When OUT, strap ad must be IN.
  - y. When IN, the microprocessor's internal ROM is selected.  
When OUT, external ROM is selected.

3.0 WANG (WA3451) SWITCH AND STRAP OPTIONS

The WA3451 series modem has been revised to include an integral line-connect (DATA/AANS/OFFL) switch on the front of the unit. Seven internal option straps (straps x, y, aa, ab, ac, ad, and ae) have also been added to the printed circuit board. The position on the straps and switches required to update the reprinted Racal-Vadic manual are specified below.

RACAL-VADIC, P/N - 81164-011 Rev. G,H (Bottom PCA)

81165-011 Rev. D (Top PCA)

CLOSED-ON  
OPEN-OFF

FUNCTION	81164 OPTION	SWITCH OR STRAP NO.		POSITION	2236DE DISPATCH MODEMS RE
A. Unattended disconnect	disabled	A-1		closed	ON
B. Respond to remote test	enabled	A-2		closed	ON
C. Character-length		A3	A5	A3	OFF
	8 bits (3400 only)	closed	closed	A5	OFF
	9 bits	open	closed		
	10 bits	closed	open		
	11 bits (3400 only)	open	open	2200-2236DE	
D. 103 operation	enabled	A-4		closed	ON

FUNCTION	81164 OPTION	SWITCH OR STRAP NO.	POSITION	
E. No option, option	disabled	A-6	closed	ON
F. Loss of carrier disconnect	enabled	A-7	closed	ON
G. Initiate remote test	remote DLB	B-1	closed	ON
H. Force data terminal ready	disabled	B-2	open	OFF
I. Mode selection	originate, answer	B-3	open	OFF
J. maximum input data rate	1205 bps-enabled	B-4	open	OFF
K. Abort timer disconnect	enable	B-5	closed	ON
L. Data format	asynchronous synchronous	B-6	open closed	OFF

FUNCTION	81164 OPTION	SWITCH OR STRAP NO.	POSITION	
M. DSR control	on in test	B-7	open	OFF
N. Line connection	switched network	a	out	OUT
O. Receive space disconnect	disable	b	in	IN
P. Send space disconnect	disable	c	in	IN
Q. Slave clock mode	disable	d	out	OUT
R. Transmitter output level	-10dbm	e 1 i?	out in	
S. Carrier delayed	normal	g f	out in	OUT IN
T. Received data in DLB	enable	w h	in out	IN OUT
U. Transmit clock	internal	j	out	OUT

FUNCTION	81164 OPTION	SWITCH OR STRAP NO.	POSITION	
U. Transmit clock	internal	j	out	OUT
V. Data rate select (EIA Pin 23)	disabled	k	out ?	
W. Signal common to chassis ground	not tied	m	out	OUT
X. Terminal control of DLB (pin 19)	disabled	n	out ?	
Y. Clear to send Control	CTS follows CXR	p q	out in	OUT IN
Z. Speed indication to Pin 12	disabled	r	out	OUT
AA. Local test Control	delayed busy out & ALB	S U	in in ?	IN
BB. Transmit and received clocks to interface (pins 15 & 17)	enabled	t v	in in	IN IN

FUNCTION	81164 OPTION	SWITCH OR STRAP NO.	POSITION	
CC. Voice data switch	enabled	x	in	IN
DD. External memory access	enabled	y	out	OUT
EE. Test indication on J3-25	enabled	aa	out	OUT
FF. Busy-out Control	pin 18	ac ab	in out	IN OUT
GG. Software Selection	enabled	ae ad	in out	IN OUT

-----81165-----option-----  
(top board)

HH. Receiver demodulator (manufacturing test only)	enabled	w5	out	OUT
II. Dynamic range select	-13 to -48 dbm	w4	out	OUT



FUNCTION	81164 OPTION	SWITCH OR STRAP NO.	POSITION	
JJ. Amplitude equalizer	disabled	w1	out	out
KK. Phase equalizer	disabled	w2	out	out
LL. Amplitude and phase response	normal	w3	out	out

#### 4.0 WANG (WA3451) EXTERNAL SWITCHES (front and rear)

##### 4.1 FRONT PANEL

1. ANS (Force Answer)      This switch is used to force the modem into the answer mode. When the telset is controlling the modem, (manual answer mode), this switch must be used after answering the telephone to force the modem answer tone and mode.
  
2. High Low (Speed)      This switch sets the speed of the modem (when in the originate mode) to either high speed of 1200 bps (3400/212) or low speed of 300 bps (103). This switch will not affect the speed of the modem in the answer mode, because it is controlled by the calling modem. The speed selection must be made before lifting the handset to originate a call.
  
3. DATA/AANS/OFFL      This 3-position switch has the following function:
  - A. DATA - Modem is off hook - forces modem to originate mode.
  - B. AANS- Auto Answer Mode will answer incoming phone call--forces modem into answer mode. D.T.R. must be present.
  - C. OFFL - Incoming call will not be answered.

## 4.2 REAR PANEL

1. DLB/OFF/ALB
 

When connected to another 3400 type modem, the DLB position manually initiates the modem into a remote test causing the remote modem to echo back its received data. The OFF position disables the device test modes.

The ALB position releases transmitter squelch, switches receiver to transmit frequency, busies line, isolates modem from line, and flashes DSR lamp. ALB is inhibited when modem is off-hook. This causes transmit data to echo back on receive data line.
2. NORMAL (left)  
SELF TEST (right)
 

This switch sets the modem to the self-test mode, causing the modem to generate a dot pattern in the high speed mode and a mark/space pattern in the low speed mode. Terminal device will register all "U's".

## 5.0 OPERATIONAL DIFFERENCES

The operational differences of the WA3451 are as follows:

1. The WA3451 automatically drops to a 10-bit data mode if internally optioned for 2200/2236DE terminal support (i.e. 11-bit data) when it detects a 212A Bell Telephone modem at the other end.
2. The WA3451 is strapped and compatible (at 300 or 1200 bps) for remote terminal connections to the 2200 MVP, VP, LVP, and SVP computers that have 2200 series interactive terminals (2236D, 2236DE, and 2236DW).

## 6.0 ADDITIONAL INSTALLATION INFORMATION

The WA3451 modem generates radio frequencies, and if not installed and used properly (in strict accordance with Wang's instructions), it may interfere with radio and television reception. However, it has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by one or more of the following measures:

1. Reorient the receiving antenna.
2. Relocate the computer with respect to the receiver.
3. Plug the computer in a different outlet so that computer and receiver are on different branch circuits.

### NOTE:

Recommended reading on this subject is: "How to Identify and Resolve Radio-TV Interference Problems", this booklet is available from the US Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.



CUSTOMER ENGINEERING  
 TECHNICAL ASSISTANCE CENTER  
 NEWSLETTER

#30125

III.H.10 (7401)  
 PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS

The following information represents the proper switch and strap options for the WANG 3451 MODEM. These options are set for Modems that have had the MIXE ECO performed. The information on the MIXE ECO can be found in the TAC newsletter 20928. Modems that have had the ECO installed will also work with the MXD controller.

↑WA3451 STRAPPING↑

<u>Strap</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function When Strap Is In</u>
a	Out	Out	Line connection switched.
	In	In	Disables 103J and 2i2A response to receive space disconnect.
c	In	In	Disables 103J and 2i2A transmit space prior to disconnect.
d	Out	Out	Enables slave mode clocking for sync operation (connects RS-232-C pin 17 to pin 24).
e	Out	Out	Select 0 dbm transmit level (3453G leased line only). "1" strap must be out.
f	In	In	Connects Carrier Detect (RS-232-C pin 8). Strap "g" must be in the reverse position.
g	Out	Out	Connect (CTS) to (CD) (RS-232-C pin 5 to 8)strap "f" must be in the reverse position.
h	Out	In	Inhibits receive data to the interface during Response To Remote Test (RTRT). Strap "w" must be in the reverse position.
j	Out	Out	Enables external transmit clock input for synchronous operation (RS-232-C pin 24).

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#30125

III.H.10 (7401)  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS (CONTINUED)

<u>Strap</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function When Strap Is In</u>
k	In	Out	Enables speed selection from RS-232-C pin 23 (front panel HS switch must be in the LS position for operation).
l	In	In	Transmitter output level -10dbm "e" strap must be out.
m	Out	Out	Connects Signal Ground to Chassis Ground (RS-232-C pin 1 to pin 7).
n	In	Out	Initiate Remote Test from RS-232-C pin 21. (MXE ECO) strap must be in.
p	Out	Out	Clear To Send following Request To Send. Strap "q" must be in the reverse position.
q	In	In	Clear To Send follows Carrier Detect. Strap "p" must be in the reverse position.
r	Out	Out	Enables speed indication C1 to RS-232-C pin 12.
s	In	Out	When strap "s" is In, RS-232-C pin 25 controls ALB and Busy Out. When strap "s" is Out, RS-232-C pin 25 controls Busy Out and RS-232-C pin 20 is required for ALB.
t	In	Out	Connects receive clock (SCR) to RS-232-C pin 17.
u	Out	In	Disables RS-232-C pin 25 control of the Busy Out ALB circuitry. (MXE ECO) strap must be out
v	In	Out	Connects transmit clock to RS-232-C pin 15.

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#30125

III:H.10 (7401)  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS (CONTINUED)

<u>Switch</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function</u>
w	In	Out	Enables receive data to the interface during Response To Remote Test (RTRT). Strap "h" must be in the reverse position.
x	In	In	Enables the operation of the DATA/AANS/OFFL switch on the modem front panel.
y	Out	In	Selects microprocessors's internal ROM.
ba	Out	Out	When in, modem will assert a logic high on pin 25 of RS-232-C connector J3 during test. (strap "ab" must be out.) When out pin 25 does not provide test indication.
ab	Out	In	Modem busies out line when logic HIGH applied to pin 25 of RS-232-C.
ac	In	Out	Modem busies out line when logic HIGH applied to pin 18 of RS-232-C connector.
ad	Out	Out	Modem internal program memory set to 4K.
ae	In	In	Modem internal program memory set to 2K.



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#30125

III.H.10 (7401)  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS (CONTINUED)

<u>Switch</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function</u>															
A1	On	On	Manual Disconnect: When On, this switch sets the modem in the manual disconnect mode. In this mode, the exclusion key of an exclusion-key telephone is placed in the DATA position to connect a call, and the handset is hung up only to break the connection. When Off, this switch sets the modem in Unattended Disconnect mode. In this mode, the telephone handset is hung up to make a connection, and disconnect is controlled through loss of carrier or by TR turning off (this mode requires the telephone to be optioned for data set control of the line).															
A2	On	On	Respond to Remote Test - When On, this switch allows the modem to respond to the remote test command from a WA3451 or 212A-type modem (High-speed mode only).															
A3	Off	On	Character Length - These switches select the character length for asynchronous data transfer. The character length option includes the start bit, information bits, parity bit (if used), and stop bits.															
A5	Off	Off																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>&gt; Switch A3</th> <th>&gt; Switch A5</th> <th>&gt; Character Length</th> </tr> </thead> <tbody> <tr> <td>&gt; On</td> <td>&gt; On</td> <td>&gt; 8 bits</td> </tr> <tr> <td>&gt; Off</td> <td>&gt; On</td> <td>&gt; 9 bits</td> </tr> <tr> <td>&gt; On</td> <td>&gt; Off</td> <td>&gt; 10 bits</td> </tr> <tr> <td>&gt; Off</td> <td>&gt; Off</td> <td>&gt; 11 bits</td> </tr> </tbody> </table>				> Switch A3	> Switch A5	> Character Length	> On	> On	> 8 bits	> Off	> On	> 9 bits	> On	> Off	> 10 bits	> Off	> Off	> 11 bits
> Switch A3	> Switch A5	> Character Length																
> On	> On	> 8 bits																
> Off	> On	> 9 bits																
> On	> Off	> 10 bits																
> Off	> Off	> 11 bits																
A4	On	On	Enable 103 Mode Operation - When On, this switch enables 103J operation.															

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#30125

III.H.10 (7401)  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS (CONTINUED)

<u>Switch</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function</u>
A6	On	Off	Enable Option Switches - When Off, switch forces the modem into the Standard Async configuration. When On, the configuration of the modem is controlled by the individual switch settings. The modem is shipped with this switch On, and the option switches set to enable 2200 RTC mode.
A7	On	On	Carrier Loss Disconnect - When On, this switch enables disconnect on 1-second loss of carrier.
B1	On	On	Initiate Remote Test - When On, this switch enables the Initiate Remote Test sequence in WA3451 and 212A modes. When Off, this switch will cause the modem to enter local digital loopback when DLB is selected in either WA3451 or 212A mode.
B2	Off	Off	Force DTR - When this switch is On, the modem will internally force on Data Terminal Ready.
B3	Off	Off	Answer Only - When this switch is On, the modem will enter answer only mode.
B4	Off	Off	Select 1220 bps - When On, this switch sets the internal transmit clocking at 1220 bps for use on time division multiplexers, or other terminal equipment that runs overspeed (WA3451 mode only).
B5	On	On	Enable Abort Timer - When On, this switch enables the 24-second abort timer.

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#30125

III.H.10 (7401)  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG 3451 MODEM SWITCH AND STRAP SETTINGS (CONTINUED)

<u>Switch</u>	<u>2200 RTC Mode Setting</u>	<u>Standard Async Setting</u>	<u>Function</u>
B6	Off	Off	Synchronous Operation - When On, this switch enables synchronous operation, allowing the transmit clock (SCT) signal to be present on RS-232-C pin 15, and the receive clock (SCR) to be present on RS-232-C pin 17.
B7	Off	Off	Force DSR Off. in Test Mode - When On, this option turns Data Set Ready off in any test mode.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20928

III.H.10  
PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: W3451 MODEM (725-Q110)

There has been confusion associated with the strapping options, switch settings, and ECO information on the Wang 3451 modem.

The following is a brief history on the modem which will help clarify any confusion.

The modems received from Racal-Vadic are made specifically for Wang. They have three switches on the front panel and the Wang logo is printed on the modem. These modems are pre-set at the factory for 11 bit asynchronous operation and all switch settings and strap options are also pre-set. These modems, although set for 11 bit operation, will work with systems that use 10 bit operation. The modem will make this change automatically; NO switch or strap changes are required.

E C O

An ECO was performed on the modem by Racal-Vadic to allow the new MXE controller to run remote diagnostics. This ECO required three strap changes, K-IN, N-IN, and U-OUT. Resistor R93 is removed and etches 2 and 4 of RN1 are cut on the on-component side of 81164 PCB. Only modems that will be used with the MXE require this ECO. Several hundred modems were shipped previous to this ECO and do not require implementation.

P R O B L E M

A small number of modems were released to the field with only part of the ECO completed. The modem would go into analog loopback when in the idle state and switch A6 on. The field fix for this was to install the U strap. Unfortunately a second problem occurred with these modems. Pin 21 (initiate remote test) may float high on occasion and cause the modem to go into the test mode. This in turn may be transmitted to a remote terminal and displayed as parity errors.

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NEWSLETTER

#20928

III.H.10

PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WA3451 MODEM (725-0110) (CONTINUED)

S O L U T I O N

The ~~proper~~ solution is to return the modem to Home Office stating on the return tag that the ECO needs to be performed. Wang will then receive proper credit from Racal-Vadic. The ~~temporary~~ field fix was to remove pin 21 from the cable or remove the N strap. THIS IS NOT ADVISABLE NOR IS IT HOME OFFICE POLICY.

The TAC newsletter #20907, Category III.H.10 states problem and fix as removing the N strap or pin 21. If experiencing this type of problem, first check modem for ECO. If not completely installed, return the modem to Home Office stating on return tag that ECO needs to be performed. Do not remove any pins from cable or straps from board.

M A N U A L # 7 2 9 - 0 9 9 7 E R R O R

The original Wang modem manual has an error on connector pin assignments. The manual states pin 19 as (RDL) initiate remote test. This should be pin 21. The error appears on pages 5-6, 5-7, 6-2.

T E L C O C O N N E C T I O N S

The modem has four wires that can be connected to the telco line. Under typical operation, two wires (tip & ring) are used. These are color coded in the modem as red/green. The other two wires black & yellow should be disconnected. The modems are shipped with T connectors that should have only two pins attached in the modem side of the connector. Check this T connector for correct option.

All feedback from the field is welcome, as these problems were discovered and reported to Home Office by field personnel.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#11117

III.H.10

PERIPHERALS-OTHER-MODEMS (RACAL-VADIC)

TOPIC: WA 3451 MODEM PART #Z25-0110

Several WA3451 modems were released to the Field missing a strap (U) on the bottom board (81164). This will cause the phone to be in the busy mode. A clear indication of this problem upon powering up the CXR (Carrier Detect) is ON, and DSR (Data Set Ready) blinking. To correct this problem, refer to C.E. Manual # (729-0997) P. 5-4. Add (U) strap as indicated on the bottom board (81164).

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20713

III.H.10.

PERIPHERALS-OTHER-MODEMS (RACAL-VADIC).

TOPIC: WANG MODEM WA3451

In some cases, before Telco allows the attachment of the WA3451 to their lines, they may ask for the following:

The FCC registration # is AJ496M-67213-DM-N

Ringer equivalence: 0.9B

The Telco Data phone USDC is RTC 503 for rotary dial  
or RTC 2503 for touch tone dial.

This information is in the Racal-Vadic manual #729-0997.

TECHNICAL SERVICE BULLETIN

SECTION: HardWare General

NUMBER: HWG 5027 REPLACES: \_\_\_\_\_ DATE: 07/30/85 PAGE 1 OF 1

MATRIX ID. 7407 PRODUCT/RELEASE# Telecommunications

TITLE: Gandalf 444/454 Modems

PURPOSE:

To notify the field of a potential problem using a Gandalf 444/454 modem.

EXPLANATION:

We have reports from the field that when the Gandalf 444/454 modem is used on a multi-drop line, and strapped to switched carrier, it will generate a tone on the line when:

1. The equipment on the modem is powered off.
2. An unterminated RS-232-C cable is connected to the modem.

This creates noise on RTS, TX and RX.

CORRECTIVE ACTION:

Field representatives encountering this problem should have the customer contact the nearest Gandalf representative for repair/replacement.

ADDITIONAL INFORMATION:

A faulty modem can be detected using a data scope, Bert test or running the analog loop back test. The tone on the line can be detected using a Butt set (phone hand set).

GROUP: Telecommunications Networking Support Group MAIL STOP: 0115A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.



TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare Technical

NUMBER: SWT 5046 REPLACES: SWT 5020 DATE: 05/07/85 PAGE 1 OF 1

MATRIX ID. 7622 PRODUCT/RELEASE# VS 2.2, 2.16, 2.19

TITLE: Tandem Dial Signal on 801C Auto Call Units

PURPOSE:

To clarify the Wang Systems Networking implementation of Bell 801C signalling requirements.

EXPLANATION:

Bell 801C Auto Call units will accept either Binary A (1010) or Binary D (1101) as a tandem dial (wait for second dial tone) signal across RS-366 pins 14 through 17. Binary (A) is produced by entering a colon (:) in the telephone number to be dialed; a Binary (D) by entering an asterisk (\*).

CORRECTIVE ACTION:

Wang Systems Networking implements this signalling in a slightly different manner. A Binary (A) is produced by entering an asterisk (\*) in the telephone number dialed; a Binary (D) by entering a colon (:).

ADDITIONAL INFORMATION:

Many A.C.U. manufacturers allow for Binary (A) or (D) via strapping options. If a customer is experiencing problems with auto-dial be sure to check these settings.

GROUP: Telecommunications Networking Support Group MAIL STOP: 0115A

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

TECHNICAL SERVICE BULLETIN  
SECTION: HardWare Technical

NUMBER: HWT 5085 REPLACES: \_\_\_\_\_ DATE: 04/16/85 PAGE 1 OF 1

MATRIX ID. 7201 PRODUCT/RELEASE# 9.6 FAM

TITLE: FCO 1118, 9.6 Frequency Agile Modem

PURPOSE:

To announce release of FCO 1118.

EXPLANATION:

FCO 1118, released March 29, 1985, documents ECO's 34028 and 36078.  
A 1.0 Amp fuse is replaced with a .5 Amp fuse on the rear panel of the  
FAM. This prevents the possibility of a overheated transformer.

FCO Kit #728-0136 will be available April 16, 1985. To obtain it, place  
a routine order through the Logistics Order Processing System.

GROUP: ECO Support Group MAIL STOP: 0122

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

Copy from  
...  
...

FYI  
Scott

**WANG**

LABORATORIES, INC.

18 1982  
RECEIVED BY

MEMORANDUM

MAY 20 1982

TO: PETER THORNTON 1309B  
TIM SLOANE 1309B  
CC: SCOTT JOHNSON  
GARY SMITH 1209  
SUBJECT: WA 3451

FROM: IBRAHIM AZAR  
MS/8250 X6130  
DATE: MAY 17, 1982  
DOC #: 1562N  
HET KASPRZAK

XC ATIS  
Keith Foster  
Mark McCawley  
Burt Kinball  
Mark Walker  
FYI  
OJK

One week ago C. E. Training group received six WA3451 and none of them will interface with 2236DE terminals.

The following problems were discovered:

1. Racal-Vadic did not implement the ECN to make it compatible with MXE. This ECN consists of removing R93 and cut Pin 2 and Pin 4 at RN1.

A clear indication of this problem upon powering up the WA 3451 CXR (Carrier Detect) is ON, DSR (Data Set Ready) blinking and CTS (Clear To Send) is ON which means it is performing DLB (Digital Loop Back) test.

2. When WANG incoming QC (Manufacturing) notices this indication instead of notifying the vendor (Racal-Vadic) they solve the problem in item No. 1 by changing the position of switch A-6 to the open (OFF) position. Unfortunately (A-6) in the OFF position supports only 10 bits.

I notified Racal-Vadic and they already fixed WA3451 in CE stock room and Manufacturing for a total of 157 modems.

Unfortunately we do not know the quantity of modems that were shipped to the field prior to discovering the above problems. If you could help us on this matter, specifically customer locations where these modems were shipped, it will expedite the solution of this problem.

Regards,

*Ibrahim Azar*

Ibrahim Azar

WE WILL FORWARD ANY INFORMATION  
IA/nsp AS WE RECEIVE IT.

*[Signature]*

**CUSTOMER ENGINEERING**

# PUBLICATION UPDATE BULLETIN

DATE: 01/17/84

This PUB: 729-1217-A1

Class Code: 7202

Base Document: 729-1217-A

Previous Notice(s):None

---

**REASON FOR CHANGE:**

This PUB contains specifications and part numbers for the Global Modem. This modem will expand the Peripheral band to cover 32 channels. It will replace the 6 channel modem which was initially included with the NETMUX.

---

**INSTRUCTIONS:**

Remove pages and insert attached pages as follows:

	REMOVE	INSERT
1.	i, ii, iii, iv	i, ii, iii, iv
2.	1-1, 1-2, 1-3	1-1, 1-2, 1-3, 1-4
3.	4-1, 4-2	4-1, 4-2
4.	5-3, 5-4	5-3, 5-4
5.		
6.		
7.		
8.		
9.		
10.		

This page is to be used as a permanent record of revisions; place it directly following the title page.



LABORATORIES INC

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 459-5000. TWX 710 343-6769. TELEX 94-7421

PRINTED IN U.S.A.

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## CHAPTER 1

## INTRODUCTION

1.1 SCOPE & PURPOSE

This manual contains information necessary to unpack, install and maintain the Wang NETMUX. Included is a functional block level theory of operation, installation instructions, corrective maintenance, schematic diagrams and troubleshooting information. With the aid of this manual the Customer Engineer will be able to make all necessary cable connections, perform initial turn-on and system checkout, make necessary adjustments, analyze failures and troubleshoot faults down to the major component and board level and remove and replace major components.

1.2 APPLICABLE DOCUMENTS

The following documents contain additional information on the WangNet system:

<u>Title</u>	<u>Wang Part No.</u>
WangNet Backbone	729-1102-A
OIS Master Cable Interface Processor Board	729-1223-A
VS Master Data Link	729-1268-A
WangNet Cable Kit	729-1183

The address for ordering the above documents follows:

Wang Laboratories, Inc.  
 c/o (your Area Representative)  
 437 South Union Street  
 Lawrence, MA 01843

1.3 GENERAL DESCRIPTION

The NETMUX is a stand-alone unit that allows up to eight serial OIS slaves to communicate with a polling unit on a Peripherals Band channel on the WangNet system. The unit contains a 4.27 Megabit frequency agile modem, a switching power supply and a digital logic section.

The MUX section provides for connection of up to eight serial devices which are connected to eight pairs of TNC/BNC connectors. This section monitors the WangNet through the modem and functions to decode instructions and data received from the master, convert it to standard serial format and move it on to the slave. It is always in a receive state with respect to the master and a transmit state with respect to a slave unless instructed by the master to pass data from the slave on to the master.

The modem provides the interface to the WangNet system. Data is transmitted at a 4.27 Megabit/sec. rate and modulation is accomplished by phase shift keying of the RF carrier. A six channel modem was originally included in the NETMUX. This modem provided six selectable frequencies in the range 97.5 to 145.5 MHz. The channels are separated by 8 MHz spacing and there are two guard bands at 82-97 MHz and 146-172 MHz. The modem connects to the WangNet system via a pair of coaxial cables (one for transmit and one for receive). The six channel modem may be externally filtered with a low pass (0-160 MHz) filter to prevent harmonic interference in the video and CIU areas of WangNet if an interference problem occurs.

A global modem is now available which extends the Peripheral Band frequency band from 101.55 MHz to 348.94 MHz, occupying 32 channels. Of these 32 channels, only 19 will be used - the original six (0-5) and 19-31. The other channels (6-18) will be suppressed through hardware filtering and software EPROM channel selection to prevent conflict in the video and CIU area.

#### 1.4 SPECIFICATIONS

##### 1.4.1 6 CHANNEL MODEM SPECIFICATIONS

###### 4.27 Mbps Modem Electrical Characteristics

Mode	Half duplex, polling, asynchronous
Data Format	Asynchronous, binary, serial
Modulation	Two-level PSK
Data Rate	4.27 Mbps
RF Interface Imped.	75 ohms unbalanced
Center Frequency	101.5 to 141.5 MHz
Channel Spacing	8.0 MHz
Frequency Stability	.01%
Transmit Level	+55 dBmv, adjustable <u>+5</u> dB
Transmit Disable Level	-50 dB min.
Transmit Spurious Level	Out of band -50 dB *In band -40 dB
Carrier Turn-On Time	**2 microsecond max.
Receiver Input Level	+5 dBmv nominal
Receiver Sensitivity	-5 dBmv min.
Image Rejection	40 dB min.
Carrier Detect Level	-1 dBmv, adjustable <u>+6</u> dB
Carrier Detect Time	**3.0 microseconds
Error Rate	$1 \times 10^{-8}$ within <u>+5</u> dB of nominal RX input level

\* 84 mHz product excepted.

\*\* Spec. depends on Saw filter transit time. TBD.

###### Modem Power Requirements

+12V @ 250 ma.  
+5V @ 1 amp.  
-12V @ 25 ma.

## 1.4.2 GLOBAL MODEM SPECIFICATIONS

4.27 Mbps Modem Electrical Characteristics

Mode	Half duplex, polling, asynchronous		
Data Format	Asynchronous, binary, serial		
Modulation	Two-level PSK		
Data Rate	4.27 Mbps		
RF Interface Imped.	75 ohms unbalanced		
Center Frequency	101.5 to 348.9 MHz		
Channel Spacing	7.98 MHz		
Frequency Stability	.01%		
Transmit Level	+45 dBmv, adjustable +3, -5 dB		
Transmit Level Flatness	+3 dB		
Transmit Disable Level	-55 dB		
Transmit Spurious Level			
	<u>Band (mHz)</u>	<u>Additive</u>	<u>Non-additive</u>
	10-82, 170-218	72	55
	82-170, 218-350	50	45
	350-400	55	50
Carrier Turn-On Time	3 microsecond max.		
Receiver Input Level	+5 dBmv nominal		
Image Rejection	50 dB min.		
Carrier Detect Level	-10 dBmv, adjustable <u>+6</u> dB		
Carrier Detect Time	3.0 microseconds		
Error Rate	1 x 10 <sup>-8</sup> within <u>+5</u> dB of nominal RX input level		

Modem Power Requirements

Approximately 10 watts with the following outputs:

+12V +5% @ 600 ma. nominal  
 +5V +5% @ 1 amp. nominal  
 -12V +5% @ 250 ma. nominal

## 1.4.3 NETMUX OVERALL POWER REQUIREMENTS

+5V @ 6 amps max.  
 +12V @ 500 ma. max.  
 -12V @ 30 ma. max.  
 -5V @ 60 ma. max.

1.4.4 NETMUX ENVIRONMENTAL REQUIREMENTS

Temperature: 10C to 32C (50F to 90F) Operating  
 -18C to +50C (0F to 120F) Storage (packed)  
 -40C to +60C (-49F to +140F) Transit (packed)

Relative humidity: 35% to 65% non-condensing operating (recommended)  
 20% to 80% non-condensing operating (allowable)  
 10% to 90% storage (packed)  
 5% to 95% transit (packed)

Altitude: 10,000 feet (operating)  
 50,000 feet (non-operating)

Physical Dimensions:      Width                  Depth                  Height  
    7.5 in.                  14 in.                  10.5 in.

Weight:                                  15 lbs (6.8 kg)

1.5 GLOBAL MODEM FREQUENCY ALLOCATIONS

Channel Spacing = 7.9805825 mHz. Will use Channels 0-5 and 19-38 only.

<u>Channel</u>	<u>Frequency</u>		<u>Channel</u>	<u>Frequency</u>	
0	101.5485431 mHz				
1	109.5291256		14	213.2766981	
2	117.5097081		15	221.2572806	
3	125.4902906		16	229.2378631	
4	133.4708731		17	237.2184456	
5	141.4514556		18	245.1990281	
-----					
6	149.4320381	↑ VIDEO ↓	19	253.1796106	
7	157.4126206		20	261.1601931	
8	165.3932031		21	269.1407756	
9	173.3737856		22	277.1213581	
10	181.3543681		23	285.1019406	
11	189.3349506		24	293.0825231	
12	197.3155331		25	301.0631056	
13	205.2961156		26	309.0436881	
-----					
				27	317.0242706
			28	325.0048531	
			29	332.9854356	
			30	340.9660181	
			31	348.9466006	

## CHAPTER 4

### INSTALLATION

#### 4.1 UNPACKING

Before unpacking the NETMUX, inspect the shipping carton for damage. Then carefully open the carton, remove the unit and inspect it for damage. Also, check that the following items are included and inspect them for damage:

<u>Item</u>	<u>Part No.</u>
Power cable	420-2019
External filter	279-0298
Six inch Cable	220-0322
RF interconnecting cable (10 ft.)	220-0294
Standard Maintenance Manual	729-1217-A

If damage is discovered, file an appropriate claim promptly with the carrier involved and notify the WLI Distribution Center (Dept. #90), Quality Assurance Dept., Tewksbury, MA 01876. Inform them of the extent of damage and arrange for equipment replacement if necessary.

#### 4.2 MINIMUM REVISION LEVELS

The circuit board and EPROM revision levels should be checked in order to assure system compatibility. The procedure for removing the boards is covered in Chapter 5. Minimum electrical revision levels are listed below:

<u>Board</u>	<u>E Rev</u>
CPU (210-8350-A)	R1
TX/RX (210-8351)	R2
Mother Bd. (210-8352)	R1

The manufacturing ID for the NETMUX unit appears on the diagnostic EPROM located on the 210-8350-A CPU board (See Figure 4-1). The number should be checked to verify that it is correct. Also, check that it agrees with the ID number shown on the unit serial number label.

There are two revisions of EPROM. Rev 0 is used with F 7.5 - F 7.8 OIS starters while Rev 1 requires F 9.0 starter for OIS usage or VS usage.

#### 4.3 SYSTEM INTERCONNECTIONS

Figure 4-2 shows the interconnections from NETMUX to WangNet and to datalink devices. Datalink devices must be connected to the proper terminals in accord with the system configuration table. The transmit and receive cables going to the modem are color coded and have opposite threads to match the connectors on the modem. The silver connector has a right hand thread and the gold connector is left hand threaded to prevent cross connecting the cables.

NOTE

When 4.27 megabit modems are connected to WangNet, interference problems may occur on the Utility (video) and Wang bands. To avoid this problem an external filter may be connected in the transmit cable to all modems. The filter should be installed only if a problem exists. The proper installation is shown in Figures 4-3 and 4-4.

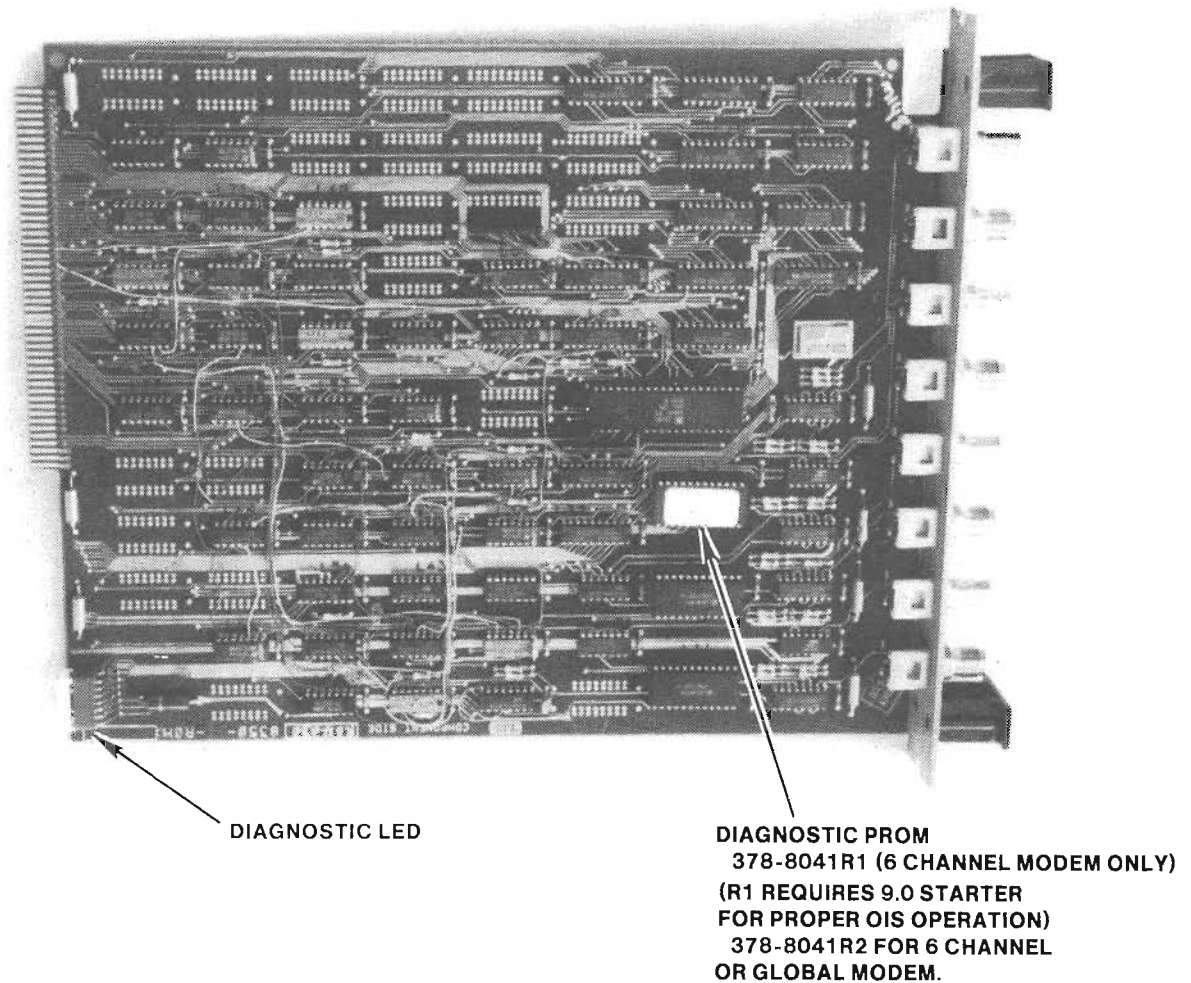


Figure 4-1 210-8350-A CPU Board

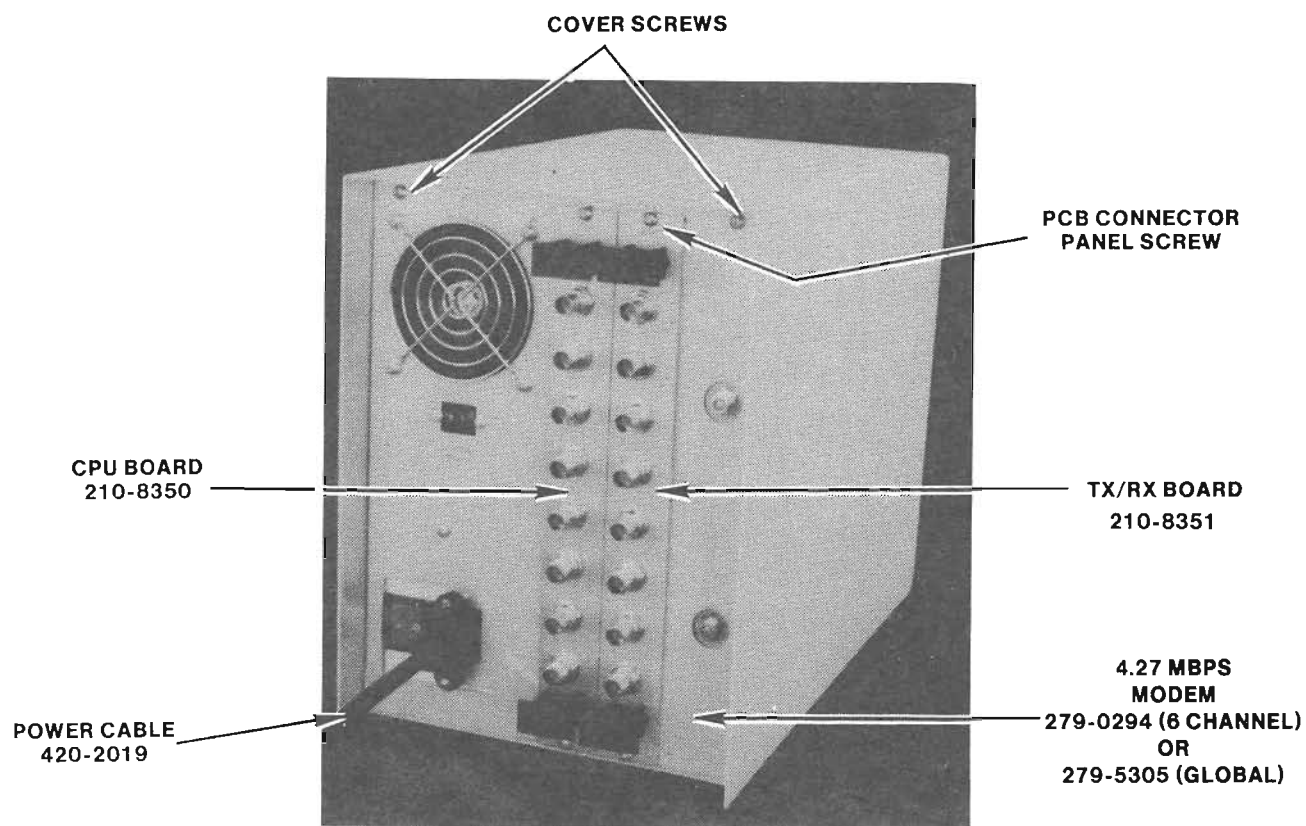


Figure 5-1 Rear of Unit

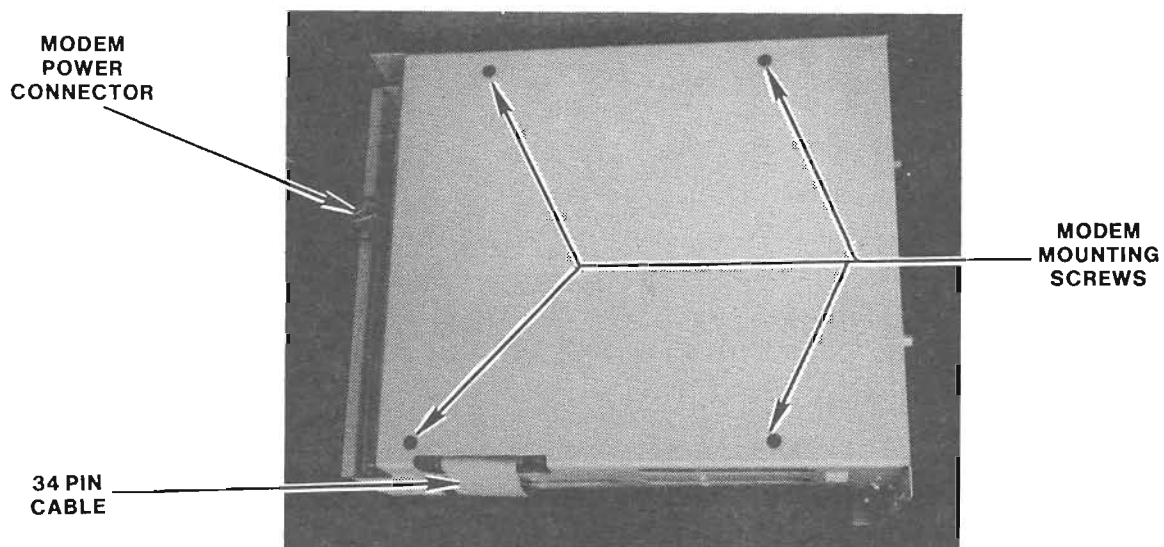


Figure 5-2 Modem Mounting

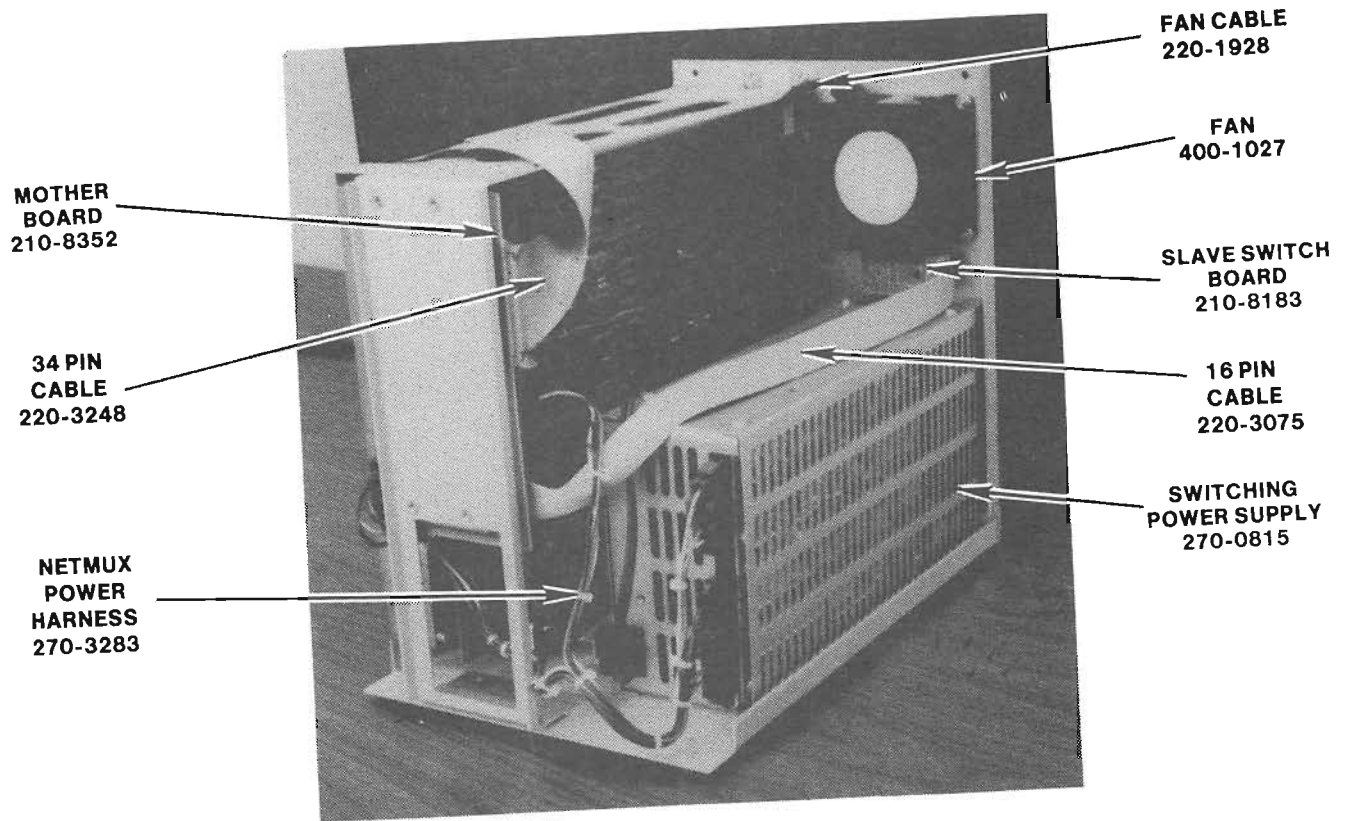


Figure 5-3 Internal Components

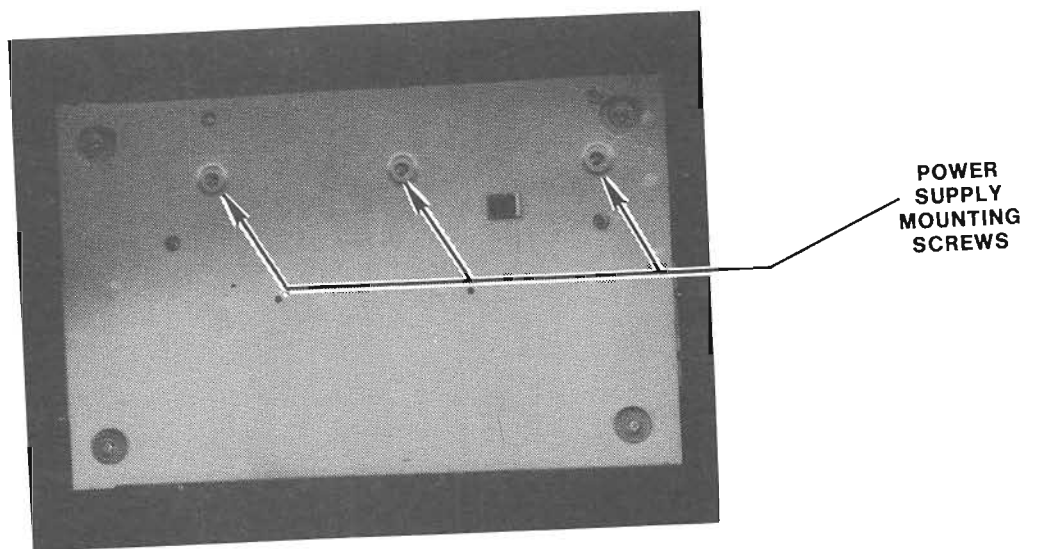


Figure 5-4 Power Supply Mounting





TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare Technical

NUMBER: SWT 5020 REPLACES: \_\_\_\_\_ DATE: 03/26/85 PAGE 1 OF 1

MATRIX ID. 7622 PRODUCT/RELEASE# OIS 2.7; VS 2.2, 2.16, 2.19

TITLE: Tandem Dial Signal on 801C Auto Call Units

PURPOSE:

To clarify the Wang Systems Networking implementation of Bell 801C signalling requirements.

EXPLANATION:

Bell 801C Auto Call units will accept either Binary A (1100) or Binary D (1101) as a tandem dial (wait for second dial tone) signal across RS-366 pins 14 through 17. Binary (A) is produced by entering a colon (:) in the telephone number to be dialed; a Binary (D) by entering an asterisk (\*).

CORRECTIVE ACTION:

Wang Systems Networking implements this signalling in a slightly different manner. A Binary (A) is produced by entering an asterisk (\*) in the telephone number dialed; a Binary (D) by entering a colon (:).

ADDITIONAL INFORMATION:

Many A.C.U. manufacturers allow for Binary (A) or (D) via strapping options. If a customer is experiencing problems with auto-dial be sure to check these settings.

GROUP: Telecommunications Networking Support Group MAIL STOP: 0127

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

# Service Newsletter

NO. 109

February 23, 1978

TELEPROCESSING #5

2200 SERIES TELECOMMUNICATION CONTROLLERS ECNS

ECN #7967 PRODUCT 2228B PCB NO. 7224

1. Cut the etch between L7-9 and L6 pins 2 and 6.
2. Cut the etch between L3-1 and resistor R12 (10K) (other end of resistor is tied to +5V).
3. Cut the etch between L3-1 and a test point.
4. Add jumper wire between L3-1 and L7-9.
5. Add a jumper wire between L6-7 (L6 pins 3, 7, 10 and 14 are tied to resistor R5-1K so any of these pins will do) and L6 pins 2 and 6 (pins 2 and 6 are tied).
6. Change EIZ level from 1 to 2.

REASON: This change corrects the design error and allows for bi-sync null modem to be connected so as to communicate to another 2228, 2228B, 62B, WPS-TC or any other compatible host CPU without requiring modem and use of telephone lines.

ACTION REQUIRED: Perform on customer complaint or requirement basis. Repair depot must perform the ECN on boards coming in for repair.

PRODUCT 2228B

ECN NO. 8143

Change PROM From: 378-2060R2  
To: 378-2060R3

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PRODUCT 2227B

ECN NO. 8144

Change PROM From: 378-2015R5

To: 378-2015R6

PRODUCT OPT. 62

ECN NO. 8145

Change PROM From: 378-2065R1

To: 378-2065R2

PRODUCT OPT. 62B

ECN NO. 8146

Change PROM From: 378-2060R2

To: 378-2060R3

REASONS:

- 1) Make break feature work (ECN #7967 must be done on 2228B).
- 2) Fix decrementing of EOR (End Of Record) counter when EOR code is translated into HEX '80'.
- 3) Disconnect feature, if used, leaves data terminal ready signal OFF until set CCV is executed.

ACTION REQUIRED: Above ECN must be performed on customer complaint basis. Repair depot must upgrade boards coming in for repair to above level.

# Service Newsletter

NO. 60

TELEPROCESSING #2

August 23, 1976

## 2227B ASYNC CONTROLLER PRELIMINARY SERVICE BULLETIN CORRECTION

The 2227B Asynchronous Controller Preliminary Service Bulletin has an error in the connector pins in Figure 1 (page 5). The figure below shows the correct numbering.

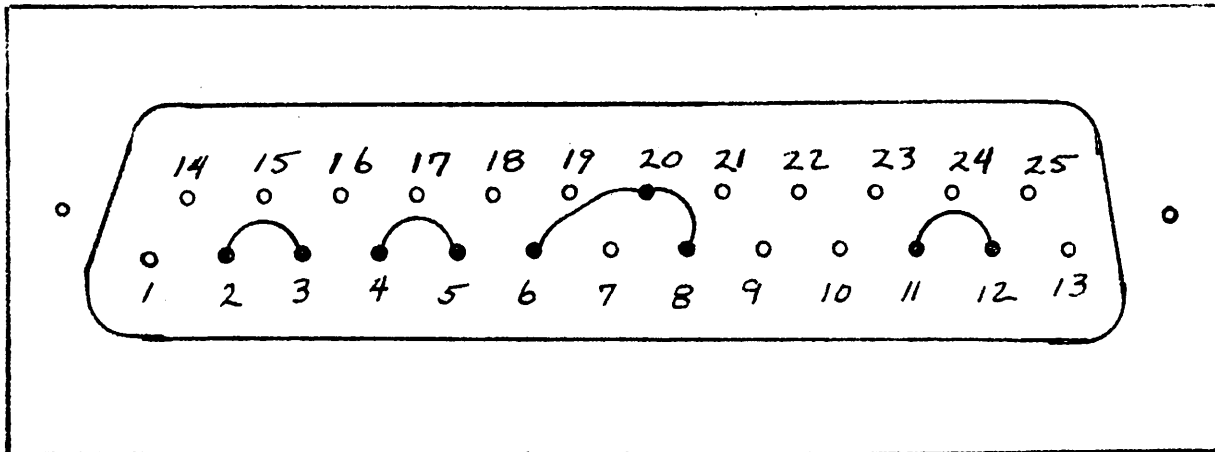


FIGURE 1 CONNECTOR JUMPER

Jumper	PIN	to	PIN
	2		3
	4		5
	11		12
	6		20
	20		8

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<b>NO.</b> 117	<b>DATE:</b> 7/12/76
<u>ITEM(S) / PRODUCT(S):</u> 2200 #3    2227B DIAGNOSTIC INFORMATION AS OF JULY 7, 1976	

Several errors have been discovered in the 2227B microcode. Two revisions of the PROM on the 6730 PC Boards have been shipped to customers; 378-2015 and 378-2015 R1.

PROM REVISION R1 CORRECTS THE FOLLOWING MICROCODE ERRORS:

1. No break.
2. Even and odd parity bits are switched.

PROM REVISION R2 CORRECTS THE FOLLOWING MICROCODE ERRORS:

1. Parity/framing error at rates higher than 300 BAUD.

CURRENT KNOWN BUGS IN 2227B MICROCODE NOT YET CORRECTED ARE:

1. Disconnect does not work. To disconnect the line, hang up the telephone.
2. Transmission code translation where SHIFT INSERT/DELETE is specified is not working, e.g.:
  - a. TELEX to 5 level BAUDOT.
  - b. 2741 to 6 level CORRESPONDENCE.

R2 PROMS will be shipped to service offices that have 2227B controllers in their area. A diagnostic tape will accompany the R2 PROMS shipped to the service offices. The diagnostic tape contains test programs and the TTY Emulator package. Tape copies of the TTY Emulator and 2227B TTY Emulator instruction sheet should be distributed



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by field personnel to 2227B customers to provide the user with a sample 2227B operating program. The TTY Emulator can be used with WYLBUR (IBM 370) in Burlington, Mass. The procedure for sign on is the same as that used for 2227 (see below).

#### EMULATOR PACKAGE

##### 2227B KEYBOARD/TIME SHARE INTERACTION

S.F. '1 = EMULATE TELETYPE 110 BAUD  
S.F. '2 = EMULATE TELETYPE 300 BAUD  
S.F. '3 = EMULATE TELETYPE 1200 BAUD  
S.F. '14 = PRINTER ON/OFF LINE FLAG

RECEIVED ERRORS WILL DISPLAY AS FOLLOWS:

PARITY = ↑ (or ~) = HEX 7E  
OVERRUN = .OVERRUN  
FRAMING = ← (or ::) = HEX 7F

SF 1 & SF 2 EMULATE TELETYPE AT 110 & 300 BAUD

WYLBUR 617 272 8120

GTWX (FOLLOW INSTRUCTIONS IN S.B. 59)

SF 3 = EMULATE TELETYPE 1200 BAUD

WYLBUR 617 272 7420

↑TWX (FOLLOW INSTRUCTIONS IN S.B. 59)

SF 14 = PRINTER ON/OFF LINE FLAG

HARD COPY OF RECEIVED DATA

##### 2227B DIAGNOSTIC

S.F. '1 = 1 BOARD ENTRY--LOOPBACK CONNECTION ADDR.=01C  
S.F. '2 = 2 BOARD ENTRY--CABLED TOGETHER ADDR= 1C AND 1F  
S.F. '3 = 2 BOARD TEST (VARYING BAUD RATE)  
S.F. '13 = BREAK TEST  
S.F. '14 = SHOW CSV  
S.F. '15 = SHOW CCV

SF 1 = 1 BOARD ENTRY - LOOPBACK CONNECTION CHECKS OUT ONE 2227B USING  
THE TEST CONNECTOR



## 2227B TTY EMULATOR

DATE: July 9, 1976

**ABSTRACT:** This program causes a Wang system 2200 or WCS system to look like a teletype to a foreign computer system. The program would typically be used to interface a Wang system to a time-sharing system that supported teletypes as terminal I/O devices.

**REQUIREMENTS:** Wang system 2200 with 8K of memory and option 2 (I/O ROM) or WCS 20/30. The system requires a Wang system 2227B asynchronous controller board. The program uses keyboard/CRT and an optional line printer.

**SUPPORT:** The teletype emulator is designed to interface with a time-share system at 110, 300, or 1200 baud. Interaction at each baud rate is activated by keying a special function key to activate a particular entry point in the program. The user may easily modify the control parameters at a particular entry point to interface with a particular time-share system. Refer to the 2227B reference manual for a description of control parameters.

**OPERATION:** mount the program  
Key CLEAR (EXEC), LOAD DCF "27B\*TTY" (EXEC), RUN (EXEC).

The CRT will blank and the following sequence appear  
2227B KEYBOARD/TIME SHARE INTERACTION

S.F. '1 EMULATE TELETYPE 110 BAUD  
S.F. '2 EMULATE TELETYPE 300 BAUD  
S.F. '3 EMULATE TELETYPE 1200 BAUD  
S.F. '14 PRINTER ON/OFF FLAG  
RECEIVED ERRORS WILL DISPLAY AS FOLLOWS:  
PARITY=↑  
OVERRUN=.OVERRUN  
FRAMING= (LEFT ARROW)

STOP KEY DESIRED START-UP

When special function key '2 is depressed the following sequence would appear on the CRT.

EMULATE TTY 300 BAUD  
1 STOP BITS---300 BAUD--HALF W/DEL MODE--ENABLE T/R BREAK--  
7 DATA BITS---EVEN PARITY  
S.F. KEYS MAY BE USED TO SEND CONTROL CODE EQUIVALENTS  
E.G. '27=HEX(1B)=ESCAPE  
'17=HEX(11)=X-ON  
S.F. '14 PUTS OUTPUT ON/OFF LINE PRINTER  
S.F. '15 IS PROGRAMMED TO SEND A BREAK SIGNAL  
KEYBOARD/T.C. NOW ACTIVE



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## 2227B TTY EMULATOR

DATE: July 9, 1976

**ABSTRACT:** This program causes a Wang system 2200 or WCS system to look like a teletype to a foreign computer system. The program would typically be used to interface a Wang system to a time-sharing system that supported teletypes as terminal I/O devices.

**REQUIREMENTS:** Wang system 2200 with 8K of memory and option 2 (I/O ROM) or WCS 20/30. The system requires a Wang system 2227B asynchronous controller board. The program uses keyboard/CRT and an optional line printer.

**SUPPORT:** The teletype emulator is designed to interface with a time-share system at 110, 300, or 1200 baud. Interaction at each baud rate is activated by keying a special function key to activate a particular entry point in the program. The user may easily modify the control parameters at a particular entry point to interface with a particular time-share system. Refer to the 2227D reference manual for a description of control parameters.

**OPERATION:** mount the program  
Key CLEAR (EXEC), LOAD DCF "27B\*TTY" (EXEC), RUN (EXEC).

The CRT will blank and the following sequence appear  
2227B KEYBOARD/TIME SHARE INTERACTION

S.F. '1 EMULATE TELETYPE 110 BAUD  
S.F. '2 EMULATE TELETYPE 300 BAUD  
S.F. '3 EMULATE TELETYPE 1200 BAUD  
S.F. '14 PRINTER ON/OFF FLAG  
RECEIVED ERRORS WILL DISPLAY AS FOLLOWS:  
PARITY=↑  
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FRAMING= (LEFT ARROW)

STOP KEY DESIRED START-UP

When special function key '2 is depressed the following sequence would appear on the CRT.

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E.G. '27=HEX(1B)=ESCAPE  
'17=HEX(11)=X-ON  
S.F. '14 PUTS OUTPUT ON/OFF LINE PRINTER  
S.F. '15 IS PROGRAMMED TO SEND A BREAK SIGNAL  
KEYBOARD/T.C. NOW ACTIVE

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# Service Newsletter

NO. 77

TELEPROCESSING #3  
2227B PROM CHANGE

November 22, 1976

## 1. DESCRIPTION

A revised 2708 PROM chip (378-2015R3) for the 2227B asynchronous telecommunications controller board has been released by ECN 5983. The revised PROM corrects several deficiencies and offers several improvements over the previously released PROM 2015 R2.

The new PROM can be ordered from Burlington. This change should be implemented on a next call basis.

The differences between PROMs 2015R2 and 2015R3 include:

- a) The disconnect function is now operable.
- b) The transmit code translation with shift character insertion selected is now operable.
- c) Sending of a BREAK signal will not terminate the receive sequence.
- d) Transmission mode has been modified. ECHOPLEX mode has been deleted. FULL DUPLEX mode requires a different input parameter. FULL DUPLEX WITH DELETION OF NULL CODES has been added.

Refer to Table 2-1 of the 2227B Interim manual for transmission mode parameters.

### PROM 278-2015 R2:

0=Half duplex

1=Half duplex with deletion of  
null codes

2=Echoplex

3=Full duplex

### New Release 2015 R3:

0=Half duplex

1=Half duplex with deletion of  
null codes

2=Full duplex

3=Full duplex with deletion of  
null codes

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- e) A capability to stop and restart transmission of data streams has been added. The microcommand sequence 440C will stop transmission of the active data stream. The microcommand sequence 440D will restart the pending output data stream.
- f) A seventh byte has been added to the communications status vector. Byte seven contains the number of bytes still remaining to be transmitted in the 2227B output buffer.

Two programs have been released to Field Service which require modifications to work properly with the new PROM. The required changes to these programs appear on the attached program comparison listing.

WAS: aa--- affected statements as they occur for PROM 2015 R2.  
SHOULD BE: bb--- affected statements as they occur for PROM 2015 R3.

The affected programs are:

27B\*TTY - Teletype<sup>R</sup> emulator with keyboard entry and CRT/line printer output.

27B\*TEST - Field Service diagnostic.

PROGRAM COMPARISON

aa=27B\*TTY1

bb=27B\*TTY

11/8/76 27B\*TTY DIFFERENCES R2 TO R3 PROM LISTING

aa-- 0010 REM 27B\*TTY1 OBSOLETE 27B\*TTY 7/02/76 -WITH PRT---2227B TTY  
EMULAT OR---PREPARED BY TYLER OLSEN, WANG LABS R&D

bb-- 0010 REM 27B\*TTY 11/04/76 -WITH PRT---2227B TTY EMULATOR---PREPARED  
BY TYLER OLSEN, WANG LABS R&D

aa-- 0500 SGIO START RCV #1(G6\$,A\$):GOTO 70

bb-- 0500 GOTO 70

aa-- 1250 P3\$(1)="HALF DUPLEX":P3\$(2)="HALF W/DEL":P3\$(3)="ECHOPLEX":  
P3\$(4)="FULL DUPLEX"

bb-- 1250 P3\$(1)="HALF DUPLEX":P3\$(2)="HALF W/DEL":P3\$(3)="FULL DUPLEX":  
P3\$(4)="FULL W/DEL"

---

2227B\*TEST:PROGRAM COMPARISON

aa=27B\*T R2

bb=27B\*T R3

11/8/76 27B\*TEST DIFFERENCES R2 TO R3 PROM UPGRADE

aa-- 0010 REM 27B\*TEST 7/01/76 -----2227B DIAGNOSTIC-----

bb-- 0010 REM 27B\*TEST 11/8/76 PROM 2015 R3 -----2227B DIAGNOSTIC-----

aa-- 0490 STR(B\$(1),2,1)=HEX(30):P3\$="FULL"

bb-- 0490 STR(B\$(1),2,1)=HEX(20):P3\$="FULL"

aa-- 1860 G8\$=HEX(440AA000440C440C) :REM /SEND DATA

bb-- 1860 G8\$=HEX(440AA000440C) :REM /SEND DATA

aa-- 1930 P3\$(1)="HALF DUPLEX":P3\$(2)="HALF W/DEL":P3\$(3)="ECHOPLEX":  
P3\$(4)="FULL DUPLEX"

bb-- 1930 P3\$(1)="HALF DUPLEX":P3\$(2)="HALF W/DEL":P3\$(3)="FULL DUPLEX":  
P3\$(4)="FULL W/DEL"

aa-- 2160 PRINT ".B.M.E.C.E.T MEANING"

bb-- 2160 PRINT ".B.M.E.C.T.L MEANING"

aa-- 2170 PRINT ".R.O.R.O.N.I"

bb-- 2170 PRINT ".R.O.R.O.I.E"

aa-- 2180 PRINT ".E.D.R.U.D.M"

bb-- 2180 PRINT ".E.D.R.U.M.F"

aa-- 2190 PRINT ".A.E.O.N.S.E"

bb-- 2190 PRINT ".A.E.O.N.E.T"

aa-- 2200 PRINT ".K.M.R.T. R"

bb-- 2200 PRINT ".K.M.R.T.R.."

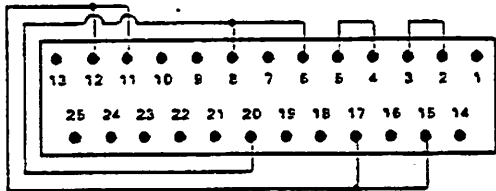
2200

TELECOMMUNICATIONS:

Troubleshooting the 2228D Board:

The following recommendations for troubleshooting communication problems on 2200 systems utilizing the 2228D controller are to be performed prior to board replacement.

1. CE should first try "power-up self test" diagnostic. By using a RS232 loop back connector (WLI #420-1040) and turning SW2-1 ON prior to power-up, the 2228D will run an additional self-test routine called "S10 Bisync External Test." (Switch 2 is located on the motherboard near RS232 connector.) The red LED will be on for approximately 10 seconds and then should go off. If LED stays on or blinks, it is an indication that the 2228D may be defective. (This is documented in the 2228D Maintenance Manual # 729-0858, pages 4-2 and 6-17.) Once this test has passed successfully, the following information should be used to run more extensive tests. **DO NOT FORGET TO TURN SW2-1 OFF!!!**



Pin#	Description	Jumper Pin Location	
		From	To
2	Transmit Data		
3	Receive Data	2	3
4	Request to Send	4	5
5	Clear to Send	6	8
6	Data Set Ready	8	20
8	Receive Line Sig Detector	11	12
11	Secondary Req to Send	12	15
12	Secondary Rec'd Line Sig Det	15	17
15	Receiver Sig Element Tim		
17	Receiver Sig Element Tim		
20	Data Terminal Ready		

RS-232 Loopback Connector (WLI #420-1040)

2. Use a Wang Operating System Software (Rel. 2.3), other than Customers, configured with a device address table which includes 2228D primary address (01C) and secondary address (09C). NOTE: Secondary address must be hex 80 higher than primary. Also, configure a partition for a minimum of 56K. (These prerequisites are a must in order to run the following diagnostics.)
3. Field Level Diagnostics
  - A. All 2228D controllers in the field should be "Rev 2 or Higher" with the exception of a limited quantity of Rev 1's originally installed at Mutual Benefit Life.
  - B. Single sided, single density (usually MVP and VP systems)  
Disk # 702-0097C 2228D TC Field Level Diagnostics Rev 2.
  - C. Dual sided, double density (usually LVP and SVP systems)  
Disk # 732-0002B LVP/SVP System Exerciser (which includes TC)  
Run "Telecommunications" and "2228D Field Service Diagnostics Rev 2."
  - D. Availability of explanatory documentation, which accompanies the above mentioned diagnostic disks, would be helpful even though the diagnostic disks are self-prompted.
4. Currently in the field, there are only two acceptable numbers for the PROM located on the memory board of the 2228D Communications Controller. They are # 4219 and # 4381.



The following information is specifically for Northwestern Mutual Life:

1. Perform all previous procedures listed.
2. Be sure system and switch box are configured properly. There are five different configurations for this account. They may all be found in the National Accounts Alert Notice #19-2 dated January 27, 1982.  
NOTE: If you are having problems bringing system up when loading TC software, you may bypass switch box by running cable directly from 2228D controller into modem.
3. Interpretation is not always available for all error codes. One of these is 4D1520. This code is peculiar to NML's operating system and appears quite often. History of the 4D1520 error code indicates that the 2228D microcode did not load properly. This may result from bad or disconnected modem, A/B switch box bad or switch in wrong position, bad or disconnected cable, and possibly a defective 2228D board. A variety of other error codes: 540220, P48, P34, etc., may indicate some equipment, usually a printer, is powered down and/or configured incorrectly. Do not overlook the possibility that Customers software may be at fault.
4. Modem considerations for NML's Async operation: Black and yellow wires should be disconnected from Telco line.

If you have any questions or would like copies of the diagnostics, please contact the District.

## WA3451 RADCAL VADIC MODEM

### Switch/Strap Settings for Dial-up and Dedicated Lines

The Wang Modem, RADCAL VADIC WA3451 (P/N 725-0110), can be configured to meet the needs of a particular installation by selecting the appropriate options. The options are selected by switch banks and solder straps within the unit. Normally these options need not be changed as they are preset to Wang specs for use with a dial up line. However, if using a dedicated (leased) line these options need to be checked as several are different.

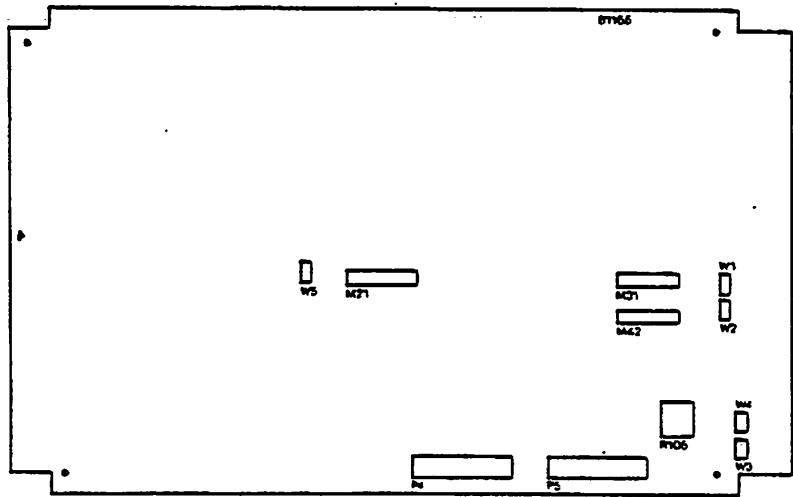
To gain access into the modem push the sides in along the middle one third at the gap and the cover should release so that it may be lifted off. See the back of this page for physical locations of options.

	<u>DIAL UP</u>	<u>DEDICATED</u>
Sw. Bk. A	1, 2, 4, 6, 7 on	1, 2, 4, 6 on
Sw. Bk. B	1, 5 on	1 on

<u>STRAPS</u>	<u>DIAL UP</u>	<u>DEDICATED</u>
A	OUT	IN
B	IN	IN
C	IN	IN
D	OUT	OUT
E/L	OUT/IN	IN/OUT (Miles Apart) OUT/IN (Within bldg or office park)
F/G	IN/OUT	IN/OUT
H/W	OUT/IN	OUT/IN
J	OUT	OUT
K	IN	IN
M	OUT	OUT
N	IN	IN
P/Q	OUT/IN	IN/OUT
R	OUT	OUT
S/U/AB/AC	IN/OUT/OUT/IN	IN/OUT/OUT/IN
T/V	IN/IN	IN/IN
X	IN	IN
Y	OUT	OUT
AA	OUT	OUT
AD/AE	OUT/IN	OUT/IN
W1	OUT	OUT
W2	OUT	OUT
W3	OUT	OUT
W4	OUT	OUT
W5	OUT	OUT

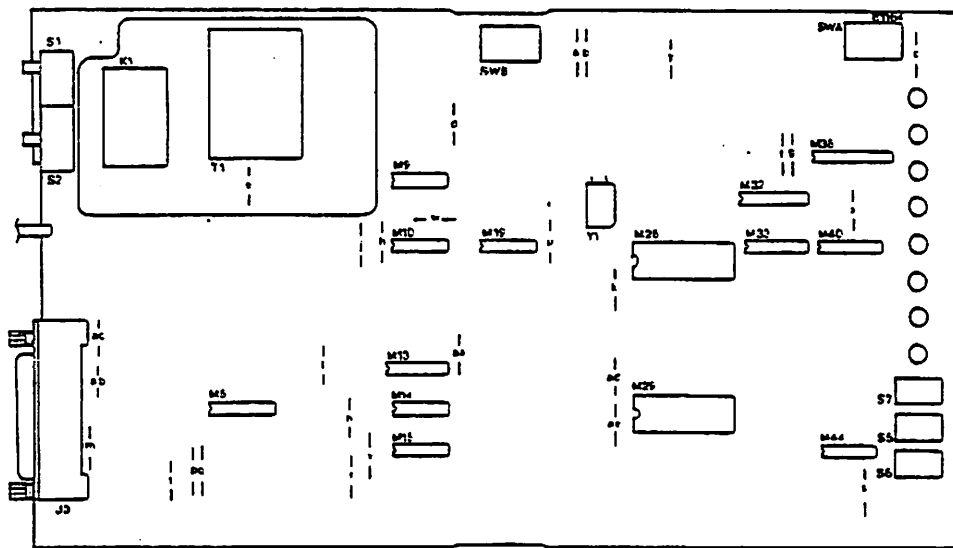
One other change internally needs to be made for use on a dedicated line. On the bottom board on the Modem is a black box. This needs to be removed by unscrewing the two screws holding it from underneath. Inside is a red wire which for a dial-up line should be attached to connector E2. For a dedicated line this red wire should be moved to connector E1 which is under the black cover along the edge of the board. Be careful not to pinch the wires when replacing the black cover.

Externally for a dedicated line both Modems on either end should have the DATA/AANS/OFFL switch set to DATA (DSR and DTR should be on) to make the connection which is done by pressing the momentary AANS switch on the remote end. The line may be broken by switching the DATA/AANS/OFFL switch to AANS or OFFL.



Top Board (81165)

VA3450-02



Bottom Board (81164)

VA3450-01

VA3450-Series Switch and Strap Locations

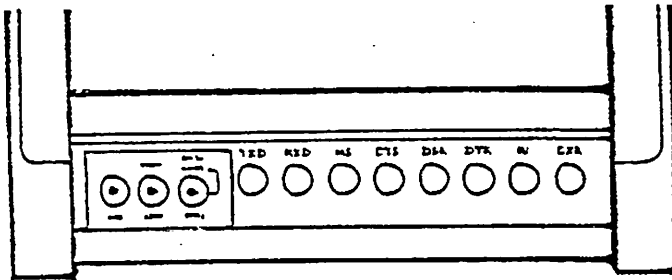
MVP/LVP

Remote 2236DE with RACAL-VADIC Modem (WA3451)

\* THIS IS A CORRECTION TO DISTRICT NEWSLETTER #17. PLEASE DISREGARD THAT WRITE-UP AND USE THIS INSTEAD.

The following information should be helpful in bringing a remote DE terminal on line. If still having a problem give us a call at the District Office.

- Terminal and Mux D port set at 1200 baud 7592 19.2K baud-sw. 1, 3 on  
1200 baud-sw. 1, 3, 5 on
- Must use TC cable part # 220-0113 12' or 220-0220 50' max  
Runs from 36DE to modem, and from Mux D port to modem.
- Racal-Vadic (WA3451) Modem switch settings  
Internal (push sides of cover in and pull up)  
Switch Bank A (on right up front)-sw. 1, 2, 4, 6, 7 on or closed  
Switch Bank B (on right mid board)-sw. 1, 5 on or closed  
External  
High/Low - High (1200)  
DATA/AANS/OFFL



DATA-this position at remote site after connection made to put modem in data mode.

AANS (center position)-this position at host site if ready to go on line/at remote use this setting while dialing host system.  
OFFL-this position at both ends when not in use to avoid running up telephone bill.

DLB/OFF/ALB (not marked, on left facing rear panel)

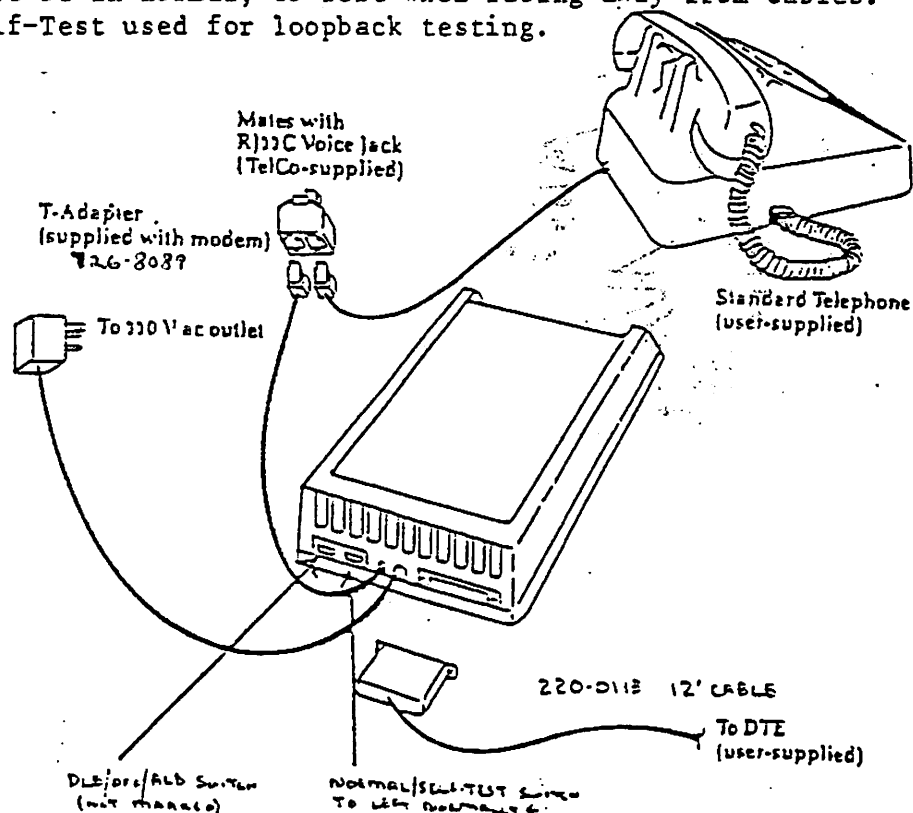
Must be in off position which is center.

ALB and DLB are for loopback testing.

Normal/Self-Test (not marked, on rear panel to the right of DLB/OFF/ALB when facing).

Must be in normal, to left when facing away from cables.

Self-Test used for loopback testing.



## TELECOMMUNICATIONS

### Incorrectly Wired Loopback Connectors

The loopback connector (Part # 420-1105) used to test the 2228D, a 2200 TC Controller, and the W4-FTC Wangwriter TC Controller may be improperly wired. A correctly wired plug should be wired as follows:

PINS 2 to 4

PINS 3 to 5 to 7

PINS 9 to 11

PINS 10 to 12 to 14

TELECOMMUNICATIONS STATUS - PAGE 3

OIS 3270 EMULATION

Vertical bar transmitted instead of exclamation.

STATUS = FIXED

PROBE = F000677

Problem with Dup function.

STATUS = FIXED

PROBE = F001152

Cent sign transmitted wrong.

STATUS = UNDER INVESTIGATION

PROBE = F001282

Print files don't print correctly.

STATUS = REJECTED (Design problem)

PROBE = F001305

OIS BATCH TELECOMMUNICATIONS

Compatibility problem between:  
TC 1.9 and OS 6.3 and  
TC 1.9 and OS 7.2

STATUS = FIXED

PROBE = F000752  
F000819, F000866

Line drops after 14 Wack's

STATUS = FIXED

PROBE = F001148

Document left in use after receiving RVI

STATUS = FIXED

PROBE = F001184

Sporadic problems with note codes.

STATUS = UNDER INVESTIGATION

PROBE = F001133

# TELECOMMUNICATIONS

## INSTALLATION OF REMOTE TERMINALS ON THE 2200: A SYLLOGISM

by Tom Thel, CE Software Support

Local or remote connection should be transparent to 2200 terminals.  
Local or remote connection should be transparent to 2200 terminal controllers.  
Therefore, modems should be heard and not seen.

(Author's note: This concludes a one-part series. For those troubled with ellipses and non sequiturs, an examination of the footnotes, synopsis, definitions and references below may be in order.)

### Footnotes:

1. Current 2200 terminals and terminal controllers:
  - a. Characteristics
    - asynchronous, full-duplex, 11-bit character (see ebc)
    - transmission rates = 300,600,1200,2400,4800,9600,19200 bps (on the MXD board, 4800 marked = 19200 actual; 4800 is obtained via C.E. intervention)
  - b. Connector Type - RS232C
  - c. Connection Points
    - Local—uninterrupted cable run up to 2000 feet  
terminal connector, terminal cable (see term cable), controller connector
    - Remote—via dial-up or leased phone line  
terminal connector, RS 232C straight-thru cable (220-0113 or 220-0119 or 220-0220)  
connecting terminal with one modem and controller connector with other modem,  
modem at each end of phone line (see modem), phone line
  - d. Terminal Models
    - 2236D (no longer on price list).
    - 2236DE and 2236DW (transmission rates of above terminals are switch selectable to 300,600,1200,2400,4800,9600,19200 bps)
  - e. Terminal Controller Models
    - LVP & MVP: either 2236MXD (4 ports) or 22C32 (see below)  
2236MXD is switch selectable to 300, 600, 1200, 2400, 9600, 19200 bps; Customer Engineer can set to 4800 bps.
    - VP: 22C32 (One port, hard-wired at 19200 bps)
    - SVP: One integral terminal port; defaults to 19200 bps; switch selectable to 300 or 1200 bps with LRS.
2. 2226 and previous terminals and associated controllers (which may be supported on the VP) are not considered in this article.
3. Attaching a remote terminal to a VP may be possible with a private line and special modems, but will not be considered in this article for two reasons: (1) a single tube system doesn't usually have a remote terminal and (2) it would be complex.
4. It may be sensible to attach a real or logical remote terminal to the SVP, e.g., for RCMS. The LRS makes it reasonable.

(continued)

## Definitions

**async** (as in kirchen) n, abbr for asynchronous communications.

**asynchronous communications** n, literally communications without regard to timing or period. 1) a form of TC in which inter-character timing is not an issue. A somewhat misleading term, as intra-character timing is critical (cf bit clocking & framing). Often employed in interactive jobs with on-line keyed input. Because of the necessity for start, stop and parity bits to be applied to each character (see framing), the maximum throughput of async is lower than that of bisync (see bisync) on a comparably-rated line. In interactive use, this apparent shortcoming may be mooted by the simplicity and consequent reduced cost of the system, and by operator reaction time - which in an input-intensive application can be several orders of magnitude greater than transmission time. 2) The flow in async needn't be two-way. E.g., if a controller outputs to a terminal CRT, the tube needn't respond (however, see echoplex and flow-control). 3) the form of communications used between 2200 terminals and 2200 terminal controllers. This holds whether the terminals are remote or local. There is only one TTCC protocol; neither the terminal nor the terminal controller knows whether the connection is local or remote.

**baud rate** n, a means of expressing line capacity. 1200 baud is roughly equal to 1200 bps.

**bisync** (bye' sink) n, abbr for bi(nary)synchronous communications. 1) a form of telecommunications in which timing remains critical throughout transactions. Block rather than character oriented. Compared to async (see async), better suited to moving mass quantities of batch data. 2) bisync inherently goes both ways, i.e., the receiving device must respond to the sender. If data blocks are small, line control overhead can be significant. 3) a form of TC not used between 2200 terminals and 2200 terminal controllers.

**bit** n, acronym for binary digit. Async breaks device-resident characters down into their component bits and ships bit-images across a bit stream. As with resident bits, async bits are either on or off. However, they are ephemera, fleeting creatures of the moment. Regular bits may be viewed abstractly, but they have physical analogs that exist in both time and space. If you are doing a bit test of HEX(FF), you know that some register has eight little bit places turned on which will stay turned on unless you turn them off. The bits that compose a character resident in a system have a parallel and simultaneous existence. Async bits exist one at a time and only long enough to copy resident bits from one device to another. Async unbuilds a character into its constituent bits and copies them over a stream that is serial and one bit wide.

**bit clocking** n, A means of using time to identify bits in a 1-bit wide serial bit stream. Bits presented to or received from a stream are represented by a positive or negative electric potential held for a known interval. Upon sensing the onset of the start bit, successive bits can be tested by measuring voltage at the expected time of their arrival. For example, if the line rate is 10 bps, and the on/off sense of the first data bit is to be tested, the line would be sampled about .15 seconds after the start bit is sensed. Note that while the first data bit's time slot would start .1 seconds after the start bit's onset, chances for error are reduced if sampling is done right in the middle of the bit's time slot. Consider the case of transmitting HEX(FF) with odd parity (see parity): the line potential would have the same value for 10 successive bit times. Using bit clocking, this apparently static condition would be resolved into 10 separate events.

**black box** n, a physical or logical entity that is handed a physical or logical entity and physically or logically returns a transmogrified physical or logical entity. Since how it does what it does is a mystery (hence, black box), it is a good idea to define to it what it is handed and for it to define what it does to what it is handed (see comparability).

**bps** n, acronym for bits per second, used in reference to line capacity.

**clock** n, a timing signal. 1) In async, both ends are expected to generate their own clocks. The sender starts its clock as it generates the start bit; the receiver starts clocking when it senses the onset of the received start bit. 2) In bisync, the modem pair generates a clock signal shared by all participants in the connection. 3) Async modems are expected not to generate a clock but rather not to distort the clocking already present.

(continued)



**compatibility** (essential). We have a series of analog and digital events shared by several hard- and software entities. It is essential that all the participants abide by commonly understood rules (see characteristics in Footnote 1. Wang-furnished equipment is fairly straightforward; the main chore is adjusting the baud rate switches on the controller and terminal. Finding and adjusting the modems, unless they are WA3451s, can get complicated. Lots of modems work fine, but they have to be optioned and strapped properly (see modems & ebc).

**ebc n**, acronym for eleven-bit character

**echoplex n**, a form of async in which the connection between the terminal keyboard and display is via the terminal controller, i.e., characters entered at the keyboard are sent by the terminal to the terminal controller which routes them back to the terminal for display on the CRT. Echoplex provides the 2200 terminal operator with a visual and aural check of data validity (see parity). Implies full duplex (see full duplex).

**eleven bit character (trouble) n**, the structure of a 2200 character frame as it is presented to or received from the modem. The first bit is a start bit. The next 8 bits are a binary representation of the character. Then comes an odd parity bit. Finally comes a stop bit to signal that the character is complete. Some documentation mentions that there can be more than 1 stop bit (e.g., 1 1/2 or 2). This is true. If this is confusing, see stop bit. This is pronounced trouble because async devices more commonly use a character frame no larger than 10 bits (see framing). In particular certain popular modems can't move ebcs properly, and people either won't hear you or won't believe you when you talk ebc (see modems).

**ends n**, within this article, ends refers to the outermost devices in the connection, i.e., the terminal and its terminal controller port.

**fcc n**, acronym for flow-control character(s).

**flow-control n**, 1) in TC, a mechanism for starting and stopping the flow of data from one device from another. In practice, the receiver asks the sender to stop sending. This may be because the receiver has other duties or is approaching buffer overflow. 2) Flow-control can be accomplished by toggling the sense of certain RS232C control lines, or by embedding flow control characters in the data stream. As a rule, 2200 terminals do the latter. Flow-control characters should be transparent to modems, but not necessarily to devices like star muxes (see star muxes).

**framing n**, the means that async uses to isolate characters in a bit stream is called character framing. The bits that constitute a character will be surrounded or framed by start and stop bits. Both ends agree to these rules:

1. Characters will be sent one bit at a time.
2. A start bit will precede all other bits and will initiate bit-clocking.
3. Wang 2200 characters will have 8 data bits. This is a little unusual, as most async terminals use 7-bit ASCII. We need the eighth bit for several reasons: special function branches, underlining, control characters, flow characters, valid graphic characters higher than HEX(7F).
4. An odd parity bit will follow the data bits.
5. At least one stop bit will terminate the character.
6. Both ends (term & controller) will clock at the same rate (see bit-clocking).

Agreeing on a clock rate is critical. Since all the bits travel across the same line, a start bit that is turned on will look just like a data bit that is turned on. What distinguishes one bit from another is its position in the character frame. When a start bit is sensed, the receiving device resets its clock and starts sampling the line (see also bit-clocking, start bit). It needn't store the start bit, but keys on its presence to set its clock such that when it samples successive bits, it will sense them right in the middle of their allotted time. As each data bit arrives, it is scooped to a register and once again has an existence in space as well as time. The arrival of the stop bit completes the frame. In combination with the parity bit, it lends credibility to the received character. The stop bit's polarity is the same as that of an idle line, so the receiver relaxes until it senses the abrupt change of the next start bit.

(continued)

**full-duplex** (full dew' plex) 1) n, a type of line discipline in which the bandwidth of the communication line is split into two channels. This allows both ends (see ends) to send and receive data simultaneously and permits echoplexing (see echoplex). It also reduces the effective data rate of the line. 2) n, the type of line and modems the 2200 terminal/controller must have.

**LRS** n, acronym for Local-Remote-Switch. An option for the 2200 SVP which allows its terminal controller to be switch selectable at 300, 1200, 19200 bps.

**modem** n, acronym for modulator-demodulator. 1) Computers generate and want to see square waves which represent the abrupt transition between consecutive bits of opposite sense. Most phone equipment deals in rounded wave forms. Modems transform the signals to meet the demands of both kinds of equipment. Modems always come in pairs (see comparibility). 2) In our case, it is a one of a modem pair meeting the characteristics described in footnote 1. i.e., it is asynchronous, full-duplex, and capable of handling ebc. **dial-up modem** — a modem that works on most standard dial-up voice lines. Suitable examples are the new WA-3451 (300 or 1200 bps), the Bell 103J (300), the Bell 212A (OK at 300, a definite no at 1200 bps). Other modems are available from Avanti, Codex, GDC, Penril, Vadic et al. **leased-line modem** — modem for leased (private) lines. Properly strapped, the BELL 202T works at 1800 bps (the net rate is 1200 since the 2200 won't clock at 1800 bps). 3) **async modem, sync modem** — see clock.

**optioned** adj, another example of the deplorable English habit of adjectivising nouns (cf. fully applanced kirchen) Describes a modem that has the proper options in place. Often, options are called out in a purchase order and strapped at installation.

**parity bit** 1) n, an optional bit within the async frame used for character validation. 2) **odd parity** (a) 'x', the number of data bits turned on, is calculated. If x is even, the sending device turns the parity bit on so that the aggregate of turned-on data and parity bits for any character is always odd. The receiving device predicts the parity sense from its own analysis of received data bits and signals an error if the parity bit isn't set right (e.g., the 2236DE presents a "#" on the screen and sounds a beep). (b) the kind of parity checking done by the 2200 TTCC. 3) **even parity**, similar to odd parity, except that aggregate of a character's data and parity bits which are turned on is set to be even.

**RS232C Cable** n, 1) in this article, a straight-thru cable furnished by Wang that meets RS232C standards and is terminated at both ends by a RS232C connector. It is used to connect the terminal controller to its modem and at the other end to connect the terminal to its modem. 2) Here are the numbers of three Wang RS232C cables: 220-0113 (12 feet); 220-0119 (25 feet); 220-0220 (50 feet, the RS232C maximum).

**sense** n, within this article, sense refers to the state of a bit, i.e, its on-ness or off-ness. If a positive electric potential means on, then a negative potential means off. It would work just as well the other way. When we test sense, we are checking whether a bit is on or off. An async bit's sense is tested by sampling voltage at a time particular to that bit (see async, bit, bit-clocking, and framing).

**start bit** n, the first bit in an async character, which starts the character frame (see framing). The start bit is of opposite sense to the stop bit (see sense). The primary purpose of the start bit is to reset the clocking of a receiver (see bit clocking). Until it senses a start bit, the receiving device idles asynchronously (see async).

**stat mux** n, abbr for statistical multiplexor. A black box which is used to attach several terminals to one modem. Like modems, stat muxes come in pairs. In our case, the one at the other end would attach the corresponding terminal controller ports to one modem. The idea of stat muxes is a fine one, and can result in substantially reduced line expense. However, stat muxes need an intimate knowledge of the particular implementation of a protocol and the consequences of their actions. In general, make no promises about the performance of a given stat mux vis-a-vis 2200 terminals (stat muxes need some method of coping with fcc, and the 2200's are unusual).

(continued)

**stop bit n**, the final bit in an async character (see ebc, framing). The stop bit is always of opposite sense to the start bit (see start bit), and completes the character frame. Since the stop bit has the same sense as an idle line, there could be a very large number of stop bits between successive characters (see bit docking). This would be the case if a slow typist were keying in characters at a terminal. In the other direction (controller feeding screen data to terminal), the stop sense could be very short. Since the stop sense must be correctly interpreted by the slowest component in the link, the sending device must assert stop sense for a defined minimum amount of bit times (1 in the case of the 2200 terminal/controller link). This needn't be an integer number of bit times as async cares about timing only within characters, not between them. Once the minimum number of stop bits have been sensed, the receiver disregards time until it senses the onset of a start bit.

**strapped adj**, refers to a modem that has had settings made with the idea of making it compatible (see compatibility). Originally, straps were little jumpers installed or removed as appropriate. Now, they are often switch settings.

**TTCC n**, acronym for the 2200 terminal/2200 terminal controller combination viewed as a system (local to this article).

**Terminal cable n**, in this article, the Wang-furnished cable used in local connection of the 2200 terminal to its controller port. Its connectors are mechanically compatible with RS232C, and thus will plug into modems. But the cable will not support a modem connection.

## SYNOPSIS

Locally or remotely, connecting a Wang 2200 terminal to its controller port demands compatibility.

In local connections, compatibility is attained by

1. setting the terminal and controller port to the same baud rate.
2. joining the terminal and controller with a Wang terminal cable.

In remote connections, compatibility is attained by

1. setting the terminal and controller port to the same baud rate.
2. joining the terminal and controller with
  - a. RS232C cables
  - b. compatible modems that will support the desired baud rate.
  - c. a phone line that will support the baud rate.

There are no system software considerations that distinguish between local and remote terminals. Since remote terminals almost inevitably will run at a lower baud rate than local terminals, prudence would dictate caution in recommending the use of display or print-intensive applications on remote terminals.

The 2200's eleven bit character structure dictates that special care be given to the selection of modems. The Wang WA3451 modem offers a simple solution to this problem if 1200 bps is adequate.

If someone wants to know how slow 1200 bps is, and a modem setup is not available, the same visual result can be obtained by locally connecting a terminal at 1200 bps.



LABORATORIES, INC.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#10331

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

TOPIC: 2228C's WITH INCORRECT PROM

Please be aware that an unknown quantity of 2228C Telecommunications controllers have been shipped with an incorrect PROM.

The part number of the incorrect PROM is 378-2060. The correct PROM for the 2228C is 378-4001.

Please insure all controllers at your location have the correct PROM.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#11117

III.H.10

PERIPHERALS-OTHER-MODEMS (RACAL-VADIC)

TOPIC: WA\_3451\_MODEM\_PART\_#725-0110

Several WA3451 modems were released to the Field missing a strap (U) on the bottom board (81164). This will cause the phone to be in the busy mode. A clear indication of this problem upon powering up the CXR (Carrier Detect) is ON, and DSR (Data Set Ready) blinking. To correct this problem, refer to C.E. Manual # (729-0997) P. 5-4. Add (U) strap as indicated on the bottom board (81164).

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20202

V.C.3

WP/OIS-SOFTWARE-UTILITIES, TELECOM INFO.

TOPIC: I. C. LOOPBACK CONNECTORS

One of each of the following loopback connectors will be shipped to Domestic and International Area, District, and Branch offices:

<u>Loopback connector</u>	<u>WLI#</u>
RS232	420-1040
RS232/366	420-1041
RS449	270-3193

The purpose of these connectors is running diagnostics on existing TC products in the Field such as TC-B1, 2228D, and TCP. For additional information refer to C. E. manuals.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20907

III.H.10

PERIPHERALS-MODEMS (RACAL-VADIC).

TOPIC: "INTERMITTENT PARITY ERROR" PROBLEM

TAC has received a report of a problem under the following conditions:

Systems: 2200 MVP CPU, 2200 LVP CPU

Device: WA-3451 MODEM

Utility: RCM (Remote Control Maint)

Function: Customer was attempting to run RCM from a 2200 MVP to several 2200 LVPs.

Problem: When attempting to run the RCM program from host system (via TC), intermittent parity errors would occur.

Solution: The problem was solved by cutting pin 21 of the RS-232-C cable. (The manuals released to the field show there is no connection to pin 21 in the modem).

The Wang modems were shipped with jumper 'N' installed on the lower board. With this jumper "IN", pin 21 can initiate remote testing. Wang systems do not control this pin so the 'antenna effect' of the wire in the RS-232-C cable would cause the modem to occasionally switch to test mode. This caused the test pattern '55' to appear on the receive data lead which showed as parity errors on the remote terminal. If occurring under TTY emulation the character 'U' may appear.

Additional information on this problem will be discussed in detail in a later TAC Newsletter.

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CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20914

BILL FRENCH x 6815

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

TOPIC: 2228D COMMUNICATION CONTROLLER TROUBLESHOOTING PROCEDURES

The following recommendations for troubleshooting communication problems on 2200 systems utilizing the 2228D controller are to be performed prior to escalation or referral.

1. C.E. should first try "power-up self test" diagnostic. By using a RS232 loop back connector (WLI #420-1040) and turning SW2-1 ON prior to power-up, the 2228D will run an additional self test routine called "SIO Bisync External Test." (Switch 2 is located on the motherboard near RS232 connector.) The red LED will be on for approximately 10 seconds and then should go off. If LED stays on or blinks, it is an indication that the 2228D may be defective. (This is documented in the 2228D Maintenance Manual #729-0858, pages 4-2 and 6-17.) Once this test has passed successfully, the following information should be used to run more extensive tests. DO NOT FORGET TO TURN SW2-1 OFF!!!
2. Use a Wang Operating System Software (Rel. 2.3), other than customers, configured with a device address table which includes 2228D primary address (010) and secondary address (09C). NOTE: Secondary address must be hex 80 higher than primary. Also, configure a partition for a minimum of 56K. (These prerequisites are a must in order to run the following diagnostics.)
3. Field Level Diagnostics
  - a. All 2228D controllers in the field should be "Rev 2 or Higher" with the exception of a limited quantity of Rev 1's originally installed at Mutual Benefit Life.
  - b. Single sided single density (usually MVP and VP systems)  
Disk #702-0097C 2228D TC Field Level Diagnostics Rev 2.
  - c. Dual sided double density (usually LVP and SVP systems)  
Disk #732-0002B LVP/SVP System Exerciser (which includes TC)

Run "Telecommunications" and "2228D Field Service Diagnostics Rev 2"

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#20914

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

TOPIC: 2228D COMMUNICATION CONTROLLER TROUBLESHOOTING  
PROCEDURES (CONTINUED)

- d. Availability of explanatory documentation, which accompanies the above mentioned diagnostic disks, would be helpful even though the diagnostic disks are self prompted.
4. Currently, in the field, there are only two (2) acceptable numbers for the PROM located on the memory board of the 2228D Communications Controller. They are #4219 and #4381.

The following information is specifically for Northwestern Mutual Life (NML).

1. Perform all procedures listed above and on previous page.
2. Be sure system and switch box are configured properly. There are five (5) different configurations for this account. They may all be found in the National Accounts Alert Notice #19-2 dated January 27, 1982. NOTE: If you are having problems bringing the system up when loading TC software, you may bypass the switch box by running the cable directly from the 2228D controller into the modem.
3. Interpretation is not always available for all error codes. One of these is 4D1520. This code is peculiar to NML's operating system and appears quite often. History of the 4D1520 error code indicates that the 2228D microcode did not load properly. This may result from bad or disconnected modem, A/B switch box bad or switch in wrong position, bad or disconnected cable, and possibly a defective 2228D board. A variety of other error codes: 540220, P48, P34, etc., may indicate some equipment, usually a printer, is powered down and/or configured incorrectly. Do not overlook the possibility that the customers software may be at fault.
4. Modem considerations for NML's Async operation: Black and yellow wires should be disconnected from Telco line.

All feedback is welcomed and will be highly appreciated. Its' use will be invaluable for future updates.



IV.C.3

2200 SYSTEMS-SOFTWARE-UTILITIES/TELECOM INFO.

TOPIC: UPDATED PROCEDURES FOR ASYNCHRONOUS SIGN-ON WITH THE BURLINGTON DATA CENTER (INTERACT) (CONTINUED)

NOTE: c/r indicates return/enter key.

WANG_Terminal	:	Host_Response
Press c/r twice.	:	invalid application id, please re-enter.
Type interact c/r.	:	ready to logon.
Type oabt c/r.	:	INTERACT LINE # time date INITIALS?
Type fes fs c/r.	:	KEYWORD.
Type ram c/r.	:	ACCOUNT-W33?
Type yes c/r.	:	COMMAND?

At this point you may run any test. The following test will echo what you type on your terminal. The host will respond by sequencing each line after you press c/r.

WANG_Terminal	:	Host_Response
Type c c/r	:	1. _ _ _ _ ?
Type (the first line of data you want to echo back). c/r	:	2. _ _ _ _ ?
Type (the second line of data). c/r	:	3. _ _ _ _ ?

When you are finished and want to read data back -

Press (Break key) (VS-PF4 2200-SF14 OIS-Page)	:	COMMAND?
Type list c/r	:	This will be the data you typed in followed by COMMAND?

At this point if you want to exit from system you must sign-off.

Terminal	:	Host_Response
Type signoff c/r	:	OK TO CLEAR.
Type yes c/r	:	System will disconnect.

Additional information on other TEST can be obtained from the Burlington Data Center 1-617-272-8550 x2327 or x2346.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#21130

VI.B.4

VS SYSTEMS-INTERFACE-TELECOM I/O PROCESSORS.

TOPIC: VS ICIOE

On Pin 19 of the R232 connectors on the V06 and the V26 IOP's, there is a clock pulse. Some of the newer modems can be strapped to use Pin 19 to trigger self diagnostics or to release the line. If you are having trouble bringing up a new line, this might be a consideration. Modem strapping should allow the early disconnection of this signal so as not to affect modem operation.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#21214

IV.B.2

2200 SYSTEMS-INTERFACE-TELECOM CONTROLLERS.

TOPIC: MULTILINE AUTOMATIC CALLING SYSTEMS (MACS)

There have been a number of instances where customers attempted to install a Multiline Automatic Calling System on a Wang system. Multiline Automatic Calling Systems will not function on 2200, OIS and VS systems and are not supported. The MACS requires a common RS366 port, whereas the RS366 ports on our systems are dedicated to a specific RS232 port and cannot be used on MACS units. There are also software constraints which will not allow this configuration. Any feedback from the field concerning this matter is welcome and would be appreciated.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

-#30215 -

III.D.1 (3401)

PERIPHERALS-TERMINALS, WORKSTATION DISPLAYS, KEYBOARDS-FOR 2200.

TOPIC: 2336 TERMINAL DIAGNOSTIC PROBLEM

There has been a recent problem with the 2336 terminal when connected to a Modem or Multiplexer on a leased line. TAC Newsletter 30201, Category III.D.1 indicates one way to circumvent the problem.

The proper field fix is to option the MODEM for switched CTS. This may be indicated as "switched RTS" in the MODEM. The modem vendor should be notified to option their equipment accordingly.

CUSTOMER ENGINEERING  
TECHNICAL ASSISTANCE CENTER  
NEWSLETTER

#30816

7300

COMMUNICATIONS-DATA-GENERAL

TOPIC: X.21 DIAGNOSTIC LOOPBACK PLUG

It has been recently discovered that the X.21 diagnostic loopback plug 420-1105 is incorrectly wired. This plug has previously been identified as being required for X.21 diagnostic loopback testing of the 2228D (2200 telecommunication controller) and the W4-FTC (Wangwriter telecommunication controller) products.

All existing orders for 420-1105 should be cancelled.

A new and correct X.21 diagnostic plug, WLI #421-0010 is being developed. Any requirements/orders for X.21 loopback should reflect the new number.

Please ensure that any documentation specifying the old number is corrected to reflect WLI #421-0010.

If you presently have an X.21 loopback connector, it may be rewired to the correct configuration by connecting pins as follows:

- Pin 2 (transmit +) to Pin 4 (receive +)
- 3 (control +) to Pin 5 (indication +) to Pin 7 (byte timing +)
- 9 (transmit -) to Pin 11 (receive -)
- 10 (control -) to Pin 12 (indication -) to Pin 14 (byte timing -)



WANG

TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare General

NUMBER: SWG 5108 REPLACES: \_\_\_\_\_ DATE: 12/31/85 PAGE 1 OF 1  
MATRIX ID. 7605 PRODUCT/RELEASE# 2200 BISYNC/6.00.02  
TITLE: New 'SCRATCH DISK' Method

PURPOSE:

PROBE #: F009616

When transmitting a file from a disk scratched with the new 'SCRATCH DISK' method, the emulator cannot find the requested file to send.

EXPLANATION:

The new 'SCRATCH DISK' method sets a flag in the disk index that tells the 2200 operating system to use a new hashing algorithm to determine where in the index to enter a file name. The disk search routines in the emulator software did not support the new hashing algorithm.

CORRECTIVE ACTION:

Modify the disk search routines in the emulator to check if the disk was scratched using the new 'SCRATCH DISK' method and if it was, use the new hashing algorithm to calculate the location in the index of the file name.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

GROUP: Telecommunications Software Support Group MAIL STOP: 0129

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

WANG

TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare General

NUMBER: SWG 5082 REPLACES: \_\_\_\_\_ DATE: 10/08/85 PAGE 1 OF 1

MATRIX ID. 7605 7619 PRODUCT/RELEASE# 2200 3271 BSC/1.12.09

TITLE: Invalid Stream Name

PURPOSE:

PROBE #: F008647

Customers were able to enter up to a sixteen character stream name. Any name greater than eight characters was illegal, and the customer could not attach to the defined cluster.

EXPLANATION:

When using 3271 communications on a 2200, you must configure a cluster(PU) that will be attaching to the host. During the definition process, one screen is for stream name modifications. When a stream name of greater than eight characters is entered, it will be accepted during definition processing. When you try to attach, the cluster terminal access is denied.

CORRECTIVE ACTION:

When a customer attempts to enter a stream name greater than eight characters, a prompt is displayed that tells the customer that they have entered an illegal name, and brings them back to the start of the module.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

GROUP: Telecommunications Software Support Group MAIL STOP: 0129

COMPANY CONFIDENTIAL

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TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare General

WANG

NUMBER: SWG 6022 REPLACES: \_\_\_\_\_ DATE: 03/25/86 PAGE 1 OF 1  
MATRIX ID. 7605 PRODUCT/RELEASE# 2200/PC File Transfer Utility/1.00.01  
TITLE: 2227B Time-out Errors

PURPOSE:

PROBE #: F100001

When transferring a file from the 2200 to the PC an I91 error occurs if a 2227B communication board is used.

EXPLANATION:

The 2227B requires a 20-byte CCV; the current software sent a 10-byte CCV as specified for a 2228B. The last 10 bytes of the CCV on a 2228B contain special character/transmission delays which were not being initialized.

CORRECTIVE ACTION:

Added a 20-byte array code to initialize the CCV on a 2227B to the program module FTSTART.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

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NUMBER: SWG 6023 REPLACES: \_\_\_\_\_ DATE: 03/25/86 PAGE 1 OF 1  
MATRIX ID. 7605 PRODUCT/RELEASE# 2200 3270/1.12.11  
TITLE: Copy Command to Printer

PURPOSE:

PROBE #: F300385

If the copy command is used to copy a buffer to the printer, the buffer is not printed, if the start print bit is set in the CCC.

EXPLANATION:

The start of each DLP device buffer contains 4 control bytes, the first byte is the WCC byte. When the FROM device buffer was copied to the printer buffer, the WCC byte was overwritten.

CORRECTIVE ACTION:

Skip the first byte when the buffer is copied as the WCC had already been updated using the CCC included in the copy command.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

TECHNICAL SERVICE BULLETIN  
SECTION: SoftWare General

NUMBER: SWG 6025 REPLACES: \_\_\_\_\_ DATE: 03/25/86 PAGE 1 OF 1  
MATRIX ID. 7605 PRODUCT/RELEASE# 2200/3270  
TITLE: Displaying Partition Status

PURPOSE:

PROBE #: F300312

When displaying partition status, partitions 14 and 15 were being overwritten by the device table.

EXPLANATION:

The cursor position used to write the device table would conflict with the partition status for the last two partitions, when the system was configured for 16 partitions.

CORRECTIVE ACTION:

Problem fixed in Version 1.14.00.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

NUMBER: SWG 6026 REPLACES: \_\_\_\_\_ DATE: 03/25/86 PAGE 1 OF 1  
MATRIX ID. 7605 PRODUCT/RELEASE# 2200/3270 1.14.00  
TITLE: Cursor on Unprotected Attribute

PURPOSE:

PROBE #: F010174

If the cursor is on an unprotected attribute and the TAB key is pressed, the cursor stays on the attribute instead of moving to the first position of the field.

EXPLANATION:

Problem fixed in Version 1.14.00.

ADDITIONAL INFORMATION:

Available in the next maintenance release.

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# TELECOMMUNICATIONS

SINGLE CURRENT SIGNALING - SWITCHING I ON & OFF

DOUBLE CURRENT SIGNALING - REVERSING DIRECTION OF I

COMMON CARRIER - COMPANIES FURNISHING TELCOMM. TO PUBLIC

MODEM (DATA SET) - ACRONYM OF 2 WORDS MODULATOR / DEMODULATOR

CONVERTS DIGITAL SIGNALS TO ANALOG & BACK AGAIN

MODEMS MUST BE MATCHED - SAME TYPE OF MODULATION & SPEED

TELEPHONE NETWORK - PAIR OF WIRE, COAXIAL CABLE, MICROWAVE, SATELLITE

RS-232-C - STANDARD INTERFACE IN US - EIA SPECS.

V-24 - STANDARD INTERFACE OTHER THAN US - CCITT SPECS.

TIME SHARING - ABILITY FOR MULTIPLE TERMINALS TO USE SAME

COMPUTER SYSTEM AT SAME TIME

DISTRIBUTED PROCESSING - REMOTE COMPUTERS DOING SOME OF THE

PROCESSING RATHER THAN CENTRAL CPU DOING ALL

## LINE GRADES

NARROW BAND OR LOW SPEED (SUBVOICE GRADE) - DATA ONLY / 300<sup>UP TO</sup> BITS/SEC. / NORMALLY TELETYPE

MEDIUM OR VOICE GRADE - DATA OR VOICE / UP TO 9600 BPS / REMOTE TERMINAL CRT

BROAD OR WIDE BAND - TV & COMPUTER TO COMPUTER / 19,200 & 50,000 BPS COMMON / CAN BE BROKEN INTO NARROW & MEDIUM BANDS

PRIVATE OWNED LINE - BELONGS TO USER, NORMALLY USED INTERNALLY WITHIN BLDG.

PRIVATE LEASED LINE - BELONGS TO COMM. CARR., PERM. CONN., LIMITED # OF SUBSCRIB.

SWITCHED OR DIAL UP LINE - COMM. CARR., TELEPHONE, CONN. EST. ON DIAL-UP BASIS

LEASE - GOOD QUALITY, 9600 (19200) BPS, FULL DUPLEX (4 WIRES), MULTI DROP, NO OVERLOAD

SWITCHED - WORSE / VARIOUS QUALITY, 2400 (4800) BPS, HALF DUPLEX (2 WIRES) MULTI DROP, OVERLOAD

DTE - DATA TRANSMISSION EQUIPMENT DCE - DATA COMMUNICATION EQUIP.

DTE TO DCE (MODEM) - BPS DCE ONTO LING - BAND

MODULATION SPEED DEPENDS ON MODULATION METHOD - SINGLE, FOUR, 8, 16 LEVEL

BPS - BETWEEN TERM OR CPU & MODEM BAND - BETWEEN MODEMS

ASYNCHRONOUS TRANSMISSION - MULTILEVEL MODULATION NOT POSSIBLE, TRANSMISSION SPEED (BPS) ALWAYS EQUALS LINE SPEED (BAUD)

SYNCHRONOUS TRANSMISSION - MULTILEVEL MODULATION, TRANSMISSION SPEED MUCH A MULTIPLE OF HIGHER THAN LINE SPEED

MULTILEVEL MODULATION - 2 OR MORE BITS GROUPED TOGETHER (DIBIT, TRIBIT) AS 1 INFO SIGNAL, DECREASING FREQ. OF ANALOG TRANSMISSION & BETTER USE OF FREQ BAND OF VOICE GRADE COMM. LINE (3000 Hz)

PT TO PT - 1 DEVICE EA. END

MULTI PT. - MULTI DEVICES WITH ONLY 1 COMMUNICATING W/ CENTRAL PROC. AT TIME  
CENTRAL PROC. - INITIATES ALL TRANSMISSIONS BY POLLING A REMOTE STATION

SELECTION - REQUEST TO REC. FOR REMOTE STAT, WHERE CPU TRANSMITS TO REMOTE

POLLING - INVITE TO SEND FOR REMOTE, CPU REC. FROM REMOTE

HALF DUPLEX - TRANSMITS IN BOTH DIRECTIONS 1 AT A TIME

FULL DUPLEX - CAN TRANSMIT IN BOTH DIRECTIONS AT ONCE

SIMPLEX - ONLY ONE DIRECTION - POOR ERROR CHECKING & CONTROL

SERIAL OR PARALLEL TRANSMISSION - 1 BIT AT A TIME OR PARALLEL BY BIT CHAR

ASYNCHRONOUS - START-STOP TRANSMISSION, EA. CHAR. PRECEDED BY START BIT & TERMINATED BY ONE OR MORE STOP BITS, EA. CHAR. INDIVID. SYNC.

1 CHAR AT A TIME, RANDOM INTERVALS, UP 1800 BPS ON DIAL UP OR 9600 BPS DIRECTLY CONN.

NORMALLY ONLY SUPPORTS PARITY FOR ERRORS

SYNCHRONOUS - BIT STREAM - COMPLETE BLOCK OF DATA SENT AT A TIME

SPEC. SYN CHAR. SENT FIRST FOR SYNCHRONIZATION

UP TO 9600 BPS ON VOICE GRADE LINE, BUFFERED TERMINALS, SOPHISTICATED ERR. DET.

BISYNC OR BSC - HALF DUPLEX  
EA. MESSAGE ACKNOWLEDGED BEFORE NEXT SENT, RULES FOR BINARY CODED DATA

CODES - USASCII - USA STANDARD CODE 7 DATA BITS & 1 PARITY BIT

EBCDIC - EXTENDED BINARY CODED DECIMAL INTERCHANGE CODE - 8 DATA BITS + BCC CHAR.

2

## Error DETECTING

VRC - VERT. REDUNDANCY CHECK - EA. CHAR. HAS PARITY BIT, ODD OR EVEN  
GEN. AT SENDING END & CHECKED AT REC. END, USED W/ ASYNCHRONOUS.

LRC - # OF 1 BITS ON EA BIT LINE CHECKED, HORIZ. PARITY, ODD OR EVEN  
USED W/ VRC & SYNCHRONOUS TRANSMISSION

Will miss 1 ERR. IN 1000 W/ LRC & VRC

REC. END GENERATES LRC & COMPARES

CRC - POLYNOMIAL CODE - CHECK CHAR. GENERATED BY DIVIDING DATA BY  
POLYNOMIAL & SENDING REMAINDER AT END OF DATA

USED W/ BISYNC, VERY RELIABLE

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TELECOMM. LANG - BY IBM - BSC - SYNCHRONOUS - HALF DUPLEX

STANDARDIZED SET OF CONTROL CHAR. & CONTROL CHAR. SEQUENCES

Code Sets - EBCDIC, USASCII (BOTH 256 CODE ASSIGNMENTS) 6 BIT TRANSCODE (64 ASSIGN)

To GET CONTROL OF IDLE LINE MUST SEND ENQUIRY, ENQ

MASTER STATION, USUALLY HOST CPU, WILL GET LINE IF ENQ AS SAME TIME

Message Block - STX (START CHAR.), DATA, ETB (END OF XS BLOCK), BCC (CHECK LRC OR CRC)

ETX (END TRANS. LAST BLOCK OF DATA) SOH (START OF HEADER BLOCK) ITB (END OF INTERMEDIATE BLOCK)

DATA - UNLIMITED DATA BLOCKS WITHIN MESSAGE

BYTES / DATA BLK LIMITED ACCORDING TO BSC TERM. (80 IBM BYTES NORM. NOT COMPATIBLE START END CHECK CHAR)

256 BYTES LAST DATA BLOCK IN MESSAGE ENDED W/ ETX

ETB - USE AFTER GROUP OF BLOCKED RECORDS OR RECORD

ITB - USE AFTER DATA BLOCK IN MULTIRECORD EXCEPT LAST TABN

ETX - AFTER LAST BLOCK OF MESSAGE OF MULTI BLOCKS

# DATA BLOCKS / MULTIRECORD & TOT. MULTIRECORD BYTE CAPAC. DEPEND ON BUFFER OF TERM

SYN - SYNCHRONOUS LOG - 2 SENT AT START OF XS FOR CHAR. PHASE SYNC.

ACKO/ACKI - PREVIOUS BLOCK ACCEPTED W/OUT ERR. & READY FOR NEXT

**NAK** - PREV. BLOCK REC. IN ERROR & READY TO ACCEPT RETRANSMISSION OR TERM. NOT 100%

**WACK** - TEMPORARILY NOT READY TO RECEIVING (SENDER MIGHT THEN SEND ENQ)

**EOT** - END OF TRANSMISSION - RESETS ALL STATIONS ON LINE

**ENQ** - USED TO OBTAIN REPEAT XSMISSION OR BID FOR LINE POS. ACK TO ENQ WILL BE ACK'D UNLESS AFTER GARBLED REPLY OR AFTER WACK

**RVI** - REVERSE INTERRUPT REQUEST POSITIVE ACKNOWLEDGEMENT

REC. STAT. REQUESTS TO TERM. XSMISSION BECAUSE OF HI PRIORITY MESSAGE - SEND STAT WILL THEN SEND ALL DATA PREVENTING IT FROM

BEING A REC. STAT.

**TTD** - ALSO USED TO ABORT XSMISSION STX ENQ TEMP. TEXT DELAY - SENDING STAT. WANTS TO RETAIN LINE BUT NOT READY TO XSMI

STX ENQ SENT 2 SEC. APPROX. AFTER IF STILL NOT READY TO SEND

**DLE EOT** - END OF XS & DISCONNECT LINE AT XS END

**MULTI-LEAVING** - FULLY SYNC, BI-DIRECTIONAL XSMISSION OF VARIABLE OF DATA STREAMS BTWN 2 OR MORE CPU USING BINARY SYNC WMA.

DATA SENT TRANSPARENTLY - DATA SENT IN WHATEVER FORM IT IS IN

**MODEM** = CLK INTERFACE, ISOLATOR, MODULATOR/DEMODULATOR, TRANS/REC., EQUALIZER/COND. DIGITAL DATA

**CCITT (EUROPE)** V28, V24, V31

**EIA (USA)** RS-232-A

RS-232-A, V28 - BINARY ONE (MARKING COND) -3V TO -25V DATA LINES

BINARY ZERO (SPACING COND) +3V TO +25V

TIMING & CONTROL LINES ON +3V TO +25V  
OFF -3V TO -25V

V24 - 25 PIN CONNECTOR

INTERFACE SIGNALS & PINS - C19 & C21

HALF DUPLEX MODEM - C22, C23

MODEM'S MODULATOR (TRANSMITTER) TURNED ON BY RTS FUNCTION ON STARTS

GENERATING & SENDING CARRIER, RTS OFF - STOP TRANSMISSION



3

8 ms, 33 ms, 66 ms, 133 ms SELECTABLE

ICE HAVE RTS, THERE IS THEN A DELAY, THEN CTS<sup>LEAK</sup> ALLOWING TO SEND

MODEM CONVERTS DIGITAL DATA TO ANALOG & SENT ON TX DATA LINE

TX DATA LINE HELD AT "1" (MARKING) BTWN CHAR & WORDS & WHEN NO DATA <sup>BEING SENT</sup>

SYNCHRONOUS TRANSMISSION - TIMING INFO BY MODEM USED TO DENOTE EA. NEW BIT LOC.

IF MODEM HAS NO CLOCK, CLK PROVIDED BY TERMINAL

ASYNCHRONOUS - CLOCK NOT NEEDED, START & STOP BITS USED FOR SYNC OF DATA

RTS OFF (REC. MODE) DEMOD. ON, WAITS FOR CARRIER, <sup>DATA PRESENCE DETECT</sup> DCD, <sup>ELIMINATING SIGNAL</sup> OR RLSO <sup>START</sup> MEANS DATA COMING

RX LINE - LINE ON WHICH DATA REC, DCD MUST BE ON

SYNC TRANS. - RX CLOCK BY MODEM LIKE TX CLK

SIGNAL TIMING - C40

4 WIRE OPERATION - <sup>C44</sup> 2 TRANSMIT, 2 RECEIVE FULL DUPLEX POSSIBLE

HALF DUPLEX - NO LINE TURNAROUND TIME RTS & CTS NOT ACTIVE

OPTIONAL MODEM SIGNAL - C50 OPTIONAL CHANNEL - C52 <sup>NO CLOCK 390 - 450HZ</sup> ALWAYS ASYNC

TX & RX ALWAYS ON WHEN MODEM ON & DATA SET & TERM. READY

SECONDARY CH. - 2 CLASSES

AUXILIARY - DIRECTION OF TRANS

BACKWARD - DIRECTION OF TRANS. ALWAYS

INDEPENDENT OF PRIMARY CH.

OPPOSITE OF PRIMARY & CONTROLLED BY RTS

USED FOR TTY OR LOW SPEED ASYNC TERM

PSEUDO 4 WIRE OPERATION C62

AUTOCALL - C75 C112

4 & 2 WIRE LEASED / PRIVATE LINES - ALWAYS CONNECTED

4 - 2 WIRE DIAL UP MODES

2 WIRE DIAL UP - 108/2 MAN. OPER. (DTR), 108/2 AUTO OPER. (DTR), 108/1 MAN. (CDSTY), 108/1 AUTO (E)

TYPES OF MODEM - C92

NULL MODEM - 100' MAX ASYNC ONLY C110 NO CLK

CARRIER WAVE - AMPLITUDE, FREQ, PHASE

AMPLITUDE MODULATION - AM - C122 No AMPLITUDE FOR "0"

FREQUENCY MODULATION - FM - C124 FREQ DETERMINES "0" + "1"

PHASE MODULATION - C126 180° PHASE SHIFT TO DETERMINE "0" + "1"

MULTILEVEL AMPLITUDE MODULATION - C128 - 2 BITS GROUPED TOGETHER, AMP VARIED

"PHASE" - C130

COMBO PHASE + AMP - C134 9600 bps POSSIBLE w/ 2400 BAUD

SPECIFICATIONS FOR MODEMS - C137

NON BELL MODEM REQUIREMENTS - C148

MODEM CRITERIA - C154

WHITE NOISE - RANDOM HISS CAUSING BACKGROUND NOISE TO SIGNAL

ACCEPTABLE IF SIGNAL AMP. SUFFICIENT

IMPULSE NOISE - NOISE OF HIGH AMP. BLOCKING OUT DATA CAUSED BY

LIGHTNING, NEARBY POWERLINES, RADAR/RADIO TRANSMITTERS, ETC.

CROSS TALK - 1 CH. PICKUP SIGNALS FROM ANOTHER

ATTENUATION FREQ. DISTORTION - ATTENUATION OF TRANSMITTED SIG. NOT = AT ALL FREQ.

ENVELOPE DELAY DISTORTION - VOICE CH. DON'T HAVE UNIFORM TRANSMISSION

SPEED FOR ALL FREQ, SIGNAL DELAYED AT SOME FREQ. MORE THAN OTHERS

NO LINE CONDITIONING REQUIRED UP TO 4800 BAUD TRANSMISSION

LOGIC "1", -12V, OFF, LOW, MARKING

LOGIC "0", +12V, ON, HIGH, SPACING

2227B ASYNCHRONOUS COMMUNICATIONS CONTROLLER - VP-T-S w/OPT 23 or 24, B or C w/OPT 2 - BUFFERED, SINGLE LINE D15

Opt 62 ASYNCHRONOUS COMMUNICATIONS CONTROLLER = 2227B E, F, PCS II

2228B SYNCHRONOUS/ASYNCHRONOUS COMMUNICATIONS CONTROLLER - VP, T, S w/OPT 24 - BUFFERED, SINGLE L D49

Opt. 62B COMMUNICATIONS CONTROLLER

2236 INTERACTIVE TERMINAL D64

223C MXC CONTROLLER

④

CONTROLLER CONSIST OF: 8080 MICROPROCESSOR, 8251 PROG. COMM. INTERFACE CHIP, RAM, PROM, SYS. INTERFACE, RS-232-C INTERFACE D8

2228B - LOADABLE MICROCODE AS OPPOSED TO 2227B

BISYNC - HALF DUPLEX SYNCHRONOUS LINE PROTOCOL THAT REQUIRES EVERY DATA MESSAGE TRANS. ACKNOWLED. BEFORE NEXT SENT

2236 MXC-1 - T OR VP      2236 MXC-2 - VP

BETWEEN 36 TERM & 36 MXC - ASYNC, FULL DUPLEX TRANS, 4 WIRE TWISTED PAIRS

DATA FORMAT - 1 START BIT, 8 DATA BITS, ODD PARITY, 1 STOP BIT ASCII

MODEM - WITHIN 50' OF MXC

2236 - NORMAL ADDRESS 01/05, 02/06, ETC.

IF HAVE 2226 TERM. 36'S WILL BE 81/85, 82/86, ETC.

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RS 232C - PIN ASSIGNMENTS FOR CABLE AT MODEM CIA

BAUD - BPS APPROX

220-0113 - CABLE FOR 2236 MX TO MODEM & MODEM TO TERM.

120-2236 - LENGTH NORMAL CABLE FOR 36 MX TO TERM.

PAD CHAR (FF) FOLLOWS ALL CONTROL CHARS.

TRANSPARENT TEXT - USED SO THAT DATA BEING SENT IS NOT CONFUSED W/ CONTROL CHAR.

DLE (10) USED BEFORE CHECK CHAR IN TRANSPARENT TEXT TO SHOW THIS IS A CONTROL CHAR

MULTI-LEAVING - FULL DUPLEX METHOD OF SIMULTANEOUS BIDIRECTIONAL TRANSMISSION OF DATA BETWEEN 2 OR MORE TERMINALS.

RS 232C - PIN 2 TRANSMITTED DATA PIN 3 RECEIVED DATA PIN 4 RTS  
PIN 5 CTS PIN 6 DATA SET READY PIN 8 REC. LINE DATA PIN 20 DATA TERM. READY

LOOP BACK CONN. (2-3) (4-5) (6-8-20)

DIAG 701-2357 BSC TC 701-2358 ASYNC TC 701-2180 B 2200  
700-4086 TC SUPPORT UTIL.

MAN 700-4719 BSC OPERATORS MAN 700-4718 ASYNC OPER MAN 700-4670 BSC/ASYNC MAN

SERV. BULLITINS - 59 (2207A + 2227) 77 (2200 TC INFO) 77.1 (2200 TC EMULATOR CHANGES)

2207 210-6362-1

2207A 210-6362-1A CONTROLLER FOR TELETYPE w/ <sup>SELECTABLE</sup> BAUD

2227 210-6362 CONTROLLER FOR TELETYPE OR CPU w/ <sup>SELECTABLE</sup> BAUD RATE & CHAR SIZE (REC 419 TRANS 410)

<sup>MP</sup> EOM <sup>SW</sup> SW - SET TO FF FOR DIAG.

2227B - ASYNC ONLY - BUFFERED

2228 BISCN ONLY

2228B BSC OR ASYNC 2 Row RAM

(10)

2228C

PCS OPT62 ASYNC 7153 OPT62B BSC 7153-1

PARITY ERR - ↑ FRAMING ERR. - NO STOP BIT & OVERRUN ERR. - LOST

~~DATA~~ 1 CHAR BY OVERWRITING BUFFER IN I/O CHAR

CCV Comm. CONTRA VECTOR - SETS UP # OF STOP BITS, CHAR BITS, & PARITY, ETC.

BSV Comm. STATUS VECTOR -

WYLBUR - ASYNC TC SYSTEM ] 2741 ASYNC 2780, 3780, 3740 BSC HASP

BELL 103 300 BAUD ASYNC 272-8120 thru 8130

BELL 2025 1200 BAUD ASYNC 272-7420 + 7421

BELL 2125 1200 BAUD ASYNC 272-9008 - 9208 - 9244

BELL 201C 2400 BAUD BISCN 272-6221 thru 6224 + 6226

SIGN ON CODE FOR 300 BAUD ASYNC GTWX

1200 BAUD ASYNC ↑ TWX

3780-80 CHAR FORMAT (TC)

BSC 1 TELECOM

3180 EMULATOR

LOAD RUN

SF' 4 3780

CARRIAGE RETURN

\* SIGNON

<sup>16</sup> REMOTE46

<sup>28</sup> TBKLDVXA

NO RETURN

DIAL #

201A

2000 BAUD

272-9460

201C

2400 BAUD

272-6221-24. + 26

208B

4800 BAUD

272-4060

C/R

TRANS. COMPLETED W/

PRINTOUT - LONG

5

2228 B CONTROLLER . . . . . BISYNC or ASYNC

ASYNC 1 TELECOM (TYPE OF DATA SET)

LOAD RUN  
SF 2 1200 ASYNC  
SF 3 TURN PRINTER ON OPT.  
DIAL WYLBUR 272-7420 + 21 GET TONE HOLD  
↑ TWX

RESPONDS WANG DATA CTR.  
TERMINAL ~~W33~~ W33  
INITIALS FES  
ACCOUNT FS  
KEYWORD RAM  
COMMAND USE 2200 ON W33002  
COMMAND LIST UNN  
RESPONDS

THIS IS A 2200 T.C. TEST ETC.  
COMMAND CLR ACT  
COMMAND SIGNOFF  
COMPUTER STAT., END OF SESSION

BSC 1 TELECOM 2780 EMULATOR

LOAD RUN  
SF 2 2780 BISYNC 2400 DK/PRR

C/R KEYBOARD  
/\* SIGNON REMOTE S3 SEUX MTKL

DIAL # 201 C MODEM (2400 BAUD) 272-6221 THRU 24 + 26  
201 A MODEM (2400 BAUD) 272-9460  
208 B MODEM (4800 BAUD) 272-4060 GET TONE + HOLD

CARRIAGE/RETURN SHOULD RESPOND TRANSMISSION COMPLETE  
DTR \* DSR \* SENT 1

CARRIAGE/RETURN  
/\* \$ DA TRANS. COMPLETED, REC'D. X, PRINT OUT

CARRIAGE/RETURN  
/\* \$ DI "

CARRIAGE RETURN  
/\* SIGNOFF TRANS. COMPLETE, LINE SHOULD DROP OFF SHORTLY

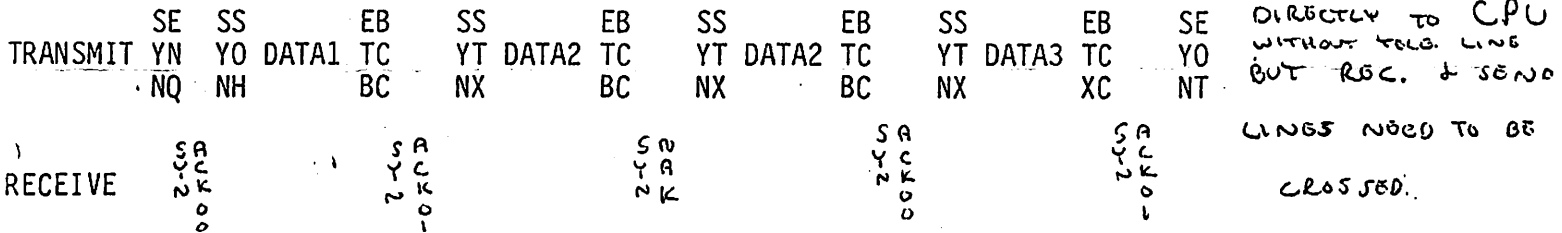
TYPE IN NO. RET

# Mrko ~ BAHIA

Why are modems needed for communications over telephone lines?

1. CHANGE DIGITAL SIGNALS OF COMPUTER TO ANALOG SIGNAL USED W/ TELEPHONE LINES. QUALITY OF TELE. LINES NOT GOOD ENOUGH FOR DIGITAL.
2. What is the purpose of a null modem? NULL MODEM IS USED WHEN REMOTE TERMINAL IS CLOSE ENOUGH TO CPU WHERE IT COULD BE CONNECTED DIRECTLY TO CPU WITHOUT TELE. LINE BUT REC. & SEND LINES NEED TO BE CROSSED.

3. Complete the receiver section of the following communication sequence:



4. Define the following:

DCE - DATA COMMUNICATION EQUIP. (MODEM)

DTE - DATA TERMINAL EQUIP. (CONTROLLER)

5. What is the difference between marking and spacing? MARKING, LOGIC "1", -12V  
SPACING, LOGIC "0", +12V

6. Match the following:

- ✓ \$GIO Word loaded into TC Board which sets operation protocol.
- ✓ BCC PARITY Used in Async TC
- ✓ UART Continually updated status of TC board (buffers, errors, etc.)
- ✓ Parity \$GIO Statements used to control TC Boards.
- X Framing bits UART Universal Async. Rec. Trans.
- ✓ CCV FRAMING BITS method of checking data integrity on Async TC
- ✓ CSV BCC Data integrity check for BSC TC





# TELECOMMUNICATIONS

## INSTALLATION NOTES FOR THE 2200 RCM SYSTEM

by Tom Theil, C.E. Software Support

The 2200 Remote Control and Maintenance (RCM) system is a Wang software package which allows a user at one 2200 CPU to access a terminal port on another 2200 CPU in a manner such that the accessed CPU thinks it is dealing with one of its own terminals. This deception is accomplished via the Terminal Emulator Program (TEP) as discussed on pages 40-41 of the July 1981 CSS Newsletter. Since 2200 CPUs do not distinguish between directly-connected and remote workstations, REMOTE treats LOCAL as a terminal local to it. In the case of a single-user REMOTE, this means that LOCAL has complete control of REMOTE. With a multi-user REMOTE, LOCAL gets whatever privileges were genned for the accessed port. Frequently, the LOCAL:REMOTE relationship tends to be more master:slave or central:satellite than peer:peer.

Note: Not all documentation is consistent in labeling the two CPUs. In this article, LOCAL will tag the accessing (originating, central, master) CPU, and REMOTE will be the accessed (remote, slave) CPU. The terms LOCAL and REMOTE as used in RCM are defined from the point of view of the operator using the Terminal Emulator Program. The LOCAL CPU executes the terminal emulator software that allows its telecommunications controller to look like a 2236-style terminal to the REMOTE CPU. (See Figure A.)

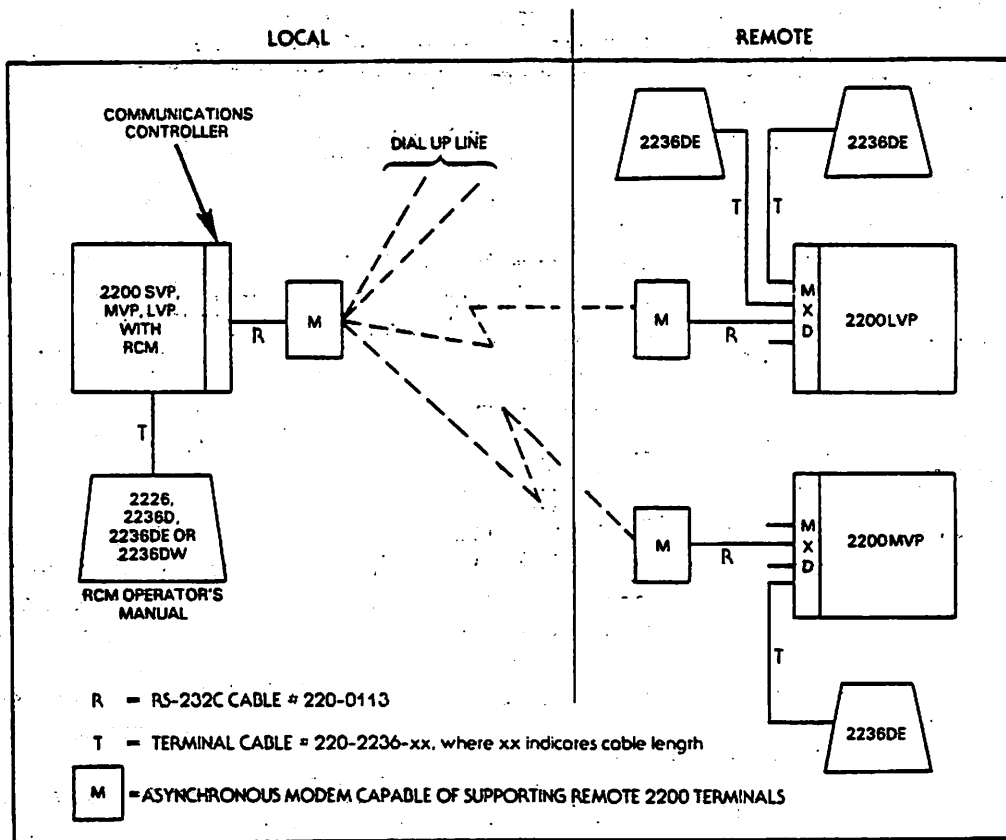


FIGURE A. Sample Remote Control and Maintenance Configuration

(continued)

## RCM Features

RCM has two primary modes of operation — terminal emulation and file transfer. Based on calls received from the field, the most prevalent user is a vendor who envisions using RCM to maintain, debug and update his clients' programs and files. Compared to simply hooking up a remote terminal, RCM offers some advantages. Most significant is the ability to transfer files in either direction as opposed to hand-keying them or hoofing it out to the customer site.

Secondary benefits include media compatibility, convenience and economy. With the advent of DSDD diskettes, Phoenix drives, and the practice of selling systems sans diskette drives, some users with older equipment have investigated RCM as a primary means of file transfer to newer systems.

Because baud-rate selection on 2236-series terminals is via switch setting, using RCM's software-selectable baud settings can save time for those who constantly toggle between in-house and remote work. Switching terminals between in-house and remote work involves swapping cables as well as manipulating switches on the back of the terminals.

RCM is an economical telecommunications method when small quantities of data are to be exchanged relatively infrequently. Unless it is necessary to reverse the LOCAL:REMOTE relationship, only LOCAL requires a TC board (and an async one at that). Async modems cost less than synchronous modems, and may already be in place if LOCAL:REMOTE have already been connected in a remote terminal setup. Gains can accrue to LOCAL without placing financial burdens upon the REMOTE(S) accessed.

## Limitations

### Speed:

Since RCM is asynchronous, baud rate is likely to be 1200 or less. Using a null modem, the Terminal Emulator Program has been run at speeds greater than 1200 bits per second. Running File Transfer at rates greater than 1200 has not been fully tested, and is therefore not recommended. Remember that transfer in the LOCAL to REMOTE mode hinges upon deceiving the terminal controller into thinking it is receiving keyed input; the controller does not expect to encounter (nor does the real keyboard allow) typists who can attain superhuman speeds.

### Error Correction:

In general, RCM validates data on a character-by-character basis. In sending characters to the REMOTE, LOCAL gets them echoed back by REMOTE's terminal controller (which thinks it is echoing keystrokes). If LOCAL doesn't get a good match, it can resend the data.

RCM transmission speeds are not symmetrical. File transmission (LOCAL to REMOTE) is slower than reception (REMOTE to LOCAL) because of the asymmetry in the communication protocol used in the terminal to terminal controller link. The LOCAL to REMOTE protocol is not code transparent. Control characters must be 'HEXPRINTED' so they won't be confused with RESET and other special control characters. Expanding a HEX(00) into two ASCII 0s takes twice as long as if it were possible to send HEX(00) directly. Validation is performed on a field basis. Keystroke echoing does not significantly slow down file transfer, because of full-duplex communication. There is a slight wait at the end of each field for the last few characters to echo back.

The REMOTE to LOCAL protocol (from a terminal controller to a terminal) is code transparent, and also supports data compression. Receiving a file should be at least twice as fast as transmitting.

### Security:

If the REMOTE port is non-programmable, RCM will have limited functionality. If the REMOTE port is programmable, the LOCAL system will be able to access all files available to partitions assigned to that port.

(continued)

### Terminals:

At the central site, terminals can include the 2226 as well as the several models in the 2236 series. While this makes the system flexible by not requiring upgrades, there may be cosmetic or functional problems with remote applications making assumptions as to the keyboard and output capabilities of the terminals they expect to deal with.

### Local:Remote Reversal

There is nothing to prevent LOCAL:REMOTE role switching if both systems have TC boards and both are eligible to be LOCALs (see Hardware, under Installation Requirements below). Since switching involves recabling, it usually implies dropping the line and redialing.

If LOCAL has an MVP or LVP, RCM can be run from one partition into another by tying the TC board and MXD port together via two 220-0113 cables and a 2227N null modem. While the advantages of such an arrangement are not boundless, it does allow for diagnostics and practice.

### RCM Ordering Information

Package Name: 2200 Remote Control and Maintenance System (RCM)  
Package Number: 195-2168-3 (8-inch 35SD) or 195-2168-5 (8-inch DSDD)  
Contents: One 8-inch diskette, number 701-2713  
One RCM User Manual, number 700-6848  
Current Release: 1.1.0  
Source: Software and Literature Control Center, Mail Stop 5222, 11 Elizabeth Drive, Chelmsford, MA 01824, telephone 800-343-0440 or 617-256-1200, extension 4999.

### Installation Requirements

The following describes hardware, software and the communications link requirements for both LOCAL and REMOTE components in order to run RCM:

#### Hardware, LOCAL System:

- CPU: MVP, LVP, VP or SVP CPU running BASIC-2.
- TC Board: 2227B, 2228B, 2228C or similar option on SVP. The 2228D series boards do not support RCM, nor have there been any announcements of impending support.
- Modem: Asynchronous, full-duplex, 11 bits per character, RS232C cable, 300 or 1200 bps.  
NOTE: the modem requirement is rigid, particularly with regard to the 11-bit character. Many popular modems can handle only 10 bits or 1200 baud, specifically the Bell 212A. RCM can use any modems suitable for use with 2236-style terminals and controllers. One suitable modem is the new Wang WA3451.
- Cable: One standard RS-232C I/O cable, number 220-0113.
- Terminal: 2236DE, or 2236DW. (The 2236D and 2226 are supported, but their displays will be disappointing.)

(continued)

**Hardware, REMOTE System:** 2236MXD. (LRS or SVP) set to 300 or 1200 baud, which rules out the VPD. Because of the difficulty of switching MXD baud rate, the port should be regarded as dedicated on LVPs and MVPs.

- Modem: Identical to or compatible with that of LOCAL system.
- Cable: One standard RS-232C I/O cable, number 220-0113. Note: SVP REMOTES require a 2236LRS switch box and three standard RS-232C I/O cables, number 220-0113.

\* For a connection (not exceeding 50 feet) between the central control system and another 2200 system at the same site, one Wang 2227N null modem can be used instead of the two asynchronous modems.

**Software**

The LOCAL system requires the 2200 Remote Control and Maintenance System software included on diskette number 704-2710. REMOTE requires no software for terminal emulation. To do file transfer, REMOTE must have the RCM program file FILERC resident. Installation cannot be via RCM, except through manual key-in which is decidedly contraindicated.

**Communications link**

• Dial-up or leased line supporting full duplex at desired baud rate.  
 • One 2227N null modem, which, if used, would replace the 2 modems listed under Hardware above.

**Installation Precautions**

**Modems:**

The modems must be able to handle 11-bit characters, as discussed under Installation Requirements above.

**Cables:**

RS-232C cables, number 220-0113, must be used. The standard terminal cable is mechanically compatible and will fit in the modem and CRT connectors, but it will not work.

**Baud rate:**

Settings must agree at four points: REMOTE's MXD or LRS port, both modems, and LOCAL's TC board. The TC board is set by RCM software. All the others require switch settings. Resetting the MXD requires shutting down the CPU and removing the board.

**Hardware addresses:**

If installation of RCM and the TC board are coincident at the LOCAL site, make sure that the TC board is set properly. The default address is '01C', which means that positions 3, 4 and 5 should be set ON on the board's dip switch. On an MVP or LVP, be sure to define the device in @GENPART.

(continued)

## Testing the Installation

The testing procedure described below is based on the following assumptions:

1. LOCAL system has a diskette drive and RCM software on diskette. This test cannot be done if LOCAL is a VP, because the terminal controller may not support an appropriate data rate.
2. A baud rate has been agreed upon (RCMSbaud) for RCM, and all controller and modem switches are set accordingly. This test cannot be done if LOCAL's terminal is a 2226.
3. At the LOCAL end, one 220-0113 cable has been attached to the modem, which is connected to the phone line. At the REMOTE end, one 220-0113 cable has been attached to the modem, which is connected to the phone line. This path from cable to cable will be immutable through these tests and will be referred to as the 'cable-to-cable path'.
4. The person performing the tests is at LOCAL's site.

Removing RCM from the picture is one way to make sure that any problems encountered go beyond hardware. Tests 1 and 2 involve a standard remote terminal hook-up in both directions. Throughout the testing, the cable-to-cable path remains inviolate; only the extremes of the connection are altered. When performing the tests, generate some heavy line activity by listing a disk index or program.

**Test 1.** At the LOCAL end, set a terminal port to RCMSbaud and hook it to the cable-to-cable path. At the REMOTE end, set a terminal to RCMSbaud and hook it to the cable-to-cable path. Dial into LOCAL. Test 1 will not work if LOCAL is a VP.

**Test 2.** Reverse Test 1. At the LOCAL site, set a terminal to RCMSbaud and hook it to the cable-to-cable path. At the REMOTE end, hook the cable-to-cable path to the terminal controller port. Have LOCAL dial into REMOTE. In this test, REMOTE's setup is identical to the way it should be for RCM. Test 2 won't work if LOCAL's terminal is a 2226.

**Test 3.** This hardware setup is identical to that required for RCM, so the following preparations should be made, even if test 3 isn't performed. Reset LOCAL's terminal to its standard rate and hook it into its normally-set terminal port. (LOCAL's terminal rate is completely unrelated to RCMSbaud, except in the bizarre instance where it is set lower than RCMS). Hook LOCAL's TC board to the cable-to-cable path. Leave the REMOTE end as set for test 2. If TTY (ASC-1) software is available at the LOCAL site, the TC board can be tested by running TTY (config options = RCMSbaud, 8-bit, odd parity, full duplex, echoplex). Use CONTROL 'R' to reset the REMOTE partition.

**Test 4.** Leave the hardware as it was for test 3. Now run RCM by doing a LOAD-RUN off the RCM diskette and choosing the Terminal Emulator Program from the menu. If the line drops from test 3 (which it might, when the TC board is reset by RCM), redial.

**Test 5.** If 'FILERS' is up on the REMOTE system, file transfer can be tested. At the LOCAL end, hit the Shift/Function keys to bring up a footer menu on the terminal emulator application screen. Then hit Function Key 3 to enter file transfer mode and try sending and receiving some files. This is where trouble may be encountered. If you want to learn a new meaning for the word slow, try sending a really long file from LOCAL to REMOTE.

## Typical Problems

### Modem Incompatibility

The majority of problems encountered deal with modem incompatibility. Most users who previously had been using the remote terminal capability of the 2200 to access remote CPUs have had relatively few problems installing RCM. The major difficulty in setting up RCM appears to be getting the right modems with the right settings.

### TC Board Problems

The second most prevalent problem has occurred with users of 2227B boards. Sometimes this is a hardware problem, but more often software. See 'Patches' below.

(continued)

## File Transfer Loops

Almost no one has reported problems in running the Terminal Emulator Program. Run-time problems have resided largely in File Transfer. What happens most frequently is that the file transfer hangs, looping on the same sector of a file. If the system is brought down and back up, the loop recurs at the same position. See 'Patches' below.

## Patches

In Release 1.1.0 of RCM, the following changes should be made to programs E2236a1 and FILER&S.

### In program E2236a1

- If Local's TC board is a 2227B (optional on 2228B):

```
CHANGE LINE 2110 TO READ ----  
2110 DATA HEX(1020332A000000000000000000000000)
```

```
CHANGE LINE 2065 TO READ ----  
2065 SGI0 LOAD CCV #4 (4580, 4402, 4000, 4000, 4000, 4000, 4000, 4400) BS
```

- If Local's CPU runs under a VP Operating System:

```
CHANGE LINE 2210 TO READ ----  
2210 DATA HEX(440902FF03FF1222C320)
```

```
CHANGE LINE 2230 TO READ ----  
2230 DATA HEX(440902FF03FF1222C320)
```

- If Local's CRT is a 2236DW:

```
CHANGE LINE 555 TO READ ----  
0555 IF TS<>"2236DW" AND TS<>"2236DW" AND TS<>"2236DE"  
AND TS<>"2236DE" THEN 560  
: DS(6)="DE"  
: TS=STR(TS,1+POS(TS=" "))  
: GOTO 565
```

Note that RCM Release 1.1.0 does a DE (not a DW) emulation.

### In program FILER&S

- Change DEFFN '81 to read:

```
0391 REM X  
KEYIN LOOP  
0392 DEFFN '81  
: PRINT HEX(05);  
: L=0  
: O2S=" "  
-0393 KEYIN AS,,396  
: IF AS = HEX(E5) THEN 395  
: IF AS = HEX(0D) THEN RETURN  
-0394 PRINT AS;  
: L=L+1  
: IF L>64 THEN 393  
: STR(O2S,L,1) AS  
: GOTO 393  
-0395 REM LINE ERASE  
: PRINT AT(2,7,64);  
: L=0  
: GOTO 393  
-0396 IF AS=HEX(7F) THEN GOSUB 127  
: GOTO 394
```