07096510-0

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REVISION HISTORY

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```
                              A2232 Tuning

        Upgrade/Modification for the A2232 Multi-Port Serial-Card

                    Version 1.03 23.3.1997

            Idea & Realisation by
          Markus Marquardt
                    Many thanks for support and inspiration to Jukka Marin


           English translation by
          Leslie Ayling
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          Important!
                          Read BEFORE Commencing!


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You will need ...

RTS/CTS Hshake

RTS/CTS-Handshake Modification

Baudrate A

Baudrate-Mod Variation A

Baudrate B

Baudrate-Mod Variation B

Technical

Technical Information

1.2   A2232 Tuning - Hints

General Hints
=============

These Instructions and Software are FREEWARE. Only a small fee for media is
permitted. Commercial use of this package is FORBIDDEN.
While all care has been taken in the preparation of this package, the author
accepts no liability for damage caused as a result of the information contained
herein.

If you use either the Modification or the "a2232.device" , or if you have any
ideas or suggestions for improvements please send me a postcard or an e-mail.

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1.3   A2232 Tuning - Introduction

Introduction
============

It was once... the 'A2232 Multi-Serial-Card for the Amiga 2000' (Quotation
from the Packaging). These Zorro-2 cards, that also work in the A3000 and
A4000, appeared on the market around 1989. For that time they were an innovative
concept. Unfortunately some limitations of the card leave it relatively unusable
in the present day. Meanwhile no similar card is currently available.

These instructions describe how to get some reasonable performance out of this "Good Old Piece".

This Package also includes a new Device ("a2232.device") as well as modification instructions for the hardware.

With the use of the new Device some existing limitations are removed, and the performance of the A2232 card is improved.

To get the maximum performance out of the A2232 card and eliminate all handshake (RTS/CTS) problems, the hardware can be improved for a relatively low cost (about 10 to 20 DM).

1.4   A2232 Tuning - Leistungsdaten der Device

```
                 Specifications of the a2232.device
                 ==================================
```

With the a2232.device the A2232 card achieves the following:

o Efficient Processor Utilization.

  The Device is written in 100% Assembler and uses a different IRQ-Handling
  Scheme compared to the original Device for the A2232 Card. Several seldom-used
  features are sacrificed in favour of speed however.

o Functioning RTS/CTS-Handshake for unidirectional Transfers

  The original Device had Problems with the RTS-Handshaking when receiving
  Data. This Problem is fixed with the new Device. However it only works if
  while receiving data, no data is sent on the same port simultaneously.
  To get fully working bidirectional handshaking, you have to modify the
  hardware as described later in this document.

o Functioning 115200 Baud Modes

  Through optimization it is possible, on a maximum of 2 ports, to achieve an
  interface speed of 115200 baud. The rest of the ports can still be used at
  19200 baud.

o These Features of the original serial.device are NOT supported:

  o DSR-Signal
  o XON/XOFF Handshake (maybe I will implement this later)
  o Sending BREAKs

1.5   A2232 Tuning - Installing the Device

```
                 Installing the a2232.device
                 ===========================
```

The Installation of the Device is trivial. Simply copy "a2232.device" to your
DEVS: directory. That's it.

                                IMPORTANT!
                                ==========

One should make sure not to access both the new a2232.device and the old
serial.device when the a2232 card is used. Because both devices attempt to access
the hardware causing a conflict.

Furthermore be aware that with the new A2232.device (in contrast to the original
device) unit 0 corresponds to the first port of the first A2232 card.


```
     Unit       Card       Port
     -----------------------------
       0          1          1
       1          1          2
       2          1          3
       3          1          4
       4          1          5
       5          1          6
       6          1          7

       7          2          1
       8          2          2
       9          2          3
      10          2          4
      11          2          5
      12          2          6
      13          2          7

      14          3          1

     etc...
```


1.6   A2232 Tuning - Tech Info for the A2232.device

                    Technical Information for the A2232.device
                    ==

The Device automatically recognises a modified A2232 card. It does this by testing
the CIA on the card to see if PA7 and PB7 have been connected. In this event it
configures itself to deal with the modified card.

The Clock rate of the ACIAs on each A2232 board is recognised by the software
automagically. On startup of the device, the software sends two NUL characters
to the first port on each installed a2232 card. By using a timer in the 8520 on
the card, the time which the ACIA needed to send these characters is measured. ↩
   With
this time, the clock rate of the ACIA's baudrate clock is calculated.

For Communicating with the A2232 card there exists for each port:

o A Data-Area for entering parameters, and to exchange control information.

o An Transmit-FiFo buffer of size 256 Bytes

o A Receive-FiFo buffer of size 256 Bytes

The new a2232.device dosen't communicate with the A2232 card through the use
of any special Interrupts. All data transfers occur during the Vertical Blank
Interrupt. Which on a standard PAL Amiga occurs at 50 times per second. (For
NTSC machines this is 60 times per second).
This therefore allows a maximum transfer rate of:
50 * 256 [fifo buffer] = 12800 bytes per second per port.

1.7   A2232 Tuning - Important Information for the Modification

                              ATTENTION!
                              ==========

On the A2232 card are components which could possibly be damaged by static-
electricity!

Therefore please use a earthing wrist-strap or discharge any buildup by touching
an earth point (like a radiator) before you begin the modifications.

The Positions of the ICs is printed on the A2232 Card. For security double-check
the part no.s on the IC's themselves. The modifications described here are for
a Rev 6 A2232 board, other revisions may have board layout differences!

The ICs can be removed from their socket's with either a special removal tool,
or just a screwdriver. Exercise caution when bending the pins so that they
don't break off, as replacements maybe hard to get.

1.8   A2232 Tuning - Modification Options

                           Modification Options
                   ====================

o Modification of the RTS/CTS-Handshake

  This mod should ALWAYS be installed, because it allows bidirectional
  Data exchange with the RTS/CTS-Handshake enabled. Bidirectional here means
  sending and receiving data simultaneously on the same port. If you never
  intend to do this (e.g. if you are running a BBS which doesn't support
  bidirectional transfer protocols like hydra or s-modem) you can skip this
  part or do this modification later when you need it.
  When using the a2232 for networking applications such as PPP or SLIP
  protocols, you will NEED this!

o Baudrate-Modifications

Through this modification the baudrates of the A2232 can be altered to the
following configurations. Each card can have EITHER variation A or variaton B
but not both.

o Variation A

  Possible Baudrates:
      75,150,300,600,900,1200,1800,2400,3600,4800,9600 und 57600 Baud.

  All 7 Ports can use 57600 Baud simultaneously with this!

o Variation B (as yet untested!)

  Possible Baudrates:
      100,150,220,270,300,600,1200,2400,3600,4800,7200,9600,14400,19200,
      38400 and 230400 Baud.

  With 230400 Baud a maximum of one Port is possible, otherwise the A2232
  is overburdened.With 230400 Baud the theoretically possible transferrate
  of 23040 Byte/Sec. is NOT reached. The maximum attainable transferrate
  amounts to 12800 bytes/sec at the VBLANK rate of 50Hz.
  For more about this see
                  Technical

1.9   A2232 Tuning - Material for the Mods

                      Necessary Material for the Mods
                      ===============================

o For all The Mods you will need:

  o A Soldering iron, better still: A SolderStation with an earthing point.

  o Solder (60/40) small gauge preferred.

  o Standard-Tools: Screwdrivers, Pliers etc.

o RTS/CTS-Handshake Mod

  For the RTS/CTS-Handshake Mod about 2 metres of thin insulated cable is required ↩
      .

o Baudrate-Mod Variation A

  o 1 x IC 74LS74

  o Desoldering tool: Desoldering pump or Solder Wick

o Baudrate-Mod Variation B

 o 1 x Quartz Oscillator at 3.6864 MHz, whith TTL compat. output

 o Desoldering tool: Desoldering pump or Solder Wick

1.10   A2232 Tuning - RTS/CTS-Handshake Modification

```
                    RTS/CTS-Handshake Mod
                    =====================
```

All of the following ICs must be removed from thier sockets and have the
following pins bent horizontally, (so that those pins no longer make make
contact with the IC socket) then replaced in their sockets.

The following ICs must be modified:

U78 (8520): Pin 9, 10, 11, 12, 13, 14, 15, 16 und 17

U52, U54, U56, U58, U72, U74, U76 (6551 or 8551): Pin 8 und 17

After the ICs have been replaced in their Sockets make the following connections
with the thin gauge shielded cable cut into short lengths.

```
   New Connections
   ---------------

   From                   To                 Signal Name

   U78 Pin 10             U59 Pin 10         /RTS #0
    "   "  11             U60 Pin 10         /RTS #1
    "   "  12             U61 Pin 13         /RTS #2
    "   "  13             U61 Pin 10         /RTS #3
    "   "  14             U79 Pin 10         /RTS #4
    "   "  15             U80 Pin 10         /RTS #5
    "   "  16             U81 Pin 10         /RTS #6

   U52 Pin 17             U51 Pin 3          /CTS #0
   U54 Pin 17             U53 Pin 3          /CTS #1
   U56 Pin 17             U55 Pin 3          /CTS #2
   U58 Pin 17             U57 Pin 3          /CTS #3
   U72 Pin 17             U71 Pin 3          /CTS #4
   U74 Pin 17             U73 Pin 3          /CTS #5
   U76 Pin 17             U75 Pin 3          /CTS #6

   U78 Pin 9              U78 Pin 17         /PA7 -> /PB7
```

These alterations are shown in the IFF-File [UMBAU.IFF].

1.11   A2232 Tuning - Baudrate MOD A

```
                    Baudrate-Mod Variation A
                    ------------------------
```

Locate the IC at position U18 (74LS74) above it is a black component with only
2 legs labelled FB1. Using a desoldering tool lift the end of FB1 nearest the
FB1 legend on the board out of the hole. FB1 should now only be connected to the
board by one lead.

Next prepare a new IC 74LS74 as follows:

Cut Pins 1, 2, 3, 4, 5, 6, 10 and 13 off completely with a pair of side-cutters.
Using the side-cutters trim pins 8, 11 and 12 (in order to solder wires to them)
then bend pins 8,11 and 12 horizontally.
Next connect pin's 8 and 12 of the new IC together.

At Pin 10 of the IC at Position U18 (74LS74) wire a small piece of shieled cable
(approx. 1cm)

Then piggyback the new IC over the top of U18 (74LS74), only soldering pins
7 and 14 of the new IC to pins 7 and 14 of U18.
All other pins of the new IC make NO CONTACT with U18.

Then connect the other end of the wire that you previously soldered to Pin 10
of U18 to pin 11 of the upper IC.

Then connect pin 9 of the upper IC to the open end of FB1. (the lead of FB1 you
desoldered earlier.)

The connections again in short-form:

```
   U18 74LS74        Piggyback 74LS74         FB1

   8 with 12

   7    <---->        7
   14   <---->        14
   10   <---->        11
                      9        <---------->   right connection(open end)
```


1.12   A2232 Tuning - Baudrate MOD B

```
                    Baudrate Mod Variation B
                    ------------------------
```

Simply replace the oscillator pack at Position Y1 with the new 3.6864 MHz
replacement.

1.13   A2232 Tuning - Hardware-Mod Technical

```
                    Technical Information
                    =====================


                    RTS/CTS-Handshake Mod
```

In an unmodified A2232 the connections are thus:

```
   Port    ACIA              RTS                CTS                DSR

   0       U52               ACIA /RTS (8)      CIA PB0 (10)       ACIA /DSR (17)
   1       U54                 "   "   "        CIA PB1 (11)         "     "    "
   2       U56                 "   "   "        CIA PB2 (12)         "     "    "
   3       U58                 "   "   "        CIA PB3 (13)         "     "    "
   4       U72                 "   "   "        CIA PB4 (14)         "     "    "
   5       U74                 "   "   "        CIA PB5 (15)         "     "    "
   6       U76                 "   "   "        CIA PB6 (16)         "     "    "
```

The Signals RTS and DSR are therefore directly connected to the corresponding
ACIA, with the CTS-Signals being sensed directly by the 8520 CIA.

Tests have shown that the ACIAs (8551 and 6551) are not able to operate the
RTS signal independently from sending characters.

The following problems exist:

o With /RTS at logic "0", there can be no transfer of data as the transmitter
  has apparently switched off.

o With /RTS (during sending) being set to logic "0" in the appropiate ACIA
  register, the ACIA /RTS output remains logic "1" until there are no more
  characters to send in the transmit shift register.

The Solution to the problem then is to handle the RTS signals not with the
ACIA but with the port B of CIA 8520 on the a2232 card. Because the port B
is already used to monitor the CTS signals, these signals have to be moved
to the DSR inputs of the appriopate ACIAs.

After the mod the system looks as follows::

```
   Port    ACIA              RTS                CTS                DSR

   0       U52               CIA PB0 (10)       ACIA /DSR (17)     not connected
   1       U54               CIA PB1 (11)         "    "    "       "    "    "
   2       U56               CIA PB2 (12)         "    "    "       "    "    "
   3       U58               CIA PB3 (13)         "    "    "       "    "    "
   4       U72               CIA PB4 (14)         "    "    "       "    "    "
   5       U74               CIA PB5 (15)         "    "    "       "    "    "
   6       U76               CIA PB6 (16)         "    "    "       "    "    "
```

                              Baudrate-Mods

The Highest selectable Baudrate of the ACIAs is equal to 1/16 of the external
Clock. At 1.8432 MHz this equals 115200 Baud. With the Flip-Flop 74LS74 this
becomes 57600 baud for Variation A , and with a different oscillator becomes
230400 baud for Variation B.

1.14   A2232 Tuning - Author

```
                          Contact address
                          ===============

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```

1.15   A2232 Tuning - English Translation

```
                          Contact address
                          ===============

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```

Any sections followed by (??) mean I'm not 100% confident in the translation.
      However nothing critical to performing the mod is wrong.

1.16   Index

```
            Index of database 07096510-0
```

Documents

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            A2232 Tuning

            A2232 Tuning - Autor

            A2232 Tuning - Baudraten-Umbau Variante A

            A2232 Tuning - Baudraten-Umbau Variante B

            A2232 Tuning - Einleitung

            A2232 Tuning - Hardware-Umbau Technik

            A2232 Tuning - Hinweise

            A2232 Tuning - Installation der Device

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A2232 Tuning – RTS/CTS-Handshake Umbauanleitung

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 Wichtig!

Markus Marquardt