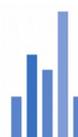**Duhlwiesen 32, 55413 Weiler bei Bingen am Rhein - Germany**
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Technical Note
TN0002

TDAT Problem Solutions Guide

Titel
TDAT Problem Solutions Guide

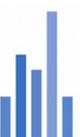## Editor
Oliver Mueller / Parts Engineer

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1.00

Updated
19.11.2009

Instruments
MassLynx Systems

Contents

1   TDAT Introduction

This guide is dedicated to all users, who still have a Micromass TDAT instrument in use. Actually there is not much knowledge left from the good old Micromass times and the old engineers might be able to remember it. This guide is a collection of information what Waters provided for their customers. Have a look in the manuals that come with a new TDAT PC or what you find in the Masslynx 3.5 knowledge base help. All pictures are made by ourselves and all information are given with no claim to be complete. For your reference, have a look in the Waters document 715001758 Rev. A.

Since the early Trio-family made by VG-Organic, TDAT was a standard interface and used for instrument control and data acquisition. The TDAT card in the Masslynx PC communicates with the MPU or TPC board in the Mass Spectrometer. It uses a twisted pair serial communication line. The name TDAT is derived from Trio-Data-Acquisition. Later it was used by Micromass and (Finnigan). Since the year 2000 the TDAT control was substituted by the embedded PC acquisition system (EPCAS).

There are several disadvantages with TDAT, for example limited cable length between the instrument and the control PC (max. 5 meters). The placement of the cable could cause communication problems especially when it is close to strong magnetic fields like roughing pump motors or transformers. The other limitation with TDAT based systems is the availability of the microprocessors. Most of them were produced in the late 80's. Each instrument required two controllers. One is the SPU or Scan Processing Unit. It is responsible for instrument communications and control. The other is called the PPU or Peak Processing Unit that is responsible for data acquisition and the tune page display. The two processors were later combined on one board called the MPU or Multiple Processor Unit. This was only used on the Platform I and II. It was then updated to the TPC or Transputer PC board that is used in all newer products.
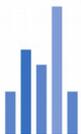
Some TDAT instruments are supported in Masslynx 4.1 but only with use of a PCI TDAT card.

For more information please ask your local Waters representative. For some Quattro LCs and Ultimas upgrade kits are available.

# 2   TDAT Acquisition Cards

ISA TDAT Card

This picture shows the TDAT ISA card. Notice the two sliders for the IRQ (interrupt request) and DMA (direct memory access) settings. By default set IRQ 5, DMA 1 and the Jumper to 2.5 MHz. You can use the windows device manager to configure the card´s resources. A working card will not be listed in the installed hardware tab. Check in the Device Manager, if a IRQ and DMA number was assigned. If you need to change the settings you need to change the parameters in the registry, run regedit, go to Hkeylocal machine/system/currentcontrolset/services and search for the TDAT entry and alter the parameter tab. After rebooting the PC, windows will try to start the tdat.sys driver with the new settings. If your card will fail again, even though in a working computer, you might need to replace the large foil capacitator.

PCI TDAT Card

The PCI TDAT card was made for use in modern PCs. The bad thing is, that this card is not a true plug and play card and you need special software change notes. First you install Windows with standard PC drivers. You can change the settings in the device manager, click on the computer icon and change the driver from ACPI PC to
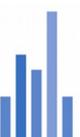
Standard PC. Windows needs to be rebooted and will reinstall all drivers. Then you should install Masslynx and the required software change note (SCN). Shut down the PC and insert the PCI TDAT card. After the new start Windows finds a new device.

ML4.0 first release needs SCN 433
ML4.0 SP2 needs SCN 485
ML4.0 SP4 needs SCN 508

The SCN includes the driver that is copied to the Masslynx folder. With the driver comes a small program tdattest.exe that is for TDAT card diagnostics.
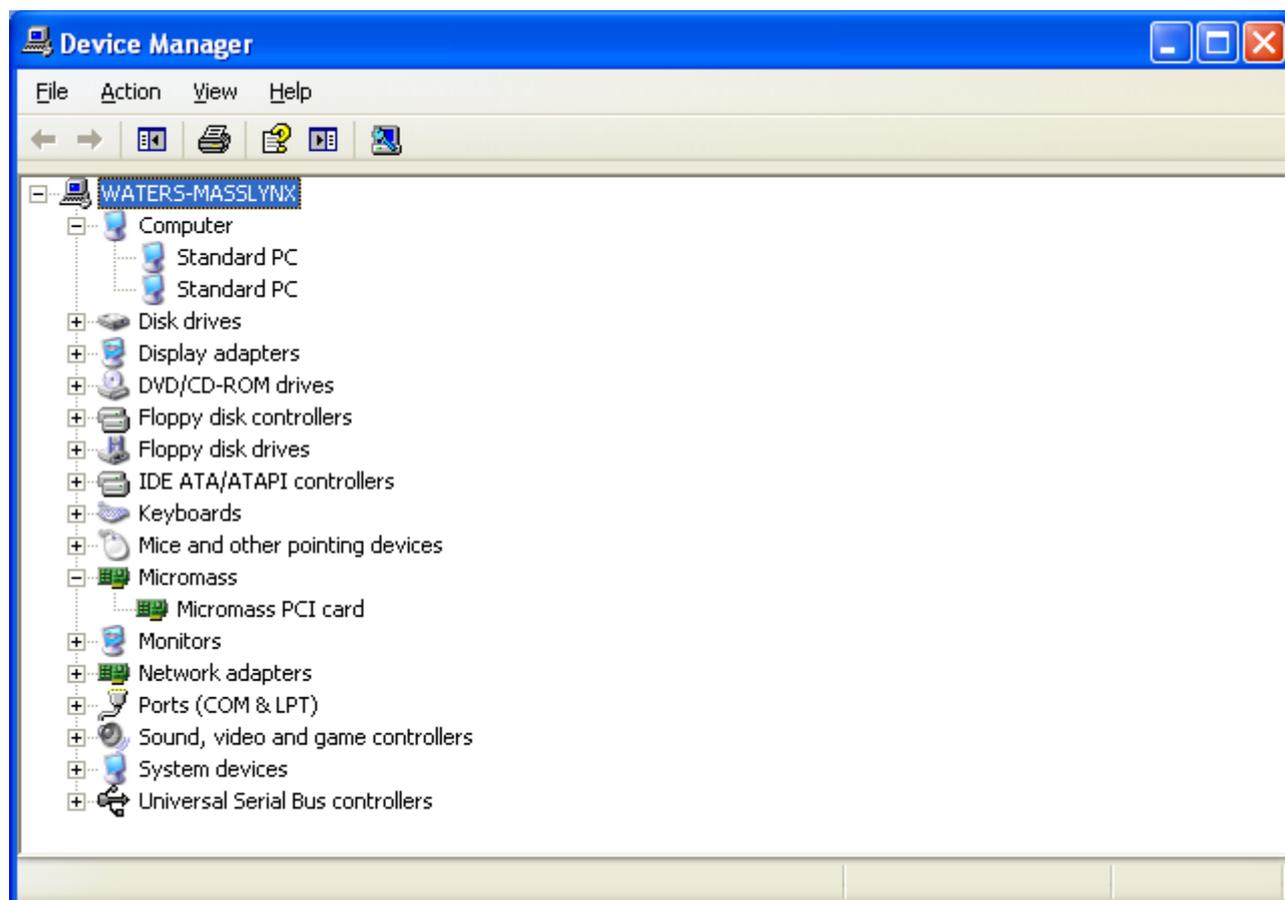
Tip: If you need to buy a PCI TDAT card, Waters charges thousands of euros for it. The card itself is no longer available as a single card, the part number disappeared and you need to order the upgrade kit. This Kit is 3 times more expensive as the card alone was, but it contains a CD with the SCN and a short manual. The best idea is to buy a complete TDAT PC from Waters for almost the same price as the kit.

3   How to diagnose a TDAT card

You need a TDAT loopback connector that plugs into the 15 pin port of your TDAT card.

The pictures show this connector, it is made very simple.

Pinout for 15 Way D-type loopback connector

Link Pin 1 to Pin 10
Link Pin 2 to Pin 9
Link Pin 3 to Pin 8
Link Pin 4 to Pin 7
Link Pin 5 to Pin 6

With the connector installed, start TdatTest.exe

Here you can choose L or D to test the card. It will increment the Passes until you hit a key. To diagnose a card it might be necessary to run the test a couple of hours.

4   Introduction to EngCon

EngCon (engineer control) is a small program located in the Masslynx folder to control the mass spectrometer directly. It is only available on TDAT systems.

If you want to start EngCon, you should close Masslynx because only one program at a time can have access to the TDAT control. Double click on engcon.exe opens this program and you can open a transputer file for your instrument. If you have an Ultima, choose Ultimam.tp. For Platform or ZMD choose a file named platlcz.tp. ZMDs show an instrum.cfg error (02) message. That is because the *.tp file was developed for the LCZ. Anyway, it will work.
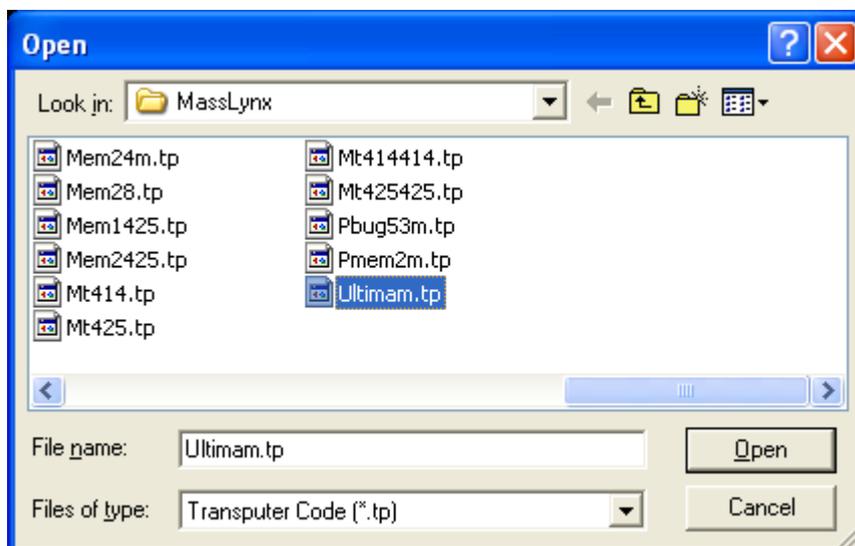
After clicking "open" you will receive a window like the one below. EngCon does a couple of self tests and when it is ready, hit the Escape (Esc) key.
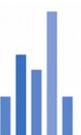
```
Ultimam.tp - NT EngCon                                    _ □ X
File  View  Help

 [icons]

SPU : Setup - STARTED

TracePackage Init: TRACE.ENABLED=FALSE, TraceLevelCurrent=TraceLevelOverride
SPU : Setup - init.a4d.board                              - FINISHED
SPU : Setup - init.csrs.etc                               - FINISHED
SPU : Setup - getting imr ..... imr reported as      2000
SPU : Setup - get.config.info                            - FINISHED
SPU : Setup - activating PPU                             - FINISHED
SPU : Setup - performing power.up.self.test
No GC detected
 - FINISHED
SPU : Setup - Initialising global variables             - FINISHED
SPU : Setup - IEnergy Ramping Disabled ... Initialising DACs  - FINISHED
SPU : Setup - FINISHED
_

Ready                                                          NUM
```

```
Ultimam.tp - NT EngCon                                    _ □ X
File  View  Help

 [icons]

  MISC Page GAS          Masslynx  QUATTRO ULTIMA v3.5_1    4190 AMU QUAD
                         Copyright 1999 Micromass Ltd.
                            All Rights Reserved

     [OP] OPERATE                      OFF    [TO] TURBOS ON          OFF
     [CC] COLLISION CELL GAS           OFF    [PC] PUMP COLLISION CELL OFF
     [E2] APCI/ESI GAS                 OFF    [AR] AutoRanging a4d      ON
     [IL] INJECT                        ON    [PR] PRESSURE REQUESTED  OFF




  <ESC> to select another page or <CTRL> X to exit

   SRC /  ION / SCAN / ACQU / MISC / MTHD /  RDB / INLT /  ASC /  MS2


  >on_

Ready                                                          NUM
```

If your MS is in vent state, you can navigate by using the arrow keys. Go to misc/gas and move to the highlighted [TO] Turbos ON / OFF. You will notice the prompt > in
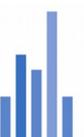
the command line. To start the roughing pump and the turbo pumps type on and hit enter, type off to vent the MS. Under RDB you find the readback pages for the turbo speed. Use the arrow keys for navigation or type rd1 for page1, rd2 for page 2, and so on.
What is the use for this program?

You can use it to check voltages, align the RF-Generator, do other instrument tests. There is the possibility to do MS-Scans. This is only used for board setup procedures, not for data acquisitions like you know from the tune page.

Most used commands

G [RETURN]   to start scanning
H [RETURN]   to stop scanning
I [RETURN]   to go to tests
T [RETURN]   to start Mass Program
V [RETURN]   shows instrument related variables

5   Additional information

During the Masslynx installation you will be asked what mass range your spectrometer has, or if you have the cone gas option installed and so on. All this settings are stored in the Instrum.cfg file. The most important one is the ZZ variable that determines the mass range. For a Qultima the file is like the one below.

MD=16
ZZ=4190
RO=0
RL=400
RR=250
ZS=1
R1=0
R2=0

The type of your mass spectrometer is stored in the AI.ini file.

[Boot]
BootFile=ULTIMAM

[Options]
PauseBoot=0
IconStart=1
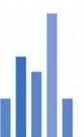
Please make sure that the files match your instrument.

6 How to build a TDAT Cable

First you need to buy a high quality shielded cable to keep the signal noise low. The maximum cable length should not exceed 5 meters.

Note: The cable pinout is numbered from the view of the connector solder site.

MS-Connector		TDAT-Card-Connector	
Link Pin	1	to Pin	8
Link Pin	2	to Pin	7
Link Pin	3	to Pin	6
Link Pin	4	to Pin	5
Link Pin	7	to Pin	2
Link Pin	8	to Pin	1
Link Pin	9	to Pin	15
Link Pin	10	to Pin	14
Link Pin	12+13	to Pin	11+12+cable shield
Link Pin	15	to Pin	9

7   Error Codes

The transputer card in the mass spectrometer has two red multisegment displays. If everything is o.k. they show 0,0. In case of an error the instrument will display an error number.

Error number list

01 - Missing CAL/CFG file: Cannot find INSTRUM.CFG or a .CAL file

02 - Bad CAL/CFG file format: Bad INSTRUM.CFG or .CAL file format

03 - Bad GC/Autosampler reply: Bad or no reply from GC or Autosampler

04 - DuartIntBadCh: DUART interrupt received but wrong character

05 - DuartNoInt: DUART didn't generate interrupt (faulty chip?)

06 - DuartIntNoCh: DUART interrupt received but no data

07 - WrongEventDuart: DUART generated interrupt but got wrong event (

08 - EventFailDuart: DUART interrupt not detected (faulty event reg?)

09 - DuartLoopFailB: DUART local loopback failed port B (faulty chip)

0A - DuartLoopFailA: DUART local loopback failed port A (faulty chip)

0B - DuartNotThere: DUART not responding

0C - DuartSpuriousInt: Unsolicited interrupt from DUART

0D - TxServerFail: Cannot transmit to PC server

0E - RxServerFail: Timeout on waiting for PC data

0F - ServerResetFail: Server reset didn't work - server corrupted or in unknown state

10 - BadResetChecksum: PC data corrupted or bad communications

11 - Missing PPU.MPO file: Cannot find TMS chip code file

12 - Bad PPU.MPO file format: TMS code chip file has bad format

13 - CAL coefficient(s) out of range: Coefficient(s) out of range in a .CAL file

14 - Wrong code for scan board: Quattro/Bio-Q has been booted with wrong code for scan board fitted

15 - No scan board fitted: No scan board could be detected on a Quattro/Bio-Q

16 - Scan board detected failed: Quattro/Bio-Q scan board detection failed because of hardware fault

2A - Inter-scan overrun: Transputer too busy during inter-scan delay to start next scan on time

2B - Scan not finished: Hardware taking too long to do scan (hardware fault?)

2C - Unrecognised event: Unrecognised type of event interrupt recieved

2D - Can't open datafile: Could not open a file via server

2E - Error writing data: Error while writing data to file

2F - Data buffers full: Scanning too fast or cannot get enough access to disk

30 - Bad checksum:Corrupt server communications

31 - Bad record length: Corrupt server communications

32 - Bad server command:Corrupt server communications

33 - ASStatus message: Receeived status message from Autosampler

34 - Undefined Error Code

35 - ADC still busy: ADC conversion not completed in time allowed

36 - Timeout server comms: server and/or link failure

37 - PC disk full: PC disk full - acquisition halted

38 - Filelist disk error: Disk error during filelist processing

39 - Filelist format error: Filelist control file has bad format

3A - Filelist command error: Error in filelist command section

3B - Undefined Error Code

3C - Total communications failure: Server or link dead

3D and 3E   Failed to identify sampling rate of the AutoRanged Analog

channels (is the jumper fitted correctly)ed to EMC

3E - AutoA4DFifoFull   AutoRanged FIFO has filled up due to irregular servicing (see

table below for maximum scan times)

The following is based on me interpreting the code on the Quattro LC.

On the Quattro LC, 3F is a 'Calibration timeout error'. This occurs at the start of a scan, when the DACs (MS1, Ramps. MS2) are calibrated. The software clears some bits what it calls 'digital IO' and then waits 250 ms for the board to register that is has done what it was supposed to. If it fails to, then it registers the error.

The code mentions the AD760 data sheet, if that helps.

FF is a bit more tricky to suss out, but I've seen it a lot before now on perfectly happy systems. It appears to be a default status that turns up, particularly when you connect MassLynx or start acquisitions.

5* errors are related to all acquisitions and may be due to acquiring saturated beams, or too much data too quickly.

51 - Bad data flag from TMS: TMS program misbehaving

52 - FIFO 1 overrun: Acquiring too fast / TMS hung / Transputer slow

53 - No response from TMS: TMS program crashed or hardware fault

54 - Bad start flag from TMS: TMS program misbehaving

55 - Undefined Error Code

56 - FIFO 2 overrun: Acquiring too fast or too much data

6* errors are related to centroid scans and may be due to acquiring saturated beams, or too much data too quickly.

64 - Overflow in moment sums

65 - Overflow in average sums

66 - Overflow in filter calculation

67 - Overfow in derivative calculation

68 - Overflow in time calculation

69 - Untracked overflow

6A - Bad transputer scan code

6B - Accumulator overflow

6C - FIFO 1 overrun

6D - Bad transputer scan parameters

E* messages are related to the boot emproms fitted to Quattro I, Quattro II and Trio-200 instruments.

The following codes appear in sequence as the machine boots up and appear for less than five seconds, after which time MassLynx behaves normally.

E0 - EpromBootStart

The machine is starting to initialise using internal EPROMs to

boot after a power on

E1 - EpromBootCSR

Initialising Vent/Standby/user IO ports

E2 - EpromBootSRC

Initialising SRC page as for ESP source

E3 - EpromBootSCN

Initialising SCN page to low masses

E4 - EpromBootMSC

Initialising miscellaneous dacs such as RF lens/Collision

Energy/Gas Cell to zero ramps

EB - EpromBootEnd

Finished initialisation