

# Rohde&Schwarz FSE- Harddisk Replacement

## 1 Introduction

I got to know, that in the R&S community there is some trouble around due to problems with the replacements of the harddisks in the FSE spectrum analyzer machines. Especially as those harddisks are getting pretting old by time, it can be a good choice to replace them by a modern flash drive ("Disk On Module") or a solid state disk. For doing that, you need first to download the complete harddisk content to an image file, then copy this to your new flash drive an install that DOM module in the FSE machine.

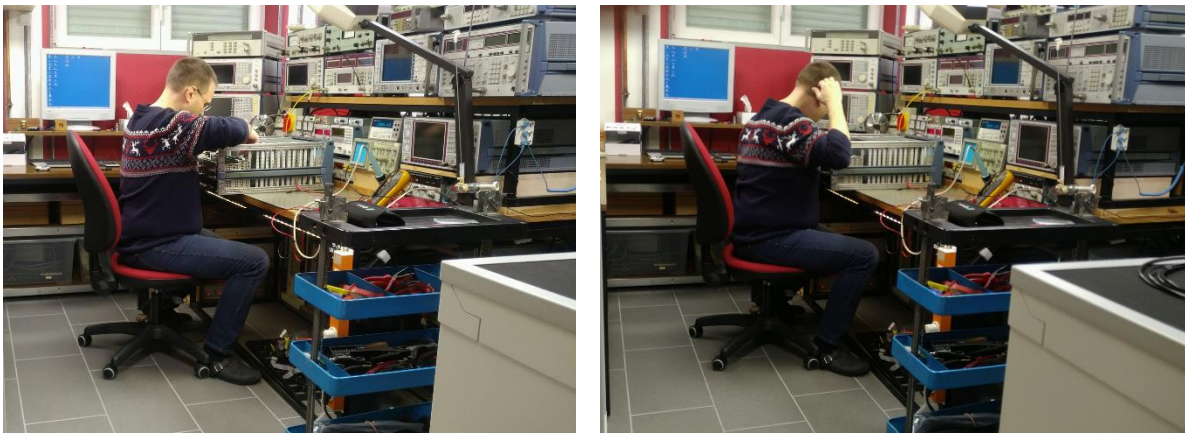


Figure 1: left: "Yeah, it works!"; right: "hmmm...no, it doesn't..." (photos: Max Michalzik)

As we know already, each step has its own obstacles and not every detail is yet completely understood. It looks like the older iRMX machines (=normally the ones with the purple coloured strip design on the fascial instead of the light blue one) are easier to handle in case of harddisk change than the newer ones running under Windows NT. These machines are very sensitive to the size of the attached harddisk; as Win NT has several GB limits, depending on the service pack version you are running the hardware. Especially a 8GB disk will not run with a Service Pack smaller than version 4, as it has its limit at 7,6 GB already.

I do not have such modern analyzers, mines are completely running under iRMX which is very DOS-like. For me, this has big advantages as service work is much easier for me on DOS systems than on Windows ones. This report should act as a guideline for a harddisk->DOM replacement. However, it is only tested for the iRMX machines, so no guarantee for the Win-NT machines to work!

## 2 Take the harddisk out of the FSE

The first step in the replacement of a harddisk is, to identify the existing one. For that, you need to disassemble the power supply unit (a nightmare!), then unscrew the shielding cover of the "computer box" in your FSE. Having done that, you can see the harddisk being upright screwed to the computer box chassis' back.

In order to prevent you from unscrewing the complete back cover of the analyzer, I suggest to remove 4 plastic plugs from the back cover instead, giving you the opportunity to reach the 4 harddisk screws "somehow"...

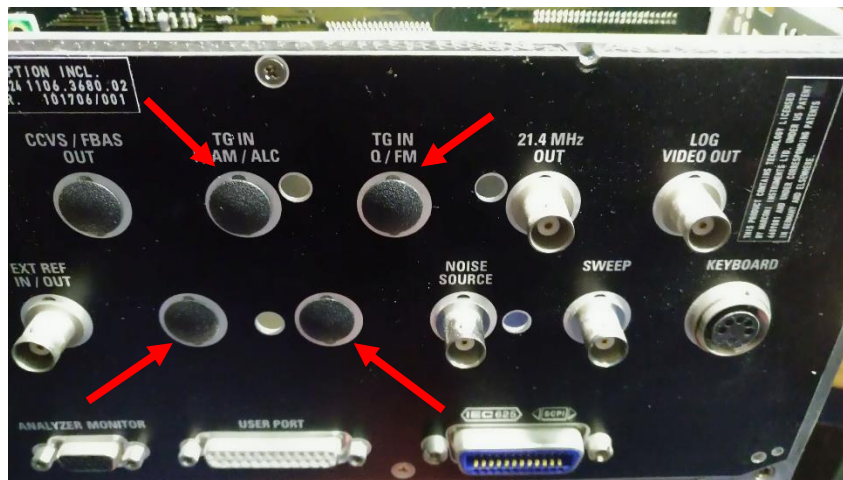


Figure 2: push out these plugs to have access to the harddisk's screws

Once loosened the screws a bit, you can push the HDD a centimeter up and take it out. The tiny 44pin IDE cable will unplug "itself" from motherboard connector when you pull the HDD out.

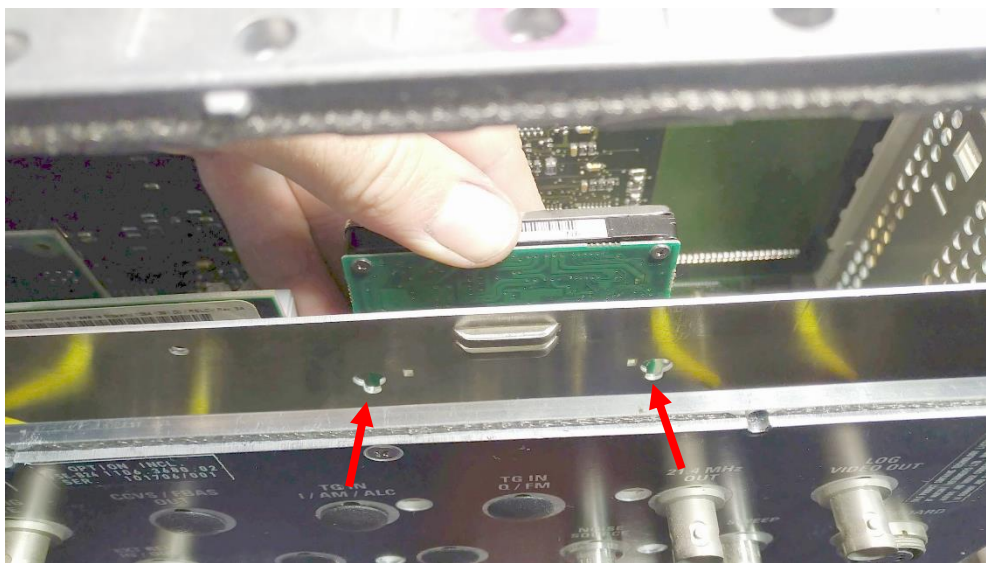


Figure 3: loosen screws, then push the HDD out

Now you will have a first look on the harddisk. There is no standard size or manufacturer that R&S uses. It can be any quality harddisk manufacturer, depending on operating system and age of the analyzer. On the FSEK that I will use as example for this report, I got a 1GB one from supplier Toshiba. Before pulling the connecting cable off, I make a small mark with a pencil to indicate Pin1 on the harddisk.



Figure 4: the harddisk that was used in my R&S FSEK

Note: if you have reached this stage of disassembly, measure the voltage of the 3,6V Lithium cell on the processor board. If not so good any more, replace it now! You won't get a better opportunity to do this with this small additional effort! Think about supplying external 3,6Volts across a 10kohm resistor to prevent from data loss during battery replacement. I do not know how critical it is for the FSE analyzers, but if you wanna be safe, then you should do it. **At least do it for R&S NRVS/NRVD power meters not to loose their calibration data!**

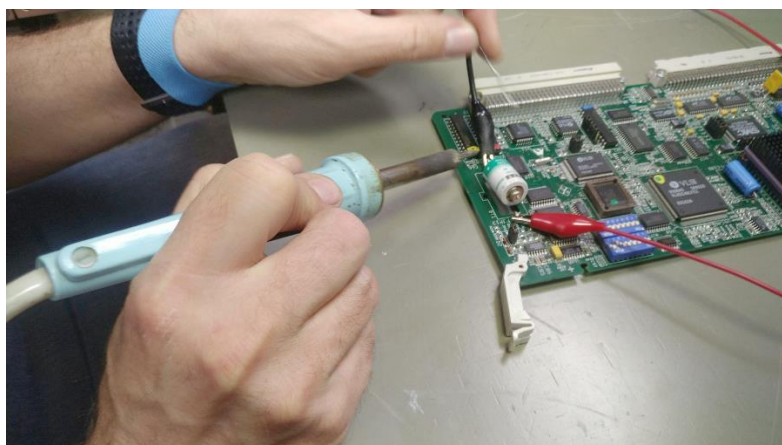


Figure 5: replacing the lithium battery on FSEK (photo: Max Michalzik)



### 3 Choice of the correct flash module (DOM)

It is not so easy anymore to get a flash drive nowadays with that requirements on size and connector. Search for those parameters:

- 44pin IDE connector
- the same size like the original harddisk (@me: 1GB)

Take note: take care for 40pin and 44pin connectors! The 40pin ones have the normal, "big" pinning grid and will not match without extra adapters. The ones that we need, do normally have 44pins and a smaller pinning grid! If you have found a useful DOM module, it will most probably provide a female connector, whereas the normal original harddisk connector is a male one! The reason is, that the DOM modules are designed for a direct plug to the main-board connector- without any cable inbetween. And exactly this fact contains a big, big trap:



Figure 6: the tools used for the FSEK harddisk replacement – here, shown with a cheap 2GB module

For putting the harddisk image on this DOM module, you cannot contact it just with a self-made double-male 1:1-pin-adapter grabbed out of the pin-array-box! You will see, that this would reverse the pin-out, flipping Pin1 to the wrong row! Don't believe it? Take a multimeter and measure by yourself! It is similar like with these old Laplink-Cables- they also needed a special cable soldered in a way that it provides a "crossover" function.



**Figure 7: highly recommended: a ready-to-use 44pin adaptor from Delock**

To overcome this problem, you need a Crossover-Adapter with two male 44pin connectors on each side, but crossed signals. For testing purposes I build one by myself and it worked, but due to the effort for making one and the mechanically very poorly realization possibilities, I recommend to buy these as a completed and ready-to-use part. A unit that works, is e.g. the Delock Adapter 44pin, Part Number 65090, and costs about 12..15Euro. Maybe not cheap, but prevents you from a long, long soldering and frustrating tryout session!



**Figure 8: works, but sucks: a selfmade 44pin x-over adaptor**



As DOM module, you can chose what you want- as long as it provides the 44pin small IDE interface. Also here, I recommend a Delock product; for my 1GB one they produce the type 54149 providing MTBF >3 millions of hours for about 50..70 Euros.

But I must confess, that for this unit I finally have chosen a different product- a cheap ebay offer for about 15 Euros including shipping. I am shure, this 2GB one will also work and as I am planning to replace all my analyzers with DOM modules (FSEB, FSEM and FSEK, maybe even ZVC), it indeed makes a difference if I pay more than 150Euros for all or only 45.

If you have ordered all the necessary parts (Cross-Adapter and DOM), all is about a tool with which you can read and write IDE stuff- like harddisks or DOM modules. For shure you can use an old laptop or PC, use cables and connect them as a second harddisk into the system, but as the external USB-IDE-readers are so cheap inbetween, making life so much easier, I strongly recommend to buy such an interface.

I use a "USB2.0 to IDE & SATA, with OTB" interface, made by Logilink, type AU0006D, and it costs only about 15Euro. But I am sure, any other product of a quality supplier will also do the job.

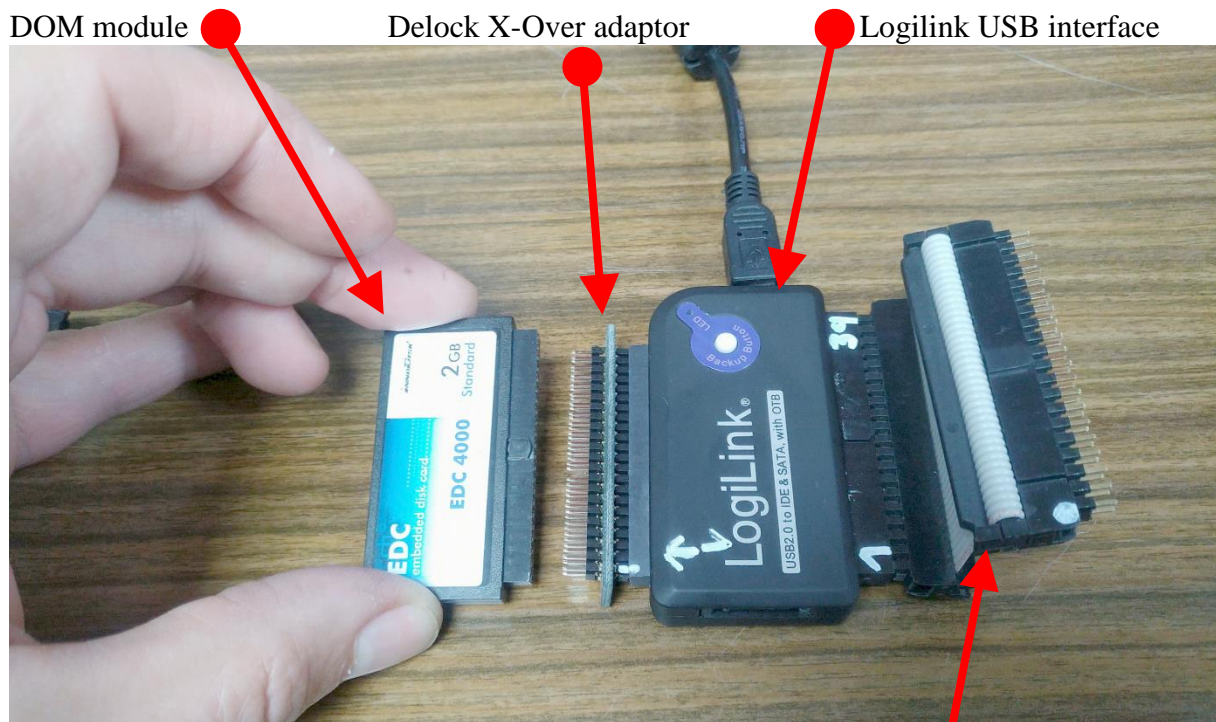


Figure 9: the tooling in detail

Not needed (40pin IDE support)

So attach the original FSE harddisk to this USB interface and plug it into your PC. After a few moments you should be able to see this harddisk appearing in your file browser, being able to access it.

Very important note: there are signs, that especially newer Windows Systems (like Windows 10) are not only passively reading the content of a harddisk that you attach via this external interface. It looks like, that those systems even modify "something" during the first system contact with this harddisk- massing up your complete harddisk for your analyzer! Take care! I did not make such observations by myself, however heard a lot about that- and even by very qualified people that I 100% do trust.

## 4 Read the data from the original FSE harddisk



Figure 10: attaching the original FSEK harddisk to the USB interface

I for myself use Windows XP and this above mentioned Logitech interface together with the software "Acronis True Image V9". In my configuration, I never had those problems like reported, but I must confess, that maybe an analyzer running under Windows NT could be more sensitive to harddisk modifications than my iRMX DOS machines.

At least, if you have successfully attached the original FSE harddisk to your PC, all is about the make an image of it. Start Acronis TrueImage and let it make the work. You should see at least 2 or 3 partitions on the FSE harddisk and your backup needs to cover the entire harddisk including all their partitions!

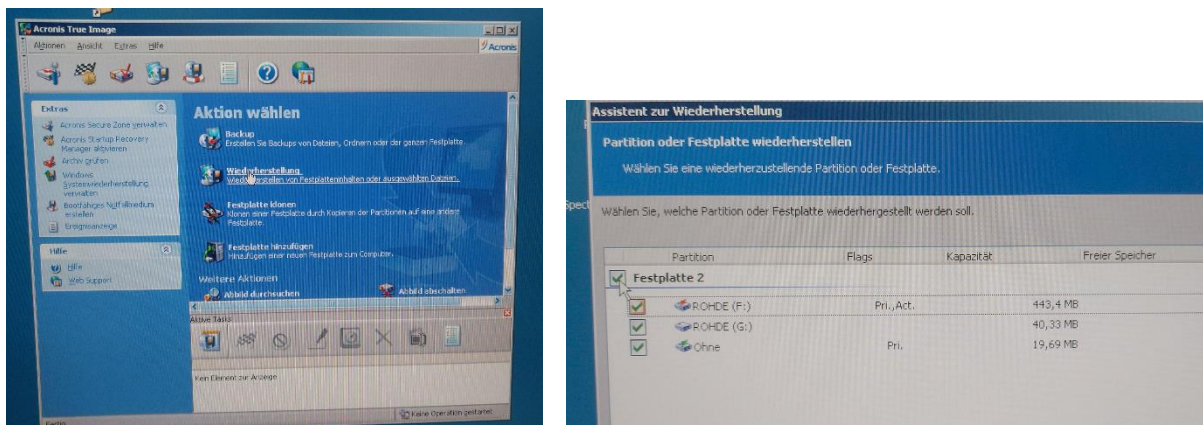


Figure 11: left: Acronis TrueImage start screen; right: the partitions on the R&S FSEK harddisk

Depending on the size of the original source harddisk the image is being written within a couple of minutes only, so very fast!



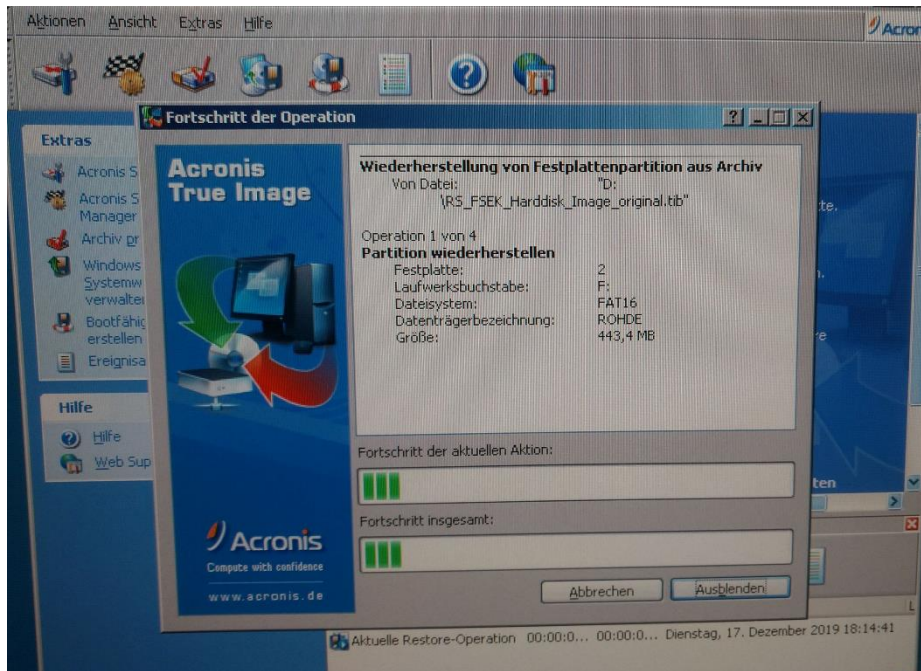


Figure 12: the FSEK harddisk image is being taken and written to internal harddisk of the PC

The end results in an image file \*.tib, that contains the complete harddisk data and partition structure of the FSE original HDD. Having this achieved, we have successfully made the first important step.

Hint: for sure, you can use linux also for reading our the harddisk. As far as I know, the "dd" command is in this case very easy and uncomplicated to use. However, I am no linux specialist, so sorry for not being able to tell you more details about that.

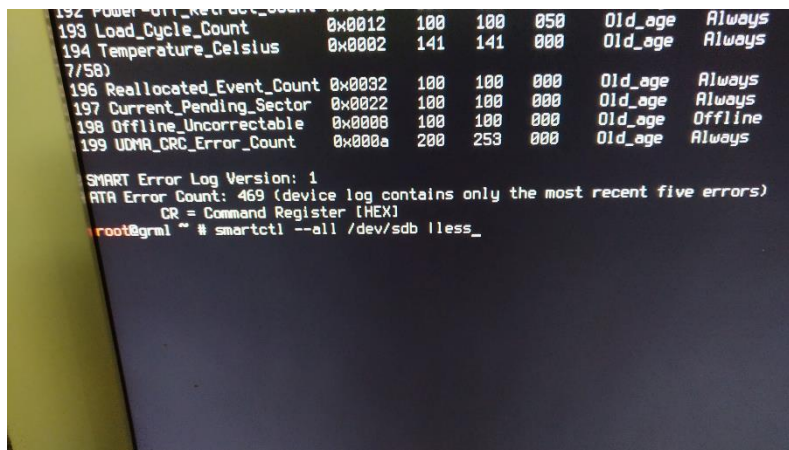


Figure 13: for sure you can alternatively use linux



## 5 Write the data to your DOM

Now comes the next critical thing that often causes problems: attaching the new DOM flash disk to your computer! The main problem is there - as I described above- the reverse gender of the connector -compared to the harddisk. If you are now only using a 1:1 pin array, you might blow up your DOM and maybe even your USB interface as well. So in case of not being 100% sure, take an ohms-meter and determine the correct path of Pin1 first!

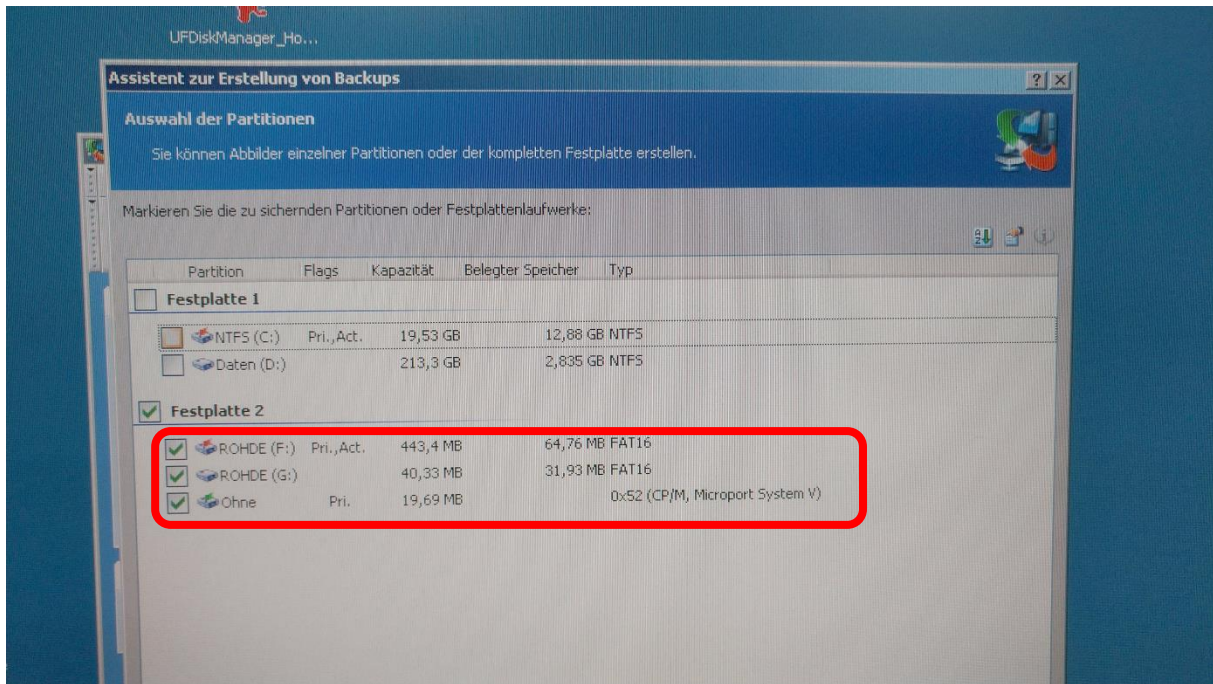
Then finally take the DOM and attach it via the Cross-Adapter to the USB IDE interface.



Figure 14: very important: always check for correct orientation! (pin1 )

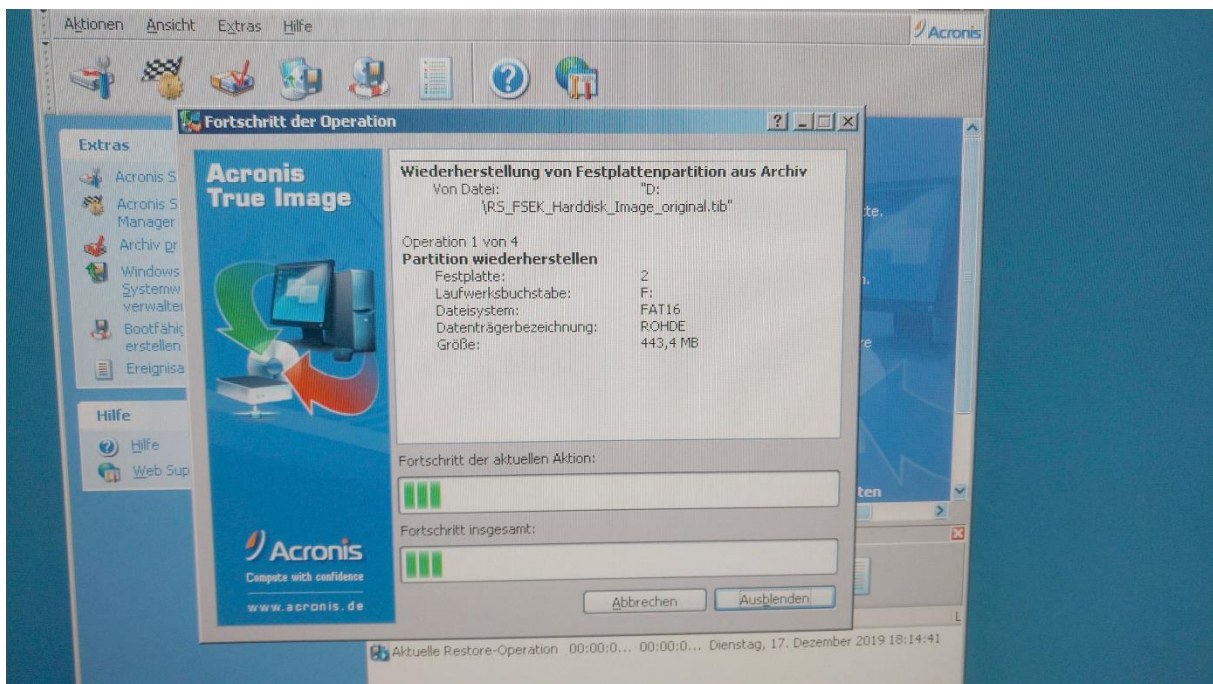
If everything fine, Windows PC will automatically recognize the attached DOM as an external harddisk. If required, use the disk manager (= Windows system tool) first to delete data and partitions on it (can happen if you have purchased a pre-owned DOM).

Then start the Acronis True-Image tool and select "Recovery" function in the main menu. Copy the complete content (including partitioning structure) to the DOM and let the Acronis tool do the work again. After a few minutes only, you will see 3 partitions (but one of them is hidden or even not assigned).



**Figure 15: at my FSEK, I have 3 partitions on the harddisk...**

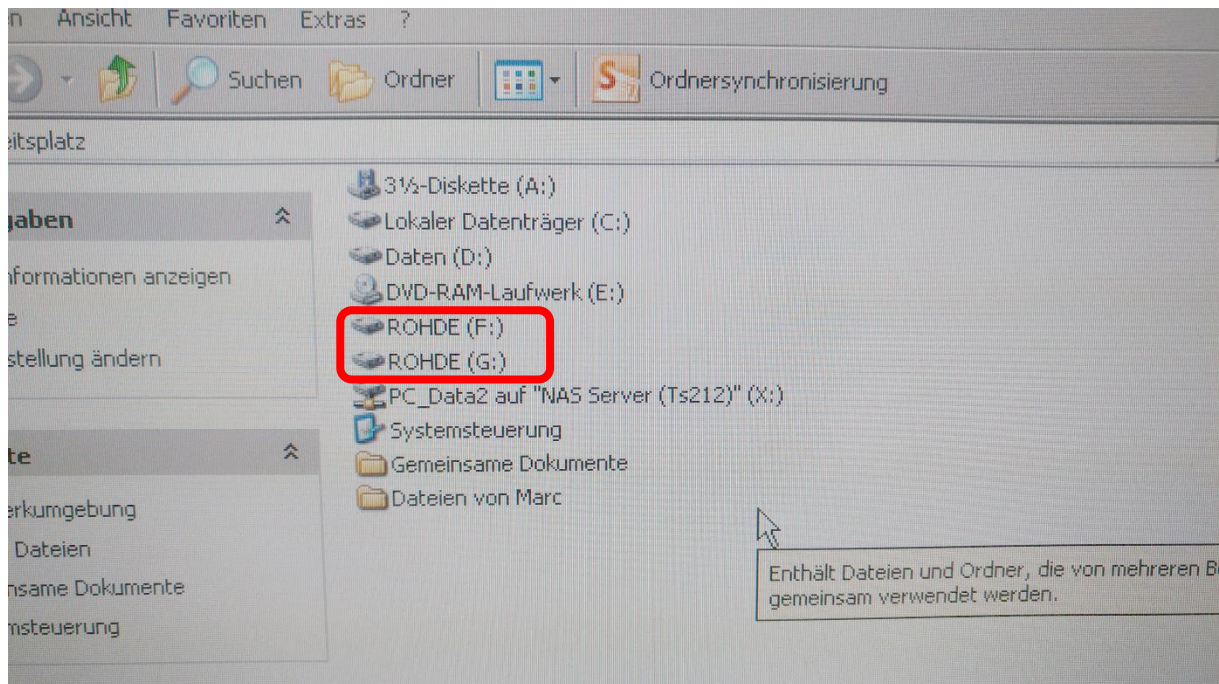
Verify that you can see the two visible partitions on the file explorer, then shutdown the USB port and disconnect the DOM from the reader.



**Figure 16: Acronis is working...**

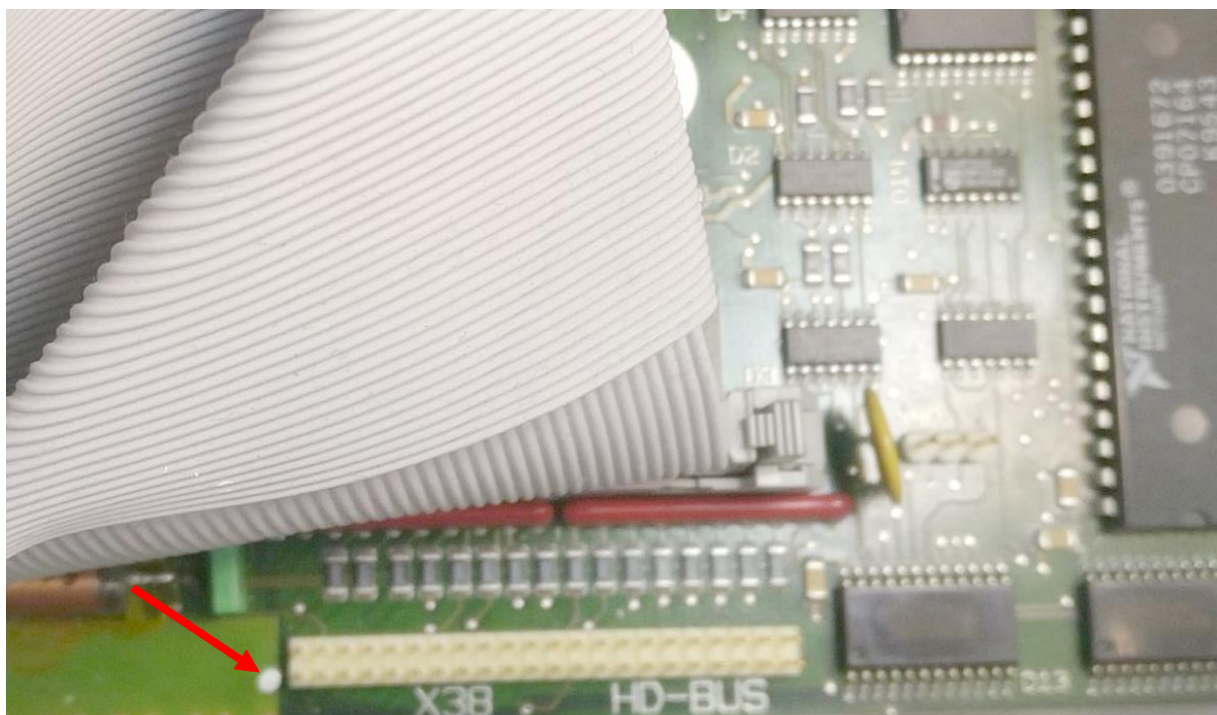
Next, push the DOM into the harddisk connector pin's in the FSE. Be very careful about the correct orientation of pin 1. Normally it is on the left front side (looking from the back), but no warranty ;-)





**Figure 17: two visible partitions in the file explorer**

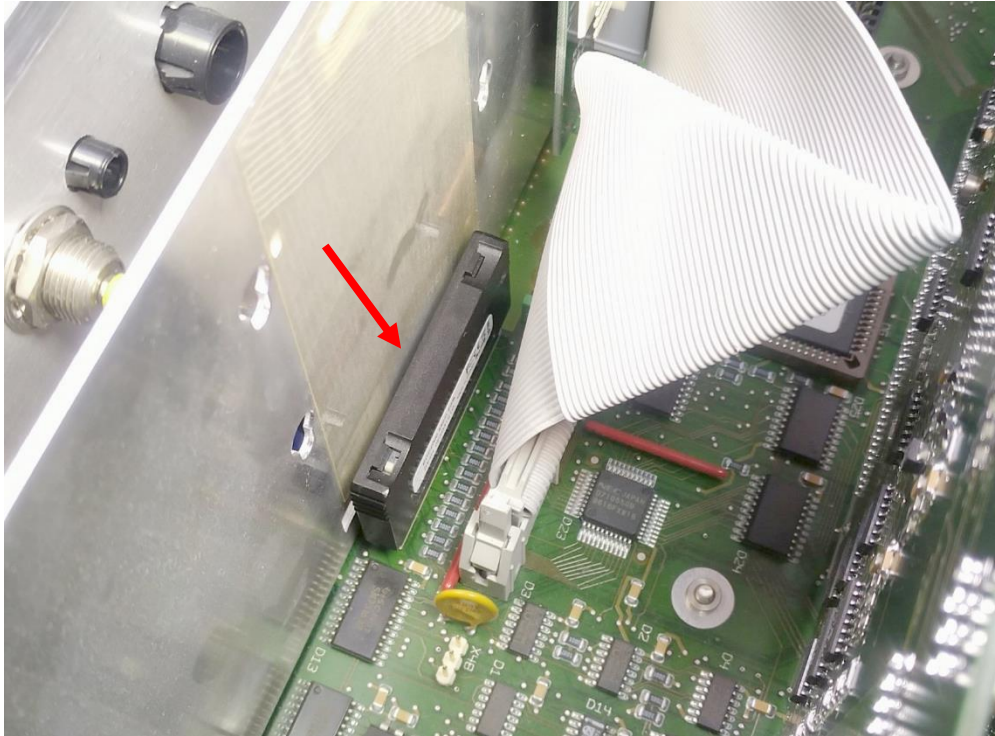
Because of the DOM being very light, I did not provide any mechanical holder or fixation. My FSEK is a precision instrument and neither the ball of a rugby game nor "on the road" many times. So for stationary lab use, it will be completely sufficient to just plug the DOM into the connector's and that's it.



**Figure 18: harddisk connector on the FSE mainboard (pin1 marked with white dot)**

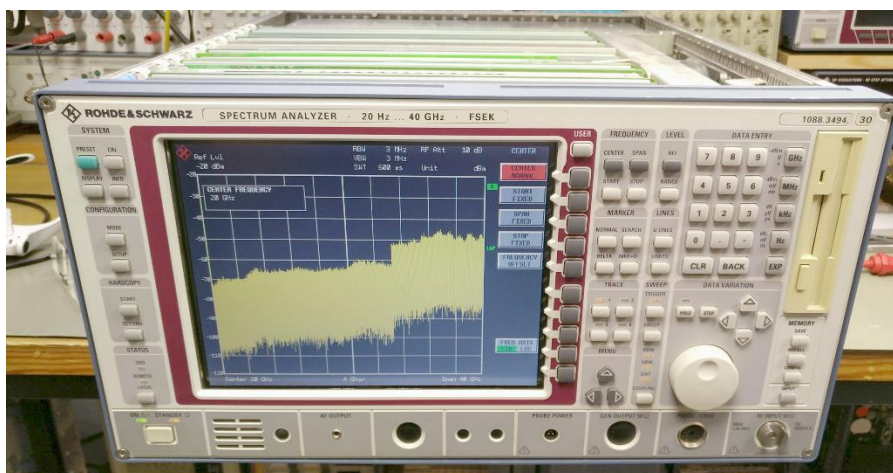
After having done, close the computer box with the shielding cover again, and re-assemble the FSE. Normally because of its complexity, it needs up to 20..30minutes. Just relax, also I need at least 15min for that. Verify your proper grounding to prevent from ESD problems; especially when touching the DOM module or the A180 detector unit when re-plugging.

After having done all screwing, make a short test. The FSE should boot up without any problems in calibration or any other "new kind of behaviors". It should run as it did before.



**Figure 19: new DOM (arrow) directly inserted to the FSE harddisk connector**

At least mine does ;-)



**Figure 20: result of successful harddisk replacement**

Good luck!



## 6 Acronis True Image and Alternatives

Acronis is still selling his product “True Image” in the current version 2020. Maybe you think it’s a bit “overshoot” to buy the complete tool for this single task. I can understand that. So you have two other options. Either you test the tool 30days for free (they offer this option on their website) or buy a used Version 9 on ebay for about 10..15Euros.

I also have already made succesful images with Norton Ghost V6.5.1, which is a DOS based tool and in minimum 20 years old now, but normally the missing of an USB support makes it difficult where to put the resulting image file. So you need a second harddisk to put this image file to, but being accessible afterwards again so that you can burn it to a CD-ROM or whatever. I am sure, Norton Ghost is one of the safe-proofest solutions in regards to unwanted harddisk-modifications by the operating system, but also generates a few other problems (versatility, connection to modern computers, needing a floppy for booting, etc.).



Figure 21: me, Marc DL8ABE, repairing the FSEK power switch (photo: Max Michalzik)

# 7 Disclaimer (german)

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