How to use Soft Sectored Media In A Northstar Advantage

1. The Northstar Advantage Computer uses like all Northstar Computers (and some others) hard sectored media. This type of disks is no longer produced today and it is even hard to find used ones on platforms like eBay. So we need to switch to soft sectored media which are still available.

2. Using soft sectored disks makes a hardware modification necessary. To make things easy and inexpensive we use an Arduino board. There are many variants of Arduinos. We use an Atmel ATMega328P based board with 32Kb Ram, a 16Mhz Clock and 5V input power. This can be an Arduino Uno Rev. 3, Arduino Nano or Arduino Mini Pro (5V variant) or any of their clones.
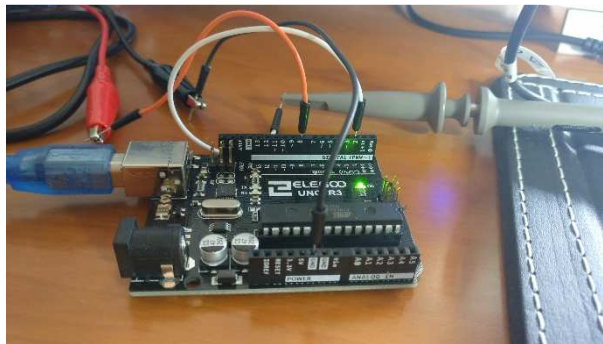

*An Arduino Uno R3 clone used for prototyping*

3. Arduino software – called Sketches – are uploaded by the Arduino IDE to the board. (For development Microsoft Visual Studio Code with the Arduino Extension is a more comfortable option). Sketches are C or C++ based programms. For our purpose we compile and load the „SectorPulseGenerater.ino" Sketch to the Arduino. The generator monitors signals on an input pin and mirrors them to an output pin. If the timings of the input signal indicate soft sectored media additional hard sector pulses are generated on the output pin. So the generator works with soft and hard sectored media (10 sectors and 16 sectors).

4. With a signal generator we can simulate all kinds of media and observe the behavior of the Arduino Sketch (input yellow: simulated media; output blue: mirrored/generated signal).
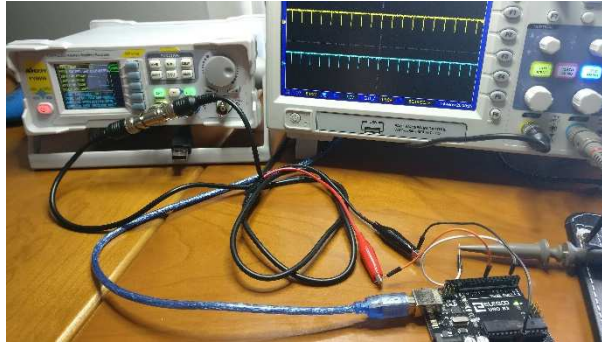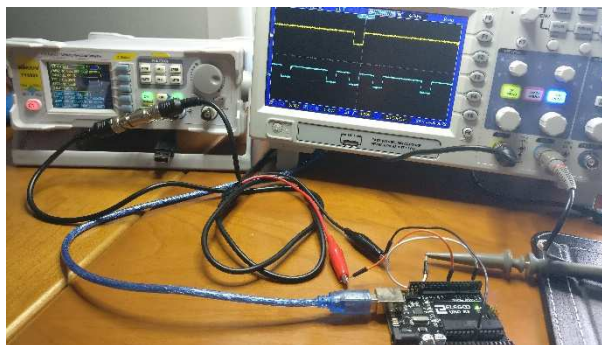
Hard sectored media (10 sectors)
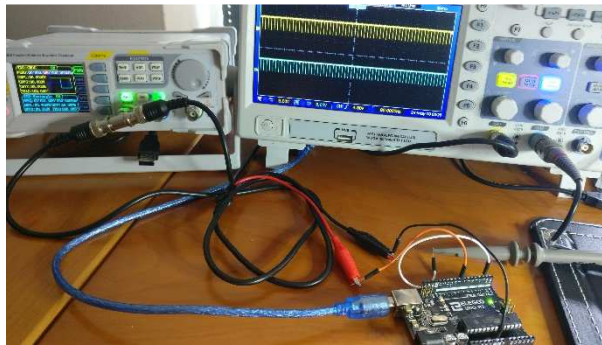
Hard sectored media (16 sectors)
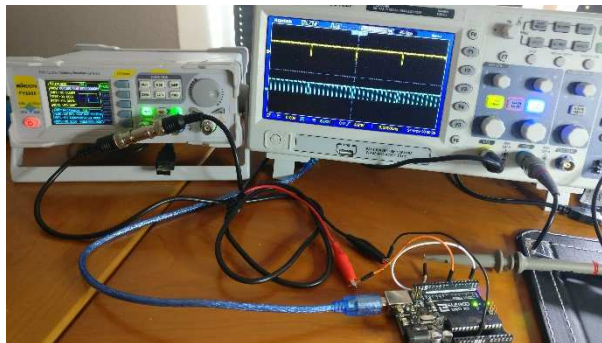
Soft sectored media

Soft sectored media(detail of sectors 9, 10 and 1)

5. The Sketch is configured to emulate 10 sector disks. In the header file you can change this to 16 sector media (untested on a real machine). Other options are an „analog" mode. In this mode an average of the rotational speed of the drive is used for timings. It is also possible to

enable a noise canceler for the input signal. In my case the default settings worked („digital" mode: use the current speed of the drive for calculating timings, no noise canceler).

6. An Arduino has a built in led. This led and the serial monitor are used by the Sketch to give some visual feedback. On the serial monitor the Sketch prints informations of the detected media type and the current rotational speed. A slowly blinking led indicates a waiting state, while fast blinking indicates that the media type could not be determined. Fast flashing indicates soft sectored media while hard sectored media leads to a dimmed led. The toggeling of the led and the output to the serial monitor are not necessary and can be commented out.

7. Adaptations to other microcontrollers should be possible with little modifications if any. The ratio clock/prescaler should lead to 4µs per tick to preserve the timing calculations.

8. To connect the Arduino to the Northstar Advantage we have to modify the floppy disk cable and to steal 5V from the floppy disk drive. In the simplest case, we cut through the index wire (pin 8 of the floppy cable) and connect one end (disk side) to Arduino pin 8 and the other side (mainboard) to pin 2. At the power supply connector of the upper disk drive we connect a 5V and GND wire to power the Arduino.

9. BUT: TO MAKE CHANGES REVERSIBLE WE SHOULD NOT MODIFY THE ORIGINAL HARDWARE. So we better use an old floppy disk cable from an IBM compatible PC with 2 connectors for 5.25" drives and a Y-floppy disk power cable.

Modify floppy cables for use in the Northstar Advantage

The male plug of the power cable goes into the drive connector, the male plug comming from the mainboard goes into the female plug of the Y-cable. From the remaining plug we only need the 5V (red) and the neighboring GND (black) wire. So you can cut off the unused 12V (yellow) and the remaining GND (black) wire. The red wire we connect to 5V (not Vin) at the Arduino, the black to GND. This way we get regulated 5V from the Northstar Advantage.

10. An IBM floppy cable has a twist for the second drive. This twist we have to remove. Since we don't need the 3.5" drive connectors we can cut the cable at the second 3.5" drive connector. Then we take the 5.25" connector from the old end and reconnect it at the end of the shortend cable. A vice makes that easy. When you have reconnected the 5.25" plug test all pins for propper connections. The distance between the two 5.25" connectors should be about 11 – 12 cm (4.5 Inch).
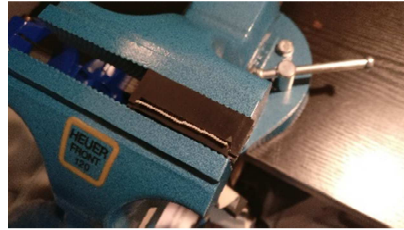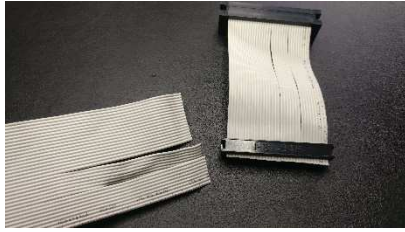
Modify floppy cable

11. To inject the hard sector pulses we have to open the index wire of the floppy cable. Wire 1 has normally a marker (red color, small triangle at the connector). The index wire is number 8. We carefully cut through this wire and solder 2 wires to the ends (example: white to the drives, blue to the mainboard). The white wire goes to the pin 8 (IPC) of the Arduino, the blue one to pin 2 (it should also be possible to feed the wires of the floppy cable directly into the Arduino board). In total we have to connect 4 wires to the Arduino (A Nano in the picture). Then we can test all connections before replacing the original floppy disk cable with our active „SectorPulseGenerator" cable.
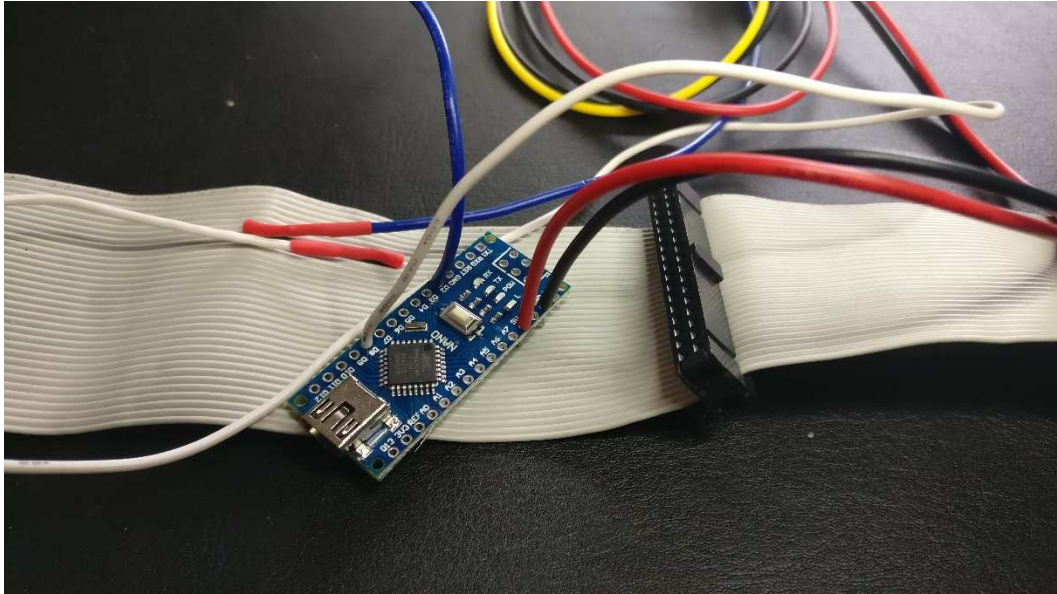
12. Insulate all open contacts of wires with heat shrink tubing. Insulate all contacts of the Arduino board and finally carefully assemble the computer again.

13. Test the modification by loading FORM2ADV over the serial line and by formating your first soft sectored disk. Best, use 360KB media for that. When you have successfully formatted the disk you can create a boot disk by using BOOT2ADV to transfer a bootable image.

14. If you have problems with the formatting you should check the output at the serial monitor or the built in led. The Sketch has to be able to identify the type of media correctly. If the rotation time of the drive is not constant enough or the deviation of speed is out of the specs using this drive is not possible. If the media can be identified by the software the rotational speed of the drive has to be 300rpm +/- 1%.

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