MAKStripe USB

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1 MAKStripe USB

MAKStripe USB is a 3-track LoCo/HiCo reader and LoCo magnetic stripe card writer/encoder. The connection of the device to a PC is made through a free USB port.

Due to the head with three tracks, all three tracks of a card can be read or written at the same time. Magnetic stripe cards can have a bit density between 1 and 210 BPI (75 BPI, 210 BPI and also other non ISO densities), which are all supported by MAKStripe USB.

MAKStripe USB is connected directly to the USB port of a PC. No external power supply is required.

The raw data are digitalized and transferred direct to the PC, where the analysis is performed. Due to the direct reading / writing, opportunities are given, which are not available with usual readers/writers.

MAKStripe USB is controlled with the software "MAKStripeExplorer" for Windows NT / 2000 / XP / Vista, Linux, Windows Mobile 5/6 and Mac OS X operating system, which is supplied with MAKStripe USB.

MAKStripe USB is connected to a PC through the USB port. The software MAKStripeExplorer runs on any PC with minimal resolution 1024 x 768, a free USB-port and on which Windows NT / 2000 / XP / Vista or Linux with a recent Gnome/KDE GUI are installed. MAKStripeExplorer can also be installed on a PocketPC with ARM CPU PXA2xx, VGA 640x480 and USB Host. Further the software runs on Mac OS X.

2 MAKStripeExplorer

2.1 Supported Operating Systems

MAKStripe USB is driven with the software "MAKStripeExplorer", which is supplied with MAKStripe USB and is working on following operating systems:

- Windows NT / 2000 / XP / Vista
- Linux with a recent Gnome/KDE GUI
- PocketPC with Windows Mobile 5/6, ARM CPU PXA2xx, VGA 640x480 and USB Host
- Mac OS X

With MAKStripe USB we do supply all versions of the Software MAKStripeExplorer for Windows, Linux, for PocketPC with Windows Mobile 5/6 and for Mac OS X.

The data, saved on any of the above operating systems is fully portable and compatible to the other operating systems, so for example data acquired on Linux operating system can be transferred and processed further on Windows and vice versa.

3 Installation

On the CD, which is supplied together with MAKStripe USB, the software MAKStripeExplorer is available for following operating systems:

- Windows NT / 2000 / XP / Vista
- Linux with a recent Gnome/KDE GUI
- PocketPC with Windows Mobile 5/6, ARM CPU PXA2xx, VGA 640x480 and USB Host
- Mac OS X

In the following chapters, the installation for all versions is explained.

Except the difference in the installation and setup procedure for MAKStripeExplorer for Windows, MAKStripeExplorer for Linux and MAKStripeExplorer for PocketPC, all other comments are valid for all versions of the software.

3.1 Installation on Windows

Please do log into Windows with administrator rights. Please DO NOT plug MAKStripe USB into the USB-port of the PC, before the software MAKStripeExplorer has been installed.

The installation on Windows is performed by starting the file MAKStripe-Setup.exe, which is available on the CD, supplied with MAKStripe USB. During the setup process, the necessary driver for Windows and the software MAKStripeExplorer will be installed.

After the software MAKStripeExplorer has been installed, MAKStripeUSB has to be plugged into a free USB port - MAKStripe USB should be identified as new hardware "Silicon Labs CP210x USB to UART Bridge". After this confirmation that the MAKStripe USB has been identified correct, the software MAKStripeExplorer can be started.

If due to some problems - for example the installation has not been performed with administrator rights - the necessary drivers have not been installed, then Windows will start the Hardware Assistant and try to install the necessary drivers. In such a case, please log out and log in with administrator rights and undertake one of the following steps:

- After logging in with administrator rights, uninstall MAKStripeExplorer and install it again from the CD, which you received with MAKStripe.

  or
- Insert the CD, which you received with MAKStripe and start from the CD the software for driver installation:
  X:\MAKStripeExplorer\Driver\cp210.exe
  Where X has to be changed to the drive letter of your CD-drive.

  or

- Go to the "Driver" sub-folder of the folder, where MAKStripeExplorer has been installed. If for example this folder is
  c:\Program Files\MAKStripeExplorer\
  then type
  cd "c:\Program Files\MAKStripeExplorer\Driver\"
  From this location you can invoke the driver installation by starting cp210.exe
  If you would like to see info and error messages during the driver installation, then please edit the file setup.ini and change
  [Install Quiet Mode]
  On
  to
  [Install Quiet Mode]
  Off

  or
- Ask the Windows Hardware-Assistant to search the drivers in the "Driver" sub-folder of the folder, where MAKStripeExplorer has been installed. If for example MAKStripeExplorer has been installed in c:\Program Files\MAKStripeExplorer, then the Windows Hardware-Assistant should look for the drivers in
  c:\Program Files\MAKStripeExplorer\Driver

In case, many other drivers, using virtual COM-Ports, have already been installed on your PC, it is possible that the software MAKStripeExplorer displays the message "MAKStripe not found" although the software has been installed and MAKStripe USB has been connected properly.

This error is a result of the fact, that all available virtual COM-Ports have already been appointed to the installed drivers and there is no free virtual COM-Port for MAKStripe USB. The virtual COM-Port Nr. assigned to MAKStripe USB can be estimated as follows.

Open the hardware device manager and from there the property panel of COM and LPT ports. The virtual COM-Port Nr. assigned to MAKStripe USB is listed under "Silicon Labs CP210x USB to UART Bridge". If this virtual COM-Port Nr. is too high (depending on the hardware), then it is necessary to allow MAKStripe USB to get a lower virtual COM-Port Nr. Herefore please temporary disable the other USB-drivers and reinstall MAKStripeExplorer software, so a lower virtual COM-Port Nr. could be assigned.

3.2 Installation on Linux

Get root privileges

```
su -
```

Create a directory, where MAKStripeExplorer should be installed and enter this Directory

```
mkdir /usr/local/MAKStripeExplorer

cd /usr/local/MAKStripeExplorer
```

Unpack MAKStripeExplorer

```
tar -xzf MAKStripe.tgz
```

Check if there is one of following USB-Ports in /dev

```
ls /dev/ttyUSB0

ls /dev/ttyUSB1

ls /dev/ttyUSB2
```

If these device are available and MAKStripe USB is connected to one of them, configuration is completed.

If none of the above listed devices are available in /dev or the name of the USB port, to which MAKStripe USB is connected has another name, create a symbolic link /dev/USBM to the USB devices on which MAKStripe USB is plugged on, as explained in the following example. The name of the USB port, where MAKStripe USB is connected is for example:

```
/dev/tts/USB4
```

In such a case, create following symbolic link:

```
ln -s /dev/tts/USB4 /dev/ttyUSBM
```

Now MAKStripeExplorer can be started as user root with the command:

```
/usr/local/MAKStripeExplorer/makstripe
```

If running MAKStripeExplorer as user myusername is desired:

```
chown -R myusername:myusername /usr/local/MAKStripeExplorer
```

Depending on the name of the USB-Port on which MAKStripe USB is plugged on:

```
chmod 666 /dev/ttyUSB0
```

or

```
chmod 666 /dev/ttyUSBM
```

3.3 Installation on PocketPC / Windows Mobile 5/6

MAKStripeExplorer for PocketPC can be installed on a PocketPC, which fulfills following requirements:

- ARM CPU: PXA2xx
- VGA: 640x480
- USB Host

MAKStripeExplorer for PocketPC has been tested on a Fujitsu/Siemens n560 PocketPC.

MAKStripe USB does take the necessary power directly from the PocketPC, so no external power supply is needed. The power, taken from the PocketPC is in Idle/Reading mode approx. 50mA and in Writing Mode : approx. 300mA.

The installation of MAKStripeExplorer for PocketPC can be made in two ways:

- Transfer the file MAKstripe.CAB from the MAKStripeUSB\PocketPC folder of the CD, supplied with the device to the PocketPC and start it on the PocketPC.

or

- Start MAKstripeSetup.exe from the MAKStripeUSB/PocketPC folder of the CD, supplied with the device. The program will start on your PC and transfer the necessary files to the PocketPC.

After the software has been installed, for using MAKStripe USB on PocketPC, the device MAKStripe USB has to be switched to USBXpress mode first:

- Start the program CP210xSetIDs.exe which is located in the folder MAKStripeUSB/PocketPC/SetID of the CD
- Change PID from 0xEA60 to 0xEA61

If later usage of MAKStripe USB on Windows or Linux is desired, the device has to be switched to its original mode again:

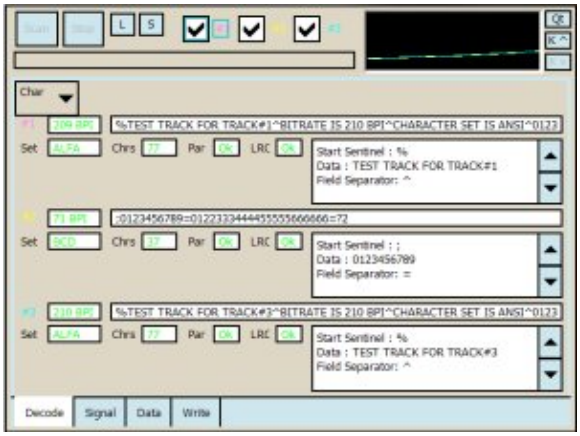
- Start the program CP210xSetIDs.exe which is located in the folder MAKStripeUSB/PocketPC/SetID of the CD
- Change PID from 0xEA61 to 0xEA60

When MAKStripe USB is connected the first time to the PocketPC, the name of the driver will be asked. Please enter following driver name: SIUSBXP

Due to the small display available for MAKStripeExplorer on PocketPC, the buttons have not a full description, but do contain only the necessary amounts of letters, so they could fit on the screen. There are also no ToolTips and there is no Help-System for the PocketPC version of MAKStripeExplorer. The disposition of the buttons and their functionality are identical with the versions of MAKStripeExplorer for Windows or Linux.

In the PocketPC version of MAKStripeExplorer a menu is missing because it would take too much place and not all buttons could appear on the screen. Therefore following menu items of the Windows and Linux version of MAKStripeExplorer are available as buttons in the PocketPC version on the top part of the screen:

- Button "L" for loading data
- Button "S" for saving data
- Button "Qt" for terminating the program
- Two "K" buttons for showing and hiding the keyboard



3.4 Installation on Mac OS X

Insert the CD, which you received with MAKStripe USB, open the folder /MAKStripeUSB/MacOSX folder and perform following steps by clicking on the appropriate dmg file.

- Install the driver
- Install MAKStripeExplorer

4 Setup

In the Setup menu of the software "MAKStripeExplorer" for Windows NT / 2000 / XP / Vista and "MAKStripeExplorer" for Linux, following parameters can be changed:

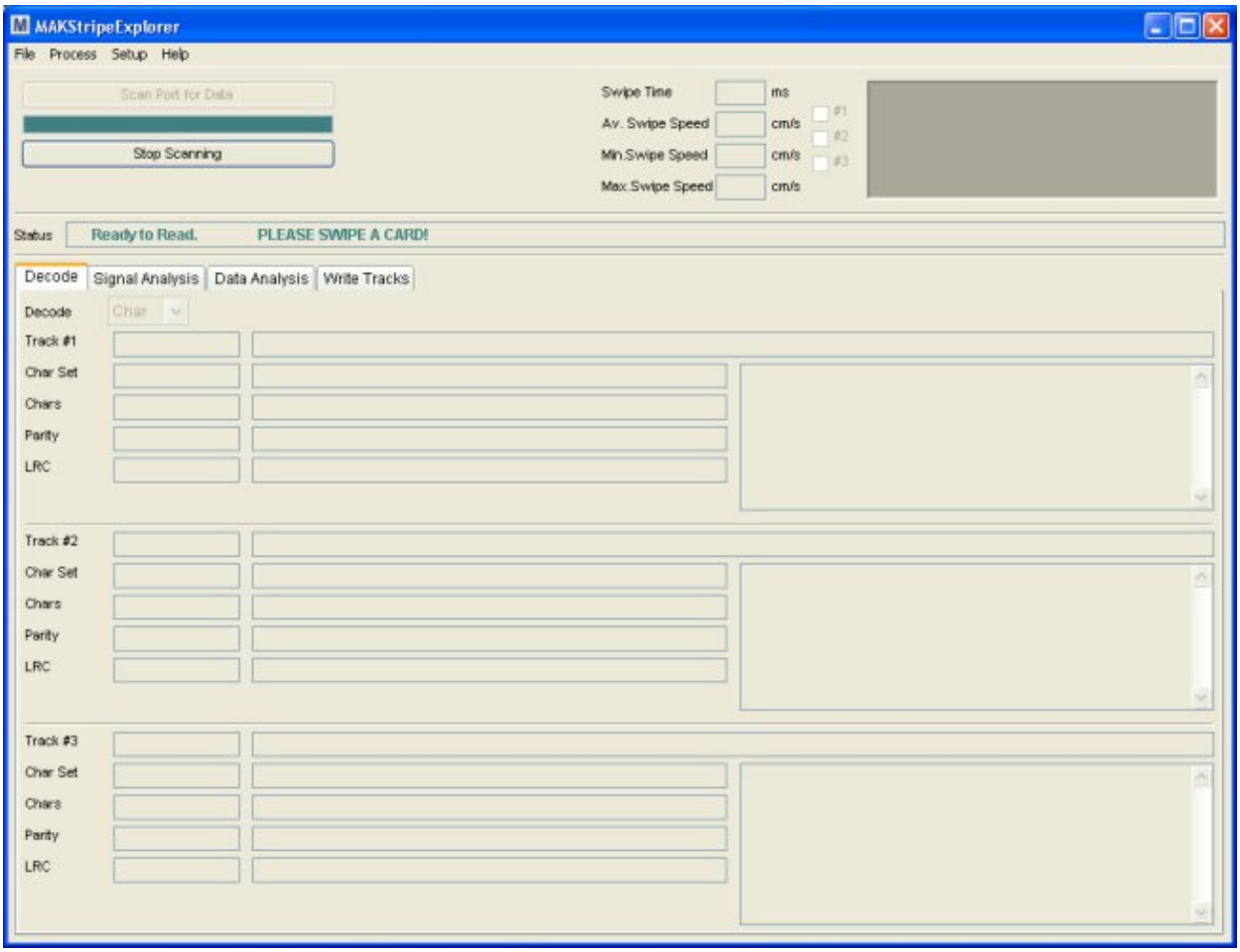
The language can be chosen between English and German. In order, the changes could take effect, it is necessary to restart MAKStripeExplorer after the language has been changed. The language can also be chosen at startup of MAKStripeExplorer, if it is started with the switch -l=en or -l=de, as for example when starting under Windows with makstripe -l=en or under Linux with ./makstripe -l=en.

The ToolTips can also be enabled or disabled in the Setup menu. If Beep is selected as on, than during the scanning, erasing, formatting and writing processes beeps will signalize successful completition.

In the Setup menu also different colour-themes can be chosen.

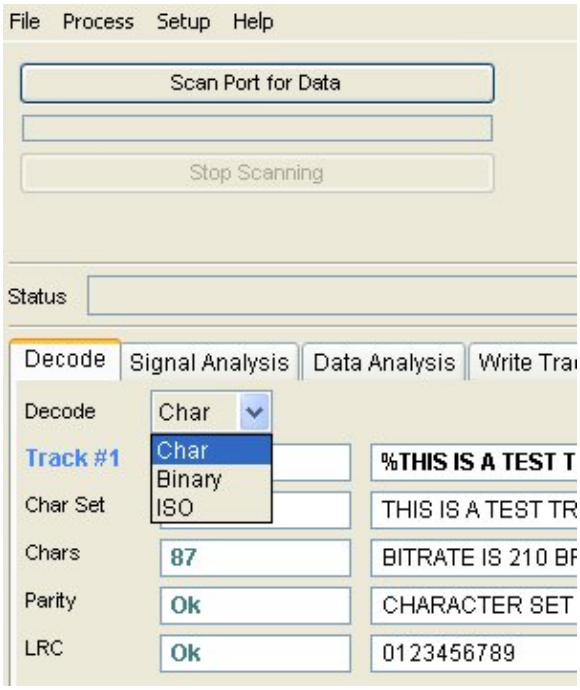
5 Reading Magnetic Stripe Cards

Start the software MAKStripeExplorer and press the "Scan Port for Data" button or the function key F5.

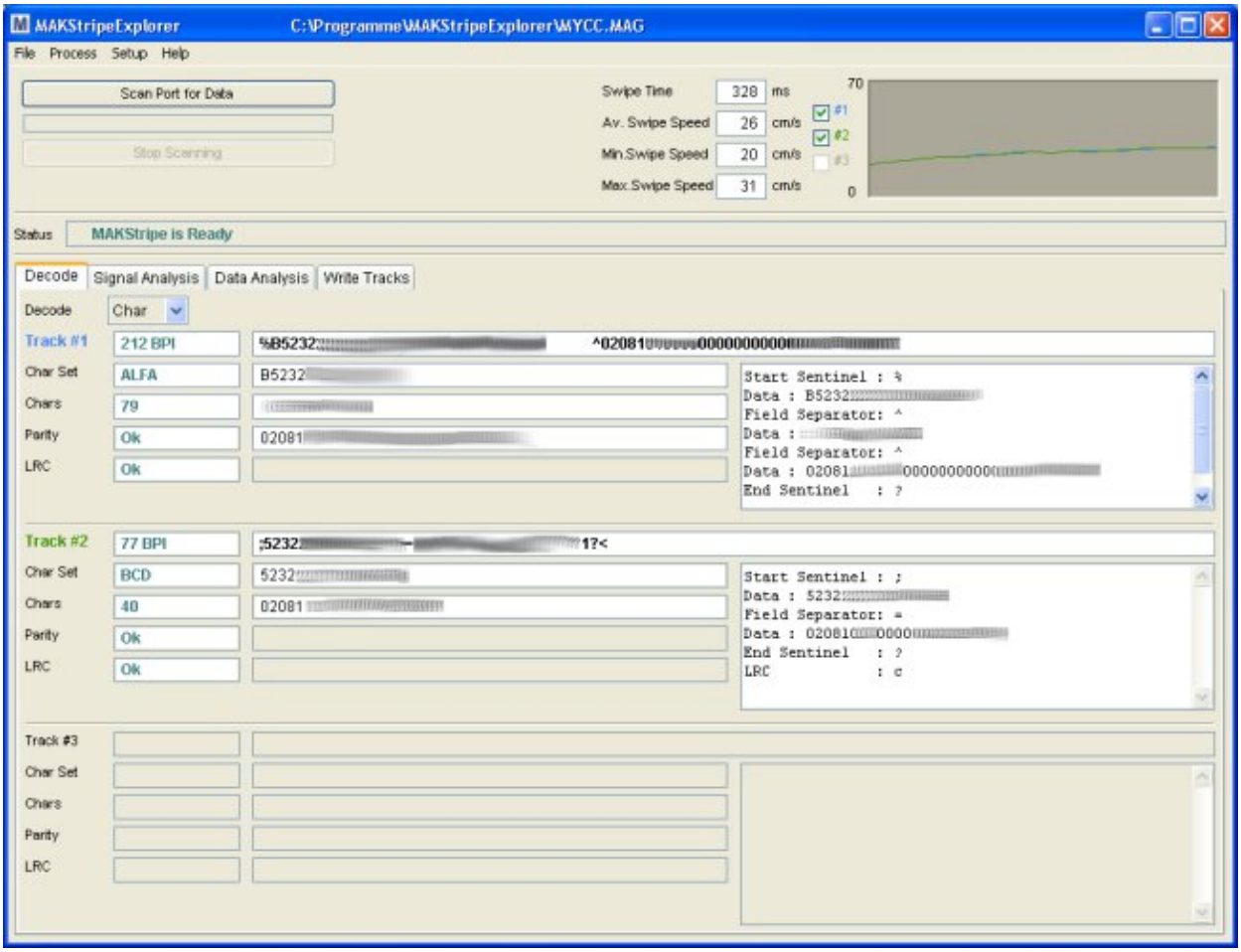


MAKStripe Explorer is now in Scanning - Mode and expecting a card to be swiped. During each swipe the data are read and displayed. The Scanning - Mode can e stopped by pressing the "Stop Scanning" button or the function key F12.

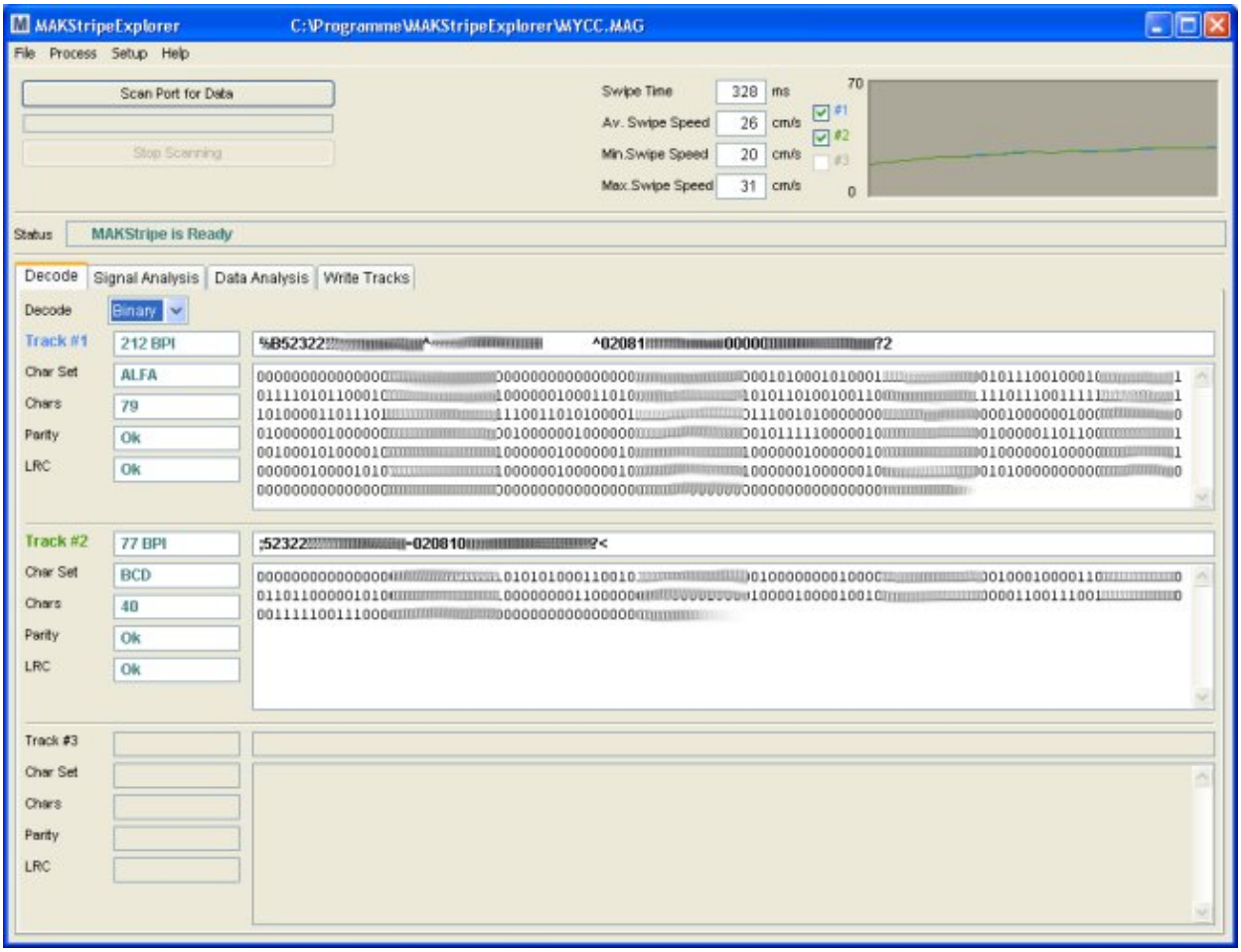
The software will read all 3 tracks from the card, the real bit rate and swipe-speed through the whole swipe process of the magnetic stripe card are estimated. The data are demodulated according the F2F modulation and displayed. If ANSI or BCD character sets are detected, the software will decode the data and check the parity and the LRC check sum. If both parity and LRC are "OK" (green) then the data has been read correctly - otherwise a new swipe has to be performed.



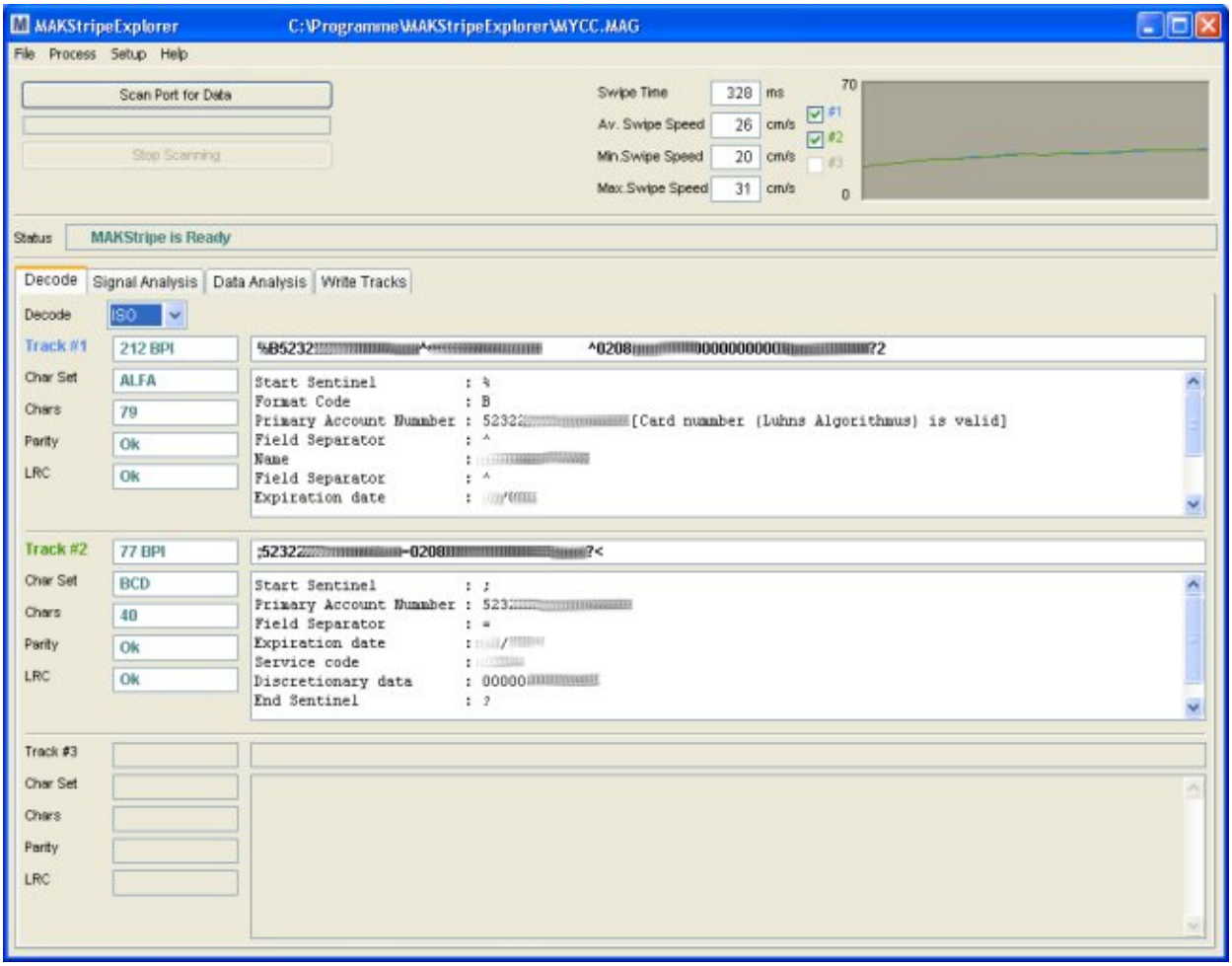
The display is given with the ALFA or BCD character set (in case, such data is present).



or in binary form



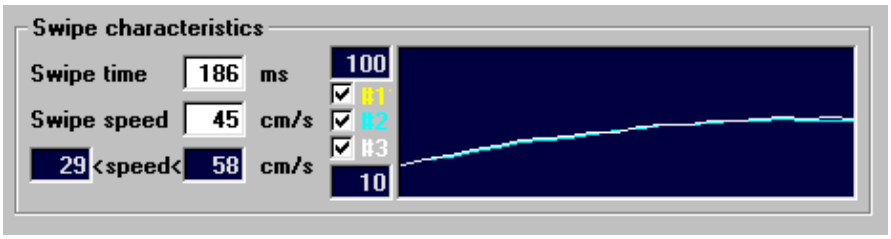
or in ISO standard



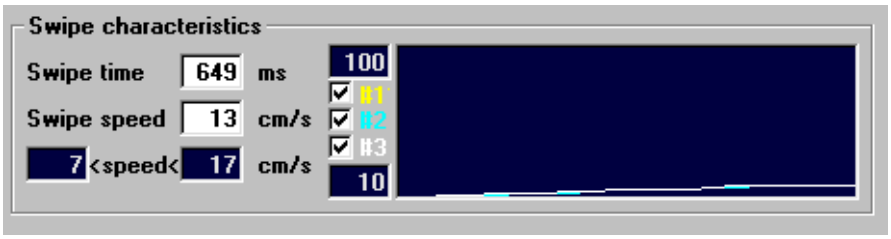
To save the data, select the "Save" command from the "File" menu. The data will be saved in original form "as is" with the complete swipe characteristics. Even if the data is in a non-standard format, it will be saved correctly.

6 Swipe Speed

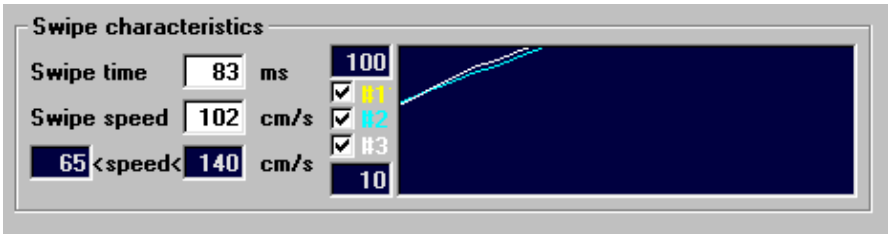
The swipe speed, with which usually a magnetic stripe card is being swiped is in the range between 20 and 50 cm/s. In this swipe speed range, the data is decoded error free with highest probability.



Depending on the quality, with which the magnetic stripe card has been written, its age and condition, it is often possible to read the magnetic stripe card successfully with a very low swipe speed ...



... or a very high swipe speed.



The minimum swipe speed in the first example is only 7 cm/s at the start of the card and the maximum swipe speed in the second case is 140 cm/s at the card end.

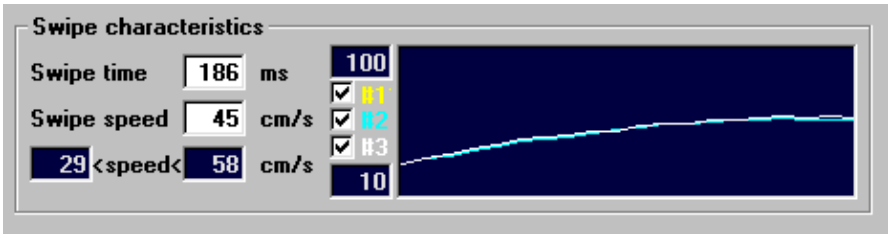
7 Signal Analysis

MAKStripe USB offers, as a direct magnetic stripe card reader, advanced signal analysis options far beyond the technical opportunities of a normal magnetic card reader.

In case of magnetic stripe card readers, which do contain a decoder chip, the data will be decoded and the signal will be submitted time delayed through two data lines (data and clock) to the PC, where further processing is performed.

Beyond the usual data decoding, the exact signals on a magnetic stripe card can be read, and with the graphical representation of this data you can identify in one look the data modulation, signal quality, and various schemes of non-standard tracks, that are used for authentication purposes.

MAKStripe USB submits the digitalized data in real time to the PC, the real bit density and also the swipe speed during the entire time interval of swiping of the magnetic stripe card can be estimated.



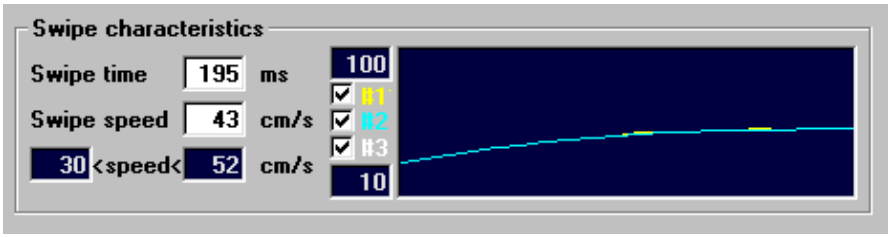
Although it is reasonable to expect that the swipe speed is constant during the whole process, the swipe speed is in the beginning rising and after a period of acceleration it reaches a relative constant value.

The reason here fore is that after the magnetic stripe card has touched the magnetic head, the swiping speed decreases rapidly for a short period of time until the magnetic head has raised and taken it's correct place on the card. Afterwards the speed is increasing and the continuous swipe speed is reached at approximately 60%.

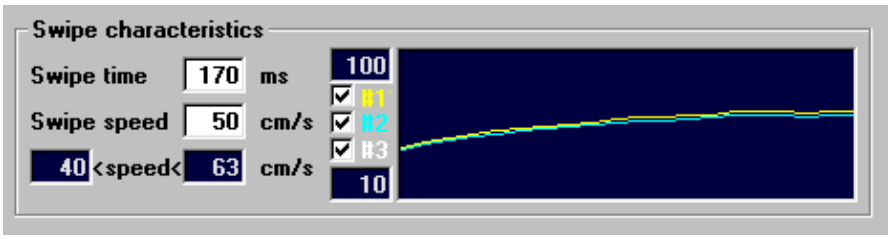
Every magnetic stripe card reader/writer is unique. The bit density differs at the beginning and the end of the card. Knowing this fact, it is possible to examine if the tracks of the magnetic stripe cards have been written with one and the same magnetic stripe card reader / writer, in single or multiple swipes, or with different writers.

Also a analysis of the quality of the written data is possible.

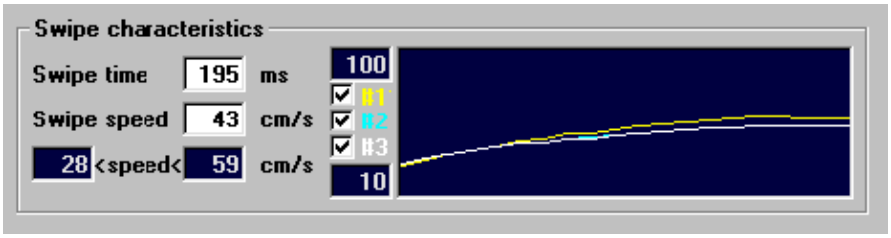
Here some typical examples:



This are data from a magnetic stripe card, written with a high quality writer. Both tracks have been written in one swipe. A difference can hardly be noticed.

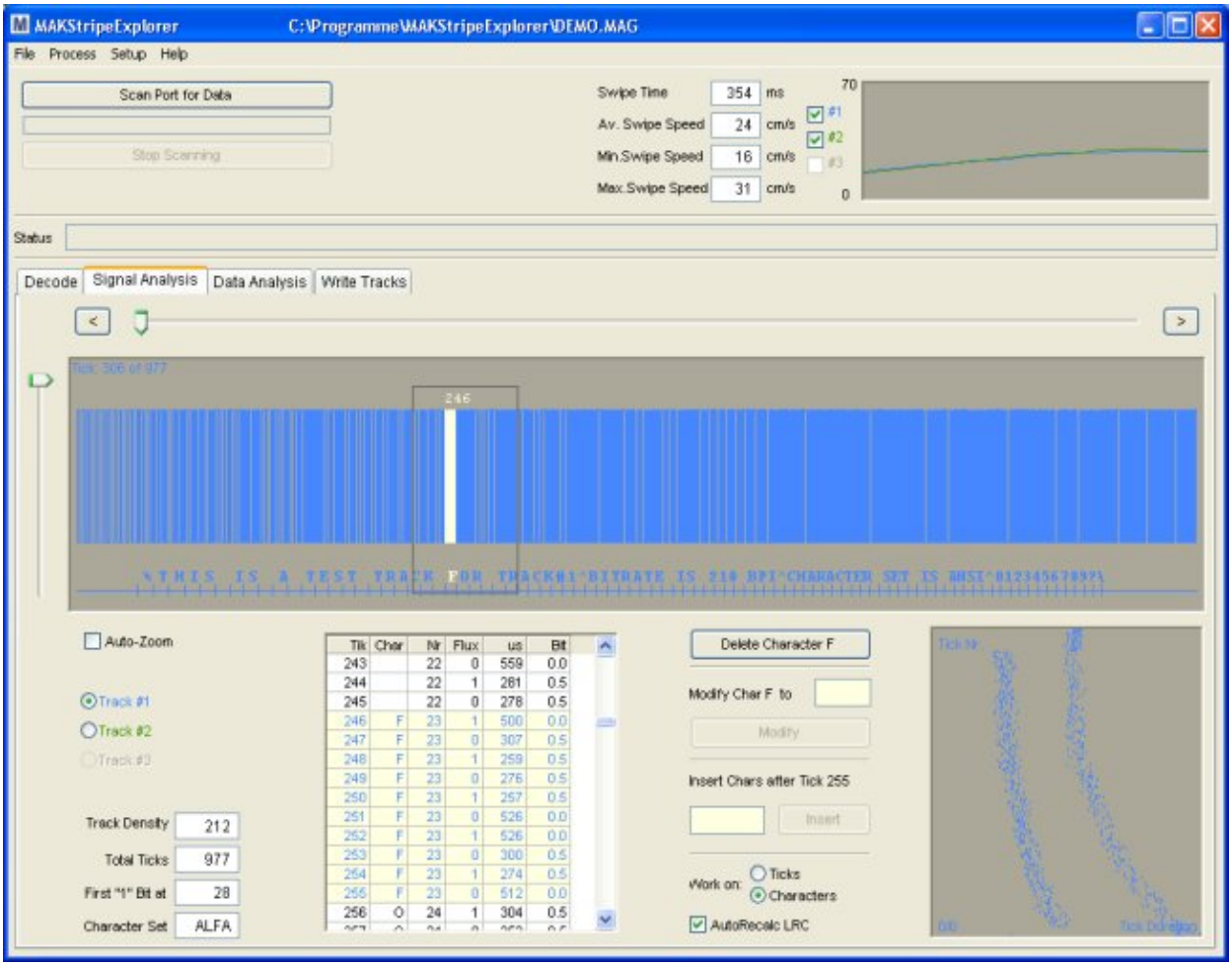


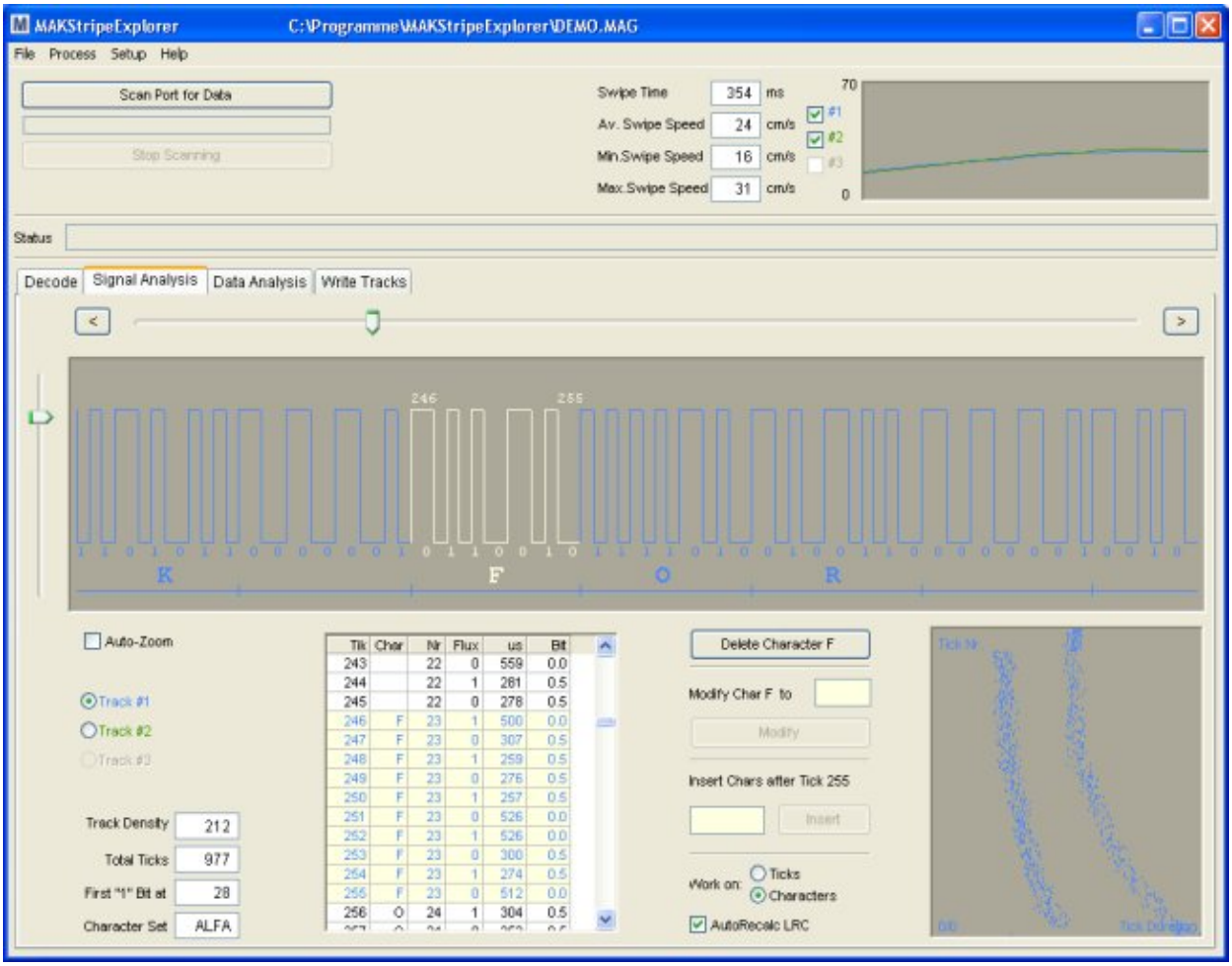
In this case the first track is written in the first swipe, the second track is written in a separate swipe. It can be noticed that both tracks have been written on the same magnetic card writer model. The two tracks are almost parallel.



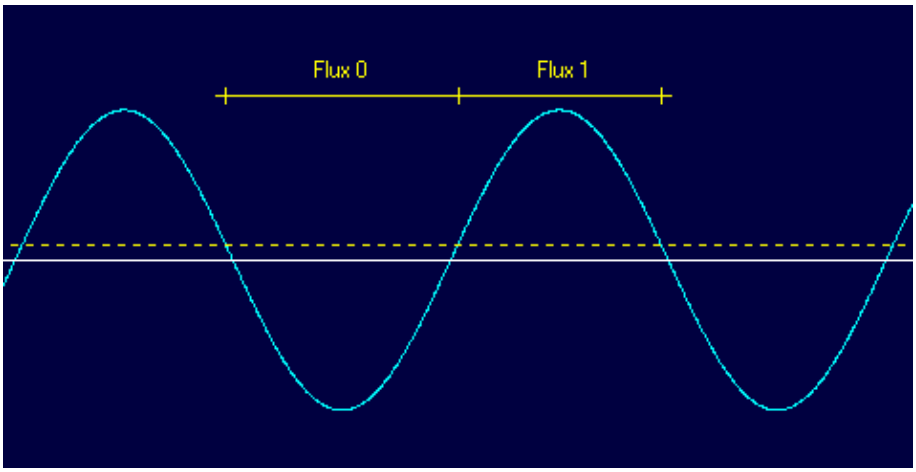
Tracks 2 and 3 have been written in one swipe. Track 1 has been written afterwards on a different magnetic card writer.

With MAKStripe USB and the software "MAKStripeExplorer", every single tick, bit or character with the flux direction, its size in microseconds, and its position can be analysed. By selecting in the "Signal Analysis" menu a part of the data, available on a track, by left clicking and moving with the mouse, all details for the selected data will be displayed.

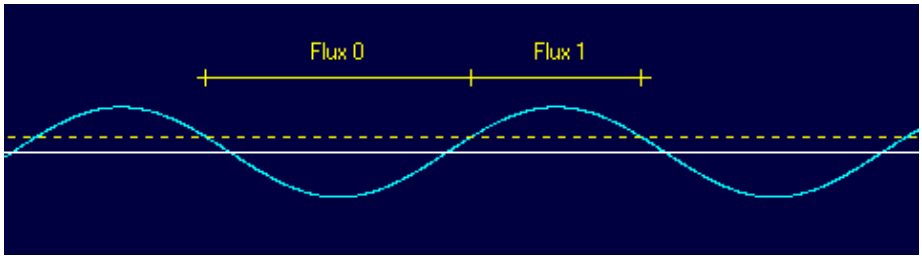

MAKStripeExplorer
C:\Programme\MAKStripeExplorer\DEMO.MAG
File Process Setup Help
Scan Port for Data
Stop Scanning
Swipe Time 354 ms
Av. Swipe Speed 24 cm/s
Min.Swipe Speed 16 cm/s
Max.Swipe Speed 31 cm/s
#1
#2
#3
70
0
Status
Decode
Signal Analysis
Data Analysis
Write Tracks
246
%THIS IS A TEST TRACK FOR TRACK#1*BITRATE IS 210 BPI*CHARACTER SET IS AHSI*0123456789?\
Auto-Zoom
Track #1
Track #2
Track #3
Track Density 212
Total Ticks 977
First "1" Bit at 28
Character Set ALFA
Tik Char Nr Flux us Bit
243 22 0 559 0.0
244 22 1 281 0.5
245 22 0 278 0.5
246 F 23 1 500 0.0
247 F 23 0 307 0.5
248 F 23 1 259 0.5
249 F 23 0 276 0.5
250 F 23 1 257 0.5
251 F 23 0 526 0.0
252 F 23 1 526 0.0
253 F 23 0 300 0.5
254 F 23 1 274 0.5
255 F 23 0 512 0.0
256 O 24 1 304 0.5
Delete Character F
Modify Char F to
Modify
Insert Chars after Tick 255
Insert
Work on: Ticks Characters
AutoRecalc LRC
Tick Nr



In order to eliminate noise and HF (radio waves) interference, the trigger level for the Analog -> Digital converter is several micro volts above 0V. For this reason when reading data from the card, the Flux1 length will be shorter then the Flux 0 length, or the opposite may take place depending on the direction the card was swiped.



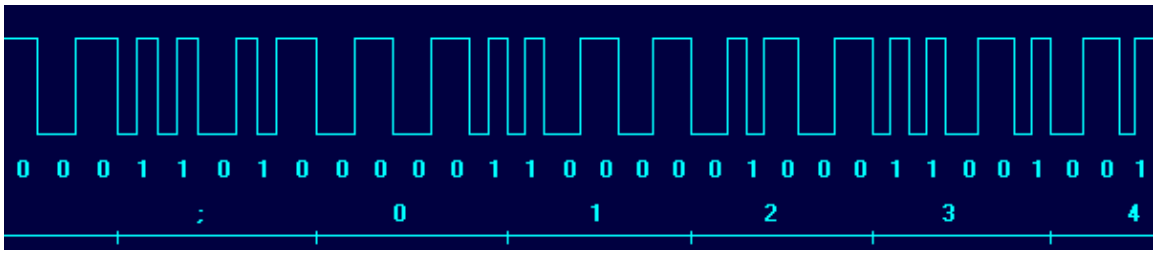
If the card is older, and the magnetic field is week, this effect will be more noticeable.



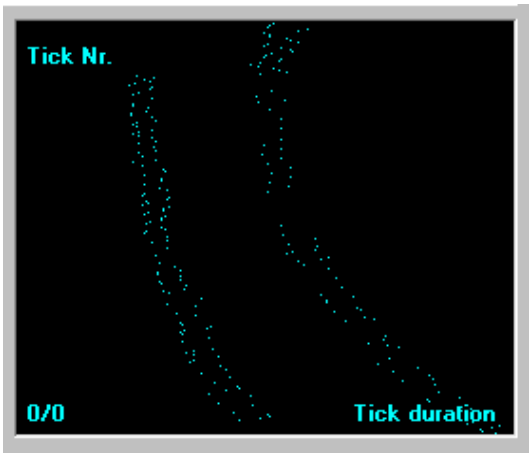
The length difference will also be different for different swipe speeds and bit density. If you swipe the card with a higher speed, the signal will be stronger then if you swipe the card with a lower speed.

The F2F modulation method, mostly used in magnetic cards applications, enables to write the data and clock together on the magnetic card. In this modulation a magnetic flux reversal between two clock cycles (a tick) will mean a logical "1" and if such a magnetic flux reversal is missing, it represents a logical "0".

The track data contains two tick duration sizes, the first smaller size for the "1 bits" and the second larger size for the "0 bits".

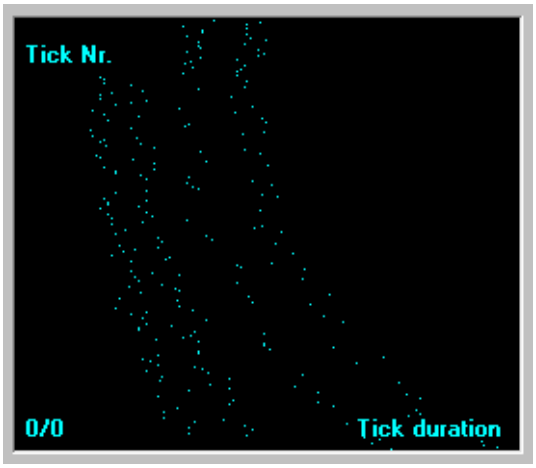


The tick duration for the "0 bits" is two times longer then the tick duration for the "1 bits".



In the Tick_Nr. / Tick_duration graphic, the Ticks are grouped in two streams. The first represents the "1 bit" ticks, the second the "0 bit" ticks.

The two data groups in one stream are the "Flux"0" and "Flux 1" Ticks, the length difference as described before, is clearly noticeable.

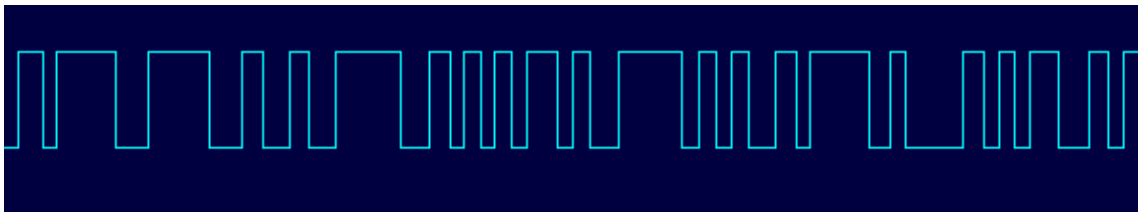


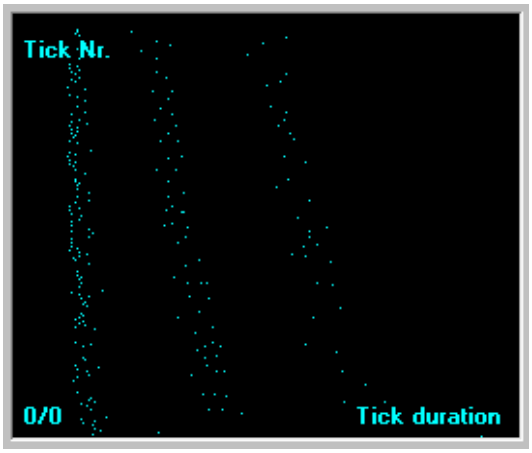
On a week signal the "Flux0" and "Flux 1" duration difference is much larger.

This card is also read error free, but it is much more error sensitive on too slow or too high swipe speeds.

With the Tick Nr. / Tick duration graphic, immediately the type of data on the track, and its quality can be seen.

A F2F modulation will have two data streams. But a track modulated with the more rarely used MFM (Modified Frequency Modulation) would contain 3 data streams.



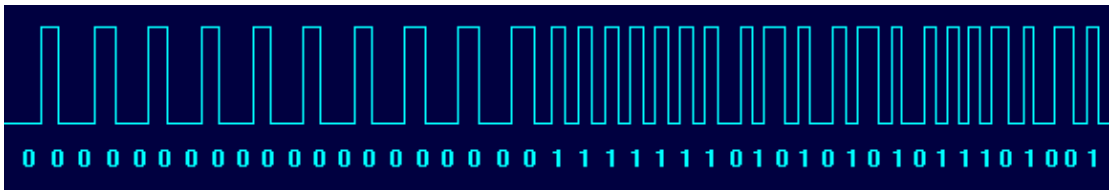


With the MFM modulation (also referred as MNRZb1, Miller Code and Delay Modulation DM) the data density is doubled without increasing the magnetic transition density.

This is achieved by using 3 tick duration sizes. A 1 bit cell tick, a 1.5 bit cell tick and a 2 bit cell tick.

If you would swipe such a card in a normal magnetic card reader containing a F2F decoding IC, you would only get a error message without knowing what has produced it. With MAKStripe USB you can exactly see what data is on the card.

A other example of a non-standard track is this track from a magnetic card used in a German company.



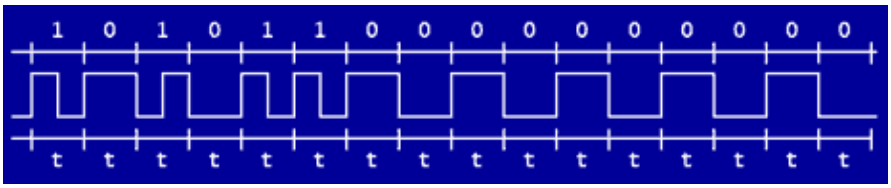
It shows a very elegant copy protection method. In the lead-in data the "Flux 0" Tick duration are much larger then the "Flux 1" ticks. After the data starts (first 1 bit) , the data stream continues with a normal F2F modulation. This anomaly can not be noticed with a normal magnetic card reader, and also not be written with a normal magnetic card writer. A card written with this track on a normal magnetic card writer, would seem like a correct copy on that reader / writer, but it would not contain the correct lead-in sequence.

Not only that MAKStripe USB shows exactly every tick duration, it is also capable to make a exact copy of this track.

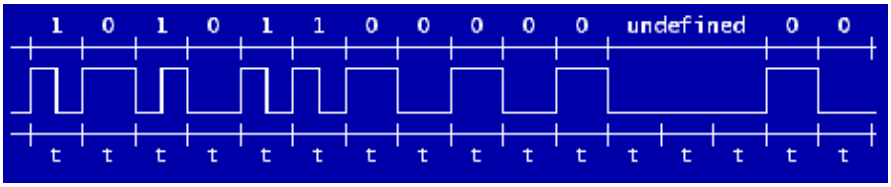
With the software "Magnetic-Stripe Card Explorer", the read data can be saved / written in RAW format, as they have been read out. No data and properties are lost.

Due to the RAW mode it is also possible to develop various copy protection schemes, to use and copy them.

For example, after the data end with the LRC (Longitudinal Redundancy Check), there are written up to 60 bits "0" until the cards end. In part - or also in the data part - a very simple but effective copy protection scheme with the use of a simple magnetic flux reversals could be implemented.



For example with a simple "lost" magnetic flux reversal, you would make a undefined and unrecognisable area in the F2F modulation.



A normal reader and / or writer would not be able to recognise this hole, but it would see this undefined area as a distortion in the swiping procedure and would ignore it. MAKstripe USB could identify this card without errors.

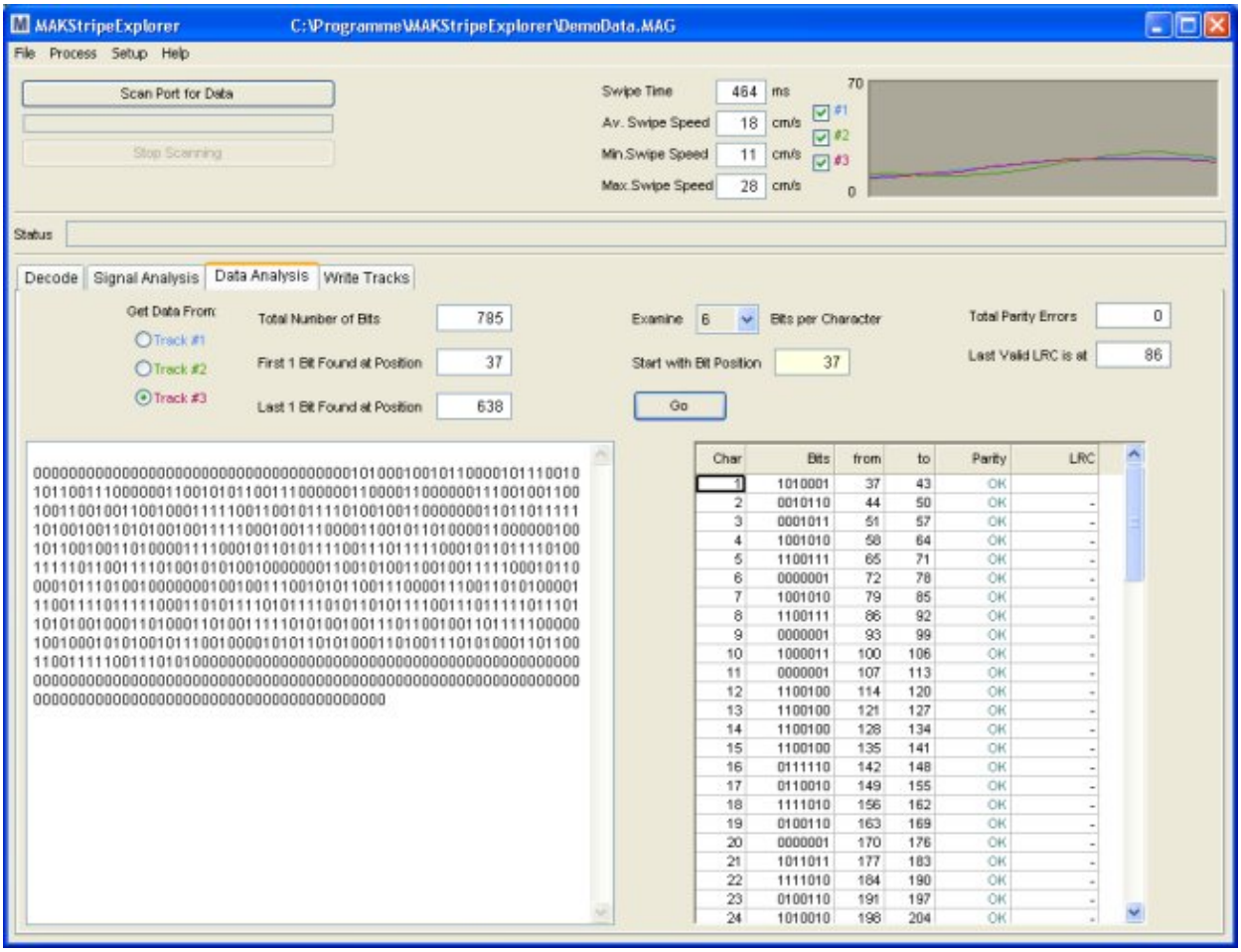
It is technically not possible to read or copy such a magnetic flux reversal sequence with a normal magnetic card reader and / or writer containing a decoder / encoder IC.

The copied magnetic card would have the same data as the original and would be seen as a successfully copy. But the whole or other magnetic flux reversal would not be present on the card.

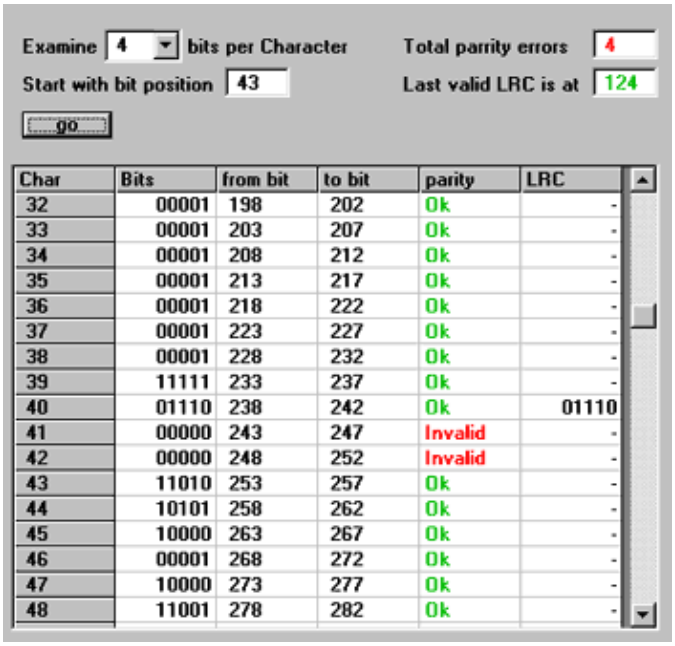
MAKStripe USB is capable to read this and other total non-standard tracks in RAW mode, to save them, and to write them later to other magnetic stripe cards. The copy would be 100% the original.

8 Data Analysis

In the "Data Analysis" tab, the data which have been read / loaded can be analysed. When displaying the data, the exact start position and the character size can be selected, so the parity for each bit group and the LRC from the start to the current position will be displayed.



Using this analysis possibilities, identification of the bit size of unknown character sets and analysis of possible errors can be performed.



Char	Bits	from bit	to bit	parity	LRC
32	00001	198	202	Ok	-
33	00001	203	207	Ok	-
34	00001	208	212	Ok	-
35	00001	213	217	Ok	-
36	00001	218	222	Ok	-
37	00001	223	227	Ok	-
38	00001	228	232	Ok	-
39	11111	233	237	Ok	-
40	01110	238	242	Ok	01110
41	00000	243	247	Invalid	-
42	00000	248	252	Invalid	-
43	11010	253	257	Ok	-
44	10101	258	262	Ok	-
45	10000	263	267	Ok	-
46	00001	268	272	Ok	-
47	10000	273	277	Ok	-
48	11001	278	282	Ok	-

For example on this magnetic card from a German company, the identical data sequences are written 3 times.

Every data sequence ends with the valid LRC and is followed by a two "00000" bit groups (parity is wrong) as separation data between the data sequences.

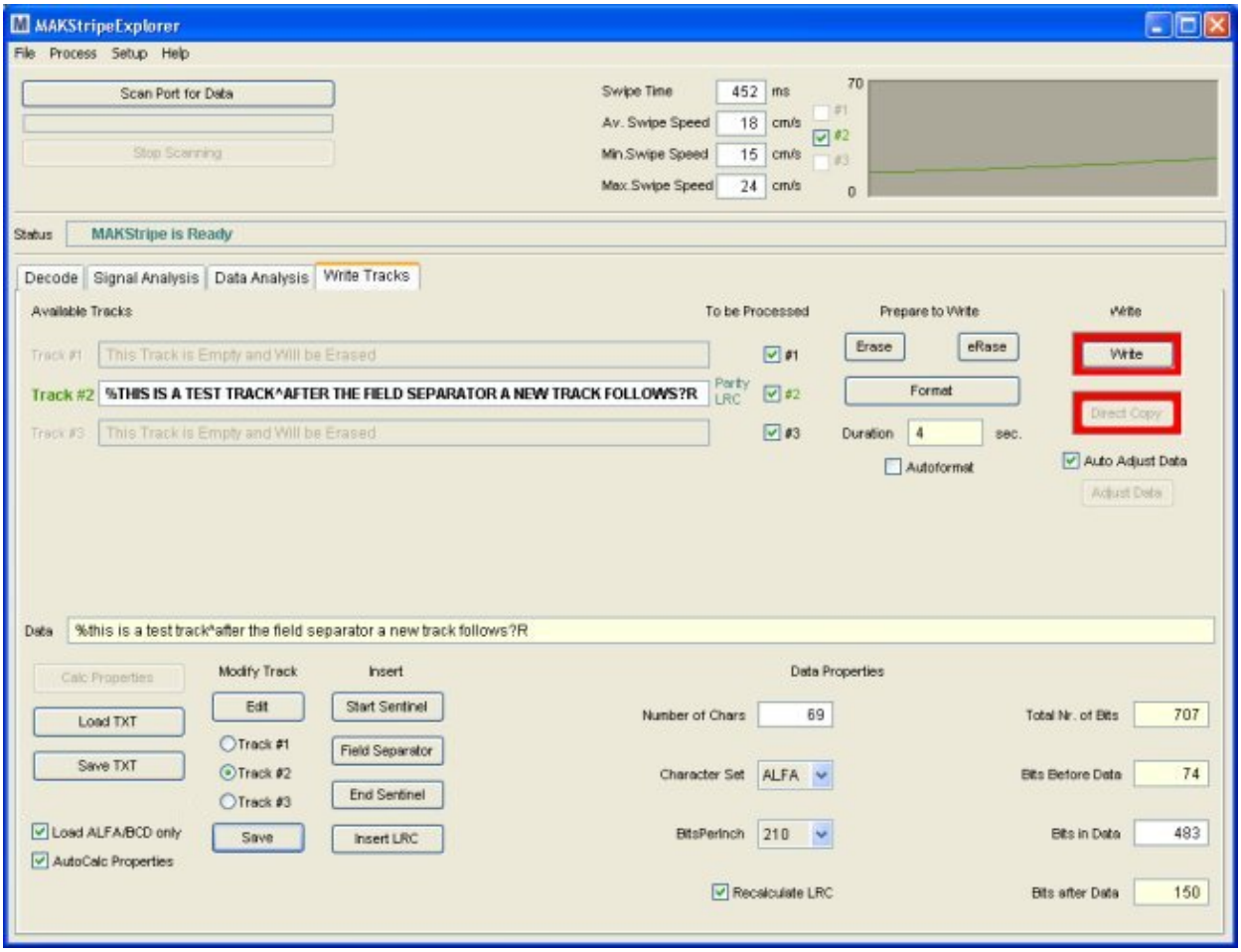
These 2*2=4 "00000" are reproducing 4 parity errors.

After the analysis we know that the data has been read correctly, even there are 4 parity errors present.

On a other card we have seen a very simple method to confuse normal software, by inserting several bits before the actual data starts. This data stream can not be normally identified, because the start sequence is not "Start Sentinel". You can examine and identify such data by skipping several bits by changing the analysis start bit.

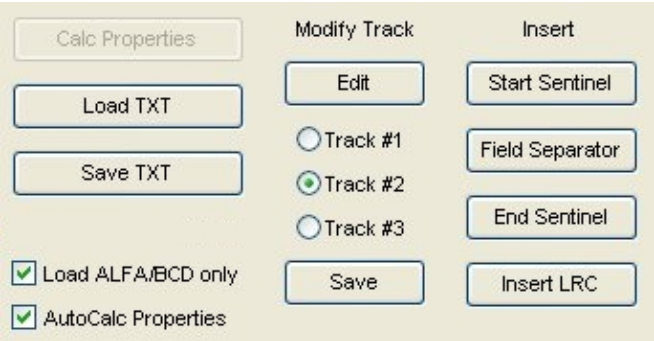
9 Data Generation

For data generation, the "Write Tracks" tab is selected. Using the "Character-Set" Combo-Box, the desired character set is chosen. Characters are entered in the In the "Data" field. If "Allow ALFA/BCD only" is checked, only characters according to the appropriate standards can be entered. The start of the text is marked with a "Start Sentinel", fields are separated with "Field Separators" and at the end, "End Sentinel" and "LRC" are inserted by pressing the appropriate buttons.



In the "Data Properties" section, the number of characters on a track, character set, track density in Bits Per Inch, total number of bits on a track, bits before data, bits in data and bits after data will be shown. The parameters character set, total number of bits, bits before data and bits after data are displayed as recognized, but can also be changed by the user.

If the "AutoCalc Properties" checkbox is enabled, these parameters will be recalculated and displayed in "Data Properties" while each new character is being entered. If this checkbox is disabled, then the "Calc Properties" button is enabled and by pressing it, the recalculation is done manually.

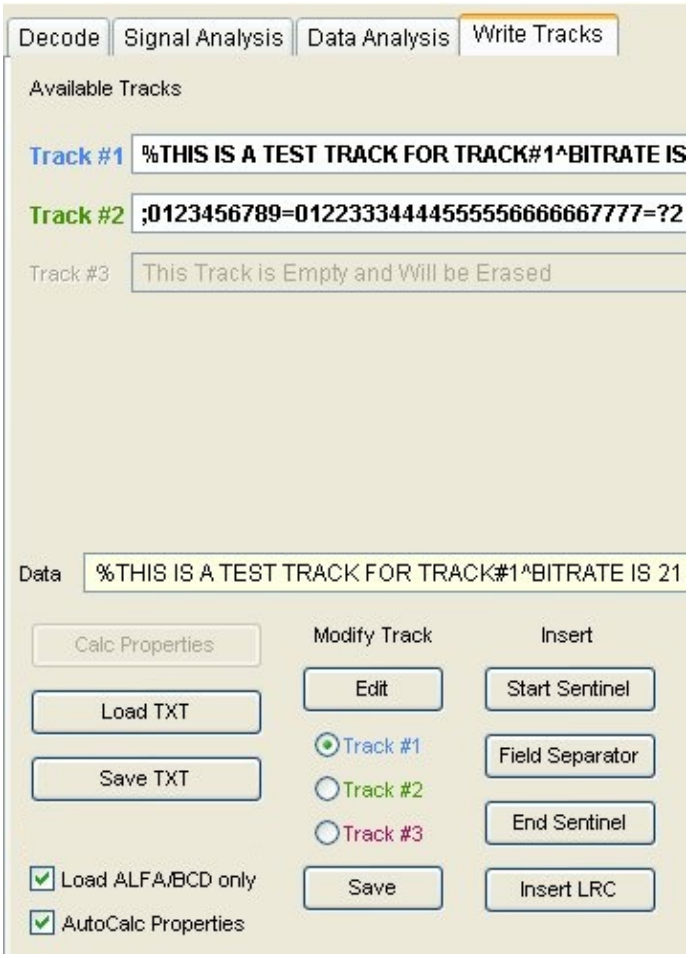


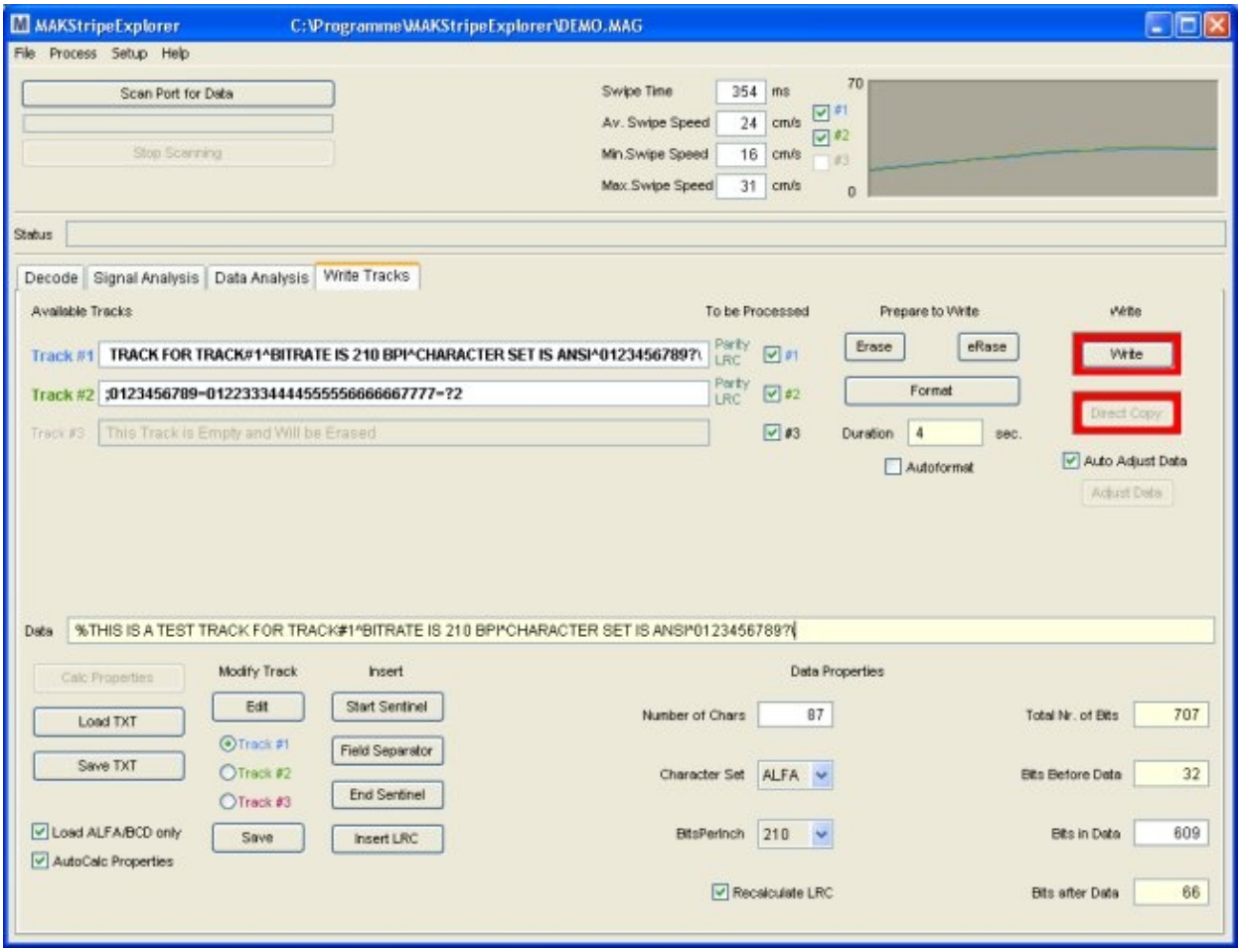
After entering data has been finished, the track, to which the data should be saved, has to be selected by clicking on the appropriate radio-button. By clicking on the "Save" button, the entered data will be transferred to the selected track. The typed characters will automatically be converted in upper case according to the standard. The generated data can be saved in MAG format by selecting "Save" in the "File" menu or in ASCII format by clicking on the "Save TXT" button. According to this procedure, data can be generated for all three tracks of a magnetic-stripe card.

Saving the generated data in MAG format (Save option in the File menu) does save all data of all three tracks in a special binary format, while saving in TXT format saves only the data of the selected track in ASCII format. Accordingly loading data in MAG format loads all three tracks. If importing of ASCII data is desired, then by pressing the "Load TXT" button, ASCII data will imported and shown in the "Data" field, where they can be modified and saved to a track by selecting the desired track and pressing the "Copy" button.

10 Data Modification / Editing

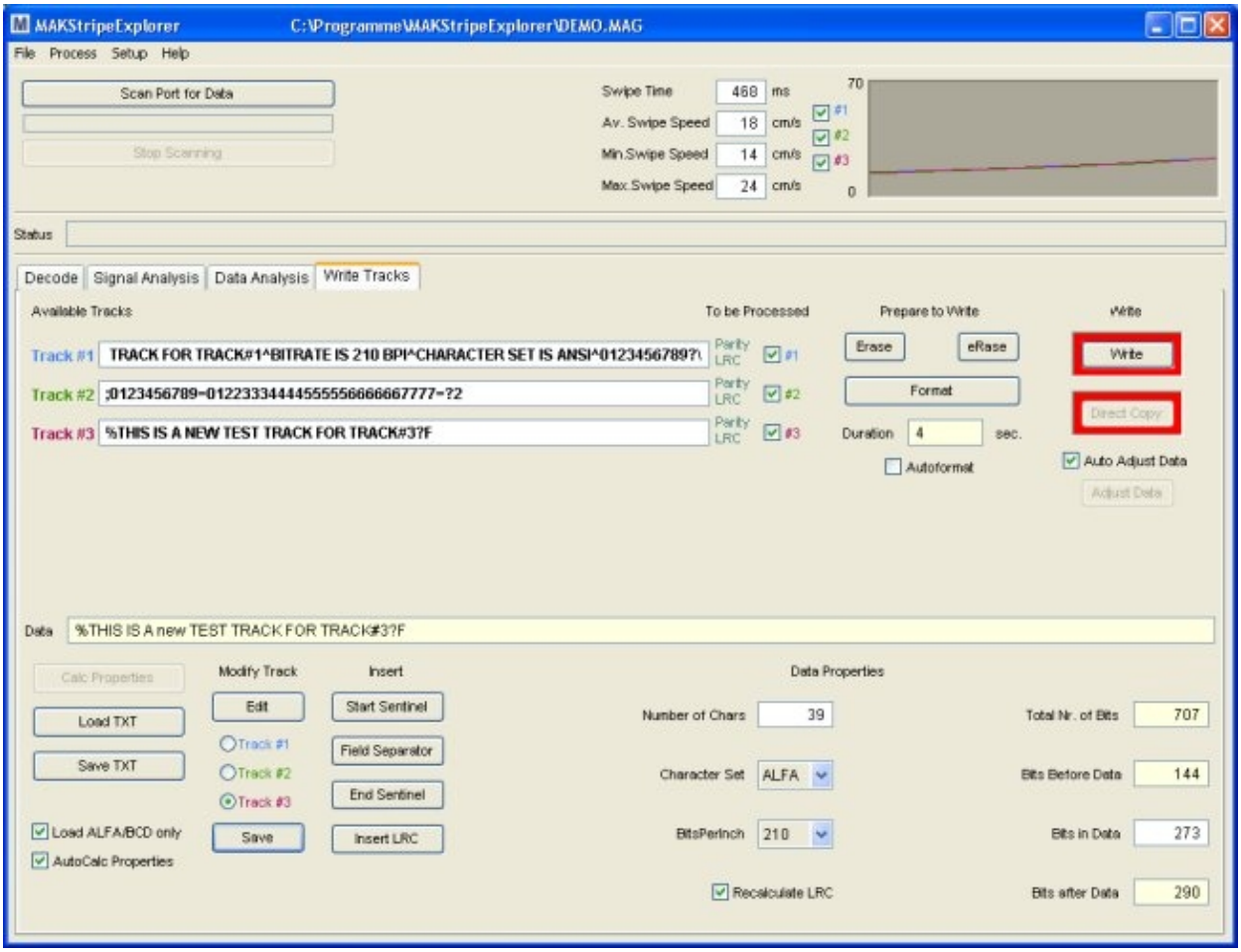
The most easy way to modify data is available in the "Write Tracks" tab. In this tab all available tracks of data which have been scanned, generated or loaded from a MAG file, are displayed. Selecting the track, which will be edited by clicking on the appropriate radio button and pressing afterwards the "Edit" button, the characters are transferred to the "Data" field, where modification can be made. The process of transferring characters from a track to the "Data" field can also be performed by double-clicking the left mouse button on the track which shall be modified.





After the data have been modified, they can be returned to the track where they came from by double clicking on the "Data" field. If the transfer to another track is desired, then this is performed by clicking on the appropriate radio-button and afterwards on the "Save" button.

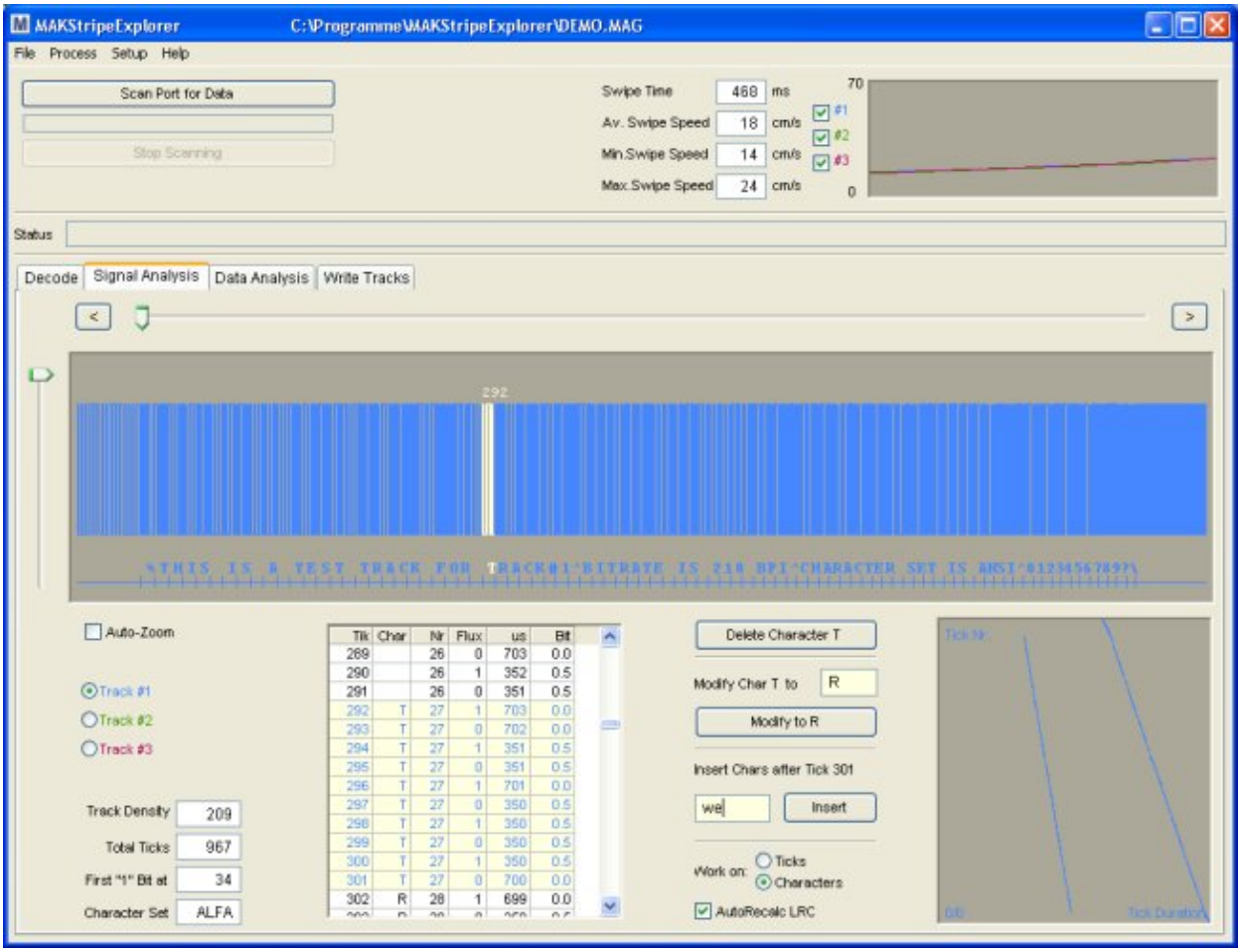
In the following example, the data from track 1 have been copied to the "Data" field by double-clicking on them. After modification, track 3 has been selected as new destination by pressing selecting the third radio button. By pressing the "Save" button, the modified data from track 1 have been transferred to track 3.



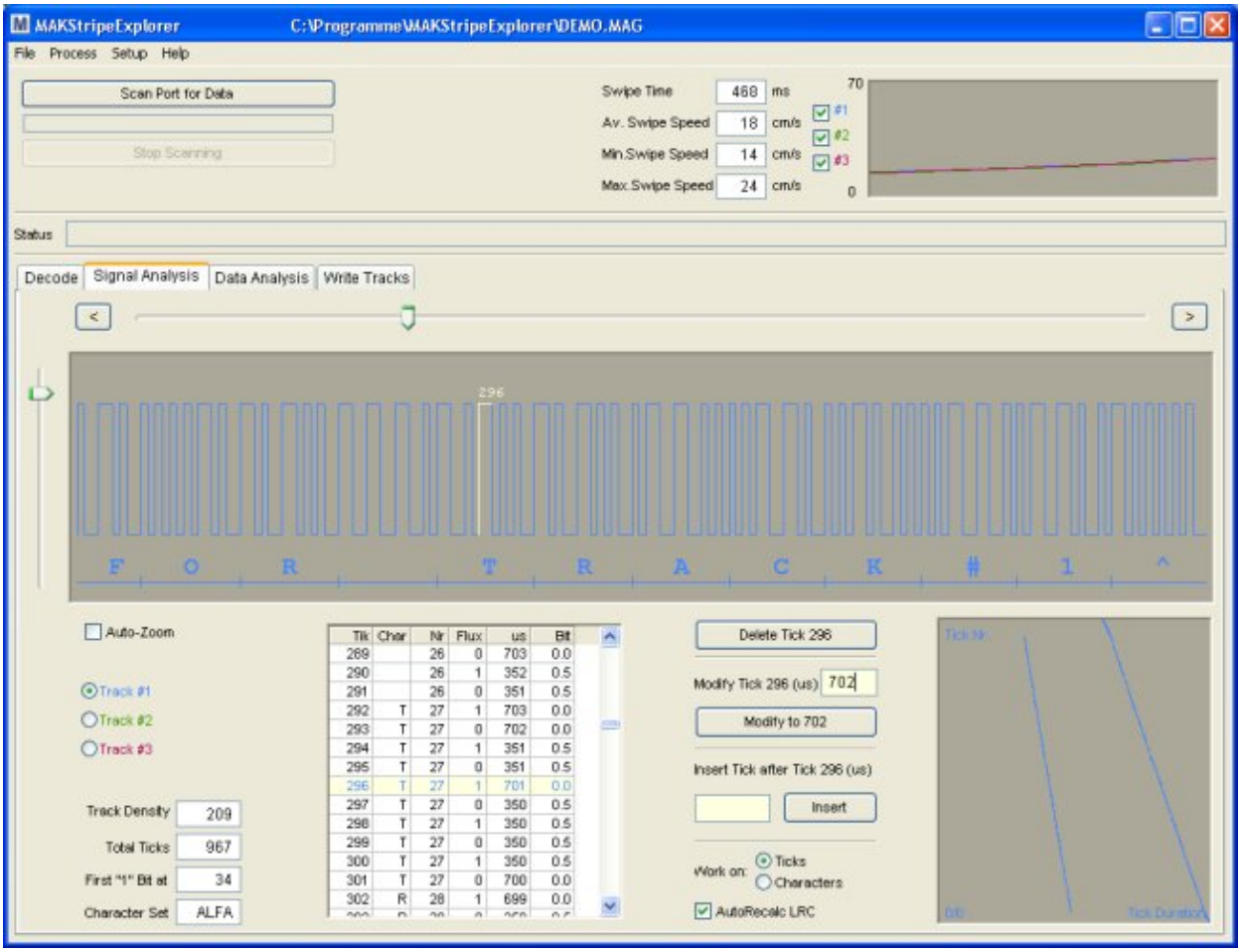
Using the procedure, described above, easy and fast modification of characters can be performed. If unusual editing of characters or ticks is desired - for example for creation of security cards, which cannot be read with other hardware, then the "Signal Analysis" tab can be selected.

In the "Signal Analysis" tab, addition sophisticated opportunities for changing and modifying of each character and even of each separate tick is available.

If "Work on Characters" is selected, by left-clicking on a character, the opportunity is given to change the select character or to insert new characters after the selected character.



By selecting "Work on Ticks" and left-clicking on a tick, the tick can be deleted, the length can be modified or new ticks inserted after the selected tick. So it is possible to work on a very detailed level in order to perform any desired modification.


MAKStripeExplorer
C:\Programme\MAKStripeExplorer\DEMO.MAG
File Process Setup Help
Scan Port for Data
Stop Scanning
Swipe Time 468 ms
Av. Swipe Speed 18 cm/s
Min.Swipe Speed 14 cm/s
Max.Swipe Speed 24 cm/s
70
0
#1
#2
#3
Status
Decode
Signal Analysis
Data Analysis
Write Tracks
296
F O R T R A C K # 1 ^
Auto-Zoom
Track #1
Track #2
Track #3
Track Density 209
Total Ticks 967
First "1" Bit at 34
Character Set ALFA
Tik Char Nr Flux us Bit
269 26 0 703 0.0
290 26 1 352 0.5
291 26 0 351 0.5
292 T 27 1 703 0.0
293 T 27 0 702 0.0
294 T 27 1 351 0.5
295 T 27 0 351 0.5
296 T 27 1 701 0.0
297 T 27 0 350 0.5
298 T 27 1 350 0.5
299 T 27 0 350 0.5
300 T 27 1 350 0.5
301 T 27 0 700 0.0
302 R 28 1 699 0.0
Delete Tick 296
Modify Tick 296 (us) 702
Modify to 702
Insert Tick after Tick 296 (us)
Insert
Work on: Ticks Characters
AutoRecalc LRC
Tick Nr.
Tick Duration

11 Writing Tracks with MAKStripe USB

MAKStripe USB is able to write to LoCo magnetic stripe cards. In each writing procedure one, two or three tracks can be written - in any desired bit density, modulation and character set. MAKStripe USB is controlled directly by the software MAKStripeExplorer, and it depends only on the software what can be done.

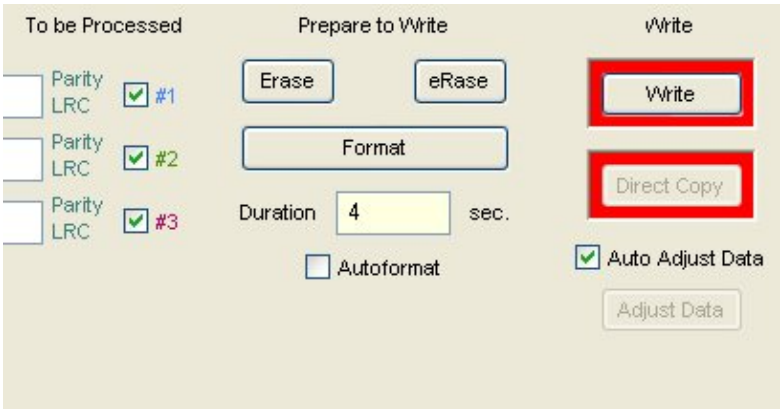
LoCo magnetic stripe cards are the most used magnetic stripe cards, as for example cash cards, credit-cards, identification cards, etc. MAKStripe USB is not suitable for writing HiCo magnetic stripe cards, which are rarely used - in industry buildings and at airports, where strong magnetic fields exist, which could damage the magnetic stripe card.

Because the data are written by MAKStripe USB direct - without using a encoder chip - it is possible to write exactly defined data to the card, with a defined start, data stream and end. For copy protection purposes also characters with inverted parity can be written and modulations used, which do not comply to any norm.

Through the input of various parameters, influence on the bit density and also the size of single bits can be undertaken. So writing of tracks with any desired properties can be performed.

Also fully unknown data, not depending on the used character sets and modulation, can be read, analysed and written on other magnetic stripe cards.

Writing a customized magnetic-stripe card is performed with two swipes. The swipe speed and characteristic is determinated by making a reference swipe before the write swipe. Both swipes should have the same swipe speed. Due to this reason, for writing to a card, there must be some data at least on one track of the destination card, which can be used as reference. Therefore if writing to a blank card is desired, there must previously be written some temporary data to this destination card. This process, called formatting a reference track is performed by pressing the "Format" button or F7 function key and swiping the destination card through MAKStripe USB. The destination card which will be formatted, has to be swiped through MAKStripe USB during the time period given in the "Duration" field. The formatting process is in fact a process of writing a simple 0 bit data stream to the selected track(s) for calibration purposes. Formatting will be performed on all tracks for which the checkoxes of "To be Processed" have been selected. It is necessary that at least one track is formatted - which track is irrelevant. After at least one track has been formatted, the writing process can be performed.

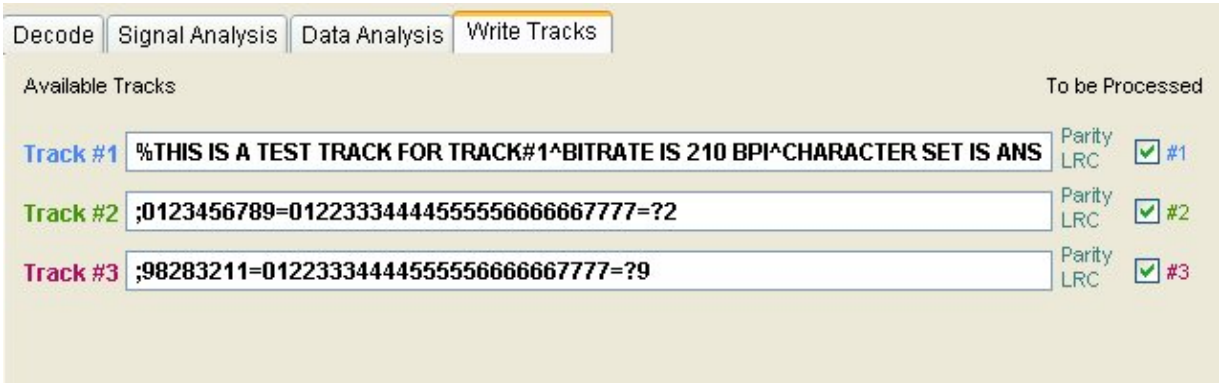


If there are already some data on any track of the destination card, then it is not necessary to perform formatting as described in the previous paragraph. In such a case MAKStripe USB will accept the existing data as a reference track for calibration.

11.1 Direct Copy

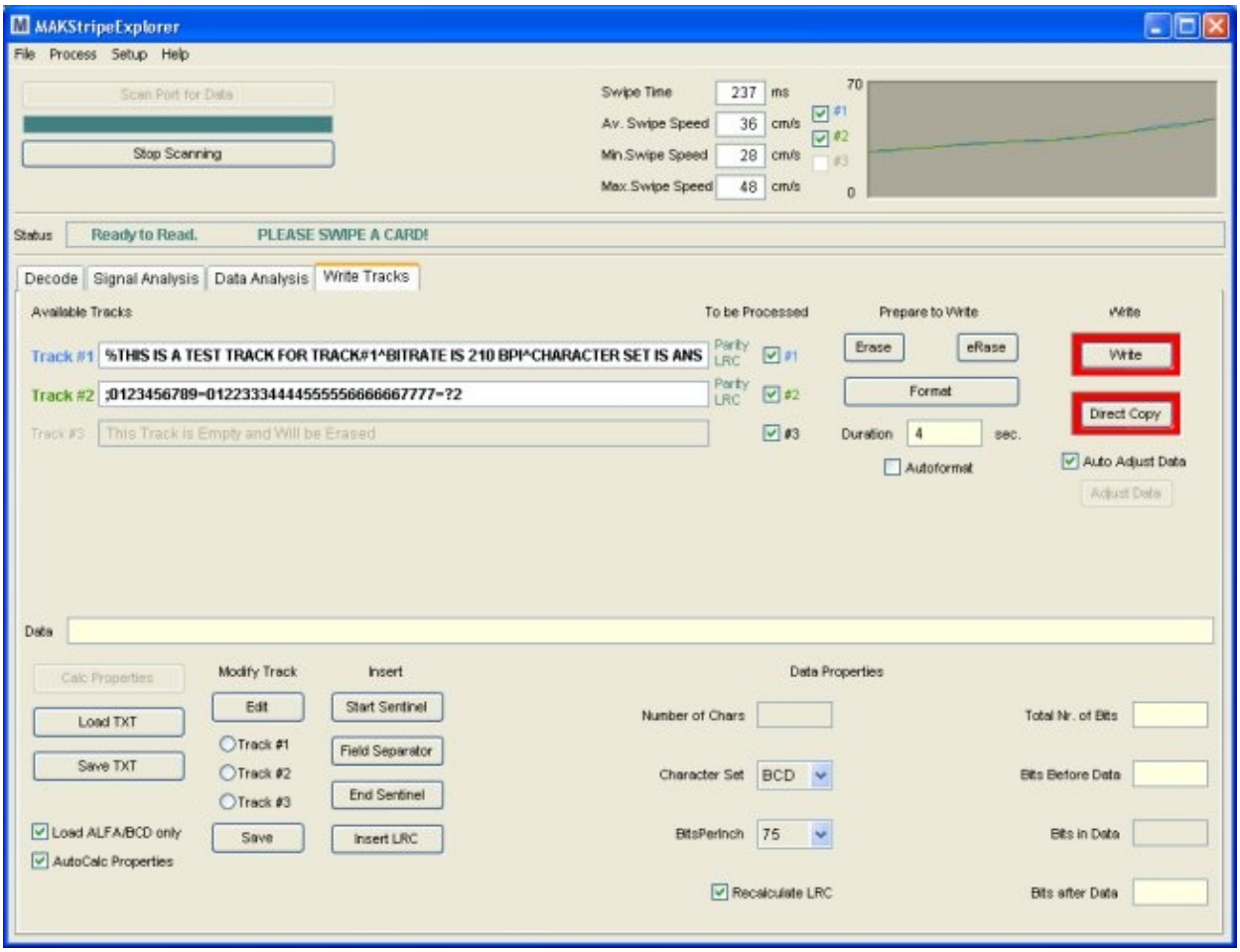
The process of direct copying is performed in two swipes. During the first swipe the source card is read and during the second swipe, the data are written to the destination card.

First the original magnetic-stripe card has to be scanned. The scan process is started by pressing the "Scan Port for Data" button or the function key F5. After a card has been swiped, the "Direct Copy" button in the "Write Tracks" tab will be enabled and the data, available on the scanned card will be displayed. All checkoxes of "To be Processed" will be selected, which means that all three tracks will be copied.



Pressing the "Direct Copy" button and swiping a formatted card or even a old card containing any data through MAKStripe USB , will result in an exact copy of the original card. When a card is swiped through Makstripe USB, the raw data from the last swipe remains in the internal buffer. With "Direct Copy" this raw data is written to a other card "AS IS", without any analysis or modification.

If all checkoxes of "To be Processed" are selected, empty tracks of the original card will also result in empty tracks on the destination card. Using "Direct Copy", beside copying all three tracks, it is also possible to copy selected tracks of the source card to the destination cards - in such a case, the appropriate checkoxes of "To be Processed" have to be selected and the unwanted tracks have to be deselected. In the example on the following picture, the scanned card has data on track 1 and track 2. Track 3 is empty. If all checkboxes are checked, a exact copy will be made with data on tracks 1 and 2 and a empty track 3. On the other side, if for example checkox 1 an 3 are unchecked, only track 2 will be transferred to the destination card - tracks 1 and 3 would be left on the destination card unchanged. If the checkbox for track 3 - which is empty on the source card in this example - would be checked, then track 3 on the destination card would be erased.



11.2 Writing Custom Tracks

Pressing the "Write" button or the F8 function key, starts the writing process of the tracks for which checkoxes of "To be Processed" are selected. If the "Auto Adjust Data" checkbox is selected, the

data will be optimized before they are written to the destination card.

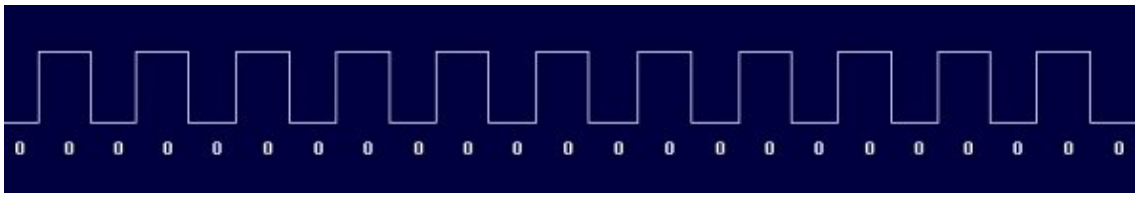
It is possible to select any combination of tracks to be written together - 1, 2 or 3 tracks. Old data on the destination card or formatted tracks will be overwritten if the appropriate checkox of "To be Processed" is selected. The process of writing is performed in two swipes. During the first swipe, MAKStripe USB reads the reference track and during the second swipe the data are written.

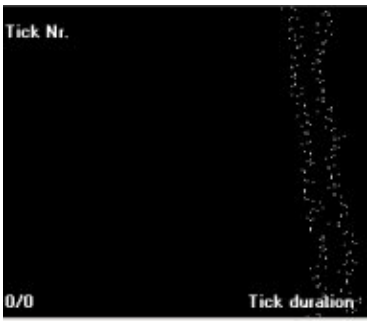
11.3 Reference Track

For successful writing to a blank magnetic-stripe car, a correct formatted reference track is required, as described above.

If data are written incorrect, please check the quality of the formatted track. If bad, then erase and reformat it.

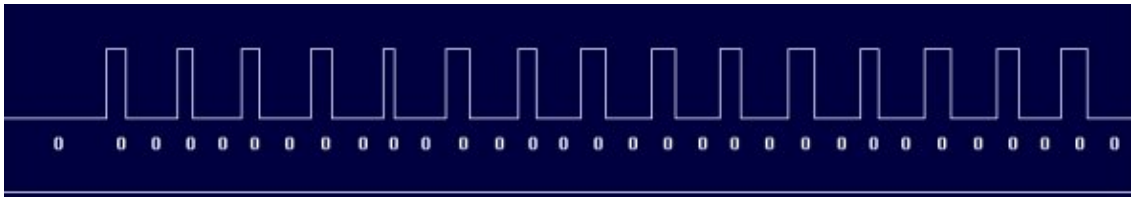
A correct formatted reference track consists of a sequence of flux0 / flux1 signals, with approximately the same spacing, as shown on the picture bellow:

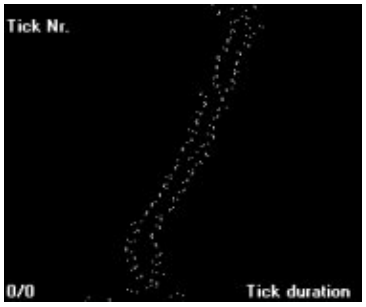




The reference track should have a density in the range between 160 BPI - 200 BPI. If the BPI is extremely outside this range, this is a sign that the swipe speed has been too fast or too low. If the swipe speed is too high, the BPI will be too low and if the swipe speed is too low, the BPI will be too high. In such cases it is necessary to repeat the formatting with a corrected speed.

A example of a bad formatted reference track, where the spacing is not equal or contains random spacing sequences, is shown bellow. In case of a such incorrect formatted reference track, the write procedure will fail. Please erase and reformat such a reference track.

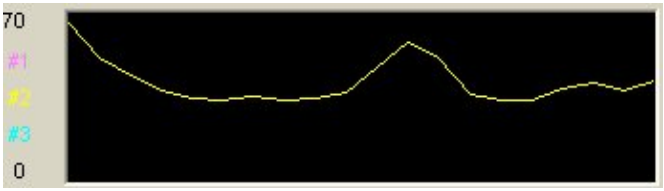




11.4 Swipe Speed in Formatting / Writing Process

Continuous swipe speed during the swipe process has a very important influence on the successful formatting / writing.

In case, the swipe speed changes during the swipe process, bad data, like shown in the following example will be written:



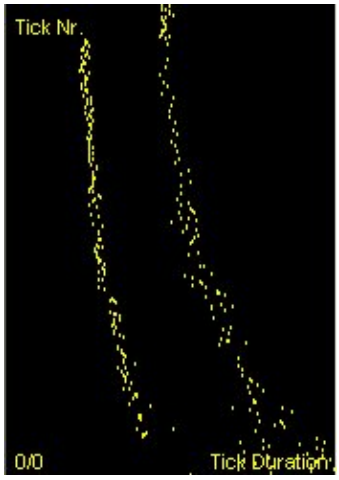
The jumps in the curve, shown above, do indicate that the swipe speed has big variations during the swipe process. Such data are unusable. It is necessary that the curve has a continuous smooth form without ups and downs.

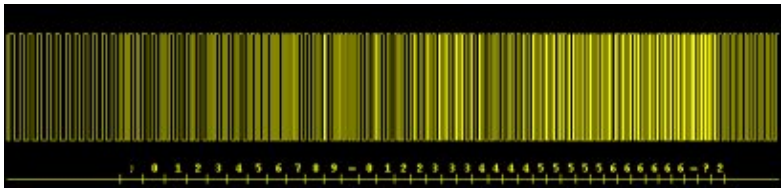
When writing tracks, during the first swipe the reference track is read and during the second swipe, the data are written. During both swipes, the swipe speed should be approx. the same. If for example, the first swipe (reading reference track) has been made faster than the second swipe (writing data), the data are written not on the whole card, but only at its beginning. On the other side, if for example the speed of the second swipe is much higher than the speed of the first speed, not all data will be written, but the last data will be cut.

The swipe speed during both swipes of the write process should be approx. the same as the speed with which during the formatting process of a reference track 160 BPI - 200 BPI have been reached.

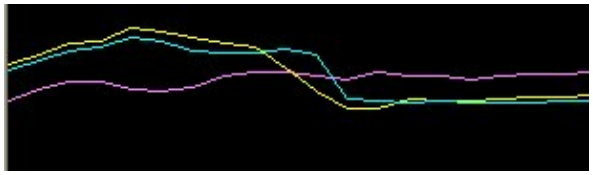
Correctly written data look like as in the following example:

Good: Continuous and smooth curves without jumps.

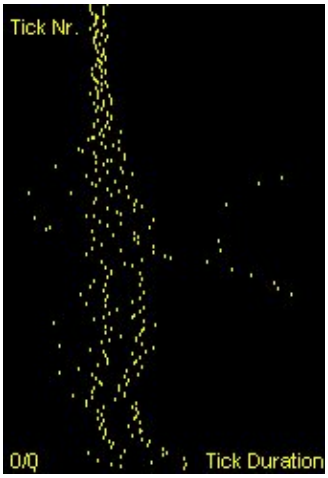


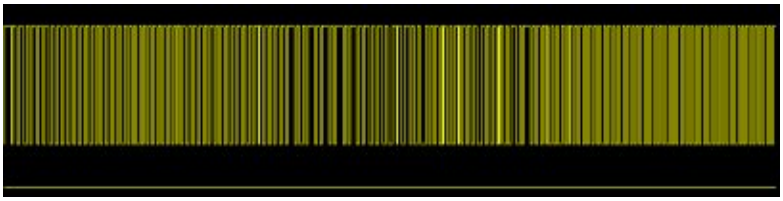


Bad written data look like as in the following example:



Bad: Curves with great spacing from each other and with big ups and downs





In this example of bad written tracks, following can be seen:

- All three curves have big ups and downs, which is the result of non-continuous swipe speed. It is necessary to preform the swipe with continuous swipe speed.
- Between the three curves, big differences are visible. The curves are not close to each other, but are clearly visible as separate curves. This indicates on flatter of the card during the swipe process. When the card flatters during the swipe process, the pressure on the magnetic head is not constant but varies, which results in such curves. In such a case, pressing the card soft to the left side of the device during the swipe process, results in constant pressure to the magnetic head, which is located on the right side of the device.

11.5 Erasing Tracks

If writing to a old card, it is not necessary required to erase any track. During the writing procedure the old data on the destination card is overwritten by the new data. But it is possible to Erase and/or eRase the track you intend to write to, in order to avoid any errors resulting from the previous data and to get a high quality track without distortion. This is performed by selecting the track(s) which shall be erased, using the checkoxes of "To be Processed", pressing the "Erase" or the "eRase" button and swiping the card through MAKStripe USB. The erase procedure will have a duration which is defined in the "Duration" field. Within this time, the card has to be swiped.

"Erase" is erasing the track in the "Flux 0" direction, "eRase" in the "Flux 1" direction.

12 Development of Own Software for MAKStripe USB

In order to provide the opportunity for development of own software, we are do also deliver with MAKStripe USB the library for Windows NT / 2000 / XP / Vista, for Linux and for Mac OS X "libmakstripe.a" with the header file "makstripe.h".

Using the library "libmakstripe.a", it is possible to integrate and control MAKStripe USB with own code as for example in a application for access control or payment system in a shop and in any other environment, where magnetic-stripe cards are used and the data should be processed through own software.

The library "libmakstripe.a" gives the opportunity to write your own software for MAKStripe USB using programming language C++. This library provides following methods:

- int Scan (bool messages=true, int seconds=20); // Scan for Data - Card can be Swiped
  // true - Diplay MAKStripe Responce
  // 20 - Wait 20 Seconds for Card to be Swiped
- bool LoadData (const char* File); // Load Data from *.MAG file (true if Load is OK)
- bool SaveData (const char* File); // Save Data to *.MAG file (true if Save is OK)
- string GetCharSet (int i); // Get Characterset for Track i
- string GetTrackData (int i); // Get Data for Track i
- int GetNrChars (int i); // Get Nr. of Characters for Track i
- int GetNrBits (int i); // Get Nr. of Bits for Track i
- int GetNrTicks (int i); // Get Nr. of Ticks for Track i
- int GetBPI (int i); // Get BPI for Track i
- bool GetParity (int i); // Get Parity for Track i (true if paritiy is OK)
- bool GetLRC (int i); // Get LRC for Track i (true if LRC is OK)

A simple console application, using the library "libmakstripe.a" could look like this example - code:

```
#include "makstripe.h"
#include <iostream>
using namespace std;

int main(){

  MAKStripe *mP = new MAKStripe;
  // Uncomment following lines if you want to read data from a MAG file
  /*
  bool readOK = mP->LoadData ("DEMO.MAG");                  // Load Data from *.MAG file
  if (!readOK){
    cout <<"\nError - File could not be opened\n\n";
    exit (0);
  }
  */

  int readOK = mP->Scan (true,20);     // Scan for Data - Card can be Swiped
                                       // true - Print MAKStripe Responce to cout
                                       // 20   - Wait 20 Seconds for a Card to be Swiped.
```

```
                                        //        If card has been swiped, then exit
                                        //        immidiately and continue ...

  if (readOK==1) {
    cout  <<"\nCard has been read correct.\nFollowing Data are on the Card:";
  }
  else {
    cout  <<"\nError - exiting programm\n";
    exit (0);
  }

  for (int i=1; i <=3; i++){                                  // Print Data for all 3 Tracks
    cout <<"\n\nTrack: "  <<i  <<"\n";
    cout  <<"Data   : "       << mP->GetTrackData(i)   <<"\n";
    cout  <<"Charset: "       << mP->GetCharSet(i)     <<"\n";
    cout  <<"Nr. of Chars: "  << mP->GetNrChars(i)     <<"\n";
    cout  <<"Nr. of Bits : "  << mP->GetNrBits(i)      <<"\n";
    cout  <<"BPI         : "  << mP->GetBPI(i)         <<"\n";
    cout  <<"Parity      : "  << mP->GetParity(i)      <<"\n";
    cout  <<"LRC         : "  << mP->GetLRC(i)         <<"\n";
  }

  bool saveOK = mP->SaveData ("DemoNew.MAG");              // Save Data to file DemoNew.MAG

}
```

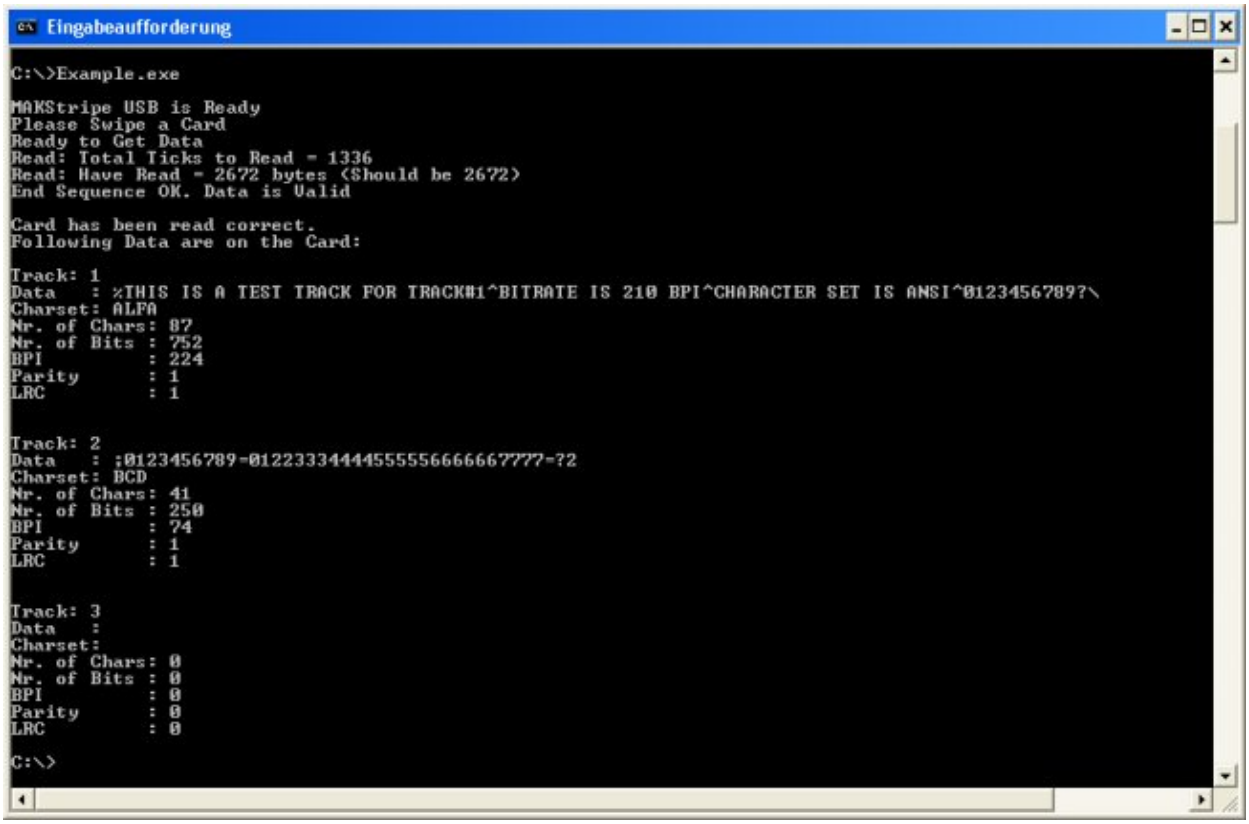
This code can be compiled on linux, with gcc, on Windows with MinGW gcc, or on Mac OS X with XCode gcc, using following command:

```
g++ Example.cpp -L. libmakstripe.a -o Example.exe
```

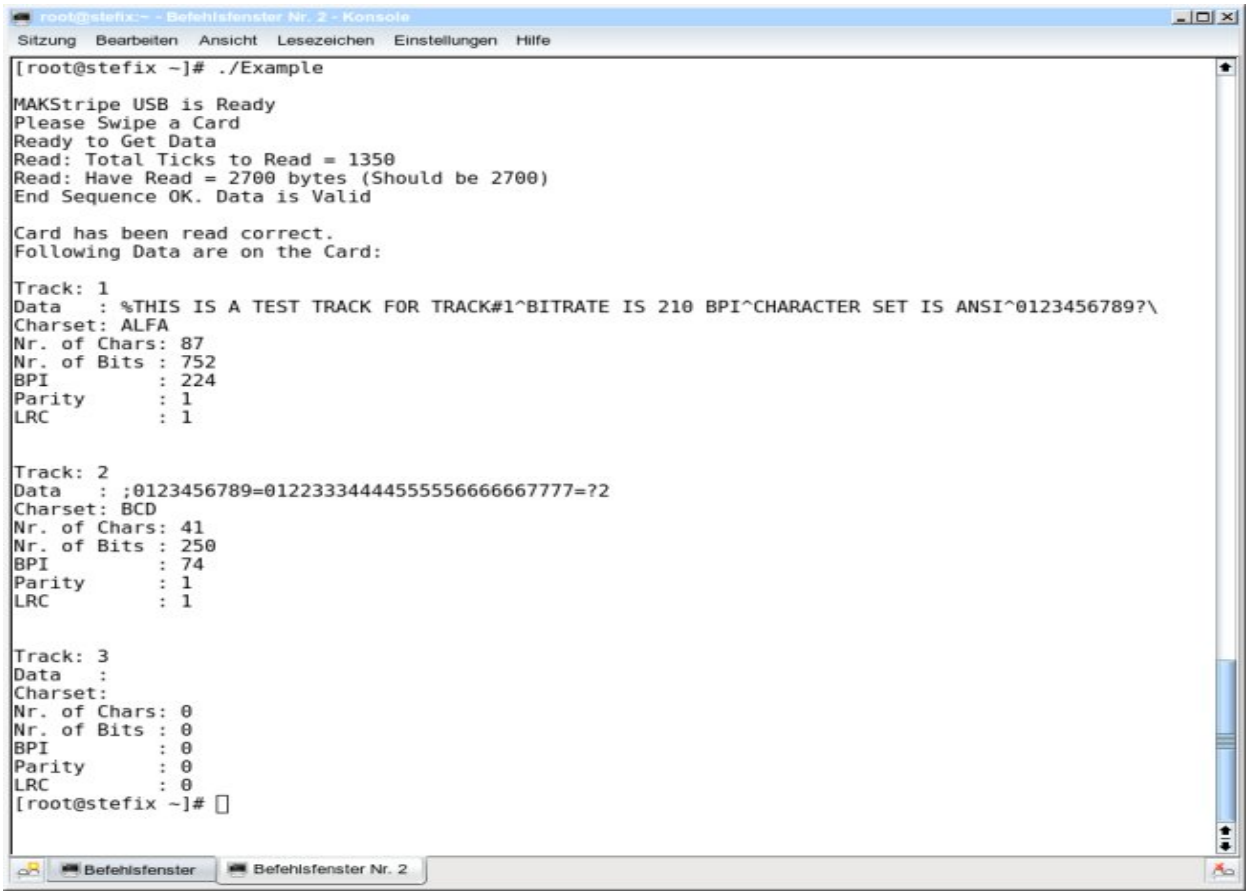
If libmakstripe.a and makstripe.h have been copied to folders, where the compiler searches for include files and libraries, also following Makefile could be used:

```
## Makefile for compilation ##
Example: Example.o
        g++ -g -o Example Example.o  -lmakstripe
Example.o: Example.cpp
        g++ -g -c  Example.cpp
```

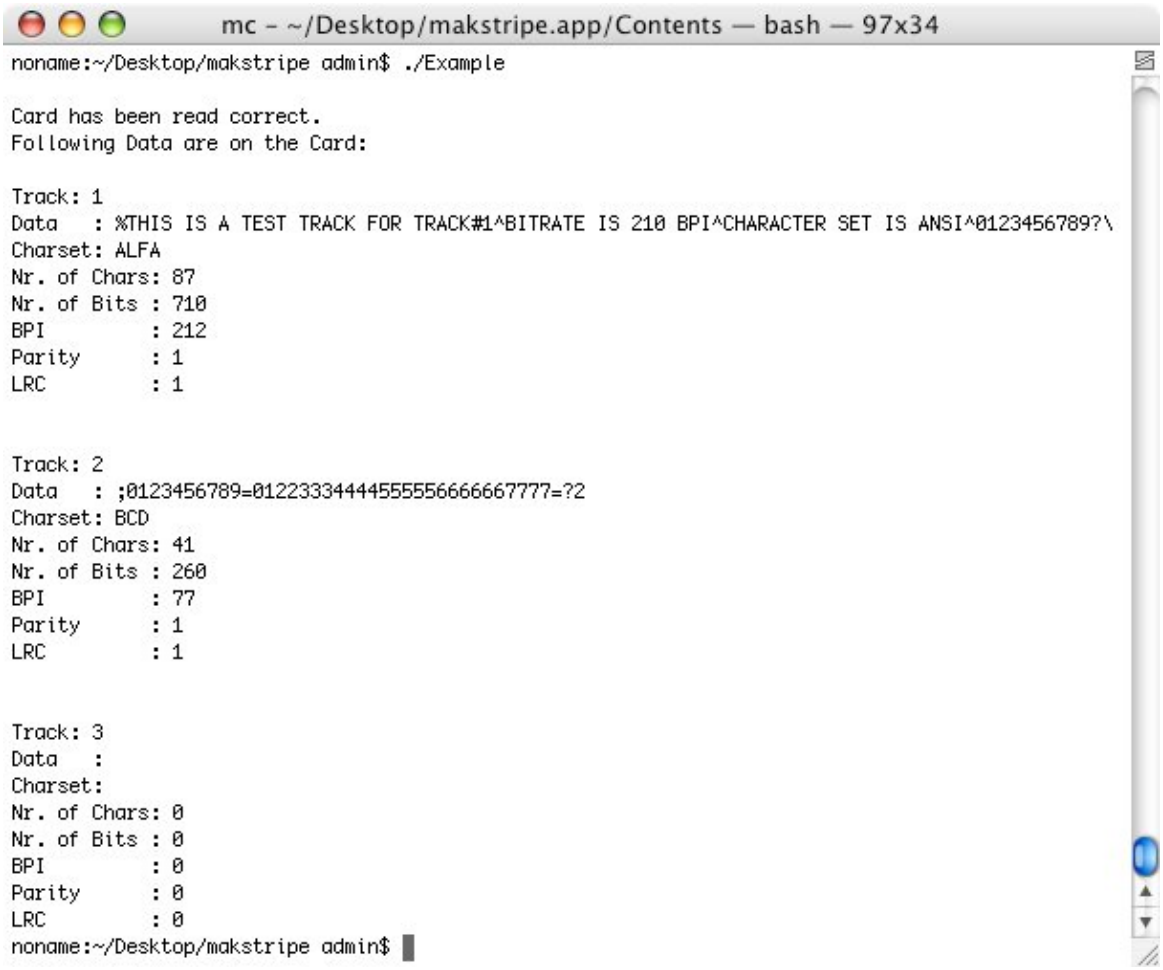
Starting the console application on Windows, and swiping a card which contains data on tracks one and two, would show the following resuts:



Sample console application, running on Windows



Sample console application, running on Linux



Sample console application, running on Mac OS X

The linux - version of the library "libmakstripe.a", the header file "makstripe.h", the code of the above Example "Example.cpp" and the appropriate Makefile.example are included in the file MAKStripe.tgz, which is located in the /MAKStripeUSB/linux on the CD, which is delivered with MAKStripe USB

The Windows - version of the library "libmakstripe.a", the header file "makstripe.h", the code of the above Example "Example.cpp" and the appropriate Makefile.example are included in the folder /MAKStripeUSB/windows/library on the CD, which is delivered with MAKStripe USB

The Mac OS X - version of the library "libmakstripe.a", the header file "makstripe.h", the code of the above Example "Example.cpp" and the appropriate Makefile.example are included in the "Resources" folder of the dmg file on the CD, which is delivered with MAKStripe USB

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