voice INTER connect

Documentation

‘vicCOM complete 2’

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History

Revision	Changes	Date	Author
01	Creation of document	15/11/2013	Kinast
02	Adaptation to software version 2.0.7.0.0	04/02/2014	Kinast
03	Review document	10/02/2014	Kinast
04	more extensive descriptions in B.4, added software features (section 5.3), added vicCOM-Manager (section 7), corrected transport layer of binary protocol	20/03/2014	Kinast
05	Adaptation to new hardware revision	26/11/2015	Kinast
06	Adaptation to software version v2.1.0.0.0	04/05/2016	Kinast
07	Adaptation to software version v2.1.1.0.0	31/05/2016	Kinast
08	Adaptation to software version v2.1.2.0.0	08/11/2016	Kinast
09	Adaptation to software version v2.2.0.0.0	29/06/2021	Kinast
10	Adaptation to software version v2.2.1.0.0	17/12/2021	Kinast
11	Adaptation to software version v2.3.0.0.0	27/10/2022	Kinast
12	Adaptation to software version v2.3.1.0.0	22/04/2025	Kinast

Contents

List Of Abbreviations

Aec	Acoustic Echo Cancellation
Aes	Acoustic Echo Suppression
Attn	Attenuation
Avc	Automatic volume control
Comp	Compressor
Dcf	DC Filter
Eq	Equaliser
Fbc	Feedback Cancellation
Fdb	Feedback
Lc	Loss Control
Lec	Line Echo Cancellation
Lim	Limiter
Mic	Microphone
Notch	Notch Filter
Ng	Noise Gate
Nr	Noise Reduction
Rms	Root Mean Square
Spk	Loudspeaker
Thr	Threshold
Vol	Volume

1 Key Features

- Acoustic echo cancellation up to 40 dB
- Acoustic echo suppression
- Line echo cancellation up to 40 dB
- Noise reduction
- Intelligent loss control
- Feedback cancellation between near end microphone and far end loudspeaker
- Signal conditioning for microphone and loudspeaker (Compressor, Limiter, Noise Gate, Equaliser, Notch filter)
- Automatic volume adjustment of the loudspeaker to ambient noise levels
- Level adjustment to signal sources and sinks
- Management of different parameter sets
- ASCII and binary protocol for setting parameters at runtime
- Multimedia bandwidth with sampling frequency $f_s = 16$ kHz
- Playback and management of audio files (e.g. ring tones) up to a total playing time of approx. 230 s
- Easy integration into existing systems (analogue signal sources and sinks)
- Software can be updated
- Electret microphone can be connected directly
- Loudspeaker can be connected directly to integrated amplifier
- Pluggable connector for easy assembly/disassembly

2 Changelog

[2025-04-22] Software v2.3.1.0.0

- Display of the internally measured audio levels via the control interface using the new commands `LevelRms`, `LevelPeak` and `LevelOutput` (see appendix A.6)

[2022-10-18] Software v2.3.0.0.0

- Automatic Volume Control (AVC) for automatic volume adjustment of the loudspeaker to ambient noise levels with new parameters (see appendix A.2): `SpkAvcOn`, `SpkAvcVolMin`, `SpkAvcVolMax`, `SpkAvcVolCurr`, `SpkAvcThr`, `SpkAvcRatio`, `SpkAvcAttack`, `SpkAvcRel`, `SpkAvcBandpassOn`, `SpkAvcLowFreq`, `SpkAvcHighFreq` and `SpkAvcNoiseLevel`
- Volume fading for smooth transition between volume changes with new parameters (see appendix A.2 and A.3): `SpkVolFade` und `MicVolFade`
- new commands (see appendix A.1): `Reset`, `AecReset` and `LecReset` to reset the entire signal processing, only the AEC or only the LEC
- new revision of parameter file (`ParamRev=8`)

[2021-12-17] Software v2.2.1.0.0

- BUGFIX: Parameters `LcDelayAudio`, `LcDelayLine` and `AesReverbTime` were not responding the full value in binary protocol

[2021-06-29] Software v2.2.0.0.0

- Most recent version of AEC and AES with a lot of improvements
- Feedback-Canceller with new parameters: `FbcOn`, `FbcDelayRatio` und `FbcDelayLength`
- GPIO outputs to signalise the status of the platform
- new command: `Reboot` to restart the platform via ASCII- or binary control command
- new parameter for echo cancellation (see appendix A.1): `AecAdaptOn`, `AecTrackSpeed`, `AecPostGain`, `AecAudioDelay`, `NrInputSnr`, `NrOutputQuality`, `LecAdaptOn`, `LecLineDelay`
- new parameter `LcAbsAttn` to output the internal calculated attenuation of loss control
- new parameter for loudspeaker (see appendix A.2): `SpkDcfOn`, `SpkDcfCutoff`
- two new ASCII control commands to influence the output: `ShowAll` for output all parameters or `ShowLess` to output only the most important parameters for better overview
- values of ASCII-Interface and parameter file are harmonised to each other (no bool or float values anymore)
- new revision of parameter file (`ParamRev=7`) and ini file (`FileRev=3`)

[2016-11-08] Software v2.1.2.0.0

- BUGFIX: Parameter `MicEqOn` was not set properly

[2016-05-31] Software v2.1.1.0.0

- BUGFIX: Boot parameter was not set properly

[2016-05-04] Software v2.1.0.0.0

- Most recent version of AEC and AES with a lot of improvements
- Residual echo (RES) is renamed to acoustic echo suppression (AES)
- `NrAttn` is now a positive value
- `LcLoopGain` is renamed to `LcRelAttn`
- `FdbAudio` is renamed to `LcFdbAudio`
- `FdbLine` is renamed to `LcFdbLine`
- `MinEchoAttn` is renamed to `LcAudioEchoAttn`
- new parameter for echo cancellation (see section A.1): `AecTailLen`, `AesNearEchoSupp`, `AesFarEchoSupp`, `AesNonlinEchoSupp`, `AesReverbTime`, `LecTailLen`, `LcLineEchoAttn`, `LcDelayAudio`, `LcDelayLine`, `LcNoiseFadeOn`, `LcNoiseFadeRate`
- new parameter for loudspeaker (see appendix A.2): `SpkLimRel`, `SpkNgAttn`, `SpkNgFade`, `SpkCompRel`, `SpkEqOn`, `SpkEq[Low|High]Freq`, `SpkEq[Low|High]Gain`, `SpkNotchOn`, `SpkNotch[1|2|3]Freq`, `SpkNotch[1|2|3]Bw`, `SpkNotch[1|2|3]Gain`
- new parameter for microphone (see appendix A.3) `MicLimRel`, `MicNgAttn`, `MicNgFade`, `MicCompRel`, `MicDcfOn`, `MicDcfCutoff`, `MicEqOn`, `MicEq[Low|High]Freq`, `MicEq[Low|High]Gain`, `MicNotchOn`, `MicNotchFreq`, `MicNotchBw`, `MicNotchGain`
- new revision of parameter file (`FileRev=6`) and ini file (`FileRev=2`)
- Changed end of line for ASCII outputs from `<\n>` to `<\r\n>`
- Changed end of line for ASCII inputs from `<\n>` to `<\r>`
- Changed value of parameter `PlayOut` (0 and 1 swapped)

[2015-11-26] Hardware v2.3

- Correction for ribbon connector: swapped RX/TX for UART connection

[2014-09-02] Software v2.0.9.0.0

- first official release of *vicCOM complete 2*

3 System Integration

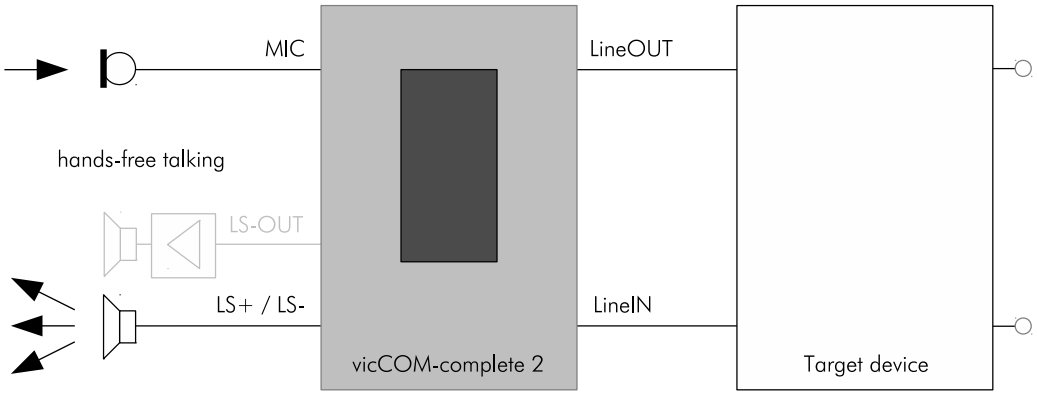

Figure 1: System integration for direct connection of an electret microphone and a loudspeaker or a loudspeaker with external audio amplifier (marked in lightgray)

Connector	Description
MIC	Direct connection of an electret microphone. The bias voltage is provided at the same time. The *vicCOM complete 2* can be adjusted to the sensitivity of the electret microphone (see section 6.1). It is also possible to set the volume of the microphone.
LS+ und LS−	Direct connection of a loudspeaker. The volume is adjustable (see section 6.2) **Caution:** Both Connectors have floating ground!
LS-OUT	Alternative connector for a loudspeaker. The connector provides line level for using an external audio amplifier.
LineIN	Loudspeaker signal with line level of target device to *vicCOM complete 2*. The *vicCOM complete 2* can be adjusted to the output level of the target device (see section 6.1).
LineOUT	Microphone signal of target device to *vicCOM complete 2*. The *vicCOM complete 2* can be adjusted to the input level of the target device (see section 6.1).

4 Hardware

4.1 Version

Description	Board version	Placement variant
vicCORE-3	2.3	3
vicBASE-3	1.3	1

4.2 Connection and Environmental Conditions

4.2.1 Absolute Maximum Ratings

Symbol	Name	Value	Unit
T_{STORE}	Storage temperature range	-65 to 120	°C
T_{OP}	Operating temperature Range	-40 to 85	°C
FC	UL94 Flammability class	V-0	
V_{DD}	Operating voltage	-24 bis 24	V
P_{MAX}	Maximum output power loudspeaker output	1.5	W
$U_{LS,max}$	Maximum output voltage loudspeaker output	4.6	V(RMS)

4.2.2 Operating Conditions

Symbol	Name	Min	Norm	Max	Unit
V_{DD}	Operating voltage		12	24	V
I_{DD}	Current consumption		60		mA
I_{MAX}	Maximum current consumption with 1.5 W power consumption of audio amplifier (Audio signal: 1 kHz Sine wave, $V_{DD} = 12$ V)			310	mA
U_{MIC}	Voltage at microphone input (with `GainMic` $= +20$ dB)		30	100	mV(RMS)
U_{IN}	Voltage at LineIN	0	1	1	V(RMS)
U_{OUT}	Voltage at LineOUT	0	1	1	V(RMS)
R_L	Impedance of loudspeaker	8	8		Ω

4.2.3 Audio Inputs

The impedance of the audio inputs is produced by the input circuitry of the *vicCOM complete 2* (see figure 2). As can be seen the input resistance of the audio codec have an importance influence (gain adjustable with `GainMic` and

GainLineIn). The relationship between the gain and the input resistance is given in the following table. The maximum DC offset is limited to 16 V.

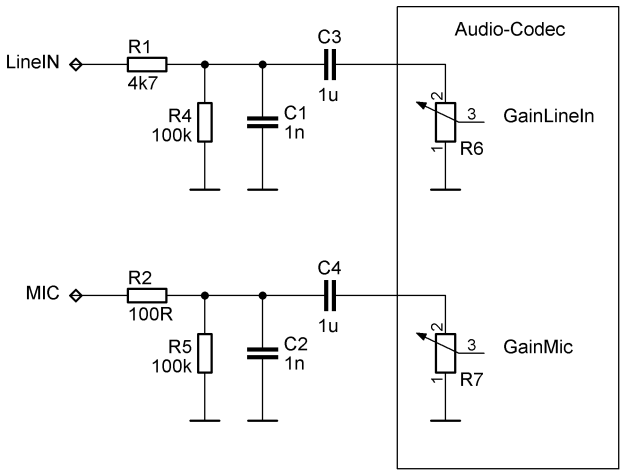

Figure 2: Audio inputs of *vicCOM complete 2*

Input resistors R6 / R7	
G in dB	R_{in} in kΩ
−12	85
0	53
25	5.6
35	2.0

4.2.4 Audio Outputs

The impedance of audio output is determined by the low impedance of the audio codec output which is not specified by the data sheet. The maximum DC offset is limited to 16 V.

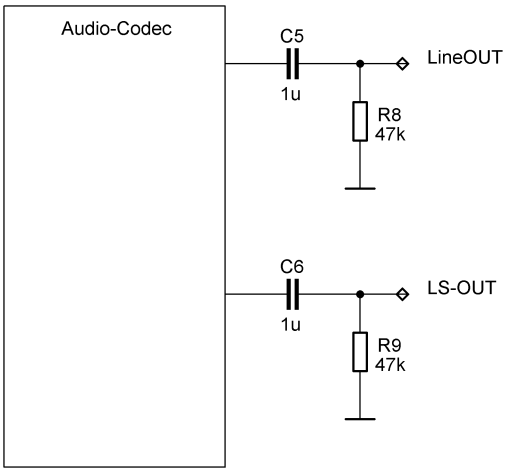

Figure 3: Audio outputs of *vicCOM complete 2*

4.2.5 Audio Amplifier Outputs

The outputs of the integrated audio amplifier have floating ground! If you connect each of them to GND the audio amplifier can be destroyed thermally.

The maximum output power of the audio amplifier is 1.5 W. If you connect a loudspeaker with less than 8 Ω the output power can exceed the maximum power and can destroy the audio amplifier thermally (depending on settings of `SpkVol` und `GainSpk`).

4.3 Connections

The *vicCOM complete 2* has a pluggable screw terminal to connect the audio signals and the supply voltage (see `X1` in figure 4).

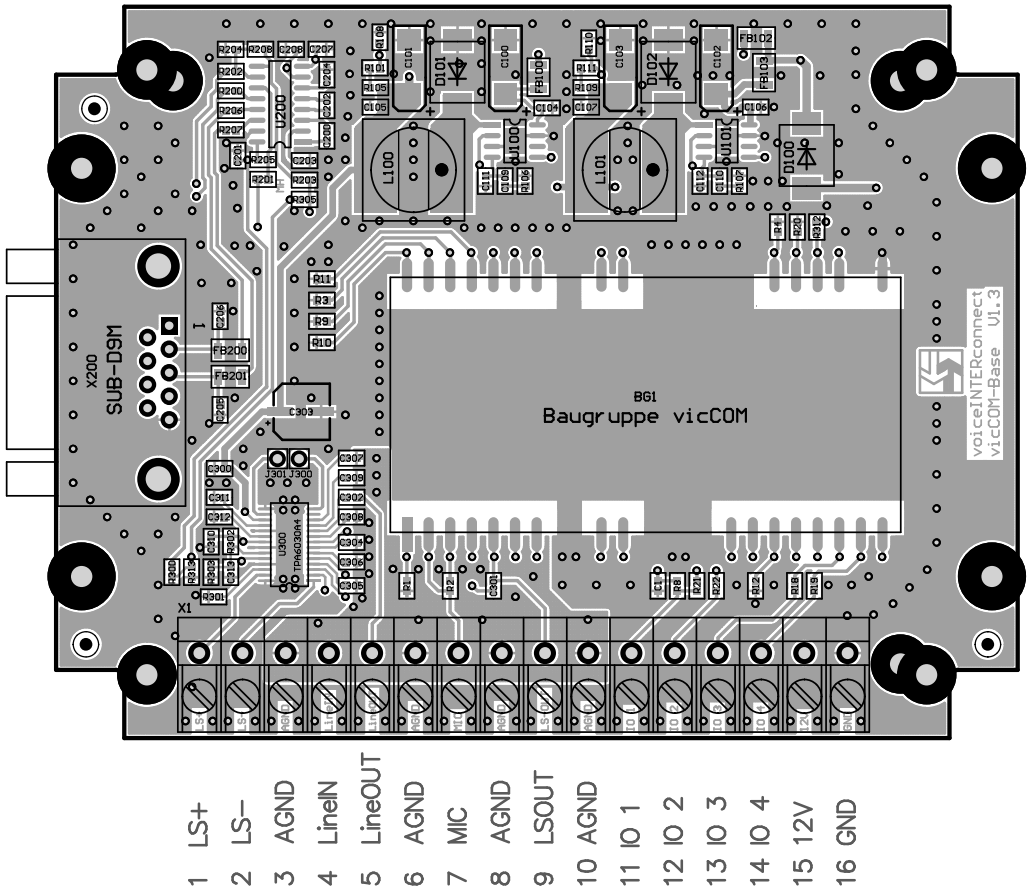

Figure 4: Connections of screw terminal of *vicCOM complete 2*

Pin	Type	Name	Description
1	Output	LS+	Loudspeaker (+) of integrated audio amplifier **Caution:** Floating ground!
2	Output	LS–	Loudspeaker (–) of integrated audio amplifier **Caution:** Floating ground!
3	Input	AGND	Ground for LineIN (connected with 6, 8 und 10)
4	Input	LineIN	Audio signal from target device
5	Output	LineOUT	Audio signal to target device
6	Output	AGND	Ground for LineOUT (connected with 3, 8 und 10)
7	Input	MIC	Microphone (+) for electret microphone (incl. bias voltage of 3.3 V)
8	Input	AGND	Ground for MIC (connected with 3, 6 und 10)
9	Output	LS-OUT	Audio signal for loudspeaker with external audio amplifier
10	Output	AGND	Ground for LS-OUT (connected with 3, 6 und 8)
11	Output	IO 1	not used
13	Output	IO 2	not used
13	Output	IO 3	not used
14	Output	IO 4	not used
15	Input	12V	Supply voltage (+)
16	Input	GND	Supply voltage (GND)

4.4 Dimensions

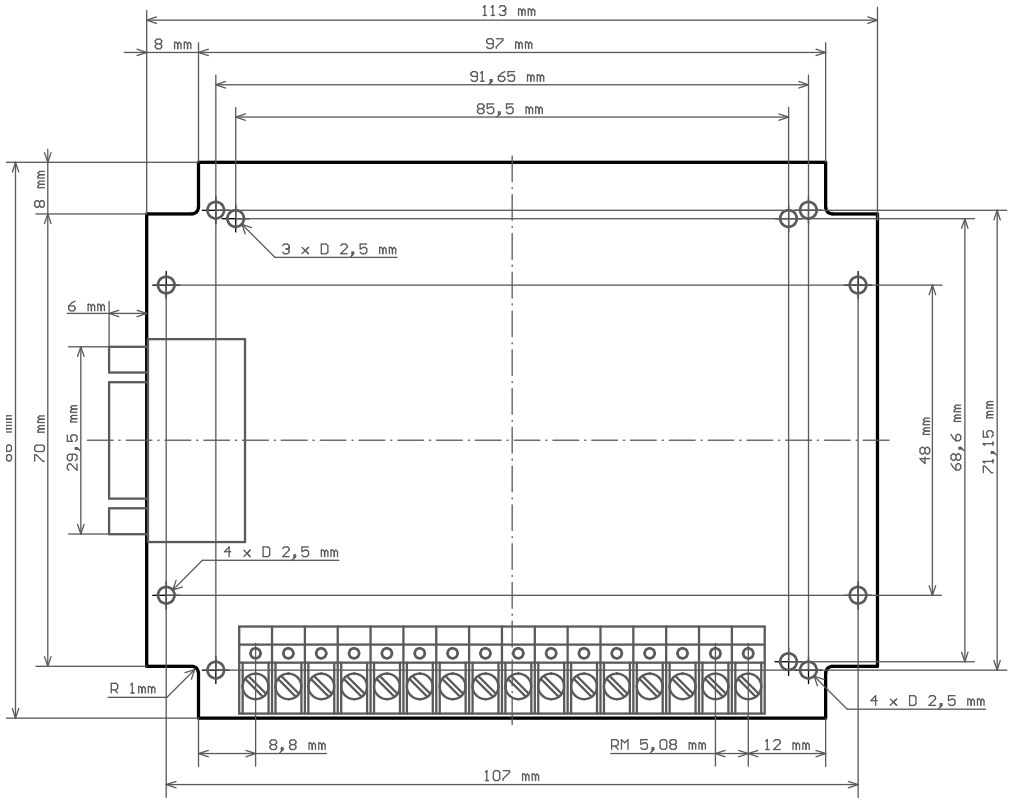

Figure 5: Dimensions of *vicCOM complete 2* in mm

5 Software

5.1 Version

Description
vicCOM2 v2.3.1.0.0

The software can be updated (see Section 5.6). The version of the software could be readout via the control interface (see Section 5.4).

5.2 Function

5.2.1 Signal Processing

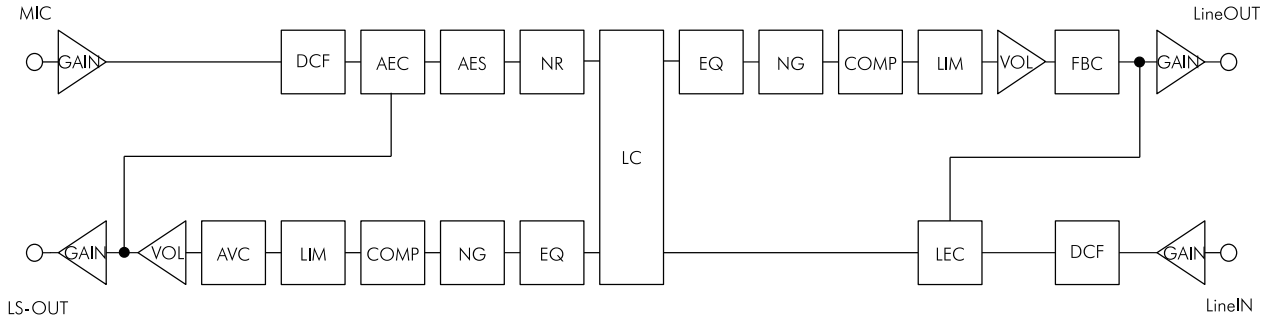

Figure 6: Block diagram of signal processing

The Figure 6 shows all signal processing blocks that can be used and adjusted with the *vicCOM complete 2*. The abbreviations inside the blocks are explained in the list of the abbreviations at the beginning of the document.

The signal processing is designed to provide a full duplex hands-free speech operation. For that the microphone signal is equipped with the acoustic echo cancellation (AEC) and acoustic echo suppression (AES) and the line-in is equipped with the line echo cancellation (LEC). Furthermore the microphone signal and the loudspeaker signal can be influenced by noise suppression (NR, NG), sound equalising and filtering (EQ, DCF) and volume adjustments (COMP, LIM, VOL, GAIN) to fit the own needs.

For challenging acoustical environments the *vicCOM complete 2* is able to switch to half duplex operation (LC) or to use full and half duplex operation side by side respectively.

If the dialogue partners are acoustically separated from each other not optimally a feedback can occur between near end microphone and far end loudspeaker. This should be prevented by using the feedback canceller (FBC).

For better intelligibility in noisy or changing environments, the loudspeaker volume can be automatically adjusted within parameterisable limits with the automatic volume control (AVC).

5.2.2 Setting and Management of Parameter

The *vicCOM complete 2* can be parametrised at runtime via the ASCII- or the binary interface respectively (see Section 5.4). The values will be set immediately but will be not saved permanently. That means these settings will be lost during switch off or reboot. To keep them permanently the parameter file has to be saved on *vicCOM complete 2*.

The *vicCOM complete 2* comes with two parameter files `default.param` and `user_1.param`. The parameter file `default.param` cannot be overwritten via ASCII-interface to protect it against accidentally saving of wrong settings. To save own settings use the parameter file `user_1.param`. To do so switch to this file **before** you start changing parameters with command `ParamRead`. After setting the parameters successfully the command `ParamSave` saves the current settings in the current active parameter file. To use multiple different parameter settings download the parameter file `user_1.param` with the vicCOM-Manager (see Section 7) to the PC, edit it and save it under a different name. The amount of parameter files depends only on the free space at the *vicCOM complete 2*.

The *vicCOM complete 2* boots by default with the parameters of the file `default.param`. The command `ParamBoot` changes the parameter file to boot from with the next boot cycle.

5.2.3 Playing Audio Files

During the normal hands-free operation at any time it is possible to play an audio file from the *vicCOM complete 2* with the command `Play`. At the end of playing the *vicCOM complete 2* switches back to hands-free operation automatically. By default the *vicCOM complete 2* provides two audio files: `ringtone.wav` and `gong.wav`. Furthermore it is possible to store your own audio files on the *vicCOM complete 2* using the vicCOM-Manager (see Section 7). The amount or the length of the audio files depends only on the free space at the *vicCOM complete 2*.

Caution: At the moment only the following audio format is supported:

- 'wav' with 16 Bit/16 kHz

5.3 Features

Besides the parameters that can be changed on runtime the software and the signal processing have some fixed characteristics listed in the following table:

Symbol	Name	Value	Unit
t_{ResetIC}	Turn-on delay by reset-chip	approx. 200	ms
t_{Boot}	Boot time of software	approx. 250	ms
t_{Total}	Time from turn-on to hands-free operation ($= t_{\text{ResetIC}} + t_{\text{Boot}}$)	approx. 450	ms
f_s	Sampling frequency of signal processing	16	kHz
$t_{\text{Mic}-\text{Line}}$	Time delay of microphone signal at line out	max. 78	ms
$t_{\text{Line}-\text{Spk}}$	Time delay of line in signal at loudspeaker output	47	ms
Lim_{Clip}	Clip mode of limiter (soft = soft-knee, hard = hard-knee)	soft	–

5.4 Control Interface

The *vicCOM complete 2* is equipped with a control interface supporting following actions:

- Readout, adjust and save parameters
- Management of parameter files
- Play and management of audio files
- Output of status messages
- Update of software

The control interface is accessible via the RS232-connector of the *vicCOM complete 2*. For the connection to the PC a cross-over cable must be used. The program 'Terminal' is recommended to use on a PC and can be downloaded for free: `https://sites.google.com/site/terminalbpp/` (Windows only).

The RS232-connector is configured as:

Data rate:	115200 Baud
Data bits:	8 Bit
Parity:	none
Stop bit:	1 Bit
Handshaking:	none

5.5 Control Protocol

The control protocol of the control interface provides two different formats:

1. *ASCII* – for human-readable protocol to use with a terminal program
2. *Binary* – for machine-based control, e.g. by a host controller

Both formats can be used at the same time, it is not necessary to switch between them.

5.5.1 ASCII

The ASCII-protocol is characterised by its easy and intuitive syntax. It is especially designed to set-up or evaluating the *vicCOM complete 2*. The control commands are divided in parameter (control commands with values) and function calls (control commands without values). All ASCII-control commands are listed in Appendix A.

The ASCII-in- and outputs are configured as:

Direction	Name	ASCII-symbols	Hexadecimal
Output	End of line	`CR+LF`	`0x0D 0x0A`
Output	Prompt	`>`	`0x3E`
Input	End of line	`CR`	`0x0D`

Inputs and Outputs

On start-up the first strings displayed by the *vicCOM complete 2* are the start-up message:

```
INF: ------------------------------
INF: hands-free  speech  application
INF: by   voice INTER connect   GmbH
INF: vicCOM2 2.3.1.0.0 (Apr 22 2025)
INF: ------------------------------

INF: starting ...
INF: Boot parameter file: default.param
INF: done.
INF: >
```

The angle bracket at the end is the prompt and signals that the *vicCOM complete 2* is ready for input:

```
<CR> <CR>
```

… outputs all control commands and parameters including their current values

```
Parameter<CR>
```

… outputs the current value of the given *Parameter*

```
Parameter=Value<CR>
```

… assigns the given *Parameter* a new *Value* (without white-spaces!)

```
Function call<CR>
```

… carries out the given *Function call* and returns the following output:

```
[<optional, function-specific output>]
Ok.
>
```

… i.e. function calls will be always acknowledged at the end by `Ok.` and a `>`

Error messages

```
Variable or command not found.
>
```

… the given control command was not found (e.g. misspelled)

```
Value out of range.
>
```

… the given value of parameter is out of range

```
Input too long.
>
```

… the input string is too long (e.g. multiple parameters on one line)

5.5.2 Binary

The binary format of the control protocol was developed mainly for machine based interaction between the *vicCOM complete 2* and a host controller. The *vicCOM complete 2* reacts to incoming messages (Request) with outgoing messages (Respond) and send its own messages (Status) without any request. The binary commands are specified in Appendix B.

The binary format of the control protocol is subdivided into a transport layer and a command layer.

Transport Layer

`<Start><Type><Length1>[<CS>][<S-Port>][<T-Port>][ACK][<Data>]`

Name	Length in Byte	Description
`<Start>`	1	Start byte `0x8F`
`<Type>`	1	specifies the following parameters: Bit [7]: 0 (reserved) Bit [6]: `<S-Port>` available (1), not available (0) Bit [5]: `<T-Port>` available (1), not available (0) Bit [4]: Request for acknowledge (1), no request (0) Bit [3]: flag for acknowledge (1), no acknowledge (0) Bit [2:0]: `<CS>` specification (see next section)
`<Length1>`	1	Length of `<Data>`
`<CS>`	1–4	Checksum **Caution:** Signature for `<Type>` byte and all following bytes! **Hint:** Length and algorithm will be determinated by the `<Type>` byte!
`<S-Port>`	1	(optional) Source port (is used as target port in the opposite direction)
`<T-Port>`	1	Target port `0x0F`: Application
`<ACK>`	1	Acknowledge of transport layer with ok (0), otherwise not ok
`<Data>`	*Length1*	Data for command layer

Checksum specification

The `<Type>` byte specifies the algorithm of the checksum. The following algorithms are implemented:

Bit [2:0]	Name	Specification
`000`	no CS	–
`001`	BYTESUM8	Length: 1 Byte BYTESUM8_INITIAL: `0x00`

010	XOR8	Length: 1 Byte XOR8_INITIAL: 0x00
011	CRC8	Length: 1 Byte CRC8_POLYNOMIAL: 0x07 CRC8_MODE: *crc_eModeForward* CRC8_INITIAL: 0xFF
100	BYTESUM16	Length: 2 Byte BYTESUM16_INITIAL: 0x0000
101	CRC16	Length: 2 Byte CRC16_POLYNOMIAL: 0x1021 CRC16_MODE: *crc_eModeForward* CRC16_INITIAL: 0xFFFF
110	CRC32	Length: 4 Byte CRC32_POLYNOMIAL: 0x04C11DB7 CRC32_MODE: *crc_eModeForward* CRC32_INITIAL: 0xFFFFFFFF
111	reserved	Length: 4 Byte for integration of particular CS

Command Layer

<Command1><Command2>[<Payload>]

Name	Length in Byte	Description
<Command1>	1	Bit [7]: ACK of command layer (1), no ACK (0) Bit [6]: Request for ACK (1), no request (0) Bit [5]: 0x00 Bit [4]: 0x00 Bit [3:0]: Command group
<Command2>	1	Bit [7:0]: Command **Caution:** Bit [0]: REQ (0), RES (1)
<Payload>	*flexible*	Payload of command

Status codes

The majority of the responses send within the payload a status byte located directly behind <Command2>. It can be used to control if the request was processed successfully. The following errors will be reported:

Status code	Description

0x00	Ok, no error
0x01	General error
0x02	Object not available
0x03	Object in use
0x04	Feature not available
0x05	Parameter out of range
0x06	Timeout
0x07	No free memory

5.6 Update

The software update of the application is provided as the file `application_release.ldr`. This file should be uploaded to the *vicCOM complete 2* by using the vicCOM-Manager (see Section 7).

Should the update affecting more files these files will be provided additionally and should also be uploaded to the platform.

Caution: Before you update parameter or ini-files please transfer your personal settings of these files. They will be overwritten by uploading them!

The new software will be used after resetting the *vicCOM complete 2*. The restart can be carried out either with a power cycle or the reboot command.

6 Parametrisation

6.1 Adjusting Audio Levels

For an optimal performance of the signal processing it is essential to adjust the audio levels properly to the connected devices. For this purpose the commands `GainSpk`, `GainMic`, `GainLineIn` and `GainLineOut` (see section A.6 or B.5) should be used. All values are in dB. The reference value is calculated with the maximum voltage level of in- and output that is given in the table in section 4.2:

$$0\,\text{dB} = 1\,\text{V(RMS)} \quad . \tag{1}$$

Example:

Electret microphone according to data sheet:

$$\text{Sensitivity} = -40\,\text{dB} \quad (0\,\text{dB} = 1\,\text{V/Pa}) \tag{2}$$

Maximum output voltage of microphone at an assumed sound pressure level of $114\,\text{dB(SPL)}$ und $1\,\text{Pa} = 94\,\text{dB(SPL)}$:

$$\text{U}_{\text{Mic,max}} = 10^{\frac{(-40+(114-94))\text{dB}}{20\text{dB}}} = 100\,\text{mV(RMS)} \tag{3}$$

`GainMic` has to be adjusted to:

$$\text{GainMic} = 20log\frac{1\,\text{V(RMS)}}{100\,\text{mV(RMS)}} = 20\,\text{dB} \tag{4}$$

That means that the input gain has to be increased by $20\,\text{dB}$ in order to use the full voltage range of the *vicCOM complete 2*. Before setting up the values ultimately consider the following hint:

> **Caution:**
> In any circumstances avoid clipping of the audio signal by a gain that is too high! Otherwise the function of the signal processing could be impaired!
> It is recommended to use an audio signal headroom of at least $6\,\text{dB}$ and to use always the commands `SpkVol` and/or `MicVol` to adjust the volume.

6.2 Adjusting Volume

The volume of microphone and loudspeaker should be always adjusted by the commands `SpkVol` and `MicVol` since the signal processing needs the current values for working optimal. External volume changes could lead to malfunctions in signal processing!

Once again, if the volume setting is to high and the audio signal is clipped the signal processing is not working properly any more.

7 vicCOM-Manager

7.1 Version

- Version: 1.6.0 (Windows)

7.2 Function

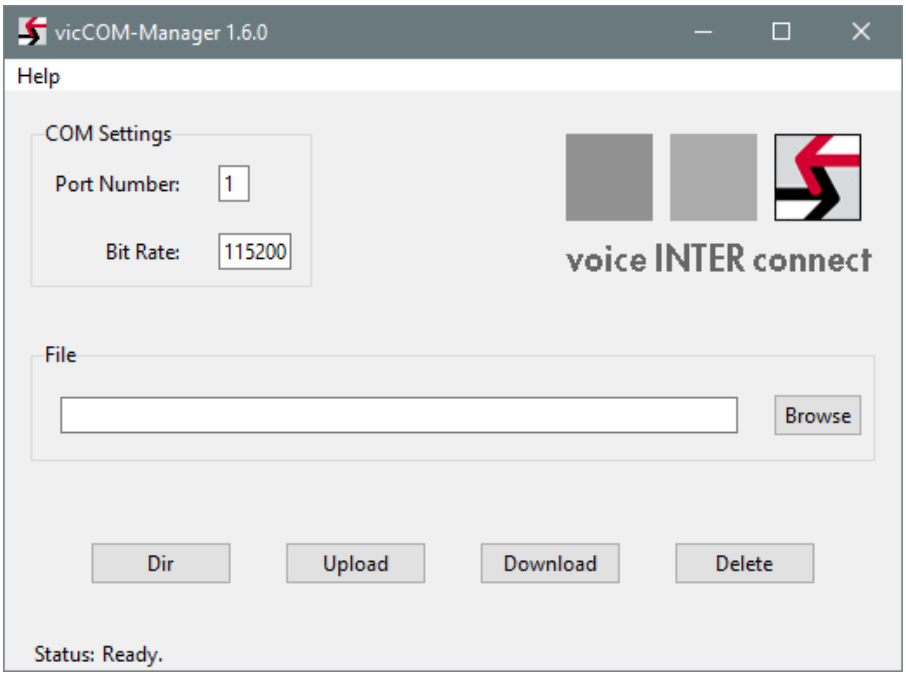

Figure 7: Screenshot vicCOM-Manager

The vicCOM-Manager is a PC-based tool to manage the *vicCOM complete 2*. It is used mainly for software updates, uploading audio files and exchanging parameter files between the PC and the *vicCOM complete 2*.

> **Caution:**
> There is no notification before existing files will be overwritten on PC or on the *vicCOM complete 2*!

Upload: (PC → *vicCOM complete 2*)

- enter number of COM-port where the *vicCOM complete 2* is connected
- choose the right file on PC with 'Browse'
- **alternatively:** enter file name including relative path directly
- click 'Upload' and wait until the status display shows 'Ok.'

Download: (*vicCOM complete 2* → PC)

- enter number of COM-port where the *vicCOM complete 2* is connected
- navigate to a folder with 'Browse' and enter the file name that should be downloaded

- **alternatively:** enter file name including relative path directly
- click ‘Download’ and wait until the status display shows ‘Ok.’

7.3 Remarks

1. The COM port should not be occupied by any other application.
2. The data exchange during up- and downloading is secured by checksum algorithm `CRC32`.
3. The data exchange is carried out using data rate of about $5.6\,\mathrm{kB/s}$.

APPENDIX

A ASCII Control Commands

A.1 Echo Suppression

Parameter/ Function	Value Default	Value Range	Description
Reset	–	–	Reset of the internal states of all signal processing blocks
AecOn	1	0/1	Switch off (=0) and switch on (=1) of acoustic echo cancellation (AEC)
AecAdaptOn	1	0/1	Switch off (=0) and switch on (=1) of adaption of AEC
AecReset	–	–	Reset of the internal states of AEC, e.g. to restart the adaptation
AecTrackSpeed	40	0 ...100	Speed of adaptation of AEC
AecPostGain	0	0 ...96	Software gain of audio signal after AEC
AecTailLen	60	20 ...100	Filter length of AEC in ms Attention: Only multiplier of 10 possible!
AecAudioDelay	10	0 ...1000	System delay in audio path in ms ATTENTION: reboot needed!
AesOn	1	0/1	Switch off (=0) and switch on (=1) of acoustic echo suppression (AES) of AEC
AesNearEchoSupp	72	0 ...100	Suppression of near, direct residual echos
AesFarEchoSupp	65	0 ...100	Suppression of far, spatial residual echos
AesNonlinEchoSupp	10	0 ...100	Suppression of nonlinear residual echos
AesReverbTime	400	0 ...1000	Reverberation time of far, spatial echos in ms
NrOn	1	0/1	Switch off (=0) and switch on (=1) of noise reduction (NR) in microphone signal
NrAttn	6	0 ...20	Strength of noise reduction in microphone signal in dB
NrInputSnr	30	0...100	Signal to noise ration of input signal (0 = low, 100 = high)
NrOutputQuality	68	0...100	Speech quality of output signal (0 = low, good NR performance, 100 = high, bad NR performance)
LecOn	0	0/1	Switch off (=0) and switch on (=1) of line echo cancellation (LEC)
LecAdaptOn	0	0/1	Switch off (=0) and switch on (=1) of adaption of LEC
ResetLec	–	–	Reset of the internal states of LEC, e.g. to restart the adaptation
LecTailLen	10	10	Filter length of LEC in ms ATTENTION: only fixed time possible at the moment!

LecLineDelay	0	0…1000	System delay in line path in ms ATTENTION: reboot needed!
LcOn	0	0/1	Switch off (=0) and switch on (=1) of loss control (LC)
LcRelAttn	0	-96 …0	relative attenuation of loss control in dB
LcAbsAttn	-20	-96 …96	internal calculated absolute (= real) attentuation of loss control in dB – *Read only parameter!*
LcFdbAudio	0	-96 …96	measured feedback between loudspeaker and microphone in dB
LcFdbLine	0	-96 …96	measured feedback between Line-Out and Line-In in dB
LcAudioEchoAttn	0	-96 …0	estimated minimum echo attenuation of AEC in dB
LcLineEchoAttn	0	-96 …0	estimated minimum echo attenuation of LEC in dB
LcDelayAudio	0	0 …1000	maximum delay between loudspeaker and microphone signal in ms
LcDelayLine	0	0 …1000	maximum delay between Line-Out and Line-In signal in ms
LcNoiseFadeOn	1	0/1	Switch off (=0) and switch on (=1) of fade out in voice inactivities
LcNoiseFadeRate	60	1 …96	Velocity of fade out in voice inactivities in dB/s
FbcOn	0	0/1	Switch off (=0) and switch on (=1) of feedback cancellation (FBC)
FbcDelayRatio	103	100 …110	Slope of feedback delay related to sampling frequency (100 = no delay)
FbcDelayLength	320	10 …1000	maximum delay length of feedback in ms

A.2 Loudspeaker

Parameter/ Function	Value Default	Value Range	Description
SpkVol	0	-96 ...96	Loudspeaker volume in dB
SpkVolFade	1000	10 ...3000	Speed at which volume changes are carried out in dB/s
SpkLimOn	0	0/1	Switch off (=0) and switch on (=1) of limiter (LIM)
SpkLimThr	0	-96 ...0	Voltage threshold for limiter in dB (0 dB = 1 V(RMS))
SpkLimRel	60	1 ...96	Release rate of limiter in dB/s
SpkNgOn	0	0/1	Switch off (= 0) and switch on (= 1) of noise gate (NG)
SpkNgThr	-96	-96 ...0	Voltage threshold of noise gate in dB (0 dB = 1 V(RMS))
SpkNgAttn	20	0 ...96	Attenuation of noise gate in dB
SpkNgFade	60	0 ...96	Velocity of fade of noise gate in dB/s
SpkCompOn	0	0/1	Switch off (=0) and switch on (=1) of compressor (COMP)
SpkCompThr	-96	-96 ...0	Voltage threshold of compressor in dB (0 dB = 1 V(RMS))
SpkCompRatio	1	1 ...10	Ratio of compressor
SpkCompRel	60	1 ...96	Release rate of compressor in dB/s
SpkDcfOn	0	0/1	Switch off (=0) and switch on (=1) of DC filter (DCF)
SpkDcfCutoff	100	0...1000	Cut off frequency of DC filter in Hz
SpkEqOn	0	0/1	Switch off (=0) and switch on (=1) of equaliser (EQ)
SpkEqLowFreq	300	1 ...4000	Cut off frequency of lower frequency band of EQ in Hz
SpkEqLowGain	0	-96 ...96	Gain of lower frequency band of EQ in dB
SpkEqHighFreq	4000	1k ...8k	Cut off frequency of upper frequency band of EQ in Hz
SpkEqHighGain	0	-96 ...96	Gain of upper frequency band of EQ in dB
SpkNotchOn	0	0/1	Switch off (=0) and switch on (=1) of notch filter (NOTCH)
SpkNotch1Freq	300	1 ...8000	Centre frequency of notch filter 1 in Hz
SpkNotch1Bw	100	1 ...2000	Band width of notch filter 1 in Hz
SpkNotch1Gain	0	-96 ...96	Gain of notch filter 1 in dB
SpkNotch2Freq	1000	1 ...8000	Centre frequency of notch filter 2 in Hz
SpkNotch2Bw	200	1 ...2000	Band width of notch filter 2 in Hz
SpkNotch2Gain	0	-96 ...96	Gain of notch filter 2 in dB
SpkNotch3Freq	4000	1 ...8000	Centre frequency of notch filter 3 in Hz
SpkNotch3Bw	300	1 ...2000	Band width of notch filter 3 in Hz
SpkNotch3Gain	0	-96 ...96	Gain of notch filter 3 in dB
SpkAvcOn	0	0/1	Switch off (=0) and switch on (=1) of automatic volume control (AVC)

SpkAvcVolMin	0	-96 …96	Minimum volume that can be set automatically in dB (relative to SpkVol)
SpkAvcVolMax	6	-96 …96	Maximum volume that can be set automatically in dB (relative to SpkVol)
SpkAvcVolCurr	0	-96 …96	Current volume, which is automatically set in dB – *Read only parameter!*
SpkAvcThr	-30	-96 …0	Threshold of ambient noise at which automatic volume control begins in dB ($0\,\mathrm{dB} = 1\,\mathrm{V(RMS)}$)
SpkAvcRatio	1	1 …5	Ratio to input signal or ambient noise
SpkAvcAttack	10	10 …96	Attack rate of volume control in dB/s
SpkAvcRel	10	10 …96	Release rate of volume control in dB/s
SpkAvcBandpassOn	0	0/1	Bandpass to limit the evaluation of the ambient noise
SpkAvcLowFreq	300	1 …8000	Lower bandpass frequency in Hz
SpkAvcHighFreq	2000	1 …8000	Upper bandpass frequency in Hz
SpkAvcNoiseLevel	-96	-96 …0	Current ambient noise level in dB – *Read only parameter!*

A.3 Microphone

Parameter/ Function	Value Default	Value Range	Description
MicVol	0	-96 ...96	Microphone volume in dB
MicVolFade	1000	10 ...3000	Speed at which volume changes are carried out in dB/s
MicLimOn	0	0/1	Switch off (=0) and switch on (=1) of limiter (LIM)
MicLimThr	0	-96 ...0	Voltage threshold of limiter in dB (0 dB = 1 V(RMS))
MicLimRel	60	1 ...96	Release rate of limiter in dB/s
MicNgOn	0	0/1	Switch off (=0) and switch on (=1) of noise gate (NG)
MicNgThr	-96	-96 ...0	Voltage threshold of noise gate in dB (0 dB = 1 V(RMS))
MicNgAttn	20	0 ...96	Attenuation of noise gate in dB
MicNgFade	60	0 ...96	Velocity of fade of noise gate in dB/s
MicCompOn	0	0/1	Switch off (=0) and switch on (=1) of compressor (COMP)
MicCompThr	-96	-96 ...0	Voltage threshold of compressor in dB (0 dB = 1 V(RMS))
MicCompRatio	1	1 ...10	Ratio of compressor
MicCompRel	60	1 ...96	Release rate of compressor in dB/s
MicDcfOn	1	0/1	Switch off (=0) and switch on (=1) of DC filter (DCF)
MicDcfCutoff	100	1 ...1000	Cut off frequency of DC filter in Hz
MicEqOn	0	0/1	Switch off (=0) and switch on (=1) of equaliser (EQ)
MicEqLowFreq	300	1 ...4000	Cut off frequency of lower frequency band of EQ in Hz
MicEqLowGain	0	-96 ...96	Gain of lower frequency band of EQ in dB
MicEqHighFreq	4000	1k ...8k	Cut off frequency of upper frequency band of EQ in Hz
MicEqHighGain	0	-96 ...96	Gain of upper frequency band of EQ in dB
MicNotchOn	0	0/1	Switch off (=0) and switch on (=1) of notch filter (NOTCH)
MicNotchFreq	1000	1 ...8000	Centre frequency of notch filter in Hz
MicNotchBw	100	1 ...2000	Band width of notch filter in Hz
MicNotchGain	0	-96 ...96	Gain of notch filter in dB

A.4 Playing Audio Files

Parameter/ Function	Value Default	Value Range	Description
`PlayerVol`	-6	-96 …96	Volume of audio file
`PlayerOutput`	1	0 …1	Output channel of audio file (0 = Line-Out output; 1 = Loudspeaker output)
`Play`	*File name*	–	Playing of given audio file

A.5 Management of Parameter

Parameter/ Function	Value Default	Range	Description
`ParamName`	–	–	Display name of active parameter file
`ParamRev`	–	–	Display revision of active parameter file
`ParamSave`	–	–	Store of current parameters in active parameter file **Hint:** The default parameter file cannot be overwritten.
`ParamRead`	*File name*	–	Load and apply settings of given parameter file
`ParamDefault`	–	–	Load and apply settings of default parameter file
`ParamBoot`	*File name*	–	Set parameter file which will be loaded after next boot sequence

A.6 Common

Parameter/ Function	Value Default	Value Range	Description
`Ping`	–	–	Check accessibility of platform
`Version`	–	–	Display of software version
`Reboot`	–	–	Reboot of software (e.g. after update)
`GainSpk`	0	-57 …6	Gain of loudspeaker output at audio codec in dB
`GainMic`	20	-12 …35	Gain of microphone input at audio codec in dB
`GainLineIn`	0	-12 …35	Gain of Line-In at audio codec in dB
`GainLineOut`	0	-57 …6	Gain of Line-Out at audio codec in dB
`LevelPeak`	0	0/1	Switch off (=0) and switch on (=1) of digital audio level meter (peak level) for all 4 audio connections in dBV
`LevelRms`	0	0/1	Switch off (=0) and switch on (=1) of digital audio level meter (RMS level) for all 4 audio connections in dBV
`LevelOutput`	1	0 …1	Display of digital audio level via UART connector 0 or 1
`ShowAll`	–	–	Shows next time the complete list of all parameter if parameter output is demanded by `<CR> <CR>`
`ShowLess`	–	–	Shows next time an overview of amplifier values and signal module switches if parameter output is demanded by `<CR> <CR>`

B Binary Control Commands

All the commands below are using the simplest way of the binary protocol without source port, checksum and acknowledgement.

B.1 Echo Suppression

Name	Command-ID
AecOn	0x02
AecTailLen	0x20
AecAudioDelay	0x22
AecAdaptOn	0x24
AecTrackSpeed	0x26
AecPostGain	0x28
AesOn	0x04
AesNearEchoSupp	0x2A
AesFarEchoSupp	0x2C
AesNonlinEchoSupp	0x2E
AesReverbTime	0xB0
NrOn	0x06
NrAttn	0x08
NrInputSnr	0xB8
NrOutputQuality	0xBA

Name	Command-ID
LecOn	0x0A
LecTailLen	0xB2
LecLineDelay	0xB4
LecAdaptOn	0xB6
LcOn	0x0C
LcRelAttn	0x0E
LcAbsAttn	0xC6
LcFdbAudio	0x10
LcFdbLine	0x12
LcAudioEchoAttn	0x14
LcLineEchoAttn	0x16
LcDelayAudio	0x18
LcDelayLine	0x1A
LcNoiseFadeOn	0x1C
LcNoiseFadeRate	0x1E
FbcOn	0xC0
FbcDelayRatio	0xC2
FbcDelayLength	0xC4

REQUEST								
	Start	Type	Length	T-Port	Command1	Command2	Command-ID	Value
SET:	0x8F	0x20	0x04/0x05	0x0F	0x02	0x02	see above	see section A.1
GET:	0x8F	0x20	0x03	0x0F	0x02	0x04	see above	–

RESPONSE Byte	Value	Description
SET		
1	0x8F	Start
2	0x40	Type
3	0x04	Length
4	0x0F	S-Port
5	0x02	Command1
6	0x03	Command2
7		Status (0x00 = ok, else error)
8		Command-ID
GET		
1	0x8F	Start
2	0x40	Type
3	0x05 0x06	Length, if length of Value = 1 Byte Length, if length of Value = 2 Byte
4	0x0F	S-Port
5	0x02	Command1
6	0x05	Command2
7		Status (0x00 = ok, else error)
8		Command-ID
9		Value (if Length = 2 Byte: low-order Byte)
10		Value, only if range > 1 Byte (with Length = 2 Byte: high-order Byte)

Reset

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x02	0x06

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x02	Command1
6	0x07	Command2
7		Status (0x00 = ok, else error)

ResetAec

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x02	0x08

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x02	Command1
6	0x09	Command2
7		Status (0x00 = ok, else error)

ResetLec

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x02	0x0A

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x02	Command1
6	0x0B	Command2
7		Status (0x00 = ok, else error)

B.2 Loudspeaker and Microphone

Name	Command-ID
SpkVol	0x30
SpkVolFade	0x4C
SpkLimOn	0x32
SpkLimThr	0x34
SpkLimRel	0x40
SpkNgOn	0x36
SpkNgThr	0x38
SpkNgAttn	0x42
SpkNgFade	0x44
SpkCompOn	0x3A
SpkCompThr	0x3C
SpkCompRatio	0x3E
SpkCompRel	0x46
SpkDcfOn	0x48
SpkDcfCutOff	0x4A
SpkEqOn	0x70
SpkEqLowFreq	0x72
SpkEqLowGain	0x74
SpkEqHighFreq	0x76
SpkEqHighGain	0x78
SpkNotchOn	0x7A
SpkNotch1Freq	0x7C
SpkNotch1Bw	0x7E
SpkNotch1Gain	0x80
SpkNotch2Freq	0x82
SpkNotch2Bw	0x84
SpkNotch2Gain	0x86
SpkNotch3Freq	0x88
SpkNotch3Bw	0x8A
SpkNotch3Gain	0x8C

Name	Command-ID
MicVol	0x50
MicVolFade	0x6C
MicLimOn	0x52
MicLimThr	0x54
MicLimRel	0x60
MicNgOn	0x56
MicNgThr	0x58
MicNgAttn	0x62
MicNgFade	0x64
MicCompOn	0x5A
MicCompThr	0x5C
MicCompRatio	0x5E
MicCompRel	0x66
MicDcfOn	0x68
MicDcfCutoff	0x6A
MicEqOn	0x90
MicEqLowFreq	0x92
MicEqLowGain	0x94
MicEqHighFreq	0x96
MicEqHighGain	0x98
MicNotchOn	0x9A
MicNotchFreq	0x9C
MicNotchBw	0x9E
MicNotchGain	0xA0

Name	Command-ID
SpkAvcOn	0xD0
SpkAvcVolMin	0xD2
SpkAvcVolMax	0xD4
SpkAvcVolCurr	0xD6
SpkAvcThr	0xD8
SpkAvcRatio	0xDA
SpkAvcAttack	0xDC
SpkAvcRel	0xDE
SpkAvcBandpassOn	0xE0
SpkAvcLowFreq	0xE2
SpkAvcHighFreq	0xE4
SpkAvcNoiseLevel	0xE6

REQUEST								
	Start	Type	Length	T-Port	Command1	Command2	Command-ID	Value
SET:	0x8F	0x20	0x04/0x05	0x0F	0x02	0x02	see above	see A.2 and A.3
GET:	0x8F	0x20	0x03	0x0F	0x02	0x04	see above	–

RESPONSE Byte	Value	Description
SET		
1	0x8F	Start
2	0x40	Type
3	0x04	Length
4	0x0F	S-Port
5	0x02	Command1
6	0x03	Command2
7		Status (0x00 = ok, else error)
8		Command-ID
GET		
1	0x8F	Start
2	0x40	Type
3	0x05 0x06	Length, if length of Value = 1 Byte Length, if length of Value = 2 Byte
4	0x0F	S-Port
5	0x02	Command1
6	0x05	Command2
7		Status (0x00 = ok, else error)
8		Command-ID
9		Value (if Length = 2 Byte: low-order Byte)
10		Value, only if range > 1 Byte (with Length = 2 Byte: high-order Byte)

B.3 Playing Audio Files

PlayerVol / PlayerOutput

Name	Command-ID
PlayerVol	0x02
PlayerOutput	0x04

REQUEST	Start	Type	Length	T-Port	Command1	Command2	Command-ID	Value
SET:	0x8F	0x20	0x04	0x0F	0x03	0x02	see above	see section A.4
GET:	0x8F	0x20	0x03	0x0F	0x03	0x04	see above	–

RESPONSE	Byte	Value	Description
SET			
	1	0x8F	Start
	2	0x40	Type
	3	0x04	Length
	4	0x0F	S-Port
	5	0x03	Command1
	6	0x03	Command2
	7		Status (0x00 = ok, else error)
	8		Command-ID
GET			
	1	0x8F	Start
	2	0x40	Type
	3	0x05	Length
	4	0x0F	S-Port
	5	0x03	Command1
	6	0x05	Command2
	7		Status (0x00 = ok, else error)
	8		Command-ID
	9		Value

Play

REQUEST							
Start	Type	Length	T-Port	Command1	Command2	StrLength	Audio file
0x8F	0x20	0x03 + StrLength	0x0F	0x03	0x06	Length	String + '0x00'

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x03	Command1
6	0x07	Command2
7		Status (0x00 = ok, else error)

The response of play command will be generated immediately in case of error (e.g. file not found) or after end of playing.

B.4 Management of Parameter

Name	Command-ID
ParamName	0x02
ParamRev	0x04
ParamSave	0x06
ParamDefault	0x0A

REQUEST

Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x04	see above

RESPONSE

Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03 [+ x Bytes]	Length (depends on command)
4	0x0F	S-Port
5	0x04	Command1
6	see above + 0x01	Command2
7		Status (0x00 = ok, else error)
[8 - x]		on ParamName: String with length of parameter file (incl. termination) on ParamRev: revision number with length 1 Byte on ParamSave: without Byte 8 on ParamDefault: without Byte 8

Name	Command-ID
ParamRead	0x08
ParamBoot	0x0C

REQUEST

Start	Type	Length	T-Port	Command1	Command2	StrLength	File name
0x8F	0x20	0x03 + StrLength	0x0F	0x04	see above	Length	String + '0x00'

RESPONSE

Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x04	Command1
6	see above + 0x01	Command2
7		Status (0x00 = ok, else error)

B.5 Common

Ping

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x01	0x02

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x03	Length
4	0x0F	S-Port
5	0x01	Command1
6	0x03	Command2
7		Status (0x00 = ok, else error)

Reboot

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x06	0x02

The reboot command causes an immediate reboot of the software therefore no response will be sent.

Version

REQUEST					
Start	Type	Length	T-Port	Command1	Command2
0x8F	0x20	0x02	0x0F	0x01	0x04

RESPONSE		
Byte	Value	Description
1	0x8F	Start
2	0x40	Type
3	0x3E	Length
4	0x0F	S-Port
5	0x01	Command1
6	0x05	Command2
7		Status (0x00 = ok, else error)
8	0x82	Application-ID
9	0x00	Instance-ID
10		Major number
11		Minor number
12		Revision number
13	0x00	reserved
14	0x00	reserved
15	0x33	Length of following string incl. termination '0x00'
16–61		Version string (padded with '0x00')

GainSpk / GainMic / GainLineIn / GainLineOut

Name	Command-ID
GainSpk	0x02
GainMic	0x04
GainLineIn	0x06
GainLineOut	0x08

REQUEST

	Start	Type	Length	T-Port	Command1	Command2	Command-ID	Value
SET:	0x8F	0x20	0x04	0x0F	0x05	0x02	see above	see section A.6
GET:	0x8F	0x20	0x03	0x0F	0x05	0x04	see above	–

RESPONSE

	Byte	Value	Description
SET			
	1	0x8F	Start
	2	0x40	Type
	3	0x03	Length
	4	0x0F	S-Port
	5	0x05	Command1
	6	0x03	Commandl2
	7		Status (0x00 = ok, else error)
GET			
	1	0x8F	Start
	2	0x40	Type
	3	0x05	Length
	4	0x0F	S-Port
	5	0x05	Command1
	6	0x05	Command2
	7		Status (0x00 = ok, else error)
	8		Command-ID
	9		Value in dB