

# **User Manual DAI Converter**

## **G70**

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## 1 Introduction



**Figure 1.1** DAI-Converter in default state

### 1.1 Purpose and Scope

This document should describe the usage for an format converter between IOM2- and DAI-datastreams, called DAI converter.

### 1.2 Glossary

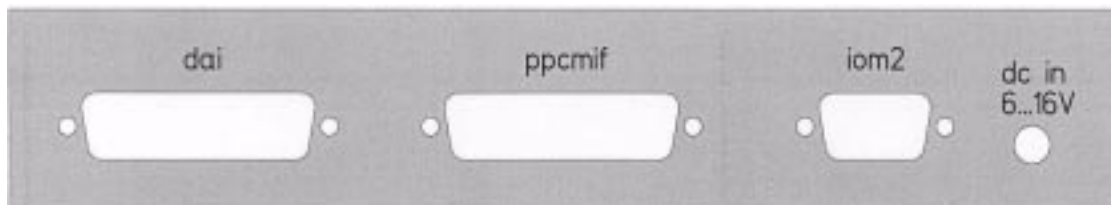
DAI	Digital Audio Interface
FTA	Final Type Approval
GSM	Global System for Mobile communication
IOM2	ISDN Oriented Modular Interface revision 2 (Siemens trademark)
LPT	Line Printer Terminal
MS	Mobile Station
PCM	Pulse Code Modulation
PPCMIF	Parallel PCM-Interface

SS                      System Simulator

### 1.3 References

- [1] “DAI - Digital Audio Interface for A2”, Target Specification 1.0p1, Rainer Dietsch, 08-Aug-2000
- [2] “DAI user manual”, version 1.0, Rainer Dietsch, 4-Nov-1999
- [3] “PCF50732 GSM Baseband and Audio Interface”, Objective Specification V2.18, 26-Oct-1999
- [4] “PCF5087x IC Family Specification”, Objective Specification V2.6, 13-Aug-1999
- [5] “Specification of DAI for PRS820”, Version 1.0, Peter Blöcher, 2-Dec-1994
- [6] “GSM 11.10 Part III Digital Audio Interface”, V 3.16.0, Feb-1994
- [7] “PCF50881 GSM/EDGE/GPRS-Baseband”, Objective Specification V2.0p3, 17-Dec-2000
- [8] “DAI converter”, Hardware Detailed Design Specification, V0.2, 25-Jan-2001
- [9] GSM 11.10-1 version 4.28.0, March 2000, chapter 30 “Speech teleservices”  
chapter 32 “Testing of speech transcoding functions”  
chapter 36 “Individual equipment and interworking -special  
conformance testing functions”
- [10] “IOM-2 Interface Reference Guide”, Edition 3.91, Siemens AG 1991

## 2 Connectors (rear panel)



### 2.1 dai

This is a 25-D-Sub-Connector (female) to connect to the standardized DAI (see details on [6], [9]) for instance to be found on the Rohde & Schwarz Audio Analyser UPL.

### 2.2 ppcmif

This is a 25-D-Sub-Connector (female) to connect to a LPT of a standard PC. The LPT must be able to work in bi-directional mode (Bit5 in LPT-Control-Register must enable/disable the bi-directional mode). The protocol on that interface is proprietary. A special PC-software (DAI Terminal described in chapter 4 on page 10) is needed to receive the data. The interface is described in [8].

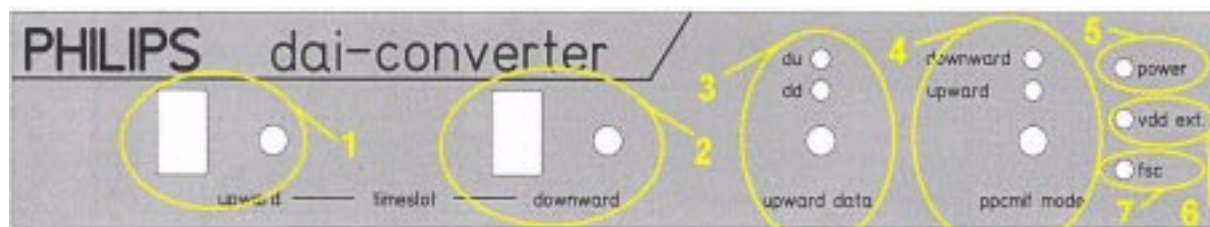
### 2.3 iom2

This is a 9-D-Sub-Connector (female) to connect to the IOM2-interface inside the Philips-Sysol-phone. At the moment the DAI converter is tested only with the Sysol1 that means with a PCF50870, PCF50872 baseband processor and the BAI PCF50732. If the IOM2 transmission follows the same conditions other chipsets are supported as well. The minimum allowed voltage on the IOM2-interface is limited by the level shifters in the DAI converter. The allowed minimum is in the current design 1.65V, the maximum is 3.6V. The interface is described in [10].

## **2.4      dc in 6..16V**

Here a power supply with a DC output between 6 and 16V and a permanent current of higher than 100 mA must be plugged in to supply the DAI converter. The inner pole is “+”.

### 3 Display and switches (front panel)



#### 3.1 1 upward-Timeslot

There is a 7-segmented display where the used timeslot of the IOM2-signal for the upward direction from IOM2 to DAI is displayed. Right from the display a button is placed where you adjust the used timeslot. By pressing this button the used timeslot is increased by one in the range from 1 to 6. If the timeslot is 6 and you press the button the display changes to “-”, this means that no data are converted in upward direction. If you press in this position the button the timeslot will return to 1. On Sysol1 the used timeslot must be set to 3.

#### 3.2 2 downward-Timeslot

There is a 7-segmented display where the used timeslot of the IOM2-signal for the downward direction from DAI to IOM2 is displayed. Right from the display a button is placed where you adjust the used timeslot. By pressing this button the used timeslot is increased by one in the range from 1 to 6. If the timeslot is 6 and you press the button the display changes to “-”, this means that no data are converted in downward direction. If you press in this position the button the timeslot will return to 1. On Sysol1 the used timeslot must be set to 3.

#### 3.3 3 upward data

There is a button where you can adjust the data which are transferred from IOM2 to DAI. Normally the data on the DD-line are converted, but you can change also to DU-line. The adjusted line is shown by 2 LED's which belongs each to one line.



### **3.4 4 ppcmif mode**

There is a button where you can adjust the data source of the data on the PPCMIF. Either you can select the upward data or the downward data are shown on that interface. The data are always the raw PCM-data from or to the IOM2-interface. The adjusted mode is shown by 2 LED's which belongs each to one mode.

### **3.5 5 power**

There is a LED which indicates that the supply power of the DAI converter is present or not. The LED is only on when the dc in 6..16V connector on the back of the DAI converter is plugged to an external power supply.

### **3.6 6 vdd ext.**

Inside the DAI converter is a level shifter which shifts the level of the IOM2-interface to the 5V-voltage domain inside the DAI converter. These level shifters are supplied by the IOM2-interface itself. There is a LED which indicates that this supply is present or not. The LED is only on when a mobile phone is connected to the iom2-connector and the mobile phone is switched on.

### **3.7 7 fsc**

The F(rame)S(yn)C-signal is provided from the IOM2-interface. There is a LED which indicates that a FSC signal on the IOM2-interface is present or not and data on the DAI interface are generated. The LED is only on when a phone is connected to the iom2-interface and a call is established.

## 4 PC-Software „DAI-Terminal“

### 4.1 General Description

The PPCMIF as a proprietary interface which is only hardware-compatible with a LPT-port of a PC needs a special software to read out the digital audio data. The DAI-Terminal is a simple PC-software which only allows to read out maximal 100.000 samples from the DAI-Converter and to store it in a ASCII-Text-file. Also it displays the sampled waveform in a graph window.

### 4.2 DAI-Terminal Requirements

To ensure the proper running of the DAI-Terminal-Software you must guarantee the following requirements :

Operating System	Win95,98,NT,2000
LPT-Port	bi-directional, switchable with Bit5 in Control-Register
CPU	>500MHz, Intel-compatible
RAM	>64MB
DAI-Converter (12NC *04412) connected to LPT1 or 2 with full-connected parallel cable	

**Table 1** System Requirements

The DAI-Terminal was tested under Win NT Service Pack 4 on a DELL-Optiplex Desktop-PC and under Win95 on a DELL Latitude-Notebook. Both equipped with Pentium3-processors. On a Compaq Desktop-PC with NT and an older Pentium a problem occurred by reading the audio data.

### 4.3 Installation

The DAI-Terminal-program is delivered on a CD-ROM which contain the following 6 files:

- dai\_terminal\_04412.msi
- DistFile.cab
- instmsi.exe
- instmsiw.exe
- setup.exe

- setup.ini

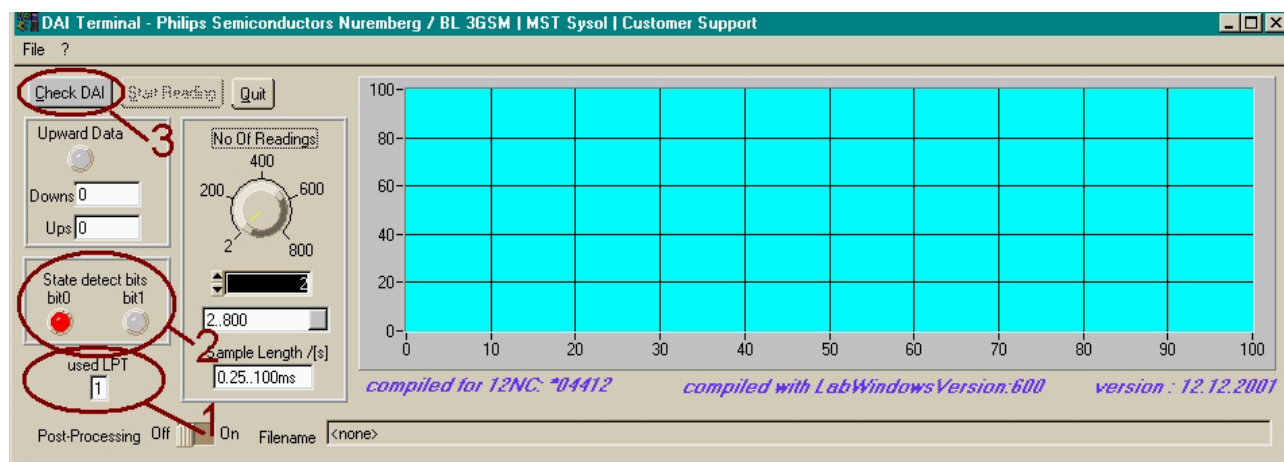
Run setup.exe and follow the instructions of the installer.

## 4.4 Start-Up

After you had installed the DAI-Terminal-application you can connect the DAI-Converter to the LPT1 or 2 of your computer and you can start dai\_terminal\_04412.exe.

In the start-up phase of DAI-Terminal, the software checks if a DAI-Converter is connected either to LPT1 or LPT2. If no one is found the program will pop-up a message and will quit.

If all is running properly the main screen of DAI-Terminal should appear.

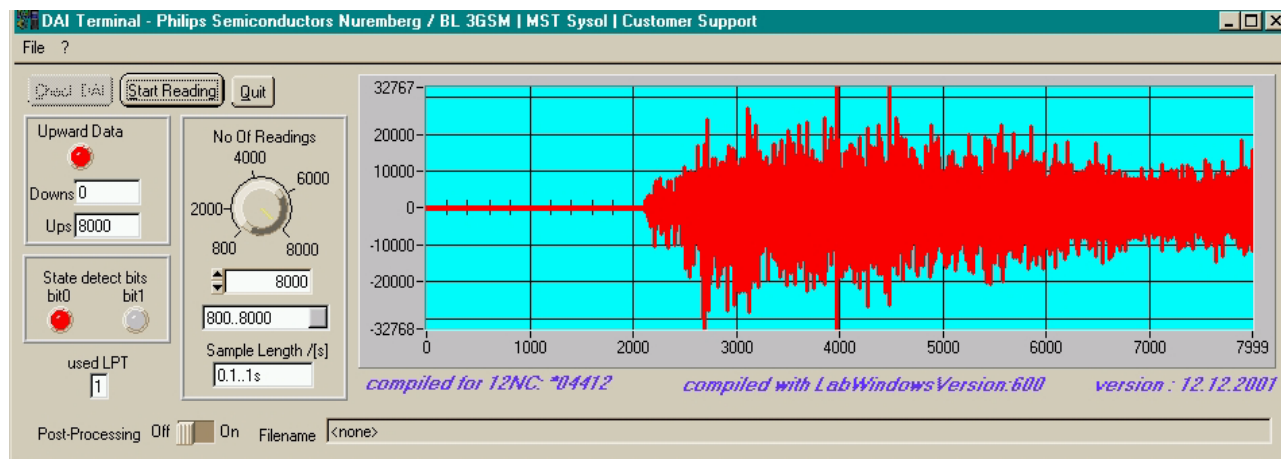


- 1 shows the LPT on which the DAI-Terminal has found the DAI-Converter
- 2 shows the state of detect\_bit0 and detect\_bit1-line of the LPT. The shown state with bit0=High and bit1=Low indicates a connected DAI-Converter
- 3 „Check-DAI“-button which could be used to check the proper working of the PPCMIF

You should connect a mobile phone to the iom2-connector of the DAI-Converter and establish a call at the mobile phone. Then you could press the „Check-DAI“-button. The DAI-Terminal software checks then if it can detect 20 L-H and 20 H-L-edges on the PPCMIF-Sync-line and 10 L-H-edges and 10 H-L-edges on the PPCMIF\_2ndFrame-line inside of 500 samples. If not an error message will pop-up. If it is possible the „Check DAI“-button will be disabled and the „Start Reading“-button will be enabled.

## 4.5 Normal use

If the start-up is done successfully a screen like this will appear :



In the „No. Of Readings“-frame you can select the number of samples which will be received from the DAI-Terminal.

You can adjust it rough with the range list box in steps of

- 2..800
- 800.8000
- 40000..100000

Next you can adjust it in fine scale with the „No Of Readings“-knob. The according sample length in seconds is shown in the „Sample Length /[s]“-text box. The shown value is calculated by the division of the number of readings by the fixed sample rate at iom2- or dai-interface which is defined at 8000 samples/second.

If you want to store the read audio values into a file you can select the „File“-menu and then the „Save As“-option. If you do this a select window will appear, where you can choose a file name and directory. The name and the directory of that file will be shown in the „Filename“-textbox at the bottom of the main window. If once a file is selected the default entry „<none>“ will disappear and whenever you read then audio data, the values are stored in the specified file. When the entry is „<none>“ the data are not stored to a file.

Additionally you can switch on the „Post-Processing“-switch. If „Post-Processing“ is on the read audio data will be processed and changed after they are read. The sense is that you will have sometimes depending on the performance of your computer read errors because of the polling of the PPCMIF. The „Post-Processing“-feature tries to find out such kind of errors and eliminates defect values by a linear interpolation process. Please note that you can have strong deviations from the real read values, so be careful with this feature.

After you have done these adjustments you can select on the DAI-Converter box with the button 4 „PPCMIF mode“ either Downward or Upward-data.

Then you can press the „Start Reading“-button in the DAI-Terminal-program. The software then polls the PPCMIF to read out the adjusted number of samples. After all samples are aquired the waveform is displayed in the graph window. If the read data are „Upward“-samples the „Upward Data“-LED will lit. The number of „Ups“and „Downs“ shows how many samples are read as „Upward“ or „Downward“-data. Normally the number of one of these must be 0, if not an read error is occured, which could be eliminated by the switching on the „Post-Processing“-feature. If a file name for saving is chosen the waveform will be stored in a plain ASCII-text file.

You can open such kind of files in many audio editing programs on the PC such as Cool Edit 2000. The sample rate of the values in that file is 8000 Hz and the numbers are stored as 16bit-values.

With the „?“-menu you can activate an „About“-menu which shows some Copyright-information.

## 5 Technical Specification

### 5.1 Limiting values Connectors :

		min	typ	max	
dc in	<i>supply voltage</i>	6		16	V
	<i>supply current</i>	35		100	mA
ppcmif	<i>sink/source current</i>			12	mA
	<i>VOH</i>	3.5		5	V
	<i>VOL</i>	0		0.8	V
iom2	<i>sink/source current</i>			12	mA
	<i>VOH</i>	$0.8 \times V_{DDD}$			V
	<i>VOL</i>			$0.2 \times V_{DDD}$	V
	<i>VIH</i>	$0.7 \times V_{DDD}$		$V_{DDD}$	V
	<i>VIL</i>	0		$0.3 \times V_{DDD}$	V
	<i>VDDD (supply voltage level shifters)</i>	1.65		3.6	V
dai	<i>sink/source current</i>			12	mA
	<i>VOH</i>	3.5		5	V
	<i>VOL</i>	0		0.8	V
	<i>VIH</i>	3.5		5	V
	<i>VIL</i>	0		0.8	V

Table 2: electrical characterization DAI-Converter connectors

## 5.2 Pin assignments of the DAI-Converter connections

Pin	Signal
2	PPCMIF_D0
3	PPCMIF_D1
4	PPCMIF_D2
5	PPCMIF_D3
6	PPCMIF_D4
7	PPCMIF_D5
8	PPCMIF_D6
9	PPCMIF_D7
10	PPCMIF_Sync
11	PPCMIF_UpDown
12	detect_bit1
13	PPCMIF_2ndFrame
15	detect_bit0
18..25	GND

**Table 3** Connector to PPCMIF

Pin	Signal
1	DD
3	DU
6	DCL
7	FSC

**Table 4** Connector to IOM2-interface

Pin	Signal
9	VDDD
others	GND

**Table 4** Connector to IOM2-interface

Pin	Signal
11	Test Control 1
12	GND
13	Test Control 2
22	Reset
23	DDU (Data to SS)
24	Clock
25	DDD (Data to MS)

**Table 5** Connector to DAI-interface

### 5.3 Interfaces

There is

- a DAI-interface specified in [6], [9] using signals Test control 1 and 2, Reset, Data clock, Data  $SS \rightarrow MS$ , Data  $MS \rightarrow SS$
- an IOM2-interface specified in [3], [4], [7], [10]
- a power supply with a phone jack
- an user interface with switches, LED's and 7segmented LED-displays
- a parallel PCM data interface, pin- and electrical-compatible with a LPT-port



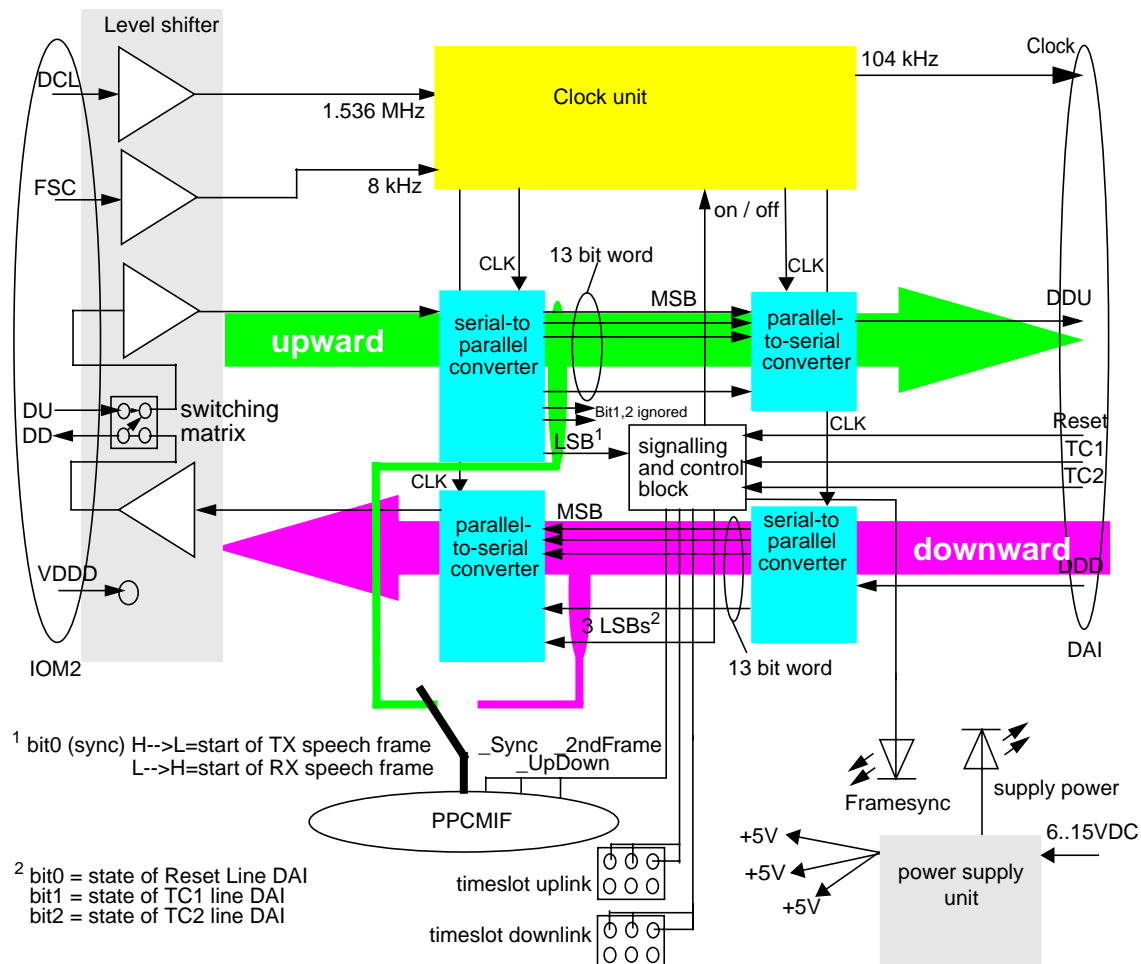
## 5.4 Product Functions

The DAI converter converter

- supports only GSM-mode of IOM2 according to [4] and [7]. This mode is defined as double clock mode, DCL-frequency = 1.536 MHz, FSC-frequency = 8 kHz, one slot uplink data, one slot downlink data
- converts IOM2-data of one slot into DAI-data and vice versa.
- provides the possibility to adjust the timeslot for IOM2-data for uplink and downlink direction separately by switches
- provides the IOM2-data of one slot (16 bit) on a parallel interface (PPCMIF = parallel PCM interface). Only one direction (downlink or uplink) is supported at one time (the PPCMIF should act only as a data output). Optional a software upgrade should provide the possibility to read down- and uplink data in one audio frame.
- provides the possibility to switch between uplink or downlink data on the PPCMIF (adjustable by hardware jumpers/switches). Optional a software upgrade should provide the possibility to read down- and uplink data in one audio frame.
- indicates operating mode synchronized to FSC-signal, kind of data on the PPCMIF, downlink and uplink time slot, external voltage and supply power via LED's
- shifts the levels between the IOM2- and the DAI-interface. Logic levels at the IOM2-interface between 1.8 and 3V will be supported. The interface to IOM2 delivers the supply for the level shifters. The DAI interface has a 5V-logic.
- provides the possibility to change upward data source between DD- and DU-line on the IOM2-interface
- detects the required DAI-mode by recognizing states of TC1 and TC2 and switches-on the 104kHz-Clock accordingly to this and according to the transition of bit 0 from DD-signal, and Reset-signal from DAI
- tristates the IOM2-bus outside the slots, where it writes to the bus

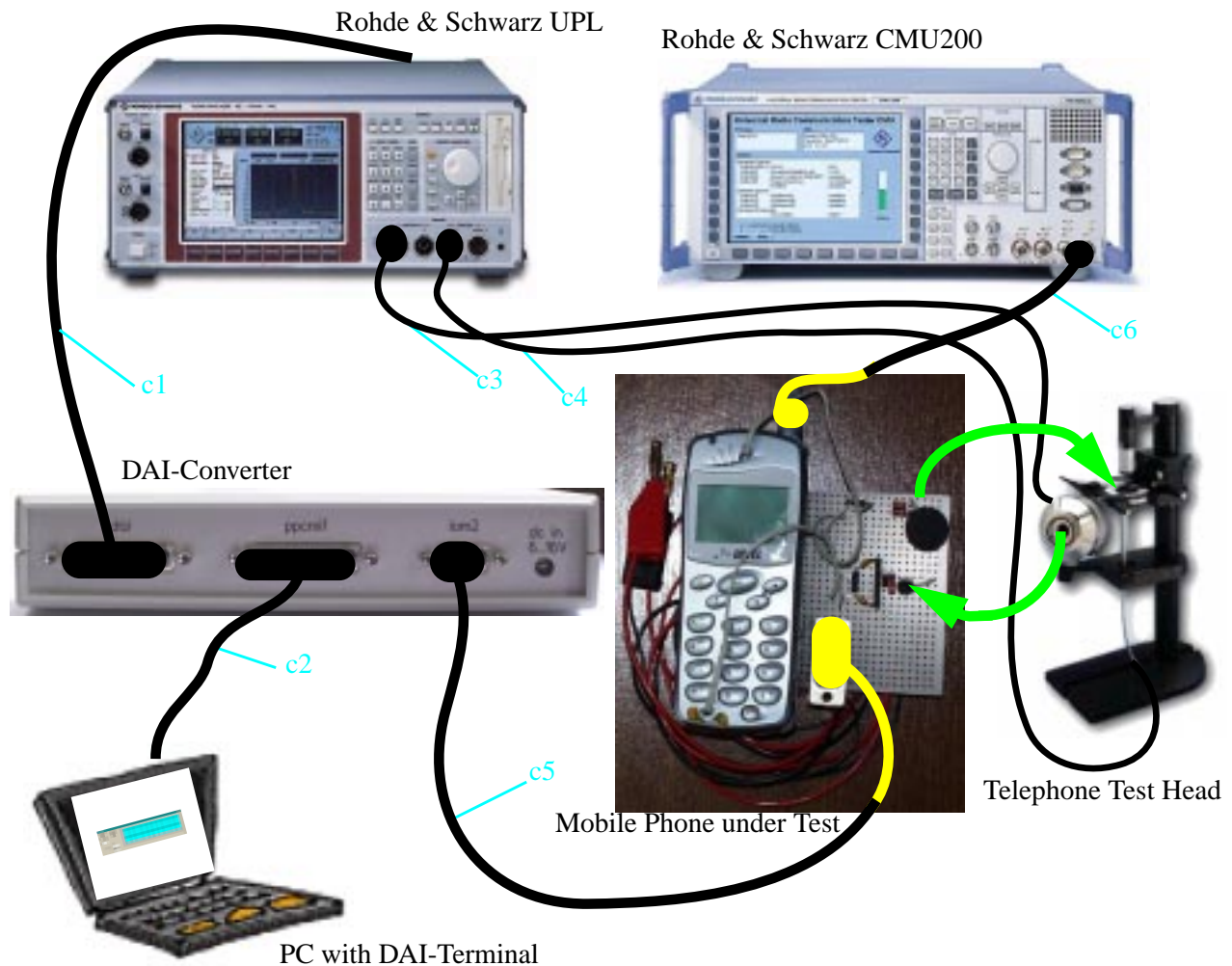
## 5.5 System overview

The following pictures gives an overview about the main sections of the DAI converter.



**Figure 5.1** Functional overview

## 6 Typical Test-Setup



- 
- c1 DAI connection / from DAI interface on the back of the UPL to DAI-connector on the DAI-converter
  - c2 PPCMIF connection / from LPT-port of a PC to PPCMIF-connector on the DAI-converter
  - c3 Mouth connection / from Generator output 1 of the UPL to the artificial mouth of the telephone test head
- 

**Table 6** Cable connections for test setups

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c4	Ear connection / from Analyzer input 1 of the UPL to the artificial ear of the telephone test head
c5	IOM2-connection / from IOM2-connector of the DAI-converter to IOM2-connector of the test phone
c6	RF connection / from RF2 connector of the CMU200 to antenna input of the test phone

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**Table 6** Cable connections for test setups