

Mikrolabor  $\mu$ LAB für:

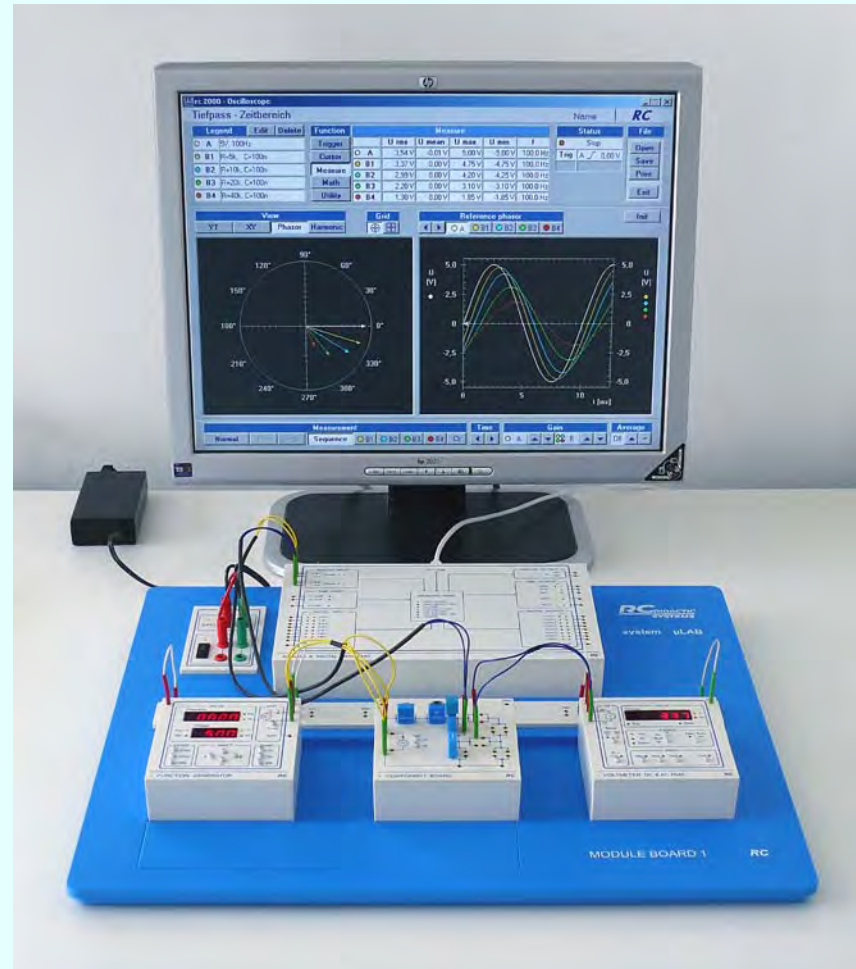
Elektrotechnik

Elektronik

Digitaltechnik

Regelung

messen + verstehen



## Gruppen

### Gerätemodule

- Messmodul + Software
- Funktionsgenerator
- Programmierbare Quelle
- Voltmeter DC&AC RMS
- Drehstrommodul

### Digitalmodule

- Universalmodul + Karten
- Zeitgenerator
- Logselektor
- Logprobe

### Aktivmodule

- Elementemodul
- Operationsverstärker
- Bipolartransistor
- Thyristor
- Buffer
- Elementemodul mit Umschalter
- Wandler U/I

### Regelungsmodule

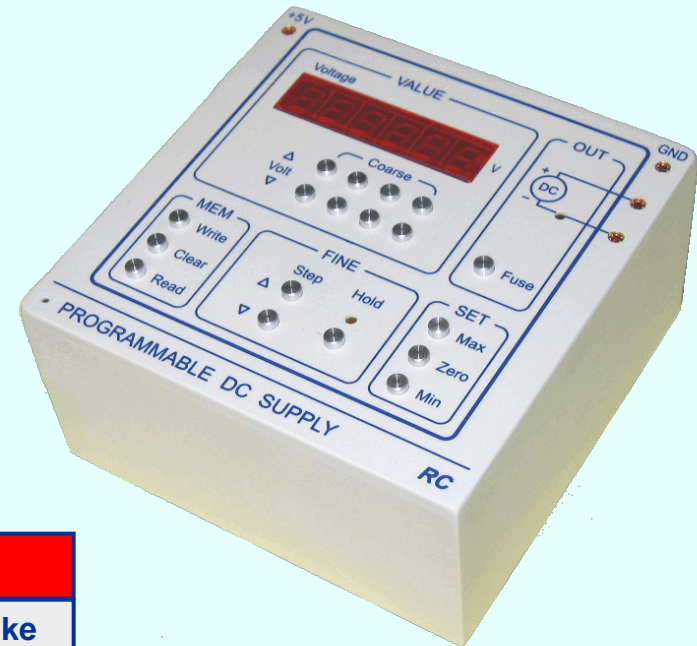
- Motor-Generator Strecke
- PID Regler
- Verzögerungsglieder
- Differenzglied

### Zubehör

- Elementesatz
- Kabelsatz
- Modulplatte
- Spannungsquelle 5V

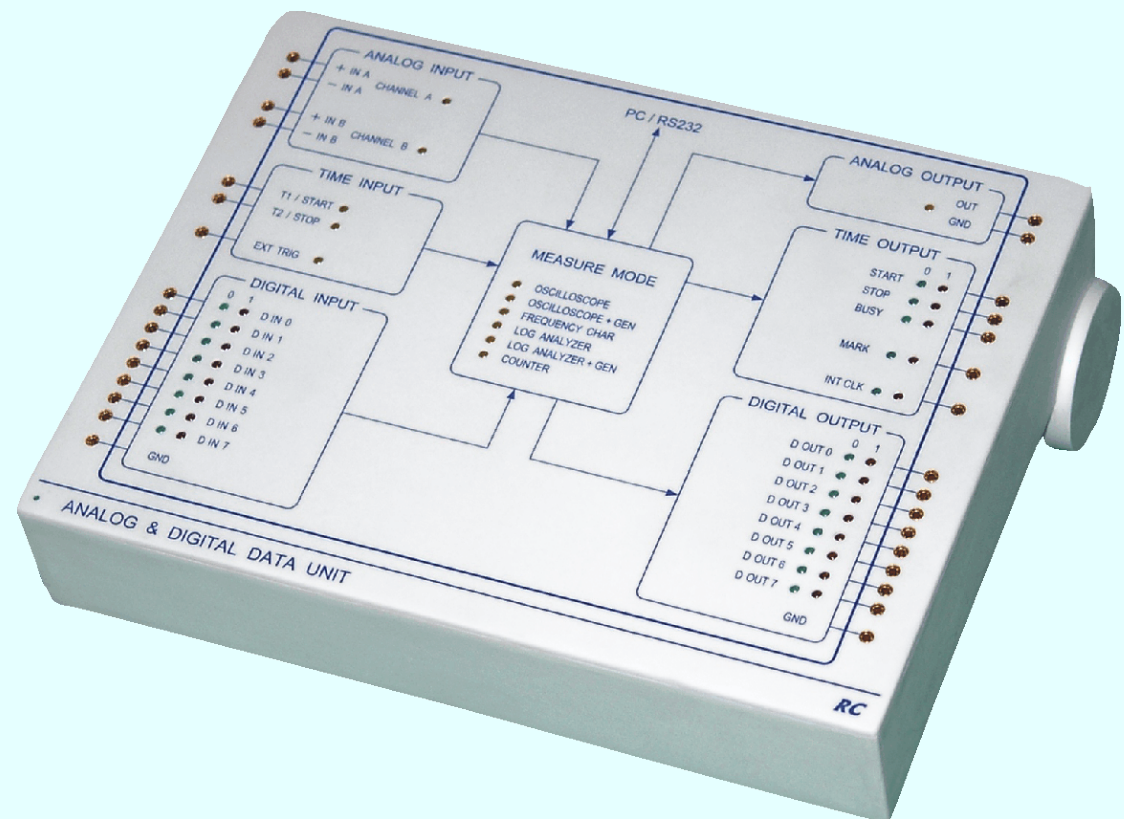
### Passivmodule

- Widerstandsdekaden
- Kondensatordekaden
- Spule



## Parameter

- 2 differentielle Analogeingänge
- 1 Analogausgang
- 8 Digitaleingänge
- 8 Digitalausgänge
- Abtastung 1 MHz
- RS 232, USB Verbindung



## 7 Messgeräte in einem Modul

Oszilloskop

Logischer  
Analysator

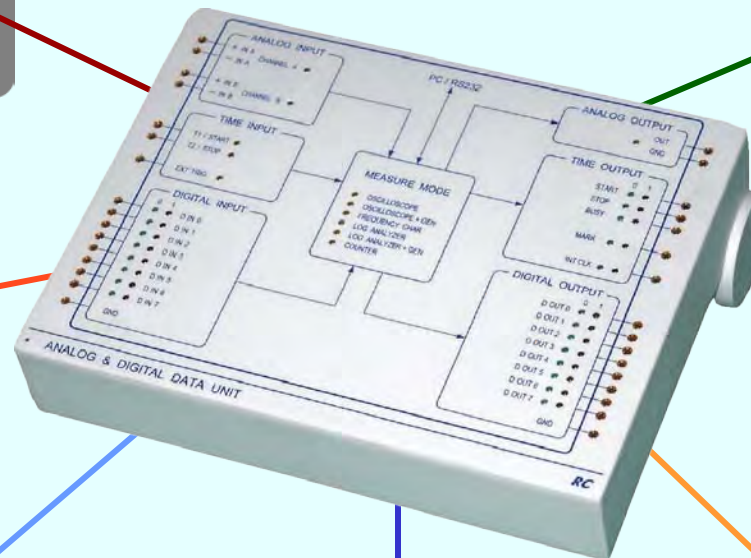
Oszilloskop +  
Generator

Log. Analysator +  
Generator

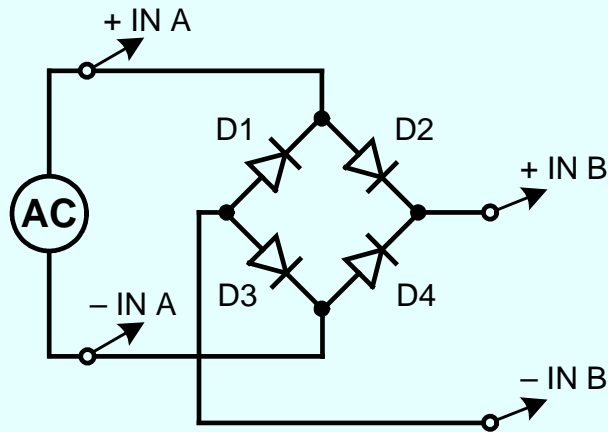
V/A Kennlinie

Zähler

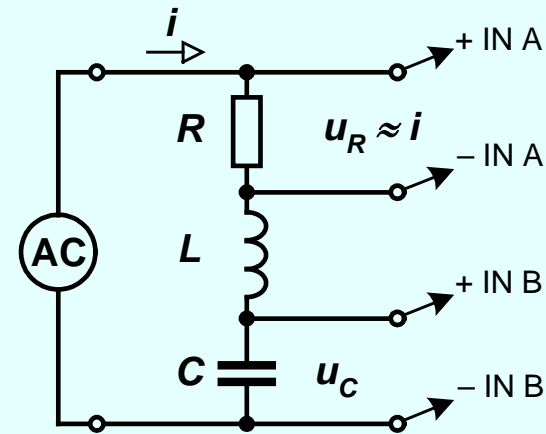
Amplituden und  
Phasengang



## Messungen in beliebigen Punkten



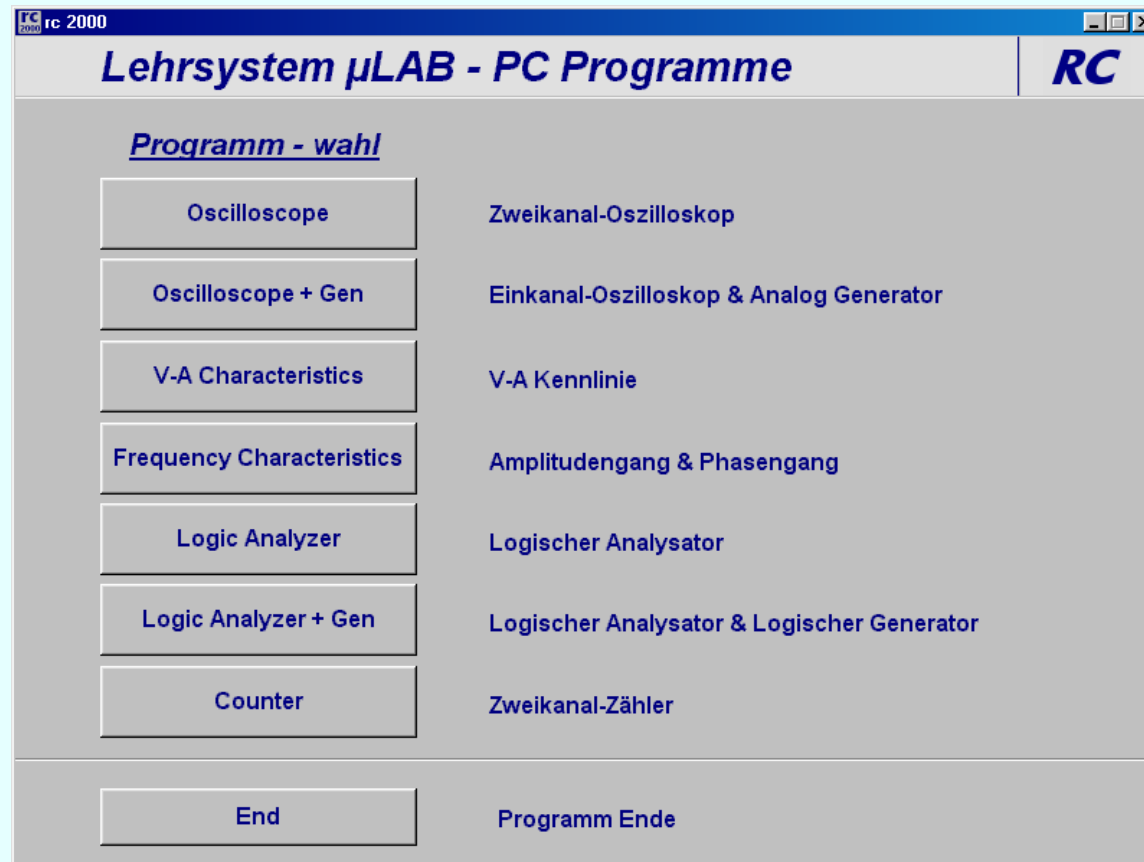
**Graetzschaltung**



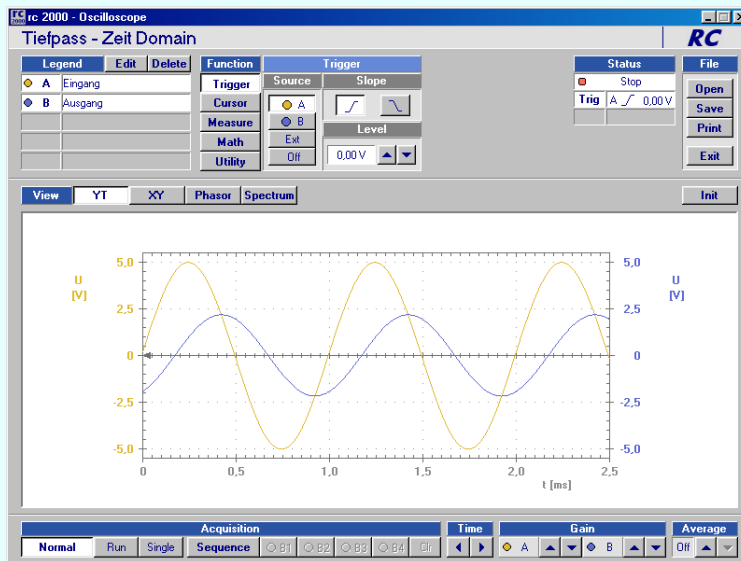
**RLC Reihenschaltung**

Mit dem „normalen“ Oszilloskop sind diese Messungen problematische

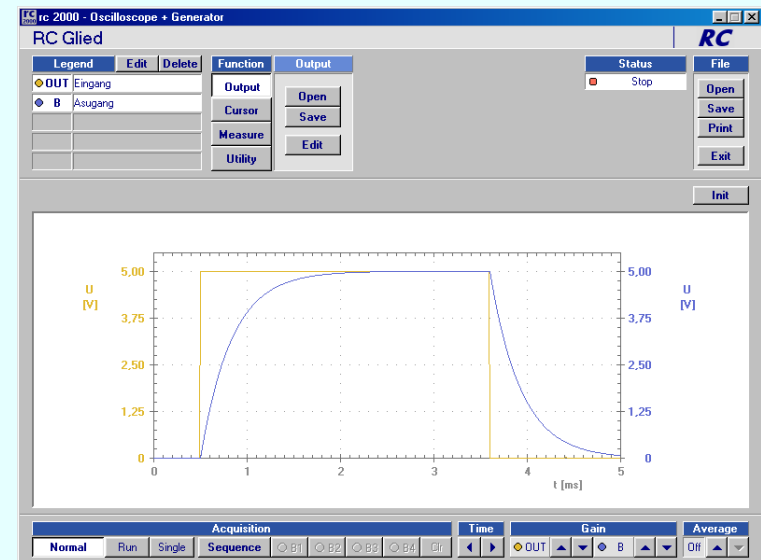
## Messmoden



## Analogtechnik I

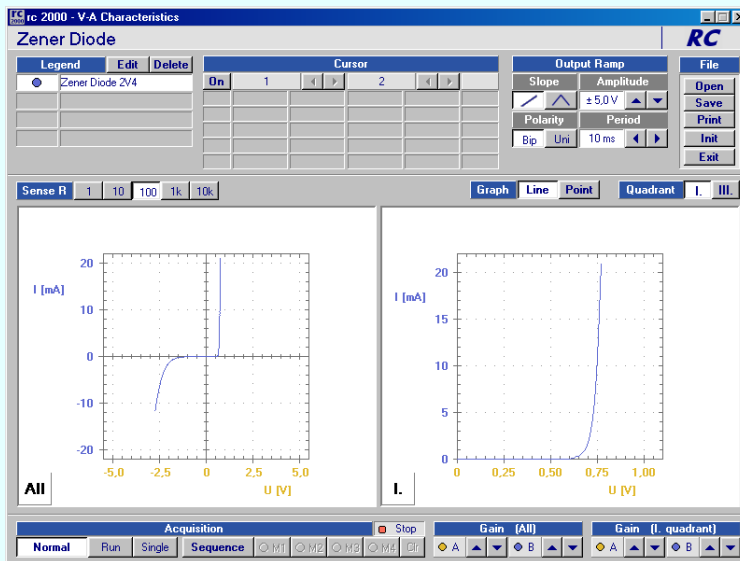


**Oszilloskop**

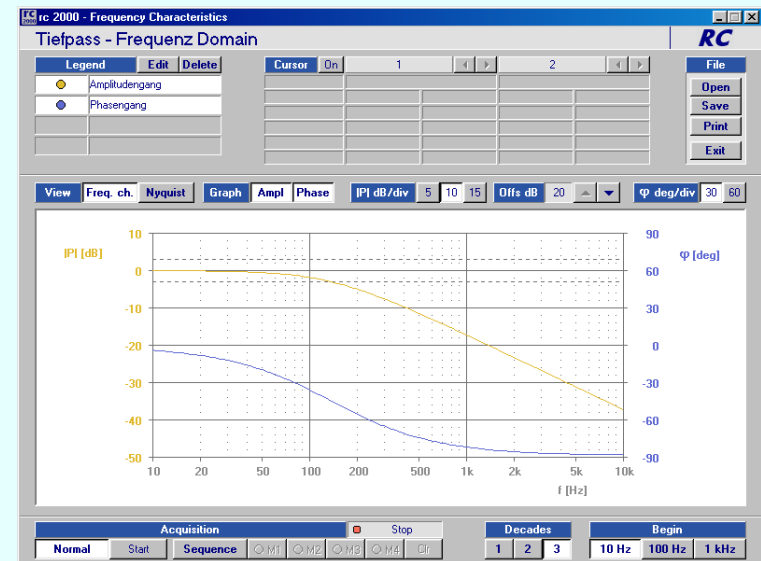


**Oszilloskop + Generator**

## Analogtechnik II

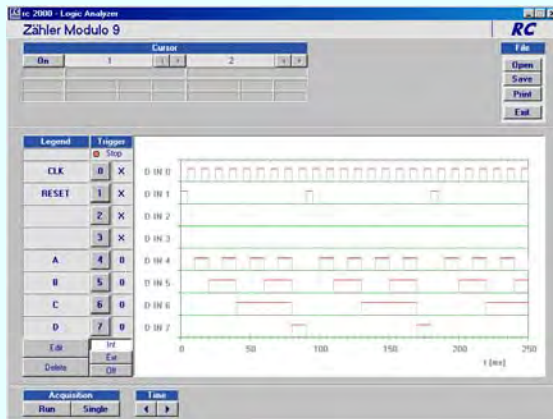


**V/A Kennlinie**

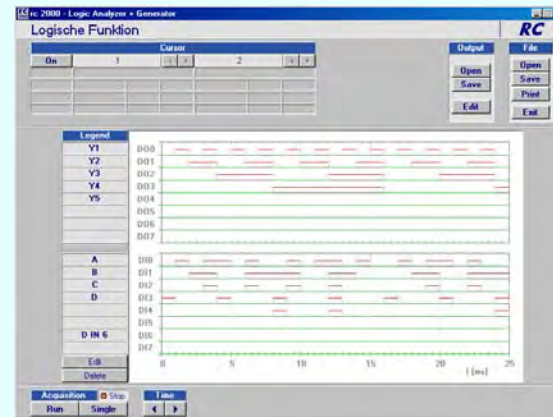


**Amplituden- und Phasengang**

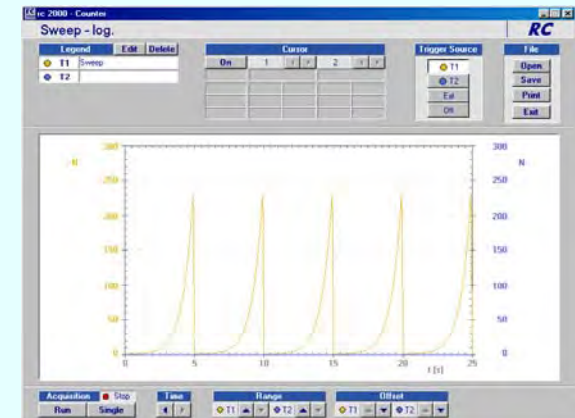
## Digitaltechnik



**Logischer Analysator**



**Logischer Analysator + Generator**



**Zähler**

## Übersichtlicher Blockaufbau

The screenshot shows the RC 2000 Oscilloscope software interface. The main window is titled "rc 2000 - Oscilloscope" and "Tiefpass - Zeit Domain". The interface is divided into several sections:

- Messenbeschreibung**: Legend table with columns for channel and description.
- Messenauswertung**: Function and Cursor tables.
- Statusfenster**: Status window showing "Stop" and "Trig A / 0,00 V".
- Dateioperationen**: File menu with "Open", "Save", "Print", and "Exit" options.
- Messendarstellung**: The main plot area showing two waveforms (A and B) over time.
- Anfangsstellung**: "Init" button.
- Messenbetriebsart**: Acquisition mode buttons (Normal, Run, Single, Sequence).
- Zeitbasis**: Time base control buttons.
- Verstärker**: Gain control buttons for channels A and B.
- Durchschnitt**: Average mode control buttons.

Channel	Description
A	Eingang
B	Ausgang

Function	Mode
Trigger	
Cursor	
Measure	
Math	
Utility	

Cursor	t [ms]
1	0,250   1,500
A	5,00 V   -0,20 V
B	1,05 V   1,90 V

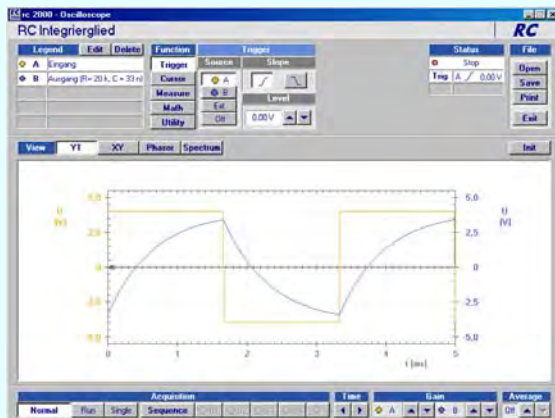
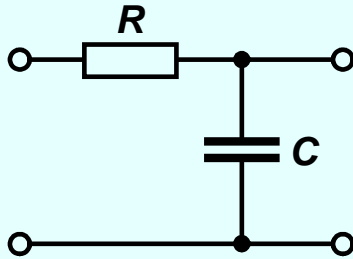
Mode	Options
Normal	Run   Single   Sequence
Sequence	B1   B2   B3   B4   Off

Channel	Gain
A	▲   ▼
B	▲   ▼

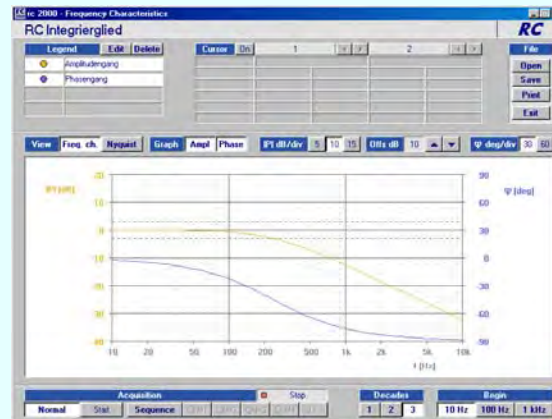
Mode	Options
Off	▲   ▼

The main plot shows two waveforms, A (yellow) and B (blue), over a time range of 0 to 2.5 ms. The vertical axis is labeled "U [V]" and ranges from -5.0 to 5.0. The horizontal axis is labeled "t [ms]" and ranges from 0 to 2.5. Two vertical cursors are positioned at 0.250 ms and 1.500 ms.

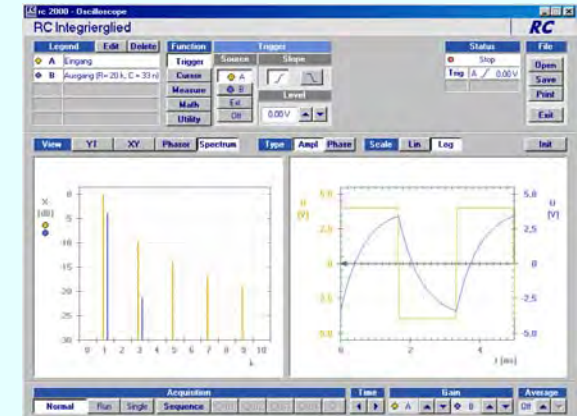
## RC Schaltung



**Zeitbereich (Rechteck)**



**Frequenzbereich (Sinus)**

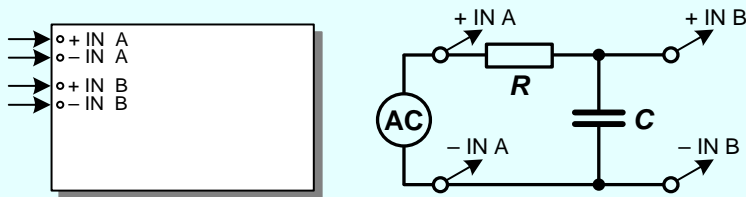


**Spektrum (Rechteck)**

# Umwandlung der Messmode

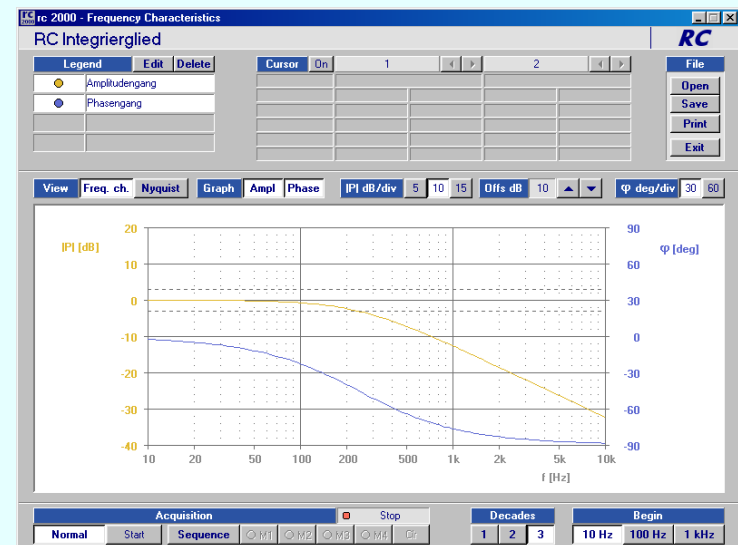
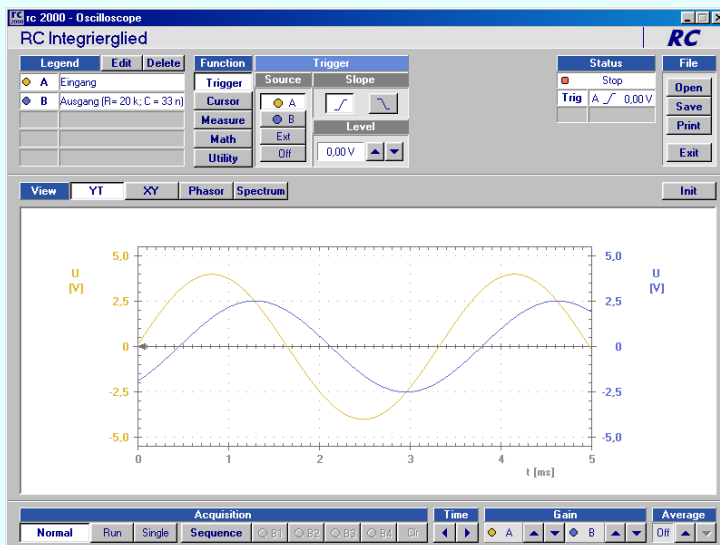
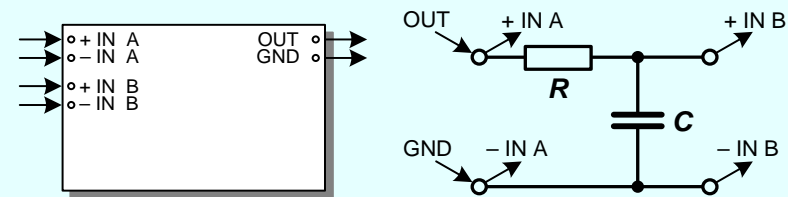
## Oszilloskop

### Oszilloskopische Messungen



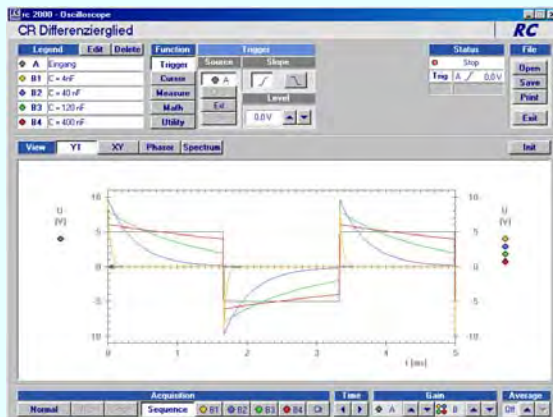
## Wobbler

### Amplituden- und Phasengang

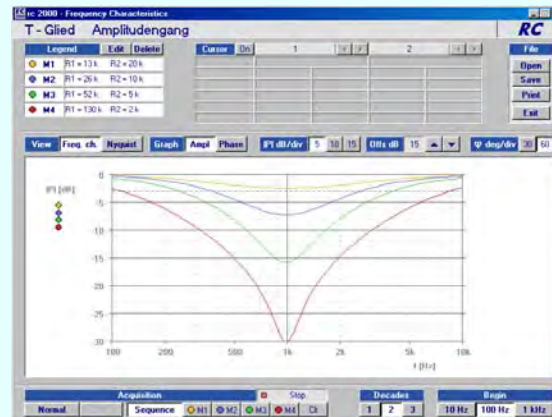


## Mehrverläufige Analyse und Darstellung

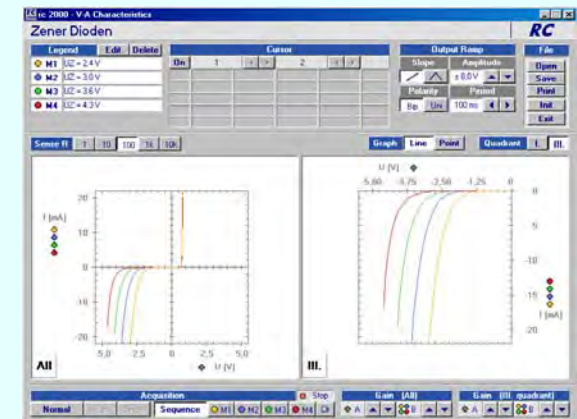
### Trendmessungen



Oszilloskop



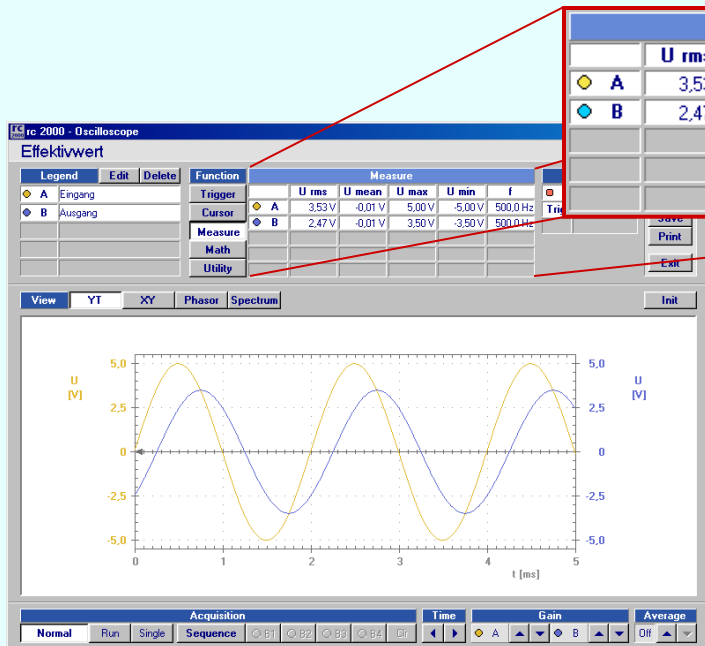
Amplituden- und  
Phasengang



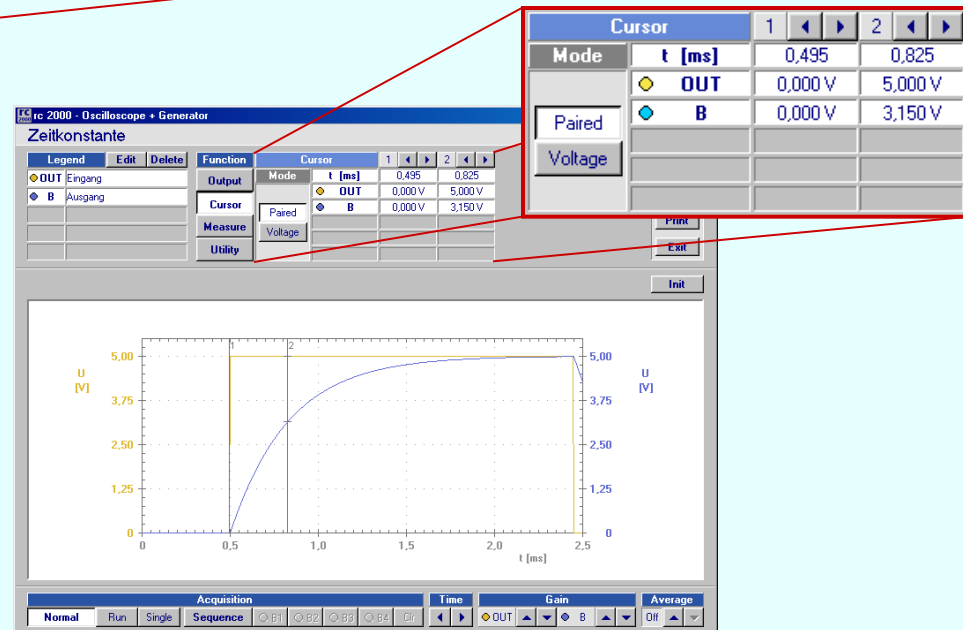
V/A Kennlinie

# Theorie ↔ Praxis

## Berechnete Werte = Messergebnisse

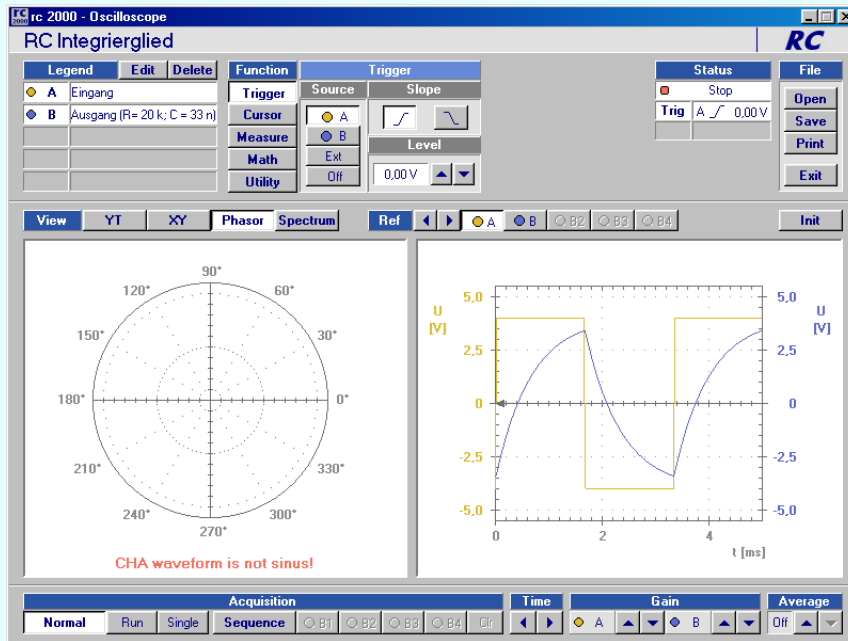


**Effektivwert, Mittelwerte, ...**

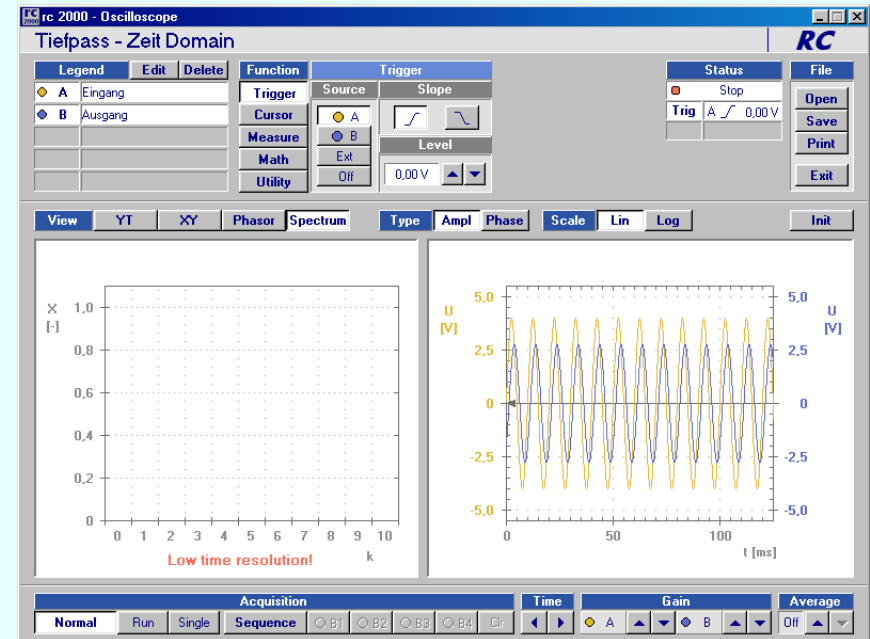


$$\tau = R \cdot C$$

## Fehlermeldung



Signalverlaufskontrolle

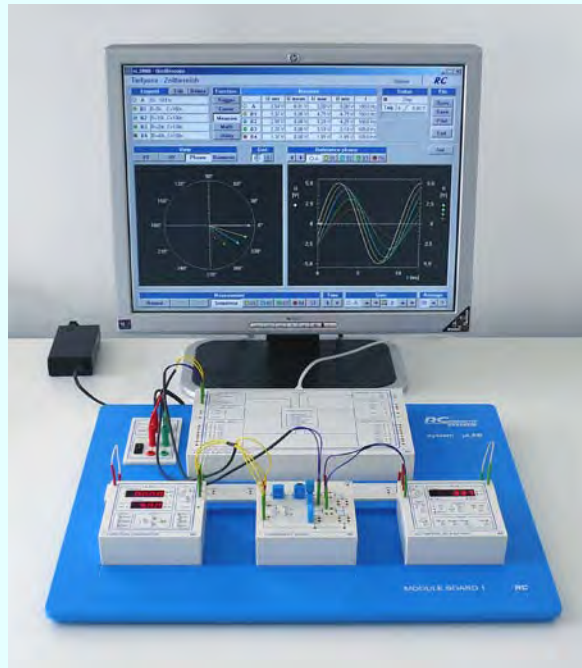


Zeitauflosungskontrolle

## Eigenschaften des Systems

- **Intelligente Module und intuitive Software**
- **Unterricht durch ein reales Experiment**
- **Sieben Messgeräte in einem Messmodul**
- **Genauigkeit (Theorie = Messen)**
- **Effektive elektronische Sicherung**
- **Elektrische und mechanische Zuverlässigkeit**
- **Produktiver messen + verstehen =  $\mu$ LAB Philosophie**

## Systemausnutzung



0.5 m



## Systemlagerung





Kunde ↔ RC Didactic Systems

