

# CLR TESTER CT 30



For high speed and very accurate automatic production testing and sorting



## CLR TESTER CT30

- 3 MEASURING FREQUENCIES  
100 kHz, 10 kHz and 1 kHz
- OVERALL ACCURACY:  
BETTER THAN 0.05%
- MEASURING TIME: 25 ms
- 12 + 4 Limits for Binning
- Automatic Measurement of Impedance and Loss Factor
- Accuracy on tan delta down to  $2 \times 10^{-4}$
- Comprehensive Jig-zeroing Facility
- Facilities for Dual Frequency Measurement
- Direct or Deviation Readings
- Nominal Value for Deviation Measurements programmed or inserted by External Standard
- Built-in Battery for Memory Retention
- 19" Cabinet for Rack Mounting or in Bench Version
- Supplied with two Digital Displays and Sealed Keyboard
- IEEE 488 and RS232C Bus Interface as Standard for Full Control and Data Readout
- Separate Bridge Unit for easy Mounting close to the Test Fixture
- Up to 5 m Cables between the Main Unit and the Bridge Unit

## GENERAL

The CT30 is a very fast, highly accurate CLR Bridge particularly suited for modern, automatic sorting equipment used in the production of various capacitors.

The 3 measuring frequencies are 100 kHz, 10 kHz and 1 kHz. The speed is 25 ms from trig to end of measurement.

The accuracy of the CT 30 is better than  $\pm 0.05\% \pm 1$  digit on the primary parameter (C, L or R) and down to  $.0002 \pm 1$  digit on tan delta.

The CT 30 consists of a Bridge Unit (CT30B) and a Main Unit interconnected by means of max. 5 m cables.

The high accuracy is achieved by mounting the Bridge Unit as close as possible to the test fixture (jig).

A jig-zeroing routine will compensate for parallel stray impedance and also for impedance to ground.

The Bridge Unit is automatic, and is controlled from the Main Unit. The Main Unit is supplied with two digital displays and dustproof keyboard.

Measurements can be taken as direct or as deviation from a nominal value, which is inserted from a remote controller, or by means of the keyboard. A Standard can also be used to establish the nominal value.

Up to 12 limits on the primary parame-

ter and 4 on the secondary parameter can be programmed.

A built-in battery will provide retention of the data in memory for at least 30 days if the AC-mains fails or is turned off.

IEEE 488 and RS232C Bus Interfaces are built-in as standard.

The CT30 has facilities for dual frequency measurement of loss factor (tan delta) and capacitance, thereby saving an extra test station on the production line.

## SPECIFICATIONS

### Measured Parameters:

Primary parameter: C, L, R, in series or parallel. Secondary parameter: For C or L: Q, d, Rs, Rp or Gp. For R: Ls or Cp is automatically selected.

### Measuring Frequencies:

100 kHz, 10 kHz and 1 kHz with a facility for dual frequency measurement.

### Measuring Voltage:

1 V RMS up to  $10 \mu\text{F}$  at 1 kHz

1 V RMS up to  $1 \mu\text{F}$  at 10 kHz

1 V RMS up to  $.1 \mu\text{F}$  at 100 kHz

Above: Linearly decreasing with the impedance.

Programmable in 0.1 V steps.



# Remote controlled CLR Bridge CT10R

The Cost-Saving Solution for Automatic  
Production Test and Sorting Purposes



- **Measuring Frequencies:** 100/120 Hz and 1 kHz
- **Accuracy:** 0.05 % over the main ranges
- **Measuring Speed:** max 500 ms at 100/120 Hz, max 100 ms at 1 kHz
- **Automatic Measurements of Impedance and Loss Factor**
- **Input Protection:** 2 Joule up to 0.6 kV
- **Automatic Range Selection**
- **Jig-zeroing Routine up to 25 pF**
- **Direct or Deviation Values**
- **9 Limits on Primary Parameter**
- **1 Limit on Secondary Parameter**
- **Open Collector Binning Output**
- **IEEE 488 and RS232C Bus Interface for Full Control and Data Readout**
- **PC Control Program on 5.25" Diskette included**
- **Housed in 19" Cabinet for Rack Mounting**
- **Up to 1.5 m Cables to External Test Fixture**

The Danbridge CT10R is a fast and accurate CLR-Bridge offering the Component Manufacturers the speed, accuracy and reliability required to test and sort a wide spectrum of passive components. The CT10R is in particular well-suited for use in a remote controlled, integrated test system.

The instrument has IEEE 488 and RS232C interfacing as standard and is fully controllable in "Talker/Listener" mode.

A control program on a 5.25" diskette for an IBM® compatible PC is included as standard too.

Up to 9 limits on the primary parameter (f.inst. C) and one limit on the secondary parameter (f.inst. tan d) can easily be programmed.

Limit outputs for binning are open collectors (relay or lamp drivers) with a positive-common protection rail.

Four BNC sockets on the front panel will accept up to 1.5 meter long interconnections to an external 4-terminal test fixture.

For manual operation an optional 4-terminal test fixture, JIG 20, can be supplied.

The CT10R is an attractive, cost-saving solution for automatic production lines and is supplied in a 19" cabinet for rack mounting.

Sockets for IEEE and RS232C are located on the rear panel and are used for remote control from a PC or a controller.

Several CT10Rs can be networked with at single controller.

## Reliability and Serviceability

The CT10R is microprocessor-controlled which, among other advantages, makes the instrument self-calibrating. Besides that, the reference components in the bridge circuit are extremely stable with respect to long-term drift.

## Effective Input Protection

The CT10R is equipped with an effective input protection of 2 Joule up to 0.6 kV, i.e. 100 V at 400  $\mu$ F, 500 V at 16  $\mu$ F or 600 V at 10  $\mu$ F.

If such a capacitor by accident has not been discharged before reaching the test fixture, no damage to the CT10R will occur. Consequently a costly production stop can be avoided.

## Why is High Accuracy so Important?

If you are producing components with  $\pm 1$  % tolerance using a bridge with 0.25 % accuracy, you will have to set the limits to  $\pm 0.75$  % in order to compensate for the measuring error. Consequently your production line will reject some components, which actually are within the specifications. The CT10R has an accuracy of 0.05 % over the main range.

This means that you can set your limits to  $\pm 0.95$  % and reduce the loss of non-faulty components considerably.

## Test Fixture

A 4-terminal (Kelvin) test fixture JIG 20 can be supplied in case that the CT10R should be used as a bench instrument.

The 4-terminal test fixture will effectively cancel all errors due to contact resistance and connecting cable impedance.

The JIG 20 has gold plated contacts, and up to 1.5 meter long cables can be connected between the test fixture and the CT10R without any deterioration of the accuracy.



# Remote controlled CLR Bridge CT10R

The Cost-Saving Solution for Automatic  
Production Test and Sorting Purposes

## Specifications

### Parameters

C (Capacitance)  
L (Inductance)  
R (Resistance)  
D (Dissipation Factor)  
Q (1/D)  
G (Conductance)  
 $\Delta$  (Deviation) on C, L or R

### Parameter Combinations

Automatically selected:

$C_s$  with D  
 $L_s$  with Q  
 $R$  with  $C_p$  or  $L_s$

Selected from controller:

$C_s$  with D, Q or  $R_s$   
 $C_p$  with D, Q,  $R_p$  or G  
 $L_s$  with D, Q or  $R_s$   
 $L_p$  with D, Q,  $R_p$  or G  
 $\Delta$  in absolute value  
 $\Delta$  in %

### Limits

Absolute Limits,  
Deviation Limits in:  
Absolute Value,  
Percentage Value,  
Bin Number.  
Separate Limit for D or Q.

### Measuring Frequencies

100/120 Hz and 1 kHz  
crystal controlled.

### Automatic Control

Range setting fully automatic.  
5 ms per step.  
Auto-zeroing from the bus interface.

### Input Protection

Safe limits.  
2 Joule up to 600 V.

### Measuring Voltages

1 V rms down to 40  $\Omega$ .  
0.1 V from 40  $\Omega$  to 4  $\Omega$ , linear  
reduction at lower impedance values.

### Input/Output

Front panel: 4 BNC sockets and  
RS232C socket.  
Rear Panel: 3 D-connectors  
SC1 – SC2 – SC3.

### SC1: Limit outputs.

Open collector, each rated at 60 V/  
0.4 A max 0.5 W. Built-in diode  
protection for relay coils (common +  
terminal). Bin 0-9 and High/Low  
(for secondary parameter).  
Bias: External DC supply, max 3 V.

### SC2: IEEE-488.

GPIO for IEEE bus interface.

### SC3: RS232C input and output, Baud rate max 9600, selectable.

Trigger input,  
contact closure to ground.  
End of measurement,  
TLL output, active low.  
Connector duplicated on front panel.

### Built-in Battery Back-up:

Memory Retention, min. 5 years.

### Temperature Range

Operating 15°C to 35°C,  
Storage -40°C to 75°C.

### Dimensions

H 90 mm, W 435 mm, D 280 mm.

### Weight

4 kg (net), 6 kg (shipping).

### Power Requirements

110-240 V AC 50-60 Hz,  
single phase 30 VA.

### Options

4-Terminal test fixture Jig 20.

## Accuracy

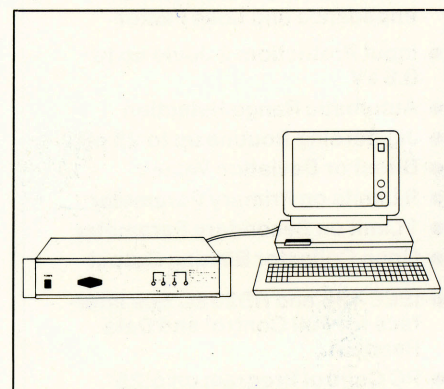
Test Frequency:	100/120 Hz	1 kHz	
	Range	Range	Accuracy
C	100pF – 300 $\mu$ F > 300 $\mu$ F –	0.1pF – 3 $\mu$ F 3 $\mu$ F – 30 $\mu$ F > 30 $\mu$ F	0.05 % or 1 digit 0.1 % or 2 digits Linear increase with capacitance value from 0.1 % limit.
L	10mH – 1000H 10 $\mu$ H – 10mH	10mH – 1000H 1mH – 10mH 0.1 $\mu$ H – 1mH	0.05 % or 1 digit 0.2 % or 2 digits 0.2 % or 5 digits
R	0.01 $\Omega$ – 10 $\Omega$ 10 $\Omega$ – 5M $\Omega$ 5M $\Omega$ – 100M $\Omega$	0.01 $\Omega$ – 10 $\Omega$ 10 $\Omega$ – 0.5M $\Omega$ 0.5M $\Omega$ – 100M $\Omega$	2 digits 0.05 % of 1 digit, linear increase with resistance to 1 % at 100M $\Omega$ .
D (with C)	500pF – 30 $\mu$ F 30 $\mu$ F – 300 $\mu$ F 300 $\mu$ F – 3000 $\mu$ F	50pF – 3 $\mu$ F 3 $\mu$ F – 30 $\mu$ F 30 $\mu$ F – 300 $\mu$ F	0.0005 0.002 0.005
Q (with L)			0.1 % + 0.05 % $\times$ Q
Speed of Measurement	max 500 ms	max 100 ms	

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# CLR TESTER CT30

## For high speed and very accurate automatic production testing and sorting

### Measuring Speed:

From trig to end-of-measurement max. 25 ms.

Dual frequency measurement max. 50 ms.

For averaging measurements  $N \times 20$  ms + 5 ms where N is the selected number of measurements per average value. N: 2 – 99.

### Length of Measuring Cables:

Max. 5 m between Bridge Module and Main Unit. 3 m supplied as standard.

Max. 1.5 m between Bridge Module and Test Fixture (Jig). 1 m special cable supplied as standard.

### Input Protection:

2 Joule up to 1 kV.

### MEASURING MODES:

#### Absolute Mode:

Absolute measurements with automatic parameter detection.

#### Delta Mode:

The nominal value can be entered either by the keyboard or by measuring a standard component.

#### Absolute Delta:

Deviation from nominal in absolute value.

### Relative Delta:

Deviation in per cent from nominal value (resolution 0.01 %).

### Bin Sorting:

Up to 12 limits on primary parameter and up to 4 limits on secondary parameter.

### Bias Voltage:

Up to 3 V DC on Generator Terminal, set in 0.1 V steps.

### Interface (rear panel):

- IEEE 488 with »Talker only« and »Talker/Listener« modes.
- True sub-set of Standard-protocol.
- RS232C with max. baud-rate 19200.
- Full two-way control/output.
- Limit outputs: Open collectors (relay drivers) with + common protection rail.
- Programmable bin/channel output and common reject pin.
- Control socket:
  - TRIG (contact closure in).
  - MEASURE END Signal.
  - TRIG READY Signal.
  - FAULT Signal.

### Key Lock:

3 positions:  
OFF – LOCK – UNLOCK.

### Built-in Battery:

Memory Retention, min. 30 days.

### Dimensions (approx.):

CT30: 510 mm W, 130 mm H, max. 500 mm D.

CT30B: 185 mm W, 35 mm H, 195 mm D.

### Temperature range

Operating 15°C to 35°C

Storage –40°C to 75°C

### Weight (approx.):

CT30: 8 kg.

CT30B: 1 kg.

### Power Requirements:

110 – 240 Volt AC, 50 – 60 Hz, single phase.

### OPTIONS:

#### Test Fixture:

A 4-terminal (Kelvin) test fixture JIG 30 can be supplied in case that the CT30 should be used as a bench instrument. The 4-terminal test fixture will effectively cancel all errors due to contact resistance and connecting cable impedance. The JIG30 has gold plated contacts.

#### Cables:

Cables to your specified length for connections between the Main Unit and the Bridge Module and between the Bridge Module and to the Test Fixture can be supplied. The lengths must not exceed 5 m and 1.5 m respectively.

## ACCURACY

TEST FREQUENCY:	1 kHz	10 kHz	100 kHz			
	Range	Range	Range	Accuracy		
	0 – 40 pF	0 – 4 pF	0 – 1 pF	C	± 0.5% ± 1 digit	D
C	40 pF – 4 µF	4 pF – 4 µF	1 pF – 1 µF		± 0.05% ± 1 digit	± .0002
	4 µF – 400 µF	4 µF – 40 µF	1 µF – 10 µF		± 0.1% ± 1 digit	± .0007
				L: ± 0.1% ± 1 digit		
L	1 µH – 100 H	0.1 µH – 10 H	0.1 µH – 1 H	Q: ± (0.1% + 0.05% × Q) ± 1 digit		
		0.4 Ω – 40 Ω		± 0.1% ± 1 digit		
R (all frequencies)		40 Ω – 4 MΩ		± 0.05% ± 1 digit		
		4 MΩ – 400 MΩ		± 0.5% ± 1 digit		

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# CLR TESTER CT30R



A cost-saving solution with high speed and accuracy for automatic production and sorting



## CLR TESTER CT30R

- 3 MEASURING FREQUENCIES  
100 kHz, 10 kHz and 1 kHz
- OVERALL ACCURACY:  
BETTER THAN 0.05%
- MEASURING TIME: 25 ms
- 12 + 4 Limits for Binning
- Automatic Measurement of  
Impedance and Loss Factor
- Accuracy on tan delta down to  
 $2 \times 10^{-4}$
- Comprehensive Jig-zeroing  
Facility
- Facilities for Dual Frequency  
Measurement
- Direct or Deviation Readings
- Nominal Value for Deviation  
Measurements programmed or  
inserted by External Standard
- Built-in Battery for Memory  
Retention
- 19" Cabinet for Rack Mounting or  
in Bench Version
- Supplied with Blank Front Panel  
with Connector for Remote  
Control.
- IEEE 488 and RS232C Bus  
Interface as Standard for Full  
Control and Data Readout
- Separate Bridge Unit for easy  
Mounting close to the Test  
Fixture
- Up to 5 m Cables between the  
Main Unit and the Bridge Unit

## GENERAL

This version of the CT30 is a cost saving solution for automatic production lines.

The CT30R has the same specifications and features as the standard CT30, except for the displays and the keyboard, which are often not needed in automatic production.

The CT30R is a very fast, highly accurate CLR Bridge particularly suited for modern, automatic sorting equipment used in the production of various capacitors.

The 3 measuring frequencies are 100 kHz, 10 kHz and 1 kHz. The speed is 25 ms from trig to end of measurement.

The accuracy of the CT 30R is better than  $\pm 0.05\% \pm 1$  digit on the primary parameter (C, L or R) and down to  $.0002 \pm 1$  digit on tan delta.

The CT 30R consists of a Bridge Unit (CT30B) and a Main Unit connected by means of max. 5 m long cables.

The high accuracy is achieved by mounting the Bridge Unit as close as possible to the test fixture (jig).

A jig-zeroing routine will compensate for parallel stray impedance and also for impedance to ground.

Sockets for IEEE 488 and RS232C are located on the rear panel and are used for remote control via the bus-interface. Several CT30R can be networked with a single controller. For set-up and service purpose a control unit, CU2, is available. Measurements can be taken as direct or as deviation from a nominal value, which

is inserted from a remote controller. A Standard can also be used to establish the nominal value.

Up to 12 limits on the primary parameter and 4 on the secondary parameter can be programmed.

A built-in battery will provide retention of the data in memory for at least 30 days if the AC-mains fails or is turned off.

IEEE 488 and RS232C Bus Interfaces are built-in as standard.

The CT30R has facilities for dual frequency measurement of loss factor (tan delta) and capacitance, thereby saving an extra test station on the production line.

## SPECIFICATIONS

### Measured Parameters:

Primary parameter: C, L, R, in series or parallel. Secondary parameter: For C or L: Q, d, Rs, Rp or Gp.  
For R: Ls or Cp is automatically selected.

### Measuring Frequencies:

100 kHz, 10 kHz and 1 kHz with a facility for dual frequency measurement.

### Measuring Voltage:

1 V RMS up to  $10 \mu\text{F}$  at 1 kHz  
1 V RMS up to  $1 \mu\text{F}$  at 10 kHz  
1 V RMS up to  $.1 \mu\text{F}$  at 100 kHz  
Above: Linearly decreasing with the impedance.  
Programmable in 0.1 V steps.



# CLR TESTER CT 30R

## A cost-saving solution with high speed and accuracy for automatic production and sorting

### Measuring Speed:

From trig to end-of-measurement max. 25 ms.

Dual frequency measurement max. 50 ms.

For averaging measurements  $N \times 20$  ms + 5 ms where N is the selected number of measurements per average value. N: 2 – 99.

### Length of Measuring Cables:

Max. 5 m between Bridge Module and Main Unit. 3 m supplied as standard.

Max. 1.5 m between Bridge Module and Test Fixture (Jig). 1 m special cable supplied as standard.

### Input Protection:

2 Joule up to 1 kV.

### MEASURING MODES:

#### Absolute Mode:

Absolute measurements with automatic parameter detection.

#### Delta Mode:

The nominal value can be entered either by the keyboard or by measuring a standard component.

#### Absolute Delta:

Deviation from nominal in absolute value.

#### Relative Delta:

Deviation in per cent from nominal value (resolution 0.01 %).

#### Bin Sorting:

Up to 12 limits on primary parameter and up to 4 limits on secondary parameter.

### Bias Voltage:

Up to 3 V DC on Generator Terminal, set in 0.1 V steps.

### Interface (rear panel):

- IEEE 488 with »Talker only« and »Talker/Listener« modes.
- True sub-set of Standard-protocol.
- RS232C with max. baud-rate 19200.
- Full two-way control/output.
- Limit outputs: Open collectors (relay drivers) with + common protection rail.
- Programmable bin/channel output and common reject pin.
- Control socket:
  - TRIG (contact closure in).
  - MEASURE END Signal.
  - TRIG READY Signal.
  - FAULT Signal.

### Key Lock:

3 positions:  
OFF – LOCK – UNLOCK.

### Built-in Battery:

Memory Retention, min. 30 days.

### Dimensions (approx.):

CT30R: 510 mm W, 130 mm H, max. 500 mm D.

CT30B: 185 mm W, 35 mm H, 195 mm D.

### Temperature range

Operating 15°C to 35°C

Storage -40°C to 75°C

### Weight (approx.):

CT30R: 8 kg.

CT30B: 1 kg.

### Power Requirements:

110 – 240 Volt AC, 50 – 60 Hz, single phase.

## OPTIONS:

### CU2 Control Unit:

The CU2 Control Unit is fitted with a dust-proof, sealed keyboard and two displays. It is housed in a light-weight, box fitted with a 1.5 m control cable, which plugs into a socket on the front panel of the CT30R.

The control unit is powered from the CT30R.

When the test program has been entered and checked, the control unit can be disconnected and used for set-up or control of another test station equipped with the CT30R.

Dimensions: 420 mm W, 135 mm H, 45 mm D. Weight: 1.3 kg.

### PC Control Software:

A PC control program on 5.25" diskette is available.

### Test Fixture:

A 4-terminal (Kelvin) test fixture JIG 30 can be supplied in case that the CT30 should be used as a bench instrument. The 4-terminal test fixture will effectively cancel all errors due to contact resistance and connecting cable impedance. The JIG 30 has gold plated contacts.

### Cables:

Cables to your specified length for connections between the Main Unit and the Bridge Module and between the Bridge Module and to the Test Fixture can be supplied as an option. The lengths must not exceed 5 m and 1.5 m respectively.

## ACCURACY

TEST FREQUENCY:		1 kHz	10 kHz	100 kHz		
		Range	Range	Range	Accuracy	
C		0 – 40 pF	0 – 4 pF	0 – 1 pF	C ± 0.5% ± 1 digit	D ± .0010
		40 pF – 4 μF	4 pF – 4 μF	1 pF – 1 μF	± 0.05% ± 1 digit	± .0002
		4 μF – 400 μF	4 μF – 40 μF	1 μF – 10 μF	± 0.1% ± 1 digit	± .0007
					L: ± 0.1% ± 1 digit	
L		1 μH – 100 H	0.1 μH – 10 H	0.1 μH – 1 H	Q: ± (0.1% + 0.05% × Q) ± 1 digit	
					± 0.1% ± 1 digit	
R (all frequencies)					± 0.05% ± 1 digit	
					± 0.5% ± 1 digit	

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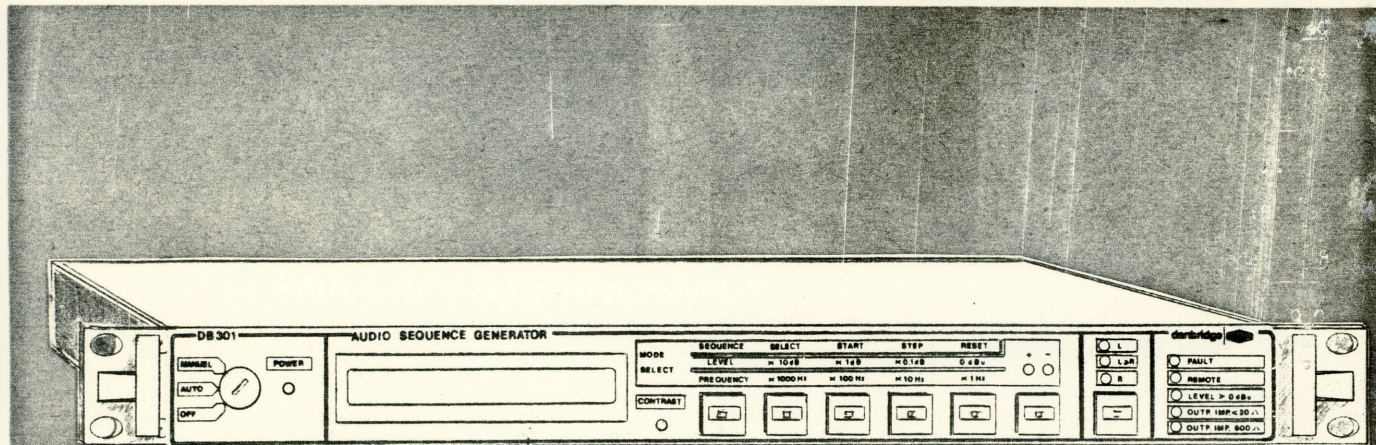
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# DB301

## AUDIO SEQUENCE GENERATOR



- \* Automatic transmission of pre-programmed Audio Test Sequences
- \* Automatic synchronization with FSK signalling
- \* Compliance with CCITT 0.33 Standard for Transmission Link Testing
- \* Remote Operation through RS232
- \* General Purpose Audio Generator through manual operation from keyboard
- \* Balanced Dual Channel loop-through facility
- \* Difference Frequency Distortion Signal
- \* Distortion Figure better than -86 dB
- \* Level Accuracy better than 0.05 dB
- \* Compact 1 HE high 19" rack design

The DB301 Audio Sequence Generator is designed for use in Broadcasting Environments for Automatic and Manual test of Audio Transmission Links, where Audio Analyser and Generator are placed at different locations. The Pre-programmed Test Sequences include customized test sequences and the internationally standardized CCITT 0.33 tests.

The unit features automatic loop-through of the input signal in all situations, except when test signals are transmitted. It is of a very compact design, convenient for rack mounting in for example Outside Broadcast Vehicles.

### General Purpose Audio Generator.

As the most modern digital technology has been used in the design of the DB301, it is possible to generate any Audio Frequency with 1 Hz steps from 20 Hz to 20 kHz with quartz crystal accuracy.

This feature is useful in fault-finding and repair, where the generator is used manually. The frequency or level generated can be read out from the built-in LCD display.

Also it is possible to step through the pre-programmed test sequences manually, in which case the test step number may be shown in the display.



### Key Protection.

A three position key switch prevents accidental misuse: OFF position with loop-through, AUTO position for choice and start of a test sequence, and MANUAL for full operation including stepping through a test sequence, change of level and frequency.

### Remote Operation.

Through the standard fitted RS232 Interface, the unit can be remote controlled, for example for testing Contribution Lines.

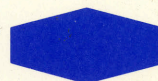
The RS232 makes the use of telephone lines possible for the control of the instrument with help of standard modems.

### KEY SPECIFICATIONS:

Level Accuracy at 0 dBu:	+/- 0.05 dB
TEST Level Range (int. adjustable):	-6 dBu to +6 dBu
Output Level Range:	-12 dB to +15 dB rel. TEST
Level Resolution:	0.1 dB
Output Level Capability:	+15 dBu
Frequency Range:	20 Hz - 20 kHz
Resolution:	1 Hz
Output Impedance:	600 ohm or < 20 ohm selectable
Harmonic Distortion:	< -86 dB
Difference Frequency Signal:	14500 Hz & 14600 Hz
Input Connectors:	XLR-3 female
Output Connectors:	XLR-3 male
FSK Signalling:	According to CCITT 0.33

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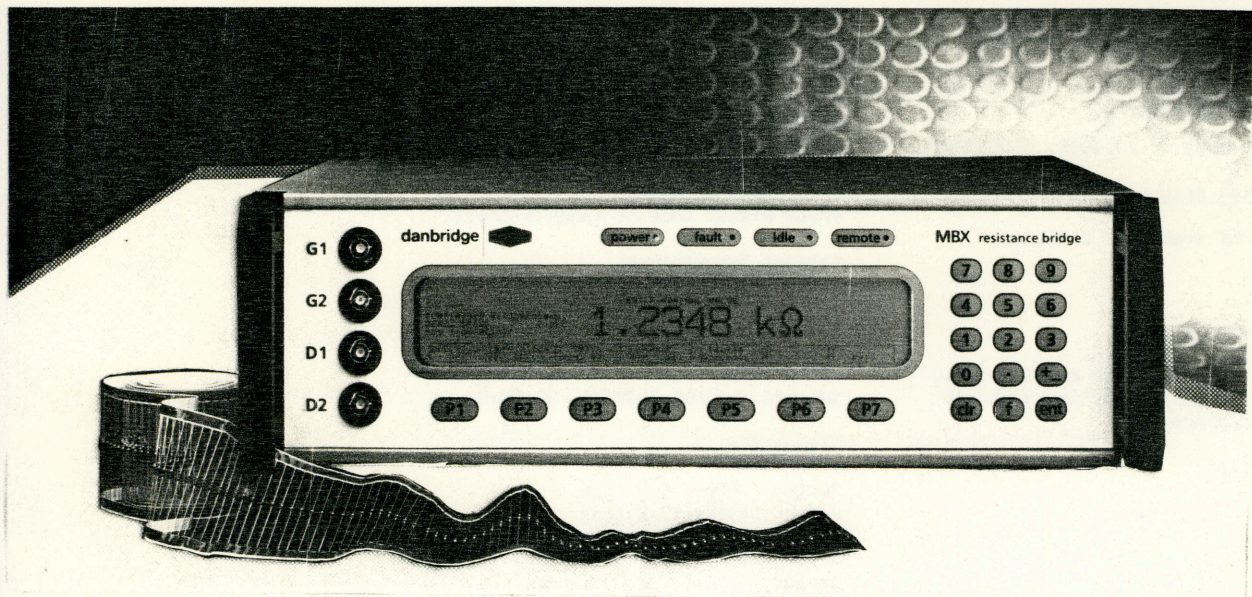


# MBX

Type Designation  
changed to DB501



## HIGH SPEED RESISTANCE BRIDGE



- \* Measuring Speed: < 10 msec
- \* 0.01% Accuracy
- \* Hum Rejection Mode
- \* Resistance Range 10 mΩ - 200 MΩ
- \* Absolute or Deviation Measurements
- \* 12 Programmable Limits
- \* IEEE 488 and RS232C Standard Fitted
- \* Guarded, 4 Terminal Connections

### Easy Operation.

With the MBX, Danbridge introduces a new line of user friendly instruments. The MBX is easily programmable from the keyboard with soft key driven menu guiding via a large alphanumeric LCD display. The keyboard is sealed and dustproof for use in tough production environments.

For Deviation measurements, nominal resistance values can be entered from the keyboard or via one of the standard fitted bus interfaces, IEEE 488 and RS232C.

The 19" cabinet is available in a benchtop version as well as a rack mountable version. The new cabinet design features access to all electrical parts after easy dismounting.

### High Speed.

The MBX is a DC Resistance Bridge designed for use where high throughput and simultaneous high accuracy is a mandatory requirement.

In the trig mode a measurement takes less than 10 msec in the range from 1 Ω to 10 MΩ including display and limit outputs.

### High Accuracy.

The accuracy of the MBX is 0.01% in the range from 10 Ω to 10 MΩ. For resistances less than 100 mΩ, the accuracy is 0.1 mΩ, and at 1 GΩ the accuracy is 0.5%.

In production the high accuracy of the MBX reduces the rejection of good components: When testing, the pass/reject limits have to be set to the specification of the resistor less the accuracy of the measuring device. Better accuracy therefore results in less waste.



## SPECIFICATIONS:

MODE A: Deviation from nominal value.

MODE B: Direct display of resistance value.

MODE A:

### Resistance Range and Nominal Value:

Inserted from the keyboard or by remote control

### Deviation Range:

$\pm 10\%$  reading to 19.999%,  $\pm 100.00\%$ .

### Deviation Accuracy:

$\pm (0.2\% \text{ of reading} + 2 \text{ digits})$ .

MODE B:

### Resistance Range:

0.1  $\Omega$  to 200 M $\Omega$  direct reading in 10 decade ranges set by the keyboard or auto-range.

### Resolution:

0.01% of each range.

MODE A & B:

### Measuring Speed:

Continuous: 3 measurements per second.

Trig mode: In the range 1  $\Omega$  - 10 M $\Omega$  better than 10 msec, and better than 50 msec in the range 0 - 0.1  $\Omega$ , including display and limit outputs.

Special 50/60 Hz hum rejection modes: 25 msec.

### Limits:

12 limits are provided with display indication and output signals for LOW, BIN Number and HIGH. Channel limits can be selected.

### Interface (rear panel):

IEEE 488 with "talker only" and "talker/listener" modes. True sub-set of Standard-protocol. RS232C with Baud rate up to 19200 Baud.

Full two-way control/output.

Limit outputs: Open collectors with common protection rail, programmable bin/channel output and common reject pin.

Control I/O:

TRIG (contact closure or opto-coupler),

MEASURE Signal,

TRIG READY Signal,

DATA READY Signal,

FAULT Signal (out of range signal).

### Ambient Temperature:

10° - 40° C.

### Power:

90-130 and 200-260V AC, 50-60 Hz.

### Dimensions:

Height: 140mm/ 5.8 inch.

Width: 438mm/17.2 inch.

Depth: 360mm/14.2 inch.

### Weight:

9.5 kg / 21 lbs

### Accessories Supplied:

Line power connector.

Four 1.5 m coax cables with BNC connectors.

Two output connectors.

Brackets for 19" rack-mounting.

### Options:

Test jig with 0.5 m leads and test fixtures for axial and radial leads.

Opto-coupler for limit output.

Resistance Range $\Omega$	Deviation A	Deviation A	Direct B	Accuracy %	
	10 % Range Test Voltage	100 % Range Test Voltage	Constant Current	A	B $\pm 1 \text{ Digit}$
0-0.1	0-20 mV	0-8 mV	80 mA	0.1 m $\Omega$	0.2 m $\Omega$
0.1-1	20 mV	8 mV	25 mA	0.1	0.2
1-10	60 mV	25 mV	8 mA	0.05	0.1
10-100	200 mV	80 mV	2.5 mA	0.01	
100-1 k	600 mV	250 mV	0.8 mA		
1 k-10 k	2 V	0.8 V	250 $\mu$ A		
10 k-100 k	6 V	2.5 V	80 $\mu$ A		
100 k-1 M	20 V	8 V	8 $\mu$ A		
1 M-10 M			0.8 $\mu$ A	0.1	0.1
10 M-200 M			80 nA	0.5	0.2
200 M-1100 M					

Max. dissipation in unknown: 4 mW.

Long Term Accuracy %			
Resistance Range $\Omega$	Deviation A		B
	1 year	3 year	3 year
0-0.1	0.1 m $\Omega$	0.2 m $\Omega$	1 m $\Omega$
0.1-1	0.1	0.1	0.2
1-10	0.05	0.05	0.1
10-100	0.01	0.02	
100-1 k			
1 k-10 k			
10 k-100 k			
100 k-1 M			
1 M-10 M			
10 M-100 M	0.1	0.1	0.2
100 M-1000 M	0.5	0.5	
Temp. Range	25° $\pm$ 2° C		15° - 35° C

ALL SPECIFICATIONS SUBJECT TO CHANGES WITHOUT PRIOR NOTICE

# danbridge as

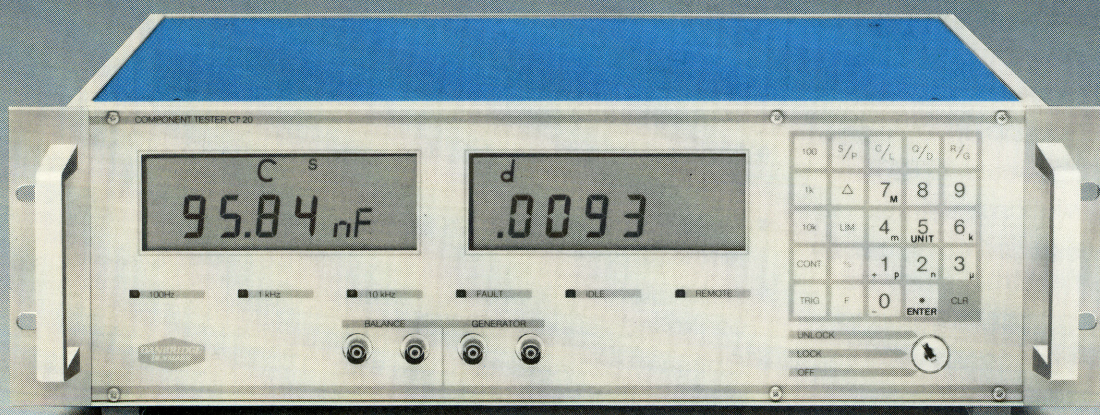
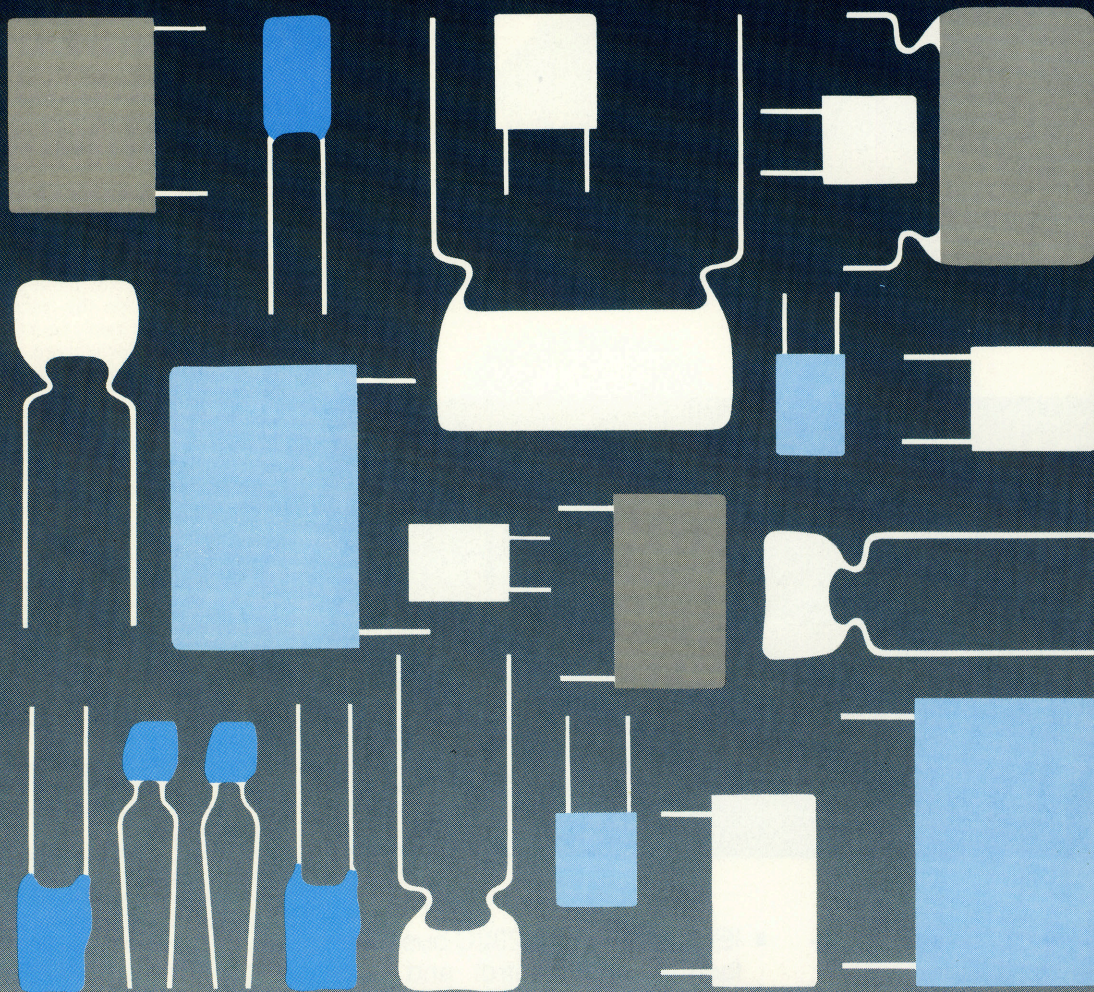


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# HIGH SPEED AND ACCURATE PRODUCTION TESTING OF PASSIVE COMPONENTS



## CLR TESTERS CT20 AND CT20R



- **3 MEASURING FREQUENCIES: 10 kHz, 1 kHz and 100 Hz**
- **BASIC ACCURACY: 0.05 %**
- **MEASURING SPEED: 50 ms at 10 kHz and 1 kHz.**

#### GENERAL

The Danbridge CT20 and CT20R are very accurate, high-speed, automatic RCL-Bridges.

Microprocessor-controlled and programmable these two precision instruments will give component manufacturers and users the speed, accuracy and reliability required to test a wide spectrum of passive components.

Primarily developed for automatic production the two instruments are also excellent for incoming inspection, Q.C., component design and evaluation.

The CT20R is in particular well-suited for use in a remote controlled, integrated test system.

Both instruments have IEEE 488 and RS232C interfacing as standard, and they are fully controllable in "Talker/Listener" mode.

A rechargeable battery will provide retention of memory data for at least 30 days, should the AC mains fail or accidentally be turned off.

The three measuring frequencies 10 kHz, 1 kHz and 100 Hz are crystal-controlled.

A unique feature is the dual frequency measuring mode, which allows the user to measure f. inst. capacitance and loss factor at two different frequencies almost simultaneously.

Up to 12 limits on the primary parameter (f. inst. C) and 4 limits on the secondary parameter (f. inst. tan  $\delta$ ) can easily be programmed.

Limit outputs for binning are open collectors (relay or lamp drivers) with a positive - common protection rail.

Four BNC sockets on the front panel will accept up to 2.5 meter long interconnections to an external 4-terminal test fixture. For manual operation an optional 4-terminal test fixture JIG 4 can be supplied.

#### PRINCIPLES (Fig. 1)

The CT20 is a 4-terminal auto-balancing bridge. A high-gain, wideband amplifier establishes a balancing current through a high-precision reference resistor.

This current is exactly the same as the measuring current through the component under test.

The voltages across the reference resistor and the unknown component are sensed by a high impedance detector system and resolved in two phases relative to a common reference signal.

The measuring signal is derived directly from the reference signal.

The outputs from the detector, i.e. the four voltage-vectors, are converted by a 16-bit A/D converter and read by the microprocessor. This calculates the value of the unknown component from these vectors and the value of the reference resistor and the selected measuring frequency.

Thus only the relative values of the bridge vectors are important, and by measuring them with the same detector, the offsets are cancelled.

This is the basis of the accuracy of the system. Besides doing calculations, the microprocessor controls the bridge and the interface system.

#### CT20R REMOTE CONTROLLED UNIT (Fig. 2)

This new version of the CT20 is an attractive, cost-saving solution for automatic production lines. The CT20R has the same specifications and features as the standard CT20. The displays and the keyboard are normally not needed in automatic production.

Consequently they have been replaced by a blank front panel.

The CT20R is supplied in a 19" cabinet for rack mounting.

Sockets for IEEE 488 and RS232C are located on the rear panel and are used for remote control from a PC or a controller. (Fig. 2).

Several CT20R can be networked with a single controller. For manual set-up and service purposes a separate control unit CU1 is available.

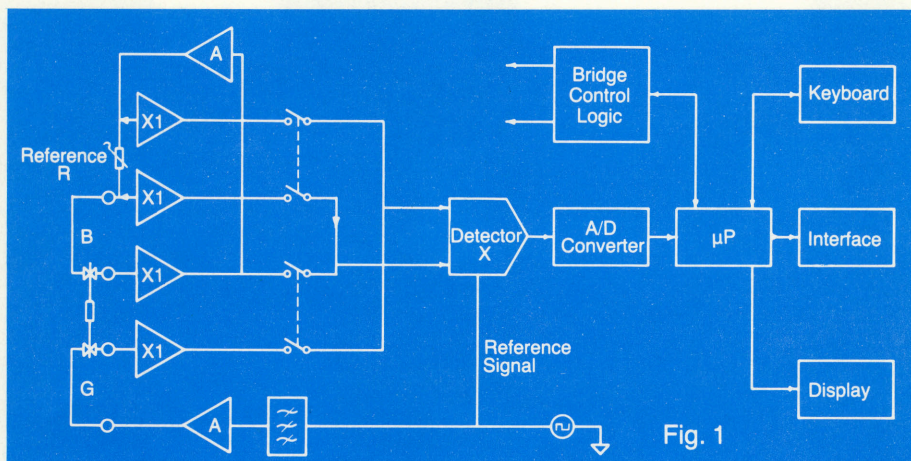


Fig. 1

- Automatic measurements of impedance and loss factor.
- Dual frequency measurements.
- Input protection: 2 Joule up to 1 kV.
- Automatic range selection.
- Jig-zeroing routine up to 25 pF.
- Two 4-digit readouts (CT20).
- Direct or deviation readings.
- Nominal value for deviation by keyboard or external standard.
- 12 limits on primary parameter.
- 4 limits on secondary parameter.
- Open collector binning output.
- DC bias up to 3.0V in 0.1V steps.
- IEEE 488 and RS232C bus interface for full control and data readout.
- Battery back-up for memory retention.
- Dust-proof keyboards with sealed membrane switches.
- Housed in 19" cabinet for rack mounting.
- Up to 2.5 m cables to an external test fixture.
- Available in a low-cost, remote controlled version, CT20R.
- Optional control unit CU1 with displays and keyboard.



## EFFECTIVE INPUT PROTECTION

Both versions of the CT20 are equipped with an effective input protection of 2 Joule up to 1 kV. For example if a capacitor of 4  $\mu$ F has been charged to 1000 Volt and, by accident, has not been discharged before reaching the test fixture, no damage to the CT20 will occur. Consequently a costly production stop is avoided.

## DUAL FREQUENCY MEASUREMENTS

Measuring tan d at 10 kHz and the capacitance at one of the lower frequencies in just one operation will cut down your measuring time and save you an additional test station equipped with a loss factor meter.

## KEYBOARD LOCK-OUT

Electronic as well as mechanical locks are provided as standard.

The keyboard lock will prevent unauthorized persons from spoiling the set-up and data stored in the memory.

## CONTROL SOFTWARE

A number of routines are incorporated in the CT20 and CT20R control software. These routines can of course also be called via the bus interface.

Below are some of the routines listed with the corresponding key-sequences.

**[F2] [C]** Bias set and bias inspection: Positive or negative bias up to 3 Volt in 0.1 Volt steps.

**[F] [UM] [X]** Primary, secondary or both bin numbers can be displayed for limit sorting.

**[F] [C/L]** Activate LC-lock: That means keeping the C or L parameter in the left-hand window as primary parameter – a useful feature when sorting small inductors with high winding resistance ( $Q < 1$  at 1 kHz) or large electrolytic capacitors with high loss factor ( $d > 1$  at 100 Hz).

A similar R-lock is also included.

**[F] [3] [0]** Blanking of Displays: One or both displays can be blanked if they f.inst. are distracting the operator.

**[F] [A] [D]** Activate/Deactivate Deviation Measurement.

**[F] [A] [C]**

**[F] [UM] [L]** Activate/Deactivate Limit-set.

**[F] [UM] [R]**

**[F] [UM] [9]** Recover Erased Limit Set: To be used if the limit-set accidentally has been deleted.

**[F] [UM] [X]** Inspection and Editing of Limits: To be used to check or change limits.

**[F] [freq] [S]** Secondary Frequency Set: Used for dual frequency measurements.

**[F] [0] [1]** Reload: Used for bus control set-up.

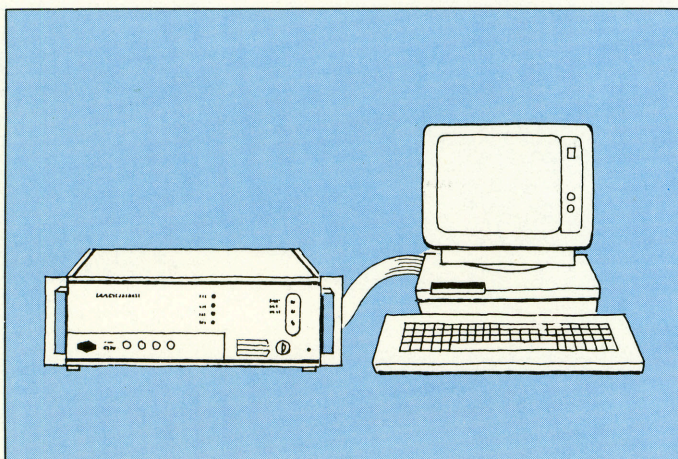


Fig. 2

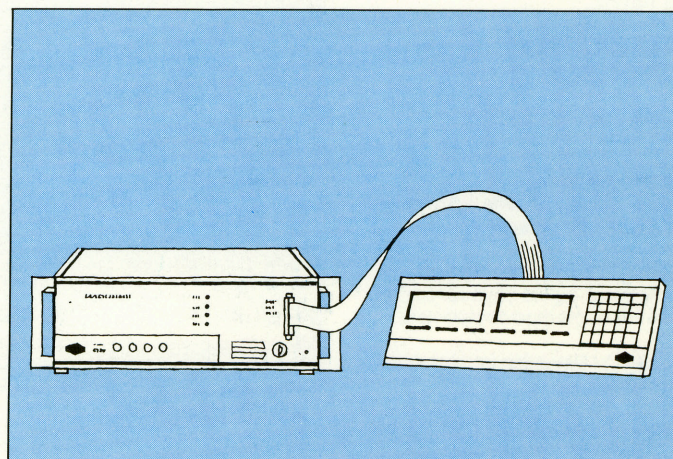


Fig. 3

## CU1 CONTROL UNIT (Fig. 3)

is another solution for remote control of the CT20R. The CU1 control unit is fitted with a dust-proof, sealed keyboard and two displays. It is housed in a light-weight, rugged box fitted with 1.5 m long control cable, which plugs into a socket on the front of the CT20R. The control unit is powered from the CT20R. When the test program has been entered and checked, the control unit is disconnected and used for set-up or control of another test station equipped with the CT20R.

## RELIABILITY AND SERVICEABILITY

The CT20 is microprocessor-controlled which, among other advantages, makes the instrument self-calibrating. Besides that, the reference components in the bridge circuit are extremely stable with respect to long-term drift.

These facts make periodical calibration of the CT20 unnecessary.

The CT20 has self-check on the RAM for RAM-errors or discharged back-up battery. A built-in test programme will on command check the main functions.

## WHY IS HIGH ACCURACY SO IMPORTANT?

If you are producing components with  $\pm 1\%$  tolerance using a bridge with 0.25 % accuracy, you will have to set the limits to  $\pm 0.75\%$  in order to compensate for the measuring error. Consequently your production line will reject a lot of components, which actually are within the specifications.

The CT20 and CT20R have an accuracy of 0.05 % in the main range.

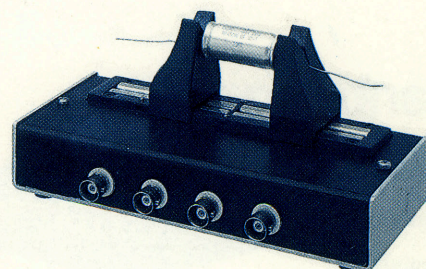
This means that you can set limits to  $\pm 0.95\%$  and reduce the loss of non-faulty components considerably.

## TEST FIXTURE

A 4-terminal (Kelvin) test fixture JIG 4 can be supplied in case that the CT20 should be used as a bench instrument.

The 4-terminal test fixture will effectively cancel all errors due to contact resistance and connecting cable impedance.

The JIG 4 has gold plated contacts, and up to 2.5 m long cables can be connected between the test fixture and the CT20 without any deterioration of the accuracy.





## SPECIFICATIONS

### Measured parameters

Primary parameter: C, L, R in series or parallel.

Secondary parameter: For C or L:

Q, D, Rs, Rp, Gp.

For R: Ls or Cp automatically selected.

### Measuring frequencies

100 Hz, 1 kHz, 10 kHz  $\pm 0.01\%$   
(crystalcontrolled) with a facility for automatically measuring the loss factor (or ESR) at 10 kHz and the capacitance at 1 kHz or 100 Hz.

### Measuring voltage

1 VRMS up to 50  $\mu$ F at 100 Hz  
1 VRMS up to 5  $\mu$ F at 1 kHz  
1 VRMS up to .5  $\mu$ F at 10 kHz  
0.2 VRMS up to 500  $\mu$ F at 100 Hz  
0.2 VRMS up to 50  $\mu$ F at 1 kHz  
0.2 VRMS up to 5  $\mu$ F at 10 kHz  
Above: Linearly decreasing with impedance.

### Measuring speed

From "Trig" to "End of Measurement"  
50 ms at 1 kHz and 10 kHz (110 ms for 1 kHz + 10 kHz loss), max. 250 ms at 100 Hz.

### Measuring accuracy

Basic accuracy: 0.05% + 1 digit.

### External measuring cables

Up to 2.5 m.

### Measuring modes

Absolute measurements with automatic parameter detection.

$\Delta$  **Mode:** The nominal value can be entered either by the keyboard or by measuring a standard component.

**Absolute**  $\Delta$ : Deviation from nominal in absolute value.

**Relative**  $\Delta$ : Deviation in per cent from nominal value (resolution 0.01%).

### Limit sorting

Up to 12 limits on primary parameter and up to 4 limits on secondary parameter.

### Bias voltage

Up to 3 VDC on Generator Terminal set by keyboard in 0,1 V steps.

### Displays

Two 4-digit LCD displays.

### Input protection

2 Joule up to 1 kV.

### Key lock

3 positions.  
OFF - LOCK - UNLOCK.

### Built-in battery back-up

Memory retention, min. 30 days.

### Power requirements

110-240 Volt AC. 50-60 Hz. single phase. 40 Watts.

### Interface (rear panel)

IEEE488 with "Talker only" and "Talker/Listener" modes. True command sub-set of IEC standards.

RS232C with full two-way control and output functions.

Limit Outputs: Open collector (relay drivers) with + common protection rail.

Control socket with:

TRIG (Contact closure in)  
DATA READY (End of measurement out).

### Options

External Desk-Top Test Fixture JIG 4.  
Handles for Desk-Top Version.  
Control Unit CU1 with displays and keyboard.

### Dimensions

CT20 and CT20R  
Approximately 510 mm W, 130 mm H, max. 500 mm D.  
CU1: 420 mm W, 135 mm H, 45 mm D.

### Weight

CT20 and CT20R: Approx. 6 kg.  
CU1: 1.3 kg.

## Accuracy

Test Frequency	Resolution	100 Hz	1 kHz	10 kHz	Accuracy
C	0.1 pF	Range	Range	Range	
			300 pF-10 $\mu$ F		0.05% or 1 digit
		100 pF-1 mF	0.1 pF-300 pF 10 $\mu$ F-100 $\mu$ F	0.1 pF-3 $\mu$ F	0.1% or 2 digits
L	0.1 $\mu$ H	1 mF-100 mF*	100 $\mu$ F-10 mF*	3 $\mu$ F-300 $\mu$ F*	0.1% $\times$ C/C <sub>min</sub> .
			10 mH-100 H		0.05% or 1 digit
		100 mH-1000 H	1 mH-10 mH	1 mH-10 H	0.1% or 2 digits
R	0.01 $\Omega$	20 $\mu$ H*-100 mH	2 $\mu$ H*-1 mH	0.2 $\mu$ H*-1 mH	0.2% + 10 $\times$ L <sup>min</sup> /L %
		0.01 $\Omega$ -500 k $\Omega$	0.01 $\Omega$ -500 k $\Omega$	0.01 $\Omega$ -100 k $\Omega$	0.05% or 1 digit
		0.5 M $\Omega$ -50 M $\Omega$	0.5 M $\Omega$ -50 M $\Omega$	0.1 M $\Omega$ -5 M $\Omega$	1%
d with C		3 nF-30 $\mu$ F	300 pF-3 $\mu$ F		0.0005
0-.9999	0,0001	300 pF-3 nF and 30 $\mu$ F-300 $\mu$ F	30 pF-300 pF and 3 $\mu$ F-30 $\mu$ F	30pF-0.3 $\mu$ F	0.001
		300 $\mu$ F-3 mF	30 $\mu$ F-300 $\mu$ F	0.3 $\mu$ F-30 $\mu$ F	0.005
Q with L 1-9999	0.1				0.01% + 0.05% $\times$ Q
Speed of Measurements	Trig	250 ms	50 ms	50 ms	
	Cont	2 per sec.	2,5 per sec.	2,5 per sec.	
	Dual f	300 ms	110 ms		

\* Note: Accuracy 10%.

All specifications subject to changes without prior notice

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Danbridge Copenhagen



## Fælles specifikationer

### Stabilitet

Udgangsspændingen varierer mindre end  $\pm 1\%$  ved netspændingsvariationer på  $\pm 10\%$ .

### Ioniseringsindikation

Et aktivt LP-filter i serie med en integreret LF-forstærker føder højttaleren og giver en hørbar indikation af ioniseringen. Lydstyrken reguleres med et potentiometer. En sokkel på forpladen giver mulighed for tilslutning af hovedtelefoner eller et oscilloskop. Max. belastning ikke under  $100\Omega$ .

### Udgang for eksterne målinger

Begge 5 V f.s. meter udgange er tilgængelige på DIN soklen på forpladen. Max. belastning ikke under  $10k\Omega$ .

### Guard Terminal

Forbindes til guard-elektroden. Strømmen til denne terminal føres udenom  $\mu A$  meteret.

## Specifikationer for JP15

### Testspænding

0-7,5 kV og 0-15 kV DC indstillelig med et 10-tørns potentiometer. Testspændingen føres via et skærmet kabel til testproben, der har indbygget afbryder. Proben er forsynet med en 4 mm lige spids.

### Afbryder for testspænding

Højspændingen aktiveres med kontakten, der er anbragt i probens håndtag. Sokkel for udvendig aktivering af højspændingen findes på forpladen.

### Voltmeter

2 områder 7,5 og 15 kV fuldt udslag. Nøjagtighed:  $\pm 5\%$ .

### Max. afgiven strøm

Ca.  $300 \mu A$  fra 0 - 15 kV, også ved kortslutning af proben.

### Microamperemeter

3 områder  $1 \mu A$  -  $10 \mu A$  -  $100 \mu A$  fuldt udslag. Nøjagtighed:  $\pm 5\%$ .

### Opløsning

20 nA

### Udgangsimpedans

Ca.  $200 k\Omega$  ved 15 kV faldende til  $120 k\Omega$  ved 15 kV faldende til  $120 k\Omega$  mellem 10 kV og 2,5 kV målt ved  $I_0 = 100 \mu A$ .

### Spændingsforsyning

100-130 V og 200-260 V AC 45-400 Hz, forbrug 15-30 VA afhængig af belastningen. 12-13,8 V DC max 2 A fra udvendig spændingskilde eller indbygget akkumulator (ekstra tilbehør).

### Dimensioner

Højde: 106 mm  
Bredde: 255 mm  
Dybde: 225 mm  
Vægt: 3,2 kg uden batteri og strømforsyning 6,8 kg med batteri og AC strømforsyning.

### Tilbehør

12 V 2 Ah vedligeholdelsesfri akkumulator. Bæretaske i læder. Batteri-modul for 9 tørbatterier eller 10 NiCd celler.

## Specifikationer for JP 30A

### Testspænding

0-3 kV, 0-10 kV og 0-30 kVDC indstillelig med et 10-tørns potentiometer. Testspændingen føres via et skærmet kabel til testproben. To udskiftelige spidser medfølger: En kugleformet til brug ved 12-30 kV og en 4 mm lige spids til området 0-12 kV.

### Afbryder for testspænding

Fjederbelastet trykknop på forpladen. Sokkel for udvendig aktivering findes også på forpladen.

### Voltmeter

3 områder 3 kV, 10 kV og 30 kV fuldt udslag. Nøjagtighed:  $\pm 5\%$ .

### Max. afgiven strøm

Ca.  $150 \mu A$  ved 30 kV, stigende til  $200 \mu A$  ved 8 kV og faldende til  $100 \mu A$  ved 2 kV. Ved kortslutning af proben  $\geq 2 \mu A$ .

### Microamperemeter

3 områder  $1 \mu A$  -  $10 \mu A$  fuldt udslag. Nøjagtighed:  $\pm 5\%$ .

### Opløsning

10 nA

### Udgangsimpedans

Ca.  $600 k\Omega$  fra 30 kV til 10 kV.  $200 k\Omega$  fra 10 kV til 3 kV.  $60 k\Omega$  fra 3 til 2 kV målt ved  $I_0 = 100 \mu A$ .

### Spændingsforsyning

100-130 V og 200-260 V AC, 45-400 Hz, 15-30 VA afhængig af belastningen.

### Dimensioner

Højde: 148 mm  
Bredde: 438 mm  
Dybde: 300 mm  
Vægt: 6,2 kg

### Tilbehør

19" Rack monteringssæt  
Justerbar strømbegrænsning.

## Ordre information

### JP 15

15 kV transportabel isolations-tester beregnet for 12 V DC tilslutning.

### JP15U

15 kV transportabel isolations-tester beregnet for drift fra 110-240 V AC og 12 V DC og med plads til en indbygget akkumulator (ekstra tilbehør).

### JP15UM

Universal strømforsyning til JP15U, beregnet til drift fra 110-240 V AC og 12 V DC og med plads til en indbygget akkumulator (ekstra tilbehør).

### JP15BM

Batteri-kassette til JP15 beregnet til tørbatterier eller NiCd celler (batterier ikke indbefattet).

### JP15CB

Bæretaske af læder til JP15 eller JP15U.

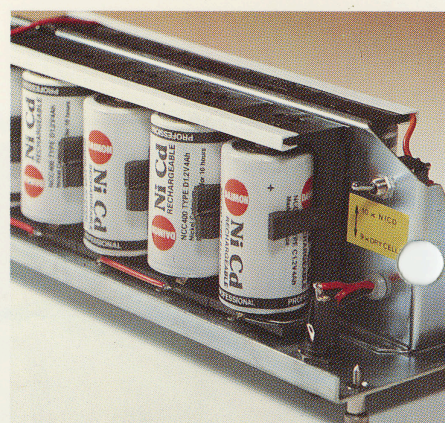
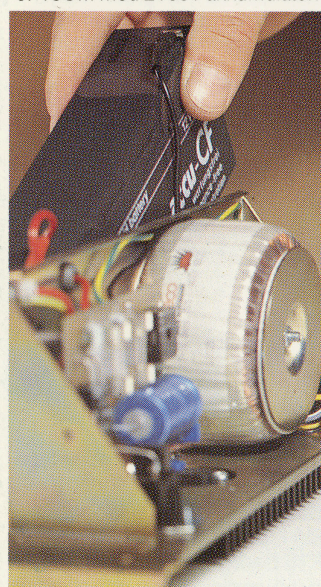
### 21001

12 V 2 Ah vedligeholdelsesfri bly-akkumulator til JP15U.

### JP30A

30 kV DC isolationstester 110-240 V AC. 37546  
19" Rack monteringssæt.

JP15UM med 21001 akkumulator.



JP15BM med NiCd celler.

Vi forbeholder os ret til at ændre specifikationerne uden varsel.

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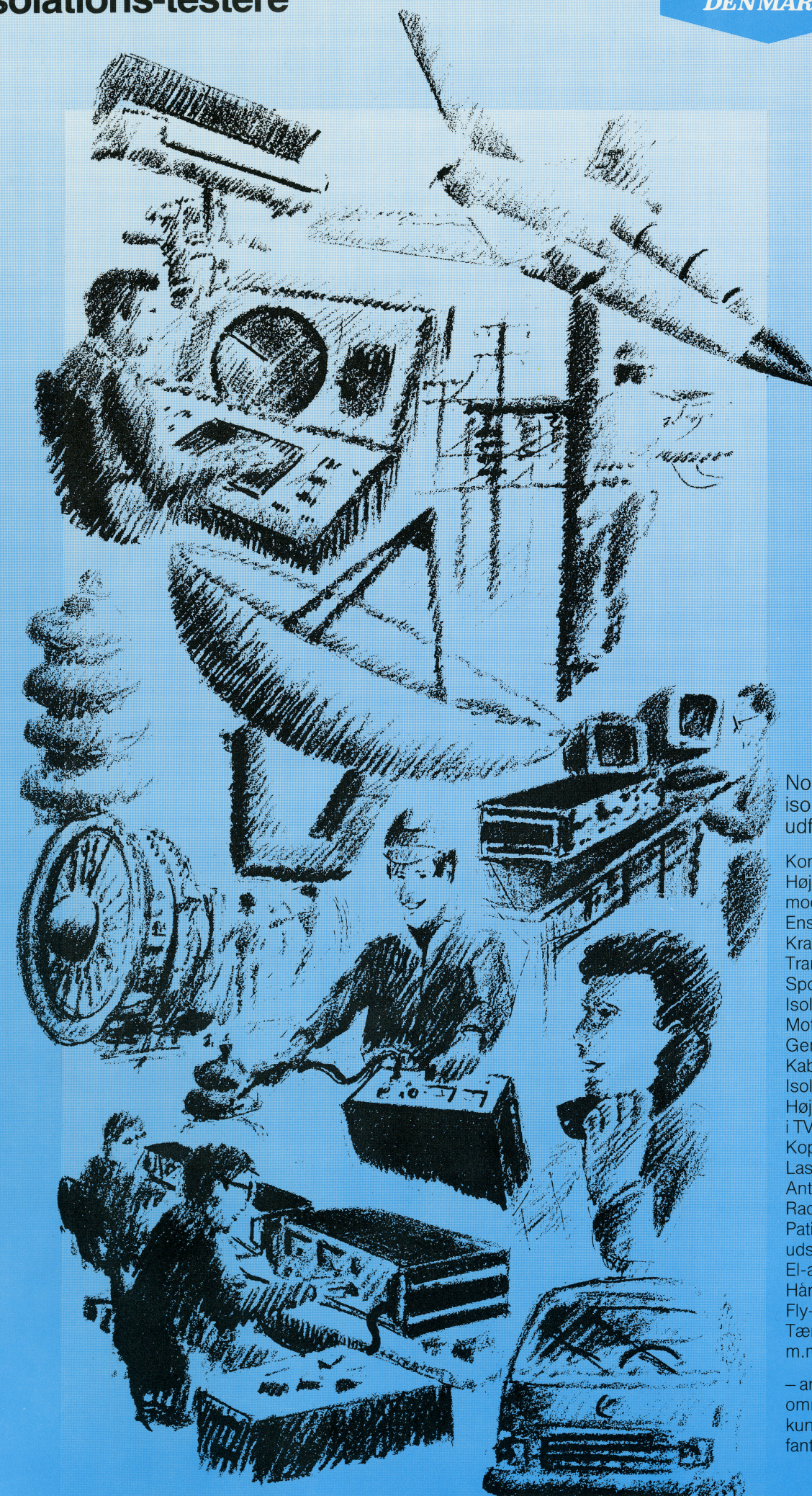
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## Non-destruktive højspændings isolations-testere

**DANBRIDGE**  
DENMARK



Non-destruktive isolationstests udføres på:

Kondensatorer  
Højspændingsmodstande  
Ensrettere  
Kraft-thyristorer  
Transformatorer  
Spoler  
Isolatorer  
Motorer  
Generatorer  
Kabler  
Isolationsmaterialer  
Højspændingsdele i TV og monitorer  
Kopimaskiner  
Laser printere  
Antennesystemer  
Radarudstyr  
Patient-overvågningsudstyr  
El-anlæg og apparater  
Hårde hvidevarer  
Fly-installationer  
Tændingssystemer m.m.

— anvendelsesområderne begrænses kun af Deres egen fantasi.



# Non-destruktive højspændings isolationstestere JP15 og JP30A

## Features

- **Minimal udladnings energi.** Den afgivne strøm er effektivt begrænset for at beskytte operatøren.
- **Meter for lækstrøm.** Giver tillige mulighed for anvendelse som Megohm-meter.
- **Guard terminal.** Strømmen til denne terminal føres udenom  $\mu A$ -meteret.
- **Justerbar udgangsspænding.** Test-spændingen kan indstilles kontinuerligt fra 0 til maksimal udgangsspænding.
- **Hørbar ioniserings detektion** med aktivt LP-filter og indbygget højttaler.
- **Hovedtelefoner** kan tilsluttes for at øge ionisering detektorens følsomhed.
- **Effektiv begrænsning af ioniseringen.** Ved test af sensible kredsløb vil der ikke opstå skader på grund af delvis nedbrydning eller ved overslag.
- **Ekstern udgang** for aflæsning af strøm og spænding.
- **Ekstern HT afbryder** kan tilsluttes stik på forpladen.
- **Kan også anvendes som højspændingsvoltmeter**

## Generelt

Anvendelsen af DC højspændings tests har en række fordele sammenholdt med AC tests, når metoden benyttes til kvalitetskontrol af produktionen, til design- og komponent-evaluering i udviklingsafdelingen samt til vedligeholdelsesarbejder og fejlsøgning i serviceafdelingen. DC tests tillader en mere kvantitativ form for analyse. Metoden kan vise, hvor god eller dårlig isolationen er. Den kan også indikere, hvor hurtigt forholdet vil forværres. Hvis der forekommer et gennemslag under en sådan DC højspændings test, vil fejlen vise sig på det sted, hvor isolationen er defekt. Med den indbyggede strømbegrænsning ( $300 \mu A$ ) vil en JP kun afgive nogle få watt energi til det defekte sted, og følgelig er denne form for DC test i realiteten non-destruktiv.

### Oversigt over test former

Højspændings tests kan inddeles efter den rækkefølge, de vil blive anvendt i under et produkts levetid:

**Design tests** udføres for at sikre en passende grad af isolation, inden den egentlige produktion af udstyr eller kabler sættes igang.

**Produktions tests** udføres hos fabrikanten for at sikre, at der er overensstemmelse mellem design, specifikationer og produktionskrav.

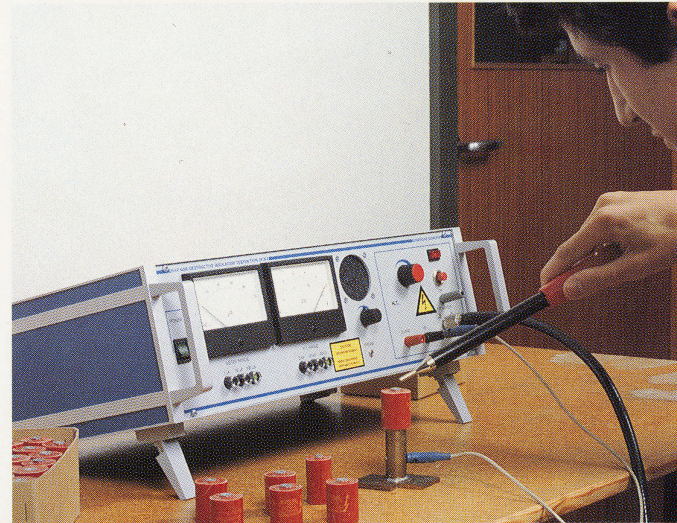
**En modtagelses test** udføres efter, at udstyret er installeret, men inden ibrugtagning.

**Sikkerheds test** udføres umiddelbart efter idriftsætning eller inden udløbet af garanti-perioden.

**Vedligeholdelses test** udføres under rutineeftersyn eller i forbindelse med reparationsarbejde.

**Fejlsøgnings test** udføres med det formål at lokalisere en skjult defekt.

Design og produktions test foregår naturligvis indenfor producentens ansvarsområde. Modtagelseskontrol foretages af køberen eller dennes entreprenør, hvorimod sikkerhedstest, vedligeholdelses test og fejlsøgning normalt udføres af en serviceafdeling under hele levetiden for det pågældende udstyr.



**Virkningen af en dårlig isolation** er enten en stigning i lækstrømmen eller en reduktion af isolationsmaterialets nedbrydningsmodstand. En forøget lækstrøm i et svækket eller beskadiget isolationsmateriale resulterer i forøget opvarmning, som derefter accelererer nedbrydningen. Spændings transienter kan forårsage bratfejl og driftsstop. Isolationen kan testes på forskellige måder, nemlig ved at måle lækstrømmen, gennemslagsspændingen eller ved at undersøge, hvorvidt isolationen kan modstå en spænding, der er højere end den normale driftsspænding.

**Isolationsfejl** kan være et helt normalt resultat af ældning. Elektrolytisk og kemisk destruktion finder sted, ligesom en fysisk skade og absorbering af fugt kan medføre, at isolationen nedbrydes. Snavs, metalstøv eller andre fremmede materialer forurener isolationsoverfladen. Høj driftstemperatur er en anden typisk årsag til hurtig ældning af isolationen.

## Gennemslag og ioniserings fænomener

En nem måde at undersøge kvaliteten af et isolationsmateriale på er at udsætte det for en høj DC spænding. I alle former for isolationsmaterialer findes et antal frie elektroner, som bringes til at accelerere under påvirkning af et elektrisk felt frembragt af en DC højspænding. En svag elektrisk strøm begynder at løbe gennem materialet, den såkaldte lækstrøm. Til sidst, når DC spændingen

overskrider en vis værdi, vil elektronerne forøge deres hastighed så meget, at de er i stand til at generere nye og frie elektroner. Dette er det såkaldte ioniserings fænomen. Antallet af frie elektroner forøges eksponentielt med tiden, og dersom der ikke var indbygget en effektiv strømbegrænsning i test instrumentet, ville lækstrømmen hurtigt blive så stor, at isolationsmaterialet ville blive ødelagt.

Fig. 1

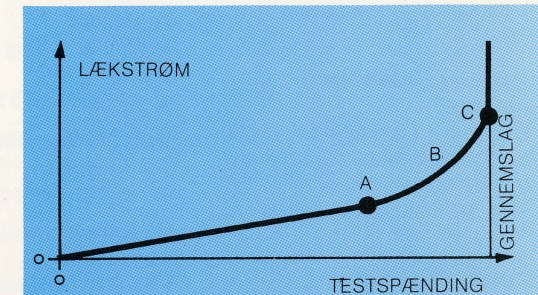
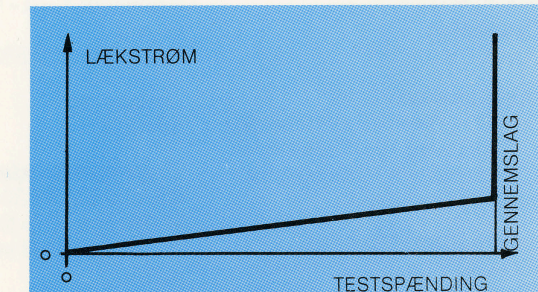


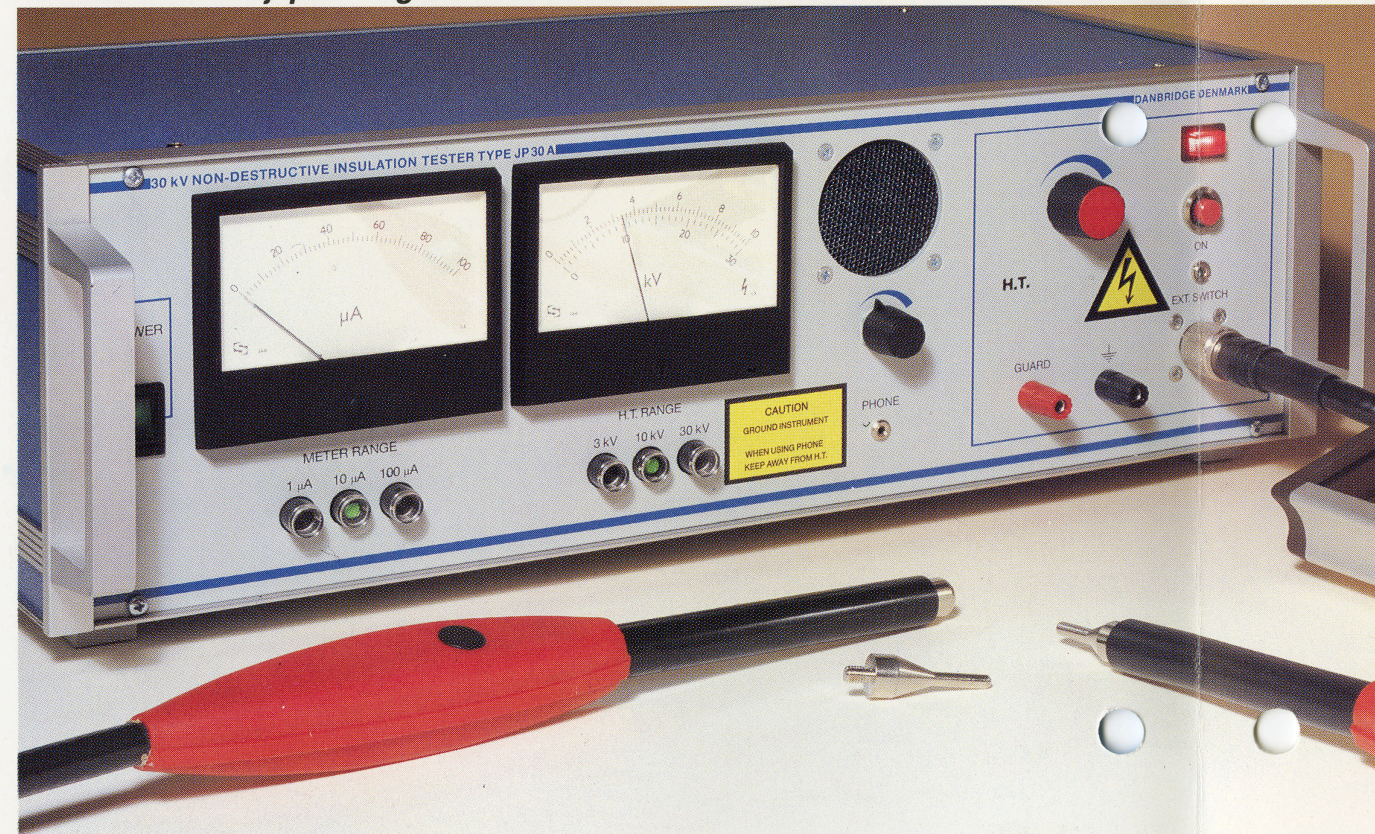
Fig. 2



En typisk kurve for lækstrøm som funktion af test spænding. Kurven er lineær fra 0 til punktet A. Efter punkt A begynder ioniseringen og strømmen stiger. Gennemslag finder sted i punkt C. Knæet B i Fig. 1 er ikke altid veldefineret.

I nogle typer isolationsmaterialer vil knæet være så tydeligt som vist på Fig. 2. Her er bøjningen næsten lodret, og man kan ikke detektere ionisering.

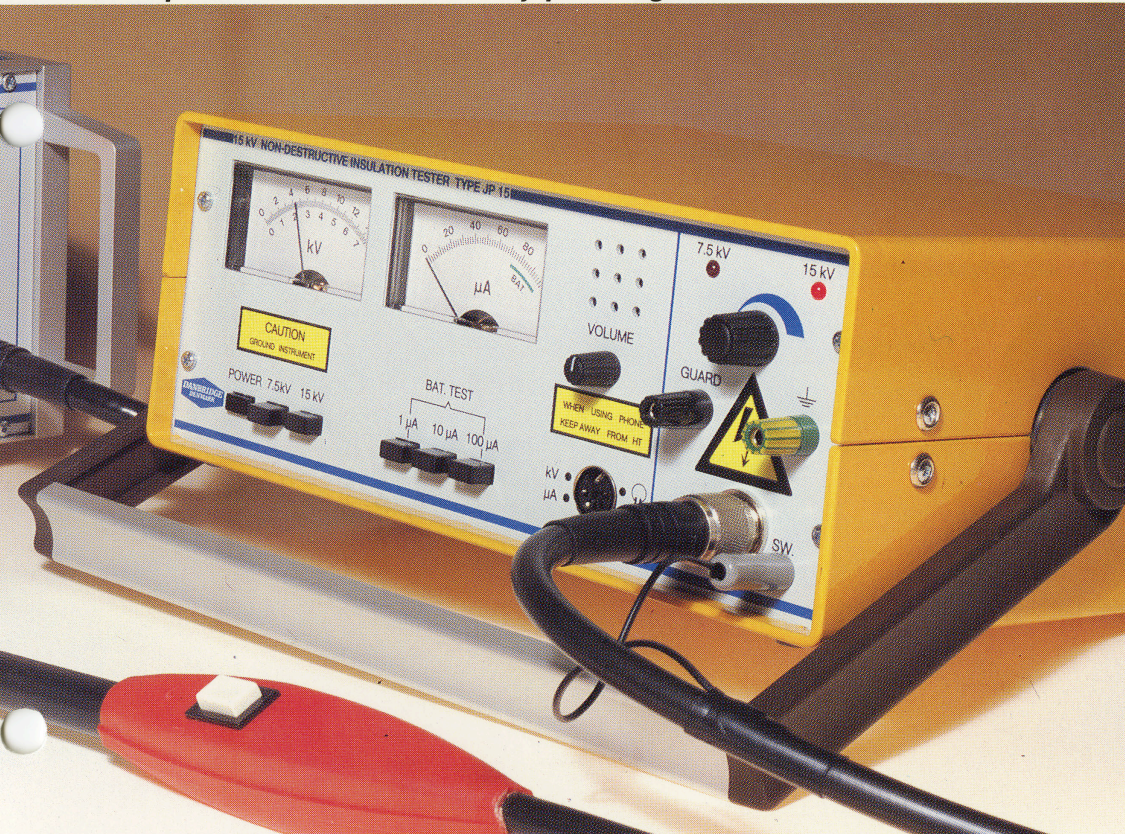
## Non-destruktiv højspændings isolationstester JP30A 30 kV DC



### Beskrivelse

JP30A er en netdrevet 30 kV DC non-destruktiv isolationstester til stationær brug på værksteder, i laboratorier, i produktionen og i kvalitetskontrollen. Opspændingsbeslag for 19" rack kan leveres som ekstra tilbehør. Strømforsyningen kan også tilsluttes 400 Hz net, hvilket gør JP30A anvendelig ombord i fly og i marinefartøjer. Udgangsspænding og -strøm aflæses på to separate 85 mm analog instrumenter. For at opnå den bedste opløsning på de laveste måleområder, er der tre måleområder pr. instrument. En effektiv strømbegrænsning sikrer, at det er ufarligt at benytte JP30A til trods for den høje spænding. På forpladen er anbragt en sokkel for fjernstyring af højspændingsafbryderen.

## Transportabel non-destruktiv højspændings isolationstester JP15 15 kV DC



### Beskrivelse

JP 15 er en 15 kV DC non-destruktiv isolationstester beregnet til transportabel og stationær brug. Den leveres i to udgaver: JP15 beregnet for tilslutning til en udvendig 12 volt strømforsyning. JP15U beregnet for 110-240 V AC net samt 12 V DC eksternt, f.eks. fra en bil. Til transportabel anvendelse kan JP15U forsynes med en ekstra 12 V 2 Ah vedligeholdelsesfri akkumulator. Når akkumulatoren er installeret, kan den oplades enten fra lysnettet eller fra en 12 V DC kilde, f.eks. i en bil under kørslen. Som ekstra tilbehør kan også leveres en batteri-kassette for tørbatterier (9 stk. lommelygtebatterier). En beskyttelsestaske af læder kan leveres som tilbehør ved transportabel anvendelse.