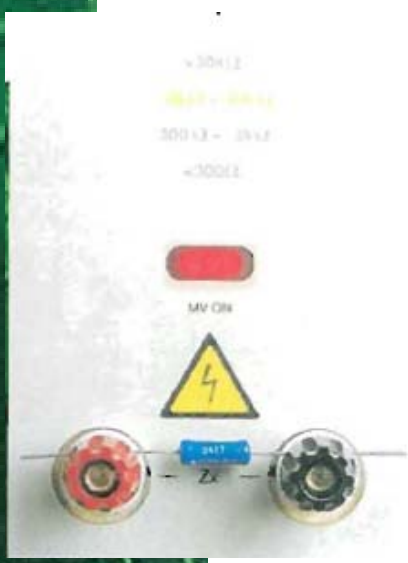
CLT 10/ 20 Component Linearity

Test Equipment

CLT10 Component
Linearity Test Equipment

- **10 kHz voltage up to 1000 V @ 4 VA**
- **More than 30 components per second**
- **Impedance range from below 100Ω to more than 3 MΩ**
- **Third harmonics below -160 dB**
- **Non-sensitive to hum**
- **Fibre optical communication**
- **Easy IEC 440 standard settings**
- **IEEE 488 (GPIB) and RS232C interfaces**
- **Programmable rejection limits**
- **CE approved**



General

The CLT10 Component Linearity Test Equipment is a further development of the well known CLT1, The equipment is used for reliability Insuring of passive electronic components.

The CLT10 determines the non-linearity of all electronic component, and takes this as an indicator of the reliability of the component. In the CLT10 the third harmonic distortion is taken as a measure of the non-linearity.

The measuring method offers a very high operational speed: it is non-sensitive to external fields: it gives a high resolution; it is non-destructive. and is therefore used for automatic 100% go/no-go production test of ,resistors and other components, according to the IEC 440 Standard publication. In the laboratory, it is also used for reliability testing of materials.

For maximum EMI robustness and lowest possible residual non-linearity, the CLT 10 is divided into two separate units interconnected by fibre optical cables: A Control Unit containing digital circuitry and a Measuring Unit containing analogue circuitry The use of optical cables eliminates ground loops and cases the installation. The residual non-linearity is kept extremely low, making it possible to measure third harmonics down to 160 dB below the fundamental voltage.

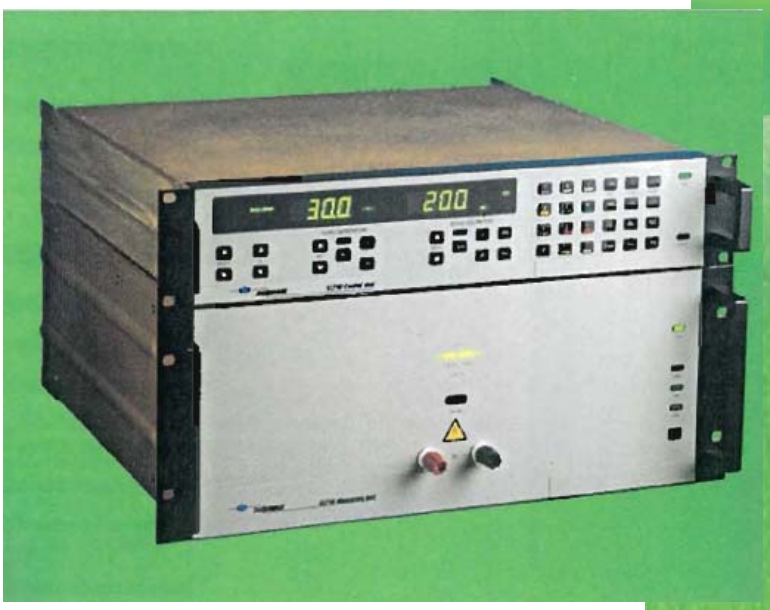
The microprocessor based CLT10 Control Unit ensures top performance and makes the equipment very simple to operate and understand.
The IEEE 488 and RS232C remote interface controller ensures system integration at all levels .

The CLT 10 Component Linearity Test Equipment conforms to the international standards: IEC 348, IEC 440, IEC 68 and RCF-2003.

Applications

The range of applications is very broad and includes:

- Productions testing
- Component development
- Acceptance testing
- Investigations of non-linear components and materials
- Screening of audio-grade components



Background

Defective components are not only unreliable; they are also non-linear due to the altered and unstable current density caused by the defects.

A measurements of the distortion generated in the component when a pure sine wave current flows through it evaluates the reliability due to the correlation's between the non-linearity and the reliability.

The non-linearly - taken as the ratio between the dominant third harmonic and the applied fundamental voltage - is expressed in dB. The non-linearity is recognised as are liability parameter just as the noise index of the component. A noise index measurement, however, is time consuming and therefore not suited for 100% testing.

A component is classified as less reliable when its non-linearity is significantly higher than the median non-linearity of the batch in question.

In production testing, a fixed rejection limit, such as a non-linearly between -90 to -130 dB, is normally used. Rejection of these dubious components improves the total reliability of the batch. The rejected components also enable the manufacturer to improve his production technique, thereby gaining higher reliability and a superior product

Component defects

Typical defects of resistors causing non-linearity.

- Poor contact between lead and cap
- Poor contact between cap and resistor material
- Poor material quality (such as film)
- In-homogeneous spots in material
- Defective spiralling
- Traces of film left in grooves

Typical defects of capacitors causing non-linearity:

- Poor Contact between electrode and terminal
- Contamination of dielectric such as iron oxide or iron particles in mica, paper, polystyrene, etc.
- Mechanical instability such as movements due to electrostatic forces
- Poor ceramic quality
- Longitudinal grooves in ceramic

The defects have the introduction of non-linearly in the component in common.

User-friendly interface

The CLT10 Control Unit has a built-in table as defined in the IEC 440 recommended operating conditions.

The coloured numeric calculator buttons make it very easy to set up the equipment to measure any given impedance just by entering its standard IEC colour code.

Furthermore, up to 99 user-defined operating conditions can be stored using the keys or by remote control. This enables the user to specify, Store. and later re-call specific component-dependent measurement conditions.

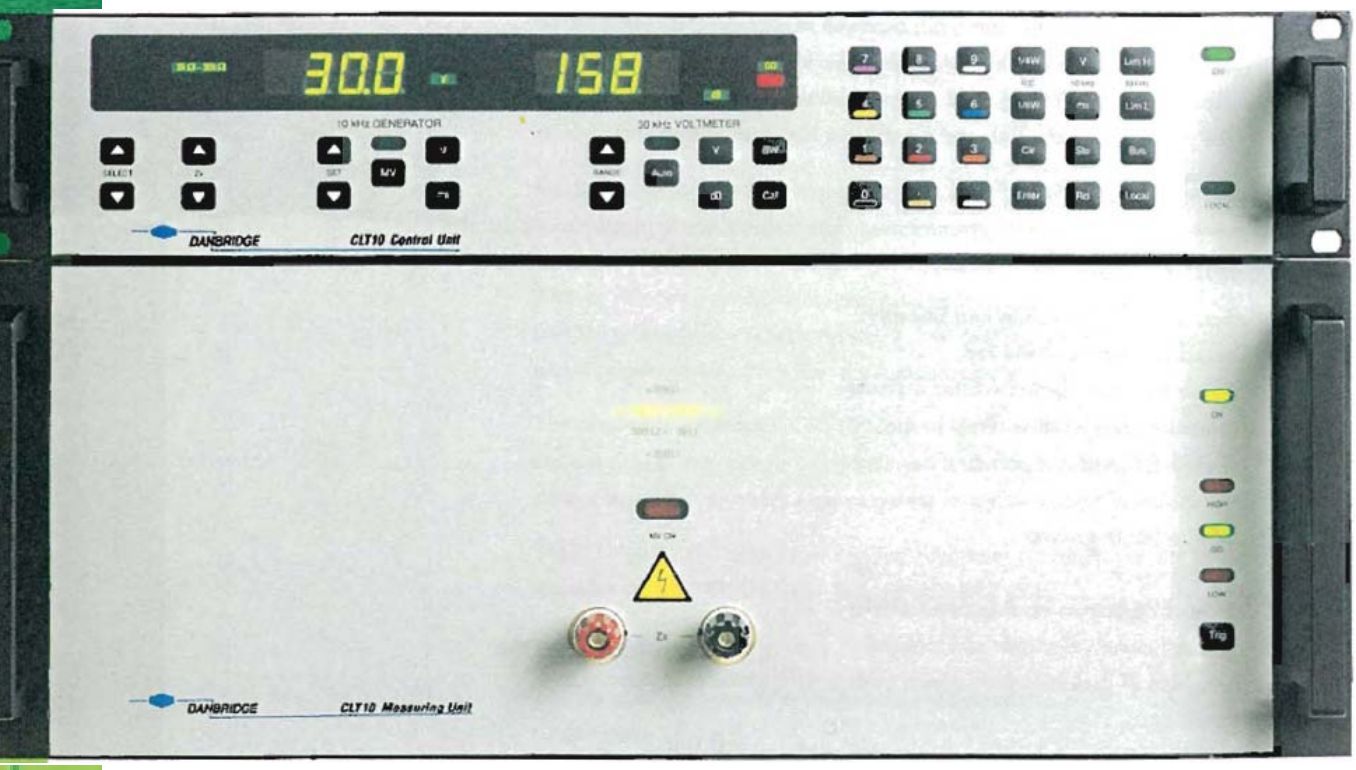
System integration

The CLT10 Control Unit has a standard IEEE 448 (GPIB) and an optional RS232C remote interface controller build in. These interfaces ensure system integration on production lines and in laboratories.

All functions are software-controlled except power on/off. In addition to the functions controlled from the front panel of the Control Unit, several enhanced features are controllable using the remote interface.

These include instrument identity; integrated system tests; inspection of setups; IEC 440 standard setup plus 1/16, 1/2 1, 2 and 4 W settings and reading of the last 99 measurements

These features enable the user to collect measurement data such as production batch documentation and statistical! analysis for later processing.



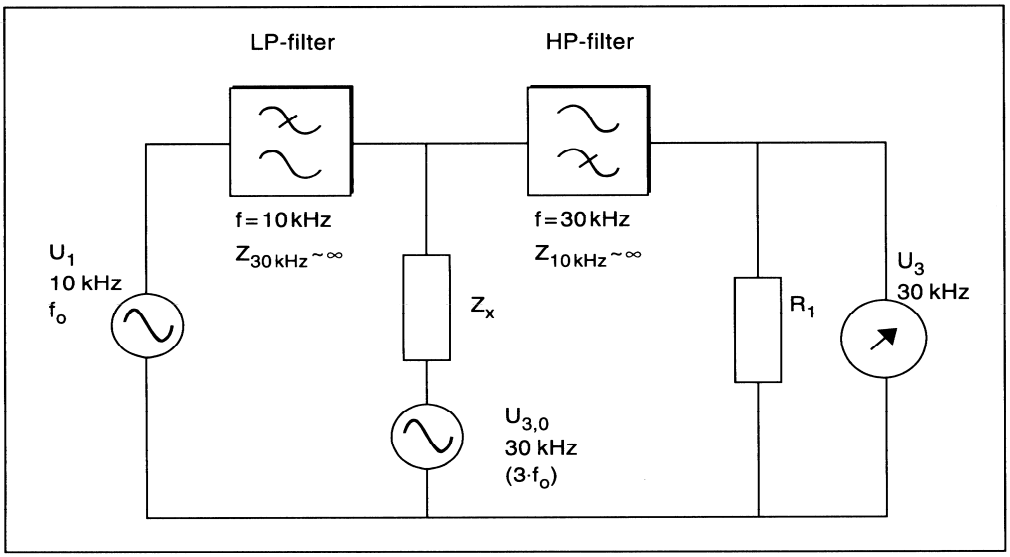


Fig. 2 - Measuring Principle

Flexible configuration

The power capacity up to 4VA of the CLT20 makes it possible to overload devices being tested for a short period. This is use-ful for stressing the device before testing under recommended condi-tions, thus ensuring an extended dynamic range of the measurement.

The system includes distortion thre-shold limits for High and Low condi-tions. These fully programmable limits control the user accessible connector outputs for use on auto-matic go/ no-go production lines.

Remote control of the equipment for system integration and for data col-lection is ensured by the standard built-in IEEE 488 and RS232C in-terfaces.

Measuring principle

The measuring method of the CLT20 Component Linearity Test Equipment is based on determina-tion of the non-linearity of normally linear components. A very pure 10 kHz sine wave voltage is fed to the component under test as shown in Fig. 2.

If the impedance of the component is not absolutely independent of the applied voltage, the sine wave will be distorted and the current will con-sist of a pure, fundamental sine wave component and its higher har-monics.

The third harmonic component is normally the dominant one and is chosen as a measure of the distor-tion - the non-linearity - of the com-ponent.

The third harmonic current is equi-valent to a no-load voltage U3,0 in series with the component under test, which has an impedance Z_X. As the 10 kHz low-pass filter blocks the 30 kHz, the third harmonic voltage U_3 is measured over the load impedance R1.

Given the values of Z_X and R1, the no-load voltage can easily be found as:

$$U_{3,0} = U_3 \cdot \left(1 + \frac{|Z_x|}{R_1}\right)$$

By inserting a special low-distortion matching transformer, the compo-nent under test can be matched to the generator and the 30 kHz volt-meter over a wide impedance range.

When measuring on a batch of components which have the same nomi-nal impedance value, the third har-monic value is found to be dis-tributed around a mean value. The distribution curve is usually a Gaus-sian distribution curve as shown in Fig. 3.

A few components may, however, exhibit a higher distortion than that of the rest of the batch. This may be due to small defects or to deviations in the ma-terial composition.

Some components contain ma-terials which have a high inherent distortion: magnetic materials; com-position resistors; high-dielectric ca-pacitors. In these components, the excessive distortion from small de-fects is concealed in high inherent distortion and cannot readily be de-tected.

At the other end of the scale there are metal film resistors in which the inher-ent distortion is very low, typi-cally -130 dB or lower. With these components, defects cause distor-tion, which normally exceeds that of the rest of the batch significantly.

What makes the CLT20 Compo-nent Linearity Test Equipment so unique is its ability to measure dis-tortion as low as 160 dB below the level of the applied sine wave.

No other commercially available in-strument can even come close to this in-credible level of sensitivity, and only with the CLT20 is it possible to detect fail-ures in today's precision resistors.

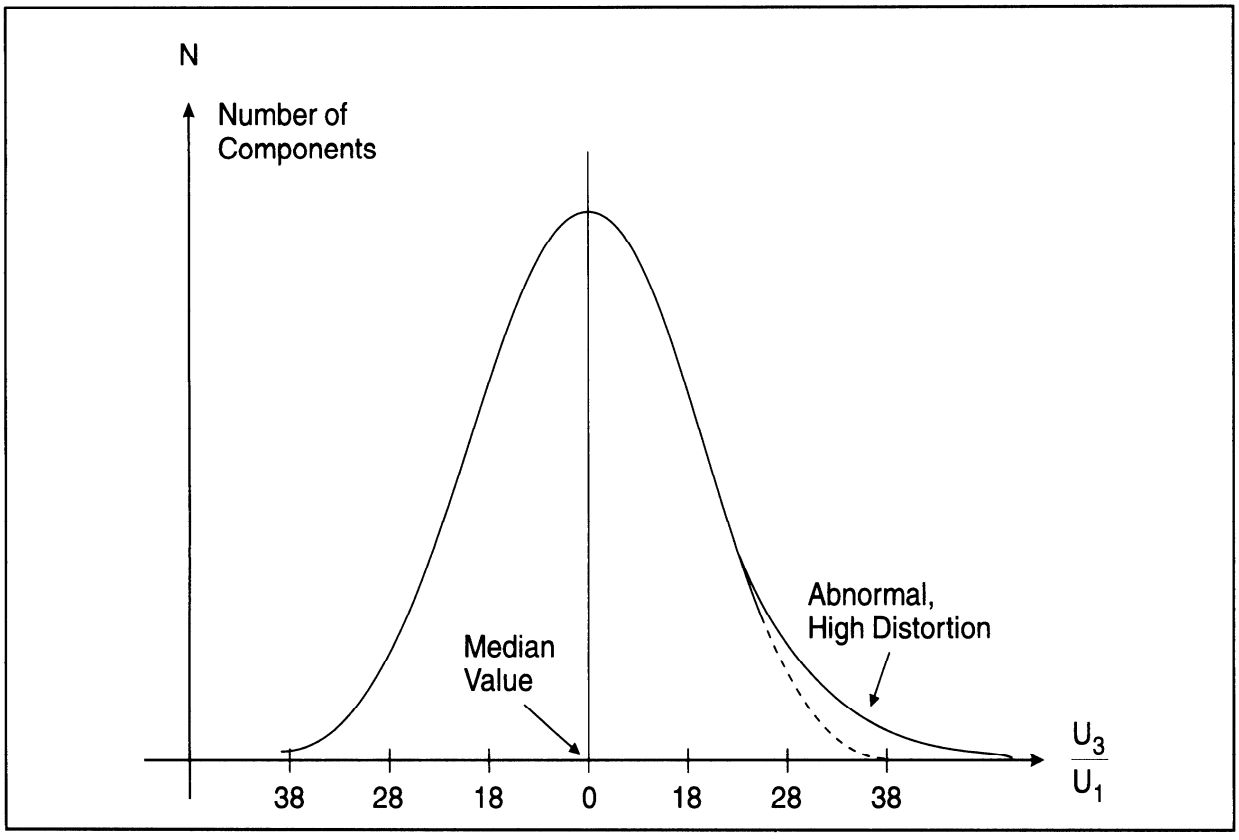


Fig. 3 - Typical Distribution of Distortion in a Component Batch

Specifications:

CLT10 Component Linearity Tester Measuring Unit

Main Specification

Generator frequency	10kHz ±2 Hz
Voltmeter frequency	30 kHz
Voltmeter bandwidth	400 or 75 Hz selectable
Measuring speed	Measuring cycle down to 10 ms excl. handling. Specifications are valid for ³ 14 ms cycle with broad voltmeter bandwidth. Test rate typically more than 30 components per second*)
Accuracy	±1 dB or 5% + 1 digit

Component Range

General	All passive impedances. Primarily impedances within 100W to 3 MW. Restrictions for other ranges exist
Range switching time	<500 ms
Range switching life	10^6 operations
<300W	
Transformation ratio	1:1
Input impedance	100W ±2%
Max. power	0.2 VA @ Z_X ³ 10 W 1 VA @ Z_X ³ 50 W 4 VA @ Z_X ³ 200 W
Max. 10 kHz voltage	36 Vrms
RNL @ 0.25 VA	-150 dB, typical -160 dB (30 to 300W load)
300 W - 3 kW	
Transformation ratio	1:1
Input impedance	1 kW ±2%
Max. power	3 VA, 4 VA @ Z_X £ 2.5 kW
Max. 10 kHz voltage	100 Vrms
RNL @ 0.25 VA	-160dB
3 kW - 30 kW	
Transformation ratio	1:10
Input impedance	10 kW ±2%
Max. power	1 VA @ Z_X ³ 5 kW 4 VA @ Z_X ³ 25 kW
Max. 10 kHz voltage	360 Vrms
RNL @ 0.25 VA	-150 dB, typical -160 dB
30 kW - 3 MW	
Transformation ratio	1:10
Input impedance	100 kW ±2%
Max. power	4 VA @ Z_X £ 250 kW 1 VA @ Z_X £ 1 MW 0.25VA @ Z_X < 3 MW
Max. 10 kHz voltage	1000 Vrms
RNL @ 0.25 VA	-140dB, typical -150 dB @ Z_X £ 300 kW -130dB @ Z_X £3 MW

*) Guideline only; depends on handling

Inputs/Outputs (rear)

Type of connector	25-pole, sub-D, female
Inputs	
Min. 10 kHz level setting	0 to 10 V for 0 to 100% voltage output within range
10 kHz voltage off	Contact closure
External trigger	Contact closure
Outputs	
10 kHz voltage	0 to 10 V for 0 to 100% within actual range
10 kHz current	0 to 10 V for 0 to 200 mA
30 kHz voltage	0 to 10 V for 0 to 100% within actual range
Control Outputs	
Impedance range	Open collector
Accept, go	Open collector
Reject, high & low	Open collector
10kHz voltage on	Open collector
Data Ready (DRDY)	TTL compatible
Measurement End (ME)	TTL compatible
Communication with Control Unit	
Type of connector	Fiber Optic Link
Type of interface	2 Mbit/s serial, bi-phase modulation
Safety Link	Contact closure

Terminals (front)

Measuring terminals	Two binding posts accept standard-size 4 mm banana plugs

General

Temperature	
Operating temperature	5° to 45° C (41° to 113° F)
Storage temperature	- 40° to 70° C (- 40° to 158° F)
Relative humidity	20 to 80%, non-condensing
Line voltage	90 to 111 V AC, 105 to 130 V AC, 180 to 222 V AC, 210 to 260 V AC
Frequency	47.5 to 63 Hz
Power consumption	100 VA
Dimensions and Weight	
Height	178 mm (6.9")
Width	483 mm (19.0")
Depth	442 mm (17.0")
Net weight	18 kg (40 lbs)
Shipping weight	25 kg (55 lbs)

Ordering Information

Code	Description
391-081	CLT 10 Measuring Unit
Accessories	
983-436	Service Manual
983-437	Operator Manual
900-215	Measuring cable
906-362	Control Unit connector cable, 1m
618-101	Control Unit connector cable, 5m

Specifications for CLT20:

CLT20 Component Linearity Tester

Main Specification

Generator frequency	10kHz ±2 Hz
Voltmeter frequency	30 kHz
Voltmeter bandwidth	400 or 75 Hz selectable
Measuring speed	Measuring cycle down to 10 ms excl. handling. Specifications are valid for ³ 14 ms cycle with broad voltmeter bandwidth. Test rate typically more than 30 components per second*)
Accuracy	±1 dB or 5% + 1 digit

Component Range

General	All passive impedances. Primarily impedances: CLT10 & CLT20 <100W - 3 MW. CLT20 down to 10mW
Range switching time	<500 ms
Range switching life	10^6 operations
Low impedance range	
Imput impedance	1Ω
3mΩ - 3Ω	Transformation ratio 31,6 : 1
3Ω - 10Ω	Transformation ratio 31,6 : 1
10Ω - 300W	Transformation ratio 1:1
Input impedance	100W ±2%
Max. power	0.2 VA @ Z_X ³ 10 W 1 VA @ Z_X ³ 50 W 4 VA @ Z_X ³ 200 W
Max. 10 kHz voltage	36 Vrms
RNL @ 0.25 VA	-150 dB, typical -160 dB (30 to 300W load)
High impedance range	
300 W - 3 kW	
Input impedance	1 kW ±2%
Transformation ratio	1:1
Max. power	3 VA, 4 VA @ Z_X £ 2.5 kW
Max. 10 kHz voltage	100 Vrms
RNL @ 0.25 VA	-160dB
3 kW - 30 kW	
Input impedance	10 kW ±2%
Transformation ratio	1:10
Max. power	1 VA @ Z_X ³ 5 kW 4 VA @ Z_X ³ 25 kW
Max. 10 kHz voltage	360 Vrms
RNL @ 0.25 VA	-150 dB, typical -160 dB
30 kW - 3 MW	
Input impedance	100 kW ±2%
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Max. power	4 VA @ Z_X £ 250 kW 1 VA @ Z_X £ 1 MW 0.25VA @ Z_X < 3 MW
Max. 10 kHz voltage	1000 Vrms
RNL @ 0.25 VA	-140dB, typical -150 dB @ Z_X £ 300 kW -130dB @ Z_X £3 MW

*) Guideline only; depends on handling
Data subject to change

Inputs/Outputs (rear)

Type of connector	25-pole, sub-D, female
Inputs	
Min. 10 kHz level setting	0 to 10 V for 0 to 100% voltage output within range
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10 kHz current	0 to 10 V for 0 to 200 mA
30 kHz voltage	0 to 10 V for 0 to 100% within actual range
Control Outputs	
Impedance range	Open collector
Accept, go	Open collector
Reject, high & low	Open collector
10kHz voltage on	Open collector
Data Ready (DRDY)	TTL compatible
Measurement End (ME)	TTL compatible
Communication with Control Unit	Fiber Optic Link
Type of connector	2 Mbit/s serial, bi-phase
Type of interface	modulation
Safety Link	Contact closure

Terminals (front)

Measuring terminals	4-terminal ERA Lemo connector

General

Temperature	
Operating temperature	5° to 45° C (41° to 113° F)
Storage temperature	- 40° to 70° C (- 40° to 158° F)
Relative humidity	20 to 80%, non-condensing
Line voltage	90 to 111 V AC, 105 to 130 V AC, 180 to 222 V AC, 210 to 260 V AC
Frequency	47.5 to 63 Hz
Power consumption	100 VA

Dimensions and Weight for a complete test system

Height	356 mm (")
Width	483 mm (19.0")
Depth	442 mm (17.0")
Net weight complete system	CLT20 28 kg (62 lbs)
Shipping weight complete syst.	CLT20 34 kg (75 lbs)

Ordering Information

Codes for a complete set	Description
73466	CLT20, 3-Harmonic Index Tester
Accessories	
983434	Service Manual CU & MU
983437	Operator Manual
86820	Measuring cable, 1m CLT20
51014	IEEE cable 2m, CE approved

Specifications:

CLT10/20 Control Unit

Main Specifications

Displays	2 x 4 digits 7 segment green LED Annunciation LEDs
10 kHz functions	Four Z_X ranges 10 kHz voltage on/off Voltage step and entry Timer step and entry IEC 440 entry extended to E192 standard series
30 kHz functions	Read-out in V or dB Manual and auto range Programmable reject limit high and low
Memory	99 setup entries, 99 measure-ment storage
Other functions	IEEE bus setup incl. force to local RS-232 serial setup
Remote Programming and Operation	
Functions controlled	All except mains power on/ off

Inputs/Outputs (rear)

Communication with	**Measurement Unit**
Type of connector	Fiber Optic Link
Type of interface	2 Mbit/s serial, bi-phase modulation
IEEE 488 Interface	
Type of connector	24-pole, Champ
Interface functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT0, C0, E2
Setups	Include IEC 440 publication setups extended to E192 stand-ard series and 99 memory en-tries

RS232C Interface

Connector type	9-pole, Sub-D, female
Baud rate	300 to 19200
Duplex	Full
Parity	Even, odd or none
Stop bits	1 or 2
Data bits	7 or 8

General

Temperature

Operating temperature	5° to 45° C (41° to 113° F)
Storage temperature	- 40° to 70° C (- 40° to 158° F)
Relative humidity	20 to 80%, non-condensing
Line voltage	90 to 130 V AC, 200 to 260 V AC
Frequency	47.5 to 63 Hz
Power consumption	20 VA

Dimensions and Weight

Height for CU for CLT10, CLT20	89 mm (3.5")
Width	483 mm (19.0")
Depth	442 mm (17")
Net weight	5 kg (12 lbs)
Shipping weight	9 kg (20 lbs)

Ordering Information

Code	**Description**
	CLT 20 Control Unit
Accessories	
983434	Service Manual
983437	Operator Manual
933350	Desktop 19" Rack Enclo-sure for CLT10 (CU and MU)
933350	Desktop 19" Rack Enclo-sure for CLT20 (CU, MU and LU)

Data subject to change

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