OPERATOR'S INSTRUCTION MANUAL

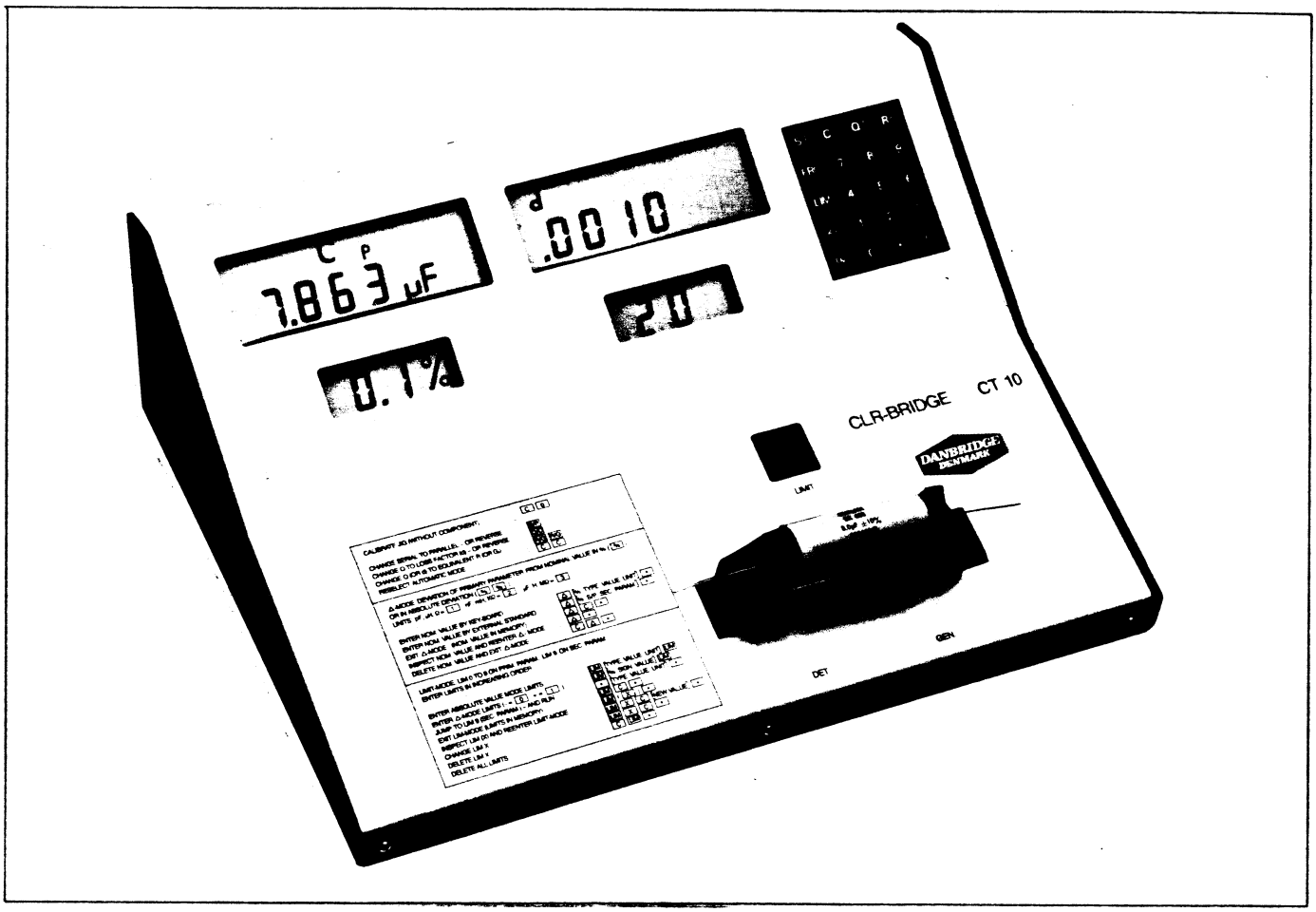
DANBRIDGE
DENMARK

CT 10

1987

AUTOMATIC CLR Bridge CT 10

DANBRIDGE DENMARK



- **Automatic measurement of impedance and loss factor**
- **Measuring frequencies 1 kHz and 111 Hz**
- **Two 4-digit readouts of measurement**
- **Two 2½-digit readouts of actual accuracy**
- **Direct or deviation readings**
- **Nominal value for deviation by keyboard or external standard**
- **Ten limits entered by keyboard**
- **µP controlled automatic range selection and autozeroing**
- **RS232 serial output**
- **IEC bus interface (optional)**
- **4-terminal test fixture with input protection**

General

The DANBRIDGE CT 10 is a microprocessor-controlled instrument for fast and accurate measurement of passive electronic components.
The desk-top design and the built-in 4-terminal adjustable test jig makes this a versatile instrument, suitable for QC, goods inward control and smaller production requirement.
The CT 10 automatically selects the correct range for any C-L-R component inserted in the test fixture thus eliminating special training of operators.
The two measuring frequencies 1 kHz and 111 Hz are crystal controlled and are switched by use of the keyboard.
The main parameters are shown on the upper left-hand LCD display and the secondary parameters on the right-hand display.
The accuracy of each measurement is calculated by the microprocessor and displayed on the two lower displays.

By use of the keyboard the operator can select alternative forms of data, e.g. deviation in percentage or absolute value.
Up to ten limits can be programmed via the keyboard. The limit or bin number is indicated on a single digit display.
The output includes as standard: Limits and Serial Data RS232
An IEC bus interface is available as an option.

AUTOMATIC CLR Bridge CT 10

Preliminary specifications

Parameters displayed:
Automatic mode: C_S - D, L_S - Q, R - C_P/L_S.
Keyboard selected mode: C_P, L_P - Q, D, R_S, R_P, G_P.
$\triangle$ mode: Deviation from nominal value either in % or in absolute value.

Measuring frequency:
1 kHz and 111 Hz, crystal controlled.

Range:
C at 1 kHz: 0-999.9 μF,
Ultimate resolution: 0.1 pF
C at 111 Hz: 0-999 μF,
Ultimate resolution: 1 pF
L at 1 kHz: 10 μH - 999.9 H,
Ultimate resolution: 0.01 uH
L at 111 Hz: 100 μH - 9999 H,
Ultimate resolution: 0.1 uH
R at 111 Hz: 0 Ω - 100 MΩ
D: 0 - .9999
Q: 1 - 9999, Ultimate resolution: 0.01

Accuracy:
Basic accuracy of impedance at 1 kHz: 0.1% within the ranges 10 pF - 10 μF, 2 mH - 2000 H and 10 Ω - 10 MΩ.
Basic accuracy of D: 0.1% of reading + 5 digits. ($5x10^{-4}$).

Measuring voltage:
1 V rms down to 20 Ω impedance, 0.1 V from 20 Ω to 2 Ω, linear reduction at lower impedance values.

Displays:
Two 4-digit LCD with automatic decimal point,
two 3-digit LCD and
one single-digit LED for test limit sorting.

Output:
RS232 Serial Data of measurement. IEC625 (IEEE488) option. Limit signal output (open collector. 60 V max, 400 mA max.).

Measuring speed:
Better than 3 per second.

Automatic control:
Auto-zeroing and auto-ranging, fully controllable either locally by the keyboard or remotely via the optional bus interface.

Test jig:
Four-terminal measurement of both axially and radially terminated components. Input protection.

Temperature range:
Operating 15°C to 35°C
Storage -40°C to 75°C

Dimensions:
H(max): 135 mm, W: 395 mm, D: 300 mm

Weight:
Approx. 5 kg

Power requirements:
110-240 V AC 50-60 Hz single phase, 80 VA.

ALL SPECIFICATIONS SUBJECT TO CHANGES WITHOUT PRIOR NOTICE

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PRINTED IN DENMARK 3.82

AUTOMATIC CLR Bridge CT 10

Specifications

Parameters
C (Capacitance)
L (Inductance)
R (Resistance)
D (Dissipation Factor)
Q (1/D)
G (Conductance)
Δ (Deviation) on C, L or R.

Parameter Combinations
Automatically selected:
C_P with D
L_S with Q
R with C_P or L_S

Selected from keyboard.
C_S with D, Q or R_S
C_P with D, Q, R_P or G
L_S with D or R_S
L_P with D, Q, R_P or G
Δ in absolute value
Δ in %

Limits
Absolute Limits,
Deviation Limits,
Absolute Value,
Percentage Value,
Bin Number,
Separate limit for D and Q.

Measuring Frequencies
1 kHz or 111 Hz ± 0.01 %, crystal controlled.

Displays
Two 4-digit LCDs with automatic decimal point for main parameters.
Two 3-digit LCDs for actual accuracy.
One single-digit LED for bin number.

Automatic control
Range setting fully automatic, 5 ms per step.
Auto-zeroing from the keyboard or remotely via the optional bus interface.

Test jig
Four-terminal measurement of either axially or radially terminated components.
Input protection, bias and guard.

Input protection
Safe limits:
Max: 150 V up to 10 µF.
Max: 100 V up to 100 µF.

Measuring Voltages
1 V rms down to 40 Ω
0.1 V from 40 Ω to 4 Ω,
linear reduction at lower impedance values.

Input/Output
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 Hi/Low (for secondary parameter).
Bias: External DC supply, max 3 V.

SC2: IEC625 or IEEE-488, GP-IP for optional IEEE bus interface.

SC3: RS232C output, Baud rate 9600. Trigger input, contact closure to ground. End of measurement, TLL output, active low.

Temperature range
Operating 15°C to 35°C
Storage –40°C to 75°C

Dimensions
H (max) 135 mm, W 395 mm, D 300 mm

Weight
4.8 kg (net) 7.0 kg (shipping)

Power requirements
110–240 V AC 50–60 Hz, single phase 80 VA

Options
IEEE bus interface
Adaptor for 1 m long cables with BNC connectors.

Accuracy

Test Frequency	***111 Hz***	***1 kHz***	***Accuracy***
C	***Range***	***Range***	***Accuracy***
		0.1 pF– 3 µF	0.05 % or 1 digit
	100 pF–300 µF	3 µF–30 µF	0.1 % or 2 digits
	>300 µF	>30 µF	Linear increase with capacitance value from 0.1 % limit
L		10 mH–1000 H	0.05 % or 1 digit
	10 mH–1000 H	1 mH–10 mH	0.1 % or 2 digits
	10 µH–10 mH	0.1µH–1 mH	0.2 % or 5 digits
R	0.01 Ω–10 Ω	0.01 Ω–10 Ω	2 digits
	10 Ω–5 MΩ	10 Ω–5 MΩ	0.05 % or 1 digit, linear increase with resistance to 1 % at 100 MΩ
	5 Ω–100 MΩ	5 Ω–100 MΩ	
D (with C)	500 pF– 30 µF	50 pF– 3 µF	0.0005
	30 µF– 300 µF	3 µF– 30 µF	0.002
	300 µF–3000 µF	30 µF–300 µF	0.005
Q (with L)			0.1 % + 0.05 % × Q
Speed of Measurement	1 per second	5 per second	

Ranges and resolution

	111 Hz	***Resolution***	***1 kHz***	***Resolution***
R	0–100 MΩ	0.01 Ω	0–100 MΩ	0.01 Ω
L	100 µH–9999 H	0.1 µH	10 µH–999.9 H	0.01 µH
C	0–9999 µF	1 pF	0–999.9 µF	0.1 pF
D	0–.9999	0.0001	0–.9999	0.0001
Q	1–9999	0.1	1–9999	0.1

OPERATING INSTRUCTIONS CT10.

TABLE OF CONTENTS: PAGE

SECTION 1.

SET-UP:

Before switch-on, make sure that the Mains Voltage Selector on the rear panel is set to the appropriate voltage and the correct fuse is placed in the power socket housing.

SECTION 2.

SWITCH-ON:

The microprocessor will continuously update the zero readings of the various circuits during use to compensate for temperature effects. None the less it will be advisable to allow five to ten minutes idling after switch-on to ensure the full accuracy of the measurements.

Displays: Main parameters are shown in the upper L/H display.
Secondary parameters are shown in the upper R/H display.
Accuracy of measurement is shown in lower L/H display.
Accuracy of d measurement is shown in lower R/H display.

Before starting to measure, two things must be done:

a: Select the measuring frequency by pushing the frequency switch [FRQ] on the keyboard. When the light emitting diode in the switch is on, 111.11 Hz is selected. At start-up 1 kHz is automatically selected.

b: When testing components with axial leads the measuring jig should be adjusted to the size of the components and a jig calibration procedure called by pushing "Clear" [C] and "Zero" [0] in that order. If the jig configuration is altered later on, a new jig calibration is necessary.

Make sure that the jig is empty when the calibration is done.

SECTION 3.

MEASUREMENTS:

A. Automatic Mode.

This mode is automatically selected at switch-on. Apply the unknown component to the jig and the displays will tell you the type and value of the component: capacitance with loss factor as the secondary parameter, inductance with Q-factor, or resistance with either equivalent parallel capacitance or series inductance whichever is dominant. The main parameter capacitance or inductance is given as equivalent series value.

B. Keyboard Control.

After insertion of the component to be measured the equivalent series mode can be changed to parallel mode (and back again) by the [S/P] key. The actual mode is shown in the displays by the indices to the parameters.

The secondary parameter, Q or D, can be interchanged by the [Q/D] key or altered to equivalent resistance (series or parallel) or conductance (Gp, parallel only) with the [R/G] key (i.e. the first stroke will select R (s or p), the second Gp and the third back to R).

To revert to the Automatic Mode just press the clear key [C] twice.

NOTE: By using [C] + [C] the jig zero is also cleared and must be redone if needed.

C. Δ Mode.

The CT10 is capable of making deviation measurements from a nominal value, displaying deviation in either absolute value or in percentage.

The nominal value may be entered either by the keyboard or by measuring an external standard. Deviation measurements apply only to the primary parameter.

The set-up of a nominal value is initiated by the [Δ] key.

If a nominal value is already in existence, this will be shown. If a component with less impedance than equivalent to 5 pF is on the jig, the CT10 will initiate a set-up routine using the component value as the nominal.

To insert a nominal value by the keyboard the jig must be empty when the [Δ] key is activated.

C1. Nominal Value using the Keyboard.
Operate the [Δ] key.

The main parameter display will show Δ,+ and the secondary display will be cleared.

The % sign will flash to ask the operator whether % deviation is wanted. % or absolute deviation value is selected alternatively by operating the [%] key.

Next the C,L and R parameter indicators in the primary display will be flashing in sequence, to ask the type of nominal component. C is selected by one stroke of the [C/L] key, L by two strokes and R by pressing the [R/G] key.

Now the value must be entered, and the first decimal point and zero flash to ask for the decimal point (if wanted at that place) and the value of the first digit.

Whenever an appropriate key is operated, the selected digit "freezes" and the next flashes. If a wrong entry has been made, you can always go back reselecting C,L or R, or even start from scratch by pushing the [Δ] key or the [C] key.

When the digit value has been entered the appropriate unit (Farad, Henry or Ohm) goes on and the exponent indicators Pico, Nanno, Micro or Milli flash in sequence ready for selection. Then the key [1] gives pF, μH or Ω, the key [2] gives nF, mH or kΩ and the key [3] gives μF, H or MΩ.

The entering of the nominal value is completed by the key stroke [•] and it disappears from the primary parameter display. When a component is inserted it will show the deviation value of any subsequent measurement, until the Δ mode is erased.

C2. Nominal Value using the External Standard.

Calibrate the jig by pressing the keys [C] and [0]. The standard should now be placed in the jig and the [Δ] key pressed.

The primary parameter display is now cleared, the % sign starts flashing asking for the type of deviation. % - or absolute deviation is selected alternatively by operating the [%] key.

Next the series/parallel indicators will flash in sequence to request the type of presentation. S/P are alternatively selected by the [S/P] key. After this has been done the measurement of the standard component will be displayed.

NOTE: The + sign will remain on the display.

The nominal value is inserted in the memory and the Δ mode measurements are initiated by the [•] key and the set-up is finished.

If the operator wants to exit from the Δ mode (to the automatic mode) but still wants to retain the nominal value in the memory, the keyboard sequence [Δ] [C] [•] should be entered.

Alternatively the [C] [C] sequence can be used.

The nominal value can be recalled for inspection any time by operating the [Δ] key and it can be reinserted by the [•] key, whereby the mode is reactivated.

In the Δ mode there is no indication of accuracy of tgδ.

If the Δ mode is no longer required (nominal value deleted from memory) the key sequence [C] [Δ] [•] should be entered.

D. Limits.

The CT10 has a separate limit display, a single digit, high intensity LED display located just above the jig.

By this it is possible to sort the components in ten classes, (including high and low reject) with respect to the primary parameter. An additional HIGH/LOW limit on the secondary parameter (limit 9) is available.

Limits can be set on both absolute measurements and in Δ mode.

The limit-display serves as both a limit number indicator when entering limits and as a class indicator when operating with limit sorting.

Class 0 (zero) will always be low reject and class 9 always high reject. On the primary parameter limit 0 is the lowest limit between low reject (class 0) and class 1 and limit 8 is the highest limit between class 8 and high reject (class 9). Limit 9 is the HIGH/LOW limit on the secondary parameter and a HIGH is indicated by a flashing decimal point or class number in the limit display.

The limits must be inserted in increasing order, e.g. if the absolute measurement mode is being used, the lowest limit (zero) has the lowest value. Any number of limits from one to ten can be used.

When less than 9 limits (limits 0 to 8) are selected for the primary parameter, class 9 is still the high reject class. In other words, if only 5 limits are inserted, class 5 to 8 will not be used and every measurement above limit 5 will be denoted as class 9.

A limit set-up procedure is called by the [LIM] key. If in Δ mode, the deviation limit procedure will be started. If not, the absolute limit procedure is initiated.

At the start of the latter it is possible to move to the Δ lim procedure by pressing the [Δ] key after the [LIM] key. In other words, it is possible to set up Δ limits without nominal value which must then be inserted later. (Parameters in accordance with the limits).

D1. Limits on Absolute Measurements.

The limits are inserted in sequence using the keyboard.

To start the sequence operate the [LIM] key. The limit display will light up and display a zero indicating that the lowest limit (between low reject and class 1) must be entered.

At the same time the measuring displays are cleared and C, L and R will be flashing in sequence in the primary display to request the type of display. The wanted parameter is "frozen" by the [C/L] or [R/G] keys (the last one only for R), and the S/P indicators will start flashing if C or L has been chosen. After selecting Serial or Parallel the first decimal point and zero start flashing.

The decimal point is inserted by the [•] key or ignored by inserting the first appropriate digit, which will start the next decimal point and digit flashing.

When the numerical value (with decimal point) has been correctly entered the exponents to the appropriate unit will flash in sequence asking for proper entry.

The key [1] gives pF, µH or Ω, the key [2] gives nF, mH or kΩ and the key [3] gives µF, H or MΩ.

The insertion of limit 0 is now complete and the next limit is called by the key [LIM]. The limit display now shows a figure one and the primary display shows the same parameter and unit. The flashing requests the first decimal point and digit of the second limit (limit 1) to be entered.

When the last digit has been entered, the LIM sign will flash asking for the next limit to be inserted.

As many limits as required on the primary parameter can be inserted, observing the rule that they must be increasing in value with increasing order.

If during the set-up of a limit a faulty entry has been made, the set-up of that limit can be restarted by activating the clear [C] key. In the set-up of the first limit (limit 0) the parameter selection is restarted by the clear [C] key.

If during the digit entry the [LIM] key is operated, the digit entry is restarted.

NOTE: A double clear [C] [C] will cancel the whole set-up procedure and revert to automatic mode without entering any limits.

When no more limits on the primary parameter are required the [LIM] key is operated once more after the next limit has been called. The LIM and first decimal point will flash alternately. The [LIM] key (for the third time) will restart insertion of the primary limit. The [•] key will start insertion of the secondary parameter.

In other words, by activating the sequence [LIM] [LIM] [•] the limit display now jumps to limit 9 which is the HIGH/LOW limit for the secondary parameter.

The secondary display now asks for type, value and unit in the same way as for limit 0.

The choice of types for the secondary parameter is limited by the fact that a resistor (which has Cp or Ls automatically chosen as its secondary parameter) cannot have a limit on its secondary parameter.

As noted previously series conductance (Gs) is not available for reactances.

If limit 9 is not required, simply press the [•] key, when limit 9 set-up is started.

NOTE: It is necessary to finish the limit set-up via limit 9 by inserting a realistic value or just bypassing it.

D2. Limits in Δ Mode.

When a nominal value has been inserted in the Δ mode, limits on the deviation can be set up both in absolute value and in percentage.

Operation of the key [LIM] initiates the limit set-up sequence by displaying limit zero and clearing the digits on the displays. The primary display will flash the % sign to ask whether % limits or absolute value limits relative to the nominal value are required.

Next the + and - will alternate to request the sign of the deviation limit. The key [0] selects - and the key [1] selects +.

Finally the value is inserted, following the prompting of the display.

If absolute deviation limits are chosen, the unit will be the same as for the nominal value.

The key [LIM] completes insertion of the first limit (LIM zero) and calls the next, where only sign and value is required.

Remember that the limits must be of ever increasing signed value with respect to their order.

When the required number of limits for the primary parameter are inserted, the sequence is finished by pressing [LIM] [LIM] [•] which changes to limit 9, the limit on the secondary parameter.

Correction of entered values: If a faulty value has been inserted, press [C] and enter the correct value.

The entire limit insertion sequence is finished by pressing the key [•] whether or not a limit 9 has been inserted.

After the final [•] key has been pressed the limits will be stored in the memory and should the operator want to inspect a particular limit, say limit X the following procedure must be followed:

Press the keys in the following sequence: [LIM] [X], and if it is correct reinsert it by [•]. If you want to inspect limit Y as well, just press [Y] after [X] and, if this limit is not correct, push [C] and you will get prompting from the display for a new value.

If a new value is not required just press [•].

If a limit is deleted, the corresponding higher class will disappear from the sorting sequence, i.e. if limit 5 is deleted, class 5 will not appear separately but components between limit 4 and 6 will become class 4.

If the highest limit for the primary parameter is deleted, the next lower limit to be inserted is the HIGH reject limit, and the class above it is then denoted 9.

Limit 0 cannot be deleted.

The secondary parameter is always limit 9.

When changing a limit value make sure that it is still lower than the value of the next higher numbered limit and higher than the next lower numbered limit, (this rule has, of course, no bearing on limit 9).

If the limit mode is to be disabled, but the limits retained in the memory, enter this sequence: [LIM] [C] [•].

The limits are reactivated by: [LIM] [•].

If all the limits are to be removed permanently, enter [C] [LIM] [•]. This is the only way to remove limit 0.

2nd edition, 23.11.1982.

Transmission Format

V24 asynchronous data with 1 start bit, 8 bit.
(No parity) and 2 stop bit.

Data Rate

9600 baud.

Data Transfer Control

An interface signal (Printer Busy ∿ +V) to SC3 pin 20 (DTR) will cause the transmitter in progress to stop the transmission.

The transmission will continue as soon as DTR return to normal (-V).

Data Output Format

32 characters in a continous string without limits.
46 characters in a continous string with limits.
Each string is terminated with CR LF CR LF.

MAIN PARAMETER CODES

		OUTPUT CHARACTER CODE
1. character	Circuit Mode Serial	S
	Parallel	P
2. character	Measuring Frequency 111 Hz	H
	1 kHz	L
3. character	Measuring Function Resistor (Ω)	R
	Inductance (H)	L
	Capacitor (F)	C
	ΔR (Ω)	W
	ΔL (H)	H
	ΔC (F)	F
	%	P
4. character	Sign of Value	+
		-
		Space
5. character		Space
6. character	Decimal Point	.
7.-10. character	Value in 4 DIGITS	
11.character		E
12. character	Sign of Exponent	+
		-
13.-14. character	Exponent in 2 DIGITS	
15. character	End of Line	CR
16. character		LF

SECONDARY PARAMETER CODES				OUTPUT CHARACTER CODES
17. character				Space
18. character				space
19. character	Measuring function		Q	Q
		Loss Factor	D	D
		Serial or Parallel Resistance	(Ω)	R
		Parallel Conductance	$(\frac{1}{\Omega})$	G
		Serial Inductance	(H)	L
		Parallel Capacitance	(F)	C
20. character	Sign of Value			+ -
21. character				Space
22. character	Decimal Point			•
23.-26. character	Value in 4 DIGITS			
27. character				E
28. character	Sign of Exponent			+ -
29.-30. character	Exponent in 2 DIGITS			
31. character				CR
32. character				LF

LIMIT PARAMETERS			OUTPUT CHARACTER CODES
33. character	With Limit Set Up on Main Parameter, else Space		L
34. character			I
35. character			M
36. character			Space
37. character		Bin Number	N
38. character	Delimiter		,
39. character			Space
40. character	With Limit Set Up on Secondary Parameter, else Space		H/L
41. character			I/O
42. character			G/W
43. character			H/Space
44. character			Space
45. character			CR
46. character			LF

TABLE 1

SC1 Pin Connections

Pin 1	LIM 2
Pin 2	LIM 3
Pin 3	LIM 4
Pin 4	LIM 5
Pin 5	LIM 6
Pin 6	Common Ground
Pin 7	LIM 7
Pin 8	LIM 8
Pin 9	LIM 1
Pin 10	LIM 0 (Low Reject)
Pin 11	Common +
Pin 12	Bias Ground
Pin 13	Bias (Max. 3V)
Pin 14	LIMIT High/Low
Pin 15	LIM 9 (High Reject)

TABLE 2

SC2 Pin Connections

SEE IEEE Option

TABLE 3

SC3 Pin Connections		In/Out
Pin 1	Protective Ground	
Pin 2	Received Data	(I)
Pin 3	Transmitted Data	(O)
Pin 4	Not Used	
Pin 5	Pseudo Clear to send	(O)
Pin 6	Data Terminal Ready	(O)
Pin 7	Signal Ground	
Pin 8	Request to Send	(O)
Pin 9	Not Used	
Pin 10	Not Used	
Pin 11	Reserved	(O)
Pin 12	Not Used	
Pin 13	Not Used	
Pin 14	Not Used	
Pin 15	Not Used	
Pin 16	Not Used	
Pin 17	Not Used	
Pin 18	Reserved	(I)
Pin 19	Not Used	
Pin 20	Data Terminal Ready	(I)
Pin 21	Not Used	
Pin 22	Not Used	
Pin 23	Not Used	
Pin 24	Not Used	
Pin 25	Trigger Input	(I)

CALIBRATE JIG (WITHOUT COMPONENT)	[C] [0]
CHANGE SERIAL TO PARALLEL – OR REVERSE	[S/P]
CHANGE Q TO LOSS FACTOR (d) – OR REVERSE	[Q/D]
CHANGE Q (OR d) TO EQUIVALENT R (OR G_s)	[R/G] [R/G]
RESELECT AUTOMATIC MODE	[C] [C]

Δ-MODE. DEVIATION OF PRIMARY PARAMETER FROM NOMINAL VALUE IN % ([%])
OR IN ABSOLUTE DEVIATION ([%] [%]).
UNITS: pF, µF, Ω = [1] ; nF, mH, KΩ = [2] ; µF, H, MΩ = [3]

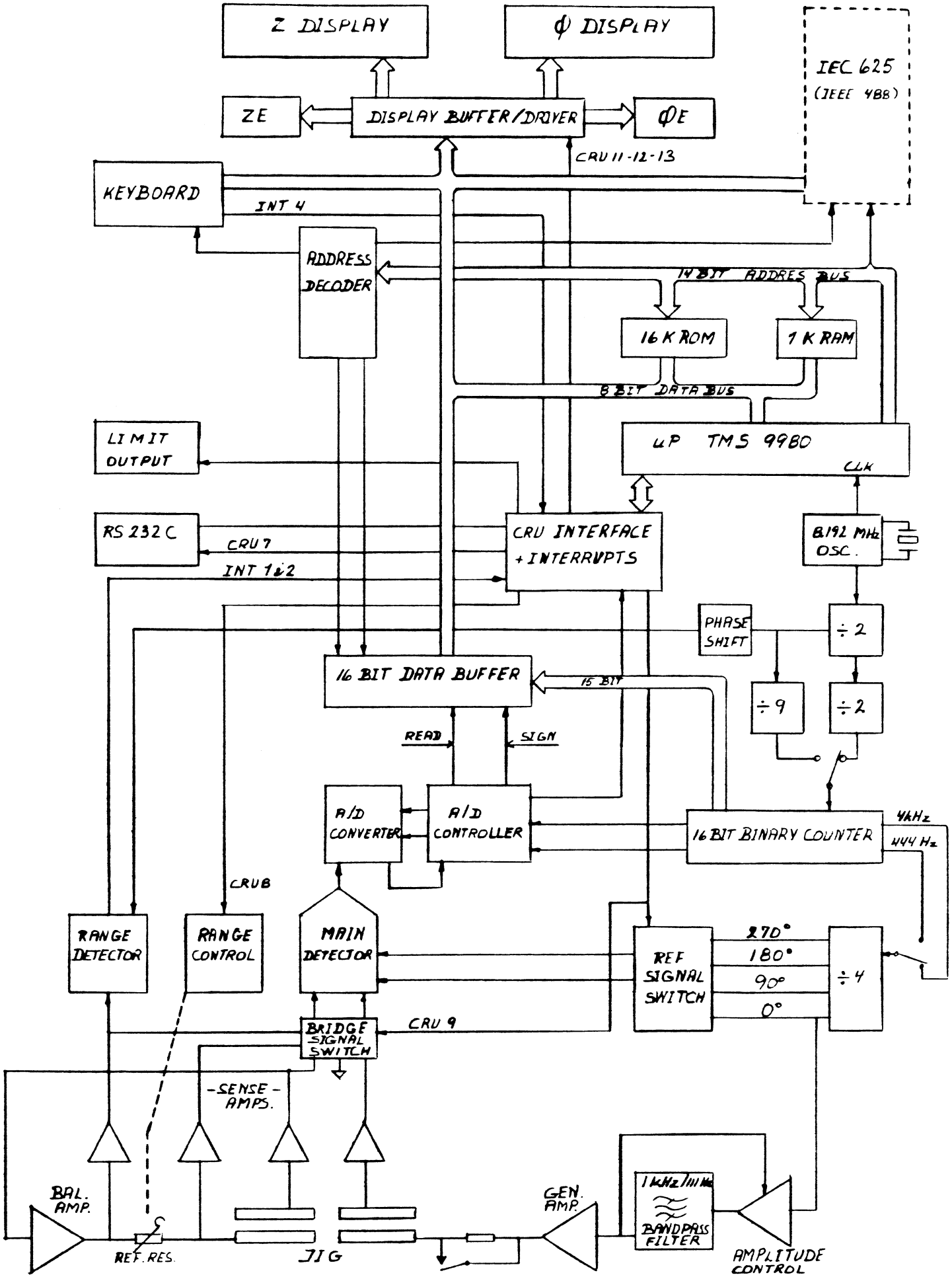
ENTER NOM. VALUE BY KEY-BOARD	[Δ] [%, TYPE, VALUE, UNIT] [•]
ENTER NOM. VALUE BY EXTERNAL STANDARD	[Δ] [%, S/P, SEC. PARAM.] [•]
EXIT Δ-MODE . (NOM. VALUE IN MEMORY)	[Δ] [C] [•]
INSPECT NOM. VALUE AND REENTER Δ- MODE	[Δ] [•]
DELETE NOM. VALUE AND EXIT Δ-MODE	[C] [Δ] [•]

LIMIT-MODE. LIM 0 TO 8 ON PRIM. PARAM., LIM 9 ON SEC. PARAM.
ENTER LIMITS IN INCREASING ORDER

	ENTER ABSOLUTE VALUE MODE LIMITS	[LIM] [TYPE, VALUE, UNIT] [LIM] ...
	ENTER Δ-MODE LIMITS (– = [0] , + = [1])	[LIM] [%, SIGN, VALUE] [LIM] ...
*)	JUMP TO LIM 9 (SEC. PARAM.) – AND RUN	[•] [TYPE, VALUE, UNIT] [•]
	EXIT LIM-MODE (LIMITS IN MEMORY)	[LIM] [C] [•]
	INSPECT LIM (X) AND REENTER LIMIT-MODE	[LIM] ([X]) [•]
	CHANGE LIM X	[LIM] [X] [C] [NEW VALUE] [•]
	DELETE LIM X	[LIM] [X] [C] [•]
	DELETE ALL LIMITS	[C] [LIM] [•]

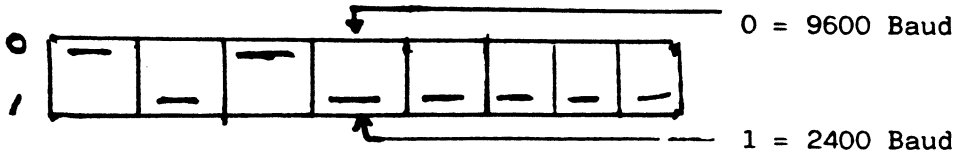
*) Correction:

JUMP TO LIM 9 (SEC. PARAM.) AND RUN [LIM] [LIM] [•]



73720	**CT 10**
danbridge a-s	**SIMPLIFIED SCEMATICS**

Set Baud rate on SW1 (inside instrument)



Transmission format
V24 asynchronous data: 1 start bit, 8 bit (no parity) and 2 stop bit

Connect SC3 pin 7 with pin 18 for data output (rear panel).

Setup string (ASCII code):

*C FL CS BD SN sp CP . 4700 E - 07 CR LF S0 PC - . 1000 E + 02

CR LF S1 PC + . 0000 E + 00 CR LF S2 PC + . 1000 E + 02 CR LF L1 J1

Explanation:

*C: Clear and restart CT10
F1: go 1 kHz
CS: Series mode
BD: Secondary parameter = D loss factor
SN: Store nominal value (Mess werte)
sp: Space

Nominal value capacitance percentage measurement

47 nF: sp CP . 4700 E - 07 CR LF

CR LF: Carriage return, line feed (string terminator)

S0: store limit zero

percentage deviation limits: -10%, 0%, +10%

PC - . 1000 E + 02 CR LF

S1: store limit one

PC + . 0000 E + 00 CR LF

S2: store limit two

PC + . 1000 E + 02 CR LF

L1: limit on

J1: create jig compensation and set jig compensation ON (may be omitted)

The CT10 is now ready for measurements.
An external trigger (SC3 pin 25) or *T will perform one measurement,
set the limit outputs (SC1) and transmit data over RS232C,
(if selected SC3 pin 18 connected to SC3 pin 7).

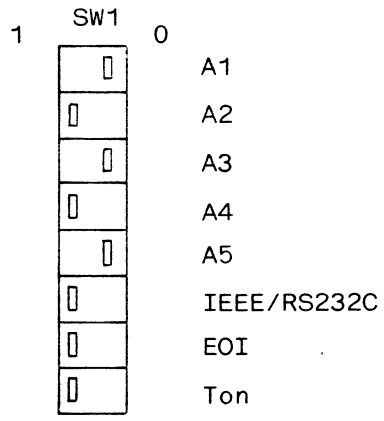
10.8.1987 SKO

General:

CT 10 can be remotely controlled by means of the IEEE 488/IEC 625 bus interface. All the keyboard functions are included in the bus interface.

IEEE Control Switch:

The IEEE control switch (SW1) located at the rear of the main PC board controls the four data transmission capabilities and sets the IEEE ADDRESS.



Set up for Talker only with END OF LINE Termination (of each output string)
Buss address > 0A.

MODE	Ton	EOI	IEEE/ RS232	IEEE Mode
DATA ON RS232C output AFTER each measurement enabled by external trig	0	0	0	NO
SRQ after each measurement enabled by external trig OR GET.	0	1	1	Talker/listener with EOI.
DATA ON BUSS when addressed to talk	0	0	1	Talker/listener without EOI.
DATA ON BUSS after each measurement	1	1	1	Talker only with EOI.
enabled by external trig	1	0	1	Talker only without EOI.

Interface Function:

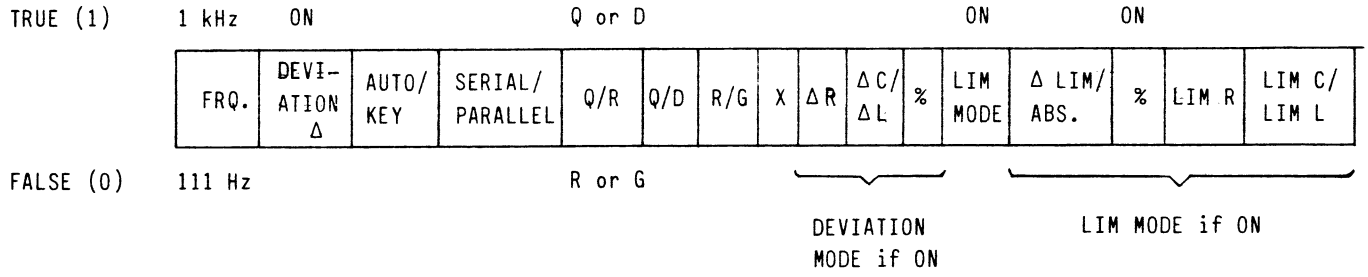
Code	Function
SH1	Source Handshake
AH1	Acceptor Handshake
T5	Talker (Basic Talker, Serial Poll, Talk only mode, unaddressed to talk if addressed to listen)
L4	Listener (Basic Listener, unaddressed to listen if addressed to talk)
SR1	Service Request
RL2	Remote/Local (without local lockout)
DC1	Device Clear
DT1	Device Trigger

Remote Program Code:

The remote program codes for CT 10 are listed in IEEE input code.

Status Mode:

CT 10 returns a service request and a 16 bit flag loaded in hexadecimal, in two characters, which indicates the current mode of operation when addressed to talk after a serial poll sequence.



Recall Reference VALUE:

CT 10 returns a service request and the selected reference value when addressed to talk after a serial poll sequence.

The output format is listed in Reference Value Codes.

Store Reference Value:

CT 10 waits for a 14 character string containing the reference data after receiving the Program Code. The input format is listed, see Reference Value Input Codes.

NB ! The required reference values must be stored in the following order:

1. Nominal Value
2. LIM 0 up to LIM 9 in ascending order

It is recommended to specify the secondary parameter by means of the B Code (see IEE Input Codes) after a Store Reference Value sequence without a LIM 9 specification.

Service Request Status Byte:

CT 10 sends SRQ when a measurement is completed and output data is available in the Talk and Listen mode, or if the CT 10 receives erroneous input strings.

Status Byte (sent out during Serial Poll)

	SRQ			LIM 9	LIM	NOM. VAL.	ERROR	
0	1	0	0	0	0	0	0	DATA READY
0	1	0	0	0	0	0	1	Syntax error in input string
0	1	0	0	0	0	1	1	RN, D1 or D2 received without a stored reference value
0	1	0	0	0	1	0	1	R 0-9 or L1 received without a stored reference value
0	1	0	0	0	1	1	1	L1 received with stored deviation limit, but without a nom. val., or deviation limits stored without a nom. val.
0	1	0	0	1	0	0	1	R9 received without a stored reference value

DATA Output Format:

The output codes are equal to the RS232C codes (see RS232C DATA Output Codes).

The DATA are transmitted in 3 strings each terminated with a CRLF.

The first string contains the Main Parameter Codes. The second string contains the Secondary Parameter Codes, and the third string contains the Limit Parameters if specified.

Examples

A: Capacitance measurements with a nominal value of 1 µF measured as series capacitance and loss factor (D) and percentage.

Limits: -10%, -2%, 0%, +2%, +10% and + 85%.

STEP	PROGRAM CODE	INPUT STRING	NOTES
1	C S		Series mode
2	S N	_ C P . 1 0 0 0 E - 0 5 CR LF	Nom. val. stored
3	S 0	P C - . 1 0 0 0 E + 0 2 CR LF	LIM 0 stored
4	S 1	P C - . 2 0 0 0 E + 0 1 CR LF	LIM 1 stored
5	S 2	P C - . 0 0 0 0 E + 0 1 CR LF	LIM 2 stored
6	S 3	P C + . 2 0 0 0 E + 0 1 CR LF	LIM 3 stored
7	S 4	P C + . 1 0 0 0 E + 0 2 CR LF	LIM 4 stored
8	S 5	P C + . 8 5 0 0 E + 0 2 CR LF	LIM 5 stored
9	B D		Loss factor selected for second parameter.

B: As A, but with a 0.2% limit on loss factor.

Omit step 1 (see above) and enter step 2 to 8 and continue with:

STEP	PROGRAM CODE	INPUT STRING	NOTES
10	S 9	S D C . 0 0 2 0 E + 0 0 CR LF	LIM 9 stored

(Enter step 10 alone if step 1 to 9 in example A is entered previously, i.e.: It is always possible to add limits).

C: Resistor measurements with a nominal value of 2.15 KΩ and deviation limits: -100 Ω, -20 Ω, +21 Ω and +150 Ω.

STEP	PROGRAM CODE	INPUT STRING	NOTES
1	L 2		Delete previously stored nom. val. and limits, if any, else omit step 1 and 2.
2	D 3		
3	S N	_R_.2150E+04 CR LF	Nom. val. stored
4	S 0	RR-.1000E+03 CR LF	LIM 0 stored
5	S 1	_R-.2000E+02 CR LF	LIM 1 stored
6	S 2	_R+.2100E+02 CR LF	LIM 2 stored
7	S 3	_R+.1500E+03 CR LF	LIM 3 stored

D: Inductance measurements, measured as series inductance and Q, and absolute limits: -3 mH, +2.5 mH.

STEP	PROGRAM CODE	INPUT STRING	NOTES
1	L 2		See notes above
2	D 3		
3	C S		Series mode
4	S 0	_L-.3000E-02 CR LF	LIM 0 stored
5	S 1	_L+.2500E-02 CR LF	LIM 1 stored
6	B Q		Q selected for secondary parameter.

IEEE Input Codes:

	Program Code	Result
2. parameter setting		
B Code	B Q	
	B D	
	B R	
	B G	
Circuit mode		
C Code	C A	Auto mode
	C S	Serie
	C P	Parallel
Deviation		
D Code	D Ø	Deviation off
	D 1	Deviation on relativ
	D 2	Deviation on %
	D 3	Deviation off delete nominal value
Frequency		
F Code	F H	Shift to 111 Hz
	F L	Shift to 1 kHz
Status mode		
K Code	K F	Return K flag
Limit		
L Code	L Ø	Limit off
	L 1	Limit on
	L 2	Limit off DELETE limits
Recall Reference Value		
R Code	R N	Return nominal value
	R Ø-9	Return limit X (Ø ≤ X ≤ 9)
Store Reference Value		
S Code	S N	Store nom. val. for deviation mode
	S Ø-9	Store limit X (Ø ≤ X ≤ 9)

REFERENCE VALUE CODES				OUTPUT CHARACTER CODES
1. character	Nominal value			Space
	LIM 0-9	Serial		S
		Parallel		P
2. character		Measuring function:		
	Nominal value	Resistor	(Ω)	R
		Inductance	(H)	L
		Capacitor	(F)	C
	LIM 0-8		%	P
		Resistor	(Ω)	R
		Inductance	(H)	L
		Capacitor	(F)	C
		ΔR	(Ω)	W
		ΔL	(H)	H
		ΔC	(F)	F
	LIM 9		Q	Q
		Loss factor	D	D
		Serial/parallel Resistance	(Ω)	R
		Parallel conductance	$(\frac{1}{\Omega})$	G
3. character	Nominal value			Space
	LIM 0-8	SIGN OF VALUE		+
				-
	LIM 9			Space
4. character		Decimal point		•
5.-8. character	Value in 4 DIGITS			
9. character	Nominal value			E
	LIM 0-8			E
	LIM 9	(Q,R,G)		E
		(D)		Space

REFERENCE VALUE CODES				OUTPUT CHARACTER CODES
10. character	Nominal Value			
	LIM 0-8			
	LIM 9	(Q,R,G)	sign of exponent	+
				-
	LIM 9	(D)		Space
11.-12. character	Nominal value		Exponent in 2 DIGITS	
	LIM 0-8		Exponent in 2 DIGITS	
	LIM 9	(Q,R,G)	Exponent in 2 DIGITS	
	LIM 9	(D)		Space
13. character				CR
14. character				LF

REFERENCE VALUE INPUT CODES			STRING CHARACTER CODES
1. character	Nominal value	(nom. val.)	Space
	LIM 0	Absolute limits	Space
		Deviation limits	R
		% limits	P
	LIM 1-8	Absolute limits	Space
		Deviation limits	Space
		% limits	P
	LIM 9	Serial mode	S
		Parallel mode	P
2. character	Nominal value	Component:	
		Resistor (Ω)	R
		Inductance (H)	L
		Capacitor (F)	C
	LIM 0-8	LIM components	
		Resistor (Ω)	R
		Inductance (H)	L
		Capacitor (F)	C
	LIM 9	Q	Q
		Loss factor D	D
		Serial/parallel Resistance (Ω)	R
		Parallel Conductance ($\frac{1}{\Omega}$)	G
3. character	Nominal value	Relative deviation	Space
		% deviation	P
	LIM 0-8	SIGN OF VALUE	+
			-
	LIM 9	LIM Components:	
		Inductance	L
		Capacitor	C

REFERENCE VALUE INPUT CODES			STRING CHARACTER CODES
4. character	Decimal point		.
5.-8. character	Value in 4 DIGITS		
9. character			E
10. character	Nominal value		
	LIM 0-8	Sign of exponent	+
			-
	LIM 9	(Q,R,G) Sign of exponent	+
			-
	LIM 9	(D)	+
11.-12. character	Nominal value	Exponent in 2 DIGITS	
	LIM 0-8	Exponent in 2 DIGITS	
	LIM 9	(Q,R,G) Exponent in 2 DIGITS	
		(D)	0
13. character			CR
14. character			LF