Tettex INSTRUMENTS

2763 / 2767 / 2769

Automatic Instrument Transformer Test Set

FEATURES

- Current and voltage transformer measurements with a single instrument
- Fully automatic measurement and digital display of current/voltage ratio errors, phase displacement, test current and voltage
- Measurements are possible on instrument transformers of practically any primary and secondary current and voltage ratings
- Test and standard transformers may have different ratios
- A cost-effective solution:
  - different transformers can be tested using one single standard transformer
  - different standard and test transformer ratios are matched without use of an external divider
- Interactive parameter entry simplifies operation
- A microprocessor monitors all entries and controls the measurement run
- Plain-language display of error messages on a 2 x 16 character dot-matrix
- Short measurement times
- Dynamic averaging
- High accuracy
- Low inherent burden
- Connection for external printer (RS 232C interface)
- Front-panel with modern keyboard (piezocrystal elements)
- Specifications conform to the standards/ recommendations of IEC 60044-1, IEC 60044-2; IEC 60044-3; IEC 60044-7, ANSI/IEEE C57.13-1978 and VDE 0414, part 2
- Including RS 232C interface for computer connection

Options

- For remote-controlled measurement - IEEE 488 interface
- Wide range of accessories (see order specification)

GENERAL

The type 2767 automatic current and voltage transformer test set marketed by TETTEX INSTRUMENTS is a modern, fully automatic instrument for fast, accurate measurement of instrument transformer errors. It is designed for use in laboratories, manufacturing processes, quality control procedures and official metrology stations. Present increasingly severe quality control requirements call for a higher degree of operating comfort and absolute reliability of the measuring equipment employed. Based on the latest design technology this instrument sets new standards of quality, reliability, convenient operation and simple maintenance.
Its measurement ranges for current/voltage errors, phase displacement and current/ voltage excitation are fully up to international standard requirements.
This measuring instrument has been tested by PTB (Physical Technical Federal Authority) in Germany. It fulfills all requirements according to the PTB test rules for measuring instrument transformers and is approved for calibration.

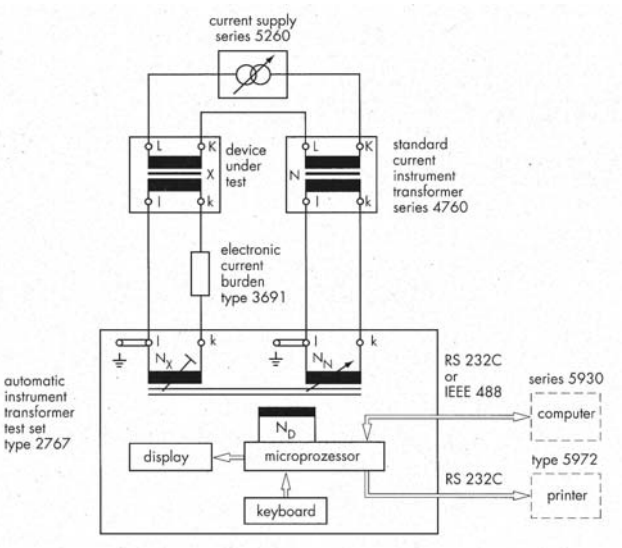
COMPLETE MEASUREMENT SYSTEMS

TETTEX INSTRUMENTS also designs and supplies computer controlled current and voltage transformer measurement facilities for specific customer requirements, comprising the following:

- Type 2767 combined test set for current and voltage instrument transformers
- Series 4760 standard current transformer (current comparator)
- Type 2763 is a test set for current instrument transformers only
- Type 2769 is a test set for voltage instrument transformers only
- Series 4820 standard voltage instrument transformer or series 4860 electronic standard voltage divider with high-voltage capacitive divider
- Type 3691 or 3695 programmable electronic burden or series 3600 passive burdens
- In addition, TETTEX INSTRUMENTS can supply all necessary peripherals (e.g. computer and printer) for external control and data recovery.
- Series 5260 current supply
- Series 5270 voltage supply
- Series 8860 heavy-current connection cables

The type 2767 test set measures transformer ratio errors by the differential method. A major advantage of this is that balancing of winding turns at the differential transformer (current comparator) and compensation via an additional winding enable fully accurate measurement although the test and standard transformer have different ratios.
Measurements are initiated simply by entering the rated test and standard transformer data, for which the built-in microprocessor has a particularly convenient man-machine interface. Current or voltage error, phase displacement, test current or test voltage are measured continuously and displayed in digital form.
A dynamic averaging facility is provided for measurements at low current or voltage, which ensures that accuracy and display stability are maintained even at poor signal/noise ratios.

Test circuit for current instrument:



TECHNICAL SPECIFICATION

1. Current transformer measurement part

X-input (test transformer)

- Rated secondary currents I_{SXR} — 0.1 - 1 - 2 - 5A
- Max. operating range — 1 ... 210 % I_{SXR}
- Inherent burden (at rated current) — < 1 VA

N-input (standard transformer)

- Rated secondary current — I_{SNR} 5 A
- Max. operating range — 1... 210 % ISNR
- Inherent burden (at rated current) — < 2.5 VA

	Permissible limits for k	
I_{SXR}	max. accuracy	reduced accuracy
5 A	0.5 k 1.6	–
2 A	1.6 k 3	–
1 A	3 k 10	10 < k ≤ 25
0.1 A	25 k 100	100 < k ≤ 500

Ratio matching factor
of test and standard transformers
(correction)

$$k = \frac{I_{PXR}}{I_{SXR}} : \frac{I_{PNR}}{I_{SNR}}$$

All entered values for I_{PR} and I_{SR} are checked and the optimum input parameters (N_X, N_N), are set by a microprocessor.

Input limit values

- Rated primary current I_{PXR}, I_{PNR} — 50 mA ... 1000 kA
- Rated secondary current I_{SXR}, I_{SNR} — 50 mA ... 5 A

(continuously adjustable)

2. Voltage transformer measurement part

X and N-inputs
(test and standard transformers)

- Rated secondary voltage (max. rated range values) U_{SXR}, U_{SNR} — 140, 300 V
  additional with factors — x 1/√ 3, x 1/3
- Max. operating range (U_{SX}, U_{SN})
  at U_{SXR} = 3 ... 140 V : 3 ... 280 V
  > 140 ... 300 V : 10 ... 400 V
- Inherent burden
  at U_{SXR}, U_{SNR} = 100 V — < 1 VA
- 140 V — < 0.5 VA

Ratio matching factor
of test and standard transformers (correction)

$$k = \frac{U_{PXR}}{U_{SXR}} : \frac{U_{PNR}}{U_{SNR}}$$

Permissible limits for k

- at max. accuracy — $0.5 \le k \le 2$
- at reduced accuracy — $2 \le k \le 10$

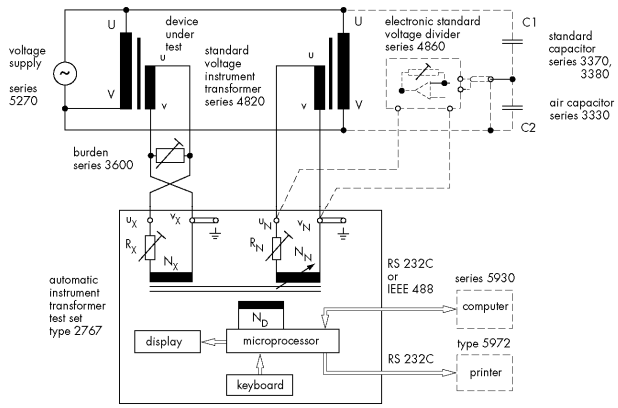
All entered values for U_{PR} and U_{SR} are checked and the optimum input parameters (N_N, R_X, R_N) are set by a microprocessor.

Input limit values

- Rated primary voltage U_{PXR}, U_{PNR} — 3 V ... 10'000 kV
- Rated secondary voltage U_{SXR}, U_{SNR} — 3 ... 300 V

(continuously adjustable)

Test circuit for voltage instrument transformer



3. Current and voltage transformer measurement part

Measurement ranges for
current/voltage errors (RATIO ERROR)
and Ratio Correction Factor (RCF)

Display of F [%] or RCF as required

Conversion

$$RCF = \frac{1}{1+F} = (F = \frac{F[\%]}{100})$$

Measurement ranges for phase displacement (PHASE ANGLE)

Display of [min] or [crad], as required.
Conversion 1 crad = 34.4 min

Current measurement ranges (EXITATION)
Display of test specimen current I_{PX} or I_{SX} as absolute values in [A] or [%] of rated current.

Voltage measurent ranges (EXCITATION)
Display of test specimen voltage U_{PX} or U_{SX} as absolute values in [V] or [%] of rated voltage.

Resolution

■ Current/voltage error	0.0001% = 10-6 (1ppm)
■ Phase angle δ	0.001 min or 0.0001 crad
■ Test current	0.001 A or 0.1 % ISNR
■ Test voltage	0.1 V or 0.1 % USNR
■ Measurement frequency	0.1 Hz

Measurement frequency ranges
15...18 Hz/ 45 ... 65 Hz

Measurement times at 50 Hz

■ First measurement	< 3 s
■ Subsequent measurements	< 1 s

Displays
- 6-digit LCD measured-value displays (height 18 mm) of:
  RATIO ERROR (current/voltage error)
  PHASE ANGLE (phase displacement)
  EXCITATION (test current/voltage)
- LCD dot-matrix, 2 x16 characters (height 7 mm) for measurement frequency, entry instructions and error messages

Mains supply	230 V or 115 V, 50/60 Hz
Power input	approx. 35 VA
Temperature range	+ 5 ... + 40 C
Dimensions	500 x 310 x 470 mm
(W x H x D)	(19.7 x 12.2 x 18.5 in)
Temperature Range	+5 to +40°C
Humidity	5 to 80% r.h. no condensing
Weight	40 kg (88 lb)

This instrument is designed in accordance with the safety requirements of VDE 0411 /part 1 and IEC 348 (safety class 1).

F [%]	± 19.99	± 1.999	± 0.1999
RCF	0.8334 ... 1.2499	0.98040 ... 1.02040	0.99800 ... 1.00200

δ [min]	± 680	± 199.9	± 19.99	± 1.999
δ [crad]	± 19.99	± 1.999	± 0.1999	

I_X [A]	0.000 ... 1.999	2.00 ... 19.99	20.0 ... 199.9	200 ... 1999
I_X [kA]	2.00 ... 19.99		20.0 ... 199.9	200 ... 1999
I_X [%]	0.000 ... 199.9		200 ... 210	

U_X [V]	0.0 ... 199.9		200 ... 1999
U_X [kV]	2.00 ... 19.99	20.0 ... 199.9	200 ... 1999
U_X [%]	Determined by U_{PXR}, U_{SXR} and operating range 3 ... 400 V		

Limits of error at current transformer mesurements
- For operating range 1 ... 210 % of rated current
- Measurement frequency 50 or 60 Hz
- Reference conditions as per IEC 359

Limits of error at voltage transformer measurements
- For operating range Usp = 3 ... 400 V
- Measurement frequency 50 or 60 Hz
- Reference conditions as per IEC 359

Explanation of limit of errors specification
... % rdg = % error of reading
... % fs = % error of value full-scale

The above limits of error also apply for test and standard transformers of different ratios. Limits of error at rated operating conditions see specifications as per instruction manual. Reference and rated operating conditions as per IEC 359, rated range of use 1.

Minimum limits of errors		(...)*The greater of both values applies
RATIO ERROR [%] or RCF	– Current ratio error	± 0.5 % rdg ± 10 ppm ± 1 Dig
	– Voltage ratio error	± 0.5 % rdg ± 50 ppm ± 1 Dig
PHASE ANGLE [min], [crad]	– Phase angle (Current instrument transformer)	± 0.5 % rdg ± 0.034 min ± 1 Dig ± 0.5 % rdg ± 10 u Rad ± 1 Dig
	– Phase angle (Voltage instrument transformer)	± 0.5 % rdg ± 0.17 min ± 1 Dig ± 0.5 % rdg ± 50 u Rad ± 1 Dig
EXCITATION [A], [V], [%]	– Measuring current – Measuring voltage	± 0.5 % rdg ± 0.5 % fs

Example of a test certificate :

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AUTOMATIC INSTRUMENT TRANSFORMER TEST SET   --  TETTEX INSTRUMENTS

     MEASUREMENT PROTOCOL
     ********************

Transformer Identification     : TRAFO 15.BD5.E

Rated currents of
   TEST OBJECT : IPXR =   500.0  A          : ISXR =   5.000  A
   STANDARD    : IPNR =  1000.0  A          : ISNR =   5.000  A
Burden at rated
   current     : B    =    12.5  VA         : PF   =    0.800


Frequency      Ratio error     Phase angle     Excitation

 50.02 Hz      0.99980 RCF     0.0040  CRAD     80.12 %  IPX
 50.03 Hz      0.0200   %      0.137   MIN     400.6  A  IPX
 50.00 Hz      0.0160   %      0.105   MIN      90.32 %  IPX
 49.99 Hz      0.99986 RCF     0.0023  CRAD    101.13 %  ISX
 50.01 Hz      0.99990 RCF     0.0020  CRAD     5.122 A  ISX
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ORDER SPECIFICATION

Standard supply
Type 2767 automatic instrument current and voltage transformer test set in a 19" case (including RS 232C printer interface).

- Ground cable — 16 mm², 10 m
- Power cable
- Mains voltage (please specify with order) — 230 or 115 V; 50/60 Hz
- Including RS 232C interface — type 2767/2
- Type 2763 is a test set for current instrument transformers only
- Type 2769 is a test set for voltage instrument transformers only

Options for type 2767/2763/2769
For remote control by external computer:

- IEEE 488 interface — type 2767/1

Other optional supplies

- Matrix printer — type 5972
- Personal computer — series 5930
- Cable data-link for RS 232C interface, 3 m — type 5991
- Fibre optic data-link for RS 232C interface — type 5992
- Bus cable for IEEE 488 interface, 4 m — type 5993
- Standard current transformers (current comparators), current ratings as follows:
  - up to 1'000 A/1- 5A — type 4761
  - up to 5'000 A/1- 5 A — type 4764
  - up to 1'0000 A/100 A *) — type 4766
  - up to 100 kA/ 100 A *) — series 4760

  *) In addition to type 4764
- Standard voltage transformers up to 220 kV/100V — series 4820
- Electronic standard voltage divider — series 4860
- Programmable electronic current burden — type 3691
- Programmable electronic voltage burden — type 3695
- Current and voltage passive burdens (to VDE and ANSI/IEEE standards) — series 3600
- Current supplies (up to 10 kA) — series 5260
- High-voltage supplies — series 5270
- Heavy-current connection cables — series 8860
- Set of spare parts (type 2767) — no. 016695-00

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