EZCT-2000C

current transformer test set

Vanguard Instruments
A DOBLE COMPANY

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EZCT-2000C

current transformer test set

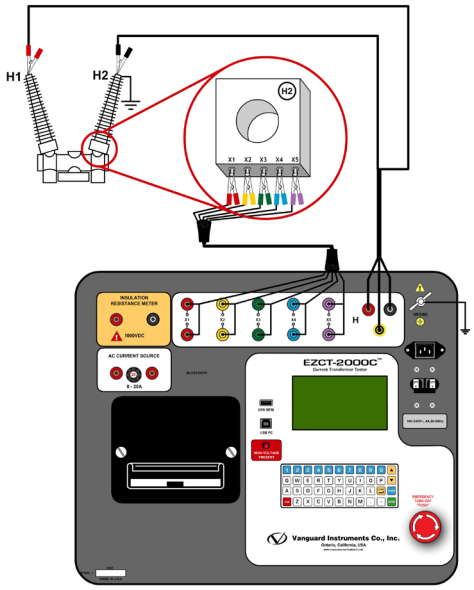
Product Overview

The EZCT-2000C is Vanguard's third-generation microprocessor-based current transformer test set. Designed specifically for CT testing, the EZCT-2000C has the following outstanding features that can greatly increase productivity and save time during the commissioning stage:

- Performs CT excitation, current-ratio, polarity, and phase angle tests
- Measures insulation resistance and winding resistance of the CT secondary windings
- Measures the CT's load burden
- Standalone or computer-controlled via USB or Bluetooth wireless interface

The EZCT-2000C's test leads can be connected to all the CT output terminals, and the complete CT test can be performed automatically without any operator intervention.

EZCT-2000C connections



Excitation Test

The CT excitation test is performed using the ANSI/IEEE C57.13.1 test method. Test voltage ranges from 50, 300, 500,1200 and 2000 Vac can be selected for the excitation test. The test voltage is raised and lowered automatically by the EZCT-2000C. The excitation test voltage and current data is collected and stored in the unit's internal memory. Knee point voltages (ANSI 10/50, IEC 60044, IEC 61869, IEEE-30, and IEEE-45) are calculated and printed on the test report. All of the test leads can be connected to the CT output terminals (X1, X2, X3, X4 and X5), and there is no lead switching required during testing. This convenient arrangement allows for testing any of the 10 possible combinations of X1 to X5. Up to 10 excitation tests can be stored in one record. Once the test is completed, the test report and CT excitation curves can be printed on the built-in thermal printer.

CT Winding Insulation Resistance Test Feature

The EZCT-2000C offers an IR test feature that can also measure the insulation resistance of the CT's secondary winding using a test voltage up to 1000 Vdc. The DC winding resistance reading range is from 2 to 500 Mega-ohms. The insulation resistance test results are displayed and printed on the report.

Ratio and Polarity Tests

The CT current-ratio is determined using the ANSI/IEEE C57.13.1 Section 8.1 measurement method. A test voltage is applied on any two terminals (X1 to X5) of the CT, and the induced voltage is measured through the H1 and H2 terminals of the CT. The CT current-ratio is displayed and also stored in memory. The current-ratio is measured from 0.8 to 5,000. The CT winding polarity is displayed as a "+" sign (in-phase) or a "-" sign (out-of-phase) and is annotated with the phase angle in degrees. The CT current ratio error and phase displacement is also calculated based on the CT burden (or rated power) and rated current.

Demagnetization

The EZCT-2000C Plus automatically demagnetizes the CT under test when performing an excitation test.

Winding Resistance Test

The EZCT-2000C can measure the DC resistance of transformer windings from 100 micro-ohms to 10 ohms.

CT Burden Test

The EZCT-2000C can measure the CT's actual connected burden by injecting a 1A or 5A test current into the load. The CT burden measurements (Voltage, current, Cos φ, and burden impedance) are displayed on the screen and printed on the test report. This important test verifies the actual CT measured burden before putting the CT in service, thus avoiding any potential configuration conflicts.

Current Ratio and Phase Error Tables

As part of the tabulated test results, the EZCT-2000C can also print the current ratio and current phase error tables.

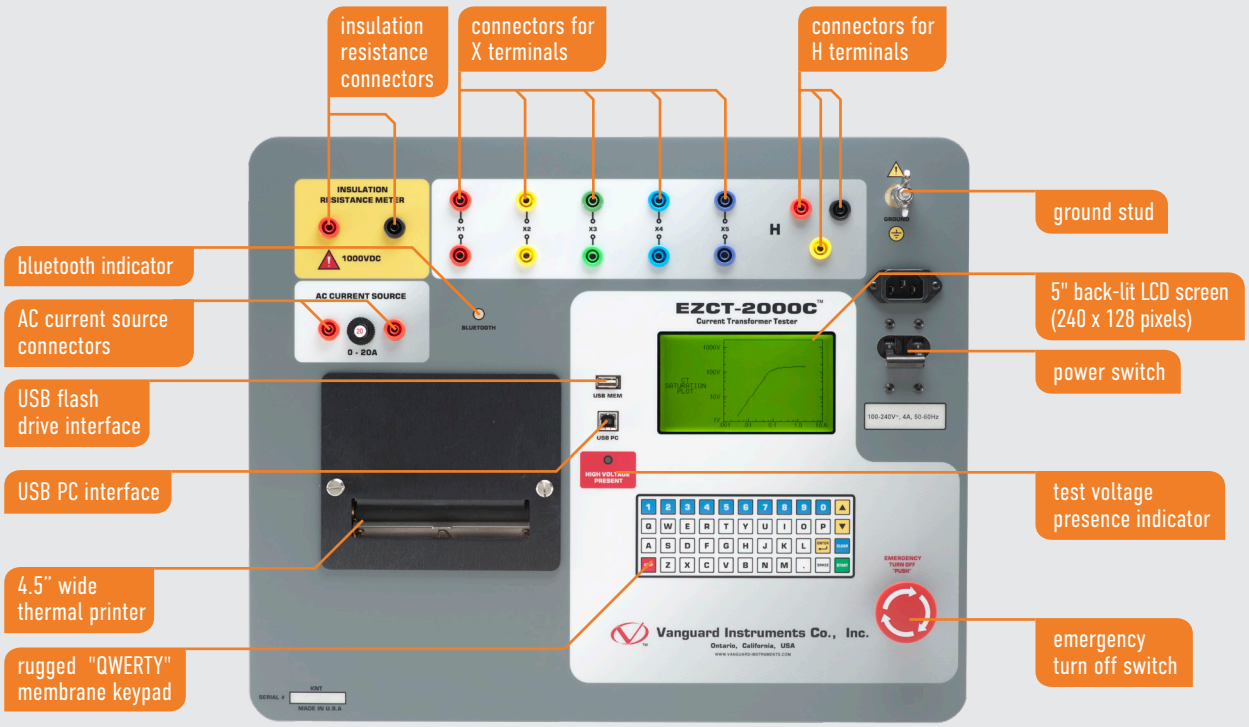
Current Source

The EZCT-2000C offers a programmable current source (0-20A, 0-15Vac) that can be used to verify CT loads. The on-time timer and output current are displayed on the LCD screen.

ordering information

Part No.	Description
9101-UC	110V EZCT-2000C, cables, and PC software
9102-UC	220V EZCT-2000C, cables, and PC software
9101-SC	EZCT-2000C shipping case
TP4-CS	TP4 thermal printer paper (24 rolls)

EZCT-2000C Features



Test Record Header Information

Test record header information, including the company, substation name, circuit ID, manufacturer, mode, CT serial number, and the operator's name, can be stored with each record. In addition to the test record header, a 20-character test description for each test in the record (10 tests per record) can also be entered.

User Interface and Display

The EZCT-2000C features a back-lit LCD screen (240 x 128 pixels) that is clearly viewable in both bright sunlight and low-light levels. A "QWERTY"-style membrane keypad is used to enter test information and to control the unit's functions.

Computer Interface

The EZCT-2000C Plus can be used as a stand-alone unit or can be computer-controlled. It can be connected to a PC via the USB port or wirelessly via Bluetooth. In computer-controlled mode, using the included CT Analysis Software, test records can be downloaded from the unit's memory, or CT tests can be run from the PC. Test plans can also be created with the provided software. A test plan defines the various test parameters (test voltage, current range, nameplate ratios, etc.) and can be used to quickly perform tests. Additionally, tabulated test records are automatically exported to PDF, Excel, and XML formats for further analysis.

Internal Test Record Storage

The EZCT-2000C can store up to 140 test records in Flash EEPROM. Each record may contain up to 10 excitation curves, burden test reports, current ratio readings, and polarity and DC resistance readings. Test records can be recalled and printed on the built-in thermal printer. They can also be transferred to a PC using the USB port, wirelessly via Bluetooth, or via the USB Flash drive interface port.

External Data Storage

The EZCT-2000C features a USB Flash drive interface that makes it very convenient to store and transfer test records and test plans. By using a USB Flash drive, test records and test plans can be quickly transferred between a computer and the EZCT-2000C without the need to connect the unit to the computer.

Built-in Thermal Printer

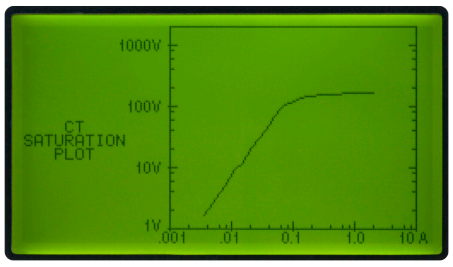
A built-in 4.5" wide thermal printer can print the current transformer test report and plot the excitation curves.

Internal Test Plan Storage

The EZCT-2000C can store up to 128 CT test plans in Flash EEPROM. A test plan is comprised of the excitation test voltage, current range selection, CT nameplate ratios, and CT winding terminal combinations (X1 to X5) for each test and also includes the insulation test definition. Up to 10 test definitions can be stored per test plan. The ability to store test plans makes CT testing an extremely simple process. To perform a test, the EZCT-2000C is connected to the CT terminals and a test plan is selected to run.

Creating test plans for the EZCT-2000C is also a simple process. A test plan can be created using the EZCT-2000C's keypad or can be created on a PC (with provided software) and then downloaded to the EZCT-2000C via the USB port or Bluetooth. For added convenience, test plans can also be copied from a USB Flash drive to the EZCT-2000C via the USB Flash drive interface.

typical test results screen



EZCT-2000C thermal printer output

RECORD NUMBER 1

CT EXCITATION TEST RESULTS

DATE: 01/07/15 TIME: 10:04:09

COMPANY:
STATION:
CIRCUIT:
MFR:
MODEL:
S/N:
COMMENTS:
OPERATOR:

TEST NUMBER: 1

TESTED TAP: X1-X2

TST NOTE:

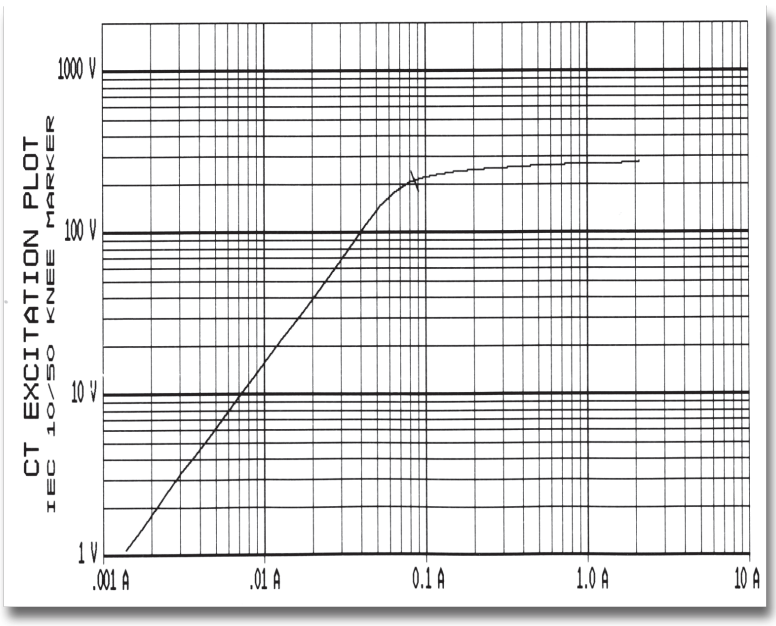
TEST VTG RANGE:	300	V
TEST CUR RANGE:	2.0	A
WINDING RES:	212.1	m-OHMS
IEC 10/50 Vkp:	213.6	VOLTS
IEC 10/50 Ikp:	0.0858	AMPS
IEEE 30° Vkp:	198.0	VOLTS
IEEE 30° Ikp:	0.0736	AMPS
IEEE 45° Vkp:	165.7	VOLTS
IEEE 45° Ikp:	0.0586	AMPS
NAME PLATE RATIO:	1000:5	
MEASURED RATIO:	199.97	
PERCENT ERROR:	0.02	%
POLARITY:	IN PHASE	
PHASE ANGLE: +	0.04°	
EXCITATION VTG:	98.2	VOLTS
EXCITATION CUR:	0.0388	AMPS

CURRENT RATIO ERROR TABLE

BURDEN	PERCENT RATED CURRENT (5.0 A)			
VA / COS φ	5%	10%	20%	40%
10.00 / 1.00	-0.05%*	-0.05%*	-0.04%	-0.04%
5.00 / 1.00	-0.03%*	-0.03%*	-0.03%	-0.03%
2.50 / 1.00	-0.02%*	-0.02%*	-0.02%*	-0.02%
1.25 / 1.00	-0.02%*	-0.02%*	-0.02%*	-0.02%
0.00 / 1.00	-0.02%*	-0.02%*	-0.02%*	-0.02%
VA / COS φ	50%	100%	120%	200%
10.00 / 1.00	-0.04%	-0.04%	-0.04%	-0.03%
5.00 / 1.00	-0.03%	-0.03%	-0.03%	-0.02%
2.50 / 1.00	-0.02%	-0.02%	-0.02%	-0.02%
1.25 / 1.00	-0.02%	-0.02%	-0.02%	-0.02%
0.00 / 1.00	-0.02%	-0.01%	-0.01%	-0.01%

CURRENT PHASE ERROR TABLE
(PHASE ERROR IN MINUTES)

BURDEN	PERCENT RATED CURRENT (5.0 A)			
VA / COS φ	5%	10%	20%	40%
10.00 / 1.00	3.19*	3.20*	2.68	2.13
5.00 / 1.00	2.16*	2.15*	2.10	1.66
2.50 / 1.00	1.63*	1.63*	1.63*	1.35
1.25 / 1.00	1.38*	1.37*	1.37*	1.24
0.00 / 1.00	1.11*	1.11*	1.11*	1.08
VA / COS φ	50%	100%	120%	200%
10.00 / 1.00	1.98	1.51	1.44	1.23
5.00 / 1.00	1.52	1.19	1.10	0.95
2.50 / 1.00	1.28	1.00	0.94	0.76
1.25 / 1.00	1.12	0.89	0.84	0.68
0.00 / 1.00	1.00	0.77	0.73	0.61



BURDEN TEST RESULTS

5 AMP BURDEN TEST

MEAS CURRENT:	4.979	A
MEAS VOLTAGE:	5.371 V,	359.2°
IMPEDANCE (Z):	1.079	OHMS
BURDEN:	26.959	VA
COS φ:	1.00	

typical burden test results

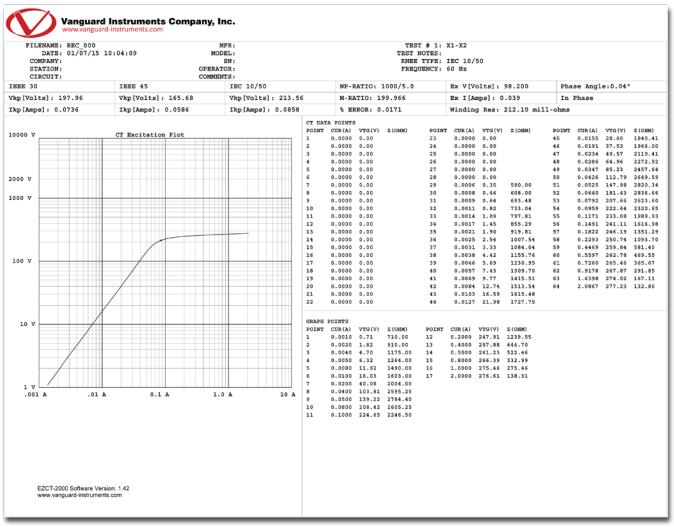
INSULATION RES TEST RESULTS

1000V INSULATION RES TEST

VOLTAGE:	997.7	V
CURRENT:	9.85	MICRO-AMPS
RESISTANCE:	101.27	MEG-OHMS

typical insulation resistance test results

EZCT-2000C desktop printer output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FILENAME: REC_000
DATE: 01/07/15 10:04:09
COMPANY:
STATION:
CIRCUIT:
MFR:
MODEL:
SN:
OPERATOR:
COMMENTS:
TEST # 1: X1-X2
TEST NOTES:
KNEE TYPE: IEC 10/50
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1000/5.0	Ex V[Volts]: 98.200	Phase Angle:0.04°
Vkp[Volts]: 197.96	Vkp[Volts]: 165.68	Vkp[Volts]: 213.56	M-RATIO: 199.966	Ex I[Amps]: 0.039	In Phase
Ikp[Amps]: 0.0736	Ikp[Amps]: 0.0586	Ikp[Amps]: 0.0858	% ERROR: 0.0171	Winding Res: 212.10 mill-ohms	

CT Excitation Plot

CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		23	0.0000	0.00		45	0.0155	28.60	1840.41
2	0.0000	0.00		24	0.0000	0.00		46	0.0191	37.53	1966.00
3	0.0000	0.00		25	0.0000	0.00		47	0.0234	49.57	2119.41
4	0.0000	0.00		26	0.0000	0.00		48	0.0286	64.96	2272.92
5	0.0000	0.00		27	0.0000	0.00		49	0.0347	85.23	2457.64
6	0.0000	0.00		28	0.0000	0.00		50	0.0426	112.79	2649.59
7	0.0000	0.00		29	0.0006	0.35	590.00	51	0.0525	147.98	2820.34
8	0.0000	0.00		30	0.0008	0.46	608.00	52	0.0660	181.43	2836.66
9	0.0000	0.00		31	0.0009	0.64	693.48	53	0.0792	207.66	2623.00
10	0.0000	0.00		32	0.0011	0.82	733.04	54	0.0959	222.64	2320.65
11	0.0000	0.00		33	0.0014	1.09	797.81	55	0.1171	230.08	1969.93
12	0.0000	0.00		34	0.0017	1.45	855.29	56	0.1451	241.11	1616.98
13	0.0000	0.00		35	0.0021	1.90	919.81	57	0.1822	246.19	1351.29
14	0.0000	0.00		36	0.0025	2.56	1007.54	58	0.2293	250.74	1093.70
15	0.0000	0.00		37	0.0031	3.33	1084.04	59	0.4469	259.84	581.40
16	0.0000	0.00		38	0.0038	4.42	1155.76	60	0.5597	262.78	469.55
17	0.0000	0.00		39	0.0046	5.69	1230.95	61	0.7260	265.46	365.67
18	0.0000	0.00		40	0.0057	7.43	1309.70	62	0.9178	267.87	291.85
19	0.0000	0.00		41	0.0069	9.77	1415.51	63	1.6398	274.02	167.11
20	0.0000	0.00		42	0.0084	12.74	1513.54	64	2.0867	277.23	132.86
21	0.0000	0.00		43	0.0103	16.59	1615.48				
22	0.0000	0.00		44	0.0127	21.98	1727.75				

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.71	710.00	12	0.2000	247.91	1239.55
2	0.0020	1.82	910.00	13	0.4000	257.88	644.70
3	0.0040	4.70	1175.00	14	0.5000	261.23	522.46
4	0.0050	6.32	1264.00	15	0.8000	266.39	332.99
5	0.0080	11.32	1450.00	16	1.0000	275.46	275.46
6	0.0100	16.03	1603.00	17	2.0000	276.61	138.31
7	0.0200	40.08	2004.00				
8	0.0400	103.81	2595.25				
9	0.0500	139.22	2784.40				
10	0.0800	208.82	2609.25				
11	0.1000	224.65	2246.50				

EZCT-2000 Software Version: 1.42
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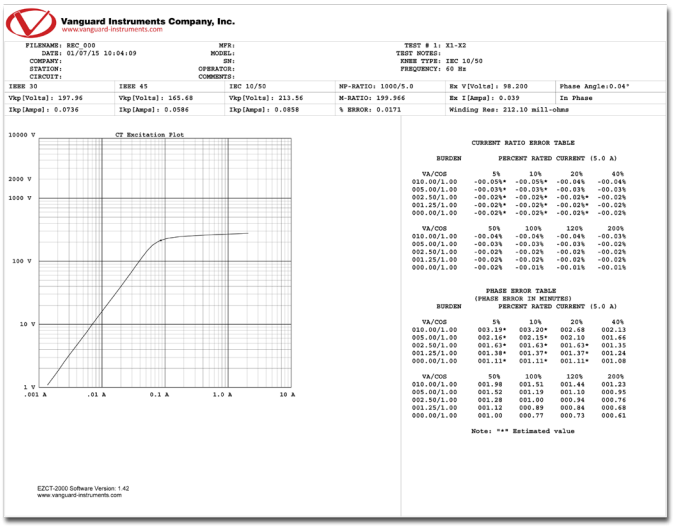
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FILENAME: REC_000
DATE: 01/07/15 10:04:09
COMPANY:
STATION:
CIRCUIT:
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MODEL:
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OPERATOR:
COMMENTS:
TEST # 1: X1-X2
TEST NOTES:
KNEE TYPE: IEC 10/50
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 1000/5.0	Ex V[Volts]: 98.200	Phase Angle:0.04°
Vkp[Volts]: 197.96	Vkp[Volts]: 165.68	Vkp[Volts]: 213.56	M-RATIO: 199.966	Ex I[Amps]: 0.039	In Phase
Ikp[Amps]: 0.0736	Ikp[Amps]: 0.0586	Ikp[Amps]: 0.0858	% ERROR: 0.0171	Winding Res: 212.10 mill-ohms	

CT Excitation Plot

CURRENT RATIO ERROR TABLE

BURDEN	PERCENT RATED CURRENT (5.0 A)			
VA/COS	5%	10%	20%	40%
010.00/1.00	-00.05%*	-00.05%*	-00.04%	-00.04%
005.00/1.00	-00.03%*	-00.03%*	-00.03%	-00.03%
002.50/1.00	-00.02%*	-00.02%*	-00.02%*	-00.02%
001.25/1.00	-00.02%*	-00.02%*	-00.02%*	-00.02%
000.00/1.00	-00.02%*	-00.02%*	-00.02%*	-00.02%
VA/COS	50%	100%	120%	200%
010.00/1.00	-00.04%	-00.04%	-00.04%	-00.03%
005.00/1.00	-00.03%	-00.03%	-00.03%	-00.02%
002.50/1.00	-00.02%	-00.02%	-00.02%	-00.02%
001.25/1.00	-00.02%	-00.02%	-00.02%	-00.02%
000.00/1.00	-00.02%	-00.01%	-00.01%	-00.01%

PHASE ERROR TABLE
(PHASE ERROR IN MINUTES)

BURDEN	PERCENT RATED CURRENT (5.0 A)			
VA/COS	5%	10%	20%	40%
010.00/1.00	003.19*	003.20*	002.68	002.13
005.00/1.00	002.16*	002.15*	002.10	001.66
002.50/1.00	001.63*	001.63*	001.63*	001.35
001.25/1.00	001.38*	001.37*	001.37*	001.24
000.00/1.00	001.11*	001.11*	001.11*	001.08
VA/COS	50%	100%	120%	200%
010.00/1.00	001.98	001.51	001.44	001.23
005.00/1.00	001.52	001.19	001.10	000.95
002.50/1.00	001.28	001.00	000.94	000.76
001.25/1.00	001.12	000.89	000.84	000.68
000.00/1.00	001.00	000.77	000.73	000.61

Note: "*" Estimated value

EZCT-2000 Software Version: 1.42
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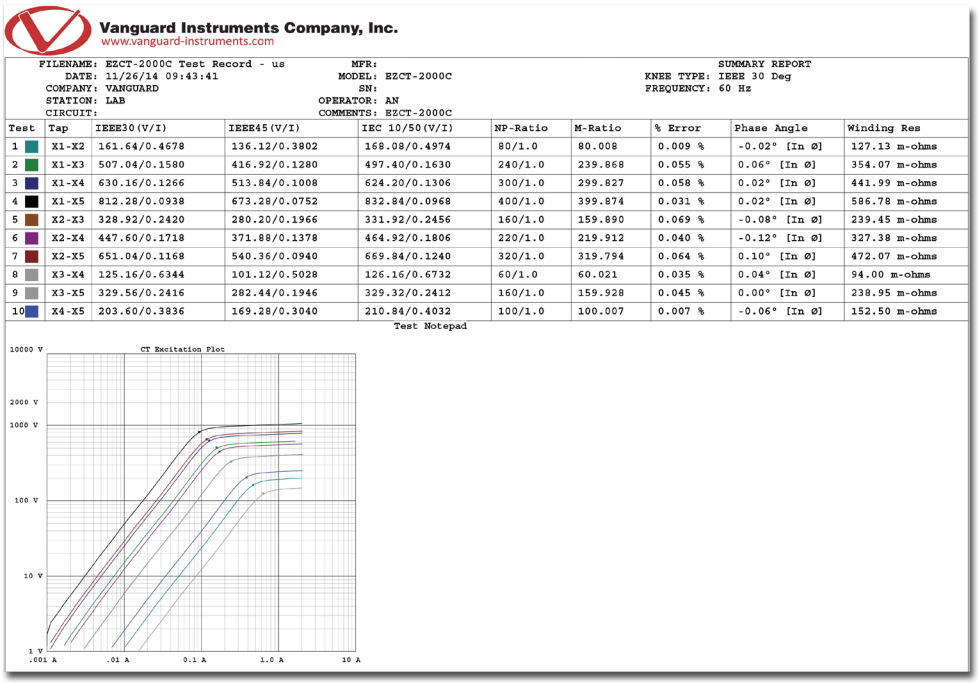
EZCT-2000C desktop printer output



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FILENAME: EZCT-2000C Test Record - us
DATE: 11/26/14 09:43:41
COMPANY: VANGUARD
STATION: LAB
CIRCUIT:
MFR:
MODEL: EZCT-2000C
SN:
OPERATOR: AN
COMMENTS: EZCT-2000C

SUMMARY REPORT
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

Test	Tap	IEEE30(V/I)	IEEE45(V/I)	IEC 10/50(V/I)	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	161.64/0.4678	136.12/0.3802	168.08/0.4974	80/1.0	80.008	0.009 %	-0.02° [In Ø]	127.13 m-ohms
2	X1-X3	507.04/0.1580	416.92/0.1280	497.40/0.1630	240/1.0	239.868	0.055 %	0.06° [In Ø]	354.07 m-ohms
3	X1-X4	630.16/0.1266	513.84/0.1008	624.20/0.1306	300/1.0	299.827	0.058 %	0.02° [In Ø]	441.99 m-ohms
4	X1-X5	812.28/0.0938	673.28/0.0752	832.84/0.0968	400/1.0	399.874	0.031 %	0.02° [In Ø]	586.78 m-ohms
5	X2-X3	328.92/0.2420	280.20/0.1966	331.92/0.2456	160/1.0	159.890	0.069 %	-0.08° [In Ø]	239.45 m-ohms
6	X2-X4	447.60/0.1718	371.88/0.1378	464.92/0.1806	220/1.0	219.912	0.040 %	-0.12° [In Ø]	327.38 m-ohms
7	X2-X5	651.04/0.1168	540.36/0.0940	669.84/0.1240	320/1.0	319.794	0.064 %	0.10° [In Ø]	472.07 m-ohms
8	X3-X4	125.16/0.6344	101.12/0.5028	126.16/0.6732	60/1.0	60.021	0.035 %	0.04° [In Ø]	94.00 m-ohms
9	X3-X5	329.56/0.2416	282.44/0.1946	329.32/0.2412	160/1.0	159.928	0.045 %	0.00° [In Ø]	238.95 m-ohms
10	X4-X5	203.60/0.3836	169.28/0.3040	210.84/0.4032	100/1.0	100.007	0.007 %	-0.06° [In Ø]	152.50 m-ohms

Test Notepad

EZCT-2000C technical specifications

physical specifications	**Dimensions:** 19"W x 13"H x 16"D (48.3 cm x 33cm x 40.1 cm) **Weight:** 73 lbs. (33.1 Kg)	**input power**	100 – 120 Vac or 200 – 240 Vac (factory pre-set), 50/60 Hz
current ratio range	0.8 – 999: ±0.1%, 1000 – 1999: ±0.3%, 2,000 – 4,999: ±1%, 5,000 – 10,000: ±1.5%	**measuring method**	IEC 60044-1, IEC 61869, ANSI/IEEE C57.13.1, and ANSI/IEEE C57.12.90
output test voltages	**0 – 50 Vac** @ 10A max; **0 – 300 Vac** @ 10A max; **0 – 500 Vac** @ 5A max; **0 – 1200 Vac** @ 2A max ; **0 – 2000 Vac** @ 1A max	**current source**	1 – 20A @ 0 – 15 Vac; displays test current and current on-time
resistance reading range	100 micro-ohms – 30 ohms; accuracy: 2% of reading ±1 count, ±10 micro-ohms	**insulation resistance test**	2 M-ohms – 500 M-ohms; accuracy: 3% of reading; 500 – 1,000 Vdc test voltage
voltage reading range	0 – 2,200 Vac accuracy: ±1.0% of reading, ±1 volt	**current reading range**	0 – 10 A, accuracy: ±1.0% of reading, ±0.02A
display	5" back-lit LCD screen (240 x 128 pixels) viewable in bright sunlight and low-light levels	**phase angle measurement**	0 – 360 degrees accuracy: ±1.0 degree
printer	built-in 4½" wide thermal printer	**computer interfaces**	one USB port and bluetooth wireless interface
pc software	Windows®-based CT analysis software is included with purchase price	**external data storage**	one USB flash drive interface port (flash drive not included)
internal test record storage	stores 140 test records. Each test record may contain up to 10 sets of excitation, resistance and ratio data		
internal test plan storage	stores 128 test plans. Each test plan can store 10 excitation test voltage and current settings	**safety**	designed to meet UL 61010A-1 and CAN/CSA C22.2 No. 1010.1-92 standards
temperature	**Operating:** -10°C to +50°C (+15°F to +122°F) **Storage:** -30°C to +70°C (-22°F to +158°F)	**humidity**	90% RH @ 40°C (104°F) non-condensing
cables	One 20-foot (6.10m) cable set (X1-X5), one 35-foot (10.69m) H cable set, current source cables, insulation test cables, power cord, ground cable, USB cable. A transportation case is included with the purchase price		
altitude	2,000 m (6,562 ft) to full safety specifications	**warranty**	one year on parts and labor

NOTE : the above specifications are valid at nominal voltage and ambient temperature of +25°C (+77°F). Specifications are subject to change without notice.

Instruments designed and developed by the hearts and minds of utility electricians around the world.

Founded in 1991 and located in Ontario, California, USA, Vanguard Instruments™ offers a wide range of diagnostic test equipment that accurately and efficiently measures the health of critical substation equipment, such as transformers, circuit breakers, and protective relays.

Our first product was a computerized, extra high voltage (EHV) circuit breaker analyzer, which became the forerunner of an entire line of EHV circuit breaker test equipment. Over the years, our portfolio has grown tremendously to include microcomputer-based precision micro-ohmmeters; single- and three-phase transformer winding turns-ratio testers; transformer winding-resistance meters; mega-ohm resistance meters; and a variety of other application-specific products.

Our instruments are rugged, reliable, accurate, and user friendly. They eliminate tedious and time-consuming operations, while providing fast, complex test-result calculations. Using our equipment helps reduce errors and eliminates the need to memorize long sequences of procedural steps.

In 2017, Vanguard Instruments became a part of Doble Engineering Company, an energy industry leader in hardware, software, and services that diagnose and monitor the health of critical assets.

Vanguard Instruments
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