

DIGITAL WINDING RESISTANCE REPORTERTM *for Accurate Measurement of Transformer Winding Resistance*

MODEL DWR-10

- *A large, color LCD screen for entering equipment details and presenting results, in various languages*
- *An enormous storage capacity for test results*
- *A robust power supply for fast testing of large power transformers*
- *An 40-character-wide built-in printer*
- *Remote tap-changer operation*
- *Compatible with Microsoft Excel[®] and Microsoft Word[®]**



Description

The DWR REPORTER can measure and save more than 10,000 high-resolution test results along with transformer nameplate data.

With its expansive memory, its bright 4 5/8" x 3 1/2" LCD screen and the attractive reports from its 40-character-wide built-in printer, the DWR sets the new standard in test equipment for the Transmission and Distribution Industry.

The DWR can store hundreds of files. Each file can contain a virtually unlimited number of resistance measurements with tap and winding details of each, and several fields of information about the transformer, its location and the operator's name.

The file manager makes it easy to locate, open, view and print past results. Files are conveniently named according to the transformer serial number (up to 99 duplicates are permitted using an automatic suffix). Files are easily transferred to PC (RS-232 and USB ports).

A large color screen presents several views including:

- Pull-down menus used to operate and configure the instrument.
- An easy-to-use on-screen GUI used to enter information.
- Tool bars for setting output current, resistance range and numerous other commands.
- Navigation through all screens is by means of a cursor controlled by a turn-and-press knob.

High Resolution and High Accuracy

The DWR features 4 1/2-digit resolution and 0.25% accuracy for precise measurement of winding resistance. Input channels have sophisticated sigma-delta A/D converters and notch filters to eliminate the effects of substation noise.

The DWR is water proof, rugged and reliable.

MAIN DISPLAY (Actual size)

S/N: 123 3 Mar. 2004 13:57:32

TESTING do not disconnect LEADS

A Protection Reading Stability

1

H1 H2

1.8100 mΩ

Tap Wdg 03/02

B Protection Reading Stability

X1 X0

9.760 mΩ

Current Status : 100 % 10.4A

Current 10A A Range 0.1 μΩ 1.9999mΩ B Range 1 μΩ 19.999mΩ Scroll Readings End & Record Session

Command / Warning indicator.

Status of internal protections indicator.

Highlight Disk Icon and press dial to save measured values.

Toolbars: Used to set test current, resistance range or auto-range, saving and ending or to scroll through the results. (Highlighted frame, controlled by knob, indicates field to be edited.)

Date and time always displayed.

Shows green when measured reading becomes stable.

Bright, easy-to-read 4½ digit display of measured resistance.

Indicates actual test current.

Unit Definition Window: Used to enter and edit unit information.

Keyboard for easy entering of information. (Highlighted frame indicates character to be entered.)

S/N: 123 3 Mar. 2004 14:08:36

Press test dump to start measuring

Unit Definition Window

Serial Number : 123

Company : YOUR COMPANY

Station : #21

Designation : T-1

Manufacturer :

Operator : JONES

Notes :

Temperature : 37

Keyboard: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 1 2 3 4 5 6 7 8 9 0 - / # * @ Space CAP <--- Clear Field END

S/N: 123 3 Mar. 2004 14:08:36

Press test dump to start measuring

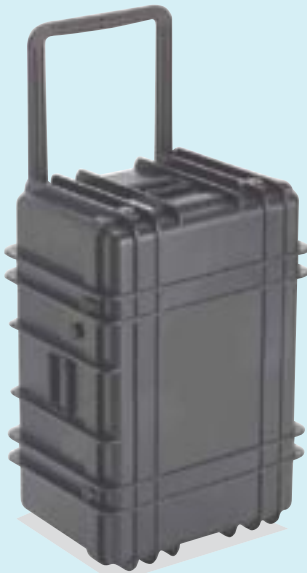
Open Manual File

Idx	Serial	Mode	No	OK	Date	Time
001	012345	M	1	Y	02 Mar. 04	11:45:37
002	012345	M	1	Y	02 Mar. 04	11:49:04
003	012345	M	1	Y	02 Mar. 04	11:41:25
004	012345	M	1	Y	02 Mar. 04	11:37:37
005	12345678	M	1	Y	02 Mar. 04	11:45:37
006	12345678	M	1	Y	02 Mar. 04	11:35:52
007	999995	M	1	Y	02 Mar. 04	11:36:58
008	999999	M	1	Y	02 Mar. 04	11:37:35
009	VVV	T	1	Y	03 Mar. 04	11:42:56
010	VVV	T	2	Y	03 Mar. 04	11:43:34

Click to Open Press BACK to cancel

The File Manager lists files using serial number as a name. The user may choose files for viewing, printing or deleting.

CARRYING / SHIPPING CASE



The DWR is available in an optional, tough, injection molded, dry transit case, designed with rigid reinforced walls to provide maximum protection.

The extendable handle and 3-inch wheels make maneuvering easy.

Layered foam filling protects the instrument from the impacts of everyday travel and the silicone o-ring seal protects the DWR from salt air, water, sand and dust.

3 Mar. 2004 14:07:31

Unit Definition

Mode: asuring

Print

Time Interval

Files

System

Date / Time

Sound: High

Communication Port: Med

Language: Low

About: Off

H1 H2

Current Status : 0 % 10.4A

Current 10A A Range AUTO B Range AUTO Scroll Readings End & Record Session

MENU TAP WINDING CLOCK START AUTO ON/OFF TAP CHANGER TEST DUMP

The familiar Menu Structure helps the user set-up the DWR.



REPORTER™ Form

Data from the DWR is importable into most popular spreadsheet and word processing programs. A Winding Resistance Test Report form in a Microsoft Excel* template is provided for easy report generation.

BUILT-IN PRINTER

DWR Reporter
MODE : Manual Mode

Date / Time : 12 Jan. 2004 10:26:55
Serial : 0112-1132
Company : ADWEL
Station : #12
Designation :
Manufacturer : XYZ Transformers Inc.
Operator : John Smythe
Temperatures : 20 C
Notes : Test

Tap	Winding	Res.	Tap	Winding	Res.	Amp
1	H1-H2	1.2345m	X0-X2	1.4321m	10	
2	H1-H2	1.2345m	X0-X2	1.4321m	1.0	
3	H1-H2	1.2345m	X0-X2	1.4321m	0.1	
4	H1-H2	1.2345m	X0-X2	1.4321m	10m	
5	H1-H2	1.2345m	X0-X2	1.4321m	10m	
6	H1-H2	1.2345m	X0-X2	1.4321m	10m	

(Actual Size)

The 40-character wide built-in printer outputs results in easy to read rows and columns.

The DWR printer prints on standard rolls of 3-inch wide thermal paper - found in most local business supply stores.

OPERATING PRINCIPLE

DC resistance of windings is measured by passing DC current through the unknown resistance, and measuring the resulting voltage drop. The DWR calculates the resistance by the formula $R=E/I$.

Winding Resistance Testing Challenges:

Measuring small DC resistance in a highly inductive environment can be a challenging task. The voltage across an inductor is defined by the formula $V = L di/dt$. Some power transformers have inductance (L) of over 1000 henrys. Therefore, minute changes in current will result in undesirable voltage swings that can make it impossible to measure the DC resistance of the transformer windings.

The ADWEL DWR addresses this challenge in several ways such

that the instrument is able to achieve stable resistance readings on the largest of transformers in record time.

- The DWR uses a powerful, highly regulated and filtered constant current source to drive current through the windings.
- The DWR uses a 10-ampere (30 Volt) source, which is sufficient to drive the core into saturation where small changes in current have no effect on the measured resistance.
- By connecting primary and secondary in series, speed of saturation is increased because there are more amp-turns contributing to the flux in the core. The resistance measurement of both windings are made at the same time on channels A and B.

GUIDEFORM SPECIFICATIONS

General:

The instrument shall be capable of simultaneously measuring resistance of two windings of a power transformer. The instrument will quickly saturate large transformers and will also quickly dissipate the "stored energy" at the end of a test. Instrument must have on board memory and a built-in printer.

Power Supply:

The instrument power supply shall be a highly regulated and filtered, constant current source, making it possible to make resistance measurements on transformers rated over 100 MVA in less than one minute.

The power supply shall have an output current of 10 amperes DC and an open circuit voltage of 30 volts.

Measurement and Indications:

The instrument shall have two measuring channels that are auto ranging. The instrument shall have a range of 0.1 microhm to 2000 ohms with a resolution of 4½ digits and accuracy shall be ± 0.25%.

The instrument shall indicate; actual test current, reading stability, protection status and other messages to assist the operator.

Operator Interface:

The instrument shall be equipped with a 120mm x 90mm, bright color LCD screen to record transformer data, tap and winding information and to set-up, operate and control the instrument using a virtual keyboard. The screen shall be clearly visible in bright sunlight.

Memory:

The instrument must store at least 100 files with at least 120 measurements each. Each file will include the following transformer information: serial number, company, station, designation, manufacturer, operator, temperature and notes. Downloading results to a PC shall be by means of USB port or RS-232. Files shall be compatible with Microsoft Excel* spreadsheets.

Printing:

A built in printer, 40 characters in width, shall be provided to print results in organized rows and columns. An integral file manager shall be provided to allow operator to retrieve, view and print past results from the instrument.

Protection:

The instrument shall be adequately protected from over-voltage transients that occur if the DC test current is suddenly interrupted.

The instrument shall have an adjustable audible horn to warn that current is flowing during and after a test.

Instrument shall have a high speed current interrupt detector for testing tapchanger function. The detector will react to current interruption by shutting down the instrument.

Other Characteristics:

Weight less than 11.4 kg.

CE certified.

Operating temperature, -10° to 50° C.

Shielding against substation noise.

Option for Manufacturers:

The instrument shall be equipped with a timer that will automatically record resistance and time at pre-determined intervals. All the measurements shall be stored in a single file along with transformer data.

Housing:

The entire instrument shall be suitably for heavy duty field use. The instrument housing shall be rugged and water proof with rating of IP-67

Warranty:

The instrument shall be guaranteed for a period of five years from the date of purchase.

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ADWELDistributor

The winding resistance test is particularly valuable for transformers with on-load

tap changers because they have hundreds of bolted connections and moving contacts. Increases in contact resistance can be detected by the DWR because of its high accuracy ($\pm 0.25\%$), $4\frac{1}{2}$ digit resolution.

many internal connections become loose as a result of vibration from years of through faults.

Tap	Winding	Resistance	Tap	Winding	Resistance	Current	Voltage
1	1	0.0000	1	1	0.0000	10.00	30.00
2	2	0.0000	2	2	0.0000	10.00	30.00
3	3	0.0000	3	3	0.0000	10.00	30.00
4	4	0.0000	4	4	0.0000	10.00	30.00
5	5	0.0000	5	5	0.0000	10.00	30.00
6	6	0.0000	6	6	0.0000	10.00	30.00
7	7	0.0000	7	7	0.0000	10.00	30.00
8	8	0.0000	8	8	0.0000	10.00	30.00
9	9	0.0000	9	9	0.0000	10.00	30.00
10	10	0.0000	10	10	0.0000	10.00	30.00

The DWR Reporter comes with PC software to download stored test results that can be imported into Microsoft Excel®

Specifications

Power Input	90 to 132VAC 50/60Hz 198 to 256VAC 50/60 Hz, 550VA max
Test Current	10, 1, 0.1 and 0.01 Amperes DC
Test Voltage	30 VDC max
Resistance Measurements	2 auto-ranging channels
Resistance Range	0.1 microhm to 2000 ohms
Protection	Protected from overvoltage transients & substation noise High speed current interrupt detector Audible warning horn during and after test Emergency off button
Accuracy	$\pm .25\%$ rdg $\pm .25\%$ FS
Resolution	$4\frac{1}{2}$ digits
Housing	Rugged, waterproof case, IP-67
Weight	Instrument: 11.4 Kg., (25 lb.)
Dimensions	Instrument: 47 cm x 35.7 cm x 17.6 cm ($18\frac{1}{2}$ x 14 x $6\frac{1}{8}$ in.)
Environmental	Operating Temperature: -10° to 50° C Storage Temperature: -15° to 80° C Relative humidity: 0 – 90%, non-condensing
Graphical User Interface	120mm x 90mm bright LCD display visible in bright sunlight. Displays: Actual current, measured values, reading stability, protection status, taps, windings and transformer details. Membrane button and knob to configure, enter and edit, using virtual keyboard, menus, and toolbars.
Memory	Over 100 files with over 120 measurements ea. in text files that are compatible with most spreadsheet formats.
Embedded Software	Menus for set-up of DWR, change languages, ports. File manager: files named by serial number, include station, designation, manufacturer, operator, temperature and notes.
Printer	Built-in 40-character wide printer
PC Connection	Download results to PC via USB port and RS-232 connection.
Standards	CE Compliance: EN61010 EN61326

Model DWR-10

Standard Accessories

- Test Leads (10m/30ft.)
- Operation Manual
- Accessories Case
- Training Video
- 3 Rolls Paper
- Calibration Certificate

Optional Accessories

- Custom Lead Lengths
- Optional Shipping Case

Optional "C" version

- Records resistance and time in a single file at predetermined intervals.



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