

# REAL WORLD CERTIFIER™

A whole new world of testing possibilities!

## MODEL RWC1000



### USER'S GUIDE



## **Limited Warranty**

The manufacturer warrants to the original consumer that this product is in good working order for a period of one year from the date of manufacture or date of purchase. During this period the product will be repaired or replaced without charge for either parts or labor. The warranty does not cover damage caused by improper use or abuse including connecting to high voltage. Repair or replacement as provided under this warranty is the exclusive remedy of the purchaser.

## **Caution when connecting**

The Real World Certifier has two RJ45 jacks ("LEFT", "RIGHT"). The LEFT jack is for testing cables (the jack is not protected from voltages). The RIGHT jack is for testing switches (it is protected from PoE voltage). Protect the RWC from telephone and Power over Ethernet (PoE) voltages by using the "RIGHT" socket when connecting to these devices and when toning.

USE <LEFT> PLUG  
TO TEST CABLES  
USE <RIGHT> PLUG  
TO TEST PORTS  
▲ MENU

## **Help with device installation and PoE**



Installers of VoIP phones, IP cameras or access points use the Power Panel for exact measurements of PoE voltage and power usage, displaying the presence of 10,100,1000 switches and the pair location of each. Note: "PoE" (Power over Ethernet) powers devices over the CAT5/6 cable. Please visit [www.bytebrothers.com](http://www.bytebrothers.com) for data and videos.

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Metric version available with display and reports in metric units.

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## **Section I. Introduction**

Over half of all network problems are caused by faulty cables. And with network speeds exponentially increasing, the need for affordable, sophisticated test equipment is more apparent than ever before.

The Real World Certifier (RWC) and Network Tester is break-through-technology that brings cable and network certification and testing to a whole new level of reality. It opens up a whole new world of testing opportunities to network cabling professionals and managers that, prior to the Real World Certifier, could only dream of performing *speed tests* on their cable and LAN devices and *printing* the results.

**WORKSWITH UTP AND ALL ETHERNET DEVICES:** Unlike traditional certifiers, the RWC uses digital circuitry and digital testing techniques to perform its tasks. These tests include traditional TIA568 cable verification (length, opens, shorts, split pairs, wire map) for UTP (unshielded twisted pair) plus RWC's own sophisticated crosstalk, timing and cable parameter tests that yield a UTP cable's category (CAT3, CAT5, CAT5E, CAT6) and speed capability (10, 100, 1000 MB)! And if you wish, the RWC can use your own network devices (hubs, switches, PCs) to test UTP cables with real live data! And, the Real World Certifier analyzes links and data from all types of hubs, switches and PCs. It performs both *single sided tests* for *advertised* speed (10, 100, 1000 MB and duplex) and *inline tests* (between devices) for *negotiated* speed. The engine of the RWC circuitry is capable of 1 nanosecond resolution.

**WORKS WITH COAX CABLE:** Use the RWC to test for the length of the cable, opens, shorts, wiremap and distance to any faults that might exist. As with UTP, coax can be toned with the toner feature and test results can be stored for later printer in the RWC's flash memory. No Real World Certification tests are performed on coax cable.

## **What is Real World Certification?**

Real World Certification means that a UTP cable passed a prescribed battery of tests and is therefore not likely to cause problems later. The Real World Certifier has two levels of verification/certification:

**RWC Level 1:** Performed with the *Main Unit* and the *Remote Probe*, Level 1 tests the cable for length; opens, shorts, split pairs and distance to the fault; wire map (displays cable wiring); NEXT and FEXT (crosstalk tests); propagation delay (time to transit cable); skew (time delay between pairs); cable category (CAT3, 5, 5E, 6); and speed projection (10, 100, 1000 MB).

**RWC Level 2:** Includes all Level 1 tests plus takes advantage of a real live data source (hub, switch or PC) to test for attenuation and device type. The result is RWC Level 2 speed certification of the cable and the LAN device.

**Networks are installed in steps.** First, cables are installed. Then hubs, switches and PCs follow. Cables and network interfaces are known as the physical layer. The higher software layers provide addressing, file transfers, etc. If the physical layer does not work, the communications layers (software) will not work. Debugging cables, ports and network software together is time consuming, frustrating and ultimately very expensive. There are too many unknowns. Real World Certifying cables eliminates unknowns, making it easier to get a network up and running. And, once the hardware is operational you can run software layer tests (ping, etc.) from any workstation (see Appendix B).

## **What is the best time to Real World Certify a cable?**

The best time to certify a cable is when the installer is still readily available to repair any faults that are found. Installers should certify before they leave, so that they will not lose money by having to return to a job site to do in warranty repairs. Network professionals should certify before the warranty period expires.

## **The RWC1000 List of Functions**

### **UTP CABLES. Real World Certification Level 1 tests:**

- ✓ Length measurement of each cable pair.
- ✓ Locates opens, shorts and distance to the fault.
- ✓ Locates split pairs and the distance to the split.
- ✓ Wire map. Graphs cables internal pairing.
- ✓ NEXT (near end) and FEXT (a far distance) crosstalk.
- ✓ Propagation delay (time for data to travel the length of the cable).
- ✓ Skew (time delay between pairs).
- ✓ Cable typing. CAT 3, 5, 5E, 6.
- ✓ Speed Projection: Displays test results as a graph projecting the cable's speed capability (up to 1 GIGABIT).

### **UTP CABLES. Real World Certification Level 2 tests. Adds:**

- ✓ Attenuation. Graphs level of real live data from PC, hub or switch.
  - ✓ Speed Certification (Level 2). Enhanced speed display samples real live data on active pairs to the limit of the device (1 Gig).
- Note: *Level 2 tests use real data from your hub, switch or PC.*

### **COAX CABLES:**

- ✓ Length, open, shorts, distance to fault, tone and wire map.

### **NETWORK DEVICE TESTING:**

- ✓ Single Sided and INLINE port tests check the ability of the hub, switch or PC to communicate by displaying their *advertised* and *negotiated* capabilities.
- ✓ Data signal strength. Single sided test exercises the suspect hub, switch or PC and displays the data signal strength of active pairs.

### **NAMING TEST RESULTS, PRINTER AND TONER PROBE:**

- ✓ Naming tests. Test names can be up to 16 characters each.
- ✓ Toner/probe. Includes a full featured toner/probe. Tones coax and all 4 UTP pairs to locate wires in crowded wiring closets.
- ✓ Printer memory. Stores test results for up to 250 UTP and coax tests for later printing (requires a PC with Excel®). USB data transfer cable and software included.

## **Section II. The Three Phases of LAN Installation**

The RWC1000 is designed for both the network installer, the network repair person and the IT manager. The tests used during the three phases of LAN installation can just as well be used to troubleshoot LANs that are suffering operational problems.

**The installation of a LAN is generally handled in phases.** The cabling is installed; then the switches and PCs are installed; and then all is connected together. The RWC1000 plays a role during all three phases, saving countless hours of troubleshooting.

**Phase I. Use the RWC1000 during cable installation (before the switches and PCs are installed).** After the LAN cable has been pulled through the building and terminated, it is good practice to Real World Certify that the cabling is terminated properly and test that the cable is proper for the intended use (e.g. CAT5E for gigabit networks).

**Phase II. Use the RWC1000 after the switches and PCs are installed.** Before connecting the cables to the switches and PCs, verify that each switch port and PC are operational. This provides a wealth of information: It verifies that the device is ON (i.e. it is transmitting); the speed of the device (10, 100, 1000 MB/s) ; duplex; and other features.

**Phase III. Use the RWC1000 when connecting the cabling to the switches and PCs.** With the cabling verified and Real World Certified (Phase I) and the switch and PCs checked out (Phase II), all that remains is 1) getting the equipment communicating and 2) verifying each LAN link is performing at the speed expected. To do this, use *Real World Certification Level 2* to test the cable and port combinations. And use the *Network Tests* INLINE capability to connect between 2 LAN devices to verify the negotiated speed of the link.

## Section III. RWC1000 Faceplate Descriptions.

### RWC1000 MAIN UNIT

The MAIN UNIT connects to any Cat 5/6, coax cable or 10, 100, or 1000 Base-T device and performs a host of tests needed for their installation and repair. For certain tests, it can be inserted *inline* between two LAN devices.

1

#### Main Unit Jacks

LEFT, COAX and RIGHT: Use the LEFT jack for UTP TESTING. Use RIGHT jack for NETWORK TESTING.

2

#### "Printer" port

Use to transfer stored testing data (up to 250 tests) to a PC. Requires Excel<sup>®</sup>. USB data transfer cable included.

3

#### Power and LCD backlighting

Press the recessed power button. To backlight the display, press the SEL button during the opening screen. The RWC1000 powers OFF if there is no activity for 10 minutes.

4

#### Cursor and SELECT buttons

Use the cursor buttons to select the function to be performed. Press the SEL button to select the functions.

5

### RWC1000 REMOTE PROBE

#### The Remote Probe performs 2 functions:

**Tracing cables:** Use it as an inductive probe to trace cables with the tone generated by the Main Unit.

6

**Far end cable termination:** The Remote Probe's jack is used to terminate the far end of the cable when the wire map test is conducted.

7





## Section IV. Documenting Testing Results

The Real World Certifier includes 3 ways to document your test results.

- 1) A custom tablet can be used to fill in the test results (included).
- 2) "PASSED" stickers can be applied to wall outlets and LAN devices to Real World Certify their capability (included).
- 3) Printer Memory that stores test results for up to 250 Real World Certification tests, basic UTP tests and coax tests for later printing (requires a PC with Excel®). A 6' USB transfer cable, driver and software is included.

CABLE NO. 33321  
LOCATION Bldg 1 Rm 212  
INSTALLED BY L. Nourse 1/17/05/05 07/15/05  
CALL ID: 244

TEST SUMMARY  
NEW WORLD CERTIFICATION (NEW)  
TEST SPEED:  PASS  NOISE  FAIL  
SECURITY:  PASS  FAIL  
ATTN:  PASS  FAIL

ByteBrothers  
Linksys E605W

Reorder:  
RWC1007 (50 sheets)



Reorder:  
RWC1011 (96 stickers)




Transfer readings to Excel® for printing (serial cable included). See the Readme.doc file on CD for USB/serial converter instructions.

## ***Section V*** **OPERATION**

### **Powering up and backlighting**

**Backlight selection screen (lighting the LCD display)**



REAL WORLD  
CERTIFIER  
REVISION 800K1  
SEL BACK LITE ON



**TURNING ON:** Press the power button (PWR) and release to turn ON the tester. The "backlighting" screen appears (above). Pressing the select (SEL) button while this screen is present turns on LCD lighting ("backlighting"). Backlighting is important when working in dim light but shortens battery life.

Note: Once enabled, the LCD will remain backlit until the tester is powered OFF. The *backlight selection screen* (above) is always lighted during the 3 second period that it is displayed. This allows you to turn the tester ON in a dark area and SELECT backlighting during the process.

## The Main unit's navigation button



### How to navigate through the Real World Certifier screen:

**PWR.** Power ON/OFF (see prior page for backlighting).

**SEL (SELECT).** Press to perform task. Appears as ► on LCD.

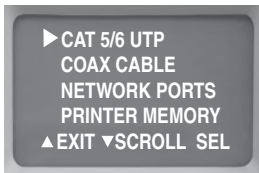
**The UP arrow.** Appears as ▲ on LCD.

**The DOWN arrow.** Appears as ▼ on LCD.

The SELECT button's function *always* selects the task. But the function of the *UP and DOWN arrow* buttons may change with each screen. For example, the Main Menu (above) uses the *UP arrow button* to return the tester to the MAIN MENU and uses the *DOWN arrow button* to scroll the cursor.

## Main Menu

### RWC1000 Menu



This menu is the gateway to all of the RWC1000's tests. Scroll the cursor with the *down arrow button* and press **SELECT** to perform the task.

▶ **CAT5/6 UTP:** Test and Real World Certify UTP cables with or without LAN devices (hubs, switches, PCs) connected. Perform basic cable tests on UTP cables. Tone UTP cables. Move the cursor to CAT 5/6 UTP and press SELECT. *Page 12.*

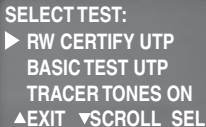
▶ **COAX CABLE:** Test coax cables for length, opens, shorts, distance to fault and wiremap. 2 adapters included. Tone coax cables. *Page 33.*

▶ **NETWORK PORTS:** Perform tests on LAN (hubs, switches, PCs) devices. Move the cursor to NETWORK PORTS and press SELECT. *Page 46.*

▶ **PRINTER MEMORY:** Printer memory is used to store the results of up to 250 RWC Level 1, Level 2, basic tests and coax tests for later printing. Move the cursor to PRINTER MEMORY and press SELECT if you want to *Review* the tests stored in memory or *Erase* memory. *Page 40.*

## CAT 5/6 UTP Cable Testing Main Menu

### UTP Cable Testing Main Menu



SELECT TEST:  
▶ RW CERTIFY UTP  
BASIC TEST UTP  
TRACER TONES ON  
▲EXIT ▼SCROLL SEL

**RW CERTIFY ("RWC") UTP:** Move the cursor to RW CERTIFY UTP and press SELECT to start RWC Level 1 testing of a cable. RWC tests have 2 levels: Level 1 uses the Main Unit and Remote Probe to perform the *Basic Cable Tests* (listed below)... plus *Speed parameter testing* (10, 100, 1000MB) and *Cable Category Testing* (CAT 3, 5, 5E, 6). When the Level 1 test is complete, you can choose to continue to Level 2 and use real data from your own hub, switch or PC to expand the testing. RW CERTIFY is designed for 4 pair cable only (use BASIC TEST UTP for other pairings). See *List of Functions* for a listing of tests. 250 test results can be stored for later printing. *Page 13.*

**BASIC TEST UTP:** Move the cursor to BASIC TEST UTP and press SELECT to test UTP cable for length, opens, shorts, split pairs (plus distance to these faults) and wire map. BASIC TEST UTP does not perform Real World Certification. *Page 30.*

**TRACER TONES ON:** Move the cursor to TRACER TONES ON and press SELECT if you wish to energize a cable with a tone (plug the cable into the Main Unit's RIGHT jack). The Remote Probe detects the tone at the far end of the cable. This is useful in locating cables in crowded wiring closets. When selected, tracer tones will stay ON for one hour. Note: Use the RIGHT jack when tracing unknown cables (it is protected from accidental high voltage exposure).



**Press down arrow button after cable is connected**

**RW CERTIFY UTP**  
**Perform Real World Certification Level 1 (UTP cables) and Level 2 (UTP cables and LAN devices)**

UN-COIL CABLE  
PLUG OPEN CABLE  
INTO LEFT PLUG  
DO NOT USE PROBE  
▲ EXIT ▼ TEST

Follow the instructions. Only an uncoiled cable will give you accurate test results. At this point in the testing, the far end of the cable should not be connected to any device. Note: If the cable is connected to a device you will be alerted to check the far end of the cable. When ready to proceed, press the down arrow (▼ TEST).

**Error Messages:** If there is a problem that stops the test from proceeding, one of the following error messages will be displayed:

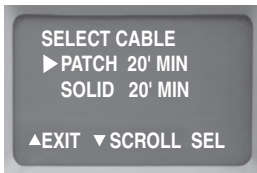
**CABLE IS ACTIVE:** There is an active network port on the far end of the cable. You will need to unplug it to proceed.

**CHECK CABLE END:** A voltage is present on one or more of the cable pairs or the REMOTE PROBE is connected to the cable end when it is not needed. You will need to unplug it to proceed.

**NO CABLE:** There is no cable connected or an inactive port is plugged into the far end of the cable.

Note: If errors persist from test to test, please contact the factory.

**Stranded or  
Solid wire  
selection  
screen**

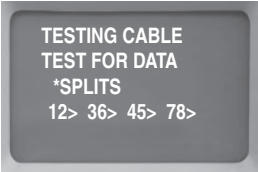


**The Real World Certifier** has the unique ability to test both cables constructed of *stranded wire* (commonly called "patch" cables) and *solid core wire*. Scroll to select the cable and press SELECT. *How to tell the difference:* If the cable is installed in a wall, it is almost certainly a solid core wire. Preassembled cable with end fittings already attached is usually stranded cable. Also, stranded cable is more flexible than solid wire. If you bend the cable and it does not attempt to spring back to its original shape it is most likely solid cable. Note: The minimum length of each cable type is shown on the screen for RW CERTIFY TESTS. If your cable is shorter than this, use the BASIC CABLE TEST. Once the selection is made, cable testing will automatically commence.

NOTE: Descriptions of all test result screens can be found in the RW CERTIFY/REVIEW section of the manual.




Testing progress  
is shown on the  
screen



```
TESTING CABLE
TEST FOR DATA
*SPLITS
12> 36> 45> 78>
```

Any problems will  
be displayed (See  
appendix C)



```
TDR
NEXT FEXT
SPEED TEST PAIRS
12> 36> 45> 78>
```

During this phase of testing, information about length, opens, shorts, split pairs, crosstalk, cable category and speed is being gathered and computed. If there are no cable problems, testing continues until you are prompted to connect the *Remote Probe* and perform the *Wire Map*. If all is OK, testing will finish (the RWC "speed" screen is displayed). Note: If there is a problem with the cable, the problem will be displayed, and testing will be halted. The problem *must be corrected* before testing can continue. See *Appendix C* for examples of cables failures.

Complete results are immediately available for **Review** and **Saving** after the test is completed. This "test now, review later" feature greatly speeds up the test process when you have multiple cable installations.

**Time to test:** Short-cables take longer to test because fewer measurements per pass are possible. The thousand of measurements required are accomplished much faster on longer cables than shorter cables.

## CAT 5/6 UTP Cable Testing / RW CERTIFY / LEVEL 1

Testing is halted until the Remote Probe is connected.

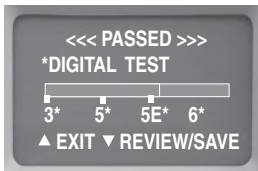
PLUG IN PROBE AT  
FAR END OF CABLE  
<RED LED = DONE>  
TRACE TONES ON  
▲ EXIT

The **REMOTE PROBE** is required for the WIRE MAP to be **constructed**. Plug the Remote Probe into the far end of the cable. Tracer tones have been turned ON to help locate cables in crowded areas (press the TRACE button on the Remote Probe and hold it close to the cable to follow the tone). The Main Unit's wire map test is triggered when the Remote Probe is connected to the far end of the cable (there are no buttons to push). The wire map tests for correct cable pairing. Note: The wire map is displayed during the **Review** process. Not during the test.

**Remote Probe LEDs.** The Remote Probe needs to be connected only for a brief period. *Flashing* LED(s) indicate the test is progressing. A *steady* LED indicates the test is completed. This saves you an extra trip to retrieve the probe. If LED(s) continue to flash the cable, the cable has a wiring problem. Disconnect the probe and go to the Main Unit to see the results. Note: If you plan to test to Real World Certification Level 2, now is a good time to plug in the hub, switch or PC (it will save you a trip).

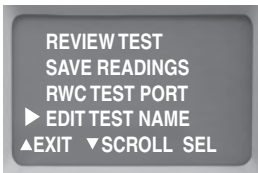


RWC Level 1 final screen (when you see this, Level 1 is completed and available for review)



When the above screen appears, the Level 1 RWC is complete. If you select **REVIEW/SAVE**, you will enter the **Test Results Option Screen**. To discard the test results immediately, select **EXIT**.

Test results option screen



**REVIEW TEST:** View results from the Level 1 test. After the review, you may return to this screen to NAME/SAVE the results. *See page 21.*

**SAVE READINGS:** Store the test results in **PRINTER MEMORY** for later printing and do not continue to Level 2 testing. The next sequential *Reading Number* (1-250) will be assigned along with any name that has been created (see **EDIT TEST NAME** below).

**RWC TEST PORT:** Continue to Level 2 certification. Requires a PC, hub or switch to drive the cable. *See page 18.*

**EDIT TEST NAME:** Create a name (not required) that is stored with the sequential reading number. If you continue to Level 2 you will have another chance to create a name. *See page 35.*

**EXIT:** Discards the test results and returns to the Main Menu.



**CAT 5/6 UTP Cable Testing / RW CERTIFY / LEVEL 2**

**RW CERTIFY UTP  
LEVEL 2**  
**Perform Real World  
Certification Level 2 (UTP  
cables and LAN devices)**

If you have selected to continue with Real World Certification Level 2, this screen appears.

PLUG IN PORT  
GIG PORT MAY  
RW CERTIFY TO  
10M 100M 1 GIG  
▲ EXIT ▼ CERT 2

**RealWorld Certification Level 2** adds to the battery of tests conducted in Level 1 by testing the cable with real live data. The source of this data can be any hub, switch or PC. Note: The screen (above) reminds you that the best source of data is a gigabit device. A gigabit device drives the cable with data up to a gigabit (1000 MB) on all 4 pairs.

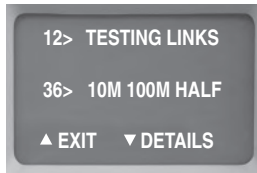
Connect the port to the cable and press ▼ to continue with Level 2.

*FAQ: What is the difference between Level 1 and Level 2 and when do I use it? Level 1 certification tests for length, opens, shorts, split pairs (including distance to the fault) along with propagation delay, skew, NEXT, FEXT, and Cable Category measurements. Level 1 testing uses simulated digital signals to test the cable. Level 2 adds to the testing with the use of real live data from a NIC, hub, or switch. Use Level 1 for new cable installations or anytime a LAN device (hub, switch, PC) is not available.*

Testing  
Link Pulses  
from a  
Gigabit device



Testing  
Link Pulses  
from a  
100MB device



The first step in the Level 2 process is to read the link pulses of the LAN device and determine its *advertised* capability. Every LAN device broadcasts its capability in terms of speed, duplex and other features (termed "advertised" capabilities) to other LAN devices.

First example (above): The RWC1000 has found a gigabit device (1000MB) on pairs 1,2 and 3,6 that is capable of transmitting at 10MB, 100MB and 1000MB at full duplex. 1000 MB devices use all 4 pairs.

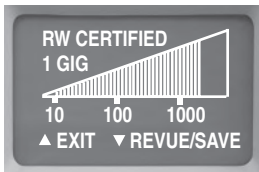
Second example (above): The RWC1000 has found a 100MB device on pairs 3,6 that is capable of transmitting at 10MB and 100MB at half duplex. Typically, devices that transmit on pairs 1,2 are PCs and devices that transmit on 3,6 are hubs and switches.

When completed, press the down arrow key (▼) to continue.

**CAT 5/6 UTP Cable Testing / RW CERTIFY / LEVEL 2**

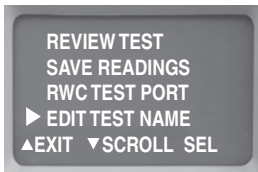
**Data Signal Levels:** Immediately following the link pulse test, the Main Unit tests the data signal levels from the LAN device. The levels are not displayed at this time but are available during Review.

**RWC Level 2 final screen (when you see this screen, Level 2 is completed and available for review).**



**When the above screen appears,** the Level 2 RWC is complete. The complete results of both the Level 1 and Level 2 readings are available for immediate review. You have the choice of discarding the test readings ("EXIT") or REVIEWING or SAVING the Level 1 and Level 2 readings in Printer Memory ("REVUE/SAVE"). Note: If you select REVIEW/SAVE, you will have an option to name the test (EDIT TEST NAME) before saving.

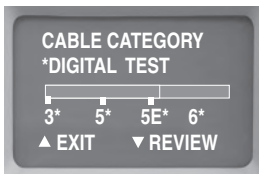
**Review, create a name for the test and/or save the test results.**





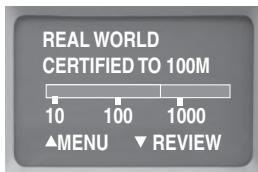
**CAT 5/6 UTP TEST REVIEW**  
*Review the readings from the most recent test or store the readings in Printer Memory. To review past readings stored in the memory see page 39.*

**Cable Category**  
is the first screen of many that are stored



The "Cable Category" is universally accepted as the speed capability of the cable. Cat 3 was the original twisted pair cable that connected 10MB networks together. Then came Cat 5 (used in networks up to 100 MB). Followed by Cat 5E (generally considered adequate for up to 1000MB networks). As you become familiar with Cable Category, you will notice that few cables get rated higher than their factory labeling. This is because cables are manufactured and tested to minimum specifications. If the cable exceeds minimum specifications it passes the manufacturer's inspection.

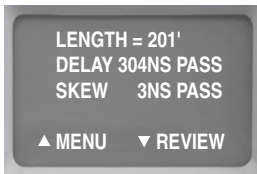
When ready to proceed, press (▼) REVIEW.

**RW Certification  
Level 1 Speed  
Projection**

**RealWorld Certification Level 1** displays the projected speed capability of the cable. The graph is a result of thousands of measurements used to project the speed of the cable. This is one of the most useful and money-saving displays. For instance, it is possible that some shorter, installed CAT5 cable (rated for 100MB) are capable of communicating at a 1000MB. This graph will indicate such. Many users conclude their cable testing with Level 1 and skip the Level 2.



### Length / Timing summary screen



**Length:** The length of the shortest cable pair (in feet). 330' is the longest cable allowed by the 802.3 standard. The Real World Certifier can test cables up to 1250' in length.

**Propagation delay:** The time it takes for a data signal to travel the length of the cable (in nanoseconds). An abnormally long propagation delay indicates the cable is "too slow" for the application. Either the cable itself is too slow or there is an error in the wiring. The standard allows a maximum 555 nsecs propagation delay (Cat 6 cables).

**Skew:** The difference in the propagation delay between the slowest pair and the fastest pair in the cable (in nanoseconds). A small skew insures that data, on each pair, will arrive at the receiver at about the same time. A large skew reading causes errors. 50 nsecs is the maximum allowable skew.

To continue reviewing, press the down arrow key (▼).

**CAT 5/6 UTP Cable Testing / RW CERTIFY / REVIEW**

**RWC Level 1  
Pass / Fail  
Summary Screen**

DELAY OK SKEW OK  
NEXT OK FEXT OK  
SPLIT OK MAP OK  
PATCH TOL 94%  
▲ MENU ▼ REVIEW

**DELAY OK:** The propagation delay of the cable is within specification. See *page 23* for the definition of delay.

**SKEW OK:** The skew of the cable is within specification. See *page 23* for the definition of skew.

**NEXT OK, FEXT OK:** Indicates that "near end crosstalk" (at the near connector) and at "crosstalk far end" (a distance removed from the near connector) is within acceptable limits. Crosstalk is interference created by signal coupling between adjacent wires of the cable.

**SPLIT OK:** The wire contains no split pairs. See Appendix D for a definition of "split pairs" and notes on making a correct cable.

**MAP OK:** The pair wiring of the cable is correct. See Appendix D.

**PATCH/SOLID:** The type of wire specified (*see page 14*).

**TOL(TOLERANCE):** A calculated value using cable length, delay, NEXT, FEXT, Cable Category (CAT 3,5,5E,6) and speed (10M, 100M, 1000M). Zero percent equals failure to meet

## CAT 5/6 UTP Cable Testing / RW CERTIFY / REVIEW

specifications at a given speed. One percent is barely passing. 100 percent is maximum *tolerance*.

*Tolerance* is largely cable length driven. The longer the cable is, the less the tolerance. However, lower Category cables eat up tolerance faster than higher Category cables.

If *Tolerance* is below 15%, you may wish to consider using a repeater, hub or switch to shorten the cable run. This is especially true if you are in a "noisy" environment (large electromechanical machines, etc.).

**Wire Map**  
**A correct wire map**  
**for a straight through**  
**cable.**



12>	203'	===	<12
36>	203'	===	<36
45>	201'	===	<45
78>	200'	===	<78
▲ MENU			▼ REVIEW

**WIRE MAP:** The wire map displays the pairing of the wires in the cable. The example wire map indicates that the first pair (comprised of pins 1 and 2) is 203 feet long and terminates in pins 1 and 2 on the far end of the cable.

**CAT 5/6 UTP Cable Testing / RW CERTIFY / REVIEW**

**Propagation  
and skew (per  
pair) screens**

```
12> 309NS DELAY
36> 309NS DELAY
45> 305NS DELAY
78> 305NS DELAY
▲ MENU ▼ REVIEW
```

```
12> 4NS SKEW
36> 4NS SKEW
45> 0NS SKEW
78> 0NS SKEW
▲ MNEU ▼ REVIEW
```

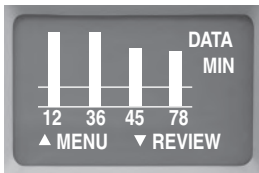
**Timing data per pair:** The next two screens give you the timing of the propagation delay and skew for each pair in the cable. Large variations between pairs indicate trouble.

Note: A given pair's skew is the difference in propagation delay between that pair and the slowest pair in the cable.

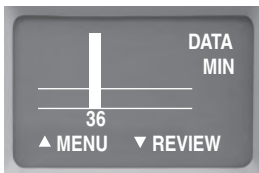
## ***CAT 5/6 UTP Cable Testing / RW CERTIFY / REVIEW***

*The following screen only appears if Certification Level 2 was performed.*

**Signal levels  
of real live  
data from a  
gigabit switch**



**Signal levels  
of real live  
data from a  
100MB switch**



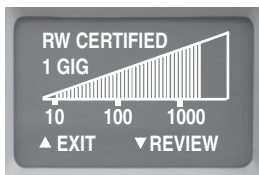
**The signal level screen** is one the most powerful tools used during Level 2 certification. It is a live signal attenuation display. If the level is below the DATA MIN line, you may experience faulty transmissions. If the signal is well above the DATA MIN line, you have plenty of "head-room". Press the down arrow key to continue.

*The two examples shown shows off the differences between gigabit devices and 10MB and 100MB devices. With a gigabit device it is possible to view real live data on all 4 pairs whereas a 10MB and 100MB can only transmit on 1 pair. A gigabit device is a full duplex device that uses all 4 pair therefore making it a perfect device to get a full view of all 4 pairs of the cable.*

## CAT 5/6 UTP Cable Testing / RW CERTIFY / REVIEW

The following screen only appears if Certification Level 2 was performed.

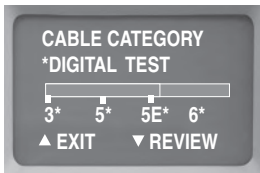
Real World  
Certification  
Level 2  
summary screen



**Real World Certification Level 2 displays** the *Real World certified Level 2 speed capability* of the cable. The display is the result of the data gathered during Level 1 testing (simulated data) and Level 2 testing (real data) into a graph that "Real World Certifies" the speed capability of the cable.

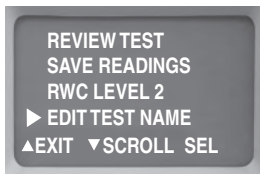
**Additional notes:** The **Level 2 testing adds real live data** with the connection of a real live data source (a hub, switch or PC) to the far end of the cable. This adds an important test element: signal attenuation of live data. Adding this to the test data gathered during Level 1 testing creates Level 2 testing. The end result of Real World Certification Level 2 is the speed graph shown above. It certifies the measured data speed capability of the cable. Use Level 2 certification whenever you want to test a cable with real live data. With the Level 2 testing you are Real World Certifying both your cable and your network port at the same time (you can test your cable with the exact port that it will use in the network).

If you see this screen again, you are reviewing the same data again



Select EXIT at any time to *stop* the Review. If you select EXIT, you will be given the option to SAVE the test results with or without a NAME or to discard the results. Select REVIEW to continue reviewing.

Test results  
option screen  
"EXIT"



See page 35 for SAVING and NAMING instructions.

Note: Once a reading is SAVED, it is too late to create a NAME.



**CAT 5/6 UTP Cable Testing / BASIC TEST UTP**

**UTP Cable Test  
Main Menu**

**BASIC TESTING OF UTP**  
**Test UTP for opens, short,**  
**split pairs, length and**  
**distance to fault.**

RW CERTIFY UTP  
 ▶ BASIC TEST UTP  
 TRACE TONES ON  
 ▲EXIT ▼ SCROLL SEL

**BASICTEST UTP:** Move the cursor to BASIC TEST and press SELECT to test a UTP cable for length, opens, shorts, split pairs (plus distance to these faults) and wire map. BASIC TEST UTP is a quick test and does not perform Real World Certification. Basic test results can be stored in Printer Memory. Note: BASIC TEST UTP is often used when a cable fails to pass the RWC test. Or it is used to test 2 pair UTP wiring (RWC can only be performed on 4 pair wire).

**Press down arrow  
button after the  
UTP cable is  
connected**

UN-COIL CABLE  
 PLUG OPEN CABLE  
 INTO LEFT PLUG  
 DO NOT USE PROBE  
 ▲ EXIT ▼ TEST

Follow the instructions on the screen (plug the cable you wish to test into the LEFT jack). Only an uncoiled cable will give you the most



## CAT 5/6 UTP Cable Testing / BASIC TEST UTP

accurate length measurement. At this point in the testing, the far end of the cable should not be connected to any device. Note: If the far end of the cable is connected to any device it will notify you to check the far end of the cable. When ready to proceed, press (▼ TEST).

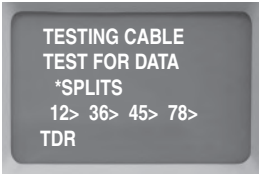
**Error Messages:** If there is a problem that stops the test from proceeding, one of the following error messages will be displayed:

**CABLE IS ACTIVE:** There is an active network port on the far end of the cable. You will need to unplug it to proceed.

**CHECK CABLE END:** A voltage is present on one or more of the cable pairs or the REMOTE PROBE is connected to the cable end when it is not needed. You will need to unplug it to proceed.

**NO CABLE:** There is no cable connected or an inactive port is plugged into the far end of the cable. Plug in the cable or disconnect the inactive port.

**Testing  
progress  
is  
displayed**



```
TESTING CABLE
TEST FOR DATA
*SPLITS
12> 36> 45> 78>
TDR
```

**Cable testing has commenced.** You can follow its progress on the display. During this phase of testing, information about length, opens, shorts and split pairs is being gathered and computed. If any cabling errors are encountered you will be alerted including the distance to any problems..

## CAT 5/6 UTP Cable Testing / BASIC TEST UTP

UTP pairs and length are displayed. Select **MAP + TRACE** for wire-map and tones

```

12> 203'
36> 203'
45> 201'
78> 200'
▲ EXIT ▼ MAP + TRACE
  
```

**Remote Probe LEDs.** The Remote Probe needs to be connected only for a brief period. *Flashing* LED(s) indicate the test is progressing. A *steady* LED indicates the test is completed. This saves you an extra trip to retrieve the probe. If LED(s) continue to flash the cable, the cable has a wiring problem. Disconnect the probe and go to the Main Unit to see the results.

LEDs



**UTP Wire Map**  
A correct wire map  
for a straight through  
UTP cable.

```

12> 203' === <12
36> 203' === <36
45> 201' === <45
78> 200' === <78
▲ EXIT ▼ SAVE
  
```

**UTP WIRE MAP:** The wire map displays the pairing of the wires. The map above indicates that the first pair ("12>"), pins 1 and 2, is 203 feet long and terminates in pins 1 and 2 ("<12") on the far end of the cable. If there were any problems, they would be displayed. Press SAVE to either SAVE or NAME and SAVE the test. See *page 35 for instructions*. Press EXIT to discard the results.



## COAX CABLE TESTING



Select **COAX CABLE** from  
Main Menu

**COAX CABLE TESTING**  
*Test coax cable for opens,  
short, length and distance  
to fault.*

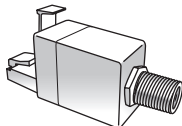
CAT 5/6 UTP  
▶ COAX CABLE  
NETWORK PORTS  
PRINTER MEMORY  
▲ EXIT ▼ SCROLL SEL

COAX CABLES

**COAX CABLE TESTING:** Move the cursor to COAX CABLE and press SELECT to test a coax cable for length, opens, shorts (plus distance to these faults). Wire map and toning is also available from this menu. COAX CABLE test is a quick test and does not perform Real World Certification. Test results can be stored in Printer Memory.

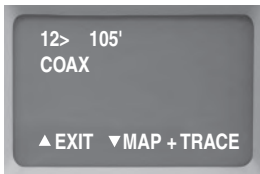
**RJ45/COAX ADAPTER:** The Main Unit has a permanent COAX connector labeled "COAX". The RJ45/COAX adapter is used to connect the coax cable to the Remote Probe.

Pins 1 and 2 of the Remote Probe's socket are used to test the coax cable.



## COAX CABLE TESTING

Connect the coax cable to the F connector on the Main Unit and select coax. The test begins.



At the beginning of the test, the far end of the cable should not be connected to anything.

The coax pair (pins 1 and 2) and length are displayed. Select **MAP + TRACE** for wiremap and tones



**Coax Wire Map**  
A correct wire map for a coax cable.

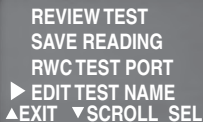


**Is the cable OK?** If the COAX CABLE TEST concludes with a wire map display and no reported errors, the cable is error free. Press **SAVE** to either **SAVE** or **NAME** and **SAVE** the test. See *the next page for instructions*. Press **EXIT** to discard the results.



## NAMING / SAVING TEST RESULTS

**Naming and Saving  
test results start at  
this screen**



REVIEW TEST  
SAVE READING  
RWC TEST PORT  
▶ EDIT TEST NAME  
▲EXIT ▼ SCROLL SEL

All RWC1000 tests, whether RWC UTP, Basic UTP or coax, eventually arrive at this screen. It is here where you decide to **SAVE** the test in **PRINTER MEMORY** (with or without a custom **NAME**).

**REVIEW TEST:** Review test results before they are **SAVED**. After reviewing the test results you can return to this screen.

**SAVE READINGS:** Store the results from the latest test in **PRINTER MEMORY** for later printing. The next sequential *Reading Number* (1-250) is automatically assigned along with any **NAME** that you created (see **EDIT TEST NAME** below). Creating a name is not required. Note: The test results of all RWC1000 cable tests can be **NAMED** and **STORED** with the exception of RWC tests that did not "PASS".

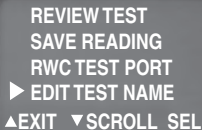
**RWC TEST PORT:** For RWC UTP tests only. *See page 18.*

**EDIT TEST NAME:** Create a name (not required) that is stored with the sequential reading number. If you are going to create a name, it must be created before the test is **SAVED**. *See the following page for instructions on creating a NAME.*

**EXIT:** Discards the test results and returns to the Main Menu.

## NAMING / SAVING TEST RESULTS

Select **EDITTESTNAME** to create a custom name for the test results. Do this before saving the test in memory.

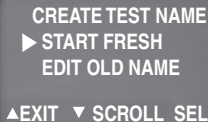


REVIEW TEST  
SAVE READING  
RWC TEST PORT  
▶ EDIT TEST NAME  
▲EXIT ▼ SCROLL SEL

To NAME a reading, you must first complete any of the RWC1000's cable tests. At the end of the test, press the DOWN arrow (labeled "REVIEW/SAVE" or "SAVE") and the above screen appears. Select EDIT TEST NAME.

*Note: Creating a name (EDIT TEST NAME) for a test result is optional. The RWC1000 automatically assigns a sequential number from 1 to 250 when SAVE READING is selected. If a name has been created using EDIT TEST name, this name will also be stored with the sequential number when SAVE READING is selected.*

Select **START FRESH** to create a name from scratch. Select **EDIT OLD** to create a new name by modifying the prior name. It saves time.



CREATE TEST NAME  
▶ START FRESH  
EDIT OLD NAME  
▲EXIT ▼ SCROLL SEL

For the purposes of learning the naming routine, select START FRESH and follow the exercises on the following page. Once you become proficient with START FRESH, give the EDIT OLD routine a try. It speeds creating names by allowing you to copy an "old" reading name as the starting point for creating the next cable reading name. See 2 pages ahead for more detail.

## NAMING / SAVING TEST RESULTS

### Naming your tests

#### TEST NAME line

A maximum 16 character name appears here.

#### Rotating "Letter loop"

Rotate loop with arrow keys until desired letter, number, space, backspace or MENU command appears on the left edge of LCD. Press SEL to copy character to the TEST NAME line. After SEL is pressed, the letter loop conveniently positions to a space character awaiting the next entry.



The UP and DOWN arrows rotate the "LETTERLOOP" to the right and left. The SEL key copies the letter to the TEST NAME LINE. Create a label: Rotate the letter loop until the letter or command desired appears at the leftmost of the display and press the SEL button.

#### Exercise the "Rotating Letter Loop"

It's the best way to learn how to create a name.

#### Exercise #1. Moving the LETTER LOOP.

- 1) Press the DOWN arrow for 5 seconds: The LETTER LOOP continually rotates to the left.
- 2) Press the UP arrow for 5 seconds: The LETTER LOOP continually rotates to the right.
- 3) Press the SEL key: The *leftmost* character of the LETTER LOOP is always copied up to the TEST NAME line. If it is a space, a space is copied. If it is a ▶ the cursor moves to the right.
- 4) Want to exit back to the menu? Use the arrow keys to position "MENU" as the leftmost character on the LCD and press SEL.

## NAMING SAVING TEST RESULTS

**Exercise #2.** Create the test name "TEST", then erase:

Step 1: Position the LETTER LOOP so "T" is the leftmost letter on the screen (use the UP and DOWN arrow keys to position the letter "T" at the left side of the LCD display).

Step 2. Press the SEL key, copying the "T" up to the TEST NAME line. Now do the same for "E", "S" and "T".

Step 3. If you make a mistake, try the letter loop's "cursor characters" (◀▶). They allow you to control the cursor's position. To erase a character, write over the character with a "space" (blank) character. There are 3 of these in the letter loop. For instance, a space character is located between the "." character and the letter A.

### Special characters in the LETTER LOOP

- ◀ Backspace over letters without erasing them.
- ▶ Forward space over letters without erasing them.
- Space (blank). Use to erase letters or add spaces.

**MENU** Use to exit the EDIT TEST NAME routine and return to the MENU. If you select MENU you have lost nothing. You can still SAVE the reading in memory or re-enter the EDIT TEST NAME routine.

**"EDIT OLD" NAME** Once familiar with the EDIT TEST NAME routine, try using EDIT OLD NAME. The EDIT OLD NAME routine requires a prior cable name to edit. Perform a cable test and when naming, select EDIT OLD NAME. It speeds creating names by allowing you to copy an "old" reading name as the starting point for creating the next cable reading name. Use the backspace, forward space, space character and other characters to modify the name. SAVE it when complete. *Note: The RWC1000 allows duplicate names but when they are printed in Excel they will appear as "Jack A", "Jack A (2)", "Jack A (3)", etc.*





## **REVIEWING PRINTER MEMORY**



**PRINTER MEMORY**  
*Review or Erase stored readings (memory stores up to 250 readings).*

To Review or Erase stored readings, select **PRINTER MEMORY** from the Main Menu

CAT 5/6 UTP  
COAX CABLE  
NETWORK PORTS  
▶ PRINTER MEMORY  
▲EXIT ▼SCROLL SEL

**PRINTER MEMORY:** "Printer memory" is the storage location for all SAVED test readings. It can store the results of up to 250 RWC tests (Level 1 and/or combined Level 1 and Level 2), Basic UTP tests and coax tests for later printing. After each test is conducted, you have the option to REVIEW, SAVE and/or NAME the test results (readings) in PRINTER MEMORY for later printing. This following screen is used if you wish to REVIEW the readings *after* they have been stored. It is also used to ERASE all of the stored readings.

See *page 41* for connecting the Real World Certifier to the PC for data transfer and printing.

## REVIEWING PRINTER MEMORY

### Review or Erase selection screen

▶ REVIEW MEMORY  
ERASE MEMORY

▲EXIT ▼ SCROLL SEL

**REVIEW:** Use the UP and DOWN arrow to find the reading you wish to review in Printer Memory. Press SEL to review. "BLANK TEST NAME" indicates a name has not been created for the test.

READING # 1

BLANK TEST NAME

▲ UP ▼ DOWN SEL

**ERASE:** Selecting the ERASE function erases *all* of Printer Memory. There is no way to selectively erase readings. **This screen verifies that you wish to erase all of Printer Memory.**

ERASE READINGS  
ERASE ALL MEMORY

▶ NO> NOT SURE  
YES> VERY SURE

▲EXIT ▼ SCROLL SEL

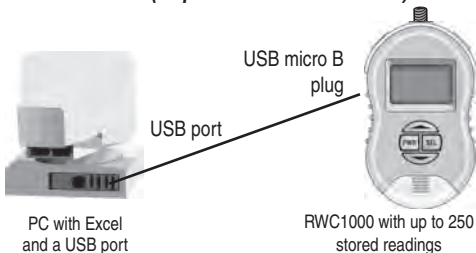
**FLASH MEMORY:** The test readings are stored in nonvolatile (flash) memory. The stored readings will remain until the "ERASE" function is performed. Powering OFF the tester or unplugging its battery will not affect the memory contents.

**UNDERSTANDING THE READINGS:** The display of the stored readings follows the same sequence as if you reviewed the test immediately after the test was conducted. *See page 21.*



## PRINTING FROM A PC

***Transfer the test readings from the Main Unit to the PC using the supplied cable, driver and software (requires Microsoft® Excel®)***



**STEP 1: INSTALL THE RWC DRIVER ON PC:** Run "install\_driver.exe" (found on the RWC software CD). This driver is needed for the PC to talk to the RWC (ignore other drivers). The RWC does not need to be connected to the PC for the driver to properly install.

### **STEP 2: TRANSFERRING TEST READINGS (RWC TO PC):**

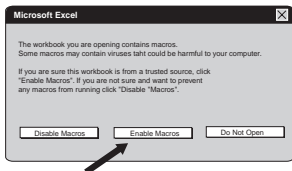
1) Connect the RWC to a USB port on your PC and turn the RWC ON.  
2) Run the "RWC1000.xls" spreadsheet (found on the RWC software CD). RWC1000.xls is itself an Excel spreadsheet that uses Excel's built-in macros to transfer the test results to your PC. Run RWC1000.xls directly from the CD or *copy* it to your hard drive. Follow the directions on the Excel screen to transfer the readings from the RWC's Printer Memory. 3) If you wish, print some or all of the tests (each test prints on a separate sheet). Or email the file to your customer as proof of test. 4) Save the file using Excel's File>"Save as". See the Readme.doc file on the RWC software CD for more details.

## PRINTING FROM A PC

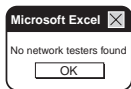
### STEP-BY STEP INSTRUCTIONS FOR USING EXCEL:

After you have installed the driver and connected the RWC1000 to the PC, launch Excel. *Select FILE, OPEN* and select *RWC1000.xls* (either from your RWC software CD or hard drive).

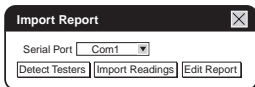
Excel asks you if you wish to "Enable macros". Select "Enable macros". Say "No" if asked if you want to open as a "Read Only" file.



Excel alerts you that it has not found the tester. Click OK to continue and use the *Import Report* routine (below) to locate the tester. .



The *Import Report* screen with 3 buttons appears. "Detect Testers" is automatic.



**PRINTING** [Detect Testers] The RWC spreadsheet's first step is to automatically assign a COM (serial) port to your USB connection and detect the RWC tester. The COM port number selected is displayed in the window (1 through 9 is acceptable). The "*Import Reading*" button will only be enabled if a RWC tester is detected. If *Detect Testers* does not work, it will respond with the error message "No Network Testers found." Verify the tester's power is ON and try again. If the problem still persists, see "Error messages" on the following page.

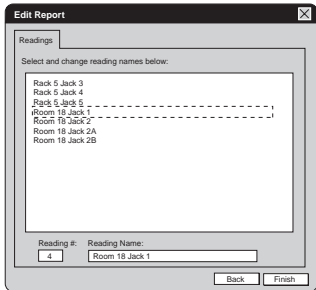
## PRINTING FROM A PC

**Import Readings** Press the *Import Readings* button next. It downloads data from the serial port specified in the drop down box. Press OK.



**Error messages:** If Excel says "Please select a serial port with a network tester connected" or "No network testers found", communication is not established with the RWC's USB port. First check the connections; is the USB cable firmly connected; is Excel's macro security set to low; and the RWC powered ON. For more help, see README.DOC on the RWC software CD and the videos at [www.bytebros.com/bb\\_tester/tech\\_support/RWC1000\\_tech\\_support.htm](http://www.bytebros.com/bb_tester/tech_support/RWC1000_tech_support.htm). It shows you the step-by-step installation procedure.

**Edit Report** Readings are downloaded, press to launch the spreadsheet. If you wish to change any NAMES that you created, do it in this opening screen. You can wait until they are in the spreadsheet but it is quicker here.



The sequential number (1-250) automatically assigned by the RWC1000 to each stored test will appear as "Reading: Cable#1, Reading: Cable#2", etc. in the spreadsheet along with any custom name that you created. The "Reading #" can only be modified in the spreadsheet. *Note: The RWC1000 allows duplicate custom names but when they are printed in Excel they will appear as "Jack A", "Jack A (2)", "Jack A (3)", etc. unless you change the name here.*

## PRINTING FROM A PC

When satisfied, press *Finish*. The spreadsheet named "RWC1000.XLS" will appear. One cable test reading occupies one worksheet. You can do anything with this spreadsheet as would with any Excel spreadsheet (save it under a different name, change the names in the cells, etc.). When you are ready to print, select *FILE*, *PRINT* and in the *PRINT WHAT* dialog box select *ALL*. All of the cable test readings will print (one per page).

	A	B	C	D	E	F	G
1	Reading: Cable# 1						
2	Length	Delay	Skew	Patch/Solid			
3	25 ft.	38ns	2ns	Patch			
4	CERT LEVEL 1: 1 GIG, 100% TOL						
5	CERT LEVEL 2: 1 GIG, 100% TOL						
6	NEXT PASSED (DIGITAL TEST)						
7	FEXT PASSED (DIGITAL TEST)						
8	SPLIT PAIRS PASSED						
9							
10							
11	WIREMAP:		12> 25' ===	<12			
12			36> 26' ===	<36			
13			45> 26' ===	<45			
14			78> 26' ===	<78			
15							
16	PROPAGATION		12>	38ns DELAY	SKEW	12>	0ns SKEW
17	DELAY (PER PAIR)		36>	39ns DELAY		36>	1ns SKEW
18			45>	39ns DELAY		45>	1ns SKEW
19			78>	39ns DELAY		78>	1ns SKEW
20							
21							
22							

PRINTING

RWC1000.XLS spreadsheet

# PRINTING FROM A PC

## Typical RWC1000 printout

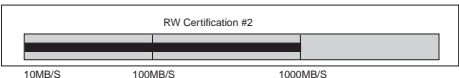
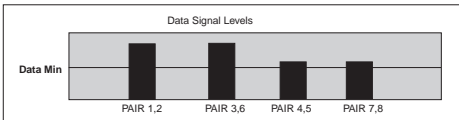
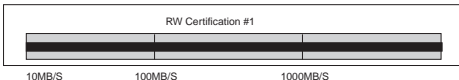
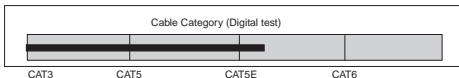
Note: If Level 2 testing was not performed, the Data Signal Levels and the RW Certification #2 charts will have no data.

Reading: Cable# 1

Length	Delay	Skew	Patch/Solid
25 ft.	38ns	2ns	Patch
CERT LEVEL 1: 1 GIG, 100% TOL			
CERT LEVEL 2: 1 GIG, 100% TOL			
NEXT PASSED (DIGITAL TEST)			
NEXT PASSED (DIGITAL TEST)			
SPLIT PAIRS PASSED			

WIREMAP:	12>	25' ===	<12
	36>	26' ===	<36
	45>	26' ===	<45
	78>	26' ===	<78

PROPAGATION	12>	38ns DELAY	12>	0ns SKEW
DELAY (PER PAIR)	36>	39ns DELAY	36>	1ns SKEW
	45>	39ns DELAY	45>	1ns SKEW
	78>	39ns DELAY	78>	1ns SKEW



PRINTING



## Network Testing Menu



**NETWORK PORTS**  
*Display the advertised and negotiated speeds of LAN devices and view the signal levels of real live data.*

### "USE RIGHT JACK" ALERT SCREEN

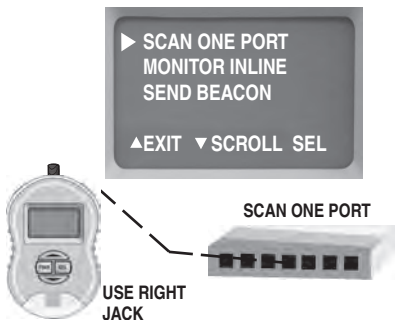
CAT 5/6 UTP  
COAX CABLE  
▶ NETWORK PORTS  
PRINTER MEMORY  
▲EXIT ▼SCROLL SEL

USE <RIGHT> PLUG  
<<TO READ HUBS>>  
HUB<POE>VOLTAGES  
DAMAGE LEFT PLUG  
▲EXIT ▼TEST PORT

**NETWORK PORTS (USE RIGHT JACK)** Select Network Ports to display the capabilities of a LAN device. LAN devices broadcast their capability in terms of speed, duplex and other features (termed "advertised capabilities") to other LAN devices. When two LAN devices are connected together, they "negotiate" to attain the highest common denominator for communicating on the link. For instance, a gigabit switch with an advertised capability of 1000MB, full duplex will negotiate down to 100MB, half duplex when connected to a 100MB, half duplex LAN device. The RWC1000 displays individual LAN devices advertised capabilities and also can connect INLINE between two LAN devices to display the negotiated results. Note: The RIGHT jack is protected from PoE voltage. Use it when connecting to devices.



## Network Testing / SCAN ONE PORT



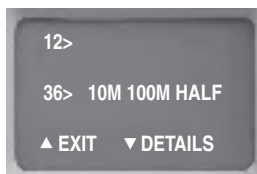
**SCAN ONE PORT:** Move the cursor to SCAN ONE PORT and press SELECT if you wish to display the advertised capability of a LAN device. You can connect to any LAN device using a patch cable or any cable of your choosing. The signal data levels of all active pairs will also be displayed. When *Scanning One Port*, the connection can be made to a live hub, switch or PC without affecting the communication of the other connected devices. See the following 2 pages for examples of *advertised capability* and the *Signal Data Level* display

## Network Testing / SCAN ONE PORT

Testing  
Link Pulses  
from a  
Gigabit device



Testing  
Link Pulses  
from a  
100MB device



The first step in the scanning process reads the link pulses of the LAN device and display the *advertised* capability. LAN devices broadcast their capability in terms of speed, duplex and other features (termed "advertised" capabilities) to other LAN devices.

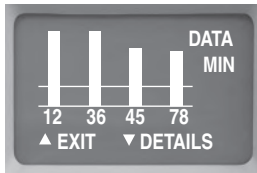
First example (above): The RWC1000 has found a gigabit device (1000MB) on pairs 1,2 and 3,6 that is capable of transmitting at 10MB, 100MB and 1000MB at full duplex. 1000 MB devices use all 4 pairs.

Second example (above): The RWC1000 has found a 100MB device on pairs 3,6 that is capable of transmitting at 10MB and 100MB at half duplex. Typically, devices that transmit on pairs 1,2 are PCs and devices that transmit on 3,6 are hubs and switches.

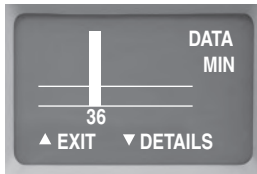
Press the down arrow key (▼) to continue.

## Network Testing / SCAN ONE PORT

Signal levels  
of real live  
data from a  
gigabit switch



Signal levels  
of real live  
data from a  
100MB switch

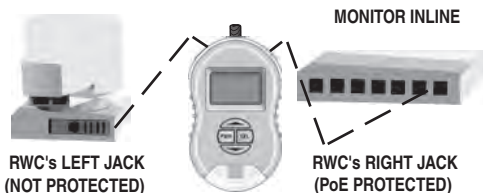
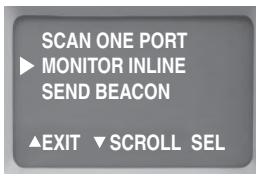


**The signal level screen** is a powerful tool. It is a live signal attenuation display. If the level is below the DATA MIN line, you may experience faulty transmissions. If the signal is well above the DATA MIN line, you have plenty of "headroom".

Press the down arrow ( ▼ ) key to continue.

*The two examples shown shows off the differences between gigabit devices and 10MB and 100MB devices. With a gigabit device it is possible to view real live data on all 4 pairs whereas a 10MB and 100MB can only transmit on 1 pair. A gigabit device is a full duplex device that uses 2 pairs to transmit and 2 pairs to receive data...and it can be tricked into displaying the data on the 2 receiving pairs.... therefore making it a perfect device to get a full view of all 4 pairs of the cable.*

## Network Testing / MONITOR INLINE



**MONITOR INLINE:** Move the cursor to MONITOR INLINE and press SELECT if you wish to view the *negotiated* results between two LAN devices. Note: Data communication can take place while the Main Unit is inline between two devices but after the negotiation is complete.

The MONITOR INLINE TEST is methodical and mostly automatic. Here is a summary of the steps that allow the RWC1000 to arrive at the *negotiated speed* (detailed steps are on the next page):

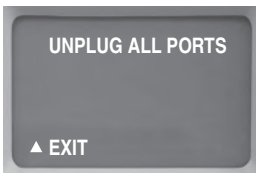
- 1) Plug in one PORT into the LEFT SOCKET of the RWC1000.
- 2) Pause for a few seconds and then plug the second PORT into the RIGHT SOCKET.
- 3) The RWC1000 displays the negotiated speed.

Note: If you suspect one of the devices has PoE, plug it into the RIGHT jack.

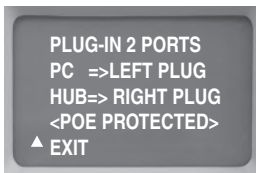
## Network Testing / MONITOR INLINE

**Screen-by-screen instructions to perform INLINE testing.** Follow the steps and wait for the RWC1000 directions. The tester will tell you when it is time for the next step.

**UNPLUG ALL PORTS.**  
When the RWC1000 senses that no ports are connected to the tester, it will begin.



**PLUG IN 2 PORTS.**  
Plug in both devices using the "LEFT" and "RIGHT" sockets of the RWC1000.



**CAPABILITY SCREEN.**  
This screen (or similar) appears as the RWC1000 monitors the devices. When complete, the RWC1000 will automatically continue to the next screen.



## Network Testing / MONITOR INLINE

The *Negotiated Speed* of the link is automatically displayed.

NEGOTIATED  
GIGA BIT FD

OK TO SEND DATA  
▲ MENU

**The MONITOR INLINE TEST is complete. Data can be transmitted between the two LAN devices without removing the tester.**

Note: Most network ports negotiate to the highest possible data rate. Some ports will negotiate to a maximum of the last data rate used. For example, if a PC and a switch communicate at 100 MB/s and a new gigabit switch is installed, the PC port may drag the switch down to 100 MB/s, even if the PC is capable of gigabit data rate. This may be solved by resetting the PC. Or use the SCAN ONE PORT option to read and *unstick* the port. If in doubt, use the tester to scan and unstick both ports, one at a time.

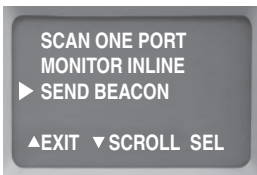


## Network Testing / SEND BEACON



**SEND BEACON**  
*Locate cable drops by lighting a link LED*

Scroll down and select SEND BEACON



USE RIGHT JACK  
(PoE PROTECTED)



PORT BEACON

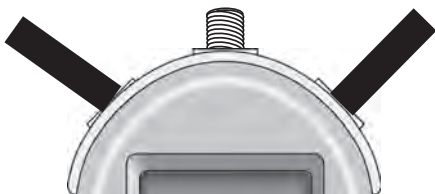
**PORT BEACON:** Use the Port Beacon to locate cable connections in crowded areas. To activate the port beacon, move the cursor to PORT BEACON and press SELECT. The Port Beacon is a link pulse that the Main Unit sends to the receiving device every 3 seconds. The Port Beacon causes the link LED to flash on the LAN device allowing you to spot the connection



## **Appendix A. Straight coupler**

When installing or troubleshooting a LAN, you might need a straight-thru cable coupler. The RWC1000's Main Unit jacks makes it easy. The tester must be OFF to utilize this feature.

**Straight-thru  
coupler**



Note: If you suspect one of the devices is capable of sourcing PoE voltage, connect the device to the RIGHT jack. The RIGHT jack is protected from PoE voltage.





## ***Appendix B. Ping and TCP/IP debugging tools***

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**What is TCP/IP:** TCP/IP is set of standards first developed by ARPA (USA DOD's Advance Research Projects Agency) that define how information is routed over the Internet. And because of its internet popularity, TCP/IP is the most popular protocol operating over twisted pair cabling... and therefore is the most popular protocol used by Ethernet (the standard for local area networking).

**Why learn about TCP/IP:** Once the RWC1000 has established that your cables and network devices are working at the hardware level your next step is to checkout the software level of your network. Understanding the basics of TCP/IP and gaining a familiarity with your operating system's built-in network debugging tools helps you diagnose and troubleshoot network problems at the software level.

TCP/IP basics: TCP/IP has 4 layers: 1) The lowest layer is the PHYSICAL layer that deals with cabling. 2) The next layer is the INTERNET layer. This is the "IP" layer (internet protocol) and it describes the assigning of an "ip" address to each data packet that is transmitted (all data on the internet must have a destination address associated with it and this is referred to as an "ip address"). The address can refer to a workstation on you local network or a server on the internet thousands of miles away. 3) The next layer is the TRANSPORT layer. Because data packets can travel through networks and the Internet using many different routes, they will not necessarily arrive in the same order as they were sent. There needs to be a mechanism that reassembles the packets in the proper sequence. This is the job of the "TCP" (transmission control protocol) and it resides in this layer. 4) Layer 4, the highest layer is the APPLICATION layer. This is where Ethernet and many other software tools reside.

Because TCP/IP is so common, Windows and many UNIX systems have built-in tools to help you debug TCP/IP network problems. These debugging programs are executed at the command line prompt of the operating system (see the end of this section for more information about the command line).

## **ping**

The most popular TCP/IP debugging program is called “ping” (after the name given to the operation of submarine sonar devices). Like the sonar, *ping* sends out a packet to an address that you specify and waits for a reply. Although very simple to use, *ping* is extremely powerful because it works at the IP level and often will respond even when the higher level TCP layer cannot. As mentioned above, ping-*ing* capability is included with most systems and there are also many shareware implementations.

USE: Determine if a workstation is connected to the network. Routers, servers and workstations are identified by an “ip” address and possibly a “name”. The ip address is a numeric string whose format is referred to as “dotted decimal” (example: 192.168.0.0.). The “name” can be any name given to a computer when it is installed or an internet URL. The ability to use a name is provided by a server’s DNS (Domain Name Service). The DNS has a lookup table that cross references ip addresses to names. If a DNS service is not available you will need to use the ip address.

EXAMPLE OF USE: #1: I have problems connecting to the Byte Brothers website from a workstation. I know the DNS name of the website is “www.bytebrothers.com”. At the workstation’s Command Prompt, enter “**ping www.bytebrothers.com**”. If connected, I will receive back bytebrother.com’s IP address (e.g. 207.115.64.64) and the roundtrip time of my ping packet. #2) I am having a problem with one of my workstations communicating to a server. I know the server’s ip address is 192.168.1.100. I enter “**ping 192.168.1.100**”

on the workstation's Command Line. If the server is connected I will receive a response to my ping. Note: It's easy to find a computer's ip address. Go to the target computer (the one you wish to ping) and on its command line enter "ipconfig". The ip address (and other addresses will be displayed). More information on the ipconfig command can be found later in this section

The Ping program has endless uses. **Ping an address (as above):** If you get a response using the IP address but do not get a response using the DNS address, there must be a problem with the DNS system. If you suspect this, try another debugging program "nslookup". **On the command line enter nslookup** followed by the DNS name (*enter nslookup www.bytebrothers.com*) and see if the IP address is displayed. If it is, your DNS appears to be working correctly. **Ping yourself:** You can use the ping command to ping yourself, either using your own IP address or what is known as the loopback address. The loopback address is a special reserved address that works on all systems:127.0.0.1 (*enter ping 127.0.0.1*). If you would like to try pinging your own workstation address but do not know it use the "**ipconfig**" command (see below). Pinging yourself is the first test that should be conducted because if it fails it most likely means that TCP/IP is not properly loaded on the workstation. If it passes and you were using your own IP address (not the loopback address), it confirms that you are the only one on the network with that address. **Ping your gateway:** If you get a response it means that the packets are making it to the router (a gateway is a device on a network that serves as an entrance to another network). On business LANs the gateway is generally the router. In homes, the gateway is the ISP (internet service provider) that connects the user to the internet.

Ping notes: If you want to ping another workstation or server and

you do not know its DNS name or IP address use **ipconfig** (below). To learn all of the ping command's option, enter **ping /?**.

### **ipconfig**

USE: Determine the IP address and other related information about a workstation.

Enter **ipconfig /?** at the prompt to display the options possible with this command. The two most common entries: ipconfig and ipconfig /all.

EXAMPLES OF USE: I want to ping a remote server but I do not know its ip address. Go to the server and at the command line prompt enter "**ipconfig**". The server's IP address will be displayed. Return to the earlier workstation and perform the ping test to this address.

### **tracert**

USE: Determines how many router hops a packet took to reach its destination. This can help determine why a network is slow (or not functioning). Enter **tracert /?** at the prompt to display the options possible with this command.

EXAMPLES OF USE: I want to determine how many routers between my system and the ISO that services Byte Brothers. Enter tracert followed by the name or IP address of the destination system (*enter www .bytebrothers.com*).

### **Netstat**

USE: Displays the current status of all listening TCP/IP ports. A TCP/IP port is where applications connect to the server or workstation.

EXAMPLES OF USE: I would like to see how many applications are tied to my system that use TCP/IP.

### Executing troubleshooting programs from the command line

All of the programs discussed must be executed from the command line of your operating system. To reach the command line on Windows 95 and 98 systems, click on START>PROGRAMS and Select the MS DOS prompt. *Then enter your command.*

On Windows XP systems, click on START>PROGRAMS> and select ACCESSORIES then COMMAND LINE. *Then enter your command.*

On other systems select **Run** from the main menu and enter "**cmd**". Then *enter your command.*

TO EXIT THE COMMAND LINE: Enter EXIT.

### Additional information:

The web has many interesting articles on network troubleshooting and also numerous sites that feature a glossary of terms. Use your favorite search engine and search for Pinging, Pinging Devices, Network management, Network Monitoring Tools, Network Testing, etc.



## Appendix C. Examples of cable faults

**A good cable:** A cable that passes its first set of cable tests will have summary screen similar to this:

**Length / Timing  
summary screen  
of a good cable**



**Bad cable (Split pair):** If errors are found, they will be displayed. Here are some examples of screens with bad cables.

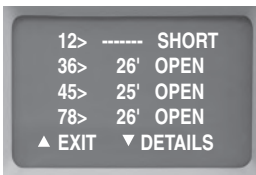
**Bad cable:  
Split pairs  
at 154'**



The screen shows a 330' cable with SPLIT pairs at 154'. If the cable goes through a wiring closet, it is possible the SPLIT pairs are in the closet (154' away). This screen shows one of the advantages the RWC has over testers costing thousands of dollars more. The RWC shows the distance to the SPLIT pair to help locate it and facilitate repair. High cost Certifiers display dBs of cross talk but do not help you locate the repairable SPLIT pair fault. Turn on the TRACE tones and use the probe to locate the cable in the wiring closet. Test each cable associated with the link (patch cables, etc).

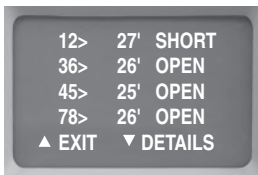
**Bad cable (Near end short):** The error is displayed as follows:

**Bad cable:  
Near End Short**



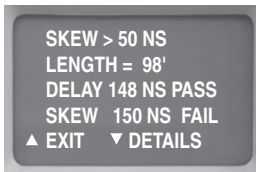
The SHORT on 12> is most likely at the connector (near end). If the short is on the FAR END of the cable it would look like this:

**Bad cable:  
Far End  
Short**



OPENS in cable pairs generate errors in both in SKEW tests and in wire map tests. The following example shows a 200' cable with a break in the middle on pair 78. The following is the first screen to show a problem.

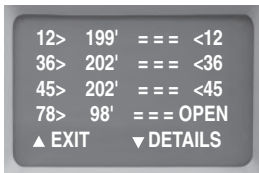
**Bad cable:  
Open**



Note there are two problems shown. The SKEW (difference in DELAY between pairs) is much greater than 50 NS. Another problem

is that the cable LENGTH is only shown as 98'. Press DETAILS and continue the tests. All will become clear when cable map is displayed. Here is a sample cable map.

**Bad cable:  
Wire map  
of open  
pair**



The sample map clearly shows the problem. There is an OPEN at 98' on pair 78>. The SKEW was so large because the timing pulses travel about 200' on pairs 12, 36, and 45, but only travel 98' on pair 78. As always, retest cable after repairs are made.

During the wire map test you probably noticed that the indicator lights on the REMOTE PROBE (connected to the far end of the cable) continue to flash. This is another indication of a problem.

If a cable has a SHORT in the middle, the wire map looks like this:

**Bad cable:  
Wire map  
of shorted  
pair**



The RWC is both a RW CERTIFIER and troubleshooting tool. It identifies the faults and gives you the distance to the OPENS, SHORTs and SPLIT pairs.





## **Appendix D. Making a correct UTP cable**

Twisted Pair Cables: Unshielded twisted pair cable is used for Base-T applications because it is inexpensive, easy to use and has excellent noise cancelling capabilities. A minimum of two pairs of twisted pair wire are required for each computer that connects to the local area network:

- One pair of twisted pair wire to transmit data.
- One pair of twisted pair wire to receive data.

There are exceptions. 100 Base-T devices (called "T4") require 4 pairs of wires. Also, gigabit devices (1000MB) require 4 pair. In both cases, 2 pair are used for transmit and 2 for receive.

As mentioned above, twisted pair cable has separate pairs of wires twisted together to minimize crosstalk. If a wiring error is made and one pair of wire is "split" with another ("split pairs"), the excess crosstalk will most likely keep the link from operating properly.

To make a proper cable, first choose a twisted pair cable that is adequate for your application. For instance, CAT 5E cable for 100MB and 1000MB applications. Use solid core wire when pulling inside a wall. Use stranded cable ("patch cable") for jumpers.

- Remove the outer jacket of the twisted pair cable exposing about a 6" of wire on each end of the cable.
- Each pair of wire must be twisted together (after crimping, the wire should be twisted right up to the connector).
- Do not make the number one wiring mistake: "Split pairs" (a wire from one pair is swapped with a wire from another pair).
- To minimize mistakes, use a standard color code throughout your project. See the following page for the correct connector pin numbers associated with each Base-T pair.
- Use good quality connectors and tools

**RJ45 Connectors (sockets and plugs):** The Base-T Standard uses RJ45 sockets and plugs. The RJ45 socket has 8 pins. The pins are numbered 1 to 8. Looking at the socket with insertion key facing down, pin number 1 is to the left.

SOCKETS



1 8 8 1

PLUGS



8 1 1 8

PIN NUMBERS

EIA/TIA 568B STRAIGHT THRU

PIN #		PIN#	WIRE COLOR
1		1	Orange/White
2		2	Orange
3		3	Green/White
6		6	Green
4		4	Blue
5		5	Blue/White
7		7	Brown/White
8		8	Brown

**Colors:** The first color is the base color on the cable. Second color is the stripe color of the cable. *A straight-thru cable has identical ends.*

*Note: The above color code is the most popular in use.*



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