ATLANTEK
Model 200
Thermal Response Test System
Operators Manual
Revised March 15, 2013

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SYSTEM OVERVIEW

The ATLANTEK *Model 200* thermal response test system is designed to provide thermal energy vs. optical print density information for imaging on direct-thermal or thermal-transfer media. This system is based on an ATLANTEK thermal print controller board which drives a standard thermal printhead and a programmable stepping drive controller. The system includes provisions for mounting four standard- performance thermal printheads. The system is controlled from a personal computer with parameter programming accomplished from menu driven software designed specifically for thermal response and performance characterizations.

For a given printhead and media type the primary factors which determine print quality are:

1) Printhead Substrate Temperature
2) Printhead Platen Pressure
3) Applied Dot Power
4) Dot Pulse Duration(Ton)
5) Print Rate(Tcycle)
6) Dot Duty Cycle(% Dot) - Dots printed per line

The ATLANTEK system is designed to control and measure these parameters and to provide results which not only produce the visual print data but which are stored in computer data files and thus can be recalled and analyzed. The two key print timing parameters are Tcycle and Ton. The difference between these two variables is Toff which represents the dot cooling time between printed dot lines.

$$Tcycle = Ton + Toff$$

To provide meaningful test data Tcycle and SPEED must be related by the expression:

$$L = (SPEED * Tcycle)$$

Where L is the amount of paper advance per dot line. In this system L is fixed at 0.125 mm providing a square matrix. This is to avoid overlapping dot lines or creating spaces between dot lines, either of which introduce error in the densitometer readings.

Thus the specification of SPEED implies a value of Tcycle. The parameter APPLIED DOT POWER (P_{DOT}) is controlled by the applied VOLTAGE through the expression:

$$P_{DOT} = [(VOLTAGE - V_d)**2 / R_{dot}]$$

where V_d and R_{dot} are parameters of the printhead. Thus the applied VOLTAGE determines P/DOT.

The system consists of four major components: the PRINT MECHANISM, the POWER SUPPLY, the ATLANTEK print controller and a COMPUTER containing the SYSTEM SOFTWARE.

PRINT MECHANISM

The print mechanism provides the capability to interchange printheads among a set of industry-standard, 8 dot/mm printheads which have been selected by ATLANTEK in order to provide a good representative cross- section of competing thermal printheads. This will allow the printhead itself to be treated as a control variable for evaluation purposes.

POWER SUPPLIES

The system power supply consists of two modules containing two separate supplies as follows:

1. Adjustable Printhead Supply
2. Motor and Logic Supply

ATLANTEK PRINT CONTROLLER

The print controller provides the following functions:

1. Stepper Motor Control
2. Printhead Control
3. Data and Control Interface to Computer

The stepper controller is a high performance stepper drive designed to provide both a wide range of paper speeds as well as smooth, precise incremental motion. The smallest programmable step increment is 50% of the dot pitch at the 8 dot/mm resolution or 16 dots/mm of position resolution. The motor drive electronics employ a combination of chopper drive and half-stepping to insure smooth, resonance free motion over the full range of paper speeds.

The printhead temperature control allows the operating temperature of the printhead assembly to be programmed as a variable parameter from ambient temperature to 50 degrees Centigrade. The computer measures the temperature and based upon the test requirements instructs the control board to heat or not heat the printhead. The control board also determines the dot pulse duration (Ton) and manages the head strobing in accordance with the test requirements.

PC-AT OR COMPATIBLE, or Equivalent Emulation

The computer resident system software, RTEST.EXE, provides for independent configuration of all variable parameters, plus a data base designed to store all test results together with their specific configurations. This software has been developed by ATLANTEK specifically for the purpose of performing thermal response characterizations and is designed to work in close conjunction with the PRINTHEAD I/O driver card to insure the data throughput requirements associated with the high speed end of the thermal characterization spectrum. All data entry and system operation will be performed via this software package which provides simple parameter configuration menus to insure user friendly operation during system operation all variables and data are passed from the computer to the control board where real time execution takes place.

PLOTTING

Plots of the test results may be obtained through the use of the optional "TECH-GRAPH-PAD" software. TECH-GRAPH-PAD is a powerful menu-driven software package whose features include the following:

- Plotting single or multiple data files

- Support for various types of hard copy devices
  Printers, Laser Printers, Pen Plotters

- User defined labels and comments

- Automatic or Manual scaling

- Curve fitting

GENERAL SPECIFICATIONS

PRINT MECHANISM

MAX. MEDIA SPEED..................................125 mm/sec.
MINIMUM STEP INCREMENT...................0.0625 mm
PRINTHEAD RESOLUTION........................8 dots/mm
TEST PRINTHEAD SUPPORTED.............Kyocera 8" Model KST-216-8MPD1

REAR PANEL CONFIGURATION

PARALLEL PRINTER INTERFACE CONNECTOR (To Host Computer)
POWER ON/OFF SWITCH
FUSE
AC POWER CONNECTOR

CONFIGURABLE TEST SYSTEM PARAMETERS

PRINTHEAD DOT SIZE AND RESOLUTION (Fixed by Printhead).
PRINTHEAD OPERATING TEMPERATURE
PAPER SPEED (Synchronous with Printing)
APPLIED VOLTAGE (Front panel setting)
SIMULTANEOUS OR MULTIPLEX STROBING OF PRINTHEAD (Automatically Selected)
DOT PULSE DURATION (T_{on})
TEST PATTERN SELECTION
MEDIA TYPE (Determined by User).
RIBBON TYPE (Transfer Imaging, Determined by User).
HEADER WIDTH
IMAGE WIDTH

COMPUTER or Emulated Virtual System:

IBM PC/AT or true compatible with the following configuration:
512K RAM minimum
12 Mhz Clock
20 Megabyte Hard Disk
Floppy Disk at Drive A:\
Standard Keyboard
Monochrome or Color System
Parallel Printer Port: 1 required, at I/O 0x378; 1 more required for graph plotting option
Serial Port: 1 required; 1 more required for automatic densitometer readings

NOTE that currently available PC systems do not conform to the Clock requirement.
If a recent system is to be used, a Virtual Machine platform must be installed on the host system, and a DOS machine configured to emulate the PC-AT environment.

PRINTHEAD OPERATING TEMPERATURE:

The PRINTHEAD OPERATING TEMPERATURE is variable under program control from ambient temperature to 50 degrees Centigrade.

TCYCLE: The TCYCLE is variable under program control from 1.00 mS to 25 mS in fixed increments as shown in Tcycle menu.

DOT PULSE DURATION:

The DOT PULSE DURATION (T_{on}) is variable under program control from 10 microseconds to 2 milliseconds.

APPLIED VOLTAGE:

The APPLIED VOLTAGE is continuously variable from approximately 13 volts to 28 volts from the system front panel.

TEST PATTERN DESCRIPTIONS:

Within the Model 200 there are several operator selectable test patterns that may be chosen to run for a desired test session. Test patterns that are included within the standard system configuration are a Checkerboard pattern and a Walking One pattern. Other supported test patterns include a Self-Generating Barcode module and a Pixel On/Off pattern. The Checkerboard patterns   are available in various sizes and densities and may be sequenced during a test session.   These test images allow an operator to study the effects of changing the dot duty cycle (number of heating elements energized per dot line) as opposed to the electrical duty cycle.   Available densities range from 10% to 100% patterns in 10% increments.

With the Walking- One pattern an operator will see a single element imaged per dot line. The output pattern will appear as diagonal line drawn from upper left to lower right one dot size in thickness. This pattern could be used to test the integrity of the dots across the printhead or used to examine the shape of a single dot imaged on a particular substrate.

The optional Imported Test File feature allows the operator to enter a .PCX file that is converted into the proper format to be printed. The PCXM2.exe application supplied needs to reside in the same directory as RTEST.exe application file. Sample .PCX files are provided, 640.pcx is a sample image file that can be printed on a Model 200 equipped with the KST- 48 printhead, TP1.pcx is a sample image file capable of being printed using the KST-216 printhead. The .PCX image file size is dependent upon the printhead installed, the KST-216 printhead requires a 800 X 600 pixel file with a 640 dpi resolution. The entire 800 X 600 file will be printed in the center of the printhead. It is important that the .PCX file have a color depth of 2 colors (or bimodal).

The optional Self-Generating Barcode Module will allow an operator to print a CODE-39 or a UPC-A bar code in the "picket fence" or "ladder" directions using direct thermal or thermal transfer printing techniques. Several densities of each bar code symbology are supported. The highest densities of both, the CODE-39 and the UPC-A symbologies are printed beyond the defined limits as specified by AIM and the UCC. However, they are included within the MODEL 200 to represent possible future trends in bar code printing and may prove useful in evaluating experimental media.

 The optional Pixel On/Off Pattern is actually a collection of five different image patterns; a 100% dot pattern, one dot On/Off (picket fence and ladder), two dots On/Off (picket fence and ladder). This pattern is very useful in evaluating the number of"voids" or amount of "blooming" for a given test session. It is also ideal for studying the effects of dot history and adjacency. It should be mentioned that the MODEL 200 employs an "overlapped" method of printing. This is a result of having the printhead's heating element larger than an incremental motor advance. Therefore, the imaged area in the ladder direction sections will be larger than the unimaged area. Due to this narrow unimaged area and inaccuracies inherent in stepper motors, the ladder direction 1 ON/OFF image may appear to be "banded" for some test conditions.

INSTALLATION

THE ATLANTEK THERMAL RESPONSE TEST SYSTEM is interconnected to the computer as follows:

1. Connect power cable to back of test controller and plug into standard AC mains supply receptacle.

2. Connect the printer cable to the female 25 pin "D" style connector LPT1.
Note: In order to assure proper system operation, the test controller MUST be connected to the LPT1: port of the computer.

3. Connect the 9 pin serial interface cable to the COM1: port of the host computer; the other end of the cable should be plugged into the SERIAL INTERFACE connector located in the rear of the test controller.

4. Connect the other end of the printer cable to the 36 pin connector on the rear of the test controller.

 5. Connect the sensor interface cable to the 15 pin female "D" style connector on the front of the test controller labeled "SENSORS".

6. Connect the other end of the sensor interface cable to the 15 pin "D" style connector on the rear of the mechanism.

7. Connect the motor cable to the 9 pin "D" style connector labeled "MOTOR" on the front of the test controller.

 8. Connect the other end of the motor cable to the 9 pin "D" style connector on the rear of the mechanism.

 9. Connect the printhead interface cable from the rear of the mechanism to the female 37 pin "D" style connector on the front of the test controller labeled "DATA".

10. Connect the printhead power cable from the rear of the mechanism to the female 25 pin "D" style connector on the front of the unit labeled "POWER".

11. Connect the printer cable from the line printer (plotter or laser printer) to the LPT2: connector on the rear of the computer (used in the plotting option only).

12. Connect the densitometer to the serial port COM2: on the rear of the computer (used for automatic densitometer input only).

** IMPORTANT ***

For proper system operation the test controller MUST be connected to the LPT1: connector and the line printer (if used) MUST be connected to the LPT2: port of the computer.

POWERING UP THE TEST SYSTEM

Before applying power the voltage adjustment knob on the front panel of the printer should be turned fully counter-clockwise. This ensures that the applied voltage is below the maximum value recommended for the printhead.

NOTE: If the voltage adjustment knob is positioned near maximum, the over-voltage protector may shut the printhead power supply off. To reset the supply turn the voltage down, turn the system off, and after several seconds restart the system.

Apply power by turning on the switch on the left side of the back of the test controller. It is a good idea at this point to press the reset button on the right side of the test controller front panel to synchronize the test controller and the PC.

LOADING THE MEDIA

The test system mechanism is designed to accept a variety print of media, both thermally sensitive and thermal transfer receptor stock. The media path is determined somewhat by the nature of the media under test and the configuration of the supply. When testing media narrower than 8 inches the media should be attached to 8.5 inch paper backing, this prevents the printhead from firing directly against the platen roller.

The media should be oriented such that the side to be printed on faces up as it passes between the printhead and platen roller. Printhead pressure should be released by rotating the cam lever on the right side of the head mounting mechanism. The media should be fed in from the back side of the printer. If the media is wound on a core, mount the two appropriately sized core plugs into the ends of the core, slide the mounting shaft through the center and insert the shaft into the slots in the supply mounts at the rear of the mechanism. Core plugs are provided for 1, 1.5, and 2 inch cores. Be sure that the brush side of the back tension plate is in contact with the roll of media.

Media may be fed to the platen in either of two paths depending on the amount of back tension necessary to prevent the target media from wrinkling. For lighter tension, thread media under the guide bar, between printhead and platen, and finally under the tear bar. If the media tends to wrinkle during printing, additional back tension may be necessary. This may be achieved by threading the media over the idler bar prior going under the guide bar.

For sheet feeding and for very thick media, the supply mount may be in the way. The supply mounting brackets may be removed by removing the two screws holding them to the base plate.

If difficulty is encountered in threading the media, the *Feed* button on the front of the printer may be pressed. This will cause the print roller to spin, assisting in the paper threading process.

Slide the paper to both center and align it with the printer. Apply printhead pressure by turning the cam shaft lever to the down position.

PRINTHEAD PRESSURE ADJUSTMENT AND MEASUREMENT

Located on the top of the printhead swivel block is an eyelet. This is provided to allow the attachment of an external force gauge for printhead pressure measurement.

Lifting on the gauge until it just releases a piece of paper pinched between the between the printhead and platen roller yields an approximate value for printhead pressure. This may be input to the data file in the comments section.

Pressure may be adjusted by loosening the lock nut on the cam lift spring (on the rear of the mechanism) and turning the adjustment nut to a new operating point. Compressing the spring increases pressure and expanding the spring decreases pressure. Be sure to tighten the lock nut after adjustment is complete.

TEST CONTROLLER FRONT PANEL CONTROLS

There are four controls on the front panel of the test controller.
Each is described as follows:

1. **RESET** - Performs a microprocessor hardware reset. This button is used to perform re-synchronization of the test controller and the computer.

2. **TEST** - Prints a test pattern. (Providing that the printhead voltage is within printing limits and the printhead is in the down position.)

3. **FEED** - Feed advances the paper to the beginning of the next page.

4. **VOLT ADJ**. - Allows the adjustment of voltage applied to the printhead. The applied voltage is displayed on the panel meter on the front of the printer as well as on the upper right corner of the RTEST screen.

****CAUTION****

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Be sure to keep the voltage applied to the printhead below the manufacturers maximum rated voltage or printhead damage may result.
****

CHANGING PRINTHEADS

Tools necessary: 1/8" Allen wrench, 9/16" thin open end wrench (approx. 0.1" thick)

Each printhead is supplied mounted on its own unique carrier plate which maintains proper dot line alignment. The carrier plates should remain attached to the printhead.

****
****IMPORTANT****
****

****
NEVER ATTEMPT PRINTHEAD REPLACEMENT WITH THE PRINTER POWER ON !!!
****

The printhead should first be electrically disconnected from the system by removing the printhead interface and printhead power connectors on the left side panel of the mechanism. Release printhead pressure by rotating the head lift cam shaft to the up position. Remove the screw in the hole at the front of the printhead swivel block. The entire printhead assembly may now be slid toward the right and removed from the mechanism.

Installation of the new printhead is accomplished by simply reversing the removal procedure.

NOTE: If the head lift mechanism is not fully lowered during a test, the system will sense that the printhead is raised and the sheet will feed without the head being energized. This will result in a blank sheet.

TEST SYSTEM OPERATION

The test system has been configured to be as user friendly and menu driven as possible.

The first message which appears on the display shows the system title and asks the user to strike the Enter key on the keyboard to continue.

At this point the system software attempts to verify the presence of a valid media in the "A:" drive that will be used as a source and destination for all data files. Note that for a Virtual Machine, this may be a virtual file path.

Next, the main system menu is displayed. All menu selections may be chosen via the function keys F1 - F10. Available functions at this point may be summarized as follows:

F1 - EXECUTE TEST - Allows the loading of print parameters as defined by either default values or a previous test. Any parameter may be altered by the user after choosing this option. Loaded parameter values are displayed in this menu. Following the test, the operator is given the opportunity to enter several lines of comments regarding the test just executed and also densitometer readings.

F2 - SINGLE PATTERN TEST - Allows the loading of print parameters as defined by either default values or a previous test. Any parameter may be altered by the user after choosing this option. Loaded parameter values are displayed in this menu. Only a single test pattern section is printed for a defined test session. No SEQUENCING is allowed with this option.

F3 - TEST FILE EDITOR - Allows for the display of comments associated with any chosen test with the capability of making any desired changes. Followed by a display of comments associated with any chosen test with the capability of making any desired changes to comments or density readings.

F4 - DIRECTORY OF TEST FILES - This selection displays a list of all previously performed tests.

F5 - VIEW A TEST FILE - Displays a list of all parameters as well as comments and densitometer readings associated with any operator selected test.

F6 - VIEW DEFAULT PARAMETERS - Lists the default parameters of the presently installed printhead, including the maximum voltage level recommended by the manufacturer for a nominal resistance printhead.

F7 - INVOKE PLOT UTILITY - Executes the TECH-GRAPH-PAD program to allow the generation of dynamic sensitivity curves without terminating the MODEL 200 test system software.

F8 - CONFIGURE TEST SYSTEM - Enables/disables the SAMPLE mode option. When in SAMPLE mode, the test sessions are not saved in a file therefore the operator is not prompted for a file name.

F10 - EXIT FROM TESTER - Allows the operator to leave the test system environment and return to DOS

NOTE:
TEST file names MUST conform to the following rules:

   - At least one character long, but less than eight characters in length.

   File names may ONLY be made up from the following characters:

   - The letters A - Z, and a - z
   - The numbers 0 - 9
   - The following special characters:
     ( ) { } @ # $ % ^ & ! - _ ' ~

Any attempt to create a file that is outside this guideline will prompt the "ILLEGAL FILE NAME" error message to appear.

SAMPLE OF THE TEST MENU

```
              TEST MENU

        Head Type: Kyocer1
        File Name: TEST1
        Printhead Set Temperature: 35
        Image Width: Full

     Choose from:                    Current values:

     F1  - Reset to default values
     F2  - Pattern type              50%
     F3  - Dot pulse Duration (Ton)  Seq up to 0.50 msec
     F4  - Cycle Time (Tcycle)       5.0 ms
     F5  - Media Type                ATL-693
     F6  - Head Heating(ON/OFF)      ON
     F7  - Wait for Temperature      NO
     F8  - Configure Output Image
     F9  - Do the Above Defined Test
     F10 - Exit to Main Menu
           Caution- choices will not be saved
```

USING FUNCTION KEYS

Choosing F2,F3,F4,F6 or F8 results in a request to input an appropriate value and a return to the TEST EDITOR MENU.

Parameter sequencing may be selected for choices F2,F3, or F4. This choice produces ten samples down the page with the first sample printed at 10% of the final value, the second at 20% and so on down the page. Sequencing of a test pattern is only available when the Checker board pattern is selected.

Changing the desired Test pattern is done by selecting the F2 option and choosing one of the supported test patterns from the displayed Menu.

Selecting the F8 option (Configure Output Image) from the TEST MENU will allow an operator to alter the image header width or change the test patterns image width.

NOTE: The following conditions automatically invoke the REDUCED printing mode.
   - Pattern Sequence tests
   - Hi Speed TCYCLE Sequence
   - Any test session where the defined TCYCLE value is less than 2.0 msec.

   Width of the REDUCED print area:

  Printhead: Reduced print width:

  Kyocera KST-216-8MPD1   4 inches

ENTERING DENSITOMETER DATA

Following a test, the operator is given the opportunity to enter optical density either manually, automatically, or not at all. If either the manual or automatic choice is selected, the operator is given a choice on the number of densitometer readings to average before recording the value and prompting for a PLOT value.

Manual entry is accomplished by simply entering the density readings at the keyboard followed by the optional PLOT value.

Automatic density readings are done by reading the densitometer via a serial interface. Before capturing density readings the operator must have connected the densitometer to the COM1: port of the computer through a serial cable and have calibrated the densitometer. Once initialized, density readings may automatically be transferred to the computer by closing the densitometer over the target area, releasing it to its normally open position, and then depressing the transmit button located at the top of the reader. An audio "beep" will be heard after the computer has received the data from the densitometer. Plot values are entered through the keyboard after the desired number of density samples are entered.

CREATING A PLOT

To create a plot the operator may invoke the Plotting software by selecting the F7 (Invoke PLOT Utility) option from the MAIN MENU, or the Tech-Graph-Pad program can be used from outside the MODEL 200 operating environment. TECH-GRAPH-PAD is started from DOS by entering "TGP" followed by a carriage return. Once started, an entry screen is displayed, and the Main Menu appears. Several templates of plot files have already been created by ATLANTEK to simplify creating test plots. These templates contain a variety of information related to labeling the plots and scaling the data. Therefore the operator must select the "Recall a Graph" rather than the "Create a New Graph" choice. Menu options are selected by pressing the arrow keys on the keyboard until this choice is highlighted. When highlighted, the operator presses the carriage return to invoke the selection. From the "Recall a Graph" menu the operator selects the "Recall an Attribute File" option. The operator must now select an attribute file to load the previously defined template information. A listing of available attribute files can be seen by pressing the F9 key. The attribute to be loaded depends on the test file to be plotted. Refer to the list below to determine the correct attribute file to load for the current data file.

SEQUENCED VARIABLE	ATTRIBUTE FILE
PATTERN	PATTERN.ATB
Tcycle	SPEED.ATB
Ton	ENERGY.ATB

An attribute file is selected by moving the highlighted area to the desired choice and pressing the return key.

After the attribute file has been selected the operator enters the name of the data file to plot by selecting the "Data Files to Use" option from the "Graph Building Menu". The operator enters the name of the data file by overwriting the asterisks in the data files area of the second entry.

NOTE: The operator must delete any unused asterisks from the file name prior to pressing the return key. Failure to do this will cause the TGP software to attempt to read an incorrect data file.

Once the data file has been correctly entered, the software automatically returns to the "Graph Building Menu" from which the operator will choose the "Scaling" option and invoke Automatic scaling. Selecting the "Output" option will now produce a plot of the current data file that may be created on the computer's display or output to a line printer.

REDUCED WIDTH PRINTING

For test conditions where higher print speeds are required the MODEL 200 dynamically adjusts the active width of data printed across the printhead. This adjustment is necessary due to the effects of having multiple strobes energized simultaneously and the percentage of dots loaded during one dot line. All tests executed with a cycle time less than 2.0 milliseconds and all pattern sequences are automatically printed in a reduced mode.

The test controller hardware connects the printhead strobes in pairs. A printhead having 8 strobe inputs is controlled by 4 lines to the processor. Similarly a 6 strobe printhead is controlled by 3 independent strobe lines. This allows the current load to be distributed over the cycle time and reduces the effects of voltage drops in the power planes within the printhead.

For tests conducted using *low density* print patterns, all of the strobe lines are activated simultaneously. However, as the print density increases the strobes need to be activated consecutively. This obviously increases the amount of cycle time consumed for actual printing. In order to accommodate high density print patterns and maintain low cycle times the number of active head strobes is automatically reduced to 2 pairs in the case of 8-strobe heads or 1 pair in the case of 6-strobe heads. This will yield printing over the center portion of the media and have wide blank margins along each side.

HIGH DENSITY PRINTING

As discussed in the REDUCED WIDTH PRINTING section, the printhead strobes are connected in pairs. This is actually a violation of the printhead manufacturers recommendations for the quantity of dots simultaneously energized during high density pattern printing. This specification violation in no way harms the printhead, it does however cause a greater than desirable voltage drop in the power planes within the printhead. This limits the actual energy delivered to the individual dots during strobing and results in a lighter than expected printout for a given set of parameters. For tests conducted using greater than 50 percent patterns, densitometer measurements should be compared on a *relative* basis rather than considered absolute.

PRINTHEAD PARAMETERS

Average resistance values of printheads supplied with system serial number _____

MANUFACTURER	MODEL
Kyocera 8"	Model KST-216-8MPD1

APPENDIX A

NOMINAL PRINTHEAD VOLTAGES
KYOCERA KST-216-8MPD1

The following is a table of recommended nominal printhead voltages for various resistances of the standard KYOCERA KST-216-8MPD1 printhead.

Printhead   KYOCERA
Model   KST-216-8MPD1
 Tcycle   5.0 msec
 Ton   0.5 msec
 Approx. temp   25 C
 Impressed Power   0.70 w/dot

Ravg (Ohms)	Nominal Voltage (Volts)
500	19.2
510	19.4
520	19.6
530	19.8
540	20
550	20.1
560	20.3
570	20.5
580	20.6
590	20.8
600	21
610	21.1
620	21.3
630	21.5
640	21.6
650	21.8
660	21.9
670	22.2
680	22.4
690	22.6
700	22.7
710	22.9
720	22.4
730	23
740	23.2
750	23.3
760	23.5