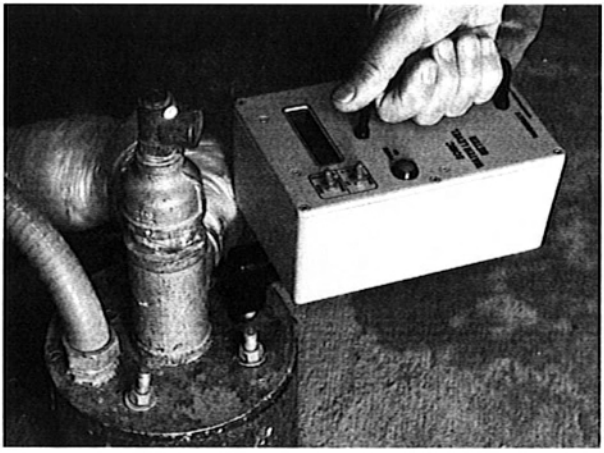
RAVENSGATE CORPORATION

SONIC WATER LEVEL METERS



USER GUIDE
MODEL 200
MODEL 200M
MODEL 200U

Table of Temperature Control Settings
Ts, degrees F

Well Water Temperature, **Tw**, degrees F	Average Daily Surface Temperature, **Tg**, degrees F																			
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
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90	77	77	78	79	80	80	81	82	83	83	84	85	86	86	87	88	89	89	90	91

Ravensgate Corporation, Ridgecrest, CA, 93555

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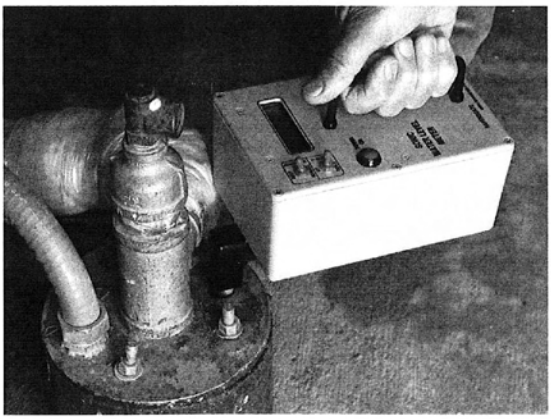
June 30, 2011

INTRODUCTION

Thank you for purchasing a RAVENSGATE SONIC WATER LEVEL METER, Model 200/200M/200U. You will find that it provides fast, accurate measurements of static water level and draw-down. Furthermore, its small size and light weight make it very convenient to carry to work sites and other locations where measurements are necessary.

Unlike most other water level measurement devices, our Sonic method operates by injecting sound waves into the well casing. The wave reflected from the water surface is then analyzed to determine the level and the result displayed on the front panel. Thus, down-hole probes or instrumentation are not necessary. All that is required is an access port in the well cap 5/8 inches (16 mm) or greater in diameter. Simply insert the measuring duct through the cap, push the power-on button and the measurement is displayed in a few seconds. If the well is uncapped, we supply the meter with an easily fitted cap for diameters up to 6 inches (150 mm). Larger diameter caps can be fabricated as needed from plastic or sheet metal.

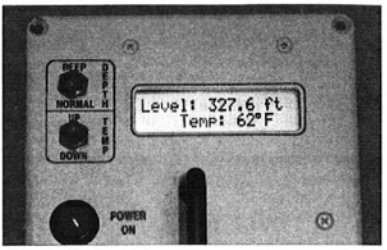


Model 200 shown with the duct properly inserted into the well head.

OPERATING INSTRUCTIONS

Operating the meter requires setting the **DEPTH SWITCH** to either the **NORMAL** or **DEEP** setting. The **NORMAL** setting should be used when the static water level is between 10 and 500 feet (3 and 150 meters) . If the static water level is outside this range, inaccurate readings

may occur. Likewise, in the **DEEP** setting, the static water level must be deeper than 200 feet (60 meters) to avoid inaccurate readings. However, when applicable, using this setting can reduce the possibility of false readings from obstructions in the upper end of the well casing or from the lower end of the casing in rock wells.



A typical meter reading on the Model 200

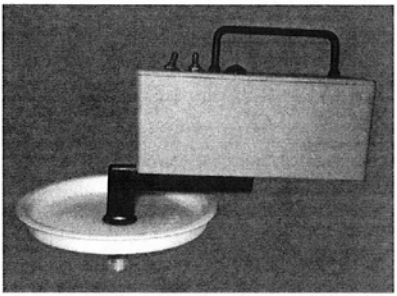
Momentarily pushing the **RED POWER ON** button activates the meter. In the **NORMAL** depth setting it will remain active for five seconds at one "ping" per second. In the **DEEP** setting it will stay active for 15 seconds at one "ping" every 2.75 seconds. Pressing and holding the button continuously will keep the meter active for longer measurement times.

At activation, the display comes alive and the temperature setting will appear. If necessary, raise or lower the setting by toggling the temperature switch either forward or backward to the desired value. The temperature setting will be retained when the power is off. For more information see the next section, ***SETTING THE TEMPERATURE .***

Making a measurement is now very simple. Just insert the measuring duct through the access port in the well cap. Make sure that the measuring duct extends all the way through the well cap and seal. Then push the **RED POWER ON** button. The well water level will usually be displayed after the first "ping". It may turn out that the initial **DEPTH** setting was inappropriate. If so, it may be changed at any time, whether the meter is activated or not. If the setting is changed while the unit is running, there may be a delay of a few "pings" before the unit changes modes.

If the well is uncapped and the depth to water is over 100 feet (30 meters), the cap cover furnished with the meter should be used. Just slide the cover onto the duct and place the meter over the casing. It is not necessary to have a tight seal. However, large gaps due to off-center or tilted placement can reduce the maximum measurable level.

The cover furnished with the unit is for casing diameters up to six inches (150 mm). For larger diameters, a cover may be easily made from any convenient material such as plastic or sheet metal.



Model 200 with 6 in. cap installed

SETTING THE TEMPERATURE

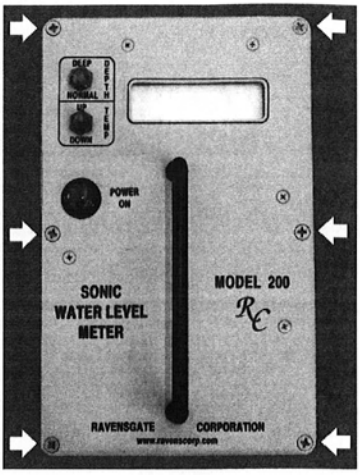
Accurate measurements are best assured when the temperature setting equals the average air temperature in the well casing. The effect of an incorrect setting is approximately one-tenth percent (0.1%) of the depth reading per degree F of error. As an example, if the error is 10°F (5.5°C), the measurement will be in error by 1%.

The map and tables furnished with the meter facilitate setting the temperature. For each meter, a map is provided for the state (USA only) where it is to be used. The map is divided into geographical regions. To find the setting temperature, simply locate your region in the left hand column of the **map table.** Then, follow across this row to the month column to find the temperature setting.

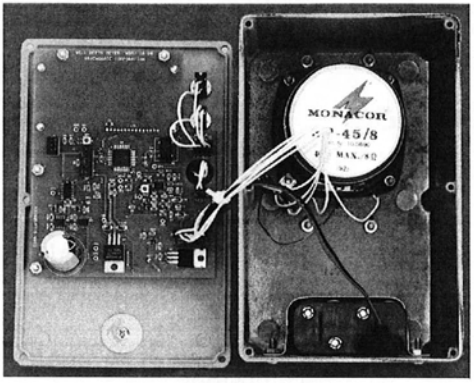
It should be recognized that the **map table** may not be useful in regions of geothermal activity or anomalous subsurface conditions. Also, map tables are not available for regions outside the USA. In this case, for best accuracy, it is necessary to know the well water temperature and the monthly average surface temperature. With this information, the **look-up table** provided gives the appropriate temperature setting. To use it, first locate the well water temperature in the left hand column. Then, follow across this row to the surface temperature column to find the setting temperature. As an example, if the water temperature is 58°F (14°C) and the average surface temperature is 85°F (28°C) degrees F, the setting will be 62°F (16°C).

BATTERY REPLACEMENT

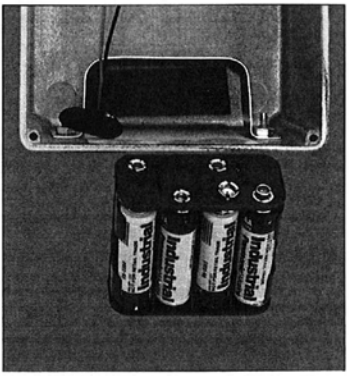
The meter comes provided with eight, AA dry cells. Battery replacement is indicated when the *LO BAT* signal on the display consistently stays on during operation. The batteries are located in a slide-out holder located inside of the meter case at the rear. To access the holder remove the six screws on the edge of the of the meter box face. The face should be carefully laid to one side, taking care not to damage or pull on the wires leading to the face. The battery pack connector should be unsnapped next. Then pull the battery pack out from its bracket. The new batteries are then inserted according to the polarity indications on the holder. For best life the new batteries should be alkaline type. These will provide about 20 hours of continuous running and up to the shelf life of the batteries under more normal intermittent operation. Other types will work, but will have a shorter lifetime. Next, slide the battery pack into the bracket, snap the connector back on the holder, replace the box face being careful not to pinch any wires. Secure with the six cover screws.



Remove the 6 outside screws to remove the cover



Case opened for battery replacement



Battery pack disconnected and removed

Model 200U Configuration Procedures

CONFIGURATION OPTIONS

The following parameters can be changed in the *Configuration Setup Mode*:

1. Units of Measurement - Metric or English/Imperial
2. Gain/Sensitivity - Variable or Fixed; factory setting is Variable
3. Temperature (also settable in normal operation)
4. Ignore Distance: the initial distance to ignore when a measurement is taken
   a. for *Normal Mode* the range is 0 to 56 ft (17 m) in 0.2 ft (0.07 m) steps. (factory setting is 10 ft (3 m))
   b. for *Deep Mode* the range is 27 to 1761 ft (9 to 560 m) in approx 30 ft (9 m) steps. (factory setting is 200 ft)

CONFIGURATION SETUP MODE

The Setup Mode is accessed as follows:

The *Mode* switch may be in either position but presetting the *Mode* switch to *Deep* is probably the most convenient. The following description assumes that the initial setting is *Deep*.

While the unit is off and before pressing the power button, hold the temperature switch in either the up or down position.

While holding the *Temp* Switch in either position press the power button.

The unit will come on in Setup Mode. The *Power* button and *Temp* switch may be released at this time and the unit will stay on until setup is complete.

Changing the settings:

1. The first parameter that can be set will be displayed. This will be the choice of "Units" of measurement.

   Use the *Temp* switch to change between "Metric" or "English", whichever is preferred.

2. To change to the next parameter, switch the *Mode* switch to the opposite position (*Norm* if you started in *Deep*).

   The display will change to "Gain Mode". The choices are "Variable" or "Fixed". Use the *Temp* switch to make your choice. The information in the section "Which Gain Setting to Use?" will help you decide which to choose under different circumstances.

3. Switch the *Mode* switch to the opposite position (back to *Deep*)

   The display will change to "Temperature". The temperature setting can be changed up or down with the *Temp* switch. (The Temperature setting can also be changed when the unit is in normal operation and is included here just because it is one of the available user settable parameters.)

4. Switch the *Mode* switch again (to *Norm*). The display will read "Norm: Ignore 1st" followed by the distance to ignore in Normal Mode. Use the *Temp* switch to change this distance if desired. The range is 0 to 55.7 ft in 0.2 ft steps. (factory setting is 10 ft)

5. Change the *Mode* switch again (to *Deep*). The display will read "Deep: Ignore 1st" followed by the distance to ignore in Deep Mode. Use the *Temp* switch to change this distance if desired. The range is 27 to 1761 ft (9 to 560 m) in approx 30 ft (9 m) steps. (factory setting is 200 ft)

6. Changing the *Mode* switch once more (to *Norm)* will terminate the Setup Mode and the unit will start operation.

The parameters that you have chosen will be retained until they are changed again by the user.

If you only want to change one of the parameters just enter the Setup Mode and cycle the *Mode* switch until you get to the item you want to change . Make your change and then cycle the *Mode* switch until you are out of setup mode.

You can also review the settings by entering Setup Mode and simply cycling through all of the parameters and out.

ITEMS THAT INFLUENCE CONFIGURATION CHOICES

Gain/Sensitivity - "Which Gain Setting to Use?"
Two choices are available - Fixed or Variable

The Variable gain mode provides, in effect, a rising gain or sensitivity with time. This method gives greater weight to return signals that occur later in the measurement cycle and is beneficial on deeper wells where the return signal is more attenuated. This also makes the units less susceptible to unwanted returns from various surfaces in the well casing that might interfere with a proper measurement.

This mode is somewhat more susceptible to interference from pump noise or other sources of high ambient noise. Also, in some specific configurations it is possible for the unit to favor a secondary return over the primary one and give a reading that is twice the actual water level.

The Fixed mode is less susceptible to interference from ambient noise and the secondary return problem. This mode can be used to advantage in such cases. Some sensitivity is sacrificed so the unit might not read the deepest water levels in this mode.

Ignore distance

The factory defaults values are 10 ft (3 meters) in Normal mode and 200 ft (60 mters) in *Deep* mode. If problems occur due to reflections from liners that don't come all the way to the top of the casing or un-

wanted signal returns from such things as pitless adaptors and such that interfere with getting a proper reading the default values can be increased so that returns within that distance are ignored. Also, if you are making draw-down measurements that require the use of deep mode but you wish to be able to measure to less than 200 ft (60 meters) you can reduce the minimum distance accordingly so that you don't have to switch modes during the test.

MEASUREMENT PROBLEMS

In older wells, the casing may be highly corroded or rough, causing high signal attenuation and unreliable water level readings. In this situation, the higher sensitivity **DEEP** setting will minimize the problem. However, to use this setting, the water level must be greater than 200 feet (60 meters).

A measurement error might occur if the casing has a discontinuity causing an erroneous reflection of the sonic pulse. This situation may occur in rock wells if there are voids or fissures in the rock wall. It may also occur in continuously cased wells if the casing diameter abruptly changes somewhere down the well.

Perforations or "slots" in the casing that are above the water surface can reflect the sonic pulse resulting in a measurement that is shorter than the actual water level.

Obstructions in the well casing such as torque arresters, wire shields or anything exceeding ½ the area of the casing may also cause erroneous level readings.

Sleeves in the well casing can sometimes cause a problem depending on how far down in the casing the top of the sleeve is because the sonic pulse can reflect from the top edge of the sleeve. **Loose fitting sleeves can cause an additional problem** because the sonic pulse can divide between the inside and outside of the sleeve which will reduce the signal level.

In some cases the signal coupling to the well casing may be poor. To avoid this, be sure that the measuring duct goes all the way through the well cap or seal. Cover plates should normally be used. Be sure that there is no large gap between the plate and the well casing.

Gases in the well casing or bore other than air can cause a measurement error. The amount of error will depend on the air to gas ratio. The water level measurement depends on knowing the velocity of sound in the well casing. This parameter is different in different gasses. The unit is calibrated for air filled casings with a nominal humidity. For a methane filled casing the difference can be as much as 30 %.)

CARE

The Model 200/200M/200U is NOT waterproof. If it gets wet, wipe it off as soon as possible. If water gets inside the unit, remove the top (refer to the instructions for changing the battery) and let it dry out before using it again. If the carrying case gets wet it should be left open and allowed to dry ***completely*** before storing the meter in it.

Avoid setting the meter down in a way that the measuring duct is in the mud or dirt. If the measuring duct becomes clogged the unit will not work properly. Cleaning mud out of the duct can be difficult and care must be taken to avoid damaging the microphone that is just behind the screen.

SPECIFICATIONS

Dimensions:

Length not including duct: 7 inches (180 mm)
Height not including duct: 4 inches (100 mm)
Width: 5 inches (125 mm)

Measuring duct:

Diameter. 5/8 inches (16 mm)
Length. 2 inches (50 mm)

Weight: 3.5 lbs (1.6 kg)

Power: 8, AA alkaline batteries

Measurement range:

Normal setting: 10 to 500 feet (3 to 150 meters)
Deep setting: 200 to 1200 feet (60 to 350 meters
(Under certain conditions this may be less. See *Measurement Problems*.)

Readout accuracy: +/- 0.1 foot (+/- 0.01 meters)

Measurement accuracy *:

(Applies for casing diameters from 2 to 10 inches (50 to 250 mm). Outside this range accuracy may vary.)

+/- 0.2 ft (+/- 0.06 m) for water level less than 100 ft (30 m);
+/- 0.2% of depth reading for water levels 100 ft (30 m) or greater.

Operating temperature range: 30°F to 140°F (0°C to 60°C)

The outside or ambient air temperature does not affect the meter operation provided the meter and its components remain within the operating temperature range.

*Under certain conditions, measurement accuracy may exceed this limit. See the previous section, *MEASUREMENT PROBLEMS.*

OPTIONS

Carrying Case
Model 200 calibrated in English units
Model 200M calibrated in metric units
Model 200U user configurable settings

WARRANTY

We, The Ravensgate Corporation warrant this product against defects or malfunctions in materials or workmanship for one year from the date of purchase by you, the original purchaser. WE MAKE NO OTHER EXPRESS WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER CONCERNING THIS PRODUCT. If any such defect or malfunction occurs within one year of the date of your original purchase, the unit will be repaired or replaced by us without charge.

This warranty does not apply when: (1) the unit has been repaired or modified by anyone other than us. (2) any defect or problem has resulted from accident, misuse, negligence or carelessness.

Return authorization under the warranty or for repair or replacement must be obtained. Contact the Ravensgate Corporation for shipping and packaging instructions.

Ravensgate Corporation is not responsible for loss or damage due to misuse or inappropriate application.

DISCLAIMER:

Ravensgate Corporation will not be responsible or liable for consequential damages caused by instrument failure for any reason whatsoever. Also, Ravensgate Corporation can not be responsible for specifications given by dealers, resellers or others that differ from those given herein.

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Frequently Asked Questions about the Performance of the Ravensgate Model 200 / 200M / 200U Sonic Water Level Meter

Q. Can the meters be used when measuring crooked wells?
A. Yes, you can even measure the length of coiled pipe.

Q. Can the meters be used with wells that have submersible pumps installed?
A. Yes, you can use our meters on wells that have submersible pumps.

Q. Can the meters be used with capped wells?
A. Yes, our meters can be used on either capped or uncapped wells.

Q. Do pipes and wires cause measurement problems?
A. Not usually, as long as the pipes and wires occupy NO MORE THAN one half of the bore area.

Q. Can the meters be used with partially cased rock wells?
A. Yes, our meters can be used with partially cased wells.

Q. Can the meters be used with large irrigation wells?
A. We do not recommend using our meters for this purpose because the measurement accuracy is less with larger wells.

Q. What is the purpose of the temperature setting on the Ravensgate Sonic Water Level Meters?
A. Accurate measurements are best assured when the temperature setting equals the average air temperature in the well casing. The temperature setting corrects for the variation of the velocity of sound with the air temperature in the well bore. The error is 0.1% per degree of temperature error.

Q. How can the temperature setting be determined?
A. Ravensgate Corporation provides maps (U.S.A. only) and tables . See "Setting The Temperature" on page 4.

Q. Does cascading water affect the accuracy of the meter?
A. No, cascading water usually does not affect the accuracy of the readings.

Q. Do gases present in the well casing other than air affect the accuracy?
A. Yes! The water level measurement depends on knowing the velocity of sound in the well casing. This parameter is different in different gasses. The unit is calibrated for air filled casings with a nominal humidity. (For a methane filled casing the difference can be as much as 30 %.)

Q. Can perforations in the casing cause measurement problems?
A. Perforations in the casing that are above the water surface can reflect the sonic pulse and result in a measurement that is less than the true water level.

Frequently Asked Questions about the Specifications of the Ravensgate Model 200 / 200M / 200U Sonic Water Level Meter

Q. What is the measurement accuracy of the meter?
A. Accuracy is +/- 0.2% of the reading, exclusive of temperature setting errors.

Q. What is the measurement range of the meter?
A. Measurement range is 10 to 500 ft (3 to 150 m) in the "NORMAL" setting and 200 to 1200 ft (60 to 350 m) in the "DEEP" setting.

Q. What well bore diameter range is necessary for best accuracy?
A. The meter is specified for a bore diameter range of 1 to 10 in (25 to 250 mm).

Q. What access in the well cap is necessary to use the meter?
A. A hole that is at least big enough to allow the 5/8 in (16 mm) diameter round aluminum duct to pass through.

Q. What power source does the Ravensgate Sonic Water Level Meter use?
A. Our meter uses 8 internal AA batteries. Alkaline batteries are preferred. Yearly battery replacement is recommended.

NOTES

Table of Temperature Control Settings
Ts, degrees C

Well Water Temperature, **Tw**, degrees C	Average Daily Surface Temperature, **Tg**, degrees C															
	0.0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0
2.0	1.5	2.0	2.5	3.0	3.0	3.5	4.0	4.5	4.5	5.0	5.5	6.0	6.0	6.5	7.0
3.0	2.5	3.0	3.5	3.5	4.0	4.5	5.0	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0
4.0	3.5	4.0	4.0	4.5	5.0	5.5	5.5	6.0	6.5	7.0	7.0	7.5	8.0	8.5	8.5
5.0	4.5	4.5	5.0	5.5	6.0	6.0	6.5	7.0	7.5	7.5	8.0	8.5	9.0	9.0	9.5
6.0	5.0	5.5	6.0	6.0	6.5	7.0	7.5	7.5	8.0	8.5	9.0	9.0	9.5	10.0	10.5
7.0	6.0	6.5	6.5	7.0	7.5	8.0	8.0	8.5	9.0	9.5	9.5	10.0	10.5	11.0	11.0
8.0	7.0	7.0	7.5	8.0	8.5	8.5	9.0	9.5	10.0	10.0	10.5	11.0	11.5	11.5	12.0
9.0	7.5	8.0	8.5	9.0	9.0	9.5	10.0	10.5	10.5	11.0	11.5	12.0	12.0	12.5	13.0
10.0	8.5	9.0	9.5	9.5	10.0	10.5	11.0	11.0	11.5	12.0	12.5	12.5	13.0	13.5	14.0
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13.0	11.0	11.5	12.0	12.0	12.5	13.0	13.5	13.5	14.0	14.5	15.0	15.0	15.5	16.0	16.5
14.0	12.0	12.5	12.5	13.0	13.5	14.0	14.0	14.5	15.0	15.5	15.5	16.0	16.5	17.0	17.0
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16.0	13.5	14.0	14.5	14.5	15.0	15.5	16.0	16.0	16.5	17.0	17.5	17.5	18.0	18.5	19.0
17.0	14.5	15.0	15.0	15.5	16.0	16.5	16.5	17.0	17.5	18.0	18.0	18.5	19.0	19.5	19.5
18.0	15.5	15.5	16.0	16.5	17.0	17.0	17.5	18.0	18.5	18.5	19.0	19.5	20.0	20.0	20.5
19.0	16.0	16.5	17.0	17.5	17.5	18.0	18.5	19.0	19.0	19.5	20.0	20.5	20.5	21.0	21.5
20.0	17.0	17.5	18.0	18.0	18.5	19.0	19.5	19.5	20.0	20.5	21.0	21.0	21.5	22.0	22.5
21.0	18.0	18.0	18.5	19.0	19.5	19.5	20.0	20.5	21.0	21.0	21.5	22.0	22.5	22.5	23.0
22.0	18.5	19.0	19.5	20.0	20.0	20.5	21.0	21.5	21.5	22.0	22.5	23.0	23.0	23.5	24.0
23.0	19.5	20.0	20.5	20.5	21.0	21.5	22.0	22.0	22.5	23.0	23.5	23.5	24.0	24.5	25.0
24.0	20.5	21.0	21.0	21.5	22.0	22.5	22.5	23.0	23.5	24.0	24.0	24.5	25.0	25.5	25.5
25.0	21.5	21.5	22.0	22.5	23.0	23.0	23.5	24.0	24.5	24.5	25.0	25.5	26.0	26.0	26.5
26.0	22.0	22.5	23.0	23.0	23.5	24.0	24.5	24.5	25.0	25.5	26.0	26.0	26.5	27.0	27.5
27.0	23.0	23.5	23.5	24.0	24.5	25.0	25.0	25.5	26.0	26.5	26.5	27.0	27.5	28.0	28.0
28.0	24.0	24.0	24.5	25.0	25.5	25.5	26.0	26.5	27.0	27.0	27.5	28.0	28.5	28.5	29.0
29.0	24.5	25.0	25.5	26.0	26.0	26.5	27.0	27.5	27.5	28.0	28.5	29.0	29.0	29.5	30.0
30.0	25.5	26.0	26.5	26.5	27.0	27.5	28.0	28.0	28.5	29.0	29.5	29.5	30.0	30.5	31.0
31.0	26.5	26.5	27.0	27.5	28.0	28.0	28.5	29.0	29.5	29.5	30.0	30.5	31.0	31.0	31.5
32.0	27.0	27.5	28.0	28.5	28.5	29.0	29.5	30.0	30.0	30.5	31.0	31.5	31.5	32.0	32.5
33.0	28.0	28.5	29.0	29.0	29.5	30.0	30.5	30.5	31.0	31.5	32.0	32.0	32.5	33.0	33.5

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