User Manual
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Seztec Ultra Pro-Lite

Clamp-On Ultrasonic Portable Flowmeter

User Manual



Ultra Pro-Lite measuring on a 1250 mm pipe in V mode.

SEZTEC Smart Systems

MADE IN BRITAIN

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1 Introduction

1.1 About the Ultra Pro-Lite



Figure 1: Ultra Pro-Lite in use with sensors on the alignment rail.

The Ultra Pro-Lite is a single-channel, portable clamp-on ultrasonic flowmeter. It is fast to set up and uses advanced digital signal processing to make accurate flow measurements from the outside of the pipe, without cutting into the line or stopping the process.

This manual explains how to plan a measurement, install the sensors, set up the meter with Quick Start, verify the installation, and download logged data to a computer.

IMPORTANT Charge both PP3 lithium-ion batteries before using the flowmeter for the first time.

1.2 Kit contents



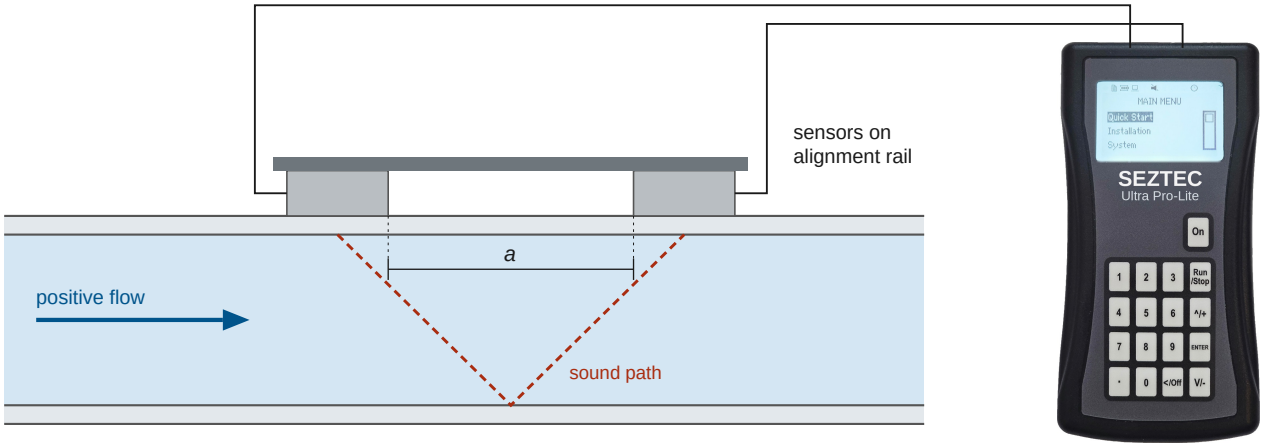
Figure 2: Ultra Pro-Lite kit in its carry case.

- Ultra Pro-Lite flowmeter
- Sensors (1 MHz standard)
- Alignment rail
- Couplant: temporary water-based gel (silicone grease and adhesive gel available)
- 5 m tape measure
- Bubble level
- 2 x USB cables (charge and data)
- Rubber bump case
- 2 x PP3 rechargeable lithium-ion batteries
- Optional: wall thickness gauge (WTG)

1.3 Measurement principle

The Ultra Pro-Lite uses the transit time difference method. Two sensors are clamped to the pipe. Each sensor alternately transmits an ultrasonic pulse and receives the pulse sent by the other. A pulse travelling with the flow (downstream) arrives sooner than a pulse travelling against the flow (upstream).

The meter measures this upstream/downstream time difference, ΔT, in nanoseconds (billionths of a second). Using the pipe geometry and fluid data you enter in the menu (pipe diameter, wall thickness, materials and fluid), the meter converts ΔT into flow velocity and flow rate.



a – sensor separation, measured between the front edges of the sensors

Ultra Pro-Lite transmitter

Figure 3: Typical measurement setup: V mode, sensors on the same side of the pipe.

2 Instrument overview

2.1 Sensor connections



Figure 4: Sensor connections. The arrows mark the positive flow direction.

Connect both sensor cables to the two connectors on the top of the meter, as shown. The arrow on each sensor label shows the positive (+ve) flow direction. In the arrangement shown, positive flow runs from left to right.

If the meter reads negative flow, check the sensor positions against the flow direction in the pipe.

2.2 Power and batteries



Figure 5: Battery compartment. The batteries are charged outside the meter.

The Ultra Pro-Lite is supplied with two rechargeable PP3 lithium-ion batteries. Each battery runs the meter for approximately 12 hours and takes about two hours to fully charge with the supplied USB-C cable.

The meter can be powered in three ways:

- the supplied rechargeable PP3 lithium-ion batteries
- a standard 9 V PP3 battery
- an external 5 V USB battery pack connected to the micro-USB port

When a USB power source is connected, the meter runs from USB and not from the internal battery.

NOTE The rechargeable batteries are charged outside the meter, directly from the USB-C cable, as shown in Figure 5. They are not charged through the meter.

2.3 Keypad and shortcut keys

Use the arrow keys (**^/+** and **V/-**) to move through the menus and **ENTER** to select. The number keys are shortcuts to the measurement and diagnostic screens. The keys marked * are the ones you will use most.



key	shortcut
1 *	Main menu (Quick Start, Installation, System, Logger)
2 *	Select sensor, then press ENTER to open the signal window
3	Signal strength
4	Flow rate and totalizer
5 *	Flow velocity, flow rate and totalizer
6	Flow information
7	Energy flow
8	Energy rate in more detail
9	Temperature for energy flow rate
. *	Sound speed and timing diagnostics
0 *	Signal strength diagnostics

2.4 Display symbols

Status symbols appear across the top of the display. From left to right:

symbol	meaning
Maple leaf	Unreliable measurement. Check the installation.
Page	Data logger on or off.
Battery	The meter is powered from USB. This symbol does not show the internal battery level.
Display	LCD backlight on or off.
Loudspeaker	Audio buzzer on or off.
Bell	Data logger error.
Clock	Timing error.
Warning triangle	Electronic component error.
Spinner	USB serial communication on or off.

3 Planning the measurement

3.1 Information required

Before clamping the sensors to the pipe, collect the following information:

1. Pipe outside diameter
2. Pipe wall thickness
3. Pipe material
4. Pipe liner, if any, and its material
5. Fluid and fluid temperature
6. Best location on the pipework for the installation
7. Best sensor arrangement (number of traverses)

3.2 Pipe diameter

Measure the pipe circumference with the tape measure and divide by 3.14159 (π) to get the outside diameter.

3.3 Pipe wall thickness

Take the wall thickness from pipe schedule tables, or measure it with the optional wall thickness gauge (WTG). The WTG is a precision probe that connects to the flowmeter. The split across the face of the probe separates two small sensors built into it.

	**Step 1** Connect the wall thickness gauge to the flowmeter.
	**Step 2** Apply coupling gel to the face of the probe. Always apply coupling gel to **all** ultrasonic sensors.

	**Step 3** Place the probe on the pipe with the split perpendicular to the pipe axis, so a good signal travels between the two built-in sensors.
	**Step 4** Hold the probe firmly against the pipe to take the measurement.
	**Step 5** On the meter, select **Quick Start** → **WTG** → **Pipe Material**. The meter then shows the thickness echo screen (called an A-scan in non-destructive testing) and the measured wall thickness.

TIP Select the correct pipe material before measuring. The WTG works very well on steel pipes. On pipes in poor condition, the measurement may not work.

3.4 Pipe material and liner

The pipe material is usually known. Check whether the pipe has a liner and, if so, what it is made of. Liners are found mainly in the water industry and in certain process applications.

3.5 Fluid and fluid temperature

Identify the fluid and its temperature. The meter compensates for temperature and uses it to calculate the correct sensor separation. If you do not know the temperature exactly, use your best estimate.

3.6 Measurement location

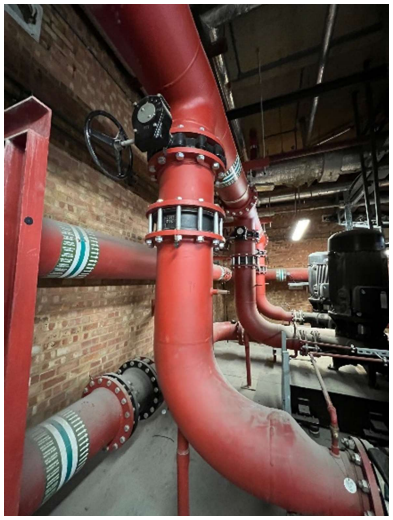


Figure 6: Selecting a location with a long straight run.

Flowmeters need long straight runs of pipe upstream and downstream. Elbows, valves and pumps distort the flow profile, so install the sensors away from them where possible.

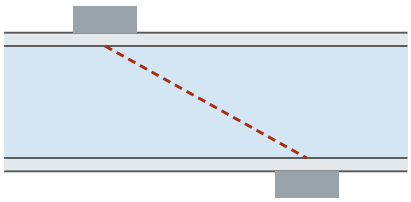
- Choose the longest straight run available and place the sensors two-thirds to three-quarters of the way along it, measured from the upstream end.
- Mount the sensors in the horizontal plane, on the side of the pipe. This avoids entrained air at the top of the pipe and debris at the bottom.
- If the ideal location is not available, install the meter where it fits and check the signal quality (Section 5).

In the installation shown, the pipes along the back wall gave the best location.

3.7 Sensor arrangement

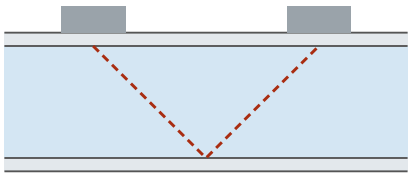
The sensors can be arranged on the same side of the pipe or on opposite sides. Each pass of the ultrasonic signal across the pipe is a traverse. More traverses multiply the measured time shift ΔT.

Z mode



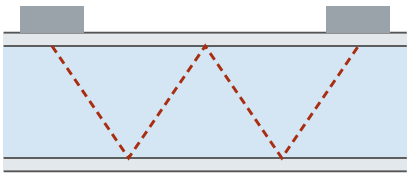
1 traverse, sensors on opposite sides

V mode



2 traverses, sensors on the same side

W mode



4 traverses, sensors on the same side

Figure 7: Z, V and W mode sensor arrangements.

traverses	1	2	4	8
sensor arrangement	Z	V	W	WW
sensor position	opposite sides	same side	same side	same side
time shift multiplier	ΔT	2 x ΔT	4 x ΔT	8 x ΔT

- **V mode** (2 traverses) is the easiest to set up and the best starting point for most installations. The cover photo shows a 1250 mm pipe measured in V mode, which is close to the limit of the device.
- **Z mode** (1 traverse) suits large pipes because it gives the strongest signal. On large water mains, use Z or V mode.
- **W and WW modes** (4 and 8 traverses) give good results on small and plastic pipes. Use them once you are familiar with the meter.

3.8 Zero offset on small pipes

At zero flow, every electronic flowmeter shows a small zero error. The sensors are matched during manufacture to minimize this offset, but a residual of about ±1 ns always remains (see Set Zero, Section 6).

On large pipes at high flow rates, ΔT is large, for example 500 ns, so a 1 ns offset is negligible. On a small pipe, it becomes significant: if the flow-induced ΔT is 20 ns, a 1 ns offset is a 5 % error.

Increasing the number of traverses reduces this error. A 20 ns shift in V mode (2 traverses) becomes 40 ns in W mode (4 traverses), halving the effect of the offset. The reading also becomes smoother, because the measurement resolution improves each time the time shift doubles. If you get a good signal in V mode, try W mode on small pipes.

4 Installation and setup

4.1 Installing the sensors

1. Select the location and confirm the outside diameter (Section 3).
2. Connect the sensors to the meter, observing the flow direction arrows (Section 2.1).
3. Apply a small amount of couplant to the face of each sensor. Couplant is always required.
4. Mount the sensors on the alignment rail and strap the rail to the pipe in the horizontal plane. Use the bubble level to align the sensors.
5. Set the sensor separation calculated by the meter. Separation is measured from the front edge of each sensor.

NOTE On long-term installations, couplant must be re-applied periodically, especially in hot climates.

4.2 Quick Start setup

Press **On**. The main menu is displayed. Select **Quick Start** with the arrow keys and press **ENTER**. Quick Start asks for the following parameters in order:

#	parameter	what to enter
1	Transducer type	The sensor type marked on the sensor label. The standard 1 MHz sensor suits pipes from 25 to 1500 mm. Installations vary, so the right sensor for a particular pipe is not always definitive.
2	Transducer mounting	V mode (sensors on the same side of the pipe) or Z mode (sensors on opposite sides). See Section 3.7.
3	Pipe diameter	Outside diameter (circumference ÷ 3.14159).
4	Pipe wall thickness	From pipe schedule tables or the wall thickness gauge.
5	Pipe material	Material of the pipe wall.
6	Liner material	Liner material, if the pipe is lined.
7	Fluid	The liquid in the pipe.
8	Fluid temperature	Actual or estimated fluid temperature. Used to calculate the sensor separation.

TIP V mode is the easiest arrangement to set up. Do not use W or other multi-traverse modes while you are learning to use the meter.

5 Verifying the installation

5.1 Signal window

Press **2** (the sensor designator is displayed) and then **ENTER**. The meter shows the received ultrasonic waveform. A vertical line marks the measured arrival time of the pulse. The arrival time is used to calculate the sound speed, the key parameter for confirming that the setup is correct.

reading	meaning	acceptable
SNR	Signal-to-noise ratio in dB. +44 dB is 100 % signal, -25 dB is 0 %. As the signal gets weaker the noise stays the same; when the noise approaches the signal level, the meter cannot measure.	clean waveform, high SNR
ATA/ETA	Actual time of arrival versus estimated time of arrival. Around 100 % means the values entered match the actual installation.	98 to 102 %



Figure 8: Signal window: correct installation.

Correct installation. The vertical line is at the correct arrival time, just before the echo and between the small marker lines. SNR is +44.1 dB and ATA/ETA is 100.3 %.

The simplest check is to look at the graph and confirm the signal is clean.

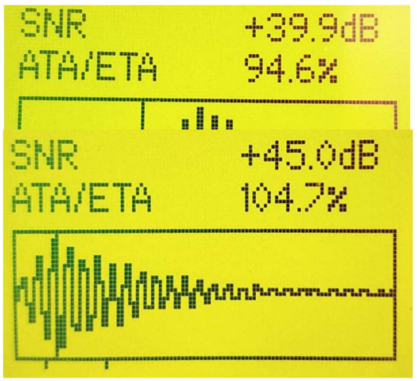


Figure 9: Signal window: two incorrect installations.

Bad installation, top. The vertical line is outside the ideal arrival markers and ATA/ETA is 94.6 %. Check the pipe, wall thickness and material settings. The lower SNR means more noise.

Bad installation, bottom. The echo is not inside the measurement window and ATA/ETA is 104.7 %. The settings are probably too large. Recheck the pipe, wall thickness and material settings.

5.2 Sound speed check

If you cannot get the signal window to match the correct installation, you can reposition the sensors, but monitor the sound speed while you do so.

1. Determine the fluid temperature.
2. Look up the sound speed for that temperature in Appendix A.
3. Press **.** to open the sound speed menu and compare the displayed value with Appendix A.

If the displayed sound speed matches Appendix A and the waveform looks like the correct installation, the meter is physically set up correctly.

6 Calibration settings

The calibration settings menu contains parameters that affect every measurement. Check them before each survey.

setting	recommended	description
Low flow cut	±0.025 m/s	Electronic flowmeters tend not to read exactly zero at zero flow, which shows as a small flow value (about ±1 ns of time shift on this meter). Enter a velocity in m/s below which the meter reports zero flow. Applies to positive and negative flow.
Corrected flow	On	Applies the flow profile correction. Leave on.
User offset	Do not use	–
User scaling	Do not use	–
Set Zero	Do not use	Cancels the small zero offset when the flow can be stopped completely. See below.
Zero tracking	Off	Forces the measurement toward zero. Switch off.
Damping	10 s (default)	Averaging time. Increase only enough to reduce flow fluctuation to an acceptable level.

6.1 Set Zero

If the flow can be stopped completely, the meter's small zero offset can be cancelled: press **2**, then **ENTER**, to zero the flow. This is not recommended.

IMPORTANT A Set Zero value stays active for the next measurement. Remove it before you measure again. Press **.** to display it as **dT Offset**. To remove it, press **2**, then **ENTER**, and switch off Set Zero Calibration.

7 Data logging

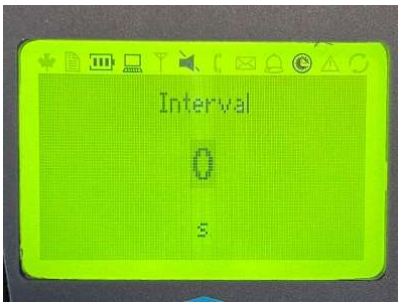
7.1 Setting the logging interval

When the logging interval is greater than 0, the logger records data whenever the flowmeter is measuring flow. To switch the logger off, set the interval to 0. The interval can be set from 0 to 255 seconds.

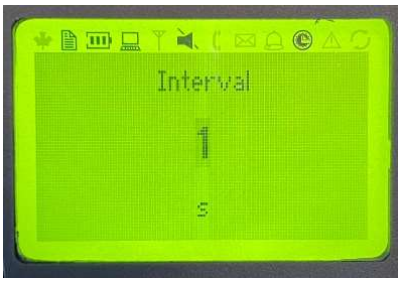
Navigate to **Main Menu → Logger → Interval** and enter the interval in seconds.



Logger menu with Interval selected.



Interval = 0. Logger off. The page symbol (top left) is off.



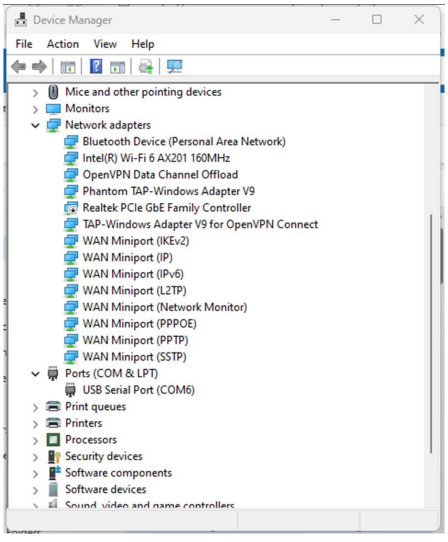
Interval = 1 s. Logger on. The page symbol is on and logging starts when the meter measures.

Figure 10: Setting the logging interval.

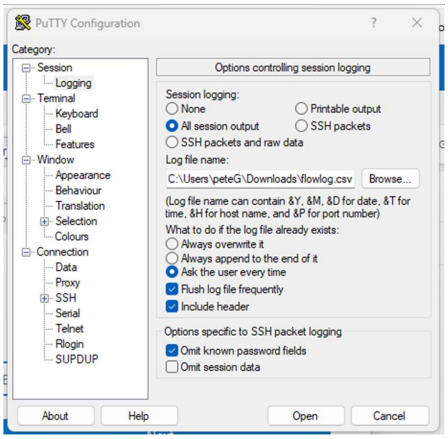
7.2 Downloading data with PuTTY

Logged data is downloaded through the micro-USB port to a Windows computer. There is currently no dedicated software for the Ultra Pro-Lite; use the free terminal program PuTTY, available from **https://putty.org**.

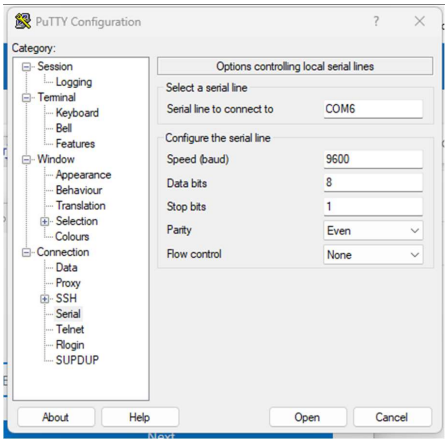
Step 1
Connect the micro-USB cable to the port on the top of the meter and to a USB port on the Windows computer.



Step 2
Open **Device Manager** in Windows (type “device manager” in the Windows search box). Under **Ports (COM & LPT)**, note the number of the USB Serial Port, for example COM6.



Step 3
Start PuTTY. Under **Session → Logging**, select **All session output** and choose a log file name and folder. Give the file a **.csv** extension so Excel opens it directly.

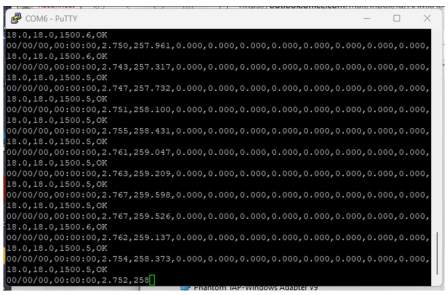


Step 4
Under **Connection → Serial**, enter the serial settings listed in the table below. In **Session**, set the connection type to **Serial**, then click **Open**. A terminal window opens.

setting	value
Serial line	COM port from Device Manager (e.g. COM6)
Speed (baud)	9600
Data bits	8
Stop bits	1
Parity	Even
Flow control	None



Step 5
On the flowmeter, go to **Main Menu → Logger → Download**.



Step 6
Check that text data is appearing in the PuTTY window. The meter shows a progress bar. When the download finishes, close the PuTTY window to close the .csv file, then open the file in Excel.

Appendix A Sound speed in water

Sound speed in water versus temperature, for the sound speed check in Section 5.2.

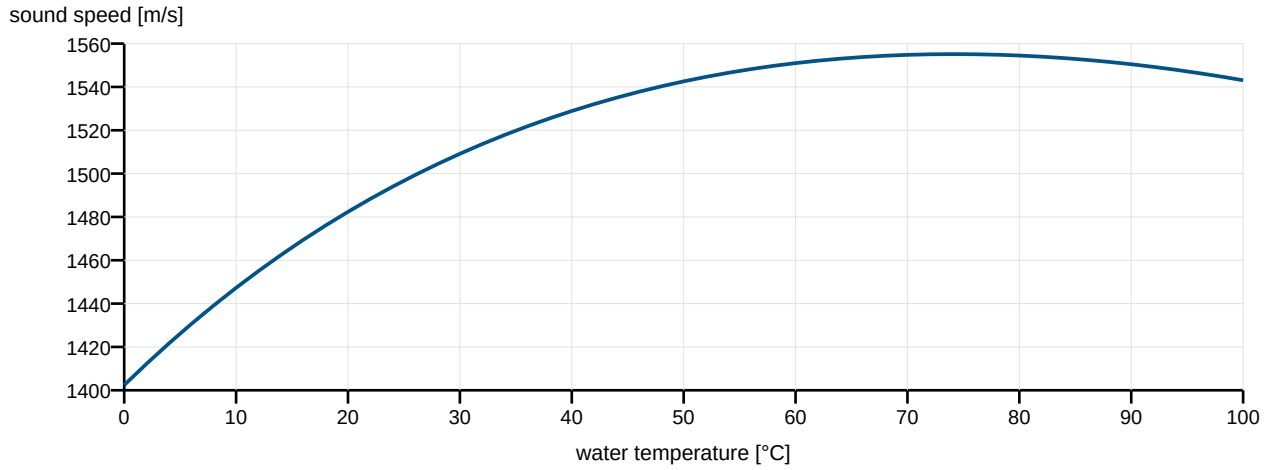


Figure 11: Sound speed in water versus temperature.

°C	°F	m/s	ft/s	°C	°F	m/s	ft/s	°C	°F	m/s	ft/s
0	32.0	1402.39	4601.0	36	96.8	1521.77	4992.7	72	161.6	1555.06	5101.9
2	35.6	1412.23	4633.3	38	100.4	1525.45	5004.8	74	165.2	1555.15	5102.2
4	39.2	1421.63	4664.1	40	104.0	1528.88	5016.0	76	168.8	1555.08	5102.0
6	42.8	1430.60	4693.6	42	107.6	1532.08	5026.5	78	172.4	1554.86	5101.2
8	46.4	1439.14	4721.6	44	111.2	1535.03	5036.2	80	176.0	1554.49	5100.0
10	50.0	1447.28	4748.3	46	114.8	1537.76	5045.1	82	179.6	1553.97	5098.3
12	53.6	1455.03	4773.7	48	118.4	1540.27	5053.4	84	183.2	1553.31	5096.2
14	57.2	1462.40	4797.9	50	122.0	1542.57	5060.9	86	186.8	1552.50	5093.5
16	60.8	1469.41	4820.9	52	125.6	1544.65	5067.7	88	190.4	1551.55	5090.4
18	64.4	1476.06	4842.7	54	129.2	1546.53	5073.9	90	194.0	1550.47	5086.8
20	68.0	1482.36	4863.4	56	132.8	1548.21	5079.4	92	197.6	1549.25	5082.8
22	71.6	1488.34	4883.0	58	136.4	1549.70	5084.3	94	201.2	1547.89	5078.4
24	75.2	1494.00	4901.6	60	140.0	1550.99	5088.5	96	204.8	1546.41	5073.5
26	78.8	1499.35	4919.1	62	143.6	1552.11	5092.2	98	208.4	1544.81	5068.3
28	82.4	1504.39	4935.7	64	147.2	1553.04	5095.3	99	210.2	1543.95	5065.5
30	86.0	1509.15	4951.3	66	150.8	1553.80	5097.8	100	212.0	1543.07	5062.6
32	89.6	1513.63	4966.0	68	154.4	1554.39	5099.7				
34	93.2	1517.83	4979.8	70	158.0	1554.80	5101.0				

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