



PRIMER ON NUTRIENTS AND pH

If you want your plants to excell, you will want to pay close attention to the nutrient solution. By monitoring nutrients, not only can you feed your plants the appropriate level of nutrition, but you can also maximize the nutrients available for uptake. Monitoring a solution ensures plants will not be underfed or burnt with too-high levels.

pH

The pH value of a nutrient solution is a measure of the acidity or alkalinity of a solution. A basic, neutral solution is numerically equal to 7. The solution gets more acidic as the numbers decrease and more alkaline as the numbers increase. The pH scale ranges from 0 pH (very acidic) to 14 pH (highly alkaline). Pure water has a pH of 7.

Different nutrients are absorbed at different pH levels. Most plants need a pH level between 5.8 and 6.5 for optimum nutrient uptake. If the pH is too low, nutrients are bound up and the roots are unable to absorb them. If the pH is too high, plants may succumb to toxic salt buildup, limiting the ability of the roots to intake water and food.

Your pH will fluctuate and should be monitored regularly. It can be tested with inexpensive pH papers or with a **pH Shaker Tester**, or you may choose to use a pH meter. pH meters come in various degrees of sophistication and price. such as the **Hanna Checker 1**, a cheap an effective entry level handheld digital meter for pH. Some are handheld and need to be turned on each time they are used. They cost less but need more frequent calibration to keep them reading accurately. We like the **Hanna Waterproof pH**, a durable, easy to use, accurate handheld meter. Other pH meters are continuous reading models which are always on and should be mounted next to the reservoir such as the **Grocheck pH meter**. *Check out the attached **comparison info sheet** at the back.*

You can tweak the pH of your solution to allow more nitrogen in the growth phases and then readjust during the bloom phase for more phosphorous uptake. Most importantly, adjust the pH based on what plants you're growing.

Adjusting the pH Level

The pH level of your nutrient solution will need to be adjusted if it is too low or too high (too basic.) You will want to keep pH Up and pH Down handy in your grow area. Use very little at a time and stir the solution thoroughly. If you use too much of one then you will have to correct it with the other. The less you end up using, the better. Be careful when handling these solutions as they can burn the skin. We sell three types of pH up and down solution.

Advanced Nutrients - strongest stuff - made for larger reservoirs. **Grow More pH solutions** - cheaper - made for small to mid-size applications. **Earth Juice Natural pH Adjusters** - *All Natural* in a powder solution.

Measuring the Nutrient Levels

By monitoring nutrients, not only can you feed your plants the appropriate level of nutrition, but you can also maximize the nutrients available for uptake. Equally important, you can be certain that your plants aren't undernourished. Both EC & TDS meters give an easy-to-read reference point of the conductivity of nutrient in solution.

TDS stands for Total Dissolved Solids and is measured in ppm or parts per million (ppm). One ppm is one part by weight of the mineral in one million parts of solution. In hydroponics TDS is estimated using a conversion from the measure of electrical conductivity (EC). TDS is currently the standard of measurement that most US growers use. This will probably begin to change in the future as manufacturers begin changing their products to EC.

Like pH, TDS (and EC) meters come in two different forms. Handhelds', like the pH meters above, are easy to use, generally cheaper in price, and are great for checking multiple reservoirs with. We like the **Hanna Primo TDS** as an affordable entry level ppm meter. The **Hanna Waterproof TDS/EC Handheld Meter** is very nice. It is durable and easy to use, and is very accurate. Lastly, we like the "bullet-proof" **Truncheon** - It comes with a 5 year warranty, is easy to use, rarely ever breaks, and never needs to be calibrated. There are also continuous meters for reading TDS/EC only. However, most people interested in these want a "combo" meter...(keep reading).

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Nutrient and pH “Combo” Meters

Most serious gardeners will eventually grow into using a “combo” meter which will measure both pH and TDS. The nicer units will also measure Temperature, and lend a higher degree of accuracy by compensating for the effect temperature has on the readings. Along with temperature & compensation, some of the nicer meters will allow a change in the Conversion Factor (what the meter uses to convert readings from Electrical Conductivity to the TDS (ppm) value). There are handhelds and there are continuous Combo Meters available.

The two handheld “combo” meters we suggest are the **Hanna “Black” Combo Waterproof TDS/EC/pH Meter**, and the more Industrial **Hanna Combo (TDS/EC/pH) Meter with the Remote Probe**. The **Hanna “Black” Waterproof** is nice because it is both temperature compensated and allows for the changing of the Conversion Factor. It also is very accurate and fairly durable. The more rugged **Industrial Hanna “Combo” Meter sporting the Remote Probe** is also Temperature compensated and allows the user to have more flexibility due to its remote probe feature. It allows its user to place its remote probe in the solution that is being measured the whole time that the solution is being set. In this way, one can add nutrients and adjust the pH occasionally swirling the probe without having to constantly turn the meter on and off to get new readings (like the other handhelds on the market).

The 3 continuous “combo” meters that we offer are the **Hanna “Grocheck” Combo (pH/TDS) Meter**, the **Hanna TriMeter (pH/TDS/Temp)**, and the **NutraDip TriMeter (pH/TDS/Temp)**. The **Hanna “Grocheck”** is great for entry level combo users or growers who have multiple reservoirs and are on a budget. It is priced to be affordable, and can read pH, and TDS values accurately, but has no temperature compensation. The **Hanna “Grocheck”** will continuously display its values and makes for easy reference and mixing of your reservoir. The **Hanna TriMeter** adds temperature compensation and further accuracy and durability to the “Grocheck” meter design. It has a 1 year warranty on its probe, as well as 2 years on its body. Our final offering is the time tested **NutraDip TriMeter** which measures pH, TDS, and Temperature. (If you are a fan of the internet and its various ‘chat’-boards you will have heard its praise by now.) The **NutraDip TriMeter** is very durable and accurate. There are users that have been known to have had one of these bad-boys for more than 10 years without any problems. (It only comes with a 2 year warranty on the body and 6 month on the probe though.) *Please note: We have not had many of these meters returned for warranty repairs, but it can take up to a month to get back from being worked on and fixed.*

Nutrient and pH Controllers

Nutrient and pH controllers allow the grower to not only monitor but provide precise control achieved through the use of set points and duration dosage times. You program in the set points you wish for and the controller will dose the reservoir with a set amount of nutrient or pH adjuster to bring the reservoir readings to the right level.

There are two delivery systems that are available for these controllers. One is gravity fed with the use of solenoid valves. The second method is with a pump delivery system which eliminates the restriction on placement. (In gravity fed systems, the nutrients must be placed directly above the reservoir.) Both of these methods work well and once you have become acquainted with the parts involved, you will find them very easy to use.

There are several nutrient and pH controllers that we supply, varying in price and quality. The **AutoGrow** uses high quality solenoid valves and comes with everything needed for set up right out of the box. It can be custom fitted for stand alone pH or TDS dosing or it can handle both. The more professional grower will be more interested in the **IntelliDoser**. This unit can dose both pH and TDS/EC. it reads temperature levels (and is temperature compensated.) It also has a built in digital cycle timer which can be hooked up to a “Drain Pump” or main “Irrigation Pump.” The **IntelliDoser** can also be hooked up to a computer for remote management and data-logging.

What nutrient level should my nutrient be at?

For seedlings, your nutrient level should be between 400ppm (800ms) and 600ppm (1,200ms). For vegetative growth, the level should be between 800ppm (1,600ms) and 1,100ppm (2,200ms). For bloom, the level should be between 1,000 ppm (2,000ms) and 1,400ppm (2,800ms). These –of course are very general levels.

How do I convert my readings from TDS to EC and vice versa?

To get the approximate TDS value, simply multiply the EC reading (in microSiemens/cm) by the conversion factor for a given TDS meter or pen. The TDS Conversion factor is either 500 or 700. Conversion Factor (either 500 or 700) x E.C. reading will give you the new TDS value. Example: Say the E.C. was 1.0 and the conversion factor is 500 (for a given meter) you would then have a TDS value of $1.0 \times 500 = 500$ ppms.

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COMPARISON OF NUTRIENT & PH METERS

(SELECTED FROM WHAT WE LIKE BEST)

NAME/DESCRIPTION	RANGE	RESOLUTION/ACCURACY	TEMP	NOTEWORTHY REMARKS
 CHECKER 1 HANDHELD PH BUDGET	0.00 TO 14.00	.01 PH ±.02 PH	N	WARRANTY: 1 YR. ON BODY. 6 MOS. ON PH PROBE. OTHER INFO: CHEAP, AFFORDABLE, ACCURATE ENOUGH, GOOD 1ST PH METER NOTE: DOES THE JOB. WILL BREAK EVENTUALLY. YOU WILL UPGRADE.
 PRIMO TDS HANDHELD TDS BUDGET	0 TO 1999 PPM (TDS FACTOR: 0.5)	1PPM ±2%F.S.	N	WARRANTY: 1YR. ON BODY. 6 MOS. ON PH PROBE. OTHER INFO: CHEAP, AFFORDABLE, ACCURATE ENOUGH, GOOD 1ST PPM METER NOTE: DOES THE JOB. WILL BREAK EVENTUALLY. YOU WILL UPGRADE.
 WATERPROOF HANDHELD PH PROFESSIONAL	-2.0 TO 16.0	.1 PH ± .1 PH	Y	WARRANTY: 1 YR. ON BODY. 6 MO. ON PH PROBE. OTHER INFO: VERY ACCURATE. EASY TO USE. THIS IS A GREAT SOLO PH METER. NOTE: TEMPERATURE COMPENSATION. NEED TO STORE PROBE PROPERLY.
 WATERPROOF TDS/EC PEN PROFESSIONAL	0 TO 2000 PPM (TDS FACTOR: 0.5 -0.7)	1PPM ±2%F.S.	Y	WARRANTY: 1 YR. ON BODY. 6 MO. ON PH PROBE. OTHER INFO: VERY ACCURATE. EASY TO USE. CAN CHANGE TDS CON. FACTOR NOTE: TEMPERATURE COMPENSATION. LONG LASTING METER.
 WATERPROOF TDS/EC/PH PEN PROFESSIONAL	PH: 0.00 TO 14.00 TDS: 0 TO 2000 ppm (TDS FACTOR: 0.5 -0.7) EC: 0 TO 3999 uS	PH: 0.01 / 0.05 TDS: 1 ppm / ±2%F.S EC: 1 uS / ±2%F.S	Y	WARRANTY: 1 YR. ON BODY. 6 MO. ON PH PROBE. OTHER INFO: VERY ACCURATE. EASY TO USE. CAN CHANGE TDS CONV. FACTOR NOTE: NEED TO STORE PROBE IN STORAGE SOLUTION. PROBES BREAK.
 GROCHECK TDS/PH COMBO CONTINUOUS	PH: 0.0 TO 14.0 TDS: 0 TO 1990 ppm (TDS FACTOR: 0.7)	PH: 0.1 / 0.2 TDS: 10 ppm / 2%F.S	N	WARRANTY: 2 YR. ON BODY. 6 MO. ON PH PROBE. OTHER INFO: GOOD OVERALL ENTRY LEVEL TDS / PH METER. SOLID. NOTE: NO TEMP. COMPENSATION ON THIS METER. NOT AS ACCURATE.
 HANNA 3-METER TDS/PH/TEMP CONTINUOUS	PH: 0.0 TO 14.0 TDS: 0 TO 1990 ppm (TDS FACTOR: 0.7)	PH: 0.1 / 0.2 TDS: 10 ppm / 2%F.S	Y	WARRANTY: 2 YR. ON BODY. 1 YR. ON PH PROBE. OTHER INFO: GREAT OVERALL METER. LONG LASTING. EASY TO READ. NOTE: DOESN'T BREAK OFTEN. TEMPERATURE IS IN FAHRENHEIT.
 INDUSTRIAL TDS/PH/TEMP HANDHELD	PH: 0.00 TO 14.0 TDS: 0 TO 1999 ppm (TDS FACTOR: 0.7) EC: 0 TO 4.0 mS	PH: 0.1 / 0.1 TDS: 1 ppm / 2%F.S EC: .01 mS / 2%F.S	Y	WARRANTY: 2 YR. ON BODY. 6 MO. ON PH PROBE. OTHER INFO: INDUSTRIAL. WELL MADE. REMOTE PROBE IS VERY USEFUL. NOTE: PROBE NEEDS TO BE CLEANED AND CALIBRATED OFTEN.
 NUTRADIP TDS/PH/TEMP TRIMETER	PH: 0.0 TO 14.0 TDS: 0 TO 9990 ppm (TDS FACTOR: 0.7)	PH: 0.1 / 0.2 TDS: 1 ppm / 2%F.S	Y	WARRANTY: 1 YR. ON BODY. 6 MO. ON PH PROBE. 2ND YEAR ON BODY PARTS. OTHER INFO: KNOWN AS THE MOST SOLID CONTINUOUS METERS ON MARKET NOTE: DOESN'T BREAK OFTEN, IF IT DOES IT TAKES A LONG TIME TO FIX.
 TRUNCETON TDS/EC/CF BULLETPROOF	TDS: 0 TO 2520 ppm (TDS FACTOR: 0.5 - 0.7) EC: 0 TO 3.6 mS	TDS: 50-70 ppm / 2%F.S EC: .1 mS / 4%	Y	WARRANTY: 5 YR. ON ENTIRE UNIT. OTHER INFO: BULLET-PROOF. THIS METER LASTS FOREVER. NOTE: DOESN'T NEED CALIBRATION. JUST CLEANING.

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