

# Gold Digger Pro



## Gold Digger Pro Drainage Plow Manual

Soil-Max, Inc.

## **Warning !!!!**

Before using the gold Digger drainage plow call 888-258-0808 (the toll-free national call before you dig number). You need to have a determination made as whether any underground gas lines, electrical lines, fiber optic or normal phone lines, or any other underground object or condition exist in the area you will be running the plow. Have these thoroughly marked and maintain the recommended distance from these areas.

Soil-Max is not liable for any damages or injury which may result from contact with any above ground or underground object.



**CALL (888) 258-0808  
BEFORE YOU DIG!!**

## Soil-Max Gold Digger "How-To" Guide

Thank you so much for purchasing the Soil-Max Gold Digger Pro. We think it is one of the most important tools you will ever have on the farm. Our purpose is to develop equipment that will make the farmer profitable.

This "How-to" guide will explain the function and use of the Gold Digger. If you have any questions about any Soil-Max equipment, tile, topography mapping, drainage design, sub-irrigation or any water management issues, please call our office and we would be glad to discuss these with you.

1-888-SOILMAX

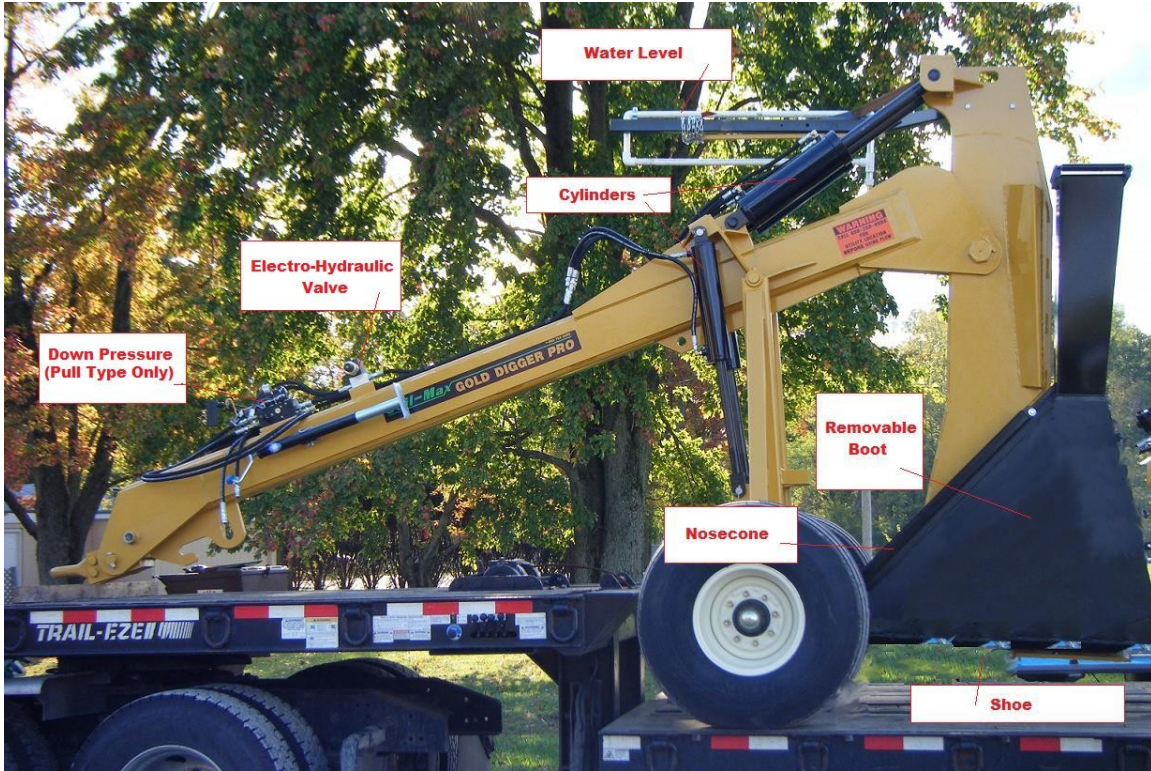
### Gold Digger Applications:

- Add tile to already existing tile systems.
- Random tiling systems, low draws, hillside seeps, etc.
- New tile systems.
- Installation of water lines, cables, etc.
- Installing sub irrigation lines or tile for orchards, vineyards, high-cash crops and greenhouses.

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## Parts Identification



**Your serial number should be found in one of two places or at both:**



The serial number located at the top will have a date code included in it, and the one at the bottom next to the hook will only contain the plow's serial number.

**Note:** Rarely would you ever need your serial number when working with Soil-Max to fix a part or when asking a question. Most users want to know their serial number for insurance purposes.

My Serial Number: \_\_\_\_\_

## Attaching the Gold Digger to a Tractor

Which Tractor:

The first decision to make before attaching the plow to a tractor is “what tractor do I use.” It is not necessarily true that the largest horsepower-rated tractor you have will work the best. You must take into consideration the weight of the tractor, how good the tires are, and what type of tire (radial or bias) and the height of the tires. Just keep in mind that a lower horsepower-rated tractor properly weighted may be able to do the job to your satisfaction. Surprisingly, a 130 hp tractor weighted to 17,000 lbs. or above can pull the plow very well in good soil conditions.

If you are using the plow in good, dry soil conditions, it may be best to pull the plow without duals. This will allow all of the weight of the tractor to be transferred to a smaller surface area. However, in less than ideal conditions, where the surface of the ground is slick or sticky, duals may enhance traction. We do not recommend pulling the plow in very muddy conditions as this will probably make your tiling job very frustrating and may cause compaction problems.

Plow Hookup:

Attaching the plow to a tractor is relatively simple. It is a 3-point, category III attachment. All pins and hardware should come with the plow. The only critical adjustment will be with the top link. Please use the bottom hole on the plow for attaching the top link if possible. **However, be careful when lifting the plow the first time.** On some tractors the top link may be too short and may actually hit part of the tractor when the plow is raised. We offer an add-on plate for John Deere 30 to 60 series tractors that may have this issue. The plate extends the top link out 2” farther from the tractor and usually eliminates the clearance problem. The top link must be adjusted so that the shoe of the plow does not drag the ground when the plow is lifted. **However, it is important that the bottom of the shoe is not any higher than 12 inches from the ground when the plow is completely lifted.** You may also need to adjust the top link when you drop the plow into the first tiling run if the 3 point arms do not allow it to go deep enough. You will want to make sure the two lower arms are locked so that they do not float within the lift arm.

The 3-point hitch will need its draft turned totally off. The 3-point hitch needs to float for the plow to work properly. For most tractors this adjustment is made with only a knob or lever. For some, however, there may be pins that will need to be removed or changed for the draft to be turned off.

The plow will come standard with pioneer hydraulic fittings. You will only need one set of hydraulic outlets. **Make sure you connect to the tractor’s primary hydraulic remote. This remote will need to have its hydraulic flow (speed) turned up all the way if possible.**

Once you have the plow attached, low it on a flat surface. Lay a level alongside the shoe and read the bubble. Now fill the water level with anti-freeze to the thick graduation where the red and green graduated marks meet. This mark represents the shoe being level (0% slope). You will need to check the again in one hour or so as the baffle in the water level may soak up some amount of anti-freeze.

## Electronics Hookup

### Intellislope GPS Control System:

If you purchased the Intellislope GPS plow control system please refer to that systems manual for this section. To learn more about the Intellislope you can visit: [www.intellislope.com](http://www.intellislope.com) or call us toll free at: 888-SOILMAX and select Sales (option one).

### Laser Guided Control System:

If you have purchased an automatic laser system, the electro-hydraulic valve mounts on the plow's frame below the top link attachment. This valve is hooked to the electronic control box to be put in the tractor cab. It controls the hydraulic cylinders on the plow for automatic (using a laser) or manual control of the shoe depth incrementally. The control box can be mounted in the tractor and needs 12 volt power supplied to it. There are two main cables to connect.

1. Connect the laser receiver cable to the receiver first.
2. Then connect the other end of the receiver cable to the control box in the cab.
3. Now connect the other cable to the control box and to the electro-hydraulic valve on the plow.
4. You will also have to connect the 12 volt power to the appropriate cable.

If you make these connections in this order, you will not make any wrong connections. You can, however, get the "up and down" functions for the plow's cylinders reversed. "Up" should extend the cylinders and "Down" should bring them back in. If this is reversed, you may need to switch the hydraulic hoses going to the tractor remote (they may be backwards), or just detent the hydraulic remote the other way. The valve block is labeled where the hoses go in. One side is labeled "P" for pressure and the other side is labeled "T" for tank. Make sure the hose that is under pressure is going into the block where it is labeled "P". The black and white wires (for lowering the plow) on the top of the valve should go closest to the middle of the plow.

The laser mast should be mounted on the 3 inch tubing on the right side of the plow. It should be mounted directly above the front of the plow shear. There will be a switch box which will need 12 volt power to run the mast up and down.

The water level should be mounted out on the end of the 3 inch tube. There should be ¼" bolts and brackets provided to mount the water level. Add anti-freeze at the back of the water level with either the bottom of the shoe on a level surface or by placing a bubble level on the bottom of the shoe. Take care in doing this for good accuracy and check again several minutes later. We recommend doing a final anti-freeze check one hour after the initial pour.

### Hydraulic flow only goes one way

The wheels will not operate correctly if the tractor remote is detented in the wrong direction. The down-pressure valve has a tank and pump marked on the ports in the front of the valve. The hose connected to the pump port should be stiff with pressure when detented correctly.

### Switchbox Instructions

The instructions in this section pertain to how you operate the wheels on a pull-type Gold Digger plow. The wheels are operated by the black switchbox with the 3 switches. One switch is to move a laser mast which would not pertain to you if you had an Intellislope or manual plow.

The switch marked “plow” operates the wheels. In the operation of tiling this switch is only used to lower the plow into the start and pick the plow up after it has been steered to the top of the ground with the 6” grade control cylinders.



The “float” switch lowers the hydraulic pressure to the tires to around 200 pounds pressure. If you have more than 200 pounds pressure, turn the round knob on the left side of the down-pressure block counterclockwise to lower pressure. The float switch must be on to adjust the pressure. If you need more pressure turn round knob clockwise. Normally you want the tires just snugging the ground so humps and dips do not affect the grade control

### Normal Sequence of operating the wheels

1. With float mode off, lower plow into start with plow switch
2. When fully lowered, turn on float switch, pressure gauge should drop to 200.
3. Install tile with float switch on
4. When done installing, tilt the plow up with the large cylinders on top
5. Pull forward 6 to 8 feet
6. Turn Float Switch off
7. Raise plow with plow switch

**Warning!!! Do not use the plow switch to try to lift plow when in the ground.**

TopCon Laser System initial setup:

**This is a very important setup procedure to run when setting the control system up on any different tractor. This setup is done using the Topcon RD2 control box (in cab unit), TopCon LSB2 receiver (on plow unit), and the RL-100 1S laser transmitter on the tripod.**

1. Turn the RD2 control box on.
  2. Detent the hydraulic remote that the plow is hooked to.
  3. With the plow raised off the ground (or raised up from the bottom of a start hole) press the ↓ (Down) button on the control box to manually make the shoe point down so that about one-half of the cylinders are in.
  4. Turn off the control box (RD2).
  5. Now hold the precision button and turn the RD2 on.
  6. You should see a flashing ↑ (up arrow) and the #1 precision light is flashing. (The flashing up arrow represents the "Up Offsets", which should be set to the minimum amount of voltage sent to the valve that is needed to just barely move the cylinders. In other words the voltage is proportional to the amount of ail needed to keep accurate grade.)
  7. Now push the "Automatic" button. If the cylinders do not begin to move, press and hold the ↑ "Up" button.
  8. Continue to hold down the ↑ "Up" button to increase the amount of voltage sent to the valve. This may take 2 minutes so be patient!
  9. Once the cylinders begin to barely move, stop pushing the ↑ "Up" button. (This can be gauged best by watching the water levels movement.)
  10. This can be reversed (or slowed down) by pushing the ↓ (Down) button therefore lowering the voltage.
  11. Push the "Precision" button.
  12. Now you should see a flashing ↓ (Down) arrow and the #2 light will begin flashing.
  13. Now push the "Automatic" button. Press and hold the button.
  14. Continue to hold down the ↑ "Up" button to increase the amount of voltage sent to the valve. This may take 2 minutes so be patient!
- Tip: A common mistake is to hold the down button since your mind is thinking of moving it down. Remember though you are increasing the voltage so you want to still push up. The system knows you are controlling the down side of the plow even though you are pushing up!*
15. This can be reversed (or slowed down) by pushing the ↓ (Down) button therefore lowering the voltage.
  16. Push the Precision button.  
Now you will be setting the "gains". This is the speed at which the plow will get back to grade if something drastic would happen. This is set by trial and error. It is actually best to watch how the plow acts on grade first before setting the "gains".
  17. Push the Precision button once more to get back to the regular control mode.
  18. Run the receiver up or down to find the lasers beam.
  19. Now set the control box on automatic. Jog the plow up or down about 3 to 4 inches with the manual up and down buttons on the control box.

20. The plow should come back to grade fairly quickly, then slow down just before it stops moving. If it overshoots where the grade should be you will need to decrease the "gains". It is best to increase the gains until it does overshoot, then decrease them just a small amount so that they do not overshoot.

If you do need to increase or decrease the gains, start back at the top of these instructions but, once you get in the setup mode, just hit the precision button until the #3 precision light is flashing. This is the setup for the gains. Again hit the "automatic" button and use the up or down buttons to increase or decrease the gains.

This setup procedure is outlined in the LSB2 laser receiver's manual. This setup is the key to controlling grade smoothly. Please contact Soil-Max if you have any questions about this procedure.

## Using the Gold Digger in the Field

Tile runs using the gold Digger Pro will need to be started at the desired tile depth in a "start hole" or if possible from a drainage ditch. However, it will be easier to start from a hole. You will always install the tile up slope from the start hole. The hole must be long enough to accommodate the whole plow shoe and make a connection if need be. Lower the plow down into the hole resting on the bottom. Insert the tile into the boot and feed it through and out the backside. You can make any connection to an existing tile or main now or after the tile has been installed. Lower the 3-point arms all the way down so that the full weight of the plow is resting on the shoe (again make sure the 3-point draft control is turned off). Someone (or something) will need to stand on the end of the tile until the plow has installed 10-15 feet of tile. In most cases you will want to travel at a speed of about 1 – 1.5 mph when installing tile depending on the depth and soil conditions. You will need to give the ground time to up heave as you are moving forward. You will actually have better pulling efficiency at slower speeds. Your tractor may only need to be at half or two-thirds (1000-1500 rpm) throttle in first or second gear.

**Depending on the soil conditions and tractor weight (traction), you may need to pre-rip once through with the plow at approximately one-half to two thirds the desired installation depth. This is very helpful in rocky conditions as you will discover many rocks before installing tile. Digging the rocks is much easier without tile in the way.** This would be a dry run to loosen up some of the soil so the plow could be pulled easier when the tile is being installed. Pre-ripping is not really a time consuming thing especially when installing a whole tile system. Once you have installed the main and one lateral, as you are driving back to the main you can be pre-ripping. You may be able to pre-rip at 3 or 3.5 MPH, so it really is not time constraining.

### **Manual Grade Control:**

This method is most commonly used where there is sufficient slope (usually >1% and no humps or valleys) and a laser would not necessarily be needed. Once you have started the tile run, you will need to make sure the water level is in the green graduated area. This means you are tiling at a positive slope. At the same time you can determine the depth of the shoe by looking at the depth chain. Watch the chain and keep a consistent depth and you will be installing tile at the slope of the land at the tile run. Between the water level and the depth chain, you should be able to do a satisfactory job on grades with sufficient slope. Once the tile has ran through the boot, extend the cylinders all the way out to run the plow to the top of the ground and lift with the 3-point.

**Automatic Grade Control:**

A laser system or Intellislope GPS plow control will be needed for automatic grade control.

**Intellislope GPS Control System:**

If you purchased the Intellislope GPS plow control system please refer to that systems manual for this section. To learn more about the Intellislope you can visit: [www.intellislope.com](http://www.intellislope.com) or call us toll free at: 888-SOILMAX and select Sales (option one).

**Laser Guided Control System:**

You will need to use the laser, grade rod, and rod receiver to survey and determine the grade and cover needed (explained in the laser section later). Once this is determined, dial in the calculated grade on the laser transmitter. Position the plow in the start hole as explained above. Now run the receiver up or down until it recognizes the lasers signal. When you begin to get close to finding the laser the lights on the left side of the control box will indicate in what direction to move the receiver. The middle row of lights indicates the receiver is locked on to the signal. Once the receiver is locked on, press the "Auto" button on the control box for Automatic hydraulics. **(Make sure to have the hydraulic remote detented so there is oil flow back to the valve.)** You can now begin the tile run and the grade control should be hands off for the most part, unless you would need to break grade or depth for some reason. Once the tile run is finished, hold the ↑ "Up" button until the plow runs to the top of the ground and lift with the 3-point hitch.

The automatic grade control should run fairly smooth. If the plow seems to be hunting grade, you may need to slow down the "gain" setting for the cylinders. If the plow does not get back to grade fast enough, you may need to increase the "gains" for the cylinders. You will need to refer to the earlier section on setting up the control system for instructions of these adjustments.

## **Designing Tile Systems**

Designing your tile system may be the most difficult part of tiling. The general layout may not be difficult but, you will need to make sure you are able to put the entire tile in at a depth where you have sufficient coverage everywhere and not have to go too deep to keep good coverage everywhere.

If you are installing a whole drainage system, you will need to make sure you have sufficient coverage of the main and the laterals. It is common that one main carry all of the water from a field to a drainage ditch, creek, or river (but this is not a necessity). The Gold Digger Pro will install up to 8 inch tile; however, you may want to install multiple mains to drain a whole field. This may actually save you money as two 6 inch tile may be cheaper than one 8 inch and give you nearly the same capacity. The main should be the deepest run on average in a system. This usually means that the main would be installed in the lowest part of the field. The slope of the main is very important as this determines the rate at which water flows.

The permeability of the soil and the size of the area to be drained also play equally important roles in designing your drainage system. All of these factors play a circular role in the design. For example, a very flat field to be drained may not allow for much grade on the main. This reduces the amount of flow rate and possibly increases the size of the tile needed to adequately drain that area.

Obtain or make a map of the area to be drained. If you have a yield monitor and you are collecting GPS data with yields, you might even be able to create a topography map that would be helpful in designing your system. USGS topography maps are also helpful. These topo maps give you an idea of how the land lays. Take your map out with you to the field to make a rough design of the system. Once you have an idea of how the design should be, use your laser to determine the grade of each run and make sure you have the desired depth for the entire tile in the system. You may decide to change the grade of a tile run after you have taken your laser shots. (The next section will explain using the laser and calculating grade and coverage for each tile run.)

The spacing of laterals within a tile system is also very important. You will want to space laterals so that your return on investment is optimum. One large advantage of owning a Gold Digger Pro is that you are able to install tile so reasonably, your optimum return of investment is not as large of a concern as it would be if you were paying a contractor to install tile. You may even want to install some tile test plots, where you monitor the benefit of different spacing on your own soil types. A yield monitor on your combine works great for this. Obviously, we have only scratched the surface in explaining the design of tile systems. Please feel free to call us. We would be glad to try to answer any questions you might have or refer you to someone who could answer your questions. Many States also have drainage guides available at extension offices that explain in detail subsurface drainage along with tables of drainage coefficients, recommended tile sizes, grades, and spacing of drainage

systems. Below is a chart taken from a drainage guide for tile sizes and the amount of acres they will drain at different grades.

**Tile Size in Acres Drained (3/8" Coefficient)**

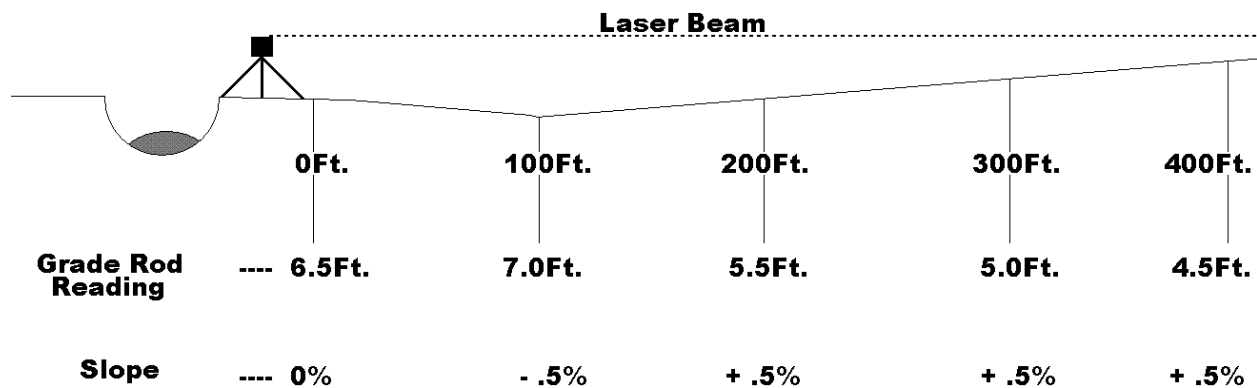
<b>Grade</b>	<b>3"</b>	<b>4"</b>	<b>5"</b>	<b>6"</b>	<b>8"</b>	<b>10"</b>	<b>Grade</b>
<b>0.05</b>	1.1	3	4	8	19	31	<b>0.05</b>
<b>0.1</b>	2	3.7	7	12	25	42	<b>0.1</b>
<b>0.15</b>	2.2	4.7	8.2	14	29	55	<b>0.15</b>
<b>0.2</b>	2.5	5.5	9.8	16	35	60	<b>0.2</b>
<b>0.25</b>	2.75	6.5	11	17.5	37.5	70	<b>0.25</b>
<b>0.3</b>	3.1	7	12.5	20	41	77	<b>0.3</b>
<b>0.4</b>	3.7	7.5	14	23	49	87	<b>0.4</b>
<b>0.5</b>	4	8	15.5	26	54	100	<b>0.5</b>
<b>0.6</b>	4.4	9	17.5	27.5	59	110	<b>0.6</b>
<b>0.7</b>	4.75	10	18	31	64	115	<b>0.7</b>
<b>0.8</b>	4.9	11	20	33	70	120	<b>0.8</b>
<b>0.9</b>	5.2	12	21	34	72	130	<b>0.9</b>
<b>1</b>	6	13	23	35	78	140	<b>1</b>
<b>2</b>	8	17	31	50	110	190	<b>2</b>
<b>3</b>	9	20	37	60	130	240	<b>3</b>
<b>4</b>	10	24	41	70	150	270	<b>4</b>
<b>5</b>	13	26	48	77	160	300	<b>5</b>

## Using a Laser-Determining Grade and Coverage

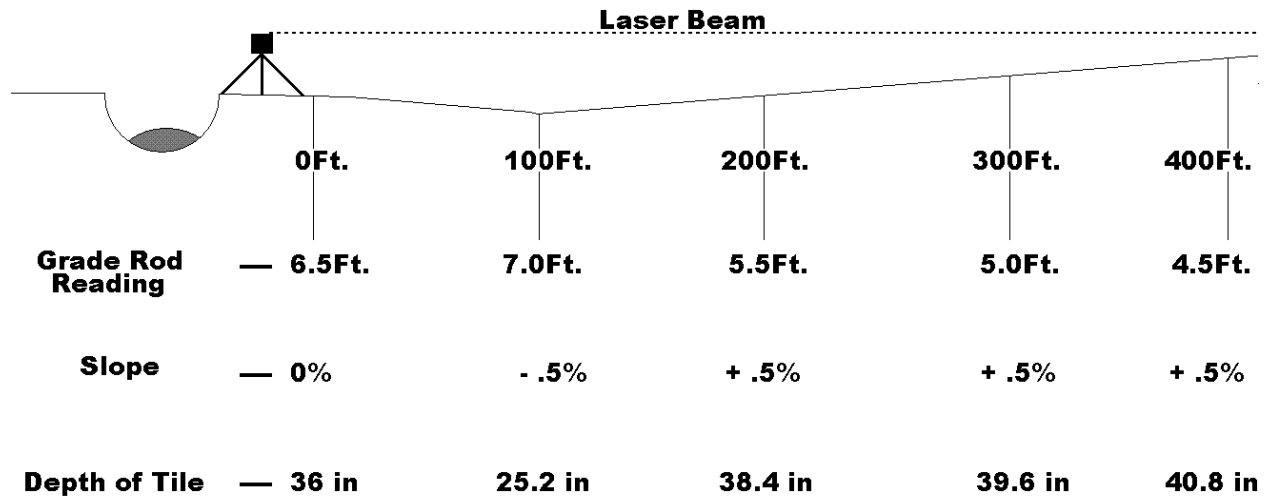
If you purchased a laser with you plow, you can use it to determine the grade of each tile run as well as the depth the tile will be at intervals within the field.

1. To determine the grade of a particular tile run, set the laser on its tripod about half way up the grade.
2. Level the laser and set the grade dial to 0.
3. Now take the grade rod and receiver and get a reading where the tile run will begin.
4. Measure or step off (its more accurate to measure) 100' and take a reading. If the reading is higher than the initial, the land is sloping down from the laser at that point. If it is a lower reading than the initial, the land is sloping up from the laser at that point.

The grade rod should be marked in feet but, the incremental marks between each foot mark are in tenths of a foot. For example, let's say the initial reading was 6.5' and the second reading was 7.0'. The slope would be  $-.5\%$  sloping away from the laser. Since the slope is the rise or fall per 100 units of run you will need to divide the reading by the number of 100' increments you take readings from. For example, let's say the initial reading again was 6.5' and another reading 700' away was 3.5'. The slope would be a 3' rise in 700' of run. The 700' would be seven, 100' increments, so dividing 3 by 7 would be a slope of  $.43\%$  ( $.43'$  in 100' of run; or 5.14 inches in 100' of run). Below is a diagram that may help in understanding the concept.



At each reading the slope is determined relative to the first reading. It is not necessary to always take a reading every 100 feet. This depends on how the land lays. If there is a low place, it may need to be checked to make sure you can get enough cover over the tile. If there is a hump, you may need to get a laser shot to make sure you will not have to go too deep to get through the hump. If the grade of the run is constant, you may only need to check the end of the tile run for slope (this is sometimes risky, because slope can fool you). Now let's throw in another calculation. On the next page is a diagram that shows the same as above but including a tile run at  $.4\%$  slope.



## Tile at .4% Slope

The depth of tile was calculated by taking the depth of the tile at the first reading (36 inches) and adding or subtracting the amount of ground cover gained or lost gained or lost by the height of the land at each reading, then subtract the depth lost by the tile sloping up. For example, at the 100' reading, you will lose 6" (.5' in 100') of ground cover and lose 4.8 inches from the tile sloping up at .4% slope (.4 x 12"). The 36" depth you started with minus 6 and 4.8 inches equals 25.2 inches of cover (36-6-4.8=25.2). At the 400' reading we gained 2' (.5' in 400' of run), so the 36 inch depth we started plus the 24" we gained minus the 19.2" we lost equal 40.8" of cover (36+24-19.2=40.8).

You can see the dilemma here. The low spot (at the 100' reading) is at 25.2" of cover while at the last reading you have almost 41 inches of cover. This should work but, if you needed to change the slope to .3% you would run the risk of going too deep out at the end of the run. If you needed to change the slope to .5% you would run the risk of getting it too shallow in the low spot. You can, however, break grade with the plow. In other words we could install the tile at less slope until we get through the low spot, then break grade and reset the laser to a higher slope so that we don't get so deep out on the end of our run. You can see that taking many laser shots is important sometimes.

The same kind of dilemma may occur when there is a hump to go through. You may have to work around the hump or if you are able to get through it with the plow, you may want to design the system so that you do not have to cross it again.

Be careful you do not drastically undersize or oversize your drainage system for the amount of land to be drained. Bigger is not always better. Over sizing the system can be more of a problem sometimes than under sizing. Some soil types are prone to "silting" tile in if there is not enough volume of water running through the tile to keep it clean. Again, check a drainage guide for this type of information.

## Tile Grade Situations

### Standard Grade Calculation

Start Rod Reading	End Rod Reading	Distance in Feet	Desired Grade
14	13.8	2600	0.008

$$(13.5 - 6.35) / (500/100)$$

$$(\text{Start Grade Rod Reading} - \text{End Grade Rod Reading}) / (\text{Distance}/100)$$

### Calculating for a desired grade with a known starting and ending depth.

Start Rod Reading	End Rod Reading	Start Depth	Ending Depth	Distance in Feet	Desired Grade
13.5	13.3	4	2	2600	0.085

$$((13.5 - 6.35) + (2 - 5.5)) / (500/100)$$

$$((\text{Start Rod Reading} - \text{End Rod Reading}) + (\text{Start Depth} - \text{End Depth})) / (\text{Dist}/100)$$

### Determining the plow depth at a known distance.

Star Rod Reading	End Rod Reading	Start Depth	Grade Setting	Distance in Feet	Ending Depth
13.5	6.35	2	0.491	500	6.695

$$(2 - ((500 / 100) \times 0.491)) + 13.5 - 6.35$$

$$(\text{Starting Depth} - ((\text{Distance} / 100) \times \text{Grade Setting})) + (\text{Start Grade Rod} - \text{End Rod})$$

### Calculating depth needed to cover a reverse grade (going over hump to low spot).

Start Rod Reading (Hump)	End Rod Reading (Low Spot)	Grade Setting	Ending Depth	Distance in Feet	Desired Depth (At Hump)
5.59	9.52	0.05	2	100	5.98

$$(9.52 - 5.59) + (.05 \times (100 / 100)) + 2$$

$$(\text{End Rod (Low Spot)} - \text{Start Rod (Hump)}) + (\text{Grade Setting} \times (\text{Distance} / 100)) + \text{Ending Depth}$$

### Calculating Starting Depth

Start Rod Reading	End Rod Reading	Grade Setting	Ending Depth	Distance in Feet	Desired Starting Depth
12.76	9.63	0.3	3	800	2.27

$$((9.63 - 12.76) + (.3 \times (800 / 100))) + 3$$

$$((\text{End Rod} - \text{Start Rod}) + (\text{Grade Setting} \times (\text{Distance} / 100))) + \text{Ending Depth}$$

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