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# **Understanding Readings From Soil Moisture Meters**

**A PROGRAMED LEARNING WORKBOOK**

**DISCARD**

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COOPERATIVE EXTENSION SERVICE

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CORVALLIS

# CONVERSION TABLE FOR SOIL MOISTURE MEASURING EQUIPMENT

Meter readings						Soil moisture tension values		
Delmhorst D-1 ("Set" at 65)	Delmhorst K-5	Rader	Irrigate*		Resistance values	Delmhorst cylindrical blocks	Irrigate stakes	
			Avg.	Range				Ohms
85	175	185	185	(182-192)	<b>330</b>	.2	....	
83	168	182	182	(179-189)	<b>400</b>	.25	....	
82	160	177	177	(174-184)	<b>490</b>	.30	.30	
81	154	174	174	(170-182)	<b>560</b>	.35	.34	
80	148	171	171	(167-178)	<b>630</b>	.40	.37	
78	135	164	164	(159-172)	<b>810</b>	.50	.43	
76	125	157	157	(151-166)	<b>1,000</b>	.60	.50	
74	115	150	150	(144-160)	<b>1,200</b>	.70	.56	
71	101	140	140	(132-150)	<b>1,550</b>	.80	.67	
70	95	137	137	(128-146)	<b>1,680</b>	.90	.71	
67	87	128	128	(120-141)	<b>2,000</b>	1.0	.80	
63	74	114	114	(106-129)	<b>2,650</b>	1.2	.97	
57	60	101	101	(90-115)	<b>3,500</b>	1.5	1.2	
52	50	87	87	(78-102)	<b>4,600</b>	1.7	1.4	
47	44	77	77	(68-90)	<b>5,700</b>	2.0	1.6	
40	34	62	62	(54-74)	<b>8,000</b>	2.5	2.1	
34	27	52	52	(45-62)	<b>10,400</b>	3.0	2.5	
29	22	43	43	(38-53)	<b>13,000</b>	3.5	2.9	
25	17	36	36	(32-44)	<b>16,000</b>	4.0	3.3	
21	13	30	30	(26-38)	<b>20,000</b>	5.0	3.9	
17	10	24	24	(20-31)	<b>25,000</b>	6.0	4.5	
15	8	22	22	(18-28)	<b>28,000</b>	7.0	4.9	
14	7	20	20	(16-25)	<b>31,500</b>	8.0	5.2	
12	6	18	18	(14-22)	<b>36,000</b>	9.0	5.8	
11	6	16	16	(12-19)	<b>39,000</b>	10.0	6.1	
8	5	11	11	(9-14)	<b>50,000</b>	15.0	7.3	

\* To obtain greater accuracy, you can measure known resistances over the entire meter range to develop a calibration for YOUR Irrigate meter. This can be done quite easily by a radio repairman.

# **Understanding Readings From Soil Moisture Meters**

## **A PROGRAMED LEARNING WORKBOOK**

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This workbook is different from most of the information booklets published by the OSU Extension Service. It contains a series of frames that present information in a planned sequence. Each frame contains a statement that you are to complete by filling in blanks or selecting alternative answers. Do each frame in order.

Work through the book using the top halves of the pages, following numbered steps from 1 through 16. Then turn back to the front and follow the bottom halves of the pages, completing steps 17 through 32.

As you turn each page, check your answer with the correct one appearing on the back of

the page you just turned. Answers are numbered for easy identification. If your answer was not correct, go back and work the step again before continuing. Be sure you understand each step before going on to the next.

Take your time. No one is grading you or checking the amount of time you take. You will find "scratch space" for use as needed on the backs of the pages, adjacent to the answers. Don't be afraid to use it.

This booklet was designed to present information in a planned order for easier learning. If any of the steps are not clear, the author would appreciate your criticism.

# Introduction

Extension Bulletin 810 explains the operation and use of electrical resistance gypsum blocks for scheduling irrigations. If you have not already read this bulletin, you should do so before continuing with this workbook. It is available free from Oregon county Extension offices or direct from the Bulletin Room, Printing Department, Oregon State University, Corvallis.

The Delmhorst, Rader, and Irrigage meters described in EB 810 are the most commonly used in Oregon. Unfortunately, the calibration of these meters is not standardized. Numerical readings on one meter do not necessarily have the same meaning as the same numerical readings on another meter. As a further complication, the two types of sensitive gypsum units most commonly used in Oregon for determining soil moisture also have different calibrations.

Meter readings and soil moisture tension values of the gypsum units are both calibrated in terms of electrical resistance values. This workbook will help you understand the relationships between these calibrations and to find the meaning of readings made by any of the meters on either of the sensitive gypsum units.

Upon completion of the workbook you should be able to:

- Write equivalent meter readings from the enclosed "conversion table."
- Write equivalent soil moisture tension values for either the Delmhorst cylindrical block or the Irrigage stake when you are given a reading on one of the four meters.
- Indicate which of the values in the conversion table means a "wet" or "dry" soil.

The Conversion Table found on the inside of the front cover of this workbook is composed of three main sections: Meter readings, resistance values, and soil moisture tension values. Look at the Conversion Table and locate these main headings before you continue. Notice the sub-headings under the main sections and indicate them at the right. Then turn the page and check your answers.

Meter readings

{  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Soil moisture tension values

{  
\_\_\_\_\_  
\_\_\_\_\_

A resistance value of 3,500 ohms is indicated on the Delmhorst K-S meter by a reading of .....

**Answer to  
Frame 1**

Meter readings

{ Delmhorst D-1  
Delmhorst K-S  
Rader  
Irrigage

Soil moisture  
tension values

{ Delmhorst cyl. blocks  
Irrigage stakes

---

**Answer to  
Frame 17**

60

Moisture tension values indicate the amount of suction required to remove water from soil. When a plant is transpiring water, this force must be transmitted through the plant system. Little suction is required when the soil is wet. One day after an irrigation, soil will have a moisture tension value that is ..... high. ....low. (Check one.)

Notice in the chart the meter readings of the Rader and Irrigage meters for the same resistance value. They need not be converted for comparison purposes since they both read the .....

**Answer to  
Frame 2**

low

---

**Answer to  
Frame 18**

same



Moisture tension values in the Conversion Table are indicated in units of bars. One bar is equivalent to a suction of about 14.7 pounds per square inch (p.s.i.). One-tenth of a bar is therefore equivalent to a suction of about ..... p.s.i.

When the soil moisture tension is at 1.5 bars, the Delmhorst cylindrical block has a resistance value of ..... ohms.

**Answer to  
Frame 3**

1.47 p.s.i

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**Answer to  
Frame 19**

3,500

If low moisture tension values indicate wet soil, then high moisture tension values indicate ..... soil.

When the soil moisture tension is at 1.4 bars, the Irrigage stake has a resistance value of ..... ohms.

**Answer to  
Frame 4**

dry

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**Answer to  
Frame 20**

4,600

Resistance values indicate the opposition a conductor offers to the flow of electrical current. In this case, the conductor is the sensitive gypsum unit. Since its resistance depends on its moisture content and it gains or loses water with the soil around it, its ..... will actually vary according to soil moisture conditions.

Moisture tensions of 1.5 bars and 1.4 bars are for practical purposes the same. You have indicated, however, that the resistance values of the two units are different.

A Delmhorst cylindrical block will have a (..... higher, ..... lower) resistance value than an Irrigage stake at the same moisture tension value. (Check one.)

**Answer to  
Frame 5**

resistance

---

**Answer to  
Frame 21**

lower

If the soil is wet, the moisture tension value is low. It also follows that if the soil is wet, the resistance value of the gypsum block is ..... high. ....low. (Check one.)

Given the following meter readings on a Rader meter, indicate tension values for Delmhorst cylindrical blocks and Irrigation stakes.

Rader meter reading	Moisture tension value	
	Delmhorst cyl. blocks	Irrigation stakes
150	_____	_____
164	_____	_____

**Answer to  
Frame 6**

low

---

**Answer to  
Frame 22**

.70, .56

.50, .43



Resistance is measured in units of ohms. Check the resistance and moisture tension values in the table. At the top of these columns both of the values are ..... high. ....low. (Check one.)

You will normally read your meter to the nearest "5". That is, instead of reading 184 you will read 185, and instead of 161 you will read .....

**Answer to  
Frame 7**

low

---

**Answer to  
Frame 23**

160

Continuing to observe the table, as soil moisture tension values increase, resistance values ..... increase.  
..... decrease. (Check one.)

To convert meter readings it will be necessary to "approximate" some equivalents. That is, if a reading of 55 is obtained on the K-S meter, an equivalent reading on a Rader meter will be between ..... and ....., or about ..... (Round to the nearest "5".) An error of 5 points is not important.

**Answer to  
Frame 8**

increase

---

**Answer to  
Frame 24**

87

101

95

Meter readings indicate the amount of current flowing through the gypsum blocks and stakes. Much current flows when there is little resistance. When resistance is high, meter readings will be ..... high. .... low. (Check one.)

Let's consider some practical application of what we have learned.

You have a Delmhorst D-1 meter and a Delmhorst cylindrical block. The meter reads 52.

What would your meter read if you were using the K-S meter? .....

**Answer to  
Frame 9**

low

---

**Answer to  
Frame 25**

50

Now compare the meter readings and resistance values in the table. When the resistance value is increased, the meter reading is (..... increased, ..... decreased) indicating a decrease in current flow. (Check one.)

You have a model K-S meter and Irrigage stakes. If you decide to use Delmhorst cylindrical blocks next year, will you have the same meter reading at the same moisture tension value? .....

**Answer to  
Frame 10**

decreased

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**Answer to  
Frame 26**

No



General relationship of the table values then is as follows: Meter readings get smaller as resistance values and tension values get .....

You look at a neighbor's soil moisture chart (he has a K-S meter) and you see that his chart showed a meter reading of 45 for the 6-inch depth before he irrigated. He was using Delmhorst cylindrical blocks. What was his soil moisture tension? ..... bars.

**Answer to  
Frame 11**

larger (higher)

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**Answer to  
Frame 27**

2.0

All of the meters discussed in this circular measure about the same range of soil moisture tension values. The D-1 meter has this range divided into 100 divisions. The other meters have the range divided into 200 divisions.

Horizontal lines in the table indicate conversion equivalents for meters and gypsum units. That is, a reading of 95 on a Delmhorst K-S meter indicates a resistance value within the gypsum unit of ..... ohms.

You are using cylindrical blocks too but have a Rader meter. What would your meter have read at this same moisture tension value? .....

**Answer to  
Frame 12**

1,680

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**Answer to  
Frame 28**

77

Meter reading and resistance relationships differ between various models of Irrigage meters due to minor changes in design and component parts. The range found among a number of meters tested is indicated beside the "average" readings in the conversion table. Use the "average" readings for conversion purposes.

In other words, if there is a resistance of 5,700 ohms in a gypsum unit, an Irrigage meter might read anywhere between 68 and 90. (Find these values on the chart.) If you are converting a reading from a different meter, you will not know what Irrigage value to use. You should, therefore, use the average value of .....

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You have been using a Rader meter which has become damaged and must be repaired. Your neighbor has an Irrigage meter which you may borrow. You wish to continue charting your readings according to the Rader meter. Must you make a conversion? .....

**Answer to  
Frame 13**

77

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**Answer to  
Frame 29**

No

A reading of 80 on a Delmhorst D-1 meter indicates a resistance value within the gypsum unit of ..... ohms.

Research shows that pole beans should be irrigated when the moisture tension value at the 12" depth reaches 1.0 bars tension. What should your K-S meter read when it indicates "time to irrigate" if you use Delmhorst cylindrical blocks? .....

**Answer to  
Frame 14**

630

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**Answer to  
Frame 30**

87



A reading of 148 on a Delmhorst K-S meter indicates a resistance value within the gypsum unit of ..... ohms.

If you use Irrigage stakes, what would it read? .....

**Answer to  
Frame 15**

630

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**Answer to  
Frame 31**

About 65

A reading of 148 on the K-S is, therefore, equivalent to a reading of ..... on the D-1 since they are on the same horizontal line.

If you answered the last five frames correctly, you did well. If you missed one or two, you may wish to review this workbook again.

**Answer to  
Frame 16**

80

Now turn back to the front of the book and continue with Frame 17.

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