TDR 350
Soil Moisture Meter

PRODUCT MANUAL

Item # 6435

General overview

Thank you for purchasing the Field Scout™ TDR 350 soil moisture meter. This manual describes the meter's general features and operation.

Soil moisture is a critical, and potentially highly variable, component of the soil environment. Time domain reflectometry is a proven technology for quickly and accurately determining volumetric water content (VWC) in soil. Electrical conductivity (EC) is a function of the moisture and salt in the soil and can be factored out to increase the accuracy of VWC measurements. The meter also measures soil surface temperature. The user can quickly transition between taking VWC readings in standard, high-clay, and sand soils.

The TDR 350's shaft-mounted probe allows the user to take measurements while standing. The meter's built-in data logger eliminates the need to record data manually. The data points can be viewed with the FieldScout Mobile app that maps out soil measurements using logged location coordinates. Measurements can also be saved to an external USB flash drive when plugged into the built-in USB port.

Contents

Includes the following components:
- TDR 350 meter (in collapsed position)
- Carrying case
- 4 AA batteries already installed

Note: **TDR rods are sold separately**

CONTENTS

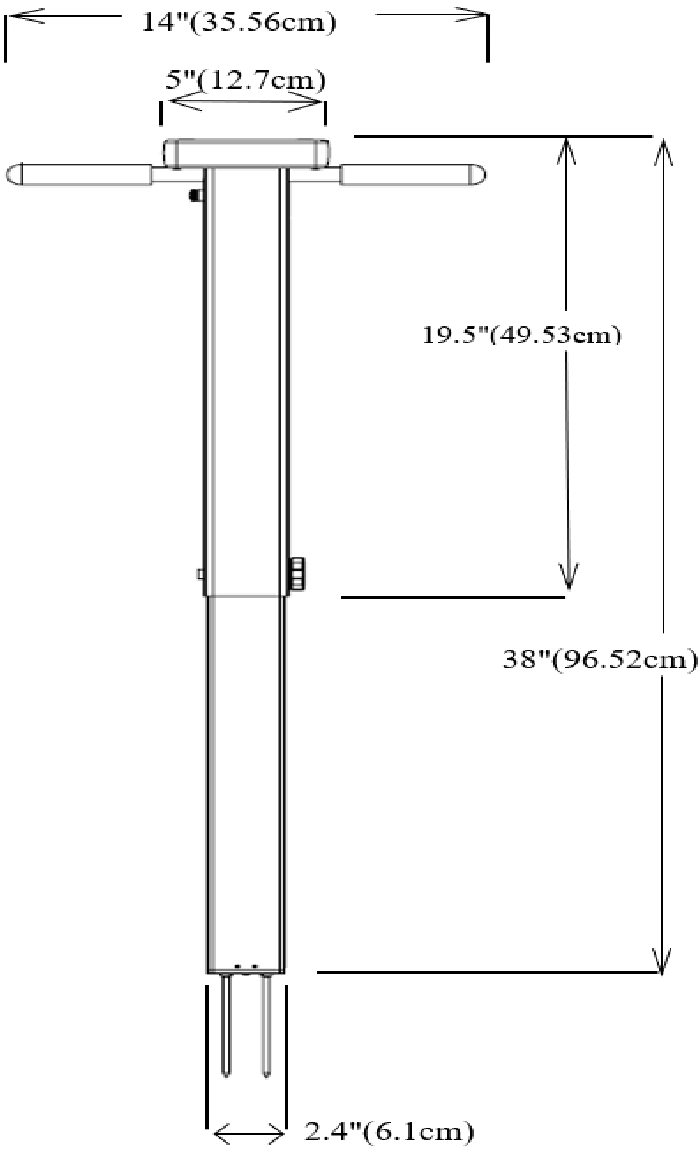
This manual will familiarize you with the features and operation of your new Field Scout™ TDR 350 Soil Moisture Meter. Please read this manual thoroughly before use

SPECIFICATIONS

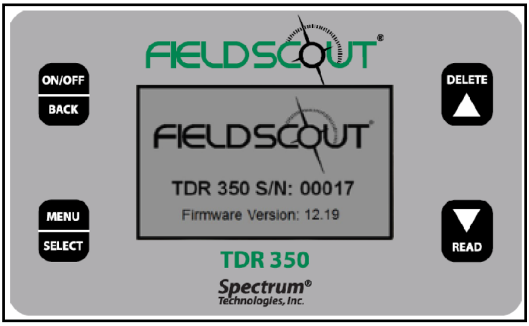
Measurement Units	Percent volumetric water content (VWC) Period (raw sensor reading)
Resolution, Accuracy and Range	**VWC**: 0.1% increment ±3.0% @ < 2 mS/cm 0% to Saturation (*Saturation is typically around 50% volumetric water*) **EC**: 0.01 increment ; ± 0.1 mS/cm; 0 - 5 range **Temperature**: 0.2 ˚F (0.1 ˚C) increment ; ± 1.8 ˚F (± 1 ˚C); -22 to 140 ˚F (-30 to 60 ˚C) Thermistor based; Infrared Optional
Connectivity	USB Type A, Bluetooth Low Energy
(GNSS)	Accuracy 1m (Galileo), 3.5 to 10m (Glonass, GPS) WAAS and EGNOS enabled
Power	4 AA alkaline batteries
Log Capacity	50,000 measurements
Display	Backlit, high-contrast, graphic LCD
Weight	4.3 lbs. (1.9 kg)
IP Rating	Display: IP54, Probe: IP67
Probe Head Dimensions	2.4” x 1.4” (6cm x 3.5cm)
Shaft Dimensions	Extended Length: 38” (96.5cm) Collapsed Length: 23” (58.4cm) Width: 1.4” (3.5cm)
Available Rod Dimensions	Turf 1.5” (3.8cm) Short 3.0” (7.6cm) Medium 4.8” (12.2cm) Long 8.0” (20.32cm) Diameter: 0.2” (0.5cm) Spacing: 1.2” (3cm)

Product dimensions

The following are the dimensions of a fully extended TDR 350. It is possible to reduce the length of the meter to 23” (58.5 cm) by adjusting the lower half of the shaft.



Button Functions



ON/OFF or **BACK** button

- Press briefly to power on.
- Press and hold to stay on logo screen.
- Press for 2 seconds to power off.
- Press briefly within a menu to return to prior screen.

MENU or **SELECT** button

- Press to enter available menus.
- Press to select or confirm a menu selection.

DELETE or **UP** button

- Press to move up within a menu.
- Delete last measurement from the running average, counter, and its entry from the internal data log (see p. 14).

READ or **DOWN** button

- Press to move down within a menu.
- From Reading screen, press briefly to make a reading.
- Press and hold to clear the average and reset the sample count to 0.

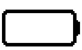
Display Screens

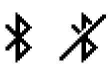
The TDR 350 has 3 main display screens;
- Startup Information (shown on previous page)
- Reading (figure 1)
- Settings Menu (see p. 8)

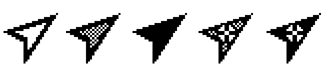
<u>Startup Information screen</u>
Initially displayed after first powered on.
- Displays firmware version information.
- Press and hold ON/OFF|BACK button to remain on this screen.

<u>Reading screen</u>
Measurements from the sensor are displayed on the Reading screen along with rod size used, soil type, and a reading count with running average.
Press READ to take readings, update Count and the Average.

Indicators:

 Battery level icon: upper right corner.

 Bluetooth icon: displayed when enabled. A bar appears through it when not actively communicating.

 GNSS location icon: When enabled, Transitions from clear to dark as location fix is achieved. Crosshatch appears when WAAS/EGNOS in use.

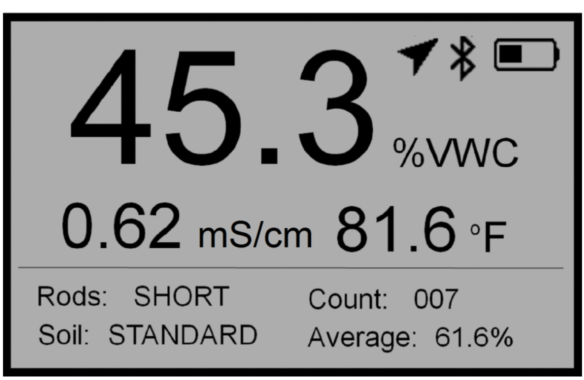


Figure 1.Sample Reading screen

Settings Menu screen

Used for changing device features, setting rod length and working with log files.
Use arrow buttons to move to the desired option.
The **Select** button toggles through option choices.

Clear Average*:
Clear the current average and resets the counter.

Rod Length: Select the Rod length See page 4 for options.

Soil Type: Standard, Hi-Clay or Sand.
- Standard: for most mineral soils.
- Hi-Clay: for soils with higher clay content (> 27%).
- Sand: for sand based fields or turf greens.

Clear Logs*: Erases data logs from internal memory.

Save to USB*: Transfers data logs to a USB flash drive if attached.

Backlight: Sets the LCD backlight: ON, OFF, AUTO. In AUTO mode, the backlight will shut off 5 seconds after a button press

GNSS Location: Enable or disable geo-location fix for new log entries

Bluetooth: Enable or disable Bluetooth connectivity to the FieldScout™ Mobile app (See p. 16).

Sound: Enable or disable beep for audible feedback.

Temp Source: Changes displayed temperature from the Soil Sensor to the IR Sensor (optional).

Temp Units: Fahrenheit or Celsius scale.

Moisture Type: Volumetric water content (VWC%), raw sensor reading (Period), or TDR 300 mode.
- VWC%: displays the volumetric water content with temperature and EC compensation.
- Period: displays the raw sensor reading - for troubleshooting or soil-specific calibration.
- TDR 300: displays VWC output without temperature or EC compensation

EC Units: EC value (mS/cm) or Salinity Index (see p. 21).

Auto-Off: Power off delay: 15, 30, 45, 60 minutes.

Current Date, Current Time: Reported values are acquired from the satellite location signal.

Timezone: Offset from Greenwich Mean Time. As the offset changes, the Time and Date will update.

Daylight Savings: ON or OFF.

Calibration*: Overrides factory calibration. See Appendix

Factory Defaults*: Resets menu settings and counter to the factory default value.

Rod Length	None	**Temp Source**	Soil Sensor
Soil Type	Standard	**Moisture**	VWC
Backlight, GNSS, Bluetooth	Disabled	**EC units**	mS/cm
		Auto-Off	15 minutes
Sound	On	**Time Zone**	GMT
Temperature	Fahrenheit		

** Pressing Select button for these options brings up an additional screen.*

Meter Operation

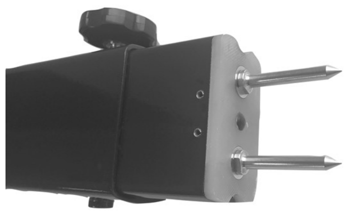


Figure 1. Shaft, fastening bolt, and rods

Setting up the meter

1. Adjust the length of the collapsible shaft (fig. 1) by removing the fastening bolt and either extending or retracting the shaft to its new position, re-insert the fastening bolt, and hand tighten.
2. Screw in and tighten the rods into the sockets at the bottom of the probe block.
3. Set the desired user settings in the settings menu. See the Settings Menu (p.8).

Taking Readings

1. Grip the TDR handles to the left and right of the display.
2. Push down on the handles maintaining a steady downward pressure to drive the rods into the soil until the sensor base is in contact with the soil surface. Be sure not to allow back and forth or side to side movement. This can introduce air pockets into the soil medium which will alter the reading.
Caution: Exercise care not to damage the rods. See **Meter Care** (p. 11).
3. Press the **READ** button and observe the change in results on the top display.

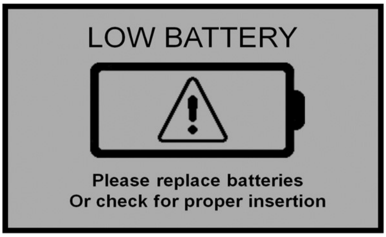
Meter Care

The FieldScout TDR meter will function properly under normal conditions experienced in field use. The sensor block is sealed and will not be damaged by immersion in water. The display is **not** waterproof, so it should not be used during heavy rainfall or left exposed during irrigation events. If the display does get wet, it should be dried out immediately.

Follow these tips to prolong the life of the device:
- Store in a cool and dry place when not in use.
- Keep the meter and probe rods clean and dry in between uses.
- Remove the batteries if not used for an extended period of time (ie: between seasons).

Battery life

If the battery level is low or a battery is inserted incorrectly, the low battery icon appears on the screen and the display will power off.



Battery life is affected by the enabled features, accessories connected, and the frequency of use. If not needed, the Bluetooth, GNSS Location and backlight features can be disabled. The backlight can also be set to AUTO mode (p. 8). This allows enough time to see the reading and conserve the battery. The chart below gives a rough estimate of the number of readings that can be taken given certain configuration parameters.

			Total Readings	
Bluetooth	**GPS**	**Backlight**	**Alkaline**	**Lithium**
ON	ON	ON	12,000	24,000
ON	ON	OFF	24,000	35,000
OFF	OFF	OFF	150,000	225,000

Figure 1. Sensor cable connection to board.

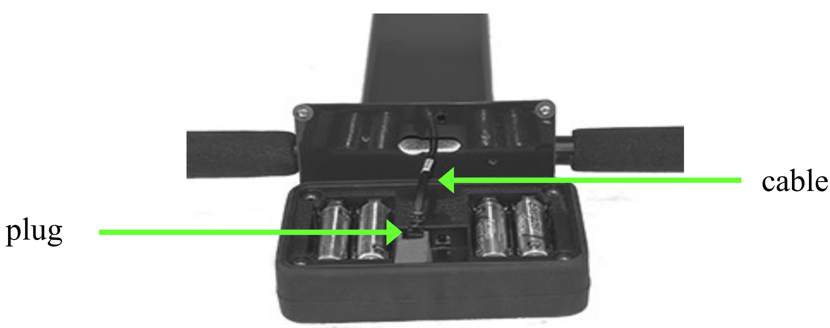
Figure 2. Shaft interface

Display and Sensor Removal:

1. Remove the rods.
2. Flip the TDR display over.
3. Remove the 4 screws at each corner.
4. Gently separate the display module from the base plate. Note: The sensor cable is attached in the center and should be pulled slightly out of the base plate for battery, sensor, or display replacements. Procedures are shown in the following sections.

Battery Replacement:

1. Follow steps above for **Display and Sensor Removal** to access the batteries.
2. Install four AA batteries and ensure correct polarity by referencing the (+) positive and (-) negative labels at either end of each slot.
3. Follow the procedure on the next page to reinstall the display.



Display Removal:

1. Follow steps for **Display and Sensor Removal** to access the display and cable connections.
2. Remove the foam spacer and unplug the sensor cable connector from the jack. If an IR temperature sensor is connected, disconnect this plug as well. **Do not discard the foam spacer.**

Display Installation:

1. Follow the procedures for **Display Removal** to access the display and cable connections.
2. Re-connect the sensor cable to the 3.5mm connector on the back of the display module.
3. Insert the foam spacer back into place behind the sensor cable. The forked end fits around the sensor cable molding.
4. If equipped with the IR temperature sensor option, attach it to the smaller diameter connector.
5. Guide the excess cable length back down through the base plate.
6. Mount the display back onto the base plate by tightening the four screws. Be sure the USB port side faces the same side as the serial number label.

Sensor Block Removal / Replacement:

1. Follow steps for **Display Removal** to access the cable connections.
2. Remove the fastening bolt that joins the probe block to the shaft.
3. Separate the probe block from the shaft (fig. 2).
4. Feed the cable from the replacement probe block through the shaft. A string fed down from the top can be used to aide in the process of cable reconnection.
5. Follow the procedure for Display Installation to complete the replacement.

Data Logs

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Time	VWC%	Period	EC	Temp_Soi	Temp_Soi	Temp_IR	Temp_IR((	Latitude	Longitude	Satellit	Fix	Rod Lengt	Soil Type	VWC Mode
2	4/12/2019 11:02	6.9	2047	0.62	14.7	58.5	15.1	59.2	41.739502	88.228590	7	1	S	S	3
3	4/12/2019 11:02	5	2026	0.62	14.6	58.4	15.2	59.4	41.739492	88.228588	9	1	S	S	3
4	4/12/2019 11:03	6	2035	0.62	14.6	58.4	15.2	59.4	41.739482	88.228592	9	1	S	S	3
5	4/12/2019 11:03	6	2037	0.62	14.7	58.4	15.1	59.2	41.739472	88.228597	8	1	S	S	3
6															

35001234

Figure 1: Sample TDR 350 data file

Downloading Data

Data stored in the meter's internal memory can be transferred to your PC with a USB flash drive.

1. Connect the flash drive to the meter’s USB port.
2. Press the **Menu/Select** button on the bottom left of the display to open the Settings Menu.
3. Choose the **Save to USB** option.
4. When prompted, press the **Menu/Select** button.

The data will be saved to the flash drive as a .csv file named with the serial number as the filename. If a previous data file exists on the flash drive with the same filename, it will be over-written*.

**Caution: If you cleared the data log before taking the current set of measurements, be sure any data on the flash drive has already been saved to your PC.*

Erasing Data

Press the **Menu/Select** button (p. 6) to open the Settings Menu. Scroll to the **Clear Logs** option and, again, press the **Menu/Select** button. Press **Menu/Select** button to complete the process or the **On/Off/Back** button to abort.

Managing Data

The data is stored in comma-delimited text files. The file name will match the serial number of your meter. These files can be opened with text-editing software or spreadsheet software (fig. 1). The data is separated into 15 fields.

Column	Description
1	Date and time[a]
2 - 8	Sensor readings[b] (VWC, Period, EC, Soil Temperature, IR Temperature)
9 - 10	Location fix coordinates (longitude, latitude)[c]
11	Number of satellites visible during reading
12	Satellite fix status[d]
13	Rod length[e]
14	Soil type[f]
15	VWC Mode[g]

[a] Time is based on the GMT offset selected in the **Timezone** option (p. 9)

[b] If "TDR 300" is selected as the **Moisture Type**, the TDR 300 VWC (without EC optimization) will appear in the VWC% column

[c] GNSS format is -DD.DDDDDD

Where DD.DDDDDD are decimal degrees, and a negative sign may appear for South or West compass directions

[d] Satellite fix status will be: 0 if unable to determine a location, 1 for location without differential correction, and 2 for location with differential correction

[e] Rod length options are **L:** **L**ong (8"), **M**: **M**ed (4.8"), **S:** **S**hort (3"), and **T**: **T**urf (1.5")

[f] Soil Type options are **S:** **S**tandard, **H**: **H**i-Clay, and **D**: san**D**.

[g] Indicates whether the value in column B is EC-compensated (V) or not (3)

Field Scout Mobile App/ SpecConnect

The FieldScout Mobile App can be used to send data directly to the SpecConnect web interface. Data can be viewed on a Smartphone in two formats. In grid mode, the site is divided into a customizable 2-dimensional grid of 3 to 5 rows and 3 to 5 columns. Measurements are taken in each grid cell. Average, color-coded data are displayed on the app (Fig. 1). In freeform mode, a color-coded pushpin icon is placed at every sampling point. If the TDR has a good GNSS location fix (p. 7), the app will use the coordinates from the meter. If not, or if the meter's GNSS location is disabled, it will use the internal location of the smartphone.
The data from the Pro version of the app is sent instantaneously to SpecConnect. Data can be viewed in map form (fig. 3), exported to a spreadsheet, or viewed as a Trend Report (fig. 4).
More details are available in the user's guide for the app.

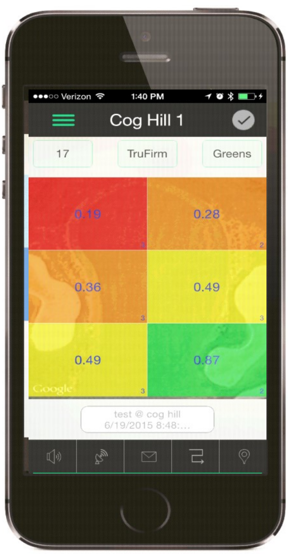


Figure 1. Grid Mode

Figure 2. Freeform Mode

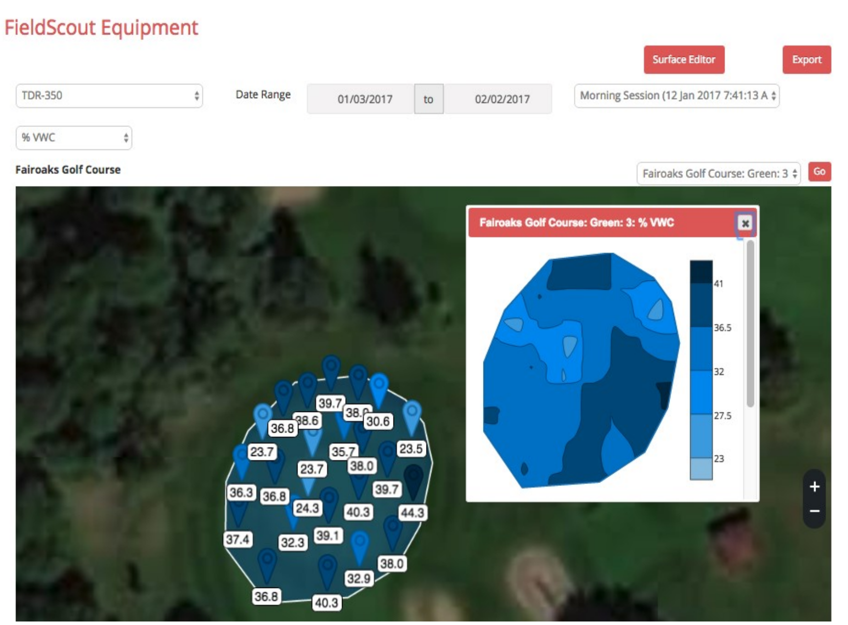


Fig. 3. 2-D Contour Plot in SpecConnect

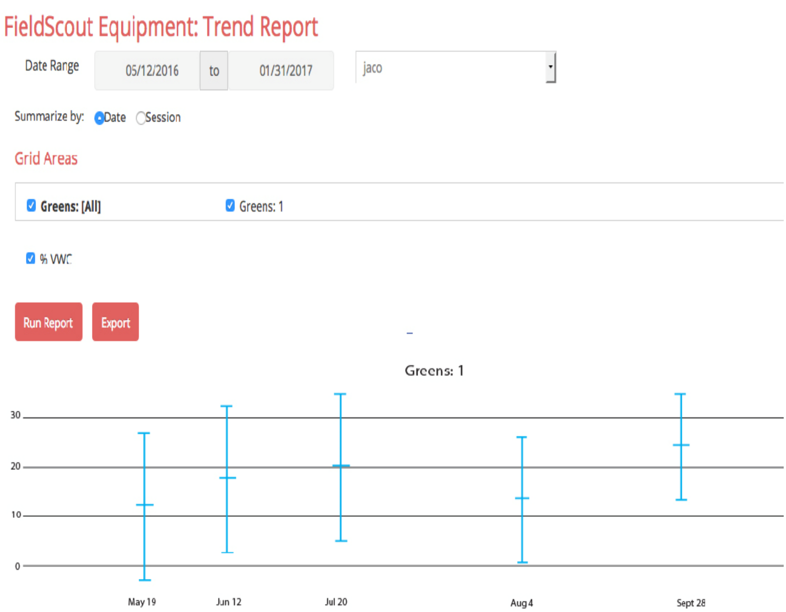


Fig. 4. Trend Report

Pairing With The FieldScout Mobile App

The internal Bluetooth radio must be paired with the smartphone running FieldScout Mobile. For some smartphone operating systems, it may be necessary to manually enable Location Services.

1. Activate Bluetooth feature on the smartphone.
2. Open the app.
3. Tap the Course/Farm icon. Select an existing course or create, name, and select a new course.
4. Select an existing session or create, name, and select a new session. This will bring up the **Select Session Mode** screen (Fig. 1). Select whether you are using Grid or Freeform (Pro version only) mode to collect data.

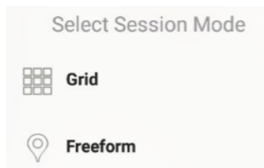


Figure 1. Session Mode screen

5. a. For Grid mode, the **Main Grid** screen (Fig. 2a) will appear. Confirm that the meter you are using appears at the top of the screen. If not, a new session must be created. Tap any of the zones to bring up the **Take Reading** screen (Fig. 2b).

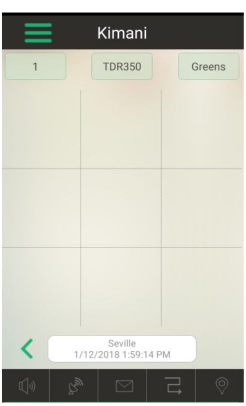


Figure 2a. Main screen

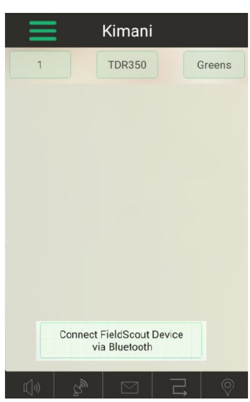


Figure 2b. Bluetooth Connect button (grid)

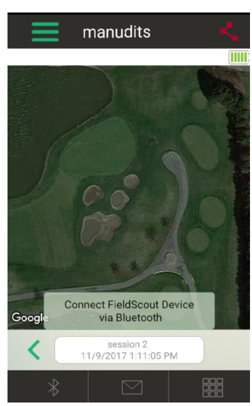


Figure 3. Bluetooth Connect button (freeform)

b. For Freeform mode, the app will immediately transition to the **Take Reading** screen (Fig. 3).

6. Tap the **Connect FieldScout Device via Bluetooth** button. If the Bluetooth feature has not been activated, you will be prompted to do so.
7. The app will search for the Bluetooth device. It should then appear in the list of scanned devices (Fig. 4).

After selecting the device, the App will be ready to take readings.

Note: Although the device appears in the app, it may not appear on the phone's list of Bluetooth devices.

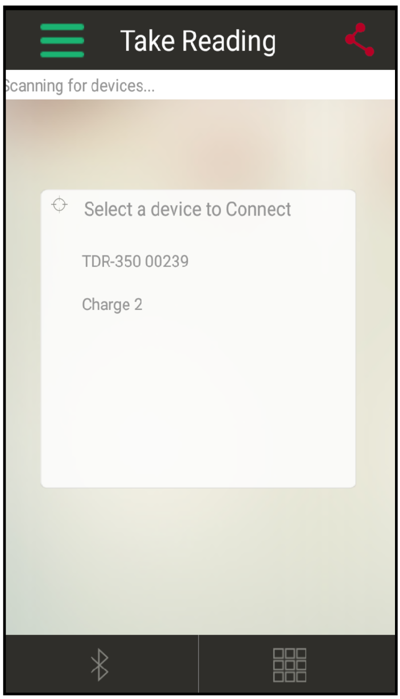


Figure 4. Scanned device list

VWC Measurements

Volumetric Water Content (VWC)
The ratio of the volume of water in a given volume of soil to the total soil volume expressed as a decimal or a percentage. Three soil moisture levels of most importance can be defined as follows:

Saturation: All soil pores are filled with water. The VWC will equal the percent pore space of the soil.

Field Capacity: The condition that exists after a saturated soil is allowed to drain to a point where the pull of gravity is no longer able to remove any additional water.

Permanent Wilting Point: The highest moisture content at which a plant can no longer extract water from the soil.

Additionally, we can define Plant Available Water as the amount of water between Permanent Wilting Point and Field Capacity. One rule of thumb is that irrigation should be initiated when half the Plant Available Water has been depleted.

Time Domain Reflectometry (TDR)
The speed of an electromagnetic wave along a waveguide in soil is dependent on the bulk dielectric permittivity (ε) of the soil matrix. The fact that water (ε = 80) has a much greater dielectric constant than air (ε = 1) or soil solids (ε = 3-7) is exploited to determine the VWC of the soil. The VWC measured by TDR is an average over the length of the waveguide.

The sampling volume is an elliptical cylinder that extends approximately 3 cm out from the rods. The high frequency signal information is then converted to volumetric water content. High amounts of clay or high electrical conductivity (EC>2 mS/cm) will attenuate the high-frequency signal and affect the reading displayed by the meter. Very high organic matter content will similarly affect the VWC reading.

Electrical Conductivity

Electrical Conductivity

The FieldScout TDR uses EC readings obtained from the same probes used to measure VWC. To improve the VWC measurement accuracy, EC is factored out of the VWC reading. This is a key advantage over its predecessor. The value measured is an average for the entire depth sampled. EC is expressed in units of mS/cm. The EC measured by an electrode is defined as the bulk EC.

The salinity level of soil is an important component of irrigation and nutrient management. The source of soil salts range from the original parent material, additions from natural sources, and management activity. High salt concentration in the soil has a negative effect as plant roots cannot bring in sufficient soil moisture. However, fertilizer exists as salt ions in that same soil solution. Low salt level can result in plants not getting the nutrients needed.

Direct measurement of salt content can only be done by subjecting a field sample to laboratory analysis. Fortunately, the electrical conductivity (EC) is a function of the dissolved salts in the soil. This proxy measurement is possible because, as salts dissolve into the soil, they disassociate into ions which conduct electricity.

Salinity Index

The TDR also has the option to report EC in the form of the Salinity Index. The salinity index is defined as the ratio of the bulk EC to the volumetric water content (expressed as a decimal). For example, if the bulk EC is 0.25 mS/cm and the VWC is 22%, the Salinity Index would be reported as 1.14 ($0.25 \div 0.22 = 1.14$). Therefore, the Salinity Index combines VWC and EC (corrected for temperature) into a parameter that will be less dependent on the sub-saturated water content.

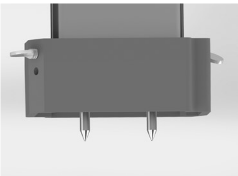
The TDR measures the bulk EC of soil that may or may not be saturated. As the soil dries, the remaining pore space solution becomes more concentrated which increases EC. However, reduced water in the pores leads to a longer and more tortuous path between the sensor electrodes, which decreases EC. The second mechanism dominates. Bulk EC will decrease as soil moisture decreases. EC measurements made at different times are comparable when the moisture content is the same. This is best observed if the readings are always taken when the site is at field capacity - when a saturated soil is allowed to drain to the point where the pull of gravity can no longer remove any additional water.

Optional Accessories

There are two optional items that can be used to expand the capabilities of the TDR350. Visit www.specmeters.com for more information and installation instructions.

Infrared Temperature Sensor (item 6435TS)
Provides an instantaneous and highly accurate temperature reading as an alternative to the existing surface temperature sensor.

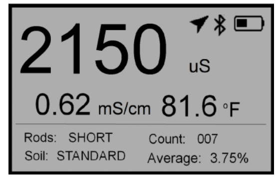
TDR Spacer (item 6435SP)



- Placed on the end of the sensor block to aide in identification of how fast and firm the turf greens are. The spacer has two orientations allowing it to work for either desired depth.
- Requires 3.8 cm (1.5”) turf rods.
- For use with firmware version 1.02 or higher
- Allows for the measurement of 1.3cm (0.5") or 2.5cm (1.0") soil depths.

Pilot Hole Maker (item 6430PH)
If the ground is especially hard or compact, you can use a Pilot Hole maker to make 3” holes to aid in starting the insertion of the probe rods.

Appendix 1: Soil-Specific Reading Correlation



To improve accuracy, correlate TDR period readings with a soil-specific sample set. VWC data can be correlated by measuring the weight of a known volume of saturated soil as it is gradually dried, by gradually wetting a known volume soil with measured increments of water, or by using a neutron probe. In most cases, gravimetric sampling is performed. This procedure is briefly described below.

1. Establish a number of field sites to sample.
2. Wet each site with varying amounts of water.
3. Obtain FieldScout TDR period reading at each sample site.
4. Extract a known volume of soil at each sample site. Ideally, an undisturbed soil core. Reduce evaporation - store samples in a sealed plastic container.
5. Weigh the wet soil samples.
6. Dry the samples (105°C for 48 hours) and weigh again.
7. Plot sample measurements against FieldScout TDR readings.

Regression analysis is used to develop a formula to correlate TDR readings to the sample data.

Volumetric water content calculations:

VWC = $100*(M_{wet} - M_{dry})/(\rho_w*V_{tot})$

Gravimetric water content calculations:

VWC =	GWC $*(\rho_b/\rho_w)$
GWC =	$100*(M_{wet} - M_{dry})/M_{dry}$
ρ_b =	M_{dry}/V_{tot}

Where:

M_{wet}, M_{dry} =	mass (g) of wet and dry soil respectively
V_{tot} =	total soil volume (ml)
ρ_w =	density of water (1g/ml)

Appendix 2
Troubleshooting

Sensor Function Verification:

Test readings can be taken in three standard environments; air, distilled water, and sand saturated with distilled water. It is important that any troubleshooting be done with distilled water. Readings taken in tap water can differ greatly from the expected results observed in distilled water. Test readings are made in a container of distilled water or saturated sand. The container should have a diameter of at least 3 inches (7.5cm) and should be tall enough so the rods can be completely immersed or inserted.

Readings should be taken with the **Soil Type** to Standard and the correct **Rod Length** selected. The meter should read VWC=0% in air. In saturated sand, it should read between 35% and 45%. The table below shows the approximate ranges of volumetric water content that are expected for the different rod lengths in distilled water.

Rod Length	Water
8 inches (20 cm)	60 - 65%
4.8 inches (12 cm)	70 - 75%
3 inches (7.5 cm)	75 - 80%
1.5 inches (3.8 cm)	65 - 70%

Unable to save data or load firmware from USB flash drive:
Confirm the drive is not full. Verify the drive has FAT or FAT32 format. Firmware should be in the root directory.

"No Sensor" appears on the display~~:~~
Confirm that the probe block is securely plugged into the display.

Note: The meter does not read 100% in water because the soil moisture calibration equations were created to be most accurate in the volumetric water contents typically found in mineral soils.

Appendix 3: Updating Device Firmware

Firmware updates may be made available to add or improve the product features. The firmware can be updated using a USB flash drive. Firmware update files can be found on the Spectrum website.

1. Confirm the flash drive is compatible with the TDR meter:
   - File system must be FAT based.
   - Must not have security or password protection features.
   - File system cannot be compressed or part of a backup storage volume.
2. Copy the latest firmware update from your PC onto the root directory of flash drive. The file will not be seen by the meter if it is renamed or stored within a folder on the drive.
3. Power off the meter.
4. Remove the protective cap from the meter's USB port.
5. Insert the flash drive into the meter's USB port.
6. While pressing the **Delete** button, press and release the **On/Off/Back** button. The meter will beep.
7. Release the buttons. Note: The display screen will remain blank during the update process. The meter will beep a second time once the process has completed and then reboot to the logo screen. The new firmware will now be displayed below the Spectrum logo.
8. The display will alert the user if further updates are to be made and show a message when completed.
9. Remove the flash drive and replace the USB cover.

Appendix 4: Calibration

The FieldScout TDR is fully calibrated at the factory. Further calibration is not required nor recommended. The meter has internal calibrations for standard, sand, and high-clay soil types which will work for many soils. Each meter will have a small difference in how it responds to identical soil conditions. This can be due to air being introduced while measuring, bent probes, loose probes, sensor drift or component tolerances. The meter allows for adjustments to the calibration to account for these differences. Should the user prefer to perform the calibration; the following are required:

1. A clean glass or plastic container. The container must be at least 10cm (4”) wide and at least 5.08cm (2”) longer than the length of the TDR rods.
2. A sufficient volume of unused distilled or de-ionized water to fill the above container. **Note: Tap water cannot be substituted**.

Procedure:

1. Pour all of the distilled/deionized water into the container. The water level must be deeper than the rods currently installed. Note: The water and container must be free of minerals and salts to calibrate properly.
2. From the Settings Menu (p. 8), set the rod length to the correct length of the rods currently installed.
3. From the Settings Menu, choose the Calibration option.
4. Press the **Select** button to initiate the calibration process. Follow the display messages.
5. While keeping objects and personnel clear from the area; raise the meter so the rods are in the air. Press the **Menu/Select** button and wait until the meter indicates it is ready.
6. Immerse the rods completely in the deionized or distilled water till the sensor base is in contact with the liquid. Keep the sensor base and rods centered in the container.
7. Press the **Menu/Select** button and wait until the meter indicates it is ready.

The meter will then show that the calibration is complete for that specific rod length. If more than one rod size is being used, a calibration operation must be done for each rod length used.

Glossary

GNSS: Global Navigation Satellite System. Standard generic term for satellite navigation systems that provide autonomous geo-spatial positioning with global coverage. This term includes e.g. the GPS, GLONASS, Galileo, Beidou and other regional systems

WAAS: Wide Area Augmentation System. Air navigation aid developed by the Federal Aviation Administration to augment the Global Positioning System (GPS), with the goal of improving its accuracy, integrity, and availability.

EGNOS: European Geostationary Navigation Overlay Service. Pan-European satellite navigation system. It augments the US GPS satellite navigation system and makes it suitable for safety critical applications.

VWC: Volumetric Water Content. The percent of the soil volume that is filled with water. At saturation, the VWC will equal the soil porosity.

EC: Electrical Conductivity. A measure of how well the soil solution conducts electricity. The EC is influenced by the amount of salt and water in the soil.

TDR: Time Domain Reflectometry. A technique for measuring soil moisture content that uses the fact that water has a much higher dielectric permittivity than air, soil minerals, and organic matter.

Warranty

This product is warranted to be free from defects in material or workmanship for one year from the date of purchase. During the warranty period Spectrum will, at its option, either repair or replace products that prove to be defective. This warranty does not cover damage due to improper installation or use, lightning, negligence, accident, or unauthorized modifications, or to incidental or consequential damages beyond the Spectrum product. Before returning a failed unit, you must obtain a Returned Materials Authorization (RMA) from Spectrum. Spectrum is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company.

DECLARATION OF CONFORMITY

Spectrum Technologies, Inc.
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Model Numbers:	6435
Description:	Portable Soil Moisture\Conductivity\Temperature Probe
Type:	Electrical Equipment for Measurement, Control, and Laboratory Use
Directive:	2004/30/EU
Standards:	EN 61326-2:2012
	EN 61000-6-1:2007
	EN 61000-6-3:2007+A1:2010
	ICES-003:2016; ITE Emissions for Canada (ANSI C63.4:2014)
	FCC Part 15:2016: Emissions for Unintentional Radiators for USA (ANSI C63.4:2014)
	EN 55032:2015

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