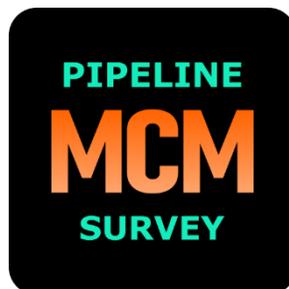


# M.C. Miller Android Pipeline Survey (PLS) Application User Guide



(rev 1.2 11-06-2023  
(Version 2.4.1)

# Contents

Introduction .....	3
□ Overview .....	3
□ Pipeline survey data.....	4
Initial Setup .....	5
□ Connection Diagrams.....	6
Android PLS Main Screen .....	8
□ Connecting A Voltmeter .....	8
□ Functions.....	10
□ Survey Data Collection Objects.....	11
□ Pipeline DCP/Feature/Location/Mode related buttons.....	14
□ Read/Start/Pause buttons .....	14
□ Flag related buttons.....	14
□ Survey Reading Graph .....	15
Android PLS Setup Process.....	15
□ New Survey Setup.....	18
Android PLS Survey Options.....	28
□ Survey Settings .....	28
□ View Settings .....	29
□ Voltmeter Settings.....	29
Android PLS Auxiliary Options.....	30
□ Voltmeter.....	30
□ Waveform .....	32
□ Pictures .....	35
□ GPS Data .....	37
□ Set Graph Scale .....	37
Android PLS Survey Modifications .....	38
□ Edit Survey Data.....	38
□ Delete Last Reading .....	41
□ Add Comments .....	41
Device and Feature Screens.....	42
□ Device button .....	42
□ Feature button.....	43
□ Device and Feature List Update.....	45
□ Devices & GeoFeatures Screen.....	46

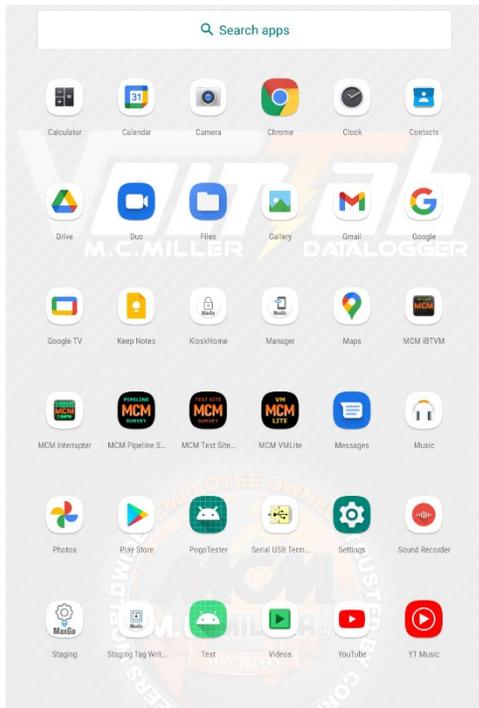
- PLS Survey Transfer to ProActive..... 47
- DCVG Survey Support..... 49
  - DCVG Survey Setup Screens ..... 49
  - DCVG Survey In Progress Screens..... 50
  - DCVG Survey Transfer to ProActive..... 52
- DCVG/CIS Combined Surveys..... 53
  - DCVG/CIS Survey Setup Screens..... 53
  - DCVG/CIS Survey In Progress Screens ..... 53
- Surface Potential Survey Support ..... 55
  - Surface Potential Survey Setup Screens ..... 56
  - Surface Potential Survey In Progress Screens ..... 57
  - Surface Potential Survey Transfer to ProActive ..... 58
- Android PLS Exception Screens..... 59
  - Flag Error..... 59
  - Far/Near Error..... 60
- NOTES..... 61

# Introduction

The Pipeline Survey Android tablet application is used in conjunction with an M. C. Miller voltmeter, either a VADER or a VoltTab. The VADER unit consists of an integrated digital voltmeter and an integrated WAAS-enabled submeter GPS receiver. The VoltTab is a combination of an Android tablet and a direct connect digital voltmeter. The Android PLS app takes advantage of the tablet camera functions to provide this type of survey support if needed.

The MCM Pipeline Survey application will execute on most Android tablet brands executing on the latest version of Android operating system software. The VADER unit is licensed from M. C. Miller Co. and when used with the MCM Android Pipeline Survey (PLS) application, it is detected and connected to the PLS app via WPAN connection.

Pipeline survey data collected via the Android PLS Data-logger app can be transferred to either a M. C. Miller ProActive PC-based application or to the M. C. Miller Android-ESD PC-based application.



## Tablet

- Apps
  - Pipeline Survey
  - Test Site Survey
  - VM Lite
  - iBTVM

## VoltTab

- Direct Connect Voltmeter
- Submeter GPS

## VADER

- WPAN Voltmeter
- Submeter GPS

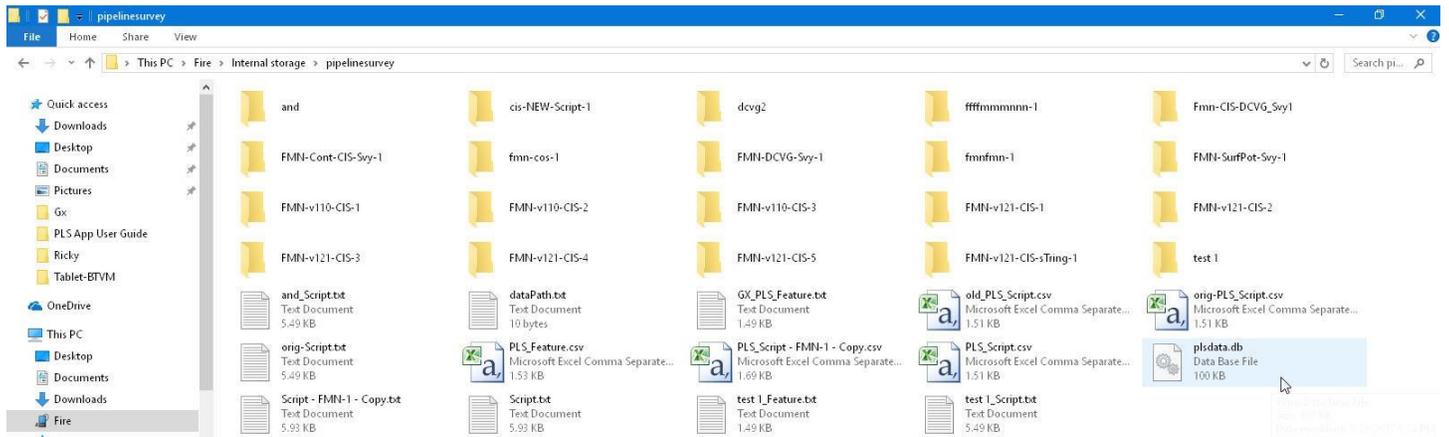
## □ Overview

The purpose of the Android Pipeline Survey (PLS) app is to collect voltage data related to the monitoring of the corrosion protection status of underground steel pipelines. The function of the Android PLS app will include all of the

functionality of the M. C. Miller Gx Data-logger PLS app with the exceptions noted later in this document. Several types of surveys can be performed. For all of the survey types, the operator will walk along the pipeline recording voltages measured at regular intervals. The PLS app will record the voltage values and the location of the reading along the pipeline. Additional supplemental data can also be recorded. The types of voltage values recorded differ by the type of voltage measurement selected and the method used to trigger the measurements. The survey types that can be performed by the PLS app are **Continuous CIS, Trigger CIS, DCVG, DCVG/CIS** and **Surface Potential**. Detailed information about the survey types and how they are performed can be found in the CIS, DCVG and Surface Potential training manuals using a M. C. Miller Gx Data-logger. The user interface for the Android PLS app is similar to the M. C. Miller Gx Data-logger user interface. Slight changes to the user interface for the Android PLS app are mainly due to the difference in screen size and tablet characteristics.

## □ Pipeline survey data

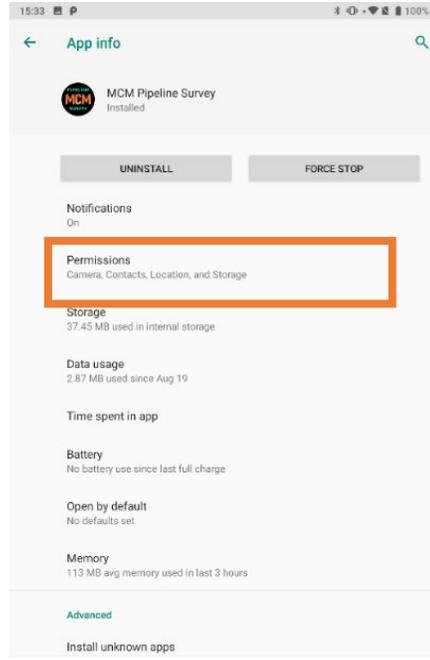
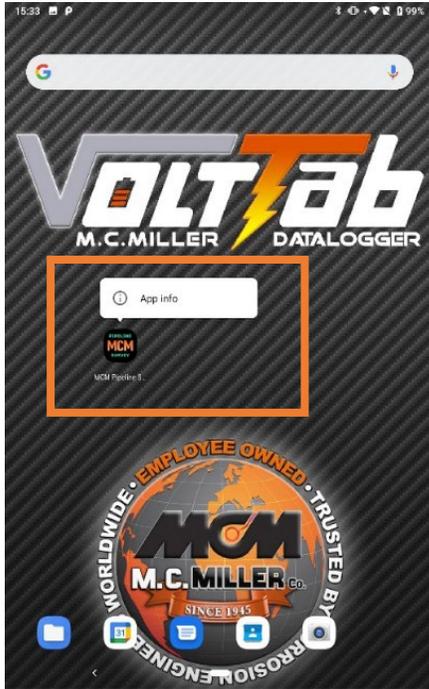
**Pipeline survey data** is in the **pipelinesurvey** folder on your Android tablet. The **survey readings data** and **waveforms** for a survey are in the **plsdata.db** SQL database. Folders having the same name as the name specified for a pipeline survey are created in the **pipelinesurvey** folder for the purpose of containing **pictures/photos** that may have been taken during a survey,



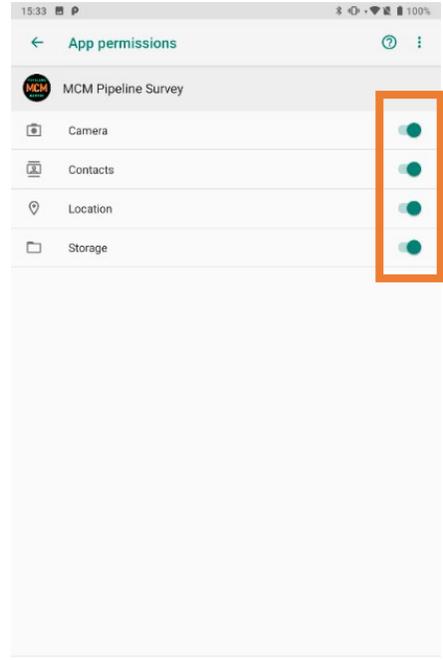
## Initial Setup

When the app is launched for the first time, it should prompt you to grant the necessary permissions such as Storage and Location. A common source of malfunction is these permissions not being granted. To ensure proper functionality, you should check that all the permissions listed in the tablet's settings for this app are granted.

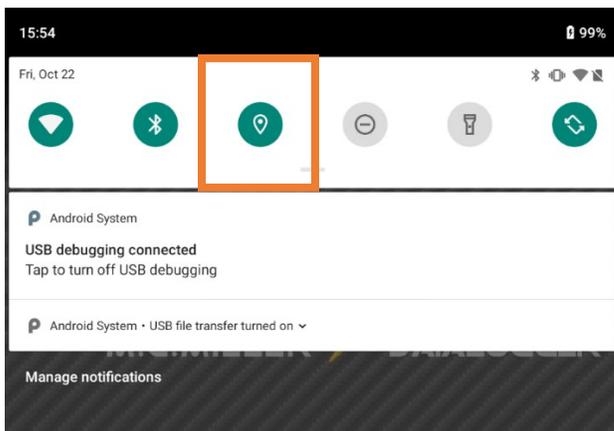
Long press icon and tap "App Info" Go to "Permissions"



Enable all listed permissions



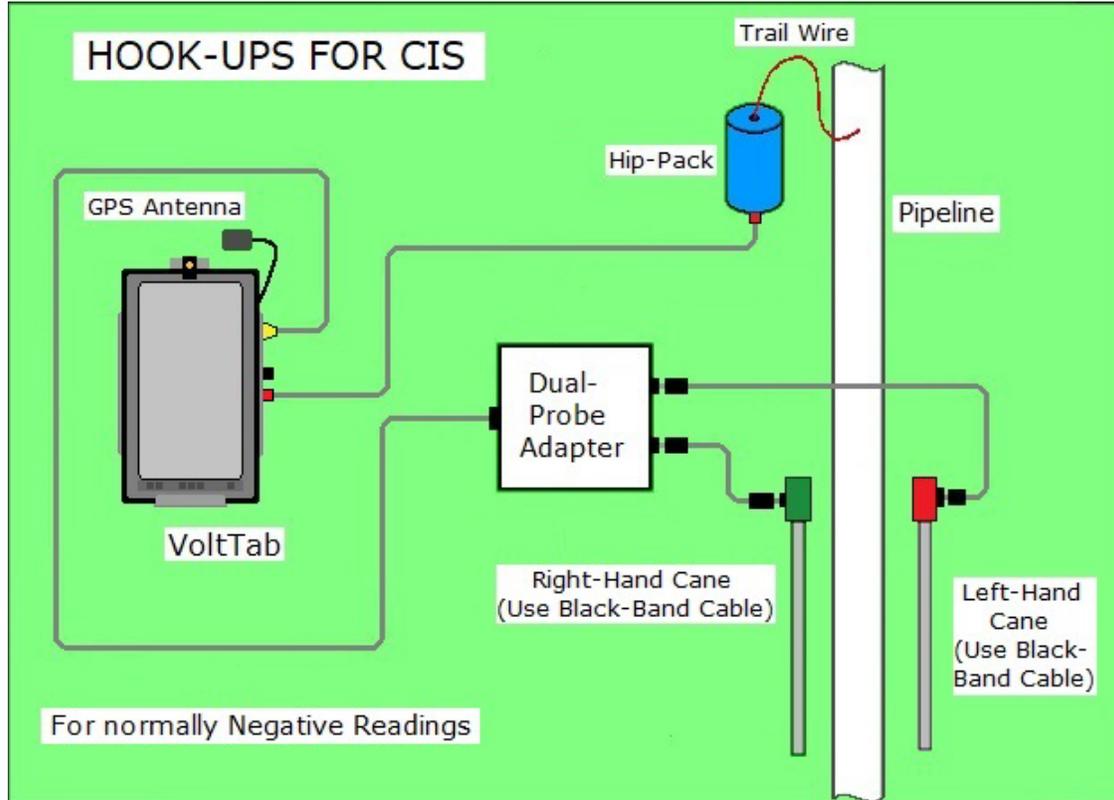
In addition to granting the permissions, some WPAN functions require that Location is turned on. Not turning on Location may prevent the app from finding your VADER.



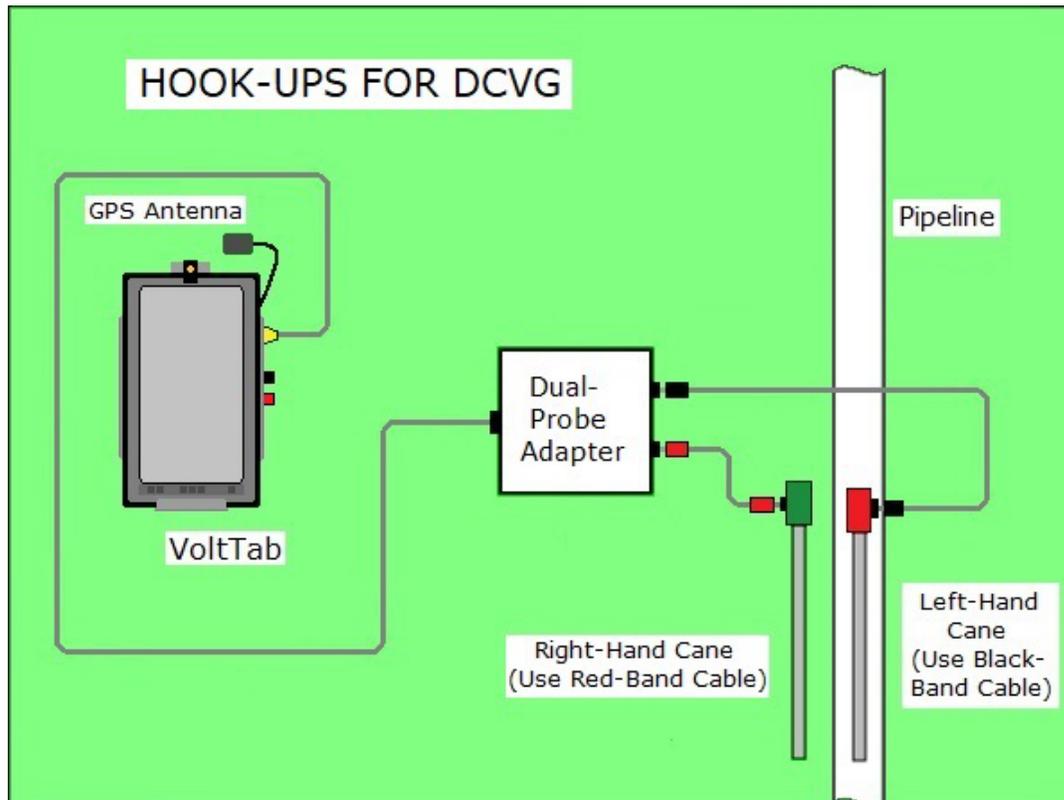
## □ [Connection Diagrams](#)

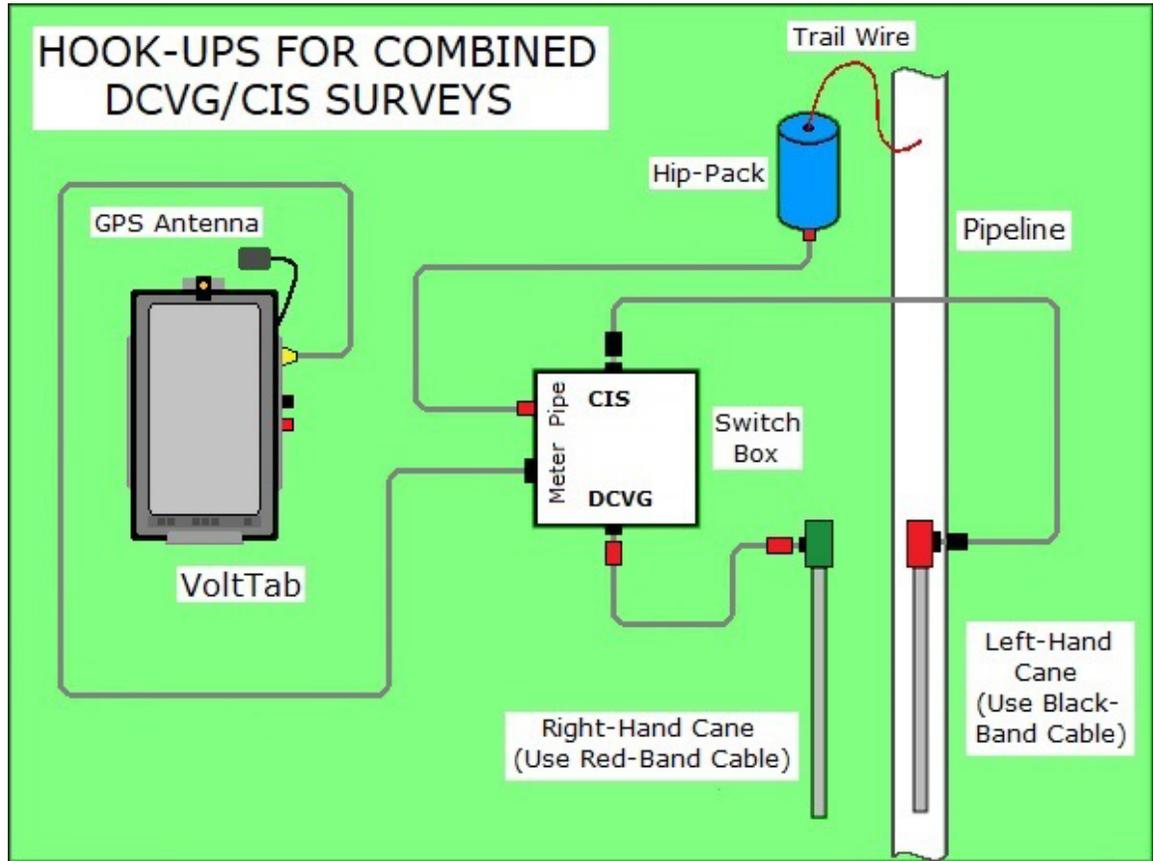
Pictured below are the connection diagrams for specific survey types. The voltmeter depicted is a VoltTab, but the connections for a VADER would be identical.

### CIS

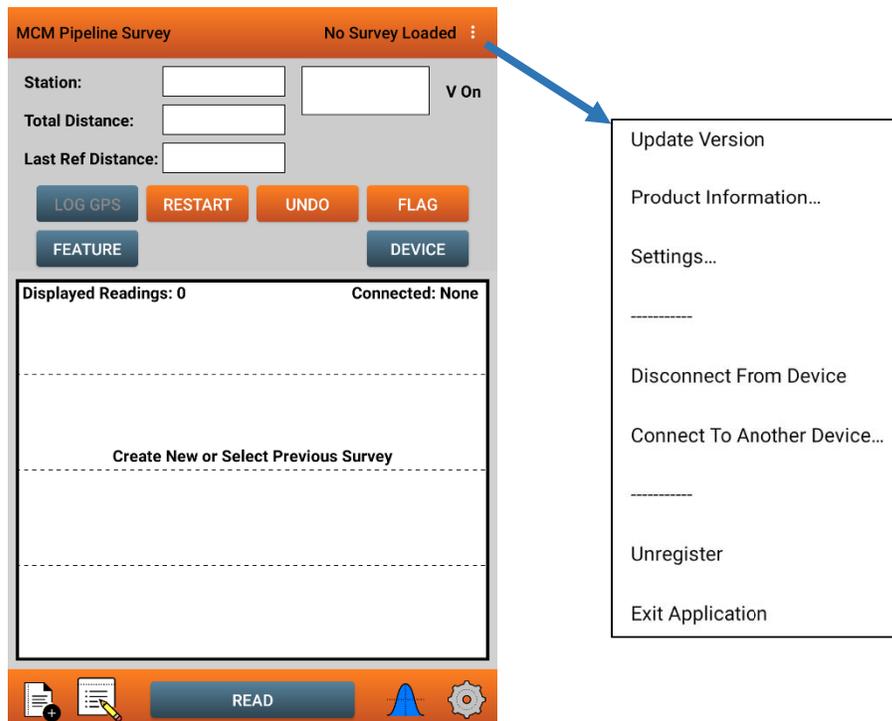


### DCVG and Surface Potential





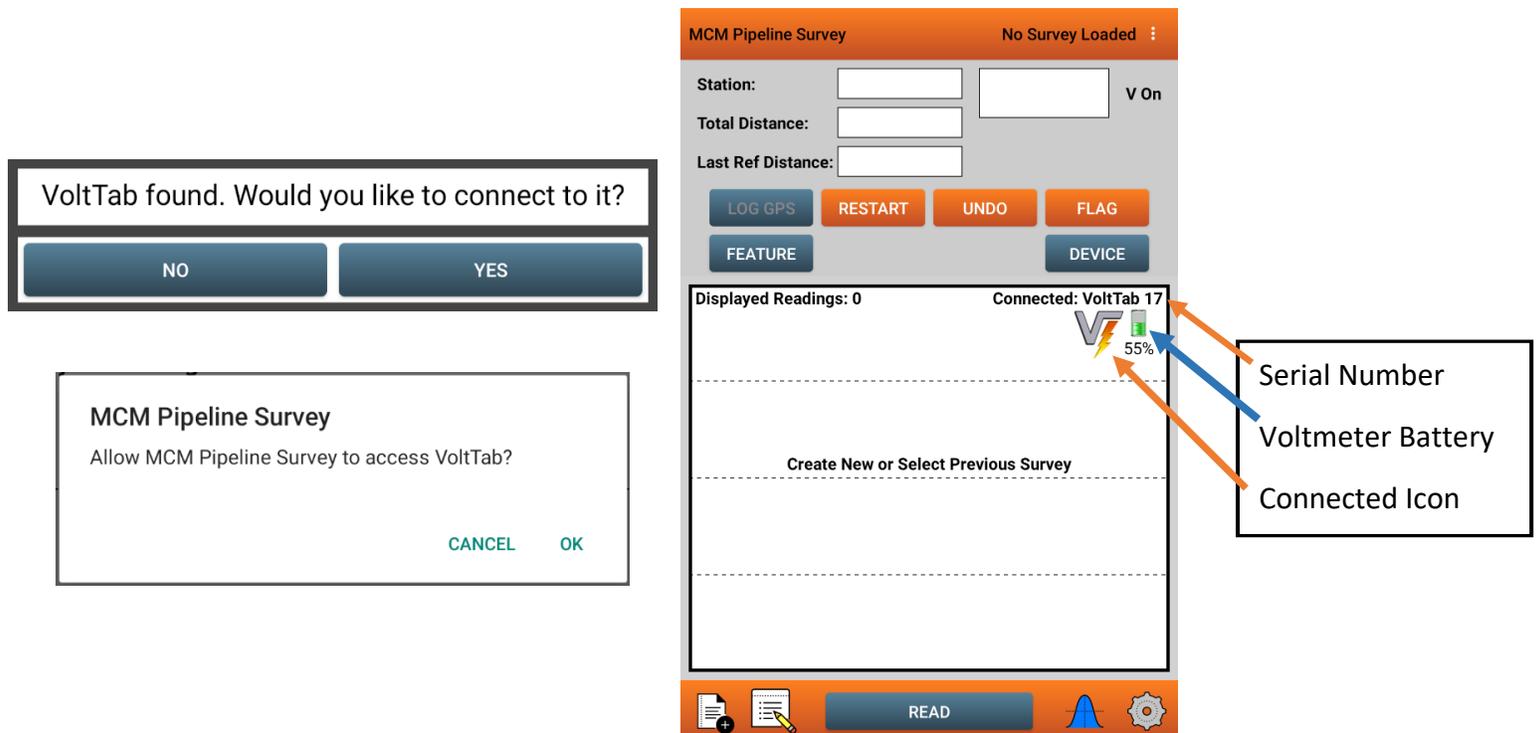
# Android PLS Main Screen



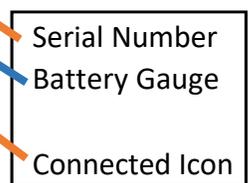
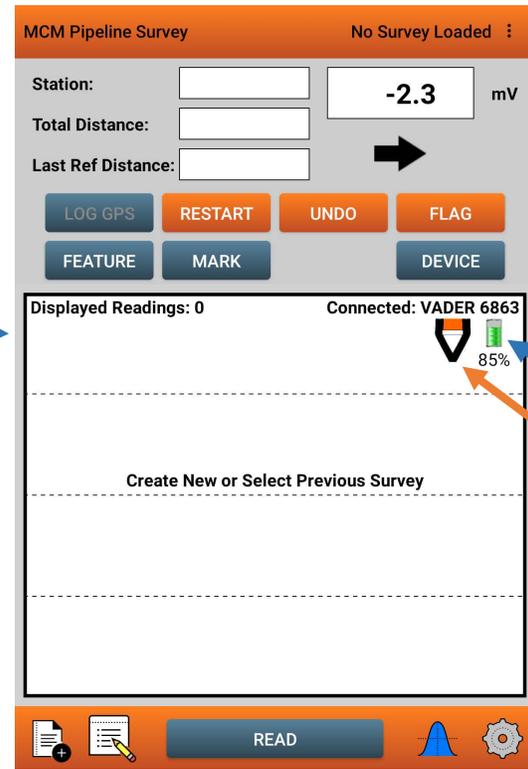
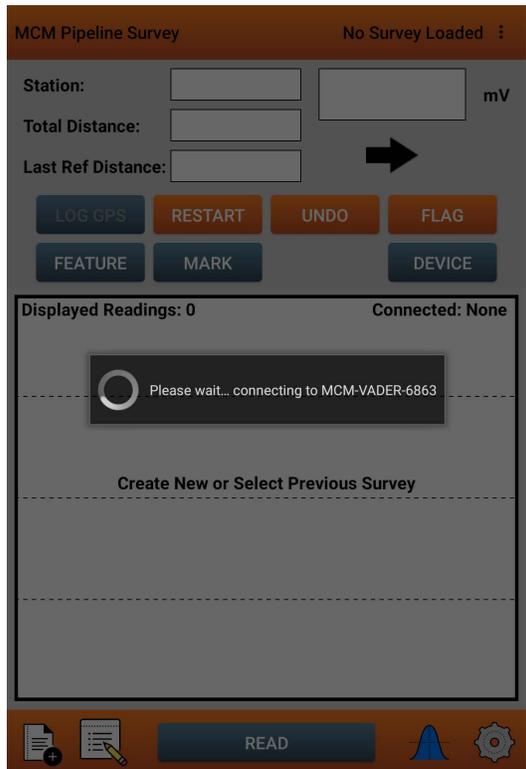
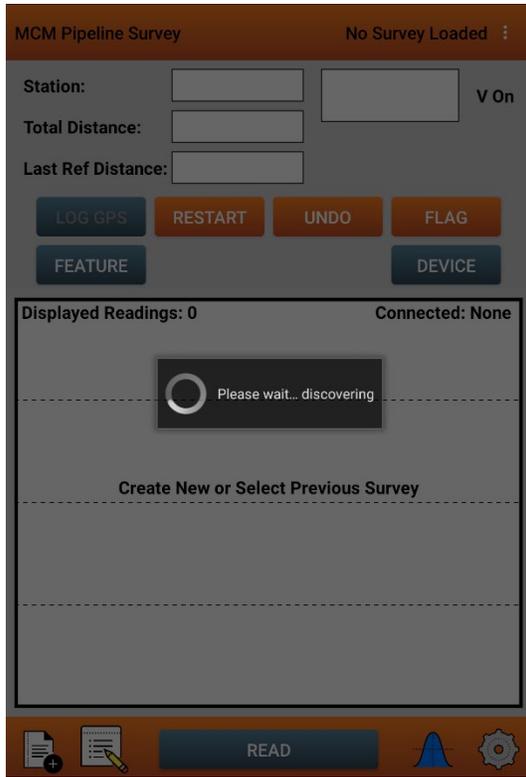
An **Android app menu** is provided (3 vertically stacked dots) that can be used to check PLS app information and connection options.

## □ Connecting A Voltmeter

To connect a voltmeter, tap on “**Connect To Another Device**” in the app menu (shown above). The app first looks for a **VoltTab**, and if one is physically connected, it will turn it on and ask to connect to it. If you choose yes, Android will then ask to allow the app to access the VoltTab. Once you allow it to do so, the app will connect to the VoltTab.



If you choose not to connect to a VoltTab, are already connected to a VoltTab, or if the app did not find one, it will proceed to search for **VADER voltmeters**. This will take roughly 20 to 30 seconds before displaying a popup listing the **discovered devices**. Tap on one of the items listed to connect to it.

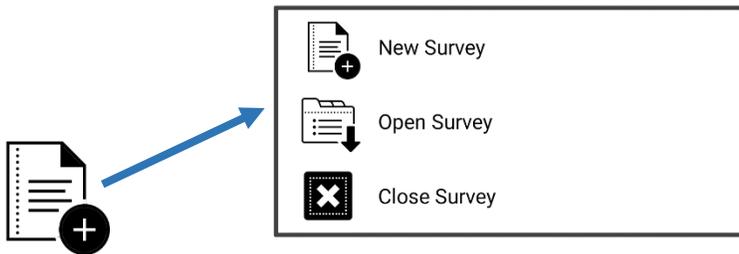


## □ **Functions**

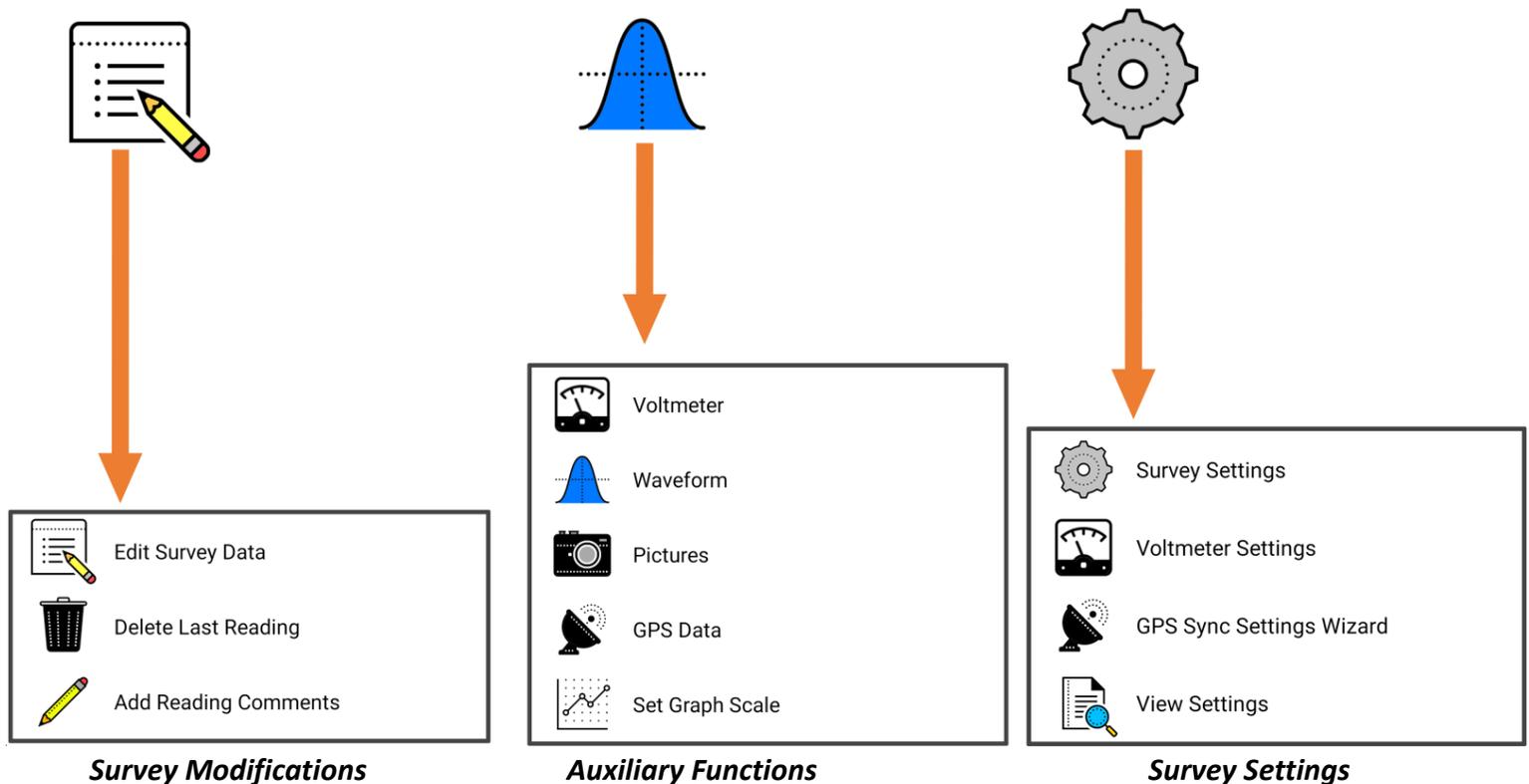
The PLS app shows a main **Function** menu bar at the bottom of the screen. The button selections provide access to **subfunctions** that may be used during certain survey events.



- The first button in this section of the screen is the **Surveys** button . Here, you can define a **new** survey, **continue or open** an existing survey, or **suspend or close** the survey currently in process...



- The next set of buttons are (**survey data modification**) , (**auxiliary functions**) , and (**survey options**) . They provide access to functions to **view or modify** data that relates to the current survey in process or to select **auxiliary** functions that can be used in situations encountered during a survey without affecting the current survey data or setups.



### Survey Modifications

- **Edit Survey Data:** Modify current survey data on a limited basis
- **Delete Last Reading:** Deletes the most recent reading taken for the current survey
- **Add Comments:** Can add a comment to the most recent reading taken for the current survey.

### Auxiliary Functions

- **Voltmeter:** Voltmeter Screen, to take a voltage/current reading
- **Waveform:** Waveform Screen, to take or review a survey waveform
- **Pictures:** Pictures Screen, to take or review a survey picture
- **GPS Data:** View current GPS data
- **Set Graph Scale:** Modify **Graph Area** y axis (vertical left side) scale Range to specific values

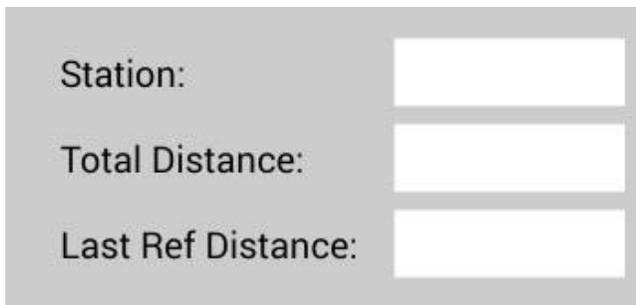
### Survey Settings

- **Survey Settings:** Shows the current survey settings via the 5 setup screens, **some of which can be modified**
- **Voltmeter Settings:** Voltmeter Settings for the current survey, **can be modified**
- **GPS Sync Settings Wizard:** Designed to help users sync their Voltmeter to their GPS Synced interrupter.
- **View Settings:** Shows the settings for the current survey, **not modifiable**

## □ [Survey Data Collection Objects](#)

The PLS Main Screen contains buttons and fields related to logging and viewing pipeline survey data. The buttons that are used to log survey related data are indicated by a **dark** color... buttons that are indicated by an **orange** color are used to **adjust Flag** related data (if used). **Data fields** are provided to show survey location and survey data... An area shown as a **whitespace** section will show in graphical format the progress of the survey and **actions taken** during the last 100 readings (may be more or less depending on screen size). The following describes the areas of the PLS Main screen.

- [Location data](#) consisting of:



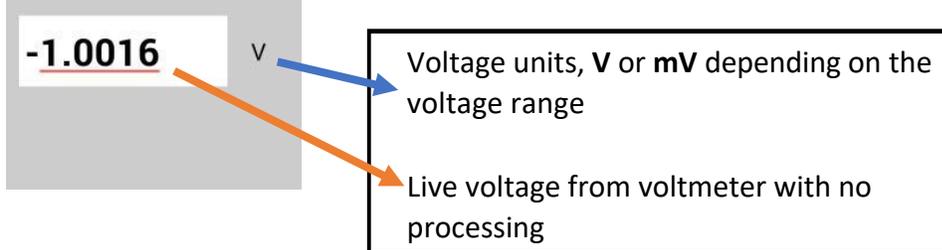
The image shows a grey rectangular area containing three rows of text and input fields. The first row is labeled 'Station:' followed by a white rectangular input field. The second row is labeled 'Total Distance:' followed by a white rectangular input field. The third row is labeled 'Last Ref Distance:' followed by a white rectangular input field.

- **Station:** The current survey location. The value shown is relative to the start of the pipeline survey as entered via the **Survey Setup 3** screen **Location Value** field. This value can be expressed as miles, feet or **Station Number** format or if metric units are being used, as kilometers, meters, or **Station Number** format.
- **Total Distance:** The current distance surveyed in the survey file. It is always expressed in feet or meters.
- **Last Ref Distance:** The survey distance since the last location reference point (**Survey Flag or Known Station**).

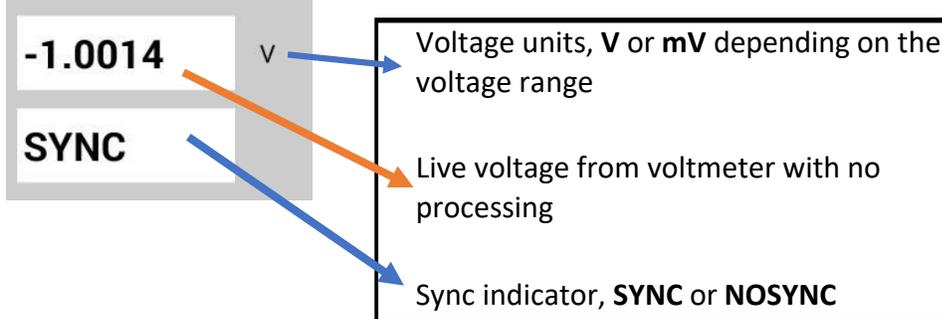
- [Voltage data](#) is shown in 2 fields that may vary depending on the type of survey and reading mode:



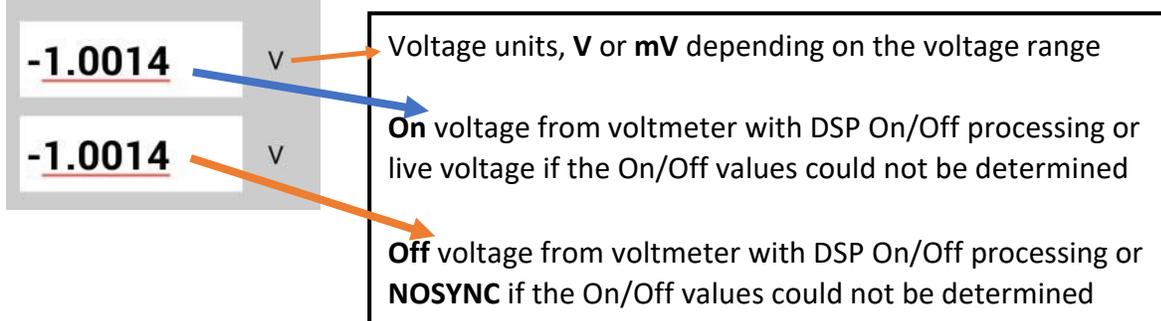
- **CIS, Single Read Mode**



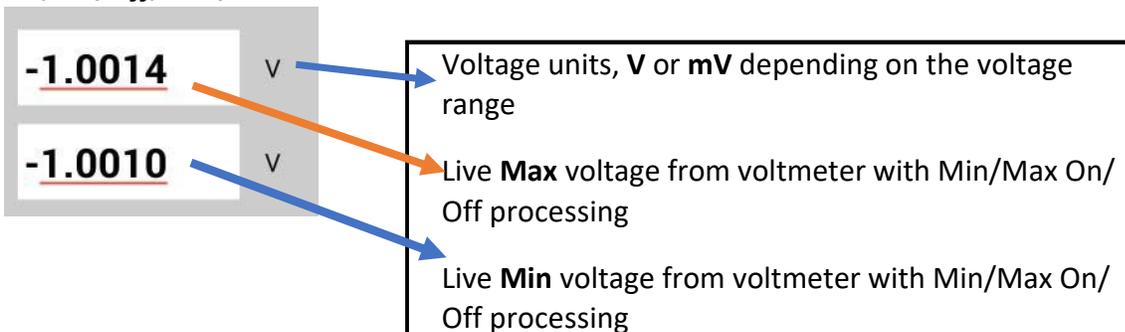
- **CIS, Single Read GPS Sync Mode**



- **CIS, On/Off DSP Mode**



- **CIS, On/Off, Min/Max Mode**



○ *CIS, On/Off GPS Sync Mode*



Voltage units, **V** or **mV** depending on the voltage range

Voltage from voltmeter recorded during **On cycle** after programmed **delay** with no processing or **live** voltage if not synced

Voltage from voltmeter recorded during **Off cycle** after programmed **delay** with no processing or **NOSYNC** if not synced

○ *DCVG*

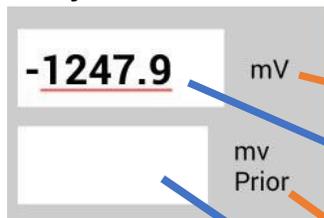


Voltage units as **mV**

Live **DCVG gradient** voltage from voltmeter or **NOSYNC** if not synced

DCVG current **direction indicator**. Arrow points **right** if voltage is **negative** and **left** if voltage is **positive**

○ *Surface Potential*



Voltage units, **V** or **mV** depending on the voltage range

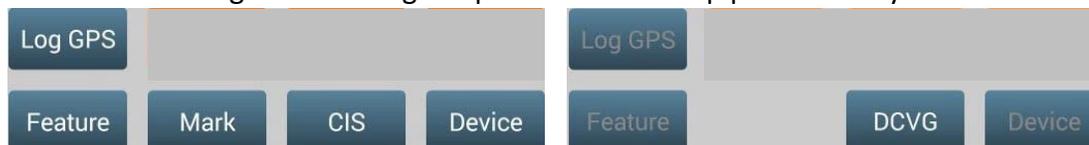
Live voltage from voltmeter with no processing

**Prior** label and voltage units, **V** or **mV**, depending on the voltage range

The **Prior** logged reading voltage.

## □ Pipeline DCP/Feature/Location/Mode related buttons

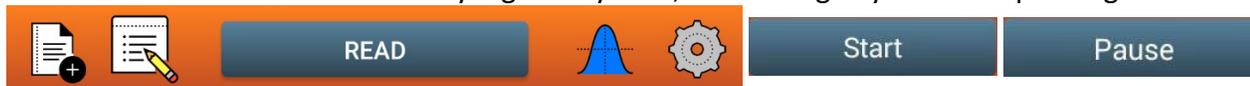
These buttons are used to log DCP (Data Collection Point) readings, Features encountered, GPS location values or to set a reading mode during the performance of a pipeline survey.



- **Feature:** Shows the Feature screen; select a geo-feature that is currently detected while doing the survey. Allows for distance modification.
- **Device:** Shows the Device Reading screen; select a currently detected DCP (Device Collection Point) for the purpose of naming, specifying an exact location, and taking a reading.
- **Log GPS:** Records the current GPS position and associates the GPS data with the last logged reading.
- **CIS/DCVG:** Shown only in CIS/DCVG Combined surveys, toggles the display between CIS and DCVG modes. This allows the user to take the specific part of the combination readings manually.
- **Mark:** Shown only in DCVG, CIS/DCVG Combined, and Surface Potential surveys, shows the Mark DCVG Anomaly screen or the Surface Potential Side Drain screen.

## □ Read/Start/Pause buttons

These buttons are used to manually log survey data, over-riding any cane setup configuration.



- **Read/Start/Pause:** **Read** logs a survey reading in all survey types except Continuous CIS. **Start/Pause** toggles readings on and off in Continuous CIS.

## □ Flag related buttons

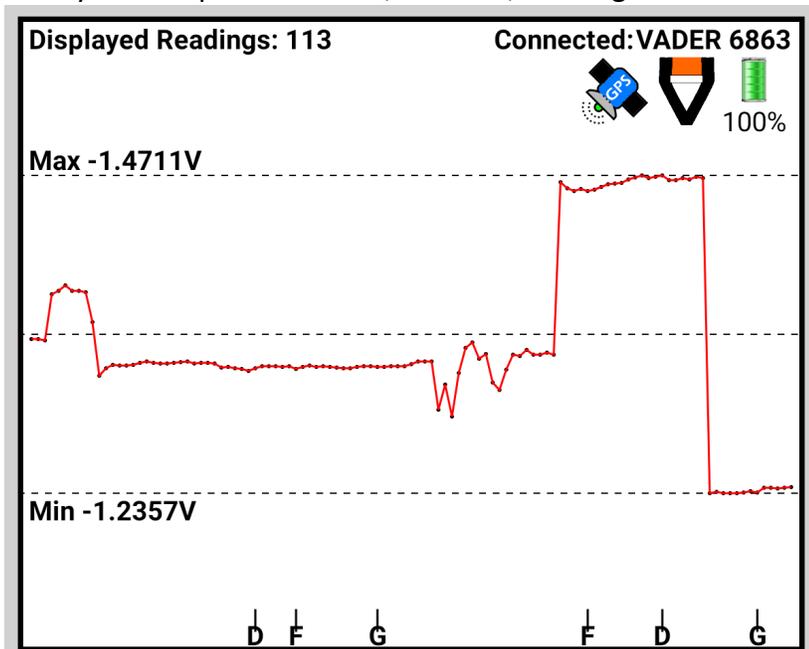
These buttons are used to set/reset the current location as the starting point for the next series of Survey Flags.



- **Restart:** Restart next series of survey Flags based on the current survey location.
- **Undo Flag:** Reverts the survey changes caused by the most recent Survey Flag.
- **Flag:** A Flag location has been identified; performs a Survey Flag location adjustment.

## □ Survey Reading Graph

This section of the PLS Main screen displays the progress of the pipeline survey and depicts points along the survey where specific devices, features, and flags were encountered...



- Displays a line graph of the last **100** survey readings (may be more or less depending on screen size).
- For Single Read CIS, DCVG and Surface Potential there is a single trace. For On/Off CIS there are two traces (ON and OFF).
- Normally the **Y** axis auto scales, but the user can manually set the **Y** scale using the **Auxiliary** Function Group:

### **Set Graph Scale.**

- When auto scaling; if the data point in the graph with the highest absolute value is negative, the **Y** scale will be inverse (negative up/positive down).
- Single letter labels are using to show locations of
  - Survey Flags, “**F**”
  - Geo-Features, “**G**”
  - Device Readings, “**D**”
  - Marked DCVG or Surface Anomalies, “**M**”

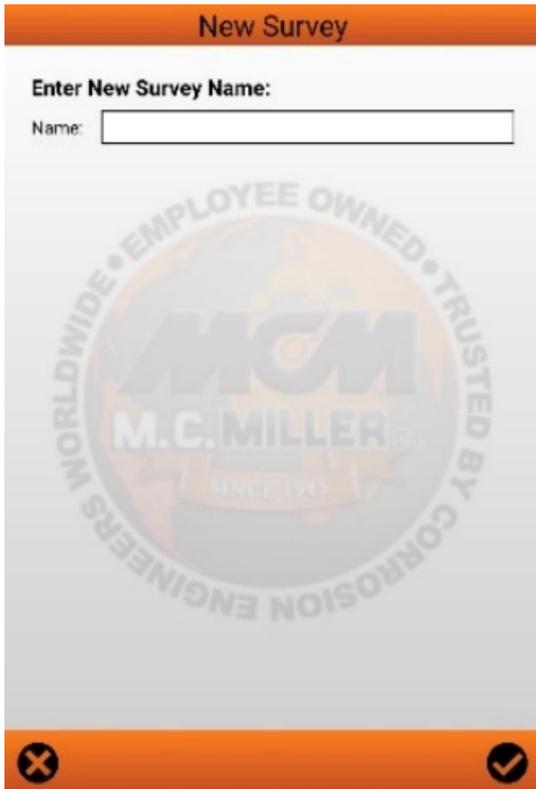
## Android PLS Setup Process

The following section describes the screens and their related functions that are referenced from the PLS Main screen and used to setup, view, or modify a pipeline survey.

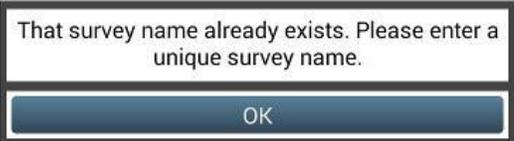
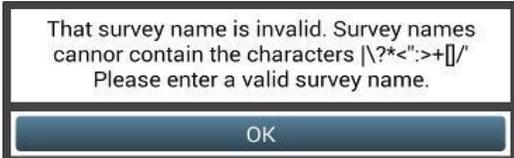


From the **Surveys** button you can select to setup a **New Survey**, continue an existing survey, or exit a current active survey...

## New Survey



The **New Survey** screen prompts the user to enter the survey filename. If the entered survey name is not a valid file name, the user will be notified and prompted to enter a valid name. If the entered survey name already exists, the user will be notified to provide a unique name.



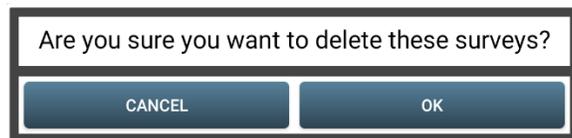
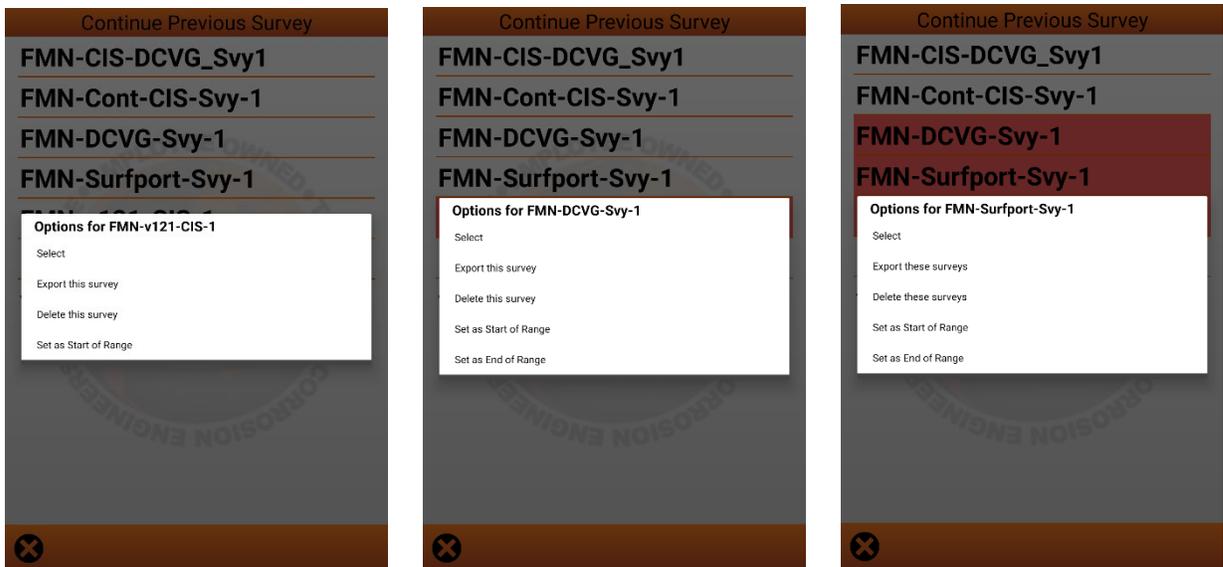
## Open Survey



The **Continue Previous** Survey screen lists the surveys on the Android PLS data logger in alphabetical order and allows the user to select a survey to open.

From the **Continue Previous Survey** screen, you will be able to long press on a survey to bring up a menu with more options. In this menu, you will be able to:

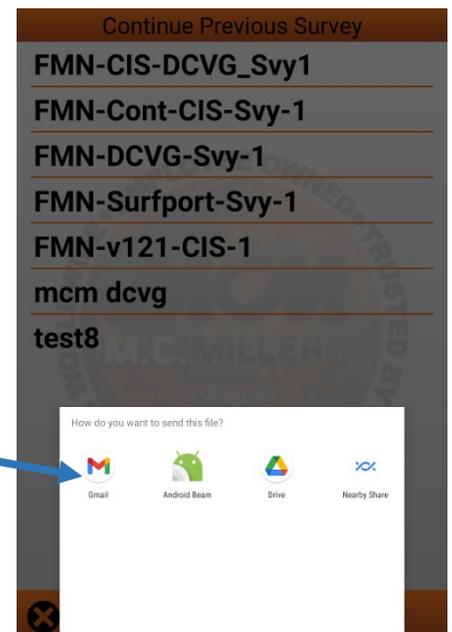
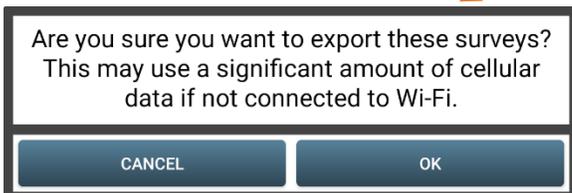
- **Select** which will open the survey and let you review the data and continue data collection.
- **Export** the survey(s) which will extract all the data from the database specific to that survey, place it in a “.db1” file, and give you the option of uploading/sending it somewhere such as your email. (This feature was added to give users another way to import data into Android ESD or ProActive since Android 11 prevents these programs from extracting the data themselves).
- **Delete** the survey(s).
- **Set as Start of Range** which will highlight the survey and allow selection of multiple surveys for the purpose of exporting or deleting more than one survey at a time.
- **Set as End of Range** (available after setting a “start of range”) which will highlight all the surveys between the current selection and the survey set as the “start of range”. Once a range of surveys is highlighted, long pressing anywhere in the range will give you the option to export or delete the entire range.



Confirmation prompt for deleting surveys.

Confirmation prompt for exporting surveys.

System file share interface



## Close Survey

MCM Pipeline Survey No Survey Loaded

Station:   V On

Total Distance:

Last Ref Distance:

LOG GPS RESTART UNDO FLAG

FEATURE DEVICE

Displayed Readings: 0 Connected: None

Create New or Select Previous Survey

READ

A '**Close Survey**' selection will close the current survey immediately. The '**Main Screen**' will revert back to a 'null' presentation.

## □ New Survey Setup

### New Survey Settings:

The survey settings are split across 5 setup screens. On some screens the visible fields will vary depending on the survey type being setup and certain prior settings. These variations will be noted in the individual screen descriptions. The **setup screens 1-5 are shown in sequence when creating a new survey** and will be so noted in the screen header. Note the variation in visible fields when **GPS Sync** is selected from the options related to the Setup 5 screen.

### Survey Setup 1 of 5

Survey Type:  >>

Rectifier Mode:  >>

Cane Button(s) Allowed To:

Device:

None  Save

Survey Red:

Flag  Read

Survey Green:

Flag  Read

Survey Locations:

Increasing  Decreasing

Use Digital Trigger Cable

Enable DCVG Sidedrains in CIS Surveys

Use Metric

### Survey Types

Continuous CIS

Trigger CIS

DCVG

DCVG/CIS

Surface Potential

CANCEL SELECT

### Rectifier Modes

Cycle On/Off

Always On

Always Off

CANCEL SELECT

### Survey Setup 2 of 5

GPS:  None  Internal  MCMiller

Application:  Best Effort ?  Required ?

Auto Log GPS:  >>

Max PDOP:  >>

A.C. Cycle:  60 Hz  50 Hz

Max Near/Far Diff:  %

Low Voltage Alarm:  V  
(9999 = Disable Alarm)

Use GPS for Altitude

Log GPS:  At Flags  At DCP/Feature

### Auto Log GPS

Never

Every Reading

Every 2 Readings

Every 5 Readings

Every 10 Readings

CANCEL SELECT

### Maximum PDOP

0.5

1.0

1.5

2.0

2.5

3.0

3.5

4.0

4.5

5.0

5.5

6.0

6.5

7.0

7.5

CANCEL SELECT

### Survey Setup 3 of 5

Name of Pipeline:

Pipeline Section:

Survey Location:

Location Values:

Station Number  >>

Distance Between Flags:  ft

Distance Per Reading:  ft

Flag Error Limit:

Auto Pacing Mode

Data Probes:  One  Two

### Values Displayed

Station Number

Feet

Milepost

CANCEL SELECT

### Survey Setup 4 of 5

Work Order:

Technician Name:

Comments/Description:

Survey Name:

Survey Date:

### Read Modes

Single Read

On/Off (DSP)

On/Off (Min/Max)

On/Off (GPS Sync)

Single GPS Sync

CANCEL SELECT

### Survey Setup 5 of 5

Reading Mode:  >>

Range:  >>

Cycle:  On (mSec)  Off (mSec)

Delay:  On (mSec)  Off (mSec)

### Ranges

40 mVDC 10 MOhm

400 mVDC 10 MOhm

5.7 VDC 400 MOhm

40 VDC 75 MOhm

57 VDC 75 MOhm

57 VDC 400 MOhm

400 VDC 75 MOhm

570 VDC 75 MOhm

40 VAC, 75 MOhm

400 VAC, 75 MOhm

CANCEL SELECT

### Survey Setup 5 of 5

Reading Mode:  >>

Range:  >>

Cycle:  On (mSec)  Off (mSec)

Delay:  On (mSec)  Off (mSec)

Cycle Beginning:  ON  ON => OFF

Start Date:  Time (24hr):

Enable GPS Leap Second Edit

GPS Leap Seconds:

You should only change GPS leap second value when notified by M.C. Miller that a change is required. See www.mcmiller.com for more info.

**Survey Setup 5 of 5 On/Off (GPS Sync) Additional Fields**

- GPS Leap Seconds** field will show a value that will initially contain the correct value (for year 2018, this value is 18). Subsequent years may require a new value to be entered; MCMiller will notify users of any change to this value.

If so, check the **Enable GPS Leap Second Edit** checkbox and modify **GPS Leap Seconds** field to correct value.

## Survey Setup 1 of 5

**Survey Setup 1 of 5**

Survey Type: Trigger CIS >>

Rectifier Mode: Cycle On/Off >>

Cane Button(s) Allowed To:

Device:  
 None  Save

Survey Red:  
 Flag  Read

Survey Green:  
 Flag  Read

Survey Locations:  
 Increasing  Decreasing

Use Digital Trigger Cable  
 Enable DCVG Sidedrains in CIS Surveys  
 Use Metric

**Survey Types**

Continuous CIS  
Trigger CIS   
DCVG  
DCVG/CIS  
Surface Potential  
CANCEL SELECT

**Rectifier Modes**

Cycle On/Off   
Always On  
Always Off  
CANCEL SELECT

- The **Survey Type** is set when the survey is created and cannot be changed after that point. The **double arrow to the right** provides selection choices. See above for selection choices.
- The **Rectifier Mode** dropdown list is used to indicate the state of Pipeline Corrosion Protection being used during the survey. See above for selection choices. For **Surface Potential** surveys, **Cycle On/Off is not a valid selection**. For **DCVG** and **CIS/DCVG** combined surveys **Cycle On/Off is the only valid selection**.
- The **Cane Button(s) Allowed To:** section is used to select the functions of the push buttons on the electrode canes (AKA data probes). The setting applies to both the left (red) and right (green) cane buttons.
  - The **Device** choice selects the function of the buttons for the **Device Reading** (AKA Data Collection Point) screen.
    - Selecting **None** means that no action will be taken when the push button is pressed. Tapping the **Read** button on the Main screen will log the survey reading.
    - Selecting **Save** means that the device reading will be saved when the push button is pressed.
  - The **Survey** choice selects the function of the buttons for the **Main Survey** screen. The **left (red)** and **right (green)** cane buttons can be set to the same function or to different functions. Depending on the Survey Type selected, the button choices can vary.
    - For a **Continuous CIS** survey, the function choices are **Flag** which marks a Survey Flag; and **Pause** which suspends the taking of a reading (**toggling between pausing and resuming the taking of readings**).
    - For **Trigger CIS**, **DCVG** and **Surface Potential** surveys the function choices are **Flag** which marks a Survey Flag; and **Read** which logs a survey reading.
    - For **DCVG/CIS** combined surveys the **right (green) cane button is not available** and the **only cane button function choice for the left (red) can button** is **Read** which logs a survey reading.
  - Your **Survey Location** selection of **Increasing** or **Decreasing** will depend on your walking direction over the pipe with respect to the pipe's stationing. You would select **Increasing** if the station number will be increasing as you perform the survey and you would select **Decreasing** if the station number will be decreasing as you perform the survey.
  - The **Survey Other** section provides survey choices that may be applicable to the Survey Type that was selected.

- The **Use Digital Trigger Cable** checkbox specifies that an automatic triggering cable is being used with the selected CIS survey. **Note:** with this specification, the **Distance Per Reading** field on the **Setup 3** screen should be set to 2.5 feet (or 1 meter), since the counter is calibrated for this distance.
- The **Enable DCVG Sidedrains in CIS Surveys** checkbox is shown only for **Continuous CIS** and **Trigger CIS** surveys. When checked the **Mark DCVG** device reading will be enabled.
- The **Soil Resistivity Distance Units** section is shown only for **Surface Potential** surveys. You will have the option to manually enter a value for soil resistivity measured at the location of a **marked SP** anomaly, which will allow the ProActive software to calculate a **Corrosion Factor** value. The units,  **$\Omega$ .cm** or  **$\Omega$ .m**, for **soil resistivity** that will appear on the SP anomaly **marking** screen for your manual data entry will depend on your selection here in the **Soil Resistivity Distance Units** field (**CM** or **M**)
- The **DCVG Anomaly Max mV = Tot mV 1st read** checkbox is only visible for DCVG and DCVG/CIS combined surveys. **If this box is checked**, the **Max mV voltage** recorded at an anomaly location **will automatically become the first voltage value used by the data-logger's software to calculate the Total mV (total voltage gradient)**. Otherwise, **if this box is un-checked**, you **will have to repeat the Max mV recording a second time as part of the Total mV determination process**.
- The **Use Metric** checkbox, if checked, sets the reading interval (distance between triggered readings) and the flag interval (survey flag spacing) to be displayed on the **Setup 3 of 5** screen in **meters**, as opposed to feet.

## [Survey Setup 2 of 5](#)

- The **GPS** selection shows a choice of which GPS **resident hardware** to use...
- **None** means that no GPS location data will be logged...
- **Internal** means that you have selected to use the GPS support in your Android tablet...
- **MCMiller** means you have selected to use the GPS support in the voltmeter, which has **sub-meter** support...
- The **Auto Log GPS** drop down list sets how often the GPS position will be included in the data when a **survey reading** is logged. The choices will be:
- **Never**, meaning that GPS location data will not be logged when a survey reading is logged.

- **Every Reading**, every survey reading will also have its GPS location data logged.
- **Every 2 Readings**, every 2<sup>nd</sup> survey reading will also have its GPS location data logged.
- **Every 5 Readings**, every 5th survey reading will also have its GPS location data logged.
- **Every 10 Readings**, every 10th survey reading will also have its GPS location data logged.
- The **Max PDOP** value can be set from a **low of 0.5** to a **high of 10.0** in increments of 0.5 ... **PDOP** is a value indicating the **relative accuracy of the GPS data**. The lower the PDOP the higher the accuracy. The **Max PDOP is just a warning value**. The operator is alerted if the PDOP is higher than the Max PDOP setting.
- The **AC Cycle** choices are 60 Hz and 50 Hz. Select 60Hz for all U.S. applications. This is an important selection with regard to the AC filtering system that's applied to all of the DC voltage channels.
- The **Max. Far/Near Diff** value controls a **reconnect alarm** for CIS surveys. The value is the maximum allowable Percent difference between the **Reconnect – Far Ground** device reading and the **Reconnect – Near Ground** device reading. If the difference is greater than the limit, the **Far/Near ground reading Error** will be shown. This setting is only visible for Continuous CIS, Trigger CIS and DCVG/CIS combined surveys.
- The **Low Voltage Alarm** value controls an audible voltage alarm for CIS surveys. A value of **9999** disables the alarm. If a negative value is entered the alarm would sound when the survey voltage is less negative than the alarm setting. For example, if the alarm value is **-0.850** volts, then a survey voltage of **-0.7 volts would trigger** the alarm and a survey voltage value of **-0.9 volts would not trigger** the alarm. This setting is only visible for Continuous CIS, Trigger CIS, and DCVG/CIS combined surveys.
- The **Use GPS for Altitude** checkbox, if checked, will log **altitude data** in addition to the Lat/Long data whenever GPS data are logged. (Note: Altitude data on some GPS units are not particularly accurate).
- The **Log GPS**: selection checkboxes specifies whether GPS data is to be logged automatically **At Flags** and/or **At DCP/Features** when encountered...
- **At Flags** specifies that GPS data will be logged automatically at survey flags when either the flag button is tapped (directly on the Survey Main screen) or when the push-button switch on the designated **flag cane** is pressed.
- **At DCP/Feature** specifies that GPS data will be logged automatically when a **Device** button is **tapped** on the Survey Main screen and a **Device reading** is logged. If the **Feature** button is tapped on the Survey Main screen and a **geo-feature** is registered.
- **At Side Drain/Anomaly** checkbox will be shown only for Surface Potential, DCVG and DCVG/CIS combined surveys. GPS data will be logged automatically for **marked** anomalies.
- If this box is checked, GPS data will be logged automatically when **SP** anomalies are **marked**.

## Survey Setup 3 of 5

Survey Setup 3 of 5

Name of Pipeline:

Pipeline Section:

Survey Location:

Location Values:  >>

Distance Between Flags:  ft

Distance Per Reading:  ft

Flag Error Limit:

Auto Pacing Mode

Data Probes:  One  Two

- Entering data for the **Name of Pipeline** and **Pipeline Section** is *optional* and any text data or no data will be accepted. These fields can be helpful when the pipeline survey is transferred to ProActive to identify where the survey was taken...
- **Survey Location:** During the initial survey setup, the **Survey Location** is the location for the **start of the survey** on a pipeline. It is entered when the survey is created and cannot be changed by the user after that point. The **Survey Location** can be the **actual pipeline location** for the start of the survey (if known) or it could be a **relative starting point** (0+00) of the survey. If it is a relative starting point, then the actual start of the survey can be determined when the survey is transferred to ProActive.

**NOTE:** When viewing this screen from the **Survey Settings**→**Survey Segment Settings** screen, the **Survey Location** field will show the current survey location of the survey and editing of the value is disabled. The location will be stored based on the setting of the **Use Metric** checkbox from the 1<sup>st</sup> setup screen. Feet if the **Use Metric** is unchecked or meters if checked.

- **Location Values:** A selection list to the right of **Location Values** controls how location values will be displayed.
  - **Station Number**, in the station number format the location value is displayed as the text value of the location in feet with a '+' inserted between the tens digit and the hundreds digit. For example, if the location in feet is 12345.6 then the station number format would be 123+45.6. If the feet value is less than 100 the leading zeros will be used as in 0+07.5. If using metric, the '+' goes between the hundreds digit and the thousands digit of the location in meters. For example, 12+345.6 meters, displayed to 1 place to the right of the decimal point (Meters if using metric)
  - **Milepost**, miles displayed to 4 places to the right of the decimal point (**Kilometers if using metric**).
  - **Feet**, feet will be displayed to 1 place to the right of the decimal point (**Meters if using metric**).
- **Distance Between Flags:** you can type in the survey flag interval (distance between survey flags) for the section of pipeline being measured, assuming that survey flags have been laid out. Typically, survey flags are located at 100 feet intervals. In such a case, you would have a new reference (a stationing correction) every 100 feet. **Note: If survey flags are not in use, enter zero in this field.** In this case, tapping accidentally on the Flag button will not adversely impact your stationing.
- **Distance Per Reading:** you can type in the interval distance, in feet (or meters), expected between readings. Typically, in CIS work this expected interval distance is 2.5 feet (or 1 meter). **Note:** 2.5 feet (or 1

meter) should be selected for the **Distance Per Reading** when readings are to be triggered using an automatic triggering cable, since the counter is calibrated for this distance.

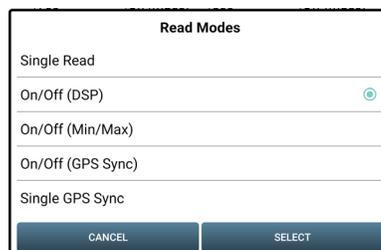
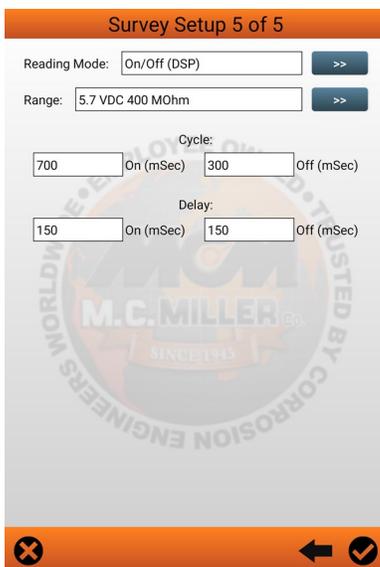
- **Flag Error Limit:** Is a percentage based on the maximum permissible error between the actual number of readings logged between 2 survey flags and the expected number of readings. For example, if the maximum permissible error is set to 20% in the **Flag Error Limit**... If the reading interval (Distance Per Reading) is expected to be 2.5 feet and the survey flag separation (Distance Between Flags) is 100 feet, this means that 40 readings are **expected**. If, however, only 30 readings are **actually** logged between survey flags, an error window will appear on the screen, since there is a 25% difference between the expected and actual number of readings in this example. No error window will appear if the difference is less than 20%. For this example, you could have a minimum of 32 readings and a maximum of 48 readings between survey flags to stay within the 20% (max.) error allowance.
- **Auto Pacing Mode:** This is *optional*... If the checkbox is checked, you would like the readings to be uniformly spaced between any two survey flags, regardless of the actual locations of the readings between the two flags. By checking the box labeled, **Auto Pacing Mode**, you will enable the data-logger to automatically adjust the reading locations in order to evenly-space the readings between two survey flags.
- **Data Probes:** In the case of the **Trigger CIS** mode, you can use one data-probe or two data-probes for the CIS. Highlight the appropriate radio button, based on your situation.
- **Auto Learn Read Rate:** This checkbox only appears for a **Continuous CIS** survey and is *optional*... In **Continuous CIS** mode, readings are logged based on timing. For example, if you indicate that you require 40 readings to be logged between 100 foot survey flags and that it will take you 60 seconds to walk 100 feet (**Time Between Flags**), the data-logger will log readings every 1.5 seconds. You can have the data-logger *learn* your walking pace, which might turn out to be different from **60 seconds for 100 feet**, by checking the box labeled **Auto Learn Read Rate**. In which case, the software will adjust the timing between logged readings accordingly in order to target 40 logged readings between 100 foot survey flags, in this example.
- **Time Between Flags:** field only appears for a **Continuous CIS** survey... It is an estimated value that represents the time in **seconds** that it will take to walk the distance that you specified for the **Distance Between Flags** field. **Note:** Pre-measured (equally spaced) survey flags are required for **Continuous CIS** and, if the pipeline does not run through an open area, extensive pausing may be required.

## Survey Setup 4 of 5



- **Work Order:** Enter the work order number associated with the survey, if known. (*optional*)
- **Technician Name:** Enter the name of the person performing the survey. (*optional*)
- **Comments/Descriptions:** You can enter any general comments you might have regarding the survey (perhaps weather conditions, soil conditions, special circumstance, etc.). (*optional*)
- **Survey Name:** This field is not modifiable. It shows the name of the survey that was specified at the time of the survey setup via **New Survey...**
- **Survey Date:** This field is not modifiable. It shows the date of the survey at the time of the survey setup via **New Survey** creation...

## Survey Setup 5 of 5



- The **Reading Mode** list shows the voltmeter reading processing types available for selection. Up to 5 choices are available for selection. Your selection of **reading mode** should be made with reference to your previous selection of **Rectifier Mode** from the **Setup 1** screen and **current-Interrupter Control** being used on the pipeline being surveyed.

- **Single Read:** This reading mode would be selected if you were performing a *non-interrupted CIS*, with either the rectifiers **ON** continuously [Always ON] or **OFF** continuously [*depolarized pipeline*].
- **On/Off (DSP):** This voltmeter mode would be selected if you were performing a *rectifier current interrupted CIS*. In this mode, the software uses *digital signal processing* (D.S.P.) to determine the voltage during the ON portion of the interruption cycle and the voltage during the OFF portion of the cycle, for each successive cycle. **Note:** A measurable difference between the ON and the OFF voltage readings is required for this reading mode, (i.e., a measurable IR drop is required). **Note:** In this reading mode, you do not have to concern yourself with selecting recording times for the On and Off readings, for each cycle, with respect to the On-to-Off transitions and the Off-to-On transitions of the waveform, as the software determines appropriate locations on the waveform for you. This is in contrast to the GPS Sync reading mode (see below).
- **On/Off (Min/Max):** This reading mode should be selected if you were performing a *rectifier current interrupted CIS* and *there was considerable interference indicated on the waveform*. In such a case, in the absence of well-defined steps (IR drops), the software determines an average value for the maxima and an average value for the minima occurring in the waveform as being representative of the On and the Off value per cycle.
- **On/Off (GPS Sync):** This reading mode can only be selected if you are using the **MCMiller** GPS mode **AND GPS controlled current-interrupters**. **Note:** A primary feature of this reading mode is that the readings data are GPS time-stamped. Therefore, applications such as telluric current compensation tools can be applied to such data. With this reading mode, you can select the recording times on the waveform for both the On and Off readings, with respect to the On-to-Off transitions and the Off-to-On transitions of the waveform, as opposed to the software determining appropriate locations on the waveform for you (as in the case of the On/Off (DSP) reading mode – see above). With this reading mode selected, the screen will display additional fields that require setup information.
- **Single GPS Sync:** This reading mode is similar to the **Single Read** mode except that in this case the datalogger uses the GPS clock signal to associate readings with the actual time they were made. **Note:** Currently, only the **MCMiller** GPS mode can be selected for this reading mode. **Note:** A primary feature of this reading mode is that the readings data are GPS time-stamped. Therefore, applications such as telluric current compensation tools can be applied to such data.
- **DCVG:** This reading mode selection is shown when a DCVG survey type has been specified on a **Setup 1 screen...**
- **DCVG GPS Sync:** This reading mode selection is shown when a DCVG survey type has been specified on the **Setup 1 screen...**
- The **Range** list sets the voltmeter range. The recommended setting for *Range for CIS is ±5.7 Volts DC*, which provides an associated input impedance value of **400MOhm**. This setting provides a relatively fast response time (~20 ms), which is important in fast cycle interruption applications. Also, the 400MOhm input impedance minimizes reading errors associated with any high source resistance measurements, and the ±5.7 V DC Range should be *suitable for most On and Off CIS reading values*. The choices are:
  - 40 mVDC 10 MOhm
  - 400 mVDC 10 MOhm
  - 5.7 VDC 400 MOhm
  - 40 VDC 75 MOhm
  - 57 VDC 75 MOhm
  - 57 VDC 400 MOhm

- 400 VDC 75 MOhm
- 570 VDC 75 MOhm
- 4 VAC 75 MOhm
- 40 VAC 75 MOhm
- 400 VAC 75 MOhm
- For the On/Off readings modes, **Cycle On and Off** setting fields will be shown. The specific **Cycle On** and **Cycle Off** times are setup based on the times that the **current interrupters have entered for On and Off times**. **Note:** Ideally, the interruption cycle period (On time plus Off time – a single waveform cycle) should be less than the time between triggered readings on a CIS or DCVG survey. For short waveform periods (1 second, for example) this is not a concern, as a typical walking pace would translate to a time between triggered readings. **However**, care should be taken if longer waveform periods are in effect (for example, several seconds), in which case a slower than normal walking (and triggering) pace would have to be employed in order to avoid recording several same value readings until the waveform data are refreshed (i.e., until a new cycle of data is used). of greater than 1 second.
  - **Cycle On:** The **On** time setup on the current-interrupter for the pipeline being surveyed. This time is entered in milliseconds.
  - **Cycle Off:** The **Off** time setup on the current-interrupter for the pipeline being surveyed. This time is entered in milliseconds.
- The field values entered for **On Delay** and **Off Delay** should be based on knowledge of the current-interrupter waveform, particularly in terms of any transition spiking. The idea is to select sampling times that will avoid any spiking. For example, if 150 ms was selected for the **Off Delay**, the data-logger would record the voltage value sampled 150 ms after the rectifier-current was switched from the ON to the OFF state. Also, if 150 ms was selected for the **On Delay**, the data-logger would record the voltage value sampled 150 ms after the rectifier-current was switched from the OFF to the ON state. The use of the **Waveform** selection from the **auxiliary** functions described previously can help in determining these settings.
  - **On Delay:** The time the datalogger waits before capturing a voltage reading after the transition from **OFF to ON**. This time is entered in milliseconds.
  - **Off Delay:** The time the datalogger waits before capturing a voltage reading after the transition from **ON to OFF**. This time is entered in milliseconds.
  - **Cycle Start = On->Off:** This checkbox reflects the state of how the current-interrupter was setup to start. If your interruption cycle starts with the current in the **ON state** (the first transition is from ON to OFF), **check** the checkbox. If the interruption cycle starts in the **OFF state** (the first transition is from OFF to ON) **uncheck** the checkbox.

# Android PLS Survey Options

Once a new survey has been setup, the settings related to the current survey in process can be viewed or modified.



The **surveys option** button provides access to the following sub-functions:

## ☐ Survey Settings

- When selected, the same setup screens will be presented as was used when the survey was initially setup... but the **screen header name reflects the functional settings being affected**. Note that most of the original survey setup fields are presented for modification. However, you **can't** change the **Survey Type**.

**Survey Setup 1 of 5**

Survey Type:   
Rectifier Mode:  >>

Cane Button(s) Allowed To:

Device:  
 None  Save

Survey Red:  
 Flag  Read

Survey Green:  
 Flag  Read

Survey Locations:  
 Increasing  Decreasing

Use Digital Trigger Cable  
 Enable DCVG Sidedrains in CIS Surveys  
 Use Metric

Navigation: [X] [Next]

**Survey Setup 2 of 5**

GPS:  None  Internal  MCMiller

Application:  Best Effort ?  Required ?

Auto Log GPS:  >>

Max PDOP:  >>

A.C. Cycle:  60 Hz  50 Hz

Max Near/Far Diff:  %

Low Voltage Alarm:  V  
(9999 = Disable Alarm)

Use GPS for Altitude

Log GPS:  At Flags  At DCP/Feature

Navigation: [X] [Previous] [Next]

**Survey Setup 3 of 5**

Name of Pipeline:

Pipeline Section:

Survey Location:

Location Values:  
Station Number  >>

Distance Between Flags:  ft

Distance Per Reading:  ft

Flag Error Limit:

Auto Pacing Mode

Data Probes:  One  Two

Navigation: [X] [Previous] [Next]

**Survey Setup 4 of 5**

Work Order:

Technician Name:

Comments/Description:

Survey Name:   
Survey Date:

Navigation: [X] [Previous] [Next]

**Survey Setup 5 of 5**

Reading Mode:  >>

Range:  >>

Cycle:  
 On (mSec)  Off (mSec)

Delay:  
 On (mSec)  Off (mSec)

Navigation: [X] [Previous] [Checkmark]

## □ [View Settings](#)

Survey: FMN-v121-CIS-1

Property	Value
Survey Type	Trigger CIS
Rectifier Mode	Cycle On/Off
Cane Red	Read
Cane Green	Read
Enable DCVG Sidedrains	Disabled
DCVG Anomaly Max = Total	Disabled
Use Metric	Disabled
Cane Function for Devices	None
Survey Direction	Increasing
Soil Resistivity Dist Units	CM
GPS	MCMiller
Use GPS for Altitude	Enabled
Auto Log GPS	Every Reading
A.C. Cycle	60Hz
Only Log Corrected GPS	Disabled
Log GPS at Flags	Disabled
Log GPS at DCP/Feature	Disabled
Log GPS at Sidedrain/Anomaly	Disabled
Maximum PDOP	6.0
Maximum Near/Far Diff	1.0
Low Voltage Alarm	9999.0
Pipeline Name	

Survey: FMN-v121-CIS-1

Property	Value
Pipeline Name	
Pipeline Section	
Survey Location	0.0
Location Value	Station Number
Distance Between Flags	100.0
Distance Per Reading	2.5
Flag Error Limit	50
Time Between Flags	40
Data Probes	2
Auto Pacing Mode	Enabled
Auto Learn Read Rate	Disabled
Work Order	
Technician Name	
Survey Note	
Survey Name	FMN-v121-CIS-1
Survey Date	10/29/2021
Reading Mode	On/Off (DSP)
Range	5.7 VDC 400 MOhm
Cycle On (mSec)	700
Cycle Off (mSec)	300
Moving Ave Samples	-875599776
On Delay (mSec)	150
Off Delay (mSec)	150
Cycle Start = On->Off	Enabled

The **View Settings** screen shows all if the survey settings in a single scrollable list.

- The **Survey** field shows the name of the survey that is opened and in process.
- The **Property** and **Value** section shows the name of the fields and their current values that have been setup for the in-process survey. These fields are not modifiable...

## □ [Voltmeter Settings](#)

Voltmeter Settings

Reading Mode:  >>

Range:  >>

Cycle:

On (mSec)  Off (mSec)

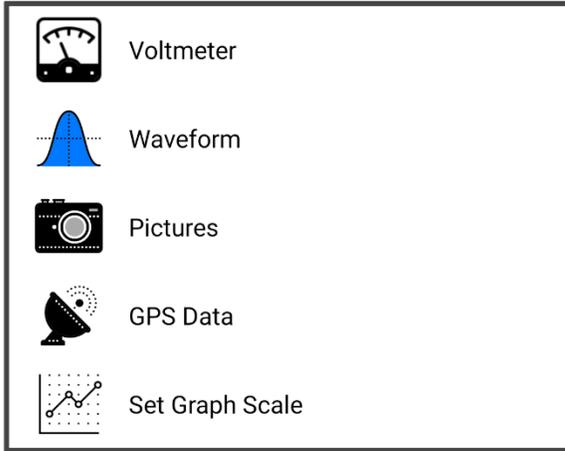
Delay:

On (mSec)  Off (mSec)

The **Voltmeter Settings** screen provides an option to modify current survey's **voltmeter settings** that were originally defined via the **Setup 5** screen. Choices will be provided as shown in the previous **Survey Setup 5 of 5** descriptions.

# Android PLS Auxiliary Options

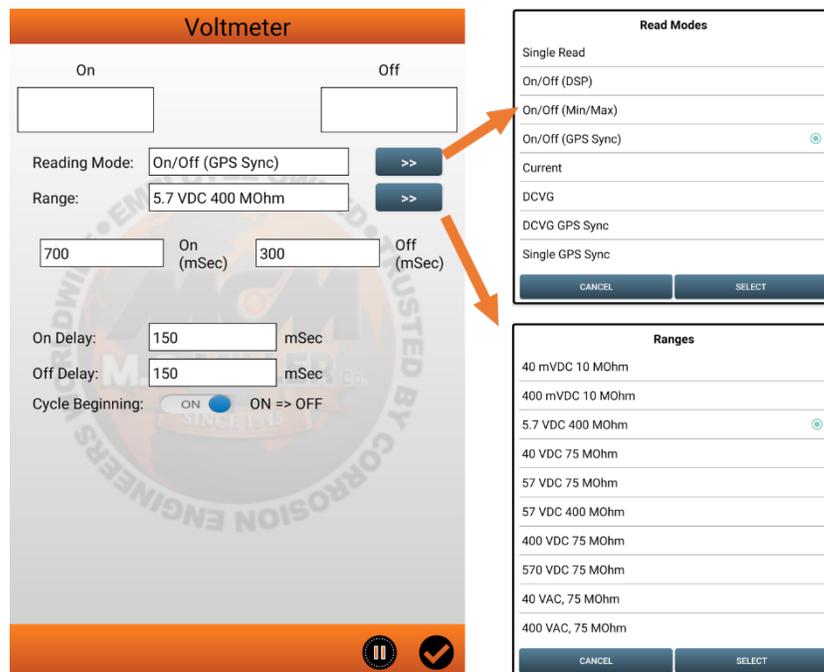
The **Auxiliary** option  button shows a list to sub-functions that can be accessed with or without a survey open:



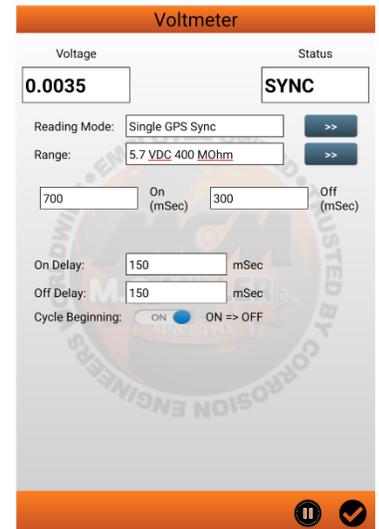
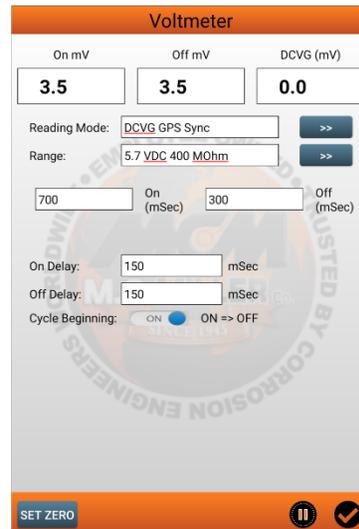
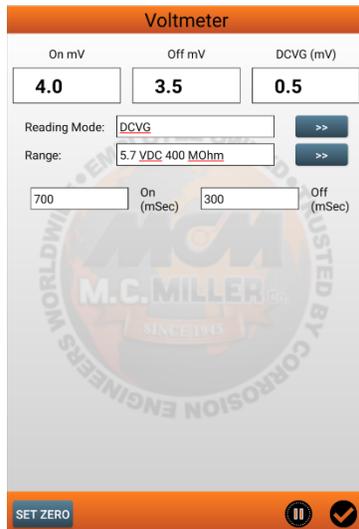
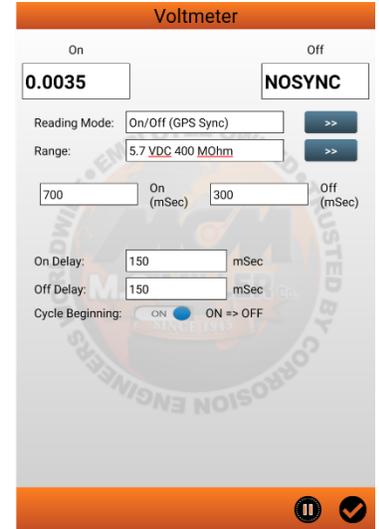
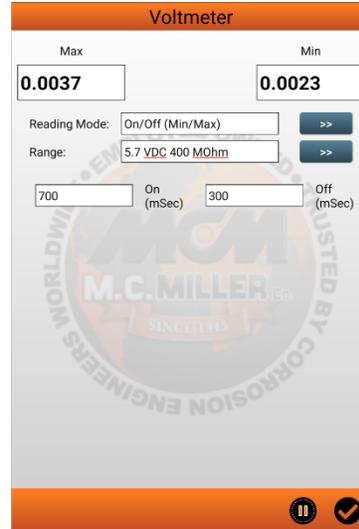
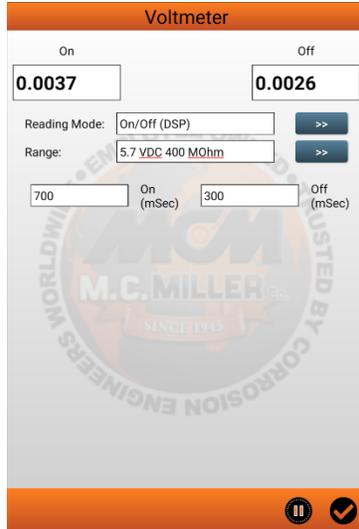
## □ Voltmeter



- When the Voltmeter selection  is **tapped**, the current voltmeter setup in effect will be presented. The Voltmeter screen can be shown with or without a survey open. The Voltmeter screen shows voltmeter data with settings that are independent from the survey voltmeter settings. The voltmeter screen settings will default to the survey voltmeter settings but changing the voltmeter screen settings will not affect the survey voltmeter settings. To make voltmeter settings changes (**Range** and **Read Mode**), tap on the menu buttons for the **Range** and **Read Mode** fields and select the options as required. For example, if **On/Off (GPS Sync)** was the current setting of the voltmeter, then tapping the double arrow for **Read Mode** options would present other selections... likewise for **Range**...



- The Voltmeter screens displayed and the visible settings depend on the **Read Mode** selected. Other selected screens can be:



**Shunt Types**

- 0.1 ohm - 10
- 0.01 ohm - 100
- 0.001 ohm - 1000
- 20A/20mV - 1000
- 1A/1mV - 1000
- Other

CANCEL      SELECT

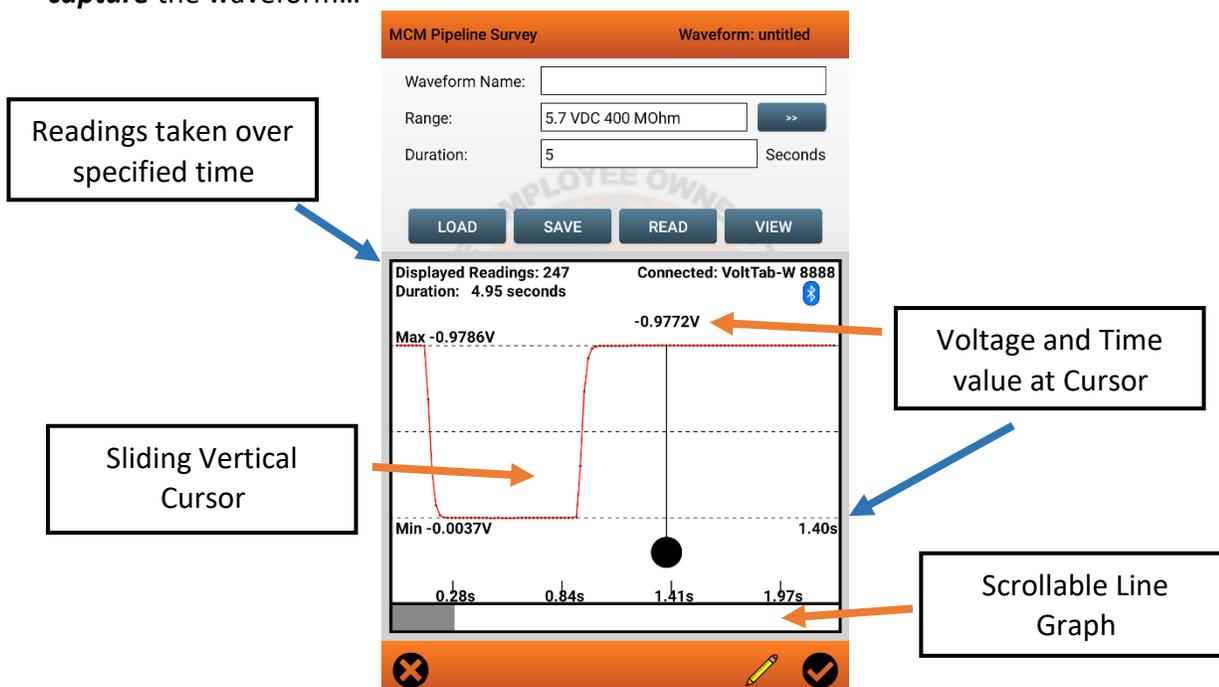
## □ Waveform



When the **Waveform** selection is *tapped*... The initial waveform screen is presented

- The **Waveform** screen can only be shown with a survey open.
- The waveform voltmeter setting (**Range**) is independent from the survey voltmeter settings. The waveform voltmeter setting will default to the survey voltmeter setting but changing the waveform voltmeter setting will not affect the survey voltmeter setting.
- When the **Read** button is tapped, voltage values will be recorded at an approximate rate of 50 reads/s for the preset period of time.
- The voltage values are displayed on a scrollable line graph.
- The X axis is time relative to the start of the waveform.
- By holding down on the graph, you can reveal a sliding vertical cursor which is used to show the voltage and time at specific points in the waveform.
- The waveform data can also be viewed in a table format.
- The waveform data can be saved. When the waveform is read and saved, the waveform data will be associated with the last logged survey reading.
- The Duration field can be set to capture the waveform over a specified amount of time in seconds.
- Comments can be entered for a waveform.

- Once your **Range** and **Duration** fields are set to your requirements, then tapping the **Read** button will *capture* the waveform...



- Tapping the **View** button will present a screen showing the captured waveform data in tabular format...

### Waveform Data

Survey: **FMN-v121-CIS-1**  
 Waveform:  
 Start Time: **01/20/2022 09:12:24**  
 Duration: **4.95 seconds**  
 Voltage Range: **-0.9786 to -0.0037**

Sample	Time	Volts
1	0.0	-0.9783
2	0.02	-0.9786
3	0.04	-0.9786
4	0.06	-0.9786
5	0.082	-0.9786
6	0.104	-0.9786
7	0.124	-0.9786
8	0.146	-0.9758
9	0.167	-0.6737
10	0.187	-0.2574
11	0.207	-0.0745
12	0.227	-0.0205
13	0.247	-0.0071
14	0.267	-0.0045
15	0.287	-0.0040
16	0.307	-0.0040
17	0.327	-0.0040
18	0.347	-0.0040
19	0.367	-0.0040
20	0.387	-0.0040
21	0.407	-0.0040

- **Survey:** Name of the survey
- **Waveform:** Name of the waveform
- **Start Time:** Start time for the waveform
- **Duration:** Time from first waveform reading to last
- **Voltage Range:** Smallest and greatest voltage values collected in waveform

• Once a waveform has been reviewed, the user can save the waveform by entering a **Waveform Name** and tapping the **Save** button...

MCM Pipeline Survey Waveform: untitled

Waveform Name:

Range:  >>

Duration:  Seconds

LOAD
SAVE
READ
VIEW

Displayed Readings: 247 Connected: VoltTab-W 8888

Duration: 4.95 seconds

Max -0.9786V

Min -0.0037V

✕

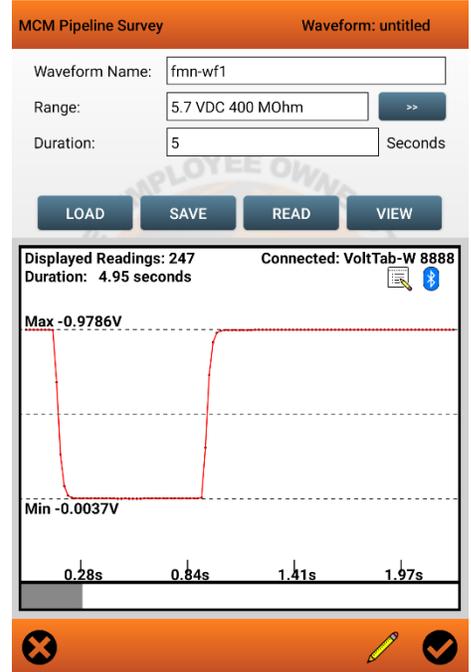
Enter **Waveform Name**

If a **comment** was entered for the waveform, a comment icon is shown

- Saved waveforms can be loaded and viewed. Tapping the **Load** button brings up a **Select Waveform** screen...



Tapping the name of the saved waveform will load the waveform. Waveform is shown similar to how it was saved.



## □ Pictures



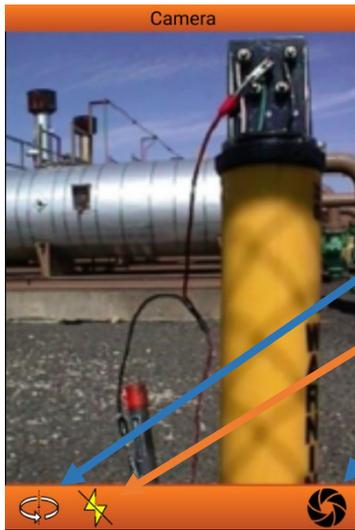
- When the **Pictures** selection is tapped, the user can take pictures during a pipeline survey. A **Pictures** screen is presented.



- The **Pictures** option is only available during a pipeline survey... a survey must be open...
- Pictures can be associated with a specific **survey reading, Geo-Feature, Device Reading, DVCG Anomaly or Surface Potential Side Drain**
- The pictures are displayed as thumbnails.
  - o Pictures can be viewed **full screen**
  - o Pictures can be deleted...
- Camera settings related to **flash, quality, and picture size** are provided via the **Camera Options** button



- Tapping the **Camera**  button at the bottom of the Pictures screen will present the camera view to enable the user to take a picture.



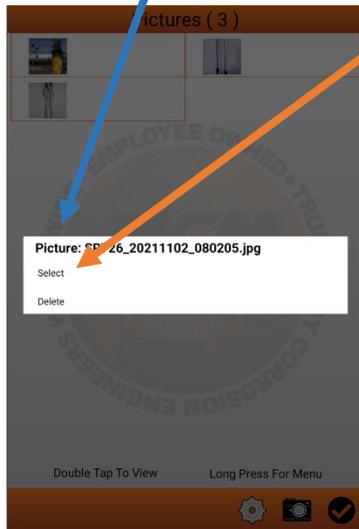
**Rear or Front** camera selection button  
**Flash or No Flash** button  
**Take the Picture** button



After picture taken, choices are presented of what to do with the picture  
**EXIT**, this will take you back to the main Pictures screen  
**Retake** the picture  
**Save** the picture just taken... this will take you back to the main Pictures screen...

**Long Press For Menu**  
 (Tap And Hold)

**Double Tap To View** or tap **Select** in the menu to view picture **full screen**



Return to main Pictures screen by using tablet's back button

## □ [GPS Data](#)

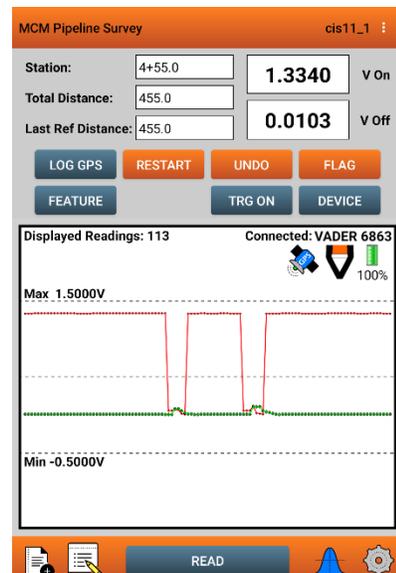
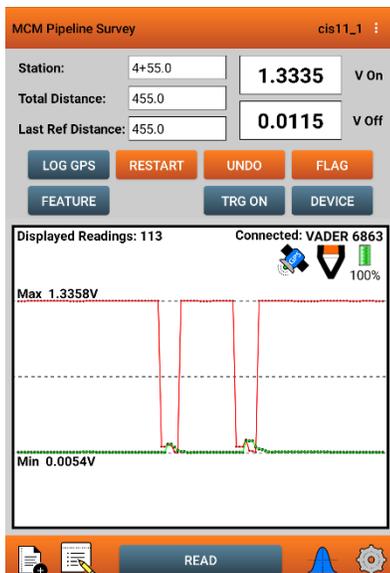
Tapping the **GPS Data**  selection will present the **GPS Data** screen. The current support for this screen is just to show the related GPS data at the user's specific location. This function can be used to determine if GPS data is being **acquired** at the current location.

Tap the Check  button to return to the **Survey** screen.



## □ [Set Graph Scale](#)

Tapping the **Set Graph Scale**  selection will provide the user the ability to change the **graph's Y scale** parameters

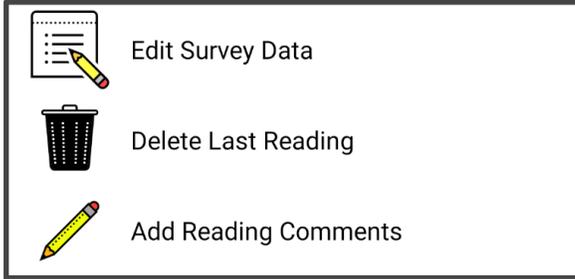


# Android PLS Survey Modifications

The current survey in process can have its' **data** reviewed/edited (to a degree) to **eliminate bad readings or related data**.



Tapping the **Survey Modification** button on the **Survey** main screen will show a list of available sub-functions.



## □ Edit Survey Data

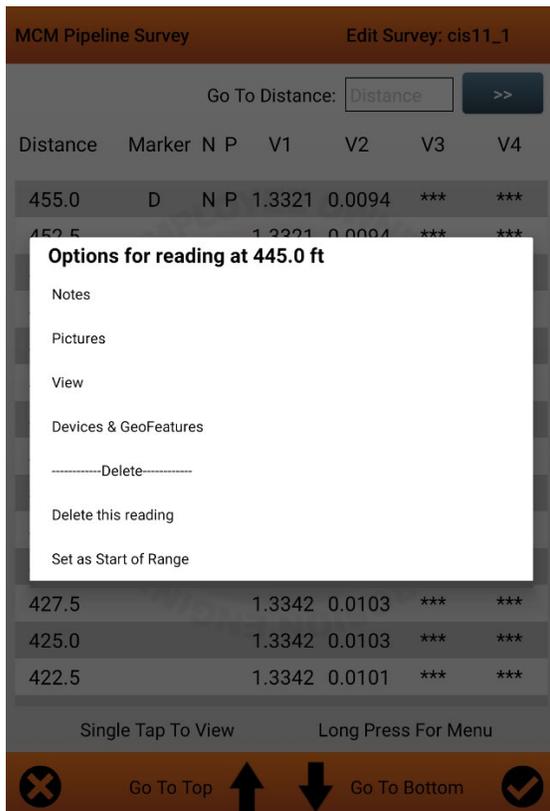
The user is presented with a **scrollable Edit Survey** screen that shows **all** readings taken for the current survey.

Distance	Marker	N	P	V1	V2	V3	V4
455.0				1.3321	0.0094	***	***
452.5				1.3321	0.0094	***	***
450.0				1.3321	0.0094	***	***
447.5				1.3346	0.0094	***	***
445.0				1.3346	0.0094	***	***
442.5				1.3346	0.0104	***	***
440.0				1.3346	0.0104	***	***
437.5				1.3319	0.0104	***	***
435.0				1.3319	0.0103	***	***
432.5				1.3319	0.0103	***	***
430.0				1.3319	0.0103	***	***
427.5				1.3342	0.0103	***	***
425.0				1.3342	0.0103	***	***
422.5				1.3342	0.0101	***	***

- The **Edit Survey** screen presents a **summary entry** for each reading taken showing **distance, reading values, and any related markers**.
- **Markers** indicate **other** data related to the reading:
  - o D – device
  - o G – geo-feature
  - o F – flag
  - o P – picture
  - o N – note/comment
  - o M – anomaly
- **Arrows** at the bottom of the screen provide a quick way to get to the **top** and **bottom** of the survey data.
- A **search bar** at the top of the screen can be used to go to a **record** at a **specified distance**.
- **Tapping** an entry or doing a **long press** will present menu to **view** the selected reading and related data

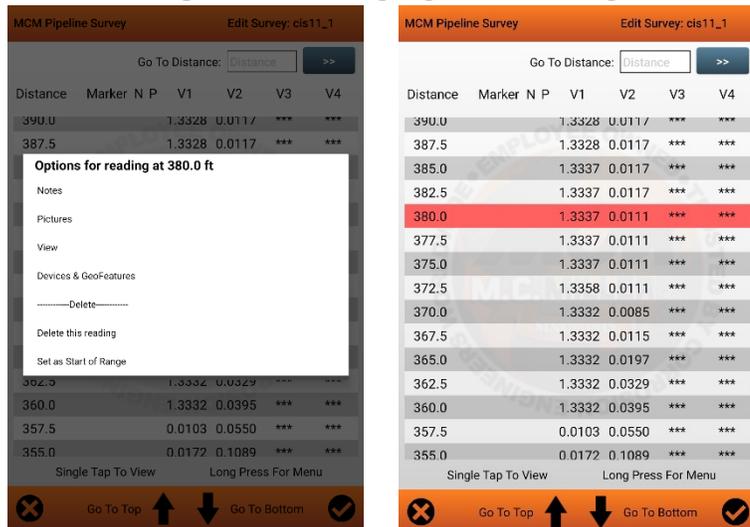


- The **View Survey Reading** screen shows more details about the reading data.
  - **Distance & Station** values
  - **Voltage & Time** values
- Any **related** data associated with this reading is shown
  - Any **Device** readings taken
  - Any **Geo-Feature** associated with this location
  - Any **Flag** associated with this reading's station location
  - Any **Picture** and/or **Note** taken at this location
  - Any **Waveform** taken at this location can be loaded and viewed via the  button.
  - For a DCVG survey, a **Mark DCVG** may be shown, indicating an **anomaly** was detected.
- From this screen, the user can take a picture and/or add a comment.
- Tapping the  button will bring you to the **Devices & GeoFeatures** screen where you can review, delete, or add **Device readings, GeoFeatures or DCVG Anomalies**.
- **Specific related** data can be deleted by tapping the  icons. The one next to the **record** field deletes the entire reading.
- Most actions taken while in this screen are not performed until the  button is tapped, and they will not be applied if you instead tap the  button. Deleting the reading happens immediately and cannot be undone.

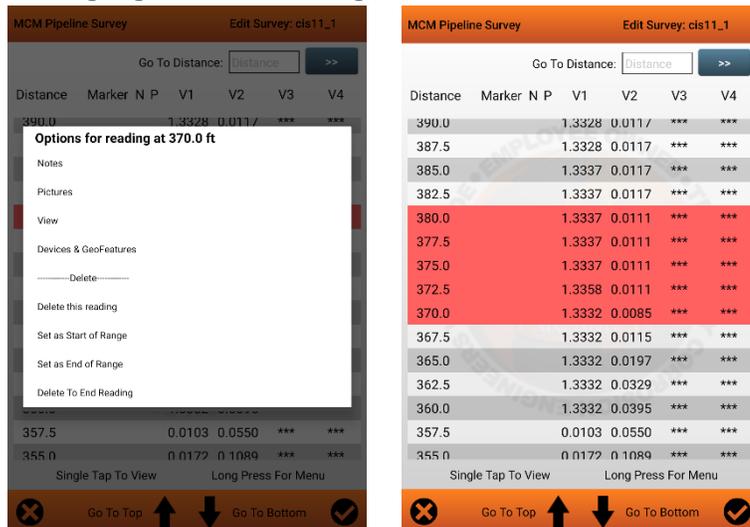


- Long pressing** on a reading in the main **Edit Survey Data** screen will open a context menu for that reading. This provides alternative ways to
- **Add or edit** a reading comment
  - **Add or delete pictures** for the reading
  - Go to the **Devices & GeoFeatures** screen
  - **Delete** the reading
- This menu also allows you to **highlight a range** of readings to be deleted **all at once**.

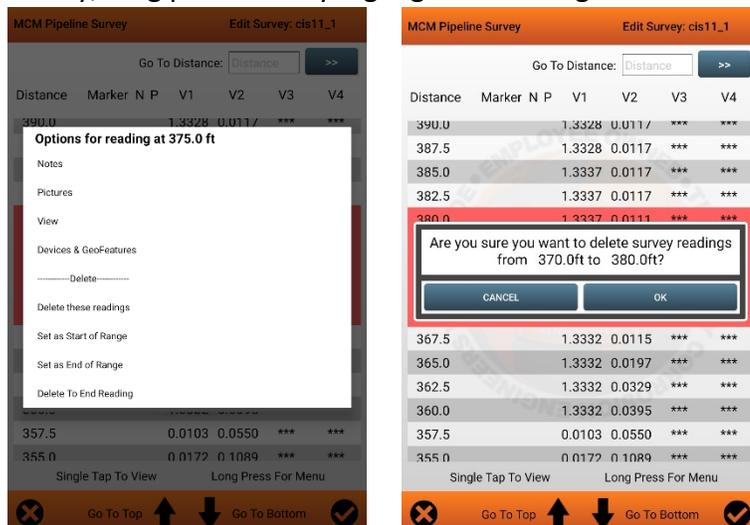
To delete a range of readings, long press on the first reading to be deleted and use the popup menu to set it as **“Start of Range”**. This will highlight the reading.



Then, long press on the last reading to be deleted and use the popup menu to set it as **“End of Range”**. This will highlight all the readings from the first selected reading to this reading.

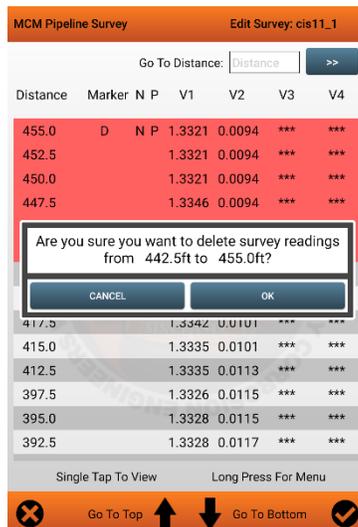
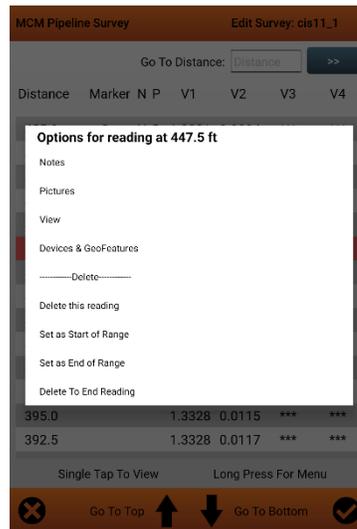
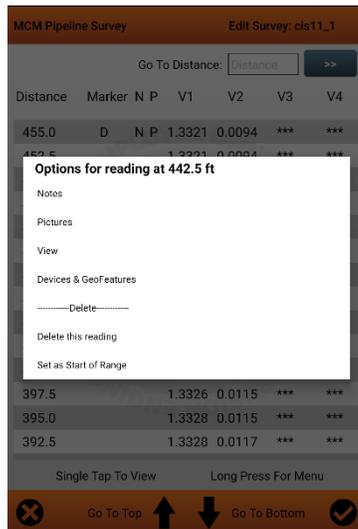


Finally, long press on any highlighted reading and use the popup menu to **“Delete these readings”**.



Note - Changing the starting point will reset the range while changing the end point will not. [rev 1.2 11-06-2023]

You can also set a start point and delete all readings from there to the most recent reading.



Selecting “Delete To End Reading” will highlight all readings from the start point to the most recent reading at the top, and immediately ask you to confirm the deletion.

**Note** – Whenever the **last reading** is deleted, the current **survey location** will move to the **most recent remaining reading location**, and the survey will continue from there. In the example pictured here, the readings from 442.5 ft to the most recent reading at 455 ft were deleted, and the survey moved back to 437.5 ft (reading at 440 ft was already deleted). The next reading that is taken will be at 440 ft.

## □ Delete Last Reading



Tapping the **Delete last Reading** selection on the **Survey Modification** list will cause the **last taken reading** to be deleted. The **survey location** will be set back to the location of the **previous reading**.

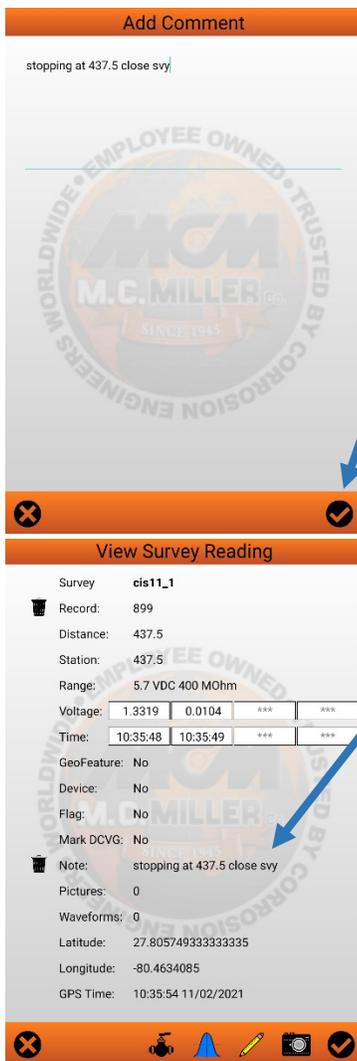


## □ Add Comments

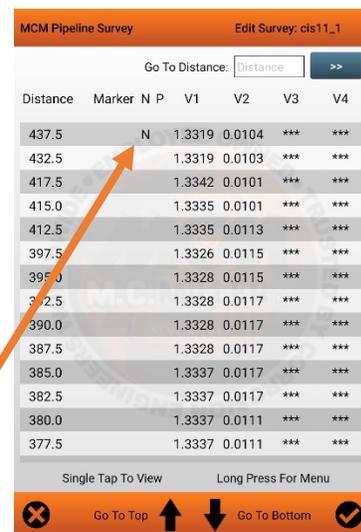


Tapping the **Add Reading Comments** selection on the **Survey Modification** list will cause the **Add Comment** screen to appear so a comment can be added to the current survey





- Tap the **checkmark** button to save your comment.
- The **comment** will be added to the last reading taken.
- A **Note** marker will be created on reading to indicate a comment is present.
- Opening the reading (to view details) will show a **portion of the comment entered**.
- Entering the **Add Comment** screen again will allow you to see the **full comment** and **edit** it if necessary.



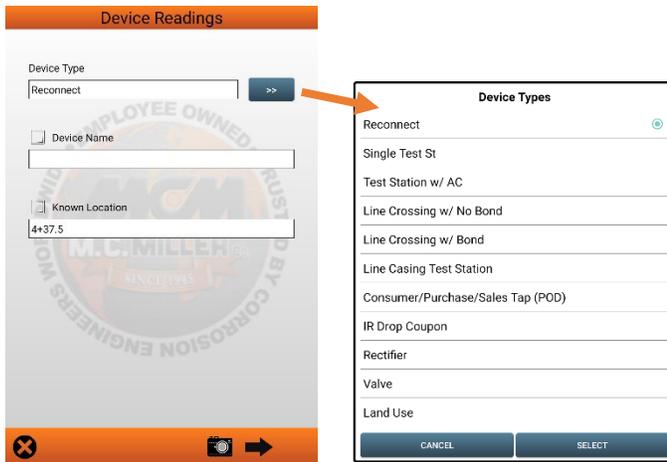
## Device and Feature Screens

As you prepare to do a pipeline survey you may want to record other pipe-to-soil potentials at **device/DCP (Data Collection Point)** locations associated with the survey. The **Device** DEVICE button can be tapped to add these to the survey.

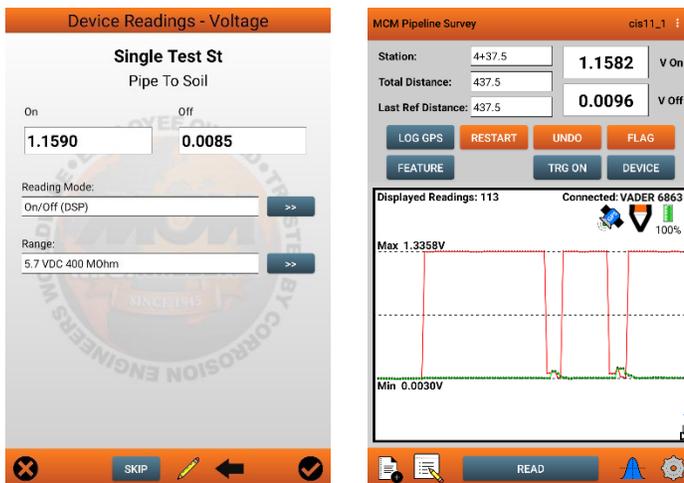
As you perform the survey, you may encounter certain obstacles, such as rocky terrain or a lake, which may or may not affect the survey. The **FEATURE** FEATURE button can be tapped to add these to the survey.

### □ Device button

- Will Bring-up the **Device Readings** screen that is initially used to identify the **Device Type** for which a reading is to be taken. In addition (optionally), one could enter a **name** and **location** for the device.



Tapping the **Next**  button will bring up the **'Voltage'** screen where you can enter the reading voltage to be taken. Depending on what **Device Type** was selected, the **'Voltage'** screen(s) specific to the **Device Type** will be shown. **Remarks/Comments** related to each of the readings can also be entered. Once completed, tapping the  button will save the data and step to the next **'Voltage'** screen or return to the main survey screen. You can alternatively tap the  button to proceed without saving. Note the 'D' marker in the Graph section once returned to the **Main Survey** screen.



## □ [Feature button](#)

- Will Bring-up the **Geographic Features** screen that provides the user a function to enter **items/observations/features** that were encountered during the survey and may have **influenced/affected** the distance/stationing of the survey data. A **feature** identified during the survey will also be listed when the survey data is transferred to the **MCMiller ProActive CP Data Management** or **ESD** software.
- The **type** of **Feature** encountered can be selected from a **Features list**. A **Quick Search** field allows you to filter the list by typing all or part of the name of a feature. Tap on the feature to select it. It will be highlighted **orange** to indicate it has been selected. A **Notes** field can be used for additional info related to the **Feature**

**Geographic Features**

Quick Search:

**Highway**

County Road

Dirt Road

Trail

Street

Asphalt Road

Driveway

Aerial Marker

Notes:

Feature Length:

Skip Distance:

Known Location:

**Geographic Features**

Quick Search:

**Power Line Crosses**

Power line Diverges

Power Pole

Notes:

Feature Length:

Skip Distance:

Known Location:

- The **Feature length** and **Skip Distance** fields provide ways for the user to identify the size of an encountered *feature* and possible impact the *feature* may have on current stationing. The **Skip Distance** field can be used to *adjust* stationing based on the *feature* that was encountered. The stationing will be adjusted based on the value entered in the **Skip Distance** field when returning to the **Survey Main Screen**.

Station:

Total Distance:

Last Ref Distance:

MCM Pipeline Survey cis11\_1

Station:  1.1523 V On

Total Distance:  0.0094 V Off

LOG GPS RESTART UNDO FLAG

FEATURE TRG ON DEVICE

Displayed Readings: 120 Connected: VADER 6863

Max 1.3358V

Min 0.0030V

READ

Feature Length:

Skip Distance:

**Geographic Features**

Quick Search:

**Stream**

Creek

Dry Wash

**Ditch**

Lake

Dry Lake

Pond

Dry Pond

Notes:

Feature Length:

Skip Distance:

Known Location:

Station:

Total Distance:

Last Ref Distance:

MCM Pipeline Survey cis11\_1

Station:  1.1528 V On

Total Distance:  0.0089 V Off

LOG GPS RESTART UNDO FLAG

FEATURE TRG ON DEVICE

Displayed Readings: 120 Connected: VADER 6863

Max 1.3358V

Min 0.0030V

READ

- You can enter a **Feature Length** value if you wish, although this entry does not have any impact on the stationing. In addition, you can check off the box labeled, **Known Station** and enter a station value if you know that the current stationing is incorrect. This will give the software a new location reference going forward.

## Device and Feature List Update

Adding entries to the **Device** or **Feature** list can be accomplished by modifying the **PLS\_Script.csv** (Device list) file. Before making any updates to a **master list**, it is recommended that a backup of the list be done prior to an update attempt. Changing a **master list** will not affect existing surveys; each survey stores a copy of the lists in use when the survey was created.

A	B	C
67	66	Dry Pond
68	67	Dry Ditch
69	68	Crest of Hill
70	69	Bottom of Hill
71	70	Terrace
72	71	Section Line
73	72	Sinkhole
74	73	Trees
75	74	Compressor Station
76	75	Plant other than Compress
77	76	House
78	77	Building
79	78	Farmyard
80	79	Residential Area
81	80	Business District
82	81	Parking Lot
83	82	Compressor Station
84	83	Pipe Corridor
85	84	Broken Lead Wire
86	85	Cont. from broken wire
87	86	Data Overlap Point
88	87	End of Page 1 - Run con't
89	88	Start of Page 2
90	89	Probe Rod Contact
91	90	Side Drain Reading
92	91	Custom 1
93	92	Custom 2
94	93	Custom 3
95	94	Custom 4
96	95	Custom 5
97	96	Custom 6
98	97	Custom 7
99	98	Custom 8
100	99	See Field Notes

The **Feature** list entry **Custom 1** was modified to show **Flooded Ditch**...

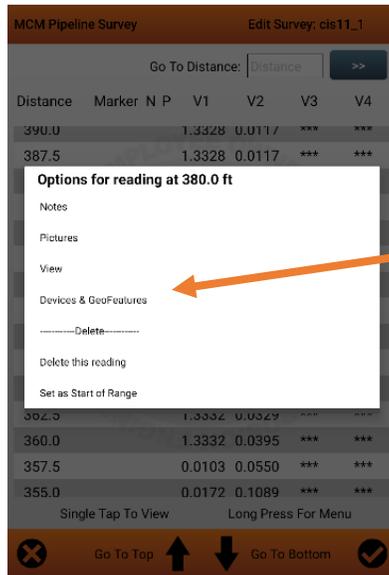
A	B	C	D	E	F	G	H
1	ScriptName	FunctionName	FunctionType	OrderNbr	DCV/SigStr	ScriptID	
2	0 DCVG Anomaly	DCVG Max/Totals	0	1	0	ANORMAL_0	
3	0 DCVG Anomaly	DCVG Max On/Off	0	2	0	ANORMAL_0	
4	1 SP Anomaly	Side Drain	0	1	0	ANORMAL_1	
5	1 SP Anomaly	SoftRes/Corr Factor	0	2	0	ANORMAL_1	
6	2 Mark DCVG	DCVG Side Drain	0	1	0	ANORMAL_2	
7	2 Mark DCVG	DCVG On/Off	-1	2	0	ANORMAL_2	
8	3 Reconnect	Far ground reading	1	1	0	TESTPOINT_1	
9	3 Reconnect	Metal IR	1	2	0	TESTPOINT_1	
10	3 Reconnect	Near ground reading	1	3	1	TESTPOINT_1	
11	4 Single Test Station	Pipe To Soil	1	1	1	TESTPOINT_4	
12	5 Test Station w/ AC	Pipe To Soil	1	1	1	TESTPOINT_5	
13	5 Test Station w/ AC	AC	1	2	0	TESTPOINT_5	
14	6 Line Crossing w/ No Bond	Pipe To Soil	1	1	1	TESTPOINT_6	
15	6 Line Crossing w/ No Bond	Foreign P/S	1	2	0	TESTPOINT_6	
16	7 Line Crossing w/ Bond	Pipe To Soil	1	1	1	BOND_7	
17	7 Line Crossing w/ Bond	Foreign P/S	1	2	0	BOND_7	
18	7 Line Crossing w/ Bond	Current	2	3	0	BOND_7	
19	8 Line Casing Test Station	Pipe To Soil	1	1	1	TESTPOINT_8	
20	8 Line Casing Test Station	Casing To Soil	1	2	0	TESTPOINT_8	
21	9 Consumer/Purchase/Sales Tap (POD)	Pipe To Soil	1	1	1	BOND_9	
22	9 Consumer/Purchase/Sales Tap (POD)	Foreign P/S	1	2	0	BOND_9	
23	9 Consumer/Purchase/Sales Tap (POD)	Current	2	3	0	BOND_9	
24	10 IR Drop Coupon	Pipe To Soil	1	1	1	TESTPOINT_10	
25	10 IR Drop Coupon	Pipe To Soil shielded	1	2	0	TESTPOINT_10	
26	11 Rectifier	RectifierID	5	1	0	RECTIFIER_11	
27	11 Rectifier	Volts	3	2	0	RECTIFIER_11	
28	11 Rectifier	Amps	3	3	0	RECTIFIER_11	
29	12 Valve	Pipe To Soil	1	1	1	VALVE_12	
30	12 Valve	Condition	6	2	0	VALVE_12	
31	13 Land Use	Land Use	6	1	0	TESTPOINT_13	
32	14 Isolation Device	PipeTo-Soil-Side 1	1	1	1	TESTPOINT_14	
33	14 Isolation Device	PipeTo-Soil-Side 2	1	2	0	TESTPOINT_14	
34	14 Isolation Device	Condition	6	3	0	TESTPOINT_14	

The **Device** list was expanded to show an **Isolated Device** entry having 2 readings to be taken along with a **textual comment** entry...

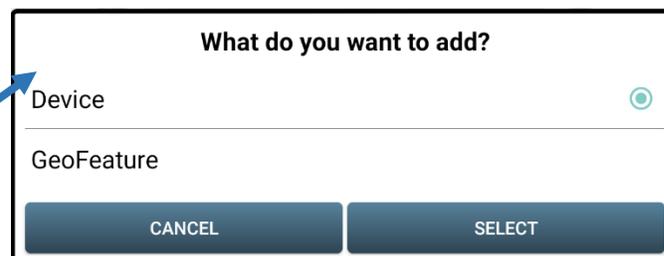
## □ Devices & GeoFeatures Screen

New in version 2.2.0.0 is the **Devices & GeoFeatures** screen. In this screen, you can review, delete, or add **Device readings**, **GeoFeatures** or **DCVG Anomalies** (*only in DCVG surveys*) associated with a specific reading. It can be reached by going to the **Edit Survey Data** screen, long pressing on the reading, and selecting the **Devices & GeoFeatures** option. You can also get there by going to the **View Survey Reading** screen for that reading and

tapping the  button.

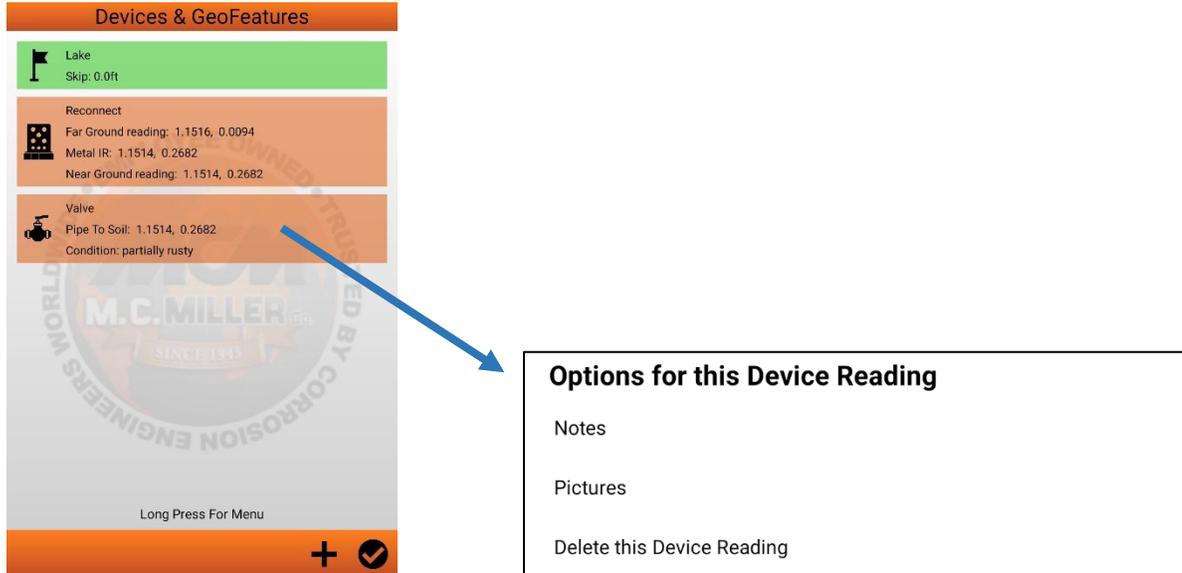


To **add** a new item to this reading, tap the  button and select the type of item you want to add.



Selecting to add a **Device** or **GeoFeature** will bring you to the same screens that the  and  buttons on the main screen bring you to. Since this screen allows you to go back and modify data at older readings, the **known location** and **skip distance** fields are **disabled**. After completing the steps to add the device or feature, you return to the **Devices & GeoFeatures** screen where you should see the new items listed. **GeoFeatures** are displayed as **green** and show the type of feature and the skip distance. **Devices** are displayed as orange and show the type of **Device** and the data that was collected like the **voltage readings** or **condition**. You

can long press on these items to open a menu that allows you to **add/edit comments**, **add/delete pictures**, or **delete the device or feature**.



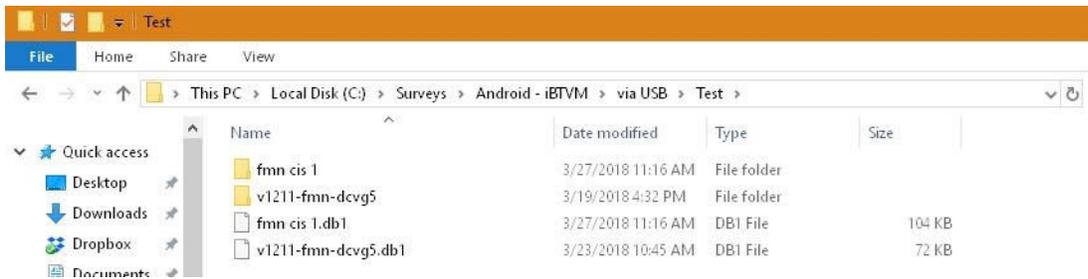
The  button will return you to either the **View Survey Reading** screen or the **Edit Survey Data** screen depending on how you navigated here.

## □ [PLS Survey Transfer to ProActive](#)

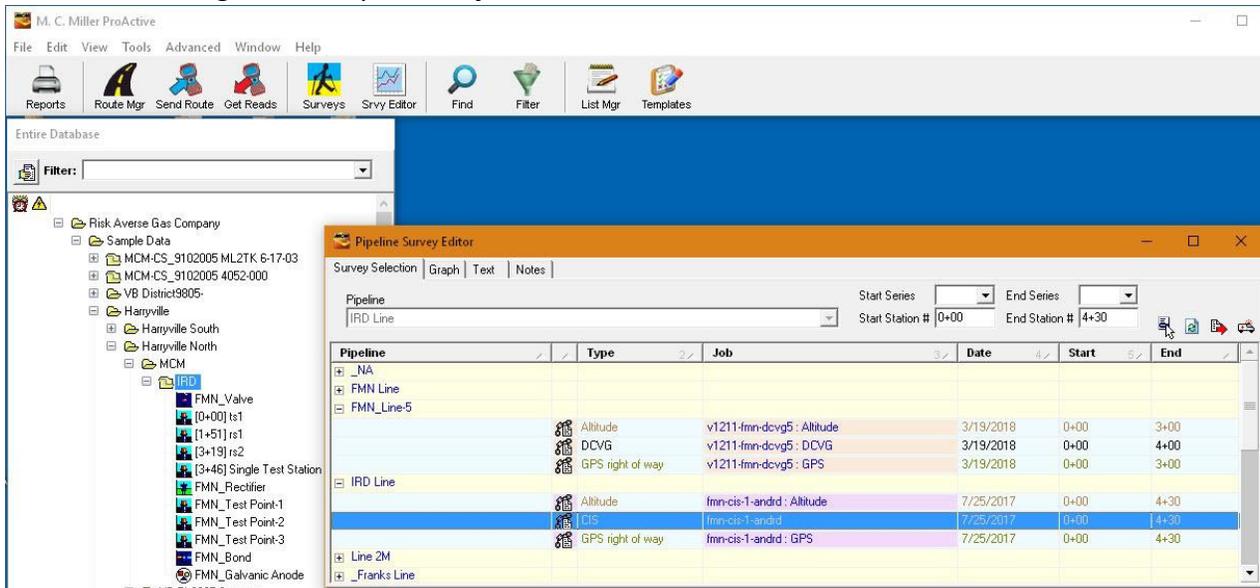
As mentioned in [Pipeline survey data](#) all PLS **raw** data resides in the **pipelinesurvey** folder on your Android tablet. This survey data can now be transferred to MCM's CP data management system, **ProActive**, which allows integration of pipeline survey data in a database system and offers extensive reporting (both textual and graphical) capabilities on the survey data. The transfer of the pipeline survey data to the ProActive software (residing on the user's PC) is accomplished via the Android tablet being connected to the PC via a USB cable. The PC must have the **Windows Mobile Device Center** application and a USB driver with Android Debug Bridge (**ADB**) capability installed. A driver with ADB capability may be downloaded from the tablet brand's website being used with the PLS application.

- The ProActive '**Surveys**' function with a *Data Logger* specification of **Android** will invoke **driver** software to perform the survey transfer. A **backup** of the pipeline survey data during the transfer can be accomplished by specifying the '**Copy to Local Folder**' option and a directory path/folder to save the data. A successful transfer will result in 2 data objects being saved:
  - **PLS survey name** folder
  - **PLS survey name.db1**

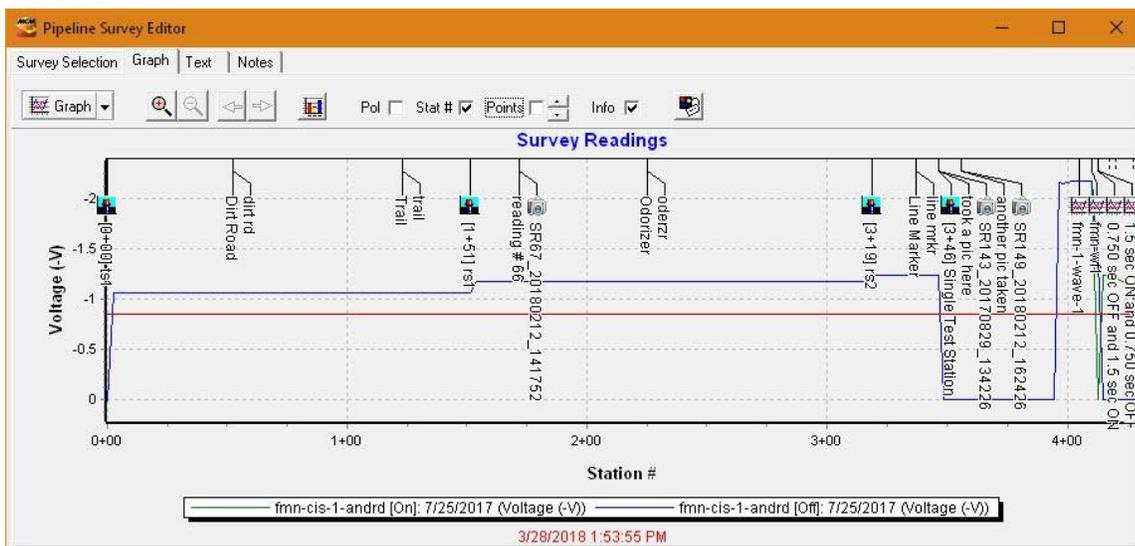
The **PLS survey name** is the name of the survey as it was created/specified on the PLS app... The **folder** object will contain any pictures/photos taken during the survey. The **.db1** filetype is a **SQL** database containing the survey data and any **waveform** data...



- A successful ‘**Surveys**’ function will update the ProActive **database tree** to reflect any **Devices** or **Anomalies** that were found during the survey. The ProActive ‘**Srvy Editor**’ function can then be used to review survey data. The below picture shows the results of the transfer of a CIS survey example to ProActive. The **Entire Database** window shows the database tree updated and the **Pipeline Survey Editor** window showing the survey data **key** elements.



- Selecting the **Graph** type in the **IRD Line** and then clicking the **Graph tab** will show the transferred survey data...



**Note:** checking the **Info** checkbox shows an additional level of detail for the transferred survey. This level of detail shows that **Devices, Features, Pictures, and Waveforms** were specified during this survey...

## DCVG Survey Support

Unlike Close Interval Potential Surveys (**CIPS** or **CIS**), Direct Current Voltage Gradient (**DCVG**) surveys do not involve an electrical connection to the pipe, other than, temporarily, to determine IR drop values at pipe connection locations. Instead, readings on DCVG surveys involve soil-to-soil potential difference measurements, as opposed to pipe-to-soil potential difference measurements.

DCVG surveys are performed in the rectifier-current ON/OFF mode, i.e., the rectifier current is switched ON and OFF in a cyclic fashion. This allows soil-to-soil potential differences to be recorded during both the ON and OFF portions of the current cycle. To understand more of the **physical principles** related to performing DCVG surveys, one can review the **MCMiller DCVG Training Reference** document.

The following section describes Android PLS app screens having fields related to DCVG survey support.

### □ DCVG Survey Setup Screens

Survey Setup 1 of 5

Survey Type: DCVG

Rectifier Mode: Cycle On/Off

Cane Button(s) Allowed To:

Device:  None  Save

Survey Red:  Flag  Read

Survey Green:  Flag  Read

Survey Locations:  Increasing  Decreasing

DCVG Anomaly Max mV = Total mV 1st Read

Use Metric

Survey Setup 2 of 5

GPS:  None  Internal  MCMiller

Application:  Best Effort ?  Required ?

Auto Log GPS: Never

Max PDOP: 6.0

A.C. Cycle:  60 Hz  50 Hz

Use GPS for Altitude

Log GPS:  At Flags  At DCP/Feature  At Side Drain/Anomaly

Setting-up for a **NEW** DCVG type survey, setup screens 1, 2 and 5, note selectable fields, normally defaulted.

- **Max mV = Total mV 1st Read if checked**, the Max mV voltage recorded at an anomaly location will automatically become the first voltage value used by the data-logger's software to calculate the **Total mV** (total voltage gradient). Otherwise, if this box is unchecked, you will have to repeat the Max mV recording a second time as part of the Total mV determination process.
- If this box is checked, GPS data will be logged automatically when DCVG anomalies are **'marked'**
- DCVG surveys are performed with the rectifier-current switched ON and OFF in a cyclic fashion, the **DCVG** selection provides this **'Reading Mode'**, [Same as On/Off (DSP)] The other available choice is **DCVG GPS Sync**. **Note:** DCVG surveys require a measurable difference between **On** and **Off** voltages, i.e., they require a significant IR drop.

Survey Setup 5 of 5

Reading Mode: DCVG

Range: 5.7 VDC 400 MOhm

Cycle: 700 On (mSec) 300 Off (mSec)

## DCVG Survey In Progress Screens

Device Readings - Voltage

1st TS  
Pipe To Soil

On  Off

Reading Mode:  
On/Off (DSP) >>

Range:  
5.7 VDC 400 MOhm >>

Use Reading for DCVG Signal Strength

SKIP

- The **On** and **Off** pipe-to-soil potentials measured (per cycle) at the starting test station will be displayed on the **Device Readings** screen. Make sure that the checkbox labeled, '**Use Reading for DCVG Signal Strength**' is checked. This will mean that the software will have its first value for IR drop to use in its %IR calculations. The above procedure should be performed at each pipe connection opportunity (test station) so that the software will be able to apply appropriate IR drop values for each **bracketed 'marked'** anomaly.
- As you enter a defect's voltage gradient field, you will observe an increase in the DCVG voltage values displayed on the Survey screen. When you observe a peak (maximum value) in the DCVG voltage readings, you would interrupt the triggering to perform the '**Mark**' process.

MCM Pipeline Survey mcm dcvg

Station: 0+52.5  mV

Total Distance: 52.5

Last Ref Distance: 52.5

LOG GPS RESTART UNDO FLAG

FEATURE MARK DEVICE

Displayed Readings: 17 Connected VADER 6863

Max -14.3mV

Min -0.7mV

READ

Mark DCVG Anomaly

mV

Read Max mV  Read Total mV

Max 0.0 mV  
( 0.0 mV On / 0.0 mV Off)

Total 0.0 mV

Range: 5.7 VDC 400 MOhm >>

Notes

CLEAR ACCEPT

You will notice that the software automatically applies the '**Max mV**' value as the first value in the '**Total mV**' determination

Mark DCVG Anomaly

mV

Read Max mV  Read Total mV

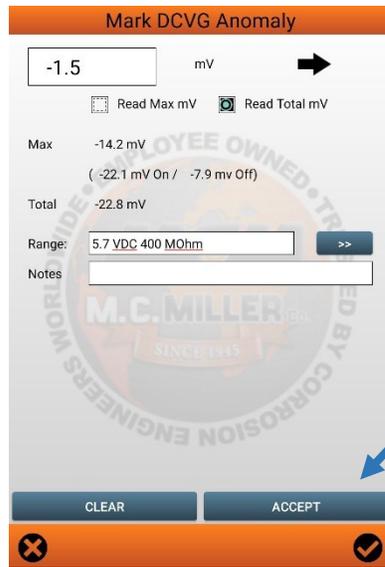
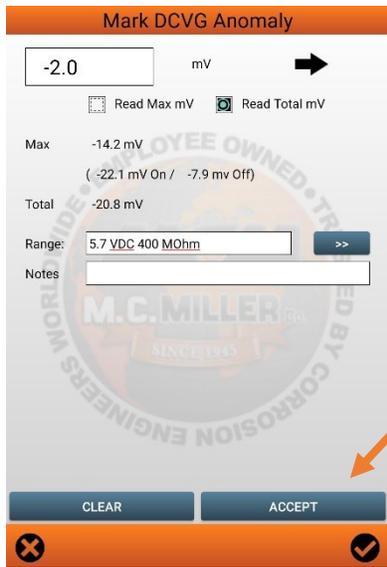
Max -14.2 mV  
( -22.1 mV On / -7.9 mV Off)

Total -14.2 mV

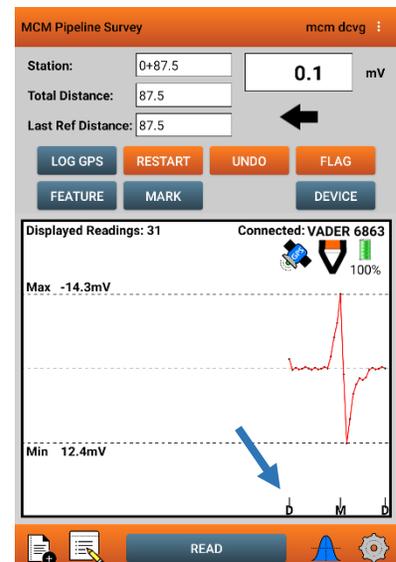
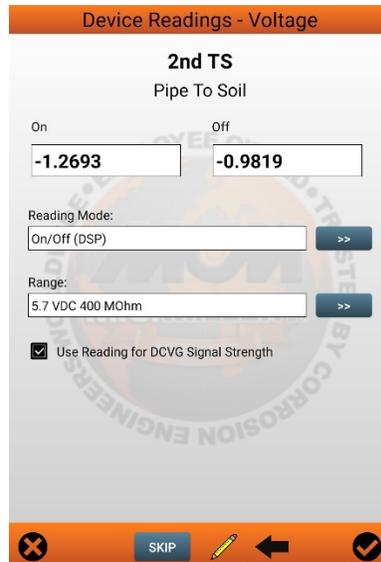
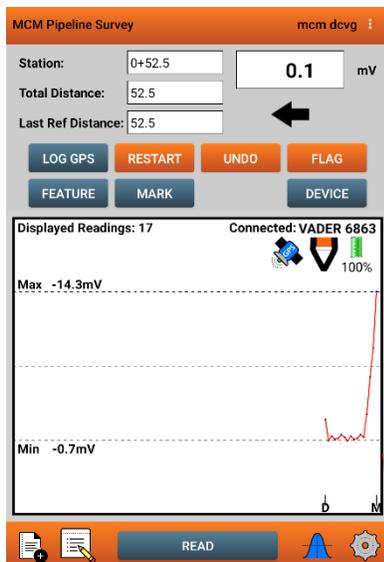
Range: 5.7 VDC 400 MOhm >>

Notes

CLEAR ACCEPT



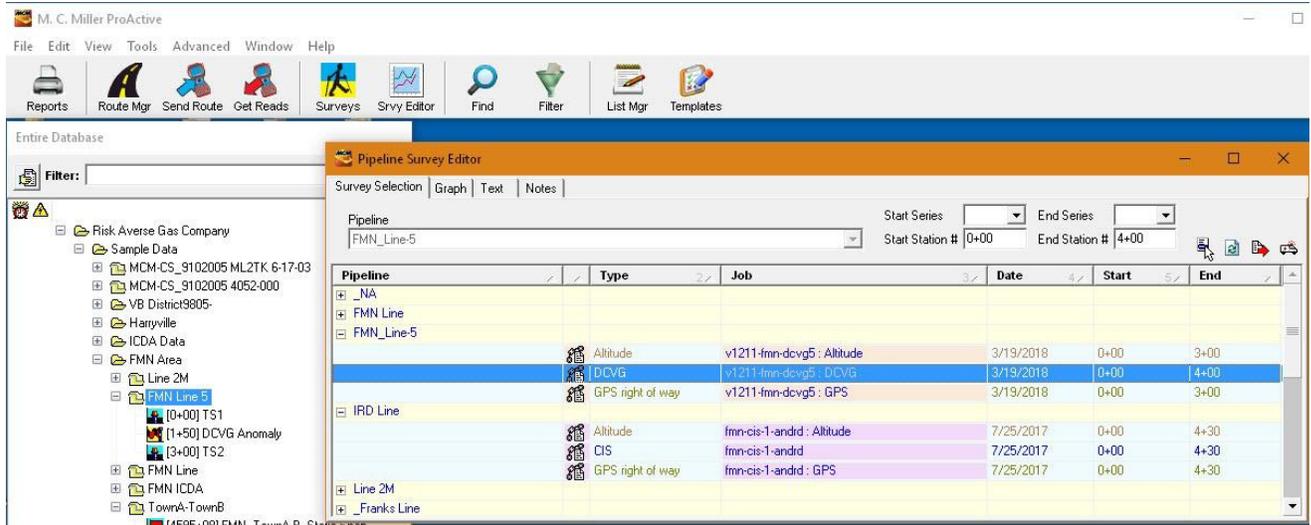
- You should then proceed to move the electrodes to their next positions, and you should **'Accept'** the second reading. You should proceed in this fashion until you are outside of the defect's voltage gradient field, i.e., the DCVG voltage reading is essentially **zero** (typically DCVG voltages less than about  $\pm 5\text{mV}$  would be considered essentially zero, on the 5.7V, 400M $\Omega$  voltmeter setting).
- At this point, you should tap on the **'Save'**  button which will save all the data associated with this defect.
- You return to the main survey screen, note the **'M'** marker
- Subsequent taking of pipe-to-soil potentials should be performed at each pipe connection (**Test Station**) opportunity so that the software will be able to apply appropriate IR drop values for each **'marked'** anomaly.
- **Note the bracketing** of a marked anomaly by test stations for this example in the main survey screen graph area...



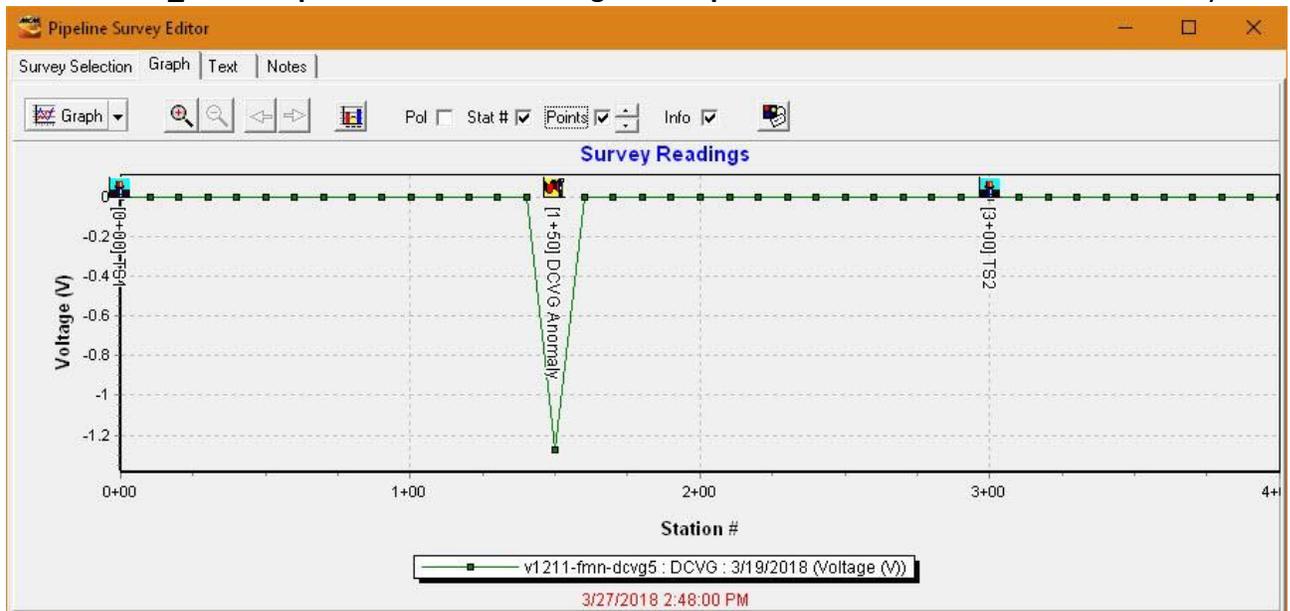
## DCVG Survey Transfer to ProActive

As mentioned in [PLS Survey Transfer to ProActive](#) all PLS *raw* data resides in the *pipelinesurvey* folder on your Android tablet.

Successful *'Surveys'* function will update the ProActive *database tree* to reflect any *Devices* and/or *Anomalies* that were recorded during the survey. The ProActive *'Srvy Editor'* function can then be used to review survey data. The below picture shows the results of the transfer of a DCVG survey example to ProActive. The **Entire Database** window shows the database tree and the **Pipeline Survey Editor** window showing the survey data *key* elements.



Clicking the **Graph** type in the **FMN\_Line-5 Pipeline** and then clicking the **Graph tab** will show the transferred survey data...

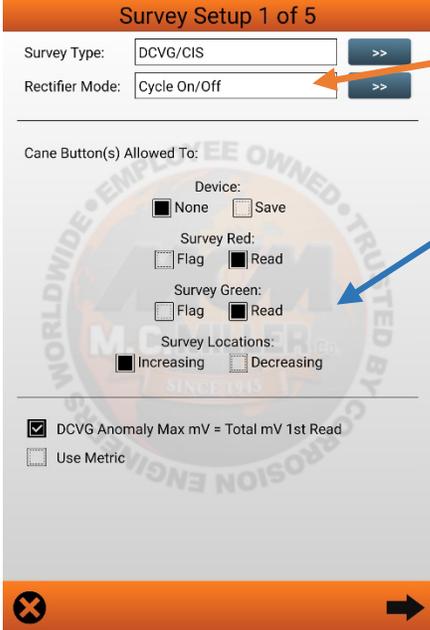


**Note:** checking the **Info** and **Points** checkboxes shows an additional level of detail for the transferred survey.

# DCVG/CIS Combined Surveys

Performing a **DCVG/CIS combined survey** allows you to complete both types of surveys at the same time. This requires an extra piece of equipment, **DCVG/CIS Switch Box Controller**, to allow for automatic switching between soil-to-soil measurements and pipe-to-soil measurements. Setup and technique for this type of survey is very similar to a typical DCVG survey.

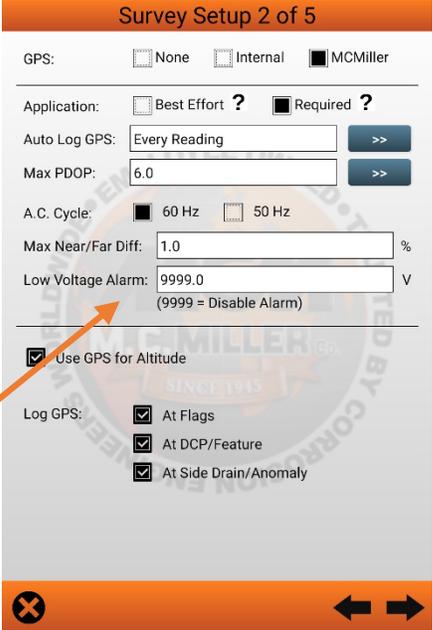
## DCVG/CIS Survey Setup Screens



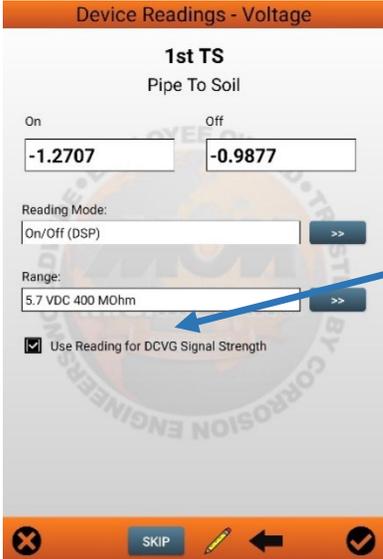
**“Cycle On/Off”** will be the only available rectifier mode.

The checkboxes for the cane buttons, “Survey Red” and “Survey Green” will both default to **“Read”**. The Green cane button will actually be **disabled** during this type of survey.

You will see settings for both DCVG and CIS on the second setup screen. **Low Voltage Alarm** will only apply to **CIS** readings.



## DCVG/CIS Survey In Progress Screens



The **On** and **Off pipe-to-soil** potentials measured (per cycle) at the starting test station will be displayed on the **Device Readings** screen. Make sure that the checkbox labeled, ‘**Use Reading for DCVG Signal Strength**’ is checked. This will mean that the software will have its first value for IR drop to use in its %IR calculations. The above procedure should be performed at each pipe connection opportunity (test station) so that the software will be able to apply appropriate IR drop values for each **bracketed ‘marked’** anomaly.

- The **primary reading mode** for a combined survey is **DCVG**. This is the mode the survey will start in. The screen will display the DCVG reading value and arrow. The graph will display the DCVG readings when in DCVG mode. The mode switch button will display as **CIS**.
- When you trigger a reading, the DCVG reading will be logged before the app automatically switches to CIS mode, takes a CIS reading, and switches back to DCVG mode.
- You can **manually switch** between modes by **tapping the mode switch button** or by **swiping vertically on the graph**.
- In CIS mode, the screen will display the On and Off CIS reading values, the graph will show the logged CIS readings, and the mode switch button will display as **DCVG**.
- If you switch to CIS mode manually and trigger a reading, the app will log a CIS reading and automatically switch back to DCVG mode.
- As defects/anomalies are detected, you can mark them just as you would during a regular DCVG survey. (see [DCVG Survey Support](#))



# Surface Potential Survey Support

The **Surface Potential (SP)** pipeline survey method is similar to the DCVG survey method, at least in terms of how the reference electrodes are employed to measure the difference in potential between two points on the surface of the soil above a buried pipeline. SP surveys, however, are typically performed on uncoated or poorly coated pipelines, whereas DCVG surveys are usually performed on well-coated pipelines that have an impressed current source providing the **signal strength**.

Localized current flow can give rise to potential gradients on the surface of the soil above a buried pipe due, for example, to the presence of corrosion cells (combinations of anodic and cathodic areas) on the pipe, and the goal of an SP survey is to locate such potential gradient fields.

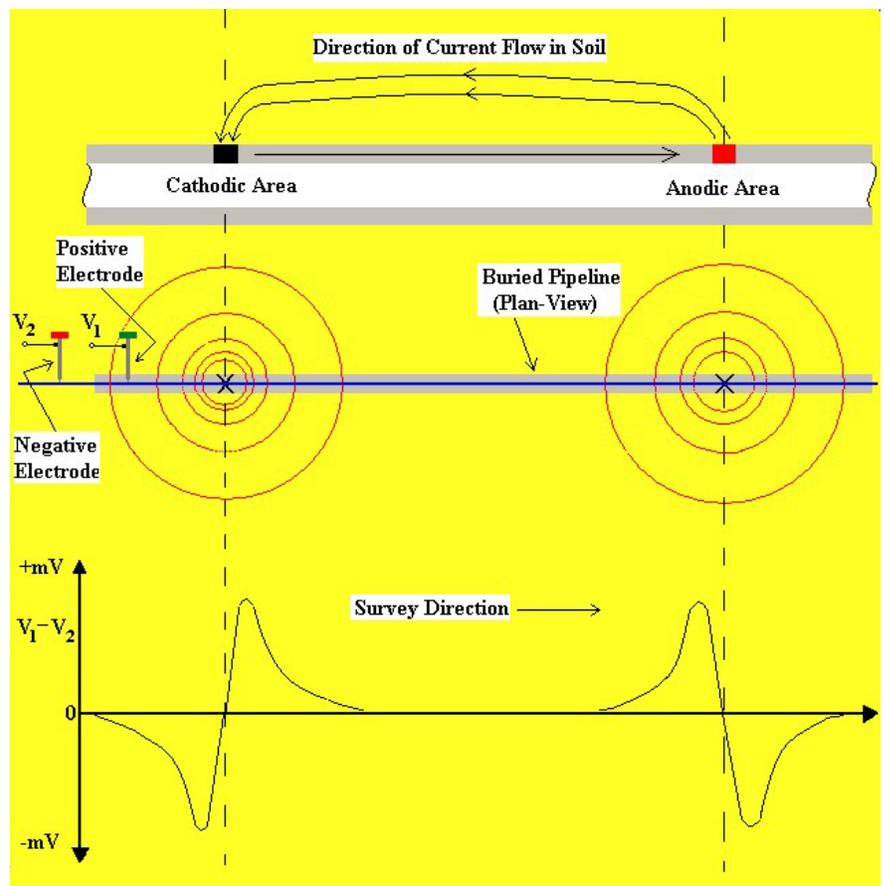
In the case of bare pipe, typically only about 10-15 % of the pipe will be subject to galvanic corrosion, and this small percentage is usually made up of small, highly localized corrosion areas (anodic areas) that are randomly distributed along the length of the pipe. Thus, an **above-the-ground** survey technique that can accurately locate these isolated areas is invaluable.

The objective of SP surveys is to locate **anodic** areas existing along a segment of pipeline, as evidenced by potential gradient fields having a particular polarity presenting themselves on the surface of the soil directly above the anodic areas. Once any anodic areas have been located, remedial action can be taken, such as the installation of **sacrificial** anodes to suppress current flow from the corroding area, with a view to preventing further external corrosion in that particular area.

One way to perform a SP pipeline survey is to use the so-called **In-Line** method. In this case, the reference electrodes are both positioned over the pipe and their separation is kept fixed as the operator, or operators in the case of large electrode spacing (for example, a 20 ft spacing), walks down the length of the pipeline section. With a view to detecting localized anodic areas and accurately measuring the longitudinal voltage profile, the survey needs to be close-interval in nature.

The **In-Line** method of conducting SP surveys. Soil-to-soil potential difference readings are plotted in the bottom part of the Diagram against the position along the pipeline of the center point between the reference electrodes

To further understand **Surface Potential** survey **Physical Principles** and **Survey Methods**, it is recommended that reader refer to the **Surface Potential Surveys Training Manual - Gx Version.pdf** document.



## □ Surface Potential Survey Setup Screens

**Survey Setup 1 of 5**

Survey Type:  >>

Rectifier Mode:  >>

---

Cane Button(s) Allowed To:

Device:  None  Save

Survey Red:  Flag  Read

Survey Green:  Flag  Read

Survey Locations:  Increasing  Decreasing

Use Metric

Soil Resistivity Distance Units:  CM  M

**Rectifier Modes**

Always On

Always Off

CANCEL SELECT

**Survey Setup 2 of 5**

GPS:  None  Internal  MCMiller

Application:  Best Effort ?  Required ?

Auto Log GPS:  >>

Max PDOP:  >>

A.C. Cycle:  60 Hz  50 Hz

---

Use GPS for Altitude

Log GPS:  At Flags  At DCP/Feature  At Side Drain/Anomaly

**Survey Setup 5 of 5**

Reading Mode:  >>

Range:  >>

Setting-up for a **NEW** Surface Potential type survey, setup screens 1, 2 and 5, note selectable fields, are normally defaulted.

- You can select either, **Always On**, if the rectifiers influencing the pipe are **ON**, or, **Always Off**, if the pipe is unprotected or is temporarily depolarized. Note: The **Cycle On/Off** option is **not available for Surface Potential surveys** as the process involves cell-to-cell potential difference **single** readings.
- To calculate a **Corrosion Factor** value in **ProActive**, the units  **$\Omega$ .cm** or  **$\Omega$ .m** for soil resistivity that will appear on the SP anomaly **marking** screen, for your manual data entry, will depend on your selection here in the **Soil Resistivity Distance Units** field (**CM** or **M**)
- If this box is checked, GPS data will be logged automatically when Surface Potential anomalies are **marked**.
- The **Single Read** voltmeter reading mode is appropriate for **cell-to-cell** potential difference single readings, which are the basis of Surface Potential surveys.

## □ Surface Potential Survey In Progress Screens

MCM Pipeline Survey surface pot test

Station: 0+260.0 0.9 mV

Total Distance: 0.0 1.2 mV Prior

Last Ref Distance: 0.0

LOG GPS RESTART UNDO FLAG

FEATURE MARK DEVICE

Displayed Readings: 1 Connected: VADER 6863

Max 1.3mV

Min 1.1mV

READ

- The current reading is displayed in the **top mV field**. The **bottom mV Prior** field will be **blank** until the first reading is logged.
- As readings are logged, the last logged reading (**the prior reading**) is displayed in the bottom **Prior mV** field and the **current reading** is displayed in the top mV field.
- In this example screen, the prior reading was 74.3 mV, and the current reading is -112.1 mV. In this example, a **positive-to-negative** polarity switch has been detected, which means that an **anodic area** has been detected. This possible anomaly can then be **marked** by taking side drain readings on both sides of the pipe at the epicenter location. Tapping on the **Mark** button on the Survey screen will bring up the **Side Drain** screen.

MCM Pipeline Survey surface pot test

Station: 0+300.0 -112.1 mV

Total Distance: 40.0 74.3 mV Prior

Last Ref Distance: 40.0

LOG GPS RESTART UNDO FLAG

FEATURE MARK DEVICE

Displayed Readings: 9 Connected: VADER 6863

Max 74.3mV

Min 0.9mV

READ

Surface Potential Side Drain

-108.1 mV →

0.0 SDL SDR 0.0

Range: 5.7 VDC 400 MOhm >>

Resistivity: 0.0 MOhm\*cm >>

Notes:

CLEAR ACCEPT

Surface Potential Side Drain

-99.7 mV →

-108.1 SDL SDR 0.0

Range: 5.7 VDC 400 MOhm >>

Resistivity: 0.0 MOhm\*cm >>

Notes:

CLEAR ACCEPT

Surface Potential Side Drain

-99.1 mV →

-0.108099 SDL SDR -0.0997

Range: 5.7 VDC 400 MOhm >>

Resistivity: 4300 Ohm\*cm >>

Notes:

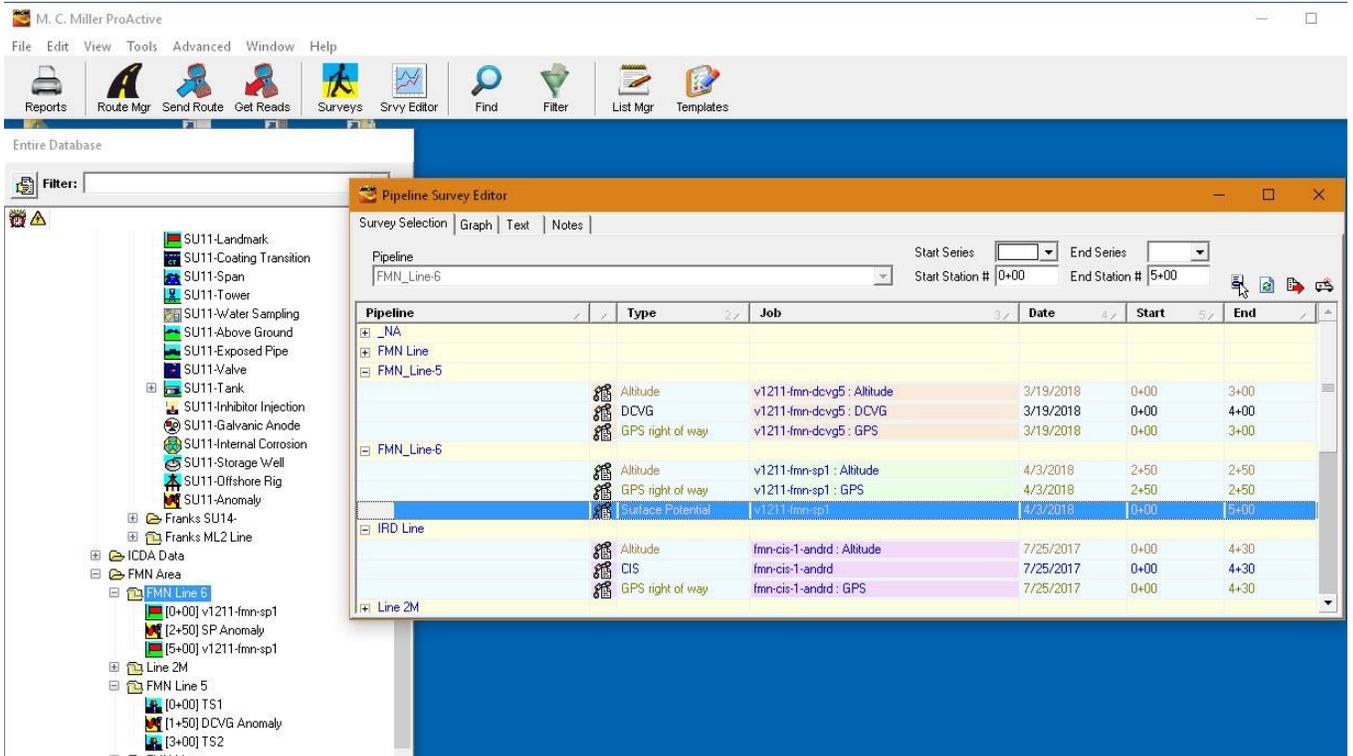
CLEAR ACCEPT

- By placing the negative data-probe over the pipe (at the epicenter spot) and the positive data-probe off to the **left-hand side of the pipe**, you can accept the Side Drain Left (**SDL**) reading by tapping on the **Accept** button.
- Next, you would keep the negative data-probe over the pipe, and you would swing the positive data-probe to the opposite side of the pipe (**the right-hand side**) to take the Side Drain Right (**SDR**) reading.
- Next, you can manually enter a value for the **soil resistivity measured in the vicinity of the anomaly**.
- At this point, you should tap on the **Save** button which will save all the data associated with the anomaly.
- The **Clear** button will clear the logged data for the active reading.

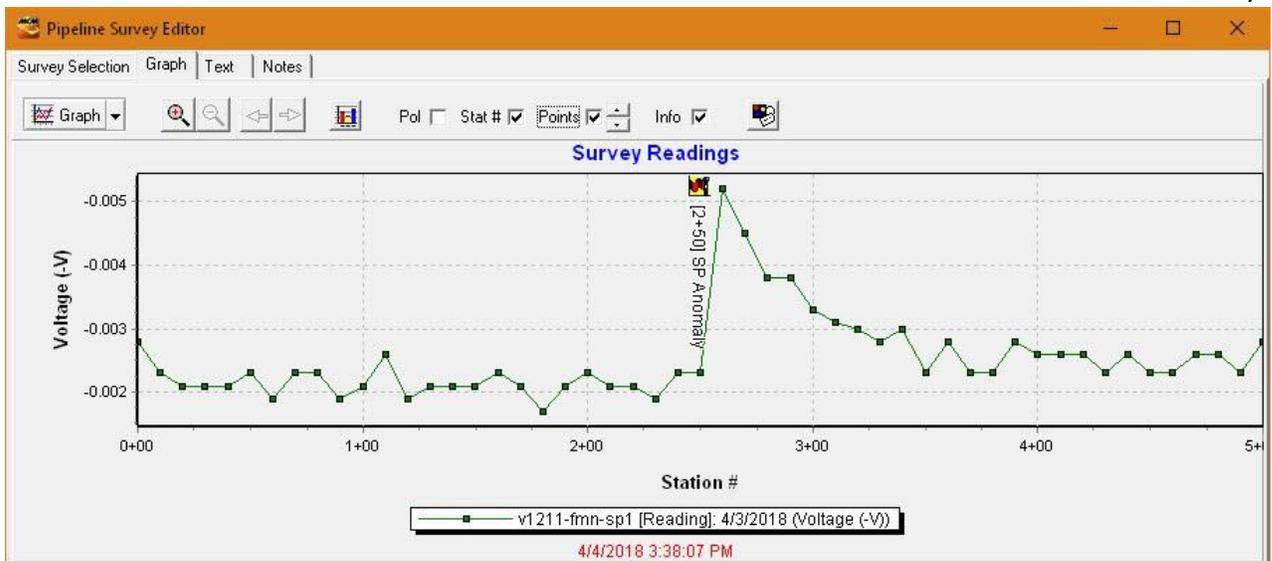
## □ Surface Potential Survey Transfer to ProActive

As mentioned in [PLS Survey Transfer to ProActive](#) all PLS *raw* data resides in the *pipelinesurvey* folder on your Android tablet.

- A successful '**Surveys**' function will update the ProActive **database tree** to reflect any **Devices** and/or **Anomalies** that were found during the survey. The ProActive '**Srvy Editor**' function can then be used to review survey data. The below picture shows the results of the transfer of a Surface Potential survey example to ProActive. The **Entire Database** window shows the database tree updated and the **Pipeline Survey Editor** window showing the survey data **key** elements.



Selecting the **Graph** type in the **FMN\_Line-6 Pipeline** and then clicking the **Graph tab** will show the transferred survey data...



**Note:** checking the **Info** and **Points** checkboxes shows an additional level of detail for the transferred survey.

# Android PLS Exception Screens

When **Flag separation distance** or a difference between **Far Ground** and **Near Ground** Pipe to Soil readings at a **reconnect** Test Station do not meet specified survey setup criteria, an **exception** screen will be presented for the user to take action.

## □ Flag Error

**Survey Setup 3 of 5**

Name of Pipeline:

Pipeline Section:

Survey Location:

Location Values:  
Station Number

Distance Between Flags:  ft

Distance Per Reading:  ft

Flag Error Limit:

Auto Pacing Mode

Data Probes:  One  Two

**Flag Error**

Percent Error from Expected Readings Between Flags:

Correct Number of Flags Since Known Station:

- In the field labeled, **Distance Between Flags**, you can type in the survey flag interval (**distance between survey flags**) for the section of pipeline being measured, assuming that survey flags have been laid out. Typically, survey flags are located at 100 feet intervals. In such a case, you would have a new reference (a stationing correction) every 100 feet. **Note:** If survey flags are not in use, enter zero in this field. In this case, tapping accidentally on the Flag button will not adversely impact your stationing.
- **Flag Error Limit** specifies the maximum permissible error between the actual number of readings logged between 2 survey flags and the expected number of readings.
- By setting the field labeled, **Flag Error Limit** you can type in the maximum permissible error. For example, the maximum permissible error is indicated as **20%** on the **Survey Setup 3 of 5** screen. If the reading interval is expected to be **2.5** feet and the survey flag separation is **100** feet, this means that **40** readings are expected. If, however, only **30** readings are actually logged between survey flags, an error window will appear on the screen, since there is a **25%** difference between the expected and actual number of readings in this example. No error window will appear if the difference is less than **20%**.
- On the **Flag Error** screen, the user can specify the **correct** number of Flags since the last known station.

## □ Far/Near Error

**Survey Setup 2 of 5**

GPS:  None  Internal  MCMiller

Application:  Best Effort ?  Required ?

Auto Log GPS:  >>

Max PDOP:  >>

A.C. Cycle:  60 Hz  50 Hz

Max Near/Far Diff:  %

Low Voltage Alarm:  V  
(9999 = Disable Alarm)

Use GPS for Altitude

Log GPS:  At Flags  At DCP/Feature

**Far/Near Ground Error**

Reading Mode: On/Off (DSP)

>>      On      Off

Far Reading	<input type="text" value="1.2504"/>	<input type="text" value="0.0057"/>
Near Reading	<input type="text" value="0.4768"/>	<input type="text" value="0.0056"/>
Difference	61.9%	3.0%

**RETAKE NEAR**

- On the **Survey Setup 2 of 5** screen, the **Max Near/Far Diff:** field will represent a threshold level with respect to the difference between a **Far-Ground P/S reading and a Near Ground P/S reading** (expressed as a percentage) recorded at a trail wire **reconnect Test Station**. For differences above the entered threshold value, **Far/Near Ground Error** screen will be presented.
- The **Far/Near Ground Error** screen will present 2 options:
  - **Retake Near** **RETAKE NEAR**
  - **Accept This Error** 
- By selecting **Retake Near**, you are given the opportunity to retake the **Near-Ground P/S reading** (perhaps you need to re-do the connection). If the percentage difference is then below your threshold level, there will be no error screen.
- By selecting the **checkmark**, you will be choosing to ignore the difference in the readings and move on with the survey (perhaps there is a significant current flowing in the pipe between the 2 test stations).

# NOTES