

# CATH-TECH

*CP Survey Instruments*

## Operation Manual for Hexcorder Pro

CIPS/DCVG/ACVG/GIS Survey Instrument



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## Limited Warranty

All Cathodic Technology Limited (Cath-Tech) instruments and equipment are warranted against defects in materials, design, or workmanship for a period of two years from date of sale. This warranty excludes damage due to misuse, abuse, tampering or acts of God such as fires, floods, wind damage, lightning etc.

We will repair or replace at our option any defective component, after examination in our manufacturing facility, if the fault is due to defective materials or labour, within two years of the purchase date. For warranty repair, a Returned Goods Authorization (RGA) must be obtained from Cathodic Technology Ltd prior to shipping the defective unit pre-paid to our location.

**Note:** *There is no warranty expressed or implied on batteries.*

### Cath-Tech Policy

- Cath-Tech extends a two-year in use warranty on all units, which have been designed and manufactured by Cath-Tech.
- Cath-Tech reserves the right to make any changes in design or specification which it deems an improvement, with no liability to make the same changes on existing equipment.
- This warranty is in lieu of all other warranties or guaranties, expressed or implied, which might otherwise exist. The purchaser is relying only upon this guarantee and not upon any representations not herein expressed.
- Any material or equipment being returned to the factory must first have a Returned Goods Authorization (RGA) from Cath-Tech.

Cathodic Technology Limited cannot offer support or warranty coverage for user-supplied tablets. Cathodic Technology Limited is not responsible for any damage or issue caused to a user-supplied tablet while using the Hexcorder Pro.

### *Tablet User Account*

The Zebra tablet is provided pre-configured for use, with the Hexcorder Pro app installed. The tablet is configured to a unique Google account created specifically for it, named as [SERIALNUMBER@gmail.com](mailto:SERIALNUMBER@gmail.com). The user may opt to change the account if they wish.

**To avoid over-discharging the battery in the future, please **do not** store the Hexcorder Pro without fully charging the battery first, and please recharge it **every 3 months** if not in active use. This will promote battery health and lifespan and keep the battery from becoming severely discharged.**

# Welcome

Thank you for selecting the Hexcorder Pro CIPS and DCVG survey instrument.

The Hexcorder Pro utilizes GPS for synchronization with current interrupters and other data logging equipment. This ensures that everything happens at the same time no matter how far apart equipment is or how long it has been out in the field. GPS coordinates are logged for each reading and stored to memory.

Open and inspect your Hexcorder Pro upon receipt. If any damage occurred during shipping, file a claim with the carrier immediately.

The Hexcorder Pro comes complete with:

- Hexcorder Pro on mounting plate with GPS antenna
- Rugged Zebra/Xplore\* Android tablet (if ordered)
- Wire dispenser/chainage counter assembly, either hip pack or back pack
- Hexcorder Pro to wire dispenser cable (attached to back pack or in the box for hip pack)
- Battery charger
- 2 x Cu/CuSO<sub>4</sub> half cells
- 2 x half cell extension poles
- 2 x Hexcorder Pro to survey pole cables
- Spool of 32AWG survey wire
- 4 point harness
- Hip pack strap (if applicable)
- Carrying case
- Mini USB cable
- Operation manual



*Figure 1 - Hexcorder Pro with Hip Pack*



*Figure 2 - Hexcorder Pro with Backpack*

***\*As of August 2020, all Hexcorder Pro units come with the new rugged Zebra L10 Android tablet.***

## Testing & Calibration

This instrument has been thoroughly tested at the factory to ensure it will perform correctly. A certificate of calibration is included. The calibration is traceable to the National Institute of Standards and Technology (NIST) or the National Research Council of Canada (NRC). Cath-Tech recommends that the Hexcorder Pro be re-calibrated on a yearly basis; contact Cath-Tech for more information.

## Charging the Battery

The battery inside the Hexcorder Pro box is the latest generation of rechargeable Lithium Ion battery, rated for 9000mAh. High quality Samsung-brand lithium cells are used. Do not allow the battery to freeze, also do not store in a hot location. **Fully charge the battery before storing long-term.**

**To avoid over-discharging the battery, please do not store the Hexcorder Pro without fully charging the battery first, and please recharge it every 3 months if not in active use. This will promote battery health and lifespan and keep the battery from becoming severely discharged.**

It is recommended that you charge the battery for 24 hours upon receiving the unit. When the charger is connected and the Hexcorder Pro is charging, a red LED on the control panel will light up. When charging is complete, this LED will turn green. When connected to the tablet, the Hexcorder Pro will display the battery life near the top right corner as a percentage. The Hexcorder Pro will automatically power down when the battery has been fully depleted. If there are any issues charging the battery, please refer to the Troubleshooting section on page 42 for detailed instructions to revive the battery.

The tablet also includes rechargeable Lithium Ion batteries, which require charging prior to use. The charging port is located behind a water-tight door on the right-hand side of the tablet (See Figure 4). Under normal survey use (100% brightness, screen always on, Wi-Fi turned off) the battery will last approximately 11 hours. Additional external batteries and a reconditioning charger are available for purchase if a longer run time is needed. External battery packs can be changed without shutting the tablet off.

## GPS Engine

A standard GPS engine/antenna as shown in Figure 3 is supplied with the Hexcorder Pro. It is capable of resolving position information with an accuracy better than 3 meters if the WAAS differential correction is being received. Optional sub-meter GPS accuracy antenna is available upon request.

The GPS engine is connected to the Hexcorder Pro by a metal circular connector on the outside of the case.

Normally the GPS will lock within 5 minutes, however, if the GPS has been moved far from its last position, has not been used for a long period or if the signal is weak, it may take over 10 minutes to lock.



Figure 3 - GPS Engine / Antenna

If the GPS engine will not lock:

- Place it in a position that has a good view of the sky in all directions, on the roof of a parked car is usually good
- Power on the Hexcorder Pro
- Leave it alone for 10 minutes or so
- Usually, the GPS will lock in this situation

If the GPS loses lock while in survey mode, this is not a problem. The PPS (Pulse Per Second) signal will be internally generated by the receiver's real-time clock and the ON/OFF measurements will still be accurate. The GPS will typically regain lock long before timing drift has any influence on the recorded data.

NOTE: The Hexcorder Pro uses the UTC date and time supplied by the GPS satellite system. The displayed time and time stored in the data can be set to your local time zone in the "parameters" screen, accessed from the Settings tab.



# Connections



Tablet Power Button

Hexcorder Pro power button



Figure 4 - Hexcorder Pro assembly - right view

Figure 5 - Hexcorder Pro assembly - left view

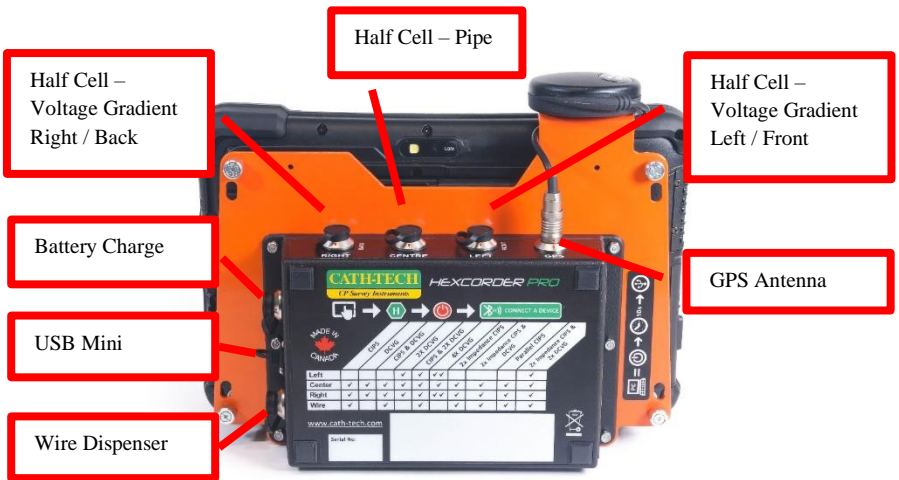


Figure 6 - Hexcorder Pro assembly - Bottom view

*Threading the Wire*

From the spool, the wire passes through the plates of the lower tensioner. Then the wire is wound clockwise around the drum twice. Finally, it passes through the plates of the upper tensioner and out the side of the wire dispenser to be attached to the pipe at the test station.

Connect the lead from the bottom of the spool to the terminal at the base of the wire dispenser.

The wire has a fine enamel coating on it that must be removed with sandpaper to make a good electrical connection.



*Figure 7 - Wire path through chainage counter*



## Setting Up

To turn on the Hexcorder Pro black box, press the red power button on the left side of the case. Turn the tablet on by pressing the power button on the right side of the tablet. When the survey day is done, hold the red power button for 5 seconds to turn the Hexcorder Pro black box off and turn the tablet off.

### ***Important Note:***

The Hexcorder Pro should be powered on only when you are ready for it to be connected to the tablet; too much idle time and the Bluetooth will no longer be “findable”. Simply power cycle the Hexcorder Pro if this occurs.

Run the Hexcorder Pro app from the tablet home screen.

### ***Using Another Tablet***

For the best user experience, we **strongly recommend** only using the rugged Android tablet supplied by Cath-Tech. The app can run on other tablets, however battery life, water resistance and daylight readability are not optimal. The minimum specifications to run are Android 6.0 with screen resolution of 1366 x 768 or better, and a 10” diagonal screen size. The tablet must also have Bluetooth 2.0 or better to communicate with the Hexcorder Pro box.

### **Connecting to Tablet**

In the app, select the “CONNECT A DEVICE” button, the Select Device window will appear. Select the Hexcorder Pro, identified by its serial number as the Bluetooth name. A connecting window will appear and then disappear when successful. The app will now show the status of the Hexcorder Pro unit (serial number, status icons, and battery power) near the top middle of screen.



*Figure 9 – Hexcorder Pro app icon*

### ***Important Note:***

When the app attempts to turn on the tablet Bluetooth receiver, the app will ask for permission to use your “Location”. It is required that you allow the app permission otherwise the Bluetooth receiver cannot scan for local Bluetooth devices.

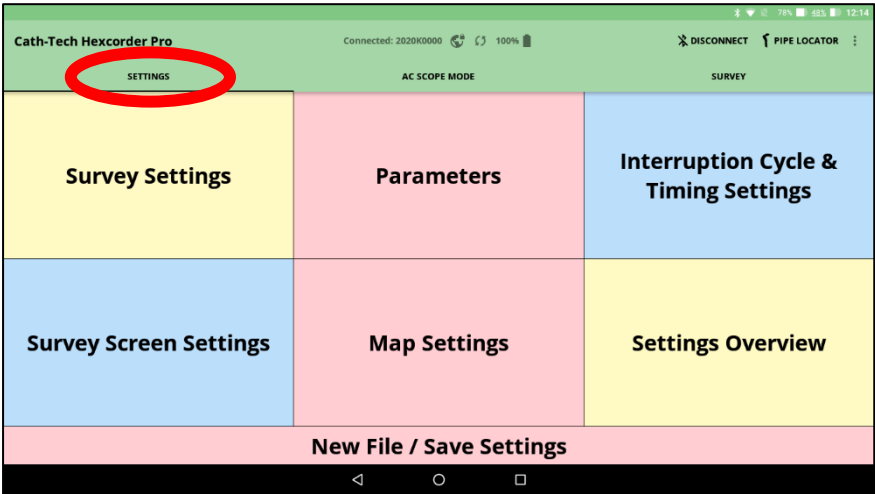
### ***Tablet and App Language***

Multiple languages are implemented in the Hexcorder Pro app. They are activated by switching the tablet language to the desired language. If the language selected is supported by the app, it will automatically change. If the language is not supported by the app, it will remain in English. Contact Cath-Tech to explore adding additional languages.

To change the language on the tablet, select the Settings (gear icon), scroll down to the Personal section, select “Language & Input” and select the first option “Language”, then select your desired language from the list. Re-open the Hexcorder Pro app to see the chosen language implemented.

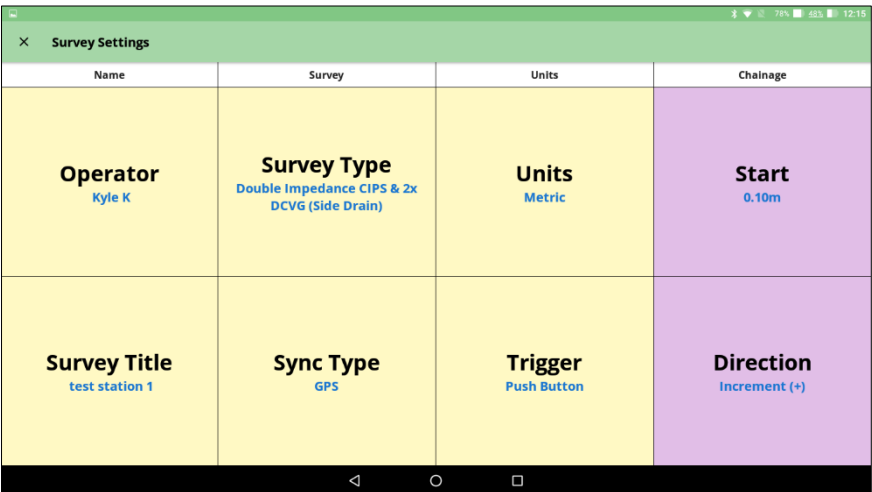
# Survey Configuration

Before a survey can be performed, the Hexcorder Pro must be configured for the type of survey to be done. The Hexcorder Pro will recall the previous survey settings. Settings are accessed and edited via the SETTINGS tab.



## Survey Settings Screen

From this screen, many survey options are accessible.



## Operator

The operator can enter their name. This is an advantage later in data analysis to track the performance of individual operators and follow up with possible issues. Operator name can be up to 32 characters.

## Survey Title

Enter information about this section of survey. It is often used to identify the line surveyed, starting point, direction, etc. up to 32 characters long. Example: Line 2 upstream from TP16874

## Survey Type

The Hexcorder Pro can perform eighteen different survey configurations, based on three different types of survey. CIPS (CIS) Close Interval Potential Survey measures the level of cathodic protection on a structure. Direct Current Voltage Gradient (DCVG) and Alternating Current Voltage Gradient (ACVG) surveys both detect flaws or holidays in the coating.

NOTE: ACVG survey is only available in units manufactured after January 2022. Contact the factory at [ctl@cath-tech.com](mailto:ctl@cath-tech.com) to find out about upgrading older Hexcorder Pro units.

The Hexcorder Pro can measure all survey types at the same time, as well as various combinations of the three. The user can select the number of input channels and input impedances, among other options. Allowable combinations of survey types will be selectable in the Hexcorder Pro application.

- **CIPS (CIS)** – standard pipe to soil potential survey. Centre and Right poles are used together so only one pole is required to be on the ground at the time of measurement. One channel (Centre and Right connected) or two channel (Centre and Right independent). Input impedance is selectable from the settings menu at 25Mohm, 250Mohm, or both 25Mohm and 250Mohm **\*NOTE: Only can be used in areas with <10V AC\***.
- **DCVG** – Direct current voltage gradient survey (pole to pole Center to Right, Center to Left). One, two, or four channel.
- **ACVG** – Alternating current voltage gradient survey (pole to pole Center to Right, Center to Left) – one or two channels, requires the same number of DCVG channels to be active.

CIPS	DCVG	ACVG
<input type="radio"/> None	<input type="radio"/> None	<input type="radio"/> None
<input checked="" type="radio"/> 1 Channel	<input type="radio"/> 1 Channel	<input type="radio"/> 1 Channel
<input type="radio"/> 2 Channels	<input checked="" type="radio"/> 2 Channels	<input checked="" type="radio"/> 2 Channels
<input type="radio"/> 4 Channels		
Impedance		
<input checked="" type="checkbox"/> 25MΩ	<input checked="" type="checkbox"/> 250MΩ	

CANCEL OK

Figure 10 - Survey mode configuration menu

## Sync Type

The user can set the Hexcorder Pro to perform in three different synchronization modes

- GPS synchronized, for synchronized timing with GPS enabled interrupters
- High/Low synchronized, for using non-GPS interrupters
- Unsynchronized, for non-interrupted surveys

## Units

The user can display and record chainage for the CIPS survey in Metric (meters) or Imperial (feet). Only applicable to surveys with CIPS.

## Trigger

The user can set the Hexcorder Pro to be triggered in one of three ways

- Pushbutton trigger – The reading will be activated by pressing the survey pole button
  - Most common selection, allows the surveyor to check the reading is accurate prior to saving
- Time – the reading will be activated by the passage of a user-selected number of cycles
  - Takes the reading regardless of half cell position and accuracy
- Distance – the reading will be triggered when the chainage increases/decreases by a user-selected amount
  - If moving fast, will only take 1 reading per interruption cycle, even if surveyor has travelled 2 to 3 times the distance specified.

It is always recommended that surveyors begin with the Pushbutton trigger until they are used to the equipment and survey techniques. If an automated survey is desired, it is recommended to automate based on Time rather than Distance. This provides a reading based on the interruption cycle. Readings based on Distance can be missed if the surveyor is moving faster than the cycle.

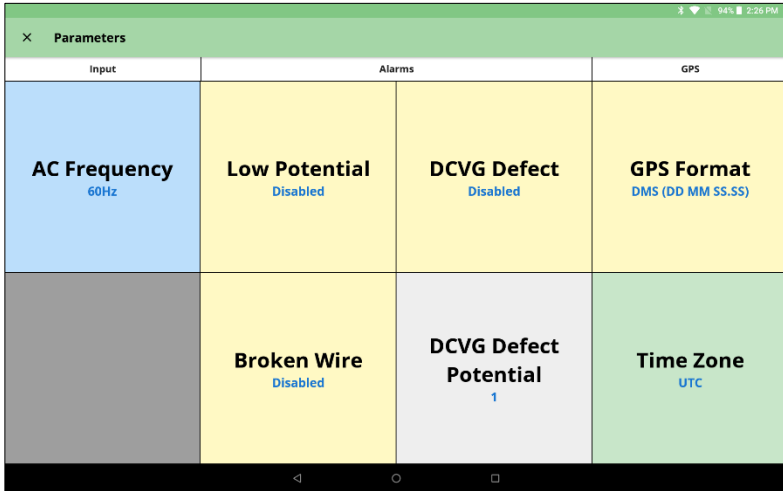
## Start

Set the starting chainage. Only applicable to surveys with CIPS. This information can be found for many test points from the official pipeline map.

## Direction

User can set the chainage to count upwards (increment) or count downwards (decrement). Only applicable to surveys with CIPS. The surveyor can walk upstream from a test point, return and then walk downstream with the chainage calculating correctly.

## Parameters Screen



This screen allows many of the parameters of the Hexcorder Pro to be set, such as alarms, GPS, etc.

### AC Frequency

The Hexcorder Pro uses software filtering in conjunction with hardware filtering. For the software filtering to work properly it needs to be configured to the local AC frequency. Select either 50Hz or 60Hz depending on the power grid in your area.

### Alarms

The Hexcorder Pro has 3 separate alarm features to help you detect and diagnose potential survey issues or equipment problems. Each alarm can be activated or disabled by tapping on it.

- **Low Potential Alarm** – sounds if the CIPS potential changes by 50% from the previous reading. This may indicate poor ground contact causing a misread, or a cable failure.
- **Broken Wire Alarm** – sounds if three readings are taken without a change in the chainage count. Under normal conditions multiple readings without the chainage increasing would indicate a broken trailing wire.
- **DCVG Defect Alarm** – sounds if the DCVG levels exceed the user-selected value. The alarm threshold value is below the DCVG defect enable/disable button.
  - Tap on the value to enter a new value in mV.

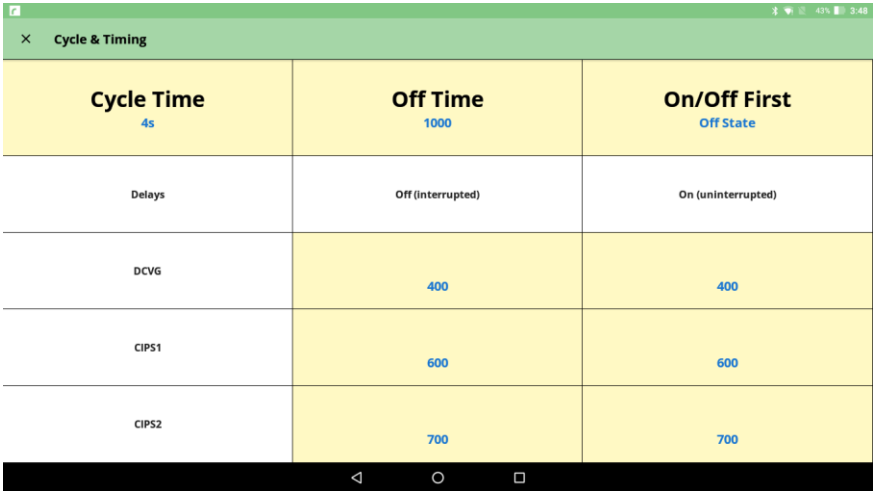
### Show GPS Coordinates in DMS Format

The user can choose to have the GPS coordinates displayed and stored in the Degrees, Minutes and Seconds (DMS) or the more commonly used Decimal Degrees (DD) during the survey.

## Time Zone

The user can select their local time zone to correct the GPS time from UTC to local time. All data is then stored in local time.

## Interruption Cycle & Timing Settings



Cycle Time 4s	Off Time 1000	On/Off First Off State
Delays	Off (interrupted)	On (uninterrupted)
DCVG	400	400
CIPS1	600	600
CIPS2	700	700

Cycle Time Set the cycle time to match the same settings you have applied on your current interrupters. The cycle time must be evenly divisible into 60 seconds. Common cycles are 1s, 2s, 4s, 5s, etc.

## OFF Time

The OFF time is set by the user, which should match the off time used by the current interrupters. Typically, the OFF time is about  $\frac{1}{4}$  of the total cycle time. The ON time is calculated from the cycle time minus the OFF time.

## ON/OFF First

The Hexcorder Pro can measure the OFF or the ON measurement first. Most interrupters function with the OFF occurring at the start of the cycle. Select the correct setting to match YOUR interrupters.



## Delay Times

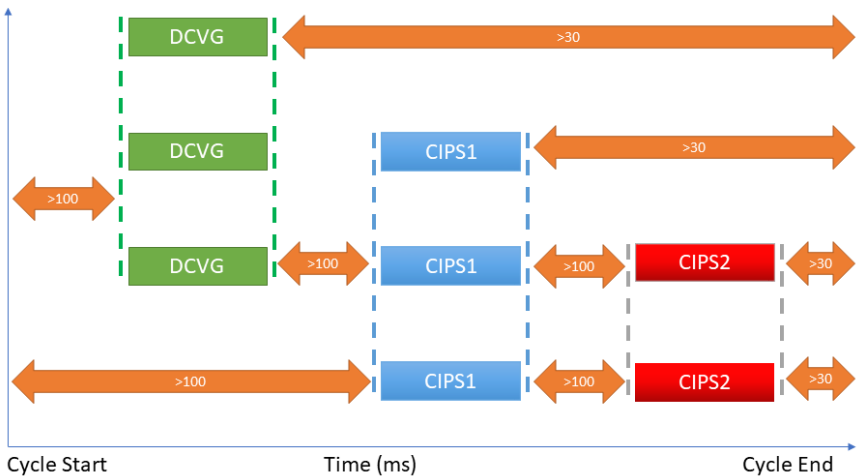
There are six delay time options for controlling the exact time that the Hexcorder Pro takes its DC measurements within a cycle. **The addition of ACVG does not affect the timing of the DC readings or the overall cycle time.** The delay times are in milliseconds and are timed from the start of their respective portion of the cycle. i.e. an OFF delay of 100 ms means the reading will occur 100ms after the interrupters turn off. An ON delay of 300ms means the reading will be taken 300ms after the interrupters turn on.

In GPS synchronized mode, the use of delays can improve survey accuracy. When the cathodic protection is first turned on or off, there can be an inductance spike in the voltage due to the capacitance of the coating. A more accurate reading can be obtained by delaying the reading, instead of taking the reading right as the rectifiers turn off. Inductive spikes can be seen on any waveforms taken; this information can be used to adjust delay settings accordingly.

The SCOPE tab can be used to confirm the correct delay time setting. View the AC and DC scope and verify that enough time is allowed to remove any influence from other sources.

The Hexcorder Pro will notify the user of any errors when the settings are saved.

## Delay Times

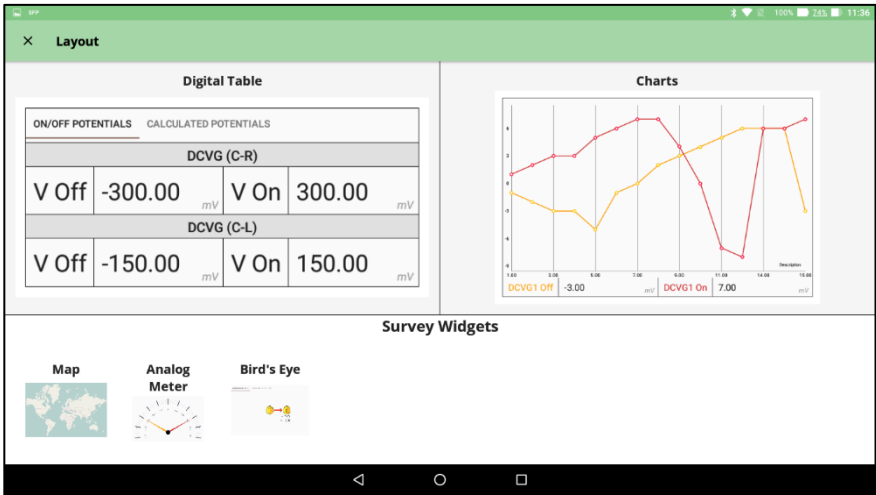


## Cycle and DC Delay Times

Minimum cycle times and DC reading delay times depend on the number of readings being taken. More readings per cycle take longer to read and store, requiring longer times. **The addition of ACVG does not affect the timing of the DC readings or the overall cycle time.**

Survey Type		Cycle		Delay (ms)		
		OFF(ms)	Cycle(s)	DCVG	CIPS1	CIPS2
CIPS only	Minimum	200	1		100	
	Recommended	200	1		150	
CIPS + DCVG	Minimum	200	1	100	170	
	Recommended	200	1	100	200	
CIPS + 2 x DCVG	Minimum	250	1	100	220	
	Recommended	300	1	100	250	
2Ω CIPS / Parallel CIPS	Minimum	250	1		100	200
	Recommended	400	2		150	300
2Ω CIPS + DCVG	Minimum	300	1	100	170	270
	Recommended	500	2	100	250	400
2Ω CIPS + 2 x DCVG	Minimum	350	1	100	220	320
	Recommended	500	2	100	300	450
DCVG / 2 x DCVG	Minimum	200	1	100		
	Recommended	200	1	100		
4 x DCVG	Minimum	300	1	100		
	Recommended	300	1	100		

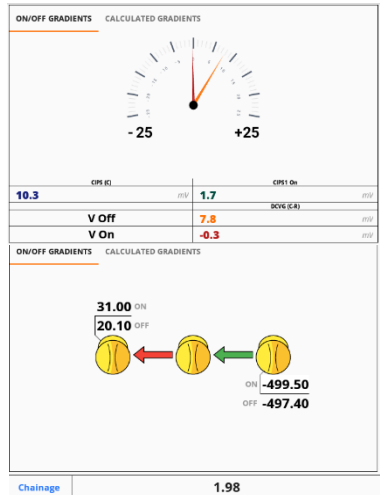
## Survey Screen Settings



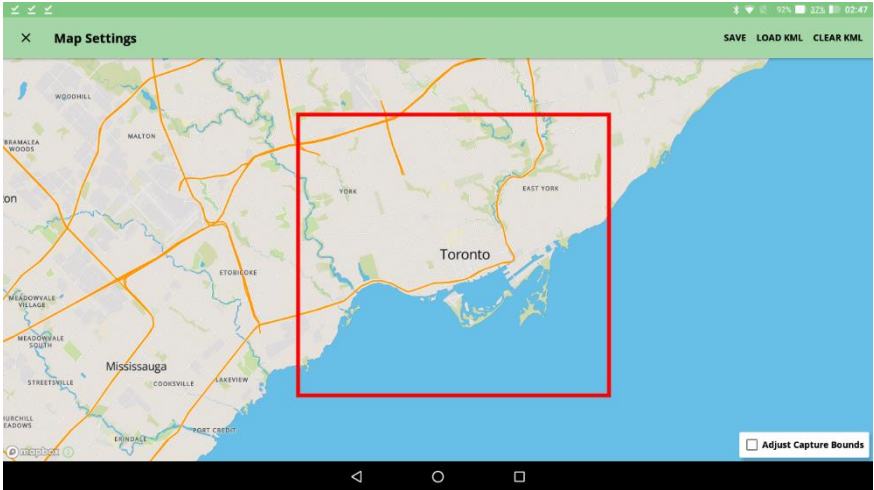
## Survey Layout Options

The Hexcorder Pro offers five different “widgets” to use during the survey. The screen is split into two halves which can be configured to the user’s needs. Simply touch and drag the widget you want from the selector bar at the bottom to the location you want it and release.

- **Digital Table** – a simple table view which shows the readings in numerical format. (either actual or calculated)
- **Charts** – a real-time graphing view which displays the readings as a line chart as they are recorded. Unlike the digital table display, the chart only shows the recorded readings, not the real-time values. This allows the operator to easily see trends in the survey data.
- **Map** – an openmaps.org-based map screen which uses the Hexcorder Pro GPS to plot the user’s path.
- **Analog Meters** – a DCVG view using virtual analog meters instead of digital values, for users who prefer the analog DCVG meters.
- **Bird’s eye view** – a DCVG view which shows the arrangement of the survey team measurements from above. This makes it easy for the user to see the flow of stray currents in the soil.

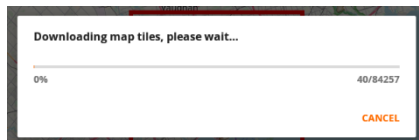


## Map Settings



The Hexcorder Pro uses Openmaps.org for mapping purposes. A Wi-Fi internet connection prior to the survey is necessary for this function to work. Map data can be saved (cached) on the tablet for later use in the field when Wi-Fi is not available.

- Turn on Wi-Fi on the tablet by pulling down the dropdown menu from the top of the screen and toggling the Wi-Fi icon to “On”.
- Connect to a local Wi-Fi network
- Select the “Adjust Capture Bounds” box and use pinch-zoom and drag to move and shape the red box to fit your survey area. (see above screenshot)
- Load KML/Clear KML – Using the buttons in the top right corner of the Map Settings screen, create your own google KML map files from previous survey data and place the file on the tablet memory. Then, select the “Load KML” button and navigate to the KML file you want to load. It will be loaded as a visible line of waypoints on the map, which can give a guiding route during the survey.
- Use pinch zoom until the desired map region is included inside the red box. Press the “SAVE” button in the top right corner and this section of the map will be cached in memory.



Later, when the tablet does not have internet access, this map section will still be available to view in the map survey widget.

- When surveying out of Wi-Fi range, turn off Wi-Fi to save battery.

## Settings Overview

The Settings Overview page is a quick reference page to check the settings if the user forgets them during a survey. Rather than having to search the various setting screens, the user can simply check the Settings Overview.

Survey	Parameters	Alarms
Title: test	Input Impedance: 25MΩ	Broken Wire: Disabled
Operator: Kyle K	AC Frequency: 60Hz	DCVG Defect: Disabled
Survey Type: CIPS & 2x DCVG (Slide Drain)	Cycle Time: 2s	Low Potential: Disabled
Trigger: Time (1 cycle(s))	Off Time: 1000	
Units: Metric	On/Off First: Off State	
Start: 0.10m		
Direction: Increment (+)		
GPS		
Time Zone: UTC-5:00		
Show Coordinates: Enabled		
Show Google Map		
Delays		
	Off (interrupted)	On (uninterrupted)
DCVG	300	300
CIPS1	500	500
CIPS2	600	600

## Conserving Tablet Battery Life

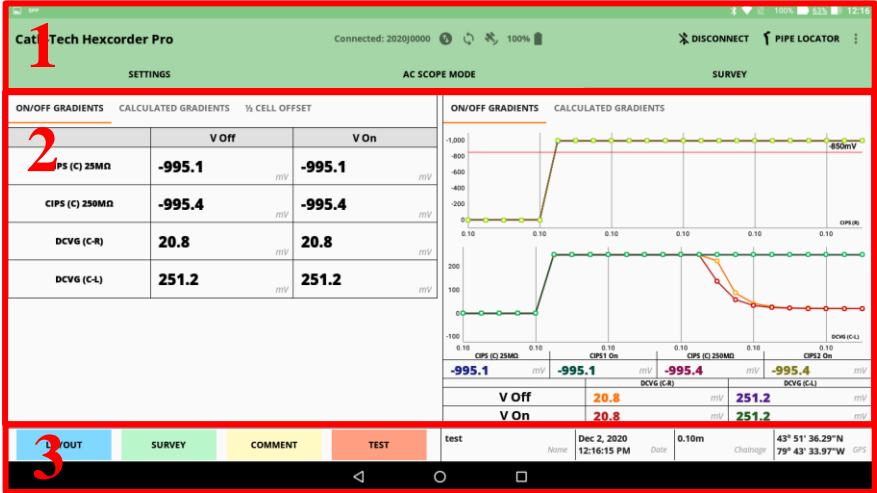
As of August 2020, all Hexcorder Pro units use a Zebra L10 tablet. The Zebra L10 tablet has one, hot-swappable (up to 60 seconds), external battery. The total battery power is 98 watt-hours.

Hexcorder Pro units sold before August 2020 use an Xplore D10 tablet. The Xplore D10 tablet has two batteries: one external and one internal. The total battery power is 100 watt-hours.

Due to the nature of survey work, the tablet screen must be set to high brightness to be visible in the sunlight, and the screen must always be on to see the readings. With Wi-Fi turned off, the older Xplore tablet will provide approximately 11 hours of continuous use time and the newer Zebra L10 tablet will provide approximately 12 hours of continuous use time. Cath-Tech recommends that to prevent the tablet from consuming any additional power, do not install any other apps to the tablet and be sure to fully charge each night before the next day’s survey. Additional external batteries with a charging dock are available.

# Survey

After setup is complete, the user is ready to begin the survey. Tap the SURVEY tab to access the main survey tab.



There are 3 main areas to this screen. The middle largest area is for the widgets chosen by the surveyor to display data.

1. **Information Bar** – Buttons for connecting/disconnecting the Hexcorder Pro from the tablet, as well as for connecting a pipe locator
2. **Survey Widgets** – the survey widgets selected by the user appear in this area. Two can be used at a time
3. **Survey Information** – this bar contains the survey start/pause button, access to the survey layout widget screen, as well as survey name, date and time, chainage, and GPS location information

## Calculated Gradients

In DCVG modes, the user can select to view the DCVG values as separate ON/OFF values or as a calculated gradient value, which automatically subtracts the ON value from the OFF value and displays the difference as well as an estimated %IR. This difference is often more useful to the surveyor.

## ½ Cell Calibration

The user can calibrate their cells in the ½ cell offset tab. Cu/CuSO<sub>4</sub> cells are not precise instruments, they are chemical cells. They have minor voltage differences between them all which causes a measurement value error. Using the ½ cell offset tab the user can calibrate their cells to correct for the error.

With the survey running, the user places the tips of the survey poles with the cells attached together. Touching the tips will reduce the non-error voltage to zero. Pressing the green ZERO button will take a reading and apply an offset to the DCVG channel(s) to correct for ½ cell error.

ON/OFF GRADIENTS	CALCULATED GRADIENTS	½ CELL OFFSET
	STORED OFFSET	CURRENT READING
DCVG (C-R)	0.0	-2.9
DCVG (C-L)	0.0	27.7
DCVG (C-F)	0.0	
DCVG (C-B)	0.0	
	RESET	ZERO

ON/OFF GRADIENTS	CALCULATED GRADIENTS	½ CELL OFFSET
	STORED OFFSET	CURRENT READING
DCVG (C-R)	3.2	0.0
DCVG (C-L)	-27.7	0.0
DCVG (C-F)	0.0	
DCVG (C-B)	0.0	
	RESET	ZERO

## Start the Survey

Press the SURVEY button to start the survey. The button will turn green when the survey is running. If GPS synchronization is enabled, survey mode will not start until the GPS engine is connected and locked. Ensure that the GPS is connected and has a clear view of the sky. Also note that the GPS may take up to 10 minutes to lock. Once the GPS is locked, the values will begin to appear, and the Hexcorder Pro will sound a small beep at the start of each cycle.

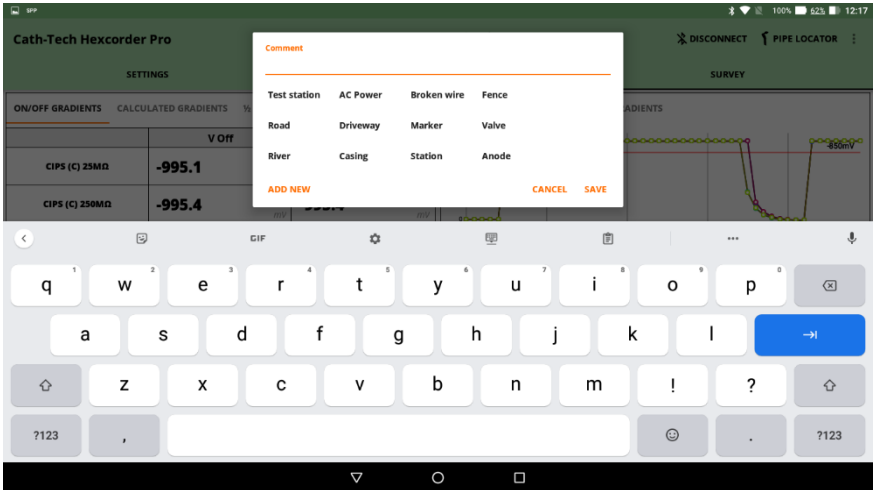
To pause the survey, press the green SURVEY button and the survey will stop, the button will turn red.

In manual mode, the surveyor presses the button on the top of any of the half cell extension poles to take a reading. That reading is stored in the file and the record# increases. As the surveyor moves, the trailing wire spools out and the chainage increases. The Hexcorder Pro will only take one reading per interruption cycle no matter how many times the button is pushed.

In any survey mode with DCVG or ACVG, two (or more) half cells must be on the ground when taking a reading. This can be done by one surveyor who pauses in place until the reading is complete or by utilizing Y-cables and multiple surveyors. When using the Y cable, the surveyor needs to only keep one of the two survey poles on the ground at any given time to be ready to take a signal, allowing for a continuous walking movement.

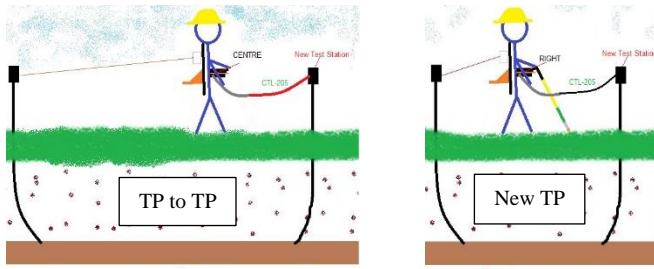
## Comments

If the user wants to add a comment to the data file to indicate a note or location information, they can press the COMMENT button. The survey will pause while the user enters the comment via the tablet keyboard. There is a selection of quick comments available, preloaded with common comment types. The user can add custom comments by typing the comment they want and click “ADD NEW” to add it to the list. The preloaded comments can be edited and deleted by pressing and holding the desired comment.



## Test

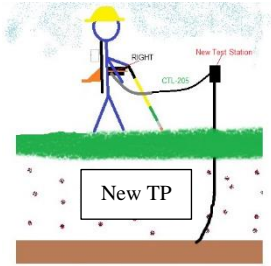
When surveying, it is often desired to test the pipe-to-soil potential of a new test point, as well as the voltage potential between the current and previous test station. This is used to prove that both test points are properly connected and to determine whether there are any issues between the two. Both these readings can be taken, without stopping the current survey, by pressing the TEST button and using our CTL-205 cable (sold separately). The surveyor can choose whether to save the readings (stored as a comment) or to simply observe the value on the screen.



The survey pole cable is disconnected from the survey pole and the CTL-205 cable is connected instead. To measure the voltage test point to test point, the CENTRE channel is used. To measure the new test station to half cell without disconnecting the trailing wire, the RIGHT channel is used.



When surveying DCVG only surveys, it is essential to record the test station OFF and ON potentials before and after any defect. This is used to approximate the size of the defect by calculating the %IR value.



## Survey Personnel & Cable Configurations

Survey Type	Left	Center	Right	Wire
CIPS / CIS		■	■	■
DCVG/ACVG		■	■	
CIPS & DCVG/ACVG		■	■	■
2x DCVG/ACVG	■	■	■	
CIPS & 2x DCVG/ACVG	■	■	■	■
4x DCVG	■ x2	■	■ x2	
Double Impedance CIPS		■	■	■
Double Impedance CIPS & DCVG/ACVG		■	■	■
Parallel CIPS		■	■	■
Double Impedance CIPS & 2x DCVG/ACVG	■	■	■	■

There are many possible configurations of personnel and cables depending on the survey types selected. The Hexcorder Pro is supplied with the Wire cable and 2 pole cables for surveys involving Center and Right channels. Additional poles and Y-cables are available for multi-channel DCVG.

## Scope Mode

Tap the SCOPE tab to enter scope mode. The term ‘scope’ and ‘waveform’ are often used interchangeably in the CP industry. There are two types of scope captures that can be used, AC SCOPE and DC SCOPE. GPS lock is required to use the scope function.

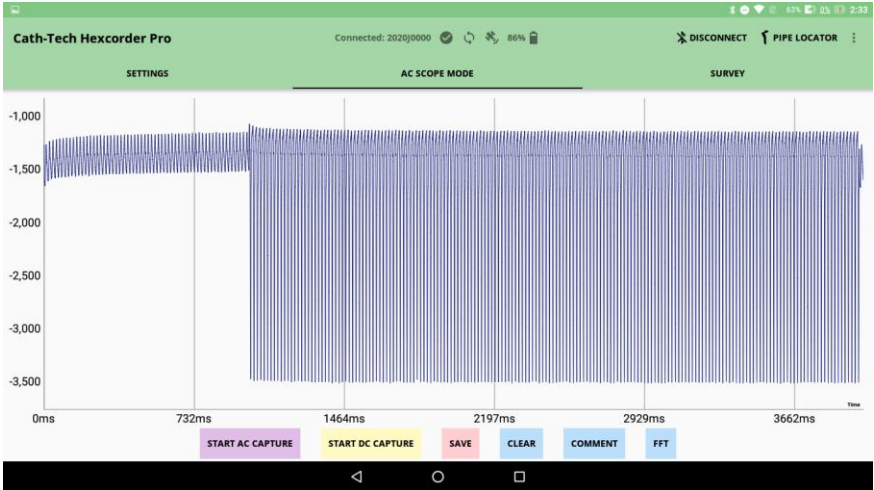
Scope readings can be useful in detecting misfiring current interrupters, AC from overhead power lines, telluric activity, and foreign influences. The scope captures 4096 samples per second, up to 30 second cycles. Longer than 30 second cycle times use a reduced sample rate due to memory buffer limitations.

## Start AC Capture

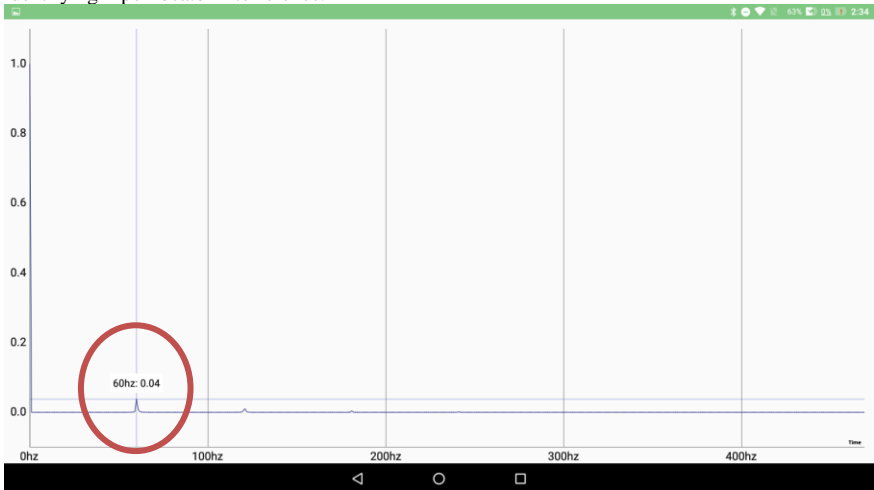
Press the START AC CAPTURE button and the Hexcorder Pro will record a 1-cycle unfiltered CIPS reading.



The reading can be manipulated in the X and Y directions by pinch zooming. The user can store a

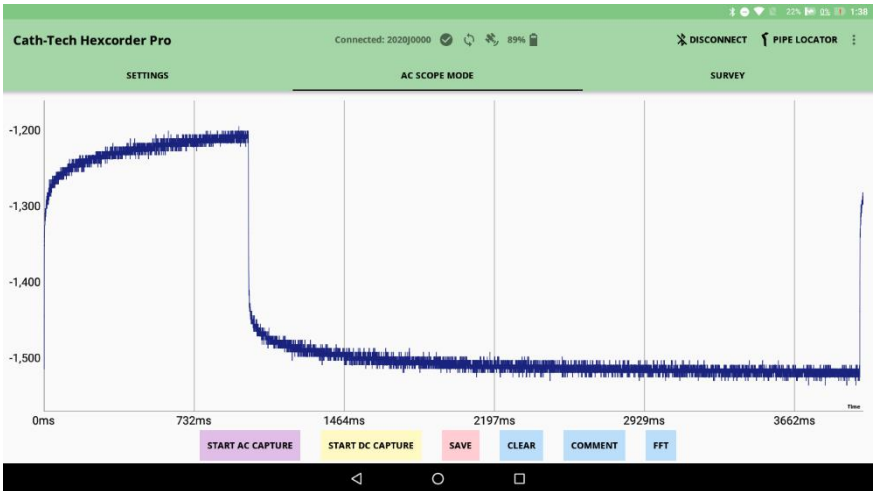


data file version by pressing the SAVE button. A .CSV file of the values will be stored on the Hexcorder Pro. The user can also add a comment that will be saved in the .CSV file with the data. The FFT button can be used to perform a Fast Fourier Transform (FFT) on the scope capture to calculate and display the frequencies found in the captured signals. FFT can also be useful for identifying Pipe Locator interference.



## Start DC Capture

Press the START DC CAPTURE button and the Hexcorder Pro will record a 1-cycle filtered CIPS reading. The DC Scope capture is especially useful at identifying the polarization curve as well inductive spikes; this can help determine what measurement delays should be chosen.

















The reading can be manipulated in the X and Y directions by pinch zooming. The user can store a data file version by pressing the SAVE button. A .CSV file of the values will be stored on the Hexcorder Pro. The user can also add a comment that will be saved in the .CSV file with the data. The FFT button can be used to perform a Fast Fourier Transform (FFT) on the scope capture to calculate and display the frequencies found in the captured signals. FFT can also be useful for identifying Pipe Locator interference.

## Data Files

Data files on the Hexcorder Pro are accessed via the USB port. Connect the Hexcorder Pro to your PC and turn it on. After 10 seconds, press the USB symbol button. This will allow the PC to access the internal SD storage. The Hexcorder Pro will appear as a standard USB drive.



The files are named based on the equipment used and a unique identifier. The ‘H’ at the start indicates that the data is from the Hexcorder Pro. Then the next 4 numbers are the last 4 digits of the serial number to indicate the unit generating the file. Survey data files have the word DATA after the serial number designator, Scope readings have the letters ACSM in the file name. The last part of the name is a sequential number.

Name	Date modified	Type	Size
 CALIBH.TXT	2/24/2017 6:06 PM	Text Document	1 KB
 CONFIG.TXT	8/8/2017 2:55 PM	Text Document	1 KB
 H9937_ACSM001.CSV	4/13/2017 7:19 PM	Microsoft Excel C...	1 KB
 H9937_ACSM002.CSV	7/13/2017 9:26 AM	Microsoft Excel C...	39 KB
 H9937_ACSM003.CSV	7/25/2017 9:23 AM	Microsoft Excel C...	39 KB
 H9937_DATA001.CSV		Microsoft Excel C...	2 KB
 H9937_DATA002.CSV		Microsoft Excel C...	2 KB
 H9937_DATA003.CSV	4/4/2017 7:59 PM	Microsoft Excel C...	2 KB
 H9937_DATA004.CSV	4/4/2017 8:00 PM	Microsoft Excel C...	2 KB
 H9937_DATA005.CSV	4/4/2017 8:07 PM	Microsoft Excel C...	2 KB
 H9937_DATA006.CSV		Microsoft Excel C...	2 KB
 H9937_DATA007.CSV	4/4/2017 8:11 PM	Microsoft Excel C...	3 KB
 H9937_DATA008.CSV	4/5/2017 12:54 PM	Microsoft Excel C...	21 KB
 H9937_DATA009.CSV	4/5/2017 12:54 PM	Microsoft Excel C...	2 KB

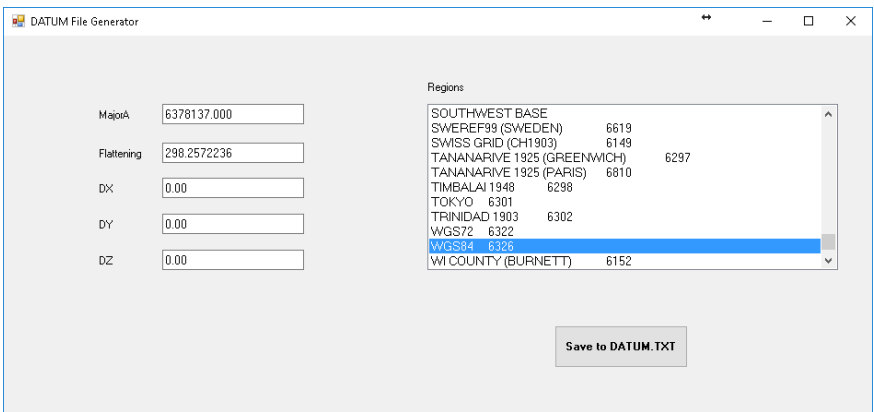
Copy and paste data files to your PC and open them in Excel or an equivalent spreadsheet program. The files are a standard Comma Separated Value (CSV) file, which can be imported into many third-party data management programs.

# GPS Datum

## Changing the Datum

All GPS units are set to the World Geodetic System 84 datum by default. This is a standard coordinate system used worldwide with reasonable accuracy. The datum used by the Hexcorder Pro can be changed to a local datum, however this will change the GPS coordinates stored in the data, and they will not align with coordinates stored in WGS84.

The GPS datum can be changed by adding a datum file to the Hexcorder Pro SD storage. The datum is stored in a text file which must be named DATUM.TXT. The datum files can be generated by a small Windows application that Cath-Tech has developed and is available on our website.



Select the datum you wish to use and press the “Save to DATUM.TXT” button. It will open a Save As window which you can use to navigate to the Hexcorder Pro SD storage. The correct DATUM.TXT file name is automatically filled in.

Custom datums can be generated using the program if the user has the Major Axis, Flattening value, and DX/DY/DZ values.

## Available Earth Datums

ADINDAN	ASTRONOMIC	CAPE
AIN EL ABD	STATION 1952	CARTHAGE
(BAHRAIN)	BD72 (BELGIUM	CHAD (WG1998)
AIN EL ABD (SAUDI	1972)	CLARKE 1866
ARABIA)	BEIJING 1954	AUTHALIC SPHERE
ARATU (BRAZIL)	BOGOTA	CORREGO ALEGRE
ARC1950	OBSERVATORY	(BRAZIL)
ARC1960	BUKIT RIMPAH	D-48 SLOVENIA
ASTRO B4 (SOROL	CAMACUPA	DEALUL PISCULUI
ATOLL)	CAMP AREA ASTRO	1970
ASTRO BEACON	CAMPO INCHAUSPE	DEIR EZ ZOR (SYRIA)
ASTRO DOS 71/4	(ARGENTINA)	DUTCH (RD)

EASTER ISLAND	INDIAN (MEAN	NAD27 (ALEUTIAN
1967	VALUE)	ISLANDS WEST)
ED50	INDIAN (NEPAL)	NAD27 (BAHAMAS)
ED50 (ENGLAND)	INDIAN (THAILAND)	NAD27 (CANADA)
ED50	INDIAN 1954	NAD27 (CANAL
(FINLAND/NORWAY	INDIAN 1975	ZONE)
)	INDONESIA 1974	NAD27
ED50 (GREECE)	IRELAND 1965	(CARIBBEAN)
ED50 (ITALY)	IRELAND 1965	NAD27 (CENTRAL
ED50 (NORTH SEA)	(1975	AMERICA)
ED50 (NORWAY	ADJUSTMENT)	NAD27 (CONUS)
OFFSHORE - N62)	IRENET95	NAD27 (CUBA)
ED50 (NORWAY	ISN93 (ICELAND)	NAD27
OFFSHORE - S62)	ISTS 073 ASTRO	(GREENLAND)
ED50 (SICILY)	JAD2001 (JAMAICA	NAD27 (MEXICO)
ED50	2001)	NAD27 (SAN
(SPAIN/PORTUGAL)	JAD69 (JAMAICA	SALVADOR)
ED79	1969)	NAD27 (YUMA
ED87	JGD2000 (JAPAN)	PROVING
EGYPT 1907	JORDAN	GROUND(S)
EGYPT GULF OF	KERTAU 1948	NAD83
SUEZ S-650 TL	KERTAU 1948	NAHRWAN (UAE)
ESTIONIA 1997	(MALAYSIA)	NAPARIMA 1972
ETRF2000 - RDN	KKJ (FINNISH GRID)	(TRINIDAD &
ETRS89	KOREAN 1985	TOBAGO)
FD 1958 (IRAQ)	KOREAN 1995	NEW ISRAELI
FINLAND/HAYFORD	KOREAN GEODETIC	DATUM (NID)
GDA 94	DATUM (KGD)	NGO 1948
(AUSTRALIAN	LA CANOA	(GREENWICH
GEODETIC 1994)	(VENEZUELA)	MERIDIAN)
GGRS87 (GREECE)	LEIGON (GHANA)	NGO 1948 (OSLO
GOOGLE MAPS	LISBON/LISBOA	MERIDIAN)
(SPHERE RADIUS	1937 (DLx)	NORTH SAHARA
6378137)	LKS92 (LATVIA)	1959
GRS80 ELLIPSOID	LUREF	NORTH SAHARA
GUAM 1963	(LUXEMBOURG)	1959 (HASSI
HARTEBEESTHOEK	LUZON	MESSAOUD)
1994 (S. AFRICA)	(PHILIPPINES)	NTF FRANCE
HERAT NORTH	MALONGO 1987	(GREENWICH
(AFGHANISTAN)	MERCHICH	MERIDIAN)
HERMANNSKOGEL	(MOROCCO)	NTF FRANCE (PARIS
HJORSEY 1955	MGI AUSTRIA	MERIDIAN)
HONG KONG 1963	MINNA	NZGD2000
HU TZU SHAN	(CAMEROON)	NZGD49
HUNGARIAN	MINNA (NIGERIA)	OBSERVATORIO
DATUM 1972	M'PORALOKO	1966
IGN72 GRANDE	(GABON)	OCOTEPEQUE
TERRE (NEW	NAD27	(COSTA RICA)
CALEDONIA)	NAD27 (ALASKA)	OLD HAWAIIAN
INDIAN	NAD27 (ALEUTIAN	MEAN
(BANGLADESH)	ISLANDS EAST)	

OLD ISRAELI DATUM  
(OID)  
OMAN  
ORDNANCE SURVEY  
1936 (OSGB36)  
PICO DE LAS NIEVES  
POINTE NOIRE 1948  
(CONGO)  
PORTUGESE 1973  
(DATUM 73)  
POSGAR94  
(ARGENTINA)  
POTSDAM/DHDN  
(GERMANY)  
PROVISIONAL  
SOUTH CHILEAN  
PRS92 (PHILIPPINES)  
PSAD56 (PROV. S.  
AMERICAN 1956)  
PSD93 (OMAN)  
PUERTO RICO  
QND95 (QATAR)  
QORNOQ  
REUNION ISLAND  
REYKJAVIK 1900  
RGF-93  
RGNC91-93 (NEW  
CALEDONIA)  
ROME 1940  
[MONTE MARIO]  
(GREENWICH)

ROME 1940  
[MONTE MARIO]  
(ROME)  
RT90  
S-42 (PULKOVO  
1942)  
S-42 ALBANIA  
S-42  
AZERBAIJAN/GEORG  
IA  
S-42  
CZECHOSLOVAKIA  
S-42 ESTONIA  
S-42 GERMANY  
S-42 HUNGARY  
S-42 KAZAKHSTAN  
S-42 LATVIA  
S-42 LITHUANIA  
S-42 POLAND  
S-42 ROMANIA  
S-42 RUSSIA  
SAO BRAZ  
SCHWARZECK  
(NAMIBIA)  
SIRGAS 2000  
(BRAZIL)  
S-JTSK (CZECH  
REPUBLIC)  
SOLOMON 1968  
(GUX 1 ASTRO)

SOUTH AMERICAN  
1969  
SOUTH AMERICAN  
1969 (BRAZIL)  
SOUTHEAST BASE  
SOUTHWEST BASE  
SWEREF99  
(SWEDEN)  
SWISS GRID  
(CH1903)  
TANANARIVE 1925  
(GREENWICH)  
TANANARIVE 1925  
(PARIS)  
TIMBALAI 1948  
TOKYO  
TRINIDAD 1903  
WGS72  
WGS84  
WI COUNTY  
(BURNETT)  
WI COUNTY  
(DOUGLAS)  
WI COUNTY  
(SHEBOYGAN)  
YACARE (URAGUAY)  
ZANDERIJ  
(SURINAME)

## Pipe Locator

### *Pipe Locator Features*

The Hexcorder Pro can be connected to Bluetooth-enabled pipe locators Vivax-Metrotech, Radio Detection and Ridgid. Data such as depth of cover and signal strength can be stored in the Hexcorder Pro data file along with the survey data.

#### ***Important note:***

The Hexcorder Pro app must have permission to use your location, allowing it to search for new Bluetooth devices. When the app asks for permission to use your location (a requirement of Android to allow apps to search for Bluetooth devices) you must allow it or else the tablet will not be able to find your pipe locator. **It is very important not to change any of the default passkeys listed below as new Hexcorder Pro units will be unable to connect to the Pipe Locator.**

## RadioDetection Pairing

### Preparing the RD8000/8100 pipe locator to pair

#### Pairing to a PDA or PC

##### Connection requirements:







- Any RD8100 locator.
- A compatible Bluetooth enabled PDA or Bluetooth enabled PC or Laptop.

**NOTE:** The procedure below describes the pairing process between a RD8100 locator and a PDA. Pairing to a PC follows the same steps for the RD8100 locator and similar steps for your PC or laptop. Consult your PC or laptop Bluetooth pairing instructions to pair with the RD8100 locator.

Pair the RD8100 locator to your PDA using your PDA's Bluetooth software.

**NOTE:** The procedure for pairing your PDA may differ depending on the PDA make and model. The following procedure should apply to most PDAs.

##### On the locator:

1. Press the  key to enter the menu.
2. Scroll to the BT menu using the  or  keys.
3. Press the  key to enter the BT menu.
4. Scroll up or down to the PAIR menu.
5. Press the  key to enter the PAIR menu.
6. Scroll up or down to the BT-PC option.
7. Press the  key and the locator will attempt to pair with your PDA.

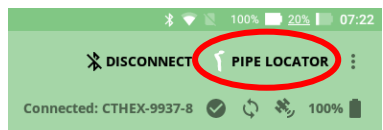
\*These steps should be performed quickly, with minimal delay between steps\*

### First time pairing

1. Power on the tablet
2. Follow the instructions above to ready the locator, the Bluetooth icon on the locator screen will be blinking
3. Open the tablet Bluetooth menu
4. Wait for the locator to be detected. The name will be something like “RD8K” followed by a 4 digit number
5. Select the pipe locator to pair, when prompted enter the passkey “1234”
6. The locator is now paired and known to the tablet








### Pairing for Use

1. Prepare the Hexcorder Pro and tablet for survey as usual
2. Ensure the above “First time pairing” steps have been completed to prepare the locator for Bluetooth connection
3. Select the Pipe Locator button in the top right corner of the app
4. Perform these steps again on the locator:






**On the locator:**

1. Press the  key to enter the menu.
  2. Scroll to the BT menu using the  or  keys.
  3. Press the  key to enter the BT menu.
  4. Scroll up or down to the PAIR menu.
  5. Press the  key to enter the PAIR menu.
  6. Scroll up or down to the BT-PC option.
  7. Press the  key and the locator will attempt to pair with your PDA.
5. Select the locator from the list of paired devices
  6. When connected, the Bluetooth symbol on the locator will stop blinking and remain solid.  
NOTE: there may not be a message to indicate successful connection.
  7. Before starting a survey, check the connection by pressing the  button. A message “Received message from the Pipe Locator” will appear on the tablet screen. NOTE: this may take up to one minute.

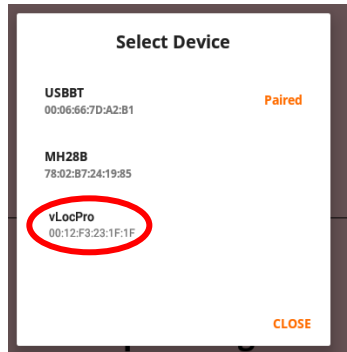
NOTE: If there is no message on the tablet, perform steps 4 through 7 again.

To save a pipe locator measurement, press the  button within 30 seconds of taking a Hexcorder Pro survey measurement. The data from the locator will be inserted in the data file along with the data from that last measurement. There is no message to indicate success, just continue surveying. If the button is pressed outside of that 30 second window, a message will appear on the tablet screen asking if you wish to store the pipe locator data. You can select to store it or not.

## Vivax Metrotech Pairing

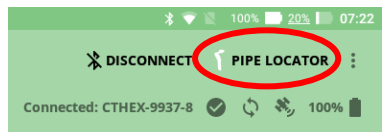
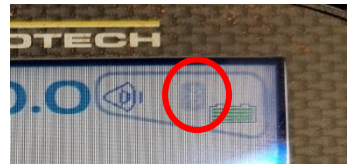
### First time pairing

1. Power on the tablet
2. Open the tablet Bluetooth menu
3. Power on the Vivax Metrotech locator, the name “vLocPro” will appear in the search results
4. Select the vLocPro and wait for it to pair, the name will move to the Paired Devices list



### Pairing for Use

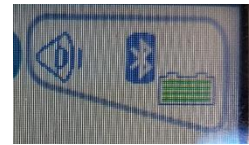
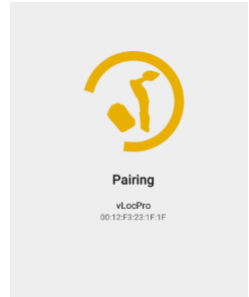
1. Prepare the Hexcorder Pro and tablet for survey as usual
2. Turn on Vivax Metrotech locator, there should be a light blue Bluetooth logo in the top right corner.
3. Tap the “Pipe Locator” button in the top right corner.
4. Select the vLocPro from the list
5. The Hexcorder Pro will pair with the pipe locator.



6. The pipe locator will now show blue Bluetooth symbol.


To confirm pairing and pipe locator data transmission, press the “I”

button followed by the “+” button on the Pipe locator. A message will display on the tablet reading “Received invalid message from Pipe locator”. This means the message was received but was not automatically associated with a particular reading. During a survey, the Hexcorder Pro will not indicate that it has received successfully. If the pipe locator loses connection with the Hexcorder Pro, a message will be displayed on screen. Loss of connection is also indicated on the pipe locator screen; the Bluetooth icon will fade to light blue instead of solid blue.



## Rigid SR-24

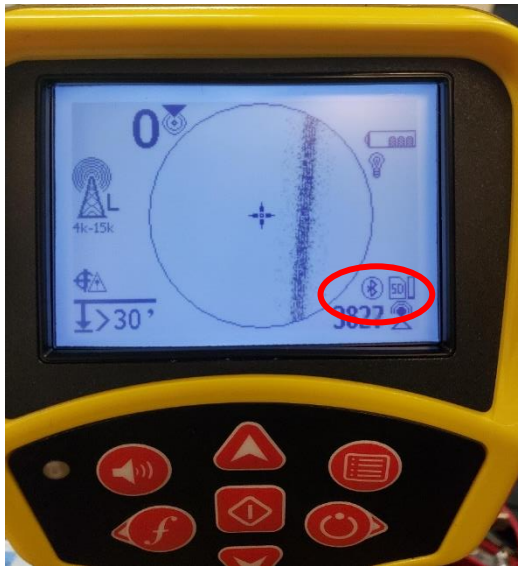
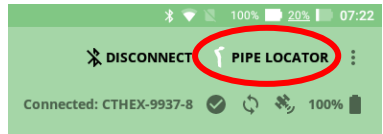
### First time pairing

1. Power on the tablet.
2. Power on the Rigid SR-24.
3. Open the tablet Bluetooth menu and enable Bluetooth.
4. Select “SR24 xxxxx” from the “Available devices” menu.
5. Select “Pair” on the tablet.
6. Press the  button on the SR24 to confirm the pair. You should see the following appear on the SR24 screen:
7. The name will move to the “Paired devices” list



## Pairing for use

1. Prepare the Hexcorder Pro and the tablet for survey as usual.
2. Turn on the Rigid SR-24.
3. Tap the “PIPE LOCATOR” button in the top right corner.
4. Select SR-24 from the list.
5. The Hexcorder Pro will pair with the pipe locator.
6. The pipe locator will now show the Bluetooth symbol in the bottom right corner.



## Optional Wired Connection

There may be occasions where there is interference with the Bluetooth signal and a wire connection between the tablet and black box is desired. A specialized cable (CTL-266) for this is included in the case.

To use the cable:

1. Connect the cable to the USB port of the tablet and the port labelled CHARGE on the Hexcorder Pro
2. Power on your GPS if using self-powered sub-meter GPS receiver
3. Wait 5 seconds for GPS to boot up
4. Turn the Hexcorder Pro on
5. Wait 10 seconds for boot up/GPS detection
6. Start the app
7. Press “Connect Device”
8. Select “USB FT232 UART” from the list
9. Wait for the Hexpro battery level, icons etc. to appear
10. Wait for GPS lock
11. Ready to survey

To return to Bluetooth mode, power cycle the Hexcorder Pro and select the Bluetooth name from the “Connect A Device” list.

If wired connection is planned to be used 100% of the time, enter the tablet Bluetooth settings and unpair the Bluetooth device named after the Hexcorder Pro serial #.



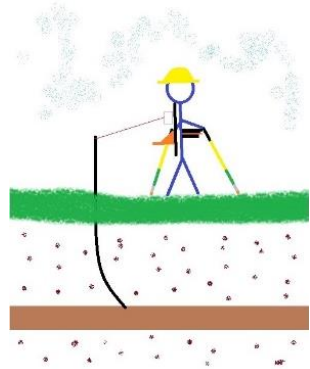
## Survey Techniques

The Hexcorder Pro is designed and built to perform above ground assessment of cathodic protection and coating integrity for buried metallic structures. Used correctly it can provide an indication of areas that are more likely to corrode or do not meet industry accepted criteria for protection. A background in corrosion or a training course from Cath-Tech is highly recommended prior to surveying for the first time.

The Hexcorder Pro is supplied with all the parts and accessories necessary to start surveying CIPS and DCVG. ACVG surveys require a separate transmitter operating at both 320Hz and 640Hz (320+640Hz). If an interrupted CIPS or a DCVG/ACVG survey is to be done, the current interrupters need to be installed in the rectifiers prior to starting. Any stationary data loggers also need to be placed.

### ***CIPS***

Turn on the Hexcorder Pro and program it for the survey as described earlier in the manual. Clean off the end of the light survey wire with some emery paper and connect it to the pipe at a convenient test station. Fill the half cells with distilled water then insert the half cells into the poles. Remove the plastic caps from the half cells so the ceramic tip makes contact with the soil. Hook the Hexcorder Pro onto the 4 point harness and connect the survey poles and wire dispenser.



The surveyor should use both survey poles and keep one half-cell in contact with the soil at all times to minimize delay while the half cell stabilizes. In areas where the soil is dry, it may be necessary to wet the soil to reduce half-cell to soil contact resistance. Higher input impedance or double-impedance surveys can also assist in dry areas.

A close interval survey is best accomplished at a comfortable walking speed. Most surveyors prefer a 1 second cycle where the rectifier is turned OFF for 200 to 300 milliseconds every second. The one-second cycle will yield a stored reading approximately every two meters at a comfortable walking speed.

To take and store a reading, observe the potential on the Hexcorder Pro display - then when you have a valid pipe-to-soil potential, press one of the buttons on the survey pole. The value you see on the screen at the time of the button press is stored. The values on screen will update once per cycle. These values along with the chainage and GPS coordinates are written to the display every second and stored to memory.

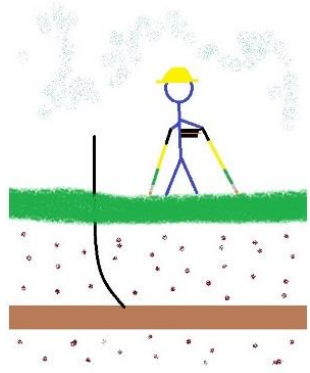
### ***DCVG and ACVG***

DCVG and ACVG both work by measuring the voltage change between two half cells placed on the ground. To undertake a DCVG survey, typically a minimum potential swing of 300-500 mV between the rectifier ON and OFF is sought and the current source output of the rectifiers is adjusted accordingly. The interrupted rectifier enables coating defects to be distinguished based on the potential differences between the half-cells. An ACVG survey requires the use of a transmitter that

outputs a 320 Hz and 640 Hz signal on the pipe. Many pipe locator transmitters are capable of producing the required signal.

The difference between the 'on' and 'off' potentials is recorded at the test point nearest the survey start point, and all other test points encountered. ACVG surveys measure the potential difference to help determine which direction current is flowing and therefore indicate the direction of a defect. ACVG measurements are only taken during ON portion of the cycle.

The surveyor walks on top of the pipeline with both half cells. When both half cells are in firm contact with the soil a reading can be taken. If one half cell is in the air, the reading will be incorrect. The half cells can be oriented to the pipe with two methods; lateral and longitudinal. For a lateral DCVG survey, one half cell is kept over the pipe and the other is to the side. A longitudinal survey has both half cells over top of the pipe. The half cells are spaced as far apart as possible.

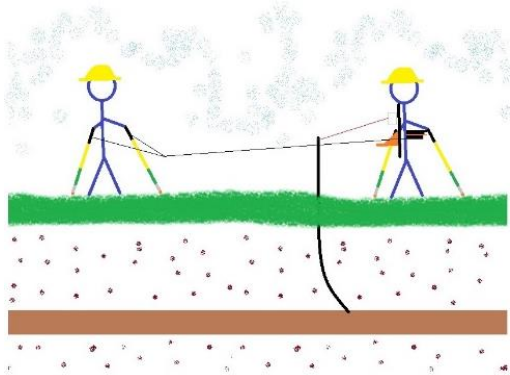


As a defect is approached, a noticeable fluctuation is observed on the Hexcorder Pro at a rate similar to the interruption cycle. The amplitude of the fluctuation increases as the defect is approached. The direction of current flow may be determined by the sign of the DCVG readings. The size of the defect can be estimated by calculating the %IR from the DCVG and CIPS data. Size cannot be estimated from ACVG data as the AC signal is attenuated by the length of the pipe.

Additional channels are available to perform multiple simultaneous DCVG/ACVG surveys with extra survey personnel. In complex piping situations, it can be beneficial to survey the gradient to left and right at the same time to locate the defect on the surveyed pipe or an adjacent pipe.

## ***Combined Surveys***

Combining CIPS and DCVG allows the surveyor to gather data on both the cathodic protection and the coating integrity in one survey. This allows for accurate data correlation after the survey. Combined CIPS and DCVG can be performed by one surveyor or with the assistance of additional surveyors. A combined survey requires a pipe connection for the CIPS reading and two half cells on the soil to capture the gradient between them.



Utilizing Y-cables can allow two surveyors to perform a combined survey and walk at a normal pace.

It is critical to know both sets of data; CIPS and DCVG/ACVG are complementary surveys. Only by knowing the level of cathodic protection at a coating defect can intelligent choices for remediation be made. The data gathered should be analyzed by a qualified corrosion professional.

## Cables

To reuse Hexcorder MM cables, the adapter CTL-270 is needed

### 1 Person Survey

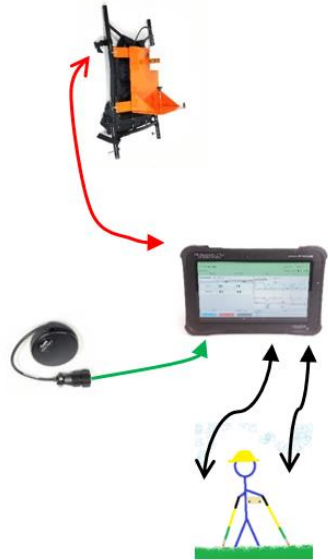
As supplied, ready for survey.

Includes:

- CTL-312 GPS
- CTL-267 (or CTL-268) for wire dispenser
- CTL-271, pair, for 2 survey poles

Possible surveys:

- CIPS
- DCVG/ACVG
- CIPS & DCVG/ACVG
- Double Impedance CIPS
- Double Impedance CIPS & DCVG/ACVG



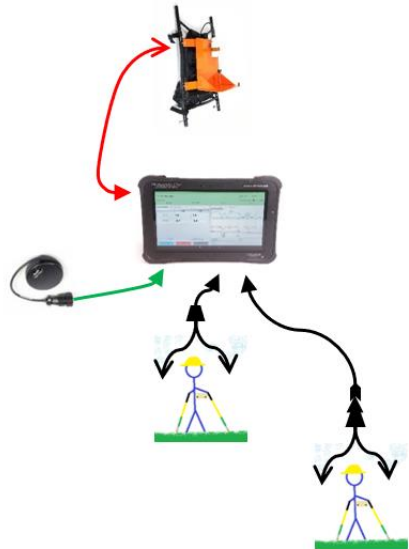
### 2 Person Survey

Additional supplies needed:

- 2x CTL-131 survey pole
- 2x CTL-272 short Y cable
- Choice of:
  - CTL-273 3m extension
  - CTL-274 6m extension

Possible surveys:

- DCVG/ACVG
- CIPS & DCVG/ACVG
- Double Impedance CIPS & DCVG/ACVG
- Parallel CIPS



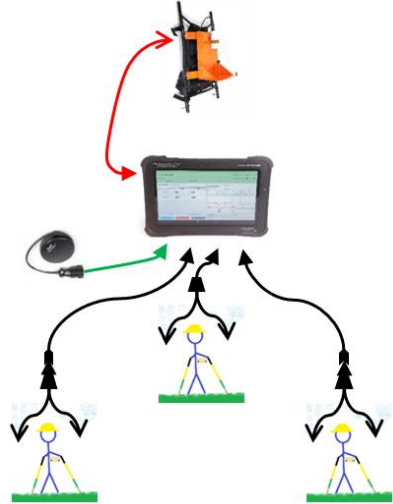
### 3 Person Survey

Additional supplies needed:

- 4x CTL-131 survey pole
- 3x CTL-272 short Y cable
- 2x choice of:
  - CTL-273 3m extension
  - CTL-274 6m extension

Possible surveys:

- 2x DCVG/ACVG
- CIPS & 2x DCVG (side drain)
- Double impedance CIPS & 2x DCVG/ACVG



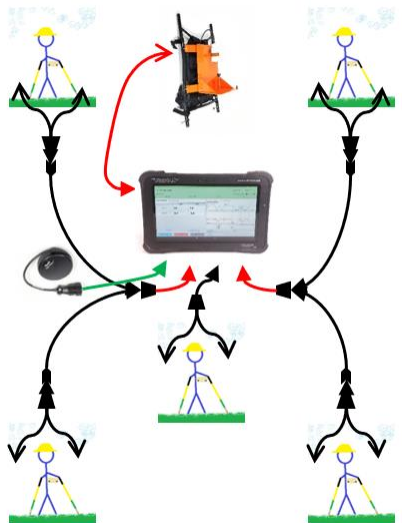
### 5 Person Survey

Additional supplies needed:

- 8x CTL-131 survey pole
- 5x CTL-272 short Y cable
- 2x CTL-275 splitter for Front / Rear
- 4x choice of:
  - CTL-273 3m extension
  - CTL-274 6m extension

Possible surveys:

- 4x DCVG





## Replacement Parts / Accessories

**CTL-111**  
Hip pack wire  
dispenser

- Does not include cables or survey wire



**CTL-131**  
Half cell extension  
pole

- Does not include half cell



**CTL-103**  
Counter wheel &  
axle



**CTL-162**  
Half cell pole  
replacement  
switch

- Includes handle assembly



**CTL-104**  
Wire tensioner



**CTL-136**  
Cu CuSO4 half  
cell with cone tip



**CTL-115**  
4 Point harness  
for Hexcorder Pro



**CTL-141**  
Small spool wire  
for hip pack



**CTL-116**  
Strap for Hip Pack



**CTL-142**  
Case small spools  
(16)



**CTL-121**  
Backpack wire  
dispenser

- Complete with cable to Hexcorder Pro
- Does not include survey wire



**CTL-143**  
Empty small spool



**CTL-122**  
Wire chainage for  
backpack



**CTL-145**  
Large spool wire  
for backpack



**CTL-146**  
Case large spools  
(4)



**CTL-273**  
3m extension  
cable



**CTL-147**  
Empty Large  
Spool



**CTL-274**  
6m extension  
cable



**CTL-205**  
Test Station cable



**CTL-275**  
Splitter for  
Front/Rear



**CTL-266**  
Wired connection  
to tablet



**CTL-247**  
115V charger for  
Hex Pro, NA plug



**CTL-267**  
Cable Hex to  
backpack, 4 wire



**CTL-248**  
230V charger for  
Hex Pro, Euro  
plug



**CTL-268**  
Cable Hex to hip  
pack, 4 wire



**CTL-254**  
Mini USB cable



**CTL-271**  
Cable Hex to half  
cell pole, pair



**CTL-312**  
GPS 18X, short  
lead  
Hexcorder Pro



**CTL-272**  
Short Y cable



**CTL-411**  
Xplore Rugged  
Android tablet

*Spare and replacement batteries for the Xplore tablet are available for sale. Contact Cath-Tech for more information.*



**CTL-562**  
Black connectors  
for Hex cables,  
with backshell



**CTL-563**  
Pin extractor



**CTL-412**  
Charger for  
Android tablet



**CTL-564**  
Alligator clips  
pack 10



**CTL-537**  
9V L-ion battery  
for Hex Pro



**CTL-582**  
Replacement  
cable connector,  
male



**CTL-560**  
Pin for Hex  
cables, black  
connectors



**CTL-583**  
Replacement  
cable connector,  
female



**CTL-561**  
Socket for Hex  
cables, black  
connectors



**CTL-642**  
Circuit board Hex  
Pro



## Troubleshooting

Issue	Possible Solution
Hexcorder Pro won't turn on	Dead battery, plug in with AC power adapter
Tablet won't turn on	Dead battery, plug in with tablet AC power adapter If power LED lights but no screen, broken screen
Hexcorder Pro and tablet won't connect	Power cycle Hexcorder Pro and then immediately try to connect
App crashes during survey	Run the app again, reconnect. The Hexcorder Pro should not need to be power cycled
Bluetooth connection drops frequently	Change to wired connection with CTL-266 cable, see page 34
Unit reads very low ON/OFF values	Check all connections <ul style="list-style-type: none"> <li>• Half cell pole cables</li> <li>• Wire dispenser cable</li> <li>• Wire spool to wire dispenser</li> <li>• Survey wire to test post</li> <li>• Caps removed from half cells</li> <li>• Distilled water in half cells</li> </ul>
Unit won't take readings	<ul style="list-style-type: none"> <li>• Switch half cell poles (bad switch)</li> <li>• Switch half cell cables (broken cable)</li> <li>• Check for manual survey mode</li> </ul>
Readings are very scattered	<ul style="list-style-type: none"> <li>• Soil conditions, if dry place half cells on green weeds for better contact</li> <li>• Check calibration of half cells</li> <li>• Recalibrate half cell offsets</li> </ul>
GPS won't lock	<ul style="list-style-type: none"> <li>• Ensure good view of sky, no trees/buildings/etc</li> <li>• Check GPS is plugged in correctly</li> </ul>
Chainage isn't increasing	<ul style="list-style-type: none"> <li>• Broken survey wire</li> <li>• Broken wire dispenser cable</li> </ul>
Unit won't respond when in survey mode	<ul style="list-style-type: none"> <li>• Power cycle Hexcorder Pro, reconnect to tablet</li> </ul>

### ***Service Bulletin – Battery not charging***

It has come to our attention that in the event the Hexcorder Pro battery becomes deeply depleted, it will not charge. When connected to the charger it still cannot turn on and does not appear to be taking a charge, regardless of the length of time left charging.

The issue may manifest in the following ways;

1. The Hexcorder Pro does not turn on when the power button is pressed
2. The Hexcorder Pro charge light blinks red
3. The Hexcorder Pro charge light turns off instead of turning green, and the battery is still dead
4. The Hexcorder Pro turns on for only a minute or two before turning off again.

The issue stems from interactions between the battery charging circuitry, power control circuitry, and battery protection circuitry. The issue only arises when the battery is extremely depleted. The effect is that the Hexcorder Pro will not appear to turn on when the power button is pressed, however some sub-circuits do become energized. These sub-circuits then interfere with the charging process and prevent charging.

The Hexcorder Pro will charge correctly if the following procedure is followed.

1. Leave the Hexcorder Pro charger disconnected
2. Press the red power button.
  - a. If no lights come on, this is expected
3. Wait 30 minutes
4. Connect the Hexcorder Pro charger to the CHARGE port
  - a. The CHARGE LED should turn a constant red
5. Wait 60 minutes, or until the CHARGE LED turns off, whichever happens first
6. Disconnect, then reconnect the Hexcorder Pro charger to the Hexcorder Pro
7. Wait at least 6 hours
  - a. If the CHARGE LED turns green, the Hexcorder Pro is fully charged
  - b. If the CHARGE LED turns off, return to step 6 and repeat
8. Turn Hexcorder Pro on, connect through the tablet app and observe the battery level to confirm it is fully charged.

**\*NOTE\*:**

**To avoid over-discharging the battery in the future, please **do not** store the Hexcorder Pro without fully charging the battery first, and please recharge it **every 3 months** if not in active use. This will promote battery health and lifespan and keep the battery from becoming severely discharged.**

## Environmental Protection

Waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your local authority or retailer for recycling advice.



# RN42 Bluetooth Transceiver Regulatory Information

## United States

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## Europe

### RN42 EUROPEAN COMPLIANCE TESTING

Certification	Standards	Article	Laboratory	Report Number	Date
Safety	EN 60950-1:2006+A11:2009+A1:2010+A12:2011	[3.1(a)]	Worldwide Testing Services (Taiwan) Co., Ltd.	W6M21402-13966-L	2014-03-24
Health	EN 62479:2010			W6M21402-13966-62479	2014-03-13
EMC	EN 301 489-1 V1.9.2 (2011-09)	[3.1(b)]		W6M21402-13966-E-16	2014-03-13
	EN 301 489-17 V2.2.1 (2012-09)				
Radio	EN 300 328 V1.8.1 (2012-06)	(3.2)		W6M21402-13966-T-45	2014-03-13
Notified Body Opinion	<b>CE0681</b>	—	Eurofins Product Service GmbH	U9M-1404-3736-C-V01	2014-04-15



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