CableData® Collector Operating Manual

technology

Model No: CDC3
Document Version: V01.01.00
Date: 8 July 2021

Version History

Date	Version	Author(s)	Notes
10/06/2021	01.00.00	Sam Russell	Initial Release
08/07/2021	01.01.00	Sam Russell	Added link to Declarations of Conformity.

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Safety Precautions and procedures

- The CableData® Collector (CDC) range is for use only with specified equipment and cables supplied by EA Technology Ltd. Misuse of the equipment can result in injury or death.
- Ensure relevant safety notes and manuals from any auxiliary equipment and sensors such as that from the HFCT are read in conjunction with this manual.
- The CDC can be used without de-energizing the local equipment, it must be considered under the relevant risk assessment.
- The CDC is designed for use at ground potential only.
- When testing electrical plant ensure metalwork is earthed before observing measurements.
- Local safety procedures and guidelines (including the use of personal protective equipment) must be followed during the installation and use.
- Maintain safety clearances between structures at high voltage and the instrument, its probes, and the operator always.
- Do not make measurements with electrical storms in the vicinity.
- Do not make measurements immediately following the energization of a circuit.
- Do not disturb the plant during measurements either mechanically (e.g., shaking or striking it), electrically (e.g., increasing the voltage) or physically (e.g., applying heat).
- Do not operate the CDC or any accessories in an explosive environment.
- Before installation and use, always check the condition of the connecting cables.
- If the equipment is used in a manner not specified by the manufacturer, any protection provided by the equipment may be impaired.
- Modification of switchgear is outside the scope of this document. Adhere to all regulatory and manufacturer standards when considering modifications. Ensure that any such modifications do not reduce structural integrity or arc flash withstand of the switchgear.
- Do not use the SD card slot or the Ethernet port, these ports are currently not supported.
- For application information email product-support@eatechnology.com.

Contents

1. Non-Intrusive Detection of Partial Discharge Activity

Partial discharges are electric discharges that do not completely bridge the electrodes. The magnitude of such discharges is usually small; however, they do cause progressive deterioration of insulation that may lead to eventual failure(s).

Non-intrusive partial discharge detection provides a means for identifying these potential sources of insulation failure that result not only in loss of supply to customers but can also endanger staff.

A partial discharge emits energy in the following ways:

Electromagnetic:

- Radio
- Light
- Heat

Acoustic:

- Audio
- Ultrasonic

Gases:

- Ozone
- Nitrous Oxides

When the partial discharge event occurs in a cable, there will be a resulting voltage pulse coupled to the earth sheath of the cable. These pulses will propagate away from the PD side in both directions. Once the pulse reaches a change in impedance, this will cause a partial reflection. This results in the pulses travelling back down the cable several times (dependent upon cable length) as they decay away.

Measurement is taken using the High-Frequency Current Transformer (HFCT) at one end of the cable. This will reveal a pattern of pulses, where the first pulse is the direct pulse from the PD event. The second pulse is the reflected pulse from the far end. If the PD site is at the far end of the cable, then the direct pulse and the reflection will be very close to each other, or perhaps superimposed on each other. Conversely, if the PD site is at the near end of the cable, the direct pulse will be received first, and then there will be a longer gap as the pulse travelling away will have to travel nearly twice the length of the cable until it is detected.

2. CableData® Collector (CDC) Hardware

2.1 Kit Contents

1 x CDC Main Unit

3 x HFCTs

4 x 5m BNC Leads

1 x USB Data & Power Cable

1 x Phase Reference Transformer (CDC2-PRT)

1 x Carry Case

1 x Software USB drive

Operating Manuals

2.2 General

The front panel offers 4x BNC connectors. 3x BNC connectors (1,2,3) are for use with the supplied HFCTs for data acquisition. The fourth connector (~) is the Auxiliary input, where the phase reference transformer is connected. Only the supplied phase reference transformer specifically designed for the CDC should be used on this input. Each channel can be identified from the top enclosure label.

Figure 1 CDC Top View

The rear of the CDC contains the following connectors:

SD card slot:	Currently unsupported/functional. Do not insert an SD card into this slot.
Three status LEDs	Further information on the LEDs in section 2.3.
Mini USB Connector	Used for instrument power and communication. The CDC is supplied with a split USB Cable allowing more power to be drawn from additional USB source if required.
Ethernet Socket	Currently unsupported/functional. Do not insert network cables into this socket.

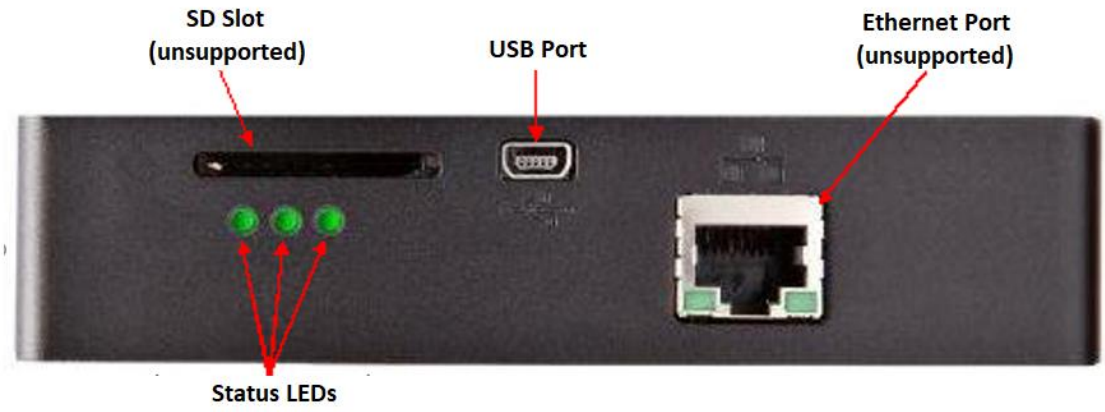

Figure 2 CDC Rear View

2.3 Status LED Definition

The outermost two status LEDs indicate the status of the firmware. When the CDC is powered up but not collecting data, they should remain solid green. When collecting data, the left (outermost) LED should briefly flash whilst collecting event data. The centre LED will flicker when collecting waveform data. As the waveform collection is a slower process, this will flash for a longer period.

The innermost LED is the phase reference indicator. When a phase reference is present, the LED should remain solid green. In the event the phase reference is lost, the LED will turn orange.

In the event any of the Status LEDs turn red, try power cycling the CDC to see if this alleviates the problem. If the red status light remains illuminated, this may indicate a possible hardware issue. If this occurs, then please contact EA Technology Product Support Team for further instructions.

2.4 Phase Reference

A phase reference is required by the CDC to improve the data analysis allowing classification of events based on phase position. There are two supported methods for this.

1) Recommended Method: Connecting a phase reference transformer to the Auxiliary channel.
2) Using a HFCT connected one of the CPD measurement channels (1,2 or 3).

2.5 Transformer Reference

The preferred (supplied) phase reference transformer provides more accurate results compared to the HFCT's. Because of this, it should be used wherever possible. Using the Transformer as a reference; plug the BNC connector from the end of the transformer cable to the Aux input (~).

Where the supplied cable is too short, a longer BNC cable from the phase reference transformer to the instrument can be supplied by EA or a mains extensions lead can be used.

The phase reference transformer input is in the form of an IEC320-C7 power cable, which can be replaced for an off the shelf version with a localised plug. If this is not possible, the transformer will work with basic travel adapters.

The more complex travel adapters that also convert the voltage may not work and should be avoided. The transformer is designed to work with an input voltage between 100V → 240Vac.

2.6 HFCT Reference

The CDC will attempt to obtain a phase reference from flowing current through the HFCTs sheath. This 50Hz or 60Hz current is due to the cable capacitance, or in some circumstances may be down to induction from the phase conductors.

A current of approx. 10A is required to give a reliable reference - if lower, the reference may become intermittent and/or unreliable. The phase reference LED may also occasionally change between green and orange. In this event it is recommended to replace with the phase reference transformer.

If the instrument is being used in Single Phase (1P) mode it will only attempt to detect the phase reference on channel 1, however, if being used in three-phase (3P) mode all three input channels (1,2,3) will be attempted. This information is logged in the capture reports which can be viewed at the end of the data capture process.

2.7 Taking PD Measurements using a HFCT

Using the CDC with a HFCT for detection of Partial Discharge (PD) on single or three-phase cables can be done non-intrusively using multiple configurations. The configuration of the test setup is highly dependent on the accessibility and layout of the location of the test. For more information on configuring a test using HFCT consult the HFCT manual and if further assistance is required contact EA technology.

Figure 3 Image of a HFCT1-F50

2.8 Calibration

It is recommended that the CDC is calibrated annually. Information on the calibration date and due date can be found by navigating to “About” in the CableData® Collector software (shown in figure 4).

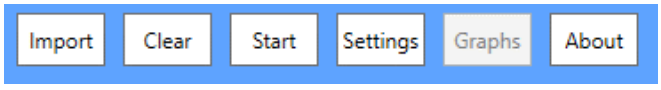

Figure 4 About button in CDC Software

Clicking the **About** button will display the instrument information window shown in Figure 5. **Calibration Due Date** will give information of the remaining time until the recommended calibration date expires.

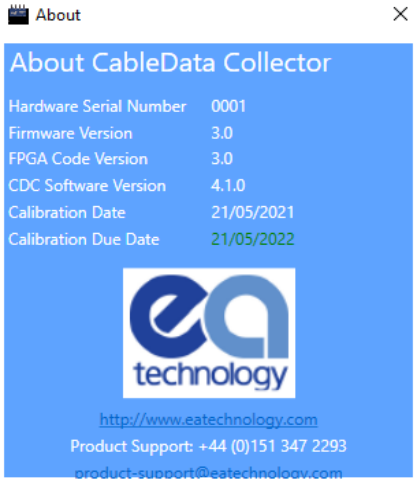

Figure 5 About Window

If the CDC calibration has expired, a warning will be displayed during start up (shown in Figure 6). Clicking OK will allow the software to continue collecting data (not recommended).

Figure 6 Warning about calibration expiry

3. CDC Software Installation & Setup

3.1 Software Installation

The CDC software requires Microsoft's .Net 3.5 framework to be installed, a separate installer is included with the setup files. If you are unsure, whether you have this installed then it is advisable to run and install this before starting with the installation of the CDC.

To start the installation, locate the install files supplied. Run the .exe file to start the installation process. Windows administrator privileges are required to install the CDC software.

Running **CableDataCollector_Setup.exe** file requires confirmation for installation progress (Figure Figure 7). To start the installation, click **Yes** and this will start the preparation process for the required virtual COM port drivers, which are necessary to communicate with the CDC.

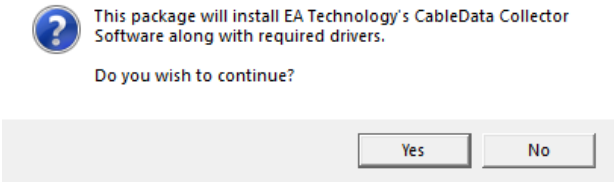

Figure 7 Install Confirmation

Upon preparation completion, the installer will wait to start, Figure 8. Click **Next** to start driver install.

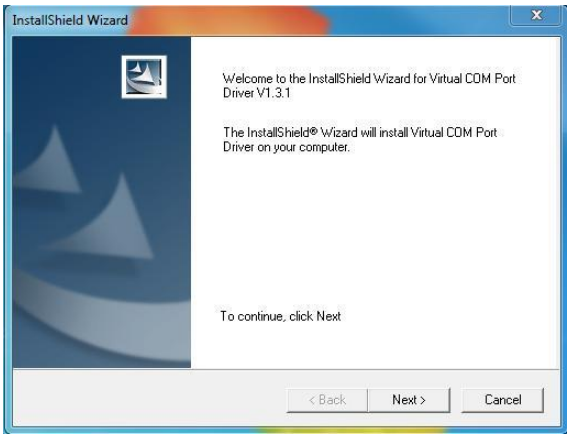

Figure 8 Virtual COM Port Driver start of installation

Upon completion, Windows Device Driver Installation Wizard will run. Click **Next** to install the driver.

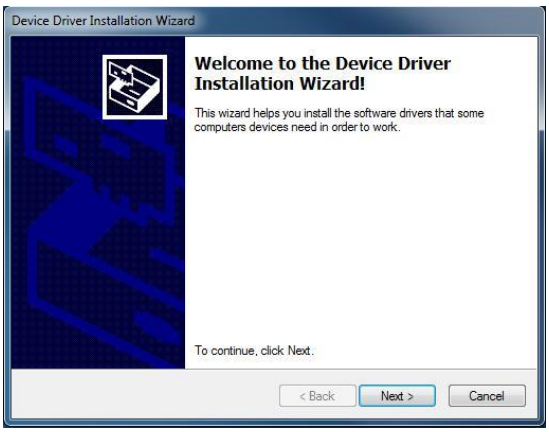

Figure 9 Windows device driver installation wizard

Once completed a confirmation screen will show, Figure 10. Click **Finish**.

Figure 10 Completed device driver installation

The next set-up screen (Figure 11) installs the CDC Software. Click **Next** to progress.

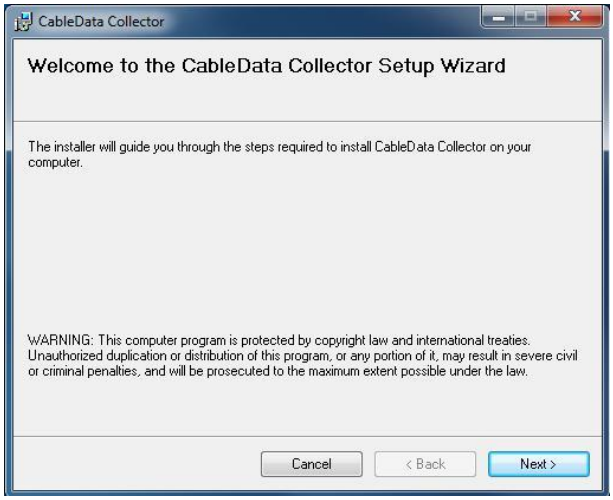

Figure 11 CDC Setup Wizard

The license agreement (Figure 12) is displayed which should be read & understood. Failure to agree to the license agreement renders Desktop collector software installation not possible. Click the **I Agree** button (To agree), followed by **Next**.

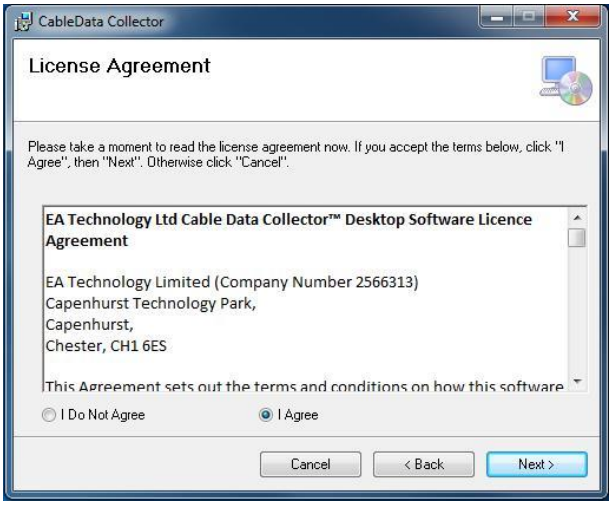

Figure 12 License Agreement

Select the Installation folder (Figure 13) allows you to select the installation location. It is recommended to be left at default. You can select whether the software is installed for all users, or just the current user (logged in).

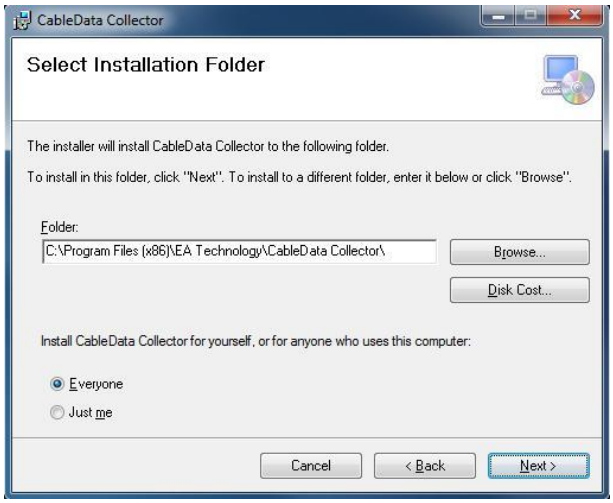

Figure 13 Selecting Installation Directory

Once installation has completed the following message (Figure 14), click Close to exit.

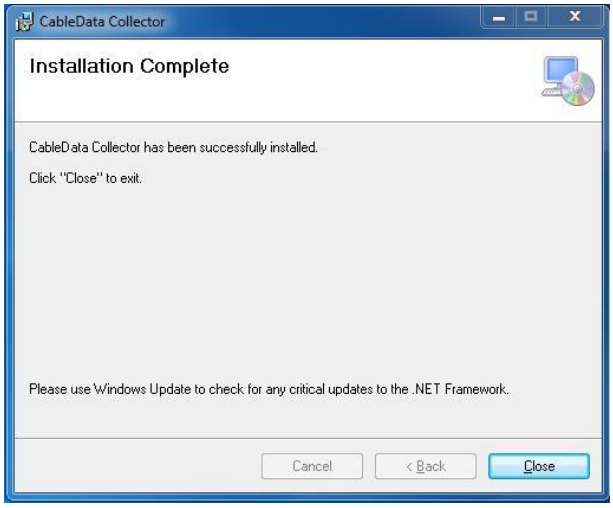

Figure 14 CDC Wizard Completion Screen

3.2 Connecting the CDC

Before the application can be run for the first time, it is important to make sure that the correct drivers are installed. To do this, connect the CDC to the PC via USB cable.

The device will automatically power on upon connection. If the CDC has not been connected before, Windows should take a few moments whilst the drivers are installed. Windows will show a notification upon the success of the driver installation.

Upon success, the software can be started.

Start > All Programs > EA Technology > CableDataCollector

3.3 Settings Setup

The first time opening the software shows a populated configuration settings screen. Figure 15.

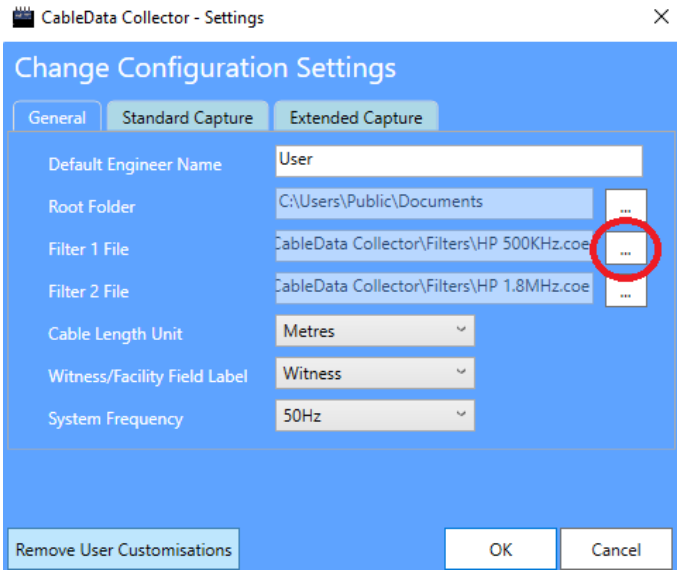

Figure 15 CableData® Collector Software Setup Screen

The **Default Engineer Name** is the name that will automatically populate the **Engineer Name** field on the main screen. This can be changed during testing if the operator changes.

The **Root Folder** is the folder where collected data files will be saved. For this installation, the folder has been set to "**C:\Users\<user>\Documents\".**

Note: When setting a root folder, it is recommended to choose a folder in the **My Documents** folder (Windows) for the logged-on user.

Two filter files are automatically copied across during installation: **Filter 1** (500kHz High Pass) & **Filter 2**. (1.8MHz High Pass). The filters in general should not need to be changed. If changes are required, this can be completed as follows:

1) Copy the COE files to the local hard drive.
2) Click the **"…"** button for Filter 1 (shown in Figure 14), navigate to where you have copied the file.
3) Select the file and repeat process for the second COE file (Filter 2).

If updating selected filters, always set so that the more restrictive filter is set to Filter 2.

For the supplied filters, the High Pass 500kHz filter will block frequencies (DC) up to 500kHz. The High Pass 1.8MHz will block frequencies (DC) up to 1.8MHz. As the High Pass 500kHz filter will let through a wider range of frequencies, this should be set to Filter 1, with the High Pass 1.8MHz set to Filter 2.

The **Cable Length Unit** has two options in the drop-down list: **Metres** and **Feet**. Select the unit that you wish to use when entering cable lengths.

The **Witness/Facility Field Label** reflects a field on the main screen. This can be set to **Witness** if there will be a witness observing any work, witness's name can then be entered. Set **Facility Name** if it is desired to record the facility name separately.

System Frequency is the operating frequency of the measured cable: **50Hz** or **60Hz**. This value is used by the CDC to detect the correct phase reference. Set the correct location frequency here.

Note: If you wish to change any of the settings in the future, click **Settings** from the main screen.

When all the settings have been entered, click the **OK** button to save the settings and close the window. The main interface should now be loaded.

4. Using the CDC Software

Connect the CDC to a PC using the supplied USB cable.

Run software located in Start > Programs > EA Technology > CDC

4.1 Software Initialisation

When the main interface has started, the software will attempt to find the attached CDC. During this process, a message (Figure 16) will appear. The window will close once the CDC has been detected.

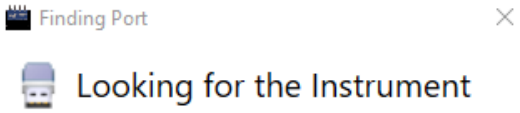

Figure 16 Looking for instrument at software start-up

This should take no more than 5 seconds. If problems detecting the CDC occur, a warning message will appear (Figure 17). This error should only occur if the CDC is not connected correctly, check USB cable is securely connected, and click Yes.

On some laptops, not all USB ports will function correctly, try connecting CDC to a different USB port if the error persists. If the error message persists and the cable and laptop have been ruled out as the source of the problem, contact EA Technology for further assistance.

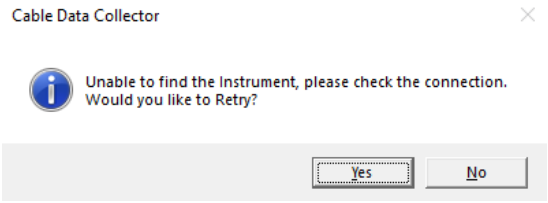

Figure 17 CableData® Collector Software Start-up

If during loading procedures, it has not been possible to read asset data, a warning will be displayed (Figure 18). If a warning is displayed, try unplugging the CDC and closing the software, re-connect the CDC and start the software again. If the warning message persists, please contact product support.

It is still possible to capture data without the asset data, however this is not advised as the results of the analysis may have reduced accuracy.

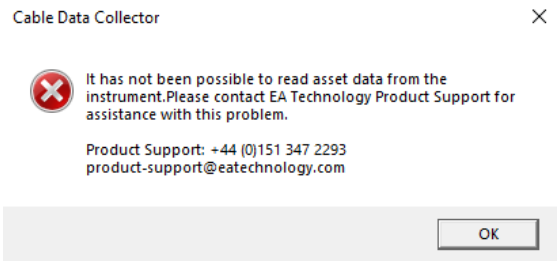

Figure 18 Error whilst reading asset data

4.2 Main Screen

Correct software initialisation & device discovery produces the main screen (Figure 19).

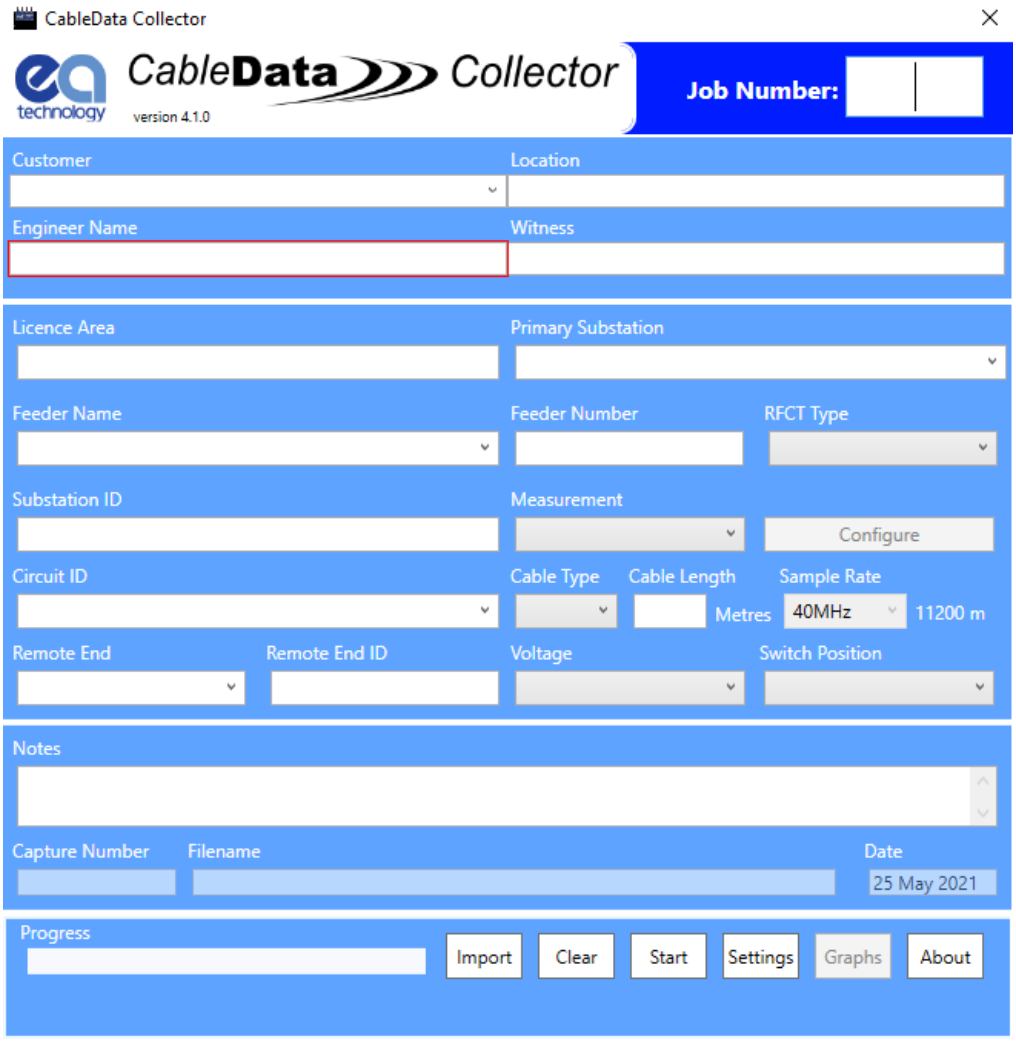

Figure 19 CableData® Collector Software Main Screen

4.3 Main Screen Data Entry Requirements

4.3.1 Main Screen Overview

Some of the input fields are required and must be completed before data collection can begin. The required fields are as follows:

- Job Number
- Licence Area
- Feeder Number
- Engineer Name
- Substation ID
- Feeder Number
- Substation ID
- Cable Type
- RFCT Type
- Voltage
- Switch Position
- Phase

Attempting to start recording data without completing the required fields will prompt 0.

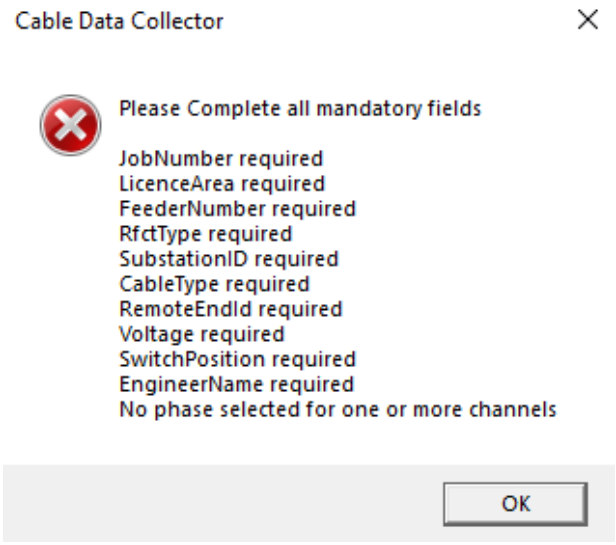

Figure 20 Error message when starting a capture with incomplete information

Required fields that are incomplete when attempting to start a capture will be highlighted in red. An example of this is shown in Figure 21.

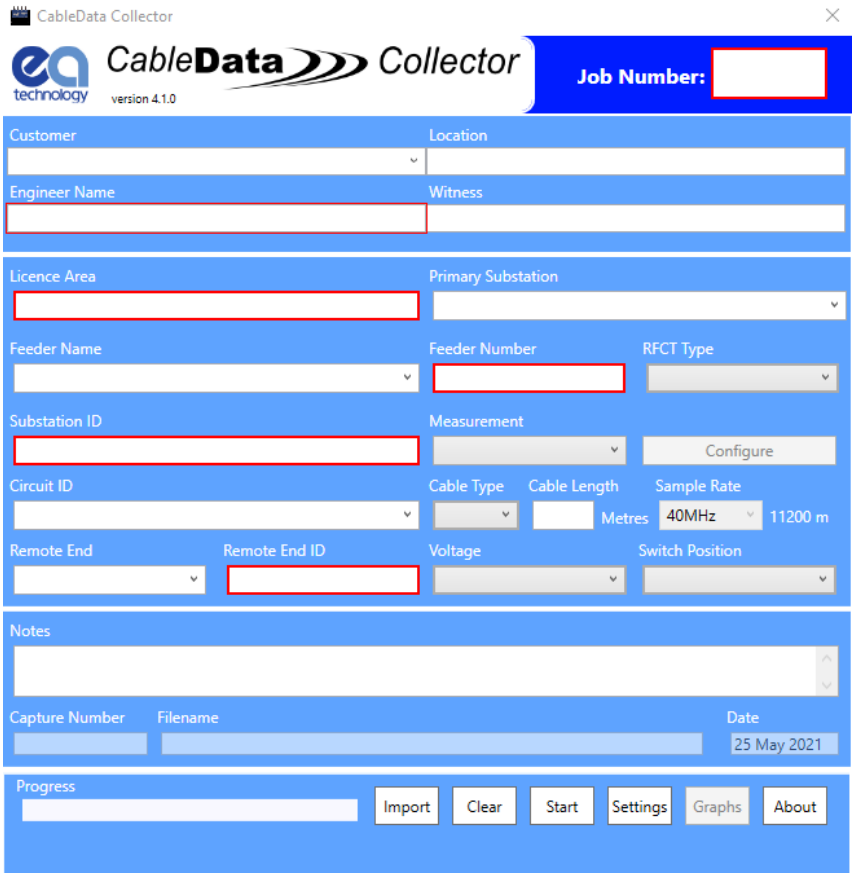

Figure 21 CableData® Collector Software with incomplete data

The first set of fields are free text and can have any values entered. These are **Job Number**, **Customer**, **Location**, **Engineer Name** and **Facility Name**.

The second set of fields relate to the circuit that is currently under test. **Substation ID** and **Circuit ID** are free text and must be populated.

4.3.2 Cable Type

The **Cable Type** must now be set. There is a drop-down list for this field. There are several of the most common cable types listed by default. Figure 22 shows the drop-down list with the default options.

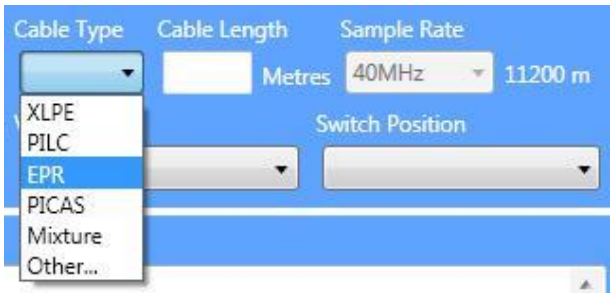

Figure 22 *Cable Type Dro*p-down

If the cable under test does not have a type listed in the available options, then a new option can be added. To do this, select the **Other...** option. A window will open with a field to enter the new Cable Type. Only the first 7 to 8 characters will be visible in the **Cable Type** drop-down list. The window is shown in Figure 23. Enter the Cable Type and click **Add**. This will add the newly entered cable type to the list of available options and will save it so that it can be selected again in the future.

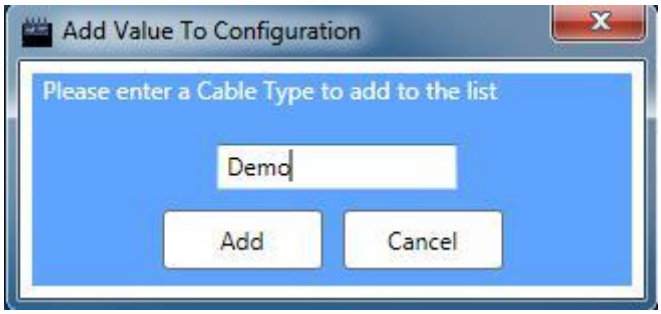

Figure 23 Adding new cable type

The newly entered option will be automatically selected for the data capture and will be available for selection in any future assessments, as shown in Figure 24.

Figure 24 Cable type selected

For cables where there is a join part of the way down the cable, **Mixture** must be selected, and a comment must be added in the **Notes** field. If data capture is attempted with the Mixture Cable Type selected, and no text in the **Notes** field, the error message in Figure 25 will be displayed.

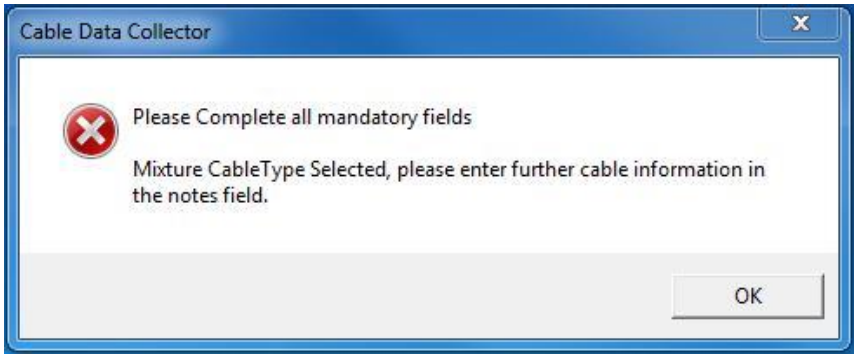

Figure 25 Error when selecting mixture for cable type without entering any notes

4.3.3 Cable Length & Sample Rate

The next field is for **Cable Length**. The units for this were set during the first run of the software. The **Cable Length** field is not required, however if cable mapping is performed then an accurate cable length is of great help.

Figure 26 shows the cable length and sample rate fields. When the cable length is blank, it is not possible to alter the sample rate, and the sample rate will always be set to 40MHz.

Figure 26 Cable length and sample rate fields

The software attempts to select the best **Sample Rate** for the entered cable length. The sample rate is the sampling interval used to capture the measured waveform. A higher sampling rate provides a better resolution of the waveform being captured; however, this limits the maximum length of the cable that can be tested.

A lower sampling rate allows longer cables to be tested; however, the high-frequency resolution will be reduced. If the cable length is an estimate, and the length is thought to be near to a length limit for the sampling rate, it is recommended to choose a slower sampling rate to ensure that mapping is possible.

The theoretical maximum cable lengths for each sample rate are shown in Table 1.

Sample Rate	Maximum Cable Length (m)	Maximum Cable Length (Feet)
160MHz	2,800	9,186
80MHz	5,600	18,372
40MHz	11,200	36,745

Table 1 Theoretical Maximum cable lengths for each sample rate

Caution: If the cable being tested is longer than allowed by the selected sampling rate, then cable mapping will not be possible from the data set. The maximum cable length is 11,200m. If this is exceeded, then the warning message shown in Figure 27 will be displayed.

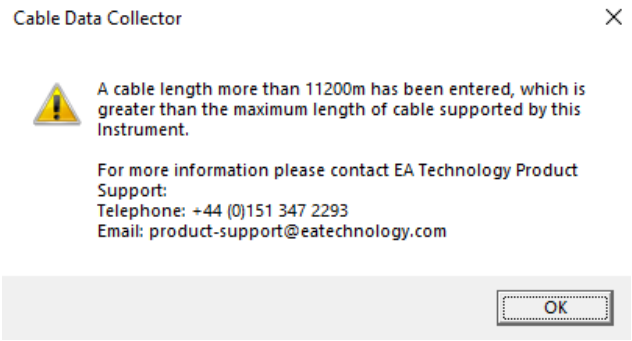

Figure 27 Warning when entering a cable length of over 11,200m

4.3.4 Voltage

The next field, visible in Figure 28, is the **Voltage** of the cable under test. Several common voltages for the UK distribution network are available by default.

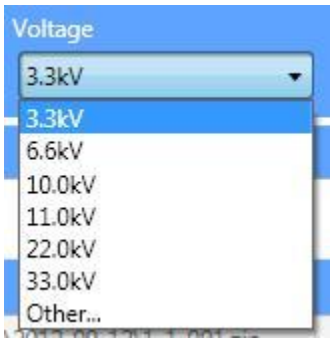

Figure 28 Voltage drop-down selection

If the cable under test operates at an unlisted voltage, it is possible to add further options. To do this, select the **Other...** option at the bottom of the list. The window, shown in Figure 29 will then be displayed, which will allow you to enter a new voltage. Only the numeric value of the voltage needs adding, as the software automatically adds the CDC. With the new value entered, click **Add**.

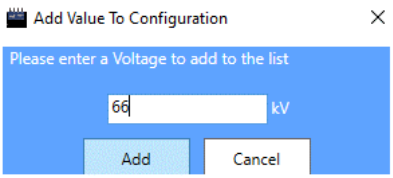

Figure 29 Voltage Entry

4.3.5 Switch Position

The **Switch Position** option is to enter the status of any switch that may be present on the cable at the point of measurement. If there is no switch present, then **Absent** should be selected. The **Open** option would be for cases when the switch is open, and the cable is energised but with no load. The **Closed** option is for when the switch is closed, and the cable is energised and carrying a load. It is only possible to perform testing on energised cables. The options are shown in Figure 30.

Figure 30 Switch position selection

4.3.6 Phase Information

Under the **Measurement** title, there is a drop-down list, which allows you to select the measurement type. This can be **Single-Phase**, **Three-Phase** or **Belted Cable** (also known as three core cable with one accessible earth). The **Single-Phase** option should be selected when each phase is tested separately. For single-phase measurements, only channel 1 is used. **Three-Phase** should be selected when all three channels are used simultaneously with separate HFCTs. **Belted Cable** should be selected when the earth conductor surrounds all three cores, and it is not possible to attach an HFCT to a separate earth conductor for each core. The drop-down list is shown in Figure 31.

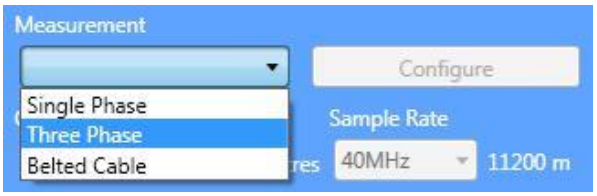

Figure 31 Measurement selection

For **Belted Cable**, no phase information is required and so the configure window is not needed as the phase setting is locked to belted. For **Single-Phase** and **Three-Phase**, once the option for the measurement type has been selected, the **Configure** button to the right must be clicked to set the phase for the measurement.

For single-phase configuration, first, select the phase naming convention from the drop-down list as shown in Figure 32.

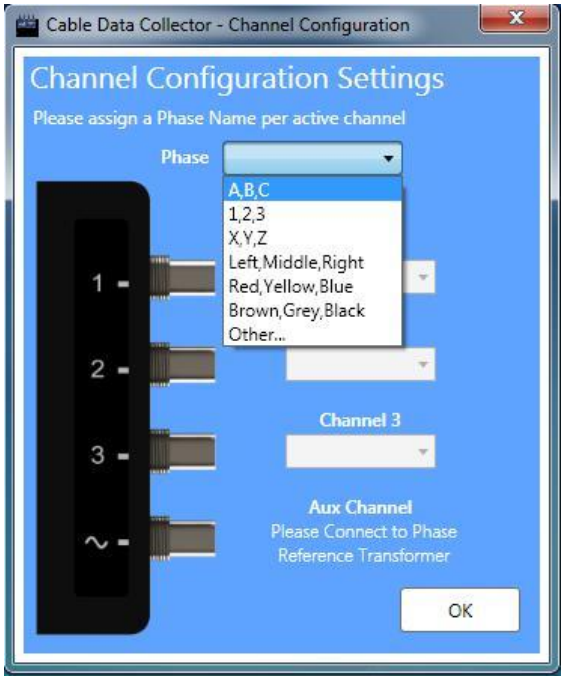

Figure 32 Selecting phase naming convention

This will populate the drop-down list under **Channel 1**, with the selected options. From this drop-down list, then select the appropriate option for the phase being tested and click **OK**, as shown in Figure 33.

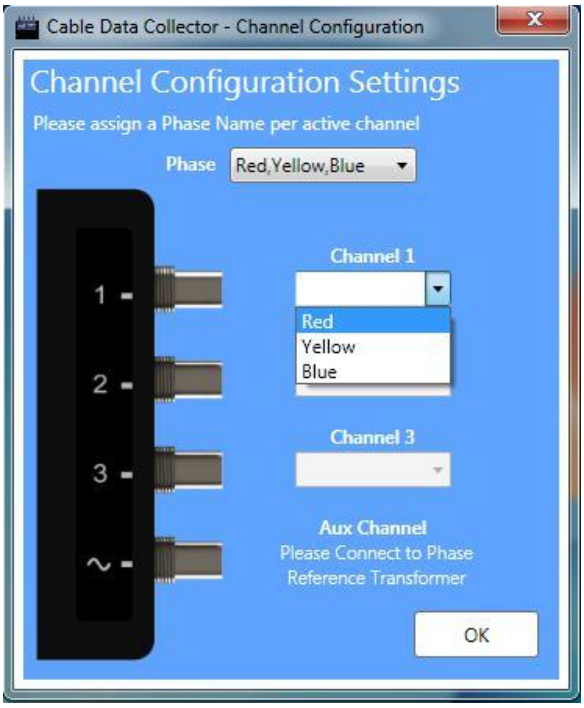

Figure 33 Setting phase for single-phase measurement

For a three-phase measurement, the phase naming convention must be set in the same way. All three drop-down lists for the channels will now be activated, and each drop-down list must have an option selected. The drop-down list for channel 3 is shown in Figure 34.

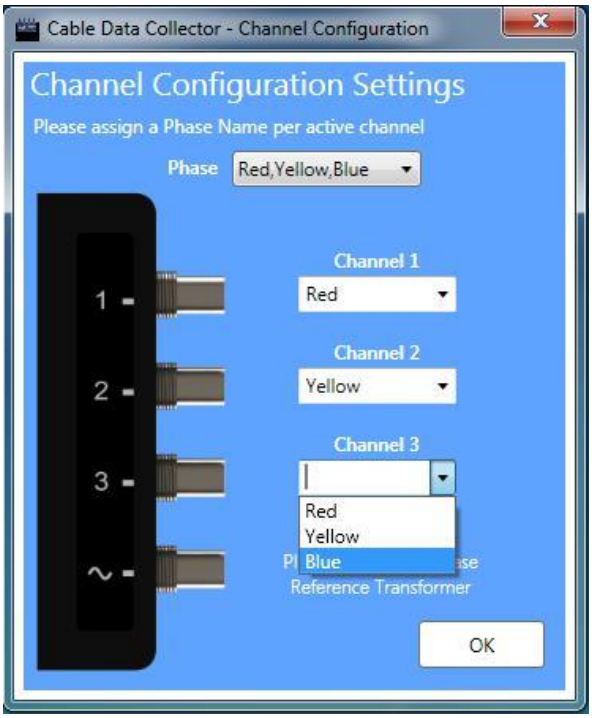

Figure 34 Setting phase for three-phase measurement

Once the phase for each channel has been set, click **OK**. Note, it is not possible to select the same phase label for multiple channels.

4.4 Data Capture

4.4.1 Starting Data Capture

With all of the required fields filled in, it is now possible to start the data capture. Press the start button shown in Figure 35 to start the capture process. Once data capture is started, all of the data entry fields will be locked and it will not be possible to modify any of the fields until the capture is complete.

Figure 35 Start Button Location

4.4.2 Aborting Data Capture

If the data capture process is taking a very long time or needs to be halted for any other reason it is possible to cancel the data capture at any time. Some stages of the data capture may be skipped to allow progression to later stages of the capture progress.

It is recommended that if, after 5 minutes on a waveform capture stage, the bar is not showing any signs of moving then the data capture should be skipped to the next stage using the **Skip** button. The **Skip** button will only be active during waveform capture, as raw data capture cannot be skipped.

During the data capture, the **Settings** button on the main screen will change to the **Cancel** button and at some stages; the **Skip** button will become active.

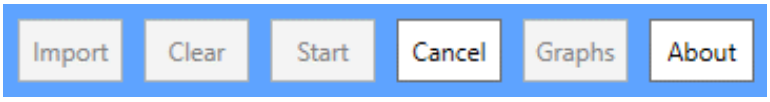

Figure 36 Cancel Button Location (once capture has started)

Clicking the cancel button will immediately cancel data collection. A message box will ask if the output should be saved. If the data capture has been halted because of very little activity on the cable, then the **Yes** button should be clicked which will save the data. If the data is not needed, then clicking the **No** button will discard the data and return to the main screen. The prompt is visible in Figure 37.

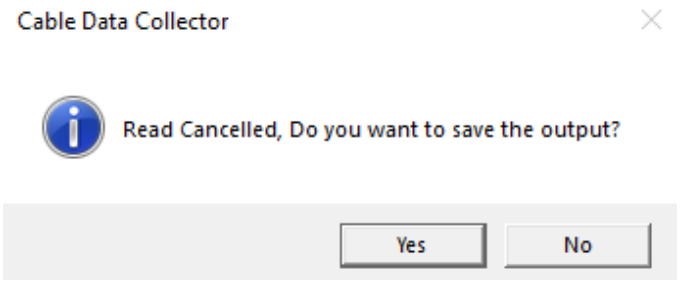

Figure 37 Cancel Prompt

If the **Yes** button has been clicked then the data will be automatically saved into the same directory as the other captured data files, with the word **Cancelled** appended to the file name.

4.4.3 Repeating Data Capture

If a data capture has been performed with the same settings, a warning will appear stating that the capture is the same as a previous capture. If this is correct and the same cable is being tested, then the **Yes** button should be pressed to repeat the measurement. If this is not correct, then the **No** button should be clicked and the cable details updated accordingly.

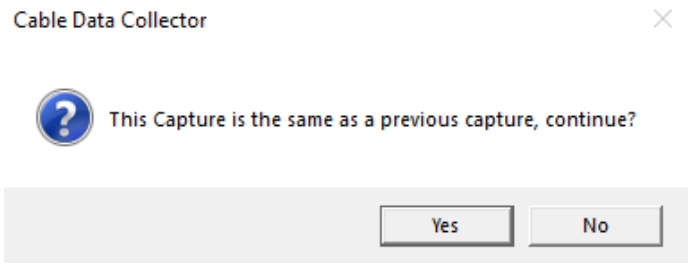

Figure 38 Warning when repeating data capture

4.4.4 Data Capture Process

There are different sequences for single and three phase capture. The data capture process collects two types of data; Raw data and waveforms. Raw data is used to generate the phase plots. The raw data capture is a 15 second run where all the detected events are recorded. This stage will always take 15 seconds for each filter.

Waveform data is used to map the location of the fault on the cable. During the data capture process, the data collection will switch between the two. In addition to this, the filter that is in use will also be changed to remove as much noise as possible from the collected data. The waveform capture time is dependent on the levels of partial discharge on the cable, and also depends on the level of background noise. If there is a quiet cable with very little activity and very little background noise, each waveform stage may take several minutes. For a cable with lots of partial discharge activity occurring, the waveform capture stages will be quicker.

4.4.5 Single-Phase Data Capture Sequence

For a single-phase data capture, only the data from channel 1 will be recorded, so the data capture will only trigger on channel 1. 100 waveforms are captured with each filter for a total of 300 waveforms.

The single-phase capture sequence is shown in Table 2.

Stage	Filter	Data Type	Trigger Channel
1	Unfiltered	Raw	1
2	Unfiltered	Waveforms	1
3	Filter 1	Raw	1
4	Filter 1	Waveforms	1
5	Filter 2	Raw	1
6	Filter 2	Waveforms	1

Table 2 Single-phase capture sequence

4.4.6 Three-Phase Data Capture Sequence

For the three-phase data capture, events for all phases will be captured, and then for each filter a waveform capture will be done triggering from each of the channels. This is shown in Table 3.

Sets of 100 waveforms are captured with each filter, for each trigger channel. As the CDC is in three-phase mode, each set of waveforms will contain a waveform from each channel. This gives a total of 2,700 waveforms or 900 waveforms per channel.

As there are more data capture stages, for cables with the same levels of activity the three-phase data capture will take longer than for single-phase captures.

Stage	Filter	Data Type	Trigger Channel
1	Unfiltered	Raw	All
2	Unfiltered	Waveforms	1
3	Unfiltered	Waveforms	2
4	Unfiltered	Waveforms	3
5	Filter 1	Raw	All
6	Filter 1	Waveforms	1
7	Filter 1	Waveforms	2
8	Filter 1	Waveforms	3
9	Filter 2	Raw	All
10	Filter 2	Waveforms	1
11	Filter 2	Waveforms	2
12	Filter 2	Waveforms	3

Table 3 Three-phase capture sequence

4.4.7 Invalid Phase Reference

When starting the data capture, if a phase reference is not detected, the error message in Table 3Figure 39 will appear. It is not possible to capture data without a phase reference present as it allows classification of events based on the phase position. If this error occurs, please address the issue by using an alternative phase reference source.

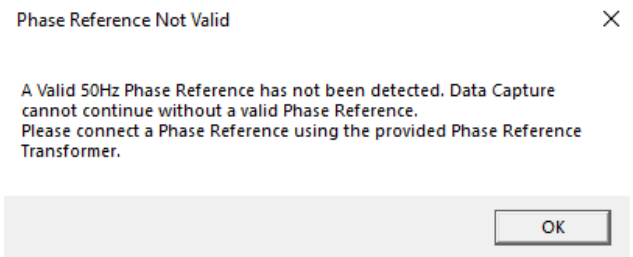

Figure 39 Invalid phase reference message

4.4.8 Progress Indication

When the data capture process is started, an additional progress bar will appear beneath the top visible bar. The top bar indicates the progress through the different data capture stages as shown in the previous section. The lower status bar indicates the progress through the current stage. To the right of the lower progress bar is a text field indicating the current data capture stage.

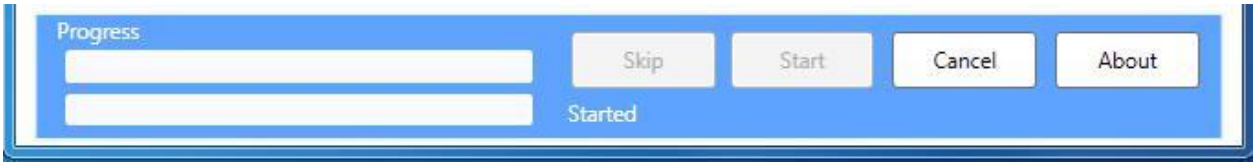

Figure 40 Data Capture Process Started

Figure 41 Raw Data Capture Process Started

Figure 42 Started Unfiltered Waveform Capture (time taken is dependent on PD activity)

Figure 43 Completed capture for all channels

If data capture is cancelled part way through the data collection process, then both bars will appear full and remain green similar to when data capture has completed.

If the phase reference source is lost or interrupted during data capture, both progress bars will turn orange. This is shown in Figure 44.

Figure 44 Progress bar latched orange after losing phase reference source

If there is an error with the device during the data capture, then the status bar will turn red (shown in 0). If this occurs, unplug the device and close the software and retry.

Figure 45 Capture failed

4.5 Capture Data & Reports

4.5.1 Saving a capture report

A capture report is a summary of the data captured, to allow an overview of the data capture process. The capture reports allow determining of the Data Capture Duration, Number of Events Captured, Number of Waveforms captured on each channel, and the number of phase reference errors. It also allows checking of the phase reference quality.

Figure 46 shows the capture report for a successful three-phase capture with a good phase reference. There are many events, 900 waveforms per channel and 0 phase reference errors. This is what a Capture Report should ideally look like.

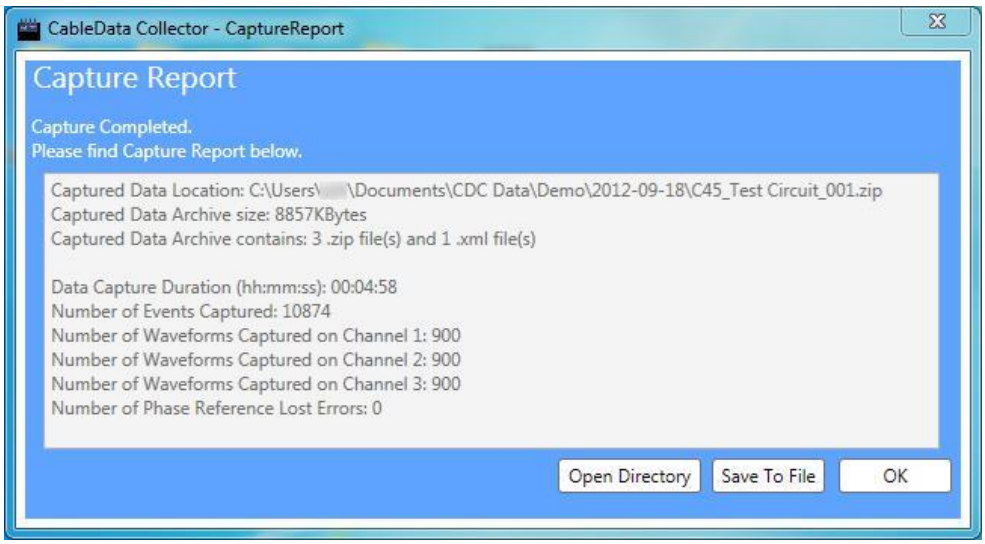

Figure 46 Capture Report for successful three-phase capture with constant phase reference

Figure 47 shows the capture report for a successful single-phase capture with a good phase reference. Again, there are a large number of events captured, and there are 300 waveforms for channel 1, with zero phase reference errors.

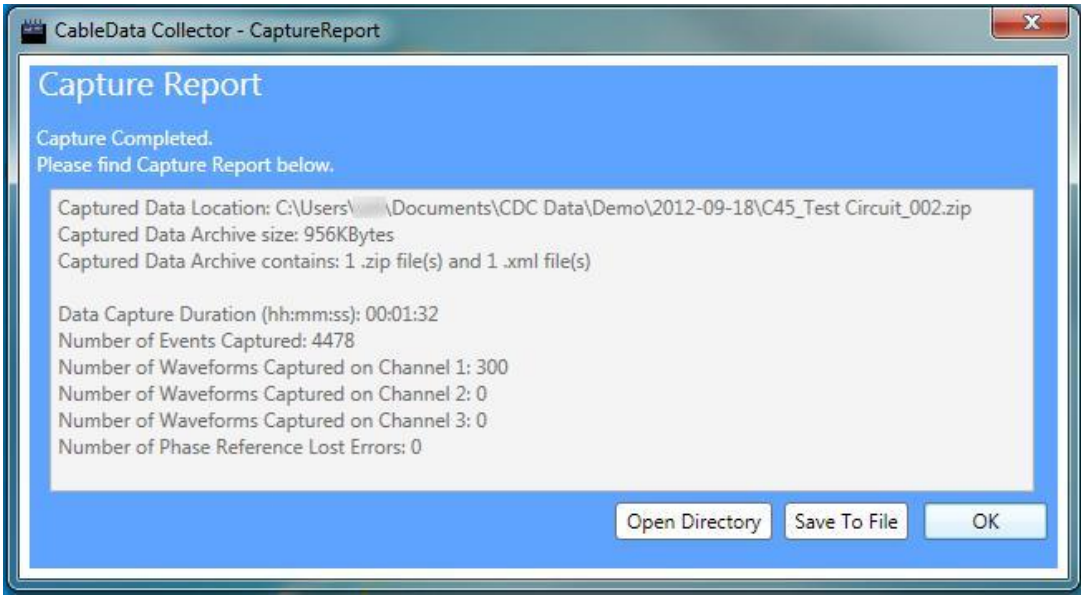

Figure 47 Capture report for successful single-phase capture with constant phase reference

If a valid phase reference is found at the start of the data capture, but is lost part way through, then this will be shown in the Capture Report at the end of the capture. In Figure 48 the last line of the Capture Report states **Number of Phase Reference Lost Errors: 1530**. This number may vary but generally for a good phase reference should be zero. If this number is anything other than zero then the phase reference transformer should be considered as an alternative source for the phase reference.

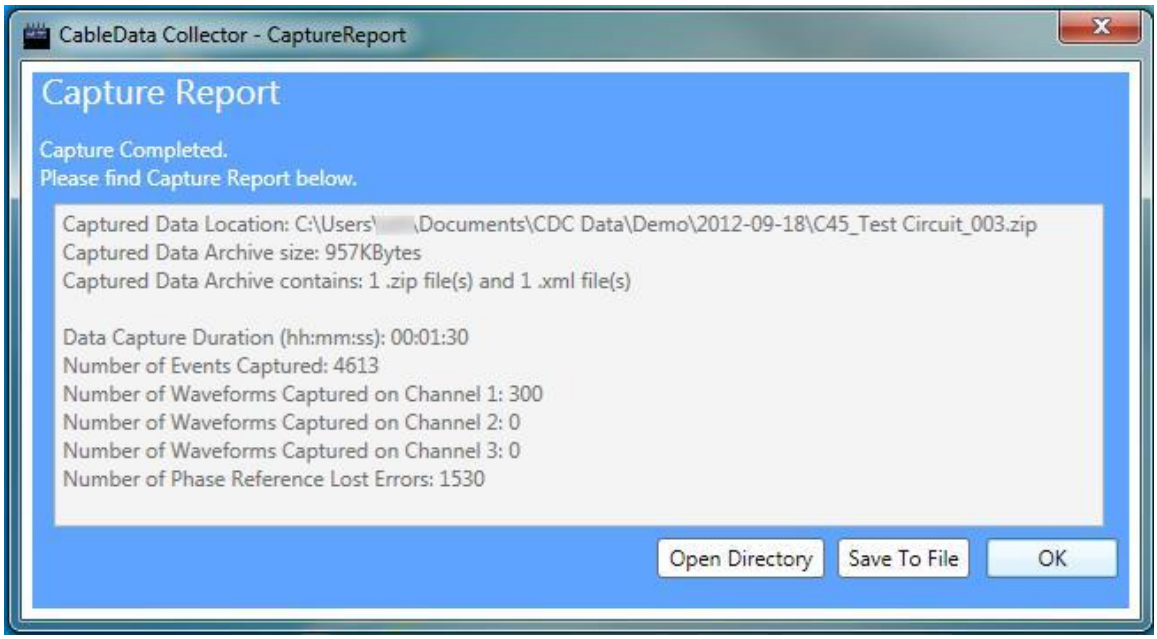

Figure 48 Status report for data with missing phase reference

The capture reports can be saved by clicking the **Save To File** button, the report save location can be selected from the file discovery window. The destination for the capture report to be saved to should be selected, and the **Save** button pressed to save the file.

4.5.2 Saving capture data

The captured data files will be saved in a file with an automatically generated name. All the data will be saved into the **Root Folder**, as set on the **Settings** window. Within this directory, a new directory will be created with the **Job Number**. In this directory, there will be a directory for each day that collection was performed. In this directory will be the individual data files. The **Substation ID** and **Circuit ID** fields are used to generate the file name for the data set. The file name also includes a run number: if the test runs again, the run number will be increased, and the data will be saved to a new file.

The Filename is displayed at the bottom of the window, as shown in Figure 49, and is automatically updated when any of the fields are modified.

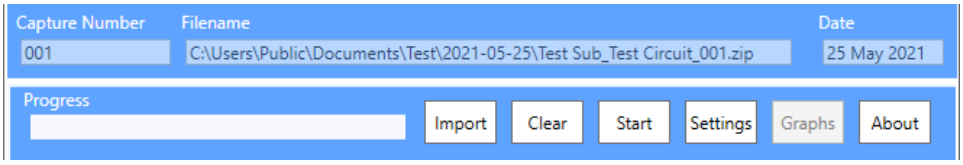

Figure 49 Main screen, output file name example

Once testing is complete, collect all of the ZIP files that have been created during testing and supply these files to EA Technology for analysis. EA Technology will produce a report with a top-level overview and more detail for each cable tested.

4.6 Restoring Software Default Options

It is possible to make changes to the options that appear in the CDC data acquisition software. The list of **Voltages** and **Cable Types** can have user options added, as shown in sections 4.3.2 and 4.3.4. If the additional options need to be removed, they can be removed using the **Remove User Customisations** button. This removes all added options and will only show the default ones.

From the software screen, click the **Settings** button, shown in Figure 50.

Figure 50 Settings button on main screen

On the Settings screen, there is a button in the bottom left corner labelled **Remove User Customisations**, visible in Figure 51.

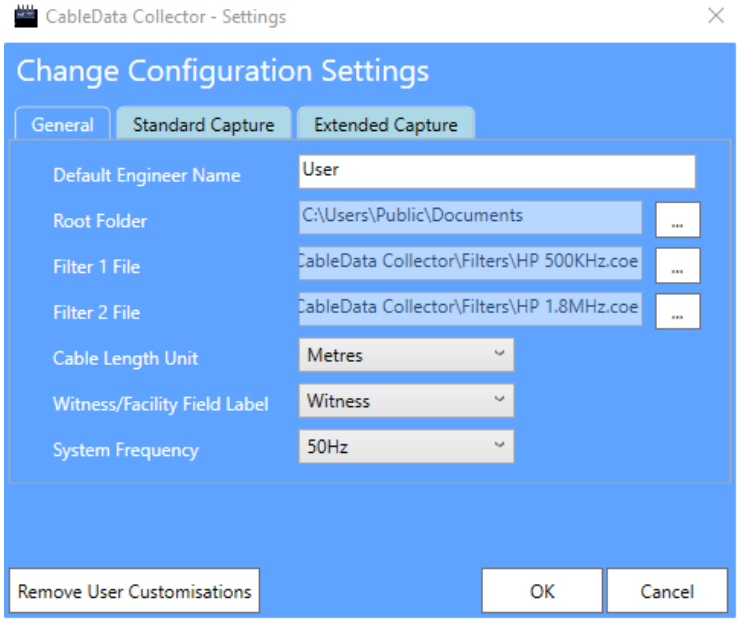

Figure 51 Remove User Customisations button

The confirmation shown in Figure 52 will be displayed, warning that all of the customisations will be lost. Clicking the **Yes** button will continue with the removal. Clicking the **No** button will return to the Settings screen.

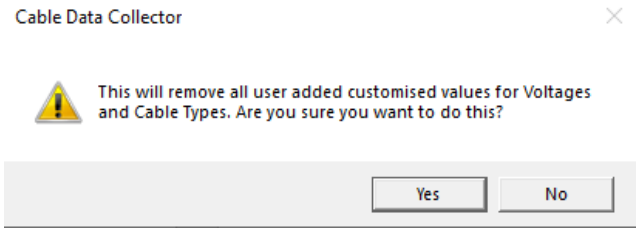

Figure 52 Confirmation of removing user customisations

4.7 Uninstalling the CDC Data Acquisition Software

The CDC data acquisition software must be uninstalled through the Add or Remove Programs interface. To open the interface, click **Start** > **Settings** > **Control Panel**. In the Control Panel, double click on **Add or Remove Programs.** The CDC data acquisition software will be on the list. This can be seen in Figure 53 where it has been selected. Click the **Uninstall** button.

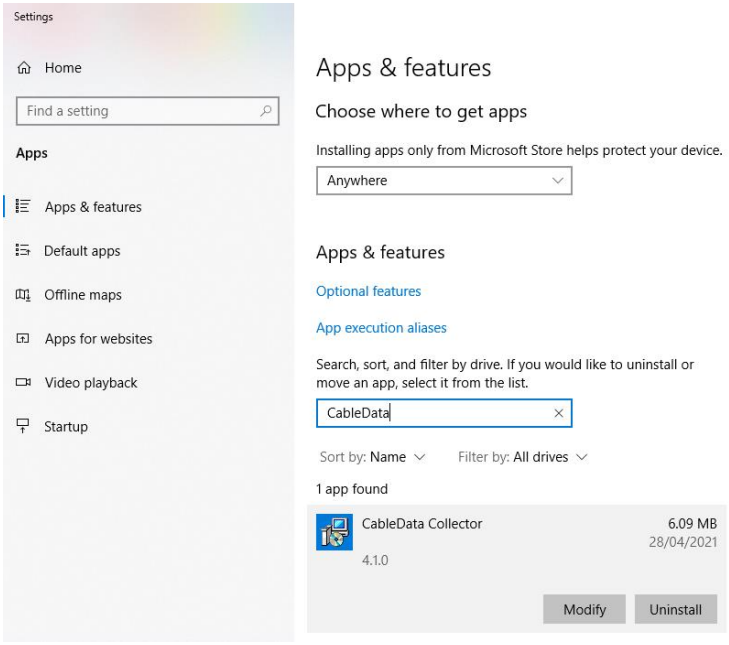

Figure 53 CDC software in Add or Remove Programs interface

4.8 Updating Software

If version 1.x of the CDC data acquisition software is already installed, this must be uninstalled before installing the updated version 2.x.x software. From version 2.x.x onwards, any updates will automatically upgrade the installed software, meaning the old software will not need to be removed beforehand.

Uninstalling the software will cause the user customisations to be lost, for example custom cable voltages, and cable types. After uninstalling the software, navigate to the installer application and follow the previous instructions on installing the software. After installation is completed, the first time that the software is run, the following warning message might appear:

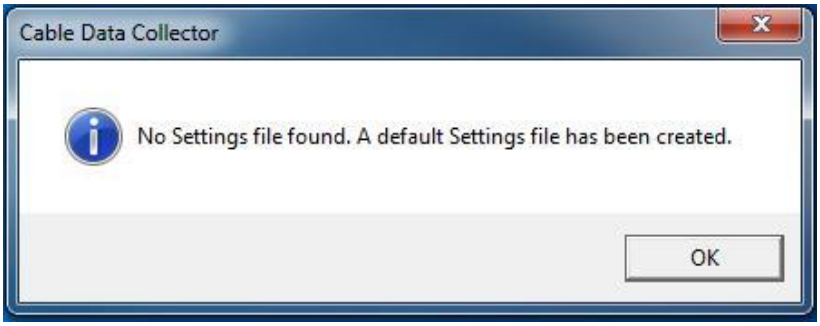

Figure 54 Figure 1 Warning when updating software

Pressing the **OK** button will allow the software to continue and the user customisations will need to be re-entered.

5. Specification

Physical

Size	176 mm x 120 mm x 28 mm
Weight	0.57 kg
Enclosure	Anodised Aluminium
Indicators	Phase Reference Events Capture Waveform Capture
Connectors	3x BNC (Cable PD) 1x BNC (Phase Reference) 1x Mini-USB (Power & Communication) 1x SD Card (not used) 1x Ethernet (not used)

Cable PD Measurement

Sensor	3x High-Frequency Current Transformer (HFCT)
Maximum cable length	Cable construction dependent
Measurement type	Single-phase or three-phase
Digital Filter Ranges	Unfiltered, 500kHz (high pass), 1800kHz (high pass)
Bandwidth (Unfiltered)	4KHz – 49 MHz
Minimum Event Detection	5pC (with HFCT1-F50)
Gain ranges	4 (-12dB, -6dB, 0dB, +6dB)
Measurement Accuracy	±1 dB
Phase reference	Auxiliary phase reference transformer (CDC2-PRT) or HFCT (10A minimum primary current)

Environmental

Operating Temperature	-20 – +50 degrees C
Humidity	0 – 90% non-condensing
IP Rating	IP3X (In accordance with EN 60529-1992+A2-2013)

Power supply

Power supply	Powered through USB connection from a PC.

PC / Software Requirements

Operating System	Windows 10
Peripheral Connectors	1x USB Port
Acquisition Software	CableData® Collector 4.1.0 (or greater)
Data Analysis Software	CableData® Analysis Studio (CDAS) 1.0.2.0 (or greater)

Compliance/Safety

Electromagnetic compatibility (EMC)	EN 61326-1:2013 (Electrical equipment for measurement, control, and lab use – EMC requirements) EN 61000-6-2:2019 (Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments) EN 61000-6-4:2019 (Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments)

6. Declaration of Conformity

Hereby, EA Technology declares that the equipment described in this document is in compliance with all applicable EU Directives and UK Statutory Instruments.

The full text of the EU and UK declarations of conformity are available at the following internet address: www.eatechnology.com/declaration

Claims of compliance made in any document other than the relevant declaration of conformity are for guidance only.

7. Maintenance

Calibration

Recommended calibration Interval: 12 Months

Cleaning and Storage

It is important that the CDC is kept clean and dry. It is not weatherproof. The CDC should be stored in clean and dry conditions and not subject to temperature extremes, excessive vibration, or shocks. The CDC should be cleaned with a damp cloth. If more heavily soiled, a foam cleanser may be used provided care is taken not to allow fluid to enter the instrument. Abrasive cleaners or harsh chemicals must not be used.

Do not stand on the case.

No attempt should be made to gain access to the internal circuitry of the instrument or its accessories. There are no user-serviceable parts. If any doubt exists over the equipment's performance or operation, advice should be sought from the manufacturer or the supplier.

Waste electrical and electronic equipment directive (WEEE)

EA Technology is a member of an approved compliance scheme as defined by the WEEE directive. When an EA Technology product reaches the end of its operational life, it must be recycled by a licensed waste management operator or returned to EA Technology for recycling.

8. Sales and Service

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For details of EA Technology's international offices and distributors, please visit our website: www.eatechnology.com/contact-us/corporate-offices

Sales

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Product Support

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Warranty Policy

What Does the Warranty Policy Cover?

EA Technology products and accessories are warranted against defects in material and workmanship. During the warranty period, EA Technology will, at its option, either repair or replace products, parts or accessories which prove defective.

What is Not Covered by the Warranty Policy?

The following are not covered: damage caused by accident, misuse, abuse, product modification or neglect; damage resulting from failure to follow instructions contained in your operating manual; damage resulting from the performance of repairs by someone not authorised by EA Technology.

Warranty Policy for Repairs

Repaired products are warranted against defects in workmanship and materials for a period of six months, or the remainder of the original warranty period, whichever is greater.

Continuous Improvement

EA Technology has a policy of continual product development and enhancement. Consequently, there may be minor variations in specifications or operation that are not covered in this operating manual.

Every effort has been made to ensure that the information provided in this operating manual is accurate at the time of going to print.

If any errors or omissions are noticed, please notify: product-support@eatechnology.com

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