Cable fault location system

Cable fault location system Operation Manual ADCF-3000L

- ✓ Please read the instructions carefully before using !!!
- ✓ Operator must possess professional operation qualifications for high
- ✓ voltage equipment
- ✓ Strictly follow the national high
- ✓ voltage equipment
- ✓ operating specifications
- ✓ This instrument has a high
- ✓ voltage characteristics, please pay attention to personal and
- ✓ equipment safety
- ✓ Make sure that the ground is good and the wiring is correct
- ✓ Unload the residual voltage by following this instruction
- ✓ after using

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ADCF-3000L Cable Fault Location System Introduction

1- Introduction

- It is a one body trolley structure, easy handling at site.
- You can do site test without complex wiring, because all test modes and switching voltage
- levels are automatically switched by weak control internal high-voltage switches.
- It can quickly locate and point low resistance, high impedance fault leakage, flashover
- faults in power cable with a variety of 220V-220KV voltage level.

2- Characteristics

- It integrates multi-gear DC high-voltage generator, multi-gear high-voltage capacitor, arcstabling units and a variety of signal acquisition in one body, which facilitates fault location
  operation.
- Switching between three gear test modes, two gear voltage levels is controlled by lowvoltage weak electricity.
- World's leading test method makes difficult fault detecting become very simple.
- The requirement to operators' level for technical equipment is low.
- The DC voltage is up to 32kV.
- Each stall of voltages, which is 16 / 32kV, can output up to 1536 J impact energy. It has longer ranging delay arc time and makes a loud voice on the fault point when locating.
- It can do high impedance fault detection directly without burning.
- Large wheels ensure a smooth, easy handling and site work.

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3- Technical Indicators

- Test methods: Arc reflection method, current sampling, and DC output.
- Types of sampling signals: Arc reflection method, current sampling, and low-voltage pulse.
- DC voltage output:
  0 ~ 32kV Negative Maximum output current: 76mA
  0 ~ 16kV Negative Maximum output current: 152mA
- Impact capacitor:
  0 ~ 32kV 3μF Maximum output energy: 1536 joules
  0 ~ 16kV 12μF Maximum output energy: 1536 joules
- Ball-gap discharge: Weak electricity control. Discharge cycle can be adjusted within 3-12 seconds. It has a specially designed silencer, which meets the requirement of silence when
- fault happened to the initial end cable.
- Protection:
  Zero voltage position protection: To prevent misuse, and to protect the safety of personal and the test product; Press "off" button, and it will release the remaining charge automatically through safety instrument inside to ensure safety.
- It is equipped with extension cable tray, which can be composed of automotive cable fault location system.

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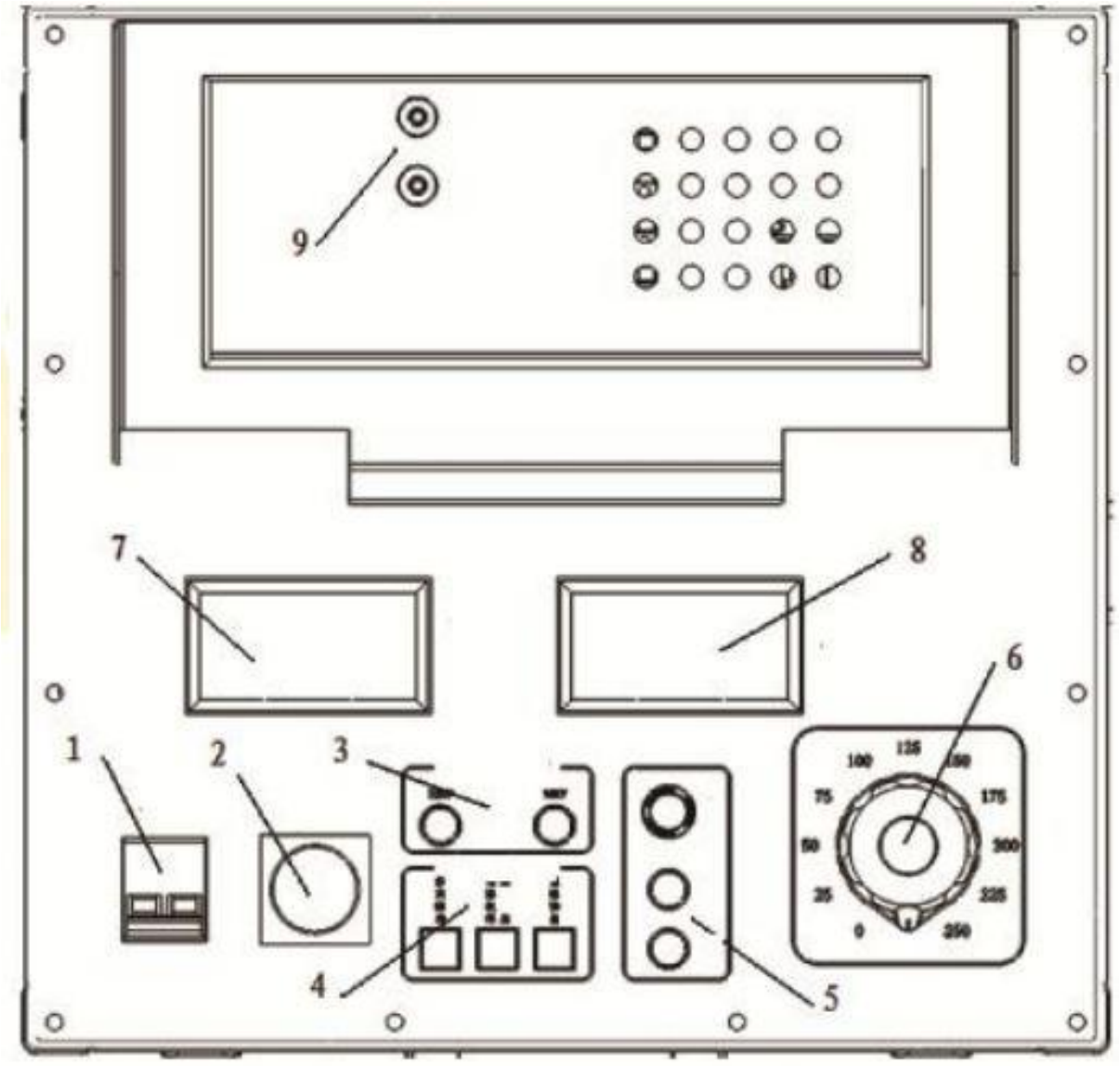
  location system.

ADCF-3000L Cable Fault Location System Operation Guide

1- Panel Figure

In the drawing:
total switch
Adjusting the ignition time
Selecting test voltage
Selecting Test Mode
Start, ignition, stop key
Regulator knob
Output voltage indicator
Output current indicator
Signal terminals



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2- Operation Steps

1-Correctly connect "Cable Fault Location System" and ground, faulty cable, AC 220V power line according to the external wiring diagram. It can also be connected via extension cable drum if equipped with one.
2-If you are preparing to locate the cable fault, connect the signal test line on "Cable Fault Location System" control panel with corresponding signal port on the pulse reflect meter (TDR). Best use its own battery for TDR.
3- Turn on the power switch; the instrument will do self-test for about 15 seconds. You can carry out subsequent operations if the self-test is passed. The buzzer will prompt you by long and short syllable if the self-test isn't passed.
4- Adjust the ignition time knob and test voltage gear button, and test mode gear button (if the test instrument is in high-voltage charged state or start state, the test voltage, test mode adjustment operation is invalid).
5- Ignition time: High-voltage ball-gap ignition intervals on impact, usually adjusted for 4-12 seconds.
6- Each test voltage gear selection: The lower voltage gear you select, the greater the impulse condenser capacity is, and the greater the impact energy the fault cable get at the same voltage when you are sure that the cable is already breakdown, which is conducive to fault location, location.

3-The meaning of each test method is as following:

A. Multiple pulses (stable arc): When doing cable high impedance fault distance test, contrast the waveform of not breakdown and breakdown on same-phase fault on one screen.
B. Current sampling: When doing cable high impedance fault distance test, it captures the current signal waveform reflected back and forth in the cable when impact.
C. Location: Cable fault pinpoint use.
D. DC output: It can output DC high-voltage to test cable.
1- Confirm that regulator knob is at zero and stop key is in non-locked state. Press the start key to start the instrument, and you can hear "plump" sound inside the instrument, which means that the high-voltage output of the instrument is connected.
2- Press the ignition button (except DC output mode), and the instrument will perform arcing ball-gap pulling in according to the set time. You can hear the ball-gap regularly pulling in sound.
3- Adjust regulator knob up to the required voltage (The boost can be slightly low, and gradually increased, but do not set voltage exceeding the voltage gear when it's the first connection).

4- The operator pulse reflect meter (TDR) will test input signals and read fault distance if it's cable fault location mode.
5- When the test is completed, the regulator knob should be back to zero, and press stop key to stop and it will automatically discharge. If an emergency situation happened, you can press stop key to stop directly and it'll automatically discharge.
6- If you need to adjust high-voltage test, repeat steps 4-9. If you want to stop the test, turn off the power switch.
7- Artificial discharge, confirms discharged completely, and then remove all the wiring.

4- Warning and Note

1- Do not set voltage over the voltage gear when boosting.
2- Do not strongly pull and fold the output high-voltage silicone cable, power line, and ground to hard curves. Heavy things, such as automotive, rolling on it is prohibited.
3- Do not use the instrument in an inclined state. If you have to use it in sloping ground, please pad something to horizon level.
4- Do not allow the instrument stopped using more than 20 minutes. Turn off the power switch if you do not use it in a long-term.

5- ADCF-3000L Cable Fault Location System Physical List

- ADCF-3000L cable fault location system host
- High-voltage cable 8 meters
- Ground line 8 meters
- Power line 1
- Extended high-voltage cable tray (optional)
- Extended power line cable tray (optional)
- Extended ground line cable tray (optional)

ADCF-3000L Cable Fault Tester Introduction

ADCF-300L cable fault tester is a new type power cable test equipment designed by our company based on the current low level of China's electric power system management, lagging of test methods. The instrument uses advanced microcomputer technology, which makes power cable test as a whole, so that user has advanced test equipment and advanced test techniques, and can pass test waveform to a computer if he has a set of the instrument. The instrument is used as a powerful cable file management tool.

1-Main Features

Fault test of power cable has been a headache for power system. Using cable fault test capabilities provided by this system will make it very simple. In line with the different nature of power cable fault, the system can perform test in a variety of test methods(such as multiple pulse, high-voltage impulse flash, high-voltage direct flash, voltage sampling, current sampling, low pulse, etc.), and therefore it can perform reliable tests to high resistance fault, low resistance fault, flashover fault and leak fault in power cable.

2- Product Characteristics

- Test mode: A variety of test methods such as multiple pulse/arc reflection method, voltage sampling, current sampling, low-voltage pulse can be implemented to meet convenience and usage habits of users on maximum to test.
- Sample frequency: 30M, 60M, 120M multiple sampling frequency, higher test accuracy.
- Test distance: up to 165Km.
- Test Pulse: 0.2 ~ 9.9μs, adjustable.
- Error: Rough measurement relative error: less than ± 0.25%
- Rough measurement absolute error: below 2 km cable length is less than one meter:5 km or more cable length no more than 2 meters.
- Error-free after location. Shortest measuring distance (blind) ≤2V/f(m) V: Speed of wave propagation in cable
- f: Actual sampling frequency.

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3- Technical Indicators

1-Reading resolution: V/2f(m), resolution of less than 0.5 m.
2-Preset four kinds of cable wave propagation speed in the instrument.
3-Four sets of waveform processing makes it easier to identify waveform, and test faster and more accurate.
4-Search for the point of fault automatically by using double cursors and automatically display distance from point of fault.
5-8.4-inch touch screen makes display more intuitive, and operation more convenient.
6-Anti-power-down waveform memory 64.
7-Configuring thermal mini printer makes printing test reports higher accuracy.
8-It can upload waveform via COM / USB interface with a computer, which is easy to manage.
9-It comes with batteries, easy to use on site. Small size, light weight, imported waterproof chassis, adapt to all kinds of harsh environment.
10-Equipped with enhanced hardware waveform processing circuit compared with DMS-3500.

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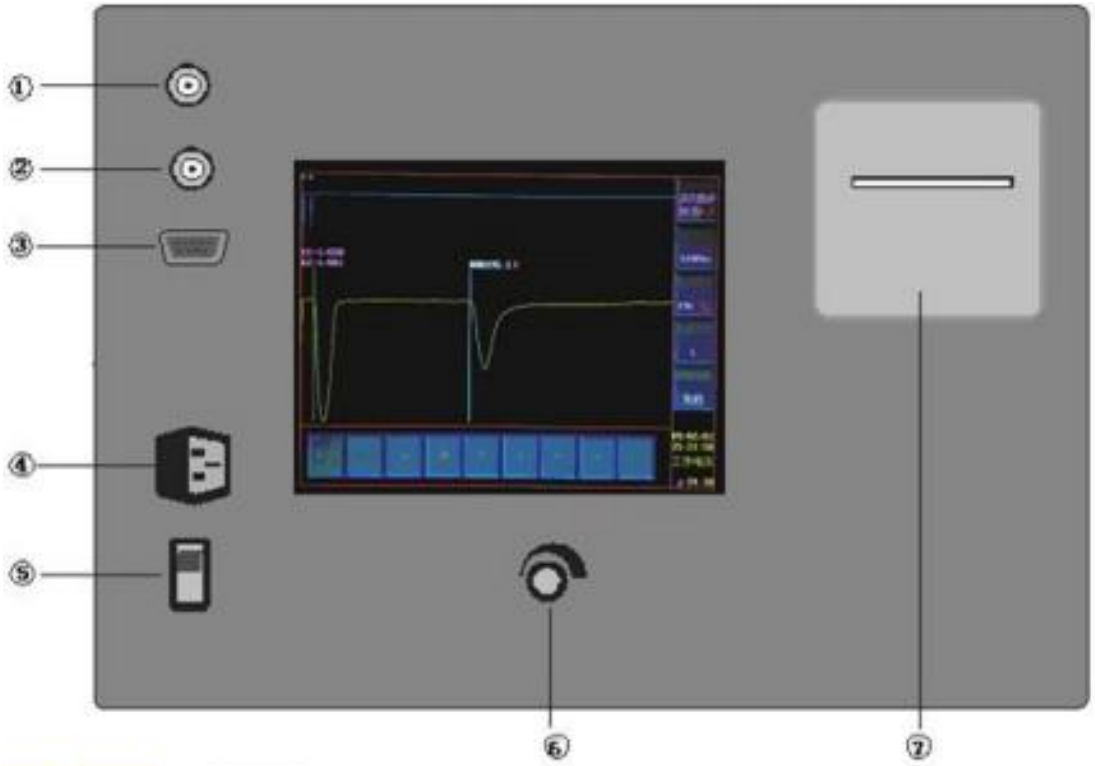
ADCF-3000L Cable Fault Tester Operation

1-Panel Structure Introduction



Panel layout schematic diagram as above, functions as following:

① Q output terminal
② Q input terminal
③ Communication interface connection with the host computer
④ AC power connector
⑤ Power switch
⑥ Waveform amplitude adjustment knob when sampling
⑦ Printer

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2- External Wiring

- Wiring of low-voltage pulse method:
- The dedicated signal cable:
- Connect "Q output terminal" and "Q input terminal" on one side Connect the red clip with cable core wire, and the black clip with cable shield ground or another phase on the other side.
- Wiring of high-voltage method:
- Connect signal test line on "Cable Fault Location System" control panel and pulse reflect meter (TDR) corresponding to the signal port. Enter the corresponding input and output.
- Better use its own battery for "ADCF-3000L Cable Fault Tester" When performing highvoltage method test.

3-Notes

1- If you want to use the internal battery, ensure that the battery is fully charged, which means being charged for more than three hours when the power switch is off.

2-Ensure that the battery is fully charged every three months, and so ensure the battery life.

3- Screen will go into protection mode if there are four minutes without any operation when it's AC power supply, and click anywhere on the screen to exit this protection.

4-Screen will go into protection mode if there is 1 minute without any operation when it's DC power supply, and click anywhere on the screen to exit this protection. During DC power supply process, it will tweet at any time. With time flying, battery power will decline, and tweet will thereupon become urgent. When voltage arrived at 10.5V, screen will not be turned on, so please turn off the switch immediately to charge.

5- Note: When measure with high-voltage mode, the cable fault tester host should use the battery with it to avoid interfering signals.

6-Directly connecting the instrument to high-voltage is strictly banned, otherwise it will damage the instrument.

7-If you are using the extension cable or delay instrument to perform test from the start point of the waveform cursor, then the result should subtract the distance of the extension cable or delay instrument.

4- Host Operating Procedures

1- Connect "input","output" signal base according to the corresponding test method(If it's a fully integrated configuration, simply corresponds to all access required). And turn on the power switch.

2-Low-voltage pulse test mode: Connect "input", "output" signal base Multiple pulse/DC arc extension test mode: Connect "input", "output" signal base Sampling voltage / current sampling test method: Connect "input" signal base

3- Go to the first screen, press touch screen to enter "Select the length range of the cable under test", and you should select item greater than the total length of the cable under test.

4-Press OK to enter the main test interface.

5- ① Select "Sampling Mode (touch cycle selection)," according to corresponding test

6-methods:

Low-voltage pulse test mode: Pulse

Multiple pulse/DC arc extension test mode: Multiple Pulse Voltage sampling/current sampling test mode: High flashover

② Select "Electric Wave Speed" according to media type of the cable under test(You can touch cycle selection, which will show several commonly used wave speed of cable, for example: for XLPE cables, you can choose "172m /μs"; If "Electric Wave Speed" is not in these types, press "Settings" - "Speed setting" to select)

③ Magnitude knob can be placed on about one-third.

7- Press "Sampling" key to collect test waveform. The upper window shows the whole picture of waveform area, and the lower shows the main waveform window area.

① Press screen between the two waveform on the upper window, and the instrument can automatically find the corresponding short-circuit waveform, which can be displayed on the lower window together with open-circuit waveform when it's multiple pulses or DC arc delay test mode. When it's waveform comparison, multiple pulses, DC arc extension mode and "Moves Selection" is "wave", you can use"↑" "↓" "←" "→" to align inflections of the two waveform on the lower window.

② If you think that the entire waveform baseline is inappropriate, press "↑" "↓" keys to adjust(when it's multiple pulses, DC delay arc mode, "Moves Selection" must be in "cursor" status, which is valid), and re-sampling takes effect.

③ If you think the amplitude of the overall waveform is inappropriate, you can adjust "Amplitude Adjustment" knob to adjust, and re-sampling takes effect.

④ If you want to compress or expand on left and right side to waveform on the lower window, press "+" "-" keys to compress or expand waveform immediately; Or press "Sampling Frequency" key to select a different sampling frequency, and re-sampling takes effect.

⑤ Vertical cursor is used to calibrate distance(when it's waveform comparison, multiple pulses, DC arc extension mode, "Moves Selection" must be in "cursor" state): Press inflection point at the start, and the vertical cursor will move over here, then you can press "←" "→ "key to fine-tune; Press "Starting Point" to locate this cursor. Press Inflection point on terminal, and the other vertical cursor will move over here, and you can press "←" "→" key to fine-tune. "Fault Distance" on the screen displays the distance between the two cursors.

8- If the cable is in an open or near fault state, it may be necessary to compress the ratio of the upper and the lower window; "Settings" - "Pulse Settings" - "Delay" / "Interval" / "Pulse" for anew setting, and re-sampling takes effect.

5- Usage of Each Function Menu, Main Menu on the Main Interface and Settings

1. Function of the Lower Row Keys

1- "Setting" button: Turn on the setting function. Each function will be set in a new opened menu.

2- "Starting Point" key: White cursor point in the waveform will be the starting point for calculating the cable length.

3- " " Key: To compress the waveform in main display area, the compression factor is the value of K2 displayed on the right.

4-" " Key: Zoom the waveform in main display area, the compression factor is the value of K2 displayed on the right.

5- "↑" Key: To adjust sampling reference point and move upward, the position indicating benchmark of left triangle appeared(In the waveform comparison and multiple pulses mode, available to move up waveform).

6- "↓" Key: To adjust sampling reference point and move downward, the position is indicating benchmark of left triangle appeared(In the waveform comparison and multiple pulses mode, available to move down waveform).

7- "←" Key: To move current cursor to the left, fast-moving after holding on for 0.5 seconds.(In waveform comparison and multiple pulses mode, available to move left waveform)

8- "→" Key: To move current cursor to the right, fast-moving after holding on for 0.5 seconds. (In waveform comparison and multiple pulses mode, to move right waveform is available).

9-"Sampling" Key: To start sampling, if you want to stop sampling, touch anywhere on the screen to end it.

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6-. Usage for Each Function Key

"Settings" key is used to open a new menu, to set various parameters and the desired operation, or to enter corresponding interface when you need to adjust parameters or process waveform.

Menu will display as follows after you press "Settings" key:

Sub-menu of "Settings" menu will appear on the left of the screen, which are "Basic Parameters", "Pulse Settings", "Speed Settings", "Cable Speed", "Waveform Processing",

"Time Setting" and "Exit", then press different keys respectively to enter sub-menu.

"Basic Parameters": Press "Basic Parameters" key and it appears as shown in the display. Press "Sampling Frequency", "Picture of Proportion", "Communication Rate" according to need, and you can enter corresponding parameter sampling frequency of 120M, 60M, 30M three-gear on the numeric

keypad, and other values are illegal. Ratio of the whole picture is the compression ratio of the picture area, the value of which can be entered between 1 and 114. Communication speed is to set the baud rate between the cable tester and host communication.

"Pulse Settings": Press "Pulse Settings" key to enter sub-menu, a "Delay", "Interval", "Width", "Delay", "Interval" is to set parameters in multiple pulses mode. "Delay" refers to interval between detection of the high-voltage flash to the start of transmission of multiple pulses, typically 50 microseconds to 200 microseconds and a maximum of 255 microseconds. It can be appropriately modified depending on the cable length. "Interval" refers to time interval between multiple pulses of an integer multiple of 10 microseconds, typically set to 2-5. The longer the cable length is, the larger this value is. "Width" refers to width of low-voltage pulse transmitted, typically long distances between width of 0.2 microseconds to 0.5 microseconds. Shorter cable use wide pulse, generally between 1 microsecond and 2 microseconds.

"Speed Settings": Press "Speed Settings" key to enter sub-menu, and you can set different speed of cable. There are four different cable speed keys already, so you can directly click to select. If it's other speed of cable, you can click "Speed Settings", before showing digital keys, which you can input speed values(Input speed numeric must be less than 300, otherwise there will be numerical error).

"Cable Speed": Press "Cable Speed "key to enter sub-menu to measure cable speed. The premise is that you've already got electric wave in "Sampling" mode, and already moved a good starting point and end point of the cursor, and already know the length of the cable under test. Then press "Cable

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Speed" key on the interface, it will show number keys. Directly input length of the cable, and the calculated electric wave speed of the cable will be displayed in "Cable Speed "key.

"Waveform Processing": There are "Waveform Recall", "Waveform Comparison",

"Waveform Storage", "Waveform Delete", "Waveform Print" in waveform processing. Select corresponding key to enter and press OK according to the operation to be performed.

"Waveform Recall": Press "Waveform Recall" to bring up the previously stored waveform.

Press up and down arrow keys in the lower row to select waveform in 60. Waveform is saved by sampling time, so select the waveform you want according to time displayed, and press "OK" key to bring it up. A small area of intermediate position of the yellow waveform

shows thumbnails of the waveform, which can display curve of the waveform to facilitate observing.

"Waveform Comparison": While main interface displays a waveform, you can call up

another waveform for comparison, and this is the time when you use "Waveform

Comparison" function. Press "Waveform Comparison" key, use up and down arrows on the

lower row to select the files that need to be compared, and you can choose any one of the

60. Press "OK" to achieve contrast, after which you can choose to move the waveform or

the cursor using "Moves Selection" on the right keypad area, then use up and down arrow

keys to move. You can move the position of the contrasted waveform(Long press and hold

on to fast-move). If you want to quit comparison mode, press "Sampling" key or "Settings"

key.

"Waveform Storage": The instrument can store 60 waveforms, and each waveform

occupies 64K bytes. Storage uses sampling time for file name. Press "Waveform Storage"

key and select the location to be stored with up and down keys on the lower row, and press

"OK" to store. If there is a file in the original place, then it will overwrite the original

one.(When you store repeated pulse waveform, then it will store two

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waveform at the same
time, so the space will be occupied by two files)
"Waveform Delete": When waveform stored do not need reservation, or storage space is
full, you can delete waveform files stored. Select the file needed to be delete with up and
down keys on the lower row, and press "OK" to delete.
"Waveform Print": To print the waveform diagram displayed on the main interface, press
"Print" key.
"Time Setting": The instrument has a separate internal clock circuit. In order to correct the time to go, you can enter this interface to set date and time. Respectively press "year, month, day, hour, second" to be set, and the corresponding figures will turn red, then you can use digital keyboard to input value. After all the input is completed, remember to press
"OK", then the exact date and time will be corrected.
"Time Setting" Interface When all the settings are completed, observe the right of the display screen, and you can see if a variety of parameters are correct.
3. "Sampling": After setting up the parameters, press "Sampling" key to start sampling. In the meanwhile it shows countdown waiting time (30 seconds). If there is no trigger signal waveform to be sampled in 30 seconds, then it will quit. If you want to quit during sampling, you touch anywhere on the screen when it displays countdown time.
The cursor of the main display can be moved not only by left and right arrows, but also click the place to move to, you can quickly move the cursor to the destination point in the main display area. Starting point is green, and the end is white. If you want to change the starting point, move the white cursor to the point to be reached, then press "Starting Point" key, and then move the cursor to place the cable distance.It displays compressed waveform in the upper area of the interface. If you want to quickly move the cursor to the point you want to see, just press in the picture area, then the waveform where the cursor is will be displayed in the main display area. Cursor of main display and cursor of picture area (triangle cursor) is corresponding to each other, which means green to green and white to white. You can zoom in/compress waveform in the main display area by "Magnifier" and "Minifier".
There are five shortcut knots on the right for fast switching function and parameters. Specific uses are in the main interface introduced before.

7- Waveform Introduction in Various Sampling Methods

The following figure shows the whole long-distance waveform for low-voltage pulse cable, or distance waveform of cable disconnection fault
The following figure shows short-circuit waveform of low-voltage pulse cable:
The following figure shows a total length of low voltage pulse, short-circuit waveform The following figure shows the voltage sampling waveform of high-voltage impulse flash(impulse L)
The following figure shows the current sampling waveform of high-voltage impulse flash The following figure shows the sampling waveform of high-voltage multi-pulse(stable arc)

8-. ADCF-3000L Cable Fault Tester Physical List

1. ADCF-3000L cable fault tester host :1
2. Single Q Line:1
3.Power line:1

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ADCF-B Cable Fault Location Instrument

1- Introduction

ADCF-B cable fault location instrument is an important instrument during searching for cable fault process. During the three-step of cable fault test "rough measurement→ searching for path → delicate location", you need to use cable fault location instrument during the last two steps. When you are in "searching for path", you need to add path signal to cable with path instrument, and receive path signal with path gear in the cable fault location instrument to determine the cable direction.

In "delicate location", you need to add cycling and repeated impact high-voltage to cable fault phase with impact high-voltage equipment, and receive discharge signal from fault point with the location gear of cable fault location instrument, to determine the location of cable fault.

Cable fault location instrument uses a 3.8 inches 320╳240 dot matrix high-resolution LCD screen design, which has abundant information display and intuitive operation. Comparing with the old location instrument pointer, it has been greatly improved. It Shows path signal waveform and fixed voice waveform simultaneously on the LCD screen, and displays time difference between the two of them. The closer from point of fault, the smaller the difference is, thus providing user with a more intuitive location method. When the old location instrument is performing delicate location, it's unable to re-confirm the cable path. High-voltage generator must be stopped and re-connect "path instrument" to add path signal to the cable, which is so troublesome. ADCF-B cable fault location instrument has a determining the cable path approach when performing delicate location.

2- Technical Parameters

- Sampling rate: 1MBPS
- Sampling accuracy: 8BYTE
- Sound gain: 95DB
- Electromagnetic gain: 80DB
- Working voltage: 3.5V-8V (4 of AA Battery)
- Current consumption: <80MA (LCD backlight off)
  <180MA (LCD backlight on)
- Magnetic acoustic difference: 0--25 ms
- Time difference resolution: 0.1 ms
- Path measurement receiving frequency: Low frequency 15KHZ
  High Frequency 75KHZ

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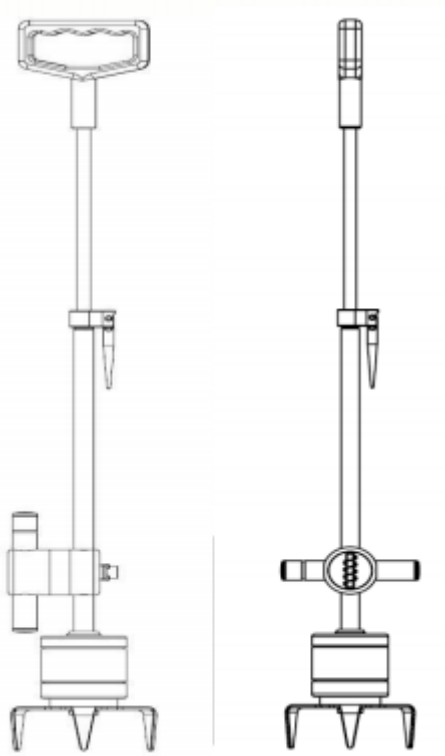
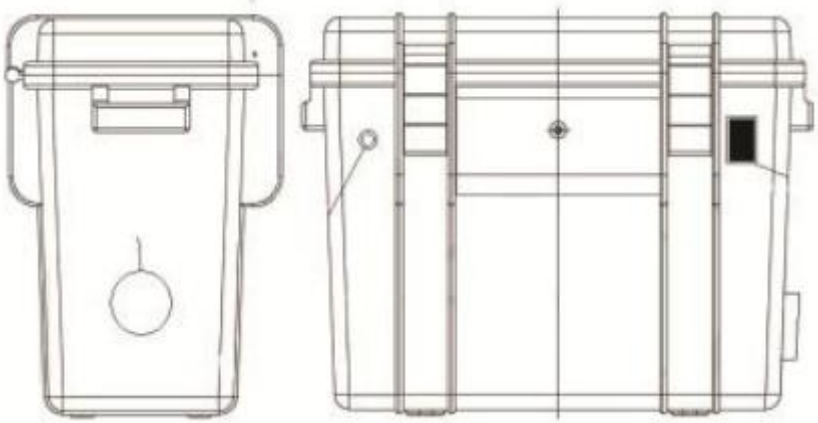
3- Structural Principles

- Probe View (magnet bar vertical position)
- Probe view (magnetic bar transverse position)





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4- Instructions:

- Panel Layout Drawing

5- Parameter settings

You can adjust display brightness of the LCD, and select the LCD backlight switch by selecting mode of location instrument or path instrument. After pressing "Settings" key to enter setting interface when menu bar appears, select parameters needed to be adjusted using arrow keys. Change the value of the parameters using left and right arrow keys: Values of LCD brightness is between 0~100%. You can select "on" or "off" for backlight. You can select "L"(Location) or "P"(path) for function. Once set up, press "Start-Stop" key to return to sampling interface.Parameter Settings - Function Selection Interface

6- Operation Instructions in Path Mode

1). Turn on the power switch
2). Press "Settings" key to enter setting interface
3). In "Function", select "P"(Path)
Press "↓" or "↑" key to make the gray cursor on "Function" menu bar. After pressing "→" or "←" key between "L"(Location) "P"(path), select "P"(i.e. select the path mode). After selecting the function, press "Start-Stop" key to exit the setting screen and enter the sampling display interface.
The path mode is a combination with a path signal generator provided by the manufacturer to work. Connect the line correctly between the signal generator and the fault cable, and plug the power supply of path signal generator, then select the signal frequency, and adjust the output power of the generator(i.e., the output current of signal generator), and make sure that the output current value is greater than 50 mA and less than 100 mA. Under normal circumstances, you can hear "beep" sound from signal generator in the headphones of the location instrument.
Press "↓" or "↑" key to adjust the size of the sound heard, and press "→" or "←" key to adjust the amount of amplification of electromagnetic receiver. Usually the electromagnetic gain is adjusted to 20% - 60%, and voice gain adjustment for 50% - 80%. You can make an appropriate adjustment according to the specific circumstances of the site.

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After moving the probe matching with the location instrument, measure the underground route of cable with maximum or minimum method according to "path measurement nprinciple"of the fifth behind.
While listening to the sound, LCD will display waveform of sound signal emitted by the current path of signal generator after detector and prompt waveform amplitude. According to the size of sound heard and magnitude of waveform observed, it can be a reference instruction for underground route of cable.

7-Instructions for Location Method

1) Turn on the power switch.
2) Press "Settings" key to enter the setting interface.
3) Press "↓" or "↑" key to make the gray cursor on "Function" menu bar. After pressing "→" or "←" key between "L"(Location) "P"(path), select "L". After selecting the function,press "Start-Stop" key to exit the setting screen and enter the sampling display interface.
In the location mode, when the sampling is "On", once comes with an electromagnetic pulse (when high-voltage ignition), it will automatically generate a waveform sampling process, and the electromagnetic waveform and sound waveform will automatically refresh and display again. Meanwhile, the trigger light will give a light a little bit. If it's near the discharge point of the fault, "bang...." sound occurs in the headphone with ignition every time. If there is no sound, and the sound waveform has also no big ups and downs, then, in general, the test point is quite far away from the point of fault. Meanwhile, the sound intensity indicates the intensity values of the current loudest sound. "Start-stop" key can "turn on" or "turn off" sampling.
When it's in "off" state: (displayed "sampling = Off" below), up or down arrow key "↓" or "↑" is used to select the sound band-pass. There are four kinds of sound band-pass, respectively, 200 Hz, 450 Hz, 800 Hz and 1500 Hz. For different geological and cable media, there is a best sound band-pass, which you can choose to use. Left or right key "→" or "←" is used to move the sound magnetic difference cursor. When you finish a sampling, to easy observation and analysis, so that the later electromagnetic trigger sampling is no longer valid, then you should press "Start-Stop" key. Then the bottom of the display, "sampling = Off", so that the analysis of waveform will not be influenced by trigger, which means no new waveform sampling. In this case, the left and right arrows are to move the sound magnetic difference cursor. At the Same time, there is the value of difference on the lower right of the sound waveform, in milliseconds (Speed is about 60 cm/ms,which is different for different geological condition). The smaller the value of magnetic sound difference indicate that the closer the probe is away from the point of fault.

Gradually move the probe to determine the smallest value of magnetic sound difference to precisely locate the fault point.

When it's in "on" state:(displaying "Sampling = ON" below), up or down arrow key "↓" or "↑" is used to adjust the amount of sound signal amplification. When you press the up and down arrow keys, the value of "the sound gain = ??%" will change. Left or right key "→" or "←" is used to adjust the amount of magnetic amplification. When you press the left and right arrow keys, the value of "magnetic Gain = ??%" will change. In usage, according to the signal strength, adjust the size of sound gain and magnetic gain to facilitate analyzing waveform.

Left or right side of Cable judgment: The location instrument has a function of judging left or right side of cable, which is able to detect which side the probes of the location instrument current point is on the cable. During high-voltage continuous ignition, move back and forth the probes of the location instrument around the fault cable. Meanwhile observe the electromagnetic waveform of the location instrument. when the first wave-shaped form of the electromagnetic wave is changed, it means that the probe has been moved from one side to the other side of the fault cable. Discrimination of electromagnetic waveform is based on the first positive pulse waveform(upward) or negative pulse(downward). That is to say, after the probe is moved, the first wave of a pulse waveform is changed, then the cable passes through the probe and the last point.

8- Principles for Usage and Wiring Methods

After the initial ranging of the cable fault, you can find out the general orientation to the point of fault according to the path of the cable. Only by fixing-point above the cable fault is it possible to set the specific location of the fault. As some of the cables are directly buried or embedded in the channel, while there is no complete drawing to clearly determine the cable path. This is where you need delicate instruments to measure the cable path. In underground pipes, multiple cables are usually arranged in parallel, so you also need to find the fault cable from among plurality of cables.

Audio sensing detection method of cable path:

1. Path Measuring Principles

Input audio signal current to the initial end of the cable under test by signal generator, and receive magnetic field signals on the ground using a magnetic antenna receiving line, and produce the induced electromotive force in the coil. After amplification, it can be monitored through headphones, the instrument pointer or other means. With the movement of the receiver coil, the magnitude of the signal will change. Path detectors are generally using headphones to monitor the signal amplitude. Depending on the sound curve detected, you can determine the cable path. Detection methods are mainly trough method and crest method.

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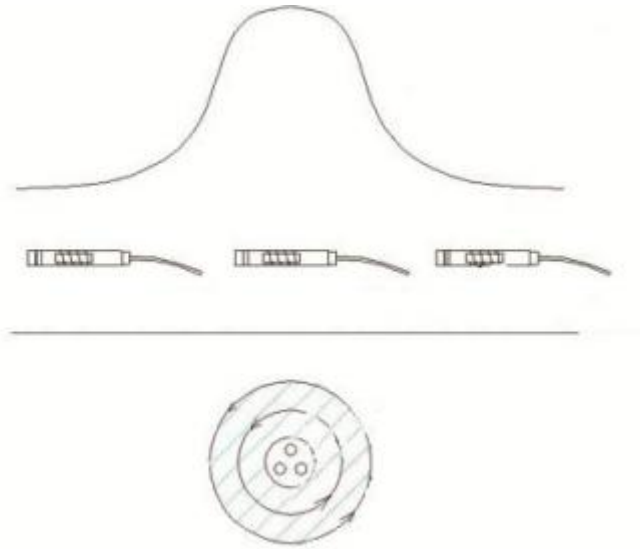
• **crest method** test theory as shown.

When conducting path detection, make the magnet coil axis horizontal to the ground, and slowly move the coil. When the coil is located directly above the wire and parallel to the cable, the magnetic field lines are perpendicular to the plane of the coil. The magnetic field lines go through the coil by maximum coupling, so the induced electromotive force in the coil is the largest, so that you can hear the loudest in the headphones. Then move the ferrite antenna on both sides. Only part of the magnetic field lines will be passing through the coil on both sides, which will generate induced electromotive force, so that you can hear the audio sound the headphones. With the slow movement of magnetic antenna, the sound gradually becomes smaller. In the vicinity of the cable, the sound and its position relationship forms a single peak curve with peaks corresponding to the test position,which is the specific location of buried cables. Connecting all of the peaks(loudest point) will be the laid path of the cable.



• **Trough method** test theory as shown.

When conducting path detection, make the magnet coil axis perpendicular to the ground, and slowly move the coil. When the coil is located directly above the wire and perpendicular to the cable, the magnetic field lines are parallel with the plane of the coil. There is no magnetic field line going through the coil, so the induced electromotive force in the coil is zero, so that you can hear nothing or lightest in the headphones. Then move the ferrite antenna on both sides. Part of the magnetic field lines will be passing through the coil on both sides, which will generate induced electromotive force, so that you can hear the audio sound the headphones. With the slow movement of magnetic antenna, the sound gradually becomes larger. When moving to a certain distance, the sound will be the maximum. Move a further distance, and the sound will gradually become weakened. In the vicinity of the cable, the sound and its position relationship forms a saddle-shaped curve with trough

corresponding to the test position, which is the specific location of buried cables.
Connecting all of the troughs(lightest point) will be the laid path of the cable.
In general, the peak method has a strong signal and wide peaks, which will not be easily subject to interference from adjacent cables. even disturbed, it is always easy to distinguish. So crest method applies perfectly when just beginning to discover cable.
The crest method has a weak signal and narrow crest, which is good for delicate location. But it is susceptible to crosstalk from adjacent cables, so it applies perfectly for the final precise positioning.

2. test of burial depth of cable

Test principle as shown:Input audio current signal between the cable conductor and the ground. Put the inductance coil magnet perpendicular to the ground, and place it just above the cable under test to find out the position where you hear the smallest sound in the headphone (the valley). Write down its corresponding ground position A, then move the magnetic antenna close to the ground and make it tilt to the ground with 45 ° angle(perpendicular to the direction of the cable) and move left or right along the cable to find out the valley points B and C. In both positions, the magnetic field lines is perpendicular to the axis of the coil, so the magnetic field lines

passing through the coil is the least, so that you can hear the smallest sound in the headphones. Line BO and CO connecting two valley point B or C and the cable location O are 45 degrees to the straight line AO, which makes triangles AOB and AOC right angle isosceles triangle, i.e. AB = AC = AO. Therefore, distance between the valley point A just above the cable and the other two valley points B or C, is equal to the depth of buried cables.

3. tips when measuring the path

The general cable has shielding layer. If the path signal is applied between the core wire and cable sheath, due to the shielding effect of the sheath of the cable, the electromagnetic signal on the ground is weak, which will greatly affect the path detection range. To detect long-distance path, you have to increase the output power of the signal generator, while the effect is not necessarily good. In circumstances when the output power of the signal source if in certain, you should disconnect the grounding wire on both ends of the cable from the system. The output of the cable core of the signal source should be connected to the cable sheath, and the output of the cable ground connected to the output of the system ground. It is equivalent to use the entire cable as the radiating antenna, which greatly enhances the

ground radiating of the cable and it can detect very far of cable path. It is worth noting that the radiation enhancement of the cable makes the cable nearby sensitive to the path signal, which may lead to finding other cables instead. The solution is:

1, Appropriate to reduce the output power of path signal; 2, Back to find the path from the end of the cable.;3, Use the peak method(observe the amplitude of the instrument). Make the magnet coil axis parallel to the ground and perpendicular to the the cable, and slowly move the coil. When the coil is located directly above the wire and perpendicular to the cable, the magnetic field lines are perpendicular to the plane of the coil. All the magnetic field lines go through the coil, so the induced electromotive force generates in the coil, and you can hear the loudest sound in headphones. Then move the ferrite antenna on both sides. A small part of the magnetic field lines on both sides will pass through the coil, generating very little induced electromotive force, so that you can hear very little audio sound in the headphones. With the slow movement of magnetic antenna, the sound gradually becomes small. Thus, this effectively avoids the interference induced radiation signal from the rest of the cable. No wrong path.

4. Locate (Precisely locate method)

In the long-term practice, it has been found that when input a surge voltage with enough amplitude to the faulty cable, it generates flashover discharge on the point of fault, at the mean time it also generates considerable "pop, pop" discharge sound, which can be transmitted to the ground surface. Using this phenomenon to locate can very accurately locate the fault point without any errors. Method to generate impulse voltage is quite the same as the method to generate impulse voltage using impulse flashover method, just remove the distance test equipment; other faults are connected to the ground simultaneously.

Wiring schematic of impact discharging sound measurement method is as follows. The following figure shows wiring schematic of impact discharging sound measurement method (if you are equipped with DMS series cable fault location system, you can switch "Test Mode Select" key to "location" mode) (a) phase - ground fault wiring diagrams; (b) open fault wiring diagrams

Find out the point of fault using location instrument, is usually performed on the basis of performing rough measurement using flash tester, and has identified the approximate distance, and cable path has been completed. On one hand, input impact high-voltage to cable to make it flashover discharge. On the other hand, listen with a location instrument probe audio meter along the cable path on the estimated location of the fault. After hearing the sound of the point of fault discharge, you still need to find out the biggest sounding

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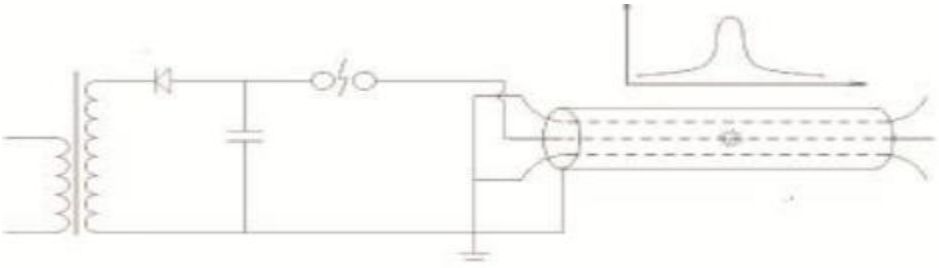
place along the cable path. Just find the loudest point; dig the soil layer will be it. That is generally right, unless the sound is spread from the cable through the tube, calandria tubes, witch causes errors. In the actual test using impulse discharge acoustic method, it usually increases the difficulty to identify due to the interference of ambient noise. This requires capacitor discharge equipment can produce steady periodic, powerful discharge pulse, so that people can distinguish the difference between the ambient noise glitch accordingly. In actual location, since people are far from capacitor discharge equipment, they can hardly hear sound receiving from air when ball-gap discharges. You may feel irritable, or even suspect that the discharge instrument does not work before you hear seismic waves emanating from discharging by the fault point. Sometimes you need to know whether the sound they heard is synchronous with discharge cycle of discharge instrument when there's interference background of pulse sound source; otherwise you can not make a final judgment. In such a case you need to do synchronized location. When using impulse discharge method, except for the sound of a discharge at the point of fault, it will also generate a high-frequency electromagnetic radiation to the ground.

This is an electromagnetic wave which can be received by magnetic antenna on the ground. It can be converted into a voltage signal to be amplified, and then shown as a display element. This creates the conditions for synchronous reception method of location instrument. When locate by synchronous receive method, if you hear the seismic waves, at the mean time they also showed an discharged electromagnetic wave by point of fault, and that means the discharge instrument is working.

As long as seismic signals and electromagnetic signals can be synchronized together, then the seismic waves you heard are credible and point of fault is in the vicinity.ADCF-B cable fault location instrument uses synchronous receive method to locate. Display unit uses a 3.8 inches 320╳240 dot matrix high-resolution LCD screen design, which has abundant information display and intuitive operation. Comparing with the old location instrument pointer, it has been greatly improved. It shows path signal waveform and fixed voice waveform simultaneously on the LCD screen, and displays the time difference between the two of them. The closer from the point of fault, the smaller the difference is, thus providing the user with a more intuitive location method.



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5- Product Note

1. The location instrument is a precision instrument. Please lift it up or down lightly. Do not shock the probe hardly or beaten.
2. Avoid noisy measurement site.
3. Check the battery voltage. 4 AA batteries (No.5 batteries) can generally be used 20 hours(not opening LCD backlight) or 10 hours(opening LCD backlight). When the voltage is below 4V, please replace the battery.

6- ADCF-B Cable Fault Location Instrument Physical Packing List

ADCF-B cable fault location instrument physical packing list		
No.	name	number
1	Host	1
2	Scalable probe	1
3	Headphone	1
4	Probe Connection	1

ADCF-C Path Instrument

1- Function

It provides 15KHZ high frequency signal and 300HZ audio signal power output. It can perform measuring cable path, buried depths, short circuit fault point with the location instrument.

2- Technical Parameters

- Power: 220V AC 80W
- Output power: 15 kHz high-frequency, no less than 50W.
  300 Hz low-frequency, no less than 70W.
- Waveform selection: Continuous or intermittent.
- Output voltage: Fourth gear of 0-10V, 0-25V, 0-50V, 0-100V
  Output Current: 0-1000mA
- Output frequency: 15 kHz (for path detection)
  300Hz (for electromagnetic location)
- Exo: 105(high) ╳240(width) ╳290(Depth) mm

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3- Usage

① Connected to power, and then turn on the switch. In this case, the screen displays the output current as 000.

② Select frequency according to the nature of the work (such as 15KHz frequency for detection path, 300Hz Audio for electromagnetic wave location). Press "Frequency", and the frequency selected will be displayed on the screen. Then select waveform according to your listening habits. Press "waveform" key, and "continuous" or "intermittent" selected will be displayed on the screen.

③ When performing path and depth detection, connect the red clip of the output signal line to the intact core wire or outer protective metal layer or extraction ground of shield layer of the cable, and left float the connection between the extraction ground and the earth over the cable. Black clip connects to the earth terminal. Connect the other end of the signal cable to the corresponding output jacks on the instrument, then the screen will have an output current indication. Output jack should be connected from the low voltage to highvoltage. When the output current indication is 200-600 range, the instrument can work reliably. When performing short circuit fault point detection, connect the two clips of output signal line to the fault line cable. Detect path or perform electromagnetic wave location combining with location instrument.

4- Path Instrument Packing List

- ADCF-C path instrument host:1
- Power line:1
- Red, black signal lines, one for each
- Baoding Hua Zheng Electric Manufacturing Co., Ltd.