

OPERATING INSTRUCTIONS

SPY® PORTABLE PULSE DC HOLIDAY DETECTOR

MODEL 785 / 790

SPY®
INSPECTION EQUIPMENT
www.spyinspect.com

WELCOME

Thank you for purchasing the SPY® Model 785/790 Pulse DC Holiday Detector.

SPY Inspection Equipment and our SPY® brand of Coating Inspection, JeepMeter and Pig Tracking equipment has been serving companies all over the world since 1953. With the purchase of this high precision instrument you can now enjoy access to worldwide service and support only SPY® and our vast Distributor network can offer.

For more information about SPY® brand equipment please visit our website at www.spyinspect.com.



The SPY® Model 785/790 meet the Electromagnetic Compatibility Directive and the Low Voltage Directive. The product is Class A, Group 1 ISM equipment according to CISPR 11. Group 1 ISM product: A product in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself. Class A products are suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

SPY is a registered trademark of SPY Inspection Equipment, Houston, Texas, United States.

A copy of this Operating Instructions Manual can be downloaded on our website at www.spyinspect.com.

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OPERATOR SAFETY

PLEASE READ THESE INSTRUCTIONS CAREFULLY PRIOR TO USING THE EQUIPMENT!



WARNING! This is a HIGH VOLTAGE device capable of producing an electrical shock if not properly grounded and/or operated in accordance with the instructions and procedures prescribed in this manual! If you have a pacemaker or other life critical electronic medical device DO NOT use this device.

Only trained and responsible personnel should operate high voltage equipment. Display warning labels prominently prior to and during testing. Portable holiday detectors are designed to operate and maintain an electric current output well below levels which could cause injury. However, you may experience a mild shock if the test electrode or ground is touched while the equipment is activated. Wear rubber or plastic gloves and non-conductive footwear to minimize potential shock. Keep in mind that the shock prevention effectiveness of the rubber or plastic glove and footwear is limited to the condition of their protective surface. Make sure your gloves and footwear are void of tears and holes and are in good condition.

Use of Portable Holiday Detectors is limited to finding defects in insulating materials. Testing should be conducted clear of personnel not involved in the testing procedure. Personnel operating Portable Holiday Detectors should be aware of the safety limitations imposed by their environment at all times. Operator should have an assistant to ensure that unauthorized personnel are kept clear of the testing area.



DANGER! Portable Holiday Detectors create an arc or spark. Use of a Portable Holiday Detector in or around combustible or flammable environments can result in an explosion. When operating in any potentially hazardous area, consult with the plant or site safety officer before proceeding with a holiday detection test in any potentially hazardous or suspect area.



DANGER! IF YOU HAVE A PACEMAKER DO NOT USE THIS DEVICE.

DO NOT CUT THE GROUND CABLE TO A SHORTER LENGTH.

CAUTION! DO NOT TOUCH THE BARE GROUND WIRE WHEN THE DETECTOR IS TURNED ON.

WARNING! DO NOT USE WHEN RAINING. If it is raining then there is a safety concern for the operator. Pure water is non-conductive, but almost any contaminant will cause water to become conductive (dust in the air or salt from an operator's hands). If conductive water covers the wand (the black plastic part of the detector where the electrode is attached) and the orange case then the operator will become the return path for the high voltage. While this is NOT LETHAL, it does hurt. Also the unit may become damaged.

If it isn't raining, but the coating surface is wet, the problem becomes one of accurately locating the coating defect (holiday). Again, the water will conduct the electricity and you may get false holiday indications many feet from the actual holiday(s). In this case it is recommended that you dry the testing area prior to inspection.

CAUTION! DO NOT USE AROUND SENSITIVE ELECTRONICS OR RADIO EQUIPMENT. When in standby the SPY® Model 785/790 Pulse DC Holiday Detector will generate radio frequency emissions which are within the limit defined by the Electromagnetic Compatibility Directive. Due to its method of operation however, the SPY® Model 785/790 Pulse DC Holiday Detector will generate broadband RF emissions when the unit is generating high voltage or when a spark is produced at the electrode. It is therefore recommended that the user does not activate the high voltage within the vicinity of sensitive electronics or radio equipment.

ELECTRODES/ACCESSORIES: It is imperative for the accurate operation of the unit that electrodes (Spring & Brush) and accessory attachments (Spring & Brush Wands & Ground Cable) be kept clean and free of dirt and debris. Please clean with a damp cloth before storing them for future use.

UNIT CALIBRATION

As the operator of this unit you require accurate, safe, and reliable equipment to perform coating inspections at the proper output voltage.

Prior to leaving our manufacturing facility SPY Inspection Equipment certifies that SPY® Model 785/790 Holiday Detector has been calibrated and demonstrates the output voltage, which appears on the display of the detector within +/- 5% of indicated setting over the range of 1-15 kV for the 785 and 5-35 kV for the 790. Since output voltage is regulated, this tolerance is maintained regardless of load.

Your unit comes with a **Factory Calibration Certificate** Traceable to NIST and a **Factory Authorized Calibration Decal** applied to the side of the unit both with the date your unit was calibrated.

Our units do not tend to drift but it is recommended that this unit be calibrated at least once per year or more frequently based on heavy usage. **Recalibration of our equipment should be performed ONLY at a SPY® Authorized Service Center due to the unique calibration process; test equipment utilized and properly trained SPY® technicians.**

We DO NOT recommend using any other calibration service other than a SPY® Authorized Service Center; using an outside service with technicians not trained to work on SPY® brand equipment could damage the unit and, if the enclosure is opened, void the warranty.

When equipment service is needed please visit our Services & Repairs page on spyinspect.com.

Fill out the online service form, submit, and then follow the instructions provided in the confirmation email that is sent to you. Please check your spam folder if you do not get the confirmation email. If you experience issues with the online service form please call us at 713-681-5837 so we can assist you.

For International Customers we have Authorized Service Centers World Wide. Please visit the Distributor Locator page on spyinspect.com to search for a local SPY® Authorized Service Center in your area. If none, please see instructions above to send to our SPY® Manufacturing Facility.

PRINCIPLES OF HOLIDAY DETECTOR OPERATION

Holiday detectors are devices that are used to detect the presence of defects in the non-conductive coatings applied to surfaces in order to minimize ion flow from a conductive substrate. This is accomplished by attempting to create an electrical circuit by passing an electrode over the non-conductive coating. A sufficient voltage is generated in the electrode to cause a spark that will jump from the electrode to the substrate if a defect is found. When a defect is found a horn will sound and a LED light will turn off.

Metal objects such as pipelines, reinforcing bar (rebar), storage tanks or structural steel are normally covered with a protective coating to prevent corrosion. Holiday detectors are used to inspect these coatings for pin holes, scratches or other coating faults. They work by generating a voltage high enough to jump a gap that is longer than the thickness of the coating.

The laws of physics determine the required voltage level to jump a given distance, or gap. Coating type also affects voltage level requirements. Environmental Conditions such as humidity, temperature, and other environmental factors will also affect voltage required to jump a given distance.

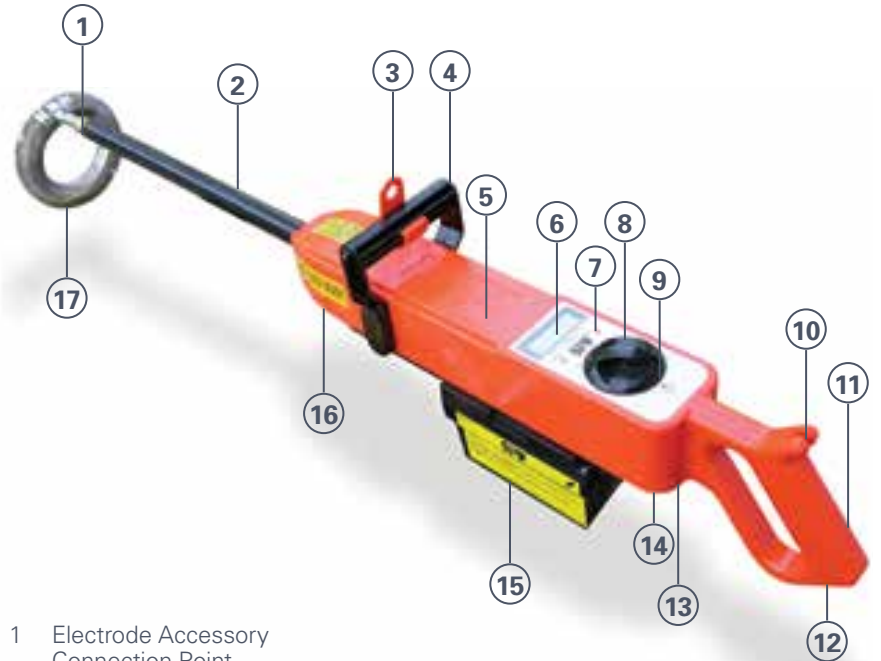
A holiday detector simply applies a voltage to the outside of the coating. With the pipe connected to ground and with the holiday detector connected to ground, a hole in the coating will allow a spark to jump or “arc” from the electrode to the pipe to complete the circuit. When a complete circuit is formed, an audible and visual signal is activated on the holiday detector.

SPY® MODEL 785 / 790 PULSE DC HOLIDAY DETECTOR OVERVIEW

The Model 785 Pulse DC Holiday Detector is a high voltage (1-15 kV) detector designed to cover a wide range of coatings from thin films to tapes to extruded or coal tar types of coatings (4-150 Mils). Since the operating characteristics of this detector are very broad it is recommended that thin film epoxy coatings be inspected with the model 780 or 785 holiday detector.

The Model 790 Pulse DC Holiday Detector is a high voltage (5-35 kV) detector designed specifically for tapes, extruded or coal tar types of coatings, and thicker somatic type coatings (50-750 Mils).

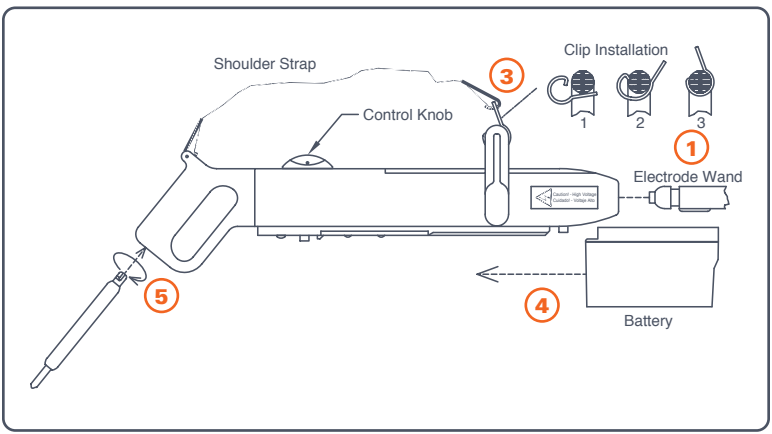
The Model 785/790 Pulse DC Holiday Detectors incorporates circuitry allowing the detectors to maintain a selected voltage, regardless of different pipe diameters, coating thickness variations and battery wear (unless the battery is totally discharged). Keep in mind that the voltage can decrease slightly depending on ground losses and/or conditions.



1 Electrode Accessory Connection Point
2 Electrode Wand
3 Shoulder Strap Connection
4 Easy Carry Top Handle
5 Model & Serial Number
6 Built In Digital LCD JeepMeter (Voltage meter)
7 Indicator Light
8 Control Knob (3 positions: Off / Voltage Set / On)
9 Voltage Set Access Hole
10 Shoulder Strap Connection
11 Comfort Grip
12 Ground Cable Connection Point
13 Horn
14 Quick Release Battery Button
15 12V Battery
16 Wand Release
17 Spring or Brush Electrode

CONNECTING ACCESSORIES

CAUTION! DO NOT TOUCH. Make sure the switch is in the OFF position prior to connecting any accessory.



STEP 1. CONNECTING THE ELECTRODE WAND. Plug into the "front" of the detector. Push the wand in until it locks in place. It can be released by pressing the release (located near the front / bottom of the unit) upwards until the wand pops out.

STEP 2. CONNECTING THE ELECTRODES. Connect the electrode to the wand. The wand comes with the spring adapter attached to the wand. If it is a spring or full circle brush electrode attach to the pipe.

CAUTION! DO NOT TOUCH THE ELECTRODE WHILE THE DETECTOR IS OPERATING.

OPTIONAL: BRUSH ADAPTER KIT. The Model 780 Kit comes with a brush adapter kit for use in connecting flat brush/neoprene electrodes, half-circle electrodes and full-circle electrodes.

STEP 3. CONNECTING THE CLIP\SHOULDER STRAP. First attach the strap clip to the black handle by placing the tab portion of the strap clip into the top groove on the back side of the handle that faces the unit display. Then push up on the bottom of the strap clip in the direction of the opposite side of the black handle until the strap clip snaps into place around the black handle. Next attach the shoulder strap to the front handle clip and the pin on top of the rear handle. The front clip can slide to the left or right on the handle to allow hand placement while using the detector.

STEP 4. BATTERY. The battery will only install one way (from the front side). It is keyed to prevent insertion in an incorrect fashion. One end of the battery is flat and the other has a step. The flat end goes towards the rear of the unit. Push the battery on until it snaps in place (the spring will be almost completely compressed when properly installed). To remove the battery, press the orange release on the bottom left side of the unit. Newer batteries can be a bit resistant when trying to remove the battery because of the newness of the battery and the tight fit on the slide path; if so give a gentle tap with your palm on the battery in the direction of removal.

STEP 5. CONNECTING THE GROUND CABLE. The ground cable plugs into the bottom side of the rear handle. It uses a quarter turn fastener, so insert the cable as far as possible and rotate it at least a quarter clockwise turn until it locks into place. The kit includes a quick connect grounding clamp that allows the option to take the clamp on or off the ground wire for different grounding methods. Earlier kit versions did not include a grounding clamp and you can order one from SPY if you would like the ability to add one to your ground cable.



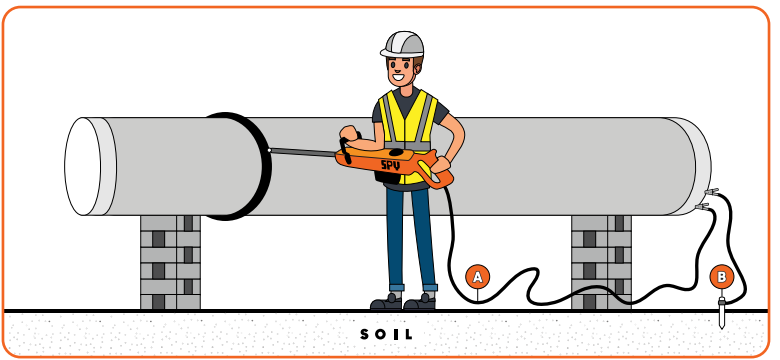
PROPER GROUNDING. Make sure the ground cable is uncoiled and extended.



CAUTION! DO NOT TOUCH THE GROUND CABLE WHILE DETECTOR IS OPERATING.

GROUNDING METHODS

1. DIRECT GROUNDING

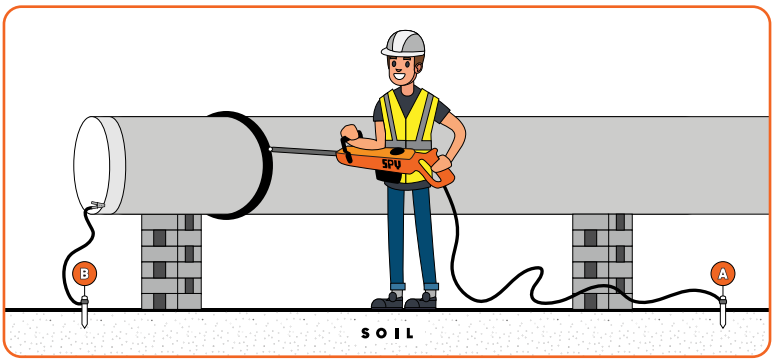


Direct grounding using the standard 50 ft ground cable is the most reliable form of grounding which offers a direct connection between the holiday detector and the non-insulated pipe end (cut back) to be tested.

A. Part #12884 50 ft ground cable

Optional Parts needed to ground using this method:
B. Part #14196 Grounding Rod

2. DIRECT GROUNDING USING A SECOND GROUNDING ROD

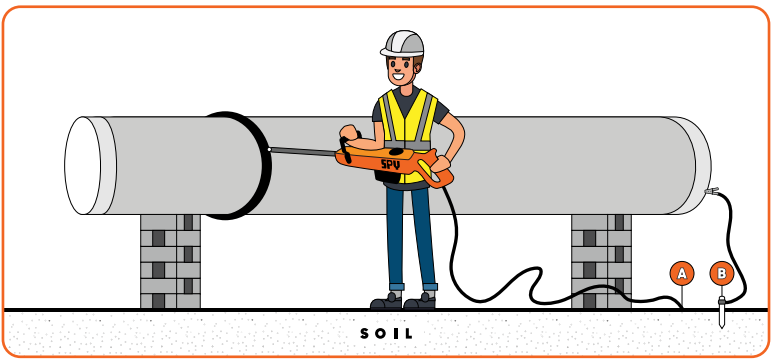


An additional grounding rod allows the direct grounding of the holiday detector, if the bare pipe end (cut back) cannot be connected using the standard 50 ft ground cable. **If desired SPY® also makes custom length ground cables of any length, contact sales for details.** Refer to the Grounding Methods on page 16 for more details.

A. Part #12884 50 ft ground cable (custom lengths available)

Optional Parts needed to ground using this method:
B. Part #14196 Grounding Rod

3. INDIRECT GROUNDING USING A TRAILING GROUND WIRE



Indirect grounding using a trailing ground. This grounding alternative allows holiday testing without an obstructing cable, if direct grounding is not possible. To use the ground cable using the trailing ground method please remove the quick connect grounding clamp if you have it attached, to keep it clean so it makes good ground connection when needed (some earlier kit versions may not have this kit part).

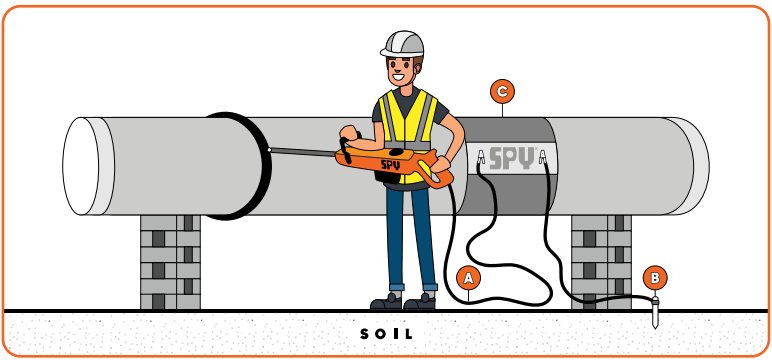
IMPORTANT: Soil Moisture is very important to establishing a good ground using the trailing grounding method, if the trailing ground wire is on soil that is too dry, there is ice or it is on cement this method will not work properly and the trailing ground will need to be connected to a grounding rod. Refer to the Grounding Methods on page 16 for more details.

A. Part #12884 50 ft ground cable (custom lengths available)

Optional Parts needed to ground using this method:
B. Part #14196 Grounding Rod

4. CAPACITIVE GROUNDING USING A GROUNDING COLLAR

FOR USE ONLY WITH 785/790 AND 125/135 PULSE DC UNITS



The grounding collar is used if no direct or indirect grounding is possible. The grounding collar is also recommended in case of bad conducting or extremely dry soil. Refer to the Grounding Methods on page 16 for more details.

A. Part #12884 50 ft ground cable (custom lengths available)

Optional Parts needed to ground using this method:
B. Part #14196 Grounding Rod
C. Part #14188 Grounding collar 4”- 8”
Part #14189 Grounding collar 10” - 18”
Part #14190 Grounding collar 20” - 30”
Part #14191 Grounding collar 32” - 42”
Part #14192 Grounding collar 48” - 60”

GROUNDING METHODS

EARTH (SOIL) GROUND AS AN ELECTRICAL CURRENT RETURN PATH

For a Holiday Detector to inspect a coated pipe properly an electrical ground return path is needed. When a holiday in the coating is detected a spark occurs forcing a low current to flow from the metal pipe back through the ground wire of the detector. An alarm circuit inside the detector senses the low current and a "JEEP" is heard.

The most optimum electrical ground return path is with the ground wire of the Holiday Detector directly connected to the bear pipe end, "cutback". This method is called "Direct Grounding". Using this method, the low current flows through a wire of very low resistance back to the detector. In this case the Earth is not part of the ground return path.

In many instances Direct Grounding is not possible. Two alternate methods can be used, "Direct grounding using a secondary ground rod" or "Indirect grounding using a trailing ground wire". In both methods the Earth (soil) now becomes part of the electrical ground return path allowing the low current to flow back to the detector.

In all cases, for the safety of all personnel during the coating inspection, the pipe should be grounded to Earth. Make an electrical connection to the bear end of the pipe, "cutback". Attach a wire from this connection to a ground rod driven into the Earth. Depending on the moisture content of the soil the ground rod should be driven down about 2 feet. Drive the rod deeper in dryer soils.

GOOD GROUNDING PRACTICES

Soil conditions must be evaluated prior to beginning the job

1. Soil Moisture Content

Since the Earth is being used as an electrical conductor the moisture content of the soil must be taken into consideration. Soils with a high moisture content offer a lower resistance to current flow and have a much lower voltage loss. While soils of a low moisture content offer a higher resistance to current flow, there is a greater voltage loss.

The voltage loss that is referred to here, exists between the ground rod where the pipe is grounded to Earth and the ground rod or trailing wire where the Holiday Detector is grounded to Earth. This distance could be 35 – 50 feet or even several 1000 feet depending on the job conditions.

As an example, if the job was located in an area of low soil moisture content, called for an inspection voltage of 2.5KV and there happened to be a voltage loss of 1.5KV between ground rods, the Holiday Detector would have to be adjusted to 4KV to compensate for the 1.5KV loss in the Earth and yet maintain the 2.5KV between the pipe and the coating. The 4KV voltage setting would have been identified by performing a "Field Calibration".

In this example, refer to illustration #3, avoid using the "Indirect grounding using a trailing ground wire" method. This method allows the ground wire to only come in contact with the surface of the soil. No ground rod is used to locate an area of higher soil moisture content.

2. "Insulating" Surfaces

When the moisture content in a soil is so low it can't provide the low resistance return path for the low current and it basically becomes an "insulator" with very high resistance and higher voltage loss.

For example, if the soil is very dry with low moisture content such as sand, dry clay or a rocky surface, when the soil is frozen or there is ice on the surface, these surfaces have become "insulators" and can't provide a low resistance return path. Other "insulating" surfaces would be concrete, cement and asphalt. In each instance there would be a significant voltage loss in the soil.

GROUND ROD DEPTH BECOMES AN ISSUE WHEN PROVIDING A GOOD EARTH GROUND

1. Shallow Ground Rod

When the moisture content of the soil is high a ground rod can be driven into the earth about 1 - 2 feet to provide a low resistance return path to the holiday detector.

2. Deep Ground Rod

When the moisture content is low the ground rod needs to be driven down deeper into an area where a higher soil moisture content exists. Driving the rod deeper helps to reduce the voltage loss in the Earth. Both ground rods, at the cutback end of pipe and where the Holiday Detector is connected, typically are driven to the same depth and could be up to 5 feet deep or greater, in some areas. Soils of this type would be sand, dry clay or very rocky soils.

PERFORM FIELD CALIBRATIONS TO MAINTAIN A GOOD GROUND THROUGHOUT THE JOB

SPY® highly suggests performing a Field Calibration at the beginning of the job, at certain intervals during the job, if the soil moisture content becomes questionable and when changing locations on the same job.

Field Calibration:

When the moisture content of the soil is high a ground rod can be driven into the earth about 1 - 2 feet to provide a low resistance return path to the holiday detector.

- How to perform a Field Calibration can be found in NACE SP0490-2007, Section 3.
- Per section 3.3.1, create a holiday that is approximately 0.031" in diameter. Ensure that the hole extends completely through the coating to the metal substrate.
- Per section 3.3.2, start with the lowest test voltage setting of the holiday detector and slowly increase the test voltage until the manufactured holiday can be positively detected at normal operating speeds.
- Per section 3.3.3, this method of test voltage adjustment shall be performed while the exploring electrode and grounding are in the expected operating position.

For example, when inspecting a good distance of welded pipeline, it would be advisable to perform Field Calibrations at certain intervals along the pipeline to verify a known holiday can still be easily detected at the specified inspection voltage. This will assure the operator that he is inspecting the pipe under optimum conditions and is not missing any holidays. A Field Calibration would also allow the operator to make any voltage adjustments to the Holiday Detector to compensate for any voltage loss in the soil between ground rods, if conditions do change.

CONSIDERATIONS – ''INDIRECT GROUNDING USING THE TRAILING GROUND WIRE'' METHOD

This grounding alternative, Illustration #3, allows holiday testing without an obstructing cable, if direct grounding is not possible.

Important: When using this method "Soil Moisture Content" is very important to establish a good ground. The moisture in the soil acts as a return path for a low current that flows back to the holiday detector allowing the unit to "Jeep" when a holiday is located. Without this low resistance return path, the unit would not Jeep and the operator would miss valid holidays.

Caution: This method should not be used when a surface becomes an "insulator" and can't provide a low current return path.

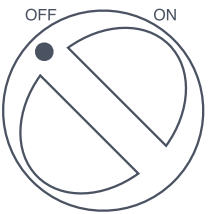
For example, if the soil is very dry with low moisture content such as sand, dry clay or a rocky surface, when the soil is frozen or there is ice on the surface. these surfaces have become "insulators". DO NOT use this method when the trailing ground must be dragged across concrete, cement or asphalt surfaces. These too are considered "insulating" surfaces.

CONSIDERATIONS – ''CAPACITIVE GROUNDING USING A GROUNDING COLLAR'' METHOD

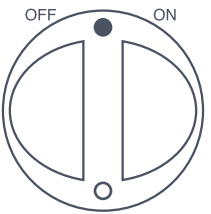
This grounding method, Illustration #4, can be used only with Pulsed DC holiday detectors such as the SPY 785 or 790. It cannot be used with the SPY 780 detector since it has a continuous DC voltage output. The DC low current that would normally be produced when a holiday is located is blocked by the capacitance of the grounding collar. Therefore, no holidays can be detected.

CONTROLS AND VOLTAGE ADJUSTMENTS

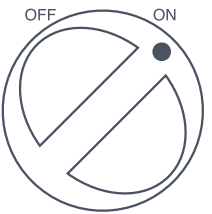
The control knob has three positions: OFF, VOLTAGE SET, and ON. In the OFF position all power is off, including the high voltage output.



POWER OFF
LEFT



VOLTAGE SET
MIDDLE

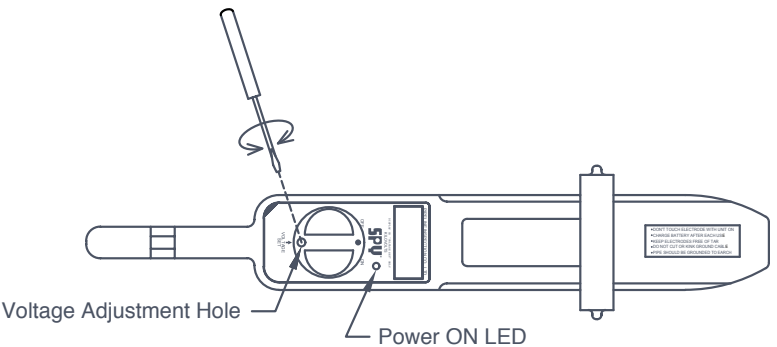


POWER ON
RIGHT

STEP 6. SETTING THE VOLTAGE OUTPUT. Turn the knob clockwise to the middle position (voltage set) this turns on the high voltage output and activates the internal JeepMeter (voltage meter), the LCD display turns on, the red indicator LED light will blink and the horn tone will pulse on and off.

Using the SPY® provided flathead screwdriver place the **flat screwdriver head through the hole on the bottom side of the knob to change the voltage setting,** the voltage (shown on display) is in kilovolts (thousands of volts). Turning the screwdriver clockwise will increase the voltage and counter clockwise will decrease the voltage.

IMPORTANT: In the field, setting the Inspection Voltage must be performed with the detector wand disconnected from the spring/pipe. The main reason for this is the potential buildup of static electricity/ static voltage on the surface of the pipe coating. The detector's internal voltmeter is very sensitive and responds to any static voltage. The static voltage typically fluctuates up and down which can be confusing when setting the Inspection Voltage. To remove this uncertainty always adjust the voltage with the detector disconnected from the spring or pipe.



STEP 7. TURNING ON THE UNIT FOR HOLIDAY DETECTION.

Turn the unit clockwise to the ON position. In this position the unit is in the normal running mode with the red indicator LED on steady, the horn tone will be steady, and **the display will turn off.**

NOTE: Voltage setting can only be viewed in the middle set position. This is to prevent confusion during detection of holidays as the voltage will drop when the unit discharges to substrate. Static electricity on protective coatings can be picked up and can cause fluctuations in Voltage reading.

TEST VOLTAGE GUIDE FOR 785/790 PORTABLE HOLIDAY DETECTOR

525* SQRT (MILS) **MINIMUM TEST VOLTAGE FOR THIN FILM COATINGS**

COATING THICKNESS		MINIMUM TESTING VOLTAGE
mm	mil	KiloVolts
0.25	10	1.67
0.30	12	1.82
0.36	14	1.97
0.41	16	2.10
0.51	20	2.35
0.64	25	2.63
0.76	30	2.88
1.0	40	3.33

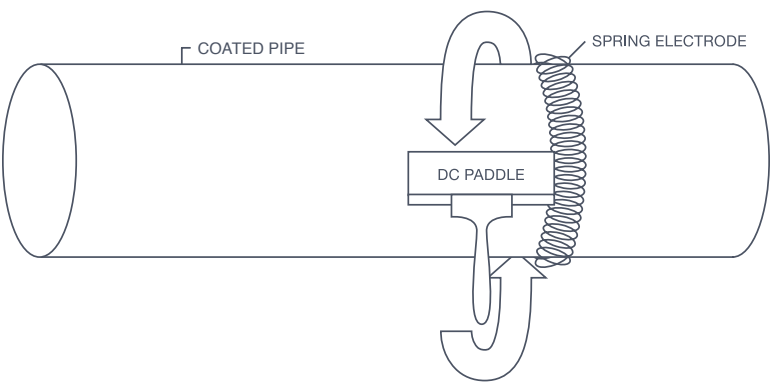
1250* SQRT (MILS) **MINIMUM TEST VOLTAGE FOR THICK FILM COATINGS**

COATING THICKNESS		MINIMUM TESTING VOLTAGE
mm	mil	KiloVolts
0.51	20	5.6
0.76	30	6.9
1.5	60	9.7
2.3	90	11.9
3.0	120	13.7
3.8	150	15.4
4.6	180	16.8
12.7	500	28.0
15.9	625	31.3
19.1	750	34.3

DC PADDLE

The Model 785/790 DC Holiday Detector comes with a DC Paddle to assist in the location of Holidays (defects in the coating). Due to the low voltage of the Model 785/790 DC Holiday Detector the spark that jumps the gap from the electrode to the substrate when a holiday (defect in the coating) is found can sometimes be hard to see as opposed to using a higher voltage detector which produces a larger brighter spark. The DC Paddle acts as an extension of the spring electrode giving the user a wider path to test areas the user suspects are producing the holiday but can't see during standard detecting travel speed.

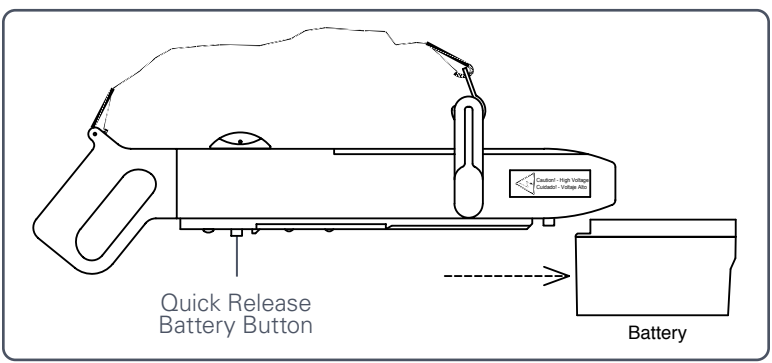
Immediately after the holiday detector indicates a fault, roll the spring electrode back approximately 2-3 inches. Place the edge of the conductive rubber paddle against the spring and wipe the paddle around the entire circumference of the pipe until the detector signal activates indicating the exact location of the coating flaw.



BATTERY CHARGING AND STORAGE INSTRUCTIONS

The SPY® battery is a completely sealed, rechargeable 12 volt unit. It can be used in any position and under most conditions. Batteries are shipped fully charged. However, prior to use we recommend you place them on the charger to verify charge level is full.

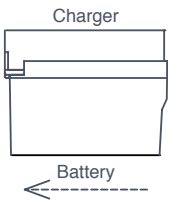
CAUTION! MAKE SURE THE SWITCH IS IN THE OFF POSITION PRIOR TO REMOVING THE BATTERY.



BATTERY REMOVAL. Press the release (orange button) on the base plate (black part) and push the battery away from the rear handle. Newer batteries can be a bit resistant when trying to remove because of the newness of the battery and the tight fit on the slide path; if so give a gentle tap with your palm on the battery in the direction of removal.

WARNING! DO NOT USE ANY OTHER TYPE OF CHARGER.
This charger is specifically designed for this battery.

CHARGING THE BATTERY. Slide the charger onto the battery as far as possible. A discharged battery requires 4-6 hours to fully charge.



There is no danger of overcharging the battery. After the battery is fully charged, the charger will maintain a trickle charge to keep the battery at peak charge.

It is recommended that the battery be charged for 4 hours after each use. After heavy usage charge the battery for 6 hours.

Do not disconnect the charge power cord while the battery is attached.

BATTERY STORAGE. The battery should be fully charged BEFORE storing. Storage at temperatures below 75˚F is recommended. After six months of storage or storage in extremely high temperatures, the battery should be recharged to maintain peak efficiency and maximize its life span.

IMPORTANT! Contacts on the battery, charger and the detector must be kept clean and bright to assure good connection!

BATTERY DISPOSAL. The battery pack is a sealed non-replaceable lead acid battery, when the battery pack is no longer good it must be recycled.



FIELD CALIBRATION INSTRUCTIONS

Prior to each use of the Model 785/790 Pulse DC Holiday Detector it is important to perform a Field Calibration to verify that the required voltage setting for the coating thickness will accurately detect defects (holidays) in the coating.

ADDING TEST DEFECTS TO THE COATING.

1. Prior to turning on and setting the voltage on the detector manually add one pinhole size defect on the coating surface, make sure the defect goes down to the substrate (bare metal).
2. Set the voltage on the detector to the minimum voltage based on the coating type and thickness. Use equation 525 x sqrt (mils) from NACE SP0490 for Fusion-Bonded Epoxy and equation 1250 x sqrt(mils) from NACE SP0274 for thick coatings. Use the spring or brush electrode to travel over the test defects. See voltage table on page 22.
3. If you see the spark jump the gap from the electrode to the substrate in the defect and the horn on the detector changes from a running tone to a loud signal horn and the light on the display turns off then you have successfully detected defects (holidays) in the coating and verified the detector operation.
4. If your test does not successfully detect the test defect then increase the voltage by 10% and test again. If test fails again continue increasing by 10% until the test is successful.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE SOLUTION	CORRECTION METHOD
HOLIDAY DETECTOR WILL NOT DETECT HOLIDAYS	Field Calibration	Perform a field calibration to compensate for environmental factors (see page 15). Use NACE equation to set min voltage. Travel over known holiday. Turn up voltage and repeat until holiday is detected. (Note: Max voltage is determined by the coating manufacture, typical values for new coating range from 400 to 1000 Volts/mil).
	Detection Testing	Touch electrode/wand directly to bare ground cable to test that the unit is functioning properly. A spark will appear and the horn will sound if switch is in the "ON" position. If it does not detect then ensure ground cable and electrode wand are correctly inserted (see page 10). If unit still fails to detect a direct short repair may be needed, Call SPY Inspection Equipment for support.
	Minimum Voltage Setting	Follow NACE standard SP0490-2007 Section 3 and NACE SP0274-2011 Section 3. Also refer to the voltage table on page 27.
	Check Detector Ground Connection	With the detector OFF remove the ground cable and fully reinsert it twisting 90 degrees until locked. Ensure the opposite end is clean and well connected to the pipe or earth ground.
	Check Electrode/Wand Connection	With the detector OFF remove the wand and fully reinsert until it locks into place. Ensure wand and electrode connection points are clean.

TROUBLESHOOTING GUIDE CONTINUED ON THE NEXT PAGE...

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE SOLUTION	CORRECTION METHOD
HOLIDAY DETECTOR WILL NOT DETECT HOLIDAYS	Check Ground Connections	If pipe is connected to an earth grounding rod and the ground cable from the holiday detector is dragging the ground make sure all connections are clean (free of debris) and secure.
		If ground cable from the holiday detector is directly connected to the pipe cutback (substrate) make sure all connections are clean (free of debris) and secure.
		If the ground cable from the holiday detector and the earth grounding rod are both connected to a grounding collar make sure all connections are clean (free of debris) and secure.
	Adjust Travel Speed	Travel speed is important on Pulse DC units and must not be too fast or holidays could be missed. Follow NACE standard SP0274-2011 section 6.3: Make or find a holiday and attempt to detect at various speeds until reliable detection is obtained.
HOLIDAY DETECTOR TURNS OFF WHILE IN-USE	Charge/Replace Battery	The detector will automatically power down if the battery voltage drops below the required level. Ensure that the battery has been fully charged before use.
		Use a second battery that is charged and see if the detector still turns off.
	Test Battery	Additional testing may need to be conducted on the battery, see Battery Troubleshooting.
THE DETECTOR VOLTAGE NEEDS TO BE VERIFIED	Use SPY JM or PJM	Do not use a regular multimeter as they will get damaged and are not rated for over 1,000 Volts. The SPY JM is rated for 7 kV DC and 35 kV Peak (crescent) on Pulse DC. The SPY PJM can measure up to 20 kV.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE SOLUTION	CORRECTION METHOD
THE BATTERY DOESN'T SEEM TO BE WORKING WELL	Check/Replace Battery	Use a multimeter to measure the battery voltage on the freshly charged battery. The voltage should read 13.0 Volts or higher if it just came off the charger. If it has been sitting for several hours the voltage can be as low as 12.3 Volts.
		If the voltage is lower than 12.0 Volts then the battery may have a problem and will probably need to be replaced. Test with a different charger if possible.
PIPELINE ENGINEERS, INSPECTOR OR OWNER REQUIRE A SPECIFIC VOLTAGE FOR TESTING BUT HOLIDAYS ARE NOT BEING DETECTED	Field Calibration	If the testing documentation on the pipeline requires a specific voltage then that setting must be used. However environmental conditions such as humidity and temperature will affect the required voltage to spark across a specific gap size (holiday). For the holiday detector to create a spark or Jeep the voltage must be high enough to overcome the gap. If the voltage is set too low for the thickness, humidity and temperature then a spark will not occur. It is recommended to perform a field calibration every day or periodically as conditions change (see page 15).
THE PIPELINE NEEDS TO BE CHECKED BUT PIPE IS WET / IT IS RAINING	Dry Pipe	Holiday detection cannot be done in the rain as it will conduct back to ground and give false holidays. Holiday detectors maybe be used with light moisture on the pipe however it is highly recommended that the pipe be dry and clean before testing. **Proper safety and safety equipment should be used when in wet conditions to prevent user from being shocked.**

MAINTENANCE AND REPAIR

If maintained the Model 785/790 Pulse DC Holiday Detector will offer you a lifetime of dependable operation. Regular care and maintenance of the unit is a requirement of good quality management practices.

WARNING! This detector does not contain any user-serviceable parts; your warranty will be voided if the SPY® unit is opened by anyone other than a SPY® Authorized Service Center or SPY® manufacturing facility.

When equipment service is needed please visit our Services & Repairs page on spyinspect.com.

Fill out the online service form, submit, and then follow the instructions provided in the confirmation email that is sent to you. Please check your spam folder if you do not get the confirmation email. If you experience issues with the online service form please call us at 713-681-5837 so we can assist you.

For International Customers we have Authorized Service Centers World Wide. Please visit the Distributor Locator page on spyinspect.com to search for a local SPY® Authorized Service Center in your area. If none, please see instructions above to send to our SPY® Manufacturing Facility.

ELECTRODES AND ACCESSORIES

Springs and Brush electrodes and all attached accessories are prone to wear and tear and will eventually need to be replaced. The timing of replacement will depend on how they are maintained and the coatings that they are used on.

SPY® MODEL 785/790 TECHNICAL SPECIFICATIONS

MODEL	785	790
Voltage Type	Pulse DC	Pulse DC
Voltage Range (kV)	1-15 kV	5-35 kV
Voltage Output Accuracy	±5%	±5%
Coating Range (Min-Max)	4-150 mils	50-750 mils
Pulse DC Repetition Rate	28 Hz	28 Hz
Operating Temperature	–20°F to 148°F	–20°F to 148°F
Internal Volt Meter	YES - User Adjustable	YES - User Adjustable
Display Type	LCD	LCD
Holiday Indicator Type	Audible/Visual	Audible/Visual
Power Type	12V Rechargeable Battery	12V Rechargeable Battery
Quick Release Battery*	YES	YES
Battery charge time	Approximately 4-6 Hours	Approximately 4-6 Hours
Unit Weight (w/ battery only)	7.45 lb	7.45 lb
Unit Dimensions (w/o battery) Unit Dimensions (w/ battery)	21.5" x 5" x 5.5" (L x W x H) 21.5" x 5" x 8" (L x W x H)	21.5" x 5" x 5.5" (L x W x H) 21.5" x 5" x 8" (L x W x H
Domestic/International Standards Unit Complies With	AS 3894.1, ANSI/AWWA C203, ANSI/AWWA C214, ASTM D4787, ASTM D5162, NACE RP0274, NACE SP0188, NACE SP0490, NACE TM0186, NACE TM0384	AS 3894.1, ANSI/AWWA C203, ANSI/AWWA C214, ASTM D4787, ASTM D5162, NACE RP0274, NACE SP0188, NACE SP0490, NACE TM0186, NACE TM0384

*Battery life is dependent upon selected voltage and load applied. Typical battery life 8 hours.

WARRANTY

SPY Inspection Equipment, hereafter referred to as (SPY®) warrants that SPY® Model 785/790 Series Holiday Detectors shall, under normal use and service, be free from defects in material and workmanship. SPY®'s entire warranty obligation shall be limited to, at SPY®'s option, the repair or replacement free of charge to the buyer of any defective equipment or parts thereof which prove to be defective in material and workmanship under normal use and service.

Claims for defective parts must be made in writing within twelve (12) months after shipment of the equipment from the works of SPY®. Fast wearing and consumable parts including, but not limited to, electrodes and ground cables, are expressly excluded from the warranty. SPY® shall have the option to require return of a claimed defective part to SPY®'s manufacturing facility in the U.S.A., freight prepaid by buyer for examination to establish buyer's claim.

Except with SPY®'s prior written approval, SPY® shall not be liable (a) for the cost of repairs, alterations or replacements or any expense connected therewith made or incurred by the buyer or its designers, or (b) for defects resulting from alterations or repairs made by others than SPY®, or its approved representatives.

SPY® shall not be liable for damages, including but not limited to direct, special, indirect or consequential, resulting from the handling, or use, whether alone or in combination with other products, or any SPY® equipment or third party designed or manufactured equipment, including without limitation, any loss or damage sustained or caused by the operation and use of the equipment which is improperly operated or its successful operation is impaired by natural elements after its delivery to the buyer.

The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral or implied (including without limitation, any warranty of merchantability or fitness for purpose).

ELECTRODE TYPES

The Model 785/790 can be fitted with a wide variety of electrodes that vary in form, size and material to fit a wide range of coating inspection projects. If we don't carry it we can custom build an electrode to fit your project needs.



FLAT BRUSH
(BRASS, STEEL
OR NEOPRENE)
1"- 72" (25-1829 MM)



FULL-CIRCLE
STEEL SPRING
2"- 80" (50-2032 MM)



HALF-CIRCLE
BRUSH (BRASS,
STEEL OR
NEOPRENE)
1"- 60"(25-1524 MM)



INTERNAL
NEOPRENE
1"- 64" (25-1625 MM)
OR SPONGE
2"- 28" (50-711 MM)



FULL-CIRCLE
BRUSH (BRASS,
STEEL OR
NEOPRENE)
8"- 60" (203-1524 MM)



30'-100' INTERNAL
PULL CABLE

Please call our office at (713) 681-5837 or email us at
sales@spyinspect.com for more product details or to place an order.

ACCESSORIES

The Model 785/790 has a wide variety of accessories to assist you with your coating inspection project.



SPRING ADAPTER FOR ELCOMETER SPRINGS
ITEM #13996



SPRING ADAPTER FOR TINKER & RASOR SPRINGS
ITEM #13995



ELECTRODE WANDS
(36" – 72")



SPRING SUPPORT PUSHER WAND (FOR SPRINGS OVER 60")



SPY® GROUNDING MAGNET



ELECTRODE FLEX WAND
(36" – 72")



GROUND CABLE
(50 FT – 600 FT)



SHOULDER MOUNT BATTERY ADAPTER



SPY® ON/OFF GROUNDING MAGNET

Please call our office at (713) 681-5837 or email us at sales@spyinspect.com for more product details or to place an order.

RELATED EQUIPMENT



SPY® MODEL 780 PORTABLE DC HOLIDAY DETECTOR



SPY® MODEL JM (VOLTAGE METER)



SPY® MODEL PJM POCKET JEEPMETER (VOLTAGE METER)

SPY®

INSPECTION EQUIPMENT

www.spyinspect.com

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