TYPE 5916
ELECTRODING DETECTOR

OPERATING INSTRUCTIONS

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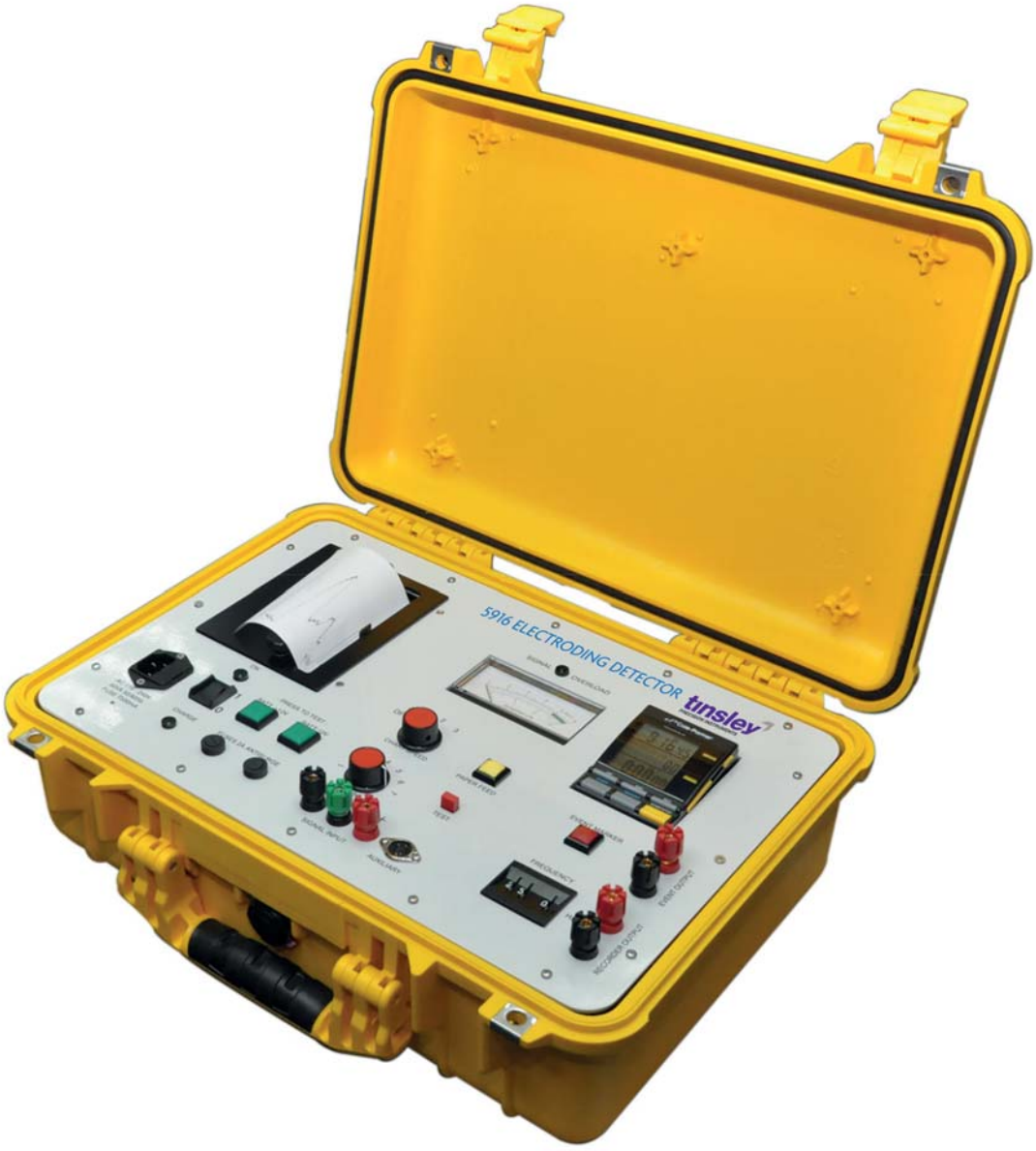

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This manual superseded all previous versions – please keep for future reference

TINSLEY, A DIVISION OF HARTEST PRECISION INSTRUMENTS LTD

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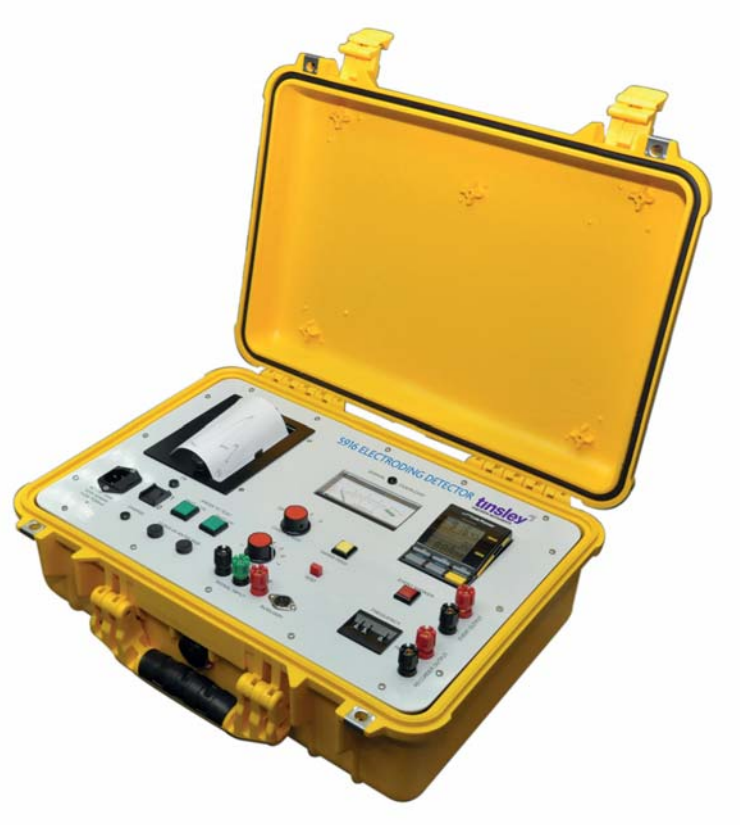

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DESCRIPTION

The 5916 Electroding Detector is a high gain low frequency selective Amplifier to detect the electromagnetic field from a submarine cable powered by an electroding generator such as a Tinsley 5915 or similar.

There are 2 inputs - one suitable for electrostatic sensors (customer supplied) and one suitable for a magnetic sensor such as a Tinsley 5917 Beach probe or a 5917D Divers Probe.

The 5916 Detector amplifies, filters, indicates and records signals of the selected frequency in the range 4Hz to 40Hz. At the highest gain setting a 1µV rms input signal of the correct frequency will give a full scale reading on the analogue front panel meter and the chart recorder.

The 5916 Detector is completely self-contained in a splashproof IP65 (when lid is closed) portable case. Rechargeable batteries are included in the case and also a mains power supply which will recharge them. A clock/timer is incorporated on the front panel to help synchronise detected events.

To use the detector either an electrostatic sensors or magnetic sensor is connected to the appropriate input connector, the exact operating frequency is then selected on the thumbwheel switches and the gain switch is adjusted to obtain a useful indication of the signal.

PRINCIPLE OF OPERATION USING ELECTROSTATIC SENSORS

The 5916 Detector when used with electrostatic sensors is capable of locating submarine cables in water of up to 180 metres (100 fathoms) in depth. A signal in the range of 4 Hz to 40 Hz is transmitted down the submarine cable by an Electroding Generator such as the Tinsley type 5915 unit. This signal is picked up by a pair of trailed electrodes connected to the detector. The Detector and receiving probes are normally aboard the repair ship, however, as they are portable, the detector may be operated from any locally available ship or launch. The received signal is processed and passed to the analogue front panel meter and chart recorder.

Normally, the Electroding Generator is located in the submarine cable terminal nearest to the survey or fault area. The Electroding Detector, Tinsley type 5916 is aboard the ship. When the ship is in the vicinity of the cable area, the Electroding Generator is powered thus applying the low frequency signal to the cable under test. At these frequencies, the field of the signal extends into the water surrounding the cable for a considerable distance.

The ship would normally steer a course to cross the cable on the landward side of the expected fault position. Before this position is reached, the ship launches the pair of electrodes which will then connect to the detector the electrostatic input terminals. The Detector is set (by thumbwheel switch) to the frequency being transmitted by the Electroding Generator on shore. As the ship crosses the cable, the field of the signal current on the cable induces a voltage difference between the two electrodes. This signal is then processed by the Electroding Detector and a deflection on the meter is registered. This may be recorded using the built-in chart recorder.

For identification purposes, the Electroding Generator may be keyed on and off periodically.

Once the cable signal has been identified and confirmed, the ship then follows the cable on a zigzag course until either the signal disappears or the point is reached where the fault has been calculated to be. When this happens, the fault or break has been located. Further probe runs may be made for a more precise fix of the fault position.

PRINCIPLE OF OPERATION USING MAGNETIC SENSORS

The 5917/5916 Probe and Detector System can be used either on land, or on the beach. The 5917D Divers Probe can also be used in up to 50 metres of water to locate submarine cables. A tone in the range of 16 Hz to 25 Hz is transmitted down the submarine cable by an Electroding Generator such as the Tinsley type 5915 unit. This signal is picked up by a Tinsley 5917 or 5917D Probe connected to the auxillary input of the 5916 Detector. The 5917 Beach receiving probe would normally be held by a person walking along the beach, however, as they are portable, the detector may be operated from any small boat or launch to search over shallow water. The 5917D would normally be held by a diver and would be connected to the 5916 in a boat/ship via an umbilical cable. It is suitable for use in depth up to 50 Metres. The received signal is processed and passed to the analogue front panel meter.

Normally, the Electroding Generator is located in the submarine cable Terminal Station nearest to the search area. When the Electroding Detector System is in the vicinity of the cable, the 5915 Electroding Generator is powered thus applying the low frequency signal to the cable under test. At these frequencies, the field of the signal extends into the land and water surrounding the cable for a considerable distance. Signals can be detected up to 20m away from the cables with a reasonable electroding current at 25Hz.

The person holding the 5917/5917D probe would normally walk/swim a course to cross the cable on the landward side of any expected cable fault position with the probe in its horizontal position at right angles to the cable.

The Detector is set (by thumbwheel switch) to the frequency being transmitted by the Electroding Generator. A frequency of either 16.7Hz or 25 Hz is recommended. As the detector crosses the cable, the field from the signal current in the cable induces a voltage into the probe. This signal is then processed by the Electroding Detector and a deflection on the meter is registered.

For identification purposes, the Electroding Generator may be keyed on and off periodically.

Once the cable signal has been identified and confirmed, the person then follows the cable on a zigzag course to plot the position of the cable, or until the signal disappears. When this happens, a fault or break has been located.

Further tests may be made for a more precise fix of the cable position by using the probe in a vertical orientation. In this case a null is registered when the probe passes exactly above the cable.

USING THE 5916 DETECTOR WITH ELECTROSTATIC SENSORS

- **Connecting up the receiving probes.**

  Two clean copper electrodes on the ends of two lengths of insulated cable make up the electrostatic sensor.

  These cables are connected to the red and black SIGNAL INPUT terminals with the green terminal as a screen (case earth).

  The Detector can be positioned in the stern of the ship with the probes directly connected, or more conveniently on the bridge if there is suitable stern to bridge cabling. The two electrodes are trailed at different lengths to give a displacement between the two electrodes roughly equivalent to the depth of water.

- **Setting the frequency.**

  Set the FREQUENCY thumbwheel switches to exactly the frequency that is required to be detected. This will normally be the same as that set on the Electroding Generator being used.

  In order to reject noise and unwanted signals the detector is very selective and no signal will be received unless the frequency is correctly set.

- **To detect the signal.**

  Sail the ship across the cable with the trailed electrodes in position, the amplitude of input signal will be shown on the meter. Use the GAIN switch to obtain a useful indication. The sensitivity can be changed by selecting positions 1 to 7. Position 5 is a useful starting point if no signal is present to start with. Please be aware that on the highest gain settings the instrument can be somewhat susceptible to other local signals (electrical noise) which may give rise to some flickering of the signal strength meter and printer output.

GAIN switch position	Approximate input signal a full scale indication
1	1000 microvolts rms
2	330 microvolts rms
3	100 microvolts rms
4	33 microvolts rms
5	10 microvolts rms
6	3 microvolts rms
7	1microvolts rms

The SIGNAL OVERFLOW indication will flash if the input to the Detector is too large. However, if this is caused by noise, that is input at any other than the frequency set on the thumbswitches, then the Detector may still give a useable indication of the required signal.

USING THE 5916 DETECTOR WITH THE 5917 MAGNETIC BEACH PROBE

- **CONNECTING UP THE RECEIVING PROBE**

  Plug the 5917 Probe into the auxiliary signal-input socket of the 5916 Detector.

  Details of the pin connections are given later for general information.

- **CHECKING THE BATTERY CONDITION**

  The state of the batteries can be checked by using the BATT+ and BATT- positions of the GAIN switch, both of which should give meter readings in the green band. If these readings are low then the batteries should be re-charged before using the Detector.

- **SETTING THE FREQUENCY**

  Set the FREQUENCY thumbwheel switches to exactly the frequency to be detected. This will normally be the same as that set on the Electroding Generator being used. In order to reject noise and unwanted signals the detector is very selective and no signal will be received unless the frequency is correctly set. Frequencies of, 16.7Hz or 25Hz are recommended.

- **DETECTING THE SIGNAL**

  Turn the 5916 unit on. N.B. the button in the handle of the 5917 Probe is for use with 5918 only.

  The level of input signal will be shown on the meter. Use the GAIN switch to obtain a useful indication. The sensitivity can be changed by selecting positions 1 to 7.

GAIN Switch position	Approximate input signal for a full scale indication
1	10 millivolts rms
2	3.3 millivolts rms
3	1 millivolts rms
4	330 microvolts rms
5	100 microvolts rms
6	30 microvolts rms
7	10 microvolts rms

The SIGNAL OVERFLOW indication will flash if the input to the Detector is too large. However, if this is caused by spurious intermittent signals, then the Detector may still give a useable indication of the required signal.

- **TESTING THE DETECTOR**

  The TEST button is used to inject a small test signal into the input of the Detector. This test signal is approximately 10 microvolt and so should give an indication of approximately 10 with the gain switch at position 7 or approximately 3 at switch position 6, however it will only be approximate.

USING THE 5916 DETECTOR WITH THE 5917D DIVERS MAGNETIC PROBE

- **The 5917D consists of:-**
  1 off 5932 Detector
  1 off 5931C1 Underwater Cable ordered separately, available in 50mm or 100m lengths.
  1 off 5917D-301 Tuning Box for 16.7/25Hz
  1 off 5917D-302 Leads from tuning box to 5916.

- **CONNECTING UP THE RECEIVING PROBE**

  Plug the 5932 Probe into the signal-input socket of the Tuning Box 5917D-301 using 5931C1/50m (or similar) cable connect the Tuning Box to the 5916 Detector using cable 5918D-302. Details of the pin connections on the 5916 auxiliary input are given later for general information.

- **CHECKING THE BATTERY CONDITION ON THE 5916**

  The state of the batteries can be checked by using the BATT+ and BATT- positions of the GAIN switch, both of which should give meter readings in the green band. If these readings are low then the batteries should be re-charged before using the Detector.

- **SETTING THE FREQUENCY**

  Set the FREQUENCY thumbwheel switches on the 5916 to exactly the frequency to be detected. This will normally be the same as that set on the Electroding Generator being used.

  In order to reject noise and unwanted signals the detector is very selective and no signal will be received unless the frequency is correctly set. Frequencies of, 16.7Hz or 25Hz are recommended.

  Set the Tuning Box to the correct frequency 16.7Hz or 25Hz.

- **DETECTING THE SIGNAL**

  The level of input signal will be shown on the meter. Use the GAIN switch to obtain a useful indication. The sensitivity can be changed by selecting positions 1 to 7 Position 5 is suggested as an initial setting if no signal is detected.

GAIN Switch position	Approximate input signal a full scale indication
1	10 millivolts rms
2	3.3 millivolts rms
3	1 millivolts rms
4	330 microvolts rms
5	100 microvolts rms
6	30 microvolts rms
7	10 microvolts rms

  The SIGNAL OVERFLOW indication will flash if the input to the Detector is too large. However, if this is caused by spurious intermittent signals, then the detector may still give a usable indication of the required signal.

- **Testing the Detector**

  The TEST button is used to inject a small test signal into the input of the Detector. This test signal is approximately 100 microvolt and so should give an indication of approximately 10 with the gain switch at position 5 or approximately 3 at switch position 4 however it will only be approximate.

POWER SUPPLY

The 5916 Detector includes its own battery supply within the case and it is recommended that this is used when working with very small input signals so that noise is not introduced from external supplies.

Switch on the 5916 with the panel switch (1 = ON, 0 = OFF) and the red On light will come on indicating that the detector is ready for use.

The state of the batteries can be checked by using the BATT+ and BATT- positions of the GAIN switch, both of which should give meter readings in the green band. If these readings are low then the batteries should be re-charged before using the Detector.

To charge the batteries a mains POWER INPUT is provided. When mains are applied the green CHARGE light will come on indicating that the battery charging voltage is present.

The Detector can be switched on or off as required while the batteries are being charged, but the lid should be left open. The batteries should be fully charged within 14 hours. If they do not charge then check the two BATT fuses on the front panel.

- **USING THE CLOCK TIMER**

  The clock/timer is provided to help synchronise detected events e.g. to give elapsed time before or after detecting a signal.

- **USING THE CHART RECORDER**

  The chart recorder operates when the CHART SPEED switch is set to position 1, 2 or 3.

  These correspond to speeds of approximately 12, 24 or 48 inches per hour. On position 2 a roll of chart paper will last about 15 hours.

  The chart recorder indication will be the same as the meter indication.

  The EVENT MARKER button can be used to make a tiny mark on the right of the chart. This can be used to synchronise the chart recording to any required event.

  The yellow EVENT OUTPUT terminals give a relay contact closure each time the EVENT MARKER button is pressed. This can be used to signal an event to the bridge if the Detector is being used in the stern.

  Full details of changing the chart recorder paper etc. are shown on page 11 & 12.

  Using an external chart recorder.

  An external chart recorder may be used from the blue RECORDER OUTPUT terminals which gives an output of approximately 1 volt corresponding to full scale reading on the meter.

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5916 SPECIFICATION

Frequency Range	4Hz to 40Hz in increments of 0.1Hz thumbwheel selection. Built-in test oscillator.
Detector Bandwidth	0.5Hz
Sensitivity	1uV RMS for full scale deflection. Electrostatic input. 10µV rms for full scale deflection. Auxillary input.
Input Impedance - electrostatic input	Balanced low impedance inputs
Input Impedance - auxillary input	10kΩ
Auxiliary Input	Connector 7 way DIN Socket
Electrostatic Input	Connector 4mm Terminals
Power	Built-in rechargeable batteries having life of over 5 hours of continuos use.
	Mains supply, single phase, 115V to 230V AC
Display	Analogue meter with battery and signal test.
Event Timing	Front panel Digital Elapsed Timer and Clock
Recorder	Chart recorder.
Event Marker	Event marker button is incorporated on the front panel for marking the recording chart and relay closure for external Event signal.
Distance Range Electrostatic Probe Input	Typically 180 metres (100 fathoms) but depths of up to 300 metres could be possible. However, this is limited by external factors:-
	e.g. :- Signal to noise ratio and attenuation of cable and the lateral distance at which the ship is operating away from the cable.
Distance Range 5917/5917D Magnetic Input	Up to 20m, However limited by external factors:- eg: signal to noise ratio and attenuation of tone in cable.
Size	Portable self-contained splashproof IP65 case (When case is closed) 470 by 360 by 175 mm.
Weight	Approximately 15 Kg.

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GENERAL INFORMATION

THERMAL PRINTER GENERAL DESCRIPTION

The Print Mechanisms incorporates a thermal printhead with dots arrayed in a single line across the width of the paper. The mechanism holds a supply roll of 4.5" wide thermal paper and moves the paper past the printhead in steps of approximately .005 inch. The print mechanism steps the paper can be printed.

PAPER LOADING

A paper sensor in the printer provides signals that are used by the 5916 to stop printing when paper runs out and requires a new paper roll. To load the printer, be sure the power is on and insert the paper end into the slot behind the rubber platen with the sensitive side (outside on the roll) away from the platen. When the paper is inserted, the platen will run, pulling about 2 inches of paper through. On print mechanisms equipped with a head lift tab, you may install paper by lifting the printhead and inserting the paper manually.

THERMAL PAPER

We recommend using B-G Instruments' type TP-4 thermal paper in the 5916 Print Mechanism. This paper produces a stable black on white image. Unlike some waxy coated papers, it does not stick to or-cause material to build-up on the printhead. TP-4 is a 4.5 inch wide, high quality facsimile grade paper that can produce high resolution permanent copy in the 5916 printer. It is available from B-G Instruments in cartons of 24 rolls.forward, pausing after each step to heat selected dots. In this manner graphic data

CONECTIONS AND FUSES