KT-20 Magnetic Susceptibility/Conductivity/IP-Resistivity Meter

KT-20 S/C Scan Mode

3F-32 Large Diameter Sensor

IP/Resistivity Sensor & Sample Holder

Outcrop Measurements

The KT-20 is a handheld instrument capable of measuring the magnetic susceptibility, conductivity, chargeability, resistivity and density of a sample. Its modular design provides users the ability to employ different sensors of optimal frequencies for either magnetic susceptibility or conductivity measurements. The sensors are available in circular and rectangular designs and can easily be interchanged allowing the KT-20 to measure smaller or larger sized samples or cores. The KT-20 also has an IP/resistivity sensor to measure the chargeability and resistivity of a sample. Additionally, density measurements are available as an option, providing more information about the sample. A picture, audio note, text note and GPS coordinates can be added to the measurements to increase the amount of information one can attach to each record.

Benefits:

- Various models to choose from: dedicated magnetic susceptibility, conductivity, or IP/Resistivity systems, as well as combined units.
- Interchangeable dual- and single-frequency sensors in circular and rectangular designs.
- High Sensitivity for magnetic susceptibility (1 x 10^{-7} SI) and conductivity (0.1 S/m).
- IP/Resistivity System to measure the chargeability and resistivity of a sample.
- Density measurements (optional).
- 3F-32 Triple-Frequency Large Diameter Sensor.
- Data profiles displayed in real-time while scanning.
- Built-in high resolution camera to capture pictures of samples.

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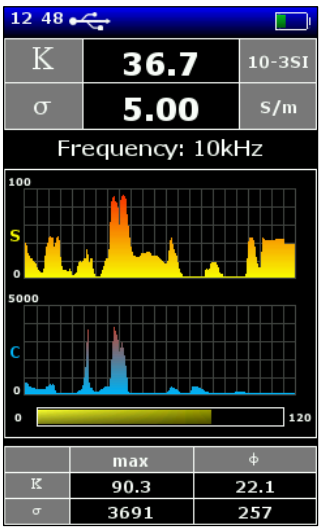
Additional benefits include:

- Integrated GPS to record location coordinates.
- Review data records directly on the display.
- Split and full core corrections for standard drill rod diameters (AQ, BQ, HQ, NQ and PQ) and non-standard sizes (2.4 to 12 cm).
- Borehole logging mode to correlate measurement results to their depths.
- Data running average and standard deviation values displayed during individual measurements.
- Built-in microphone and speaker.
- GeoView 2 Data Management and Visualization Software.
- Upgrades and support available via the internet.



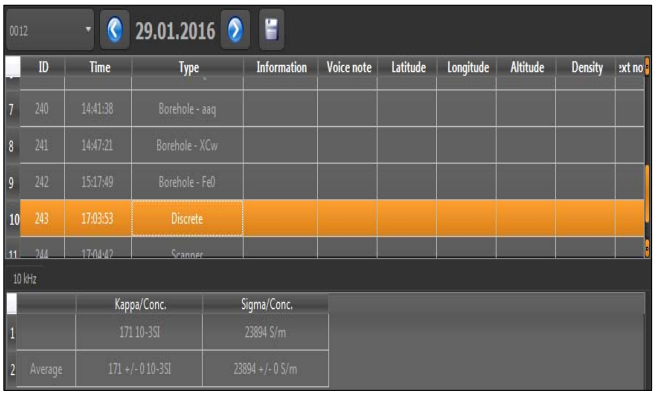
KT-20 S/C Data Profile

GeoView 2 Software

GeoView 2 is an easy-to-use data management and visualization software program that is compatible with all Windows operating systems.

It enables users to download, store and view a KT-20 meter's data on a PC and export it to Excel. Data is organized by date, or by instrument serial number when there are data from multiple instruments. Additional information collected can also be viewed in GeoView 2, including averaged readings, standard deviation, text notes, voice notes, pictures and GPS coordinates.

GeoView 2 is also a data visualization tool. Numerical values from discrete measurements are displayed in a table format; data from scanned and borehole mode measurements are displayed as a graph. Furthermore, data from the borehole mode will show measurements from specific depths.



Discrete Measurements

Borehole Mode Measurements

Induced Polarization (IP) / Resistivity / Conductivity System

The KT-20 IP is an induced polarization and resistivity measuring system that displays decay curves, chargeability and resistivity parameters in real-time. It can also measure the conductivity of a sample using either a dual- or single-frequency sensor (sensor is not included with the KT-20 IP and is sold separately).

The KT-20 IP is available in two models: **Standard and Pro**.

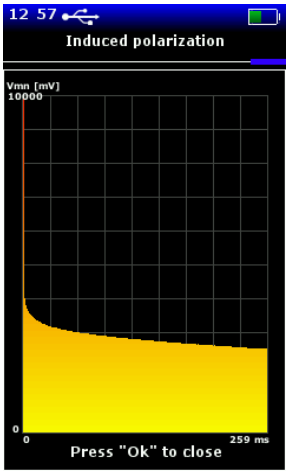
The KT-20 IP **Standard** calculates total chargeability (M x) using the traditional 20 windows method and Mx Fit. Mx Fit is an algorithm that measures total chargeability over the same time period, but uses several thousand windows instead of 20. The purpose of Mx Fit is to provide increased accuracy and confidence in the measurements.

The KT-20 IP **Pro** enables users to analyze decay curves with up to 16,000 data points for any measurement time. Through these data points the decay curve is studied to calculate total chargeability (M x) and initial chargeability (M ip). Users are also able to customize their own chargeability windows (M User) and time periods (t1 and t2).

Additionally, an extra early delay time, as fast as 2 ms after turn-off, allows KT-20 IP Pro users to collect data much earlier than before. This early time IP data provides geophysicists with new capabilities to improve their interpretation.

The system consists of a KT-20 console, IP sensor (includes transmitter and receiver electronics) and a sample holder. It can be used as a dedicated instrument, or integrated into any existing KT-20 console.

KT-20 Console with IP/Resistivity Sensor (includes Tx-Rx Electronics) and Sample Holder

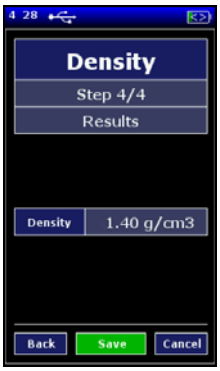


Decay Curve

Density Measurements

Density Measurement: Sample in Air

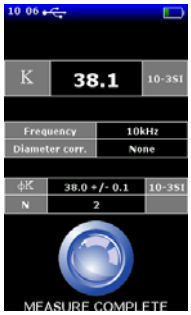
Density Measurement: Sample Submerged in Water



Density Measurement Results

KT-20 Models

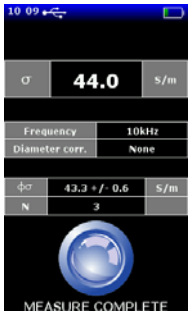
KT-20 Magnetic Susceptibility Meter



KT-20 Measurement Screen

- Maximum Sensitivity: 10^{-7} *(using 10 kHz single- frequency sensor without pin)*
- Maximum Range: 2 SI units
- "Plus" upgrade for iron ore (optional):
  - Increase measurement range to 10 SI units
  - Iron ore concentration estimates (%) directly from the display based on calibration curve for magnetite

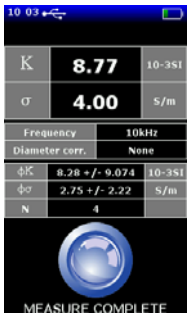
KT-20 C Conductivity Meter



KT-20 C Measurement Screen

- Maximum Sensitivity: 0.1 S/m *(using 100 kHz dual-frequency sensor without pin)*
- Measurement Range: 0.1 to 15,000 S/m *(using 100 kHz dual-frequency sensor)*
  1.0 to 100,000 S/m *(using 10 kHz frequency)*
- Absolute conductivity meter, calibrated using multi-point algorithm
- "Cx" upgrade to increase measurement range to 200,000 S/m (optional)
  - Note: Cx option is only available with 1 kHz and 10 kHz frequencies.

KT-20 S/C Magnetic Susceptibility/Conductivity Meter



KT-20 S/C Measurement Screen

- Maximum Sensitivity:
  - Magnetic susceptibility: 10^{-7} *(using 10 kHz single-frequency sensor without pin)*
  - Conductivity: 0.1 S/m *(using 100 kHz dual-frequency sensor)*
- Measurement range:
  - Magnetic susceptibility: 2 SI units
  - Conductivity: 0.1 to 15,000 S/m *(using 100 kHz dual-frequency sensor)*
    1.0 to 100,000 S/m *(using 10 kHz frequency)*
- Absolute conductivity meter, calibrated using multi-point algorithm
- "Plus" upgrade for iron ore (optional):
  - Increase measurement range to 10 SI units
  - Iron ore concentration estimates (%) directly from the display based on calibration curve for magnetite
- "Cx" upgrade to increase measurement range to 200,000 S/m (optional)
  - Note: Cx option is only available with 1 kHz and 10 kHz frequencies.

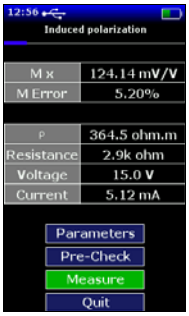
KT-20 models section continues on the following page…

KT-20 Models

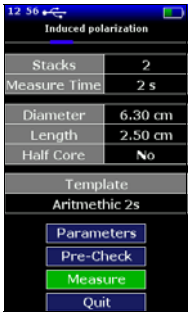
KT-20 IP Induced Polarization / Resistivity / Conductivity System

Standard Model

- Chargeability calculated using 20 windows, using arithmetic, logarithmic, semi-logarithmic and Cole-Cole plotting options
- Chargeability also calculated using the Mx Fit, an algorithm that uses several thousand data points for greater accuracy
- Resistivity and resistance measured
- Automatic voltage and current calibration
- Total Tau
- Absolute conductivity meter, calibrated using multi-point algorithm (A dual- or single-frequency sensor is required to measure conductivity. Sensor is not included with the KT-20 IP and is extra)



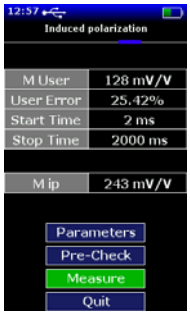
Standard & Pro



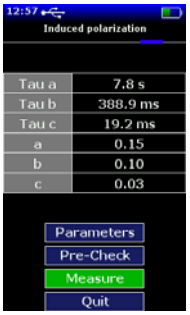
Standard & Pro

Pro Model

- Full waveform decay curve analysis using 16,000 data points
- Initial chargeability (M ip) calculated
- Decay analysis starting 2ms after switch off
- Chargeability calculations from user defined time intervals (M User)
- 3 time constants (Tau) calculated
- 3 exponential decay models
- Raw data recording



Pro Only



Pro Only

Sensors

- Multiple sensors available, including single-, dual- and triple-frequency sensors for magnetic susceptibility or conductivity measurements, and an IP/resistivity system to measure chargeability and resistivity.
- State-of-the-art design enables sensors to be easily interchanged.
- Circular and rectangular sensor designs to adapt the KT-20 to large and small sized samples (note: 10 kHz single-frequency sensor is only available in a circular design).
- 10 kHz single-frequency sensor includes a pin for measuring rough or uneven surfaces.
- Each KT-20 model requires one sensor for operation. Multiple sensors can be purchased with the KT-20 or added afterwards.

Circular and Rectangular Sensor Designs

1 / 10 kHz Dual-Frequency Sensor		
Operating Frequencies	1 kHz	10 kHz
Magnetic Susceptibility Sensitivity	1 x 10^{-5} SI	1 x 10^{-6} SI
Conductivity Sensitivity	21.3 S/m	1 S/m
Magnetic Susceptibility Measurement Range	0.01 x 10^{-3} to 1999.99 x 10^{-3} SI	0.001 x 10^{-3} to 1999.99 x 10^{-3} SI
- Extended Range (Plus Option)	*0.01 x 10^{-3} to 9999.99 x 10^{-3} SI*	*0.001 x 10^{-3} to 9999.99 x 10^{-3} SI*
Conductivity Measurement Range	21.3 to 100,000 S/m	1 to 100,000 S/m
- Extended Range (Cx Option)	*21.3 to 200,000 S/m*	*1 to 200,000 S/m*
Benefits	▪ Reduces the influence of a sample's conductive properties on magnetic susceptibility measurements. ▪ Linear conductivity measurements	▪ Provides a sensitivity of 1 x 10^{-6} SI for magnetic susceptibility.
Sensor Designs	Rectangular or Circular	

10 / 100 kHz Dual-Frequency Sensor		
Operating Frequencies	10 kHz	100 kHz
Magnetic Susceptibility Sensitivity	1 x 10^{-6} SI	-
Conductivity Sensitivity	1 S/m	0.1 S/m
Magnetic Susceptibility Measurement Range	0.001 x 10^{-3} to 1999.99 x 10^{-3} SI	-
- Extended Range (Plus Option)	*0.001 x 10^{-3} to 9999.99 x 10^{-3} SI*	-
Conductivity Measurement Range	1 to 100,000 S/m	0.1 to 15,000 S/m
- Extended Range (Cx Option)	*1 to 200,000 S/m*	-
Benefits	▪ Provides a sensitivity of 1 x 10^{-6} SI for magnetic susceptibility.	▪ Provides a sensitivity of 0.1 S/m for conductivity measurements.
Sensor Designs	Rectangular or Circular	

Sensor section continues on the following page…

10 kHz Single-Frequency Sensor		
	Without Pin	With Pin
Operating Frequency	10 kHz	10 kHz
Magnetic Susceptibility Sensitivity	1 x 10^{-7} SI	1 x 10^{-6} SI
Conductivity Sensitivity	1 S/m	10 S/m
Magnetic Susceptibility Measurement	0.0001 x 10^{-3} to 1999.99 x 10^{-3} SI	0.001 x 10^{-3} to 1999.99 x 10^{-3} SI
- Extended Range (Plus Option)	*0.0001 x 10^{-3} to 9999.99 x 10^{-3} SI*	*0.001 x 10^{-3} to 9999.99 x 10^{-3} SI*
Conductivity Measurement Range	1 to 100,000 S/m	10 to 100,000 S/m
- Extended Range (Cx Option)	*1 to 200,000 S/m*	*10 to 200,000 S/m*
Benefits	▪ Provides high sensitivity (1 x 10^{-7}) for magnetic susceptibility measurements.	▪ Pin enables sensor to measure samples with rough or uneven surfaces
Sensor Design	Circular Only	

3F-32 Large Diameter Sensor			
Operating Frequencies	1 kHz	10 kHz	100 kHz
Measurement Frequency:	- 4 Readings per second in stationary mode - 10 Readings per second in scan mode		
Magnetic Susceptibility Sensitivity	1 x 10^{-5} SI	1 x 10^{-6} SI	1 x 10^{-5} SI
Conductivity Sensitivity	1 S/m	0.1 S/m	0.05 S/m
Magnetic Susceptibility Measurement Range	0.01 x 10^{-3} to 1999.99 x 10^{-3} SI	0.001 x 10^{-3} to 1999.99 x 10^{-3} SI	0.01 x 10^{-3} to 1999.99 x 10^{-3} SI
Conductivity Measurement Range	1 to 10,000 S/m	0.1 to 10,000 S/m	0.05 to 10,000 S/m

Induced Polarization (IP)/Resistivity Sensor	
Parameters Calculated and Displayed	Chargeability, Error, Apparent Resistivity, Current, Voltage, Resistance
Chargeability Resolution	10 µV/V
Chargeability Precision	0.2%
Voltage Resolution	10 µV
Current Sensitivity	10 µA
Transmitter:	
Signal Waveform	Time Doman (ON+, OFF, ON-, OFF)
Pulse Duration	0.5, 1, 2, 4 and 8 seconds
Current	Maximum 150 mA (electronically fused)
Voltage	6V and 15V DC
Contact Resistance:	50Ω to 5MΩ:
	- 50Ω to 2MΩ @ 6V DC
	- 100Ω to 5MΩ @ 15V DC
Voltage and Current Calibration	Automatic
Receiver:	
Voltage Resolution	10 µA
Current Resolution	10 mA
Early Delay Time	2 ms (Pro model only)

Options

Additional Sensors

Various sensors are available for the KT-20, including dual- and single-frequency sensors, the 3F-32 triple-frequency large diameter sensor (pictured right), and the IP/resistivity sensor to measure the chargeability and resistivity of a sample. Each sensor can be purchased with a KT-20 or added afterwards.

3F-32 Sensor

Instrument Upgrades

Plus Option for Magnetic Susceptibility Measurements:

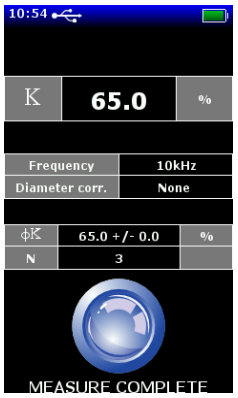
- Increase measurement range to 10 SI units.
- Iron ore concentration estimates (%) directly from the display based on a calibration curve for magnetite (pictured right).

Cx Option for Conductivity Measurements:

- Increase measurement range to 200,000 S/m *(only available for 1 kHz and 10 kHz frequencies)*

Pro Option for Induced Polarization/Resistivity Measurements:

- Full waveform analysis up to 16,000 data points
- Initial chargeability (M ip) calculated
- Decay analysis starting 2 ms after switch off
- Chargeability calculation from user defined interval
- Raw data recording
- 3 time constants (Tau) calculated
- 3 exponential decay models



Plus Option

Density Scale Assembly:

- Enables the KT-20 to measure the density of a sample through water displacement. Density scale assembly includes a tensiometer, sample holder and water containment bag.

Bar Code Scanner:

- Enables the KT-20's built-in high resolution camera to read bar codes to improve archiving.

Accessories

Carrying Pouch

- To store and protect a KT-20 console and one sensor while not in use (pictured right).

Carrying Pouch

Pads

Magnetic Susceptibility Calibration Pads

Two calibration pads with low or high susceptibility values are available to verify the KT-20's magnetic susceptibility measurements. They can also be used to recalibrate magnetic susceptibility readings. A test certificate is provided with calibration pad confirming its parameters.

	Low	High
Approximate Nominal Susceptibility Values: *(values will vary between pads)*	34 x 10^{-3} SI Units	2500 x 10^{-3} SI Units
Diameter:	145 mm	145 mm
Height:	70 mm	70 mm
Weight:	2.65 kg	2.65 kg
Colour	Orange	Blue

Magnetic Susceptibility Calibration Pads

Conductivity Reference Pads

Three reference pads are available to verify the KT-20's conductivity measurements. These reference pads are available with low, medium or high conductivity values. Each pad has been independently tested using different methods for measuring conductivity (AC, DC and impedance bridges). A test certificate is provided with each reference pad confirming its parameters.

	Low	Medium	High
Approximate Nominal Conductivity Values: *(values will vary between pads)*	9 S/m	700 S/m	85,000 S/m
Diameter:	152 mm	128 mm	152 mm
Height:	50 mm	50 mm	50 mm
Weight:	1.2 kg	1.0 kg	1.8 kg
Colour:	Red	Yellow	Green

Conductivity Reference Pads

IP-T10 Reference Pad

The IP-T10 is a dedicated reference pad for the KT-20 IP to verify the instrument's various measurement parameters. The IP-T10's housing is shaped like a core sample, and is made from polished granite to minimize the influence of any surface contamination. Relative precision of the reference pad is +/- 1% at 20°C. A test certificate is provided with each IP-T10 confirming its parameters. Results are based on one second ON/OFF, using 6V.

Total Chargeability (Mx Fit): *(values will vary between pads)*	17 mV/V
Initial Chargeability (M ip): *(measurement available in Pro model only)*	96.5 mV/V
Resistance:	101 kOhm
Total Tau (Discharging Time Constant):	220 ms
Maximum Voltage:	Up to 50V
Dimensions:	60 mm (length); 70 mm (diameter)
Weight:	700 g

IP-T10 Reference Pad

Specifications

KT-20 Hardware Specifications	
Memory:	4 GB
Data Input/Output:	USB and Bluetooth
Power Supply:	2 x Li-Ion Rechargeable Batteries
Operating Temperature:	-20°C to 60°C
Display Dimensions:	76 x 47 mm
Display Resolution:	400 x 240 pixels
Circular Sensor Dimensions:	66 mm
Rectangular Sensor Dimensions:	66 (L) x 40 (W) mm
Rating:	IP65
Maximum Sample Weight for Density Measurements:	1.0 kg
Size:	260 x 72 x 60 mm
Weight:	0.60 kg
Internal GPS Accuracy:	2.0m
Internal GPS Receiver Satellite Accessibility:	SBAS (WAAS, EGNOS, MSAS)
Built-in Camera :	2 Mega Pixels

Specifications are subject to change without notice (June 6, 2017)

Instrument Configurations & Contents

KT-20, KT-20 C & KT-20 S/C

Standard System Include:

(1) KT-20 Console
Including:
- Digital Camera
- Transreflective Colour Display
- Internal GPS Receiver

(2) Rechargeable Li-Ion Batteries with Charger
(1) Dual- or Single-Frequency Sensor
(1) USB Cable
(1) GeoView 2 Software CD
(1) Operations Manual with Quick Start Guide
(1) Rugged Transportation Case

KT-20 IP S/C Standard & KT-20 IP S/C Pro

Standard Systems Include:

(1) KT-20 IP S/C (Standard or Pro Model) Console
Including:
- Digital Camera
- Transreflective Colour Display
- Internal GPS Receiver

(2) Rechargeable Li-Ion Batteries with Charger
(1) IP/Resistivity Sensor (includes Tx-Rx electronics)
(1) IP/Resistivity Sample Holder and Accessories
(1) Dual- or Single-Frequency Sensor
(1) USB Cable
(1) GeoView 2 Software CD
(1) Operations Manual with Quick Start Guide
(1) Rugged Transportation Case

Note: Other configurations are available, including the KT-20 IP Dedicated IP/Resistivity/Conductivity Measuring System.