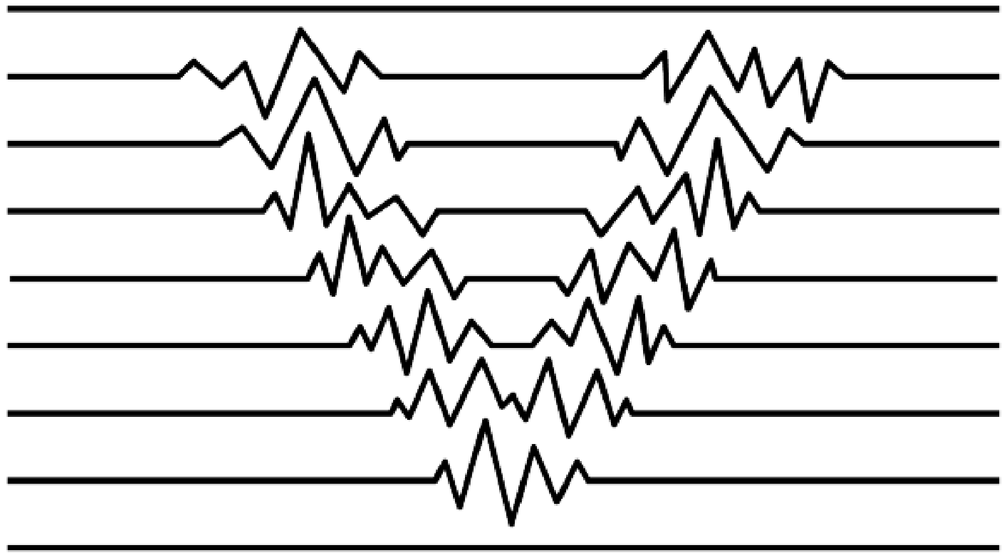
New Realms In Classic Seismic Instrumentation

KINEMETRICS



SPIN

MONITORING A RESTLESS EARTH

"**SPIN** : **S** eismological **P** arameters and **In** strumentation"

52 YEARS OF EXCELLENCE

 |

Edelvays Spassov
Kinemetrics Inc.

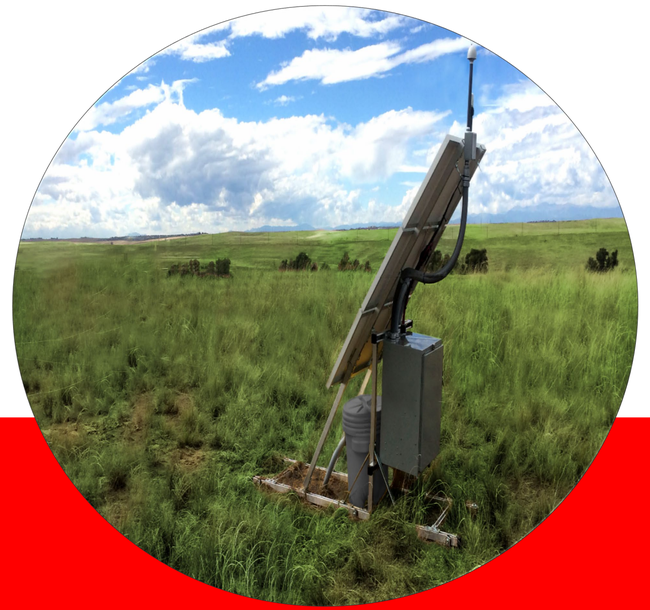
KINEMETRICS – MORE THAN JUST GOOD INSTRUMENTS

Established in **1969**, Kinemetrics & its subsidiaries have been the global market leaders in designing technologies, products, and solutions for monitoring seismic events and their effects on people and structures.

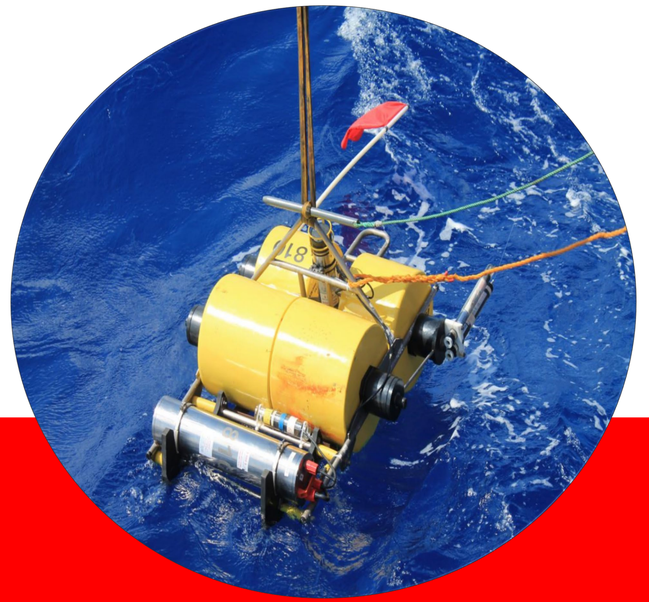
Kinemetrics offer the least expensive **Total Cost of Ownership** (TCO), with not only the initial cost of purchase, but also the accumulated costs of non-fault operation, maintenance, troubleshooting, repair and related sites visits and **no loss of data** due to equipment failure.

KINEMETRICS' PRODUCTS EVERYWHERE!

We are the only company with over 50 years on the market, the only company, which very successfully operates 450 stations critical operations network since 2012, and the only company with sensor on **Mars.**



Land



Sea

Space

KINEMETRICS IN SPACE

NASA InSight Lander reached Mars on November 26, 2018 and started recording continuously from Sol4

SP was switched on also during the flight and the horizontal sensors recorded “ambient” noise - the lowest noise possible

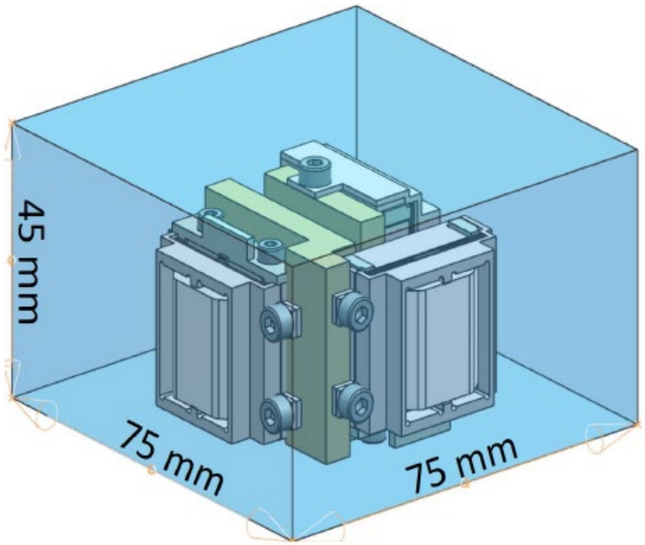
Although called Short-Period, it’s a wideband 10 s – 100 Hz seismometer

Rugged, designed to withstand takeoff & landing accelerations, strong flight vibrations, as well high cosmic radiation

Designed to operate at -65 degrees Celsius and with 15 degrees tilt

More Instruments To Send in Space!

The Lunar Seismic Package (LSP) evolved from the InSight Short Period (SP) seismic sensor and Back End Electronics (BEE). Planned to land on the **Moon**.



LSP Sensor Package Optimization for Lunar Missions:

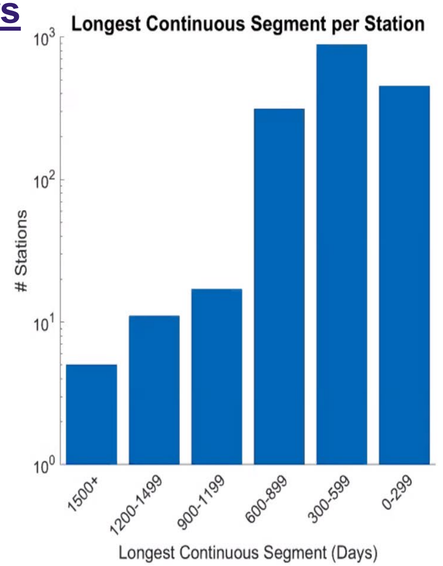
- Triaxial, Identical Sensors
- Lower noise than InSight SP
- Enhanced Calibration
- Sensor head, proximity electronics and magnets can be packed in ~50 mm cube
- ~650 g for sensor+feedback (triaxial)
- 360 mW for sensor+feedback (triaxial)
- Does not require leveling in lunar gravity

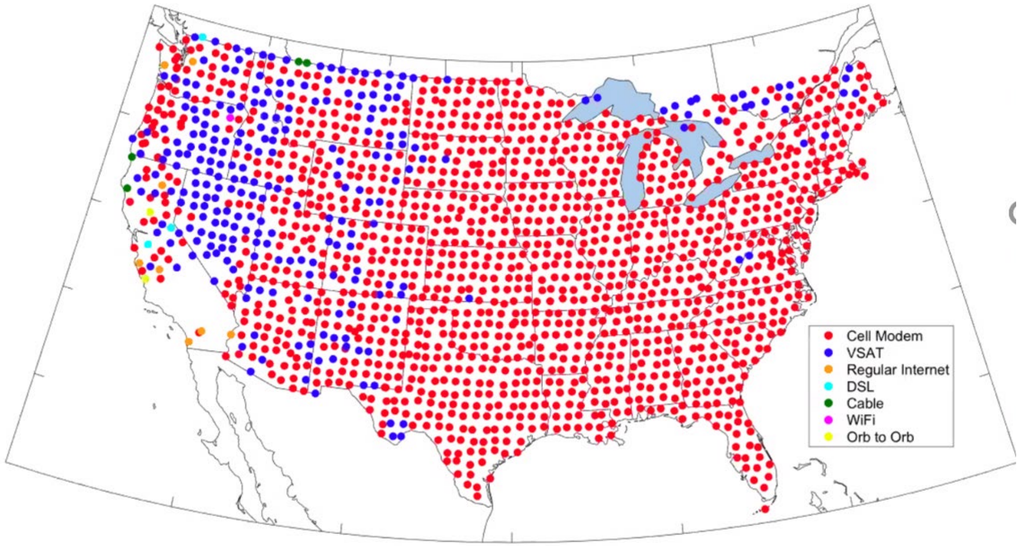
Kinemetrics Digitizers - NO Data Gaps

USArray Data Continuity

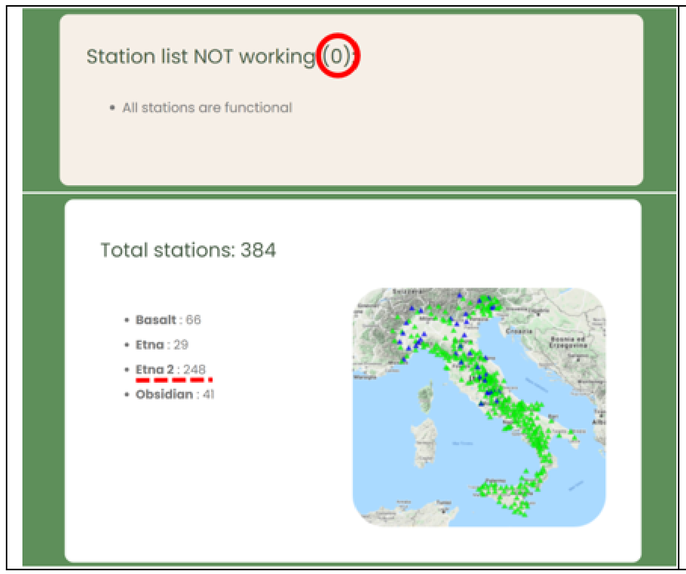
1,800 stations over 12 years

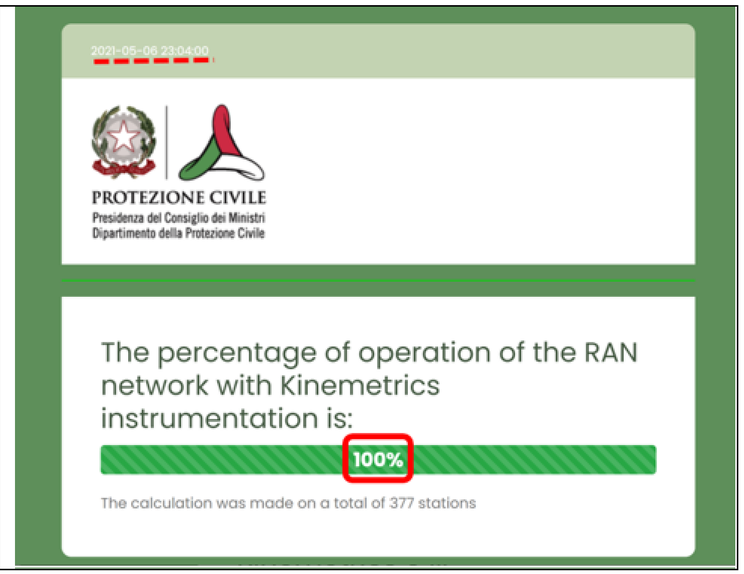
- 99.7% data return
- longest contiguous time series 1827.6 days (~5 years),
- median 416.8 days





Kinemetrics operate the DPC network, known as RAN (*Rete Accelerometrica Nazionale*- (***ran.protezioneciviille.it***)) since 2012 consisting of **450 seismic stations** connected in real-time to the DPC data center in Rome often with 100% station availability.





Amazing Progress Since 1990

52 YEARS OF EXCELLENCE

2020

More than 7,000 units in the field!

The newest “Q8”, on top of the Pile:

- Samples 20 × the data rate
- Stores 1000 × the data
- In a volume 50 × smaller
- Consumes 100 × less power
- Compared to“Q680” data system of 1990 (bottom)

a combined factor **100,000,000 x**“better” than the systems of 1990.

1990

KINEMETRICS

New Q8 & Pebble Digitizers

What Is Q8?

- Feature-packed, higher-performance Ultra Low Power replacement of Q330!
- Web-based operation and control – no cable required
- WiFi, Ethernet and Mesh communication interfaces
- Multiple (4) High-Integrity Storage Media (internal 32GB eMMC plus internal and removable USB flash drives and an internal SD card up to 256GB)
- Universal serial sensor interface
- GNSS timing or external timing (PTP) via RS-485
- Streaming low-latency (<1s) data packets for EEWS applications
- Antelope & Seedlink compatibility

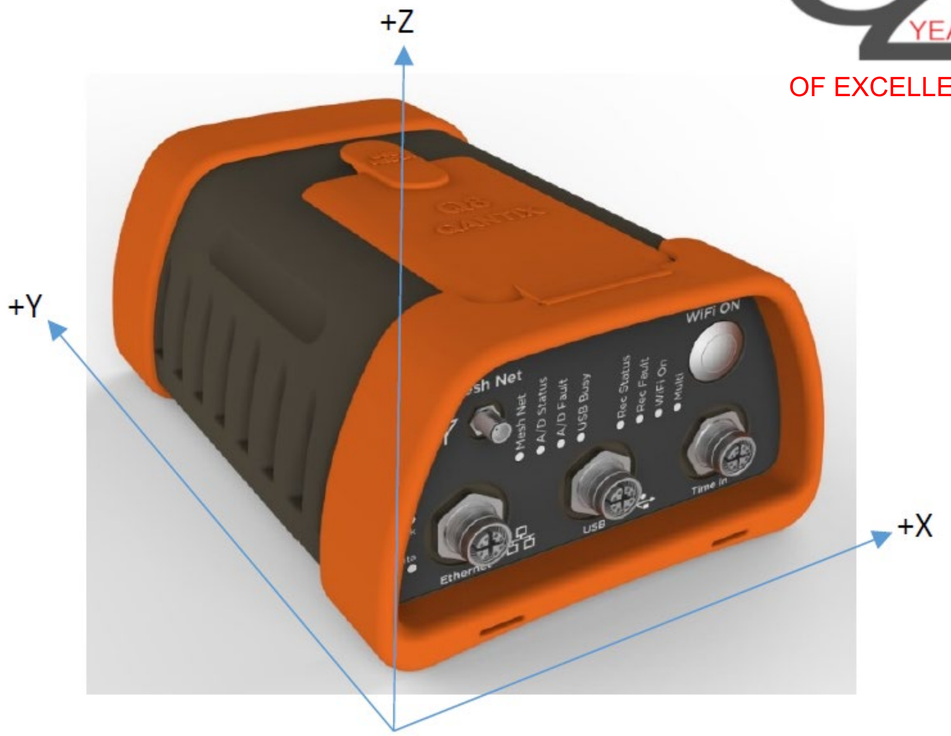
WiFi ON Button

This button is the main user control and performs 3 functions: In cycled recording mode, a brief (~½ sec) press will power up the recorder and activate the WiFi AP. If the recorder is powered, and the WiFi is off, a brief press will turn on the WiFi. If the WiFi is already on, a brief press will power down the recorder.

Q8 employs an 8-th generation (hence the name, Q8) "floating point" ADC converter, not limited to 32-bits.

Selected Unique Features

- **4 x real-time telemetry options**: Q8's native "Q660 Protocols", Seedlink, and BRTT Antelope, QSCD2.0.
- **4 x "archival" devices** available: SD card, eMMC, internal USB drive, and external USB drive. In addition, the "Deep Packet Buffer" may be stored in RAM or on the SD card
- A **built-in accelerometer** with resolution level ~1mg, can also be used as a tamper detector, orientation detector (tip/tilt) and/or with the "wake on shake" function.
- "**Wake on Shake"** function. This wakes the system if the internal accelerometer exceeds a specified threshold, if unit is in cycled operation mode.
- "**High Resolution"** mode combines all 6 physical A/D channels to provide 3 data channels with an improvement of roughly 3dB dynamic range and 10-20dB reduction in low-frequency thermal drift.
- Supports packetization with less than 1s time intervals - **"low-latency"** data to provide data with minimal delay. These data are transmitted in addition to the standard 1s packetized data.



Accelerometer Orientation & Configuration

New Pebble Digitizer/Datarecorder

2.5” thick, 3” tall, 5.8” wide

USB, SD Card & Console Connector

The New OMNI Sensor - Features

52 YEARS OF EXCELLENCE

All internal sensors are mutually aligned, and no mass lock or mass centering are necessary. The cable is Y-terminated at the surface to be used with a 6-channel digitizer: best matched with Q8, Q330S+ and Obsidian8X datalogger.

Selected Episensor Features

- Low noise
- Extended bandwidth - DC to 200Hz
- User-selectable full-scale range (at time of order)
- Calibration coil (standard)
- Double-stage transient protection

Selected MBB-2 Features

- No mass lock required
- No mass centering required
- Small, portable, 120 second (to 160 Hz) broadband sensor
- Large operational tilt range
- Sensitivity of 1,500 V/(m/s)

OMNISensor Installation Tools

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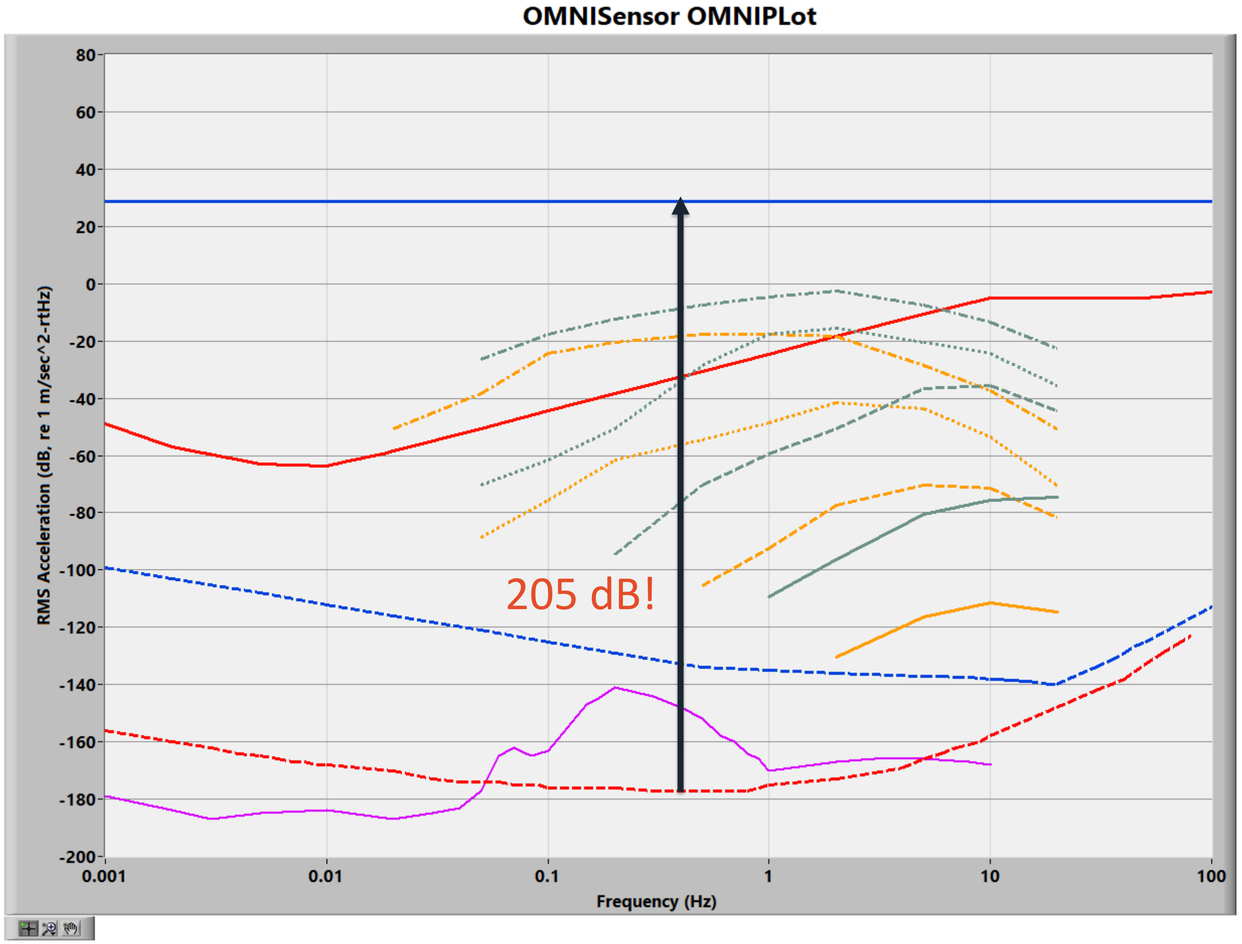
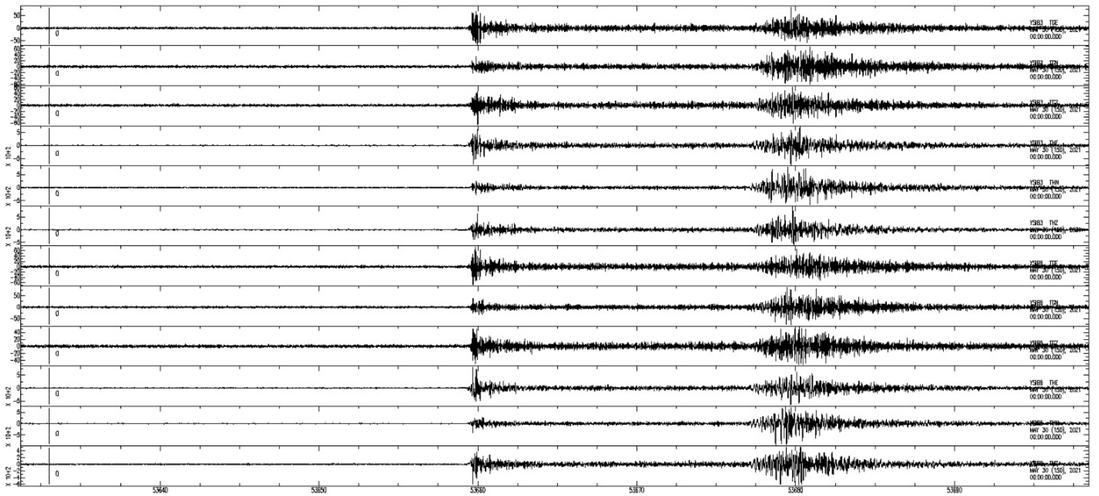
New OMNI Sensor – Dynamic Range



Test Measurements at 300 m (top 6 traces) & 600 m depth at Yeonsei University, South Korea of a M = 2.4 Korea event on 05/30/2021 (top 3 traces from BB seismometer)



The OMNISensor covers more than 220 dB velocity dynamic range (205 dB acceleration) in one watertight enclosure, with one marine connector, one cable, for posthole and borehole installations. No earthquake of interest will be too small to be lost or too large to be off scale.

Headquarters, Corporate, Kinemetrics, Pasadena, California – USA
Headquarters, Quanterra, Harvard, Massachusetts – USA
Headquarters, Metrozet, Los Angeles, California – USA
Headquarters, BRTT, Boulder, Colorado – USA
Network Operation, Denver, Colorado – USA

Headquarters, Streckeisen, Pfungen – Switzerland
Office in Switzerland
Training Center, Vienna – Austria
Network Operation, Italy

Office in Japan

Office in Abu Dhabi
Network Operation, Abu Dhabi
Network Operation, Saudi Arabia

Network of over 60
representatives worldwide

Thank You!

KINEMETRICS

Address
Kinemetrics
222 Vista Avenue
Pasadena, CA 91107

Phone & Fax
Direct Line: +1-626-795-2220
Fax: +1-626-795-0868
sales@kmi.com

Social Media
facebook.com/osskinemetrics
twitter.com/osskinemetrics
linkedin.com/company/kinemetrics