MetroCount®
Traffic Data Specialists

MC5710 Installation Guidelines

MC5700 Series RSUs

October 2005

MC5710 Installation Guidelines

Overview

The MetroCount 5710 is a two-channel vehicle classifier, designed for use with piezo-electric axle sensors. The MC5710 uses the same time-stamped raw data format used by MetroCount's other vehicle classifiers, providing a high degree of accuracy, and the array of analysis tools provided by MCReport.

MC5710 with Measurement Specialties BL Piezo Sensor

Piezo-electric material has the practical property of generating a charge when a force is applied. A strip of piezo-electric material can be used as a highly sensitive axle sensor, either temporarily attached to, or permanently embedded in, the surface of a road.

Piezo axle sensors have several advantages:

- Positional stability gives excellent speed and classification accuracy.
- Excellent signal-to-noise ratio, and enormous dynamic range.
- Sensors can be installed in each lane of a multi-lane site.
- Long-term durability and reliability.

Installation is the key to realising the advantages of piezo sensors. This document provides some crucial guidelines for consideration when installing piezo sensors, to ensure maximum reliability and minimise installation costs, including:

- Site selection.
- Type of piezo sensor.
- Installation of the sensors and cabling.
- Roadside cabinet.
- Installation validation and commissioning.

Piezo Sensors

The MC5710 is optimised for the Measurement Specialties *RoadTrax BL Traffic Sensor*, which give exceptional results when installed per the manufacturer's recommendations. A *Class II* sensor should be used with the MC5710. These are more economical than the Class I BL sensor used for weigh-in-motion applications.

Measurement Specialties Roadtrax BL Sensor

The BL sensor is a flat brass strip, which can be directly installed in a slot in the road using a suitable grout. BL sensors are supplied pre-terminated to coaxial cable, and are available in a variety of lengths, from 2.5 to 5.5 metres, or 6 to 13 feet.

The length of sensor chosen should adequately cover one or both of the wheel tracks in a lane, to ensure the sensor is consistently hit by one or two wheels. Partially covering a wheel track will cause inconsistent signal levels.

Further information regarding the BL sensor is available from the Measurement Specialties website:

http://tech-metrocount.com/meas-spec

Site Selection

Road surface quality is one of the primary criteria when selecting a site for piezo sensors. A road surface should be:

- Smooth and flat, with no rutting or shoving.
- Stable enough to support a slot.
- Free of joints, cracks and other inconsistencies.
- Free of irregularities ahead of the sensors, which can excite vehicle suspension and alter sensor readings.

As with any axle-based classifier, also consider the following:

- Vehicles should be travelling at a constant velocity. Try to avoid bends, intersections and steep inclines.
- Vehicles should be free-flowing. Try to avoid areas with congestion.

Also consider future, scheduled road maintenance. If a road is resurfaced, the piezo sensors must be replaced.

Installation

Safety

Safety should be foremost consideration when planning a piezo installation. Traffic management may need to be employed for anywhere up to two hours per lane.

Installation should be by competent, and, if and where applicable, duly qualified personnel. Installers should ensure that they have referred to and have regard to all relevant statutes and regulations in force in the locality where installation and use is to be made.

Procedure

Measurement Specialties RoadTrax BL sensors should be installed per their installation instructions, available at:

http://tech-metrocount.com/meas-spec

An installation video is also available. The inductive loop sensor referred to in these instructions is not required.

The following sections contain additional suggestions and guidelines to supplement these instructions.

Spacing

The MC5710 requires a pair of piezo sensors in each lane, at a known spacing. Spacings of 1 - 3 metres, or 4 - 12 feet are acceptable.

Longer sensor spacing will give highest speed accuracy. For sites with dense traffic or congestion, a shorter spacing should be used.

Slots

The sensor slots should be cut perpendicular to the traffic flow, which may not necessarily be perpendicular to lane markings or kerb. Wheel tracks are often a good guide. Slot pairs should be parallel at the selected spacing.

When placing the piezo sensor in the slot, uniform depth from the road surface (approximately 10mm) is extremely important to avoid varying sensitivity along the sensor. Also ensure the sensor is not twisted as this also affects sensitivity.

The piezo sensor should not touch the slot wall at any point, to ensure complete encapsulation.

BL Sensor installed, ready to be encapsulated

Grout

Piezo sensor sensitivity and reliability is highly dependent on the characteristics of the embedding grout used, including hardness, long-term durability, and behaviour versus temperature.

Two types of grout are recommended for installing Measurement Specialties BL sensors:

- *Global Resins PU200* - PU200 is a two-part polyurethane resin, supplied pre-measured to the correct mix ratio. PU200 is a non-toxic, fast curing resin, with a low exotherm that will not damage the piezo sensor or feeder cable. Lanes can be opened within an hour, but full cure takes up to 48 hours.
- *International Road Dynamics AS475* - AS475 is a two-part acrylic grout, supplied as a sand/resin pourable mixture, with a peroxide powder as the hardener. AS475 has a much higher exotherm, but reaches its fully cured state in around an hour, and can be used in cold conditions.

Slots should be absolutely clean and dry before pouring. Slot fill should be level with the road surface or slightly raised, and uniform along the length of the slot.

Feeder Cables

Feeder (or "home-run") cables, running from the piezo sensors to the cabinet and MetroCount RSU, should have the following characteristics:

- Continuous, with no joins.
- Minimal number of bends.
- Maximum bend radius of 45 degrees. Right-angle bends can be removed with mitre cuts.
- Free of kinks at internal corners.

Feeder cables should be run through, or under kerbs, with the cable protected from chafing from slight road or kerb movement. The feeder cable supplied with BL sensors is rated for direct burial, however conduits are highly recommended.

Cabinet

MC5710 RSUs must be housed in a suitable, weatherproof cabinet. Cabinets should be free of condensation, which generally requires venting.

All sensor cables need to be terminated with BNC connectors. These are commonly available, with appropriate cable stripping and crimping tools. Each cable should be fitted with strain relief boots, clearly marked and colour-coded.

Terminate coaxial cable with BNCs

Sufficient cable should be left in the cabinet for repeated re-termination, and to allow equipment to be moved or placed on the ground.

Site Validation and Commissioning

Measuring the following piezo sensor characteristics can be used to determine the success of an installation, and on-going reliability of a site:

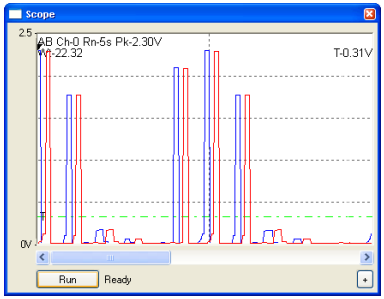
- Leakage resistance.
- Capacitance.
- Signal amplitude.
- Signal-to-noise ratio.
- AC and DC noise.

An *MC5740 Piezo-Test RSU* can be used to perform all of these tests, and offers several key advantages over common test equipment such as LCR meters and oscilloscopes:

- Familiar and intuitive MetroCount software interface, without unnecessary and confusing features. Can be operated from a Pocket PC or laptop.
- Instantaneous measurements for leakage, capacitance and noise, for four inputs.
- Capture piezo sensor output waveforms to measure signal amplitude.
- Ability to save all measurements and waveforms to files, with meaningful names for future reference.
- Continuous logging mode to characterise a site versus time of day, types of traffic, and weather conditions.

Checking piezo sensors with an MC5740 and Pocket PC

Instantaneous measurements are performed using the MC5740's *View* mode. Measurements that are not within a reasonable range of values will be highlighted with a red circle. The MC5740's *Scope* mode displays piezo sensor output voltage versus time, for a pair of inputs.

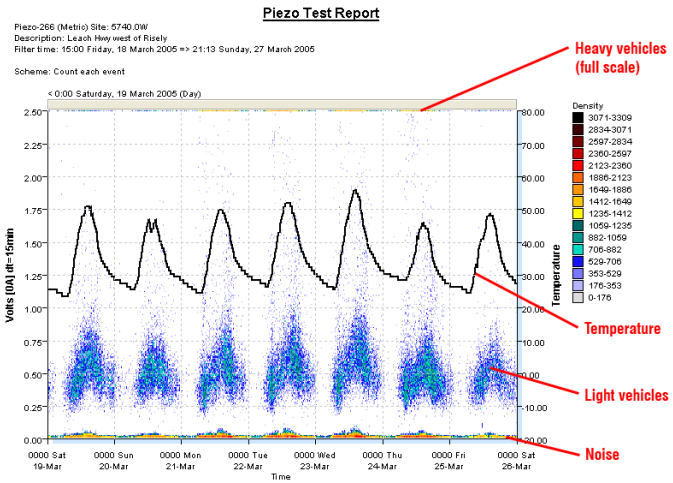


MC5740 "Scope" view

Checking piezo sensor capacitance and leakage resistance prior to installation is good practice to ensure a functioning sensor is installed. Checking again immediately after cables have been fed and terminated also ensures no breaks have occurred, and a successful crimp.

Once sufficient curing time has elapsed, the lane can be opened, and piezo output should be checked using the MC5740's Scope mode. Passenger vehicles should reliably produce a signal amplitude in excess of 200mV, depending on the grout used.

An MC5740 should be installed in its continuous logging mode for the first seven days to characterise the site. Ideally a site will produce a Piezo Test Report with a good signal-to-noise ratio. Some variation in signal amplitude with temperature is normal.



Piezo Test report, with good signal-to-noise ratio, and some temperature variation

Finally, MC5710 RSUs should be configured for the site. The Piezo Test Report can be used to determine a suitable sensitivity threshold. The threshold setting closest the peak noise level should be selected.

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