Rocoil
PRECISION ROGOWSKI COILS

ROCOIL RAIL CURRENT TRANSDUCER

FEATURES

- Portable transducer for measuring signalling currents in railway lines.
- Measures signalling currents in the presence of a large 50Hz component.
- Quick and easy fitting on the track.
- Frequency response up to 10kHz.
- Measures from a few mA up to 45A rms.
- Overload indicator.
- Will not be damaged by large overloads.
- Analogue wave-form output for the direct monitoring of current wave-forms or for use with an AC meter or spectrum analyser.
- Powered by internal batteries (2 x PP3).
- Long battery life sufficient for several days' use with alkaline batteries.
- Built-in battery condition monitor.
- Robust construction.
- Insulated from the rail.

1. INTRODUCTION

The **Rocoil**® Rail Current Transducer can be used to measure accurately the current in a railway line in a compact and portable measuring system which is simple to use.

There are other devices that measure electric current without making electrical contact with the conductor. Many of these, including the conventional current transformer, use a ferro-magnetic core and are subject to magnetic saturation effects that limit the range of currents that they can measure. A Rogowski coil, on the other hand, does not saturate and is ‘linear’ over an enormous range of currents 'from milliamps to millions of amps'. This feature enables low currents at certain selected frequencies to be measured accurately even when extremely large currents at other frequencies are present.

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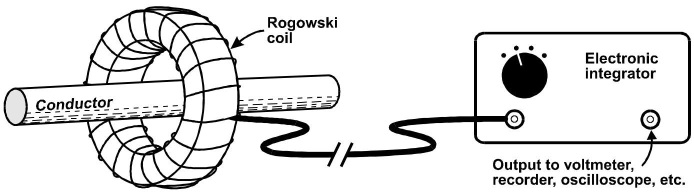
2. THE ROGOWSKI COIL PRINCIPLE

The coil is an ‘air cored’ toroidal winding placed round the conductor such that the alternating magnetic field produced by the current induces a voltage in the coil. The coil is effectively a mutual inductor coupled to the conductor being measured and the voltage output direct from the coil is proportional to the rate of change of current.

In an ideal situation the coil should completely encircle the conductor being measured. This is not possible with the rail transducer and the coil is in the form of an inverted 'U' which encircles roughly half of the rail. The output of such a coil is sensitive to the distribution of current in the rail and the current distribution is a function of the frequency. The dimensions of the coil have been carefully chosen to minimise the effect of this change in current distribution with frequency.

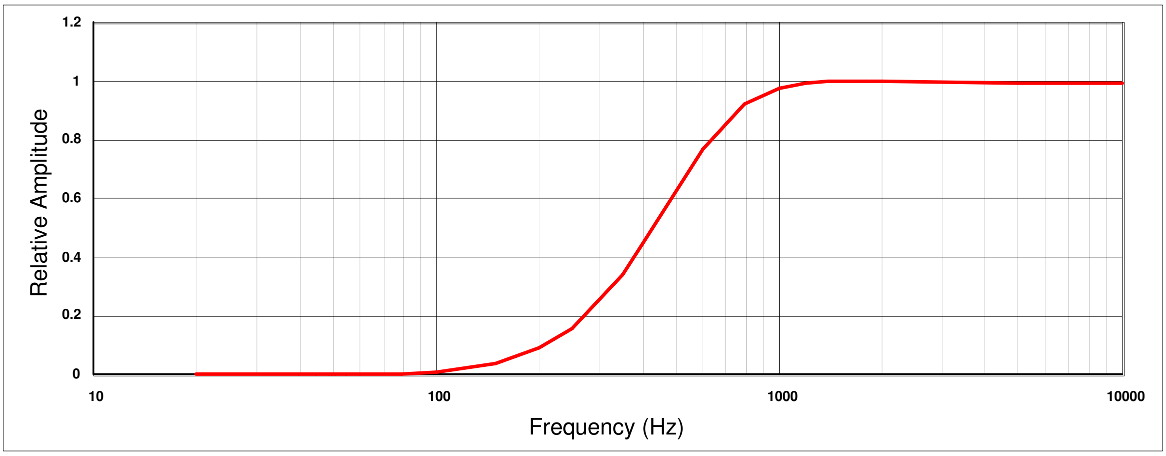
To complete the transducer the coil output voltage is integrated electronically to provide an output that reproduces the current wave-form. This combination of coil and integrator provides a system where the output is independent of frequency. In the Rail Transducer additional filtering has been built into the electronics to provide a frequency characteristic with excellent rejection of 50Hz currents but with a flat frequency response for frequencies above 1.3kHz. The output from the integrator can be used with any form of high-impedance electronic indicating device such as a voltmeter, oscilloscope, or spectrum analyser.



3. SPECIFICATION

3.1 Frequency Response:

This transducer has been designed to have a flat frequency response in the frequency range above 1.3 kHz but with good rejection of signals at lower frequencies, particularly 50 Hz and DC. The graph shows the measured frequency response normalised to the output at 1.5kHz.



The rejection of 50 Hz currents is particularly good. In actual tests it was possible to measure 1.5 kHz currents using the 1A/Volt sensitivity range in the presence of a superimposed 50Hz current greater than 500A. The measuring capability of this transducer will not be affected by large DC currents.

NOTE: The transducer can also be supplied without the 50Hz rejection feature.

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3.2 Sensitivity:
There are two sensitivity ranges selected by a switch.

10A/volt, maximum current 65A peak
1A/Volt, maximum current 6.5A peak.

The maximum current refers to currents in the frequency range greater than 1.3kHz with the transducer powered from fresh batteries. At lower frequencies the maximum current can be larger in accordance with the frequency response curve shown above. The calibration is sensitive to the rail type and ideally it should be calibrated using a section of rail of the correct type

3.3 Overloads.
A red LED on the top of the transducer indicates when the transducer is near the overload condition. This LED lights before the overload condition is reached so if it indicates a marginal overload with the LED flickering there is no real overload. When the transducer is first switched on the overload LED lights for about two seconds. Prolonged operation in the overload condition will not harm the transducer but there will be an increased battery consumption.

3.4 Output connections
Output is via 4mm sockets.

3.5 Enclosure
The Transducer is enclosed in a plastic box which ensures that the internal circuitry cannot make contact with a live rail. If the enclosure is damaged it may not be safe to use the unit.

3.6 Electromagnetic Compatibility
The transducer has no oscillatory circuits and there are no internal fast-edge transitions that could cause harmful emissions. The enclosure is screened internally to minimise interference from external sources of radiation.

4 POWER SUPPLY

4.1 Batteries
The transducer is powered by two PP3 batteries. These are accessed in compartments in the side of the transducer and can be changed without removing the lid of the transducer. NOTE the battery holders are mounted up-side down. This is to prevent rain water collecting in the battery trays.

4.2 Battery Monitor
When the switch is turned to 'TEST' an LED labelled 'BATTERY TEST' indicates the approximate state of the combined battery voltage as follows:

Green:	combined battery voltage greater than 16.5V
Flashing red / green	combined battery voltage in the range 14.5 - 16.5V
Red	combined battery voltage less than 14.5V

4.3 Battery Life
Estimated to be greater than 80 hours continuous use when alkaline batteries are used.

5 OPERATION

The transducer is placed over the rail and is located by the studs on the base. There should be no packing between the transducer and the rail as this will affect accuracy. The transducer should be positioned approximately mid way between rail supports.

The transducer is switched on using a rotary switch having positions OFF, TEST, 10A, 1A. When the transducer is switched from TEST to 10A the overload LED lights for about 2 seconds. Apart from this the transducer requires no ‘settling time’.

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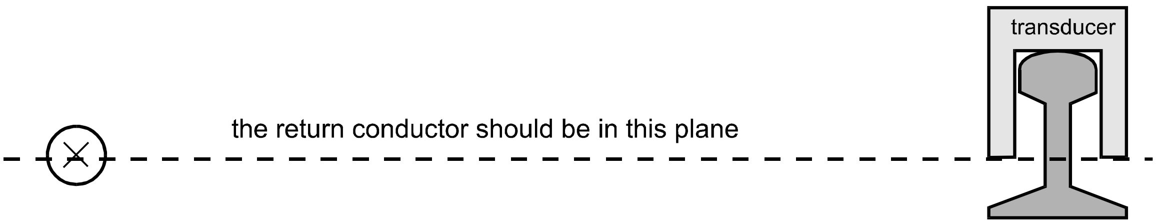
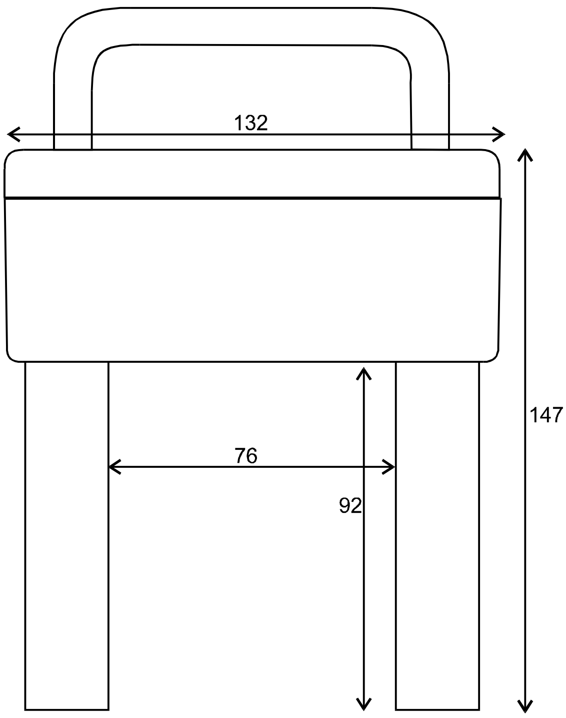
6 TESTING

If the transducer is tested in a laboratory some precautions are necessary to ensure accurate results:

1) The transducer should be tested on a section of rail of the correct cross section.

2) The 'return conductor' should be in a plane as shown in the figure below. If the return conductor is in a different position the transducer will be affected by the current in the return conductor and give an inaccurate reading.





Approximate dimensions. Case material: black plastic .

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