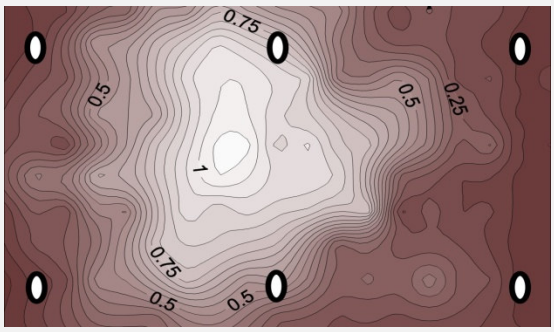
Portable Scanner Systems for Periodic Monitoring of Industrial Plant

Part of a Suite of Scanner Systems



Non-Intrusive, Intermittent Monitoring of Internal Plant Conditions (Corrosion or Cracking) using External Sensor Arrays

Designed for Locations where Continuous Monitoring is not Appropriate

Possible Applications include Pipes, Storage Vessels and Ducting

Uses Established and Refined Electrical Resistance Techniques

Rowan Technologies' scanner systems perform on-line monitoring of corrosion/erosion rates and thermal characteristics, such as temperature or heat flux, directly on sections of industrial plant. These systems may also be suited to crack growth monitoring depending on application.

The systems use arrays of sensors, directly attached to external plant surfaces, and are capable of monitoring large areas, or smaller localised areas. They are non-intrusive, as the item of plant itself becomes the ‘sensor’. This avoids the requirement for probe entry ports - especially important where pressure vessels are concerned.

Portable versions of the scanner technology have been developed for applications where a fixed system may not be the most appropriate or cost-effective means of monitoring. For example where there is a requirement for monitoring in a number of areas of a plant, situated some distance apart, as in a chemical complex or refinery.

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APPLICATIONS

- Pipes, storage vessels, membrane walls etc
- Hazardous areas (under work permit) and non-hazardous areas
- Monitoring of corrosion, erosion and crack propagation.
- Monitoring and mapping of large or small areas (<1m^2 to >100m^2).
- Highly localized monitoring e.g. around pipe welds or broader application e.g. general corrosion – electrode layout tailored to suit application.
- Thick or thin walls/membranes (<1mm to >50mm).

PRINCIPLE FEATURES AND BENEFITS

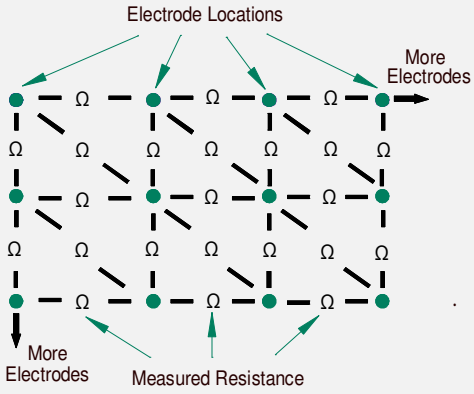
- On-line or off-line monitoring of internal wall or surface conditions.
- The actual plant itself is monitored - no need for insert probes and entry ports.
- Cost effective method of monitoring multiple locations.
- Portable instrumentation – readily transported between monitoring locations.
- Monitoring of corrosion, erosion or crack propagation.
- Suited to high temperature plant and remote locations.
- Fixed sensors – permanently welded to external surfaces.
- Multiple sensor arrangements for a variety of applications.
- Developed for use in a wide range of ambient temperatures.
- Suited to hazardous environments when conditions are deemed safe.
- Electronics powered by portable battery source - no mains required.
- Established and refined electrical resistance measurement techniques.

MONITORING OF PLANT INTEGRITY

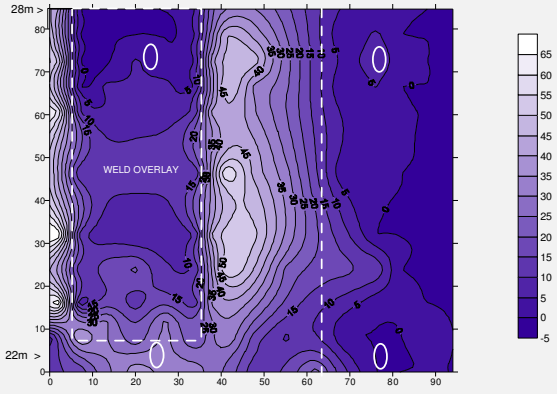
Scanner systems were first developed in the late 1990s as fixed systems for continuous real-time monitoring of corrosion rates of boiler membrane walls. Details of our fixed scanner technology can be found via the Rowan Technologies website.

The portable scanner systems are an evolution of the fixed scanner technology and use the same measurement principles. To monitor plant integrity (corrosion/erosion or crack propagation) the systems use established and refined electrical resistance measurement techniques where thinning of a metal surface (or propagating surface wall cracks) increases measured electrical resistance values. Measured resistance values also heavily depend on metal temperature and so the systems measure and compensate for these temperature variations.

During the resistance measurements, current is passed between adjacent pairs of sensor (electrode) locations. The precise techniques employed depend on the application – the example below shows how the technique is used to monitor corrosion rates of a fireside tube wall of a power generation boilers. In this application, resistance measurements are made by passing current horizontally, diagonally and vertically in a pre-defined sequence to build a complete two-dimensional maps of wall corrosion rates.

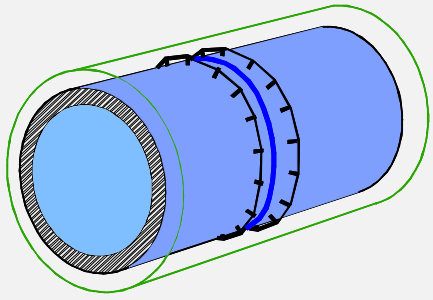


Array of External Scanner Electrodes



Fireside Tube Wall Corrosion Rates

In a very different application, the schematic on the right illustrates the use of the portable scanner technology to monitor the area of a pipe weld for any signs of cracking. In this scenario, electrodes are positioned either side of a weld joint.

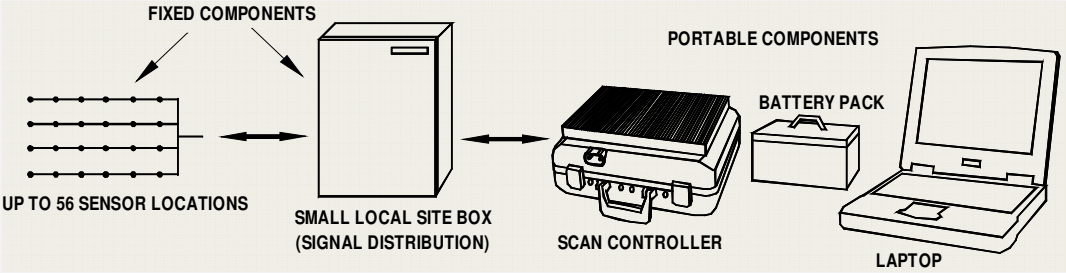


Electrodes Positioned either Side of a Tube Weld

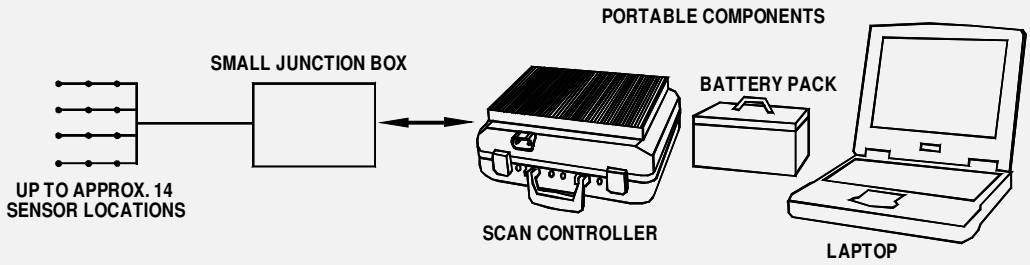
MONITORING CONFIGURATIONS AND APPLICATION

The portable equipment has been designed for use in a wide range of ambient temperatures (approx. -20 to + 50°C) and the electronics is protected to IP65. The system's portable components are battery pack, laptop computer and scan controller, designed to be easily transported to each monitoring location. Power is supplied from the battery pack - there is no requirement for any other power source. As power is only supplied when the portable components are connected, this can allow monitoring in normally hazardous environments, when conditions are deemed safe.

For all applications, sensing electrodes are permanently fixed (welded) to external surfaces at each monitoring location. A choice of three instrument configurations are shown below:

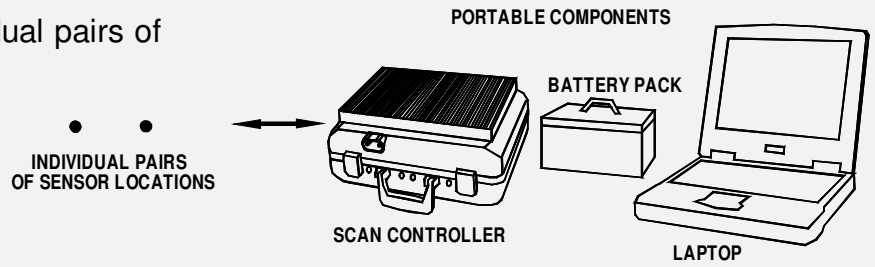


Option 1 above: cabling from the sensors run to a small (fixed) site box housing signal multiplexing electronics. A single cable then connects the portable components to the site box.



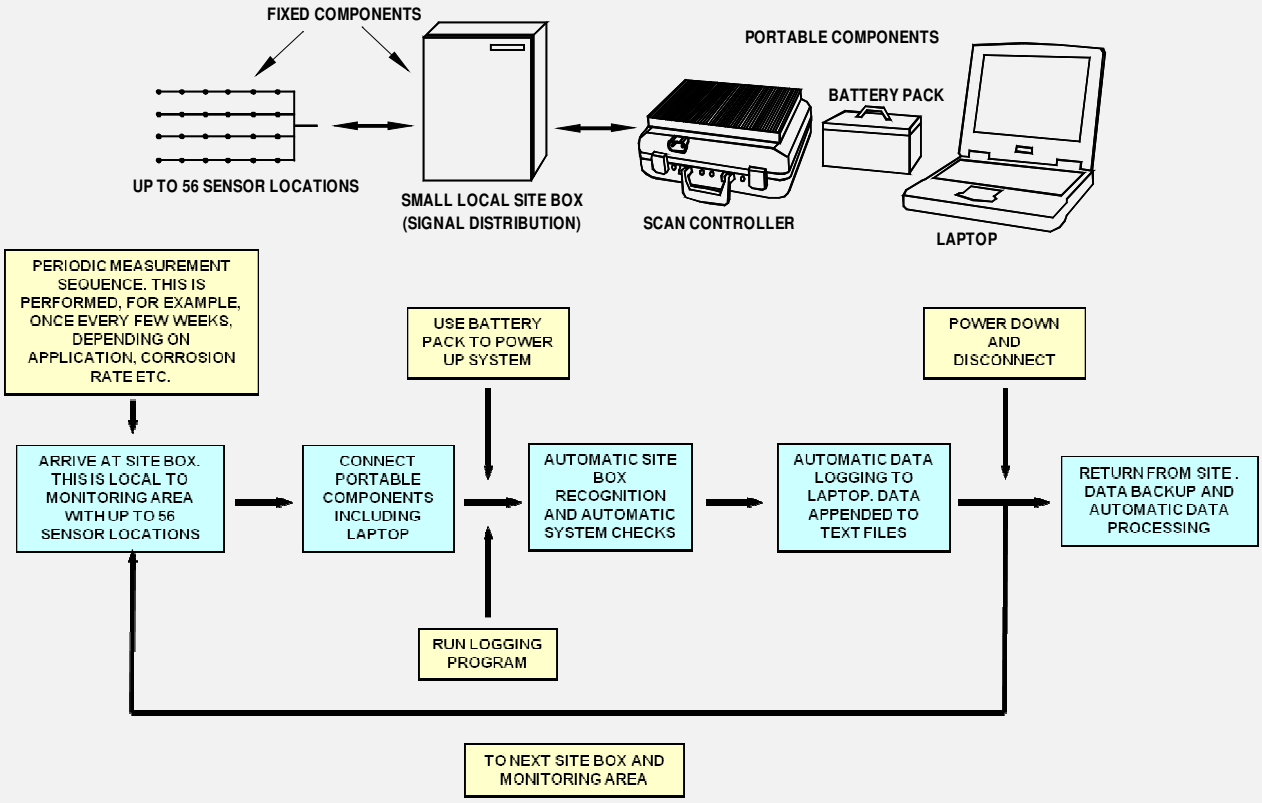
Option 2 above: as option 1 except the multiplexing electronics is replaced by a fixed box with robust signal connection points that are connected manually during the measurement sequence.

Option 3 right – connections are made directly to individual pairs of sensor locations.



DATA ACQUISITION AND ANALYSIS

Typically, the portable equipment would be taken to site every few weeks or months (depending on application). Systems are designed for easy connection and data acquisition is virtually automatic. Post processing of acquired data would usually be performed after all measurements are complete, using dedicated software. The flowchart below outlines the measurement process using fixed site boxes containing multiplexing electronics:



DETECTION AND QUANTIFICATION

Detection and quantification of corrosion/erosion or cracking may take as little as a few days, depending on circumstances and application. Detection and quantification is faster for:

- Higher corrosion/erosion or crack propagation rates.
- Thinner walls or membranes.
- Thermally more-stable conditions.

Please contact the company to discuss specific applications.

Rowan Technologies Ltd
Manchester UK
mail@rowantechnologies.co.uk
www.rowantechnologies.co.uk