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1 Overview

Analatom's AN110 and micro-linear polarization resistance (μ LPR) corrosion sensors provide direct real-time measurements of electrochemical activity for structural health monitoring (SHM) applications. Utilizing established linear polarization resistance (LPR) technology, sensors output an identical corrosion rate for the metallic structure on which they are placed, as they are constructed from the exact metal, alloy and temper. These flexible sensors can be placed on bare metal surfaces and beneath coatings to allow fitting to virtually any surface.¹

1.1 Target Applications

- Aircraft (fixed wing / rotary)
- Ground vehicles
- Ships
- Buildings
- Bridges
- Pipelines

1.2 Benefits

- Direct corrosion measure
- Low power: battery or external
- Wireless communication / mesh network
- Fast measurement response time

1.3 Description

Analatom's Corrosion Health Monitoring System (CHMS), shown in Figure 1, consists of a network of AN110 Data Acquisition (DAQ) nodes. The AN110 DAQ unit connects to eight μ LPR and/or time of wetness (TOW) sensors and a humidity/temperature sensor. The unit is battery powered, but can also be operated using external power. Linear Polarization Resistance (LPR), resistance for TOW, temperature and humidity is measured and stored locally on the unit. Data can be retrieved by either using a wired interface such as RS232 and RS485 or wirelessly using the ZigBee protocol. The CHMS software converts LPR and resistance data into a corrosion rate and TOW value.

Each μ LPR/TOW sensor is made of two electrodes that are interdigitated at 150 μ m and 300 μ m spacings. The μ LPR sensor is fabricated from shim stock of the source/sample material that is to be monitored. The shim is prepared using photolithographic techniques and electro chemical etching (ECM). It adhered to a layer of Kapton to produce a highly ductile and mechanically robust micro sensor that is sensitive to corrosion. Each sensor connects to one of the AN110 eight channels. Specifications for the μ LPR and the TOW sensors are available.

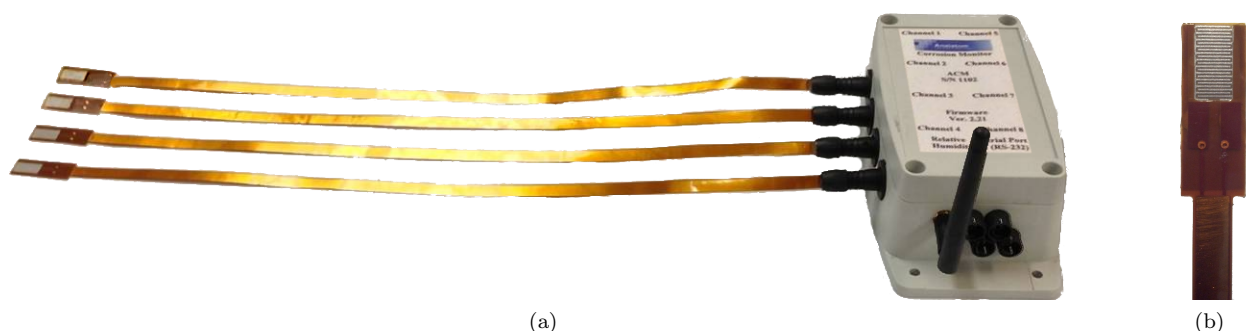


Figure 1: Wireless CHMS consisting of (a) one AN110 DAQ node connected to four μ LPR sensors and (b) a close up of one μ LPR sensor.

¹Military version of the AN110 is also available. Contact Analatom, Inc. at info@analatom.com for more information.

2 Specifications

Table 1: Specifications for the Analatom AN110.

General Specifications	
Primary Power Source:	Internal 3.6V lithium-thionyl chloride (Li-SOCl ₂) primary cell
Battery life:	> 7 years
External Power Source:	5 – 30 VDC
Operating Current (Internal Battery)	11 μ A idle / 50 mA peak
Communication Protocol:	RS232, RS485, and 802.15.4 (ZigBee)
RF Frequency:	2.4 GHz
Working Temperature:	-40 °C to 85 °C
Size:	7.0" \times 3.0" \times 2.75"
Weight:	320 g
Measurements:	8 μ LPR / TOW channels, 1 temperature/relative humidity
Sample Period:	1 – 1,440 min
Capacity:	52,428 samples (Combination of 8 μ LPR and TOW sensors) 43,690 samples (8 μ LPR with 1 temperature/relative humidity sensors)
Measurement Range	
LPR Resistance:	1 k Ω – 20 M Ω
Corrosion Rate:	Material dependent / computed from LPR (See sensor specifications.)
Temperature:	-40 °C to 85 °C
Relative Humidity:	0 – 100%
Sensor Accuracy	
Resistance:	\pm 1%
Corrosion Rate:	Material dependent / computed from LPR (See sensor specifications.)
Temperature:	\pm 1.5 °C
Relative Humidity:	\pm 2% (10% < RH < 90%) or \pm 4% (0% < RH < 100%)
Sensor Precision	
Resistance:	\pm 1%
Corrosion Rate:	Material dependent / computed from LPR (See sensor specifications.)
Temperature:	\pm 0.1 °C
Relative Humidity:	\pm 0.1%

3 Hardware Layout

The AN110 consists of an IP-67 rated enclosure with a total of 14 IP-67 rated external ports. Along each of the AN110's sides are a set of four ports to connect either an LPR or TOW sensor, as shown in Figure 2(a). The front of the unit contains the remaining 6 ports for: an antenna, power, relative humidity and temperature sensor, two RS485 ports, and an RS232 port, as shown in Figure 2(b). A top-down view of the unit is also given in Figure 2(c).

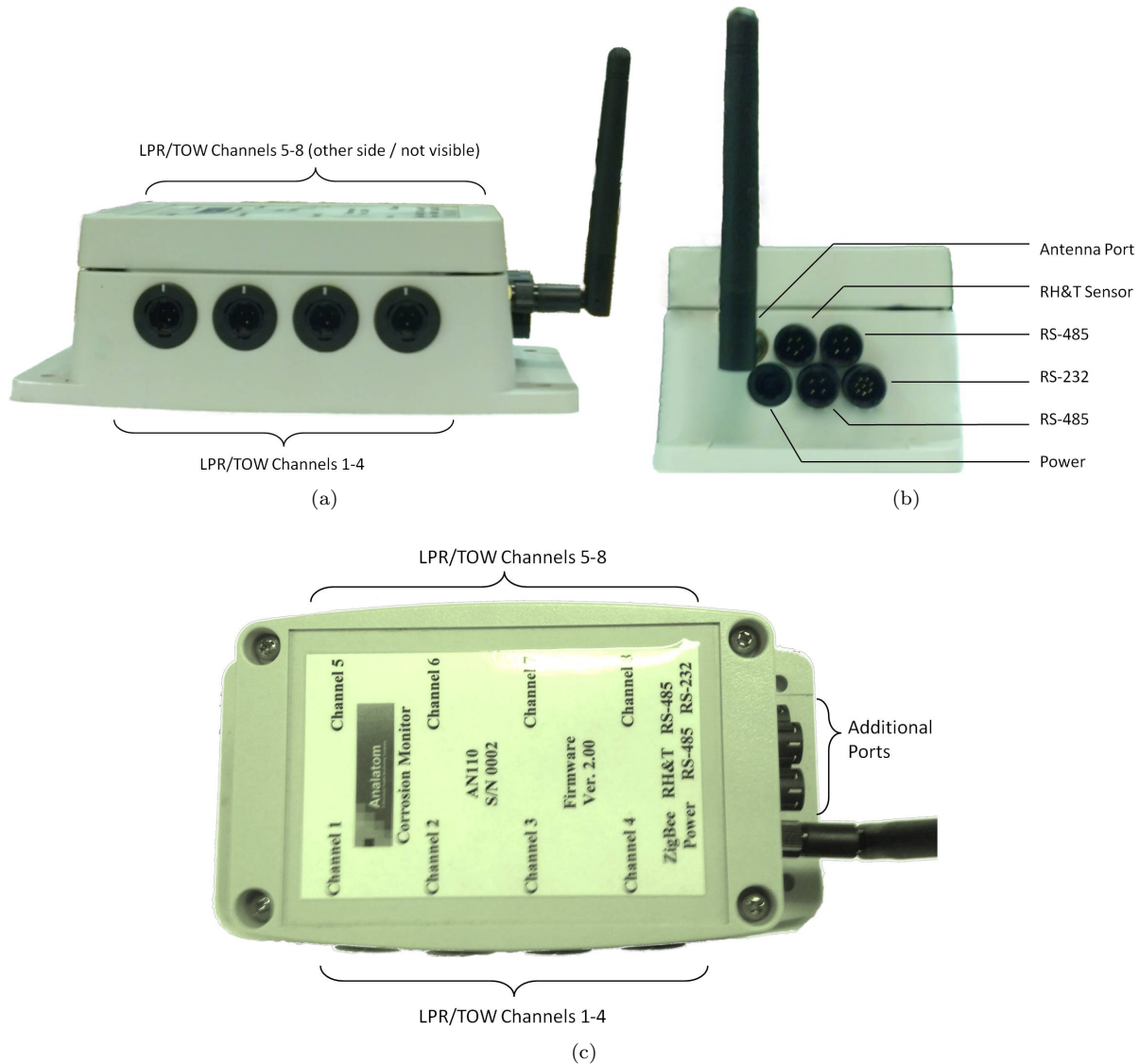


Figure 2: AN110 enclosure showing the (a) side view, (b) front view and (c) top view.

4 Enclosure Drawings

