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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/rotary wing)
- Ground vehicles
- Ships
- Buildings
- Bridges
- Pipelines

1.2 Benefits

- Direct corrosion rate measurement
- Low power usage: battery or external power
- 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. Each AN110 DAQ unit can support any combination of up to 8 sensors providing simultaneous corrosion rate, time-of-wetness (TOW), and salinity measurements as well as temperature, and humidity. The unit is battery powered and can be operated using external power. LPR, TOW, salinity, temperature, and humidity are measured and stored locally in the unit's internal memory. Data can be retrieved using either an industrial wired interface, RS-232 and RS-485, or wirelessly using the ZigBee protocol. The CHMS software converts LPR and resistance data into a corrosion rate, TOW, or salinity value.

Each μ LPR sensor is made of two electrodes with interdigitated fingers spaced between 150 μ m to 300 μ m apart depending on the sensor material. μ LPR sensors are fabricated from shim stock of the source/sample material monitored. The shim is prepared using photolithographic techniques and electrochemical etching (ECM). It is adhered to a layer of Kapton to produce a highly ductile and mechanically robust micro sensor, sensitive to corrosion. A sensor connects to one of the AN110's eight channels. Specifications for the μ LPR, TOW, and salinity sensors are available.



Figure 1. Wireless CHMS consisting of one AN110 node connected to four μ LPR sensors (left) and a close-up image of a μ LPR sensor (right).

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

2 Specifications

General Specifications	
Primary Power Source:	Internal 3.6 V 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 Interfaces:	Wired: RS-232, RS-485. Wireless: 802.15.4 (ZigBee)
RF Frequency:	2.4 GHz
Working Temperature:	-40 °C to 85 °C
Size:	7.24" x 3.63" x 2.38" (length includes base mounting flanges)
Weight:	430 g
Measurements:	8 μ LPR/TOW/salinity channels + 1 temperature/relative humidity channel
Sample Period:	1-1,440 min
Capacity:	52,428 samples (Combination of 8 μ LPR, TOW, and salinity sensors) 43,690 samples (8 μ LPR/TOW/salinity + 1 temperature/relative humidity sensor)
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	
Electrochemical Resistance:	\pm 4%
Corrosion Rate:	Material dependent, computed from LPR (see sensor specifications); typical: \pm 10%
Temperature:	\pm 1.5 °C
Relative Humidity:	\pm 2% (10% < RH < 90%), \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 internal CPU of the AN110 is housed inside an IP-67 rated enclosure with 14 IP-67 rated external ports. Along each side of an AN110 are four ports to connect either LPR, TOW, or salinity sensors, as shown in Figure 2(a). The front of the unit contains the remaining 6 ports for: an antenna, power, a relative humidity and temperature sensor, two RS-485 ports, and an RS-232 port, as shown in Figure 2(b). A top view of the unit is also given in Figure 2(c).

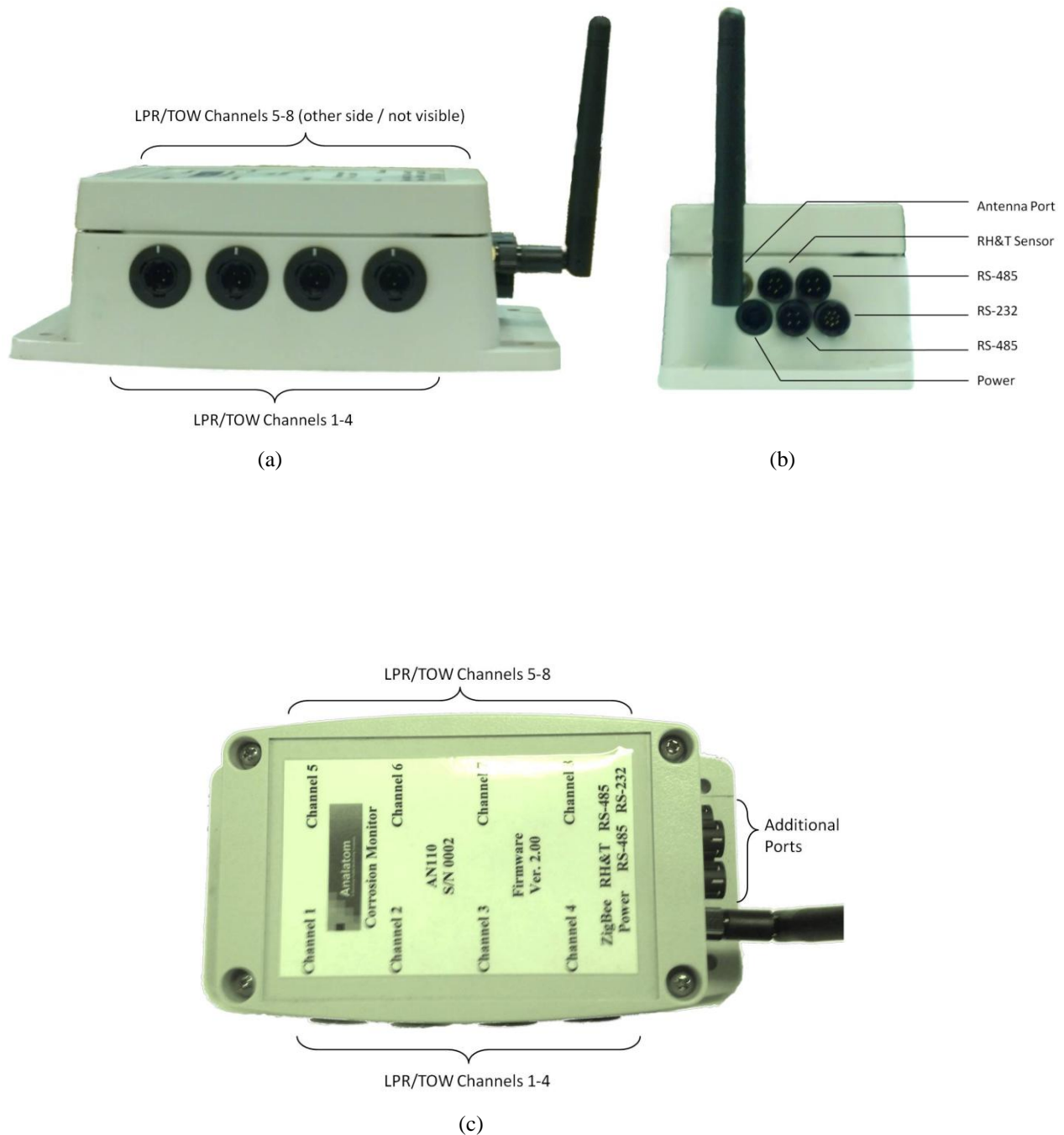


Figure 2. AN110 enclosure showing the (a) side view, (b) front view, and (c) top view.

4 Enclosure Drawings

