

Cyclone

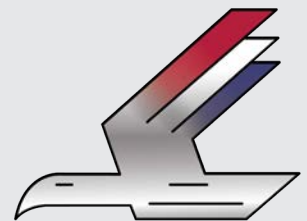
Data Acquisition for Aerospace



Product Specification

Overview | Tech Specs | Sensors | Support

Innovative products solving the challenges of aerospace



**RadioBro
Corporation**
WWW.RADIOBRO.COM

INTRODUCTION

Overview

The Cyclone product line allows aircraft owners and operators to have an after-market data acquisition system. The components are powerful enough to support common aerospace testing or monitoring needs. The system is designed to remove major headaches found in traditional instrumentation while adding advantages of Industry 4.0 and the Internet-of-Things.

New users can instrument an aircraft within weeks without customization.

Invention

Cyclone was invented in 2014 to serve as the instrumentation of during the first flight of a highly-modified airframe. The product line focused on improving the state-of-the-art in flight test instrumentation.

Since 2015, the product line has grown to a second generation design ready to serve an aircraft for 10 years with the ability to rapidly reconfigure sensors to meet the changing needs of aircraft measurement.

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PRODUCT OVERVIEW

Key Features

- Plug-and-play sensors
- Embedded precision power to each sensor
- Powerful ADC and serial interfaces for each sensor
- Expandable Ethernet system allows for expansion
- Ethernet system allows for users to monitor data with a simple web browser

Key Benefits

- Automated software configuration saves time and reduces complexity
- Rugged enclosure and circuits operate in harsh conditions
- Miniature size is easy to mount by aircraft mechanic
- Smart data outing saves time in moving data to servers or the cloud

Typical Applications

- FTI - Flight test instrumentation for manned aircraft
- HUMS - Health and usage monitoring system
- Remote vehicle monitoring system



**First Cyclone Mission, January 2015
Thrush Aircraft, Albany, GA, USA**

SYSTEM SPECIFICATIONS

Stand Alone Configuration

12 measurements or less
Single node operating alone
Local GPS for time synchronization
Internal data storage on node

Networked Configuration

Ethernet-network of many nodes
PTP time synchronization from central GPS
Server-based data storage
Real-time, on-board data visualization

Sensor Installation and Excitation

Sensors will source power from the node, therefore only one cable to each sensor is required. Each channel has precision power control. After a sensor is connected, a customer may choose to calibrate or tare sensors over the local website.

System Operating Procedure

For most installations, RadioBro will prepare the node to talk to the customer's server.

1. Connect the power to Cyclone Power, which energizes all devices via the network cables
2. Wait for the server to boot fully and for nodes to link to the server, 3 to 5 minutes
3. Monitor data integrity from web browser

Data Download

Users can connect a computer via Ethernet cable or Wi-Fi to Cyclone to download the data as JSON or CSV as requested.

Data Cloud Upload

Users can command Cyclone Server to route the data to the cloud after each mission. Depending on facility limitations, data can be uploaded by wired Ethernet, Wi-Fi, or a LTE cellular connection. Cyclone cloud allows users to store and share data in a secure manner.

Cloud Apps

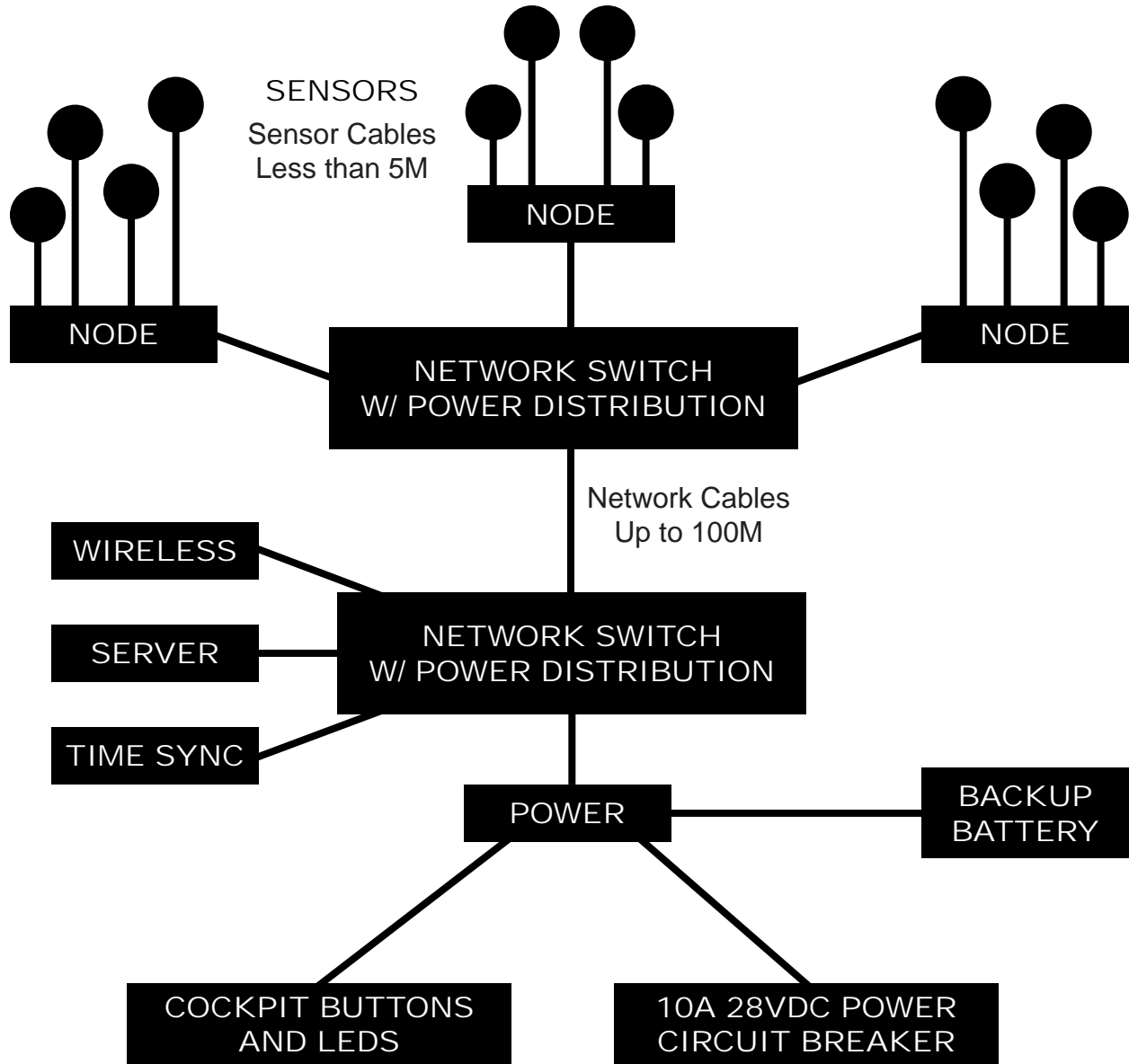
Cyclone Cloud offers enabling features.

1. Allows users to monitor health of devices and sensors
2. Review the quality of measurements
3. View data on map overlays
4. Pass data to customer servers in any export format: JSON, CSV, etc

Upgrades

Cyclone devices with Cyclone Cloud allow for remote upgrades. RadioBro does not automatically upgrade devices, ensuring the Cyclone products stay in customer-specified configurations. When authorized, RadioBro can command remote updates of devices through Cyclone Cloud.

SYSTEM DEVICE MAP



SWAP - SIZE, WEIGHT, AND POWER

Cyclone Node

Model Number C2A-12A

Dimensions

8.9 x 3.025 x 1.25in

Weight

1.35lbs (0.68kg)

Power

Max of 30W Power over Ethernet or 28VDC, 1.1 A

Includes sensors being powered by the Cyclone channels of the node

Thermal

Cyclone Node is solid-state. Keep in well ventilated area, directly mount the unit to a structure, or mount to a cooling plate to remove heat. Details shown in the mechanical interface drawing.

Cyclone Server

Model Number C2A-Server

Dimensions

8.9 x 3.025 x 1.25in

Weight

1.35lbs (0.68kg)

Power

30W Power over Ethernet or 28VDC, 1.1 A

Thermal

Cyclone Node is solid-state. Keep in well ventilated area, directly mount the unit to a structure, or mount to a cooling plate to remove heat. Details shown in the mechanical interface drawing.

Cyclone 5-Port Switch

Model Number C2A-Switch

Other specifications to be defined

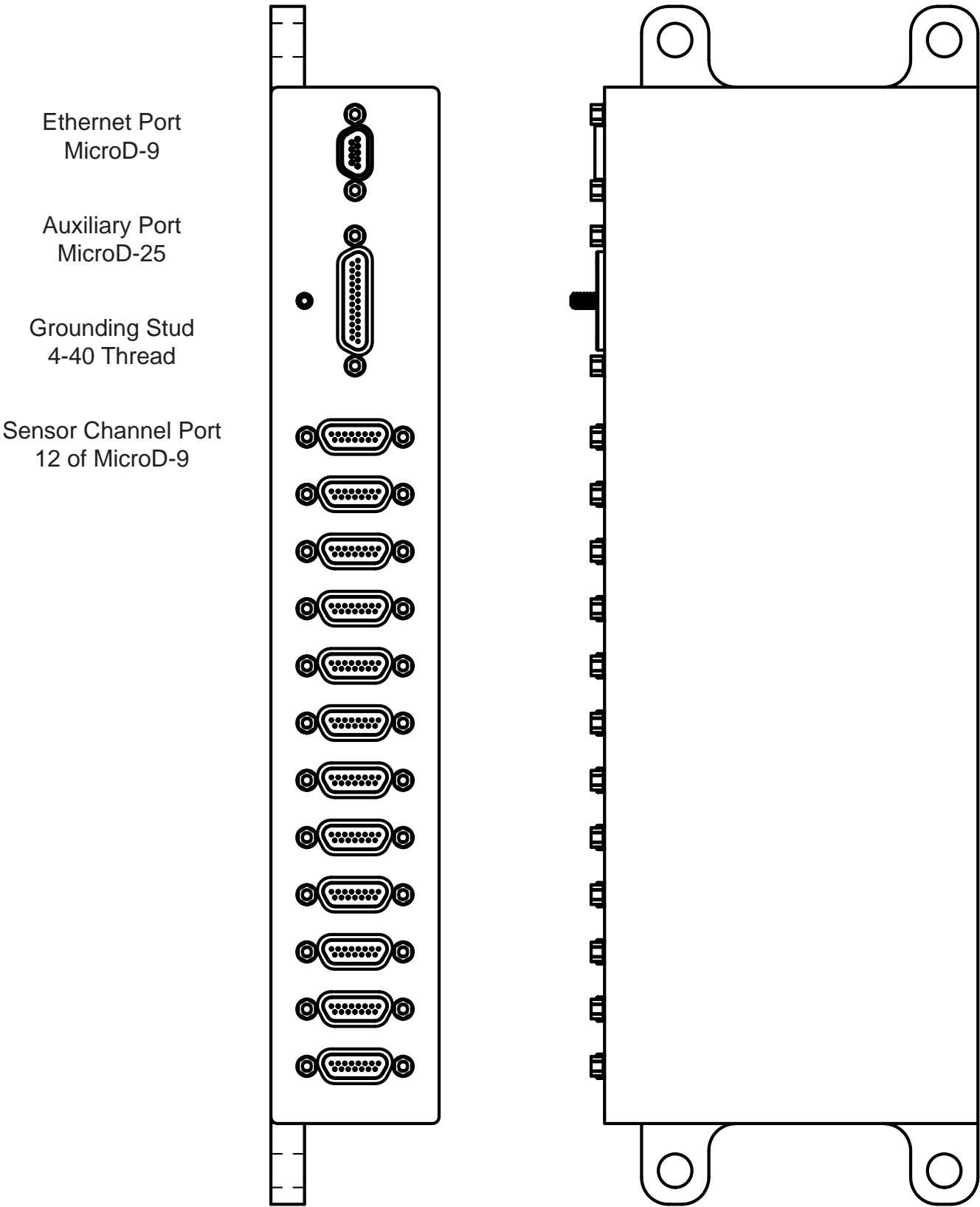
Cyclone Power

Model Number C2A-Power

Other specifications to be defined

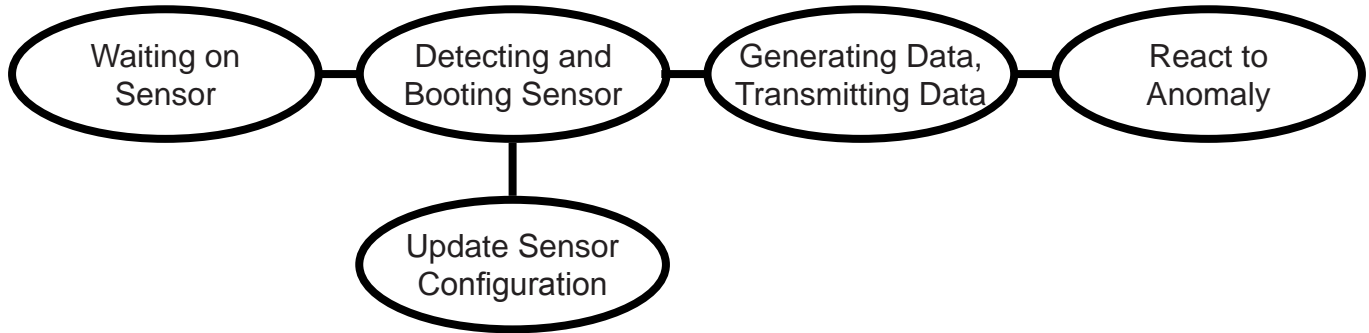
SWAP - SIZE, WEIGHT, AND POWER

100% Scale of C2A-12A Node, Same overall size as C2A-Server



CHANNEL SPECIFICATIONS

Cyclone Channel State Diagram



Channel Specifications

Sensor Operation

Each channel within the node has a primary operation of detecting and operating a sensor to generate data. The channel, through the node, passes this data to the local server, or, in some applications, it can retain the data for node-storage.

Embedded Excitation

- DC output of 1V to 22VDC, up to 500mA
- Optional constant current for Class I sensor, like PCB Piezotronics microphone and accelerometer
- Power output monitoring

Embedded ADCs

- Primary ADC resolution - 32bit
- Primary ADC Max Sample Rate - 38kHz
- Secondary ADC resolution - 24bit
- Secondary ADC Max Sample Rate - 800Hz

Embedded Logic Analyzer and Serial Port

- Protocols Available - RS232, RS422, RS485
- Flow control available
- Adapters for ARINC 429, ARINC 825, and CAN Bus



SMART CONNECTOR

The Cyclone Smart Connector integrates an memory module into the connector head of each sensor connector. When attached to Cyclone, the node determines what sensor is connected, if it has been approved for use, and allows the channel to auto-configure the sensor power and measurement.

The channel uses the serial number to route data to the server.

The Cyclone Smart Connector uses the multi-vendor MicroD-15 form factor.



COMMERCIAL SENSORS

Existing Sensors

- Strain Gage - 1/4, 1/2, Full Bridge
- Thermocouples (Adapter)
- String Potentiometer
- Load Pin / Load Cell
- Pedal Force
- GPS / INS / AHRS
- Analog Air Data Boom
- Digital Air Data Boom
- Aircraft Data Bus



C2A-A-Strain4
Based on Omega KFH

Digital Configurations

- RS232, RS485, RS422
- With Adapter: ARINC 429, ARINC 825, CAN

Analog Input Limits

- Class 1 - Current Measurements, 4-20 mA
- Class 2 - Voltage Measurements, 0-32VDC



C2A-A-SP-MT2A-15E
Based on TE Meas Spec - MT2A Series



C2A-A INS with Ellipse D
Based on SBG - Ellipse Series



C2A-A-Pedal-300
Based on FUTEK - FSH Series

CALIBRATION



**National Institute of
Standards and Technology**
U.S. Department of Commerce

Calibration is approached in many ways. For most load cells, pressure transducers, and temperature sensors, the sensor can be sent to a calibration house. RadioBro has access to various NIST certified labs for these services.

The Cyclone user or the RadioBro support team can also perform in-system calibrations. This strategy is accomplished with a test procedure approved or the desired sensor.

CONFIGURATION

1 - Requirements Evaluation

RadioBro starts each configuration with a requirements evaluation. Most sensor types and measurement rates are established here.

2 - Hardware Selection

RadioBro identifies to the customer common sensors and reviews customer suggested sensors for use in the instrumentation kit. RadioBro itemizes the components of Cyclone required.

3 - Sensor Configuration

Once on contract, RadioBro finalizes selection of each sensor. The instrumentation engineering, in cooperation with the electrical engineer, defines each channel measurement rate and channel mathematical functions used to convert the raw measurement into the parameter data.

4 - Hardware Deployment

RadioBro can ship the system for a customer-assigned mechanic to install. RadioBro will provide training for installation of sensors, components, and wires. As a standard option, RadioBro supports first-time installation with in-person training.

5 - Data Processing and Routing

For some functions, connectivity of the aircraft to the Internet or local network may be necessary. Data transfer can also be accomplished with a removable memory card. Exported data is always stored in an open-architecture data file like CSV or JSON.

6 - Continuous Support

RadioBro will offer product support under warranty and continuing support contract to ensure customer satisfaction and mission success. Many support features can be operated via the Internet. RadioBro is available to be on-site as requested by the customer.

3D FLIGHT VISUALIZATION

Using open-source tools, Cyclone and Cyclone Cloud allow operators to have full awareness of single aircraft or entire fleets. RadioBro has integrated with Cesium to show flight paths on 3D terrain maps in real-time and for in-depth flight review.



SPARES

Spare Sensors

Replacing or adding more sensors to a node is even faster. Mount the sensor to the final location. Plug the sensor into any available channel. The sensor will be automatically adopted and begin collecting data.

RadioBro has a private web store for Cyclone customers to order replacements.

Spare Computer Devices

Replacing or adding more nodes or servers is a short task. For a node, most operators would remove each sensor and the network cable. The existing device would be replaced. Reconnect the cables.





CONTACT Us

Cyclone Sales and Support

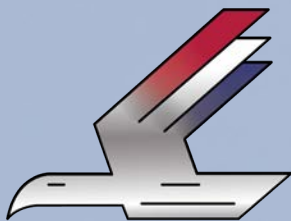
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Product Support

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