ping200XR™ TSO

User and Installation Guide

UAV-1007121-001
Rev B

Patent uavionix.com/patents

1 Revision History

Revision	Date	Comments
A	2/26/2024	Initial release
B	7/31/2024	GPS antenna port current specification

2 Warnings / Disclaimers

All device operational procedures must be learned on the ground.

uAvionix is not liable for damages arising from the use or misuse of this product.

This equipment is classified by the United States Department of Commerce's Bureau of Industry and Security (BIS) as Export Control Classification Number (ECCN) 7A994.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

3 Limited Warranty

uAvionix certified products are warranted to be free from defects in material and workmanship for two years from the installation of ping200XR in or on the aircraft. For the duration of the warranty period, uAvionix, at its sole discretion, will repair or replace any product which fails in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost.

Restrictions: This warranty does not apply to cosmetic damage, consumable parts, damage caused by accident, abuse, misuse, fire or flood, theft, damage caused by unauthorized servicing, or product that has been modified or altered.

Disclaimer of Warranty: IN NO EVENT, SHALL UAVIONIX BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Warranty Service: Warranty repair service shall be provided directly by uAvionix. Proof of purchase for the product from uAvionix or authorized reseller is required to obtain and better expedite warranty service.

Please email or call uAvionix support with a description of the problem you are experiencing. Also, please provide the model, serial number, shipping address and a daytime contact number.

You will be promptly contacted with further troubleshooting steps or return instructions. It is recommended to use a shipping method with tracking and insurance.

4 Table of Contents

1 Revision History 3
2 Warnings / Disclaimers 4
3 Limited Warranty 5
4 Table of Contents 6
5 System Information 9
5.1 Certification 9
5.2 TSO Authorization 10
5.3 System Functions 10
5.4 TSO Deviations and Incomplete 11
5.5 FCC ID 12
5.6 Device Marking 13
5.6.1 ping200XR Hardware 13
5.6.2 ping200XR Software 13
5.7 Environmental Qualification Form 14
5.8 Continued Airworthiness 15
5.9 System Limitations 16
5.10 Regulatory Compliance 16
6 System Specifications 18
6.1 System Functionality 18
6.2 ping200XR TSO Specifications 18
6.2.1 General Specifications 18
6.2.2 Mode S Transponder Specifications 19
6.2.3 Altitude Encoder Specifications 19
6.2.4 GPS/SBAS Specification 19
6.2.5 Control Interface Specifications 20
6.2.6 System Interfaces 20

7 Installation 22
7.1 Unpacking and Inspecting 22
7.2 Authorized Part Numbers 22
7.3 Installation Materials and Tools 22
7.4 Additional Required Equipment 23
7.5 Mounting 23
7.6 Wiring 24
7.7 Transponder Antenna 25
7.8 GPS Antenna 26
7.9 Static Pressure Port 26
7.10 Cooling Requirements 27
8 Control and Configuration Interface 28
9 Configuration and Calibration 28
9.1 Configuration 29
9.1.1 ICAO Address 30
9.1.2 Aircraft Maximum Speed 30
9.1.3 Aircraft Stall Speed 31
9.1.4 Aircraft Length / Width 31
9.1.5 Aircraft Registration 31
9.1.6 GPS Antenna Lateral / Longitudinal Offset 31
9.1.7 Aircraft Emitter Type 32
9.1.8 ADS-B In Capability 32
9.1.9 Baro Altitude Source 32
9.1.10 Serial Port Baud Rate 33
9.1.11 SIL / SDA 33
9.1.12 Default Control Mode 33
9.1.13 Default Squawk 33
9.1.14 Baro Altitude Resolution 34
9.1.15 In / Out Protocols 34

9.2 Control 34
9.3 Post-Installation Checks 34
9.4 Software Part Number 37
9.5 Altitude Encoder Calibration 38
10 Normal Operation 39
11 Maintenance 39
12 Support 39
Appendix A Control Interface 40
Appendix B Equipment Compatibility and Interconnect Drawings 44

5 System Information

5.1 Certification

This installation manual provides mechanical and electrical information necessary to install ping200XR. It is not equivalent to an approved airframe-specific maintenance manual, installation design drawing, or installation data package. The content of this manual assumes use by competent and qualified personnel using standard maintenance procedures in accordance with Title 14 of the Code of Federal Regulation and other related accepted procedures. The conditions and tests required for approval of this article are minimum performance standards. Those installing this article either on or within a specific type or class of aircraft must determine that the aircraft installation conditions are within the standards which include any accepted integrated functions not specified by the standards. TSO articles, articles approved with 14 CFR Part 21.8(d), and any accepted integrated function(s) not specified in the standard must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements. This is an incomplete system intended to provide the functions identified in, and when installed according to, this installation manual.

5.2 TSO Authorization

ping200XR complies with the following TSOs when properly installed and interfaced with equipment as detailed in this guide.

Function	TSO / MPS	Class / Type
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS / Mode S) Airborne Equipment	TSO-C112e RTCA/DO-181E	Level 2els, Class 1 [1]
Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 MHz	TSO-C166b RTCA/DO-260B	Class B1S
Automatic Pressure Altitude Reporting Code-Generating Equipment	TSO-C88b SAE/AS8003	N/A
Airborne Navigation Sensor Using the Global Position System (GPS) Augmented by the Satellite Based Augmentation System (SBAS)	TSO-C145e INCOMP RTCA/DO-229E	Beta 1

[1] Anticipating RTCA/DO-181F Level 2 Transponder requirements, ping200XR does not support the UM protocol, does not support the Comm-A protocol, and does not have the capability to process and transmit air-initiated Comm-B messages. See Section 5.4 for additional details.

5.3 System Functions

System Function	TSO	DO-178C DAL	DO-254 DAL
Mode S Transponder	TSO-C112e	C	C
1090ES Transmitter	TSO-C166b	C	C
Altitude Encoder	TSO-C88b	C	C
GPS/SBAS	TSO-C145e	C	C

5.4 TSO Deviations and Incomplete

TSO	Deviation
C112e	uAvionix was granted a deviation from TSO-C112e Paragraphs 3.e and 6.f to use RTCA/DO-178C in place of RTCA/DO-178B.
C112e	uAvionix was granted a deviation to not implement Utility Message (UM Field) support, consistent with RTCA/DO-181F and FAA/TSO-C112f Level 2 transponder requirements. This impacts the Mode S Level 2 transponder SARPs requirements as contained in ICAO Annex 10 Volume IV §§3.1.2.6.5.3.1, 3.1.2.6.11.3.2.1.3, 3.1.2.6.11.3.4.2.2, and 3.1.2.7.9.2.3.
C112e	uAvionix was granted a deviation to not implement Comm-A support, consistent with RTCA/DO-181F and FAA/TSO-C112f Level 2 transponder requirements. This impacts the Mode S Level 2 transponder SARPs requirements as contained in ICAO Annex 10 Volume IV §§2.1.5.1.2, 3.1.2.6.11.1.2, and 3.1.2.10.5.2.1.1.
C112e	uAvionix was granted a deviation to not implement broadcast interrogation support, consistent with RTCA/DO-181F and FAA/TSO-C112f Level 2 transponder requirements. This impacts the Mode S Level 2 transponder SARPs requirements as contained in ICAO Annex 10 Volume IV §§2.1.5.1.2, 3.1.2.6.11.1.2, and 3.1.2.10.5.2.1.1.
C112e	uAvionix was granted a deviation to not implement multi-site message support, as it applies to the Comm-B operation of Level 2 transponders, consistent with RTCA/DO-181F and FAA/TSO-C112f Level 2 transponder requirements. This impacts the Mode S Level 2 transponder SARPs requirements as contained in ICAO Annex 10 Volume IV §§2.1.5.1.2 and 3.1.2.6.11.3.

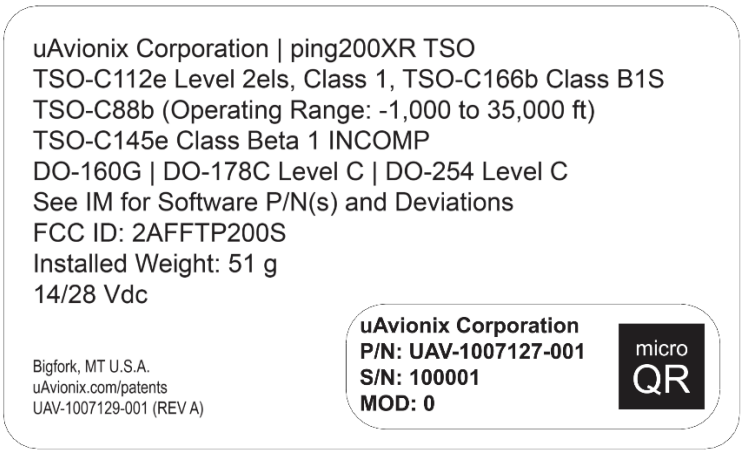
C112e	uAvionix was granted a deviation to not implement Air-Initiated Comm-B support, consistent with RTCA/DO-181F Level 2 and FAA/TSO-C112f transponder requirements. Air-initiated Comm-B messages are neither processed nor transmitted. This impacts the Mode S Level 2 transponder SARPs requirements as contained in ICAO Annex 10 Volume IV §§2.1.5.1.2 and 3.1.2.6.11.3.
C112e	uAvionix was granted a deviation to not reply to ATCBRS/Mode S All-Calls, as required by ICAO Annex 10 Volume IV §3.1.2.1.5.1.1.1 on or after January 1, 2020, and consistent with RTCA/DO-181F and FAA/TSO-C112f requirements.
C166b	uAvionix was granted a deviation from TSO-C166b Paragraphs 3.e and 6.h to use RTCA/DO-178C in place of RTCA/DO-178B.
C166b	uAvionix was granted a deviation to not implement Airborne Velocity Subtypes 3 and 4, consistent with RTCA/DO-260C and FAA/TSO-C166c requirements.
C88b	uAvionix was granted a deviation from TSO-C88b Paragraphs 3.e and 6.h to use RTCA/DO-178C in place of RTCA/DO-178B.
C88b	uAvionix was granted a deviation from TSO-C88b Paragraph 3.d to use RTCA/DO-160G in place of RTCA/DO-160E.
C145e	uAvionix was granted a deviation from TSO-C145e Paragraph 3.g to use RTCA/DO-160G in place of RTCA/DO-160E.

5.5 FCC ID

Model	FCC ID
ping200XR TSO	2AFFTP200S

5.6 Device Marking

5.6.1 ping200XR Hardware



5.6.2 ping200XR Software

The software contained in ping200XR is identified by electronic marking. Reference Section 9.4 for information on determining the software part number.

5.7 Environmental Qualification Form

Conditions	DO-160G Section	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to Categories B2,C4
Low temperature ground survival	4.5.1	-55°C
Low Temperature Short-Time Operating	4.5.1	-35°C
Low Temperature Operating	4.5.2	-35°C (see Note 1)
High Temperature Operating	4.5.4	+70°C
High Temperature Short-Time Operating	4.5.3	+70°C
High Temperature Ground Survival	4.5.3	+85°C
Loss of Cooling	4.5.5	Cooling air not required (+70°C operating without cooling)
Altitude	4.6.1	35,000 ft (see Note 2)
Decompression	4.6.2	Equipment identified as Categories B2,C4 – no test
Overpressure	4.6.3	Equipment identified as Categories B2,C4 – no test
Temperature Variation	5.0	Equipment tested to Category B
Humidity	6.0	Equipment tested to Category A
Operation Shocks	7.0	Equipment tested to Category B
Crash Safety	7.0	Equipment tested to Category B Type 5
Vibration	8.0	Aircraft zone 2: type 5 Category S level M
Explosion	9.0	Equipment identified as Category X – no test
Waterproofness	10.0	Equipment identified as Category X – no test
Fluids Susceptibility	11.0	Equipment identified as Category X – no test
Sand and Dust	12.0	Equipment identified as Category X – no test
Fungus	13.0	Equipment identified as Category X – no test
Salt Spray	14.0	Equipment identified as Category X – no test
Magnetic Field	15.0	Equipment tested to Category Z
Power Input	16.0	Equipment tested to Category BX
Voltage Spike	17.0	Equipment tested to Category B
AF Conducted Susceptibility	18.0	Equipment tested to Category B
Induced Signal Susceptibility	19.0	Equipment tested to Category AC
RF Susceptibility	20.0	Equipment tested to Category TT
RF Emissions	21.0	Equipment tested to Category B
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category A2XXXX (see Note 3)
Lightning Direct Effects	23.0	Equipment identified as Category X – no test
Icing	24.0	Equipment identified as Category X – no test
Electrostatic Discharge	25.0	Equipment tested to Category A
Fire, Flammability	26.0	Equipment identified as Category X – no test

Notes:

1. Tested to operating low of -45°C when used with an external altitude encoder
2. Tested to 50,000 ft
3. 4-wire serial/power conductors tested to A2XXXX, MMCX GPS conductors tested to A1XXXX

5.8 Continued Airworthiness

Maintenance of the ping200XR is "on condition" only.

Periodic regulatory function checks of the transponder and altitude encoder must be performed. Every 24 months, or after any maintenance is performed where data correspondence error could be introduced:

1. The transponder must be tested, inspected, and found to comply with the requirements of 14 CFR Part 91.413, as described in 14 CFR 43 Appendix F.
2. The altitude encoder must be tested to ensure correspondence to the primary flight altimeter, as described in AC 43-6D and 14 CFR 43 Appendix E, to meet the maintenance requirements of 14 CFR Part 91.411. If the altitude encoder demonstrates correspondence errors in excess of ±125 feet, then calibration as described in Section 9.5 must be performed. If the error cannot be corrected using the calibration procedure, the unit must be repaired or replaced.

Annually, confirm the ADS-B software version is current per Service Bulletins available at the uAvionix website.

The aircraft must be returned to service in a means acceptable to the appropriate aviation authority.

Note: *Transponders certified after January 1, 2020 must not respond to ATCRBS/Mode S All-Calls (Long P4 interrogation). This may cause unexpected results to be obtained by transponder test sets.*

Note: *Mode S transponders must only respond to Mode S Only All-Calls when airborne. ping200XR can be placed in an airborne state for test purposes by entering "Ground Test Mode" using the "ping200X Control & Config" Windows application, or by using certain compatible control heads. For more details see Section 9.3.*

5.9 System Limitations

Installation

This article meets the **minimum** performance and quality control standards required by a technical standard order (TSO). Installation of this article requires a separate approval.

GNSS Fault Detection Prediction

Cannot be used for navigational guidance where Fault Detection (FD) prediction capability is required, such as during execution of certain approach operations outside of SBAS coverage.

GNSS Supported Modes

ping200XR's truFYX GNSS does not implement LNAV approach mode. It operates in En Route/Terminal mode only.

SatCom

The ping200XR GPS has not been demonstrated as compatible with SatCom equipment and should not be installed on SatCom equipped aircraft[1].

Note 1: SatCom equipment is defined as radio transmitters transmitting on or near the L1/L2 frequency bands. This does not include passive receive-only systems such as additional GPS receivers or unidirectional satellite data link receivers.

5.10 Regulatory Compliance

Aircraft using ping200XR must evaluate their needs to be compliant with 14 CFR 91.215, 91.225 and 91.227. While in transponder airspace specified in 14 CFR 91.215, ping200XR must be maintained to 14 CFR Part 91.413. While in ADS-B OUT airspace specified in 14 CFR 91.225, ping200XR must be configured and equipped to meet the requirements of 14 CFR 91.225 and 91.227.

To meet 14 CFR 91.225 and 91.227 with no operational limitations, dynamic (in-flight) control is necessary. See Section 8 and Appendix A for details on the control interface, and Appendix C for compatible equipment.

For additional guidance on ADS-B OUT installation and approvals, reference AC 20-165B.

6 System Specifications

6.1 System Functionality

ping200XR is a Mode S, Level 2els, Class 1 transponder with ADS-B extended squitter, elementary surveillance, SI code support and internal Class Beta 1 SBAS/WAAS GPS position source. The ping200XR has a nominal power output of 250W and meets the power output requirements for a Class 1 transponder. The ADS-B function meets DO-260B Class B1S.

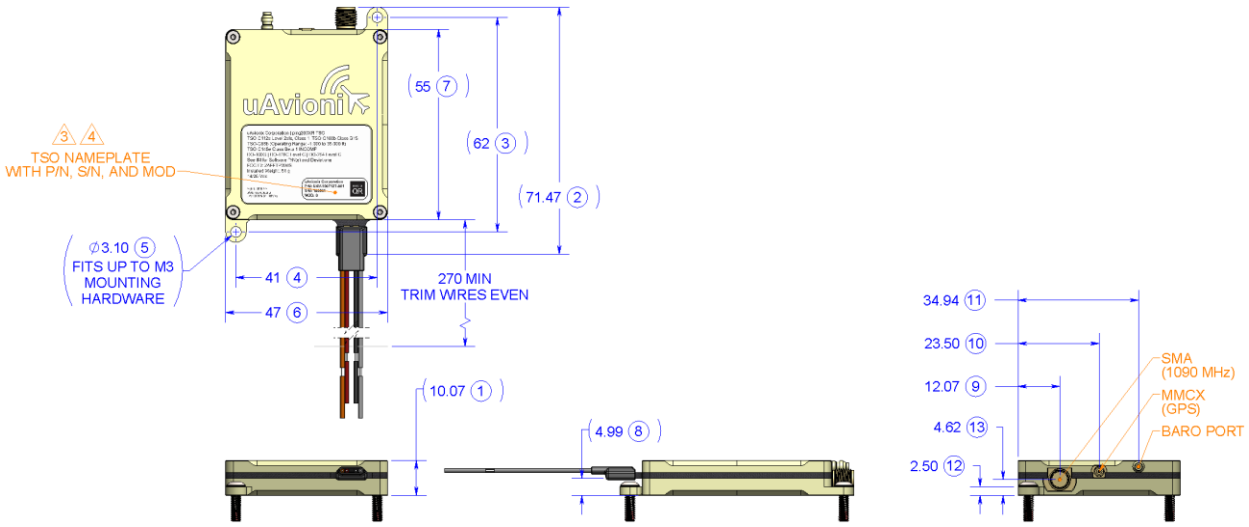
This transponder replies to both legacy Mode A/C interrogations and to Mode S interrogations from both ground radar and airborne collision avoidance systems. In all cases, the interrogations are received by the transponder on 1030MHz and replies are transmitted on 1090MHz.

6.2 ping200XR TSO Specifications

6.2.1 General Specifications

Characteristics	Specifications
Width	47.00 mm
Height	10.07 mm
Depth	71.47 mm
Weight	51g
Operating temperature range	-35°C to +70°C (internal barometer) -45°C to +70°C (external barometer)
Maximum pressure altitude	35,000 ft (internal barometer) 50,000 ft (external barometer)
Input voltage range	9 to 30.3 VDC
14V current	0.16A idle 0.25A maximum
28V current	0.13A idle 0.20A maximum
Inrush Current Limit [1]	1A
Export Compliance	ECCN 7A994

[1] Inrush and internal short-circuit protection is internally current limited to 1A



6.2.2 Mode S Transponder Specifications

Characteristics	Specifications
Transmit frequency	1090 MHz
Transmit power	54 dBm (250 W)
Receive frequency	1030 MHz
ATCRBS sensitivity	-74 dBm
Mode S sensitivity	-74 dBm
RF Impedance	50 Ω
RF Connector	SMA

6.2.3 Altitude Encoder Specifications

Characteristics	Specifications
TSO-C88b Operating Range	-1,000 ft to 35,000 ft (TSO compliant)
Maximum Differential Pressure Altitude (static port to installation environment)	36,000 ft
Maximum Rate of Altitude Change	20,000 fpm
Static Pressure Port	M3 barb fitting

6.2.4 GPS/SBAS Specification

Characteristics	Specifications
Number of Channels	15 (12 GPS and 3 GPS/SBAS)
Frequency	1575.42 MHz L1, C/A code

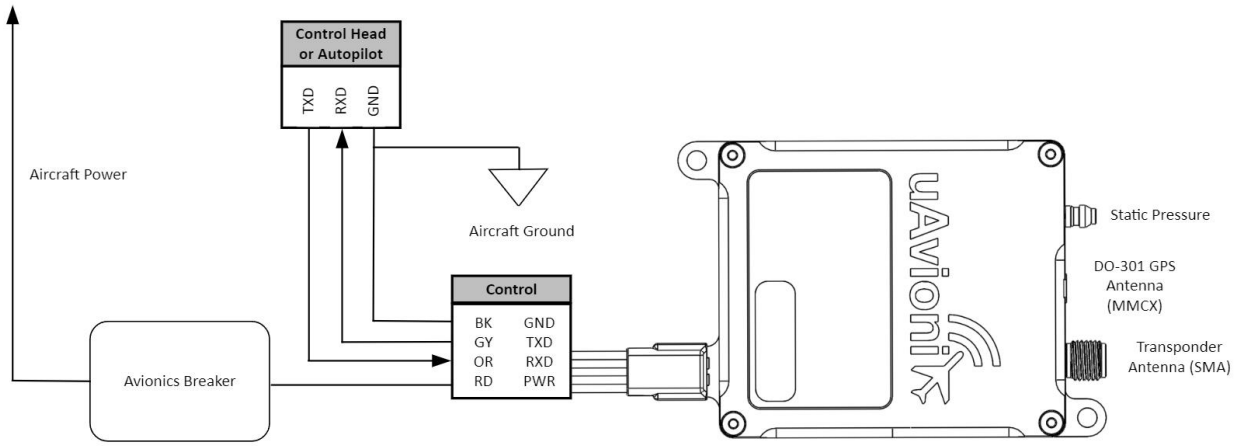
Sensitivity Tracking Reacquisition Cold Start Hot Start	 -166 dBm -160 dBm -148 dBm -160 dBm
Horizontal position accuracy	5 m RMS with SBAS
Velocity accuracy	3 m/s
TTFF (Time to First Fix)	58 seconds typical with current almanac and position
Reacquisition	1 second typical
Position update interval	0.2 second (5 Hz)
Time Mark	±30 nSec of UTC
Datum	WGS-84
Altitude output	Height Above Ellipsoid (HAE)
SDA (System Design Assurance)	2
SIL (Source Integrity Level)	3

6.2.5 Control Interface Specifications

Characteristics	Specifications
Physical	RS-232
Rate and properties	57,600 bps 8N1
Protocols	UCP, UCP-HD, Apollo and Mavlink (Navigation message only)

For more control interface details, see Appendix A .

6.2.6 System Interfaces


Control Head
or Autopilot
TXD
RXD
GND
Aircraft Power
Aircraft Ground
Control
BK GND
GY TXD
OR RXD
RD PWR
Avionics Breaker
uAvionix
Static Pressure
DO-301 GPS
Antenna
(MMCX)
Transponder
Antenna (SMA)

7 Installation

7.1 Unpacking and Inspecting

Carefully unpack the device and make a visual inspection of the unit for evidence of any damage incurred during shipment. If the unit is damaged, notify the shipping company to file a claim for the damage. To justify your claim, save the original shipping container and all packing materials.

7.2 Authorized Part Numbers

Item	P/N
ping200XR Hardware	UAV-1007127-( )
ping200XR Software	UAV-1002393-( )

7.3 Installation Materials and Tools

ping200XR requires configuration, either using the available uAvionix Windows-based application, or dynamically using the described configuration protocol. Typical installations will be configured using:

- “ping200X Control & Config” Windows application, UAV-1004567-001
- ping200X USB configuration adapter, UAV-1004050-001

ping200XR may require standard aviation parts for installation, such as:

- Screws or appropriate hardware
- Wire
- Shielded wire (2 or 3 conductor)
- Circuit breakers
- Environmental splices
- Ring terminals for grounding
- Static pressure lines and fittings
- Thread locking compound. We recommend Loctite® 242 or 243 which works well with stainless steel hardware.

Minimally, ping200XR installation requires access to the following tools:

- Screwdriver or other appropriate driver
- Appropriate crimping tool(s) or soldering equipment

7.4 Additional Required Equipment

ping200XR is a “remote” transponder. To fully function it requires connection to a controlling device, often referred to as a control head. It is possible to statically configure ping200XR, but certain capabilities, such as changing the squawk code and responding to annunciations, will not be available when no controlling device is connected.

For transmission of complete ADS-B data elements, and 14 CFR 91.225 compliance, ping200XR requires connection to a compliant position source.

The following table details the functions provided directly by ping200XR.

Transponder	ADS-B Transmitter	Altitude Encoder	GPS Receiver	GPS Antenna	Transponder Antenna	Control Head w/ Annunciation
X	X	X	X			

In typical configurations, the control head provides control, display, and annunciation.

7.5 Mounting

The ping200XR is designed to be mounted in any convenient location in the cockpit, the cabin, or an avionics bay.

The following installation procedure should be followed, taking care to allow adequate space for installation of cables and connectors.

- Select a position in the aircraft that is not too close to any high external heat source. The ping200XR is not a significant heat source itself and does not need to be kept away from other devices for this reason.
- Avoid sharp bends and placing the cables too near to the aircraft control cables.

Secure the transponder to the aircraft via the two integrated mounting brackets. The brackets are designed to accept screws up to size M3 or 4-40. Thread locking compound should be used as appropriate, and the ping200XR should be mounted on a flat surface.

Note: Installation of the ping200XR must be in accordance with AC 43.13-2B, Chapter 1.

7.6 Wiring

ping200XR requires connections to power, ground and an RS-232 control interface.

4-wire Control Interface		
Color	Type	Function
Red	Power Input	Aircraft Power
Black	Power Input	Aircraft Ground
Grey	Data Output	Control RS-232 Transmit
Orange	Data Input	Control RS-232 Receive

If new power wiring is required, refer to AC 43.13-1B Chapter 11 for guidance. The wiring should present an impedance of less than 0.5 Ω. The following table provides guidance for typical aircraft hook-up wire.

Gauge	ohm/km	Maximum Length for 0.5 Ω
20 AWG	35	14.2 m
22 AWG	64	7.8 m

Refer to Appendix B for example wiring diagrams and installations.

7.7 Transponder Antenna

An appropriate L-band antenna, designed to receive and transmit vertically polarized signals at 1030 and 1090 MHz, must be installed.

Prior to powering the ping200XR, ensure an appropriate antenna or commercially available 50 Ω load is connected to the SMA port. Powering the ping200XR without an attached load will result in damage to the device not covered under warranty.

The following antennas may be used:

- Standard 50Ω vertically polarized antenna with VSWR ≤ 1.5:1 over the 1030 to 1090 MHz frequency band
- TSO-C74( ) or TSO-C112( ) antennas that meet the above specification
- uAvionix non-TSO SMA dipole, P/N UAV-1004675-003

Take into consideration the antenna manufacturer's installation instructions. General guidance is provided below.

- The antenna should be mounted external to the airframe, and typically on the bottom of the aircraft.
- The antenna should be mounted in a vertical orientation when the aircraft is in level flight. For uAvionix UAV-1004675-003, see below for proper orientation.

- Keep the cable lengths as short as possible and avoid sharp bends in the cable to minimize the Voltage Standing Wave Ratio (VSWR) (i.e. Return Loss).
- Ensure that cable and connector losses do not reduce power output below allowed levels for your aircraft operation.
- Conventional monopole antennas require an appropriate ground plane. For metallic aircraft, ensure good ground connection to the antenna. For composite aircraft, a ground plane must be installed.
- The antenna connections should be protected from the elements, and antenna cabling should be installed to minimize RF energy radiated inside the aircraft.

The antenna used must be installed to provide a separation distance of at least 20 cm from all persons.

7.8 GPS Antenna

ping200XR provides a 5 VDC bias voltage (25mA max current) for active DO-301 antenna operation. Only an appropriate TSO-C190 or DO-301 compliant antenna with an MMCX connector and 5VDC bias voltage should be integrated with ping200XR. This antenna should be mounted at a minimum of 4 feet from any aircraft transmit antennas and have a clear view of the sky with no obstructions.

For applications where a TSO antenna is not required, uAvionix non-TSO GPS antenna (part number UAV-1007165-001) has been shown compatible.

7.9 Static Pressure Port

ping200XR contains a TSO-C88b altitude encoder. The barb fitting (size M3) located on the unit's enclosure should be securely attached to the aircraft's static pressure system. Minimize static pressure line lengths as possible. Press-plastic tubing (PVC, soft nylon or polyurethane) with a nominal ID of 1/8" (3.18mm) can be used, and secured with a small tie wrap. Adapters may be used to convert the barb to match the aircraft's current static plumbing. Ensure any fittings are free from leaks.

Upon completion of installation, a case leak test should be performed per 14 CFR Part 43 Appendix E.

If an external altitude encoding source is configured, the internal altitude encoder is unused, and the static pressure system does not need to be connected to the ping200XR static pressure port. The Maximum Operating Altitude listed on the ping200XR nameplate is not applicable when used with an external altitude encoding source – instead reference the Environmental Qualification Form in Section 5.7.

7.10 Cooling Requirements

ping200XR is designed to meet all applicable TSO requirements without forced-air cooling.

Attention should, however, be given to the incorporation of cooling provisions to limit the maximum operating temperature if ping200XR is installed in close proximity to other avionics which would otherwise cause operational temperature limits to be exceeded (see Section 5.7 Environmental Qualification Form).

8 Control and Configuration Interface

ping200XR has a control and configuration serial interface. It is used to configure the equipment at installation time, and to control the device while operating. Typically, a control head or unmanned aircraft flight control computer is connected to the device during operation.

Transponder control provides the ping200XR with data such as operating mode, emergency status, squawk code, IDENT, and optionally external pressure altitude information. Status and annunciation information is provided by ping200XR over the control interface.

For 14 CFR 91.225 compliance with no operational limitations, dynamic (in-flight) control is necessary.

For details on the ping200XR control interface, refer to Appendix A.

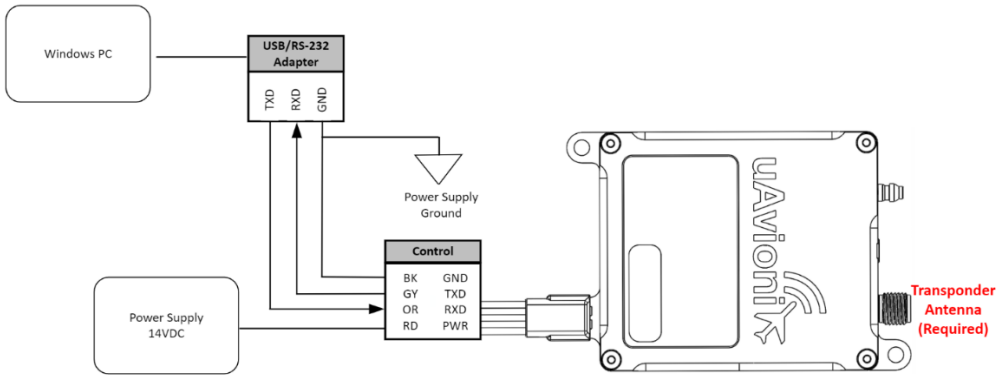
For typical installations, refer to Appendix C.

9 Configuration and Calibration

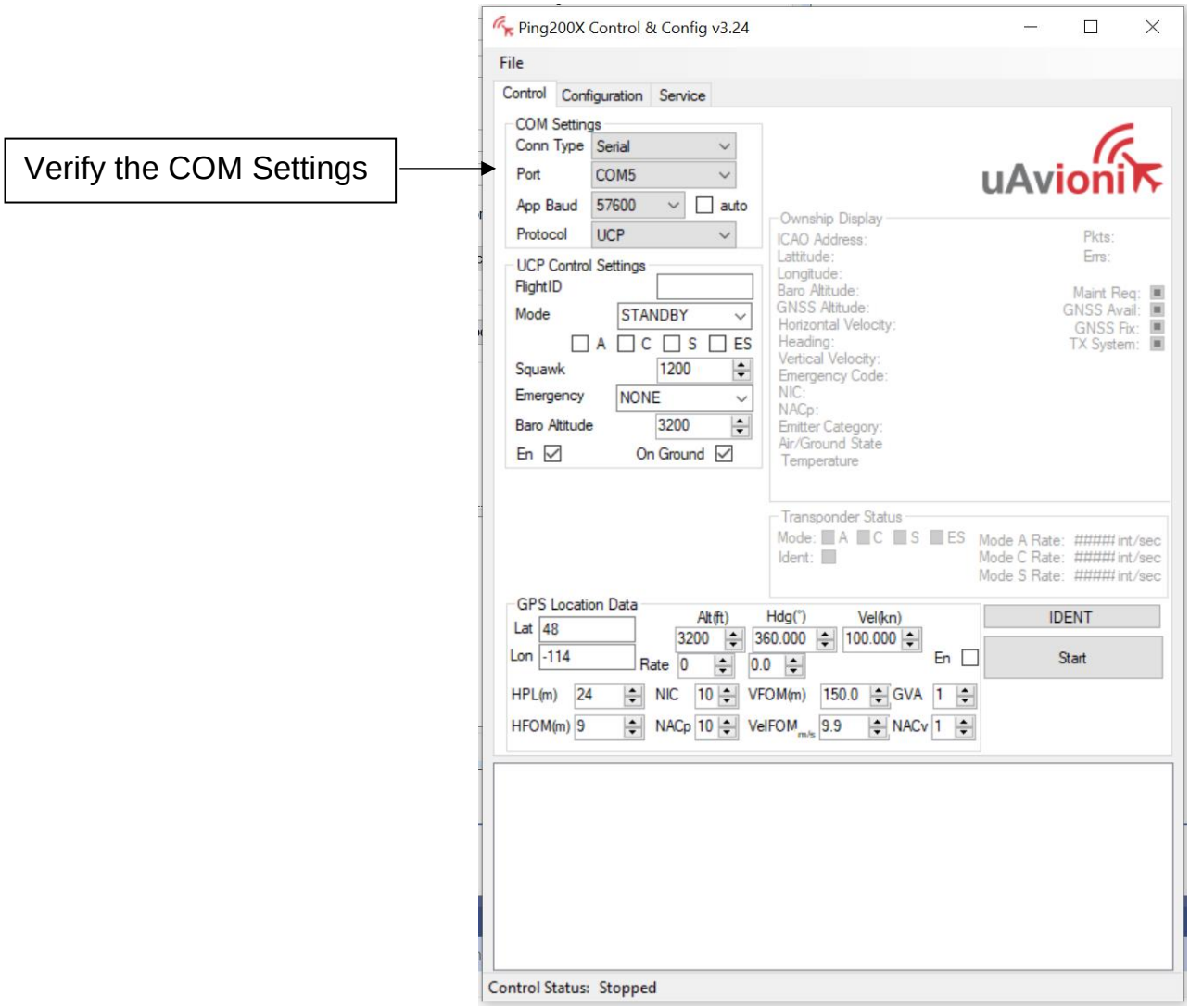
The transponder system must be configured during initial system installation. This can take place on the bench or in the aircraft, but device power and connection to a PC must be available.

Prior to powering the ping200XR, ensure an appropriate antenna or commercially available 50 Ω load is connected to the SMA port. Powering the ping200XR without an attached load will result in damage to the device not covered under warranty.

Connect the ping200XR to a PC running the Configuration and Control application via the USB COM port adapter.



Set ‘Conn Type’ to ‘Serial’, ‘Port’ to the USB or serial port connected to the ping200XR, ‘App Baud’ to ‘57600’ and ‘Protocol’ to ‘UCP’.



Click ‘Start’.

9.1 Configuration

The configuration items list below should be used to document the system installation for future reference. These items can be found on the ‘Configuration’ tab and are permanently stored in the ping200XR.

Configuration Item	Default	Configured
ICAO Address	0x000000	
Aircraft Maximum Speed (kts)	< 75	
Aircraft Stall Speed	0	

Aircraft Length (m)		L ≤ 15	
Aircraft Width (m)		W ≤ 23	
Aircraft Registration		“ “	
GPS Antenna Lateral Offset (m)		0	
GPS Antenna Longitudinal Offset (m)		Applied by sensor	
Aircraft Emitter Type		No Information Available	
ADS-B In Capability	UAT RX	NO	
	1090ES RX	NO	
Baro Altitude Source		Internal	
Serial Port Baud Rate (bps)		57600	
SIL		<= 1E-7 (3)	
SDA		<= 1E-5 (2)	
Default Control Mode		None (Off)	
Default Squawk		1200	
Baro Altitude Resolution (ft)		25	
In Protocols		UCP	
Out Protocols		UCP	

9.1.1 ICAO Address

The ICAO address is a 24-bit number issued to the aircraft by the registration authority of the aircraft. These addresses are usually written as a 6-digit hexadecimal number, although you may also encounter one written as an 8-digit octal number. The ping200XR understands the hexadecimal format. An octal number must be converted to hexadecimal format before entering.

Tip: By using the N-Number Look Up function on https://www.faa.gov, locate and use the “Mode S Code (base 16 / hex)” value. Applies to U.S. registered aircraft only.

9.1.2 Aircraft Maximum Speed

Mode S transponders can transmit their maximum airspeed characteristics to aircraft equipped with TCAS. This information is used to identify threats and to plan avoidance action by the TCAS equipped aircraft. The airspeeds are grouped in ranges.

9.1.3 Aircraft Stall Speed

The default aircraft stall speed is 0. Set as appropriate for your aircraft to allow automatic air/ground state determination. Set to 0 to lock in airborne state, or to allow switching by the control head. See Appendix A for more details.

9.1.4 Aircraft Length / Width

When on the ground, ADS-B transmits encoded aircraft size information which is used by ATC to identify taxiing routes and potential conflicts. Enter the length and width (wingspan) fields and the appropriate size codes will be calculated for transmission.

Aircraft Length in Meters	Aircraft Width in Meters
L ≤ 15	W ≤ 23
15 < L ≤ 25	28.5 < W ≤ 34
25 < L ≤ 35	33 < W ≤ 38
35 < L ≤ 45	39.5 < W ≤ 45
45 < L ≤ 55	45 < W ≤ 52
55 < L ≤ 65	59.5 < W ≤ 67
65 < L ≤ 75	72.5 < W ≤ 80
75 < L ≤ 85	W > 80
L > 85	Any

9.1.5 Aircraft Registration

The Aircraft Registration can be up to an 8 alpha-numeric code that corresponds to the tail number of the aircraft. (0-9, A-F). This value is used by default in the ADS-B “Callsign” field, unless a valid “Flight ID” is provided via the control interface.

Note: This is typically your aircraft N-number, unless otherwise advised by the FAA or ATC.

9.1.6 GPS Antenna Lateral / Longitudinal Offset

The GPS antenna offset is used in conjunction with the length and width to manage taxiway conflicts. A typical GPS does not report the geographic position of the center of the aircraft, or even the tip of the nose of the aircraft; instead, it usually reports the location of the actual GPS antenna (not the GPS receiver). In normal flight operation, this distinction is of no importance at all, but if ADS-B is used to manage taxiway conflicts, a

significant offset in antenna position could mean the aircraft footprint is not in the same place as the ADS-B reported position. Although the GPS Antenna Offset is primarily intended for position correction on large transport aircraft, General Aviation aircraft can also have a significant offset. For example, if the aircraft has a long tail boom and the GPS antenna is on top of the tail, the GPS position could be 4 meters or more from the nose of the aircraft.

GPS Antenna Lateral Offset from roll axis (meters)	GPS Antenna Longitudinal Offset from aircraft nose (meters)
0	0 to 60 meters in 2-meter increments
Left 2	
Left 4	
Left 6	
Right 2	
Right 4	
Right 6	

9.1.7 Aircraft Emitter Type

The aircraft emitter type default is ‘No Information Available’. This must be configured as appropriate for the host aircraft.

9.1.8 ADS-B In Capability

The ADS-B transmissions include an indication to the ground stations of whether the aircraft includes a 1090MHz ADS-B receiver, a UAT ADS-B receiver, or both. This data is used to transmit ADS-R or TIS-B broadcasts to your aircraft if conditions indicate. ping200XR does not include an ADS-B receiver. Only select these items if you have a separate ADS-B receiver on-board.

9.1.9 Baro Altitude Source

By default, ping200XR utilizes pressure altitude measurements from an internal TSO-C88b altitude encoder for Mode C, S and ADS-B messages. If desired, an existing or external altitude encoder can be used in lieu of the internal altitude encoder. To do so, change the ping200X’s “Baro Altitude Source” from “Internal” to “External”. If set to “External”, the ping200XR will use the barometric pressure altitude reported in the Control Message in all Mode C, S and ADS-B messages.

9.1.10 Serial Port Baud Rate

This setting configures the speed of the control interface serial baud rate in bps.

9.1.11 SIL / SDA

Set SIL according to the advertised integrity level of the GPS source.

- If the ping200XR is configured to use the internal GPS source, set the SIL to 3 (default).
- If an external GPS source is interfaced, set the SIL based on the external GPS source.

Per AC 20-165B, ping200X's System Design Assurance (SDA) must report the lowest SDA value of the ADS-B system. The ADS-B system includes *both* the SDA of the ping200XR and the external GPS position source.

- If the ping200XR is configured to use the internal GPS source, set the SDA to 2 (default).
- If the paired external GPS source has an advertised SDA that is less than 2, configure the ping200XR SDA value to the SDA of the external GPS source. For GPS's SDAs greater than or equal to 2, configure the ping200XR SDA to 2.

9.1.12 Default Control Mode

Select the default operating mode, to be used prior to arrival of control messages. This setting configures the ping200XR for Mode A, Mode C, Mode S and ADS-B Extended Squitter transmissions.

- None selected disables all modes
- Mode A - Squawk
- Mode C – Altitude
- Mode S – Addressed Identification and Altitude
- Mode ES – ADS-B Identification and Position reporting

When not used with a control head or equivalent device, modes A / C / S / ES must be enabled by default to meet all authorized TSOs.

9.1.13 Default Squawk

The default squawk is 1200. To assist ATC tracking of aircraft, an aircraft squawk is transmitted. The configured value is the squawk code that will be transmitted in lieu of available control data.

9.1.14 Baro Altitude Resolution

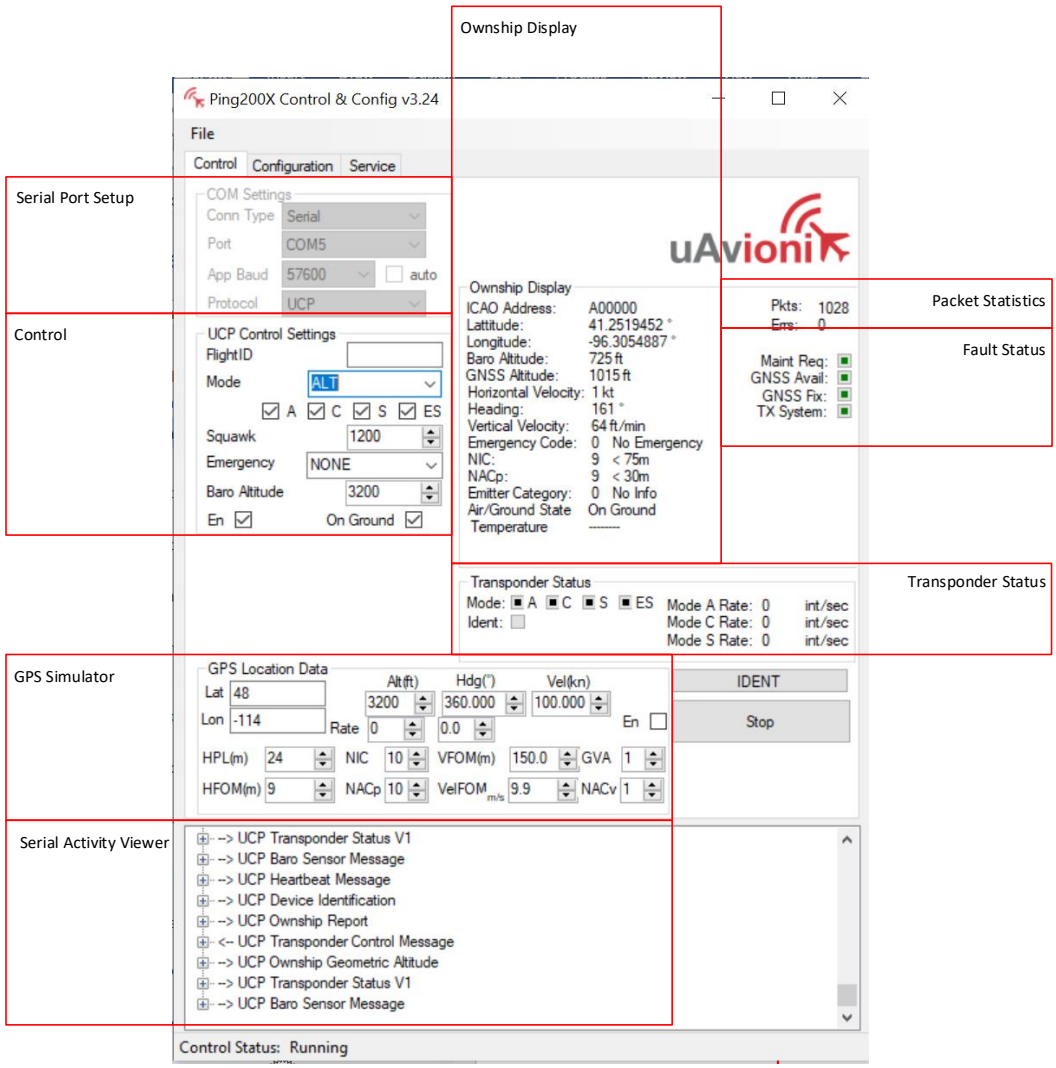
The barometric pressure altitude source resolution default is 25 (ft).

9.1.15 In / Out Protocols

The default In / Out protocols are UCP.

9.2 Control

The ‘Control’ tab allows the installer to exercise and verify the transponder’s operation. This simulates a control head or similar equipment.



9.3 Post-Installation Checks

Post-installation checks must be performed by the installer, after configuration, as appropriate for the aircraft and type of installation.

To ensure compliance with regulations in the United States, verify functionality identified in 14 CFR Part 43 Appendix F (ATC Transponder Tests and Inspections) and 14 CFR Part 43 Appendix E (Altimeter System Test and Inspection).

Aircraft with ping200XR installed may be subject to requirements in 14 CFR 91.215, 91.225 and 91.227. For additional details reference Section 5.10.

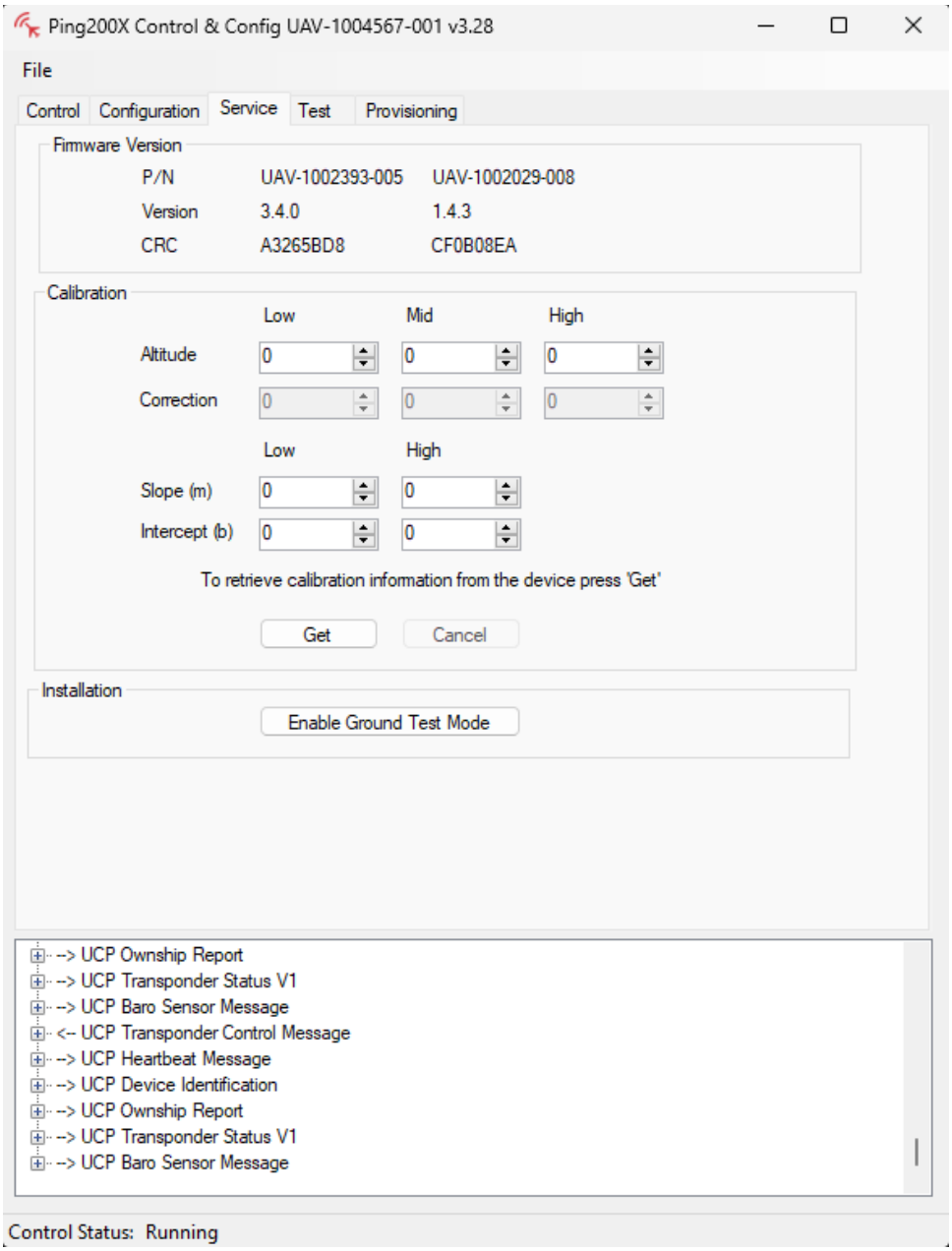
A complete post-installation check may be performed by using a ramp tester such as a VIAVI IFR6000. A simplified post-installation check procedure follows.

STEP	CHECK
Launch the 'ping200X Control & Config' Windows application	
Set Port to the USB or serial port connected to the ping200XR	
Set the 'App Baud' to '57600'	
Set 'Protocol' to 'UCP' - If the ping200XR has been reconfigured for a protocol other than UCP, this procedure may not apply	
Connect the antenna	
Apply power from a minimum of a 11V, 1A power source	
Press 'Start' in 'ping200XR Control & Config' Windows application	
Confirm activity in 'Serial Activity Viewer' and incrementing 'Pkts' in 'Packet Statistics' of 'Control' tab	
Verify 'ICAO Address' in 'Ownship Display' is correct for your aircraft, and not '000000'	
Confirm 'Baro Altitude' in 'Ownship Display' shows the current pressure altitude; i.e. the current altitude as displayed on an altimeter set to 29.92	
If a GPS is connected and the GPS antenna has a clear view of the sky, allow the GPS time to obtain a position fix; confirm that 'Latitude' and 'Longitude' are correct in 'Ownship Display'	
Select 'ALT' from the 'Mode' selection box in 'Control'	
Verify 'TX System' fault annunciation LED turns green in 'Fault Status'	

STEP	CHECK
If you are in range of Radar or connected to an interrogating test set, ‘Transponder Status’ will indicate interrogations	
If not already in airborne state, access the ‘Service’ tab and select ‘Enable Ground Test Mode’ - This will enable airborne state until the ping200XR is power cycled	
Return to ‘Control’ tab and verify ‘Air/Ground State’ displays ‘Airborne’ in ‘Ownship Display’	
Perform ramp test procedures as necessary for required aircraft operations	
An EFB application such as ForeFlight Mobile, when connected to an ADS-B receiver such as Sentry, can be used to verify ADS-B transmissions; - Using ForeFlight Mobile, in the ADS-B Device screen, select ‘Ownship’ when detected, and verify transmitted parameters	

9.4 Software Part Number

Launch the ‘ping200X Control & Config’ Windows application.

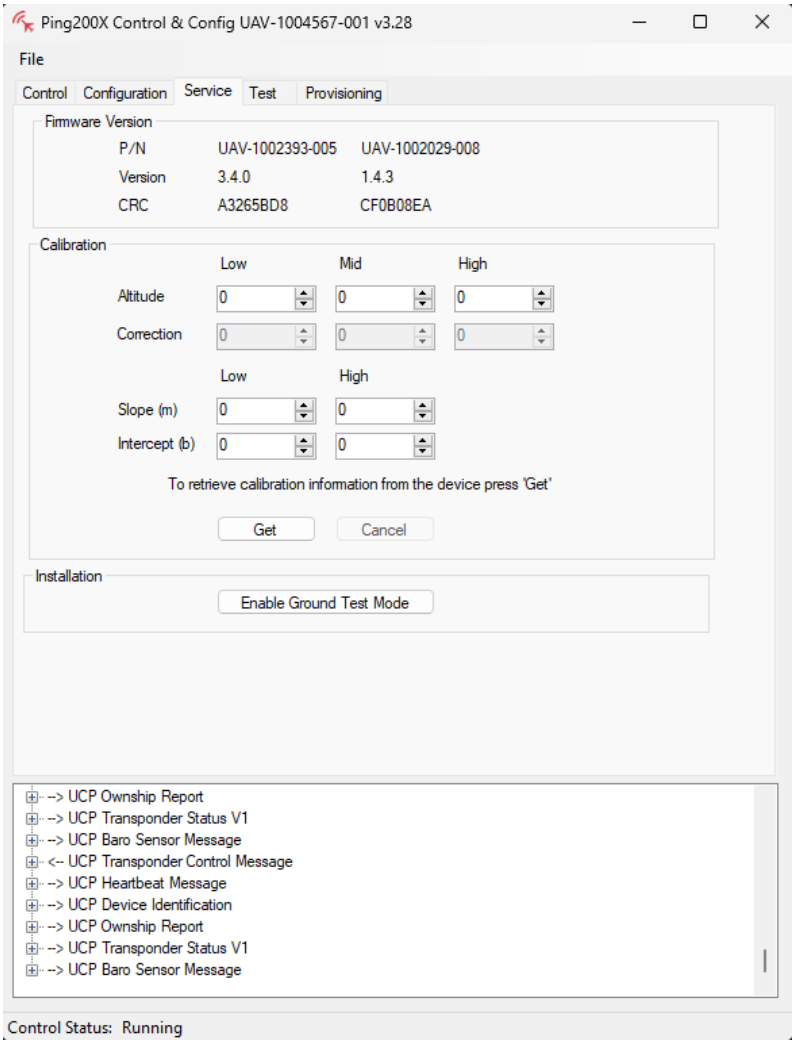


Confirm the displayed ‘P/N’ and ‘Version’ on the ‘Firmware Version’ section of the ‘Service’ tab is current per Service Bulletins listed at:

https://uavionix.com/support/ping200XR/

If not current, apply Service Bulletins as appropriate to update the software.

9.5 Altitude Encoder Calibration

STEP	CHECK
Launch the ‘ping200X Control & Config’ Windows application 	
Set Port to the USB or serial port connected to the ping200XR	
Set the ‘App Baud’ to value noted in Section 9.1	
Set ‘Protocol’ to value noted in Section 9.1	
Apply power from a minimum of a 11V, 1A power source	
Press ‘Start’ in ‘ping200X Control & Config’ Windows application	
With a Pitot Static Test Set connected, select the ‘Service’ tab	

Press ‘Get’ to retrieve the calibration information	
Adjust Pitot Static Test Set to the Low calibration altitude	
Wait for Pitot Static Test Set to reach the Low calibration altitude, then click 'Start'	
Wait for calibration to complete	
Adjust Pitot Static Test Set to Mid calibration altitude	
Wait for Pitot Static Test Set to reach the Mid calibration altitude, then click 'Start'	
Wait for calibration to complete	
Adjust Pitot Static Test Set to the High calibration altitude	
Wait for Pitot Static Test Set to reach the High calibration altitude, then click 'Start'	
Wait for calibration to complete	
Click ‘Send’ to send updated calibration to the device	

10 Normal Operation

ping200XR must be enabled, typically in ALT mode (Mode A, Mode C, Mode S, Extended Squitter), during all phases of flight including surface movement operations.

11 Maintenance

The ping200XR is not a user serviceable product. All service must be performed either by uAvionix or an authorized uAvionix repair center.

12 Support

For additional questions or support please visit:

https://www.uavionix.com/support/

Appendix A Control Interface

ping200XR is controlled and configured using the data interface specified below.

Characteristics	Specifications
Physical	RS-232
Data rate	57,600 bps (default)
Parity	None
Data bits	8
Stop bits	1
Protocol	UCP (RX/TX enabled by default) UCP-HD (disabled by default) Apollo (disabled by default)

UCP is enabled by default for use as the input protocol. Apollo input can optionally be enabled simultaneous with UCP, and messages are processed based on the received data format.

UCP is enabled for use as the output protocol. Additionally, Apollo output is automatically enabled upon receipt of an Apollo input message.

The data rate and protocols can be configured by the UCP/UCP-HD Transponder Configuration message. UCP or UCP-HD input is required to be enabled to allow device configuration.

A.1 UCP

uAvionix Control Protocol (UCP) is documented in *uAvionix UCP Transponder Interface Control Document* UAV-1002375-001. This document is made available to authorized parties, and may be obtained by contacting uAvionix.

UCP can be used to configure, control, and monitor status of the ping200XR.

A.1.1 Control Message

The Control message must be supplied to ping200XR as documented in the UCP ICD. Minimally, Mode A (squawk) code, IDENT, emergency state, and transponder mode are provided in this message.

Mode

To set the transponder operating mode, appropriate enable bits must be set in the Control message. The mapping of traditional transponder modes to required Control message enablement bits follows.

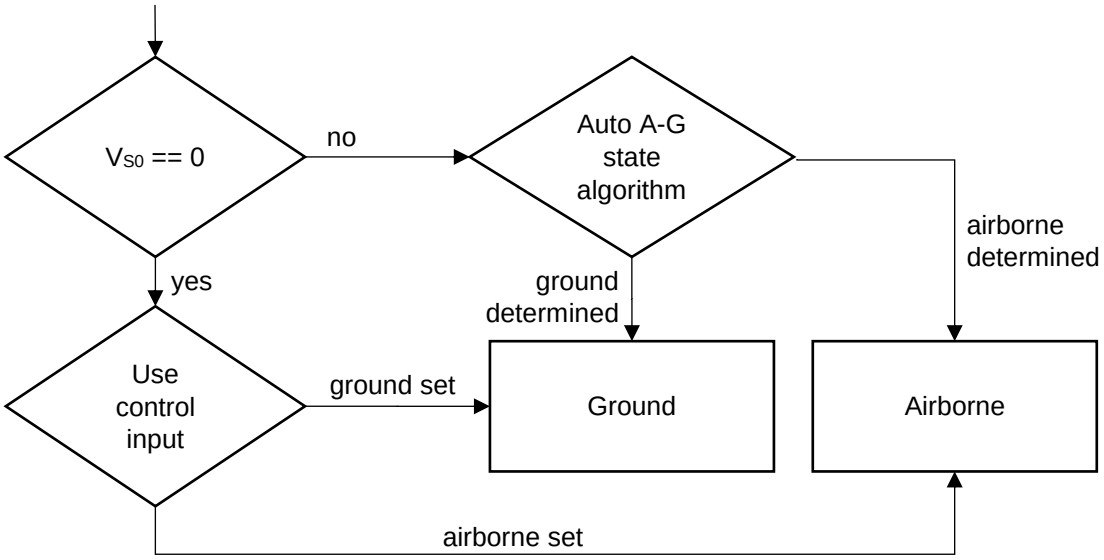
Operating Mode	Mode A	Mode C	Mode S	1090ES
STBY				
ON (suppress altitude)	X		X	X
ALT	X	X	X	X

Flight Identification

If Flight Identification is provided in the Control message, that value is transmitted as Flight ID. If none (all spaces) is provided, the Call Sign/Aircraft Registration value configured in the device is transmitted.

Air-Ground State

Optionally, air-ground state may be provided in the Control message. To use air-ground state from the control message, the device must be configured with a V_{S0} of zero. Air-ground logic is described by the following chart.



Airborne subsonic and supersonic state is automatically determined by ping200X.

A.1.2 Heartbeat Message

With UCP enabled, the Heartbeat message is sent once per second. The following specific fault indications are available in the Heartbeat message, and should be mapped to annunciations compliant with applicable regulations. TSO-C166b requires annunciations of ADS-B transmission device and function failures (see RTCA/DO-260B §2.2.11.5)

Fault	Description
Maintenance Required	ICAO address not set (RTCA/DO-181E §2.2.10.3) ICAO address not set (RTCA/DO-260B §2.2.11.3.1) Multiple position sources available – check configuration (RTCA/DO-260B §2.2.5.3)
Failure TX System	Transponder replies not enabled or acquisition squitter rate failure (RTCA/DO-181E §2.2.10.4) Transmit not enabled or extended squitter rate failure (RTCA/DO-260B §2.2.11.2.1 and §2.2.11.5.1)
Failure GNSS No 3D Fix	No valid 3D position from GNSS (RTCA/DO-229E §2.1.2.6)
Failure GNSS Unavailable	Unable to communicate with GNSS subsystem (RTCA/DO-260B §2.2.11.6)

A.2 UCP-HD

uAvionix Control Protocol – Half Duplex (UCP-HD) is documented in *uAvionix UCP Transponder Interface Control Document* UAV-1002375-001. This document is made available to authorized parties, and may be obtained by contacting uAvionix.

UCP-HD can be used to configure, control, and monitor status of the ping200XR.

A.2.1 Control Message

See A.1.1 for a description of the Control message.

A.2.2 Transponder Status

With UCP-HD enabled, the Transponder Status is sent in response to each Control message, as documented in the ICD.

The presence of a fault to annunciate is delivered by the “Fault or Failure Indicated” bit being set. To determine the specific fault, query the Heartbeat message using a Message Request. See A.1.2 for a description of the fault indications available in the Heartbeat message.

A.3 Apollo

Apollo can be used to control and monitor status of the ping200X. To use, ensure Apollo is enabled as an input protocol. Once an Apollo message is received, Apollo message output is enabled until device reset.

A.3.1 Supported Input Messages

The following input messages are supported:

Mode (#MD)

The Mode message configures the operating mode, Mode A (squawk) code, and IDENT.

Setting	Description	Mode A	Mode C	Mode S	1090ES
‘O’	STBY				
‘A’	ON (Altitude Suppress)	X		X	X
‘C’	ALT	X	X	X	X

Altitude (#AL)

The altitude message provides pressure altitude information.

A.4 Legacy XP Transponder Protocol

ping200XR supports operational transponder control via the XP Transponder Protocol. This includes Mode A selection, Callsign, Emergency Status, IDENT and Transponder Mode (STBY/ON/ALT) control.

Appendix B Equipment Compatibility and Interconnect Drawings

ping200XR can be statically provisioned, or dynamically controlled in-flight by a control head or unmanned aircraft flight control computer. To meet installation or operational requirements, dynamic control may be required (e.g. to provide in-flight updates to the squawk code).

For 14 CFR 91.225 compliance with no operational limitations, dynamic control is necessary.

For 14 CFR 91.225 compliance, a position source is necessary.

The installation information below serves as a supplement to any manuals describing controlling devices, and concern basic wiring of the transponder control and position functionalities only. For further installation and operating instructions, please reference the appropriate installation manual and pilot's guide. The installer should become fully familiar with the installation process for the controlling device. These descriptions are informational, and in no way grant an installation approval.

B.1 Compatible Control Protocols

ping200XR can be controlled using equipment compatible with UCP, UCP-HD and Apollo protocols, as documented in Appendix A.

B.2 Compatible Equipment

The following equipment has been shown to be compatible with ping200XR, and can serve as a controlling device.

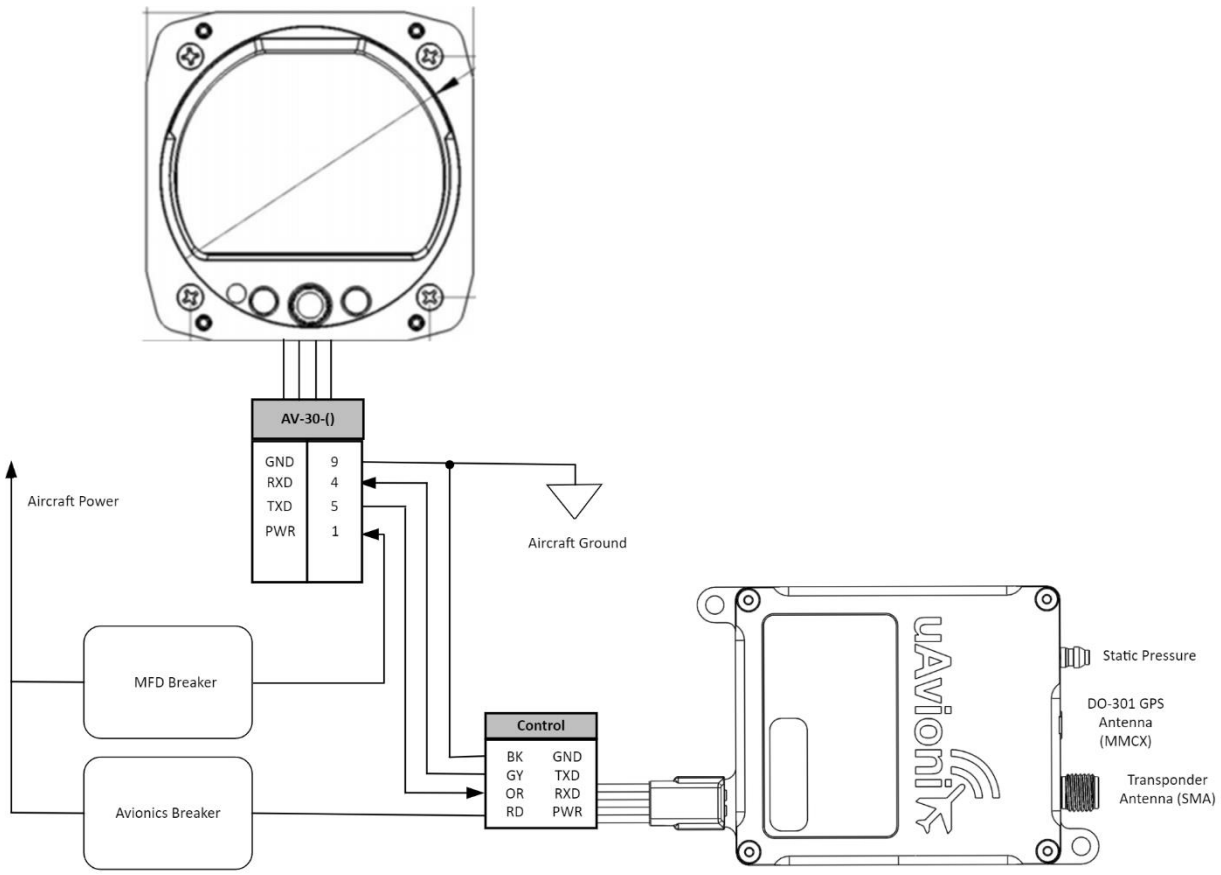
Manufacturer	Model	ping200XR Protocol	Controller Configuration
uAvionix	AV-20-E	UCP-HD *[1]*	Enable "XPDR CTRL" page
	AV-30-E	UCP-HD *[1]*	SERIAL 2: "BEACON X" GPS NAV SRC: "BEACON X" (optional, enable if GPS track and velocity information desired)
	AV-30-C		

[1] Protocol must be enabled on ping200XR and baud rate set to 2400

See below for example interconnect drawings.

B.2.1 AV-30-C or AV-30-E Control Head

This installation uses the ping200XR's internal truFYX GPS for position data. The uAvionix AV-30-C or AV-30-E provides control, status, and altitude encoder data.



Configure the ping200XR as appropriate, ensuring the following values have been updated from defaults:

Parameter	Value
In Protocols	UCP-HD
Out Protocols	UCP-HD
Serial Port Baud Rate	2400
Baro Altitude Source	External

B.3 Third-party Equipment

The following devices are reported to be compatible with supported ping200XR control protocols. These EFIS displays have the capability to send barometric pressure altitude data and control the mode and squawk functions of the ping200XR through any available RS-232 serial output. ping200XR configuration must still take place through the “ping200X Control & Config” Windows application.

Manufacturer	Model	ping200XR Protocol	Configuration	Function Provided
GRT	MINI-B	Apollo	Serial Output: SL70/STX175 Serial Rate: 57600	Control
	MINI-AP			
	MINI-X			
	Sport EX			
	Horizon EX			
MGL	iEFIS	Apollo	Type: STX165(R) Serial Rate: 57600	Control
	Xtreme EFIS			

Proper operation of the interface and system, with the specific equipment configuration, must be demonstrated at installation time.

B.3.1 ping200XR Configuration

Configure the ping200XR as appropriate, ensuring the following values have been updated from defaults:

Parameter	Value
In Protocols	UCP and Apollo
Out Protocols	Apollo
Serial Port Baud Rate	57600 or as appropriate
Baro Altitude Source	External

B.3.2 Controller Configuration

Only the EFIS serial OUTPUT is required. If no configuration information is provided in the compatible equipment table above, the parameters should be set as follows.

Characteristics	Specifications
Physical	RS-232
Rate and properties	57,600 bps 8N1 (or as configured on ping200XR)
Protocol	SL70, STX 165R, or UCP

B.3.3 Interconnect

Connect the ping200XR control port Orange (RXD) wire to the appropriate EFIS serial port transmit (TXD) line.

Example pinout options for certain compatible EFIS displays are shown below. Please consult the EFIS installation manuals for additional options and information.

GRT Mini-X / Mini-AP	Serial 1	Serial 2
TXD Pin	5	1

GRT Mini-B	Serial 1	Serial 2	Serial 3
TXD Pin	5	1	9

GRT Sport EX / Horizon EX	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5	Serial 6
TXD Pin	A2	A4	A25	A5	A3	A1