XP Transponder User Guide Rev 1.3

DOC7010R01

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Contents

Introduction

Sagetech Corporation is dedicated to making integration of our XP family of transponders a straight-forward and simple exercise.

We want your experience with Sagetech to be unparalleled in product quality and customer service. If you have questions, you can email or call us at:

support@sagetechcorp.com

1 (509) 493-2185

We also are interested in your feedback (good or bad) on our products, documents, and customer service.

This document provides basic information necessary for a user to install and use the Sagetech XP family of transponders.

Sagetech XP Family of Transponders by Part Number

Part Number	Product Name
XPC-TR	Mode C Transponder
XPS-TR	Mode S Transponder with ADS-B Out
XPG-TR	Mode S Transponder with ADS-B Out and Integrated GPS
XPS-TRB	Mode S Transponder with ADS-B In/Out

Unless otherwise specified, the information in this document applies to all Sagetech XP transponders.

Transponder Certification

The XP family of transponders is not currently TSO certified, although certification work by Sagetech is underway. For information about the TSO certification timeline, contact Sagetech Corporation.

Equipment Safety

This product, like all microcontroller products, uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, use standard ESD practices to ensure the transponder is not damaged.

Important:

Whenever power is supplied to the transponder, a 50 ohm load must be provided to the SMA connection. You can use an antenna or a commercially available 50 ohm load (for example, part number TS180M-10W available from RFMW.com).

XP Transponder Fundamentals

The Sagetech XPC-TR Mode C Transponder interacts with air traffic control (ATC) by transmitting and receiving standard secondary surveillance radar pulses per ICAO requirements. The transponder replies to requests from ATC with a squawk code and altitude data. Altitude data can be based on the transponder's integral, calibrated pressure sensor and encoder (termed a *blind encoder*) or one provided external to the transponder.

The Sagetech XPS-TR Mode S Transponder with ADS-B Out contains all the functionality of the Sagetech XPC-TR Mode C Transponder. In addition, it provides Mode S replies (includes data such as ICAO[1] address and call sign) and is capable of being selectively interrogated. Also, it adds Automatic Dependent Surveillance-Broadcast (ADS-B) Out capability. If configured with a GPS data source it can broadcast aircraft position and other relevant data to the ATC system and surrounding aircraft.

The Sagetech XPG-TR Mode S Transponder with ADS-B Out contains all the functionality of the Sagetech XPS-TR Mode S Transponder except Mutual Suppression. In addition, the transponder is preconfigured to use the installed GPS module with an internal GPS Antenna. A connector is provided to enable use of an optional external antenna as a GPS receiving source.

The Sagetech XPS-TRB Mode S Transponder with ADS-B In/Out contains all the functionality of the Sagetech XPS-TR Mode S Transponder with ADS-B Out. In addition, it receives ADS-B traffic information from the ATC system and surrounding aircraft and reports this data to the flight computer, which can then communicate it to the user. Transponders with ADS-B In are useful for sense and avoid applications as ADS-B In provides the user with surrounding traffic information within a nominal range of 120 nautical miles (NM).

[1] A 24-bit address used to identify aircraft.

Specifications

	XPC-TR	XPS-TR	XPG-TR	XPS-TRB
Serial Communications / General				
Operating Altitude	unrestricted	unrestricted	Unrestricted	unrestricted
Transmit Power	250 W nominal	250 W nominal	250 W nominal	250 W nominal
1030 Receive Sensitivity	-73 +/- 4 dBm	-73 +/- 4 dBm	-73 +/- 4dBm	-73 +/- 4 dBm
1090 ADS-B IN Sensitivity	N/A	N/A	N/A	-84 dBm
RF Impedance	50Ω	50Ω	50Ω	50Ω
Serial Com0 Control	Proprietary protocol RS-232, 57.6 Kb	Proprietary protocol RS-232, 57.6 Kb	Proprietary protocol RS-232, 57.6 Kb	Proprietary protocol RS-232, 57.6 Kb
Serial Com2 GPS Input	N/A	Accord NexNav, NMEA RS-232, Adj data rate	N/A	Accord NexNav, NMEA RS-232, Adj data rate
Serial Com1 ADS-B In Messages	N/A	N/A	N/A	Proprietary protocol RS-232, Adj data rate
Mutual Suppression	Yes	Yes	No	Yes
Altitude Encoder	20,000 – 60,000 ft	20,000 – 60,000 ft	20,000 – 60,000 ft	20,000 – 60,000 ft
ADS-B Out (Extended Squitter)	No	Yes	Yes	Yes
ADS-B In (TIS-B)	No	No	No	Yes
Export Compliance	ECCN 7A994	ECCN 7A994	ECCN 7A994	ECCN 7A994
Power				
Supply Voltage	10-32 V	10-32 V	10-32 V	10-32 V
Power Consumption (ON & ALT)	4 watts (typical) 11 watts (max)	7 watts (typical) 12 watts (max)		8 watts (typical) 14 watts (max)
Power Consumption (STBY)	< 1 watt	< 1 watt	< 1 watt	< 1 watt
Certification Plan – TSO and Certification Efforts On-Going				
Minimum Operational		RTCA DO-181E, RTCA DO-260B		RTCA DO-181E, RTCA DO-260B
Performance Standards		SAE AS8003		SAE AS8003
FAA		TSO-C112e Level 2els, Class 1, TSO-C166b Class B0, TSO-C88b		TSO-C112e Level 2els, Class 1, TSO-C166b Class A0, TSO-C88b
EASA		ETSO-2C112b, ETSO-C166a, ETSO-C88a		ETSO-2C112b, ETSO-C166a, ETSO-C88a
FCC		FCC part 87, Part 15		FCC part 87, Part 15
Software		DO-178B level C		DO-178B level C
Complex Hardware		DO-254 level C		DO-254 level C
Environmental Testing		DO-160G		DO-160G
Physical/ Environmental				

	XPC-TR	XPS-TR	XPG-TR	XPS-TRB
Dimensions	89 x 46 x 18 mm (3.5 x 1.8 x 0.7 in)	89 x 46 x 18 mm (3.5 x 1.8 x 0.7 in)	97 x 46 x 25 mm (3.8 x 1.8 x 1.0 in)	89 x 46 x 18 mm (3.5 x 1.8 x 0.7 in)
Mass	98 g (3.45 oz)	98 g (3.45 oz)	147 g (5.2 oz)	100 g (3.53 oz)
Operating Temperature	-20 to 70 °C (-4 to 158 °F)	-20 to 70 °C (-4 to 158 °F)	-20 to 55°C (-4 to 131 °F)	-20 to 70 °C (-4 to 158 °F)
Storage Temperature	-55 to 85 °C (-67 to 185 °F)	-55 to 85 °C (-67 to 185 °F)	-20 to 85 °C (-4 to 185°F)	-55 to 85 °C (-67 to 185 °F)
Humidity	Max: 95% non-condensing	Max: 95% non-condensing	Max: 95% non-condensing	Max: 95% non-condensing

Serial Communication

Sagetech XP transponders are controlled through a straightforward communication system via a serial interface (RS-232). Many flight computers support the proprietary Sagetech XP Transponder protocol allowing plug-and-play integration with the Sagetech XP family of transponders. If you have a proprietary flight computer, data link, or other method of controlling the transponder, please contact Sagetech for the Sagetech XP Serial Communication Document.

ESD protection (at 2kV HBM or better) is provided on the main RS-232 interface pins

ADS-B, GPS and Extended Squitter Functionality

ADS-B is a critical component of the FAA's NextGen initiative to expand airspace capacity and make it more efficient while maintaining or improving safety. By augmenting or – in some cases – replacing expensive ground-based surveillance radars, ADS-B promises to reduce air traffic control costs while concurrently enhancing controller and pilot situational awareness.

ADS-B equipment is built to meet one of two sets of US government standards, DO-260B or DO-282B. By the year 2020 all aircraft operating in the airspaces listed below will be required to carry equipment that broadcasts ADS-B surveillance data. The ADS-B Out variants of the XPS transponders, once TSO Authorized, are intended to meet all requirements defined for NextGen transponders.

XP transponders with ADS-B Out support a message type known as the extended squitter (ES). The ES is a periodic message transmitted automatically, without the transponder first being interrogated. This message typically provides identification, position, velocity, status, and other aircraft data.

GPS data is provided to the transmitter from the avionics system integrator in one of two ways:

a) GPS serial data stream on XP serial interface Com2. The data format is either NMEA or a proprietary format from a NexNav Mini GPS (a TSO-C145c compliant solution).

> **Note**: The XPG-TR streams GPS data from Com2 using the internal GPS module and antenna. It may be configured to use an alternate source on Com0.

b) GPS data is incorporated into the command and control protocol packets on XP serial interface Com0. For more information, see the Sagetech XP Transponder Serial Communication Document.

> **Note**: Sagetech recommends using the external Accord Technology NexNav Mini receiver. It is the smallest TSO-C145c Class Beta-1 receiver we have identified.

> **Note**: Do not implement both external GPS data to Com2 and flight computer GPS data to Com0 at the same time. The GPS Source byte of the Installation Message controls which interface is used. For more information, see the Sagetech XP Transponder Serial Communication Document.

If no GPS source is connected to the transponder or if the GPS data is determined to be unreliable, the ES messages are still transmitted, but without GPS-based position data.

Mutual Suppression Functionality

The Sagetech transponders include a mutual suppression line designed to coordinate transmission of potentially conflicting signals. When the XP transponder's Mutual Suppression line is pulled down it stops transmitting until the mutual suppression line re-opens. The transponder starts transmitting again within 15 microseconds of the end of the mutual suppression pull-down condition. Sagetech recommends use of an open collector transistor circuit able to sink 1 mA to drive this interface. Interface must be able to pull this line below 400 mV to ensure transponder is fully suppressed. When not suppressed the transponder weakly pulls up the Mutual Suppress line to the input supply voltage (with range between 10 to 32 V). No pull-up resistor is required on customer hardware.

Leave the Mutual Suppression pin unconnected if not used.

XPG-TR does not have Mutual Suppression functionality.

Electrical connections to the transponder, including the Mutual Suppression signal, are defined in detail in Appendix C of this document.

Transponder Installation

Installation of Sagetech XP Transponders consists of:

- Mounting the transponder in your airframe.
- Routing power cables to the transponder (but not yet powering it up).
- Connecting the transponder cable's free end terminations to your control interface.
- Connecting to a GPS data source if it is an ADS-B Out variant.
- Installing an antenna.
- Routing and connecting the antenna cable.
- Connecting the altitude sensor/encoder to system Static Pressure.

Transponder Mounting

The mounting holes in the transponder accept 4-40 (or M3 x .05) machine screws. Most transponders are 0.7 inches thick (18mm) at the mounting points; the XPG-TR with its GPS assembly is 1.0 inch thick (25mm). The required minimum machine screw length depends on specific installation variables, including the thickness of your mounting hardware, any washers, and the nut. When determining a proper machine screw length, ensure excess machine screw length does not interfere with other components.

The machine screws listed in Table 1 represent an approximate starting point in a search for the correct screw for your custom installation.

Table 1 – Common Machine Screws

Quantity Required	Description	Vendor	Vendor PN
4	1 1/4" Pan Head 4-40 Machine Screw	McMaster-Carr	90279A117
8	Washers	McMaster-Carr	98029A024
4	Lock Nuts	McMaster-Carr	90631A005

Sagetech recommends applying Loctite 242 Threadlocker to the machine screw threads, or using lock washers or nuts.

Power

The transponder can be powered with 10-32 volts DC (at the transponder). Transponder power consumption is documented Table 2. If you are supplying voltage to the transponder at the lower end of that range, avoid voltage loss by using short power supply wires and/or larger diameter power supply wires.

Zener diodes are used on the DC Power pins to protect the transponder against overvoltage and reverse polarity.

Electrical connections to the transponder, including DC power, are defined in detail in Appendix C of this document.

Sagetech recommends use of an appropriate amperage inline fuse for the supplied current.

Table 2 – Maximum Current Consumption

Variant	Supply Voltage	Max Average Current	Note
XPC-TR Mode C Transponder	10 V	1.1 A	Measured
	32 V	0.4 A	Measured
XPS-TR Mode S Transponder with ADS-B Out	10 V	1.2 A	Measured
	32 V	0.4 A	Measured
XPS-TRB Mode S Transponder with ADS-B In/ Out	10 V	1.4 A	Estimated
	32 V	0.5 A	Estimated

Important:

Transponder inrush current when the transponder is switched from OFF/STBY to ALT/ON is as follows (all variants): 6A at 32v and 4A at 10v. Contact Sagetech if you need actual graphical data depicting inrush current for your particular application.

Thermal Management

The XP transponder is designed so its case conducts thermal load to the aircraft frame. The transponder can be firmly mounted directly to the aircraft, or to other components within the aircraft.

The transponder should be mounted away from sources of excess heat to better guarantee an operating environment within its designed temperature range.

Control Interface

Sagetech XP transponders are controlled with a straightforward communication system via a serial interface (RS-232 port).

Sagetech provides a Transponder Interface Cable (part number XP-CBL-001) which includes a transponder-side connector and is un-terminated at the flight control side. Electrical connections to the transponder, including serial interfaces, are defined in detail in Appendix C of this document.

Sagetech XP transponders are plug-and-play compatible with many standard flight computers to simplify operation and use. Currently MicroPilot, UAV Navigation, and Cloud Cap are working on updates. Control of the transponder will be supported by each flight computer vendor's documentation.

If you have a proprietary flight computer, data link, or other method of controlling the transponder, please contact Sagetech for the Sagetech XP Serial Communication Document.

In installations where the transponder does not interface with a flight computer, a data link or other method can control the transponder using the serial port.

> **Note**: When you connect the transponder interface cable to the transponder, tighten the screws sufficiently so the connector does not loosen due to aircraft vibration.

GPS Interface

For XPS transponders with ADS-B Out, GPS data must be provided to the transponder from the aircraft system integrator in one of two ways:

a) GPS serial data streams on XP serial interface Com2. The data format is either NMEA GPRMC format or the NexNav Mini GPS (http://www.accord-technology.com/nexnav_mini.html). Com2 is an RS-232 port defined in detail in Appendix C of this document. Using the external interface also allows a faster GPS data rate and therefore slightly increased accuracy.

   The XPG-TR variant of the Mode S transponder is preconfigured to automatically stream GPS data from its internal GPS module, with signal coming from either its internal or an external antenna.

b) GPS data incorporated into the command and control protocol packets on XP serial interface Com0. For more information on the serial command protocol, see the Sagetech XP Transponder Serial Communication Document.

> **Note**: Sagetech recommends using the external Accord Technology NexNav Mini receiver. It is the smallest TSO-C145c compliant receiver we have identified.

> **Note**: Do not implement both external GPS data to Com2 and flight computer GPS data to Com0 at the same time. The GPS Source byte of the Installation Message controls which interface is used. For more information, see the Sagetech XP Transponder Serial Communication Document.

Antenna

The transponder should have its own antenna. An exception to this rule is use of a high quality diplexer that enables antenna sharing between a transponder and certain ADS-B equipment. Further guidance on diplexer use can be found in RTCA documents DO-282B and DO-260B, the minimum operational performance standards for UAT and 1090 MHz ADS-B, respectively.

Use an antenna designed to be used with aviation transponders with the characteristics documented in Table 3.

Table 3 – Transponder Antenna Requirements

Antenna Requirements	
Frequency	1030 to 1090 MHz
Polarization	Vertical
Nominal Impedance	50 Ω
VSWR	<1.5 between 1030 to 1090 MHz
Radiation Pattern	The gain must not be less than the gain of a matched quarter-wave stub minus 3 dB over 90 percent of a coverage volume from 0 to 360 degrees in azimuth and from 5 to 30 degrees above the ground plane when installed at the center of 1.2 m (4 foot) diameter (or larger) flat circular ground plane.
Mounting Location	Underside of aircraft fuselage, nominally at the wing root

Note: If your installation does not meet all of the above requirements, transponder performance (range) may be hindered and damage to the transponder could result.

Important:

Whenever power is supplied to the transponder, a 50 ohm load should be provided to the SMA connection. Ensure that the antenna selected provides a 50 ohm termination for the transponder.

Table 4 – Examples of Transponder Antennas

Thumbnail	Type	Vendor	Vendor PN	Weight	Connector
	Monopole Antenna	Aircraft Spruce and Specialty	11-17995	30 g	BNC Female
	Blade Antenna	Aircraft Spruce and Specialty	AV-74	100 g	BNC Female

The antenna should be mounted on the outside of the aircraft according to the manufacturer's installation instructions. The ideal location is a vertical orientation, mounted on the underside of the aircraft, near the wing root.

Try to minimize the distance between the transponder and the antenna. Take care to locate the antenna away from any objects that may disrupt the ground plane for the antenna, such as doors and landing gear. Do not place the antenna close to engine exhaust. Try to keep the antenna located at least 36" away from other antennas on the aircraft. The antenna should be located as close to the centerline of the fuselage as space allows, while trying to keep the antenna on a flat surface.

A ground plane is required for most transponder antennas (including examples listed above). Failure to provide a good ground plane can result in degradation of antenna performance.

Also, take care not to over-torque the antenna in an attempt to reduce a gap between the antenna and the mounting surface; torque the antenna to the manufacturer's instructions.

GPS Antenna

The XPG-TR uses an active GPS, and if an external antenna is required it should meet with the following requirements.

Table 5: GPS Antenna Specifications

Antenna Requirements	
Frequency	1575.42 MHz
Polarization	RHCP
Nominal Impedance	50 Ω
VSWR	≤ 2
Voltage	2.8 V at 50mA max
Gain	25-33 dB
Mounting Location	Topside of aircraft fuselage, with clear view of sky.

Sagetech offers an external GPS antenna GPS-ANT-001 (GPS active antenna module with cable) that meets these requirements, as well as XP-AT-002 (GPS active antenna module, bulkhead) and XP-CBL-005, a cable to connect the antenna to the XPG-TR unit.

Antenna Cable

A suitable antenna cable consists of a male SMA connector, a length of co-axial cable, and a suitable connector for your antenna. For example, if you are using a simple monopole antenna (as shown in Table 4) with a BNC female connector, your antenna cable will need a BNC male connector.

The antenna cable should have no more than 2dB of signal loss from the transponder to the antenna. This includes losses in the connectors and cable. Generic and custom built cables can be obtained from suppliers such as Pasternak, Richardson, and Aircraft Spruce.

Avoid sharp bends in the antenna cable that could lead to additional signal loss.

Static Pressure

The transducer plumbs into the aircraft's static pressure source. This can be accomplished by plumbing the altitude encoder connection to a static pressure line that shares the same source as the main aircraft altimeter. The XP transponder sensor accepts tubing with an inside diameter of 5mm or 3/16". Typically, the tubing will need to be secured to the pressure transducer with a cable tie, clip or other suitable method. However, in installations where the tubing is held in place by compression and is unlikely to come lose (for example, a short, straight run of tubing between the transponder and a fitting held in a fixed location), a mechanical fastener such as a cable tie may not be necessary.

If your installation requires cables ties, consider using something similar to Mouser part number 644-PLT.6SM-M0.

In general, try to minimize the tubing length between the transducer and the static pressure system.

Your static pressure system may use 1.8mm, 2.5mm, 3mm, 3/32", 3/16", 1/4" or other sized fittings. Many aircraft installations use standard silicon tubing; e.g., Du-Bro part number 197m size medium, available from radio control supply houses. Other systems use tubing from Cole Palmer (Tygon R-3603), Beswick Engineering (part number MUT-1012), or McMaster-Carr (part numbers 5155T14or 5119K41). If the tubing is stiff and needs to be stretched to fit on the pressure transducer, utilize needle nose pliers as shown in Figure 1.

Figure 1 – Utilizing Needle Nose Pliers to Stretch Tubing

If you have to step up or step down in tubing size within your static pressure system, you can often slip one hose inside another and secure this overlap with a clip, cable tie, or other suitable fastener. Some flight computer vendors make custom step fittings.

A typical installation will have a T or Y fitting in the static pressure line with one end running to the transponder. Suitable Y-barbed tube fittings are available from suppliers such as McMaster-Carr.

Appendix A: Contact Sagetech

General Contact Information

Phone:	1 (509) 493-2185
General E-Mail:	Info@SagetechCorp.com
Transponder Inquiries:	Transponder@SagetechCorp.com
Web form:	http://sagetechcorp.com/home/contact-us

Support Contact Information

Phone:	1 (509) 493-2185x500
Support E-Mail:	Support@SagetechCorp.com

Appendix B: Glossary

ACK: Each time the transponder receives a message, it responds with an acknowledgement message indicating that the information was received and set correctly. The acknowledgement message also contains transponder status information. This message is called the Acknowledge Message or ACK for short.

ADS-B: Automatic Dependent Surveillance-Broadcast (ADS-B) is an emerging system for cooperative air traffic control. The ADS-B unit broadcasts GPS and other aircraft-related data to the ATC system and nearby aircraft. Some units only broadcast ADS-B data while others broadcast and receive ADS-B data. When using a data link frequency of 1090 MHz, often ADS-B functionality is implemented as part of a transponder.

ATC: The air traffic control system uses ground-based hardware and air traffic controllers to direct aircraft traffic.

GPRMC: Recommended NMEA 0183 sentence that contains all of the basic GPS requirements for a transponder. See NMEA 0183 below.

GPS: A space-based global positioning system that provides reliable location and time information. Note that other systems that provide equivalent data may be used (GLONASS, Galileo, etc). It is not the intent of this document to limit the user to only GPS.

ICAO address: A 24-bit address used to identify aircraft. ICAO stands for International Civil Aviation Organization.

Ident: Ident is short for identify. When air traffic control requests that the aircraft “identify,” the pilot uses the Ident function to send a message to ATC that enhances or exaggerates the blip on the air traffic controller’s radar screen. The Ident function should only be activated at the request of ATC.

NMEA 0183 message (using GPRMC): The National Marine Electronics Association (NMEA) defines a messaging protocol called 0183. GPRMC is a specific message type within that protocol.

Non-volatile memory: Data stored in non-volatile memory is not lost when power to the device is removed or interrupted.

Squawk code: The ATC system for a given geographic area assigns a unique four digit number to each transponder equipped aircraft in that area. This number is called a squawk code, and it is transmitted by the transponder only when interrogated by ATC to aid in aircraft identification.

TSO: A Technical Standard Order is a minimum performance and design assurance standard set by the FAA for specified materials, parts, and appliances used on civil aircraft. When authorized to manufacture a material, part, or appliance to a TSO standard, this is referred to as TSO Authorization (TSOA). Receiving a TSOA is both design and production approval. A TSO by itself is not an approval to install and use the article in an aircraft, though it greatly facilitates obtaining an approval.

Appendix C: Electrical Connections

The Sagetech XP transponder has one 26 pin (RS-232) main electrical connector for power and serial communication. There is one female, center conductor SMA connector, used to connect the transponder to an antenna via a coax cable. This connection is used to send and receive RF signals via the antenna.

Transponder Interface Cable / Connectors

Sagetech provides an accessory interface pigtail cable (part number XP-CBL-001) that can be used to implement the interface from the transponder to the control source. The Interface Cable uses a 26 pin connector mated to twisted pair shielded 28 gauge wire with 16 conductors.

If you wish to build your own transponder interface cable, the cable type (solder cup) connector is Honda part number HDR-E26MSG1+ (and the cable backshell is Honda p/n HDR-E26LPH). If the ideal interface is for you to design a circuit board interface, the PCB SMT mount connector is Honda p/n HDR-EA26LMYPG1+.

Sagetech provides an accessory GPS antenna cable for the XPG-TR external GPS connector (part number XP-CBL-005) that can be used for the installation of an external GPS antenna.

If you wish to build your own GPS cable for the XPG-TR, the external GPS antenna connector is a Hirose MS-151 RF connecter.

Transponder Main Connector Pin-out

The following diagrams show the transponder main connector pin designations. Figure 2 shows the face of the transponder assembly. Figure 2 shows the four row representation of the Honda harness connector solder-cup pins.

Table 6 provides the pin assignments for the main connector while Table 7 provides the pin assignments for the XPG-TR variant.

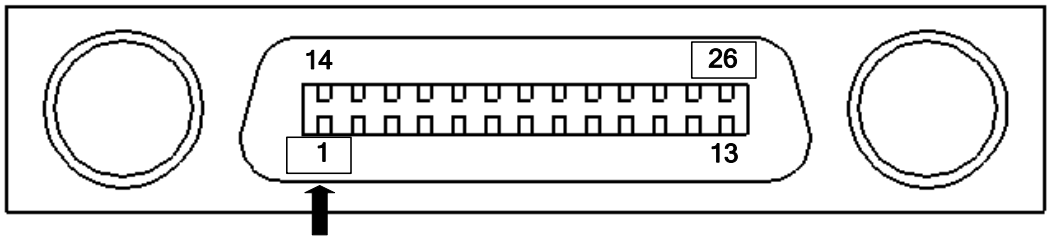
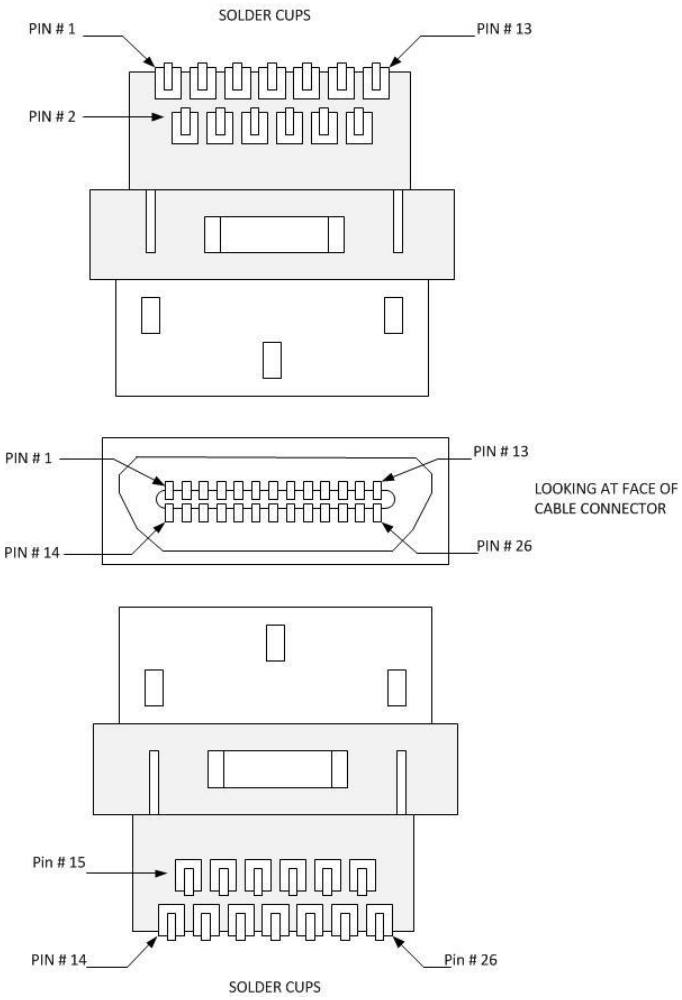


Figure 2 – Transponder Main Connector Pin locations (looking at face of transponder connector)



Main Connector - Important Notes

All four power pins ***must*** be connected. Zener diodes are used on the DC Power pins to protect the transponder against overvoltage and reverse polarity.

At least four of the ground pins *must* be connected. If you must leave one of the five ground pins unconnected, you may leave #15 or #17 unconnected.

Pins 13, 18, and 19 are used for production programming and must **NOT** be connected.

Other Not-Connected pins 20 through 26 should not be connected (left floating).

Pin 11, Mutual Suppress, is designed to connect to an aircraft's bidirectional suppression bus. See the Mutual Suppress paragraph in this document for details. Leave unconnected if not used.

ESD protection (at 2kV HBM or better) is provided on the main RS-232 interface pins

Table

Main Connector - Important Notes

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ESD protection (at 2kV HBM or better) is provided on the main RS-232 interface pins

Table 6 – Transponder Main Connector Pin Assignments

Pin Number	Signal	Direction	Signal Char.	Wire Color in Sagetech Harness p/n XP-CBL-001 (Solid/Band)	Required
1	DC Power	Power	10-32 VDC	White/Tan	Y
2	DC Power	Power	10-32 VDC	White/Brown	Y
3	GND	Power	Gnd	Tan/White	Y
4	GND	Power	Gnd	Brown/White	Y
5	DC Power	Power	10-32 VDC	White/Pink	Y
6	DC Power	Power	10-32 VDC	White/Orange	Y
7	GND	Power	Gnd	Pink/White	Y
8	Com1 RX ADS-B In Data	Input	RS232 Rcv	Orange/White	Optional
9	Com1 TX ADS-B In Data	Output	RS232 Tx	White/Yellow	Optional
10	Com0 TX Command & Control	Output	RS232 Tx	White/Green	Y
11	Mutual Suppression	I/O	I/O	Yellow/White	Optional
12	Com0 RX Command & Control	Input	RS232 Rcv	Green/White	Y
13	NO CONNECT	-	-		Y – DO NOT CONNECT
14	Com2 RX GPS Interface	Input	RS232 Rcv	White/Blue	Optional
15	GND	Power	Gnd	White/Violet	Y
16	Com2 TX GPS Interface	Output	RS232 Tx	Blue/White	Optional
17	GND	Power	Gnd	Violet/White	Y
18	NO CONNECT	-	-		Y – DO NOT CONNECT
19	NO CONNECT	-	-		Y – DO NOT CONNECT
20	Not Connected	-	-		-
21	Not Connected	-	-		-
21	Not Connected	-	-		-
23	Not Connected	-	-		-
24	Not Connected	-	-		-
25	Not Connected	-	-		-
26	Not Connected	-	-		-

Table 7 – XPG-TR Main Connector Pin Assignments

Pin Number	Signal	Direction	Signal Char.	Wire Color in Sagetech Harness p/n XP-CBL-001 (Solid/Band)	Required
1	DC Power	Power	10-32 VDC	White/Tan	Y
2	DC Power	Power	10-32 VDC	White/Brown	Y
3	GND	Power	Gnd	Tan/White	Y
4	GND	Power	Gnd	Brown/White	Y
5	DC Power	Power	10-32 VDC	White/Pink	Y
6	DC Power	Power	10-32 VDC	White/Orange	Y
7	GND	Power	Gnd	Pink/White	Y
8	Com1 RX ADS-B In Data	Input	RS232 Rcv	Orange/White	Optional
9	Com1 TX ADS-B In Data	Output	RS232 Tx	White/Yellow	Optional
10	Com0 TX Command & Control	Output	RS232 Tx	White/Green	Y
11	Not Connected	-	-		-
12	Com0 RX Command & Control	Input	RS232 Rcv	Green/White	Y
13	NO CONNECT	-	-		Y – DO NOT CONNECT
14	NO CONNECT	-	-		Y – DO NOT CONNECT
15	GND	Power	Gnd	White/Violet	Y
16	NO CONNECT	-	-		Y – DO NOT CONNECT
17	GND	Power	Gnd	Violet/White	Y
18	NO CONNECT	-	-		Y – DO NOT CONNECT
19	NO CONNECT	-	-		Y – DO NOT CONNECT
20	Not Connected	-	-		-
21	Not Connected	-	-		-
21	Not Connected	-	-		-
23	Not Connected	-	-		-
24	Not Connected	-	-		-
25	Not Connected	-	-		-
26	Not Connected	-	-		-

Appendix D: Revision History

This Table lists the revision history of the XP Family of Transponders User Guide.

Table 8 – Sagetech XP Family of Transponders by Part Number

Date	Version	Revisions
May 6, 2011	1.0	Initial Release
June 30, 2011	1.1	Added MicroPilot Content
April 6, 2012	1.2	Style change, removed MicroPilot section, document title change, added Mode S content, updated Packaging Drawing
July 7, 2014	1.3	Added XPG-TR to document.