

## **PTC Passive Transponder and Portable Tester/ Programmer**

**ASTS USA Passive Transponders play a key role in Positive Train Control (PTC) Systems, delivering essential positioning indications and messaging to moving trains. The onboard cab system uses Transponder data to enforce permanent and temporary speed limits. These units are constructed to withstand the rugged railway environment, and reliably upload information without interference from water, snow/ice, RF fields, transient electrical signals or dirt. Mounting options include on or between the ties.**

**The associated Transponder Programmer/Tester is a fully portable unit designed to read and program the "telegram" message in the Transponder. Programming is easily accomplished using a standard laptop PC running Microsoft Windows and special "TranEdit" software.**

### **General Description: PTC Transponder**

#### *Functions and Applications*

The PTC Passive Transponder is mounted on the track at key locations, for example, head of home signals or civil speed restriction zones. Each unit is programmed with data unique to that location to ensure that speed and/braking is enforced when the train passes over. The data stored in the Transponder is referred to as a "telegram" and is loaded into the unit at ASTS USA's factory. When a train passes over a Transponder, its undercar antenna emits a unmodulated 27 MHz signal in the direction of the antenna. This signal triggers a modulated 4.5 MHz return signal (carrying the telegram data) back to the train antenna. The 27 MHz signal also serves as the energy source for the Transponder's return signal. The returned telegram message is then processed by the train's onboard PTC system.

A telegram consists of a base message package and may include one or more optional packages. The total available message space is 255 bits, consisting of data, filler and Cyclical Redundancy Check (CRC) bits. Examples of base messages include Transponder position along the track, linking distance to the next transponder set and configuration of the group (total number of transponders in the group)

Each Transponder set has a unique identifier encoded within the telegram data string that indicates its positioning point inside the network. The use of this



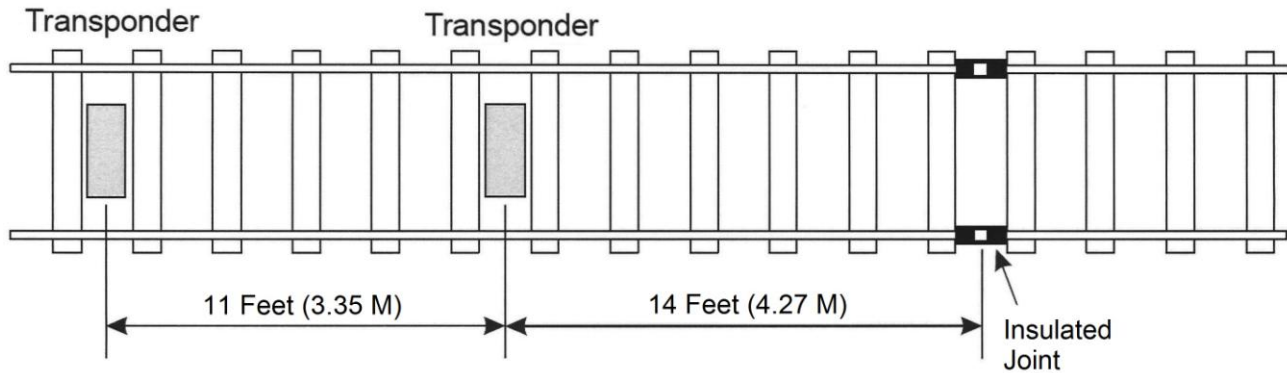
unique identifier, which includes the line number, milepost location and track number, does not permit any two Transponder sets to have the same identifier.

A Passive transponder layout typically contains a minimum of two Transponders but can have as many as four. The number of transponders at a given location is dependent upon the amount of information that has to be stored and uploaded to the vehicle. The typical distance of the first Transponder is 14 feet from the insulated joint. Remaining transponders are placed 11 feet apart. Actual Transponder arrangements are based on the type of signal, territory type, and data space requirements.

Passive Transponders can contain information for both directions. In the Up direction the train reads the first transponder in the set beginning with the #1 Transponder, then the #2 Transponder, and so on to #3 and #4 if present. For the Down direction, the train reads the Transponders in a declining sequence. If a transponder set consists of only two transponders, the train could read Transponder #2, then Transponder #1 or Transponder #1 and then #2 (dependent upon direction).

#### *Design and Installation*

The Passive PTC Transponder is a rigid, compact and sealed device mounted between the rails, either on or between the ties. Internal electronics are mounted in a sealed compartment in a molded, high-impact plastic structure. This ensures protection for the internal electronics in the wayside environment. If the unit is faulty, it can be returned to ASTS USA for repair or replacement. There is no repair of internal components.

**Typical Transponder Installation****General Description: PTC Transponder (cont'd)**

Each Passive Transponder is designed to be mounted flat on a tie using two bolts, two washers and a mounting mat. M10 or M12 bolts may be used. M10 bolts are strong enough to keep the Transponder in place, but M12 bolts are recommended in order to get a greater pressure surface at the fastening point. If M10 bolts are used, a tube is used to fill the gap between the bolt and the transponder's mounting hole. This tube is installed in order to ensure that the transponder will stay in its position. If the transponder bolts cannot be fastened into the tie, a mounting bracket can be used.

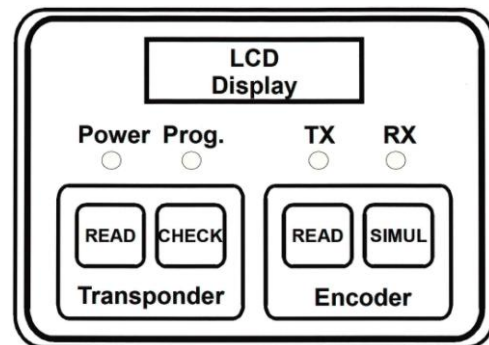
The Transponder can be oriented in the transverse (preferred) or longitudinal position. Longitudinal mounting gives a little longer contact area.

**General Description: Tester/Programmer**

The portable Transponder Tester/Programmer is used to program the Passive PTC Transponder and to read the stored telegram. It is powered by a rechargeable 1.2 Ah 12V sealed lead-acid battery. During programming, the Transponder is connected to a PC running ASTS USA's "TranEdit" software. Control panel devices include an LCD alphanumeric display, buttons, LEDs and power ON/OFF switch. In addition, the control panel incorporates three connectors that link the Tester to the programming PC, battery charger and the Transponder.

Each time the Transponder Tester/Programmer is turned on, a self-test sequence starts. If no failure is detected, the sequence ends with a battery status message and the message "READY" appears on the LCD display.

A "READ" button checks that the transponder sends the required signal level back and that the telegram is correct. The telegram is shown in hexadecimal form on the LCD display for the 255 bit telegram if the Transponder is working properly. If the Transponder is not responding, "NO BALISE" is shown on the LCD display and the unit will generate higher transmitter levels to search for the Transponder.

**Tester/Programmer Control Panel Layout**

A "CHECK" button activates the unit's transmission-test function to test the condition of the Transponder. The Tester/Programmer increases the transmission effect to a specified level. If the received telegram is correct, the Tester displays "GOOD RESPONSE AT HIGH LEVEL." The unit then proceeds to a lower level. If correct, the display displays "GOOD RESPONSE AT LOW LEVEL." If the test fails, the display shows "BAD RESPONSE".

If the test function stops without giving any of the above messages, the CHECK is pressed button again. A counter is displayed to indicate that an ongoing test sequence is taking place.

To protect the electronics and battery, a fuse is inserted in the battery cable. In the case of wrong polarity or short-circuit, the fuse will protect the cables from burning due to the high current capacity of the battery.

Equipment and software required for programming the Passive Transponder includes:

- Laptop PC with TranEdit software and Windows 95-based (or later) software
- Appropriate CRC file from the TranEdit software
- Tester-to-PC cable
- Tester-to-Transponder cable

## General Description: Tester/Programmer (Cont'd)

During the programming procedure, the "TranEdit" program is opened, followed by the appropriate CRC File (generated by the TranEdit compiler). This opens the telegram .txt file. At the end of the procedure the user selects "Program Transponder" from a drop-down menu. The figure at the bottom shows a typical Transponder telegram .txt file screen.

## Advantages

- Transponder reliably uploads PTC data to trains.
- Uploads unaffected by moisture, ice, dirt, electrical fields, other RF fields
- No power feed required (powered by vehicle signal)
- Simple mounting on or between ties
- Designed to withstand wayside environment
- Tester/Programmer performs both telegram reading and programming
- Fully portable unit powered with rechargeable battery
- Easy-to-use control panel
- Programming accomplished with standard PC interface and ASTS USA's "TranEdit" software.

## Specifications

### *Passive Transponder*

Unit Dimensions:	1.6 x 9.9 x 16.8 in. (4.1 x 25.1 x 42.7 cm)	Battery:
Weight:	12.0 lbs. (5.4 kg)	
Total Message Size:	255 bits	
Message Content:	180 data bits, 3 filler bits 72 CRC bits	

## Specifications (Cont'd)

Mounting Bolts:	M10 or M12
Bolt Tie Penetration:	2.76 inches (7 cm) minimum
Track Center Tolerance:	± 0.4 in. (1 cm).
Temperature Range:	-40° to +70°C
Shock:	50g, 3*1000
Vibration:	10g, 1-1000Hz, 3*2h
Humidity:	0-100%
Watertight Depth:	>15.75 in. (40 cm)
Debris Resistance:	Water: 3.9 in.(10 cm) Oil: 0.03 in. (1 mm) Sand, ballast, gravel: 3.9 in (10 cm)
Ultraviolet Resistance:	20 years, tropical flux
Surge Protection:	IEC 571
Dielectric Strength:	25kVAC
EMI/EMC:	ETSI 300 330

### *Transponder Programmer/Tester*

Unit Dimensions:	23.0 x 20.0 x 8.5 in. (58.4 x 50.8 x 21.6 cm)
Weight:	15 lbs. (6.8 kg), approx.
Tester-to-PC Cable:	Null modem type Tester end: 9-pin D SUB male PC end: 9 or 25-pin D SUB female.
Battery:	12V, 1.2Ah Sealed lead-acid accumulator type Size: 3.86 x 1.89 x 2.00 in. (98 x 48 x 51 mm) Model: Hitachi HP1.2-12

```
16N1_1.1.txt
package FIXED / NO_DUPLICATE
Trans_Pos      :1      -Size: 2   Code: UP_1
Set_Size       :2      -Size: 2   Code: UP_1
Dispersed      :NO     -Size: 1   Code: BOOL
Link_Not_Exact :NO     -Size: 1   Code: BOOL
Linking        :692    -Size: 10  Code: LINK_DIST
Railroad_and_line :114  -Size: 8   Code: NO_CODE
Position       :52161  -Size: 16  Code: MILESTONE
Track_ID       :1      -Size: 3   Code: UP_1
end - package size: 44

package POSITIVE_STOP_PTS / DISTANT_SIGNAL
Direction      :UP     -Size: 1   Code: DIRECTION
Dist_To_Home_Signal:617 -Size: 11  Code: SCALE_10
Controlling_Grade :0.08 -Size: 5   Code: GRADIENT_CODE
```

**Typical Telegram .txt File Screen**

**Specifications (Cont'd)***Transponder Programmer/Tester*

Battery Charging: Charge voltage: 14V  
(max.)  
Charge Current: 0.5A  
(max.)  
Initial Charge Current: 0.3A

Fuse Type: Fast blow 2A (3AG)

**Ordering and Additional Information**

- Refer to ordering tab below for unit and equipment part numbers.
- Contact your ASTS USA Account Executive for PTC system design and application possibilities.
- Request ASTS USA service manual 2G1.0001 for additional Transponder and Tester technical information.

<b>Order No.</b>	<b>PTC Passive Transponder and Programmer/Tester</b>
L340000000	Passive Transponder
L341000000	Programmer/Tester
L341004008	Tester/Programmer-to-Transponder Cable
L341004014	Tester/Programmer-to-PC Cable