



sinbad  
engineering corp

# **Pagoda Wireless Timing System Installation**

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## Summary

For the Pagoda PHA Hillclimb course, the start and finish lines are on opposite sides of the mountain from each other. If the antennas were placed at the start and finish lines, we would need significant elevation (over 100 feet) to clear the ridge and have a strong enough signal for successful timing communication.

To work around the terrain of this event, we located the B T-Link antenna on the flagpole hill next to the Pagoda, the Z T-Link antenna in the grassy area across from the old Parks building (at turn 2), and the A T-Link antenna between turn 2 and turn 1 (near the 25 MPH speed limit sign). Because the antennas are not near the start and finish lines, we also need to run cable for this event for all 3 T-Link units.

## Antenna Setup Detail

<b>B T-Link</b>	<b>Antenna Type</b>	Yagi – Use 14dBi antenna belonging to BMR
	<b>Location</b>	On Pagoda Flagpole hill, to right (facing finish line) of flag pole.
	<b>Height</b>	Mast raised to 49 feet (upper sections at 2 ft, rest at 1 ft)
	<b>Direction</b>	angled downwards at minimum angle, aimed at 295° (magnetic)
<b>Z T-Link</b>	<b>Antenna Type</b>	Yagi – Use 14dBi antenna belonging to BMR
	<b>Location</b>	Near old pagoda start line, in grassy area to north of vendor / pit parking area <b>NOTE:</b> base is approx. 17.5' from road, 7.2' from lot
	<b>Height</b>	Mast raised to 48 feet (upper 2 sections at 2 ft, rest at 1 ft)
	<b>Direction</b>	angled upwards at minimum angle, and aimed at 115° (magnetic)
<b>A T-Link</b>	<b>Antenna Type</b>	Yagi (9 dB / smaller)
	<b>Location</b>	At 25 MPH sign between turn 1 and turn 2
	<b>Height</b>	Approx 16 feet using extender pole
	<b>Direction</b>	Point at Parks Building

## Cable Runs

<b>B T-Link to Finish Sensor</b>	<b>Needed.</b> Need to run approx 1000' cable down to the finish line, crossing the road overhead at least once at the hill behind the Pagoda. Use 1000' cable on hose reel.
<b>A T-Link to Start Sensor</b>	<b>Needed.</b> Need to run 300' of cable from down to the start line from 25 MPH sign between turn 1 & 2. Use 300' cable on orange electrical cord reel.
<b>Z T-Link to Timing Station</b>	<b>Needed.</b> Need to run 1000' of cable from to the start line – use 1000' cable on hose reel. Also use wireless RS232 units across road at start line (to avoid cable crossing at start line).

## Signal Strength at Previous Events

**2011 Test:** B-Z Signal strength averaged from 30-90%, generally staying above 50%, but sometimes dipping as low as 10%. A-Z strength generally stayed above 50%. One missed finished signal.

## Map and Photos

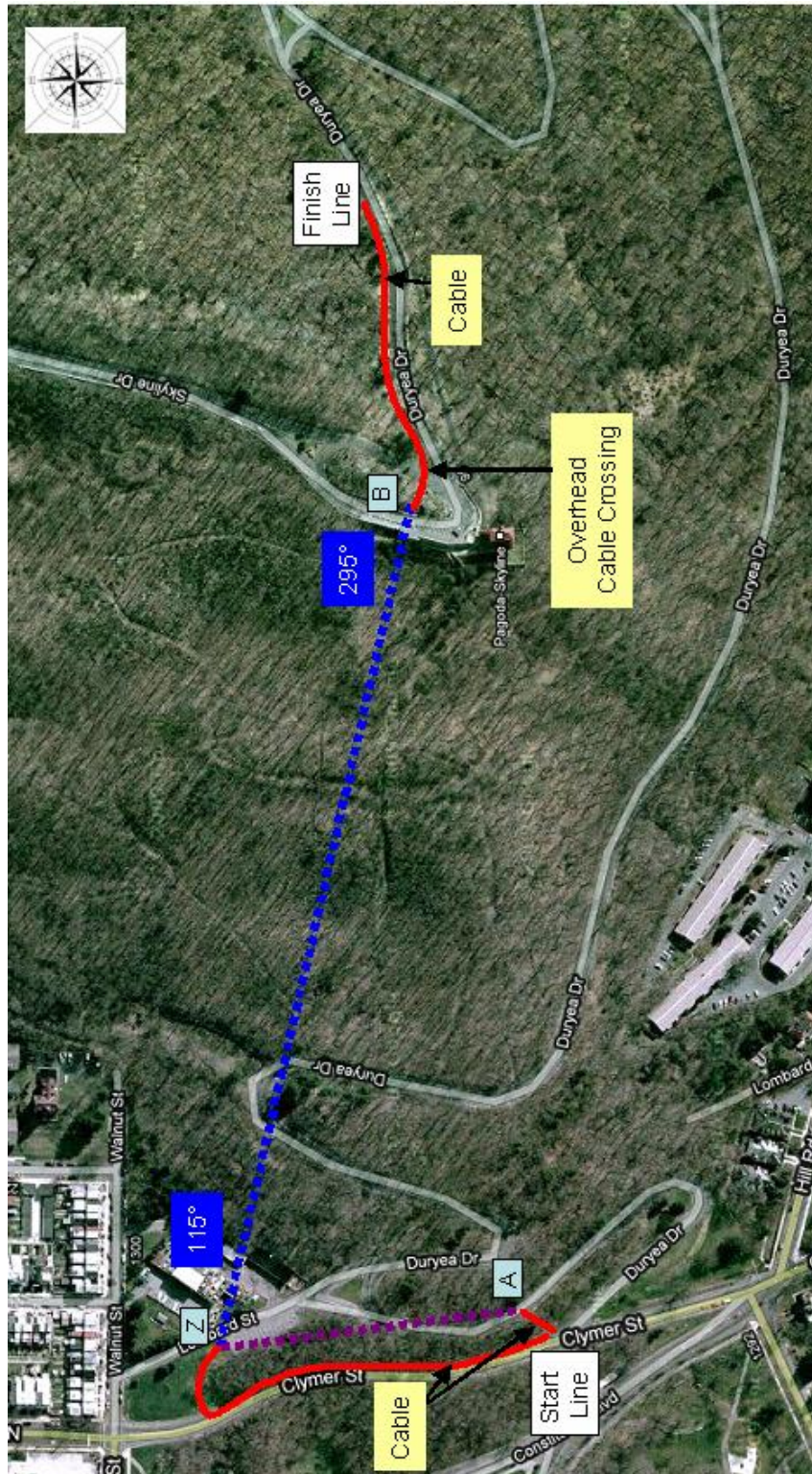


Figure 1: Pagoda Course Map and Wireless Component Locations



**Figure 2: Pagoda Z T-Link Antenna Mast Base Position**



**Figure 3: : Pagoda Z T-Link Antenna Mast Direction**



**Figure 4: Pagoda B T-Link Antenna Mast Base Position**



**Figure 5: Pagoda B T-Link Antenna Mast Direction**



**Figure 6: Pagoda A Antenna Location View 1**



**Figure 7: Pagoda A Antenna Location View 2**

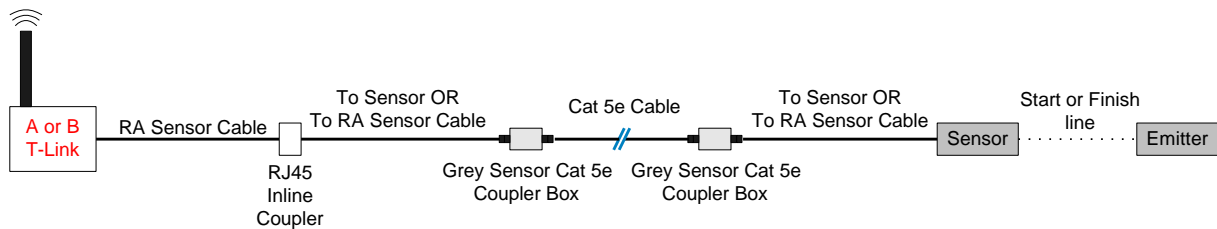
## A or B T-Link to Sensor Cabling

Since the A and B T-Link units are more than 50 feet from the start and finish lines, a long Cat5e cable is needed to connect the T-Link units to the timing sensors.

To connect this cable to the sensors and A or B T-Link units, you will need the following components:

- 1 Race America Sensor Cable
- 1 white RJ45 inline coupler
- 2 “Sensor Cat5e Coupler” gray boxes
- 2 “To Sensor or To RA Sensor Cable” cables

These components are connected as follows:



**Figure 8: Sensor Long Distance Connection Wiring Diagram**

**NOTE:** On the T-Link side, be sure to plug the RJ45 (8 pin) connector into the T-Link unit, and the RJ11 (6 pin) connector into the RJ45 inline coupler.

Also, the “Sensor Cat5e Coupler” gray boxes can be distinguished from the regular in-line coupler boxes, because one connector the standard Conec RJ45 connector (to match the waterproof connector on the Cat5e cable), and the other is an Assman RJ45 connector (to match the waterproof connector on the “To Sensor Or To RA Sensor Cable” cable).



## Z T-Link to Timing Computer Cabling

For Pagoda, a long Cat5e cable is needed to connect the Z T-Link unit to the computer. In order to handle the longer cable lengths, we need to convert the RS-232 signal to RS-422 using RS422 adapters. We also use the wireless RS232 units at the start line to avoid crossing the road to the Timing Station.

**Note on power sources:** the RS422 units require a 9V power source, which can be supplied via a 9V battery, or using the AC Transformer (if AC power is available). The 9V batteries can generally last for the entire day of an event, but a new battery should be used each day. You may also need to switch the 9V battery out mid day, depending on how long the event has run.

The wireless RS232 units require a USB power source, which can be supplied via a USB power pack, or using the AC Transformer (if AC power is available). The USB power pack should last the entire event. The main power packs are rechargeable and the spare power packs take 4 AA batteries.

To connect the Z T-Link to the Timing Computer, you will need the following equipment:

- 2 RS422 converters and power sources
- 1 Race America T-Link to Timing PC cable
- 1 DB9M / DB25M adapter
- 2 Grey Inline Coupler Boxes
- 1 RJ11 Straight Thru Cable
- 1 RJ11 Crossover cable
- 1 DB9F / DB25M short cable
- Cat 5E cable to 4000 feet (if using more than one cable, also need one Grey Inline Coupler box to connect each set of cables).
- 2 wireless RS232 units and power sources
- 1 DB9M / DB9F null model adapter
- 1 DB9M / DB9M gender changer
- 1 DB9M / DB9F cable

These components are connected as follows:

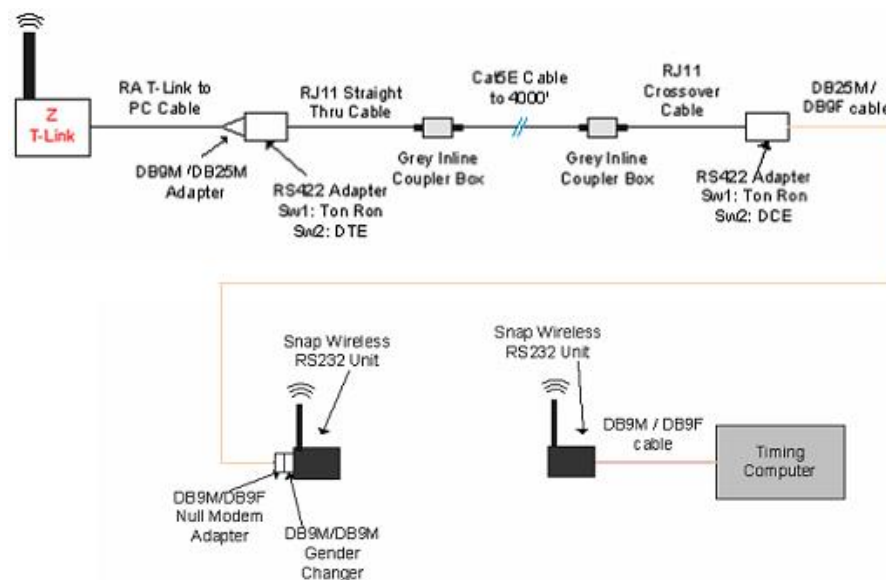
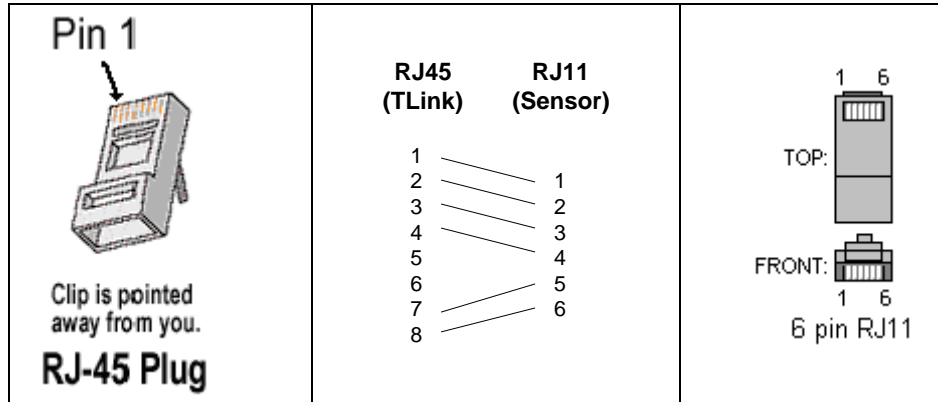


Figure 9: RS422 and Wireless RS232 Connection, Wiring Diagram

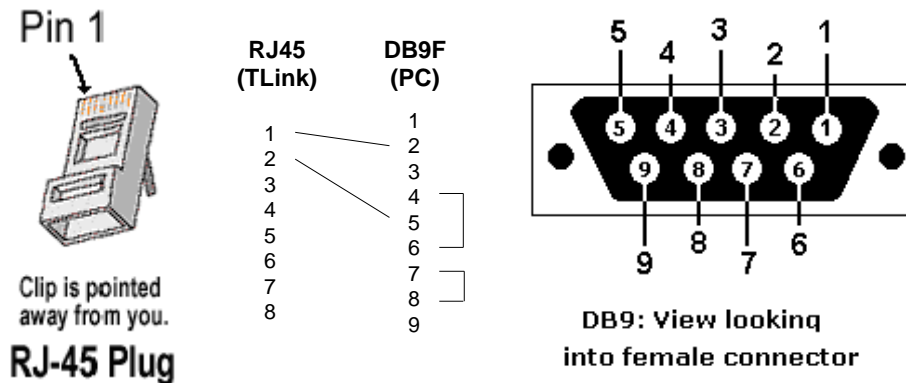
## Cable Pinouts

This section includes pinouts for the Race America and other custom cables used for this event.

### Race America Sensor Cable Pinout

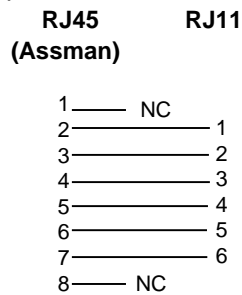


### Race America Z T-Link to PC Cable Pinout



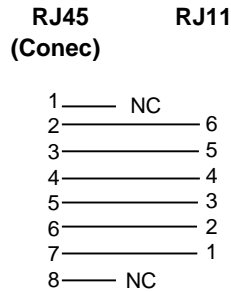
### Custom "To Sensor or To RA Sensor Cable" cable

This cable is used to connect the Grey "Sensor Cat5e Coupler" boxes to the Race America sensors or to the Race America cable at the T-Link end. Note that this cable has an Assman RJ45 A-RJ45M-SR-R connector on one end (which plugs into the grey box), and an RJ11 connector on the other end (which plugs into the sensor or the white inline coupler used to connect to the Race America cable)



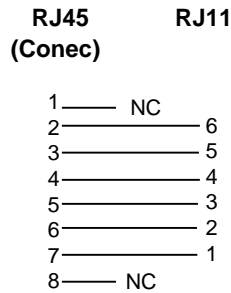
### Custom “RJ11 Straight Thru” cable

This cable is used to connect the Grey “Sensor Cat5e Coupler” boxes to the RS422 adapter on the Z T-Link side. This cable has a Conec 17-10001 RJ45 connector on one end (which plugs into the grey box), and an RJ11 connector on the other end (which plugs into the RS422 adapter).



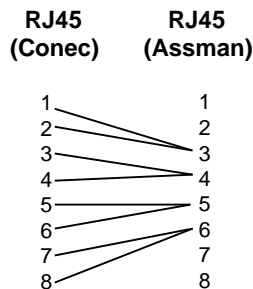
### Custom “RJ11 Crossover Thru” cable

This cable is used to connect the Grey “Sensor Cat5e Coupler” boxes to the RS422 adapter on the Timing PC side. This cable has a Conec 17-10001 RJ45 connector on one end (which plugs into the grey box), and an RJ11 connector on the other end (which plugs into the RS422 adapter).



### Grey “Sensor Cat5e Coupler” box

The grey “Sensor Cat5e Coupler” boxes have Conec 17-10019 jack on one side (with Conec 17-10002 cover), and Assman RJ45KU-R jack on the other side (with A-WP-COVER2-R connector). The grey box is Bud Industries PN-1331-DBG. These boxes convert 8 wires to 4 wires as follows:



### Grey “RJ45 Inline Coupler” box

The grey RJ45 Inline Coupler boxes have Conec 17-10019 jacks on both sides (with Conec 17-10002 covers). These boxes are wired RJ45 straight thru. The box enclosure is Bud Industries PN-1331-DG.