Timer Configuration for Cross Country Skiing

At Summit Systems, we want you to be successful in your race timing efforts. The goal of this document is to help educate you on which timer configurations are appropriate for which type of races, and why. Every race is unique, so we cannot cover every possible scenario. But after reading this document and studying the accompanying timer configuration diagrams, we hope you gain a better understanding of what equipment is appropriate for your needs, based on the types of races you are running, and the budget you have available. Before diving into specifics, it is important to explain some basic concepts of our timing systems.

Flexibility

Flexibility is one of the major advantages of Summit Systems timing systems. Many timers can be connected to a single computer. In fact, there is no practical limit to the number of timers that can be used. Timers can be connected by cables or timers can be wireless. Events often have several timing points, so multiple timers can be used for start times, for intermediate times (ie lap times), and for finish times. Summit Systems timers can be connected to many combinations of input types (keypads, plungers, photo beams, start wands, pressure switches, bar code readers, etc.). Summit Systems timers can even interface to transponder systems (ie chip systems).

Scalability

Scalability is another major advantage of Summit Systems timing systems. This means a club can buy one or two timers this year and add more timers in the future. Often, additional timers are desired for more reliability or for extenuating circumstances. We also rent timers to existing customers (who own at least one timer) at a modest rate. As a result, a club can buy enough timers to handle small, simple races, and then rent additional timers for bigger events. One customer timed the Vermont 100, a 24-hour running race with splits every 5 miles. The customer already had access to 10 timers, then rented an additional 10 timers, and had enough to time his event in style.

Considerations:

Here are some general issues to consider when putting together a timing system:

- What is your budget?
- What are the distances between your finish line, starting line, and timing computer?
- What are you and your events' tolerance for running wires between timers and the timing computer?
- Is your race venue fixed or do you run races in a variety of venues/locations?
- How many races do you run a year?
- Do you already have equipment you can integrate into your new system such as printing stopwatches, start wands, photo beams, etc.

In this document we discuss a few timing system options for **wave start** races and **interval start** races. Even if you run races other than interval or wave start, this document should be useful in educating you in some of the concepts we use in guiding our recommendations for timer usage scenarios.

Backup and Redundancy

In order to have a successful race timing experience you need to have reliable data! Since we live in the real world where spectators walk through photo beams, people make typos, and race volunteers may lack experience, it is critical to have redundancy.

Learning these guidelines will empower you to configure a race timing system that allows for reliable results even if the real world tries to thwart your efforts.

At Least Three Timers are Recommended for Interval Start Races

All alpine ski races are interval start races. To produce results, accurate start and accurate finish times must be taken for each racer. If the timing data is somehow lost for any racer, it is impossible to hand out awards, and everyone will leave empty handed and possibly angry.

As a result, FIS (The International Ski Federation) requires that alpine skiing have a complete “A” timing system, a complete “B” timing system, and a manual backup “C” system. If the A system fails, start and finish times will most likely be captured by the B system. If both the A and B systems failed, then the start and finish times should be captured by the manual C system.

The FIS does not have similar requirements for cross country skiing, but anyone in the timing business should learn the FIS guidelines for alpine skiing. We recommend that for interval start races, 3 timers be used to take start times, and 3 timers be used to take finish times. This can be accomplished with only a total of three timers, if each timer takes both start and finish times.

Only Two Timers are Required for Wave Start Races

In wave start (or mass start) races, medals are handed out based upon order of finish. Therefore only an accurate finish order is required. In this situation, times are important, but are not a matter of life and death. In our opinion, two timers (a primary and a backup) are sufficient for most wave start races.

Backup versus Validation

Backup systems have long been used when reliability is important. Traditionally, backup data is only examined when the primary system has failed. In other words, backup data is often ignored if the primary data appears good.

There was a cross country ski race where medals were handed to the wrong racers. The backup data was not examined, because the primary data **appeared** to be fine. In reality, a spectator had walked through the photo beam, so the primary data had extra, spurious impulses.

We strongly believe primary data and all backup data should be compared against each other during the race. Summit Systems computer software looks for any discrepancy between the primary data and all backup data. In this sense, the backup data is not just a backup, but is also **VALIDATION** of the primary data.

Let's assume there is a photo beam at the finish of an interval start race. In addition, there are two volunteers with plungers at the finish line. There should then be three impulses (ie three different finish times) for each finisher. Good timing software should compare all three times, and flag an error if the times do not agree (within 0.5 seconds).

Suppose a spectator walks in front of the photo beam. The photo beam registers an extra A time, but there are no corresponding B or C times. Summit Systems timing software will flag an error. The volunteers with the plungers told us there was no racer, because they did not press the plungers. These volunteers are our eyes and ears at the finish line.

Suppose later that day two racers finish together, but there is only receive a single impulse from the photo beam. Both volunteers pushed their plungers twice, because two racers finished. The photo beam registers a single A time, but the plungers register two B times and two C times. The volunteers have clearly indicated that two racers finished. Again, our software will flag an error.

When an error is flagged, the computer operator is responsible for carefully examining the situation, figuring out exactly what happened, and fixing the problem. Sometimes it is necessary for the computer operator to contact the volunteers at the finish line and hear their side of the story.

We recommend **NEVER** using a photo beam for a wave start race, because it is not necessary, and because there would be missing data every time two racers finish close together. In wave start races, we recommend two volunteers with plungers at the finish line. We prefer not to classify one volunteer as primary and the other as backup (as the backup volunteer might just tune out and take a nap). Instead, think of each volunteer as backing up the other. Either one can make a mistake or two, as long as they do not both miss the same racer. If one plunger misses a racer, or one plunger plunges for a non racer, or if one plunger is distracted and pushes the plunger late, then the data will not agree, and the computer software will flag an error. Again, it is up to the computer operator to figure out what happened and to fix the problem.

Wired Timers versus Wireless Timers

Wireless timers are a fantastic convenience, but are more expensive than Basic (wired) timers. If considering Basic timers in consideration of budgetary constraints, an important guiding factor is how tolerant you (and the logistics of your race) are to cables between your computer and your first timer, and from timer to timer.

Our experience has shown that wireless timers are extremely reliable when the distances are short (less than a few hundred meters) and when there is good line of sight from the wireless base unit to the timers (the wireless base unit transmits the data from the wireless timers to the computer). We have never seen an issue with interference from other wireless devices (such as cell phones). All data packets are error checked, and are retransmitted if necessary.

Our systems offer extreme flexibility in the combination of wireless and non-wireless components. If the timing computer is located far from the start and finish lines, you are probably best served by having a wireless base unit connected to the timing computer, and at least one wireless timer on the field of play to communicate wirelessly with the wireless base unit, which is in turn connected to the timing computer. Other non-wireless timers can then be connected to the wireless timer if the logistics of the race permit.

If you are primarily running races in one specific venue and you can permanently install underground cable between the timing computer location and the start/finish lines, then basic (wired) timers may be a viable alternative to a wireless base station and 1 or more wireless timers. Remember to consider the cost of running cable to the cost of upgrading to a wireless system.

Basic timers cost less than wireless timers, so weigh budgetary constraints against the race logistics and consider the flexibility and ease of wireless, in order to determine what is right for you.

It is important to note that basic (wired) timing units can be connected to wireless units via RS485 cables (depending on the length of the cable). Also, wireless timers can be utilized as wired timers, but a wireless base unit must still be connected to the timing computer in order to communicate wirelessly with the wireless timing unit(s).

You cannot use a wireless timer connected to the computer with a serial cable to communicate wirelessly between your computer and other wireless timers. This should become clearer by looking at the timer usage graphics associated with this document.

Wave Start Races

In a wave start race, medals are handed out based on the order of finish. Therefore an accurate finish order is **absolutely critical**. Times are important, but are not a matter of life and death. It is our opinion that two timers (one primary and one backup) are sufficient for most wave start races.

In most wave start races, the timers need not be at the starting line. Instead, they can be stationed at the finish line for the duration of the race. The plungers at the finish line can be pushed for each wave start, or, the start times can be manually entered into the race timing software at any point prior to results calculation.

Since the timers aren't needed at the start line, two timers are sufficient. Refer to the associated diagrams: **Wave Start Timer Usage Configuration A, Configuration B, and Configuration C**. Note that the plunger is a push button that is pushed once for each racer crossing the finish line.

Wave Start Configuration A consists of 2 wireless timers, 2 plungers, a wireless base unit, and the timing computer. This is the most flexible of the three systems shown. Because both timers are wireless, no wires are required between the timers, or between the timers and the computer. This allows the computer to be a significant distance from the finish line and the two timers to be placed on the finish line.

Wave Start Configuration B consists of 1 wireless timer, 1 basic timer, 1 RS485 cable, 2 plungers, a wireless base unit, and the computer. This configuration allows the timing computer to be further from the finish line without running cables between the computer and the finish line. This also saves money with only one wireless timer. The RS485 cable connects the timers together, and the wireless timer transmits the data from both timers to the computer.

Wave Start Configuration C consists of 2 basic timers, 2 plungers, 1 RS232 cable, 1 RS485 cable, and the computer. One timer is connected to the computer via the RS232 cable (up to 100 feet). The two timers are connected via the RS485 cable (up to 4000 feet). This is the most cost effective system because it uses basic timers. Because this is a fully wired system, you'll need sufficient lengths of RS232 and RS485 cables for this system to be practical.

Interval Start Races

In an interval start race, each participant starts at a different time, so the finish order is not significant, but **TIMES ARE EVERYTHING**!! For this reason, interval start races require more levels of backup & redundancy than wave start races. As mentioned previously, FIS (the International Ski Federation) requires A, B, and C systems for timing alpine races (an type of interval start races).

There are a great number of basic and wireless combinations that will create practical timing systems. With your basic understanding of how basic and wireless timers work together, 6 possible options are listed here. Contact us directly via our website or by telephone to discuss further options for your particular interval start race timing system.

Please note it is not necessary to have a start wand and a photo beam for a club race. A single plunger can be substituted for a start wand, for a photo beam, or two plungers can substitute for both.

Interval Start Configuration A consists of a dual output start wand, 2 photo beams at the finish, 4 wand-beam cables (connect timers to the start wand and photo beams), 6 wireless timers (3 at the start, 3 at the finish), 3 plungers, a wireless base unit, and the computer. This system gives you triple redundancy and full wireless operability. If your budget permits, this system gives the greatest flexibility, the greatest reliability, and is the easiest to use.

Interval Start Configuration B is nearly identical to Configuration A, minus one timer. The A Timer is utilized at both the start and finish line. So, there are a total of 5 wireless timers. This configuration is only practical when the start and finish lines are physically close to one another.

Interval Start Configuration C consists of a dual output start wand, 1 photo beam at the finish, 2 wand-beam cables, 3 wireless timers, 3 plungers, a wireless base unit, and the computer. Each of the 3 timers is utilized at both the start and finish lines, therefore this configuration also requires the start and finish lines are physically close to one another. This is a fully wireless system that also allows for redundancy.

Interval Start Configuration D is an example of fully wireless system that utilizes 2 printing stopwatches for an additional level of backup.

Interval Start Configuration E consists of a start wand, a photo beam, 2 wand-beam cables, 2 RS485 cables, 2 basic timers, 1 wireless timer, 3 plungers, a wireless base unit, and the computer. This allows the computer to be further from the start-finish lines with only one wireless timer. Redundancy is achieved with 3 timers, since they take data at both the start and finish. The advantage is that a wireless base unit costs significantly less than a complete system. Again, this is option requires the start and finish lines be close together, perhaps no more than 100-200 feet.

Interval Start Configuration F consists of a start wand, a photo beam, 2 wand-beam cables, 3 RS232 cables, 1 RS485 cable, 3 basic timers, 3 plungers, and the computer. This system works well for races with the start and finish line close together. It does require the timing computer to be hard-wired via an RS232 cable to one of the timers. It is the least expensive option since all the timers are basic and each timer takes information at both the start and finish lines.

Additional Thoughts

Timers
Two types of timers are described in this document, and on the diagrams. The Basic is also called wired, and on the diagrams is labeled SRT500. The Wireless timer is the SRT500R on the diagrams.

Plungers
Plungers are push buttons connected to the timer by a 12-foot cable. The operator pushes the button once for each racer that crosses the timing line. Please note that a plunger can be substituted for a start wand or a photo beams.

Computer
Most customers use a notebook computer for race timing, but a desktop computer is fine. There are no special requirements for the computer; virtually any computer will suffice. The timing computer (supplied by you, the user) should be a reasonably recent PC running Microsoft Windows (Windows 95 or newer). Clearly, the faster the better. Also, the larger the screen the better. When timing outdoors, there may be a lot of glare, so the brighter the screen the better. Summit Systems software has been tested with Windows 95, Windows 98, Windows ME, Windows 2000, and Windows XP. Some testing has been done with Vista, but additional testing must be performed.

Serial Ports
Summit System timers interface to the timing computer via a serial port on the computer. If the computer does not have a serial port (and most newer laptops do not) then you will need to purchase a USB to serial adaptor. Some of the available adaptors work well, and some do not. Summit Systems sells USB to serial port adaptors that we have found tested well.

RS232 Data Cable
An RS232 cable is a communications standard, and is often used to connect a serial port on a computer to a device (such as a timer or a scoreboard). This type of communication is only rated up to 50 feet, but experience has shown it can be reliably used up to 100 feet. RS232 uses a 3 wire cable.

RS485 Data Cable
The RS485 cable is also a communications standard that can go up to 4000 feet. RS485 can be configured to use a 3 wire cable or a 5 wire cable. Timers that are connected by RS485 cable can either be connected via a daisy chain configuration, or connected in a star configuration.

Wand-Beam Cable
This is a very basic cable that is connected to any start wand or any photo beam.

Labeling of Cables on the Diagrams
All cables labeled in **blue** are associated with the start line. All **red** cables are associated with the finish line.

Timing Line, Timing Point, or Timing Location
We use the term “timing line” or “timing point” for a generic timing location. A time is taken for each racer that crosses the timing line. Often the only timing line is the finish line, although many races have intermediate timing lines.

Impulse
A signal from a plunger or a start wand or a photo beam is often called an “impulse”.

Timing Software

Excel is familiar to a broad base of computer users, allowing many users to get up and running faster than would be possible using an entirely customized interface. There are three options regarding software.

1) **Excel Race Management Software** is free with the purchase of timer(s). This is an intuitive and easy to use software which is sufficient for club or school races.
2) **Summit Systems Professional Database** is available for purchase. This software is both powerful and flexible, but requires a dedicated user to master its powerful features.
3) **Software purchase from other vendors:** both BART and Zone4 sell (Nordic ski) software that is compatible with Summit Systems timers. You can find a complete list of compatible vendors for other sports on our website.