

P.A.C.T. MKIV CHAMPIONSHIP TIMER & CHRONOGRAPH

User's Manual
For Rev. Bx Software
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Introduction

We've been building shooting timers since 1982. Our design philosophy is to build for the customer, not the engineering department. Whenever a PACT customer calls with a suggestion for improvement (or a complaint) we write it down and act on it. We incorporate most of these changes into our product line on a continuous bases. However, some of them would have required a complete overhaul of the timer to implement so that's exactly what we've done. Your MKIV Championship Timer incorporates every practicable neat idea that's been suggested to us over the last ten years.

As you may know we make several different timers and chronographs. To be frank, some of our other products are more profitable then the Championship Timer line. But I must tell you that the Championship Timer is really our favorite. Our entire staff is made up of active shooters. While not all are competitors, everyone here is interested in learning how to get the most out of his equipment. The MKIV Championship Timer is dedicated to this pursuit of skill at arms.

The design of your MKIV Championship Timer is left wide open for future software up-grades. We have only used a portion of the available memory space. So you can count on a long and interesting string of refinements and additions. These will always be made available to you at a minimum cost. What form will these changes take? You tell us!

We encourage you to spend an hour or so at the range with your new MKIV Championship Timer and this manual working down the learning curve. On one hand a 16 page manual for a timer may seem a little excessive, on the other hand the software in your timer contains over 8000 lines of code. Were we to actually walk you through every possible permutation of key strokes this manual would get a lot thicker. You wont get your moneys worth out of this timer if you don't get past the **GO**, **REVIEW** and **PAR** functions.

System Overview

The MKIV Championship Timer has a completely redesigned "Hot Key" user interface which allows the shooter to set the timer up for complex courses of fire without having to scroll through lengthy menus. The MKIV Championship Timer has 5 modes of operation: Timer TIME, Chronograph CHRN (optional), Ballistic Computer TRAJ, Rate of Fire RPM and Man Vs. Man mode (auto selected by plugging a stop plate into PLT 2 on the back of the machine). The options available on the OPTN key are appropriate to the mode selected.

Whenever you turn the MKIV Championship Timer on it will come up in Timer Mode with all the defaults reset. If you get "lost" in the software just turn it off and back

on again. Because the MKIV Championship Timer is primarily intended for use as a shooting timer, the remaining keys are dedicated to easy access of the advanced training features of the MKIV Championship Timer.

Timer Operation

The on/off switch is located on the back of the Championship Timer. Switch it to ON. The timer will give a short "BEEP", display the version number of the software installed, such as "**Championship Timer Revision B2**". Our copyright notice is then displayed followed by **TIMER COMMAND** and a flashing cursor. At this point you are ready to roll. Note that the Championship Timer always wakes up in **TIMER MODE**.

With the MKIV Championship Timer displaying **TIMER COMMAND** it is now ready to issue a randomly delayed start beep and count shots. To use the timer in this manner, just push the "GO" button (the green one), 3 to 3.5 seconds later you'll hear a beep - this is your go command.

As you fire, the timer will automatically display and record the shot number, split time and the time that each shot was fired. A new feature of the MKIV Championship Timer that Mike Plaxco requested is the display of the first shot on the bottom line. You'll find this both useful and entertaining; "I may have dumped 3 shots but look at that first shot time."

OK, let's say you just fired an "El Presidente" (six-reload-six) you don't bother checking the target (you know you shot all "A's") but you are concerned about how you did in the time department. You check the display and it reads **#012 .37 6.87** on the top line and **FIRST SHOT: 1.26** on the bottom line. With no button pushing you know quite a bit about your string. First of all the timer is telling you how many shots it heard (12) which is correct, the last shot it heard was shot number 12, which came .37 seconds after shot 11. Your total time from the start to your twelfth shot was 6.87 seconds and your first shot came at 1.26 seconds.

Go ahead and press the **REVIEW** key. The MKIV Championship Timer now displays the first shot on the top of the display and **FIND SHOT:** on the bottom line. Each time you press **REVIEW** the timer will step to the next shot in memory. However you're mainly interested in how long your reload took so you press **7, REVIEW** and the MKIV Championship Timer jumps to shot number 7 and displays **#07 1.65 4.54**. You see that your reload took **1.65** seconds (the time between shot 6 and 7). This time is a little long and you seriously consider switching to an auto-loader.

If you purchased our printer you can print the string at any time after you are done firing, before or during review by pressing the "**PRNT**" key.

To begin another string just push **GO**. If you would like the timer to add the time of your second and subsequent strings together (as you might on a IPSC standards drill) press the **CST GO** button. This will not clear the memory the way the **GO** button does. While this is a nifty training feature we caution you against using it in matches. If you accidentally hit normal **GO** you'll wipe the shooters string.

How Do I Enter A "PAR" Time?

The **PAR** button allows the shooter to enter a time limit (or PAR time in IPSC parlance) for a given string. Push the **PAR** button. The timer will ask you to **ENTER PAR TIME AND PRESS SET**. Push **1.2, SET**. The timer now displays **PAR TIME 1.20** on the bottom line of the display.

***Note:** If you are entering a number and make a mistake use the back arrow key to delete the incorrect number.*

Push **GO**. Each time the shooter fires the timer will display the shot number, split time and total time on the top line of the display as before. When 1.2 seconds comes around the timer will beep telling you that the time limit has been reached. If the shooter fires after this signal the timer will display the number of late shots (fired after the stop signal) allowing easy calculation of penalties.

To turn the **PAR** time off push **PAR, SET** with out entering a number.

How Do I Change The Delay Or Turn It Off?

The **DLY** button allows the shooter to control the type and length of delay (if any) between the pressing of the go button and the start signal. When the timer wakes up it defaults to a random delay of 3 to 3.5 seconds. The shooter can adjust these delay points to suit him or have the machine give him a fixed delay. To turn the delay off just push **DLY, NO, GO**. Now when you push **GO** the timer will beep immediately.

I think you'll find that the default delay bracket of 3 to 3.5 seconds is just about right. However it's easily changed. Push **DLY, YES, YES**. The MKIV Championship Timer will briefly display **INPUT LIMITS AND PRESS SET** then **LOWER: 3.00**. Push **5, SET**. The timer asks **UPPER: 3.5**. Push **10, SET** and **GO**. This time the MKIV Championship Timer will start its' countdown from between 5 and 10 seconds giving you all sorts of time to psych yourself into a zombie like state of confusion.

What's A Benchmark?

The **BNCH** button activates the PACT Benchmark feature. This allows the shooter to program the timer with a series of beeps or cues at specific times after the go signal which allow him to simulate moving and pop-up targets.

Press **BNCH, YES**. The timer asks you for a time. Press **2, SET, 3.5, SET, 5, SET, 6.25 SET, GO**. The timer will beep at these times. All of the other timing features remain intact.

If you always want the same spacing between shots use the cadence feature described below.

How About Keyed Beeps?

The **KEY** button activates the Keyed Beep feature. This is a neat training tool that provides the shooter with a beep a certain number of seconds after a specific shot. This is particularly useful in practicing reloads. Let's tell the MKIV Championship Timer to give you a keyed beep 1.5 seconds after the 6th shot. Press **KEY, YES**. The timer asks you for a shot number. Push **6, SET**. You must now tell it the length of the delay, enter **1.5 SET**. As with the Benchmark function you can enter more than one keyed beep. When you are done entering keyed beeps you can either press **SET** without entering a number to return to **TIMER COMMAND:** or you can just push **GO** to start the string.

Go ahead and press **GO**. When the timer hears your 6th shot it will start a secondary timer and give you a yell 1.5 seconds later. At first you're just getting the magazine to the gun at the beep. After some practice you find that you're almost back on target at the beep. The feedback of the timer allows you to objectively evaluate equipment and technique. You could also use multiple keyed beeps off of the same shot to break the reload down some more.

The New Cadence Function

One of our favorite customers P.Z. of San Antonio Texas had been hounding us for years to add a metronome feature to allow dry firing without having to keep pressing **GO**. We've gone a step beyond this with the Cadence Function which not only provides this capability but also the ability to begin the cadence at a specified time after the **GO** signal or after the first shot.

We've been programming quite a bit of stuff into your MKIV Championship Timer. Let's clear it out by turning the unit off and back on. From the **TIMER COMMAND** prompt push the **CAD, YES**. Your timer will ask you if you'd like it to start the cadence on the first shot, tell it **NO** this time. Enter the initial delay. This should be

the cadence on the first shot, tell it **NO** this time. Enter the initial delay. This should be the time you want to take from the go signal to your first shot or click. For this drill enter **3, SET**. The **CYCLE DELAY** is the time between cadence beeps. Push **1.5, SET** and **GO**. MKIV Championship Timer will give you a start signal, beep at 3 seconds then every 1.5 seconds for ever and ever.

We see this primarily a dry firing tool but you can also use it for live fire. You might have it trigger off of the first shot to take the draw time out of some sort of long range "Bill Drill" practice. Have fun and remember, "never let your muzzle cover anything you're not willing to destroy."

Keyboard Lock Out

In order to prevent the accidental resetting of the timer during a shooters run (a problem in movement stages where the RO runs with the shooter and leaves his finger on the **GO** button) the MKIV Championship Timer has a keyboard lockout. To activate it the RO pushes the **OPTN** button. The timer asks "**Lock out go keys?**" Push **YES** and the timer will lock its' keyboard after the next **GO** command. To reset the timer the RO pushes the **REVIEW** key. This time the timer asks "**ENABLE GO KEY?**" Push **YES** and you're back in business.

The **PAR** and **DLY** keys will remain hot. They are far enough out of the way that this does not pose a problem. We wanted to keep those commonly used features easily accessible.

Lead Calculator

The second option on the Timer Mode **OPTN** menu allows the shooter to calculate lead based on the velocity of the bullet and target and the distance to the target. Note that this is the lead in a vacuum. No allowance has been made for the deceleration of the bullet. At close pistol ranges (25 yards) this error is small. However we do not recommend this function for use at long range.

Press **OPTN, OPTN, YES**. The MKIV Championship Timer asks you for the velocity of your ammo. Enter **1050, SET** with a target range of 15 yards (**15, SET**) and a target velocity of 30 FPS (**30, SET**). The timer tells you that the lead required to bust this running Jack Rabbit is 15.1 inches. If this is getting too easy try starting from the leather.

Rate Of Fire Mode

Several of our customers are dedicated Buzz Gunners. They had tried to use their Championship Timer to check the rate of fire of their weapons. Unfortunately the timer software will not accept shots that happen faster then .1 seconds (600 RPM). We

set it this way on purpose to minimize the echo problem. Pete Kokalis, J.D. Jones and Jim Kozinski of Gun Machines conspired at the '91 shot show to bribe our chief programmer into writing them a custom "Full Auto" chip. His integrity compromised by an irresistible combination of pizza and beer young Dr. Haddick set aside his copy of Easy Rider and ground this thing out in a weekend. (We wish he'd work as fast on our projects). This software has been "standard" equipment on our Championship Timers ever since and has proven surprisingly popular.

To switch to Full Auto Mode just press the **RPM** button. The MKIV Championship Timer now displays **FULL AUTO COMMAND**. Press **GO** instead of giving you a go beep the timer displays **FIRE WHEN READY**. Fire a fairly long burst of a known number of rounds (so you have enough data to be meaningful). You'll note that the timer is now displaying you time to the thousandth of a second. Press **REVIEW** and the timer will tell you the number of rounds fired, the total time and the cycle rate. Remember that the total number of cycles is one less then the number of shots fired.

This feature is a lot of fun with tap guns as well. Think you can whip old Ed McGivern. Forget the playing card, can you can put 5 shots into the burm in .4 seconds? Not!

Ballistic Calculator

When we introduced our revolutionary Professional Chronograph with Ballistic Computer last year we immediately began getting requests for this software in the Championship Timer. Unfortunately the MKIII simply did not have the room in memory. This has been corrected on the MKIV and an abbreviated version of the Ballistic Computer has been installed in your MKIV Championship Timer at no extra charge.

The benefits of having easy access to trajectory information are twofold. First of all you can find an "optimized" zero for your specific gun/load combination, zero your weapon accordingly and take to the field with a new confidence about the required hold over (or lack of it) for a given shot. The second benefit you'll enjoy (and the one you'll probably get the most use out of) is using the Ballistic Computer as a ballistics teacher. An hour or two of "what if" will destroy a lot of ballistic myths that most of us hold dear and make you a real bore at your next cocktail party.

The Ballistic Calculator is so easy to use that you really don't need much explanation. But it does have some trick features that may not be apparent on the first pass. Turn your MKIV Championship Timer on and press **TRAJ**. The first thing the Ballistic Computer needs to know is the velocity to base the calculation on. If you're shooting at the range it will pick up the current average velocity (which you can override) from the chronograph. If none is present in memory it will default to **2500.0 FPS**. The format for entering information into the Ballistic Calculator is always the same:

1. Pushing **SET** means that you want the machine to use the data on the screen. For example when you first enter the Ballistic Calculator it will display a default velocity. If you push **SET** it will accept this and move on to the next question or calculation.

2. If you want to change the default stay away from the **SET** key and first tell the machine what it needs to know. For example if you want the machine to use 2650 FPS for its calculation just type **2650**. If you make a mistake entering a number just use the back arrow key **GO** to erase it. When the number entered is OK with you hit **SET** and the Ballistic Calculator will accept it and move to the next screen.

3. Yes/No questions are answered with the **YES** and **NO** keys. No **SET** is required.

4. Any time you are messing around with the Ballistic Calculator and you realize you've painted your self into a corner hit (gently now) the **REVIEW** button. This will take you out of the Ballistic Calculator. Then hit **TRAJ** again and it will let you start from the beginning with the last things you entered as the defaults.

Let's make a sample trajectory printout. If you haven't already pressed the **TRAJ** do so now so that the screen shows:

ENTER VELOCITY: 2500.0

Let's change the velocity to **2650** and press **SET**. The Ballistic Calculator will now ask you for the Ballistic Coefficient (BC). This is always a decimal number (a "." in front of the number) but the Ballistic Calculator is smart enough to add the decimal if you forget it. Enter a BC of **.475** and press **SET**.

Note: *The Ballistic Calculator will only produce correct results with ``C1" ballistic coefficients. This is the industry standard and is what you will find in every bullet manufactures current specifications even if they don't label it as ``C1."*

Next the Ballistic Calculator asks you if you want it to use Standard (sea level, 59 degrees) or nonstandard conditions. Tell it **YES** to accept the standard conditions. If you answer **NO** it will ask you for altitude and temperature information. Based on the this data the Ballistic Calculator will correct the BC to your nonstandard conditions.

The next question the Ballistic Calculator asks you is the sight height of your gun. Sight height is the distance from the center of the bore to the center of your sight. If you're just playing around, use the default of 1.5". However if your making a ``for real" field drop card do it right and measure the thing (a pain in the back side). If you're using an iron sight gun (particularly handguns) don't use the 1.5" number at all. It's so far from your gun that the resultant trajectory data will be pretty bad.

The Ballistic Calculator now has all the data it needs for the trajectory calculation. You'll now need to tell the Ballistic Calculator what sort of zero you want. If you select the **MAX PB RANGE** the Ballistic Calculator will find the maximum range at which you can fire the gun with out the bullet traveling more than so many inches above or below the line of sight. This option is strongly recommended for field marksman (hunters and warriors). The default value is a six inch "vital zone." This means that you'll end up with a zero that keeps the bullet within an imaginary six inch tube (three inches above to three inches below the line of sight) from the muzzle to the maximum "point blank" range. The Ballistic Calculator will tell you where to zero at 100 yards for this and print a drop table according to that zero.

The second option of **SPECIFIC RANGE** is of use to target shooters. If your local range only goes to 100 yards but your competition is at 500 yards you can have the Ballistic Calculator figure out where to set your gun at 100 to be dead on at 500. Again it will print you a drop table based on that zero. One neat trick we added to this zero option is the ability to off set the zero. Normally when the Ballistic Calculator asks you if you want an off set you'd just hit **SET** to accept the zero default. However, if you've got a gun in the safe that you have already zeroed two inches high at 100 you can use this feature to back into a drop table that puts the bullet two inches high at 100. The off set option will add about 20 seconds to the drop calculation. It is, however, quite a bit faster than rezeroing your gun.

At the moment the math in the Ballistic Computer will "blow up" as Dr. Haddick says, if you try to use the zero off set at pistol ranges. We are working on a way to use this feature on the up-hill side of the trajectory and will get it to you on a future upgrade.

The next three questions (starting range ending range and increment) are self explanatory. You'll probably find your self hitting the **SET** key three times to accept each default. The final question is whether or not you want the Ballistic Calculator to print to the screen or paper. If you opt for a paper print out the MKIV Championship Timer will go on automatic from here giving you a print out based on your parameters. If you find your self using the Ballistic Computer a lot you really ought to look into getting a printer. It really enhances the operation of this feature. If you want to print to the screen you'll use the **SET** button to advance from screen to screen. To make another print out just push **TRAJ** again. All of the parameters you used on the last print out will appear as defaults (assuming you did not turn the machine off) speeding data entry.

The CHRONO-MOD

The optional Chrono-mod should provide you with years of trouble free service. If you are already familiar with your Timer, you could probably use your Chrono-mod without reading this section but take a few minutes to look it over, you'll be glad you did.

A Few Points to Remember:

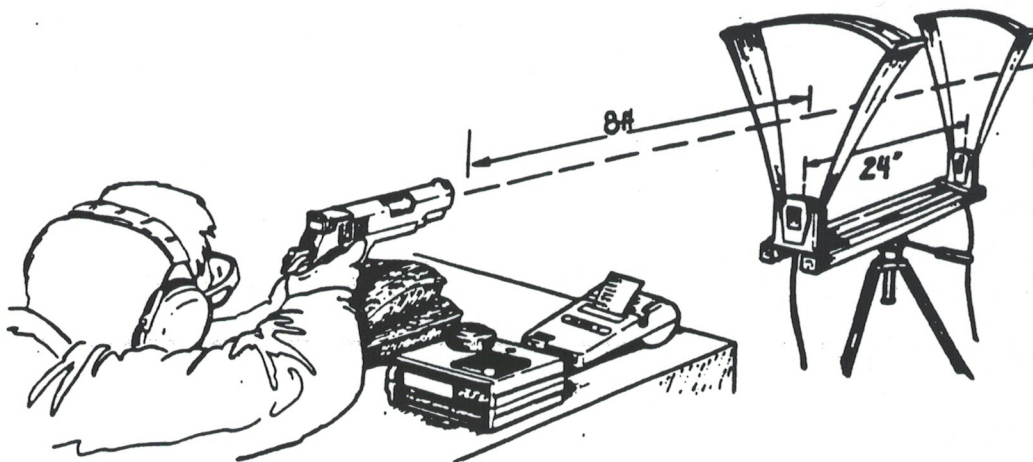
- ♦ **ALWAYS WEAR EYE PROTECTION WHEN SHOOTING!**
 - ♦ **DO NOT PLACE ARMOR PLATE IN FRONT OF YOUR SKY SCREENS!**
 - ♦ **IF YOU SHOOT A PLATE OF STEEL A FEW FEET IN FRONT OF YOUR FACE BITS OF METAL WILL FLY BACK AT YOU AND RIP YOUR EYES OUT!**
-
- When you set your skyscreens up, put them two feet apart, center to center. (The PACT bracket is already set to an exact 24" separation). When you switch to Chronograph Mode, it assumes this separation. If you are using a different screen separation, just push the "SET" key and enter your separation in inches, i.e; 48 inches would be 48, then push "SET" again.
 - Chronographs don't like sunlight reflecting off of shiny bullets. If you are chronographing on a sunny day and start getting odd velocities, this is probably the cause. Rigging up some sort of sun screen so that the bullet is in the shade while it passes over the skyscreen will eliminate this problem. Also note that snow on the ground will bounce a lot of light off the underside of the bullet.
 - Chronographs also don't like florescent lights. If you are going to use your chronograph indoors, you will have to rig an incandescent light over each screen.

Skyscreens

Your Championship Timer comes equipped with the finest Skyscreens on the market. The new PACT MK5 Professional Skyscreen contains two lenses that serve to magnify the bullet and bring it into sharp focus. This provides more accurate triggering at a given range than un-lensed skyscreens. The diffuser screens provide serve as both an aiming guide and light diffuser. (On blue sky sunny days they make it easier for the chronograph to see the bullet by providing a portable cloud for the sun to illuminate.)

If you have our optional skyscreen mounting bracket just screw the skyscreens to it as shown in the illustration. The skyscreens should fit snugly against the cross pieces to insure proper screen separation. The center of the bracket is threaded for a standard camera tripod (1/4-20). If you have one this is a pretty good way to go although you can set the bracket on any flat surface.

If you are fabricating your own mounting bracket take care to insure that the screens are precisely 24 inches apart, center to center. Whatever % error you make in screen separation will result in the same % error in velocity readings. Fit the side pieces into the cross piece and slip the unit into the skyscreen. When you have done this to each skyscreen the completed package should look like this:



Plug the first screen into the **START** plug located on the back of your timer, and the second screen into the **STOP** plug. Switch the timer on, from **TIMER COMMAND** push the **CHRN** button. The timer will switch to "**CHRONO COMMAND**" and display the current screen separation on the bottom line of the display. If you need to adjust the screen separation, you can do so now.

When you fire, aim in such a way that the bullet passes over the center of each screen at an altitude of between 4 and 6 inches above the screens. If you get lazy and fail to set up an aiming point, you will probably shoot your second screen. (Welcome to the club!)

Let's do some shooting. Push **GO**, the timer will display "**Chronograph Mode Running**". Fire a round over your skyscreens. The display should say something like this:

```
#001 856.2 FPS  
AV 856.2 FPS
```

Each time you fire, the shot number and velocity of your last shot will appear on the top line of the display and your current average velocity will appear on the bottom:

```
#001 714.5 FPS  
AV: 714.5 FPS
```

Now let's say that an odd-ball velocity appears, like "**6952.3 FPS**". This is an obvious error. You can remove it from memory by pushing the "**NO**" key. The Championship Timer will "back up" to the previous shot.

Note: *The Chrono-mod needs about 1.5 seconds between shots. This is to allow the smoke to clear. If you fire too soon, the Chrono-mod will not record the shot or get a very odd reading and another 1.5 seconds will be required before it is again ready.*

When you are done with your string, the Championship Timer will provide you with a statistical summary of your string. If you have a printer just push the **PRT** key

and you will receive a hard copy of you string number, statistical summary and each shot.

Push **REVIEW**

HI #003 868.2
LO #007 823.5

The highest and lowest shot velocities and their corresponding shot numbers are displayed.

Push **REVIEW** again:

SD: 45.8
CV: 5.99%

The Standard Deviation of your string is displayed in addition the SD is displayed as a percent of your average velocity (coefficient of variation).

Push **REVIEW** again:

MAD: 38.4
CV: 5.02%

Your Championship Timer calculates the **Mean Absolute Deviation** (average variation) of your string and once again displays it as a percent of your average velocity. *This number is the key to measuring the velocity variations in your loads.* The load illustrated varies an average of 5.02%. This is the number that should be used to compare one load to another. The smaller the better.

One more time:

ES: 105.9 FPS
AVRG: 763.8 FPS

"ES" stands for Extreme Spread which is the difference between the high and low shot velocities. "AVRG" is obviously the average velocity of you string. At this point you can continue to press the review key and review each shot. The "**FIND SHOT**" function is identical to counterpart in timer mode.

You can **EDIT** out individual bad shots with the **NO** button during review. The Championship Timer will recalculate your statistical summary less the edited shots.

When you are done reviewing your data, you can push "**GO**" and the timer will clear its memory an you can start another string or you can push "**CST GO**" (Comstock Go) and add more shots to the existing data base.

Note: If you don't want to mess around with all the review functions, you can start a fresh string by pushing "GO" at any time.

Automatic Power Factoring (APF)

With **CHRONO COMMAND** displayed on the screen push the **PAR** button. The timer will ask you to **ENTER BULLET WEIGHT AND PUSH SET**. Push **2, 0, 0, SET**. Now press **GO** and chronograph a round.

#001 866.2 FPS
200 GRN, PF 173.2

Remember that the power factor for the individual shot is displayed, not the average.

Recommendations

Having worked with dozens of chronographs, both our own and those of our competitors, I have one strong recommendation to IPSC and NRA Action Shooting competitors. Make sure to give yourself some leeway on the velocity of your match ammo. In other words, if you need 850 FPS to make Major, don't load 851 and think that are safe.

The problem is not so much one of inaccuracy on the chronographs, but variation in the performance of ammo due to weather conditions, i.e; barrels expand and contract with temperature changes, in addition, powder burns at different rates at different temperatures. In addition, despite what chronograph manufactures may claim, the shot to shot variation will go up on sunny days although the average will generally work out to be the same. We recommend that you give yourself at least a 25 fps cushion, 50 fps would be better.

If you get into trouble at a match, you might whip out your tape measure and check the skyscreen separation. If the screens are too far apart, the velocity will read low.

Notes On Screen Separation

The screen separation of your Championship Timer can be set at increments from 6 to 120 inches. So what's the "best" screen separation for you? First of all understand that, unlike some other chronographs on the market which use very dated designs, there is no electronic limit on how close you place your screens. In other words you can set your screens at 6" and blaze away with your 4000+fps .17 wizbang and, while the quality of your readings will be poor, the Championship Timer will read.

Secondly, because the bullet starts decelerating as soon as you drop it into our nice thick atmosphere, the farther apart your screens are the greater the instrumental error. To illustrate this principal with another extreme example, imagine the sort of readings you would get with you screens set at 100 yards. To be sure, you would have a wonderfully "accurate" reading which would shed little light on the question of your actual muzzle velocity.

The effect of mechanical errors in set up, such as improperly spaced skyscreens and manufacturing variances in the photo transistors and skyscreens, is aggravated by close screen separation. On the other side of the coin, lugging a six foot long mounting bracket around in your Porsche 959 is a drag.

We recommend a screen separation of 24" for most applications. This is a pretty good compromise between accuracy and ease of transport and set up. If most of your shooting is done in the 3000+ fps range you might consider stretching your screen separation out to 36 or 48 inches. However we have had some very knowledgeable people opt for the closer screen separation right through the 4000 fps mark. They have felt that the slight loss of accuracy was a small price to pay for the convenience of the closer screen separation.

How It Works

Each skyscreen contains a photo-transistor which is constantly measuring the current light level. Because the bullet is darker than the sky, when a bullet goes over the skyscreen the light level drops a little bit. The amplifier inside your Championship Timer takes note of this drop in light level and amplifies it to the point that the drop is big enough for the computer to notice. The computer then times how long it took for the bullet to travel from the first screen to the second screen where the light level again drops. Accurately converting this time into a velocity is easy; provided the computer knows how far apart the screens are. The Championship Timer always tells you the skyscreen separation it is looking for when you turn it on

Many light sensitive chronographs have a reputation for being flaky under certain light conditions. We have gone to great lengths to minimize this problem, but you will still occasionally run into a combination of conditions that may make it hard for your chrono to read correctly. It will help if you develop an understanding of how your chronograph works.

Your PACT Championship Timer is looking for a decrease in light level when the bullet passes over the screen. Assuming that enough light was entering the screen to begin with, your Championship Timer will always get an accurate reading. If, on the other hand, the light level increases as the bullet crosses the skyscreen, you will probably get no reading at all.

How could the light level increase? Let's say that you are chronographing under a dark blue sky and that the sun is reflecting brightly off of the bullet. Now the bullet is actually brighter than the sky above it. When it crosses over the skyscreen the light level goes up instead of down, thus we get no reading. Note that with a slow bullet like a 45 ACP fired under these conditions you may still get a reading. This is because the bullet may be over the screen long enough for the bullet to be considered the "normal" light condition. When the bullet leaves the light level drops and triggers the computer. This will still give you an accurate reading, but it is not "ideal".

If you find that your Championship Timer is having trouble getting readings on a sunny day with a dark blue sky you should try shooting lower over the skyscreens. You may also eliminate the problem by changing the light conditions. Put a shade to the side of your screens so that the bullet is in the shade when it crosses over the skyscreens, thus increasing the contrast in light level between the bullet and the sky. You might also try changing the direction of fire and/or tilting your skyscreens. Remember we are trying to get as big a contrast between the bullet and the sky as possible.

Muzzle Blast

Most of our original customers were pistol shooters and we designed into our chronograph some special "anti blast" circuitry which really minimizes muzzle blast problems without sacrificing sensitivity. When you fire a subsonic (below around 1200 FPS) round, the sound of the gun reaches the skyscreens before the bullet does. If it shakes the screens hard enough they will trigger and give you an incorrect reading. For example, let's say that you are firing a .45 ACP at 850 FPS and find that your Championship Timer is telling you that your round is going 680 FPS. What's happening is that the muzzle blast is triggering the start screen before the bullet gets there, but it lacks sufficient power to trigger the stop screen by the time its traveled that far. So we have a situation where the blast started the computer and bullet stopped it, hence the low reading. If the blast is severe enough to trigger both screens, you will be measuring the speed of sound instead of your bullet velocity. In either case the solution is simple: **BACK UP!**

When you fire a supersonic round the bullet gets to the skyscreen before the blast does. Keep the muzzle a couple of feet back from the first skyscreen to keep from beating it up. Remember that the farther your screens are from the muzzle the lower the velocity your chronograph will read (the bullet starts slowing down as soon as it leaves the barrel). If the blast shakes the screens hard enough they may trigger together causing an erroneous reading.

Another muzzle blast problem occurs when the skyscreens trigger on the shadow of the muzzle blast. This can happen when the sun is quartering to directly behind you and fairly low on the horizon (otherwise known as shooting north in the winter months). What happens is that you have a fairly dark blue sky, so the Glint

Guard turns up its sensitivity. The sun is reflecting off the edge of the slit in your skyscreen. When you fire, your muzzle blast expands rapidly outward and as it crosses the line between the sun and your skyscreen the amount of light impacting the edge of the skyscreen slit drops producing an absurdly high reading (like 2700 FPS for your rim fire 22 pistol). Changing the direction of fire will solve the problem. Another solution is to attach a small piece of cardboard to the front of each skyscreen so that the slit is in the shade.

One other odd effect of muzzle blast occasionally crops up when the blast so severe that it will cause the skyscreen jacks to vibrate in the chronograph causing both the start and stop screens to trigger together. Because this occurs before the bullet gets to the start screen no velocity will be recorded and the unit will appear to be dead. This problem seems to crop up most often with heavy revolvers, pistols chambered for center fire rifle cartridges and rifles with muzzle brakes. If your Championship Timer seems to have mysteriously capped out the moment you pulled out your .500 Linbough try firing a few rounds with a .22 rim fire or other low blast gun. If the Championship Timer goes back to working you'll know that shock wave was causing the trouble.

To correct the problem make sure that the cables are not stretched out (they should be touching the ground between the Championship Timer and the skyscreens. Secondly don't run the cables directly under the muzzle, place them to the side. The last thing to try would be to place the Championship Timer behind something (shooting box, jacket, bench) so that the Championship Timer is not line of sight to the muzzle. The problem seems to only crop up with high blast guns and is worse when the sky is dark because the Glint Guard circuit will turn its sensitivity up under these conditions which of course also increases the units sensitivity to blast.

**DON'T BE A DUMB ASS!
ALWAYS WEAR EYE PROTECTION!**

If you ever have a problem with your MKIV Championship Timer that you can't resolve please don't suffer in silence! Call us at 1-800 PACT INC. We'll get you squared away.

Good Luck and Good Shooting!