

PACT PRECISION CHRONOGRAPH

Preliminary users manual

Versions 1.2x,1.3x

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To begin with familiarize yourself with your PC. Note the on/off switch and skyscreen inputs on the back of the unit, marked "Start" and "Stop", as well as the 9 volt battery compartment. All PACT Products share the same back panel so don't be surprised to find a few extra holes in the back of your machine. These are used for the stop plate inputs on the PACT MKIII Championship Timer and do not affect the operation of your PC Chronograph. The control buttons are located on the front panel. They control the Edit and Review functions (more about those later) and are used together to begin a new string. Underneath the PC is the tilt stand which can be lowered for easier viewing of the display.

THE BATTERY

Your PC uses a standard 9 volt Alkaline battery. Battery life will vary with the quality of the battery (Duracell Alkaline seem to be the best) and the light level of the sky. The brighter the sky the more current the skyscreens will draw. In addition you will get more total "on" hours out of a battery by turning your chronograph off between strings, although the cost savings may not be worth the hassle.

As the battery runs down the sensitivity of the skyscreens will begin to drop and the display will begin to grow faint. Keep in mind that the computer in your PC requires far less power to run than the skyscreen/detector system. On very cold days you might consider keeping an extra battery in warm your pocket and trading them out as the battery in your machine freezes. On the other hand if it's that cold outside you might be better off staying home with your sweetheart and enjoying a hot buttered rum while you supervise her loading your ammo.

SKYSCREENS

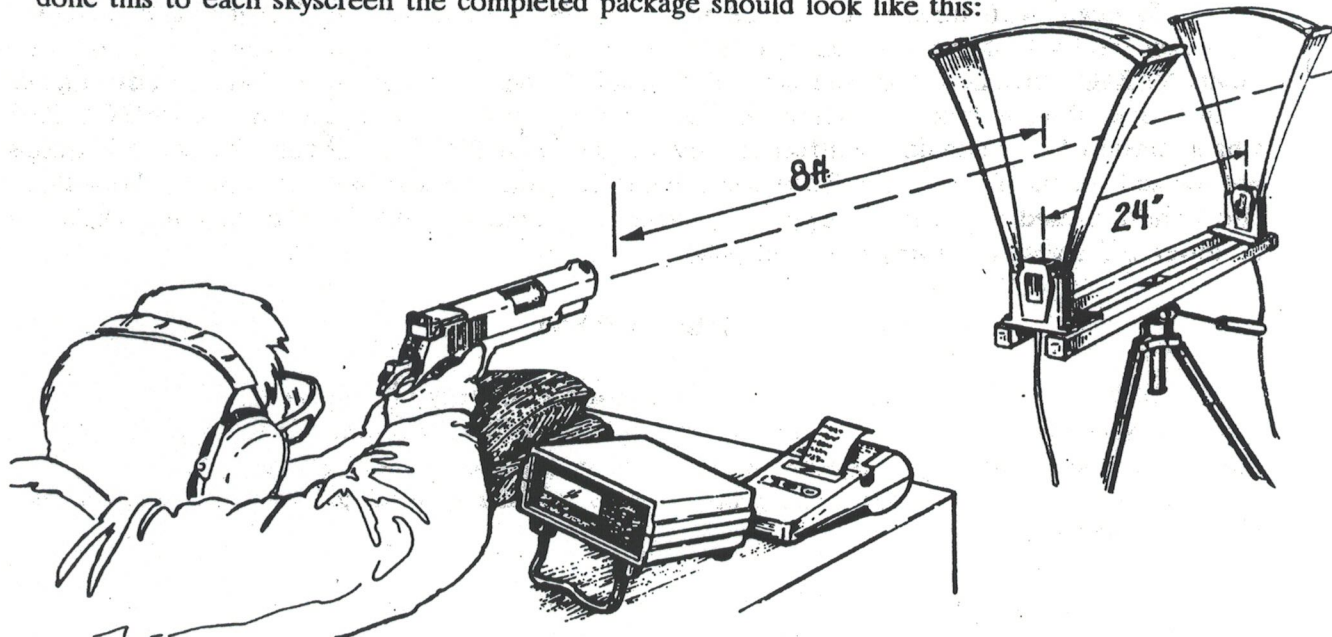
Your PC comes equipped with the finest Skyscreens on the market. The new PACT MKV Professional Skyscreen contains two lenses that serve to magnify the bullet and bring it into sharp focus. This provides more accurate triggering at a given range than un-lensed skyscreens. The diffuser screens provide 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.

Carefully peel off the adhesive backing off of the diffuser material. Affix a diffuser to the underside of each arched cross piece. The diffuser material should be smooth with out any "waves" in it. When you are satisfied that you have it on straight rub the edges down firmly with your thumbs.

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:



The first skyscreen the bullet will pass over should be plugged into START, the second screen should be plugged into STOP.

When you fire you should aim in such a way that the bullet passes over the **center** of both screens at 4 to 6 inches above them. Under ideal conditions (a bright overcast day) you will find that you can fire much higher over the screens and still get a reading. However, *the higher you shoot over your screens the lower the quality of your reading.* Under poor conditions (low light level or low contrast) you may have to shoot lower in order to get readings.

LETS CHRONOGRAPH SOME LOADS

Set your skyscreens up making sure that they are pointed in a safe direction. Place your PC where you can read it at a glance and turn it on. It will display:

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CHRONO COMMAND  
SCR SEP 24.0
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This tells you that it is ready to go and assumes that the screens are exactly 24 inches apart. Hold the EDIT and REVIEW buttons down together for a moment and release them. The display will now read:

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CHRONOGRAPH  
RUNNING
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Your PC is now waiting for you to shoot.

MAKE SURE YOU HAVE YOUR SHOOTING GLASSES ON - IF YOU HIT A SKYSCREEN OR THE BRACKET HOLDING IT, BITS OF PLASTIC, METAL AND BULLET WILL FLY IN ALL DIRECTIONS.

DON'T PUT METAL PLATE IN FRONT OF YOUR SKYSCREENS

Go ahead and fire a round over your skyscreens. The PC should display something like:

#01 855.8 FPS
AV: 855.8 FPS

If it does not, make sure that the first screen is plugged into START and the second screen is plugged into STOP. If this checked out you probably missed the "window". Try again, remember 4 to 6 inches over the center of the screens.

Note that you must wait about 1 second between shots, we make you do this to allow the smoke to clear. If you fire too soon you will either get no reading or a very odd reading like 10 fps. Remember give it a second between shots.

Go ahead and fire a few more shots. Each time you fire, the shot number and velocity will appear on the top line and the current average will appear on the bottom line.

If you notice a bad reading, push the EDIT button. This will erase the last shot from the display and from the computer's memory. You can also use this feature after you have finished your string so don't feel like you have to fuss with your PC in the middle of a string.

When you are done with your string, the PC will provide you with a statistical summary of your string. If you have the Print Driver installed the PC will give you the option of printing the string when you press the Review key. If you think you might have a "bad" reading in your string you may want to review **before** printing.

Push "RVW"

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 PC 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 of 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. You can continue to press the review key and review each shot. When you have gone through each shot the PC will display:

CHRONO COMMAND
SCR SEP 24.0

At this point you can either start a new string by pushing REVIEW and EDIT together or you can review your shots again using the REVIEW key. If the Print Driver is installed you will once again be given the opportunity to print your string. *Note that you can start a new string at any time. You don't have to go all the way through your review to start a new string.*

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 PC 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 PC always tells you the skyscreen separation it is looking for when you turn it on:

CHRONO COMMAND
SCR SEP 24.

NOTES ON SCREEN SEPARATION

The screen separation of your PC 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 PC 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.

To change the screen separation of your PC remove the top of the unit and place it in front of you with the display facing away. **MAKE SURE THE PC IS TURNED OFF!** Located on the circuit board just behind the display is a four position DIP switch. We will call the left most switch #1. There may be a piece of clear tape covering the switch, feel free to remove and discard it. These switches can me switched using a ball point pen or the tip of a knife (don't use a pencil). After setting the switches to the desired positions turn the unit on and check the display to insure that the correct separation has been entered. Changing switch settings with the unit turned on will not change the display. In addition you might short something out.

Switch settings for PACT PC 1=off 0=on

6"	0000
12"	0001
18"	0010
24"	0011
30"	0100
36"	0101
42"	0110
48"	0111
60"	1000
72"	1001
84"	1010
96"	1011
108"	1100
120"	1101
12"	1110
24"	1111

LIGHT CONDITIONS

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 may 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 PC 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 PC 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 PC 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 PC 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 PC seems to have mysteriously crapped 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 PC 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 PC 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 PC behind something (shooting box, jacket, bench) so that the PC 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.

PROBLEMS

Hopefully you won't have any problems with PACT PC. We have busted our rears to make this thing as reliable as possible. Of course every so often a capacitor dies, a resistor breaks or an integrated circuit does whatever it does when it dies. These things don't happen very often and we go to great lengths to see to it that we only use the best possible components. If your PC does misbehave, here are some things to check:

Are the screens plugged in correctly?

Is the battery charged? When it gets low on power your PC will get less sensitive. For example it may have trouble seeing a bullet although it can still pick up your hand.

Is the bullet darker than the sky? If it's not, the PC will have a hard time seeing it. You might try shooting lower over the screen.

Water can wreak havoc inside your skyscreens. If you leave them out in the rain they will fill with water which will short out the photo transistor. If this happens, it may be necessary to take them apart to dry them out. You probably won't leave them out in the rain twice.

If you do have a problem, for goodness sake, **DON'T SUFFER IN SILENCE!** Call us. We have been building electronic products for shooters for years. We will get you sorted out. Please don't hesitate to call us on our toll free line (800) 722-8462.

ODDS AND ENDS

How do you know if your PC is telling you the truth? If the reading you get is close to what it should be you can count on it being within .5%. That's point five per cent **not** five percent. Normally you will find that the reading are actually better than that. If the unit prints a bad velocity it should be off by enough to be obviously wrong. Bright overcast days will produce more accurate and consistent readings than blue sky sunny days.

In almost six years of chronograph building we have yet to have a unit returned for repair because it read too high. However about once a month a member of the Magnum/Weatherby club has us "check his unit out" because it reads "200 feet low." While we have seen a few bad counter chips, out of thousands of chronographs tested, it is dam near impossible for a unit to read "200 feet low" with one cartridge and correct with another.

If you want two compare two chronographs you should set them up so that a single shot registers on both units. We recommend that you compare average velocities on 10 shot strings. To compare the "Variability" of one chronograph to another compare the SD's or MAD's (if available) recorded on each string on each chronograph. If chronograph "A" has a 10% lower SD or MAD **on the same string** as chronograph "B" than you can correctly say that chronograph "A" has a slightly lower "total system error."

PRINT DRIVER

If your unit is equipped with our Print Driver and you have a Hewlett Packard HP82240A Infrared Printer you have the option of printing your shot strings.

Set the printer up as shown in its manual and place it 4 to 6 inches behind your PC so that the LED in the back of your PC is line of sight to the sensor in the front of your printer. Lowering the tilt stand may decrease the range of the printer.

When you complete a string press the review button. The PC will ask you if you want to print the string. At this point you can either print the string or review the shots. If you suspect that you may have some bad readings in the string, review the shots first, editing any bad shots out of the string, then press review until you are again asked if you want the string printed this time tell it yes.

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