ROBOSCOPE INSTALLATION & OPERATION
ROBO PROGRAM VERSION: 5.4
07/17/2013 DM

INTRODUCTION

Do not read this once! Use Roboscope maybe 6 to 10 nights and constantly refer back to these instructions until you become familiar with all routine operations, some of the most useful information described here will be forgotten in your early learning process!

Roboscope is a program developed at Tech2000 specifically for use with Dob-Driver II controls. Use of this program in other situations is prohibited without specific consent of Tech2000.

Roboscope allows a telescope that was not designed to be motorized, much less automated, do a fair to excellent job of locating and tracking celestial objects for the amateur user. Operating in a manner similar to digital setting circles, the user sights 2 reference stars or other reference objects and Roboscope calculates the local sidereal time and latitude at the observing site - relieving the user from consulting geographical charts for latitude/longitude and entering accurate local GMT time/date Lat/Lon North align, etc. All of this is not necessary now.

Several advanced features developed by TECH2000 celestial mechanics are put to use (note 1). Tip/tilt errors in the mount, optics, and base leveling are mostly factored out by the unique alignment functions - which do not even require a “Level Me” step to make the axes perpendicular before sighting the reference stars! (off the shelf setting circle units generally require that extra step before you can begin observing). And the Tech2000 innovation of the dual mode Flying-Align feature improves calibrations even further while you observe, not to mention a built-in clock trimmer in software.

There is a nice cost reduction in the fact that Roboscope does not need digital setting circle encoders to accomplish the mission. It is operated “open loop” which means there is no position feedback except for your eyeball and your keyboard inputs. These aligning features are critical to make a typical amateur Dobsonian telescope, and similar altaz mounts, which were not built with automation in mind, come closer to the performance of precision-machined steel shafts & bearings found on an expensive mount built for automation.

All of the operating functions are menu driven and you will be lead through each selection intuitively - meaning you probably will not need specific instructions to use this program. However pay CLOSE ATTENTION to the initial calibrations and sections in this manual dealing with error sources and use of Flying-Align features if you would like to hit your target objects with maximum precision.

INSTALLATION

Connect the PC cord provided with Roboscope to the Dob-Driver II "PC-LINK" 6-pin jack in the hand control (typically called a Pendant by Tech2000). Connect the other end to your parallel printer port (or adapter card – see FAQ's "Parallel Ports" at the end of this document). No particular sequence is required aside from the fact you should have the Dob-Driver II hand control powered up and in PAN mode when you launch Roboscope. The Dob-Driver display will read 'PC' when it recognizes the connection, that will happen either immediately on connection, or after Roboscope starts, depending on the port state of your PC initially. See sections below for more detailed information about parallel port addressing and resource assignment and adding a parallel port if your PC machine does not have one already.

You may run copies from a floppy disk, thumbdrive, or hard disk. Though you can run it from a CD-ROM disk, you can't write your calibration files to that when you calibrate, nor swap-and-run User catalogs that you created, so first copy all files to a file folder (or DOS subdirectory for DOS users) on your hard disk. Name the folder "Robo" or whatever you like, as it does not matter what the directory is called during operation. There is no installation program or other procedure required. No Windows registration etc. You may also wish to make a spare copy for safekeeping of all the original files ;-). If you have a floppy drive or USB thumb, it is usually better to use that during operation because less battery energy is used than a hard disk motor 'wakeup' every time you access a catalog object. Hard disks take more time to come up to speed and then stay on for up to several minutes each time they're accessed (laptops) whereas floppies or solid-state drives only run briefly during an access then shut off their power consumption. Roboscope does not access a drive until or unless an object coordinate needs to be fetched for GOTO.

INITIAL CALIBRATION

EACH MOUNT or telescope configuration used will need specific information regarding its azimuth and altitude ENCODING (positioning) calibration, which is internally expressed in degrees per motor step. This does not apply to Giro II mounts since we already have the GR2.CAL file provided on the disk – although this procedure can be used to improve pointing precision on those too if desired. Also each instrument will need to know PRECICELY how much BACKLASH (looseness) is in each axis. These parameters are established in the Calibrations section of the main menu. Each equipment configuration you use (mount & tube assembly together) will be required to be NAMED so a file can be generated to store the specific information. When you first run the program with a new instrument, you will use the name "New" shown on the screen list (or GR2 in the case of Giro mounts), to identify your equipment calibration filename, which is required to start the program. Later when you run any calibration function, upon exiting the calibrations menu, you will be prompted for saving of the data and the name of the instrument up to 8 characters (no .ext) for example "DAVES18". And if the calibration file name you typed does not exist yet, your newly named scope data will be stored under this equipment name you enter, and next time you start the program your equipment will be shown on the selection list. If your calibration file for that scope name already exists, only the changed cal information you did will be updated.

Any calibration-file (FILENAME.CAL) that you generate or alter afterward for your scope will be saved to the *SAME drive/directory path or folder that you started the program in*. Beware of confusion if you change any calibration (.cal file) and you later copy it to a different place than your usual Roboscope files location. You may end up with two .cal files for the same 'scope - only one of which is the "latest" one you slaved over to create (or recreate). If you end up having two .cal files that you are uncertain of which is the last one you updated, then generally you can decide which is current by looking at the date listed for the file.

Azimuth and altitude Encoding Calibrations are most conveniently done in the daytime BEFORE taking the scope out since you do not need the sky to do this. Azimuth and altitude Backlash Calibrations must be done either during the day on a far away stationary object, or on a (relatively) stationary object near or at the pole star until you become familiar with the process. The program will guide you through the details.

Encoding Calibrations should be repeated several times initially. At the finish of each procedure the screen will show the % deviation from the last time you calibrated that axis. This result should be less than .3% (.003) and preferably less than .1% (.001) - for example .1% of 360 deg is .36 degrees error! Admittedly, its not as bad as it looks since the azimuth axis will never turn more than 180 deg to get to any target, so worst

case will be a .18 deg GOTO error, and the altitude axis will likely never slew more than 45 deg to a target and so will be 4 times more accurate than that given the same % error.

If the % error does not stay under these limits, it is likely you have a drivewheel or belt slip problem which must be corrected before you can attempt 2-star alignment reliably. Make sure the telescope has a good balance in altitude motion always at all angles to avoid problems with the tube "leading" or "lagging the actual drive motor position. See Sources of Error below. The first time you do each calibration type, using the scope named "NEW", you will see rather large % deviations, but that is a different scope so don't be concerned about it until you have calibrated your own "scopename" at least once.

GENERAL OPERATION

NOTE: THE FIRST 4 CALIBRATIONS shown on the calibration menu MUST be performed at least once before you can begin using Roboscope normally (except Giro GR2 mounts which already have known calibration provided at least pretty darn close), and after some seat-in period of use (see error sources below - AZ wheel) you should perform the calibrations again, particularly if you have made any change in bearings or general structure of your instrument. Calibration functions are accessed from 'ROBO' main menu so you can do this anytime the program is running. DO NOT CROSS AZIMUTH NORTH BETWEEN ANY TWO ALIGNMENT STARS - ERRORS WILL RESULT – PICK ALIGNMENT STARS THAT ALLOW YOU TO GO FROM STAR-1 to STAR-2 WITHOUT CROSSING AZIMUTH NORTH POSITION.

- To run Roboscope in DOS, change to the drive and the directory containing the program files. The programs will run directly from a floppy disk if you plug it into drive A, or a thumbdrive, for a CD-ROM disk you should have it copied onto your hard drive in order to save important info like ".CAL" files. Either way, type ROBO and hit enter. This will run the file called Robo.bat (a batch file)
- To run 'Robo' under Win/95 and up, double-click the file Robo.bat. You could also select "exit to DOS" in the older Windows OS systems and leave Windows entirely if you need to, but this does not allow running two programs at once as Windows will do. Windows will let you also run a sky-chart program such as TheSky at the same time Robo is controlling your telescope! Some rules apply for doing this: On the chart program- Set your location and time for viewing the sky properly on the screen (do NOT use system time & date if Roboscope has been aligned, Roboscope changes the system time clock to LST on older Windows systems). For the same reason, disable any automatic time/date tracking, or other chart motion that uses the PC clock if you are running older Windows (you can tell this because after 2-star alignment the PC clock will read correct or change to match the LST that Roboscope displays on screen).
- Enter your equipment name from the list presented (without the .CAL extension). Robo checks all the parallel port base addresses available on its' list, looking for a Dob-Driver device, selecting and displaying one that answers on the main Robo screen. If you get a "No Comm Link" response then see FAQ's section below.
- Sight 2 stars with the align function, and begin observing. This program will not work properly if you are located outside of the latitude range -60 to +60 degrees. DO NOT CROSS AZIMUTH NORTH BETWEEN THE TWO ALIGNMENT STARS - ERRORS WILL RESULT – PICK ALIGNMENT STARS THAT ALLOW YOU TO GO FROM STAR-1 to STAR-2 WITHOUT CROSSING THE NORTHERLY DIRECTION. Other alignment stars, or objects that are not on the bright-star list presented, can be used to align on if you have accurate coordinates for them (see the last entry on the star list). Note- After the two star alignment, your second reference star will continue to drift until computation is complete (drives are not tracking yet). When the computing is done, and you hit enter as requested, tracking will turn on and the alignment star should come back to the SAME EXACT POSITION that it was when you hit F1 after centering it. If it does not, you may only have a poor alignment with the sky (minimal star separation, got wrong star etc.), or an incorrect encoding or backlash calibration. This will not prevent you from continuing to use the program successfully, especially if you limit hop distances between successive objects and center each before continuing. However, if this continues to be the case each time you perform 2-star align, you should check the (easy to set) backlash calibrations. If further problems persist, re-do the (more involved) Encoder Calibrations for each axis. If the condition continues to occur, carefully check each of the "Sources of Error" section below to correct the problem(s). Most positioning and tracking errors are traced to mechanical specifics of the particular

mount, some of which can not be overcome without rebuilding the mount to machine-shop specifications - which we want to avoid! Roboscope software 4.1 and up demonstrates accurate positioning to the nearest 1/100 degree. This is FAR more precise than most uses will require.
Another easy check of alignment & calibration quality is to read the latitude displayed on the main screen after the second alignment star is done. This is a computed number which locates you on the planet (Earth in this case), and IF the telescope ground board was level during the 2-star align, the latitude displayed should be very close to your actual latitude.

- After 2-star alignment, using the Manual Pan function will continuously read out both the alt/az and ra/dec position of the instrument, allowing you to locate your current view anywhere on your field charts or from any chart program. Also, after 2-star alignment, slew-to targeting functions will allow you to enter either alt/az coordinates, ra/dec coordinates, or select directly from catalogs.
- A new GOTO shortcut is available with Roboscope 4.2 & up. It saves keystrokes. While tracking is on, just type in the catalog # like M57, NGC3000, k21, ic1004, User99. Single catalog letters are OK, like n3000 instead of NGC3000. Capitals and spaces do not matter. The telescope will slew directly without further ado when you hit the enter key, provided the object is above the horizon at least 5 deg.
- Use of cursor keys allows only ONE axis at a time to be moved. When the program auto-slews to a new target however, both axes will move at the same time for fastest access.
- You can resize the Robo window down to about 1" square and move it around as needed, floating over your chart (set Robo window Properties to "Always On Top"), and clicking on either the chart or Robo window. The scope will pause (cease tracking) when the chart program is active or anytime Robo is not. See notes below if you experience odd errors with Windows such as scope direction wrong, program freezes, scope moves erratically, etc.
- ALTAZ-ONLY USES: Alternately if you choose to, you could start the Roboscope program with the scope level and pointing to polar north (this is not required for normal operation and in fact is rarely used – and don't forget that polar north varies from magnetic north depending on your longitude so you will likely need to determine that offset). You would do this in order to use the altitude and azimuth readouts to lead you to geo-stationary objects or a time/position coordinate without the 2-star aligning being necessary - using a sky chart on PC, magazine info, or internet to give you the altaz coordinates. Also its useful as a surveying tool for angular positions down to $1/100^{th}$ degree. Of course the instrument will not move from the altaz coordinate if you auto-slewed there or manually panned there, since no alignment has been performed hence no tracking is expected. IMPORTANT NOTE: The DDR2 hand control and Roboscope use the common altaz positioning system known as Horizon-Coordinate-System, this means that altitude is expressed with zero being scope-leveled at horizon and increasing positive up to zenith at 90 degrees, and azimuth being zero at polar north and increasing positive in a clockwise rotation along the horizon up to 360 degrees. For this to read correctly without any 2-star alignment the hand control MUST be initialized as follows… You MUST power the hand control first, use the pushbuttons to set your initial 0,0 altaz start position, and MUST finish by pressing the Up and Right buttons even just a little – this sets the initial positive directions for Up and Right (CW) rotations. ONLY THEN can you connect the Roboscope PC cord to the hand control and start Roboscope for this altaz-only use.

FLYING ALIGN

- Consists of 2 parts... Local-Register and Long-Slew-Recalibration.
- Always use a widefield eyepiece to slew to far-away objects so you can detect them and center-up when the telescope arrives there. A deep space finder of 10 x 50 can be useful during the first 10 or so observing sessions when you are (sometimes without realizing) gathering experience and data for your scopes .cal file, or when the particulars of your mount never seem to give good targeting performance for long slews.
- Local Register allows "registering" a large area of sky surrounding your target, precisely with the coordinate of that object, if ra/dec coordinates are precise. It then will allow very close centering for other objects in that sector, which can be very densely packed in places like the Virgo cluster of galaxies. Local Register happens when tracking is on and you are using the cursor keys to center the object. The scope does NOT update position data when you center an object or micropan around with

cursor keys while tracking is ON. For this reason, the cursor speed is restricted to slow speeds so you don't roam too far (use the manual pan function on the menu if you want to roam around fast and have it maintain coordinates while doing so). And it is IMPORTANT TO NOTE that before autoslewing to catalog items or other positions you should CENTER THE OBJECT before the move so the telescope is on the coordinates displayed. This is crucial to flying-align data accuracy as well as visual upon arrival at the new target.

- "Flying Align Available" comes on screen if a long slew allows automatic adjustment of the motor step size (encoder) calibration given by your scopes ".cal" file. If you have left an object of known coordinates and auto-slewed to a new object fairly far away, and its not very well centered, this allows you to center-up the object and then it calculates the calibration adjustment required (too far, too short, and by how much) so it will slew more accurately next time. Deep space finder useful here if initial axis is not calibrated precisely. Flying-align is an elective function - most of the time you should not use it (Hit F1 to exit) until you gain experience with Roboscope. If all calibrations are correct for both axes (you have allowed wear etc. and all calibrations are fairly recent and accurate) then "fine tuning" with Flying-align should actually not be necessary. After a few flying align adjustments the residual errors are solely a function of mount construction. This data is not saved – it is only "per-session".

MANUAL TUBE MOVEMENT - VERY USEFUL!

Manual tube movement (motors declutched) can be done anytime Roboscope has coordinates of a KNOWN OBJECT on screen - REGARDLESS of where the scope is actually pointing! For instance you have just commanded a slew to a catalog object and the alignment is poor or a belt slipped a little, whatever the error problem is, the object is not visible in the eyepiece. Since Roboscope always thinks it is tracking the object, you can release the motor drives and manually sweep the close by area instead of using cursor keys to hunt - then re-engage the motors and use the cursor keys to center up your target. Then even with a poor alignment you will still be registered with decent accuracy in that region of sky...this would not be possible if encoders were used - you would HAVE TO realign! In fact you can manually move the scope ANYWHERE IN THE SKY AS LONG AS YOU WANT, and later return to that same object to engage motors, center up object, and continue to use Roboscope!

Hint - when engaging drives on a Dob-Driver, clamping the altitude belt lever makes no change in tube position, but releasing the azimuth quick-release knob lowers the scope on the back end - raising the tubes altitude position slightly. Because of this, when you manually position the eyepiece view before engaging motors, center the object left & right, but place the object a bit below center in the up/down area of the eyepiece - then when the azimuth motor is engaged the object will move back UP toward the center of eyepiece field. Note this and you will become familiar with just how far that is with your usual wide-field eyepiece which you use for hunting objects with Roboscope. Makes no difference to goto accuracy anyway.

CATALOG HANDLER

- You can use it with or without the scope. You can do all Catalog Handler functions without a scope connected. You can also enter the Catalog Handler, unplug the scope cord in the middle of an observing session and plug in a parallel printer, print catalog info, then plug the scope back in! If you don't move the scope during this, alignment will not be lost.
- Select Catalog Handler from Robo main menu. Select a catalog to use.
- You can print the catalogs in portions, one or several objects, or the entire catalog. Watch out - NGC is BIG! Note the IC (index catalog) does not have an object in every catalog entry position, this is normal. Also note that "Windows printers", USB or otherwise, have issues printing from the DOS window and those require a utility program – see FAQ's below.
- Select objects from the current catalog by object number.
- After viewing the database info on that object you can choose to have the telescope slew to it.
- You can add objects to, or rewrite data of any object in any catalog. A user catalog is also there for you to enter up to 100 objects with your own private catalog numbers, for instance objects 1-to-10 to present

a showy sky-tour of your fave-raves this season... and another group of object numbers 11-to-20 for an explicit constellation study, special brackets for special interest groupings, etc.

- You may also have an UNLIMITED number of User catalogs with object entry numbers 1-100 in each of them. To do this, enter the object info via the Catalog Handler and save your USER catalog. IMMEDIATELY copy the saved catalog (a USER catalog can only be named USER in the Robo folder) to a SEPARATE FOLDER then re-name it anything that indicates to you what it is, including author and comments in the Windows File Info if you like. Later, to use one of your own catalogs, delete the USER catalog currently in the Roboscope folder and copy one of yours there instead, renaming it USER.

SOURCES OF ERROR - EQUIPMENT

- MOST IMPORTANT RULE... before using Roboscope programs, the telescope itself with Dob-Driver II clock drive, must be operating VERY WELL on its own without Roboscope! Then errors will be minimal.
- Users of GiroDrive on a Giro 2 mount will pay less attention to the information below about mechanical coupling details for Dobs, and instead pay more attention to good and proper balance on the Giro rig, and also add rosin to the grip belts in order to increase belt grip when using heavy instruments typically over the 12 to 25 LB instrument weight range, and assure there is enough grease in the altitude shaft to allow fluid movement.
- The traction wheel on the azimuth drive, being a certain thickness, can (and will) usually cause a very significant change in the EXACT radius it is rolling, around the pivot bolt in the ground board. This error can be rather severe for positioning purposes and is NOT predictable and is therefore NOT accounted for in the software. If desired or required by the user, the problem can be reduced and positioning performance thereby improved by either tilting the drive with washers under the inner edge of the mount cleat (so that only one rim of the traction wheel is in contact with the ground board - never the other), or in the case of very large instruments a different scheme can be fabricated such as a V-groove on the wheel following a bent-rod track or some other such means to hold the weight yet still provide a precise radius for all azimuth positions. RECALIBRATE the axis after making any changes!
- The easy solution is that after installing a new drive or tilting the existing one, allow wear to occur in the path of the wheel. This will slowly change the precise encoding values due to the change in contact radius as it seats-in to a repeatable happy medium. Be sure to recalibrate the axis occasionally when this wear becomes evident as diminished targeting accuracy during use.
- Also if the az driveheel is not perfectly tangent to its circular track-path, the contacting radius may be slightly different in one direction vs. rolling in the other direction. That sort of problem can be adjusted by shimming the drive cleat in small amounts to bring it closer to a tangent (ie- the drive wheel axle should point directly to your central Pivot Bolt bole). This can be tested (and calibration in general including backlash) by using the 'slew-to' altaz menu function without a 2-star align. Just command the scope to slew from altaz 0,0 to 90,90 and back again, go all around, backwards etc. in azimuth position until you have confidence that pointers you taped on with masking tape on the first pass always return very close to the positions you type in, especially always going back to 0,0 altaz home (the position you started from at the outset). A 1/8" err from such a return-home move is not bad, but <1/16" is considered excellent.
- The motors may "miss" some positioning steps if Maxspeed setting on DOB-DRIVER II PENDANT is too high for voltage available, as in lo-battery, or zones of instrument position which cause a higher drag than other positions where Maxspeed was set. Or a change in balance (or friction load) has occurred in altitude. Set a bit lower Maxspeed until all looks good then set Maxspeed up again later to see if this is a problem.
- Non-orthogonal (perpendicular in all positions) axes on an altaz mount are inevitable and are commonly non-orthogonal on MOST commercial and homemade telescopes. This problem is not seriously crucial with Roboscope since the fly-align functions average it automatically. If you however are manufacturing a mount for the purpose - keep it ORTHOGONAL. Otherwise remember this is a common error source. We have numerous analytical methods to assess this but they are too involved to describe here.
- The rollers and drive wheel of the azimuth axis should be exactly the same height from the ground board ie- you should see exactly the same gap between the bottom of the rocker box and the ground board in all positions regardless of where you position the scope in azimuth. If this is not perfect, or the ground board is not dead-flat (planar), the azimuth will not rotate "true" with respect to the point where

altitude axis crosses azimuth axis (an imaginary point in space at the center of your tube where both axis lines cross - this point should never shift when moving the scope in altitude or azimuth - but it ALWAYS DOES on mounts we amateurs build and buy).

- Severe warps or bowing of the ground board will cause errors in true altitude position in addition to azimuth wheel-rolling-radius errors mentioned above. Normally not a problem of serious significance, it can be improved by assuring the ground board is PLANAR at least in the zone of rotation where the drive wheel tracks.
- Cocking or lateral-motion activity in the azimuth pivot bolt could cause an error, especially when directions of movement change, which is very often during use. Keep the pivot bolt rigidly vertical.
- Of course if an altitude bearing is not PRECISELY radiused on-axis, that will cause a significant error too. Not usually a serious problem but still an addition to all other errors in the total.
- Wall height as measured from ground-board surface to true center of altitude bearings should be equal on left and right flanks. Else the altitude axis will not be orthogonal to the azimuth axis.

SOURCES OF ERROR - USER

- Backlash calibration of each axis is CRITICAL for the program to KNOW the true position of each axis since there are no encoders to feedback the actual position of the instrument. Changes in altitude balance or bearing friction are usually the culprit when you have already set the altitude backlash calibration as best you can. Do the backlash calibration over again in these cases.
- On Dobsonian mounts, the altitude axis is predominantly the most problematic. Always some variation in balance, belt stretch, belt creep on the pulley, variance of these at different angles. The altitude backlash calibration should always be set with the tube around a 45 to 50 degree position where nominal conditions of observing occur.
- A user's coordinate entry of right ascension can be a big source of error.

One minute of Ra is 15 times larger than 1 arcminute of Dec!
Accurate scope position is based SOLEY on those Ra/Dec coordinates
and Flying-Align uses them. Estimate fractions of minutes like this...

COORDINATE GIVEN	YOU ENTER
Ra 11h 12m 15s	11,12.25
Ra 11h 12m 30s	11,12.5
Ra 11h 12m 45s	11,12.75
Ra 11h 12m 59s	11,13

SOURCES OF ERROR – PC CLOCK & YOUR LST TRIM FUNCTION

- Long term cumulative error will result if PC clock (RTC or Real-Time-Clock) rate is not accurate. Not "accurate-time" per-se… we don't actually care about that since we get our own precision local time from star alignment, but the "rate" at which the PC clock reference runs. Sadly, long-term error is more common since computers today update their clock only occasionally via internet at startup, if you have an internet connection on, but do not keep it current while running and they do not care about rate precision much anymore because of that. The Dell I'm typing this on right now gains 17 seconds per hour – unacceptable for astro-imaging precision! But wait! There's more! Robo maintains a separate internal clock for LST (Local Sidereal Time) that is based on the PC clock rate. Robo 5.4 and up adds a User-Trim calibration that beeps whenever the Local Sidereal Clock rate is auto-adjusted. The calibrations menu item "LST Rate" tells you the basics and lets you trim your LST rate to compensate anytime you are running after you have aligned on stars. We list here some deeper tips…
- This calibration-menu function is not normally necessary to do. Only those people who are using the PC for periods far longer than just one evening of GOTO astronomy, perhaps until dawn, perhaps over days of constant "PC-on", and those whom are very particular about astro-imaging details, will be interested in this ability to adjust seconds-per-hour of sky position error. If your PC drifts just 10 sec per hour, that's a 1 second sky-shift in just a 6-minute exposure… a 15-arcsecond imaging smear!

- Robo 5.4 introduces a main-screen info label called “Trim:”. It shows seconds remaining before an LST trim adjustment will be made, with a comma followed by the correction sign +1 or –1 which may be anything from a fractional second to a full second. The PC will emit a beep when the countdown reaches zero. If you are imaging, note the seconds remaining and if not too long a wait, start your exposure after the beep.
- Use an external hand timer to test the Roboscope LST clock, since the PC clock is the problem it can not be used to gage. Verify your hand timer rate-accuracy with a high-quality atomic watch or NIST sites such as http://www.timeanddate.com When you use internet like that, be SURE to always click your browser Refresh button to update the time from that site just before you start timing, and anytime just before you compare their true time refreshed-update to your hand timer. This is because after each time the page is loaded… your PC clock is the only thing keeping time… until you click the Refresh button on your browser again! Mark the +/- error (if any) on your hand timer. Mine holds <1sec/hour well.
- Time at least one-hour, comparing when Roboscope LST seconds roll onto “00”. After (about) 1-hour, the displayed LST on screen should be 9.8 seconds ahead of your civil timer elapsed time (we round to 10 sec/hr unless we do 5 hours examination then the total ahead should be 49 sec over 5 hours).
- Go to the calibrations menu and the LST item, then if your Roboscope displayed LST was short of the +10 sec/hr expected when compared to your timer, then enter the seconds of difference (a positive number is implied without a “+” sign being required). If your displayed LST was ahead of that +10 expected, then enter the –seconds per hour to be deducted. Decimal fractions of seconds are accepted but we normally don’t bother with that since observing timers visually is not very accurate. However, if you have an error less than 10 seconds from the expected time displayed, then that is considered good, and 5 seconds or less deviation is considered excellent. Think about past customers over the last few decades whom were quite happy and never did mention clock errors… not realizing that they had over 20 seconds/hr of tracking error just from their PC-Clocks!
- We noticed that running other Windows app’s changes the PC-clock rate quite significantly. When you are timing your LST clock speed you should have applications running that you normally would have on during use. For instance maybe a favorite sky chart, and camera applications. If you normally have an internet connection or Wi-Fi on then do not turn that off, else keep ‘em off always. Use your timer again anytime to verify that LST holds or you need a trim.
- Advanced users will realize that there are numerous ‘live-internet’ feeds that will periodically and frequently sync your PC clock, similar to the internet clock ‘refresh’ comparison for your timer that we described above, but done automatically and set for specific period updating automatically too. Some are for a fee but I tend to gravitate toward government/NIST-based services since taxpayer dollars are, in the end, funding YOUR benefit. This gets around various app’s problems deviating your clock, and your imaging work.

ERROR SUMMARY

- All errors sum together to either make-it-worse, or sometimes cancel each other to make-it-better. Primarily, do the best you can to use Roboscope software functions to minimize the mechanical errors by checking backlash regularly and be sure to repeat encoder calibration if you suspect errors are too large. Secondarily and for higher precision, check your LST clock rate described directly above. Generally, you should expect close targeting with experience, particularly in regions that you have “local registered” on. If not, analyze the above described situations to see if improvement is available.

NOTES

1. HELP! HELP! TECH2000 is holding us captive in the lab in Monroeville! Send more pizza and USER catalogs (don't tell the Boss or any astrophysical gnomes that may hang around – we could get in trouble for it wink-wink).

2. WINDOWS-95/98/98SE...
   General: At first, run Roboscope privately (no other applications running). This will dedicate sufficient PC resources to Robo and let you verify that everything works. Then you can begin to try chart programs along with Robo, which is excellent for hopping around by directly entering the ngc, m, ra/dec, etc into the Robo window (presumably shrunk small as described elsewhere).

   Problems with early Win chart programs: If you experience erratic behavior with the telescope while charts or other database programs are running, activate the Robo window and click on the Properties button (or right-click the window header bar to get properties). Select the 'General' tab and uncheck the 'Allow Screen Saver' box to avoid annoying interruptions. Select the 'Misc' tab and make sure the property 'Always Suspend' box is checked. This sets "always suspend" when the Robo window is inactive. The telescope drives will be heard to pause their singsong tracking sound whenever the Robo window is inactive. The scope will be motionless. Activating Robo's window again will cause the telescope to catch up to the current time coordinate and resume tracking the object.

3. WINDOWS-XP/NT/2000...
   These operating systems require Roboscope V5.1 or higher since they protect the I/O ports from direct program access. Due to this you may see some exceptions to certain expected behavior on various PC brands with differing I/O BIOS & system drivers... ie- on a Dell, Robo usually does not change the PC system clock since there is a 'virtual' one available, and more recent service-paks and Windows updates make this standard. The 'properties' (mentioned above) of the window Robo runs in will be accessed differently. See more detailed info below.

4. JERKY SLEW:
   Really-Old PC's only… or newer ones with many app's or heavy anti-virus processing loads… If slewing is jerky when using the keyboard during 2-star align or manual pan: PC keyboards have a setting which controls how fast key-codes issue when a key is held down. Dob-Driver gobbles slew codes very quickly and if the cursor key you are holding down doesn't spit out key-codes fast enough the drives will decelerate when slewing manually, then speed up again when they get more key-codes. This causes a lurching motion notably during 2-star align when the scope is being slewed by cursor keys. This will not cause any errors in positioning so you can live with it if you like without being concerned. Except for the very-old PCs, you can set this keyboard key-repeat speed parameter from the setup screen when your machine is booting up. Usually "ctrl-alt-s" will enter the setup mode as your machine is starting, it varies so check your manual. You can directly see the key repeat speed - just hold down a letter key in your word processor and watch! Newer Windows keyboard Control Settings can access the parameter without requiring the setup screen, but then – the faster machines have made this problem a thing of the past anyhow.

FAQ's - Frequently Asked Questions

Q: I bought a new computer but it can't run DOS applications.
A: Download a "DOS-Box". Google it and find plenty leads, some for free. There are many app's, not just the DOS-Box trade name, that create a VDM (Virtual DOS Machine) that allows you to run the billions of lines of code that were previously written for that OS. Gamers in particular are pointedly interested in that since there were a very large number of DOS games, hence the need is well-supported. These VDM's have been written, and continue to be written, for all sorts of different platforms, even small handheld machines. And the scientific industries are using them widely also.

PARALLEL PORTS - Roboscope use on Windows XP and Windows 2000 (aka NT-based operating systems)…

Q: I have no parallel port connector on my machine (25 pin D-Shell connector with female pins).

Reason: In the 2000 decade, numerous makers of laptop/notebook/netbook/tablet PCs stopped including a parallel port connector altogether, along with the floppy disk and external docking connectors and spare USB ports etc., in order to cut the cost and thickness and weight etc. and make room for more battery and WI-FI subsystems etc. USB printers became common to shore-up the reduction in PC I/O ports. Yet it is nice to have a parallel port since many imaging cameras and scientific instrument sectors still use that for control connections.

Solution: There are several methods from 3rd-party manufacturers that will add a parallel port connector via the slide-in PCcard slots as in PCMCIA/CardBus/ExpressCard, and USB-to-Parallel port adapters too. Look for one that can be set to an SPP parallel port to use legacy LPT1 (PRN) devices that require direct read and write to the port address, without a separate driver like printers use. The company "Quatech" in Ohio sells the best slide-in Cardbus units for PCMCIA or XpressCard slots. They are several times more expensive than the widely-available USB-to-Parallel Port adapters, but the USB stuff almost never does the job right – let us know if you happened to have had one and tried it that works – we will name the model here. Quatech has great tech support too on phone assist for free etc. as well as guaranteed results or money-back.

Problem: I have a parallel port, seems OK status, but I'm still getting "no-comm link" to Dob-Driver.

Possible Reasons/Solutions:

1) Some makes configure a parallel port based on a connected device behavior instead of using the system default settings. Make sure you have a Dob-Driver II connected with a proper Roboscope cord, and the Driver is powered up first and in PAN mode before starting Roboscope.
2) Old Legacy "Base-Addresses" for a 'native' LPT1 port are typically at 0378 or 03BC, and new add-on parallel port adapters frequently generate some other different address when they are installed. Roboscope 5.4 and up will check at all of these shown here, listing them on screen, and use the active one that responds from a Dob-Driver II telescope control that is powered on and in PAN mode… 0378, 03BC, FCD8, FCE8, FEF0, FFF8. Note- check your port base address etc. with ControlPanel/System/Hardware/DeviceManager/Ports/PrinterPorts(LPT1)/Properties/Resources). If you can not change your Parallel port base address to one of these shown above, contact Tech2000 so they can add another address to match yours. If this eventually becomes a large list then we may simply add a Roboscope program module that takes the address from you typed in directly and saves it. But for now this list is quite short.
3) Your LPT1 parallel port may be in bi-directional mode, which "pulls-up" all the data bits to the one-state, but should be all zeros instead. The port needs to be configured to normal "SPP" (Standard Parallel Port) mode since most science instruments do not use bi-directional modes. It is not uncommon to see a LPT1 parallel printer port configured in the bi-directional mode, particularly if you had installed a (multifunction) DOS printer that uses it, or perhaps had installed some other

parallel port device like some zip drives – which require that bi-directionality. Some makes just have it set up that way when new just because they thought they should.

4) Addresses OK? Might be an old TSR problem. If you have actual *parallel* printers installed then try de-activating them so there is no system default printer, or uninstall them entirely - this is normally never a problem except for some brands of older multifunction printers that run software on standby continuously on your PC whenever the system starts (Terminate and Stay Resident) - prohibiting other devices to use the port since these types of drivers are always active. Note that we routinely use these Roboscope cords on many various PCs with printers installed in addition to Zip drives etc. all using the same parallel port connector when needed, one device active at a time of course, and have had no problem at all without any configuring or changing of things to use any device anytime we want. Use 'Device Manager' described above to configure parallel ports within Windows. If that doesn't work then directly check & set the LPT1 configuration yourself... you will not normally be able to do that from old Windows prior to W'98, you must usually go into the system setup screen before Windows boots. See your manual as the method is different amongst manufacturers. Upon power-up, your screen may (briefly!) show the required key for system setup before Windows begins loading, like Esc, F2, F10, or Ctrl-Alt-Del... else only your manual can be definitive. If you have any difficulty contact the PC manufacturer support for help in configuring SPP mode.

Problem: I've been through all of the above, but still get "No com-link to Dob-Driver" when starting Roboscope.

Reason: Some PC makes that use "NT-based" XP or 2000 operating systems (mainly W2000pro) block Roboscope from accessing the printer port for communication with the Tech2000 Dob-Driver II. Many customers report it works directly just fine out-of-the-box, even when they added their own parallel port adapter, but this actually depends on the manufacturers' BIOS and Windows Service-Pak extensions and the type of Windows-Update patches that are installed for security (of which as you know there are MANY!). Earlier versions of Windows, 95, 98, 98SE, ME, including original XP editions up through SP3, do not have this blocking feature so always work well out of the box without any modifications or special setup. The Roboscope program is like many industrial and scientific utility programs that are now defined by Microsoft as "User-Mode" programs. The same applies to many other astronomy equipment devices on the market like some Attick, SBIG cameras etc. Microsoft has issued updates that for security reasons block the direct access to hardware ports like LPT1 etc. that these kind of industrial/science programs use.

Solution: Install a kernel-mode driver. Only after you are sure that the telescope drive unit is working normally by itself without Roboscope, and you have set up LPT1 for the system default printer port, and verified the correct LPT1 device physical address and other criteria defined above... then install a kernel mode driver to get around this problem… its quite easy to do and is a snap to use once you understand their manuals' instructions well enough.

UserPort.sys is a kernel mode driver for WinNT/2000/XP that gives 'usermode' programs like Roboscope access to I/O ports. This makes it possible to access hardware directly from a normal executable program in the same way as under Windows 95/98/ME. This driver does not work on Windows 95/98/ME and there is really no need to run it anyway because I/O ports are always granted to usermode programs on those operating systems.

Download: The latest zipfile can be downloaded from this webpage (it's only about 34 KB)
http://www.embeddedtronics.com/design&ideas.html

If you have no internet or the page was removed there, a version of it that worked well is included in a subfolder with Roboscope.

The kernal mode package is called "UserPort".

Download it, read the pdf about using & installing & security issues, then install/configure it. Quite simple.

User notes from Larry F on Cloudy Nights: "I installed UserPort on my Windows2000. It's simplicity itself. You just run the UserPort program (which identifies the port address to be opened to free access) and keep it running while you run Roboscope. I made sure my boot configuration identified my LPT1: address port and similarly I saw the same in the hardware profile (Control Panel/System/Hardware/Device

Manager/Ports/Printer Port/Resources) I made sure I selected a profile that also had the same address. Once that's done, everything will work fine, including your printer if you have one. (What you are going to do with a printer during an observing session is quite another matter)."

Problem: Why can't my printer print out my catalogs? I want to print my USER catalogs.

Reason: Most printers are now "Windows Printers". Roboscope outputs the older "Line Printer" format. So your system does not recognize this, and does not tell you about that, Windows ignores it.

Solution: Install a utility called Printfil (the 8-character word for "Print-File"). It converts the Line Printer style output of Roboscope from a "LPT1" format to the Windows Graphical Print File format. You can print anything with that, pictures, text, graphics etc. become all just dots. Download the latest from http://www.printfil.com or if you have no Internet just go into the folder we include with Roboscope. Read the instructions and install it, set it up. It's very tiny but very effective.

Problem: Why does my "LST:" display sometimes skip a second?

Reason: The LST displayed on Roboscopes' main screen does not actually depict real-time in less than 1-second increments. The program is busy working on more important things than the simple user-reference to Apparent Local Sidereal Time. So sometimes it will display a second that is .9999 seconds away from changing, then the next display interrupt is .0001 seconds longer. The result is the display appears to skip a second. Patient watching on the screen like we do begins to reveal this effect as seconds appear to come faster compared to a regular hand timer then suddenly skip to catch-up. This display behavior is unrelated to the accurate time routines running in the program that handle motor math and update rates. The display is just that… a user reference but not a control sync function.

Q: What is that easier way to GOTO a catalog object without going through all that "Catalog Handler" stuff?

A: A new GOTO shortcut is available with Roboscope 4.2 & up. It saves lots of keystrokes. While tracking is on, just type in the catalog # like M57, NGC3000, k21, ic1004, User99. Single catalog letters are OK, like n3000 instead of NGC3000. Capitals and spaces do not matter. The telescope will slew directly without further ado when you hit the enter key, provided the object is above the horizon at least 5 deg.