



Astronomical Telescope Accessories

*SkySensor 2000·PC**

User's Guide Supplement

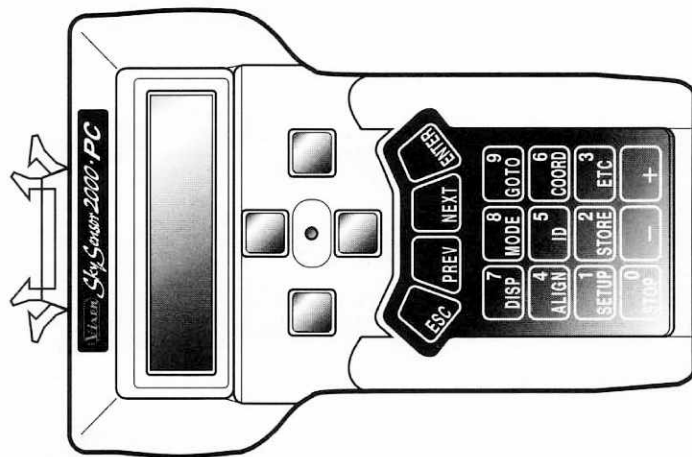
This booklet explains the added features of SkySensor 2000PC.
Please see SkySensor 2000 User's Guide for instructions on basic features and operations.

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* SkySensor 2000 does not have computer connectivity.

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1 Main Features of SkySensor 2000PC

SkySensor 2000PC has many features in addition to those of the SkySensor 2000 model to make astronomical observation even more convenient and enjoyable. Some of the main features of SkySensor 2000PC are:

- ☐ Telescope control from a personal computer using commercial astronomy software.

You can connect SkySensor 2000PC to a PC and remotely control the telescope using commercially available astronomy software. You will be able to take advantage of the software's database, graphic interfaces, and remote control capabilities. SkySensor 2000PC can be used with either Meade Instrument's LX200 or Celestron International's Ultima 2000 command protocols. It is also possible to write your own program to control the telescope.

- ☐ Increased internal database.

The number of astronomical objects in the SkySensor 2000PC database has been increased to 14,942, including the surface features of Moon and the Galilean satellites of Jupiter.

The following menus has been expanded.

NGC menu :	Now contains all NGC objects (7840)
IC menu :	Now contains all IC objects (5386)
Moon menu :	Now contains 138 surface features
Planet menu :	4 Galilean satellites have been added

- ☐ There are a number of other features, such as object direction menu and key operations, which were improved to make them more convenient to use.



075 ...	Menelaus	119 ...	RupsRecta	.....	StraightWall
076 ...	Messala	120 ...	Schickard		
077 ...	Mosting	121 ...	Schiller		
078 ...	MsArgaeus	.....	Seleucus		
079 ...	MsBlanc	.....	SinsAestuum	.....	SeethingBay
080 ...	MsHuygens	.....	SinsIridum	.....	BayRainbows
081 ...	MsLaHire		SinsMedii	.....	CentralBay
082 ...	MsPico	.....	SinsRoris	.....	BayOfDew
083 ...	MsPiton	.....	Stoffler		
084 ...	MtsAlpes	.....	Taruntius		
085 ...	MtsApennines	.....	Thebit		
086 ...	MtsCarpathus	.....	Theophilus		
087 ...	MtsCaucasus		Timocharis		
088 ...	MtsHaemus	.....	Tycho		
089 ...	MtsHarbinger	.....	ValAlpes	.....	AlpineValley
090 ...	MtsPyrenaeus	.....	ValRheita	.....	RheitaValley
091 ...	MtsRecti	.....	Vendelinus		
092 ...	MtsRiphaeus	.....	Walter		
093 ...	MtsSpitzbergen	.....	Werner		
094 ...	MtsTaurus	.....	Wilhelm I		
095 ...	MtsTeneriffe	.....			
096 ...	OcnProcellarum	.....			
097 ...	PalsEpidemiarum	.....			
098 ...	PalsNebularum	.....			
099 ...	PalsPutredinis	.....			
100 ...	PalsSomnii	.....			
101 ...	Parry				
102 ...	Petavius				
103 ...	Piccolomini				
104 ...	Pitatus				
105 ...	Plato				
106 ...	Plinius				
107 ...	Posidonius				
108 ...	Proclus				
109 ...	Ptolemaeus				
110 ...	Purbach				
111 ...	Regiomontanus				
112 ...	Reiner				
113 ...	Reinhold				
114 ...	Riccioli				
115 ...	RimAriadaeus	.....			
116 ...	RimHyginus	.....			
117 ...	RimSirsalis	.....			
118 ...	RupsAltai	.....			

2 Using SkySensor 2000PC with a PC

SkySensor 2000PC can be used in conjunction with a personal computer. When SkySensor 2000PC is connected to a PC, its controller is still active, so you can use either the controller or the PC to control the telescope at any time.

You will need a connector cable and an astronomy software that has either the LX200 control or the Ultima 2000 control to control the SkySensor 2000PC from a PC. (Please see the Appendix section of the User's Guide for the specification of the connector cable.)

2.1 Setting Up the PC Connection Menu

We will setup the PC connection parameters for the SkySensor so that they match those of the PC that you are using.

1. Turn on the power switch on the SkySensor.
2. When the message "Set scope in horiz.pos.and press ENTER" is displayed, press the ENTER key.
3. Press SETUP to enter the setup mode and press ENTER to select a setup number.
4. Press NEXT until the following "Telescope Config" category is displayed on the screen.

Setup Categories	Setup Category
Telescope Config	Selection

Press ENTER to display the setup menu.

4. Press NEXT until the following PC connection menu is displayed.

PC	Protocol	Baud
SkySensor2000	2000	9600

PC Connection Menu

Protocol is the command protocol, which can be selected from "SkySensor2000", "LX200", or "Ultima2000". To change the command protocol, press the UP or DOWN direction key when the cursor is blinking over the protocol selection.

Baud is the connection speed. It is set to 9600 (the speed normally used by most astronomy software) by default. To change Baud, press the RIGHT key to move the cursor to over the baud selection, and press the UP or DOWN key.

5. Press ENTER to set the selection.
6. This completes the PC connection parameter setting. Press ESC a few times to get back to the main menu. The parameters are stored in the memory even when you turn off the power.

2.2 Controlling the Telescope from a PC

The general outline for controlling the telescope from a PC is described here. The procedure for controlling the telescope, such as how to point the telescope to an object, depends on the particular astronomy software that you are using. It is assumed here that the basic parameters such as the date, time, observation location on the SkySensor have been set. (Please see the User's Guide on how to set these parameters.)

1. Turn on the power to the SkySensor and press ENTER. It is convenient to do the telescope alignments at this point, but the alignments can be done later from the PC control. You can connect the SkySensor to the PC at

Table A List of Moon Menu Items

No.	Latin Name	Common Name
001	.....	Moon Center
002	.....	Moon North
003	.....	Moon South
004	.....	Moon East
005	.....	Moon West
006	.....	Coord 0,0
007	.....	Apollo 11
008	.....	Apollo 12
009	.....	Apollo 14
010	.....	Apollo 15
011	.....	Apollo 16
012	.....	Apollo 17
013	Albategnius	
014	Aliacensis	
015	Alphonsus	
016	Archimedes	
017	Aristarchus	
018	Aristillus	
019	Aristoteles	
020	Arzachel	
021	Atlas	
022	Autolycus	
023	Bessel	
024	Bullialdus	
025	Cassini	
026	Catharina	
027	Clavius	
028	Cleomedes	
029	Copernicus	
030	Cyrillus	
031	Endymion	
032	Eratosthenes	
033	Euclides	
034	Eudoxus	
035	Flamsteed	
036	Fracastorius	
037	Furnerius	
038	Gassendi	
039	Gauss	
040	Grimaldi	
041	Guericke	
042	Hercules	
043	Herodotus	
044	Hevelius	
045	Hipparchus	
046	Janssen	
047	JuliusCaesar	
048	Kepler	
049	LacMortis	
050	LacSomnium	LakeDreams
051	Langrenus	
052	Lansberg	
053	Letronne	
054	Longomontanus	
055	M.Anguis	SerpentineSea
056	M.Australe	SouthernSea
057	M.Crisium	SeaCrises
058	M.Fecunditatis	SeaFertility
059	M.Frigoris	SeaOfCold
060	M.Humboldtianum	HumboldtSea
061	M.Humorum	SeaMoisture
062	M.Imbrium	SeaRains
063	M.Nectaris	SeaNectar
064	M.Nubium	SeaClouds
065	M.Serenitatis	SeaSerenity
066	M.Smythii	SmythSea
067	M.Spumans	FoamingSea
068	M.Tranquillitatis	SeaTranquility
069	M.Undarum	SeaWaves
070	M.Vaporum	SeaVapors
071	Macrobius	
072	Maginus	
073	Manilius	
074	Maurolycus	

☐ If you select the "Star" type in the ID menu or the object selection menu, variable and double stars as well as normal stars will be included in the search. This makes it more convenient to search for a star to do an alignment, for example.

☐ When specifying the type in the ID menu and the object direction menu, pressing 0 key to 9 key will let you select the types directly. Pressing [-] key selects [--] (all).

Key:	Type
0	: Stars
1	: Variable stars
2	: Double stars
3	: Dark nebulas
4	: Light nebulas
5	: Planetary nebulas
6	: Open clusters
7	: Globular clusters
8	: Galaxies
9	: Clusters and Nebulas
-	: --- (All)

☐ When you execute a GOTO, the telescope slows down as it comes close to the object and stops gradually. When the telescope reaches the object, you will hear a beep.

☐ The parameter in the sun observation menu can now be set globally by the default menu. Previously, the parameter had to be set for each setup number.

any time, even during the observation, by following the steps below.

2. Turn on the power to the PC and start the astronomy program.

Please make sure that the parameters on the astronomy program, such as the observation location, date, and time are set correctly. Also please verify that the telescope control is set to the command protocol (LX200 or Ultima 2000) you have set up in the SkySensor.

3. Connect SkySensor to the PC.

Connect the RS232C port on the SkySensor to the serial port (sometimes referred to as COM port) on the PC using the connection cable. (Please see the Appendix section in the User's Guide for details on the cable and the ports.)

4. Establish the connection between SkySensor and the PC. This is usually done by selecting the "Establish Connection (or Link)" button in the telescope control menu in the astronomy software. When the link is established, the astronomy program usually show the position of the telescope on the start chart. (Some software may not display the position if the telescope is pointing below the horizon.)

5. The telescope control is now ready.

Most astronomy software let you move the telescope to the object you want to observe by clicking on the object on the screen.

If the astronomy program has the telescope synch (alignment) function, you can use that to align the telescope. Using the telescope synch function has the same effect as entering the coordinates on the SkySensor controller and pressing the ALIGN key (*). The number of reference points that was used will be displayed on the controller display.

Due to the limited precision of the coordinate format used

(*) Caution: If you point the telescope at an object using the PC and then press the ALIGN key on the SkySensor controller, SkySensor will align on the coordinates being displayed on the controller and not that of the coordinates being displayed on the PC.

by the PC command, the accuracy of the alignment from a PC may be less precise than the alignment done using the SkySensor controller.

If the astronomy program has the telescope initialization functions, it is possible to set the date, time, time zone, longitude, and latitude of the SkySensor from the PC.

- 6. When you are done with the observation session, terminate the link on the astronomy program and switch off the SkySensor power.

Notes about Connecting to a PC

- 1. About the communication parameters:

The following communication parameters are used:

Number of data bit	: 8
Number of stop bit	: 1
Parity	: None
Flow Control	: LX200 and Ultima 2000 - 'None' SkySensor2000 - 'Xon/Xoff'

- 2. About the command protocols:

Although not all commands in the LX200 and Ultima 2000 command protocols are implemented by SkySensor2000 (which is neither possible nor necessary) most commands used by popular commercial astronomy software are supported.

- ☐ LX200 Commands:

Of the LX200 commands, you can use the commands to get the current telescope position, set the object position, slew to object position, align to object coordinate, set date, time, time zone, longitude and latitude, set speed mode, and command to move the motors 4 directions.

The speed mode correspondences are:

LX200		SkySensor
Slew speed	=	Fast Speed
Find speed	=	Medium Speed
Center speed	=	Slow Speed
Guide speed	=	Guide Speed

- ☐ When specifying the constellation in the object direction menu in the setup, pressing 0 key to 9 key will jump to the intermediate points (#8, #16, ...) in the constellation list. Pressing [-] key selects [--] (all). This makes it possible to select any constellation with a few key strokes. The constellation list is in the alphabetical order, so you can quickly locate a constellation.

Key:	Constellation
0	: Aur (Auriga)
1	: Car (Carina)
2	: Col (Columba)
3	: Del (Delphinus)
4	: Her (Hercules)
5	: Lep (Lepus)
6	: Mus (Musca)
7	: Phe (Phoenix)
8	: Sco (Scorpius)
9	: TrA (TriangulumAus)
-	: --- (All)

Example: To select the constellation Cassiopeia

- (1) Press 1 to jump to Carina.
- (2) Press the UP direction key to display Cassiopeia.
- (3) Press ENTER to set the selection.

- ☐ You can now do the alignment with NGC, IC, and Messier objects. Previously, a warning was given if this was attempted and you were not allowed to use those objects for alignments. Now a warning is still given, but the alignment will be done anyway.

Caution: Because the nebulas and star clusters are extended objects whose center is not well defined, and also because the database coordinates for these objects are not as precise as those of a star, it is recommended that you avoid using nebulas and star clusters for alignments.

4 Other Features of SkySensor 2000PC

Improvements were made in some menus and key operations for SkySensor 2000PC.

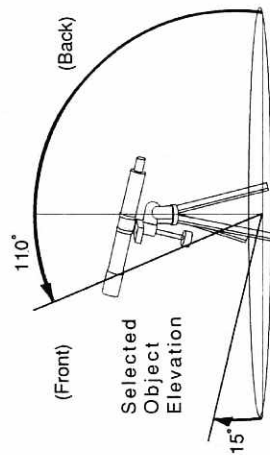
- ☐ The object direction menu has been modified so that you can specify the maximum elevation angles. This is done by setting the minimum Back elevation to greater than 90 degrees. You may think of this as the blocked area from the back side going over the top to the front. This feature is useful, for example, when observing from an area with roof blocking the view directly overhead.

Example: To limit the view angle to south (azimuth of 90 to 270 degree) with the minimum elevation of 15 degrees and the maximum elevation of 70 degrees, set the front elevation (Elv) to 15 and the back elevation (Bk) to 110.

Elv(Bk) Azimuth Cnst
 15(110) 090> 270 ----

Object Direction Menu

The object elevation specified by the above example



When the object elevation is specified, only the objects which are in the specified elevation range will be listed in the object selection menu when the PREV/NEXT key is pressed. You can always display any object by entering its number or point the telescope to it outside the selected range.

You can use either the normal format or the long format to send the coordinates to SkySensor. SkySensor will automatically determine the coordinate format. The formats may be intermixed. When sending the coordinates, SkySensor uses the normal coordinate by default. You can toggle this format by using the ".U#" command.

- ☐ Ultima 2000 Commands:

Of the Ultima 2000 commands, you can use the commands to GOTO AltAz, GOTO relative AltAz, GOTO RaDec, get current RaDec, get current AltAz, align to coordinate, cancel slew and echo a character.

- ☐ SkySensor2000 Commands:

Use the SkySensor 2000 commands to send the orbital elements for comets and satellites. The commands format for SkySensor 2000PC has not been changed, but the baud, which has been fixed at 300 in the previous versions, can now be set at higher speed, enabling you to enter data much faster. Please see the User's Guide about the SkySensor commands.

You can send the commands manually by using a terminal program. (Manual commands are usually not necessary when using a commercial astronomy program.) To send the LX200 or Ultima 2000 commands manually, you must know the command formats. For details about LX200 and Ultima 2000 commands, please refer to the LX200 and Ultima 2000 manuals.

3 Expanded Menus

3.1 Moon Menu

The Moon menu has been greatly expanded in SkySensor 2000PC. There are now 138 items in the menu, including surface features such as craters, seas, mountains, and valleys. Please see Table A for the complete list.

The Moon menu is helpful in learning the features of the moon, and you will find it especially useful for pointing the telescope to a moon feature at high magnifications. This is a fun menu to use, especially on the nights when deep sky objects are difficult to observe because of the bright moon.

The name of the moon features are displayed in either Latin or by its common name, if that is available. You can switch between the two in the object selection menu by pressing [+] key to list the Latin name and [-] key to list the common name. This will make it easy to find the names on a moon atlas which often lists the names in Latin.

The item #1 in the Moon menu is the apparent center of the Moon. The item #6, the coordinate 0,0 is slightly different from it due to the parallax effect. The items #2

Some Tips for Using the Moon Menu

- ☐ Use a prominent feature such as Copernicus crater or Tycho crater (during a full moon) to align the telescope. This allows the other objects to be pointed to accurately.
- ☐ The backlash setting greatly affects the apparent pointing accuracy when moving the telescope back and forth over small angular distances such as on the moon. To minimize the effect of backlash, set up the mount with its RA axis deliberately away from the pole. This will cause the Declination motor to move constantly and the gears to mesh in one direction, minimizing the effect of backlash.

through #5 are respectively the Moon's apparent North, South, East, and Western edges. The items #7 through #12 are the landing sites of the Apollo spacecrafts. The other items in the Moon menu are numbered in order of the alphabetical order of the Latin names.

The size of the moon features are displayed in kilometer, except for the Moon Center which shows the size of the moon in arc minutes.

You can use the ID key to learn the identity of the features in the area where the telescope is pointed. However, if you do an ID search away from the Moon, only the "Moon Center" will be listed if you are pointing more than 1 degree (about two moon diameters) away from the center of the Moon. This is to avoid getting all Moon features in the search result when you are doing the search in the area close to the Moon.

3.2 Satellites of Jupiter

The Galilean satellites of Jupiter have been added to the planet menu.

Planet Menu No.

No. 9	- Io
No.10	- Europa
No.11	- Ganymede
No.12	- Callisto

As with other planets in this menu, you can do GOTO, ALIGN, ID, and STO these items.

These items are useful for identifying the satellites of Jupiter. The Jovian moons usually appear lined up almost in a straight line around Jupiter. To identify them, select Jupiter in the menu and GOTO and center it in the field of view, and do alignment with Jupiter. Then select a Jovian moon from the menu and press GOTO to bring it to the center of the field of view. It is better to use a high powered eyepiece when doing this.