

LUMICON

"Innovation in Astronomy"

Dual Star Drive Manual

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Specifications

Weight.	.3.25 pounds
Dimensions.	.2.5H x 6.1W x 6.25D
Voltage Input	.12 VDC or 120 VAC
Voltage Out Declination	.+- 12 VDC @ 100mA nominal
Voltage Out	.120 VAC
Power Out	.15 Watts
Vernier Range	.55 to 65 Hz.
Correction West	.80 Hz.
Correction East	.40 Hz.
Stability	.0.005% per degree C

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Operation

Plug the DC power cable into a cigar lighter and into J1 or plug the AC power cable into a 120 VAC outlet and into J4. If both are plugged in, the unit will automatically and instantly transfer to battery power in the event of an AC power failure. Plug the Switch Pod into J2. Plug the telescope clock drive motor into J3. Plug the declination cable from the telescope drive motor into J5. Turn the vernier control to zero. Turn S1 ON by sliding the switch handle to the right. Pressing West on the Switch Pod will speed the drive from 60 Hz to 80 Hz, increasing the relative speed by 5 arc seconds per second. The LED will flash rapidly. Pressing East will slow the drive from 60 Hz to 40 Hz, decreasing the relative speed by 5 arc seconds per second. The LED will again flash rapidly. The vernier can also be used for tracking on other celestial objects by fine adjustment. At the zero position the LED should flash very slowly being either on or off for long periods.

Press North on the Pod; the telescope should drive to North. Press South on the Pod; the telescope should drive to South. If just the reverse happens the gearing in your motor probably has one stage more or less than others. Or if you use an image erecting prism the directions may be reversed also. On German Equatorial Mounts this also happens when you switch the telescope from the West to East side of the sky. To correct for this simply requires reversing the Reversing switch on the back panel.

The controls are simple and straightforward, basically you press the switch for the direction you want the star in the eyepiece to move. A few minutes, however, should be spent guiding with the slow motion controls to familiarize yourself their effect on the movement of a star before doing any astrophotography.

Polar Alignment

This procedure is not required; provided corrections are made using the North South buttons on the Switch Pod. But the better the alignment, the fewer corrections.

1. Roughly aim the telescope's polar axis north.
2. Find a star slightly north of the celestial equator (near zero degrees Declination) and near the meridian.
3. Use the illuminated reticle eyepiece at normal guiding magnification and track the star, keeping it centered in right ascension.
4. The direction of the drift indicates the direction to correct for azimuth. * (See Note below):
   a. North drift-move the axis east.
   b. South drift-move the axis west.
5. Repeat this process until the drift is no more than a few seconds of arc over a half hour. The axis is now aligned in azimuth.
6. Next, find a star again slightly north of the celestial equator (near zero degrees Declination), but this time near the eastern horizon.
7. Use the illuminated reticle eyepiece at normal guiding magnification and track the star, keeping it centered in right ascension.
8. The direction of the drift indicates the direction to correct for elevation. * (See Note below):
   a. North drift-move the axis down.
   b. South drift-move the axis up.
9. Repeat this process until the drift is no more than a few seconds of arc over a half hour. The axis is now aligned in elevation.
10. The azimuth procedure may need to be repeated if the elevation correction was large.

* Note: For telescopes using German Equatorial Mounts these corrections can be reversed, depending on whether the telescope tube is on the West or East side of the mount. Always move the polar axis to <u>decrease</u> drift in declination.

Flexure

Your telescope should be checked for flexure. Flexure is the movement any any one part of the telescope optics relative to another. The amount can be just a few thousandths of an inch, and won't be noticed until your film is processed. The guide telescope may make a small movement due to sag of the main telescope tube. The main mirror or secondary vane spider might shift slightly. The camera may flex on the focuser.

The only reliable and permanent cure for flexure is off-axis guiding. Therefore LUMICON strongly recommends that serious astrophotographers consider use of an off-axis guider, such as the LUMICON EASY-GUIDER. Then any flexure is automatically corrected. A separate guide-scope is helpful for comet photography. However, for all deep-sky photography, off-axis guiding always yields more consistent and reliable results. Call or write Dr. Jack Marling at LUMICON for any technical questions about astrophotography.

Guiding

There are several points to guiding. First, in almost all cases the reticle cross hairs should be oriented in the same direction as right ascension and declination. Check this by pressing the control buttons. LUMICON highly recommends the use of Guiding eyepieces with dual cross lines which form a box. These are available from LUMICON, Meade, and others. Dim stars can be centered in the box and are thus easier to see. Second. The star image in the guiding eyepiece should be in sharp focus. This makes dim stars easier to see. More importantly it eliminates parallax guiding errors. The postion of an out-of-focus star could move when your eye moves, ruining guiding accuracy.

The required guiding maginificatin is 8-12X the photographic magnification. Since 35mm camers have the same magnification as a 50mm eyepeice, the proper guiding magnification is determined by dividing the focal length of the photographic optics by 4-6mm. Thus for an 8" f/6 telescope the proper guiding magnification is 1200mm/4mm = 300X. At this magnification you will get a perfectly

guided photo if the star image stays within the box for dual crossline guiding eyepieces. For the recommended off-axis guiding, the main telescope is also the guide-scope. Thus the proper guiding magnification is automatically achieved by using a 2X - 3X Barlow with the common 12mm guiding eyepieces.

For the case of piggyback photography, the camers and lens sit on the main telescope. For a 50mm (wide angle) lens, the proper guiding magnification is thus 8-12X. If you use a 8" f/10 Schmidt-Cassegrain, for example, a 12mm guiding eyepiece yields 167X. Thus the star could drift 10 box diameters (box formed by the dual crosslines) and you would still get a good photo. For a 300mm lens, 300mm/4mm = 75X. Thus at 167X the star could drift up to 2 box diameters and still yield a good photo. Clearly piggyback photography has a greater margin for error, and is highly recommended for initial astrophotography.

Calibration

Calibration, if ever required, is accomplished as follows: First insure that the unit has reached operating temperature by letting it run for about half an hour with the cover on before calibrating. Use a small AC clock with sweep second hand plugged into the outlet J3. A second clock with a sweep second hand plugged into household AC or a stop watch is used as a reference to time the clock running from the unit.

Set the front panel vernier to zero. Open the unit to gain access to R11. With the cover off, the unit will cool down slowly over a few minutes giving time to make the adjustment. Exercise care not to touch anything except R11 with the cover off since hazardous voltage is present. Adjust R11 for the test clock plugged into J3 to equal 60 seconds on the reference. The LED should zero out at the correct point.

Precautions:

1. Pressing East with the vernier fully CounterClockwise will lower the output frequency to near 35 Hz. This could possibly damage the drive transistors, the output transformer or maybe even your clock drive motor and therefore is not advised.

2. Starting or running the automobile engine while the unit is running can create noise spikes exceeding the capability of the unit's voltage regulators. Therefore the input to the unit is protected by a 30 volt zener diode and a .1 microfarad capacitor. However, an automobile with a poor electrical system (high output voltage, battery low on water, corroded battery terminals, noisy generator or alternator, or bad diodes) could exceed the capability of this protection circuit. It is advised therefore to run the unit only with the engine off.

3. Clock drive motors will run to rather low input voltages, but require full voltage typically to start. Therefore, if you have run the unit for some time dropping the battery voltage; and the unit is shut off and subsequently turned back on the clock drive motor may not restart. In this event shut the unit off and call it a night. However, if the unit had been left on, the restarting problem does not occur.

4. The ON-OFF switch on the front panel only controls the DC voltage and not the AC primary voltage. Therefore if opening, removing the PC board, or servicing the unit MAKE certain the AC line and DC power cables are unplugged.

5. Do not leave the unit turned on without a clock drive motor plugged into J3 for extended periods. The unit actuallu uses more power in this state and although the circuitry is not damaged, extended operation without the telescope drive motor can cause the transistors to over-heat causing cosmetic damage to the plastic case. Therefore, make certain the unit is unplugged when not in use.

Circuit Description

Input voltage of 12 VDC goes through circuitry protection fuse F1, (3A), reverse voltage protection diode CR1, to the power switch S1, to over voltage spike protector diode CR4, (1N4751), spike filter C12, (.1 UF), and into voltage regulator U1 (78L08). For 120 VAC operation the input voltage goes through circuitry protection fuse F3 (.5A), to step down transformer T2, (PC-20-1200). The output of T2 is full wave rectified by diodes CR2, CR3, CR6, and CR7. Capacitor C1, (6800 UF), filters the rectified voltage into a smooth DC voltage which is then connected to the power switch as if 12 VDC were in use.

U1 supplies all power required for the timing and frequency control circuit. Its output voltage of 8V insures that voltage variations at the input do not effect the output frequency. The output is filtered by C3, (100 UF), and supplied to U3, and U4.

Integrated circuit U3, (LM555), is the main oscillator and generates the basic timing for the output frequency desired. One percent timing components minimize temperature drift. Vernier R2, (50K), varies the output from 110 to 130 Hz. Switch S2, when pressed parallels R2 and R3, (78.7K), with R1, (107K), dropping the resistance to 58K ohms nominal. This increases the frequency to 160 Hz. Switch S3, when pressed parallels C5, (.047 UF), with C4, (.022 UF), increasing the capacitance to .069UF. This decreases the frequency to 80 Hz. R4, (66.5K), is part of the timing circuit and C6, (.022 UF), stabilizes U3. R11, (50K), is used to calibrate the zero mark on the front panel at 60 Hertz.

The output of U3 is divided by 2 by integrated circuit U4 (74C74) and made into symmetrical drive waveforms. This drive is applied through resistors R5 an R6, (10K), to power FET transistors Q1, Q2, (VN10LM), and to bipolar switching transistors Q3, and Q4, (2N4240), as a Darlington push pull drive for the input of transformer T1, (PC-16-1500). Capacitor C7, (.47 UF), suppresses switching noise and smooths the input to T1.

Transfonmer T1 steps the voltage up to 120 VAC at its output. Capacitor C8, (.22 UF), suppresses switching noise and smooths the output of T1. The output is fused by F2, (.5A), for over current and supplied to outlet J2 for connection to the drive motor.

Capacitors C9, (33 PF), and C10, (10 PF), and resistor R7, (10M), bias crystal Y1 into oscillation at a frequency of 3.579545 MHz. Integrated circuit U5, (MM5369), divides this by 59659 to produce a reference frequency of 60.0000 Hz. This reference is applied to the second half of U4, (74C74). The difference between the reference frequency and half the output frequency of U3, (LM555), is determined. This difference, (Beat Signal), is used to light the indicator LED CR4.

Integrated circuit U2, (78L12), is a voltage regulator which supplies the power for the declination motor and provides output short circuit protection. The output of U2 is filtered by C2, (100 UF), and also supplies power to U6, (74C00), and U7, (74C04). The fact that these are powered by a different source from the main oscillator, means that running the declination motor does not cause interference to the main oscillator and change its frequency. Resistors R9, (10K), and R10, (10K), are used to pull the input of U6 high until a switch closure of either S4 or S5 brings the input low. Integrated circuit U6 is wired to prevent damage if both S4 and S5 are pressed at the same time. The output of U6 is inverted by U7 which then drives the power FET transistors Q5, Q6, Q7, and Q8, (VN10LM). These transistors are in a bridge configuration so that the motor can be driven bidirectionally with only a single supply voltage. Capacitor C11, (.1 UF), suppresses motor noise; helping to protect the output transistors and the stability of the main oscillator.

Service

In the unlikely event that the unit malfunctions, carefully pack the entire unit in the original package with a description of the trouble and ship it freight pre-paid to:

DAVIONX
3535 Shafer Drive
Santa Clara, Calif. 95051
Department W.

Labor and parts are covered during the first 90 days. After 90 days, the charge is a maximum of $25.00 for labor; plus the cost of replacement parts.

Parts List

	BOARD, PC STAR DRIVE	1
	BOARD, PC SWITCH POD	1
	BOX, SWITCH POD	1
	BOX, STAR DRIVE	1
	BUSHING, LED	1
	CABLE, AC LINE	1
	CABLE, DC POWER W PLUG	1
	CABLE, TIE	1
	CABLE, 5 COND W SHIELD	1
C10	CAP, 10PF	1
C9	CAP, 33PF	1
C4, C6	CAP, .022UF 100V 5%	2
C5	CAP, .047UF 100V 1%	1
C11, C12	CAP, .10UF 100V 10%	2
C8	CAP, .47UF 400V 10%	1
C7	CAP, .47UF 100V 10%	1
C2, C3	CAP, 100UF 16V	2
C1	CAP, 6800 UF 25V	1
Y1	CRYSTAL, 3.58MHZ	1
CR4	DIODE, 1N4751	1
CR1,CR2,CR3,CR6,CR7	DIODE, 2.5A 50V	5
CR5	DIODE, LED RED	1
	FEET, STICK ON	4
F1	FUSE, 3 A	1

F2, F3	FUSE, 1/2 A	2
	HEATSINK, TO-66	2
	HOLDER, FUSE	3
U6	IC, 74C00N	1
U7	IC, 74C04 or CD4069	1
U4	IC, 74C74N	1
U3	IC, LM555CN	1
U1	IC, LM78L08CT	1
U2	IC, LM78L12CT	1
U5	IC, MM5369N	1
	INSULATOR, SIL PAD	2
J4	JACK, AC INLET	1
J3	JACK, AC OUTLET	1
J1	JACK, DC POWER	1
J5	JACK, DEC RCA	1
J2	JACK, DIN 6 PIN FEMALE	1
	JACK, DIN 6 PIN MALE	1
	KNOB, 1"	1
	LOCKWASHER, #4	4
	LOCKWASHER, #6	4
	MANUAL, INSTRUCTION	1
	NUT, 2-56 3/16" HEX	2
	NUT, 4-40 1/4" HEX	4
	PANEL, BACK	1
	PANEL, FRONT	1
	PANEL, SWITCH POD	1
	PLUG, CIGAR LIGHTER	1
R11	POT, 50K CALIBRATION	1
R2	POT, 50K VERNIER	1
R8	RESISTOR, 1.0K 1/4W 5%	1
R5, R6, R9, R10	RESISTOR, 10K 1/4W 5%	4
R4	RESISTOR, 66.5K 1/4W 1%	1
R3	RESISTOR, 78.7 1/4W 1%	1
R1	RESISTOR, 107K 1.4W 1%	1
R7	RESISTOR, 10M 1/4W 5%	1
	SCREW, 2-.4 X 10 mm	2
	SCREW, 2-56 X 3/8"	2
	SCREW, 4-40 X 1/4"	3
	SCREW, 4-40 X 3/8"	2

	SCREW, 4-40 X 3/8" FLAT	2
	SCREW, 6-32 X 3/8"	4
	SCREW, 6-32 X 1 1/2"	2
	SOCKET, IC 8 PIN	2
	SOCKET, IC 14 PIN	3
S1	SWITCH, PC SLIDE	1
S6	SWITCH, CHASSIS SLIDE	1
S2, S3, S4, S5	SWITCH, PC PUSHBUTTON	4
T1	TRANSFORMER, PC-16-1500	1
T2	TRANSFORMER, PC-20-1200	1
Q1, Q2, Q5	TRANSISTOR, VN10LM	6
Q6, Q7, Q8		
Q3 Q4	TRANSISTOR, 2N4240	2

DRAWING 1. DAVIONX DUAL STAR DRIVE SCHEMATIC

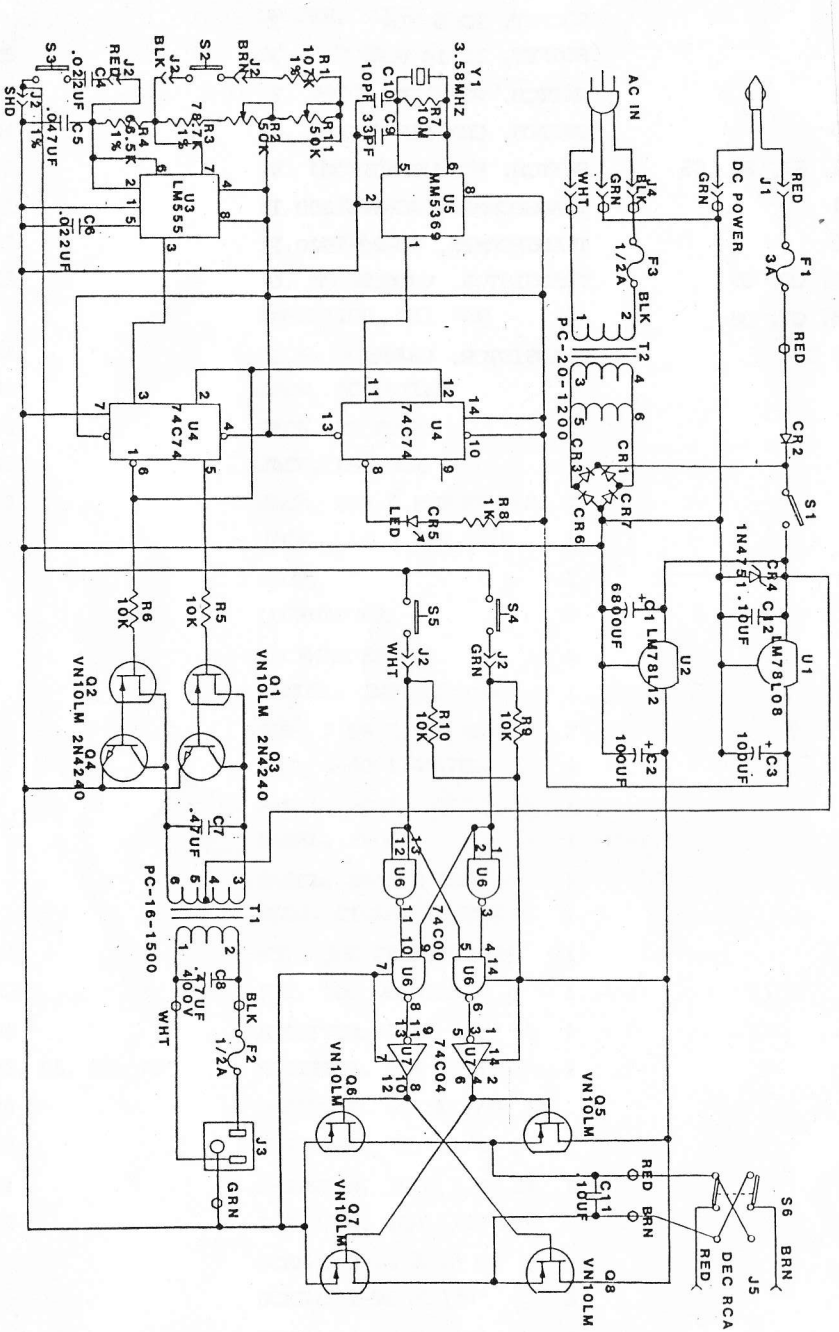
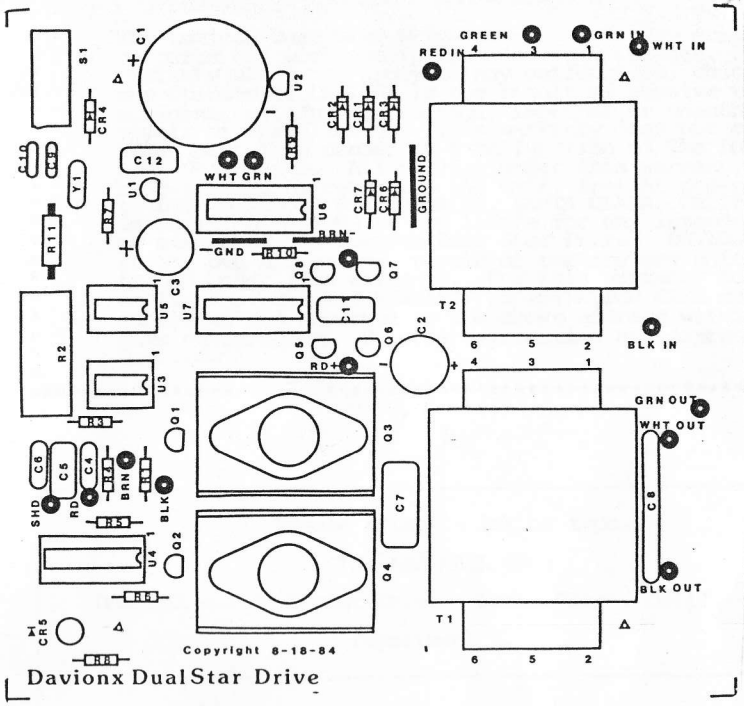
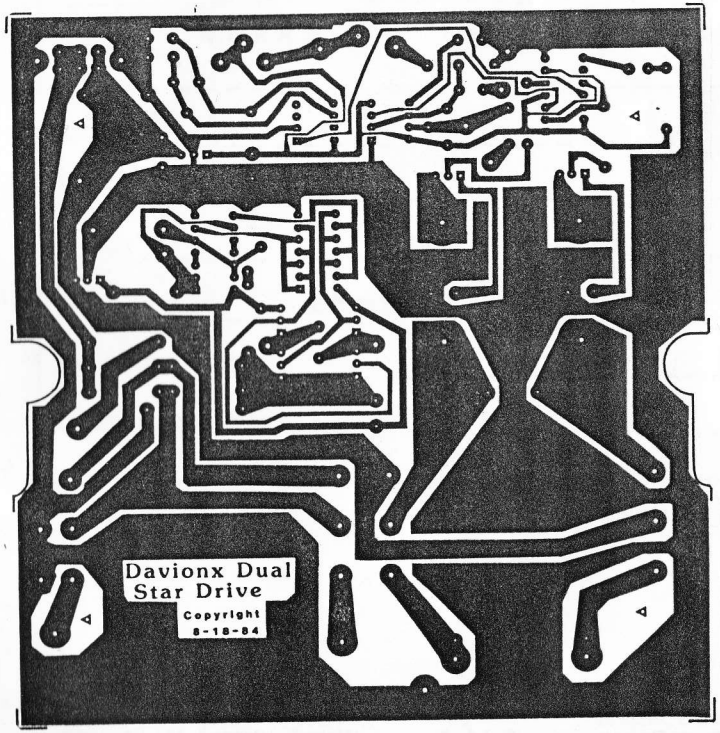


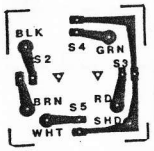
FIGURE 1. DAVIONX DUAL STAR DRIVE ARTWORK.



Davionx Dual Star Drive







WARRANTY

The Lumicon Dual Star Drive carries a 90 day guarantee on parts and workmanship from date of purchase. This warranty shall not apply to any malfunction, which in the opinion of DAVIONX is the result of abusive use, accident, willful destruction, improper or unauthorized repair or installation. This warranty does not cover any subsequent loss caused by a malfunction of the Lumicon Dual Star Drive. All service under this warranty must be performed by returning the unit, freight pre-paid, to DAVIONX, 3535 SHAFER DRIVE, SANTA CLARA, CALIF. In addition DAVIONX is not liable for any intended use, or misuse of the Lumicon Dual Star Drive. DAVIONX will at its own discretion, repair or replace any unit returned under this warranty. For this warranty to become active the attached WARRANTY REGISTRATION CARD must be completed and returned to the above address within (10) days of purchase. No other warranties are expressed or implied.

Please print in ink or type.

CLIP AND MAIL TO :

DAVIONX - 3535 Shafer Drive - Santa Clara, Calif. - 95051

Department K.

LUMICON
WARRANTY REGISTRATION

NAME: _____

ADDRESS: _____

CITY: _____

STATE: _____ ZIP CODE: _____

AGE: _____ OCCUPATION: _____

DATE PURCHASED: _____

BRAND & SIZE TELESCOPE _____

LUMICON

2111 Research Drive

Livermore, CA. 94550

(415) 447-9570