



ASTRA AUTOMATIC ACTIVATION DEVICE (AAD)

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ADVANTAGES.

FXC designed the Astra for external mounting. This high visibility allows for easy "Gear check" on the Astra's operational status and is therefore a significant improvement to safety.

The Astra is easily field tested, using the Cutter Test Probe, for firing accuracy and function by any approved rigger using any test chamber that shows altitude and rate of descent. Because the Astra can be functionally tested in the field there is no requirement for mandatory expensive and inconvenient factory overhaul.

Field replaceable modular components allow any rigger to do all field changes on the Astra. Modular components facilitate installation allowing cables to be disconnected and the narrower ends easily fed through sleeves etc.

The Astra is very quick and easy to install.

Simple and quick to operate, accessible but well protected Astra On/off switch operation is an advantage e.g. under canopy compared to a time consuming "multiple response" system while at the same time preventing accidental operation.

The flashing indicator light that constantly shows correct program function is a positive indication that the Astra Central Processing Unit is actually checking altitude and rate of descent.

Sensors are in the Altitude Control Unit, so the Astra is not attitude sensitive. If the sensor unit were in the battery pack inside the container, an "adjustment factor" would need to be added which leads to erroneous readings if unusual attitudes occur.

The Astra has a capacitor in the battery box to ensure that as long as the indicator light is flashing that there will always be sufficient charge to fire the cutter. Without a capacitor it would be possible for a unit to indicate a satisfactory battery condition but there may not be sufficient charge to fire the cutter.

Robust machined aluminum Astra Control Unit case prevents breakage. A similarly machined aluminum battery case prevents the hazard of leaking acid into the reserve container. The smooth rounded corners on the space saving low volume battery pack prevent wear spots in the reserve container and permit mounting in the main container.

Robust heavy duty cable connections prevent accidental disconnect or breakage.

High level of EMF protection.

US manufactured but locally serviced.

Inexpensive battery packs that do not have to be replaced if the unit has fired. Battery voltages easily checked by any commercial Multitester.

Low initial purchase price and cost of maintenance.

The program design allows recovery of firing altitude data for later analysis.

1.0 DESIGN CONCEPTS

1.1 The **ASTRA** Automatic Activation Device is a computer controlled electronic altimeter that determines the rate of descent and the altitude above ground level (AGL) and fires a locking-loop cutter if an unsafe condition is detected.

1.2 The program stored in the microcontroller reads the digital value from the analog-to-digital converter and determines the rate of descent and the altitude above ground level (AGL).

2.0 FUNCTION

2.1 The **ASTRA** (P/N 811-00356-1) is designed to automatically cut the parachute container locking-loop if the unit's preset activation altitude is reached and, for whatever reason, the rate of descent exceeds 130 feet per second (**ASTRA** Expert settings). Under normal conditions, the **ASTRA** will not operate because the parachutist will have deployed his main chute, thus slowing his rate of descent to less than 115 feet per second before reaching the preset activation altitude.

2.2 The **ASTRA** is small in size, extremely rugged, and simple to operate. The 'ON/OFF' switch, when turned to 'ON', automatically calibrates the unit, checks continuity of the entire system, and continuously confirms the status of the batteries.

Designed to fire at	Altitude Setting:	1000 +/- 200 feet AGL
	Rate of Descent:	130 +/- 15 feet per second

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3.0 COMPONENTS

3.1 The **ASTRA** consists of three (3) major components:
The **Altitude Control Assembly**, the **Power Pack**, and the **Cutter Assembly**.

3.2 Altitude Control Assembly:

3.2.1 The Altitude Control Assembly contains a microcontroller circuit which has an EEPROM programmed with FXC's custom software. The unit also contains a high resolution pressure transducer and circuits which convert ambient air pressure into an electronic signal. This signal is amplified, and then converted to a digital value by an analog-to-digital converter.

3.2.2 The microcontroller reads the digital value from the analog-to-digital converter and determines the rate of descent and the altitude above ground level(AGL).

NOTE:

**THE ASTRA IS NOT MOISTURE-
PROOF**

3.3 Power Pack:

3.3.1 The Power Pack contains a Battery Pack and a back-up circuit which provide enough energy to fire the cutter until the battery is too weak (minimum of 150 hours of normal use).

3.4 Cutter Assembly:

3.4.1 The Cutter Assembly contains a pyrotechnic cartridge which cuts a standard parachute locking-loop when unsafe conditions are detected by the Altitude Control Assembly. See container manufacturer for approved locking loops.

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4.0 OPERATION:

4.1. GENERAL OPERATION PROCEDURES

4.1.1 The **ASTRA** is very simple to operate. Turn it on at the drop zone. The green light will flash rapidly 5 times, flash slowly at least 10 times, then flash once each second. The momentary flashing confirms that the unit is calibrated to fire the cutter at 1000 feet above the ground level of that drop zone ([SEE OPERATION STEPS TABLE](#)).

4.1.2 If the green light stays 'OFF' or 'ON' continuously, either the battery voltage is too low, or the cutter connection is faulty. The unit must be removed from service until the problem is corrected.

4.1.3 Once the unit is calibrated, it will 'ARM' itself automatically during climbing but 'ONLY' after reaching 1700 feet above that ground level (AGL).

4.1.4 If a jump is aborted after climbing above 1700 ft, turn the unit 'OFF' before descending so that it will not inadvertently fire.

4.1.5 The **ASTRA** is designed to fire the cutter at 1000 feet above ground level and at a rate of descent of 130 feet per second for the **ASTRA** Expert.

4.1.6 The **ASTRA** 'WILL NOT FIRE' above 1400 feet (AGL) regardless of the parachutist's rate of descent.

4.1.7 The **ASTRA** 'WILL NOT FIRE' at any altitude if the rate of descent is less than 115 feet per second for the **ASTRA** Expert.

4.1.8 The **ASTRA** 'WILL FIRE' when the parachutist reaches the unit's altitude setting and the rate of descent is greater than 145 feet per second for **ASTRA** Expert.

4.1.9 The **ASTRA** 'WILL FIRE' when the parachutist is at or below the altitude setting and the rate of descent increases from less-than to more-than 130 feet per second for **ASTRA** Expert.

4.1.10 When the unit 'FIRES', the green light will 'STAY ON' continuously until the unit is turned 'OFF'. If the unit is turned 'ON' before replacing the cutter, the green light will 'STAY ON'. The green light 'STAYS ON' continuously because of a faulty cutter circuit.

OPERATION STEPS TABLE

STEP 1.	Slide the ON/OFF switch to 'ON' only at the ground level of the drop zone.
STEP 2.	Observe that the indicator green light blinks quickly five (5) times.
STEP 3.	Observe that the green light stays 'ON' for one (1) second then turns 'OFF' for one (1) second, until the unit calibrates itself to fire at 1000 feet above the ground level (AGL) at that drop zone.
STEP 4.	Observe that once calibrated, the indicator green light 'SHORT FLASHES' periodically the entire time the ASTRA is used.
STEP 5.	After each jump, slide the 'ON/OFF' switch to 'OFF'.

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CALIBRATION

To Calibrate:

Slide the "ON/OFF" switch to "ON" (Figure 1). The indicator light (Green) will blink quickly 5 (five) times. The light will stay "ON" for 1 second then will turn "OFF" for one second, until the unit calibrates itself to 1000 feet above ground level.

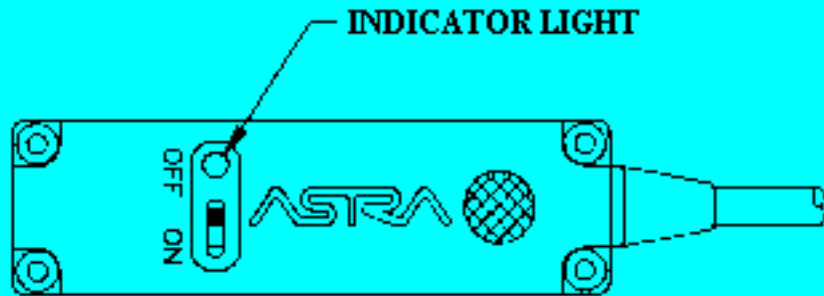


Figure 1 - ALTITUDE CONTROL UNIT

4.2 MANDATORY OPERATION PROCEDURES:

4.2.1 The barometric pressure changes daily, therefore, for safety, the unit must be recalibrated before each jump at the ground level of the drop zone by performing all the steps in the operation steps table (knowledge of field elevation and barometric pressure is not required).

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5.0 TYPICAL INSTALLATION:

5.1 Installation of the **ASTRA** has been specifically designed to be container-fit friendly, rigger-in-the-field friendly, and jumper friendly, to the extreme. The unit fits into most existing mounting configurations and locations.

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6.0 THEORY OF OPERATION:

6.1 The unit is battery operated and contains an absolute air pressure sensor, miniature computer, and electrically actuated pyrotechnic cutter. The computer averages 16 pressure readings each second and stores the initial average value (approximately 20 seconds after turn-on), the last average value, and the current average value. The difference between the initial value and the current value indicates altitude, and the difference between the current value and the last value indicates rate of change in altitude. The proper functioning of the unit is verified by tests, in an altitude chamber, during manufacturing. The computer will fire the cutter only when the current altitude value is less than the calculated altitude limit and the current rate-of-descent value is greater than the calculated velocity limit. Other restraints imposed by the computer program are:

6.1.1 At some point in the flight the altitude must exceed 1700 feet above the drop zone before the unit will 'ARM' itself. If this altitude is never reached the ASTRA 'WILL NOT FIRE' the cutter under any condition. The purpose of this safety feature is to minimize the risk of an inadvertent firing during ascent.

NOTE:

Once the unit is calibrated, it will 'ARM' itself automatically during climbing but 'ONLY' after reaching 1700 feet above the ground level (AGL) at that drop zone.

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7.0 MAINTENANCE:

7.1 The only maintenance required is to replace a weak Battery Pack or a fired Cutter Assembly.

7.1.1 BATTERY REPLACEMENT :

- a. Slide the 'ON / OFF' switch to 'OFF'.
- b. Remove the four (4) screws on the Power Pack cover, and remove the cover.
- c. Remove the Battery Pack (P/N 811-00374) by pulling up on its lifting tab, and install a new one.

WARNING:

Before installing a Cutter-Cable-Assembly, short the outside pin of the 3 pin circuit to the center pin . This 'WILL' discharge any residual voltage on the capacitor thus preventing the possibility of the cutter firing as it is plugged in.

- d. Plug the cutter cable onto the 3 pins on the flex circuit in the Power Pack. Take care to align the sockets with the pins before pushing down hard on the connector.

7.1.2 Cover Installation:

- a. Slide the 'ON/OFF' switch to 'ON', the green light should be flashing.
- b. Reinstall the cover to the housing.
- c. Confirm that the green light is still flashing momentarily, and then slide the, 'ON/OFF' switch to 'OFF'.

8.0 FUNCTIONAL TEST.

8.1 During every repack of the parachute , a functional test is recommended on the **ASTRA**, using the

Cutter-Test-Probe and the Portable Altitude Test Chamber .

8.2 To test the ASTRA using the Portable Altitude Test Chamber perform the following steps:

Step 1	Remove the four screws holding the cover on, then remove the cover.
Step 2	Carefully remove the cutter, and then carefully install the Cutter-Test-Probe.
Step 3	Turn the Portable Altitude Test Chamber 'ON'.
Step 4	Turn the ASTRA 'ON'.
Step 5	Place the ASTRA inside the Portable Altitude Test Chamber, so that the Green Light on the Altitude Control Housing shows.
Step 6	Make sure that the control valve on the test chamber is closed and that the ASTRA has completed its calibration (green light is 'SHORT' flashing periodically).
Step 7	Place the cover of the Portable Altitude Test Chamber onto the Chamber, holding it in place. Now using the hand pump, start pumping to the desired altitude.
Step 8	When at the desired altitude, turn the valve to start your descent. Record the readings of altitude and rate when the green light turns on steady.
Step 9	Turn the ASTRA 'OFF'
Step 10	Now remove the Cutter-Test-Probe, and discharge the capacitor.
Step 11	Replace the Cutter Assembly and the cover.
Step 12	Test is completed.

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TEST SUMMARY 1/20/96

This report summarizes various testing on the **ASTRA** AAD. It is drawn from the full **ASTRA** test report (FXC Engineering QTR8557). Twenty Test-Units were used in the testing and all units contained the "expert" program.

Chamber Testing.**Must-Fire Test.**

The test units were placed in a test chamber. The chamber was taken to 3000 ft, stabilized, then descended at a rate of 100 fps to ambient. All the test units passed the test.

No-Fire Test.

The test units were placed in a test chamber. The chamber was taken to 3000 ft, stabilized, then descended at a rate of 80 fps to ambient. All passed.

Temperature Test.

Units were chilled to -23 degrees Centigrade for 45 minutes and then function tested. All passed.

Units were heated to 50 degrees Centigrade for 45 minutes and then function tested. All passed.

Shock Test (3 foot drop).

Units were dropped from three feet onto 2 inches of steel plate on concrete. The test was conducted in both directions of the 3 axes of the unit, for a total of six drops/unit. The units showed no signs of damage and all functioned successfully.

Crush-Load Test.

The cases were subjected to a 500 LB load, applied by a 1/2 inch diameter steel rod, perpendicular to each surface of the test unit. The test unit was supported uniformly over the opposite surface. The units showed no signs of damage and all units functioned successfully.

Cable "bend and pull" Test.

Components were secured in a vice and the attached cabling was manipulated back and forth over 1500 times. Then cabling was subjected to 40 lb. pull for one minute. Continuity was checked. All passed.

EMI Test, as per Mil-STD-1818, with the units "ON".

The unit should not fire during testing. The unit must functional test successfully. All passed.

Dummy-Drop Tests.

The units were installed in rigs on dummies and dropped from a variety of altitudes. All units fired within tolerance.

Live-Jump Test.

The test units were attached to the outside of the parachute container, the cutter mounted next to the jumpers altimeter and the **ASTRA** Control/Sensor unit mounted in a variety of positions. All units fired within tolerance.

Beta Testing.

A number of units have been released for ongoing Beta testing. All test units must perform satisfactorily

in the "wear and tear" of field conditions. The test is in process.

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FREQUENTLY ASKED QUESTIONS.

OPERATIONAL:

1) Does it matter if one cannot remember the sequence of flashing lights when the unit is turned "ON"?

No. Turn it on, if after a little while the green light keeps on flashing about once a second the unit is OK, if it is anything else for example a solid light, or no light etc. then it is not OK.

2) When must you turn the unit "ON" and when should you turn the unit "OFF"?

Turn the unit "ON" just prior to entering the aircraft. Turn it "OFF" just after you land.

If convenient, you can turn the Astra "OFF" under canopy. This will: a) Allow you to choose when to deploy the reserve if involved in a canopy wrap. b) Conserve battery life.

3) Does it matter if the unit is not turned "OFF" between jumps ?

We recommend turning the unit "ON" before each jump to recalibrate and after the jump to turn it "OFF" to conserve battery life. (If you do not allow the unit to recalibrate, any changes in barometric pressure between the time that the unit was previously calibrated will be introduced as an error).

4) What altitude does the unit fire at?

1000 feet +/- 200 feet. Given that one could also experience a reserve pilot chute hesitation and a slow opening, we feel that 1000 feet is an appropriate altitude to account for the real world variables that do not occur in a test chamber. Because the unit is not "altitude" sensitive there is significantly less chance of a "high" firing.

5) What if the light goes solid?

When the battery voltage goes down to 7.2 volts the Astra will disarm itself and show a solid green light.

The light will also go solid green if there is a short in the firing circuit. Switch the unit off. (You can check a battery using a regular multi tester. New should read 9.0 to 9.5 Volts DC, midlife should be around 8.0 Volts DC).

6) Could the unstable air pressures in the doorway of an Aircraft cause the unit to misfire?

The program is designed to prevent this occurring.

7) What happens if the ACU casing touches something that is electrically charged?

Probably nothing. The casing is insulated by it's annodization.

8) Is the unit "attitude" sensitive?

No. Because the sensors are located in the Altitude Control Assembly there is no need to add an "adjustment factor". (In other units the sensor is located in the battery pack mounted in the reserve container. The low pressure area produces an erroneous altitude reading. This error is theoretically predictable and a set figure is subtracted from the apparent altitude. However if the "attitude" of the falling body changes the low pressure area is degraded and a higher than normal firing altitude will result.)

9) What is the maximum altitude the unit can go to and still function?

There is no limit.

10) Will hook turning or fast spiral descents cause the Astra to fire?

No. We had a very small number of incidents when the units were first released with a rate of descent setting of 90 feet per second. After investigation and further testing we increased the rate of descent to 130 feet per second as well as redesigning the filtering software. We designated that upgrade as the Mod 3. We have had no incidents of Astras with the Mod 3 upgrade firing inappropriately.

TECHNICAL:

1) What types of reserve closing loop is approved for use with the Astra ?

Spectra CSR style #9512-300, Spectra CSR style #9512-725

Cypres Locking (Spectra Cord),

2) What is the battery life of the Astra?

Battery life of the Lithium batteries is a minimum 150 hours under normal load and at standard temperature of 22.2 Centigrade. We are currently testing an improvement that doubles battery endurance

which will be a direct replacement in your existing Astra when the improvement becomes available.

3) What is the purpose of the Capacitor?

The capacitor stores a charge so that as long as the unit is functioning with a flashing green light there will always be enough electrical charge to fire the cutter.

4) Is there a mandated service life on the Cutter and/or battery?

The Battery has a shelf life of five years. The Cutter has a shelf life of ten years.

5) What if the light goes solid?

When the battery voltage goes down to 7.2 volts the Astra will disarm itself and show a solid green light.

Switch the unit off. (You can check a battery using a regular multi tester. New batteries should read 9.0 to 9.5 Volts DC, midlife should be around 8.0 Volts DC).

6) How does the unit compare in size to other units on the market?

In order to assist in developing a standard Industrywide Electronic AAD installation, the Astra has been designed with many similar dimensions as the Airtec "Cypres". The Battery box is slightly smaller. The cutter is the same size and cable lengths are all the same size or longer. The Altitude Control Assembly is the same length and width but because it contains ALL of the sensor package it is about 0.16" thicker.

7) Why mount the unit on the front?

There used to be a stigma attached to the use of AADs amongst experienced jumpers and so AADs were hidden out of sight. This is no longer true. The control unit should be protected but easily visible to the jumper and other jumpers for safety checks before the skydive; and it should be easily accessible to cycle the unit for recalibration and to conserve battery life after a skydive.

8) If it is mounted on the front lift web, isn't it vulnerable to abrasion or being switched off accidentally?

No. Not if it is mounted with the Astra Switch Cover. It is visible, accessible and well protected.

9) Is there any field testing that can be done on the unit and who can do this testing?

Yes. A cutter test probe (P/N 811-00377) is available which in combination with any test chamber showing altitude and rate of descent will indicate correct functioning of the unit. The test chamber is operable by an approved parachute rigger. We recommend that this be done at each repack cycle. Using a

Multitester battery voltages can also be checked.

10) How frequently does the Astra have to be returned to the manufacturer?

Never. The combination of self testing and live functional testing in an altitude chamber means that the user can always know the performance characteristics of the Astra. The only reason to return an Astra to FXC would be if there is a problem with the unit.

11) What cable lengths are available between the Altitude Control Assembly and the Battery box?

26" or 31 1/2". The units sent out for fit check to the US rig manufacturers have 26 " cable. At this time units are shipped with the 26" cable as standard. If the 31 1/2" cable is required please request it and the longer cable will be shipped. In the future it is expected that 31 1/2 " cables will be the standard.

SERVICE & SUPPORT

1) What are the applicable Federal Aviation Regulations concerning installation on a container/harness ?

Far 105 refers to the provisions of TSO 23C and D. The intent is that anything that might affect the functioning of the harness container system is to be approved by the TSO holder or the FAA. Some rig manufacturers feel that the installation of an AAD of this type in no way affects the functioning of the harness or reserve system and therefore installation does not require official instructions or a 337, while other manufacturers hold an opposing view. Either way most rig manufacturers have already approved the "Cypres" type installation. The rational approach is that both the rig manufacturer and the AAD manufacturer need to agree to and be satisfied with the installation. That is why FXCs approach has been cooperative in nature, FXC has made outline installation recommendations while allowing the rig manufacturers to decide upon the detailed routing and mounting methods should they differ from the already approved "Cypres" installation.

2) In outline, are any authorizations required from Container/harness (rig) manufacturers?

The Rig manufacturers have a responsibility to approve modifications to the Rig insofar as the modification affects the proper functioning of the container/harness and the reserve. Almost all rig manufacturers have now approved the Cypres "style" installation on their rigs. The Astra can use the same already approved Cypres installation "style" therefore no additional approvals are required to install the Astra.

Minor differences such as Astra Control Unit location, or battery box location in no way affect the functioning of the container/harness or reserve system and therefore do not require special approvals.

3) Should the rig manufacturers test functioning of the unit ?

FXC has done and will continue to do extensive testing on this unit. However it is neither the responsibility nor for most of the rig manufacturers, their expertise, to evaluate an AAD's performance or suitability other than its direct physical impact upon the functioning of the harness/container and reserve. Naturally anyone else is welcome to test the units in whatever ways they wish. FXC encourages such testing. The value that FXC places on the results of such testing will be a function of the test methodology.

4) Are the rig manufacturers familiar with the Astra?

Yes. FXC shipped Astras or Astra "mock ups" to major U.S. and International rig manufacturers in the fall of 1995 and the spring of 1996 for fit checks and informational purposes.

5) How specifically is the unit installed on a particular rig?

As per the rig manufacturers instructions for the Cypres installation except that the Astra Control Unit is best mounted on the front right lift web. Each rig on the market is unique, therefore the manufacturers are the best qualified to issue instructions for the routing of the cable and the mounting of the Altitude Control Unit on the lift web. Actually within the U.S. any FAA Master Rigger can do the installation any way that he or she wishes at all but then they are obliged to go through the somewhat tedious process of submitting a FAA form 337.

6) Who is authorized to change batteries and/ or the cutter?

An FAA approved parachute rigger or foreign equivalent or FXC trained personnel .

7) What other if any field servicing can be done and by whom?

The ACU housing and cable assembly can be changed out by an FAA approved parachute rigger or foreign equivalent.

8) What other items will be supplied with the unit?

Manual and Astra Switch Cover. Should you require an Installation kit (Battery pocket, cable channeling , and cutter retainer) it can be supplied on request at no extra charge.

9) Can the Unit be supplied in different designer colors?

No. We are planning that all future units will be black.

10) Will a Student model be available?

A Student model is available on request.

Will a two pin model be available ?

Perhaps. Currently undergoing evaluation and Beta testing.

Will a Tandem version be available?

Yes. Currently undergoing evaluation and Beta testing.

Will a Military version be available?

Yes. Expected later in 1998.

11) Does the end user have a responsibility to register the purchase of their unit with FXC?

Yes. And if ownership of the unit is transferred the new owner must register the transfer with FXC.

12) Where can an Astra be purchased ?

The best place to purchase an Astra is from one of the local Astra dealers in your area. If you require a list of dealers please contact FXC direct on (714) 556-7400 Monday to Friday normal business hours Pacific Standard Time or e-mail us any time at fxc@pia.com.

13) How long of a wait for delivery.

We have units in stock now. So a few days after receipt of order depending on your chosen method of shipment.

14) Do you sell direct to the public?

Yes, we can sell direct to the public. However we do sell at the recommended Retail Price so as not to undercut our own dealers. Often a purchaser can find a more advantageous deal from an Astra Dealer.

15) Who do we contact and how if we have further questions?

Your local dealer should be able to answer most questions. If that is not sufficient contact Stella Peyton or Alasdair Boyd. You can call us anytime on (714) 556-7400 or Fax on (714) 641-5093. Or E-mail us at fxc@pia.com

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Pricing.

- Lower recommended retail price.
- Lower replacement battery price.

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ASTRA PRICING 1/24/96

1.0 Pricing in U.S. dollars, less shipping, tax etc:

Item	Part No.	Retail Selling Price
Astra	811-00356-1	\$995
Battery	811-00374	\$45
Cutter/Cable	811-00375	\$145
Cutter Test Probe	811-00384	\$60

2.0 FXC Corporation reserves the right to adjust the selling price at any time.

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