

# KING KR 87

## SILVER CROWN DIGITAL ADF

### This is King's "stay-ahead" digital ADF

At the push of a button, King's KR 87 puts more useful information at your fingertips than any other panel-mounted ADF you can buy.

Standing just 1.3 inches high in your Silver Crown stack, this compact TSO'd unit gives you accurate bearing to stations in the 200 kHz to 1799 kHz frequency range. Complete ADF, ANT and BFO tuning modes are provided, along with audio output for station identification and monitoring of AM radio broadcasts.

The KR 87's advanced "coherent detection" design is similar to King's highly regarded Gold Crown KDF 806. It rejects unwanted frequency interference, achieves significantly greater range and has less susceptibility to engine noise, static and atmospheric interference.

And to help you "stay-ahead" of your flight plan, the KR 87's innovative "flip-flop" frequency display allows you to switch between pre-selected "standby" and "active" frequencies just by pressing a button.

Both pre-selected frequencies are stored in a non-volatile memory circuit (no "keep alive" battery power required) and displayed in large, easy-to-read self-dimming gas discharge numerics. The active frequency is continuously displayed in the left window, while the right window will display either the standby frequency or the selected readout from the built-in electronic timer. When either of the timer functions are selected, the "active" ADF frequency can be tuned directly by simply turning the selector knobs. This feature is particularly useful when searching for stations with unknown frequencies.

The KR 87's unique digital timer works in two ways. First as an automatic flight timer, it starts clocking whenever the unit is turned on or when an optional external switch (like a gear strut switch) is activated. This lets you keep track of total time enroute for fuel management, dead reckoning, and other navigation functions up to 59 hours, 59 minutes.

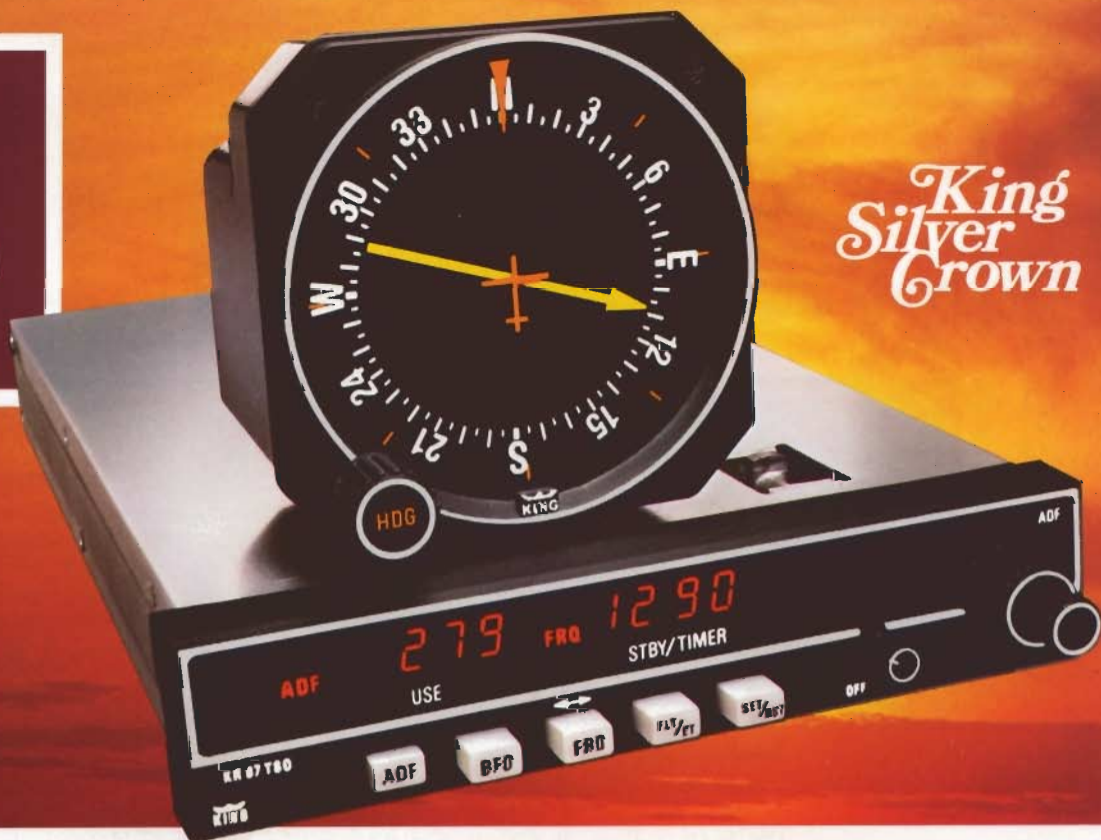
Secondly, as an elapsed timer, the separate programmable "stopwatch"

function can be reset to :00 anytime you need to start timing a holding pattern, a nonprecision approach or an individual trip leg.

You can program the elapsed time function to clock forward from :00, or to count down from any preset time interval up to 59 minutes, 59 seconds. When a preset time interval has been programmed and the countdown reaches :00, the display will flash for 15 seconds and an alarm output is provided to activate an optional audio alarm device. As an added backup, the timer will automatically start clocking forward from :00 once the countdown has been completed. And since both the flight timer and elapsed timer operate independently, you can monitor either one without disrupting the other.

You have to see the system in action to really appreciate how simple and useful it is.

**KING**



*King*  
*Silver*  
*Crown*

- Crystal filter selectivity improves long range reception.

- All tuning is performed electronically, using a microprocessor and LSI single crystal digital frequency synthesizer circuit. Fewer mechanical parts are used, resulting in greater reliability.

- Filtering on all connectors for greater suppression of electrical noise.

- Flip-flop frequency control and clock functions are made possible through use of a reliable micro-processor. Timing is precisely controlled by a quartz crystal timer.

- **EAROM (Electrically Alterable Read Only Memory)** provides non volatile storage of frequencies during shut down or temporary interruption of power.

ANT/ADF mode annunciation

IN USE frequency

STANDBY frequency annunciation

STANDBY frequency, FLIGHT TIME or ELAPSED TIME

Flight timer and Elapsed timer mode annunciation



Select ANT mode (out position)  
Select ADF mode (in position)

Select BFO

Frequency transfer button

Select FLIGHT TIMER or ELAPSED TIMER

Set and Reset ELAPSED TIMER

ON/OFF/VOL control switch

Frequency Select Knobs

NOTE: All mode annunciation shown for illustration only, actual operation will vary.

- Coherent detection circuitry that locks on to even weak stations for greater range.

- Fold out, modular construction provides easy access to all circuits and components for fast inspection and servicing.

- Power Supply Operates from 11-33 VDC, eliminates aircraft related noise and more efficient design generates less heat, eliminating need for external cooling.

- Rugged metal front panel (no plastic faceplate).

- Positive detent makes frequency select knobs easy to use during turbulence.

- Back lit pushbuttons for fingertip easy control of radio functions.

- Gas discharge display, self-dimming, easy-to-read.

# THE KR 87 ADF SYSTEM

The basic KR 87 system includes the KR 87 receiver, the KI 227 indicator with rotatable compass card and the aerodynamically designed KA 44B combined loop and sense antenna, plus mounting racks and connectors.

The all solid-state KR 87 receiver will operate on any DC voltage from 11 to 33 volts. It draws only 12 watts power, so no external cooling is required.

The standard KI 227 ADF indicator has an optically coated, non-reflecting glass lens that can be cleaned without scratching and has a manually rotated compass card. An optional KI 227-01 slaved indicator is available that takes heading input from the standard KCS 55A Compass System to drive the compass card and display magnetic heading.

The compass card in the KI 227-01 is synchronized to the KI 525A compass card by rotating the SYNC knob until the heading matches that of the KI 525A.

Also available is the KI 228 dual ADF Pointer indicator for use with dual KR 87 installations. Like the KI 227, it is available in both manual (KI 228-00) and slaved (KI 228-01) versions.

The KR 87 will also drive the KI 229 or KNI 582 RMI's directly. An optional RMI Adaptor (KDA 692) is available for interfacing with other conventional (3-wire) RMI indicators.

The KA 44B combined loop and sense antenna is an aerodynamically clean design, and greatly simplifies installation. It contains preamplifier and modulator circuits which combine the antenna signals into a single signal input to the receiver. **Cable length is not critical**, and, as only one cable is required, this ADF system is simple and fast to install.

## The electronic timers in the KR 87 add a new dimension to flight management.



**The flight timer** is a real aid for fuel management or dead reckoning on extremely long legs. It will measure flight time up to 59 hours and 59 minutes. The flight timer starts when power is applied to the unit through an avionics master, the unit's own ON/OFF switch or optional external switch (like a gear strut switch or other device).

Flight time will be displayed in the right hand window in place of the standby frequency when power is first applied. "FLT" will be annunciated. Flight time may then be checked at any time during a flight, regardless of what is being displayed in the right window, simply by pressing the FLT/ET button to annunciate "FLT".

The flight timer will always be automatically reset to :00 whenever power is interrupted either by the avionics master switch or the unit's ON/OFF switch. An optional external switch may be installed which, when activated, will stop or start the flight timer. This switch would be of use during a non-refueling stop when resetting the flight timer is not desired. On some aircraft it may be desirable to use the aircraft strut switch instead of a manual switch to stop and start the flight timer. It should be emphasized that the start/stop function will only operate with power applied to the unit. Always read flight time prior to power shutdown.



**The elapsed timer** provides a separate programmable "stopwatch" function which is invaluable for timing a holding pattern, a nonprecision approach, or an individual trip leg. The elapsed timer can be programmed to clock forward from :00 or to count down from any preset time interval up to 59 minutes, 59 seconds.

In the count down mode, when the elapsed timer reaches :00 the right-hand display will alert you by flashing for 15 seconds as the timer starts counting up. An optional aural alarm (if installed) will be activated for about one second.

It should be noted that, while the elapsed timer is being used or the flight timer checked, you do not lose your standby frequency. It is retained in memory and may be called up instantly by pressing the FRQ button. While the standby frequency is not being displayed (because the timers are being used) the pilot may select a new "in use" frequency by direct tuning, bypassing the preselection of a standby frequency and flip-flop transfer of standby to active. As stated earlier, this feature is particularly useful when searching for stations with unknown frequencies.

## "Flip-flop" of standby and active

frequencies just by pressing the FRQ button provides digital Silver Crown "stay-ahead" capability. Clear annunciation of the mode in use tells you your status at a glance. (Note: all modes are annunciated in this photo.) The push buttons, back lighted for good visibility, are spaced for convenience. The frequency channeling knobs have positive detent so you can **feel** the challenging action even in rough air, while the all metal faceplate is typical of the rugged, quality construction of the KR 87.

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**The elapsed timer also has a "count-down" mode.** To enter the countdown mode, the SET/RST button is depressed for about two seconds, or until the "ET" annunciation begins to flash. It is now in the ET set mode, and a time up to 59 minutes, 59 seconds may be preset into the elapsed timer with the concentric knobs. The preset time will be displayed and remain unchanged until SET/RST is pressed again, which will start the elapsed timer counting down from the preset time. When the timer reaches :00 it will start to count up as the display flashes for 15 seconds and an aural alarm, if installed, is activated for about 1 second.

**NOTE:** The standby frequency which is in memory while flight time or elapsed time modes are being displayed may be called back by pressing the FRQ button, then transferred to active use by pressing the FRQ button again.

While FLT or ET is displayed the "in use" frequency on the left side of the window may be changed, by using the frequency select knobs, without any effect on the stored standby frequency or the other modes. This feature is especially useful when searching for stations with unknown frequencies.

## **ERRONEOUS ADF BEARINGS DUE TO RADIO FREQUENCY PHENOMENA**

### **Station Overlap**

In the U.S., the FCC, which assigns AM radio frequencies, occasionally will assign the same frequency to more than one station in an area. Certain conditions, such as Night Effect,

may cause signals from such stations to overlap... This should be taken into consideration when using AM broadcast stations for navigation.

Sunspots and atmospheric phenomena may occasionally distort reception so that signals from two stations on the same frequency will overlap. For this reason it is always wise to make positive identification of the station being tuned, by switching the function selector to ANT and listening for station call letters.

### **Electrical Storms**

In the vicinity of electrical storms, an ADF indicator pointer tends to swing from the station tuned toward the center of the storm. Location of the storm can be useful information, but the erratic behavior of the pointer should be taken into account.

### **Night Effect**

This is a disturbance particularly strong just after sunset and just after dawn. An ADF indicator pointer may swing erratically at these times. If possible, tune to the most powerful station at the lowest frequency. If this is not possible, take the average of pointer oscillations to determine relative station bearing.

### **Mountain Effect**

Radio waves reflecting from the surface of mountains may cause the pointer to fluctuate or show an erroneous bearing. This should be taken into account when taking bearings over mountainous terrain.

### **Coastal Refraction**

Radio waves may be refracted when passing from land to sea or when moving parallel to the coastline. This should be taken into account when operating near coastal areas.

# PILOT'S GUIDE THE KING KR 87 ADF SYSTEM



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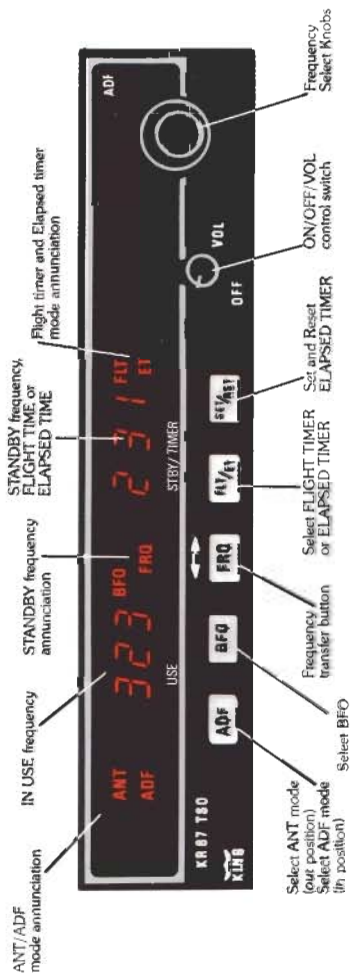


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# OPERATING INSTRUCTIONS



## TURN-ON

Rotate the ON/OFF/VOL knob clockwise from the detented "OFF" position. The unit will be activated and will be ready to operate. Rotation of this control also adjusts audio volume. The KR 87 has "audio muting" which causes the audio output to be muted unless the receiver is locked on a valid station.

## FREQUENCY SELECTION

The active frequency (to which the ADF is tuned) is displayed in the left side of the window at all times. A standby frequency is displayed in the right side when "FRQ" is annunciated. The standby frequency is placed in "blind" memory when either FLT (Flight Time) or ET (Elapsed Time) mode is selected. With "FRQ" annunciated, the standby frequency is selected using the frequency select knobs which may be rotated either clockwise or counter clockwise. Pull the small inner knob out to tune 1's. Push the small inner knob in to tune 10's. The outer knob tunes the 100's and the 1000's up to 1799.

The standby frequency selected may then be put into the active window by pressing the "FRQ" button. The standby and active frequencies will be exchanged (flip-flopped), the new frequency will become active, and the former active frequency will go into standby.

## OPERATING MODES



Antenna (ANT) mode is selected and annunciated when the "ADF" button is in the "out" position. ANT provides improved audio reception from the station tuned and is usually used for identification. The bearing pointer in the KI 227 indicator will be deactivated and immediately turn to the 90° relative position and remain there during ANT reception.



The ADF mode is selected and annunciated when the "ADF" button is in the depressed position. ADF activates the bearing pointer in the KI 227 indicator, causing it to move without hesitation to point in the direction of the station relative to the aircraft heading. The compass card on the KI 227 may be rotated as desired by using the heading knob.

NOTE: The KI 227-01 or KI 228-01 indicators, when installed with a King KCS 55A Compass System, have a slaved compass card. Magnetic heading of the aircraft will be under the lubber line. **The indication of this**

compass card should be compared with that of the KI 525A master indicator from time to time. Check especially after steep bank turns and taxi turns. If a discrepancy between the two readings exists, the KI 227-01 or KI 228-01 compass card should be synchronized to the KI 525A compass card by rotating the "SYNC" knob on the indicator.



Outside of the United States some stations are unmodulated and use an interrupted carrier for identification purposes. The BFO mode, activated and annunciated when the "BFO" button is depressed, permits the carrier wave and the associated Morse code identifier broadcast on the carrier wave to be heard.

## ADF TEST (PRE-FLIGHT OR IN-FLIGHT)

Select ANT mode. This will cause the bearing pointer to move directly to the parked 90° position. Make sure the unit is tuned to a usable frequency. Now select ADF mode and the needle should move without hesitation to the station bearing. Excessive sluggishness, wavering or reversals indicate a signal that is too weak or a system malfunction.

## OPERATING THE TIMERS

The flight timer will always be automatically reset to :00 whenever power is interrupted either by the avionics master switch or the unit's ON/OFF switch. An optional external switch may be installed which, when activated, will stop or start the flight timer. This switch would be of use during a non-refueling stop when resetting the flight timer is not desired. On some aircraft it may be desirable to use the aircraft strut switch instead of a manual switch to stop and start the flight timer. It should be emphasized that the start/stop function will only operate with power applied to the unit. Always read flight time prior to power shutdown.



Flight time or elapsed time are displayed and annunciated alternatively by depressing the FLT/ET button. The flight timer continues to count up until the unit is turned off or stopped with an external switch. The elapsed timer may be reset back to :00 by pressing the SET/RST button. It will then start counting up again. (NOTE: pressing the SET/RST button will reset the elapsed timer whether it is being displayed or not.)



KI 227

KI 227-00 shown, slaved  
KI 227-01 also available



KI 228

Slaved KI 228-01 shown.  
Standard KI 228-00 also available with manually



KI 229



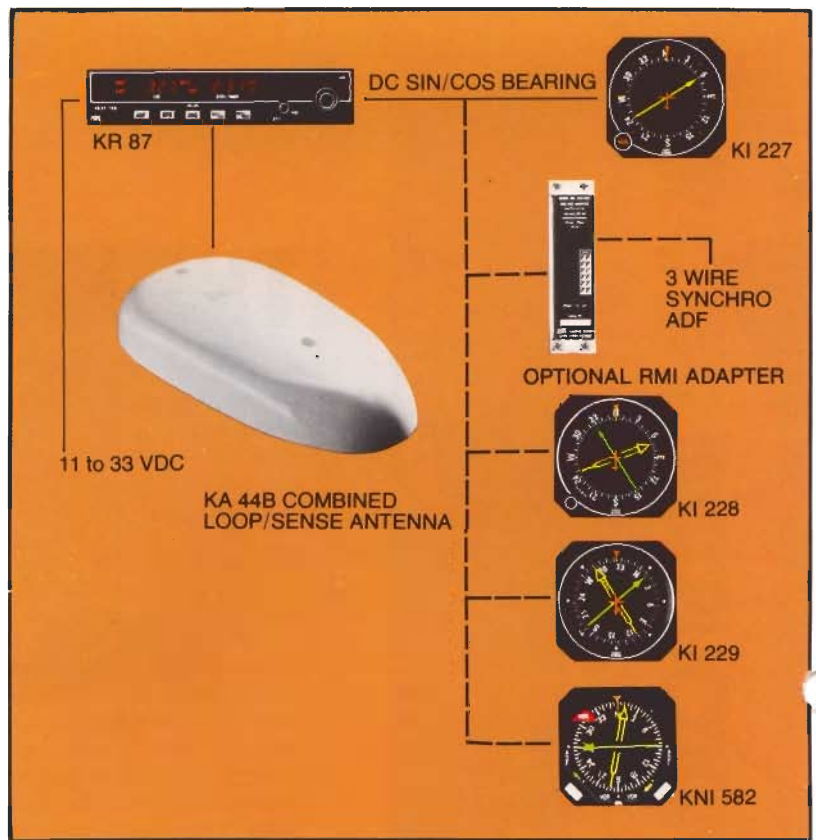
KI 582



## The new generation King Silver Crown Digital Avionics

The introduction of the KR 87 ADF is an important addition to King's new generation of digital avionics. The entire system has been designed to relieve the pilot's workload and make cockpit management easier and more efficient. Combined functions such as NAV/RNAV and ADF/Flight Time/Elapsed Time reduce installation time and save space and weight. The "stay-ahead" standby frequency selection with "flip-flop" transfer feature adds convenience and extra operational flexibility.

These new generation Silver Crown avionics demonstrate King's continuing leadership in state-of-the-art electronic design and the full utilization of microprocessor and display technology to bring you tomorrow's avionics today.



## KR 87 ADF System Specifications

### KR 87 ADF RECEIVER

SPECIFICATION	CHARACTERISTIC
APPLICABLE DOCUMENT:	FAA Minimum Performance Standards—RTCA Document DO-142
TSO COMPLIANCE:	C41c CL. A DO-160 Env. Cat. A1D1/A/SKP/XXXXXX/ZBABA
System Weight	5.60 lbs. (2.55 kg)
System Power Requirement	11-33 VDC (12 watts)
ENVIRONMENTAL SPECIFICATIONS:	
Temperature:	-20°C To +55°C
Altitude:	To 50,000 feet
SIZE (including mounting racks):	
Length:	11.28 in. (28.65 cm)
Width:	6.31 in. (16.03 cm)
Height:	1.38 in. (3.51 cm)
WEIGHT:	
Without rack and connectors:	2.9 lb. (1.32 Kg)
With rack and connectors:	3.2 lb. (1.45 Kg)
POWER REQUIREMENTS:	11 to 33VDC input voltage, 12 Watts
FREQUENCY RANGE:	200kHz to 1799kHz in 1kHz increments.
RECEIVER SENSITIVITY:	ADF mode: Typically 150uv/m maximum for $\frac{s+n}{n} = 6\text{dB}$ ANT mode: Typically 70 uv/m maximum for $\frac{s+n}{n} = 6\text{dB}$
RECEIVER SELECTIVITY:	6dB Bandwidth: $\pm 2\text{kHz}$ maximum off center frequency 80dB Bandwidth: $\pm 7\text{kHz}$ maximum off center frequency
ADF BEARING ACCURACY:	$\pm 3^\circ$ from 70 uv/m to 0.5V/m RF input signal level
ADF INDICATOR SPEED:	7 seconds max. with indicator 175° off bearing and 70 uv/m to 0.5V/m RF input signal level
OUTPUT TO INDICATOR:	DC sine and cosine voltages 4.5V $\pm$ 3.0V (150mA max.)
AUDIO OUTPUT:	10 mw across 500 ohm
ALARM OUTPUT:	Maximum current 1.0 Amp Maximum open circuit voltage 33.0 Volt

### KA 44B ANTENNA UNIT

SPECIFICATION	CHARACTERISTIC
WEIGHT:	2.8 lb. (1.27 Kg)
POWER REQUIREMENTS:	+9VDC supplied from KR 87 (80mA max.)
VERTICAL HEIGHT (from A/C fuselage):	1.8" (4.57 cm)
TSO COMPLIANCE:	TSO C41c CL. A DO-160ENV. CAT. B2B2/A/LJY/XXXXXX/ABABA

### KI 227 INDICATOR

SIZE (with connector):	
Length:	2.75 in. (6.99 cm)
Width:	3.26 in. (8.28 cm)
Height:	3.26 in. (8.28 cm)
WEIGHT (with connector):	.7 lb. (.32 Kg)
POWER REQUIREMENTS:	
Lighting:	.16A@14V .08a@28V
Compass Card Motor (-01 Model only):	12A@12V
SIGNAL INPUT:	DC sine and cosine voltage, $\pm 3.0\text{V}$ max. across each winding
Compass Card Input (-01 Model only):	2 phase digital stepper signals
TSO COMPLIANCE:	Same as KR 87



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