Honeywell

INSTALLATION MANUAL

BENDIX/KING®

KMD 150

Multifunction Display/GPS

MANUAL NUMBER 006-10607-0000
REVISION 0 November, 1999

WARNING
PRIOR TO EXPORT OF THIS DOCUMENT, REVIEW FOR EXPORT LICENSE REQUIREMENT
IS NEEDED.

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1. INTRODUCTION

1.1 Description

KMD 150 is a panel mounted long range GPS based navigation system featuring a high resolution color TFT map display and world-wide database coverage contained in a series of three PCMCIA cards. The KMD 150 is also supplied without an internal GPS receiver for use as a repeater in conjunction with a host GPS unit such as a KLN 89B to provide a moving map display. In addition the KMD 150 can be interfaced to a BFGoodrich WX-500 Stormscope sensor and thereby display thunderstorm information.

The primary purpose of the equipment is to provide the pilot with a clear graphical display of present position relative to coastlines, controlled airspace, airways, airports and aeronautical beacons. The equipment also provides facilities for flight planning and the display of route information.

Ergonomics, i.e. the man machine interface has been a major feature of the design process, the equipment is controlled via five soft keys and a joystick to provide ease of use. Each keystroke brings an appropriate prompt message to the display screen, which means that at all times the exact information and/or action for a particular keystroke is defined.

The main processing of information is handled by a 32bit Motorola microprocessor resident on the main PCB. It drives the outputs to the graphics driver board, resolves the incoming navigation data from the internal or external GPS receiver and provides input/output information to the aviation interface board for driving external outputs. The aviation interface board has its own microcontroller which control's the Stormscope interface, and provides analog autopilot outputs. The maximum system update rate is 1 Hz for navigation data computation and screen updates.

The internal GPS receiver features 8 channel parallel tracking of satellites, position accuracy to 25 meters (Selective Availability off), time to fix of 15 seconds (almanac, position, time & ephemeris known) and 15 minutes (no almanac, time or date). The display is a high contrast, high resolution, TFT display mounted behind an anti-reflective glass window. The unit is housed in an aluminum enclosure.

This manual provides brief details of the performance of the units and guidelines for achieving a successful installation in the chosen aircraft. It covers the mechanical and electrical installation requirements along with the entire pin out information.

1.2 Soft Keying

On the KMD 150's screen, you will notice that a label is drawn down the right hand side alongside each valid Key. Whenever a new function is selected, by pressing a valid Key, a new screen is displayed along with its new Key labels. This capability of drawing Key labels that are only applicable to a particular screen is referred to as 'soft keying', and allows one key to perform multiple functions without the complications of multiple key presses on a conventional keypad.

For the purpose of describing the function of a particular key in this Manual, assume that all the Keys on the pictured screen drawings are numbered 1 - 5 from top to bottom. The ensuing text will use this numbering sequence to refer to each specific Key. The number shown alongside the pictured screen drawings refers to the number of the screen that is called when that Key is pressed. By using these numbers it is possible to follow the paths through the operating system for all functions. If the word RET is printed next to a Key, this means that after the Key function is performed the same screen is RETurned.

1.3 Technical Characteristics

1.3.1 KMD 150 Multifunction Display/GPS

The internal GPS version of KMD 150 utilizes an integral 8 channel parallel GPS receiver but can also operate from an external GPS receiver. The external GPS version requires an input from an external GPS unit in order to operate.

1.3.1.1 Physical Configuration

Physical Dimensions: Refer to Figure 2-6

Weight:	3lbs (1355 grams) nominal, inclusive PCMCIA Card
Screen:	5" (127mm) color TFT active matrix LCD (76,800 pixels)
Cooling:	5V brushless Cooling Fan, 2.9l/sec flow for unit cooling
Mounting Rack:	Mounted via six M3 clearance holes in Rack, KMD 150 unit retained in Rack by M3 extended Socket Head Screw

1.3.1.2 Performance Characteristics

Max. speed:	1000 knots
Acceleration:	6g (GPS Engine 4g for acquisition)
Max. altitude:	35,000 feet.
Temperature:	-20°C to +70°C
	Fan cooling is used to de-rate the system electronics, full performance is maintained at the maximum temperatures following loss of cooling.
Humidity:	95% non condensing
Power input:	10 to 33 volts DC. 20 Watts max.
Memory battery:	Lithium Thionyl AA Cell, UL 1642 Approved.

1.3.1.3 GPS Receiver

Receiver architecture:	8 channel parallel
Tracking capability:	8 simultaneous satellite vehicles
Time to first fix:	15s (almanac, position, time & ephemeris known)
	45s (almanac, position & time known)
	15 minutes (nothing known)
Typical re-acquire:	1.5 seconds
Receiver Accuracy:	25 meters (without Selective Availability)
System Accuracy:	Better than 0.124Nm, Selective Availability On

1.3.1.4 Internal Database

Geographical Database	Coastline, terrain, urban areas, cities, roads, major railway routes, lakes, rivers and obstacles over 500 feet (USA only).
Jeppesen® Database	ARINC 424 Format VORs, NDBs, airfields, runway information and graphics, comms frequencies, airways and intersections, danger areas and upper/lower controlled airspace limits
Database updates	Aeronautical data updated every 28 days. Feature and geographic upgrades are available periodically within updates

1.3.1.5 User Defined Database

Waypoints:- Holds 500 user defined waypoints and up to 25 user configurable airfields for those that are not Jeppesen listed
Routes- Holds up to 99 reversible routes, each with up to 99 turning points.

1.3.1.6 Interfaces

Inputs:- Capable of receiving differential GPS data (RTCM-104 format) and data from a BFGoodrich WX-500 Stormscope sensor.
Outputs:- TO/FROM Flag, CDI Bar, NAV Flag, NAV Superflag, WPT Annunciator, Message Annunciator, RS232 / NMEA / WX-500 Stormscope control output and an audio annunciator output.
External GPS: Requires ARNAV R-30 (King) (RS232 or RS422 9600 baud), NMEA0183 (4800 or 9600 baud) or Northstar Proprietary data (1200 baud).

1.3.2 Mounting Rack

Physical Dimensions: Refer to Figure 2-7
Weight: 0.5lbs (220 grams) nominal, inclusive Connectors

1.3.3 KA 92 Antenna

TSO Compliance: See Appendix 4
Physical Dimensions: Refer to Figure 2-8
Weight: 4.80 oz. (0.14 Kg) maximum.
Output Impedance 50 Ohms (nominal)
Airspeed Rating: 600 kts. TAS
Power Requirements: Supplied by KMD 150.

1.4 Units and Accessories Supplied

1.4.1 KMD 150 Multifunction Display/GPS

PART NUMBER	DESCRIPTION
066-01174-0101	With Internal GPS
066-01174-0201	Without Internal GPS

1.4.2 KMD 150 Mounting Rack

PART NUMBER	DESCRIPTION
047-12541-0001	Mounting Rack

1.4.3 KA 92 GPS Antenna

PART NUMBER	DESCRIPTION
071-01553-0200	TSO'd GPS Antenna

1.4.4 KMD 150 Installation Kit

Installation Kit part number is 050-03603-0000. The contents of this kit is as follows:

PART NUMBER	DESCRIPTION	QUANTITY
030-01157-0011	Socket Crmp 20G	37
030-02351-0023	Conn Hood Size 37	1
030-01175-0000	Conn Sub-D HSG 37S (Female Pins)	1
030-00101-0002	Panel Mount Plug	1
057-05628-0000	GPS Disclaimer	1
089-02353-0001	Nut Clip 6-32	6
089-06012-0006	Screw FHP 6-32X3/8	6
089-05499-0005	Screw FHP 4-24X5/16	2
089-08094-0030	Flat Washer STD .446	1
089-08168-0002	Wave Washer	1
090-00019-0007	Retaining Ring .438	1
159-08242-0002	FAA-PMA Parts List	1

1.4.5 KA 92 Installation Kit

Installation Kit part number is 050-03318-0000. The contents of this kit is as follows:

PART NUMBER	DESCRIPTION	QUANTITY	VENDOR/PART NUMBER
030-00134-0001	Coax Conn Right Angle	1	TED/5-30-102-1
047-10735-0002	Antenna Doubler	1	Lee Stamping/047-10735-0002
089-05909-0012	Screw PHP 8-32X3/4	4	AlliedSignal
187-01831-0000	Antenna Gasket	1	Metro Industries/187-01831-0000

1.4.6 PCMCIA Database Cards

The following is a list of available database cards:

PART NUMBER	DESCRIPTION
071-00162-0101	Americas
071-00162-0102	Pacific International
071-00162-0103	Atlantic International

1.5 Minimum Standard - HSI/CDI/Autopilot Coupled System

KMD 150   Hardware - MOD Standard 00 or above.
            Software - Version 1.06 or above.

1.6 License Requirements

There are no license requirements for the KMD 150 Multifunction Display/GPS.

1.7 Instructions for Continued Airworthiness

FAR Part 25.1529 Instructions for continued Airworthiness is met per the following instructions:

    A.   The removal of the KMD 150 is on condition of failure. There is no required maintenance. Suggested maintenance is covered in Section 1.8 of this manual.

1.8 Suggested Maintenance

A lithium battery is located within the KMD 150. It is recommended that this battery be replaced after ten years.

Dispose of Lithium batteries in accordance with applicable federal, state and local regulations. Recycle battery if possible. Lithium batteries are potentially reactive and, if not completely discharged, should be properly managed as a hazardous waste. In the event of battery leakage, avoid contact with corrosive electrolyte contained in battery.

1.9 Reference Documents

006-18220-0000	Pilot's Guide
006-10607-0000	Installation Manual
006-18221-0000	Getting Started Sheet
006-00869-0000	Airplane Flight Manual Supplement – Cessna 182S
006-00775-0000	STC Installation Manual – Cessna 182S

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2. INSTALLATION CONSIDERATIONS

The Installation Kit (P/N 050-03603-0000) includes all the parts required for the KMD 150 with an internal GPS. In the event that the installed 150 internal GPS engine is **not** used, the following parts in the kit will not be required: -

P/N 057-05628-0000 GPS Placard
P/N 030-00101-0002 Panel Mount Plug
P/N 089-08094-0030 Flat Washer
P/N 089-08168-0002 Wave Washer
P/N 090-00019-0007 .438 Retaining Ring

The KMD 150 is supplied complete with a rack mount. The rack includes 6 mounting holes that are clearance for #6 100^0 countersunk screws, it is strongly recommended that all 6 are utilized when installing the rack. With regard to the location of the Rack, the following three points should be considered:

2.1 Air Circulation

The KMD 150 incorporates a cooling fan at the rear, which draws air into the unit down either side of the rack and exhausts the warm air out of the rear. It is recommend that there is at least 4" (100mm) open space at the rear of the unit to allow proper air circulation.

2.2 Compass Safe Distance

The declared compass safe distance is 4" (100mm) for less than a 1^0 deflection.
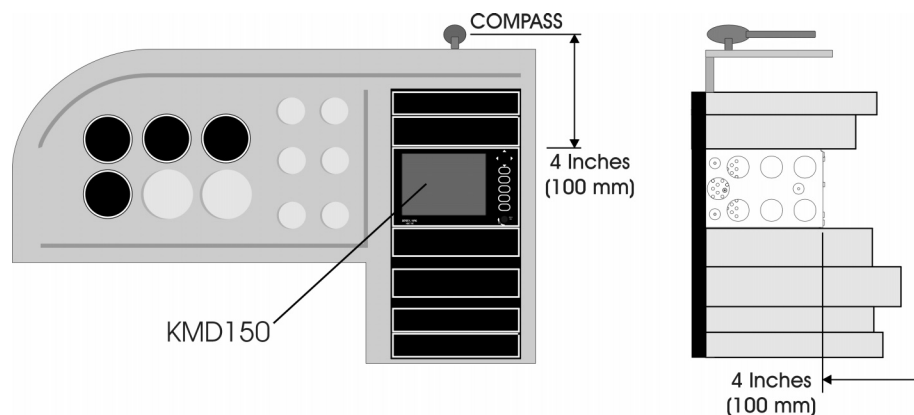
2.3 Viewing Angle

The KMD 150 can be viewed from approximately 30 degrees above the horizontal, and 45 degrees from either side, from below the viewing angle is less than 20 degrees. It is therefore important to ensure that the unit is correctly positioned to allow a clear view from the P1 position.

2.4 Securing into the Rack

Securing the KMD 150 unit in the rack is achieved by self engaging pins and a clamping screw with socket head, located in the lower right hand corner of the unit. The antenna and power / data connections are automatically made once the unit is fitted into the rack and tightened.

2.5 Placards

The KMD 150 is supplied with a placard, advising that the GPS is limited to VFR use only and that it is a Class 3 Radio Instrument under the terms of the UK Air Naviga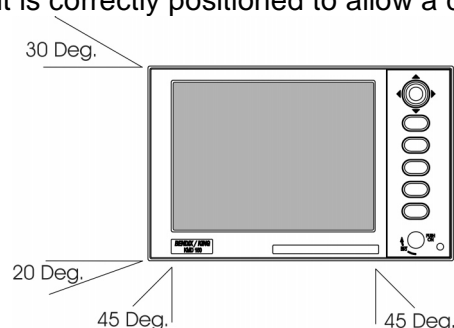tion Order. If the KMD 150 being installed has an internal GPS, this placard should be displayed prominently on or near the equipment. If the operational requirements with regard to placards are different in the geographic region of the installation, use instead placards that meet the national standards of that region. If the KMD 150 contains no internal GPS, the placard included in the installation kit may be discarded.

2.6 VHF Transmission

The KMD 150 GPS receiver is susceptible to signal suppression resulting in loss of 3D FIX at the following frequencies 121.15, 121.175, 121.2, 131.25, 131.275 and 131.3MHz if the aircraft installation does not achieve a 100dB isolation between the GPS receiver and the VHF transceiver. The insertion of Low Pass or Notch Filters should be considered if during post installation fit the GPS receiver exhibits loss of 3D FIX during transmission checks on the VHF Comms. At all other frequencies in the VHF communications band there are no adverse affects to the GPS from transmissions.

2.7 Antenna Considerations

The KMD 150 is designed to work with a Bendix King KA 92 Antenna. The installer will need to supply M17/60-RG142 (MIL-C-17G) or equivalent (eg RG400/U) cable to mate with kit supplied connectors.

The antenna should be mounted on top of the fuselage near the cockpit. Avoid mounting the antenna near any projections, the propeller, and the T-tail of the aircraft, where shadows could occur. It is recommended that there be a separation of at least 3 ft between the GPS antenna and any VHF Comm antenna on the aircraft. The antenna baseplate must be level within $\pm 5°$ in both axes when the aircraft is in level flight. If the antenna is tilted more than $\pm 5°$ or is mounted close to other objects that shadow it, loss of some of the satellites will occur and system performance may be degraded. Antenna cable and connector information, including vendor information, is listed in the following table. Refer to Figure 2-2 and 2-3 (TNC) and Figure 2-4 (BMA) for cable/connector assembly instructions for the 0 to 40 feet category using RG 400/U or RG 142B/U. Refer to Figure 2-5 for the 0 to 80 feet and 80 to 100 feet categories.

NOTE

KA 92 nominal gain and noise figures are 2.3 dB. With .050" ice on the antenna, gain will not decrease by more than 2.0 dB when viewing a satellite from 30° above the horizon to zenith, as compared to a no ice condition.

CABLE LENGTH	CABLE PART NUMBER	BMA CONNECTOR	TNC CONNECTOR	MAX. ALLOWABLE LOSS (dB)
0 to 40 ft.	P/N: 024-00002-0000 VPN: RG142B/U	P/N: 030-00101-0002 VPN: TED Mfg. 9-30-10	P/N: 030-00134-0000 VPN: TED Mfg. 5-10-30	8.0
	P/N: 024-00051-0060 VPN: RG400/U	P/N: 030-00101-0002 VPN: TED Mfg. 9-30-10	P/N: 030-00134-0000 VPN: TED Mfg. 5-10-30	8.0
0 to 80 ft.	P/N: 024-00072-0000 VPN: ECS 311601	P/N: 030-00452-0000 VPN: TED Mfg. 9-30-26	P/N: 030-00108-0002 VPN: TED Mfg. 5-10-307	8.0
0 to 100 ft.	P/N: 024-00071-0000 VPN: ECS 311201	P/N: 030-00452-0001 VPN: TED Mfg. 9-30-25	P/N: 030-00108-0003 VPN: TED Mfg. 5-10-306	8.0

100 to 165 ft.   Contact TED, ECS or PIC for complete cable/connector assembly.

TED Manufacturing Corp.
11415 Johnson Drive
Shawnee, Kansas 66203
Tel: (913) 631-6211

Electronic Cable Specialists (ECS)
11227 W. Forest Home Avenue
Franklin, Wisconsin 53132
Tel: (800) ECS-WIRE
  or (414) 421-5300

PIC Wire and Cable
N63 W 22619 Main Street
P.O. Box 330
Sussex, Wisconsin 53089
Tel: (800) 742-3191
  or (414) 246-0500

2.7.1 Antenna Mechanical Installation

2.7.1.1 Installation Procedure

A. Using the correct template for the antenna chosen, mark the mounting holes on the aircraft fuselage. Refer to Figure 2-8 and 2-9.

B. Drill and/or punch the required holes.

C. Use a piece of fine sandpaper or emery cloth to sand the area on the fuselage skin on which the backing plate for the antenna is to be mounted and on the aircraft skin under where the antenna will be mounted.

D. Apply Alumiprep No. 33, P/N 016-01127-0000, to both the inside and outside areas of the fuselage and to the back of the doubler plate. Follow the directions on the container to cleanse the metal of any left over residue.

E. Apply Alodine, P/N 016-01128-0000, to both locations following the directions on the container. This is used to ensure good bonding of the antenna and to prevent oxidation.

F. Refer to Figure 2-8 and 2-9 for the KA 92 installation drawing and mount the antenna as shown. It is imperative that the backing plate and the conductive gasket make a good electrical bond with the aircraft skin.

G. When installing the KA 92 antenna, do not exceed 50 inch/lbs of torque on the antenna mounting screws.

H. Apply a bead of sealant around the base of the antenna and seal the antenna mounting screw holes to prevent water damage.

2.8 System Assembly

2.8.1 Rack Assembly

Prior to fitting the rack into the aircraft panel, the cable bundle must be connected to the 37 Pin D Type connector and the connector must then be secured to the rear of the rack. This is achieved by bringing the cable bundle up through the D Type Shell and installing the crimp contacts to the cable ends. Refer to Figure 2-1.

Push the crimp contacts into the appropriate holes in the D type socket housing. Slide the D Type shell up over the socket housing and tighten the cable clamp. Offer the entire D Type assembly up to the rear of the rack. Ensure that it is the correct way up to mate with the main unit and pass the two #4 screws through the rack back panel into the D Type shell and tighten to clamp the assembly together. Use only the number of contacts required for the particular installation. Thirty-seven (37) contacts are supplied, more are available if required.

Finally, secure the complete rack assembly into the panel of the aircraft using all six mounting points.

2.8.2 KMD 150 Installation

Once the Rack and electrical back plane connections are installed in the aircraft, slide the KMD 150 unit into the rack. Ensure that the unit slides in smoothly and that the two locating pins at the rear of the unit mate correctly with the guide holes in the rear of the Rack. If the assembly is tight, remove the KMD 150 and inspect the Rack for squareness. Also inspect the mounting screws/bolts to ensure that they do not protrude into the engagement zone of the KMD 150.

Once any adjustments are completed to ensure a smooth fit into the Rack, finally install the KMD 150 by sliding the unit in until contact is made by the pins and then push the unit firmly into the rack until fully engaged.

Note: Ensure during this action that the floating BNC connector is pointing straight out of the back of the Rack. Twisting the BNC cable to the left/right or up/down can cause problems with engagement and damage the BNC connector.

To secure the KMD 150 in place, tighten the Hex Head Screw (3/32) in the lower right hand side of the front panel until the unit is firmly in place and the screw is secure.
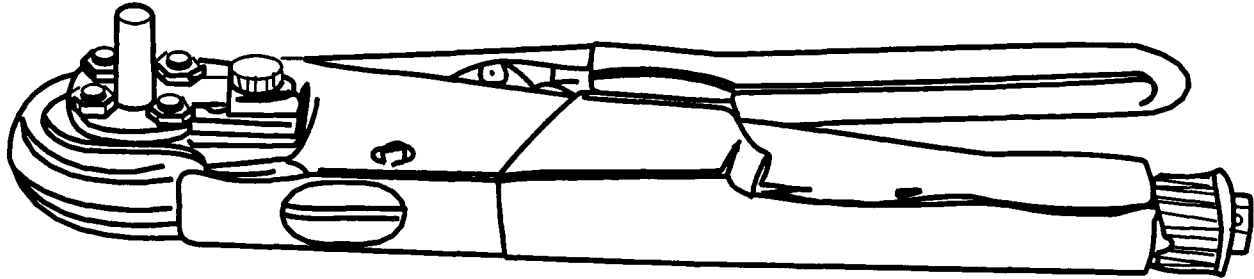
CRIMPING TOOL P/N: 005-02012-0021
BUCHANAN P/N 612118
POSITRONIC P/N: 9508

POSITIONER P/N: 005-02012-0023
BUCHANAN P/N 612513
POSITRONIC P/N: 9502-7

INSERTION/EXTRACTION TOOL P/N: 005-02012-0025
AMP P/N 91067-2
MIL SPEC P/N: M24308/18-12

Figure 2-1 Crimping and Insertion/Extraction Tools

WASHER   CLAMP   TEFLON SHOULDER WASHER   TEFLON INSULATOR

NUT   GASKET   METAL SHOULDER WASHER   MALE CONTACT   PLUG BODY

−0000 STRAIGHT CONNECTOR

−0001 RIGHT ANGLE CONNECTOR

Place nut and gasket, with "V" groove toward clamp, over cable and cut jacket to dimension shown.

$\frac{5}{16}"$

Comb out braid and fold out. Cut cable dielectric to dimension shown. Tin center conductor, using minimum amount of heat.

$\frac{3}{16}"$

Pull braid wires forward and taper toward center conductor. Place clamp over braid and push back against cable jacket.

Fold back braid wires as shown, trim to proper length and form over clamp as shown. Slip metal shoulder washer and teflon shoulder washer over center conductor and teflon insulator. Solder contact to center conductor, avoiding excessive heat which might swell cable dielectric. Slip teflon insulator over contact.

$\frac{1}{8}"$

Insert prepared cable termination into connector body. Make sure sharp edge of clamp seats properly in gasket. Tighten nut.

**Figure 2-2 KA 92 Antenna TNC Connector Assembly (Male Contact Type Connector)
RG 142B/U or RG 400 0 to 40 ft. Length Installation
Connector P/N 030-00134-0000/0001**

Place nut and gasket, with "V" groove toward clamp, over cable and cut jacket to dimension shown.

0.550

Comb out braid and fold out. Cut cable dielectric to dimension shown. Tin center conductor, using minimum amount of heat.

3/16

Pull braid wires forward and taper toward center conductor. Place clamp over braid and push against outer jacket of cable.

Fold back braid wires as shown, trim to proper length and form over clamp as shown.

0.150

Insert prepared cable termination into connector body until center conductor is completely into slot of contact, tighten cable nut and solder center conductor. Insert insulator into connector body as shown in upper figure. Insert end cap and tighten completely.
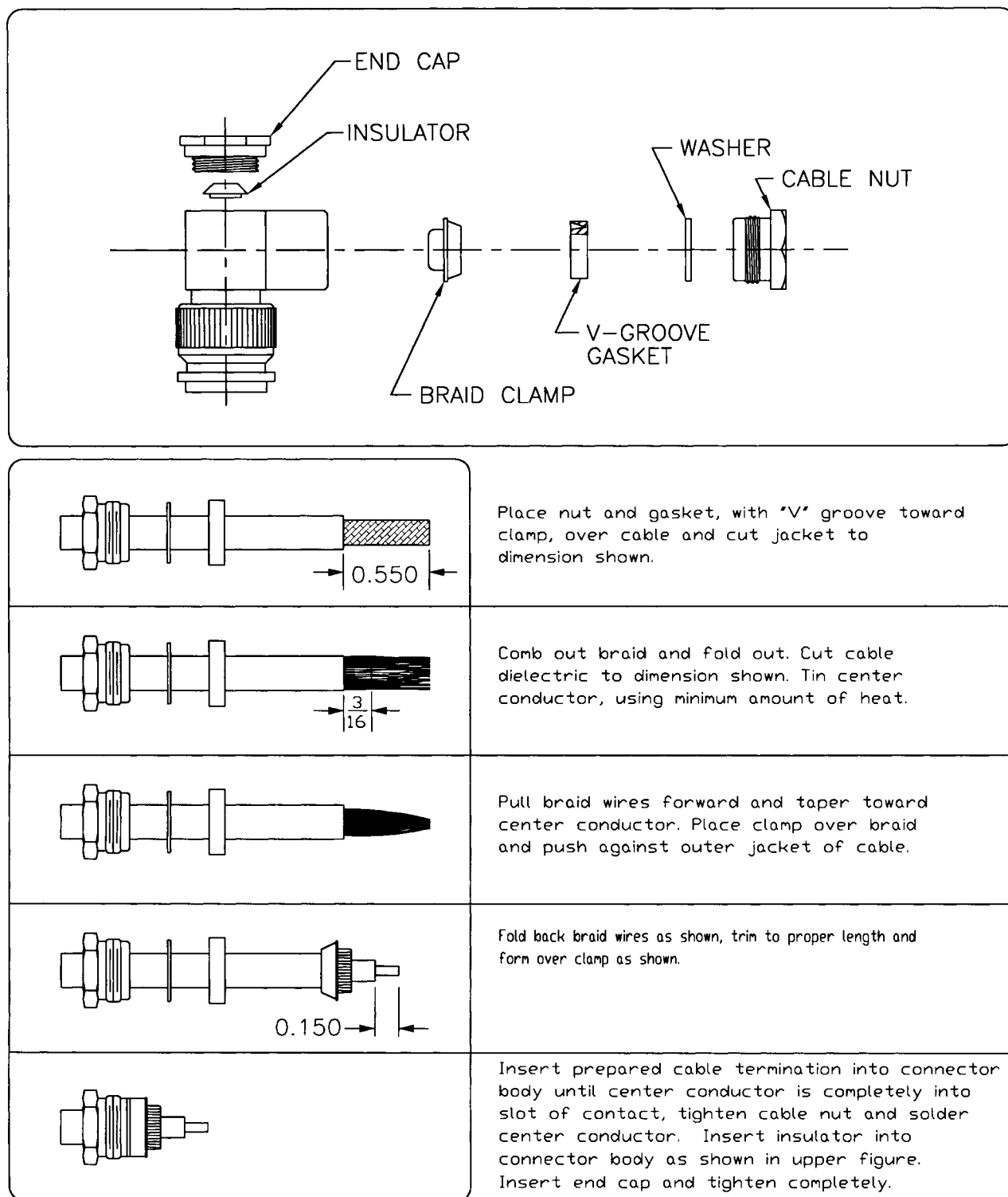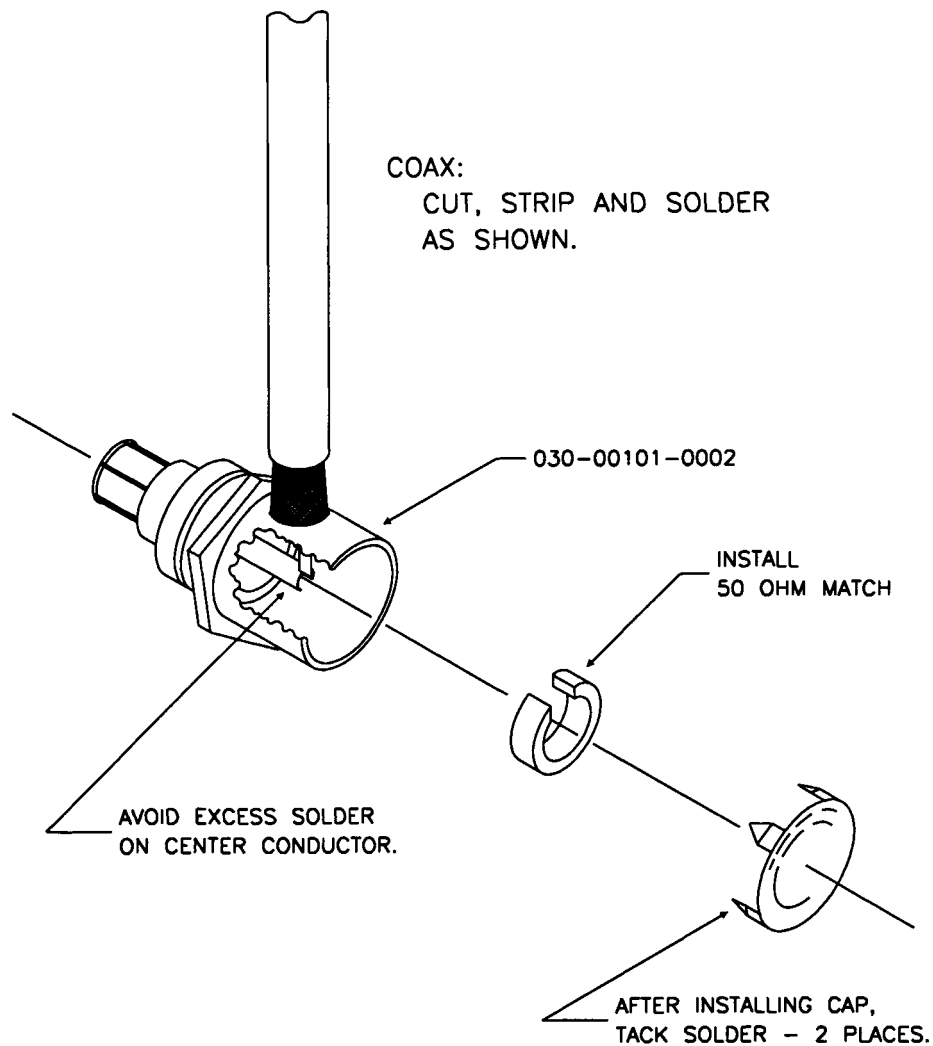
Figure 2-3 KA 92 Antenna TNC Connector Assembly (Without Male Contact)
RG 142B/U or RG 400 0 to 40 ft. Length Installation
Connector P/N 030-00134-0000/0001

COAX:
   CUT, STRIP AND SOLDER
   AS SHOWN.

030-00101-0002

INSTALL
50 OHM MATCH

AVOID EXCESS SOLDER
ON CENTER CONDUCTOR.

AFTER INSTALLING CAP,
TACK SOLDER – 2 PLACES.

NOTES:

1. WHEN SOLDERING, AVOID APPLYING EXCESS HEAT TO
   CONNECTOR BODY, HEAT SINK SPRING CONTACTS, AND
   CENTER CONDUCTOR INSULATOR.

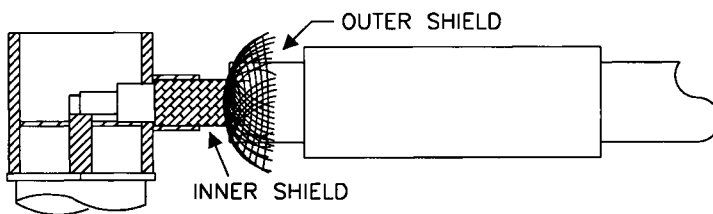**Figure 2-4 KMD 150 Right Angle Rack Connector Assembly
RG 142B/U or RG 400 0 to 40 ft. Length Installation
Connector P/N 030-00101-0002
(Sheet 1 of 2)**
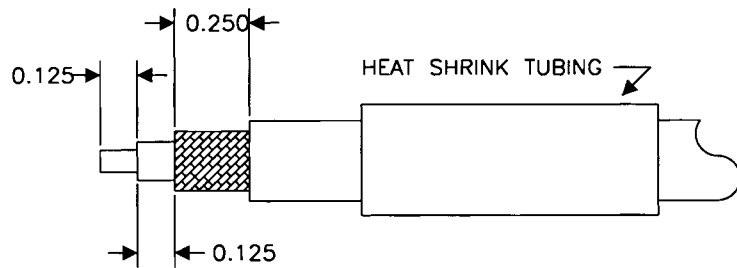
1. STRIP RG-142B/U
   (P/N 024-00002-0000)
   AND PLACE 1" HEAT SHRINK
   TUBING (P/N 150-00025-0010)
   OVER COAX.

2. SOLDER CENTER CONTACT AND
   SOLDER INNER SHIELD INSIDE.
   SEE NOTE 1.

3. SOLDER OUTER SHIELD OUTSIDE.
   SEE NOTE 1.
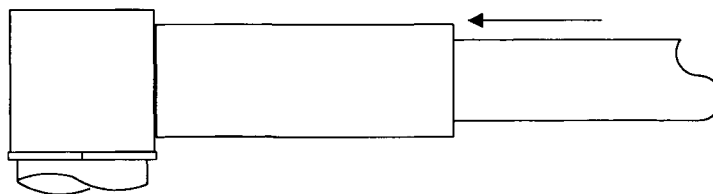
4. SLIDE HEAT SHRINK TUBING
   FORWARD (FLUSH WITH CONNECTOR)
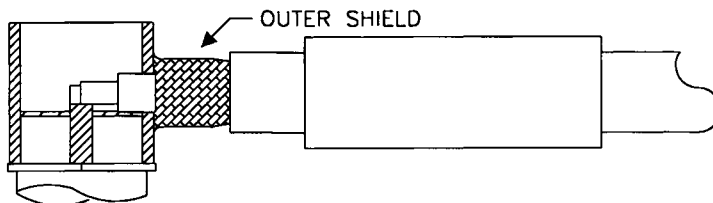   AND ADD HEAT TO SHRINK
   THE TUBING.

**Figure 2-4 KMD 150 Right Angle Rack Connector Assembly
RG 142B/U or RG 400 0 to 40 ft. Length Installation
Connector P/N 030-00101-0002
(Sheet 2 of 2)**

SPLIT 4 PLACES

0.675

0.250

0.050

0.350

CABLE NUT

BRAID CLAMP

CONTACT ASS'Y

BUSHING

SOLDER
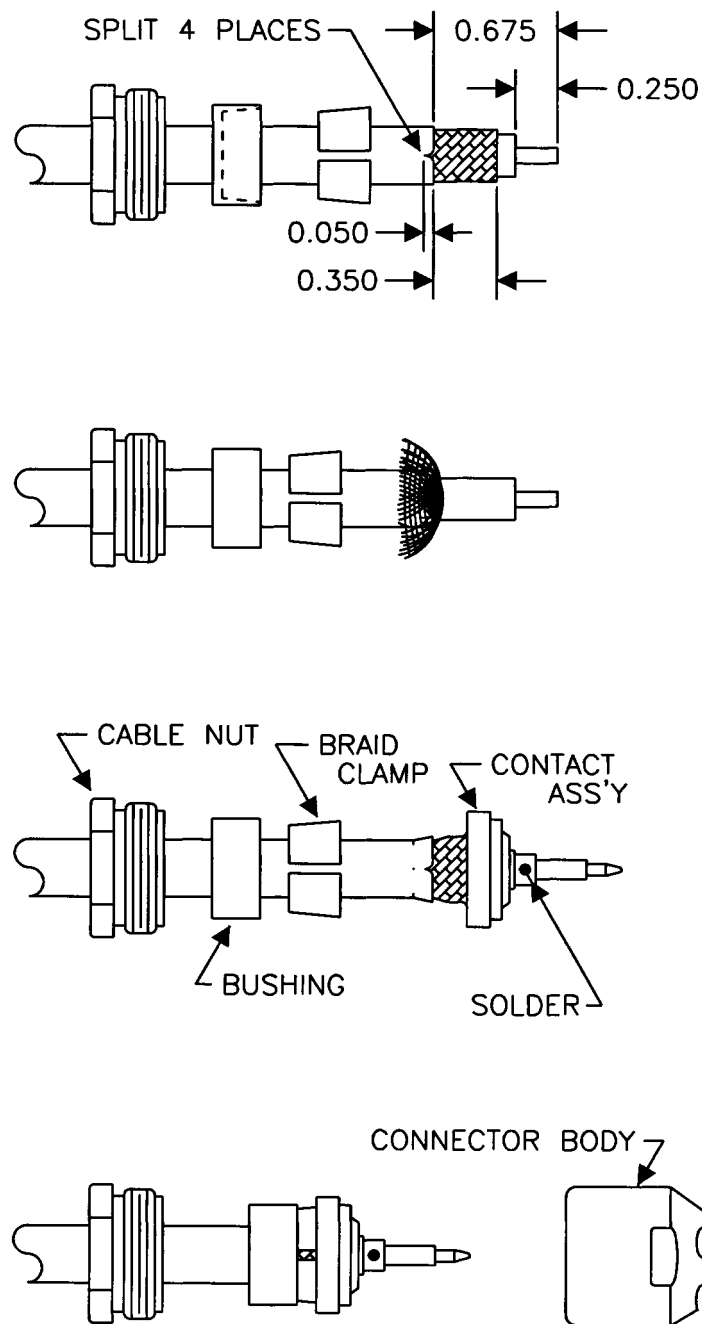
CONNECTOR BODY

Figure 2-5 KA 92 Antenna TNC Connector Assembly
RG 142B/U or RG 400 0 to 80 ft. and 0 to 100 ft. Length Installation
For Cable P/N 024-00071-0000 and 024-00072-0000
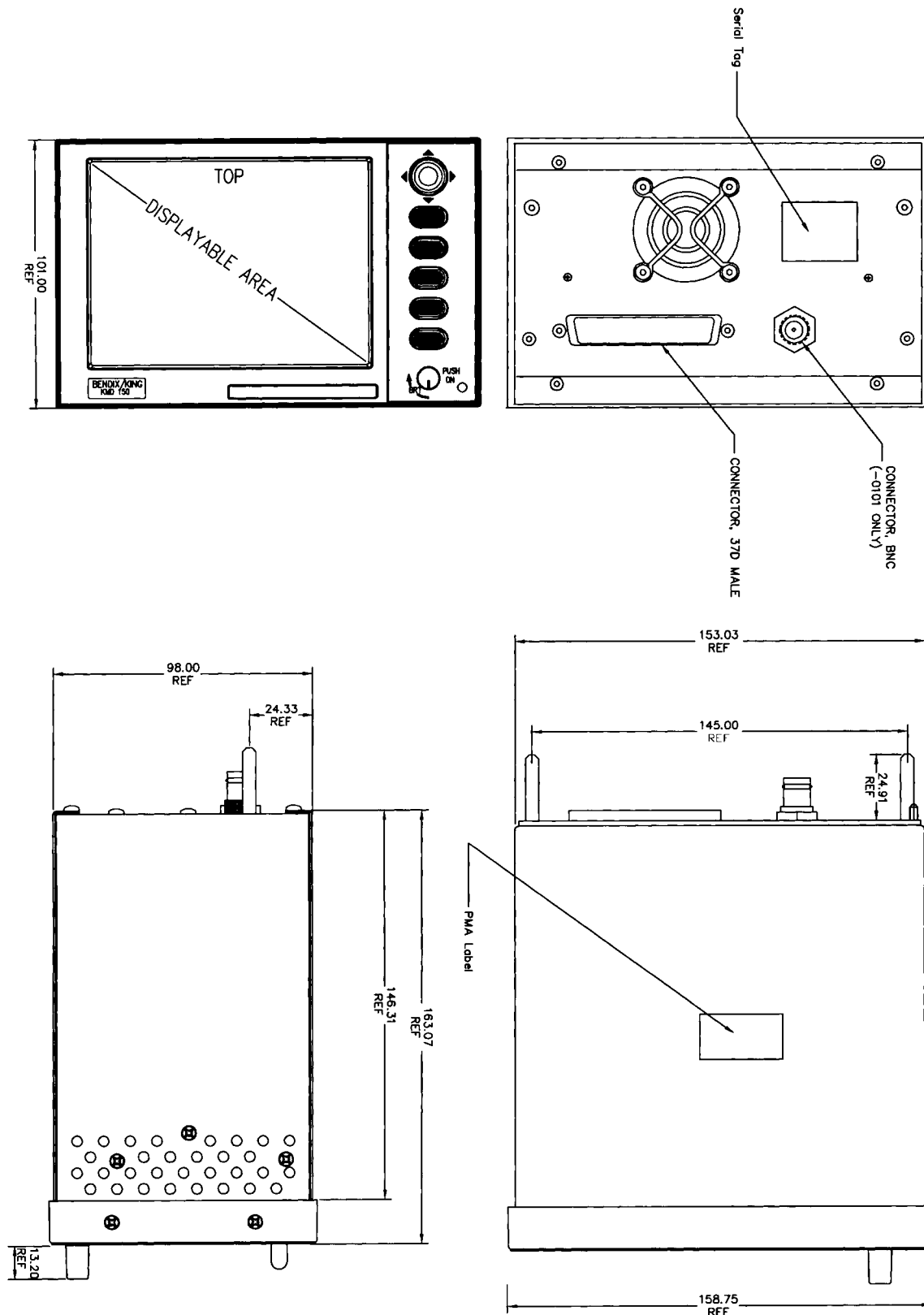
Note: Dimensions are in millimeters
± 0.8 mm

**Figure 2-6 KMD 150 Outline and Mounting
Drawing Number 066-01174-0000 R1**
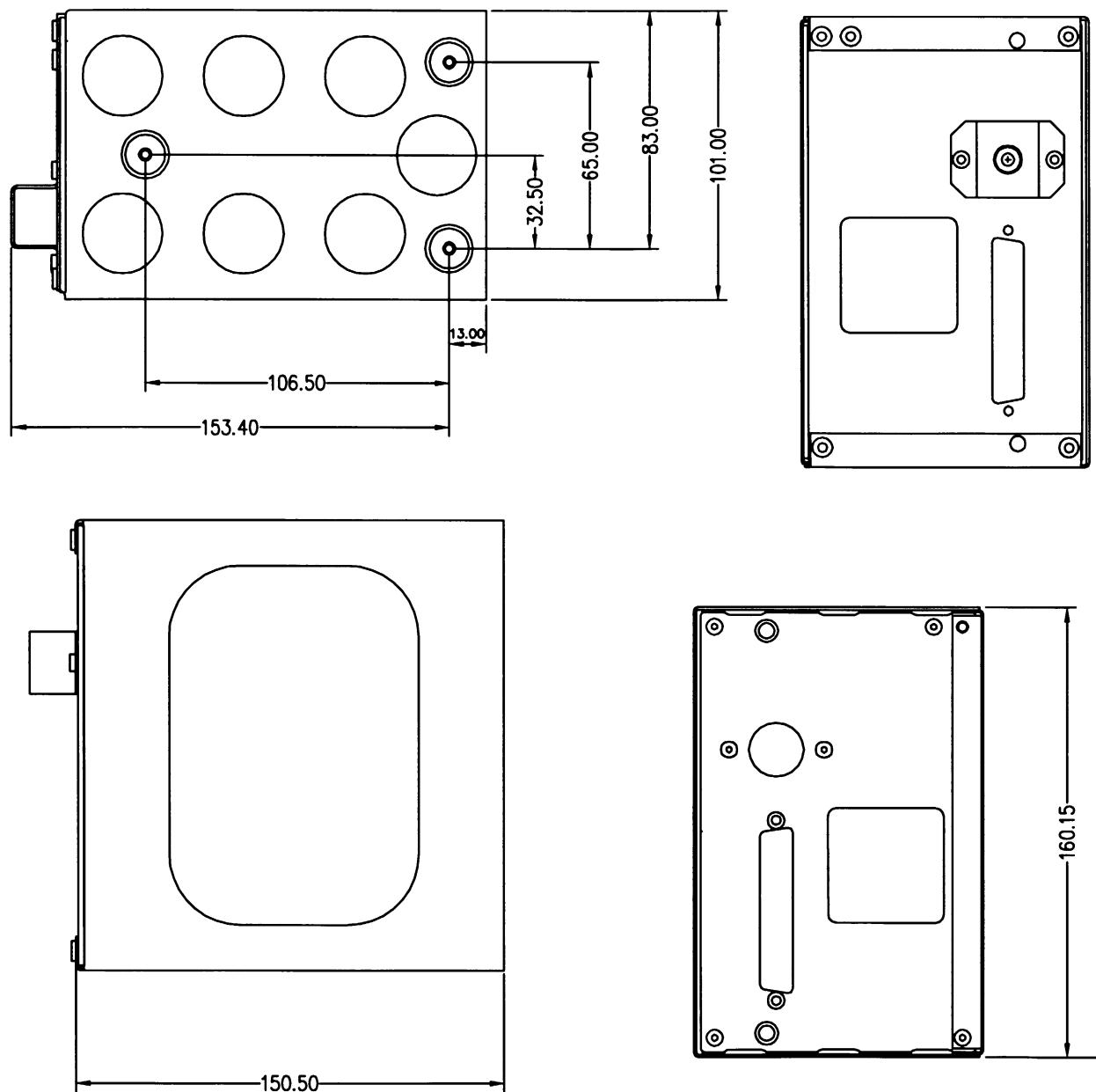
If rack assembly is engraved with number 243099, see manual part number 006-00775-0000 for proper drawing.

Note: Dimensions are in millimeters
± 0.8 mm

Figure 2-7 Mounting Rack Outline and Mounting
Drawing Number 047-12541-0000 R0
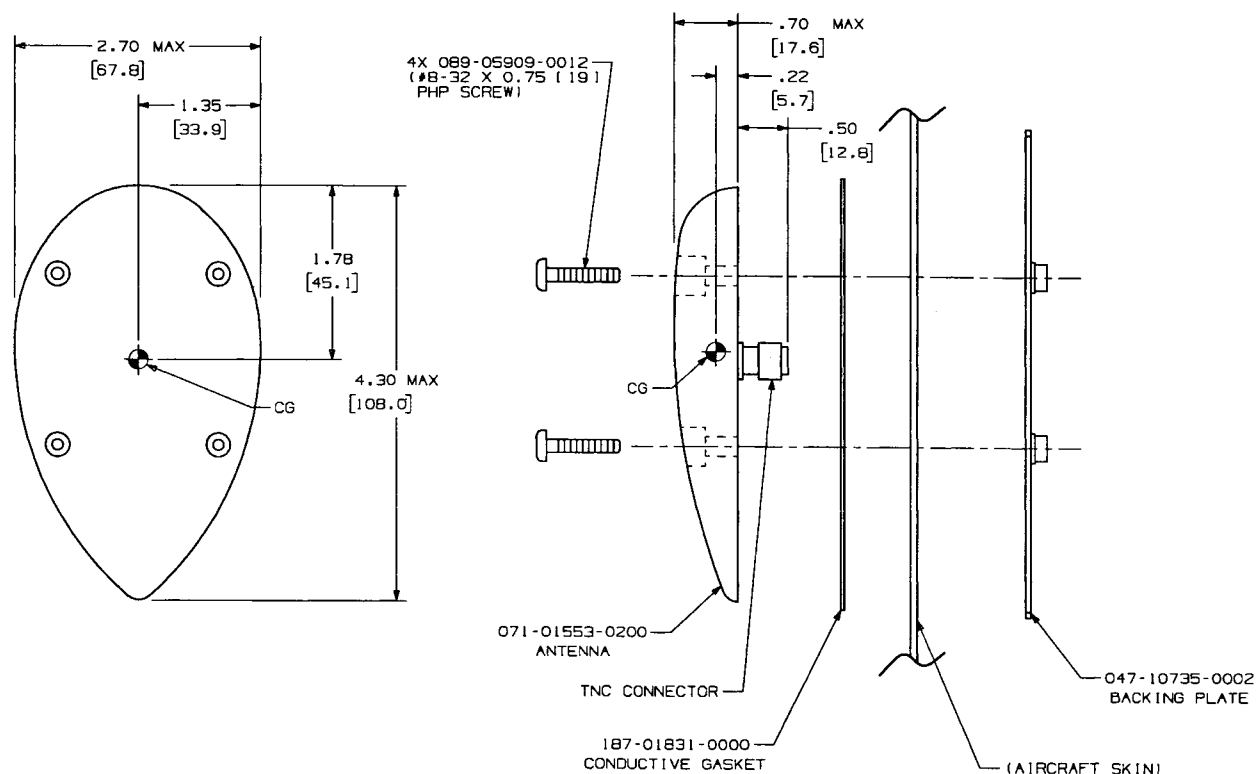
NOTES UNLESS OTHERWISE SPECIFIED:
1. REMOVE PAINT IN AREA OF ANTENNA INSTALLATION.
2. DIMENSION IN INCHES [MILLIMETERS]
3. FOR BEST PERFORMANCE, BOND BETWEEN AIRCRAFT AND
   ANTENNA TO BE 10 MILLIOHMS RESISTANCE OR LESS.
4. UNIT WEIGHT IS .27 LBS [.12 KG]
5. APPLY WHITE RTV SEALANT AROUND BASE OF
   INSTALLED ANTENNA. FILL MOUNTING SCREW HOLES WITH RTV SEALANT.
   (KPN 016-01129-0000 OR EQUIVALENT)
6. ANTENNA SHOULD BE MOUNTED LEVEL ±5° WITH AIRCRAFT
   AT LEVEL FLIGHT ATTITUDE.
7. DO NOT PAINT ANTENNA.
8. AIRSPEED RATING 600KTS MAX TAS.

Figure 2-8 KA 92 Antenna Outline and Mounting Diagram
Drawing Number 155-06019-0000 Rev 2 (Sheet 1)

3.00
[76.2]

1.62
[41.3]

.81
[20.7]

4X ∅ .25
[6.4]

∅ 1.00
[25.4]

5.00
[127.0]

1.75
[44.4]

.75
[19.1]

2.50
[63.5]

DIMENSION IN INCHES [MILLIMETERS]

1.50
[38.1]

MOUNTING PATTERN

Figure 2-9 KA 92 Antenna Mounting Pattern
Drawing Number 155-06019-0000 Rev 2 (Sheet 2)

The following diagram shows a full installation of the KMD 150 wired to use both internal and external GPS and Stormscope.
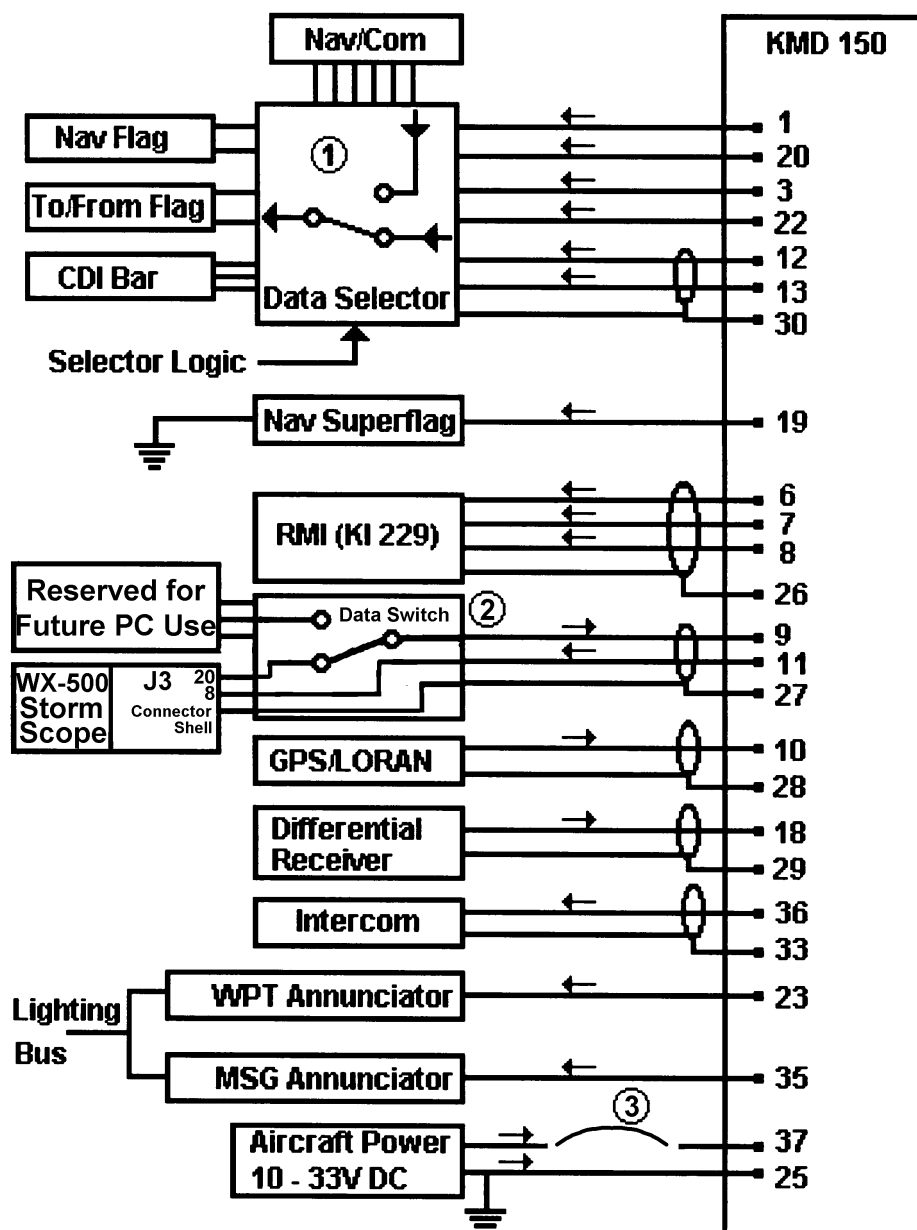
Notes:
1. The data selector shown schematically assumes that the KMD 150 will be coupled such as to allow conventional NAV instruments to be switched via a changeover relay with the fail safe to the NAV instruments for IFR use.

2. The Data Switch is optional and allows for installation of a panel-mounted connector for future use with a laptop computer.

3. The maximum power consumption is 20W. It is recommended that the unit be connected to aircraft power through a 3 amp circuit breaker for a 28 VDC system or a 5 amp circuit breaker for a 14 VDC system.

Figure 2-10 Connector Schematic

2.9 Electrical Inputs/Outputs
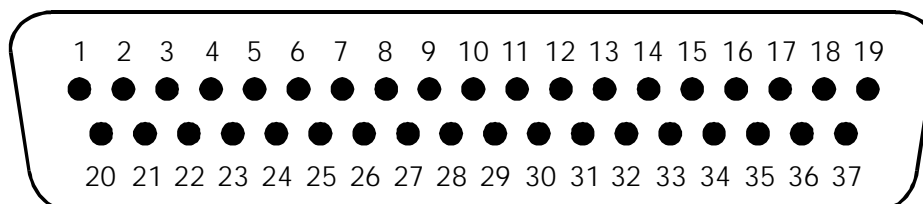
2.9.1 Connector Pin Functions

This section provides pin out details and the input and output standards for the Avionics Interface element of the KMD 150 unit.

Pin	Definition.	Notes.
1	CDI Flag (negative)	Use with pin 20.
2	Reserved	Do not use
3	From Flag (positive).	Use with pin 22.
4	Reserved	Do not use
5	Reserved	Do not use
6	OBI/RMI Sync.	Use with pins 7,8 & 26.
7	OBI/RMI Clock.	Use with pins 6,8 & 26.
8	OBI/RMI Data.	Use with pins 6,7 & 26.
9	Stormscope Serial Data in.	Use with pin 27.
10	GPS Serial Data in.	Use with pin 28.
11	RS 232 / Stormscope Serial Data out.	Use with pin 27.
12	CDI D-Bar Left (positive)	Use with pins 13 & 30.
13	CDI D-Bar Right (positive)	Use with pins 12 & 30.
14	Reserved	Do not use
15	Reserved	Do not use
16	Reserved	Do not use
17	Reserved	Do not use
18	Differential GPS correction input.	Use with pin 29.
19	Nav Superflag High.	Use with aircraft ground.
20	CDI Flag (positive)	Use with pin 1.
21	Reserved	Do not use
22	To Flag (positive)	Use with pin 3.
23	Waypoint Annunciator Low.	Use with aircraft supply.
24	Reserved	Do not use
25	Aircraft Ground (negative supply)	Main aircraft ground.
26	OBI/RMI output cable shield.	Use with pins 6,7 & 8.
27	Stormscope Serial Data in ground.	Use with pin 9.
28	GPS Serial Data in ground.	Use with pin 10.
29	Differential data input ground.	Use with pin 18.
30	CDI D-Bar shield.	Use with pins 12 & 13.
31	Reserved	Do not use.
32	Spare Ground.	Spare Ground.
33	Audio Out ground.	Use with pin 36.
34	Reserved for ARINC 429 In shield.	Use with pins 16 & 17.
35	Message Annunciator Low	Use with aircraft supply.
36	Audio Out.	Use with pin 33.
37	Aircraft Power (+10v to +33v)	Main power in.

```
  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 17 18 19
  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●
    ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●  ●
   20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
```

View of 37 Pin Connector from the rear of the unit

2.9.2 Electrical Outputs.

Set up tests refer to settings on screen 37 (output test screen) of the KMD 150.

1. **CDI** pins 12 & 13. Analog D-Bar fly left/right. Capable of driving up to three 1000ohm parallel loads. +/- 150mV FSD.

    Pin 12. D-Bar left+ Voltage swings +/- 300mV with respect to (wrt) pin 13.

    Set up tests.
    CDI centered   pin 12 output =   0V wrt pin 13.
    CDI FSD left   pin 12 output = -150mV wrt pin 13.
    CDI FSD right   pin 12 output = +150mV wrt pin 13.
    CDI MAX left   pin 12 output = - 300mV wrt pin 13
    CDI MAX right   pin 12 output = +300mV wrt pin 13.

2. **CDI flag** pins 20 & 1. Analog output capable of driving up to three 1000ohm parallel loads. High level on pin 20 is 375mV with respect to pin 1, low level on pin 20 is < 40mV with respect to pin 1.

    Set up test. CDI flag in view (no fix):
    Pin 20 sits at < 40mV with respect to pin 1.

    Set up test. CDI flag out of view (fix valid):
    Pin 20 goes up to between 350mV and 900mV with respect to pin 1.

3. **To / From flag** pins 22 & 3. Analog output capable of driving up to three 200 ohm parallel loads. Output on pin 22 is +/- 82mV with respect to pin 3.

    Set up test. Flag out of view
    Output on pin 22 will be <40mV with respect to pin 3.

    Set up test. TO flag in view
    Output on pin 22 will be between +40mV and +160mV with respect to pin 3.

    Set up test. FROM flag in view
    Output on pin 22 will be between -40mV and -160mV with respect to pin 3.

4. **Nav Superflag** pin 19. Analog output capable of driving positive logic Nav Superflag by sinking up to 500mA from the aircraft power input to pin 19.

    Set up test. Nav Superflag active
    Pin 19 will source up to 500mA at aircraft supply voltage.

5. **Waypoint annunciator** pin 23. Analog output capable of driving negative logic annunciator by sinking up to 500mA from aircraft supply down pin 23.

    Set up test. Arrival Alarm on.
    Pin 23 will sink up to 500mA from the aircraft supply.

6.   **Message annunciator** pin 35.   Analog output capable of driving negative logic message annunciators by sinking up to 500mA from aircraft supply down pin 35.

    Set up test. Message Alarm on.
    Pin 35 will sink up to 500mA from the aircraft supply.

7.   **OBI/RMI data** pins 6, 7 & 8.   Output providing bearing to waypoint data for a Bendix/King RMI (KI 229 or equivalent).

    The OBI/RMI data output from the Color Skymap comprises three digital lines, clock (pin 7), data (pin 8) & sync (pin 6).   All lines are open collector pull down.

    In the OBI/RMI receiver the three lines are pulled up to 9 volts (+/- 15%) through 2K resistors. The three outputs from the Color Skymap are open collector transistor outputs.

    Set up test.
    Can only be tested when connected to an RMI.   Test for correct operation.

8.   **Message audio output** pin 36.   This is an audio output capable of driving 10mW into 600 ohms at 2KHz.   This output is designed to interface to the aircraft intercom.

    Set up test. Message Audio On.   A 2kHz tone will be heard in the headset.

9.   **Stormscope / RS232 Serial Data Output.**   Pin 11.   This output is for outgoing serial data or control data to a Stormscope WX-500 (if fitted) and is RS 232C compatible.

2.9.3 Electrical Inputs.

1.   **Stormscope Serial Data Input**.   Pin 9.   This input is for incoming Stormscope WX-500 serial data and is RS 232C compatible.

2.   **GPS Serial Data input.**   Pin 10.   This input is for incoming serial data from an external GPS and is RS232C, RS422 and NMEA compatible.

3.   **Differential GPS Correction Data Input.**   Pin 18.   To operate correctly in differential mode, the KMD 150 requires a 9600 baud RTCM SVC-104 Version 2.0 format sentence.

3. POST INSTALLATION CHECKOUT

Once the system is installed in the aircraft rack, ensure that the PCMCIA card is installed in the slot provided below the display. Energize the unit from the ON/OFF switch located on the lower right hand side of the display by pushing it in and rotating it fully clockwise for full brightness. Ensure that the initial BENDIX/KING header screen comes up. For some of the following tests the aircraft should be located outside with a clear view of the horizon to be able to acquire satellites. The following chart shows the structure of options used in the tests performed in Section 3.1.
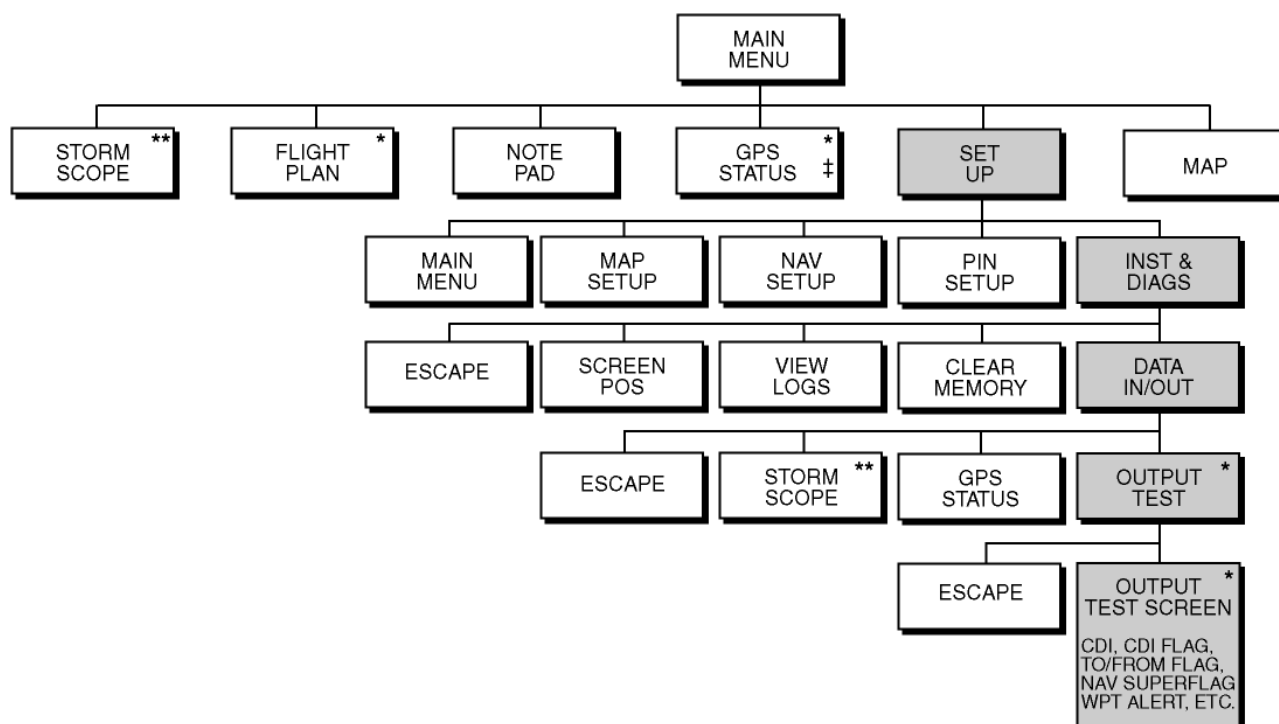
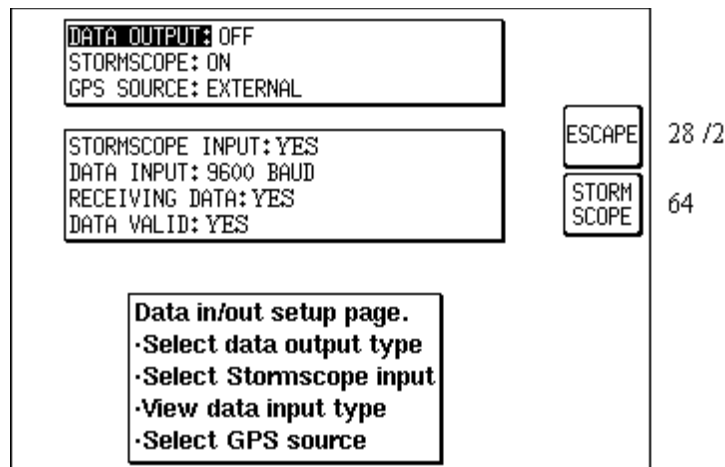* Available only if KMD 150 is set for internal GPS. ** Available only if Stormscope is set to ON. ‡ Displayed only if Stormscope is set to OFF.

Most settings and selections on the setup and test screens are made using the joystick e.g. the setting up of GMT, the testing of CDI output etc. These tests and/or setup activities can be achieved by toggling the joystick UP/DOWN and LEFT/RIGHT to move the cursor and adjust values.

3.1 Setup

Following the path illustrated in the previous diagram, press SET UP followed by INST & DIAGS (Installation and diagnostics) followed by DATA I/O

3.1.1 Data In/Out Screen


```
DATA OUTPUT: OFF
STORMSCOPE: ON
GPS SOURCE: EXTERNAL

STORMSCOPE INPUT:YES          ESCAPE   28 /2
DATA INPUT: 9600 BAUD
RECEIVING DATA:YES            STORM    64
DATA VALID:YES                SCOPE

         Data in/out setup page.
         ·Select data output type
         ·Select Stormscope input
         ·View data input type
         ·Select GPS source
```

Screen 35: Data Input/Output Setup and Test Screen

On entry to this Screen, details of the current settings for data output are displayed in the top box and a cursor is positioned over the words DATA OUTPUT. Settings for data output can be adjusted using the joystick and the options available are as follows. (The default settings are listed first.)

External GPS Source selected: DATA OUTPUT: OFF / ECHO INPUT.
Internal GPS Source selected: DATA OUTPUT: OFF / RS232 (AR NAV) / NMEA 0183

Data output when using an external GPS receiver is limited to echoing the data input. This provides a useful RS232 buffer for connecting other listening devices to the host GPS data output.

KMD 150 with GPS can output standard aviation RS232 data or NMEA 0183 format RMC and GGA sentences at 9600 baud. See Appendix 1 for full details.

Below the DATA OUTPUT setting is the STORMSCOPE setting. If the KMD 150 is interfaced to a BFGoodrich WX-500 Stormscope sensor, this option should be selected to ON. If selected ON, Key 2 will be labeled STORMSCOPE and will give access to screen 64, the Stormscope diagnostics cover page. See Section 3.4 for all Stormscope related functions**. If you do not have a Stormscope connected, ensure this option is switched off.**

Below the STORMSCOPE setting is the GPS SOURCE setting. This allows you to use either the KMD 150's internal GPS receiver (if fitted) or an external GPS receiver. When you move the cursor to the right of this field the following Warning / Confirmation request will be displayed:

Screen 35B: GPS Source Change Warning Screen

If you press ESCAPE, the GPS source remains unchanged. If you press Yes, you can then use the joystick to toggle the GPS SOURCE between INTERNAL and EXTERNAL. When set to INTERNAL, the internal GPS receiver will be used. When set to EXTERNAL, the KMD 150 will use data generated by an external GPS receiver. Please note if you are installing a non-GPS version of the KMD 150, the internal option will not be available.

When KMD 150 is used with an external GPS source, the data output will be limited to OFF and ECHO INPUT.

The second box is for information only and will only appear if the GPS SOURCE is set to EXTERNAL or if the Stormscope interface is switched ON. If the Stormscope interface is switched on, the presence of incoming Stormscope data is indicated by the word YES next to the STORMSCOPE INPUT: heading.

3.1.2 External GPS Data Input Option.

If you are installing the non-GPS version of KMD 150 or as an alternative to using the internal GPS receiver, an external GPS is to be used, the KMD 150 requires a data input to function in Map Mode. To operate correctly the KMD 150 requires a 9600 baud Trimble TNL, Garmin AIU or King equivalent ARNAV R-30 sentence. Alternatively a 4800 or 9600 baud NMEA 0183 data sentence containing latitude, longitude, track, ground speed and variation information with an RMC header may be used.

Once the physical connection to the host GPS has been made, **it is essential to select an appropriate data output on the host unit.** This can be done by referring to the manual for the host GPS and choosing an option that corresponds to one of the compatible data input types listed above.
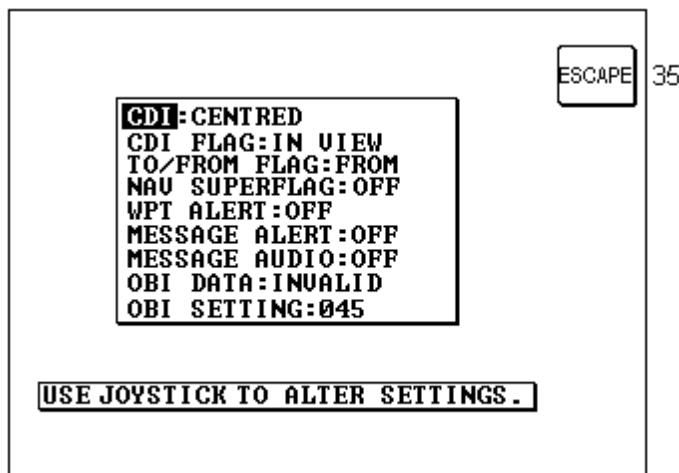
If the host GPS is correctly connected, switched on and outputting data, the KMD 150 will automatically start to read and decode the incoming data. There is no need to set an input type on the KMD 150 as this is done automatically.

After a few seconds if data is being received, the word YES will appear next to the RECEIVING DATA: heading. The type of data being received will then be displayed beside the DATA INPUT: heading.

If the data being received contains valid fix information (i.e. the host GPS has a fix) the word YES will appear next to the DATA VALID: heading. Once the unit is receiving and validating the incoming data select ESCAPE and return to the MAIN MENU Screen.

3.1.3 Output Test

If you are installing an Internal GPS version of the KMD 150 and have made connection to other avionics equipment on the aircraft, screen 37 allows you to run some installation tests. Screen 37 is accessed by pressing Key 4 (OUTPUT TEST) on Screen 35. Once the tests are complete, return to screen 35 by pressing key 1 (ESCAPE).

```
                                        ┌────────┐
                                        │ ESCAPE │ 35
                                        └────────┘

        ┌──────────────────────────────┐
        │ CDI :CENTRED                 │
        │ CDI  FLAG:IN VIEW            │
        │ TO/FROM FLAG:FROM            │
        │ NAV  SUPERFLAG:OFF           │
        │ WPT  ALERT:OFF               │
        │ MESSAGE ALERT:OFF            │
        │ MESSAGE AUDIO:OFF            │
        │ OBI  DATA:INVALID            │
        │ OBI  SETTING:045             │
        └──────────────────────────────┘

        ┌──────────────────────────────┐
        │ USE JOYSTICK TO ALTER SETTINGS. │
        └──────────────────────────────┘
```

Screen 37: Aviation Interface Output Test Screen

The following flags and commands can be functioned from the OUTPUT TEST screen:-

CDI
Full Scale (FSD) Left   Ensure CDI is deflected full scale left (5 dots)
Full Scale (FSD) Right   Ensure CDI is deflected full scale right (5 dots)
Centered   Ensure that the CDI is centered

CDI FLAG
In View   Ensure CDI or NAV flag is visible
Out of View   Ensure CDI or NAV flag is not visible

TO/FROM FLAG
TO   Ensure TO flag is visible
FROM   Ensure FROM flag is visible
FLAG OUT OF VIEW   Ensure TO and FROM are not visible

NAV SUPERFLAG
ACTIVE   Ensure Nav Superflag is active
INACTIVE   Ensure Nav Superflag is inactive

WPT Alert

OFF	Ensure the WPT Annunciator is OFF
ON	Ensure the WPT Annunciator is ON

Message Alert

OFF	Ensure the MSG Annunciator is OFF
ON	Ensure the MSG Annunciator is ON

Message Audio

OFF	Check Audio output is OFF
ON	Check Audio outputs is ON

OBI/RMI

VALID	Ensure that OBI/RMI output reads the selected value
INVALID	Ensure that the OBI/RMI is INVALID

OBI SETTING

Set in steps of 45•	Use in conjunction with the above to test OBI/RMI

3.2 Internal GPS Setup and Test

Having established that the various FLAGS and outputs are working correctly, return to screen 35 then select the GPS status screen by pressing key 3 (GPS STATUS). Check that the correct GMT, date, Local Offset etc. are set.
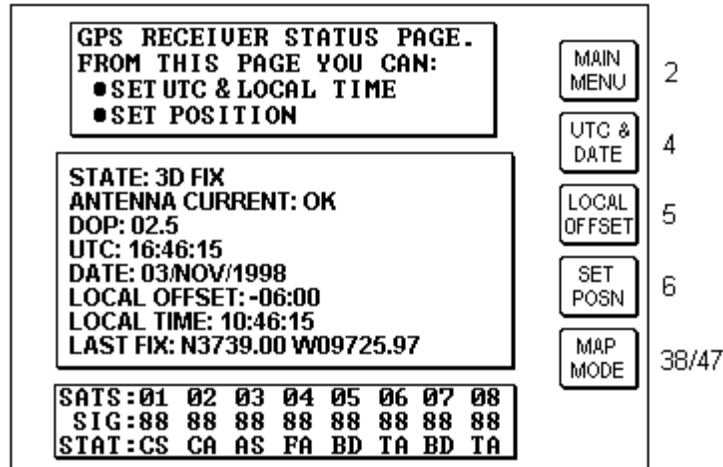
Screen 3: GPS Status Screen

This Screen is only accessible if Internal GPS source is selected.

The GPS Status Screen will display the receiver STATUS. This can be any of the following:

BAD ALMANAC	<3 SATS	DIFFERENTIAL	ACQUIRING
2D FIX	3D FIX	POOR DOP	POS PROP

The meanings of these displays are:

BAD ALMANAC means the GPS receiver's information concerning satellite positions is out of date. If this occurs the unit should be left alone with the antenna connected and in view of the

sky for approximately 15 minutes during which period it will automatically lock onto a satellite and load an up-to-date almanac.

<3 SATS means that according to the current information available, there are less than three satellites in view and a fix can not be calculated. This message is very rarely displayed.

DIFFERENTIAL This word will be displayed in conjunction with 2D FIX or 3D FIX and means that the KMD 150 has a fix and is also receiving differential correction signals from an external source. To operate correctly in differential mode, KMD 150 requires a 9600baud RTCM SVC-104 Version 2.0 format sentence (Refer to the KMD 150 Pilot's Guide for further details concerning differential operation.)

ACQUIRING means the unit is currently searching for satellites or is loading information from one or more satellites.

2D FIX means the unit is calculating position in two dimensions (i.e. latitude and longitude only, with no height information).

3D FIX means that the unit is calculating position in three dimensions and can give latitude, longitude and height information.

POOR DOP means that the unit is unable to calculate position owing to the poor geometry of the visible satellites. (DOP stands for Dilution of Precision.)

POS PROP means that navigation has been temporarily lost and the KMD 150 is dead-reckoning (or propagating) its position based on the last known position, track and ground speed. It will not dead-reckon for more than a few seconds at a time.

Other information which is displayed on this Screen includes:

ANTENNA CURRENT against this heading there will be an indication if the antenna is drawing too much, too little or the correct amount of current. If the indication is <5mA then the antenna is probably open circuit and must be investigated. If the indication is >40mA then the antenna is probably short circuited and must be investigated. If the indication is OK then the antenna is drawing the correct amount of current.

DOP (Dilution of Precision) This is a number between 00.0 and 99.0 that represents the dilution of quality of the calculated fix due to satellite geometry. 00.0 is best, 99.9 is worst. If this figure is greater than 5.0, performance of the system is likely to be degraded because some of the visible satellites appear too close to each other. DOP is calculated from the angular separation between the various visible satellites. Greater separation results in better fix geometry and a lower DOP. (This DOP figure is not measured in any specific units.)

UTC/DATE is Universal or Greenwich Mean Time and Date.

LOCAL OFFSET is the difference between UTC and local time.

LOCAL TIME which is calculated by adding Local Offset to UTC.

LAST FIX. If the unit does not have a current valid fix, this is the position at which it last had a fix. If the unit has a fix, this is the present position.

SATS (eight satellite numbers), **SIGS** (signal strength for each satellite) and **STAT** (status of each satellite).

Each satellite has a PRN (Pseudo Random Noise) or identification number. The satellite PRN numbers are displayed in a line beside the word SATS. The two digit number under each PRN number is an indication of the signal strength being received from that satellite expressed in terms of a percentage. The best is 99 the worst is 00. These numbers can be used for finding and eliminating electrical interference. Readings of 60 and above indicate a good installation.

Under each signal strength number is a two character code. These indicate the status of each satellite. These codes are: CS, CA, AS, FA, BD, MD, TA, EA, and AP. These relate to the eight possible receiver modes and are detailed below.

CS: Code Search. This is the receiver's initial stage in acquiring a satellite. It means that the receiver is trying to match its internal code to the satellite signal.

CA: Code Acquire. This means the satellite code has been received and matched to the receiver-generated code.

AS: AGC Set. This means the satellite strength has been assessed and the Automatic Gain Control has been set.

FA: Frequency Acquire. This means the receiver has correctly locked onto the satellite data frequency.

BD: Bit Sync Detect. This means the receiver is synchronized with the satellite's data bit stream.

MD: Message Detect. This means the receiver is synchronized with the satellite's message stream.

TA: Time Available. This means the satellite is fully locked in and has sent down UTC time and date information to the receiver.

EA: Ephemeris Acquire. This means the receiver is reading the constellation health status message from the satellite. This usually takes around two minutes and is a function that is performed in the background even if the receiver has a fix.

AP: Available for Position. This means the satellite is fully locked in and tested and can be used for calculating position. A minimum of three satellites must be available for a 2D fix.

Key 1 returns to the previous screen. Date, Time, Local Time Offset and Present Position can be adjusted by selecting one of Keys 2, 3 or 4. Direct access to Map Mode is available by pressing Key 5.

When using the KMD 150 for the first time (or after it has been relocated by more than 100 miles since it was last used) set up the present position (to within 50 miles) and ensuring that UTC and Date are correct (to within a few minutes). This will considerably speed up the TTFF (time to first fix). It is not absolutely necessary to do this, since given time, the receiver is capable of working out its own position.

3.2.1 Adjusting Time and Date
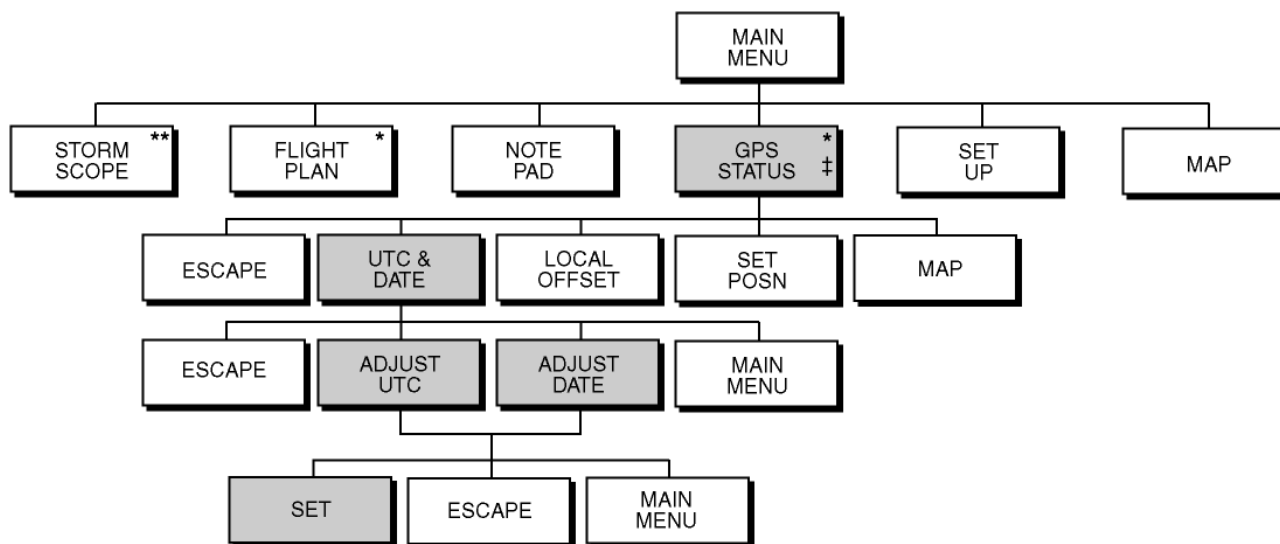
* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.
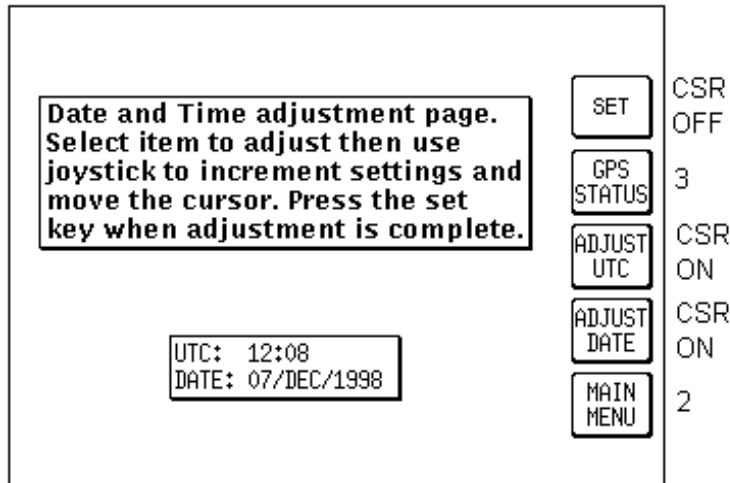

Screen 4: Date and Time Adjustment Screen

Pressing GPS STATUS followed by UTC & DATE accesses this Screen. Pressing Key 3, ADJUST UTC, places a cursor over the first digit of the Hours value on the time display. The value can then be increased or decreased by moving the joystick up or down. Pushing the joystick to the right then moves the cursor to the next digit. Similarly, moving the joystick left can move the cursor back along the data entry field. When the time is adjusted, the information will only be saved if you press Key 1 SET.

Pressing Key 4 puts a cursor onto the Date entry field. The date is adjusted in the same way as time. With the cursor over the Month when the joystick is moved up or down, the first three characters of each month are scrolled together i.e. JAN, FEB, MAR, APR etc. Adjusting the year works in the same way. Your KMD 150 unit is fully Year 2000 compliant. Only after pressing Key 1 SET is the new date saved. The Time and Date will be automatically corrected as soon as the first satellite reaches TA (time available) status. If any satellite is already at status TA or above, user inputs of time and date will be ignored.

3.2.2 Setting Local Time Offset
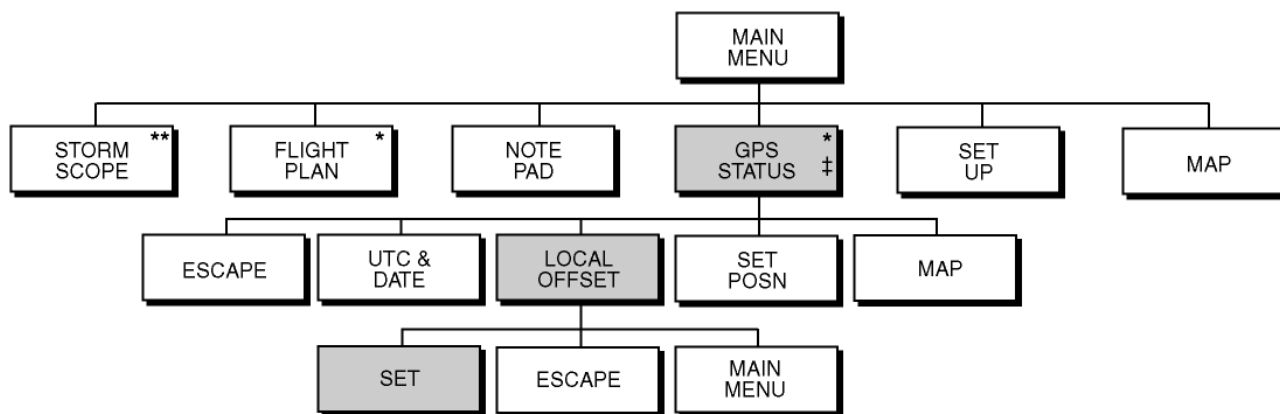
*Available only if KMD 150 is set for internal GPS.   **Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.
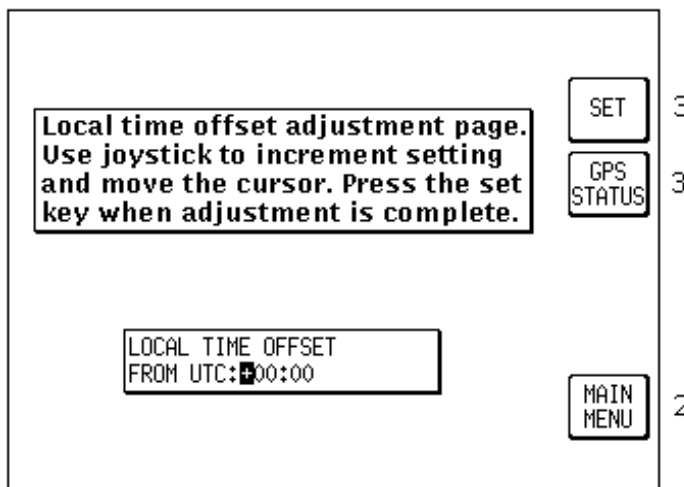

Screen 5: Local Time Offset Screen

Pressing GPS STATUS followed by LOCAL OFFSET accesses this Screen. When this Screen initially appears a cursor will be active in the data entry field. The hour's value can be adjusted between the limits of +12 and -12 by using the joystick. The cursor can then be moved to the right to adjust the minutes to one of two values, 00 or 30. Only after pressing Key 1 SET is the information saved and the display reverts to Screen 3, GPS Status Screen.

The local offset is held in RAM and added to UTC time when calculating ETA's. Default value is +00:00. **It is important to set local offset correctly to ensure ETA's given in NAV Mode are correct.**

3.2.3 Setting Present Position
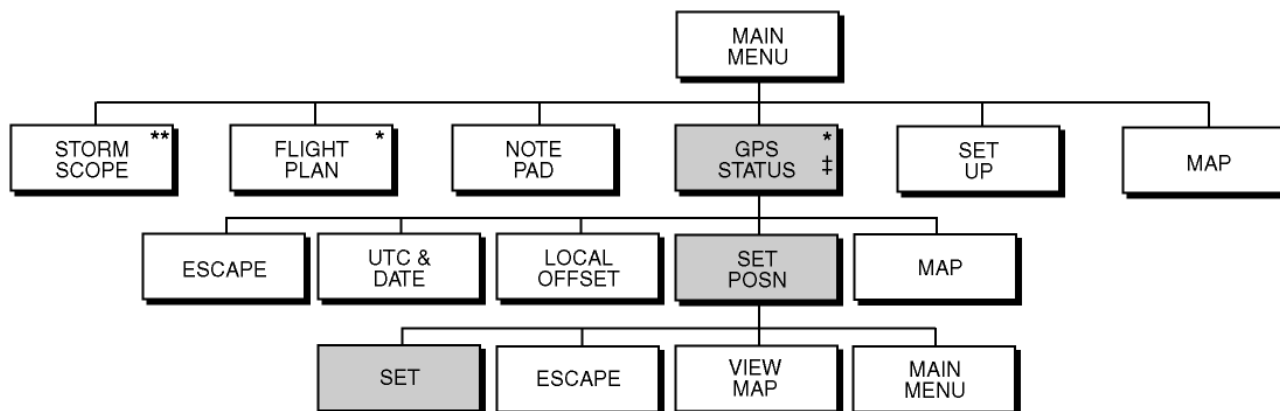
* Available only if KMD 150 is set for internal GPS. ** Available only if Stormscope is set to ON. ‡ Displayed only if Stormscope is set to OFF.
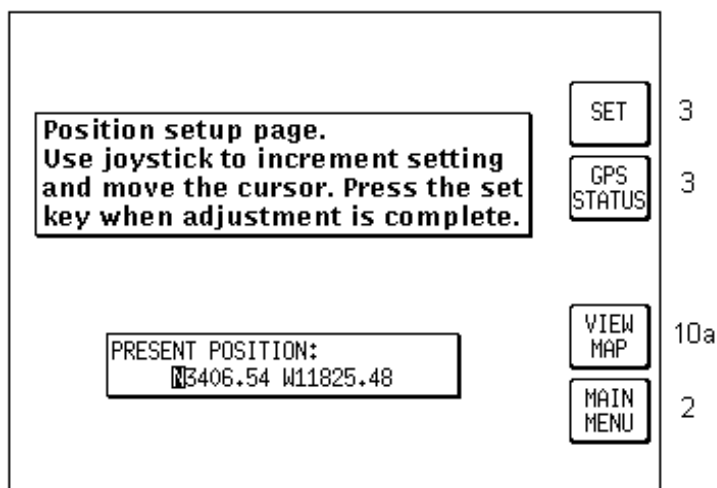

Position setup page.
Use joystick to increment setting and move the cursor. Press the set key when adjustment is complete.

PRESENT POSITION:
N3406.54 W11825.48

Screen 6: Present Position Setup Screen

Pressing GPS STATUS followed by SET POSN accesses this Screen. On entry to this Screen a cursor is positioned over the first character of the latitude as shown above. The joystick can then be used to increment or decrement values and to move the cursor right and left.

Alternatively you can press Key 4 VIEW MAP and using the joystick, simply point at your present position.
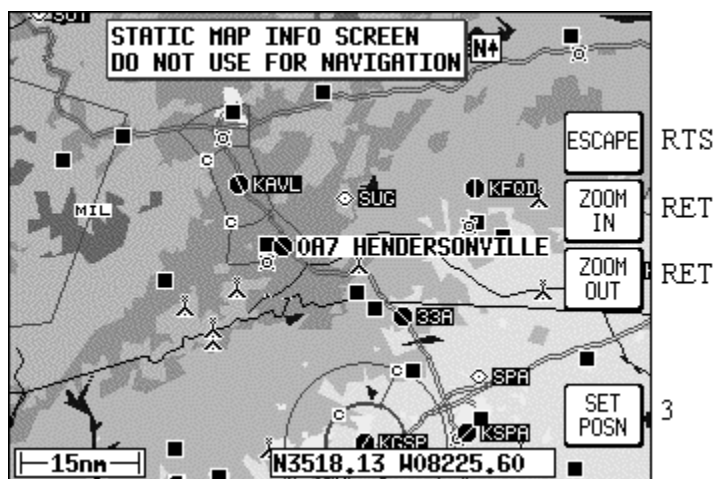
Screen 10A: View Map Screen

When Screen 10A is displayed you can zoom in or out using Keys 3 or 4. By using the joystick you can 'bump' the borders of the map window to view anywhere in the world. The POS: box at the bottom of the screen displays the latitude and longitude of the pointer.

Once you have the joystick pointing at your present location, press Key 1 ESCAPE to return to Screen 6, Present Position Setup Screen. The pointer latitude and longitude will then be fed into the PRESENT POSITION box on Screen 6.

When new values for latitude and longitude have been selected either numerically or on the map, pressing Key 1 SET will enter the new latitude and longitude and revert to Screen 3. If the unit is receiving sufficient satellite signals to calculate a fix, user-entered latitude and longitude will be ignored. Keys 3 and 4 give direct access to Time and Date adjustment.

3.3 Map Check

Once the KMD 150 has acquired a signal from either the internal or external GPS and the system is giving correct information on the DATA IN/OUT screen, return to the MAIN MENU screen by continually pressing ESCAPE. From the MAIN MENU screen select MAP and ensure that the map appears with the correct location displayed. Once these tests are completed the system is ready for operation. To use all of the functions incorporated in the unit refer to the KMD 150 Pilot's Guide.
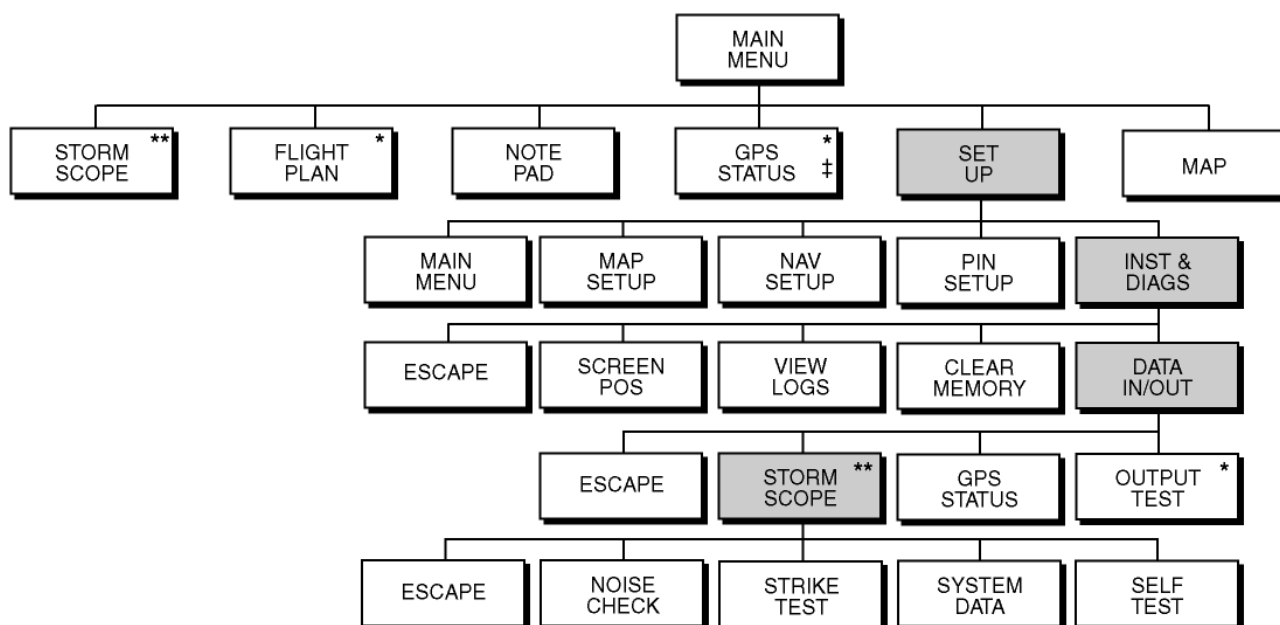
3.4 Stormscope Interface Test

* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.

If a BFGoodrich WX-500 Stormscope sensor has been connected to the KMD 150, the interface should be activated by first selecting the Data I/O screen then using the joystick, set the STORMSCOPE: to ON. A new key will then appear in position 2 marked STORMSCOPE. Now press key 2 to display screen 64, which will allow access to four standard Stormscope test screens. These are:

  ➢ Noise Check
  ➢ Strike Test
  ➢ System Data
  ➢ Self Test

The following text should be read in conjunction with the installation manual provided with the WX-500.

3.4.1 Stormscope Maintenance Cover Page

From screen 35, press key 2 (Stormscope) to call screen 64.

Stormscope Maintenance section cover page (Screen 64)

3.4.2 Stormscope Noise Check Page
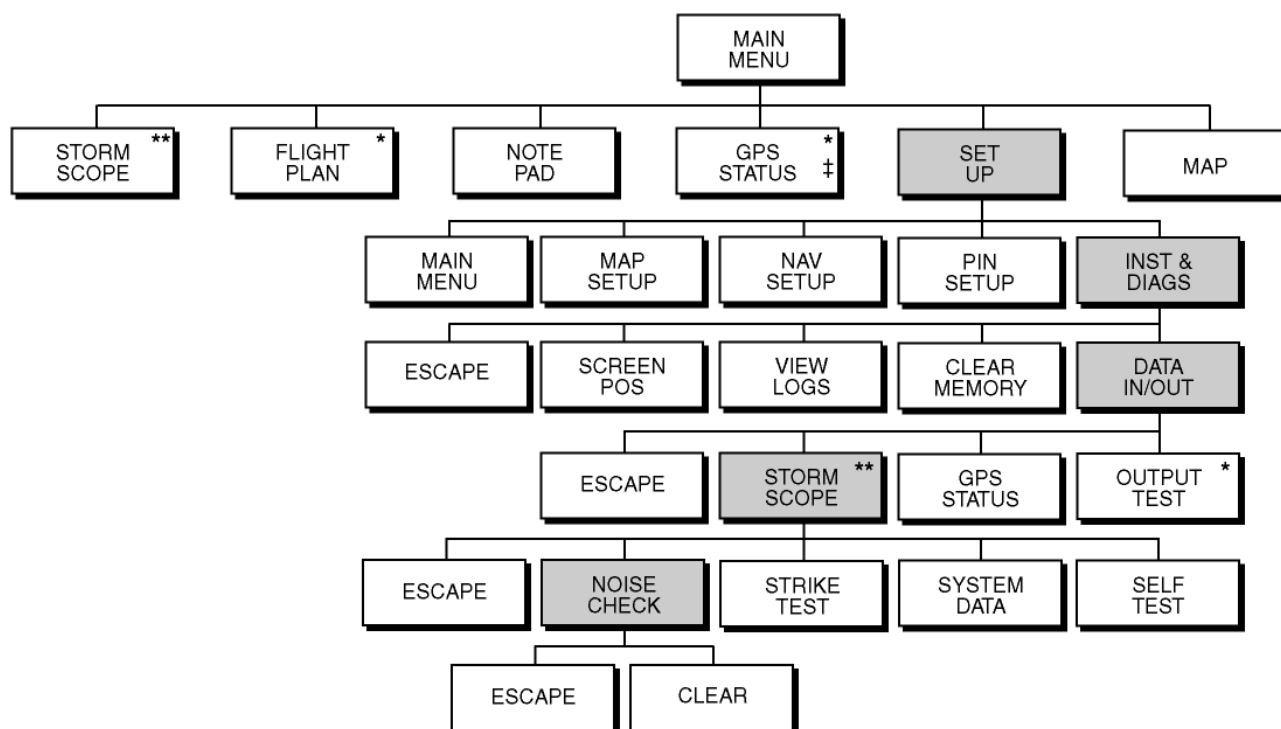
* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.
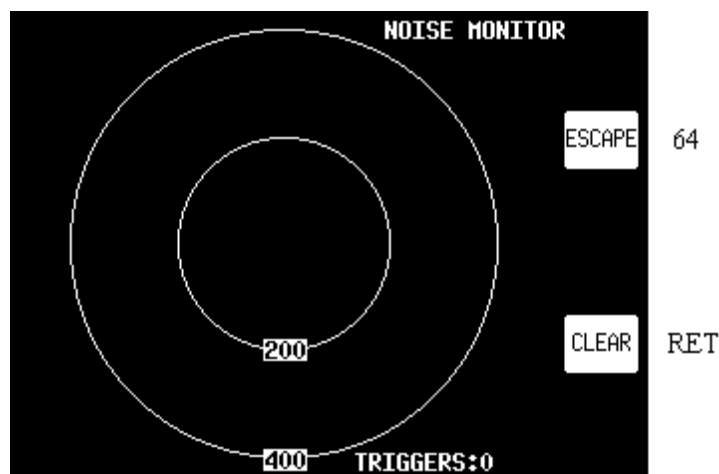
Noise Check page (Screen 65)

Running a noise check. Pressing key 2 from screen 64 will display screen 65, the Noise Monitor screen. When this screen is entered the WX-500 will be put into noise monitor mode and noise strikes will be plotted as small crosses at the relevant range and bearing. This screen has a fixed scale of 400nm.

If key 4 (CLEAR) is pressed, the KMD 150 will send the clear command to the WX-500.

3.4.3 Stormscope Strike Test Page
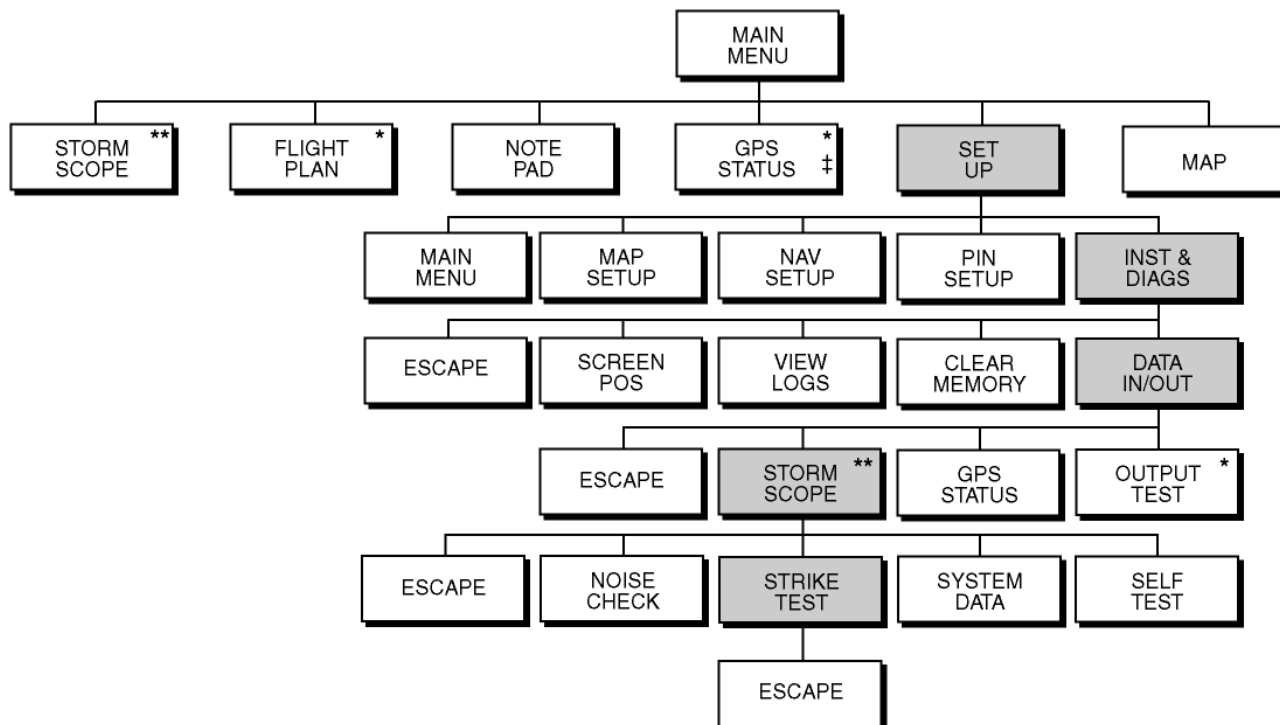
* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.
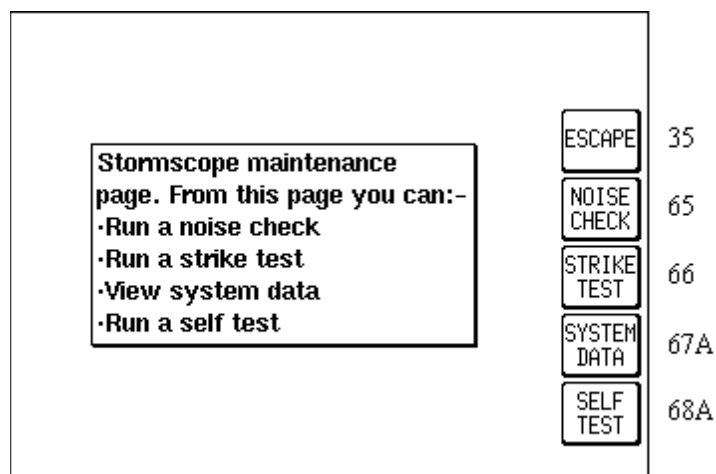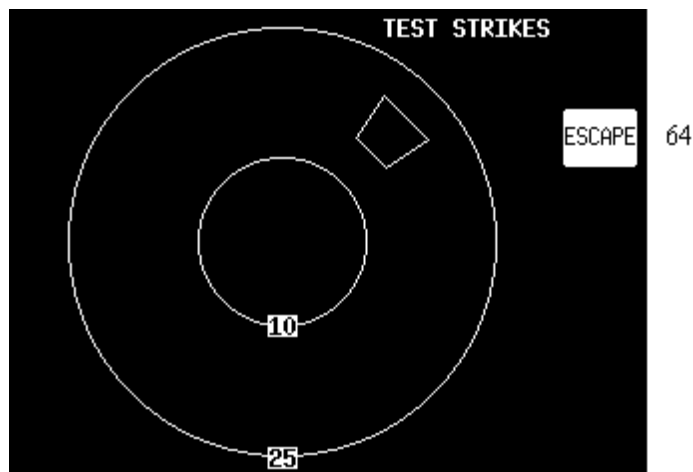
Stormscope Strike Test page (Screen 66)

Running a strike test. Pressing key 3 from screen 64 will display screen 66, the Strike Test screen. When this screen is entered the WX-500 will be put into strike test mode. Incoming test strikes will be plotted as small crosses at the relevant range and bearing and should fall within the box drawn at the 2 o'clock position. This screen has a fixed scale of 25nm. The strikes shall be displayed for two seconds then removed.

3.4.4 Stormscope System Data Page

* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.

```
                    ┌─────────────────────────────┐
                    │  Configuration              │   ┌────────┐
                    │                             │   │ESCAPE │  64
                    │  Hdg: XYZ: J3-1    Jumper   │   └────────┘
                    │           J3-2     Open     │
                    │  Hdg Valid Flag    No Fla   │
                    │  Flag Sense        +vld     │   ┌────────┐
                    │        J3-4        Jumper   │   │ S/W    │  67B
                    │  Hdg Value          0       │   │ VER    │
                    │  Inhibit Line      Off      │   └────────┘
                    │  Antenna Mount     Top      │   ┌────────┐
                    │        J3-3        Jumper   │   │ ENV    │  67C
                    │                             │   │ DATA   │
                    │                             │   └────────┘
                    │                             │   ┌────────┐
                    │                             │   │ FAULT  │  67D
                    │                             │   │ LOG    │
                    └─────────────────────────────┘   └────────┘
```

Stormscope System Data page (Screen 67)

Stormscope system data falls into four categories; Configuration data, Software data, Environment data and Fault data. All four classes of data can be displayed via screen 67 by pressing one of the four soft keys. The default data category is Configuration. When a category is being displayed, its soft key label is deleted.
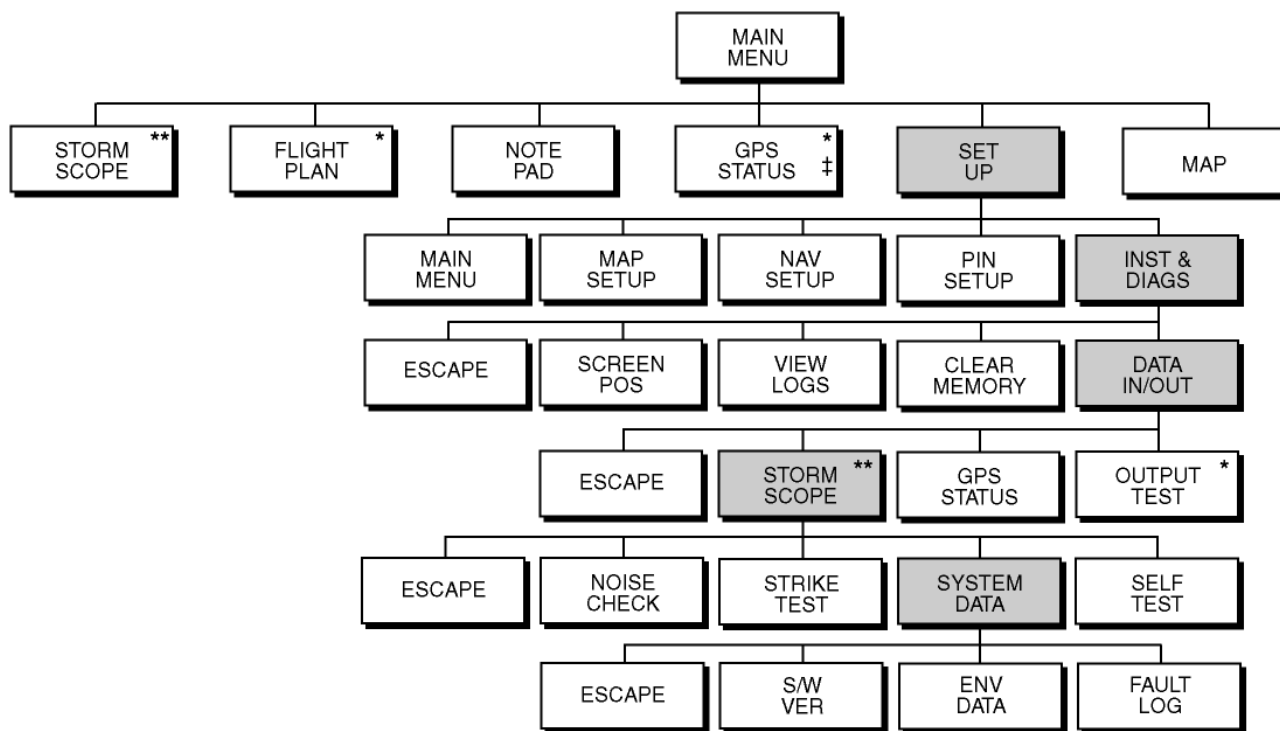
3.4.5 Stormscope Self Test Page

* Available only if KMD 150 is set for internal GPS.   ** Available only if Stormscope is set to ON.   ‡ Displayed only if Stormscope is set to OFF.
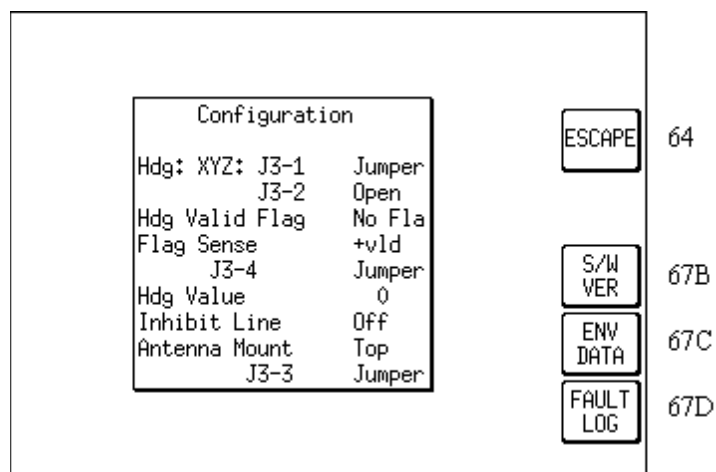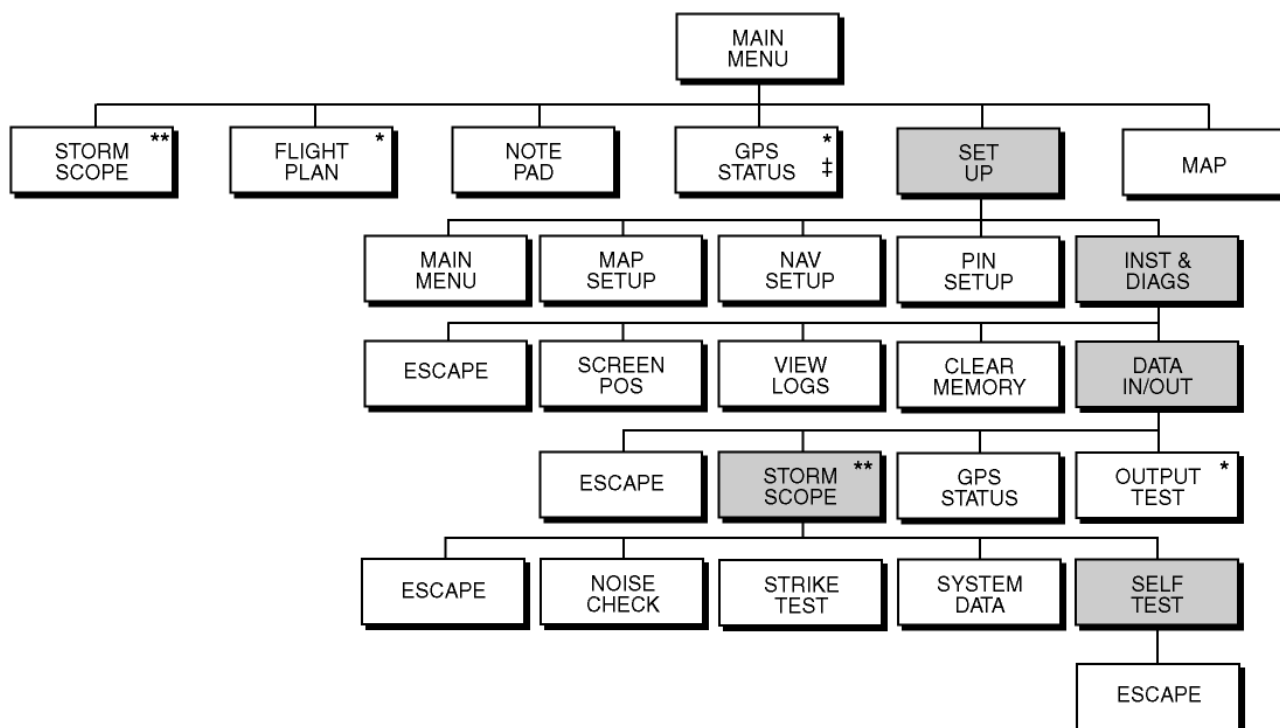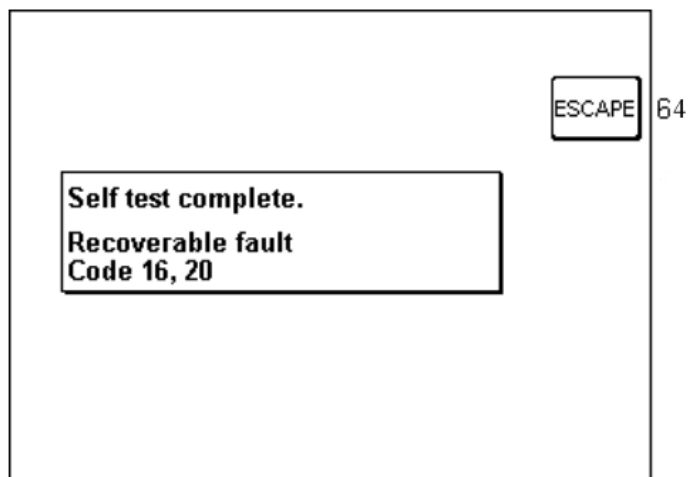
```
                                      ┌─────────┐
                                      │ESCAPE│ 64
                                      └─────────┘

        ┌─────────────────────────────┐
        │ Self test complete.         │
        │                             │
        │ Recoverable fault           │
        │ Code 16, 20                 │
        └─────────────────────────────┘
```

Stormscope Self Test Data page (Screen 68)

Running a self-test. Pressing key 5 from screen 64 will display screen 68, the self-test screen. When this screen is entered the WX-500 will be sent a self-test request message and a Please Wait message will be displayed while the test is performed.

After the self-test is completed the results will be displayed showing the system status.

If the status is OK then "SYSTEM OK" will be printed in the box.

This Page Reserved

Appendix 1 - KMD 150 Digital Data Output Sentences.

NMEA Data Sentences, 4800 baud. Each sentence is followed by a checksum (*hh), carriage return (CR) and a line feed (LF). Sent every two second.

RMC Sentence.

$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,
<10>,<11>*hh<CR><LF>

<1> UTC time of position fix,hhmmss format.
<2> Status, A= Valid position, V=warning
<3> Latitude,ddmm.mmm format.
<4> Latitude hemisphere, N or S.
<5> Longitude, dddmm.mmm format.
<6> Longitude hemisphere, E or W.
<7> Speed over ground (000.0-999.9 knots).
<8> Course over ground (000.0-359.9 true).
<9> Date of fix ddmmyy format.
<10> Magnetic variation 000.0-180.0°.
<11> Variation direction E or W.

Sample sentence.

$GPRMC,132404,A,5111.465,N,00102.845,W,090.0,304.1,020492,004.3,W*7A

GGA Sentence.

$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,M,<10>,M,,*hh<CR><LF>

<1> UTC time of position fix, hhmmss.
<2> Latitude, ddmm.mmm format.
<3> Latitude hemisphere, N or S.
<4> Longitude dddmm.mmm format.
<5> Longitude hemisphere, E or W.
<6> GPS quality. 0 = no fix, 1 = fix good, 2 = fix good, differential mode.
<7> Number of sats in use, 00 to 08.
<8> DOP, 01.0 to 99.0.
<9> Antenna height above MSL (metres).
<10> Geoidal offset in metres.

Sample sentence.

$GPGGA,091636,5119.607,N,00122.001,E,1,04,1.8,18.3,M,-47.0,M,,*5D

RMB Sentence.

$GPRMB,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>,<13>*hhCRLF

1. Position valid (A = valid, V = invalid).
2. XX.XX Cross track error in nautical miles.
3. X Direction to steer (L = left, R = right).
4. XXXX Four character start waypoint identifier. (first four characters of name).
5. XXXX Four character destination waypoint identifier.
6. DDMM.MM Destination Lat.
7. X Destination hemisphere (N or S).
8. DDDMM.MM Destination Long.
9. X Destination hemisphere (E or W).
10. XXX.X Range to destination in nautical miles.
11. XXX.X Bearing to destination TRUE.
12. XXX.X Closing velocity in knots.
13. X Arrival flag. (A = arrival, V = not arrival).

Sample sentence.

$GPRMB,A,00.00,L,1,2,5142.20,N,00217.10,W,048.8,304.0,090.0,V*18

Notes.

1. Note the direction in field 3 is direction to steer, ie off track to the right, steer left.

2. If not in NAV or GOTO mode, the flag in field 1 will show invalid (V).

3. If in GOTO mode there will be no start point identifier so field 4 will be blank (spaces). If in GOTO direct mode where the GOTO point is just a point in space with no name, field 5 will be blank (spaces) also.

4. The arrival flag in field 13 is set to A when the TP imminent message shows on screen and stay set until the next leg is selected even if the TP passed message comes up on screen.

5. At the end of the route or GOTO when the unit drops out of NAV mode, the flag in field 1 will change to a V.

6. The closing velocity in field 12 is the vectored velocity towards the waypoint. There is no provision for showing negative numbers so if answer is negative, all zeros will be sent.

RS-232C King data sentences, 9600 baud. Sent every two seconds.

Position Data (type 1 sentence). Each line of data is followed by a carriage return (CR) and a line feed (LF) character except the STX and ETX lines.

Header	Data	Description.
STX		Hex 02.
z	aaaaaCRLF	GPS altitude in feet.
A	s dd mmhhCRLF	Latitude where s = N or S, dd = degrees
		mm = minutes, hh = hundredths of minutes.
B	s ddd mmhhCRLF	Longitude designated as above.
C	dddCRLF	Magnetic track in whole degrees.
D	sssCRLF	Ground speed in knots.
E	dddddCRLF	Distance to waypoint in 1/10ths of nm.
G	snnnnCRLF	Cross track error where s = L or R (of track)
		and nnnn = error in 100ths of an nm.
I	ddddCRLF	Desired magnetic track in 10ths of a degree.
		ie BRG to waypoint **if you were on track.**
K	cccccCRLF	Destination waypoint name. Dashes sent after
		name if shorter than 5 characters.
L	ddddCRLF	Actual magnetic bearing to WPT (in 1/10ths
		of a degree).
Q	sddddCRLF	Variation. s= E or W. dddd = 1/10ths degrees.
S	----eCRLF	e = Nav flag. - = nav valid, N = nav not valid.
T	---------CRLF	Indicates end of sentence type 1.
ETX		Hex 03.

If the unit is not in Nav mode or does not have a fix, dashes (---) will be sent in fields E, G, I, K, L. Part e of field S will be set to N.

If the unit does not have a fix, dashes will be sent in the lat, long, track and ground speed fields.

Flight Plan Data (type 2 sentence)

Item designator, sequence number, waypoint identifier, latitude/longitude, and magnetic variation of each waypoint defined in the active flight plan are transmitted with the below format:

If the "direct-to" waypoint is in the active flight plan, the "direct-from" waypoint, the "direct-to" waypoint and those waypoints, if any, coming after the "direct-to" waypoint in the active flight plan will be transmitted, the sequence and waypoint numbers will start from "1".

If the "direct-to" waypoint is not in the active flight plan, only the "direct-from" waypoint and the "direct-to" waypoint will be transmitted. The sequence and waypoint numbers, in this case, should start from "1".

The identifier field of the "direct-from" waypoint shall always be blanked.

The waypoint designator (wdd below) and the sequential waypoint number - byte 1 bits 4-0 below) will be the same number, with the first waypoint sent being number one; these numbers do not necessarily match the flight plan page waypoint numbers.

If the flight plan is invalid no flight plan data will be transmitted.

Item Designator
>   wdd
>
>>   w = 'w'
>>   dd = 01 to 99
>>   Note: A maximum of 32 waypoints shall be transmitted.

Sequence Number
>   Byte   1
>   Bit   76543210
>   xlannnnn
>
>>   x = undefined
>>   nnnnn = Sequential waypoint number, Unsigned binary
>>   a = 1 if waypoint is active
>>   l = 1 if last waypoint of flight plan

Waypoint Identifier

Byte	2	3	4	5	6
Bit	76543210	76543210	76543210	76543210	76543210
	aaaaaaaa	aaaaaaaa	aaaaaaaa	aaaaaaaa	aaaaaaaa

>   aaaaaaaa = ASCII characters of five-character identifier
>   Note: A value of 7FH in byte 2 indicates that the waypoint identifier is unknown and bytes 2 through 6 should be ignored.

Latitude/Longitude

Latitude and longitude of waypoint. Packed, unsigned binary values for degrees, minutes, and hundredths of minutes.

Byte	7	8	9
Bit	76543210	76543210	76543210
	sddddddd	xxmmmmmm	xhhhhhhh

>>   s = 0 North latitude
>>   s = 1 South latitude
>>   x = Undefined
>>   ddddddd = Latitude degrees
>>   mmmmmm = Latitude minutes
>>   hhhhhh = Latitude hundredths of minutes
>   Note: A value of 7FH in byte 7 indicates that latitude and longitude are not presently available and bytes 7 through 13 should be ignored.

Byte	10	11	12	13
Bit	76543210	76543210	76543210	76543210
	sxxxxxxx	dddddddd	xxmmmmmm	xhhhhhhh

>>   s = 0 East longitude
>>   s = 1 West longitude
>>   x = Undefined
>>   dddddddd = Longitude degrees
>>   mmmmmm = Longitude minutes
>>   hhhhhh = Longitude hundredths of minutes

Magnetic Variation

        Byte   14   15
        Bit   76543210   76543210
                nnnnnnnn   nnnnnnnn

        nnnnnnnnnnnnnnnn = Magnetic variation at waypoint. Two's complement binary in
        sixteenths of degrees. Easterly variation is positive.

        Note: A value of 7FH in byte 14 indicates that magnetic variation is not presently
                available and bytes 14 and 15 should be ignored.

This Page Reserved

Appendix 2 - Hardware & Software Change Record

This section defines the major software and hardware changes incorporated in to the KMD 150 since its initial entry into service in October 1999. Visit www.bendixking.com for current releases.

MOD STD	DESCRIPTION	VERSION	DESCRIPTION
MOD 00	None	Ver 1.06	Initial production release.

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Appendix 3 – Supplemental Type Certificate

Supplemental Type Certificate

Number SA00819WI-D

This certificate issued to

AlliedSignal Inc.
23500 W. 105th Street
Olathe, KS 66061

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 23 *of the* Federal Aviation *Regulations and* additional requirements as specified in TCDS 3A13.

Original Product - Type Certificate Number:	3A13
Make:	Cessna
Model:	182S

Description of Type Design Change:
Installation of the Bendix/King KMD 150 MFD (Multi-Function Display) and optional BF Goodrich WX 500 Stormscope.
REQUIRED DATA: 1. Master Drawing List 159-08242-0001, Rev. A, dated 9-20-99; and 2. Airplane Flight Manual Supplement 006-00869-0000, Rev. -, dated 10-1-99.
Later FAA approved revisions to the above listed data are incorporated without further revision to this Supplemental Type Certificate.

Limitations and Conditions:
1. This approval should not be extended to other specific airplanes of this model on which other previously approved modifications are incorporated, unless it is determined that the interrelationship between this change and any of those other previously approved modifications will introduce no adverse effect upon the airworthiness of that airplane.

(Continued on Continuation Sheet)

If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: July 20, 1999

Date reissued:

Date of issuance: October 1, 1999

Date amended:

By direction of the Administrator

_____
(Signature)

Chris Durkin
DAS Coordinator, DAS4CE

_____
(Title)

United States of America

Department of Transportation -- Federal Aviation Administration

Supplemental Type Certificate

(Continuation Sheet)

Number SA00819WI-D

Limitations and Conditions: (continued)

2. The KLN 89 and 89B GPS have been evaluated as a navigation input source for the KMD 150 Multi-Function Display and found to be compatible; the interface of these systems is approved.

3. The KMD 150 GPS has been evaluated for use under IFR when interfaced to an IFR qualified KLN 89B.

- - - End - - -

Appendix 4 – Environmental Qualification Forms

RTCA DO-160C
ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE:	**KMD 150** PANEL MOUNTED MFD
PART NUMBER:	066-01147-0101 (with internal GPS) 066-01147-0201 (no internal GPS)
TSO NUMBER:	N/A
MANUFACTURER'S SPECIFICATION:	Skyforce Test Spec CM410
MANUFACTURER:	Skyforce Avionics Limited (An AlliedSignal Company)
ADDRESS:	5 The Old Granary, Boxgrove, Chichester West Sussex PO18 0ES United Kingdom

CONDITIONS	SECTION	CONDUCTED TESTS
Temperature and Altitude	4.0	Category B1 with modified temp range (-40C to +85C storage) (-20C to +55C operating)
Temperature Variation	5.0	Category B
Humidity	6.0	Category A
Shock	7.0	7.2 and 7.3
Vibration	8.0	Category MN
Explosion	9.0	Category X (Not Tested)
Waterproofness	10.0	Category X (Not Tested)
Fluids Susceptibility	11.0	Category X (Not Tested)
Sand and Dust	12.0	Category X (Not Tested)
Fungus	13.0	Category X (Not Tested)
Salt Spray	14.0	Category X (Not Tested)
Magnetic Effect	15.0	Class Z
Power Input	16.0	Category B
Voltage Spike Conducted	17.0	Category B
Audio Frequency Conducted Susceptibility	18.0	Category B
Induced Signal Susceptibility	19.0	Category B
Radio Frequency Susceptibility	20.0	Category U
Radio Frequency Emission	21.0	Category B
Lightning Induced Transient Susceptibility	22.0	Category X (Not Tested)
Lightning Direct Effects	23.0	Category X (Not Tested)
Icing	24.0	Category X (Not Tested)

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Filename: KMD 150 Environmental Qual Form.doc
AUTHORIZED PRINT

P/N 004-02186-4800
Revision -
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REMARKS

Vibration Critical Frequencies

Location of Measurement	Top front right hand side corner	Top rear left hand side corner
Axis Vibration applied	Lateral	Lateral
Axis Vibration measured	Lateral	Lateral
Frequency of resonance	115.1 Hz	117.2 Hz
Amplitude of resonance	10.75g	8.72g
Magnification factor	7.2	5.8

AlliedSignal Inc.
Filename: KMD 150 Environmental Qual Form.doc

P/N 004-02186-4800
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Nov/99

REVISION HISTORY

Revision	PRN/CO #	Description of Change	Date
-	PRN 162864	Original Issue	Sep-99

RTCA/DO-160C

ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE:	KA 92 ANTENNA
PART NUMBER:	071-01553-0200
TSO NUMBER:	C129
MANUFACTURER'S SPECIFICATION:	See Specification Control Dwg. 071-01553-0200
MANUFACTURER:	ALLIEDSIGNAL GENERAL AVIATION AVIONCS
ADDRESS:	400 N. ROGERS ROAD OLATHE, KS 66062 USA

CONDITIONS	PARA	CONDUCTED TESTS
TEMPERATURE AND ALTITUDE	4.0	Category A2 and F2
TEMPERATURE VARIATION	5.0	Category A
HUMIDITY	6.0	Category C
SHOCK	7.0	Operational Shock Test
VIBRATION	8.0	Categories C, L, M and Y
EXPLOSION	9.0	Category X (NOT TESTED)
WATERPROOFNESS	10.0	Category R
FLUIDS SUSCEPTIBILITY	11.0	Category F
SAND AND DUST	12.0	Category X (Not Tested)
FUNGUS	13.0	Category X (Not Tested)
SALT SPRAY	14.0	Category S
MAGNETIC EFFECT	15.0	Class Z
POWER INPUT	16.0	Category A and B
VOLTAGE SPIKE CONDUCTED	17.0	Category A and B
AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	18.0	Category A, B and Z
INDUCED SIGNAL SUSCEPTIBILITY	19.0	Category A
RADIO FREQUENCY SUSCEPTIBILITY	20.0 Change 3	Category R
RADIO FREQUENCY EMISSION	21.0 Change 3	Category A
LIGHTING INDUCED TRANSIENT SUSCEPTIBILITY	22.0 Change 2	Category XXE3
LIGHTING DIRECT EFFECTS	23.0 Change 1	Category 1B
ICING	24.0	Category C

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KRC AUTHORIZED PRINT

RTCA/DO-160C

ENVIROMENTAL QUALIFICATION FORM

REVISION HISTORY

REV NUMBER	ECO NUMBER	DATE
0	ORIGINAL ISSUE	DECEMBER 1994
1	102111	JANUARY 1995

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<u>REMARKS</u>

-Fluids Susceptability

Fluids Used: Ethylene Glycol
Isopropyl Alcohol
Denatured Alcohol
1,1,1 Trichloroethane
Jet A Fuel
Aviation Fuel
Skydrol, Type IV
Dichlorvos (DDVP)
Pyrethrum - Based Inseticide
AEA Type 1
AEA Type 2

Swelling of KA 92 observed when exposed to Dichlorvos (DDVP).

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Appendix 5 – Flight Manual Supplement

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

CESSNA 182S

WITH

BENDIX/KING® KMD 150 MULTI-FUNCTION DISPLAY

AND OPTIONAL BF GOODRICH WX-500 STORMSCOPE SERIES II WEATHER MAPPING SENSOR

Reg. No. _____

Ser. No. _____

This supplement must be attached to the FAA Approved Airplane Flight Manual when the Bendix/King KMD 150 Multi-Function Display is installed in accordance with STC SA00819WI-D. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement; consult the basic Airplane Flight Manual.

FAA APPROVED: _*signature*_

FOR CHRIS DURKIN
DAS Coordinator
AlliedSignal Inc.
DAS4CE

DATE: ___*10-1-99*___

FAA APPROVED: ORIGINAL ISSUE   006-00869-0000

LOG OF REVISIONS

REV	PAGE(S)	DESCRIPTION	APPROVAL/DATE
-	All	Original issue.	See Cover

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TABLE OF CONTENTS

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SECTION 1- GENERAL

This supplement is provided to acquaint the pilot with the limitations as well as normal and emergency operating procedures of the Bendix/King KMD 150 Multi-Function Display System. The limitations presented are pertinent to the operation of the KMD 150 system as installed in the Cessna 182S airplane; the KMD 150 must be operated within the limitations herein specified.

The KMD 150 Multi-Function Display is certified in this airplane interfaced with the Bendix/King KLN 89/89B GPS Navigation System and the optional BF Goodrich WX-500 Stormscope Series II Weather Mapping Sensor.

Every 28 days Bendix/King receives data base information from Jeppesen Sanderson. This information is processed and downloaded onto data base cards. Bendix/King makes these cards available to KMD 150 users.

The KMD 150 system provides a multi-color moving map containing topographical and navigation features useful for both instrument and visual navigation. The KMD 150 system will in the future contain an internal GPS navigation receiver qualified for VFR navigation only. The installation as approved in the Cessna Model 182S does not contain the internal GPS receiver and must rely upon position and navigation information from the external Bendix/King KLN 89/89B.

NOTE: This supplement does not contain information required for operation of the KLN 89/89B GPS.

The KMD 150 system provides lightning strike awareness on the moving maps as well as on dedicated stormscope screens when installed with the optional BF Goodrich WX-500. Control of the WX-500 is through the KMD 150 Control Display Unit.

The **AVIONICS MASTER** switch supplies power to the bus bar for the KMD 150, KLN 89/89B and the WX-500 circuit breakers.

The airplane **BAT MASTER** switch function is unchanged and can be used in conjunction with the alternator switches to shut off electrical power.

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The following circuit breakers are used to protect the following elements of the KMD 150, KLN 89/89B and WX-500 systems:

LABEL	FUNCTION
MFD	Supplies power to the KMD 150 system.
GPS	Supplies power to KLN 89/89B system.
S/SCOPE	Supplies power to the WX-500 system (if installed).

SECTION 2 - LIMITATIONS

1. The KMD 150 Pilot Guide and Installation Manual, Document No. 006-18220-0000, Rev. 0, Dated September 1999 (or later applicable revision) must be immediately available to the pilot when the system is used for IFR operation.

2. KMD 150 IFR operation is prohibited unless the pilot verifies the currency of the KMD 150 data base.

3. KMD 150 IFR operation is approved only when interfaced to an IFR approved KLN 89B.

4. The KMD 150 Multi-Function Display is provided to enhance situational awareness under VFR and IFR conditions. Precise lateral guidance must be predicated on the associated remote CDI/HSI instrument, or on the KLN 89/89B internal left/right indication.

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SECTION 3A - EMERGENCY PROCEDURES

None.

SECTION 3B - ABNORMAL PROCEDURES

1. In the event of a stormscope fault, resulting flags may be decluttered from the map screens by turning the stormscope OFF.

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SECTION 4 - NORMAL PROCEDURES

1.   Brightness – **ADJUST** as desired.

NOTE: To obtain the minimum usable brightness level for dark cockpit operations, select the TOPO OFF map presentation.

2.   Map set up – **REVIEW**. Modify as necessary.

3.   Stormscope – **ON** as desired (if installed).

4.   **GPS EXT** annunciation – **VERIFY**.

5.   KLN 89/89B – **ON** for navigation.

NOTES: • The KLN 89/89B active flight plan will be sent to the KMD 150 and will be displayed automatically when in a map mode.   The one exception is during curved flight segments such as DME arcs.   During a DME arc the KMD 150 will continue to show position and track, however flight plan routing will not be displayed.

   • Ignore the instantaneous heading as depicted on the map while maneuvering in turns.

   • The KMD 150 map will default to north-up orientation in the absence of a GPS ground track.

SECTION 5 - PERFORMANCE

No Change.

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