

# Avionics

## APM-424(V)4

Interrogator/Transponder Test Set (Including Mode S ELS/EHS)  
(NSN: 6625-01-600-6784)



Easily accommodates a variety of aircraft, ground and ship platforms to test Transponder and Interrogator performance including Mode S Elementary and Enhanced Surveillance

- Transponder Test Set Modes 1, 2, 3/A, C, 4, S (including ELS and EHS)
- Interrogator Test Set Modes 1, 2, 3/A, C, 4, S, TCAS, ETCAS
- DO-260B compliant; ADS-B Out test capability
- Mode 5 upgradable
- Hand-held, battery powered and lightweight (<11 lbs)
- One piece, 3-button point and shoot Go/No-Go operation
- Self-diagnostic
- Automated MTL measurement
- Parametric test results can be stored for downloading to a PC for review or maintenance logging
- TS-4542 shipboard interrogator test capability

The APM-424(V)4 is a performance and capability upgrade to the TS-4530 and APM-424 test sets. The APM-424(V)4 is fully compliant with DoD AIMS standards for testing Mark XIIIA performance of Mode 4 equipment, DO-260B ADS-B Out performance, and ICAO Annex 10 international standards for Mode S ELS/EHS performance.

The APM-424(V)4 closely replicates legacy operation for utilization of existing procedures, making the APM-424(V)4 a cost effective, highly accurate upgrade to fielded test sets.



The 20-character 4-line display provides for easily viewable data and parametric measurements as required for Mode S Elementary and Enhanced Surveillance testing. For legacy test modes, the menu structure and displayed data format have been retained so that minimal changes are required of fielded procedures.

# GENERAL SPECIFICATIONS

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## USER INTERFACE

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### Displays

Internal: 20 character by 4 line alpha-numeric OLED, 0.197" font height with green Accept, red Reject and battery status indicators

### Controls

3 buttons: test sequence advance, test sequence repeat and test result data.

## MODES OF OPERATION

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### TRANSPONDER TESTING

**Test Range** 10 to 150 ft.

### Test Capability

- 1,2,3A - Displays code, identification and emergency status
- C - Displays altitude
- 4 - Stand alone operation, but must be filled with challenge video patterns from COMSEC, displays code A or B and verification bit status. Requires KIR or KIV with adapter to operate.
- S - Interrogates with: UFO, UF11 (all call), UF4 (altitude), UF5 (identity), UF4 asking for DF20 (altitude), UF5 asking for DF21 (identity), containing Datalink capability report, DF16 (long TCAS surveillance) Decodes and displays Mode S ELS DAP's  
  
BDS 1,0 Data Link Capability Report: Subnet Version, DTE, GICB Report, SI Capability, Specific Services Capability, Squitter Capability, Cont Flag, Aircraft ID Capability, UELM Capability, DELM Capability.  
  
BDS 1,7 Common Usage GICB Report  
  
BDS 1,8-1,C Specific Services Report  
  
BDS 2,0 Aircraft Identification  
  
Flight ID  
  
BDS 3,0 ACAS Resolution Advisory: RAT, RAC, ARA & EHS DAP's  
  
BDS 4,0 Vertical intention: MCP/FCU Alt  
BDS 5,0 Track and Turn: True Track Angle, Ground Speed, Track Angle Rate, Roll Angle  
  
BDS 6,0 Heading & Speed: Mach Nbr, Baro Alt Rate, Magnetic Heading, Indicated Air Speed

### ADS-B

DO-260B compliant, ADS-B Out

### INTERROGATOR TESTING (INCLUDING TCAS)

**Test Range** 30 to 200 ft.

### Static Targets

- 1 - responds with 1200
- 2 - responds with 1202
- 3/A - responds with 1203 (4096 code)
- C - responds with configurable altitude
- 4 - requires KIT or KIV to operate
- S - Replies to: UF11(all call),UFO (short TCAS surveillance), UF16 (long TCAS surveillance), UF4 (altitude), UF5 (Identity), UF20 (long altitude), UF21 (long identity)

Measures interrogation rate

### Dynamic Target Scenarios

- Level - Intruder closing level at configured altitude
  - Above - Intruder closing level 2000 ft. above configured altitude
  - Dive - Intruder closing from 5000 ft. above descending to configured altitude
  - Climb - Intruder closing from 5000 ft. below climbing to configured altitude
- Intruder starts at 15 nmi distance from UUT, ends at approx. 0 nmi  
Closing speed fixed at 720 knots  
Configured altitude is 0-20,000 ft.

### Target Simulation

- Multiple 4, 8, 16, 32, 64, 128, and 256 nmi
- Single 4 nmi, IDENT On/Off, EMERG On/Off, Pilotless
- Group 12 targets 2 nmi apart, starting at 4 nmi

## ANTENNA

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(End-fire antenna with sum and difference feeds)

### Interrogation Beamwidth

Approximately  $\pm 5$  degrees

### Polarization

Vertical

## DIRECT CONNECTION PORT

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### Impedance

50  $\Omega$

### SWR

1.3:1 max

### Connector

TNC

Note: All over-the-air and direct connection port testing use identical test criteria to allow easy data comparison when evaluating or testing an installation.

## POWER SUPPLY

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### Operating Modes

Unit operates either from external DC input power or internal batteries

### External DC Input

11.5 to 28 V DC input, 25 W max.

### Surge Protection

MIL-STD-704E figure 9 (50 volts peak for 12.5 ms, then reducing linearly to 29 V over 70 ms)

### Reverse Polarity

-30 volts max.

### Battery Compatibility

Replaceable internal batteries, disassembly of unit is not required.

Reverse polarity protected

NiCAD re-chargeable battery assy, 7.2 volt DC nominal

Compatible with commercial 'C' size NiCAD, NiMH or alkaline batteries

### Internal Battery Charger

Operates from external DC input

Full re-charge time within 8 hours from fully discharged state (actual charge time depends on level of discharge). Battery will charge with unit operating unless an external COMSEC is connected.

Automatic charge termination when fully charged

Automatic charge restriction to 0 to +40°C nominal battery temperature range

Safety charge termination at +85°C nominal battery temperature range

### Low Battery Indication

Battery fuel gauge indicates battery status

### Discharge Protection

Test set automatically shuts off to prevent excessive battery discharge

## SIGNAL GENERATOR

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### Generator Frequency

1030 or 1090  $\pm 0.01$  MHz

### Generator Power

+4 to -44 dBm, 1 dB resolution,  $\pm 1.5$  dB accuracy at antenna connector

$\pm 2$  dB radiated antenna field strength -40 to -88 dBm, 1 dB resolution,  $\pm 1.5$  dB accuracy at direct port

### Pulse Shape and Timing

Modes 3/A, C, S comply with RTCA/DO-181D, Modes 1, 2, 4 comply with NATO STANAG 4193 Part V & DOD AIMS 03-1000A

### ISLS Amplitude

Equal to P1 on difference or sum ports when enabled

### Interrogation Rate (transponder test mode)

Modes 1,2,3/A,C,4 235  $\pm 5$  Hz

Mode S 50  $\pm 5$  Hz

### Harmonics

2nd and 3rd harmonic >30 dBc

### Spurious

Applies at greater than 60 MHz from TX center frequency; -50 dBm max. in standby; 50 dBc or -50 dBm max. in transmit when measured at the antenna connection

## MEASUREMENT RECEIVER

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### GENERAL

#### Frequency Range

1090 or 1030 MHz

#### Amplitude Range

+68 to +20 dBm at direct port, +24 to -24 dBm at antenna port

#### Input Protection

1  $\mu$ s pulse width, 1% max duty cycle

#### Direct Input

+68 dBm

#### Antenna Input

+30 dBm at antenna connection

### RECEIVER MEASUREMENTS

#### Received Power

1 dB resolution,  $\pm 1.5$  dB accuracy at antenna port,  $\pm 1.5$  dB at direct port,  $\pm 2$  dB antenna field strength

#### Method

Peak power of pulse obtained using 100 ns averaging period

#### Frequency

0.01 MHz resolution  $\pm 0.10$  MHz accuracy with >400 ns pulse width (transponder mode)

$\pm 0.05$  MHz accuracy with >750 ns pulse width (interrogator mode)

#### Method

Average frequency between 90% points

#### Frequency Range

Within  $\pm 5$  MHz of nominal for specified accuracy of amplitude and frequency measurements

#### Pulse Spacing

$\pm 25$  ns measured between leading edges for pulses with rise times <100 ns

#### Pulse Width

$\pm 25$  ns for pulses with rise times of 50 to 100 ns, fall times of 50 to 200 ns

#### Receiver Bandwidth

>10 MHz at 3 dB points

#### Oscillator Leakage

-50 dBm max. at antenna connection

#### Image Rejection

>40 dBc

### COMSEC INTERFACE

#### Connector

Accessory interface cable or adapter provides the required interface connector.

#### Compatibility

KIR-1A/1C, KIT-1A/1C, KIV-6 with appropriate cable or adapter

**Power for COMSEC**

KIT-1A/KIR-1A - External 115 VAC provided through KIT/KIR-1A interface cable

KIT-1C/KIR-1C: 22 to 29 VDC at 3 W max. (provided by test set)

KIV-6: 15 ±0.75 VDC at 200 mA max. (provided by test set)

**TEST PARAMETERS**

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**Reply Code**

Indicates reply code

M1/M2/M3A: 4096 code

MC: Altitude in ft.

MS: 4096 code

**Pulse Spacing (Interrogator)**

Displays  $\mu$ s

M1/M2/M3A/MC: P1, P3

MS: P1, B56

M4: P1, P4

**Pulse Width (Interrogator)**

Displays  $\mu$ s

M1/M2/M3A/MC: P1, P3

MS: P1, P6

M4: P1, P4

**Pulse Spacing (Transponder)**

Displays  $\mu$ s

M1/M2/M3A/MC: F1, F2

MS: P1, B56

M4: R1, R3

**Pulse Width (Transponder)**

Displays  $\mu$ s

M1/M2/M3A/MC: F1, F2

MS: P1, B56

M4: R1, R3

**Percent Reply**

Indicates % reply

**Receiver Sensitivity (Transponder)**

Displays MTL in dBm

**Receiver Sensitivity (Interrogator)**

Tests MDL margin 0 to -12 dB

**Interrogation Rate**

Displays Hz

**Transmitter Power (Interrogator)**

Displays dBm

M1/M2/M3A/MC: P1, P3

MS: P1, B56

M4: P1, P4

**Transmitter Power (Transponder)**

Displays dBm

M1/M2/M3A/MC: F1, F2

MS: P1, B56

M4: R1, R3

**Transmitter Frequency (Interrogator)**

Displays MHz

M1/M2/M3A/MC: P1, P3

MS: P1, B56

M4: P1, P4

**Transmitter Frequency (Transponder)**

Displays MHz

M1/M2/M3A/MC: F1, F2

MS: P1, B56

M4: R1, R3

**Squitter**

Displays

MS: DF11 Acquisition (sec)

**Mode 4 Word**

Indicates presence of A or B word

**VER BIT 1 Word**

Indicates presence of A1 or B1 word

**Reply Delay**

Displays in  $\mu$ s

**ISLS Operation**

Indicates % reply

**Identify Response**

Indicates presence

**Emergency Response**

Indicates presence

**Pilotless Response**

Indicates presence

**Angle Reflection**

Indicates unacceptable levels of multi-path interference

**Umbilical Testing**

Connector provided for direct connection to transponder

**Mode S Testing**

Supports the RF link portion of the installed equipment performance requirements of DO-181D and ED-73A (Additional equipment is required to simulate aircraft pressure altitude for the altitude reporting verification.) Decodes and displays ELS and EHS data.

## ACCESSORY SPECIFICATIONS

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### AC POWER ADAPTER

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**Temperature**

0 to +40°C

**Altitude**

Less than 2,000 m operating

**Humidity**

10 to 80% non-condensing, indoor operation only

**Weight**

1 lbs./0.45 kg

**Input Voltage**

100 to 240 VAC  $\pm$ 10%

**Input Current**

1.0 A AC max.

**Frequency**

47 to 63 Hz

**Input Connector**

IEC 320 3 pin receptacle, 6 ft. (USA standard line cord provided)

**Output Connector**

6 ft./1.8 m cable with 5.5 x 2.5 x 9.5 mm barrel connector

**Output Voltage**

+12 V DC nominal

**Output Current**

2.0 ADC nominal

**EMC**

FCC class B, CISPR 22 class B

**Approvals**

UL, CE

## EXTERNAL BATTERY CHARGER

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**Temperature**

0 to +40°C

**Altitude**

Less than 2,000 m operating

**Humidity**

10 to 80% non-condensing, indoor operation only

**Weight**

1 lbs./0.45 kg

**Size**

12.2" L x 2" H x 3.3" W

**Functions**

Charges or discharges one battery stick

**Power Source**

Requires connection to supplied AC Adapter, 12 V DC  $\pm$ 0.5 V, 2 A min, 4 A max.

**Input Connector**

Accepts 5.5 x 2.5 x 9.5 mm barrel connector

**Charge Time**

3 hours max. for 3 AH battery, dependent on battery charge state  
Automatic shut off when fully charged

**Discharge Rate**

700 mA typical, automatic shut off when discharged

## DC POWER CABLE

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**Supply Connector**

Banana plugs

**Unit Connector**

5.5 x 2.5 x 9.5 mm barrel connector

**Length**

6 ft./1.8 m

**Weight**

0.22 lb./0.1 kg

## RF DIRECT CONNECT CABLE

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**Length**

12 ft./3.6 m

**Connectors**

TNC male right angle, TNC male straight  
TNC female to N, male adapter included

**Weight**

0.5 lb./0.25 kg

## **KIT/KIR-1C COMSEC CABLE**

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### **Supported COMSEC**

KIT-1C/TSEC, KIR-1C/TSEC

### **Length**

4 ft./1.2 m

### **Weight**

2 lbs./0.9 kg

### **RS-232 Connector**

9 pin D sub-female

### **External DC Connector**

Accepts 5.5 x 2.5 x 9.5 mm barrel connector

### **KIT/KIR Power**

28 volt nominal at 3 W max. supplied from test set

## **KIT/KIR-1A COMSEC CABLE**

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### **Supported COMSEC**

KIT-1A/TSEC, KIR-1A/TSEC

### **Length**

4 ft./1.2 m

### **Weight**

2 lbs./0.9 kg

### **RS-232 Connector**

9 pin D sub female

### **External DC Connector**

Accepts 5.5 x 2.5 x 9.5 mm barrel connector

### **KIT/KIR Power**

115 V AC, 400 Hz supplied externally

## **RS-232 SERIAL DATA CABLE**

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### **Connectors**

9 pin D sub-male/female

### **Length**

5 ft./1.5 m

### **Weight**

0.22 lb./0.1 kg

## **KIV-6 ADAPTER**

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### **Mounting**

Attaches to handle and circular connector

### **Size**

7" L x 5" H x 5" W/175 x 125 x 125 mm max.

### **Weight**

1.5 lb./0.7 kg max. without KIV-6

### **Humidity**

To 100%, rain exposure acceptable

### **RS-232 Connector**

9 pin D sub-female

### **External DC Connector**

Accepts 5.5 x 2.5 x 9.5 mm barrel connector

## **AUTOMOTIVE DC ADAPTER CABLE**

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### **Length**

10 ft./3 m

### **Compatibility**

21 mm or 22.2 mm sockets

### **Fuse**

3 AG 250 V 3 A

## **BATTERY STICK**

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### **Type**

High Capacity Rapid Charge NiCad

### **Voltage**

7.2 V DC nominal

### **Capacity**

3 amp hour at +25° C nominal

### **Temperature**

Operating -20 to +55° C recommended. Will operate at -40° C with 25% of +25° C capacity and degraded cycle lifetime  
Storage -55 to +85° C  
Re-charging 0 to +40° C

### **Weight**

1.5 lbs./0.7 kg

## **TRANSIT CASE**

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### **Type**

Watertight sealed enclosure with pressure release valve

### **Size**

Length	26.25"/667 mm
Height	16.75"/425 mm
Width	16.00"/406 mm

### **Weight**

Empty	16 lbs./7.3 kg
Full	38 lbs./17.3 kg

## **BENCH UTILITY SOFTWARE**

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### **Function**

Allows download, viewing, and saving test data from test set.

### **Compatibility**

Microsoft Windows 95, 98, 2000, XP, NT 4.x

### **Format**

CD ROM

## **ENVIRONMENTAL**

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### **Physical Dimensions: (Test set without accessories)**

Length 14.1"/358 mm

Height 7.5"/190 mm

Width 11.5"/292 mm

Weight 12.25 lbs./5.6 kg (with battery)

### **Temperature**

-40° C to +55° C operating, -55° C to + 85° C storage

### **Relative Humidity**

To 100% for at least 6 hours

### **Splash Proof**

Rain at 1.8 inches per hour and the wind velocity is at least 20 miles per hour (mph), for a period of no less than 60 minutes

### **Altitude**

4,600 meters operating, 50,000 ft. storage

### **Shock Transit**

36 inch drop in transit case

### **Shock High Impact**

36 inch drop

### **Shock Functional**

30 G 11 ms half sine

### **Random Vibration**

10 Hz to 2000 Hz/60 mins per axis

### **EMI/RFI MIL-STD-461E**

CE101 Power Leads, 30 Hz to 10 kHz

CE102 Power Leads, 10 kHz to 10 MHz

CS101 Power Leads, 30 Hz to 150 kHz

CS114 Bulk Cable Injection, 10 kHz to 200 MHz

CS115 Bulk Cable Injection, Impulse

CS116 Cables & Power Leads, Damped Sinusoidal Transients

RE101 Magnetic, 30 Hz to 100 kHz

RE102 Electric, 10 kHz to 18 GHz (RX and TX standby)

RE103 Antenna Spurious and Harmonics, 10 kHz to 40 GHz (TX active)

EXCEPTION: -50 dBc spurious limit, transmit harmonic levels are not required to be lower than 10 dB above the RE102 transmit standby limits.

RS101 Magnetic, 30 Hz to 100 kHz

RS103 Electric, 2 MHz to 18 GHz, 50 V/m

EXCEPTION: does not apply within 10% of RX and TX operating frequency



## VERSIONS, OPTIONS AND ACCESSORIES

<b>Order Number</b>	<b>Description</b>
87866	APM-424(V)4 Interrogator/Transponder Test Set w/ ELS/EHS (NSN: 6625-01-600-6784)
<b>Factory upgrade kits for existing units</b> (COMSEC adapters sold separately)	
67197	Kit, upgrade TS-4530 or AN/APM-424(V)3 to APM-424(V)4
86738	Kit, upgrade TS-4530 or APM-424(V)3 to APM-424(V)5
88573	Kit, upgrade APM-424(V)4 to APM-424(V)5
88572	Kit, upgrade TS-4530-1 to APM-424(V)5

### **Standard Accessories**

12028	Transit case with pressure release valve
58077	COMSEC cable - KIT/KIR-1C (55-1045-10)
58078	RF direct connect cable (55-1045-11)
58081	RS-232 serial data cable (55-1045-15)
38589	RF adapter (30-0225-01)
11492	AC power adapter (15-0360-MO)
58080	DC power cable (55-1045-14)
905	External battery charger (01-1045-10)
47621	Battery sticks (2) (43-0012-00)
88974	Getting Started manual
88470	Operators manual (CD)
67468	Bench utility software (CD)
6154	Battery instruction sheet
	Calibration certificate
	Standard 2-year warranty

### **Optional Accessories**

58079	Adapter, KIV-6 (55-1045-13)
58082	Cable, KIT/KIR-1A (55-1045-16)
11958	Transit case for KIV-6 (ACKIV6CASE)
67474	Tripod
138331	Tripod, heavy duty
58084	Automotive DC adapter cable (55-1045-18)
86633	Bench utility with field maintenance (CD)
88568	Maintenance manual (CD)
84357	Extended warranty 36 mo w/ scheduled calibration
84358	Extended warranty 60 mo w/ scheduled calibration

#### **EXPORT CONTROL:**

This product is controlled for export under the International Traffic in Arms Regulations (ITAR). A license from the U.S. Department of State is required prior to the export of this product from the United States.

#### **EXPORT WARNING:**

Aeroflex's military products are controlled for export under the International Traffic in Arms Regulations (ITAR) and may not be sold or proposed or offered for sale to certain countries including: Belarus, Burma, China, Cuba, Haiti, Iran, Liberia, Libya, North Korea, Somalia, Syria, Sudan, and Vietnam. See ITAR 126.1 for complete information.

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