SI-1404 *MK12/Mode S IFF Accessory Unit*

SI-1404 provides a comprehensive 3rd Line/Depot Level test solution for next generation MK12/Mode S IFF transponders

- *Comprehensive Mode S (level 4) and Mode 4 interrogator simulation*
- *Accurate measurement of transponder reply pulse parameters*
- *Configuration memory stores 5 complete SI-1404 configurations*
- *Extended squitter DF17 capability*
- *Mode 4 crypto simulation plus external crypto interface*
- *Built-in self test*
- *LCD display with adjustable back-light*
- *IEEE-488.2 GPIB & RS-232 interface*
- *Two-year limited warranty*

IFR is a leader in the design, manufacture and marketing of Avionics test systems.

SI-1404

The SI-1404 is a Depot Level/3rd Line test accessory, used in conjunction with the ATC-1400A Transponder/ DME test set, for testing IFF transponders in a maintenance or production environment.

The SI-1404/ATC-1400A may also be utilized by OEMs to perform most of the MOP (Minimum Operational Performance) tests defined in RTCA/DO-181A, required in the Mode S transponder certification process.

The SI-1404 and ATC-1400A form a comprehensive SSR ground station simulator capable of parametric and protocol testing MK10A (Mode 1, 2, 3/A, C), MK12 (Mode 1, 2, 3/A, 4, C) and MK12/Mode S transponders.

OPERATION

Display

Operation of the SI-1404 is via a menu system displayed on a 40 column x 4 row alphanumeric LCD display. The display has an adjustable illumination backlight, which provides viewable screens under all ambient lighting conditions.

Keypad

Menu selection and data entry is provided via a 4 x 5 main key pad, four directional cursor keys and a slew knob. Dedicated keys are provided for commonly used functions.

SI-1404/ATC-1400A Interface

The SI-1404 is interfaced to the ATC-1400A via two rear panel bus cables and three RF coaxial cables.

The SI-1404 provides the ATC-1400A with Mode S DPSK modulation and monitors replies on Ant A (ATC-1400A).

The ATC-1400A provides UUT power and frequency measurement and has a fully synthesized RF generator for performing receiver bandwidth and selectivity tests.

ATC mode selection and SLS testing is provided via the ATC-1400A controls.

Remote Control

The SI-1404 may be controlled via the ATC-1400A IEEE-488 GPIB interface as an integrated system, or via a separate high speed GPIB interface available on the SI-1404 rear panel.

A RS-232 interface is provided for a screen dump to an external printer.

Test Menus and Screens

Testing under manual control is via a series of menus. Menu types are 'C' (Control), 'S' (Sequence) and 'T' (Test). C10 menus relate to control and monitoring of the 'A' antenna RF I/O port (ATC-1400A) and C20 menus relate to the control and monitoring of the 'B' antenna RF I/O port (SI-1404).

The C10 and C20 menus contain a number of 'f' or function screens. The function screens are structured for manual testing.

Control fields are provided for Ant A RF level vernier and Ant A to Ant B diversity time delay.

Measured parameters displayed are, percent reply for Ant A (ATC and Mode S), Ant B (all replies), reply delay and Mode S squitter period.

Main C Menu

Access to all menus and screens is provided via the main 'C' control menu.

```
  C00          MAIN CMENU
1)FUNCT A   4)REPLY DELAY  7)SETUP MENU
2)FUNCT B   5)SQTR 1of2    8)SYSTEM MENU
3)%REPLY    6)SQTR 2of2    9)CAL MENU
```

ATC Screen

Displays Mode 1,2,3/A code or Mode C altitude and provides P_3 control field.

```
C10 f01:ATC (ATCRBS)         Arf:+1.2
                      P3:CAL
Code=ID7777X  Dly=3.0125  Sqtr= 2.10
AntA%:ATC=100,S=0  AntB%=0   AntB:+.95
```

Mode S Sequence Screen

Provides selection of P_6 control, pulse width and deviation, P_2 control, SPR control and deviation. Mode S formats are configured in the sequence menu.

```
C10 F02:SEQ (ModeS)    Arf:+1.2
P6:CAL,Wd: CAL,Dv: CAL  P2:CAL
SPR:ON,Dv: CAL Dly=128.00    Sqtr= 2.10
AntA%:ATC=0,S=100  AntB%=0   AntB:+.95
```

ACS (All-Call Short) Screen

Provides selection of P_4 control, pulse width and deviation. Displays DF11 all-call reply and transponders discrete address.

```
C10 F03:ACS (ALL CALL SHORT)  ARF:+1.2
P4:CAL,Wd:   CAL Dv:CAL        P3:CAL
DF=11         Dly= 128.00    Sqtr= 2.10
AntA%:ATC=100,S=0  AntB%=0   AntB:+.95
```

ACL (All-Call Long) Screen

```
C10 f04:ACL (All Call Long)   Arf:+1.2
P4:CAL,Wd:  CAL,Dv: CAL        P3:CAL
DF=11,AA=123456  Dly=3.0125 SQTR= 2.10
AntA%:ATC=0,S=100  AntB%=0   AntB:+.95
```

Interlace Screen

Provides selection of ATC to Mode S interlace ratio.

```
C10   f05:INTLCE;Ratio:1to999   Arf:+1.2
Dly= 3.0125  Sqtr= 2.10
AntA%:ATC=100,S=100  ANTB%=0   ANTB:+.95
```

Double Interrogation Screen

Provides selection for 1st and 2nd interrogation modes. Interrogation spacing control is provided by the ATC-1400A.

```
C10   f06:DI;1st:ATC,2nd:ATC    Arf:+1.2
                           P3:CAL
Code=ID7777X    Dly= 3.0125    SQTR= 2.10
AntA%:ATC=100,S=0    AntB%=0   ANTB:+.95
```

Burst Screen

Select desired burst format ATC, ASC, ACL or SEQ. Select burst number 1 to 9999. Press burst key to send burst.

```
C10     f07:BURST;SEQ:9999   Arf:+1.2
P6:CAL,Wd: CAL,Dv: CAL        P2:CAL
SPR:ON,Dv: CAL Dly= 3.0125  SQTR= 2.10
AntA%:ATC=0,S=100 AntB%=0  AntB:+.95
```

ATC Monitor Screen

Displays the same parameters as the f01 ATC screen plus F_1/F_2 framing pulse spacing and pulse width, reply jitter and emergency replies.

```
C10  F08:ATC MON;MODE:1        ARF:+1.2
F1toF2=20.3000, F1WD=0.4500, F2WD=0.4500
Code=ID7777X EM  Dly=3.0125   Jtr=0.1500
AntA%:ATC=100,S=  0  ANTB%=100 ANTB:+.95
```

Mode 4 Screen

Displays TDV jitter (from external crypto), triplet reply delay and jitter. Provides selection of Mode 4 P_2, P_3, P_4 control and P_4 deviation.

```
C10 f10:Mode4;Code:CRYPTO     Arf:+1.2
P2:CAL  P3:CAL  P4:CAL,DV:+0.00
TDV Jtr=0.0000 Dly=202.0125 JTR=0.0500
A%:ATC=10,S= 0,M4=90   B%=0    ANTB:+.95
```

Mode 4 Monitor Screen

Displays P_4 to enable trigger spacing, trigger width, Triplet T_1 to T_2 spacing, T_1 to T_3 spacing and T_1, T_2, T_3 widths.

```
C10 f11:Mode4  Mon;Code:EXT  Arf:+1.2
P4 to  EnaTrg=0.2000, EnaTr Wd=0.4500
T1Wd=0.4625, T2Wd=0.4475, T3Wd=0.4625
T1toT2=1.7500, T1toT3=3.5000 AntB:+.95
```

S Menu

Allows the input of Uplink Formats in a programmable sequence of up to 1000 items. Downlink Formats are read-only.

```
  S000:D;UF11,PR=0, IC=0, CL=0,
  +                     ADDR=FFFFFF
  RPLY:D;DF11,CA=5,AA=292492,
                        ADDR=000000
```

Uplink Format

The following Mode S 'D' formats are provided with predefined data fields... UF00, UF04, UF05, UF11, UF16, UF20, UF21 and UF24.

Formats 'S' & 'L' allow the user to define 56-bit and 112-bit words consisting of 5 bits octal/hex formatted data, 27 bits (S) and 83 bits (L) of octal/hex formatted data and 24 bits of octal/hex address data.

Downlink Format

The following Mode S 'D' formats are provided with predefined data fields… DF00, DF04, DF05, DF11, DF16, DF20, DF21 and DF24.

Formats 'S' & 'L' are three fields of generic data consisting of 5 bits octal/hex formatted data, 27 bits (S) and 83 bits (L) of octal/hex formatted data and 24 bits of octal/hex address data.

Percent Reply Screen

Displays Ant A and Ant B, statistical percent replies for ATC, Mode S Mode 4 groups, plus Bad or No Replies.

```
C30            PERCENT REPLY
         ATC  ModeS  Mode4  BAD  NOREPLY
AntA%=   70    10     10     5      5
AntB%=   60    10     20     5      5
```

Reply Delay Screen

Displays Min and Max reply delays for ATC, Mode S and Mode 4 replies.

```
C40           REPLY DELAY
  ATC:  3.0125,Min=  3.0100,Max=  3.0250
ModeS:128.0125,Min=128.0100,Max=128.0250
Mode4:202.0125,Min=202.0100,Max=202.0250
```

Set up Mode 4 Menu

Provides selection of Mode 4 disparity pulse control, sync source, delay, deviation and pulse width. Also provides selection of Mode 4 reply type, sync source, delay, deviation and triplet pulse width.

```
C78           SETUP – MODE 4
         Sync  Var   Dv    Wd
 DispOut:VAR, INT, 198, +0.95, 1.50 (US)
ReplyOut:RND, INT, 202,  CAL , CAL  (US)
```

Set up PPMG Menu

Provides Peak Power Measurement Gate pulse selection for ATC, Mode S, DELM and Mode 4 replies.

```
C74       SETUP – PPMG (POWER)
        ATC  ModeS  DELM  MODE4
Enable:OFF   OFF    OFF   OFF
 PULSE:A1    P116   16    T1
```

Squitter Screen 1

Displays squitter address in hex/octal, tail number and country (if algorithm available), squitter type DF11 (all-call), DF17 (extended squitter).

```
C50          SQUITTER (1 of 2)
Addr:h=A07613,o–50073023,Tail=N129KS
    COUNTRY=UNITED STATES
Counts/120s:DF11=110,DF17= 36,DF17S=24
```

Squitter Screen 2

Displays DF11 and selected DF17 (A, I, O, P, S or T), content, Ant and squitter period.

```
C60            SQUITTER (2 of 2)
DF CA   AA        ME        II ANT TIME
11  4 A07613                 0  A  1.00
17I 4 A07613  1A8C9A3124BA53  0  A 10.05
```

Set up Screen

Provides selection of S menu data type in octal or hex. A factory set of default formats may also be selected plus the discrete address utilized in the S menus can be selected as User defined or Xpdr (obtained from DF11/DF17 squitters).

```
C76           SETUP – SMENU
SmenuRadix:OCTAL    SetAllSmenu:XPDR
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

MISC - MTL Screen

Displays pre-programmed MTL test

```
T23            MISC – MTL          PASS
 Reply%:100  Time:10Sec    MTL:–65.3DBM
Antenna: A   Error: 2=PASS
        Press BURST to start test
```

Specification

NOTE: These specifications supersede ATC-1400A specifications when the ATC-1400A is connected with the SI-1404. Refer to paragraph 1-3-1 in the ATC-1400A Operation Manual for specifications not outlined in this section.

RF

Antenna A (ANT A), RF I/O Connector

Frequency:	Per ATC-1400A Specifications
Level:	Per ATC-1400A Specifications

Vernier Control

Range:	±3.0 dB
Step:	0.1 dB
Accuracy:	±0.05 dB or ±10%

Antenna B (ANT B), RF I/O Connector

Frequency:	1030 MHz
Accuracy:	0.001%
Level:	
Range:	-20 to -83 dBm
Step:	1 dB
Accuracy:	±0.5 dB relative to ATC-1400A at -20 dBm into 50 Ω

Attenuator Accuracy:

Level	Accuracy
-30 dBm	±0.4 dB
-40 dBm	±0.4 dB
-50 dBm	±0.4 dB
-60 dBm	±0.5 dB
-70 dBm	±0.61 dB
-80 dBm	±0.72 dB

Vernier Control

Range:	±3.0 dB
Step:	0.1 dB
Accuracy:	±0.05 dB or ±10%

Pulse Characteristics

NOTE: Pulse characteristics are verified from the RF I/O or ANT B Connectors using a Heterodyne Monitor.

General

ANT A

Rise and Fall times:	Per ATC-1400A Specifications

ANT B

Rise Time:	50 to 90 ns
Fall Time:	50 to 200 ns
On/Off Ratio:	>80 dB
P_1 Position (CAL):	Relative to ANT A P_1
Deviation:	Variable from CAL (±0.95 µs)
Step:	0.05 µs

ANT A to ANT B Tracking Accuracy: ±15 ns

PRF Limitations

ATC Function:	7999 Hz
SEQ Function:	2500 Hz
ACS Function:	2500 Hz
ACL Function:	2500 Hz
INTLCE Function:	1250 Hz
DI Function:	1250 Hz
BURST Function:	7999 Hz (ATC)
	2500 Hz (All others)
ATCRBS Monitor Function:	4000
Mode 4/Mode 4 Monitor Functions:	2500

PRF Accuracy (TrigGen)

Range (Hz):

	1 to 2500 Hz (All functions except INTLCE and DI)
	1 to 1250 Hz (INTLCE and DI)
Step Size:	1 Hz
Accuracy:	±1 Hz, ±0.0035%
Range (Sec):	0.0004 to 99.9999 Sec (All functions except (INTLCE and DI)
	0.0008 to 99.9999 Sec (INTLCE and DI)
Step Size:	0.1 ms
Accuracy:	±100 ns, ±0.0035%

External Sync Input, EXT SYNC IN Connector

Maximum Input Frequency

ATC Function:	7999 Hz
SEQ Function:	2500 Hz
ACS Function:	2500 Hz
ACL Function:	2500 Hz
INTLCE Function:	1250 Hz
DI Function:	1250 Hz
BURST Function:	7999 Hz (ATC)
	2500 Hz (All others)
Minimum Input Low Time:	200 ns

ATC Function

P_2 P_3

Amplitude (CAL) (ANT A):	0 dB, relative to P_1
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL):	0.8 µs
Range:	Variable from 0.2 to 1.85 µs
Step:	0.05 µs
Accuracy:	±10 ns
Width (CAL) (ANT B):	0.8 µs
Range:	Variable from 0.2 to 1.85 µs
Step:	0.05 µs
Accuracy (CAL):	±10 ns
(Variable ≤0.8 µs):	±20 ns
(Variable >0.8 µs):	±10 ns
Position (CAL) (ANT A and ANT B):	2.0 µs following leading edge of P_1
Deviation:	Variable from CAL (±1.85 µs)
Step:	0.05 µs
Accuracy:	±10 ns

P_3

Amplitude (CAL) (ANT A):	0 dB, relative to P_1
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 µs
Range:	Variable from 0.20 to 1.85 µs
Step:	0.05 µs
Accuracy:	±10 ns

Width (CAL) (ANT B):	0.8 µs		**Step:**	1 µs
Range:	Variable from 0.20 to 1.85 µs		*Accuracy:*	±50 ns ±0.005%

Width (CAL) (ANT B): 0.8 µs

Range: Variable from 0.20 to 1.85 µs

Step: 0.05 µs

Accuracy (CAL): ±10 ns

  (Variable <0.8 µs): ±20 ns

  (Variable ≥0.8 µs): ±10 ns

Position (CAL) (P1 to P3):

  3.0 µs (Mode 1)

  5.0 µs (Mode 2)

  6.5 µs (Mode T)

  8.0 µs (Mode 3/A)

  17.0 µs (Mode B)

  21.0 µs (Mode C)

  25.0 µs (Mode D)

Deviation: Variable from CAL (±1.85 µs)

Step: 0.05 µs

Accuracy: ±10 ns

Interference Pulse (PrePulseOut OFF or 0) (<1200 PRF)

Amplitude: 0 dB, relative to P_1

Range: Variable from -19 to +6 dB

Step: 1 dB

Accuracy: ±0.3 dB for -10 to +3 dB

Width: Variable from 0.2 to 5 µs

Position: Variable from 17.5 µs prior to P_1 to 399.9 µs following P_1

Step: 0.1 µs

Accuracy: ±0.1 µs, ±0.005% of pulse position selected on the ATC-1400A

Suppressor Pulse (PrePulseOut OFF or 0) (<1200 PRF) through SUPPRESSOR

OUTPUT Connector

Amplitude: Per ATC-1400A Specifications

Width: Per ATC-1400A Specifications

Position: 0.8 µs prior to leading edge of P_3

Range: Variable from 17.5 µs prior to P_1 to 399.9 µs following P_1

Step: 0.1 µs

Accuracy: ±0.1 µs, ±0.005% of pulse position selected on the ATC-1400A

Prepulse through PREPULSE OUT

Connector

Position: Variable from 0 to 260 µs prior to leading edge of P_1

External Sync Output through EXT SYNC

OUT Connector

Position: Variable from -9.95 to +9.95 µs from rising edge of P_1

Step: 0.05 µs

Accuracy: ±50 ns

ATCRBS Discrete Pulse through ATCRBS OUT Connector

Width: 3.0 µs

Accuracy: ±50 ns

Position: 1.0 µs prior to leading edge of P_1

Accuracy: ±50 ns

SEQ Function

P_2

Amplitude (CAL) (ANT A): 0 dB, relative to P_1

Range: Variable from -19 to +6 dB

Step: 1 dB

Accuracy: ±0.3 dB for -10 to +3 dB

Width (CAL) (ANT A): 0.8 µs

Range: Variable from 0.20 to 1.85 µs

Step: 0.05 µs

Accuracy: ±10 ns

Width (CAL) (ANT B): 0.8 µs

Range: Variable from 0.20 to 1.85 µs

Step: 0.05 µs

Accuracy (CAL): ±10 ns

  (Variable <0.8 µs): ±20 ns

  (Variable ≥0.8 µs): ±10 ns

Position (CAL) (ANT A and ANT B): 2.0 µs following leading edge of P_1

Deviation: Variable from CAL (±1.85 µs)

Step: 0.05 µs

Accuracy (CAL): ±10 ns

P_5 SLS

Amplitude (CAL) (ANT A): 0 dB, relative to P_1

Range: Variable from -19 to +6 dB

Step: 1 dB

Accuracy: ±0.5 dB for -10 to +3 dB

Width (CAL) (ANT A): 0.8 µs

Accuracy: ±100 ns

Position (CAL) (ANT A):	0.4 µs before Sync Phase Reversal (SPR)	
Deviation:	Controlled by SPR deviation	
Accuracy:	±100 ns	

P6 (ANT A and ANT B)

Width (CAL):	16.25 µs for short formats
	30.25 µs for long formats
Range:	Variable from CAL (±1.5 µs)
Step:	0.05 µs
Accuracy:	±10 ns
Position (CAL):	3.5 µs following leading edge of P_1
Deviation:	Variable from CAL (±1.95 µs)
Step:	0.05 µs
Accuracy:	±10 ns

SPR (ANT A and ANT B)

Position (CAL):	2.75 µs following leading edge of P_2 (CAL)
Deviation:	Variable from CAL (±1 µs) (DPSK data deviates accordingly.)
Step:	0.05 µs
Accuracy:	±10 ns
DPSK	
Phase Reversal Time:	<80 ns (10° to 170°)

Interference Pulse

Same as in ATC Function

Suppressor Pulse (PrePulseOut OFF or 0) (<1200 PRF) through SUPPRESSOR OUTPUT Connector:

Amplitude:	Per ATC-1400A Specifications
Width:	Per ATC-1400A Specifications
Position:	0.8 µs prior to SPR (CAL)
Deviation:	Variable from 17.5 µs prior to P_1 to 399.9 µs following P_1
Step:	0.1 µs
Accuracy:	±0.1 µs, ±0.005% of pulse position selected on the ATC-1400A

Prepulse through PREPULSE OUT Connector

Same as in ATC Function

External Sync Output through EXT SYNC OUT Connector

Same as in ATC Function

ACS/ACL Functions

P_2 SLS Same as in ATC Function

P_3 (ANT A and ANT B) Same as in ATC Function

P_4:

Amplitude (CAL) (ANT A):	0 dB, relative to P_1
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A)	0.8 µs for short P_4 (ACS) or
	1.6 µσ for long P_4 (ACL)
Range:	Variable (independent of P_1, P_2 and P_3) from 0.2 to 3.55 µs
Step:	0.05 µs
Accuracy:	±10 ns
Width (CAL) (ANT B)	0.8 µs for short P_4 (ACS) or
	1.6 µs for long P_4 (ACL)
Range:	Variable (independent of P_1, P_2 and P_3) from 0.2 to 3.55 µs
Step:	0.05 µs
Accuracy (CAL):	±10 ns
(Variable <0.8 µs):	±20 ns
(Variable ≥0.8 µs):	±10 ns
Position (CAL)	2.0 µs following leading edge of P_3
Deviation:	Variable from CAL (±1.95 µs)
Step:	0.05 µs
Accuracy:	±10 ns

Interference Pulse

Same as in ATC Function

Suppressor Pulse through SUPPRESSOR OUTPUT Connector

Same as in ATC Function

Prepulse through PREPULSE OUT Connector

Same as in ATC Function

External Sync Output through EXT SYNC OUT Connector

Same as in ATC Function

INTLCE Function

ATC Interrogations: Same as in ATC Function (CAL settings)

SEQ Interrogations: Same as in SEQ Function (CAL settings)

Position:	200 µs from ATC interrogation P_1 leading edge to SEQ interrogation P_1 leading edge

DI Function

First Interrogation

Refer to applicable function

Second Interrogation

Refer to applicable function (CAL settings).

DI Spacing (P_1 leading edge of 1st interrogation to P_1 leading edge of 2nd interrogation)

ATC, ACS or ACL (either interrogation):

Range:	0 to 399.9 µs
Step:	0.1 µs
Accuracy:	±50 ns, ±0.005%

SEQ (both interrogation):

Range:	40.0 to 399.9 µs
Step:	0.1 µs
Accuracy:	±50 ns, ±0.005%

BURST Function

Interrogations: Refer to applicable function.

ELM Function

SEQ Interrogations: Refer to applicable function (CAL settings).

Mode 4 (Internal) Function

P_2 - P_4

Amplitude:	0 dB, relative to P_1
Width (CAL):	0.5 µs
Range:	P_1, P_2 and P_3 are variable from 0.2 to 1.85 µs. (P_4 is fixed.)
Step:	0.05 µs
Accuracy:	±10 ns (for pulse widths from 0.2 to 1.5 µs)
Width (CAL) (ANT B):	0.5 µs
Range:	P_1, P_2 and P_3 are variable from 0.2 to 1.85 µs. (P_4 is fixed.)
Step:	0.05 µs
Accuracy:	
(CAL):	±20 ns
(Variable) at <0.8 µs:	±20 ns
(Variable) at ≥0.8 µs:	±10 ns (for pulse widths from 0.2 to 1.5 µs)
Position (CAL) (P_1 to P_2):	2.0 µs (±10 ns)
Position (CAL) (P_1 to P_3):	4.0 µs (±10 ns)
Position (CAL) (P_1 to P_4):	6.0 µs (±10 ns)

Deviation:

P_2 and P_3:	Variable from CAL (±1.85 µs)
P_4:	Variable from CAL (-1.85 µs to +1.0 µs)
Step:	0.05 µs
Accuracy:	±10 ns

P_5 (SLS)

Amplitude	-19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width	0.5 µs
Accuracy:	±10 ns

P_6 - P_{37}

Amplitude (ANT A)	0 dB, relative to P_1
Width (ANT A)	0.5 µs
Accuracy:	±10 ns
Position (P_1 to P_N)	9.0 to 72.0 µs
Deviation:	Pulses are distributed throughout the 9 to 72 µs range at 1, 2 or 3 µs increments.

Some pulses are shut off.

Accuracy:	±10 ns

Reply Out through REPLY (TTL) OUT and REPLY (3-27 V) OUT Connectors

Amplitude

REPLY (TTL) OUT Connector: Positive TTL into 90 Ω

REPLY (3-27 V) OUT Connector: Nominal 4.5 V, Internally adjustable +3 to +27 V into 1 kΩ

Width

CAL:	0.45 µs
Range:	Variable from 0.10 to 1.25 µs
Step:	0.05 µs
Accuracy:	

REPLY (TTL) OUT Connector: ±10 ns

REPLY (3-27 V) OUT Connector:±100 ns

Pulse Spacing

T_1 to T_2 Spacing:	1.75 µs
Accuracy:	±10 ns
T_1 to T_3 Spacing:	3.5 µs
Accuracy:	±10 ns

Position (CAL ReplyOut)

Mode 0 (ZERO Code):	232.0 µs following Sync Source leading edge
Mode A (A Code):	202.0 µs following Sync Source leading edge
Mode B (B Code):	262.0 µs following Sync Source leading edge
All (ALL Code):	250.0 µs following Sync Source leading edge
Random (RND Code):	218.0 µs following Sync Source leading edge
Mode Accuracy:	±50 ns
Sync Source:	P_4 or Enable Trigger pulse input through ENABLE TRIG IN Connector (Enable Trigger leading edge must occur within P_4 time period).
Position (RND ReplyOut)	202.0 to 262.0 µs (16 different positions) following Sync Source leading edge in a quasi-random fashion

Position (VAR ReplyOut)

2 to 270 µs	
Step:	1 µs
Accuracy:	±50 ns
Deviation	Variable from CAL (±0.95 µs)

Disparity Pulse through DISPARITY

OUT Connector

Width

CAL:	0.5 µs
Range:	0.10 to 1.50 µs
Accuracy:	±10 ns
Position (CAL)	198.0 µs following Sync Source leading edge Sync Source: P_4 or Enable Trigger pulse input through ENABLE TRIG IN Connector (Enable Trigger leading edge must occur within P_4 time period).
Accuracy:	±50 ns
Position (VAR)	Variable from 2 to 275 µs following leading edge of Sync Source.
Step:	1 µs
Accuracy:	±50 ns
Deviation	Variable from CAL (±0.95 µs)

Mode 4 (External) Function

Trigger Pulse through SCOPE TRIG OUT Connector

Width:	1.0 µs
Accuracy:	±50 ns

External Modulation input through EXT MOD IN Connector

Polarity:	Positive
Amplitude:	2.5 to 15 V

UUT Measurements

Reply Delay

ANT A

ATC (leading edge of P_3 [CAL] to leading edge of F_1)

Range:	2 to 4 µs
Resolution:	12.5 ns
Accuracy:	±50 ns

SEQ (SPR to leading edge of reply P_1)

Range:	126 to 130 µs
Resolution:	12.5 ns
Accuracy:	±50 ns, ±1 count

ACS/ACL

ATCRBS Reply (leading edge of P_3 [CAL] to leading edge of F_1):

Range:	2 to 4 µs
Resolution:	12.5 ns
Accuracy:	±50 ns, ±1 count

Mode S Reply (leading edge of P_4 [CAL] to leading edge of reply P_1):

Range:	126 to 130 µs
Resolution:	12.5 ns
Accuracy:	±50 ns, ±1 count

Mode 4 Reply (leading edge of P_4 to leading edge of T_1)

Range:	202 to 270 µs
Resolution:	12.5 ns
Accuracy:	±50 ns

ANT B:

ATC (leading edge of P_3 [CAL] to leading edge of F_1)

Range:	2 to 4 µs
Resolution:	12.5 ns
Accuracy:	±100 ns, ±1 count (UUT VIDEO Connector unterminated)
	±200 ns, ±1 count (UUT VIDEO Connector terminated into 50 Ω)

SEQ (SPR to leading edge of reply P_1)

Range:	126 to 130 µs
Resolution:	12.5 ns
Accuracy:	±100 ns, ±1 count (UUT VIDEO Connector unterminated)
	±200 ns, ±1 count (UUT VIDEO Connector terminated into 50 Ω)

ACS/ACL

ATCRBS Reply (leading edge of P_3 [CAL] to leading edge of F_1):

Range:	2 to 4 µs
Resolution:	12.5 ns
Accuracy:	±100 ns, ±1 count (UUT VIDEO Connector unterminated)
	±200 ns, ±1 count (UUT VIDEO Connector terminated into 50 Ω)

Mode S Reply (leading edge of P_4 [CAL] to leading edge of reply P_1)

Range:	126 to 130 µs
Resolution:	12.5 ns
Accuracy:	±100 ns, ±1 count (UUT VIDEO Connector unterminated)
	±200 ns, ±1 count (UUT VIDEO Connector terminated into 50 Ω)

Mode 4 Reply (leading edge of P_4 to leading edge of T_1)

Resolution:	12.5 ns
Accuracy:	±50 ns

% Reply

ATCRBS Valid Reply (ANT A and ANT B)

Range:	0% to 100%
Resolution:	1%
Accuracy:	±1 step

Mode S Valid Reply (ANT A and ANT B)

Range:	0% to 100%
Resolution:	1%
Accuracy:	±1 step

Mode 4 Valid Reply (ANT A and ANT B)

Range:	0% to 100%
Resolution:	1%
Accuracy:	±1 step

Pulse Characteristics

ATCRBS Monitor Pulse Function (ATC Mon):

Reply Pulse F_1 and F_2 Width (into ANT A or ANT B at 500 W)

Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Reply Pulse F_1 to F_2 Spacing (into ANT A or ANT B at 500 W)

Resolution:	12.5 ns
Accuracy:	

(ANT A):	±50 ns
(ANT B):	±100 ns

Mode 4 Monitor Pulse Function (Mode 4 Mon)

Enable Trigger Pulse (into ENABLE TRIG IN Connector) Delay from leading edge of P_4

Range:	Enable Trigger Pulse must occur within P_4 time period.
Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Enable Trigger Pulse Width (into ENABLE TRIG IN Connector)

Resolution:	12.5 ns
Accuracy:	±50 ns

Reply Pulse T_1, T_2 and T_3 Width (into ANT A or ANT B at 500 W)

Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Reply Pulse T_1 to T_2 and T_2 to T_3 Spacing (into ANT A or ANT B at 500 W):

Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Mode 4 TDV Jitter

TDV Jitter (peak to peak jitter in delay from leading edge of P_1 to leading edge of Time Decoded Video pulse input through DECODED VIDEO IN Connector)

Range:	0 to 9.999 µs
Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Miscellaneous Outputs

SIGNAL NAME (CONNECTOR)	LEVEL Voh (Min)	Vol (Max)	LOAD IMPEDANCE
ANT B GEN OUT (J22)	2.4 V	0.6 V	≥90 Ω
ANT B VIDEO OUT (J6)	2.4 V	0.6 V	≥90 Ω
ATCRBS OUT (J5)	2.4 V	0.6 V	≥90 Ω
DISPARITY OUT (J23)	2.4 V	0.6 V	≥90 Ω
EXT PRF OUT (J17)	2.4 V	0.6 V	≥90 Ω
EXT SYNC OUT (J8)	2.4 V	0.6 V	≥90 Ω
PPMG (J14)	2.4 V	0.6 V	≥90 Ω
PREPULSE OUT (J9)	2.4 V	0.6 V	≥90 Ω
REPLY (TTL) OUT (J25)	2.4 V	0.6 V	≥90 Ω
SCOPE TRIG OUT (J7)	2.4 V	0.6 V	≥90 Ω

Miscellaneous Inputs

SIGNAL NAME (CONNECTOR)	LEVEL Vih (Min)	Vil (Max)	INPUT IMPEDANCE
DECODED VIDEO IN (J20)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)
ENABLE TRIG IN (J24)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)
EXT MOD IN (J3)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)
EXT SYNC IN (J4)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)
MODE GRP TRIG IN (J18)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)
REPLY GRP TRIG IN (J19)	+2 to +15V	0.0 to 0.7V	≥1 kΩ (Typical)

General

Calibration Interval

1 year

AC Supply

100 to 120 VAC, 220 to 240 VAC, 50 Hz to 60 Hz, ≤+10% of the nominal voltage

48 W maximum (180 W maximum with ATC-1400A)

AC Output

Line output, fused at 3 amps and switched

ENVIRONMENTAL

Temperature

5° to 40°C

Relative Humidity

≤80% for temperature upto 31°C decreasing linearty to 50% at 40°C (Non condensing)

Altitude

≤4000 m (13,124 ft.)

Electromagnetic Compatibility

Complies with the limits in the following standards:

EN55011 Class B

EN50082-1

Safety

Complies with EN61010-1:1993 for class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category 1 or 2 supply.

Dimensions

425 mm wide x 89 mm high x 467 mm deep

16.8 in. wide x 3.5 in. high x 18.4 in. deep

Weight

6.75 kg (15 lbs.)

Versions and Accessories

When ordering please quote the full ordering number information.

Ordering Numbers
Versions

1404–110	SI-1404 Modes S & 4 Transponder with MLD, 110 VAC Certificate of Calibration
1404–220	SI-1404, 220 VAC Operation

All IFR Avionics products delivered with Factory Certificate Of Calibration