IRIG-B ANALYZER

USER MANUAL

Contents

1   INTRODUCTION

The IRIG-B Analyzer helps you decode and validate your IRIG-B timing signals, automatically handles optical or multilevel copper signal inputs and is battery powered with an easy to read backlit LCD display, ideal for use in areas with poor lighting.

It comes complete with all components required for IRIG-B measurement including an optical converter, a BNC-Tee and test leads to measure copper-based IRIG-B signals.

2 IRIG-B ANALYZER KIT: CONTENTS

The IRIG-B Analyzer kit consists of the following items:

Rubber Protective Cover	Test Leads
Figure 1: IRIG-B Analyzer fitted with rubber cover	Figure 2: Supplied leads
ST to SC Fiber Adaptor	**BNC Tee Adaptor**
Figure 3: ST to SC Fiber Adaptor	Figure 4: BNC Adaptor

Carry Case

Figure 5: Carry Case

3   FITTING BATTERIES

The IRIG-B Analyzer is powered from two AA batteries (not included). To fit these batteries, follow the steps below:

1. Remove the protective rubber cover by pulling the rubber cover off both bottom corners of the analyzer first (as per Figure 6).

Figure 6: Removing the rubber cover

2. Slide the battery housing cover off the underside of the Analyzer.

3. Fit two fresh AA batteries ensuring the polarity of each is as shown in Figure 7 below.

4. Re fit the battery cover.

5. Re fit the protective rubber cover starting by fitting the cover top first then stretch the bottom over the analyzer.

Figure 7: Two AA batteries correctly fitted

4   IRIG-B ANALYZER KEYPAD AND SCREEN

The IRIG-B Analyzer has 6 buttons with the functionality indicated below:

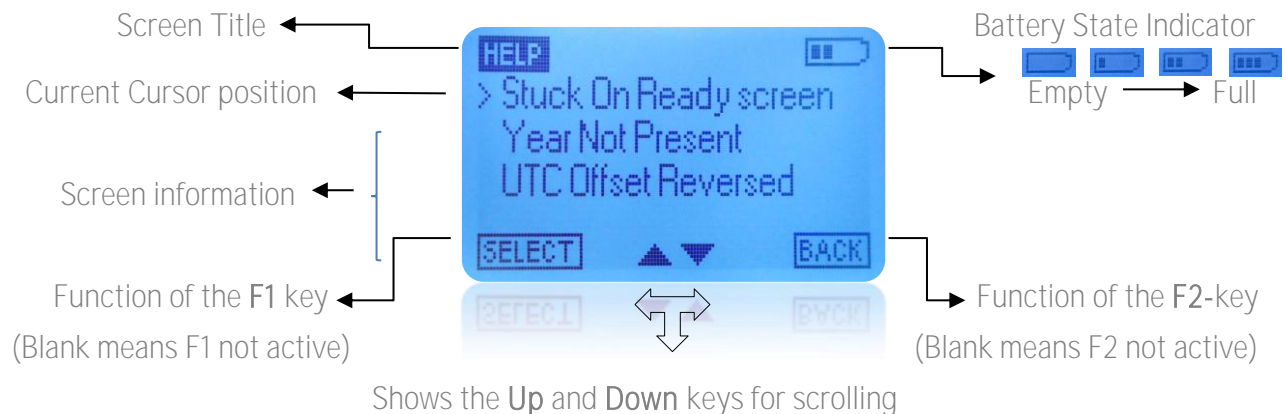| Key	Name	Function
F1	F1	The function of this button is dependent on the mode of the Analyzer. The current function is displayed just above the F1 button.
F2	F2	The function of this button is dependent on the mode of the Analyzer. The current function is displayed just above the F2 button.
△	Up	This key is used to scroll the screen in the upwards direction.
▽	Down	This key is used to scroll the screen in the downwards direction
⓪	Power	This key is used to turn the IRIG-B Analyzer on or off. When turning the unit off, hold down for 3 seconds. Note: The unit will automatically switch off after 6 minutes of inactivity.
☼	Backlight	Pressing this key toggles the LCD back light on and off.

The IRIG-B Analyzer has the following general screen layout:

Screen Title

Current Cursor position

Screen information

Function of the **F1** key
(Blank means F1 not active)

Shows the **Up** and **Down** keys for scrolling

Battery State Indicator

Empty ⟶ Full

Function of the **F2**-key
(Blank means F2 not active)

HELP

> Stuck On Ready screen
Year Not Present
UTC Offset Reversed

SELECT ▲▼ BACK

5   POWERING ON THE IRIG-B ANALYZER

Pressing the **Power** [⏻] button will turn the IRIG-B Analyzer on. During start up, an initialization screen with the Serial Number will be shown for a short time. Refer to Figure 8

Figure 8: Startup Screen

Once initialized, the IRIG-B Analyzer will display the **Home** screen as below in Figure 9

6   HOME SCREEN

Whilst in this state the unit will start searching for both fiber and copper IRIG-B inputs. Whilst searching for a valid input signal, the analyzer will transition between different status screens (Figure 9).
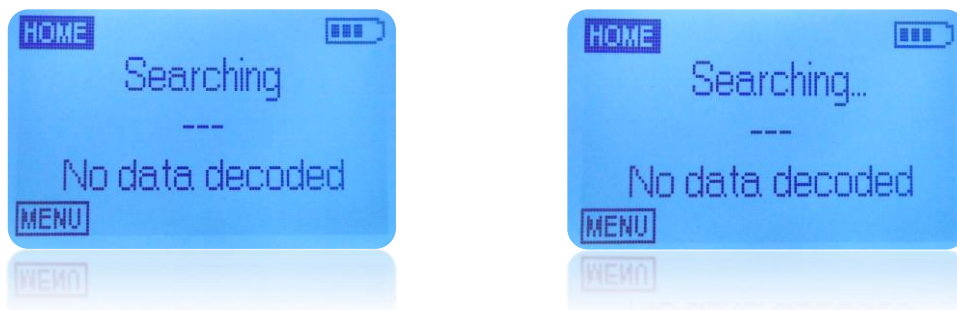
Figure 9: Sample of the displayed screens when searching for an IRIG-B signal

7   MEASURING COPPER IRIG-B SIGNALS

⚠️ **Warning**: The IRIG-B signals to be measured can be at a voltage level that presents a shock hazard. Care should be taken when doing these measurements to avoid touching any exposed terminals.

If the IRIG-B signal being measured exceeds 48V (AC or DC), then a **High Voltage** symbol will be displayed at the top of the screen as in **Figure 10** below.
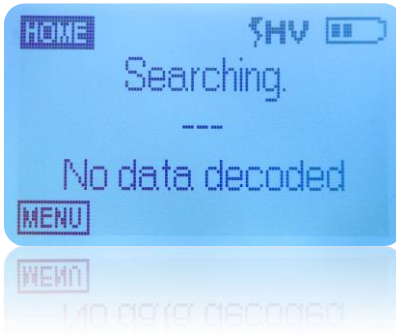
Figure 10: High Voltage warning display

1. To measure electrical IRIG-B signals connect the two test leads to the IRIG-B Analyzer as shown in Figure 11. Ensuring that the red plug is inserted into the red socket, and the black plug is inserted into the black socket.

Figure 11: Test leads connected ready to read copper IRIG-B signals

2. Hold the probes to the exposed IRIG-B cabling test point ensuring the red lead is connected to the positive and black to the negative side of the IRIG-B signal.

3. The IRIG-B analyzer will detect if an IRIG-B signal is present and display the screen in Figure 12 for 1 second.

Figure 12: Signal detection screen

4. The IRIG-B Analyzer will display the signal properties as shown in Figure 13, the arrow keys can be used to navigate through the listed details.

Figure 13: Typical Detail Screen

Note: A full description of the signal properties displayed on the details screen can be seen in the Appendix.

When viewing the **Details** screen you can press **F2** to return to the HOME screen to re-test the IRIG-B signal.

8   MEASURING FIBER IRIG-B SIGNALS

SC Fiber Cable

1. Remove the protective plug from top of IRIG-B analyzer to expose the SC fiber socket as per Figure 14 below.
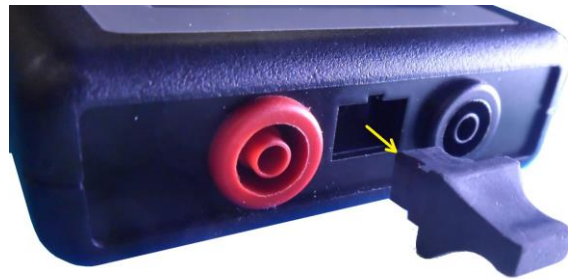
Figure 14: SC Fiber socket with protective plug removed

2. Connect the IRIG-B SC fiber cable to the IRIG-B Analyzer ensuring the tab on the fiber plug matches the notch in the fiber socket as shown below in Figure 15 below.

Fiber plug tab aligned with fiber socket notch

Figure 15: Correct orientation of fiber plug

ST Fiber Cable

1. If the fiber cable is a **ST** type cable, plug the **SC** to **ST** adaptor into the analyzer as below ensuring the fiber plug tab is oriented with the socket notch as described above.

2. Next plug the **ST** Cable into the adaptor making sure the **ST** plug tab aligns with the adaptor notch as shown below before engaging the bayonet style locking mechanism.

Line up socket slot with connector tab

Signal Details Screen

1. The IRIG-B analyzer will detect if an IRIG-B signal is present and display the screen in Figure 16 1 second.

Figure 16: Signal detected

2. The IRIG-B Analyzer will then display the signal properties as shown in Figure 17, the arrow keys can be used to navigate through the listed details.

Figure 17: Fiber IRIG-G Signal details

Notes:

- A full description of the signal properties displayed on the details screen can be seen in Appendix.Figure 18Figure 18: Transferring Data

3. When viewing the **Details** screen you can press **F2** to **return to the "HOME" screen and** re-test the IRIG-B signal.

⚠ **Warning**: Important note!! Always replace the rubber protective plug after use to prevent the optical receiver from being subjected to dust and other contaminants which could inhibit the IRIG-B Analyzer from operating correctly in future.

9 MENU OPTIONS

The IRIG-B analyzers menu can be accessed from the "Home" screen by pressing **F1** (Menu). To navigate the menu, use the arrow keys to highlight the different options. **F1** can be used to select items and **F2** can be used to navigate backwards or exit the menu. Refer to Figure 19

Figure 19: Main Menu

The menu contains the following fields:

- Help

    o Provides troubleshooting advice and instructions on performing a firmware upgrade. See the Help Screen details (<u>HELP SCREEN</u>) for more information.
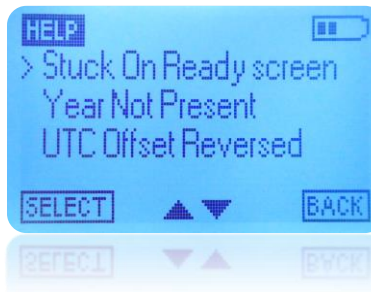
Figure 20: The help menu screen

- Firmware Upgrade

    o Entering this section will enable the unit to connect to the computer to start a firmware upgrade via Wireless. Refer to the **Upgrading the IRIG-B Analyzer Firmware** document available from <u>http://tekron.com/power/irigb-analyzer</u> for more information.
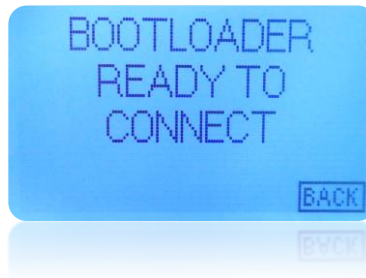
Figure 21: Bootloader Screen

- About

  - o Provides company information, and a scrollable display showing the current firmware version, serial number and hardware revision.

Figure 22: The About screen

10 HELP SCREEN

The IRIG-B Analyzer Help screen can be accessed from the Menu screen and gives a brief help on the following topics.

Stuck On Home Help Screen
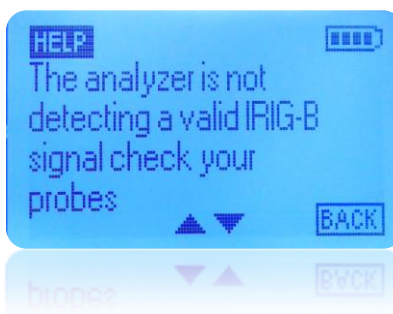
Figure 23: Stuck on Ready Help Screen

This is where the IRIG-B Analyzer is not detecting a valid IRIG-B signal when on the **Home** screen. Refer to the Troubleshooting section below for possible causes.

Year Not Present Help Screens
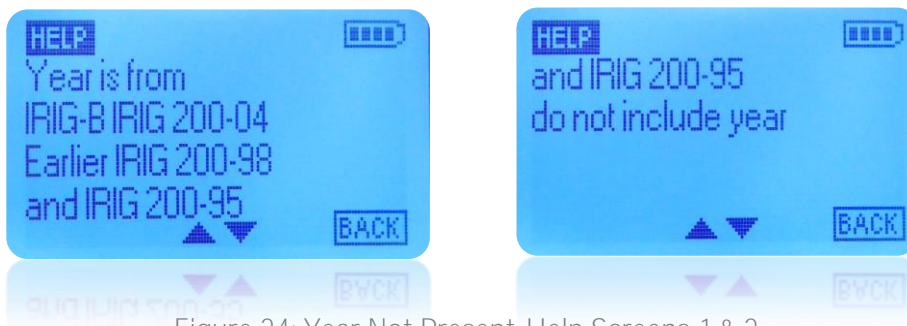
Figure 24: Year Not Present-Help Screens-1 & 2

This may be encountered when the IRIG-B signal is from a Clock conforming to earlier IRIG standards.

UTC Offset Reversed
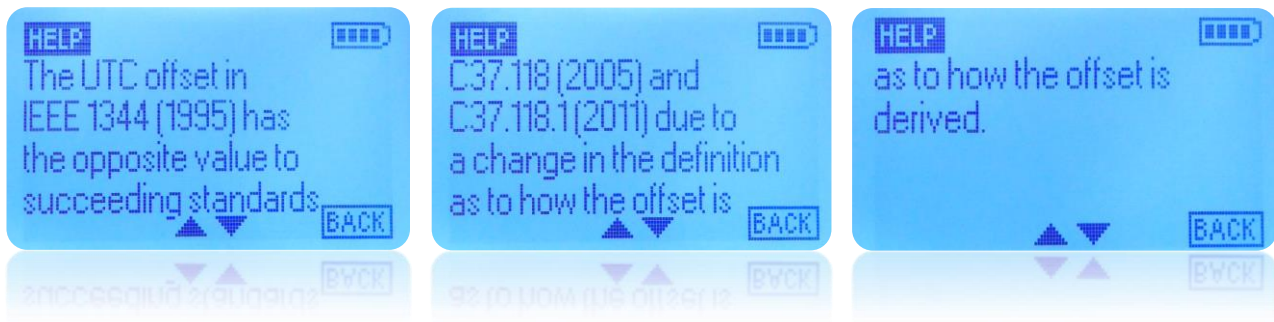
Figure 25: UTC Offset Reversed-Help Screens 1, 2 & 3

This may be encountered when the IRIG-B signal is from a Clock conforming to earlier IRIG standards

Firmware Upgrade

Figure 26: UTC Offset Reversed-Help Screens 1, 2 & 3

This is a brief help with upgrades of the Analyzer software in the field. For further information, refer to the Upgrade Guide available from www.tekron.com.

Polarity Inverted

Figure 27: Polarity Inverted- Help Screens 1, 2, 3 & 4

This help screen prompts the user to check the probes are connected to the IRIG-B signal with the correct polarity and explains why RS-232 IRIG-B normally is reported as inverted. See the Troubleshooting section below for more help on Inverted Polarity.

11 TROUBLESHOOTING GUIDE

1. No Signal Detected

   a. Confirm the source of the IRIG-B signal is configured to output IRIG-B and that it is in operation.

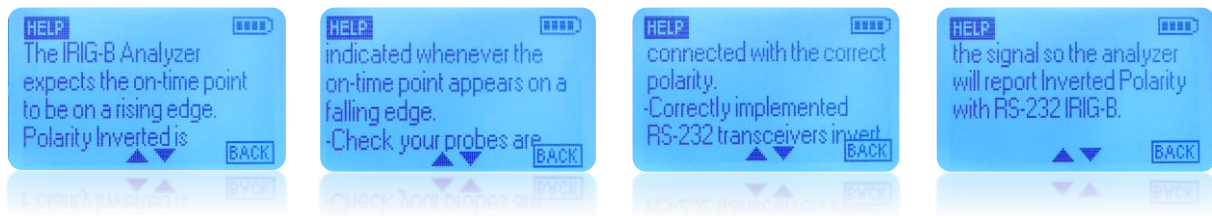   b. For copper IRIG-B, check the probes are making secure contact with the line. Some pressure may be required to get good signal detection. The IRIG-B Analyzer is able to measure IRIG-B signals down to 2V peak to peak.

   c. For fiber IRIG-B, check the fiber connectors are properly inserted into the fiber socket and ensure the fiber signal being measured is using the correct standard (i.e. 820nm λ multi-mode fiber). Check the fiber patch cable being used supports 830nm λ multi-mode signals.

2. Blank Screen when powered up

   a. Check battery condition, replace with fresh batteries if needed. Check they are installed in the IRIG-B Analyzer with the correct polarity.

   b. If the problem persists, contact Tekron at: support@tekron.com

3. Measured IRIG-B Signal Reported as Inverted
   The IRIG-B Analyzer is optimized to measure electrical IRIG-B signals where the IRIG-B logic 1 level is more positive than the logic low level, (for example in TTL levels Logic 1 is nominally +5v and Logic 0 is 0v).

The RS-232 standard however has the logic levels reversed so that logic 1 is a negative voltage and a logic 0 is a positive voltage. As a consequence, when measuring RS-232 signals with the IRIG-B analyzer, it is normal that the polarity is reported as inverted.

RS-422 and RS-485 IRIG-B signals are balanced signals so when measuring these with the IRIG-B analyzer care should be taken to measure the signal between the two signal wires and not from one

or other with respect to ground. It is important to ensure the probes are oriented correctly still by connecting the red probe to the non-inverted signal wire and the black probe to the inverted signal wire.

4. Upgrades.

Refer to the Upgrade Guide available from http://tekron.com/power/irigb-analyzer

If your problem is not covered above, or it persists contact Tekron International's technical support at support@tekron.com

12 CLEANING THE IRIG-B ANALYZER

Smear marks on the keypad and LCD window can be cleaned by using a damp soft cloth and light pressure. Do not use any other chemicals or immerse in liquid.

13 NOTES

The information in this manual may change without notice. The manufacturer assumes no responsibility for any errors that may appear in this manual.

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14 WARNING

This product has been designed to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against such interference when operating in a commercial environment.

15 DOCUMENT REVISION HISTORY

Version	Author	Compatible with firmware version	Date Completed	Published Date	Changes Made
1.0	R Brown & A Lippitt	01.01	28 Aug 2015	15 Sept 2015	First revision of the manual
2.0	R Brown	01.08	05 April 2016	4 April 2016	Product imagery updated and some sections have been added

16 APPENDIX

IRIG-B signal properties

Example	Properties	Copper IRIG-B	Fiber IRIG-B
SIGNAL TYPE			
DC Level Shift or Fiber Manchester	Signal Type	○ IRIG-B00x (DCLS) ○ IRIG-B12x (AM) ○ IRIG-B22x Modified Manchester	○ IRIG-B00x Fiber Unmodulated ○ IRIG-B22x Fiber Manchester
IRIG 200-04 IEEE C37.118.1	Displays the standard the IRIG-B signal conforms to		
POLARITY INVERTED	This field is displayed only when the polarity of the signal is reversed. Check your tests leads are not reversed. If measuring a RS-232 IRIG-B signal it is normal for the analyzer to report the polarity as inverted		

SIGNAL PROPERTIES		
Amplitude 5.0V	Amplitude of the IRIG-B signal	This value excludes any DC offset on the IRIG-B signal and This value represents the peak to peak value of the IRIG-B signal and excludes any DC offset. Not applicable to fiber.
Zero Avg 2.0ms	Average pulse width of a logic zero data field	The IRIG-B signal carries 100 bits of data every second by way of pulses. The logic state of a particular field is determined by the width of these pulses which are nominally 2ms for a logic zero and 5ms for a logic one.
One Avg 5.0ms	Average pulse width of a logic one data field	

SIGNAL PROPERTIES

PosID Avg 8.0ms	Average width of Position ID pulses.	The IRIG-B signal data is grouped into ten frames every second with the start of each frame identified by a Position ID marker pulse. The last frame in the second contains a second marker pulse immediately preceding the start of the next second. The Position ID pulses are nominally 8ms.
Modulation Ratio	Ratio of a logic one to a logic zero carrier level	Amplitude modulated IRIG-B signals signify the logic state of the particular field by varying the amplitude of a carrier signal. The Modulation Ratio is a ratio of the peak to peak values of a logic one and logic zero signals, (nominally 3:1). Not applicable to fiber. The logic one and zero signals are displayed as High Amplitude and Low Amplitude values respectively.

SIGNAL DATA TIME

16:13:52 17 AUG 15 or 16:13:52-Day of Year 265	Time decoded from the IRIG-B signal. 24 HR format HH:MM:SS If IRIG-B Year information is present, the Date decoded from the IRIG-B signal day month year in format HH:MM:SS-DD-MMM-YY If IRIG-B Year information is not present, the date decoded from the IRIG_B. signal does not contain the year and is in format HH:MM:SS-Day of Year nnn. A warning is displayed if any of the date/time elements (day of year, hour etc) are not valid.

SIGNAL EXTENSIONS

Local Offset + 12H	Should match the IRIG-B signal UTC offset including any Daylight Savings offset		
Daylight Saving Off	Indicates whether the Daylight Saving Flag is present in the IRIB-G signal		
Time Quality UTC Traceable	The Time Quality (TQ) is an indicator of the time accuracy of the IRIG-B signal at the "on time" point relative to UTC. The top line shows the TQ indicator number and the line	TQ Quality	Meaning
		0	Clock is locked to a UTC traceable source
		1	Time is within <1ns of UTC
		2	Time is within < 10ns of UTC

		3	Time is within < 100ns of UTC
	below shows its meaning.	3	Time is within < 100ns of UTC
		4	Time is within < 1µs of UTC
		5	Time is within < 10µs of UTC
		6	Time is within < 100µs of UTC
		7	Time is within < 1ms of UTC
		8	Time is within < 10ms of UTC
		9	Time is within < 100ms of UTC
		10	Time is within < 1s of UTC
		11	Time is within < 10s of UTC
		15	Fault – Clock failure, time is not reliable
CTQ <100ns	The Continuous Time Quality (CTQ) is an indicator of the time accuracy of the IRIG-B **signal at the "on time" point** relative to UTC. The CTQ was added to the IRIG-B signal to give an indication of accuracy when in sync because the Time Quality Indicator always shows 0 when in sync. A comparison is made between IRIG-B time quality and CTQ. If there is a discrepancy, a warning is given.	**TQ Quality**	**Meaning**
		0	Not used (indicates code from previous version of standard)
		1	Estimated maximum time error < 100 ns
		2	Estimated maximum time error < 1µs
		3	Estimated maximum time error < 10µs
		4	Estimated maximum time error < 100µs
		5	Estimated maximum time error < 1ms
		6	Estimated maximum time error < 10ms
		7	Estimated maximum time error > 10mS or time error unknown

SIGNAL EXTENSIONS

AFNOR Day of Week	1 = Monday, 7 = Sunday. This value is compared to the day of week value derived from non-AFNOR IRIG-B data and if there is a discrepancy a warning is displayed.
AFNOR Month	1 = January. This value is compared to the month value derived from non-AFNOR IRIG-B data and if there is a discrepancy a warning is displayed.
AFNOR Day of Month	1 = 1st of month. This value is compared to the day of month value derived from non-AFNOR IRIG-B data and if there is a discrepancy a warning is displayed.
Binary Seconds 58432	A count of the number of seconds since the start of the day.
Time = Binary Seconds or !TIME NOT EQUAL TO BINARY SECONDS	Indicates whether the binary second value matches the signal data time in the IRIG-B Signal.
Parity EVEN or Parity ODD	Indicates an even or odd parity of the read IRIG-B frame. It cannot detect 'no parity'. The IRIG-B standard does not require parity and is added with the IRIG-B extensions. Parity is suppressed if AFNOR is decoded.
Daylight Saving Pending	Shows when there is a daylight savings change pending along with an offset.
Leap Second Pending	Shows when there is a leap second is pending along with an offset.
Miscellaneous Warnings	In the IRIG-B signal, some bits are always set to zero. The IRIG_B Analyzer will check all such bits and warn if any are not zero as expected.

17 SPECIFICATIONS

Physical Specifications		
Analyzer Dimensions	Width	82 mm
	Length	165 mm
	Height	26 mm
Weight (Analyzer + carry case with all accessories)		720g (With no batteries fitted)
Analyzer Case		ABS molded plastic with protective rubber surround.

Protocols Supported
Modulation Type
Amplitude Modulated IRIG-B12x
DC Level Shift IRIG-B00x
Modified Manchester IRIG-B22x
IRIG-B Standards
IRIG 200-95
IRIG 200-98
IRIG 200-04
Control Functions (extensions)
IEEE 1344
IEEE C37.118
IEEE C37.118.1
AFNOR extensions

Voltage Levels
TTL
RS232
RS422
RS485

Accuracy	
Copper IRIG-B Voltages	±5%
Fiber IRIG-B Pulse timing	±2%
Copper IRIG-B Pulse timing	±10%

Certifications	
The IRIG-B Analyzer meets the following certifications:	**IEC 61010-1** **CATIII 600V** CE ✓ RoHS COMPLIANT

Inputs	
Fiber RX	(62.5 / 125 um, **λ** 820 nm, compatible with multi-mode fiber (SC Fiber connection)
Copper	1.2m banana plug test leads
Bluetooth	Supports field upgradeable firmware

Outputs	
Waveform capture and decoded IRIG-B data.	The captured waveform and decoded IRIG-B data may be downloaded via Bluetooth to a Smart device running the Tekron IRIG-B Analyser application and displayed. Refer to the application quick-start guide available at www.tekron.com for more details.

Environmental Specifications	
Operating Temperature Range	-0 to +50 ºC
Ingress Protection	IP41 with rubber surround and fiber cap fitted.

Electrical Specifications	
Power Supply	2 x AA batteries
Extended battery life	140 hours

Front Panel	
Display	**2.5" Backlit monochrome** negative blue LCD display

18 WARRANTY

For terms and conditions of Tekron's Warranty see the Web Site

http://tekron.com/about-tekron/warranty