will'tek
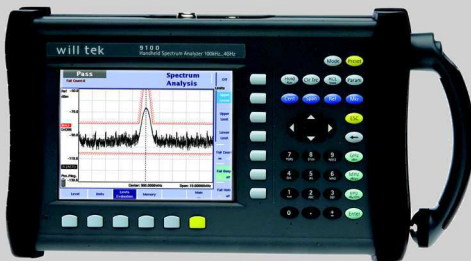
Willtek
9101

Handheld Spectrum Analyzer

getting started manual

For serial numbers 0204001 and higher

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Ordering information This guide is issued as part of the **Willtek 9101 Handheld Spectrum Analyzer**. The ordering number for a published guide is M 295 004.
A full user's guide is also available; the document number is M 290 004.
The ordering number for the 9101 is M 100 401.

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Table of Contents

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About This Guide

This section contains the following basic information:

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Purpose and scope

The purpose of this guide is to help you successfully use the 9101 Handheld Spectrum Analyzer features and capabilities. This guide includes task-based instructions that describe how to install, configure and use the 9101 Handheld Spectrum Analyzer. Additionally, this guide provides a description of Willtek's warranty, services, and repair information as well as the software license agreement.

Assumptions

This guide is intended for novice users who want to use the 9101 Handheld Spectrum Analyzer effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic RF test concepts and terminology.

Related information

Use this guide in conjunction with the following information:

Doc. no. M 290 004: Willtek 9101 Handheld Spectrum Analyzer – user's guide

Willtek also offers a glossary on "Spectrum and network analysis". The ordering number is SPEC/CT805/0703/EN.

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Technical assistance

If you need assistance or have questions related to the use of this product or call one of Willtek's technical assistance centers. You can also contact Willtek by e-mail at customer.support@willtek.com.

Table 1 Technical assistance centers

Region	Phone number	Fax number
UK	+44 (0) 20 8408 5720	+44 (0) 20 8397 6286
Europe, Middle East, Asia, Africa	+49 (0) 89 996 41 386 +49 (0) 89 996 41 227	+49 (0) 89 996 41 440
Americas	+1 317 595 2021 +1 866 WILLTEK	+1 317 595 2023

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Conventions

This guide uses naming conventions and symbols, as described in the following tables.

Table 2 Symbol conventions

	This symbol represents a general hazard.

	This symbol represents a risk of electrical shock.

	NOTE
	This symbol represents a note indicating related information or tip.

Table 3 Safety definitions

	WARNING
	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

	CAUTION
	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Safety Information

This chapter provides the safety notes for the 9101. Topics discussed in this chapter include the following:

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Safety class

The external power supply of the 9101 Handheld Spectrum Analyzer is a safety class I equipment as defined in EN 60950:2000.

Do not try to open the power supply; there are no serviceable parts inside. If the power supply is defective you can obtain a new one from Willtek Communications (ordering number M 860 224).

Safety notes

This product is designed for indoor use. As exposure to water can damage the instrument it has to be protected against moisture when used outdoors.

WARNING

Only use a 50 Ω N-type connector to connect to the RF IN port of the 9101. Use of any other connector may result in damage of the instrument.

WARNING

Do not cover the ventilation slits (at the bottom left-hand corner and on the top). Covering them may result in serious damage and fire.

WARNING

The maximum input power level at the RF IN connector is 1 W. Higher input levels may result in serious damage of the instrument.

WARNING

Operate the instrument within the temperature range from 5°C (40°F) to 45°C (110°F) only. Operation outside this range will lead to invalid results.

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⚠ Safety advice for the battery

Do not crush. Do not heat or incinerate. Do not short-circuit. Do not dismantle. Do not immerse in any liquid, it may vent or rupture! Do not charge below 0°C (32°F) nor above 45°C (110°F).

━━━ Battery usage

The battery is for use with the 9101 only. Willtek does not accept any liability for damage of the battery or other equipment if the battery is used with other electric or electronic equipment.

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Declaration of EU Conformity

Manufacturer	Willtek Communications GmbH Gutenbergstr. 2 – 4 85737 Ismaning Germany
Product designation	9101
	The designated products conform to the following European directives:
The low voltage directive	**73/23/EEC**, has been superseded by the directive 93/68/EEC
EMC directive	**89/336/EEC**
	The conformity of these products to the above directives is demonstrated by application of the following standards:
EMC	**EN 61326**
Safety	**EN 61010, Part 1**

Ismaning,
December 19, 2003

J. Schwarzhuber

_____
J. Schwarzhuber, R&D Director

This declaration is not a guarantee of features. Pay attention to the safety instructions in the product documentation.

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Overview

1

This chapter provides a general description of the 9101. Topics discussed in this chapter include the following:

About the 9101 Handheld Spectrum Analyzer

The 9101 is a lightweight, full-featured spectrum analyzer for many applications:

–   Used in mobile phone repair to detect and locate faulty parts of mobile phones and components.

–   Used in R&D labs for basic measurements and verifiying EMI clean circuits.

–   Used in manufacturing to check and align the output of the unit under test (UUT).

–   Used in the field to measure and verify base station emissions.

This rugged instrument is suitable for stationary and mobile usage and meets many application needs.
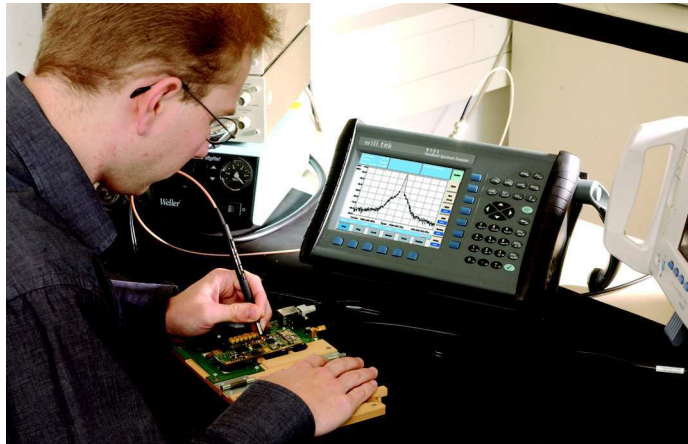
Features and capabilities

Frequency range from 100 kHz to 4 GHz

Digital IF for accurate measurements

Auto mode for basic parameters

Four markers, up to three delta markers

Large and bright display

Small footprint, large front

Lightweight, high battery power

Remote control via RS-232 or LAN

Options

The following accessories are available:

Table 4 Accessories for the 9101 Handheld Spectrum Analyzer

Order number	Description
M 248 640	1205 RF Probe 20 dB
M 886 097	Adapter N (male) to BNC (female)
M 886 098	Adapter N (male) to TNC (female)
M 205 011	Standard battery (rechargeable, 4 Ah)
M 205 012	High-capacity battery (rechargeable, 8 Ah)
M 241 013	Soft carrying bag
M 860 388	Null modem cable

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Table 4   Accessories for the 9101 Handheld Spectrum Analyzer

Order number	Description
M 860 389	12 V car adapter
M 248 633	9190 Demo Signal Generator
M 860 261	Antenna, 900 MHz (TNC)
M 860 262	Antenna, 1800/1900 MHz (TNC)
M 860 146	Antenna, 2400 MHz (TNC)
M 867 037	Safety lock
M 897 137	91xx Data Exchange Software

Physical description

The 9101 Handheld Spectrum Analyzer is delivered with the 91xx Data Exchange Software which can also be ordered separately (order number M 897 137).

The user-accessible parts of the 9101 can be broken down into several sections:

– Front panel with large screen, softkeys, numerical, cursor, and function keys.

– Connectors accessible from the top of the 9101.

– On/off switch, power supply connector and battery shelf.

– Handle which can be turned in steps to serve as a stand, allowing the 9101 to be operated at an angle.

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Installation

2

This chapter describes how to install and set up the 9101. The topics discussed in this chapter are as follows:

Scope of delivery

When unpacking the 9101, ensure that you do not miss any of the following items:

– The Willtek 9101 Handheld Spectrum Analyzer, including battery

– A power supply with a mains cable to connect to the power outlet

– A CD containing the 91xx Data Exchange Software (please note the "End-User License Agreement" on page 29)

– Manual package containing this getting started manual and a CD with the user's guide

– RS-232 null modem cable

Before first-time use

The 9101 is delivered with a rechargeable battery. This battery must be charged before first-time use. Please allow six hours to charge the battery while the 9101 is connected to an external power supply and switched off. For more information, see section "Installing and maintaining the battery" on page 9.

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Using the handle

Carrying the 9101
The 9101 Handheld Spectrum Analyzer can be carried easily by holding its handle. The handle should be kept in the upright position for transport to ensure that it is safely carried. To put the handle back in the upright position, press the button and turn the handle.

Positioning the 9101
The 9101 Handheld Spectrum Analyzer can be used in different positions: the upright position and two tilt positions. The first tilt position is recommended when using the instrument on a work-bench. The second tilt position is useful when standing while operating the 9101.

– Put the 9101 upright. With the handle in parallel with the instrument body, this takes up the least footprint. The connectors and the power switch are easily accessible from the top.

– The 9101 can also be operated in a slanted position.

1 Press the button at the handle and turn the handle back a little bit.

2 Release the button and continue turning the handle back. The button locks in the first tilt position.

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3 Repeat steps 1 and 2 if you want to lock the handle in the second (and final) tilt position.

4 Release the instrument on the handle.

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Installing and maintaining the battery

The 9101 comes with a preinstalled, rechargeable lithium-ion (Li-Ion) battery. This battery must be charged before first-time use. Please allow six hours to charge while the 9101 is connected to an external power supply and switched off.

The battery charge status is indicated with a symbol on the screen. See the user's guide for detailed information on this symbol.

The battery can be recharged simply by connecting the DC power supply and turning the 9101 off. A completely discharged battery takes about 3.5 hours to charge (the optional high-capacity battery takes 6 hours to charge). While operating the 9101, you can view the battery charge status on the display, at the bottom left.

Please refer also to section "Battery status LED" on page 18.

If the 9101 is switched on, the battery takes about three times as long to charge compared to when the 9101 is switched off. After eight hours of continuous charging, the battery charger is automatically switched off to ensure that the battery is not damaged by too long charging periods. The battery may not be fully charged at the time. Therefore Willtek recommends to charge the battery only while the 9101 Handheld Spectrum Analyzer is switched off.

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NOTE

Disconnecting the mains cable from the power source resets the eight hour maximum charging period. In order to make sure that the battery is fully charged when the 9101 is switched off, unplug the mains cable first and plug it in again.

A completely discharged battery is not recharged if the power supply is connected while the instrument is operating. Therefore it is advisable to switch off the instrument before connecting the power supply to the 9101.

Safety advice for the battery

Do not crush. Do not heat or incinerate. Do not short-circuit. Do not dismantle. Do not immerse in any liquid, the battery may vent or rupture! Do not charge below 0°C (32°F) nor above 45°C (110°F).

Battery replacement

To replace the battery, use genuine Willtek spare parts only. The ordering numbers for different battery types can be found on page 3.

The battery compartment can be found on the back panel of the instrument. You can replace the battery as follows:

1   Switch off the 9101 Handheld Spectrum Analyzer.

2   Remove the battery by tearing the black rubber down and pulling the battery off the compartment.
     Do not try to open the battery!

3   Line up the new battery with the connectors to the bottom and pointing towards the battery compartment.

4   Gently slide the battery into the battery compartment until it locks completely.

5   Fully charge the new battery.

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The risk of memory effects is low with Li-Ion batteries. For optimum performance and lifetime, please follow the advice below:

– Before first-time use, charge the battery completely while the 9101 Handheld Spectrum Analyzer is switched off. This takes about six hours.

– If you do not use the battery for months: Fully charge the battery and remove it from the 9101. Check the battery twice a year and recharge it if necessary.

– Do not store the battery above 45°C (110°F) or below 0°C (32°F).

– Do not touch the battery contacts with your fingers; keep them clean.

– Do not drop the battery to the ground (risk of cracks).

Dispose of the battery safely

Do not simply throw the battery away. Dispose of the battery in line with national or regional regulations.

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Getting Started

<div style="text-align: right">3</div>

This chapter describes the instrument's functions. Topics discussed in this chapter are as follows:

Connecting the 9101 Handheld Spectrum Analyzer
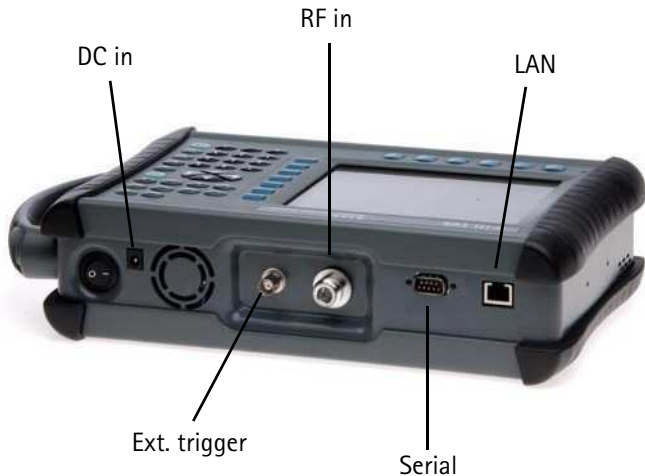
Figure 1   9101 connectors

DC IN connector The 9101 can be operated either from the internal battery or from an external DC source such as the power supply which is delivered with the 9101, or a car battery. The DC voltage must be in the range from 11 to 15 V.

In addition, the battery is loaded when an external DC source is connected. The instrument should be switched off before connecting the DC source.

Apply the source to the **DC IN** connector at the top of the 9101.

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RF IN connector **RF IN** is a 50 Ω N-type connector (female).

If you have a 50 Ω shielded RF cable with an N-type connector (male) to connect to the unit under test, simply screw the connector tightly to the 9101.

If you have a 50 Ω shielded RF cable with a BNC connector (male), use an N to BNC adapter to connect the cable to the 9101. Willtek offers an appropriate adapter; see section "Options" on page 3.

CAUTION

The maximum allowable input level at the **RF IN** connector is 1 W. Higher levels at this port can damage the instrument!

CAUTION

Only use a 50 Ω N-type connector to connect to the **RF IN** port of the 9101. Use of any other connector may result in damage of the instrument.

Take care of proper termination

Use of cables and sources with an impedance other than 50 Ω results in inaccurate measurements.

External trigger connector The external trigger connector is not used in this hardware revision.

SERIAL (RS-232) connector This 9-pin sub-D connector of the 9101 Handheld Spectrum Analyzer can be used to control the 9101 remotely via serial interface (RS-232). The command set and the responses conform to the SCPI standard and are explained in the user's guide.

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The RS-232 connector can also be used to load and store results and settings and to update the operating software in conjunction with the 91xx Data Exchange Software. See the user's guide for more details.

To connect the 9101 to a controlling PC, use a null modem (PC to PC) cable. This cable is delivered with the 9101.

LAN connector The 9101 can also be controlled via local area network (LAN), using a TCP/IP connection. This high-speed connection can as well be used to transfer traces to a PC or to update the system software.

The IP address can be set up in the system configuration menu or via RS-232. The 9101 can be operated in networks using 100 Mbps, but is capable of transmitting and receiving at 10 Mbps only.

Setting up the IP address, the command set to control the 9101 and the responses from the 9101 are explained in the full user's guide.

Connect the 9101 to the LAN with a standard LAN cable with RJ-45 connectors. Alternatively, you can connect the 9101 to a PC directly using a cross patch cable.

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Powering the unit

The 9101 is switched on and off using the power switch located at the top of the instrument. It takes a couple of seconds for the 9101 to load and start its software.

NOTE

The warm-up time for precision measurements is 30 minutes.

NOTE

Please wait a few seconds between switching the instrument off and on again. It will not start otherwise.

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Using the front panel

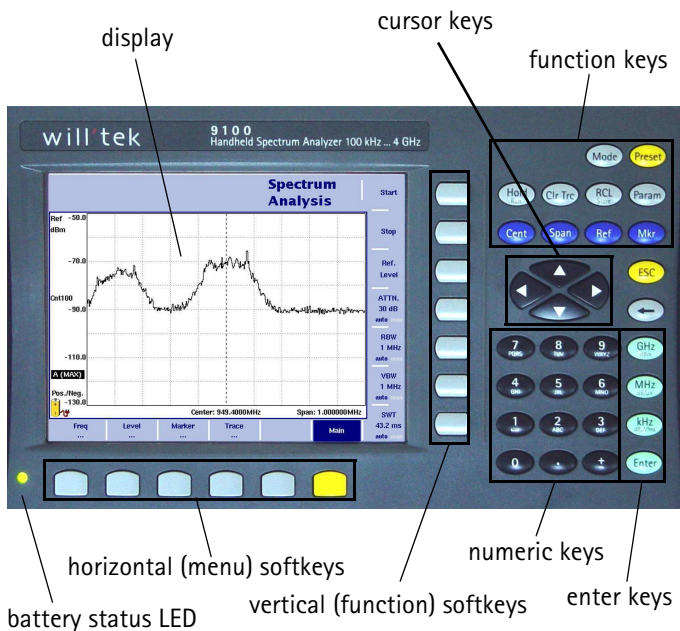**Overview** The front panel is divided into different sections as follows:

Figure 2 Front panel elements

Battery status LED This LED has different states:

– The LED lights green when the 9101 is being operated from its battery and no external power is supplied.

– The LED lights yellow when the battery is connected to an external power supply.

– The LED may initially go on and off intermittently (yellow, qualification charge, less than three minutes).

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– When the LED is flashing yellow quickly for less than a minute, the battery is being checked.

– When the LED is flashing yellow quickly and permanently, there is a problem with the battery or the charger. Please report this problem to a Willtek service center.

– The LED is off in all other cases.

For more information about the battery, see section "Installing and maintaining the battery" on page 9.

Display The 6.5 inch display is divided into the following sections (see Figure 3):

– Marker field

– Input field

– Status section

– Results area

– Softkey descriptions
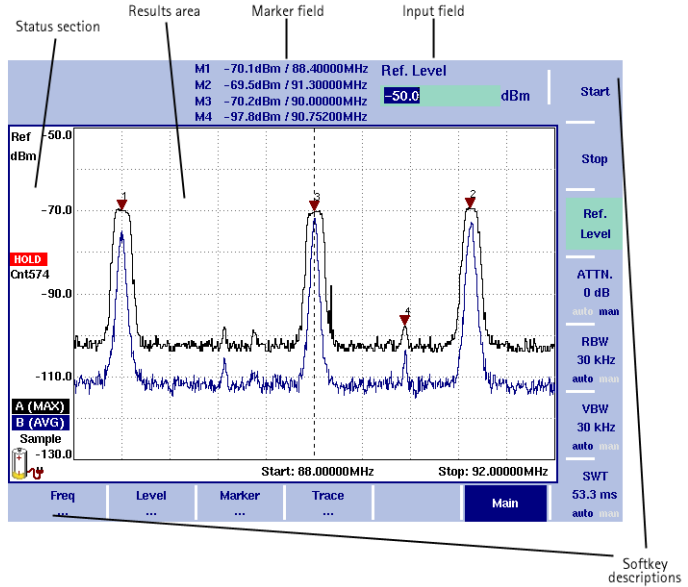
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Figure 3   Display sections

Results area The results area utilizes most of the screen and provides you with the measurement results. A grid of ten vertical and eight horizontal lines eases readability of the results from the axes. There may be one or two graphs, depending on the number of traces selected.

Marker field

If any of the markers is active, the marker field is displayed, showing the measurement values at the marker positions. Up to four markers are displayed with their level and frequency values. A marker can be switched from absolute to relative values; the values are then shown relative to those of marker M1.

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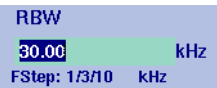
Input field

The input field allows you to enter a number or a text, depending on the selected function. The meaning of the input value is expressed by the header line. Values or text are entered using the numeric keys; the input field is closed with one of the green enter keys (see page 23).

Softkey descriptions

The softkey descriptions indicate the assignment of a function to a softkey. At the bottom side, they are aligned with the horizontal softkeys and with the vertical softkeys at the right-hand side. See below for more information about the softkeys.

Status section The status section provides you with more information about the present 9101 status and the measurement conditions. This includes information about:

– the battery status

– the network link (if available)

– trace settings

– Hold mode (if active)

Keypad The front panel carries a large number of keys, giving you direct access to functions and menus and allowing you to enter test parameters such as the center frequency. The keypad is divided into the following sections:

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Function keys

The function keys have specific assigned functions which do not change. The function keys are described in more detail in the user's guide.

Cursor keys

In an input field, the up and down cursor keys are used to increase or decrease the current value. The left and right cursor keys move the cursor position by one digit or character.

If a marker field is active, the up and down cursor keys move the marker by half a division up or down, respectively. The left and right cursor keys move the marker pixelwise.

Immediate reaction

Any change of an input parameter with the cursor keys has immediate effect. With the straight feedback on the screen, you can easily adjust parameters to the optimum values with a trial-and-error approach.

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Numeric keys

The numeric keys allow you to enter a value similar to a pocket calculator. On some input fields, you can enter text instead, as on a mobile phone.

▬▬▬▬

Invalid entries

If you enter an invalid number or string, the 9101 beeps and corrects the entry to the closest valid value.

Enter keys Any input of numerical or alphanumerical entries must be closed or can be affected by one of the enter keys. The meaning of the keys is as follows:

Table 5 Enter keys

Key	Function
GHz/dBm	In frequency input fields, closes the entry by applying the unit GHz (giga-hertz). In power input fields, assigns the unit dBm to the entered value.
MHz/dB/µs	In frequency input fields, closes the entry by applying the unit MHz (mega-hertz). In power input fields, assigns the unit dB to the entered value. In time parameter input fields, assigns the unit µs (microsecond) to the value.

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Table 5 Enter keys

Key	Function
kHz/dBµV/ms	In frequency input fields, closes the entry by applying the unit kHz (kilohertz). In power input fields, assigns the unit dBµV to the entered value. In time parameter input fields, assigns the unit ms (millisecond) to the value.
Enter	Confirms an entry without a unit or with the units Hertz or seconds.

Escape key   If pressed while an input field is open, the **ESCAPE** key closes this input field without changing the previous value.

In a menu the **ESCAPE** key also leads to the main menu.

Backspace key   Deletes the last entered alphanumerical (backspace).

When an input field is entered, all digits are marked. By pressing the backspace key, the entire entry is deleted.

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Softkeys The functions of the softkeys change with description on the screen as given next to the respective key.

Horizontal (menu) softkeys

The horizontal softkeys provide access to the various menus. The active menu is highlighted; the functions and parameters within a menu are offered on the vertical softkeys.

Vertical (function) softkeys

The vertical softkeys allow you to change the settings of the 9101.

Changing center frequency, span, or reference level

These functions are easily accessible from the main menu.

1 Push the respective function softkey on the vertical softkey bar.

2 Enter a new value.

3 Close the input field by pushing one of the enter keys.

The change takes effect immediately.

Changing RBW, VBW, sweep time, or attenuation

These parameters are accessible from the main menu. They can be changed automatically by the 9101 with a change of any of the other parameters, or can be adjusted manually.

In the main menu, the vertically aligned keys for resolution bandwidth (RBW), video bandwidth (VBW), sweep time, and attenuation indicate whether the parameter is in auto(matic) or manual mode: The current setting is highlighted.

Switching to automatic mode
To change the setting from manual to automatic, proceed as follows:

1   Push the function softkey once.
    The function softkey is activated. This is indicated by highlighting the softkey.

2   Push the same function softkey for a second time.
    The highlighting of "manual" disappears and the word "auto" is highlighted instead. Next time you change any of the other values, the parameter in automatic mode is changed by the instrument for best results and visibility.

Switching to manual mode
When the function softkey is set to automatic, you may want to adjust the parameter manually. Or you may want to adjust another parameter without the function in question being changed automatically. Both can be achieved by setting the function softkey to manual mode.

You can switch to manual mode

–   either by selecting the function softkey and then entering a new input value,

–   or by selecting the function softkey and pushing it again to change from auto to manual mode.

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Maintaining your unit

The 9101 Handheld Spectrum Analyzer is a measurement device. As with all such instruments, the 9101 should be calibrated on a regular basis to ensure the accuracy. Willtek recommends calibration of the 9101 at yearly intervals.

Willtek seeks to permanently improve its products. Software updates are available on the Internet at www.willtek.com.

Please take also advantage of our Frequently Asked Questions and our electronic newsletter, both available on the Internet.

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End-User License Agreement

This appendix describes the conditions for using the 91xx Data Exchange Software.

All copyrights in and to the software product are owned by Willtek Communications or its licensors. The software is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties.

This end-user license agreement grants you the right to use the software contained in this product subject to the following restrictions. You may not:

(i) use the software and/or any copy of the software in different computers concurrently, unless the software is an update that has been downloaded from the Internet at www.willtek.com;

(ii) copy the software, except for archive purposes consistent with your standard archive procedures;

(iii) transfer the software to a third party apart from the entire product;

(iv) modify, decompile, disassemble, reverse engineer or otherwise attempt to derive the source code of the software;

(v) export the software in contravention of applicable export laws and regulations of the country of purchase;

(vi) use the software other than in connection with operation of the product.

The licensor's suppliers do not make or pass on to end users or any other third party, any express, implied or statutory warranty or representation on behalf of such suppliers, including but not limited to the implied warranties of noninfringement, title, merchantability or fitness for a particular purpose.

Willtek Communications shall not be held liable for any damages suffered or incurred by you or any other third party (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising out of or in connection with the delivery, use or performance of the software.

Warranty and Repair

B

This chapter describes the customer services available through Willtek. Topics discussed in this chapter include the following:

Warranty information

Willtek warrants that all of its products conform to Willtek's published specifications and are free from defects in materials and workmanship for a period of one year from the date of delivery to the original buyer, when used under normal operating conditions and within the service conditions for which they were designed. This warranty is not transferable and does not apply to used or demonstration products.

In case of a warranty claim, Willtek's obligation shall be limited to repairing, or at its option, replacing without charge, any assembly or component (except batteries) which in Willtek's sole opinion proves to be defective within the scope of the warranty. In the event Willtek is not able to modify, repair or replace nonconforming defective parts or components to a condition as warranted within a reasonable time after receipt thereof, the buyer shall receive credit in the amount of the original invoiced price of the product.

It is the buyer's responsibility to notify Willtek in writing of the defect or nonconformity within the warranty period and to return the affected product to Willtek's factory, designated service provider, or authorized service center within thirty (30) days after discovery of such defect or nonconformity. The buyer shall prepay shipping charges and insurance for products returned to Willtek or its designated service provider for warranty service. Willtek or its designated service provider shall pay costs for return of products to the buyer.

Willtek's obligation and the customer's sole remedy under this hardware warranty is limited to the repair or replacement, at Willtek's option, of the defective product. Willtek shall have no obligation to remedy any such defect if it can be shown: (a) that the product was altered, repaired, or reworked by any party other than Willtek without Willtek's written consent; (b) that such defects were the result of customer's improper storage, mishandling, abuse, or misuse of the product; (c) that such defects were the result of customer's use of the product in conjunction with equipment electronically or mechanically incompatible or of an inferior quality; or (d) that the defect was the result of damage by fire, explosion, power failure, or any act of nature.

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The warranty described above is the buyer's sole and exclusive remedy and no other warranty, whether written or oral, expressed or implied by statute or course of dealing shall apply. Willtek specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. No statement, representation, agreement, or understanding, oral or written, made by an agent, distributor, or employee of Willtek, which is not contained in the foregoing warranty will be binding upon Willtek, unless made in writing and executed by an authorized representative of Willtek. Under no circumstances shall Willtek be liable for any direct, indirect, special, incidental, or consequential damages, expenses, or losses, including loss of profits, based on contract, tort, or any other legal theory.

Equipment return instructions

Please contact your local service center for Willtek products via telephone or web site for return or reference authorization to accompany your equipment. For each piece of equipment returned for repair, attach a tag that includes the following information:

– Owner's name, address, and telephone number.

– The serial number, product type, and model.

– Warranty status (if you are unsure of the warranty status of your instrument, include a copy of the invoice or delivery note).

– A detailed description of the problem or service requested.

– The name and telephone number of the person to contact regarding questions about the repair.

– The return authorization (RA) number or reference number.

If possible, return the equipment using the original shipping container and material. Additional Willtek shipping containers are available from Willtek on request. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. Willtek is not liable for any damage that may occur during shipping. The customer should clearly mark the Willtek-issued RA or reference number on the outside of the package and ship it prepaid and insured to Willtek.

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Publication History

Revision	Changes
0211-100-A	First version.
0304-110-A	Scope of delivery amended. Manual for serial numbers 0004001 and higher.
0311-120-A	Keyboard layout changes, additional accessories, Declaration of EU Conformity, license agreement added. Valid for serial numbers 0104001 and higher.
0312-120-A	Battery information amended, new Willtek contact information.
0404-130-A	More information on LED and battery charging times. New declaration of conformance.
0409-200-A	Information on battery charging times amended, more information added.

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Willtek Worldwide Offices

West Europe/Middle East/Africa

Willtek Communications GmbH
Gutenbergstr. 2 – 4
85737 Ismaning
Germany

info@willtek.com

Willtek Communications SARL
Aéropôle – Bâtiment Aéronef
Rue de Copenhague – BP 9001
95728 Roissy CDG Cédex
France

willtek.fr@willtek.com

Willtek Communications Ltd.
Roebuck Place, Roebuck Road
Chessington
Surrey KT9 1EU
United Kingdom

willtek.uk@willtek.com

North America/Latin America

Willtek Communications Inc.
7369 Shadeland Station Way, Suite 200
Indianapolis, IN 46256
USA

willtek.us@willtek.com
willtek.cala@willtek.com

Asia Pacific

Willtek Communications
22, Malacca Street
#09-00, Royal Brothers Building
Raffles Place
Singapore 048980

willtek.ap@willtek.com

will'tek