will'tek

Willtek 8100

General Purpose Receiver

user's guide

version 4.00

WARRANTY

HARDWARE: Willtek warrants its hardware products to be free from defects in workmanship and materials, under normal use and service, for one year from the date of purchase from Willtek or its authorized agent. Willtek certifies that all instruments are tested and inspected to comply with the published specifications originating from the company.

If a product does not operate as warranted during the warranty period, Willtek shall, at its option, repair the defective product or part (except batteries), deliver an equivalent product or part to replace the defective item, or refund the purchase price paid for the defective product. Transportation of the defective product or part to the factory or service centre is to be pre-paid by the customer. All products that are replaced will become the property of Willtek. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer.

SOFTWARE: Willtek warrants that the software programs licensed from it will perform in substantial conformance to the program specifications for a period of one year from the date of purchase from Willtek or its authorized agent. Willtek warrants the magnetic media containing software against failure during the warranty period. Sole obligation hereunder shall be (at Willtek discretion) to refund the purchase price paid for any defective software products, or to replace any defective media with software which substantially conforms to applicable published specifications. Willtek makes no warranty that its software products will work in combination with any hardware or applications software products provided by third parties, that the operation of the software products will be uninterrupted or error free, or that all defects in the software products will be corrected. Willtek will make reasonable efforts to provide compatibility, except where the non-compatibility is caused by a defect in the third party's product.

All information in this manual is given in good faith. However, Willtek Communications shall not be liable for any loss or damage whatsoever arising from the use of this manual, the product described in it or any errors or omissions in either.

Willtek Communications Limited
Roebuck Place
Roebuck Road
Chessington, Surrey KT9 1EU
UNITED KINGDOM

Tel: +44 (0)20 8408 5720
Fax: +44 (0)20 8397 6286
Email: willtek.uk@willtek.com
Web: www.willtek.com

TABLE OF CONTENTS

ELECTROMAGNETIC COMPATIBILITY

To comply with the Electromagnetic Compatibility Directive of the European Union the cables connected to the Willtek 8100 Series General Purpose Receiver must be less than 2 metres in length. All cables with the exception of the DC power lead must be screened.

To comply with the Electromagnetic Compatibility Directive of the European Union the 8100 must only be operated from its internal battery and must not be charged whilst in use.

The external battery charger used with the 8100 must be CE marked as meeting the Low Voltage and EMC Directives.

CAUTION

(1) Exercise care when removing the instrument from its shipping container to ensure that no damage has occurred.

(2) It is inadvisable to leave the receiver exposed to strong direct sunlight or low temperatures for long periods before making measurements. The receiver temperature may fall outside that given in the specification (see Section 8) so causing the measurement accuracy and display response to be impaired.

(3) Facilities are provided for giving a direct level readout of signal field strength, using the VBA6106B for VHF, and the UPA6108 log periodic antenna for UHF. Many other antennas can be used, but a correction factor has to be applied if a readout in dBµV/m is required.

(4) Care must be taken not to operate the receiver continuously at very high volume, to prevent damage to the receiver circuits and loudspeaker.

(5) The internal NiCd battery is connected to pins on the Auxiliary 1 and Auxiliary 2 connectors. A fire risk could result if these pins are shorted to the chassis of the receiver.

SECTION ONE – GENERAL INFORMATION

1.1 SCOPE AND ORGANISATION OF THE MANUAL

This manual provides a comprehensive operating guide to the Willtek 8100 Series portable VHF and VHF/UHF measuring and monitoring receivers.

Sections 1 to 7 of the manual provide information generally applicable to all receivers in the 8100 range. Wherever possible, differences between specific types and models in the range are detailed where they occur, but in some instances it is necessary to refer to Section 8 for specific information.

Section 8 provides detailed specifications for all current 8100 models, at the date this manual was printed. Please confirm which model you actually have, and refer to the appropriate table for that model (Table 8-4).

Section 9 contains information about how to use the 8100 with the Willtek 8181 GPR Down Converter (formerly GFC 4903).

The manual is organized to provide the user with operating information in the order in which it is needed. Before turning on the equipment, it is recommended to read Sections 1 to 4 and the "Detailed Concept of Operation/Methods" in Section 5.

Section 6 need only be read, if remote control of the equipment is to be used.

1.2 PURPOSE OF EQUIPMENT AND GENERAL FEATURES

The Willtek 8100 Series of measuring and monitoring receivers are tailored to specific needs, their modular design allowing for easy upgrading. Section 5 provides an introduction to the range of typical applications, plus examples of operating procedures common to these uses.

The receivers are true field instruments, both rugged and portable. They have a laboratory accuracy and yet are easy to use. The comprehensive features have been incorporated without the need for a large number of controls, and a single push-button enables more than 40 parameters to be set up and stored in non-volatile memory, backed up for ten years. The LCD display, with an adjustable viewing angle, is ideal for outdoor use.

Using a "SOFT" push-button, critical parameters can be changed instantly, and field strength can be either read directly or with a bargraph to indicate trends. Forty front panel settings, including the squelch level, can be stored and recalled with edit facilities.

1.3 BASIC CONCEPT OF OPERATION

The receiver has two types of basic operation: NORMAL OPERATION and LIST OPERATION.

(1) NORMAL OPERATION is used to carry out general measuring and monitoring functions.

(2) LIST OPERATION is used to set up the required functions and parameters.

There are also two modes of operation: FREQUENCY MODE and MEMORY MODE.

(1) FREQUENCY MODE is used for the measuring and monitoring of signals, up to the full frequency range of the receiver, and also "LIMIT SCANNING" between two previously

entered frequencies. Unwanted frequencies can be LOCKED OUT, and thereafter bypassed during scanning.

(2) MEMORY MODE is used to measure and monitor specific frequencies, stored whilst in FREQUENCY MODE. These frequencies can be scanned, and made "DORMANT" if not currently required. Each memory channel stores, not only the frequency, but the current receiver status at the time the frequency is memorized.

Refer to the "Detailed Concept of Operation/Methods" in Section 5, for a comprehensive explanation of these operating methods.

1.4 FRONT PANEL DETAILS

With the exception of the ON/OFF control, the Front Panel provides all the operating controls for the 8100 Series receivers. Figure 1-1 shows a view of the panel and details the main functions of each control.

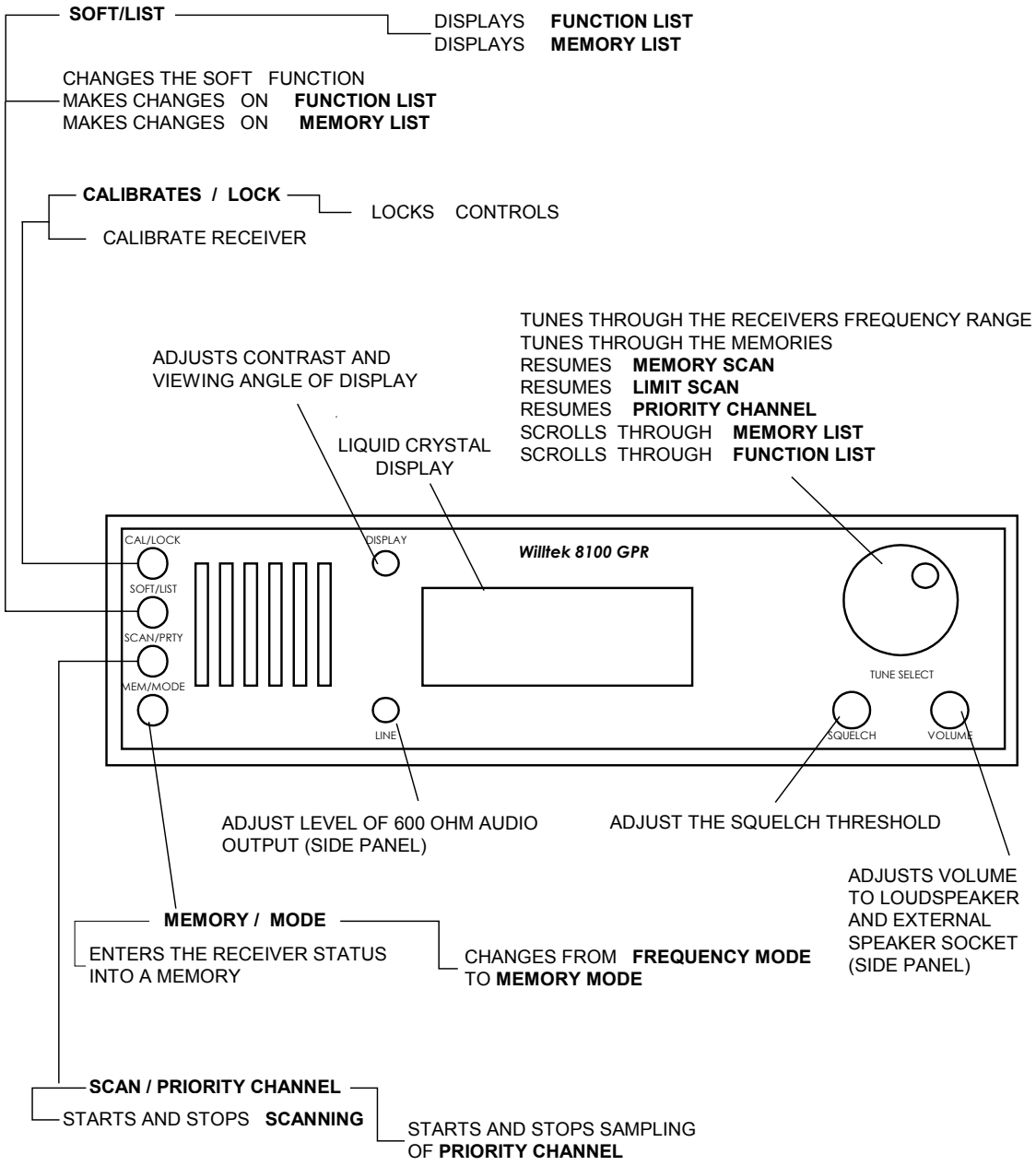


Figure 1-1. FRONT PANEL CONTROLS

1.5 SIDE PANEL DETAILS

This panel provides the ON/OFF switch, charger socket and indicator, and a reset switch plus various external connectors. The external connectors are as follows:

(1) **Headphones/Speaker.** This socket provides a nominal output of 1 W to 3 W_{rms} into 8 Ω (dependent upon battery state).

(2) **Line.** This socket provides a low level audio output, variable using Front Panel LINE rotary control but nominally 0 dBm (into 600 Ω).

(3) **RS-232-C 9-pin 'D' Male**

Pin No.	Designation
2	RXD
3	TXD
4	DTR
5	GROUND
7	RTS
8	CTS

(4) **Auxiliary 1 15-pin Compact 'D' Male**

Pin No.	Designation
1	Battery +Ve output (switched)
2	NC
3	+12 V External Power & Battery Charge In
4	0 V
5	0 V
6	Remote On/Off +Ve In
7	Remote On/Off +Ve In
8	Remote On/Off +Ve In
11	Battery +Ve (Un-switched)
12	Battery +Ve (Un-switched)
13	Battery +Ve (Un-switched)

(5) **Auxiliary 2 15-pin 'D' Female**

Pin No.	Designation
1	0 V
2	Battery Power output (Switched)
3	Unfiltered Demodulation output
4	No Connection
5	No Connection
6	No Connection
7	SPEAKER OUT (8 Ω)
8	600 Ω LINE OUT (Nominal 0 dBm)
9	SIGNAL LEVEL OUT (1 V to 6 V)
10	Normally Open Squelch Relay 1
11	Normally Closed Squelch Relay 1
12	Common Squelch Relay 1
13	Normally Open Squelch Relay 2
14	Normally Closed Squelch Relay 2
15	Common Squelch Relay 2

SECTION TWO – PREPARATION FOR USE

2.1 INTRODUCTION

This section contains procedures for unpacking, inspection and initial power-on checks; instructions for antenna fitment, plus battery charging and replacement, are also provided.

2.2 UNPACKING AND PHYSICAL INSPECTION

Examine the shipping carton for damage before unpacking the equipment. If the carton has been damaged, have the carrier's agent present when the equipment is removed from the carton. Retain the shipping carton and padding material for the carrier's inspection, if damage to the equipment is evident after it has been unpacked.

CAUTION **Exercise care when removing the instrument from its shipping container to ensure that no damage is incurred.**

See that the equipment is complete, as listed on the packing slip. Visually examine the equipment for any evidence of physical damage. If any damage is evident, or if the contents are not complete, immediately notify the carrier and also your local Willtek sales office. After completing the physical inspection, the Initial Power-On Checks should be performed.

2.3 INITIAL POWER-ON CHECKS

Carry out the initial Power-on checks as follows:

(1) Ensure that no external equipment is connected via the RS-232-C interface.

The RS-232-C interface may be used after successful completion of these checks, and instructions for use of this facility are contained in Section 6.

(2) Referring to Section 3, switch ON the equipment and check if the correct power-up indications result.

Lack of power available may be due to discharged batteries.

It is now recommended to get to know all the equipment functions by reading the rest of this handbook and carrying out typical operations. A check of each operational function should be made as soon as possible after obtaining the equipment.

If problems are encountered, carry out the simple troubleshooting procedures detailed in Section 7. When a definite equipment failure is identified, write down full details of the problem and contact your local Willtek sales office.

2.4 FITTING ANTENNA

There are many types of antennas available for use with the equipment and the one to be fitted depends on the particular application.

Facilities are provided for giving a direct level readout of field signal strength, using the VBA6106 biconical antenna in the VHF range and the UPA6108 log-periodic antenna in the UHF range up to 1000 MHz.

2.5 BATTERY CHARGING AND CARE

2.5.1 Introduction

The receiver contains a pack of eight “D”-size nickel cadmium cells, giving at least eight hours use. This life is considerably increased if the loudspeaker is operated at a low volume.

For the cells to be charged a 13.8 VDC source of suitable current rating is required (the normal charging current for a receiver is 500 mA). The CBC 9710 battery charger is designed for this purpose. The battery charger socket is located on the side panel (see illustration in Section 1).

Because the current limiting required for the nickel cadmium cells is carried out within the receiver, other DC sources can be used (including the use of a 12 V vehicle battery).

The receiver can be left on charge indefinitely, without any harm to the cells. The receiver can also be left on charge whilst it is in use (the batteries will be recharged, but at a reduced rate).

The receiver contains potentially hazardous Nickel Cadmium batteries, the safe disposal of which must be carried out according to local government regulations.

2.5.2 Battery Failure

There is no simple rule about the life of nickel cadmium cells because there are so many factors affecting their life, e.g. the number of charge/discharge cycles, the depth of discharges, the temperature, etc.

There are three main failure modes:

(1) Gradual loss of capacity

(2) Short-circuit

(3) Inability to accept charge

After several hundred charge/discharge cycles, a reduction in the order of 20% of original capacity will be experienced.

2.5.3 Battery Care

To prolong cell life it is good practice to occasionally run the batteries down so the battery warning is left sounding for several minutes. If the receiver is not going to be used for a long period of time, it should be stored with the cells in a fully charged condition.

It is inadvisable to leave the receiver on for a long time after the low battery warning operates, as one or more of the cells may become reverse polarized. When this happens, it is common for the cell not to accept any more charge.

When the cells are coming to the end of their charge/discharge life, it is possible for a sudden short-circuit in one of the cells to occur. If it is suspected that one or more of the cells is defective, or the capacity of the cells is below normal, the whole set of cells should be replaced.

In the interest of reliability, it is recommended that the cell pack be replaced every three years.

2.6 BATTERY REPLACEMENT

To remove the set of battery cells, remove the receiver from its leather case and remove the 8 screws around the bottom of the receiver to release the battery cover.

WARNING **DO NOT INCINERATE OR SHORT-CIRCUIT OLD CELLS**

CAUTION **Do not operate the receiver with the battery charger connected and the batteries removed.**

SECTION THREE – SWITCHING ON

3.1 PRELIMINARY ACTIONS

If this is the first time that the equipment is to be used, carry out the instructions for Preparation for Use in Section 2.

CAUTION **It is inadvisable to leave the receiver exposed to direct strong sunlight or low temperatures for long periods before making measurements. The receiver temperature may fall outside that given in the specification (see Section 8) so causing the measurement accuracy and display response to be impaired.**

3.2 SWITCHING ON PROCEDURE

The switching on procedure detailed here should always be followed. If any problems are encountered, refer to Section 7, Troubleshooting. Proceed as follows:

(1) Make sure that the VOLUME control is turned down (fully counterclockwise).

(2) Check that the DISPLAY control is turned up to approximately three-quarters of maximum (clockwise).

(3) Press the ON/OFF switch on the left hand side of the receiver to ON.

(4) Check that the display shows the receiver type, the version of the software and the date of issue; if not, take action as appropriate:

NOTE: It may be necessary to readjust the DISPLAY control for the best contrast and viewing angle.

(1) **Suspected Discharged Batteries.** If discharged batteries are suspected, carry out Battery Charging as detailed in Section 2.

(2) **Corrupted Display Readout.** When this problem occurs, switch OFF the receiver, wait a few seconds, and then switch it back ON Again.

The receiver should now start calibrating, with the display reading “CALIBRATING” along with a signal level readout and bargraph. This takes about 10 seconds.

If dBµVm had previously been selected, the warning message “CHECK TYPE OF ANTENNA” should appear for 3 seconds, and a series of beeps should sound in the loudspeaker or headphones.

The receiver is now ready for use with the same status set-up as when it was last switched OFF.

NOTE: On first switch on after delivery, the receiver status will be at the standard factory settings.

SECTION FOUR – BASIC DISPLAY AND CONTROL FUNCTIONS

4.1 INTRODUCTION

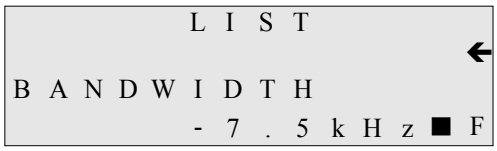
This section details the display and control features of the Front Panel. Example LCD display readouts are illustrated and described, along with the function of each control.

The control firmware of the receiver allows complex functions to be easily obtained and monitored; a single push-button enables more than 40 individual parameters to be set up and stored in non-volatile memory.

4.2 DISPLAY FEATURES

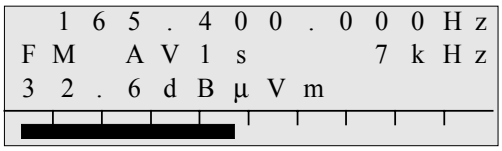
The receiver has a dot matrix LCD display. Either four lines of alphanumeric characters, or three lines of alphanumeric characters plus a bargraph along the bottom, can be shown.

The display has an adjustable viewing angle, controlled by the DISPLAY rotary control. The numeric readout of data facilitates greater resolution than the bargraph, however trends in signal level changes are more easily seen on the bargraph.



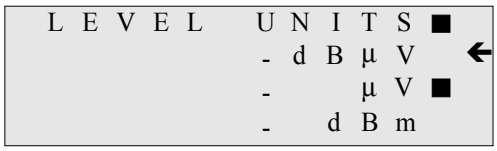
DISPLAY 1

FUNCTION LIST



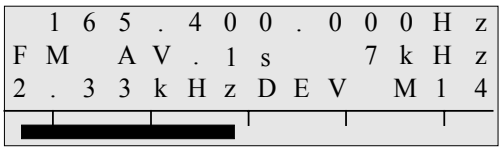
DISPLAY 4

FIELD STRENGTH MEASUREMENT



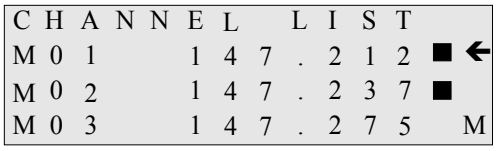
DISPLAY 2

SELECTION 'FLAG'



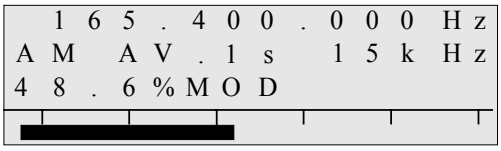
DISPLAY 5

PEAK FM DEVIATION



DISPLAY 3

MEMORY LIST



DISPLAY 6

PEAK AM PERCENTAGE

Figure 4-1. DISPLAY TYPES

4.2.1 Basic Display Features

As there are many possible permutations of functions, it is not practical to show all possible displays, and Figure 4-1 is only intended to show the basic display features. A description of Typical Operating Procedures performed to produce these displays is given in Section 5.

4.2.2 SOFT Function Display Abbreviations

The SOFT function is initiated by use of the SOFT/LIST push-button control (described later in this section). Table 4-1 details the abbreviations which may appear on the display, and their meaning.

Table 4-1. SOFT FUNCTION DISPLAY ABBREVIATIONS

ABBREVIATION	MEANING
ACD	Automatic Calibration Deselcted (off)
ACS	Automatic Calibration Selected (on)
AFD	Audio Filter Deselcted (out)
AFS	Audio Filter Selected (in)
ATD	ATtenuator Deselcted (out)
ATS	ATtenuator Selected (in)
LEV	Readout displays signal LEVel
LOD	LOckout Deselcted (off)
LOS	LOckout Selected (on)
LUS	Level Units SOFT Selectable
MOD	MODulation, readout displays A.M percentage or FM deviation
RLD	Relative Level Deselcted (off)
RLS	Relative Level Selected (on)
TS1	Tuning Steps 500 Hz
TS2	Tuning Steps 1 kHz
TS3	Tuning Steps 5 kHz
TS4	Tuning Steps 6.25 kHz
TS5	Tuning Steps 10 kHz
TS6	Tuning Steps 12.5 kHz
TS7	Tuning Steps 20 kHz
TS8	Tuning Steps 25 kHz
TS9	Tuning Steps 50 kHz*
VAD	Variable Averaging De-selected (off)
VAS	Variable Averaging Selected (on)

* Options M 248 610 and M 248 611 have tuning steps 30 kHz and 200 kHz respectively for soft function TS9.

4.3 ROTARY CONTROLS

The receiver has five rotary controls mounted on the front panel as shown in Figure 4-2. The following paragraphs detail the functions of these controls.

4.3.1 DISPLAY Control

This control sets the contrast and viewing angle of the display, and it should be adjusted for best readability.

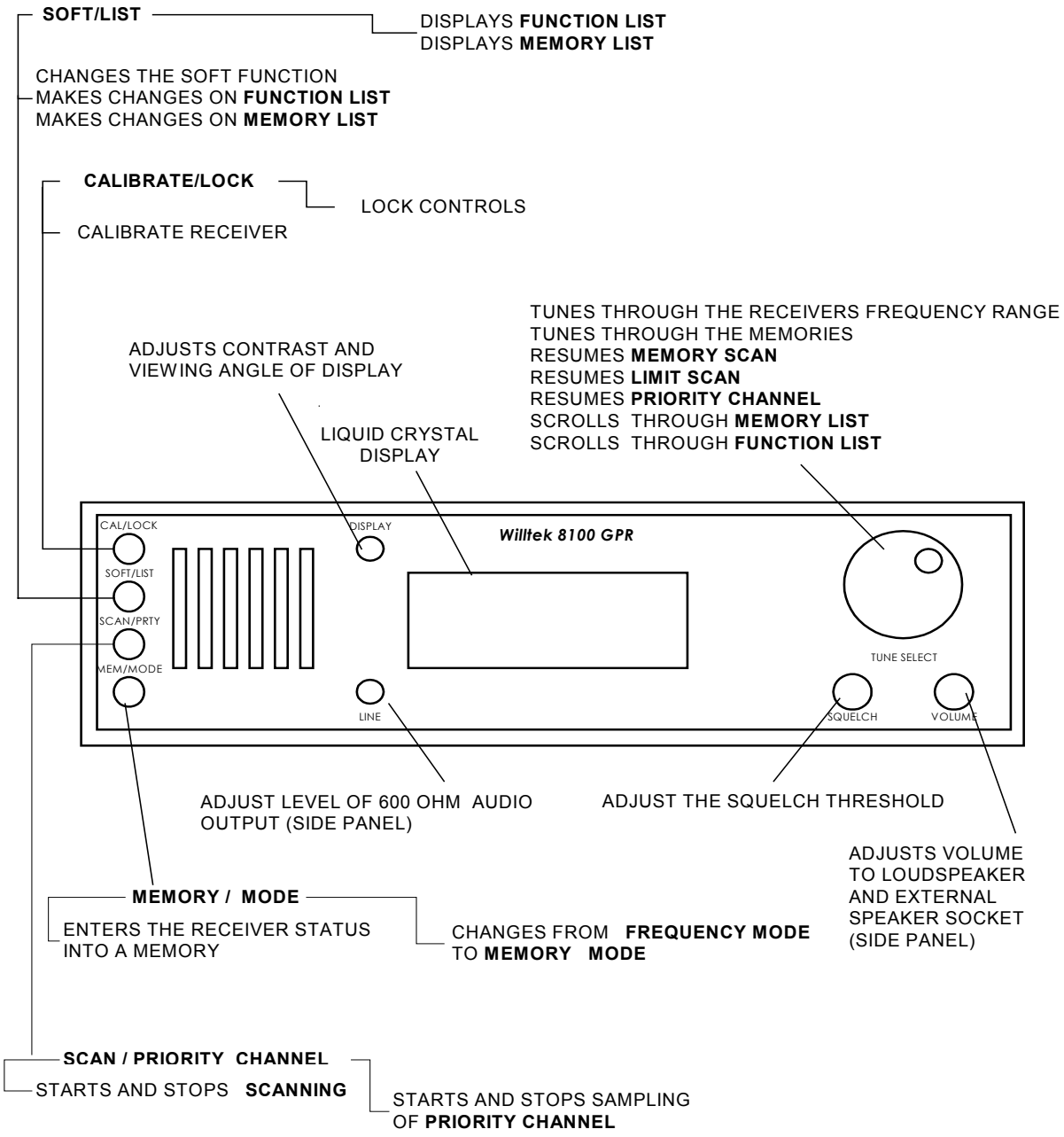


Figure 4-2. FRONT PANEL CONTROLS

4.3.2 LINE Control

This control adjusts the level of the 600 Ω audio line output.

4.3.3 SQUELCH Control

This control varies the threshold level at which the squelch (mute) opens. A visual indication of the threshold level is shown on the LEVEL bargraph scale, and the level can be varied with this control over the whole range of the bargraph.

The squelch level is part of the receiver status, and is stored in the memories and the PRIORITY CHANNEL. Moving the squelch control at any time when a MEMORY or the PRIORITY CHANNEL is in operation, will change the level that is stored.

4.3.4 VOLUME Control

This control adjusts the level to the speaker and headphone output.

4.3.5 TUNE/SELECT Control

This is a multifunction rotary control:

(1) **NORMAL OPERATION, FREQUENCY MODE.** The control functions as a TUNING control, and increments the frequency by one selected increment per click (frequency increments are selected using the FUNCTION LIST, explained later).

A speed up mechanism is incorporated, whereby the rate of incrementation increases when the control is turned more than one revolution per second, reaching maximum speed at three revolutions or more per second.

(2) **NORMAL OPERATION, MEMORY MODE.** The control increments through the active memories at the rate of one memory per click (if turned slowly).

(3) **LIST Selected.** When LIST is selected (see SOFT/LIST Push-button) the control scrolls the LIST, and enables different functions to be selected. The functions of REL, VARIABLE AVE, LIMIT SCAN, SCAN DELAY and PRIORITY CHANNELS, plus, for VHF/UHF receivers only, ATTENUATION, have variable parameters which can be altered with this control.

(4) **Receiver Scanning.** When the receiver is scanning in either FREQUENCY or MEMORY MODES, the control alters the direction of scan, and is used to resume scan (see SCAN/PRTY Push-button).

4.4 PUSH-BUTTON CONTROLS

The receiver has four multipurpose push-button controls. All push-buttons are of the non-locking type and the function selected depends upon the time that the push-button is pressed, and the receiver functions already in operation.

The push-buttons are operated in one of two ways:

(1) **A Momentary Press.** The push-button is pressed for less than half a second and a single “beep” is produced by the receiver.

(2) **A One Second Press.** The push-button is pressed until a double “beep” is produced by the receiver, after one second.

4.4.1 CAL/LOCK Push-button

NOTE: This push-button is not functional when LIST is displayed.

Functions Whilst Receiver is not Scanning

CAL **Receiver Calibration (Momentary Press).** The receiver will automatically calibrate itself with its built-in reference oscillator.

LOCK **Function Lock (One Second Press).** The receiver will be "locked", inhibiting the use of a number of controls.

Function Whilst Receiver is Frequency Limit Scanning

A one second press (double beep), will make the present frequency dormant. This causes the frequency to be ignored during future scans.

Function Whilst Receiver is Memory Scanning

A one second press (double beep), will enter the present frequency into the LOCKOUT LIST. This causes the frequency to be ignored during future scans if the LOCKOUT is on.

CAL Function

When the CAL function is initiated (momentary press), the word "CALIBRATING" will appear on the display, and the level of the calibration signal will be seen on the bargraph. The time taken to calibrate is about one second. If, due to a fault, the receiver fails to calibrate after three seconds, the word "UNCAL" will be shown in place of the level readout. The receiver can still be used to monitor signals, and it may still be possible that calibration might be achieved on other frequencies or bandwidths.

For maximum accuracy when making level measurements, the receiver should be recalibrated whenever a change of frequency or bandwidth is made. It is possible for this to be done automatically (see AUTO CAL under "Function List" or "Memory List" in Section 5).

LOCK Function

When the LOCK function is initiated (one second press) the following controls are inhibited:

(1) SOFT/LIST push-button

(2) SCAN/PRTY push-button

(3) MEM/MODE push-button

(4) TUNE/SELECT rotary control

Another one second press will return the operation of all these controls to normal.

To indicate that the receiver is in the LOCKED condition, the word "LOCKED" will alternatively flash with the displayed frequency. The receiver can still be calibrated whilst it is in the locked condition.

4.4.2 SOFT/LIST Push-button

This push-button provides the following functions:

SOFT **Programmed Function Change (Momentary Press).** Each momentary press of this button will step through, or switch ON or OFF, a preprogrammed function; a single beep occurring on every press.

LIST FUNCTION or MEMORY STATUS LIST, or PRIORITY CHANNEL STATUS (One Second Press). Information on the operation these functions is given under the LIST Function heading below.

SOFT Function

By use of the FUNCTION LIST, this button can be programmed to change the parameter of, or switch ON or OFF, almost any receiver function without going out of NORMAL OPERATION (see SOFT Function under Function List in Section 5). The SOFT Function Display Abbreviations are listed under DISPLAY FEATURES at the beginning of this section.

LIST Functions

The LIST function provides different facilities depending on the current receiver status:

Signal holding receiver on PRIORITY CHANNEL frequency. With PRIORITY CHANNEL operation selected (SCAN/PRTY push-button) and a signal holding the receiver on a PRIORITY CHANNEL frequency, the PRIORITY STATUS LIST will be displayed. Using the TUNE/SELECT rotary control to scroll through the list, a momentary press will select the required functions.

At all other times during NORMAL OPERATION. Either the FUNCTION LIST or the MEMORY STATUS LIST is displayed, depending upon which MODE has been selected (using the MEM/MODE push-button). Details for changing either of the above lists are given in Section 5 under Set Up Facilities.

In either of the above cases, a further one second press of the push-button will return the receiver to NORMAL OPERATION.

4.4.3 SCAN/PRTY Push-button

NOTE: This push-button is not functional when LIST is displayed.

The SCAN/PRTY push-button provides the following functions:

SCAN **Frequency Scanning ON/OFF (Momentary Press).** A momentary press of this button will start either FREQUENCY MODE frequency scanning, or MEMORY MODE frequency and receiver status scanning, dependent upon the mode in use. A further momentary press will stop scanning.

PRTY **PRIORITY CHANNEL Operation (One Second Press).** Selects or deselcts PRIORITY CHANNEL operation.

SCAN Function

Scanning is available in both FREQUENCY MODE and MEMORY MODE.

FREQUENCY MODE. In FREQUENCY MODE, a momentary press will start the receiver scanning from the present frequency (if inside the limits) to the highest limit frequency in the frequency steps selected in the FUNCTION LIST. If the TUNE/SELECT rotary control is turned one click or more counterclockwise, it will reverse the direction of scan (i.e. from the present frequency downwards). A clockwise turn on the TUNE/SELECT rotary control will again reverse the direction of scan. Setting the upper and lower scan limits is done using the FUNCTION LIST.

MEMORY MODE. Initiating the SCAN function in MEMORY MODE, will cause the receiver to scan through the active memories. A clockwise or counterclockwise movement of the TUNE/SELECT rotary control will reverse the direction of scan as in FREQUENCY MODE. The setting of the active and dormant memories is carried out in using the MEMORY LIST function (see "Memory and Memory Status Lists" in Section 5).

If the receiver stops on a signal (in either mode), scanning can be resumed by moving the TUNE/SELECT rotary control clockwise or counterclockwise, depending on the direction of scan required.

A RESUME TIME can also be set using the FUNCTION LIST or MEMORY LIST function, as appropriate. This will cause scanning to continue after the preset time has elapsed.

PRTY Function

Up to two frequencies can be selected for PRIORITY CHANNEL operation by use of the SOFT/LIST push-button, as detailed under Function List in Section 5. A one second press of the SCAN/PRTY push-button will cause the PRIORITY CHANNEL or CHANNELS to be sampled at the rate set on the FUNCTION LIST.

A further one second press of the push-button will stop the PRIORITY CHANNEL sampling function.

PRIORITY CHANNEL sampling is temporarily stopped when a LIST is displayed.

4.4.4 MEM/MODE Push-button

This push-button provides the following functions:

MEM **Memorize Receiver Status (Momentary Press).** Enters the current frequency and current receiver status into one of forty memories, and causes that memory to become active.

MODE **Select FREQUENCY or MEMORY MODE (One Second Press).** Each one second press changes the receiver to the other mode of operation.

MEM Function

As previously described, this function enables the current frequency and receiver status to be stored and causes the memory used to become active.

There are forty memories available, numbered M01 to M40. If when attempting to store frequency and receiver status details, all of the memories are full, the words "MEMORIES FULL" will momentarily appear on the display and four beeps will sound. To store another receiver frequency and status, some of the memories will have to be deleted using the MEMORY LIST function (detailed in Section 5).

MODE Function

A one second press on the MEM/MODE push-button will change the mode of operation from FREQUENCY MODE to MEMORY MODE (or vice versa).

When going from FREQUENCY MODE to MEMORY MODE, the first memory recalled will be the last frequency and receiver status entered, or if in the meantime that memory has been deleted or made DORMANT, the memory recalled will be the next lowest number of ACTIVE memory.

If when changing to MEMORY MODE, all the memories are either clear or dormant, the message ALL MEMORIES CLEAR or ALL MEMORIES DORMANT will appear as appropriate, and the receiver will maintain its FREQUENCY MODE status in memory mode (given the memory number M00). This is only to indicate that the receiver is now in MEMORY MODE; M00 will not appear on the MEMORY CHANNEL LIST, and this reference will disappear as soon as there is an available ACTIVE memory.

SECTION FIVE – DETAILED OPERATING INFORMATION

5.1 INTRODUCTION

This section provides a detailed description of the concept of operation of the equipment and information on how to use combinations of control sequences to provide the different equipment functions.

5.2 DETAILED CONCEPT OF OPERATION/METHODS

To enable the receiver to be used efficiently it is important that the overall operational concept of the receiver is clearly understood. The receiver can be regarded as operationally divided up into four sections as follows:

(1) FREQUENCY MODE, NORMAL OPERATION.

(2) FUNCTION LIST/PRIORITY STATUS LISTS/LOCKOUT LIST.

(3) MEMORY MODE, NORMAL OPERATION.

(4) MEMORY STATUS LISTS/MEMORY LIST.

Figure 5-1 shows the relationship between these operational sections.

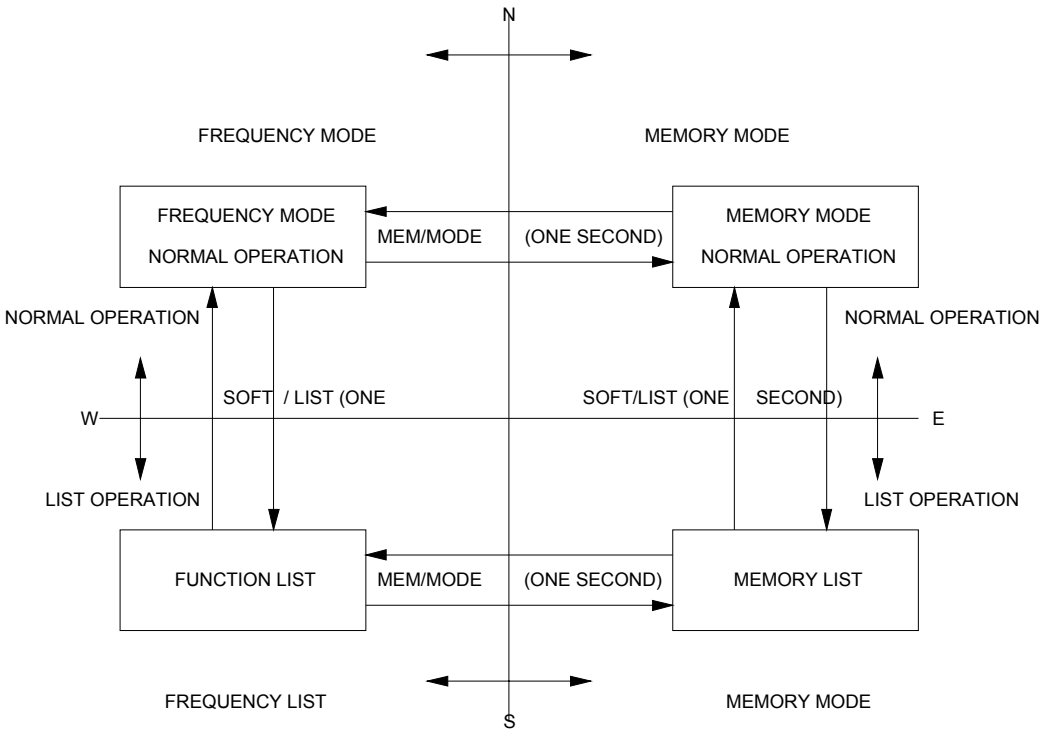


Figure 5-1. Willtek 8100 GPR – OPERATIONAL SECTIONS

5.2.1 Normal and List Operation

The receiver is used for two types of operation: NORMAL OPERATION and LIST OPERATION.

NORMAL OPERATION

The receiver is used most of the time in one of the sections above the West-East line, this being referred to as NORMAL OPERATION.

LIST OPERATION

The receiver is used below the West-East line (LIST OPERATION) when changes in functions or parameters need to be made.

Changing between NORMAL and LIST OPERATION

Changing between NORMAL and LIST OPERATION (across the West-East line) is carried out by a one second press of the SOFT/LIST push-button (two beeps).

5.2.2 Frequency and Memory Modes

The receiver has two modes of operation: FREQUENCY MODE AND MEMORY MODE.

FREQUENCY MODE Operation

When the receiver is used to the left of the North-South line it is in FREQUENCY MODE, and it can be tuned through all of its frequency range.

In this mode the FUNCTION LIST, PRIORITY STATUS LISTS (one for each of two PRIORITY CHANNELS) and LOCKOUT LIST can be displayed.

MEMORY MODE OPERATION

When the receiver is used to the right of the North-South line it is in MEMORY MODE and it can only be tuned through the preprogrammed memory channels.

In this mode the FUNCTION LIST, PRIORITY STATUS LISTS (one for each of two PRIORITY CHANNELS) and LOCKOUT LIST can be displayed.

Changing between FREQUENCY and MEMORY MODES

Changing between FREQUENCY and MEMORY MODES is carried out by a one second press of the MEM/MODE push-button (two beeps).

5.2.3 Status List “Transfer” Function

Selecting TRANSFER in either the PRIORITY STATUS LIST or MEMORY STATUS LIST will change the receiver to FREQUENCY MODE, NORMAL OPERATION, with the current status as parameters.

5.2.4 Front Panel Controls

Each Front panel push-button has two functions associated with it. When the push-button is enabled, the function to the left of the oblique stroke is actioned by a momentary press (less than one second) and one beep will sound. A longer press will action the function to the right of the oblique stroke and two beeps will sound.

NOTE: Certain push-buttons may be non-operational at particular times (when their functions are not relevant to the operation being carried out), and if a non-operational push-button is pressed, an informative error message is displayed.

Full details of all Front Panel push-button and rotary controls are given in Section 4.

5.3 WARNINGS AND PROMPTS

When the receiver is in use a number of warnings and prompts (operational messages) can appear on the display. The following paragraphs list these messages and describe their meaning.

5.3.1 "ALL MEMORIES CLEAR"

This message is displayed when going from FREQUENCY MODE to MEMORY MODE and all forty memory locations are CLEAR. Four beeps will sound.

5.3.2 "ALL MEMORIES DORMANT"

This message is displayed when going from FREQUENCY MODE to MEMORY MODE and all forty memory locations are DORMANT. Four beeps will sound.

5.3.3 "AVERAGE.1s AND 1s ONLY FOR MODULATION MEASUREMENTS"

This message is displayed when a modulation or deviation measurement is attempted with PEAK or AVERAGE 5 ms selected. Four beeps will sound.

5.3.4 "BATTERY FAIL"

This means that the internal battery backed-up memory chip needs replacing. The receiver will still function normally for a short time. It is recommended that the receiver is returned to Willtek for chip replacement.

5.3.5 "BATTERY LOW"

This message will flash alternately with frequency, and is an indication that the batteries need recharging.

5.3.6 "BOTH PRIORITY CHANNELS DORMANT"

This message is displayed when PRIORITY CHANNEL sampling is commenced and both PRIORITY CHANNELS are dormant. Four beeps will sound.

5.3.7 "CANNOT STORE FREQUENCY WHEN IN MEMORY MODE"

This message is displayed when the receiver is in MEMORY MODE and an attempt is made to store the frequency as if it were in FREQUENCY MODE. Four beeps will sound.

5.3.8 "CAN ONLY USE LOCKOUT WHEN HOLDING"

This message will be displayed when an attempt is made to LOCKOUT a frequency when the receiver is still scanning. Four beeps will sound.

5.3.9 "CHECK TYPE OF ANTENNA"

When dBµVm is selected, the level readout is only correct with one type of antenna, and this serves to remind the user to check that the antenna in use is the correct one. A series of beeps will also be heard when dBµVm is selected.

5.3.10 “LOCKED”

This message is displayed alternately with frequency when the receiver controls are locked. No beeps will sound when the buttons are pressed.

5.3.11 “LOCKOUT LIST CLEAR”

This message is displayed when the LOCKOUT LIST is selected and it is clear. Four beeps will sound.

5.3.12 “LOCKOUT LIST FULL”

This means that all one hundred positions in the list are full. Four beeps will sound.

5.3.13 “MEMORIES FULL”

This means that all forty memories are full. Four beeps will sound.

5.3.14 “MICRO UNIT FAILURE”

The receiver is controlled by a microprocessor which also gives the operational messages. If a fault develops in the MICRO UNIT, it is possible for the display to become corrupted and for none of the controls to function normally. If this happens a press of the RESET button may clear it.

When the RESET button is pressed, the receiver will commence its switch-on calibration routine (10 seconds) after which it will assume the status listed in Tables 5-1 to 5-4. The recessed RESET button is located on the left-hand side of the receiver.

Table 5-1. GENERAL STATUS AFTER RESET

FUNCTION	PARAMETER
FREQUENCY	100,000,000 MHz
OPERATION	NORMAL
LOCK	OFF
SOFT FUNCTION	AUDIO DETECTOR
SCAN FUNCTION	OFF
PRIORITY CHANNEL	OFF
MODE	FREQUENCY

Table 5-2. MEMORY LIST AFTER RESET

FUNCTION	PARAMETER
CHANNEL LIST	ALL MEMORIES CLEAR
SCAN DELAY*	
– DWELL TIME	0 s
– HOLD TIME*	3.0 s
– RESUME TIME*	OFF
AUTO CAL*	OFF
VARIABLE AVE.	1 s

NOTE: The memory list can only be entered when at least one frequency has been memorized (detailed in MEMORY STATUS LIST Facilities, paragraph 5.4.4). Until a frequency is memorized, the functions marked with a "*" can not be displayed.

Table 5-3. FUNCTION LIST AFTER RESET

FUNCTION	PARAMETER
BANDWIDTH	7.5 kHz
REL LEVEL	20 dBµV
	OFF
LEVEL UNITS	dBµV
LEVEL DETECT	AVERAGE.1 s
VARIABLE AVE	1.0 s
	OFF
AUDIO DETECT	FM
AUDIO FILTER	IN
ATTENUATION	0 dB
AUTO CAL	OFF
TUNING STEPS	12.5 kHz
STEP OFFSET	OFF
READOUT	LEVEL
LIMIT SCAN	100 kHz – 1000 MHz
SCAN DELAY	
– DWELL TIME	0 s
– HOLD TIME	3.0 s
– RESUME TIME	OFF
PRIORITY 1 FREQUENCY	100,000,000 MHz
PRIORITY 2 FREQUENCY	100,000,000 MHz
PRIORITY 2	1000,000,000 MHz
DC GFC490x	OUT
LOCKOUT	OFF
SERIAL DATA	
– PARITY	XX
– STOP BITS	2
– SPEED (BAUD RATE)	9600

Table 5-4. MISCELLANEOUS PARAMETERS AFTER RESET

FUNCTION	PARAMETERS
LOCKOUT LIST	CLEAR
PRIORITY LISTS 1 & 2	AS FUNCTION LIST
MEMORY STATUS LISTS	
M01 TO M040	CLEAR

5.3.15 "MORE THAN ONE BUTTON PRESSED"

This message is displayed along with a warble beep to indicate that two or more buttons have been pressed together. The receiver will not action any changes if this occurs.

5.3.16 "NOT A SOFT FUNCTION"

This message is displayed when an attempt is made to bring up a flag next to the FUNCTION TITLE of a function that is not soft selectable. Four beeps will sound.

5.3.17 “OUT OF LOCK”

This means that there is a fault in the synthesizer section of the RF UNIT. It is possible for the receiver to be out of lock on some frequencies and not others. Four beeps will sound.

5.3.18 “OVERLOAD”

This means that the signal into the RF input is beyond the receiver’s measuring range. The receiver will be damaged if the input exceeds 3.5 V_{rms} (250 mW). A continuous beeping will sound while the receiver is overloaded.

5.3.19 “OVER RANGE”

This message is displayed when the readout is in dB rel, and occurs when low (or no) signals are being received and the rel value on the FUNCTION LIST is set very high.

5.3.20 “PRESS FOR ONE SECOND TO COME OUT OF LIST”

This message is displayed when the SOFT/LIST push-button is momentarily pressed and the pointer is next to a flag or is not against a function. Four beeps will sound.

5.3.21 “REDUCE RF INPUT LEVEL”

This message is displayed when calibration is attempted when a signal level of above 60 dBµV is being measured. Four beeps will sound.

5.3.22 “REMOTE”

This message is displayed when the receiver is being remotely controlled by the RS-232-C interface.

5.3.23 “ UNCAL”

This means that there is probably a fault in the RF UNIT, or the IF signal processing circuitry in the IF UNIT. It is possible for the receiver to calibrate on some frequencies and not on others. Four beeps will sound.

5.3.24 “USE ONLY SOFT AND LIST”

This message is displayed when using a list and a button is pressed that will not action any function. Four beeps will sound.

5.3.25 “USE ONLY SOFT LIST AND MODE”

Identical to “USE ONLY SOFT AND LIST” message, above.

5.3.26 “USE MEMORY LIST TO CHANGE VALUE”

This message is shown when an attempt is made to vary the variable average time in a MEMORY STATUS LIST.

5.3.27 “VARIABLE AVE AND PEAK NOT SELECTABLE TOGETHER”

This message is displayed when PEAK is selected with the VARIABLE AVERAGE on, or when VARIABLE AVERAGE is selected with PEAK 1 s in operation. Four beeps will sound.

5.4 SET UP FACILITIES

The Willtek 8100 Series General Purpose Receivers have comprehensive set up facilities to control and memorize receiver functions. This enables functions and parameters to be modified to suit the intended working conditions. Because the required settings are held in non-volatile memory, it is not necessary to re-enter these details each time the receiver is switched ON.

Set up is generally performed by use of the list facilities; the only exception being the ability to define a SOFT function, the parameters of which may be altered without entering a list (described under FUNCTION LIST Facilities, paragraph 5.4.1).

FREQUENCY MODE Setup

In FREQUENCY MODE, the general receiver status is set up using the FUNCTION LIST facilities (paragraph 5.4.1).

Some functions can also be modified by the use of separate lists, entered via the FUNCTION LIST, and these include the PRIORITY STATUS LIST (paragraph 5.4.2) and LOCKOUT LIST (paragraph 5.4.3).

MEMORY MODE Setup

In MEMORY MODE, the status of a selected memory channel can be changed by using the MEMORY STATUS LIST (paragraph 5.4.4).

A MEMORY LIST (paragraph 5.4.5), showing a list of ALL memory locations, plus functions that are common to all memories, can be entered from within the MEMORY STATUS LIST. The common functions within this list can be altered, if required.

5.4.1 FUNCTION LIST Facilities

Introduction

With the receiver in FREQUENCY MODE, NORMAL OPERATION, the FUNCTION LIST may be entered by pressing the SOFT/LIST push-button for one second (two beeps). A flashing “F” will appear in the bottom right-hand corner of the display.

When the list is entered, it can be scrolled up or down by turning the TUNE/SELECT rotary control. The following paragraphs detail each function, and how its parameters may be viewed and set up.

BANDWIDTH Function

This function enables the required IF bandwidth to be selected. The IF Bandwidths available are fully described in paragraph 5.10.

To set up, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required bandwidth with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selected bandwidth, indicating that this bandwidth is now in use.

REL LEVEL Function

The receiver has a facility for setting a signal level reference and giving a readout in dB relative to that set reference.

NOTE: If it is required to change the units in which REL LEVEL is measured in (as shown on the display), set up the required new units using the LEVEL UNIT function.

The reset values of REL LEVEL are 20 dBµV, 10 µV or −87 dBm depending upon the LEVEL UNIT selected. The range of reference levels that can be selected, is the same as the measuring range of the receiver.

When REL LEVEL is selected as a SOFT function in NORMAL OPERATION, the set reference level will momentarily flash on the display before giving the readout in dB REL. When very large values of reference levels are entered, the error message "OVER RANGE" may appear on the display when low levels of signal are being received.

Selecting Value of REL LEVEL. To set up the required REL LEVEL, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the current REL LEVEL value with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the value.

(3) Using the TUNE/SELECT rotary control, adjust the REL LEVEL to the required value.

(4) Momentarily press the SOFT/LIST push-button. The selected value will be entered and the flag will be removed. The value set up will be remembered for all subsequent activation's of the REL LEVEL function.

Selecting/Deselcting REL LEVEL. To select (RLS) or deselct (RLD) REL LEVEL proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either ON or OFF with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

LEVEL UNITS Function

This function selects the units in which received signals are to be measured in (whilst in FREQUENCY MODE).

To select the required measurement unit, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required measurement unit with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selected unit, confirming that this unit will now be used for all measurements in FREQUENCY MODE.

NOTE: If dBµVm is selected, the message "CHECK TYPE OF ANTENNA" will appear on the display for around 3 seconds. This warning message is to inform the operator that accurate measurements using this unit can only be made with the correct type of reference antenna.

LEVEL DETECT Function

This function is used to select the required level detector. This can be either PEAK or AVERAGE reading, and set at a number of values. The signal level detectors are fully described in paragraph 5.7.

To select the required detector, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required level detector with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selected detector.

VARIABLE AVE Function

Facilities are provided for the user to apply a VARIABLE AVERAGE time (adjustable from 1 s to 99 s) on the displayed level readout. A full description of this facility is given in paragraph 5.7.5.

Selecting VARIABLE AVE Time. To vary the averaging time, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the current VARIABLE AVE time with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the time.

(3) Using the TUNE/SELECT rotary control, adjust the VARIABLE AVE time to the required value.

(4) Momentarily press the SOFT/LIST push-button. The selected time will be entered and the flag will be removed.

Selecting/Deselcting VARIABLE AVE. To select (VAS) or deselct (VAD) VARIABLE AVE, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either ON or OFF with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

AUDIO DETECT Function

The AUDIO DETECT can be set to either AM (amplitude modulation) or FM (frequency modulation). A full description of the AM/FM Audio Detectors is given in paragraph 5.8.

To select the required detector, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either AM or FM with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selected audio detector.

AUDIO FILTER Function

This facility allows a steep-sided audio bandpass filter to be selected (AFS) or deselcted (AFD). Full details on the Switchable Audio Bandpass Filter are given in paragraph 5.9.

To switch the filter IN or OUT, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either IN or OUT with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

ATTENUATION Function

This function allows a selectable amount of attenuation to be applied to the received signal. Full details of this feature (including an explanation of fixed attenuation) are given in paragraph 5.12. In VHF/UHF receivers the amount of attenuation can set to one of a number of levels, whereas VHF only receivers have two set levels of RF attenuation.

Selecting/Deselcting ATTENUATION. To select (ATS) or deselct (ATD) ATTENUATION, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either ATS (IN or 40 dB), or ATD (OUT or 0 dB), with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

Selecting ATTENUATION Value (VHF/UHF Receivers only). To select the attenuator with the required value, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the current attenuation value with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the value.

(3) Using the TUNE/SELECT rotary control, select the value of attenuation required.

(4) Momentarily press the SOFT/LIST push-button. The selected value of attenuation will be entered and the flag will be removed.

Setting Fixed ATTENUATION. To set fixed ATTENUATION, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align ATF with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

AUTO CAL Function

The receiver has an automatic calibration facility. When selected, the receiver will calibrate itself automatically one second after the last change in bandwidth or frequency, or immediately when scanning and the receiver stops on a signal. A full description of the Calibration Facilities is given in paragraph 5.11.

To select (ACS) or deselct (ACD) the AUTO CAL function, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either ON or OFF with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

TUNING STEPS Function

The receiver has the ability to be tuned or scanned in FREQUENCY MODE using one of a number of tuning steps (see Section 10 for those available on the receiver supplied).

On some receivers these can also be OFFSET by a frequency of half the selected TUNING STEPS value, enabling double the number of spot frequencies to be covered (see OFFSET function).

To select the required tuning steps, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required TUNING STEPS frequency with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

READOUT Function

This function enable either the LEVEL (field strength) or MOD (modulation/deviation) of the received signal to be displayed. With MOD selected, either the FM deviation or AM percentage modulation is displayed, dependent upon the detector in use (selected with the AUDIO DETECT function). Full details on these features are included in the description of Measurement Facilities, paragraph 5.5.

To set up this function, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align either LEVEL or MOD with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the selection.

LIMIT SCAN Function

Facilities are provided to scan between two preprogrammed frequencies. These frequencies can be entered in any order or position, as scanning always starts from the lowest frequency. A full description of the scanning facilities is included in paragraph 5.13.

To change the upper and lower LIMIT SCAN frequencies, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the first frequency with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the value.

(3) Using the TUNE/SELECT rotary control, adjust the value to the scan limit frequency required.

(4) Momentarily press the SOFT/LIST push-button. The selected scan limit frequency will be entered and the flag will be removed.

(5) Repeat steps (1) to (4) for the second scan limit frequency.

SCAN DELAY Function

Three delays associated with the scan function are provided:

DWELL TIME This is the time the receiver remains on a frequency before moving on to the next one if no signal is present.

HOLD TIME This is the time the receiver stays on a frequency after the received signal has ceased, or falls below the squelch threshold, before the scan continues.

RESUME TIME This is the time that the receiver stays on a frequency with a signal present before automatically resuming scan.

Full details on frequency scanning are contained in paragraph 5.13.

To set up DWELL, HOLD or RESUME TIMES, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required time (e.g. DWELL) with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear next to the value.

(3) Using the TUNE/SELECT rotary control, adjust the value to the time required.

(4) Momentarily press the SOFT/LIST push-button. The selected time will be entered and the flag will be removed.

(5) Repeat steps (1) to (4) for other times (e.g. HOLD and RESUME), as required.

PRIORITY CHANNELS 1 & 2 Functions

The receiver has facilities for momentarily sampling one or two frequencies (with full receiver status information) and these are called the PRIORITY CHANNELS. Of the two channels available either, both or neither can be sampled at a rate set up on individual PRIORITY STATUS LISTS. A full description of the priority channel facilities is given in paragraph 5.13.

To ENTER a PRIORITY CHANNEL. This procedure is the same for both priority channels:

(1) If not already in NORMAL OPERATION, FREQUENCY MODE, return to this condition by pressing the SOFT/LIST push-button for one second (two beeps).

(2) Tune to the frequency to be entered.

(3) Enter the FUNCTION list by pressing the SOFT/LIST push-button for one second (two beeps). A flashing “F” will appear in the bottom right-hand corner of the display.

(4) If required, alter the receiver status as appropriate.

NOTE: If it is not desirable to alter the FREQUENCY MODE receiver status, remember that the PRIORITY CHANNEL status can be changed later via the PRIORITY STATUS LIST.

(5) Using the TUNE/SELECT rotary control, align ENTER with the pointer (under the PRIORITY 1 or 2 heading, as appropriate).

(6) Momentarily press the SOFT/LIST push-button. A flag will momentarily appear next to ENTER, and the receiver status set up in FREQUENCY MODE will be entered as the selected PRIORITY CHANNEL. The frequency of this channel will be shown immediately above the ENTER parameter and the channel will automatically be made ACTIVE.

ACTIVE or DORMANT Indication and Selection. To see whether a PRIORITY CHANNEL is ACTIVE or DORMANT, and change this condition if necessary, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the frequency underneath either the PRIORITY 1 or PRIORITY 2 heading (as appropriate) with the pointer.

(2) If a flag is alongside this frequency it indicates that the PRIORITY CHANNEL is ACTIVE, and conversely, if a flag is not present it indicates the PRIORITY CHANNEL is DORMANT.

(3) When it is required to change to the other condition, make a momentarily press of the SOFT/LIST push-button; the flag will be displayed or removed, as applicable.

Displaying the PRIORITY STATUS LIST. To display this list for either of the PRIORITY CHANNELS, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align STATUS under either the PRIORITY 1 or PRIORITY 2 heading (as appropriate) with the pointer.

(2) Momentarily press the SOFT/LIST push-button. The PRIORITY STATUS LIST will now be displayed and a flashing “P” will appear in the bottom right-hand corner of the display.

NOTE: Most functions in the PRIORITY STATUS LIST can be changed in the same way as for the FUNCTIONS LIST, but the parameters entered only apply to the selected PRIORITY CHANNEL. Full details on the PRIORITY STATUS LIST facilities are given in paragraph 5.4 2.

LOCKOUT Function

The LOCKOUT facility provides a store of up to 100 frequencies to be ignored during either Frequency Limit Scanning or Memory Scanning, as appropriate. Frequencies are “locked out” using the CAL/LOCK push-button whilst scanning (see Push-button Controls in Section 4 for details) and added to the LOCKOUT LIST.

The LOCKOUT Function allows the list of “locked out” frequencies to be displayed, then modified or deleted if required.

Displaying the LOCKOUT LIST. The list of frequencies “locked out” is displayed as follows:

(1) Using the TUNE/SELECT rotary control, align LIST with the pointer.

(2) Momentarily press the SOFT/LIST push-button. The LOCKOUT LIST will now be displayed and a flashing “L” will appear in the bottom right-hand corner of the display.

NOTE: If the LOCKOUT LIST is selected when it is CLEAR, the message “LOCKOUT LIST CLEAR” will appear on the display and four beeps will sound.

(3) To scroll through the list of frequencies, use the TUNE/SELECT rotary control.

Exiting from LOCKOUT LIST. To exit from the LOCKOUT LIST and return the receiver to FREQUENCY MODE, NORMAL OPERATION, press the SOFT/LIST push-button for one second.

Clearing the Complete LOCKOUT LIST. To Clear the complete list, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align CLEAR with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will momentarily appear adjacent to CLEAR LIST, indicating that the list has now been cleared.

NOTE: The LOCKOUT LIST will also be cleared every time the SCAN LIMITS are changed, or when the receiver is switched OFF.

Deleting Individual "Locked Out" Frequencies. With the LOCKOUT LIST displayed, individual frequencies can be deleted as follows:

(1) Using the TUNE/SELECT rotary control, align the frequency to be deleted with the pointer.

(2) Momentarily press the SOFT/LIST push-button. The frequency will be deleted from the list.

SERIAL DATA Functions

Certain parameters for the RS-232-C serial port can be configured within the FUNCTION LIST. A full description of Programmable (RS-232-C) Operation of the receiver is provided in Section 6.

Changing the BAUD RATE. The baud rate of the receiver's RS-232-C serial port can be set up as follows:

(1) Using the TUNE/SELECT rotary control, align BAUD RATE with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will adjacent to the function.

(3) Using the TUNE/SELECT rotary control, alter the displayed BAUD RATE to the required value.

(4) Momentarily press the SOFT/LIST push-button. The flag will disappear and the BAUD RATE selected will be entered.

Changing the PARITY and STOP BITS. These parameters are set up in the same manner as BAUD RATE above. Refer to Table 5-5 for an explanation of the PARITY ABBREVIATIONS used.

Table 5-5. RS-232-C PARITY - FUNCTION LIST ABBREVIATIONS

FUNCTION LIST ABBREVIATION	Tx PARITY (FROM 8100)	Rx PARITY (INTO 8100)
XX	None	None
EE	Even	Even
OO	Odd	Odd
EO	Even	Odd
OE	Odd	Even
EX	Even	None
OX	Odd	None

5.4.2 PRIORITY STATUS LIST Facilities

The PRIORITY STATUS LIST details the status of the PRIORITY CHANNEL 1 or 2 as appropriate. Refer to PRIORITY CHANNEL 1 & 2 Functions (under Function List Facilities, paragraph 5.4.1) for full details of the priority channels and the procedure for displaying the list.

5.4.3 LOCKOUT LIST Facilities

The LOCKOUT LIST is a record of up to 100 frequencies currently "locked out" for scanning purposes. Full details of the LOCKOUT and LOCKOUT LIST facilities are included in the LOCKOUT Function (under Function List Facilities, paragraph 5.4.1).

5.4.4 MEMORY STATUS LIST Facilities

Introduction

A receiver status (frequency, plus all other parameters as detailed in the FUNCTION LIST) can be stored in one of forty memories (M01 to M40).

With the receiver in FREQUENCY MODE, NORMAL OPERATION, a momentary press of the MEM/MODE push-button will enter the current receiver status into memory.

Memories will automatically fill up with the lowest frequency in M01, and with ascending memory numbers for increasing frequencies, even if the lowest frequency is the last one to be entered.

With the receiver in MEMORY MODE, NORMAL OPERATION, the MEMORY STATUS LIST (for the selected memory) may be entered by pressing the SOFT/LIST push-button for one second (two beeps). A flashing "M" will appear in the bottom right-hand corner of the display.

When the list is entered, it can be scrolled up or down by turning the TUNE/SELECT rotary control. The following paragraphs detail each function, and how its parameters may be viewed and set up.

SELECT LIST Function

This function is used to enter the MEMORY LIST (described in paragraph 5.4.5).

(1) Using the TUNE/SELECT rotary control, align SELECT LIST with the pointer.

(2) Momentarily press the SOFT/LIST push-button. The MEMORY LIST will be displayed. The flashing "M" in the bottom right-hand corner of the display will continue, indicating that the receiver is still in MEMORY MODE list.

TRANSFER Function

This function allows the receiver status for the currently selected memory channel to be transferred to become the current receiver status in FREQUENCY MODE, NORMAL OPERATION.

After TRANSFER has been actioned, the FUNCTION LIST will be identical to the MEMORY STATUS LIST for the memory channel transferred.

(1) Using the TUNE/SELECT rotary control, align TRANSFER with the pointer.

(2) Momentarily press the SOFT/LIST push-button. The receiver will be returned to FREQUENCY MODE, NORMAL OPERATION, with the receiver status the identical to that of the memory channel that it was transferred from.

Functions Operating as FUNCTION LIST

The following functions in the MEMORY STATUS LIST operate in an identical manner to the similar named functions in the FUNCTION LIST (refer to FUNCTION LIST Facilities, paragraph 5.4.1, for selection procedures):

(1) BANDWIDTH Function

(2) LEVEL UNITS Function

(3) LEVEL DETECT Function

(4) VARIABLE AVE Function

NOTE: The VARIABLE AVE value is shown for reference only, but the function can be switched on and off.

(5) AUDIO DETECT Function

(6) AUDIO FILTER Function

(7) ATTENUATION Function

(8) READOUT Function

5.4.5 MEMORY LIST Facilities

Introduction

The MEMORY LIST shows a list of ALL memory locations, plus functions that are common to all memories. By use of the SELECT LIST function, the MEMORY LIST can be entered from within the MEMORY STATUS LIST of any memory channel.

Details of how frequencies are entered into memory, and how they are stored, are given in the Introduction to the MEMORY STATUS LIST Facilities, paragraph 5.4.4.

The following paragraphs detail the facilities and functions provided by the MEMORY LIST, and how they are used.

ACTIVE-DORMANT Memory Channel Function

When a frequency is entered into a memory channel it is always stored as ACTIVE (i.e. it has a flag against it in the MEMORY LIST, indicating that the status of this channel will be monitored during a MEMORY SCAN). If this memory channel is to be ignored for scanning purposes, it can be made DORMANT (no flag against it in list).

To change the ACTIVE/DORMANT condition of a memory channel, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align the required memory channel with the pointer. If there is a flag next to the frequency, the channel is ACTIVE, if a flag is not present, the channel is DORMANT.

(2) If it is required to change to the other condition, momentarily press the SOFT/LIST push-button.

(3) Repeat steps (3) and (4) as required.

MEMORY CLEAR Functions

Facilities are provided for clearing the whole MEMORY LIST (CLEAR LIST) or individual memories (DELETE).

CLEAR LIST Facility. To clear all the memory channels, proceed as follows:

(1) Using the TUNE/SELECT rotary control, align CLEAR LIST with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will momentarily appear against CLEAR LIST, and CLEAR will now appear by all memory numbers, in the list.

DELETE Facility. To clear one or more memories individually, process as follows:

(1) Using the TUNE/SELECT rotary control, align DELETE with the pointer.

(2) Momentarily press the SOFT/LIST push-button. A flag will appear against DELETE.

(3) Align a memory that is to be deleted with the pointer.

(4) Momentarily press the SOFT/LIST push-button. The memory will immediately be deleted from the MEMORY LIST, and the memories will re-arrange themselves with an extra CLEAR position at the end of the list.

(5) Repeat steps (3) and (4) for any other memories to be deleted.

(6) When deletion of the required memories is completed, using the TUNE/SELECT rotary control, realign DELETE with the pointer.

(7) Momentarily press the SOFT/LIST push-button. The flag against DELETE will disappear indicating that the ACTIVE/DORMANT memory channel function is operational again.

NOTE: When the receiver is returned to NORMAL OPERATION, a flag next to DELETE will be automatically removed. However, to prevent unintentional deletion of a memory channel when attempting to change its condition between ACTIVE and DORMANT always manually remove the flag, as detailed in steps (6) and (7) above.

Functions Operating as FUNCTION LIST

The following functions in the MEMORY LIST operate in an identical manner to the similar named functions in the FUNCTION LIST (refer to FUNCTION LIST Facilities, paragraph 5.4.1 for selection procedures):

(1) SCAN DELAY Function

(2) AUTO CAL Function

(3) VARIABLE AVE Function

NOTE: The actual value of VARIABLE AVE is common to all memories. The status lists are used to switch it on and off.

5.5 LEVEL (FIELD STRENGTH) MEASUREMENT

The level (field strength) or a received signal can be measured. With LEVEL selected, a digital readout of the signal level will be shown in the READOUT display. The bargraph will read in increments of 1 dB, with the marks on the associated scale marked of in 10 dB increments. The

range of the bargraph with the ATTENUATION out is from −24 dBµV to 60 dBµV (or the equivalent in other units). The bargraph range is dependent on the selected level of attenuation; e.g. with 50 dB attenuation selected, the bargraph range is 26 dBµV to 110 dBµV (or the equivalent in other units).

The bottom 14 dB of the signal level bargraph is outside the receiver specification, but can be used for making measurements with reduced accuracy. When dBµVm is selected, the bargraph will still read dBµV. Only the level readout will have the antenna correction factor applied to it.

The squelch threshold marker can be set anywhere on the bargraph scale by the squelch control.

5.6 MOD (MODULATION/DEVIATION) MEASUREMENT

With MOD (Modulation/Deviation) selected, a digital readout of the modulation (or deviation) level will be shown in the READOUT display.

The modulation readout is in kilohertz when FM is selected, and modulation percentage when AM is selected. The bargraph steps for both AM modulation percentage and FM deviation are as detailed in Table 5-6.

Table 5-6. BARGRAPH MODULATION/DEVIATION STEPS.

BANDWIDTH SELECTED	AM/FM	BARGRAPH INCREMENTS	SCALE DIVISIONS
N/A	AM	1.5%	20%
7.5 kHz	FM	50 Hz	1 kHz
15 kHz	FM	100 Hz	1 kHz
120 kHz	FM	1 kHz	10 kHz

The range of the bargraph, for both AM modulation percentage and FM deviation, is detailed in Table 5-7.

Table 5-7. BARGRAPH MODULATION/DEVIATION RANGES

BANDWIDTH SELECTED	AM/FM	DISPLAYED RANGE	SPECIFIED RANGE
N/A	AM	0% to 126%	0% to 90%
7.5 kHz	FM	0 kHz to 4.2 kHz	0 kHz to 3.75 kHz
15 kHz	FM	0 kHz to 8.4 kHz	0 kHz to 7.5 kHz
120 kHz	FM	0 kHz to 84.4 kHz	0 kHz to 60 kHz

A good signal-to-noise ratio is required to make accurate modulation measurements, especially at low AM percentages or low FM deviations, and for maximum accuracy a signal level of 30 dB, or greater, above the receiver noise level is recommended.

When measuring AM percentages, 0.1 s under LEVEL DETECT should normally be selected. The bargraph shows levels that are outside the receiver specification, however measurements can be made, but with reduced accuracy.

AM measurements can not be made with the PEAK detector selected, and the message “AVERAGE.1 s AND 1 s ONLY FOR MODULATION MEASUREMENTS” will be shown when this is attempted.

When modulation is being measured, the value of the readout will be the maximum peak value of the modulation percentage in AM, and the maximum peak deviation in FM. The readout will hold the maximum peak value for one second; however, this value will be immediately updated if a higher level occurs during the one second holding period, and a new one second holding time will commence. The bargraph will follow quick changes in modulation level and is a good guide to instantaneous changes.

When steady tones are measured, jitter on the readout will occur due to the peak detector responding to the noise superimposed onto the audio. This effect will tend to get worse at low signal levels.

When measuring modulation with significant high frequency content, a wider bandwidth should be selected. The receiver is calibrated with a modulating tone of 400 Hz.

5.7 SIGNAL LEVEL DETECTION

5.7.1 Introduction

Signal level detectors are selected from the FUNCTION LIST. The normal detectors provided are:

AVERAGE 5 ms	–	5 millisecond response time.
AVERAGE.1 s	–	100 millisecond response time.
AVERAGE 1 s	–	1 second response time.
PEAK 1 s	–	1 second hold time.

With the AVERAGE detectors, the signal readout will not vary when receiving steady signal level or AM (amplitude modulated) transmissions if the modulation is symmetrical (i.e. the increase above the carrier level is the same as the decrease).

Some transmitters have asymmetrical modulation and this will be reflected in the readout, which will be higher or lower, depending upon whether the modulation is upward or downward. Some transmitters are adjusted for upward modulation to give more “talk power”.

With FM (frequency modulated) transmissions, a slight reduction of the readout may occur, depending upon the amount of deviation, the modulating frequency and the receiver bandwidth selected. This is because some of the energy in the transmission will fall outside the receiver bandwidth.

5.7.2 AVERAGE 5 ms Detector

This detector is used when the external signal level output is used to measure rapidly changing signals, or when FM transmissions are being monitored under changing conditions (e.g. when mobile). This detector is not suitable for the monitoring of AM transmissions.

When either of the other average detectors are selected and scanning is commenced, this detector will automatically be selected. The receiver will automatically revert back to the previously selected average detector when the SCAN function is deselcted, or when the receiver stops on a signal. This is to enable the receiver to respond quickly to signals despite the fast rate of scan.

This detector is also automatically selected momentarily when a PRIORITY CHANNEL is sampled, the receiver again reverting to a stored PRIORITY CHANNEL status if it is busy. Due to the response time of the liquid crystal display, the bargraph will only respond to signals varying at the rate of 2 Hz or less. This will only give an approximate of the signal strength variations under mobile conditions, especially at high frequencies where the signal flutter can be very rapid.

5.7.3 AVERAGE.1 s Detector

This detector is suitable for most general purpose monitoring and measuring applications. When making AM measurement, the minimum modulating frequency that can be measured accurately is 100 Hz.

5.7.4 AVERAGE 1 s Detector

This detector is used when monitoring AM transmissions which contain a low frequency audio content. A good quality external loudspeaker is recommended for doing this. With this detector selected, the signal level bargraph will have a slow response.

5.7.5 VARIABLE AVERAGE Facility

The facility is provided for the user to apply a VARIABLE AVERAGE time (normally adjustable from 1 s to 99 s) on the displayed level readout.

This averaging differs in type from the other AVERAGE times selected under the LEVEL DETECT title (described above); these times are determined by the response of the gain control loop within the receiver IF, whereas the VARIABLE AVERAGE acts on the readout only. This means that although a long VARIABLE AVERAGE time is selected, the restrictions of the control loop time constants will apply when demodulating AM transmissions.

For the majority of measuring applications with the VARIABLE AVERAGE in operation, select the 0.1 s time under LEVEL DETECT.

The starting level for the variable averaging function is made equal to the existing signal level in the receiver whenever VARIABLE AVE is turned ON, and whenever the receiver is calibrated. This is useful when a long variable averaging time has been set, and enable signal level readings to be taken immediately.

The level readout is updated every second with the new averaged value. This feature is particularly useful for removing jitter on the readout at very low signal levels.

To give an indication of the instantaneous signal level when a long VARIABLE AVERAGE time is selected, the bargraph time constant will be that of the time under LEVEL DETECT.

VARIABLE AVERAGE is not available when PEAK is selected and the message “VARIABLE AVE and PEAK NOT SELECTABLE TOGETHER” will be shown when this is attempted.

5.7.6 PEAK 1 s Detector

This detector is used to capture the level of a burst of carrier down to 1 ms in duration, and holds the reading on the level readout for one second.

The bargraph will respond to changes in signal much quicker than the readout, to give an indication of the signals existing while the readout is holding. It will also capture the peak level of a signal which is changing rapidly.

The readout is updated immediately a signal occurs that is greater than the existing reading, and the increased signal re-starts the one second holding time. Although peak responding, the PEAK readout shows the rms value of a sine wave having the same peak level as the signal being measured; therefore, for a steady state signal with no modulation, the level measured will be the same as for AVERAGE. It will be noticed however, that at signal levels near the residual noise level of the receiver, the reading on PEAK will be slightly more than AVERAGE for a steady state signal. This is because the PEAK detector will respond to the peaks of the noise that will be superimposed onto the signal at low levels.

When measuring the signal level of AM transmissions, this detector will respond to the peaks of the modulation envelope, i.e. if the transmission is 100% modulated, a reading 6 dB in excess of the unmodulated carrier level will be indicated.

AM measurements can not be made with the PEAK detector selected and the message "AVERAGE. 1 s AND 1 s FOR MODULATION MEASUREMENTS" will be shown if this is attempted.

When transient signal levels of over 60 dBµV occur, the readout may not be correct because of the finite amount of time the ATTENUATOR takes to switch in. If high transient signal levels are measured the appropriate amount of attenuation must be manually switched in, using the ATTENUATION function in the FUNCTION LIST.

5.8 AM/FM AUDIO DETECTORS

There are two types of audio detector for reception of AM (amplitude modulated) and FM (frequency modulated) signals.

5.8.1 AM Detector

The AM detector has a low distortion for modulation depths up to 90%. When AM is selected, the bargraph and level readout on MOD will read the peak modulation percentage.

The volume level in AM will change less than 1 dB over the receiver's specified measuring range for a given percentage of modulation.

5.8.2 FM Detector

When FM is selected, the bargraph and level readout on MOD will read peak deviation. When MOD and FM are selected, the de-emphasis is switched out. The volume level in FM will change less than 1 dB over the receivers specified measuring range for a given amount of deviation.

5.9 SWITCHABLE AUDIO BANDPASS FILTER

Facilities are provided for switching a steep-sided audio bandpass filter IN and OUT.

5.9.1 Audio Filter OUT

In this condition, the frequency response of the receiver is determined by the IF bandwidth and the de-emphasis. The −3 dB frequency response of the loudspeaker, headphone and 600 Ω line outputs are listed in Table 5-8.

FM deviation measurements may be taken with an accuracy of ±500 over the audio frequency ranges in Table 5-7.

Table 5-8. HEADPHONE AND 600 OHM LINE OUTPUT RESPONSES

DET.	BANDWIDTH	TYPICAL RESPONSE
FM	7.5 kHz	20 Hz to 3.5 kHz
FM	15 kHz	20 Hz to 4.5 kHz
FM	120 kHz	20 Hz to 10 kHz
AM	7.5 kHz	20 Hz to 3.5 kHz
AM	15 kHz	20 Hz to 7.5 kHz
AM	120 kHz	20 Hz to 10 kHz

AM modulation percentage measurements may be taken with an accuracy of ±5% AM, over the audio frequency ranges in Table 5-7.

Any sub-audible or supervisory tones can be heard or measured with the audio filter out.

5.9.2 Audio Filter IN

With the audio filter IN, the receiver is suitable for monitoring speech transmissions, with the signal-to-noise ratio of weak signals being enhanced. Sub-audible tones are effectively filtered out, with at least 45 dB rejection of a 200 Hz tone being given, as compare with peak speech level in a typical system.

In MOD, the modulation measurement will be of only the frequencies within the passband of the audio filter (300 Hz – 1 dB to 2.4 kHz – 1 dB). The measurement accuracy may be slightly impaired with the audio filter IN.

5.10 IF BANDWIDTH SELECTION

All 8100 Series receivers have three bandwidths available: 7.5 kHz, 15 kHz and 120 kHz. Some models of receiver have an additional bandwidth available. Refer to Section 8 for details of the IF bandwidths available on your receiver.

5.10.1 7.5 kHz Bandwidth

This bandwidth is normally used for monitoring and level measurements in FM 12.5 kHz channel spacing systems. 7.5 kHz bandwidth can also be used with FM 25 kHz channel spacing systems where the deviation is low; it may also be used for AM speech transmissions.

5.10.2 15.0 kHz Bandwidth

This bandwidth is normally used for monitoring and level measurements in FM 25 kHz channel spacing systems. This bandwidth should also be used when monitoring or measuring signals with high deviation, or with significant high frequency contents.

5.10.3 120 kHz Bandwidth

This bandwidth is normally used for monitoring and level measurements of FM broadcast and cellular radio telephone systems.

5.11 CALIBRATION FACILITIES

5.11.1 Introduction

Willtek 8100 Series General Purpose Receivers have an accurate internal reference source which is switched into the RF input when calibration is in progress. To prevent strong signals at the RF input leaking through the calibration relay and upsetting the calibration level, 20 dB of attenuation is automatically selected during calibration.

To ensure accuracy calibration is inhibited when a signal level of above 60 dBµV exists in the receiver, and the warning message "REDUCE RF INPUT LEVEL" will be and four beeps will sound.

The time to calibrate is about one second, and during this time the word "CALIBRATING" will be shown in place of frequency on the display.

The receiver will automatically calibrate every time it is switched ON. When in use, if the receiver fails to calibrate after three seconds, the word "UNCAL" will be displayed in place of the level readout and four beeps will sound. The receiver can still be used to monitor signals, and calibration may be achieved on other frequencies or bandwidths.

5.11.2 Calibration with AUTO CAL OFF

In this condition, the CAL/LOCK push-button must be momentarily pressed to initiate calibration. If accurate measurements are required, it is recommended that the receiver is calibrated:

(1) Every 10 minutes.

(2) Whenever the frequency or bandwidth is changed.

(3) Whenever there is a marked change in ambient temperature.

For general monitoring applications it is not necessary to recalibrate.

5.11.3 Calibration with AUTO CAL ON

When accurate measurements of many signals have to be made, with AUTO CAL selected, the receiver will automatically calibrate one second after a change in frequency has been made, or immediately when scanning and the receiver stops on a signal, or if a change in bandwidth is made.

AUTO CAL will be inhibited on any frequency or memory channel where a signal level of over 60 dBµV exists. When AUTO CAL is selected in MEMORY MODE, calibration will occur immediately a new memory is selected. AUTO CAL appears on both lists and can be selected independently for MEMORY MODE and FREQUENCY MODE.

5.12 SELECTABLE ATTENUATION

5.12.1 Introduction

The 8100 Series receivers have an attenuation facility, which can be switched in to enable large signals to be measured. This facility is also useful when a good VSWR at the receiver input is required at all frequencies, and when the receiver is used in a very high field strength area which could cause a receiver overload.

Attenuation can either be switched IN (ATS, 10, 20, 30, 40 or 50 dB attenuation, as selected in the appropriate LIST), or OUT (0 dB attenuation). Regardless of whether attenuation is selected or deselected, an automatic attenuation ranging facility is normally in operation to keep the received signal on the display during high RF input conditions. An additional facility, attenuation fixed (ATF), may be used to set the attenuation to a fixed level, regardless of RF input level.

5.12.2 Attenuation Deselcted (ATD)

With ATTENUATION deselcted, if the measured signal exceeds the maximum able to be indicated on the bargraph/numeric display, attenuation is progressively added. First, the receiver will put in 20 dB RF attenuation. If the signal is still over range, 20 dB IF attenuation will be added, and if still over range, the final 10 dB IF attenuation will be added.

Beeps may sound when above occurs; because the receiver goes into momentary overload in the time the attenuation takes to switch IN, activating the overload warning beeps for a short period of time.

The range of the bargraph with the ATTENUATION out is from –24 dBµV to 60 dBµV (or the equivalent in other units). When “ATD” is shown on the display, it will only change to “ATS” when attenuation is selected manually.

5.12.3 Attenuation Fixed (ATF)

When attenuation fixed (ATF) is selected, the attenuation is fixed at the current level, regardless of RF input level. When in the FUNCTION LIST, a flag is shown against ATF indicating that fixed attenuation is in operation.

5.12.4 Attenuation Selected (ATS)

With ATTENUATION selected, the receiver has variable attenuation (10, 20, 30, 40 or 50 dB), and the bargraph range is dependent on the selected level of attenuation: e.g. with 50 dB attenuation selected, the bargraph range is 26 dBµV to 110 dBµV (or the equivalent in other units). The selected attenuation level (shown in the respective LIST) is normally applied, unless a high RF input is received which would otherwise exceed the maximum indication. When this condition occurs, attenuation is progressively added (as described in 5.12.2) until the indication is below the maximum on the bargraph/numeric display.

When in FUNCTION LIST, a flag will only show against “ATS” (IN or –40 dB) when ATTENUATION has been selected manually, even though automatic selection of ATTENUATION may have occurred.

5.13 SCANNING AND PRIORITY CHANNEL FACILITIES

5.13.1 Introduction

Facilities are provided to automatically scan between two selectable limit frequencies, scan the ACTIVE memory channels, or periodically sample one or two PRIORITY CHANNELS. When scanning the memories or between frequency limits, the letters SC will be displayed flashing in place of “Hz” at the top of the display. Scanning will be halted whenever a station is received that is above the squelch threshold level or whenever the squelch is turned fully counterclockwise, and SC will stop flashing.

When the PRIORITY CHANNELS are in operation, the letters P1 or P2 will be shown flashing in place of Hz. The receiver will stay on a PRIORITY CHANNEL whenever a signal above the squelch threshold level of a PRIORITY CHANNEL is received, or whenever the squelch is turned fully counterclockwise, and P1 or P2 will stop flashing.

When PRIORITY CHANNELS and SCANNING (Limit Scan or Memory Scan) are both in operation, SC will flash alternately with P1 or P2.

See SCAN DELAY Function (under paragraph 5.4.1, FUNCTION LIST Facilities), for details of the SCAN HOLD, DWELL, SAMPLE and RESUME times associated with the SCAN and PRIORITY CHANNEL functions.

If scanning is halted by, or if a PRIORITY CHANNEL receives a signal above, 60 dBµV, a fixed attenuation level will automatically be applied to the signal (see Selectable Attenuation, paragraph 5.12). Because this will reduce the level indicated on the bargraph, and the squelch threshold level is controlled by the bargraph level, the SQUELCH control may have to be turned an amount counterclockwise to stop the receiver moving on to the next frequency or memory.

5.13.2 LIMIT SCAN Function

When LIMIT SCAN is commenced, if the present receiver frequency is outside the LIMIT SCAN frequencies (set on the FUNCTION LIST), the receiver will immediately jump to the lowest frequency limit and start scanning up.

If the present receiver frequency lies anywhere between the limit frequencies, the receiver will start scanning from its present frequency upwards.

If halted by a signal, scanning can be manually resumed, or the direction of scan changed, by a clockwise (up) or counterclockwise (down) turn of the TUNE/SELECT control.

When scanning, a fixed receiver status is automatically set up to enable the receiver to scan quickly. Upon halting on a signal, the receiver will immediately revert back to the status that existed before scan commenced. Any alteration of the SOFT function is subsequently stored as part of the receiver status that will be recalled when the receiver next halts on a signal. SCAN DWELL, HOLD and RESUME times (adjusted in the FUNCTION LIST) should be adjusted as required.

When 0 seconds DWELL time is selected, the receiver will scan as fast as possible 20 MHz per minute equal to twenty-six 12.5 kHz channels in one second), but the display will be updated slowly. If a faster display update is required, the DWELL time should be adjusted to 0.1 seconds or longer, but this will be at the expense of scan speed.

Up to 100 unwanted frequencies can be skipped over by entering them into the LOCKOUT LIST, however the speed of scan will be slower with the LOCKOUT ON. When a signal on the unwanted frequency is being received, during receiver scanning, LOCKOUT can be performed by a one second press of the CAL/LOCK push-button. The LOCKOUT LIST will automatically be cleared when new LIMIT SCAN frequencies are entered or when the receiver is switched OFF.

5.13.3 MEMORY SCAN Function

When MEMORY SCAN is commenced, the receiver will start scanning all the ACTIVE memories up from the present memory selected. When scanning, a fixed receiver status is set up to enable the receiver to scan quickly.

Upon halting on a signal, the receiver will automatically revert back to the memorized receiver status. Any alteration to the squelch level will be stored as the new squelch level for that particular memory. It must be born in mind that with a short HOLD time selected, there may not be enough time to update a new squelch level if the signal ceases.

With SCAN DWELL time (set on the MEMORY LIST) at 0 seconds, the scan will be as fast as possible, which is nominally all 40 memories in four seconds, but this will vary slightly depending on the frequency separation of the memories.

To have a display update for every memory channel, the DWELL time (on the MEMORY LIST) should be adjusted to 0.1 seconds or longer, but this will be at the expense of scan speed.

Any number of memory channels can be skipped over by making them DORMANT. This can be done by means of the MEMORY LIST or immediately by a one second press of the CAL/LOCK push-button when a signal on the unwanted memory is being received.

5.13.4 PRIORITY CHANNELS Functions

The PRIORITY CHANNELS are sampled at the rate set on the FUNCTION LIST. The time the receiver actually takes to sample the PRIORITY CHANNELS depends upon the PRIORITY CHANNEL frequencies relative to the existing receiver frequency, but will be in the order of half a second.

If a station is being received, an apparent break in transmission will occur for approximately half a second every time a PRIORITY CHANNEL is sampled. The PRIORITY CHANNELS can be considered as other memory channels because the complete receiver status entered into the PRIORITY CHANNELS is recalled when a signal occurs on that channel.

Any adjustment of the squelch when a PRIORITY CHANNEL is being received will become the new squelch level that forms part of a PRIORITY CHANNEL status. With a short HOLD or RESUME time selected, there may not be time to update the new squelch level before the receiver goes back to its previous frequency.

If the SOFT/LIST push-button is pressed for one second when receiving a PRIORITY CHANNEL, the appropriate PRIORITY CHANNEL STATUS LIST will be displayed, enabling function changes relating to the PRIORITY CHANNEL to be made. A PRIORITY CHANNEL status can be made the FREQUENCY MODE, NORMAL OPERATION status by actioning the TRANSFER function on a PRIORITY CHANNEL STATUS LIST, and that PRIORITY CHANNEL will now become DORMANT.

5.14 TYPICAL OPERATING FUNCTIONS

The operating functions detailed in the following paragraphs, describe some of the basic operations that the equipment is used for. Figure 5-1 details the displays to be expected in each case.

5.14.1 Setting Up (FUNCTION and MEMORY LISTS)

Setup is achieved by selecting each required parameter from the FUNCTIONS LIST (Display 1). Each selected function is indicated by a “flag” (Display 2), with each selection being automatically stored in non-volatile memory. The receiver status and frequency of operation can be memorized, and the MEMORY LIST (Display 3) indicates the frequency of each memorized setup, and the availability of unallocated memories.

5.14.2 Field Strength Measurement

In this receiver mode the display indicates the main receiver parameters (Display 4). These parameters include:

(1) Tuned frequency.

(2) Level detector type and time constant.

(3) Measurement bandwidth.

(4) "SOFT" function, if set up.

(5) A numeric reading of field strength in the selected units.

(6) A bargraph indication of the relative field strength in the measurement range (typically 84 dB, with a total of 124 dB with selectable or automatic attenuation facility).

(7) Bargraph indication of squelch level (set by Front Panel control).

5.14.3 Modulation Measurement

The modulation level of speech transmission can be measured dynamically under operational conditions. A direct reading of peak FM deviation (Display 5) or peak AM percentage (Display 6) is displayed.

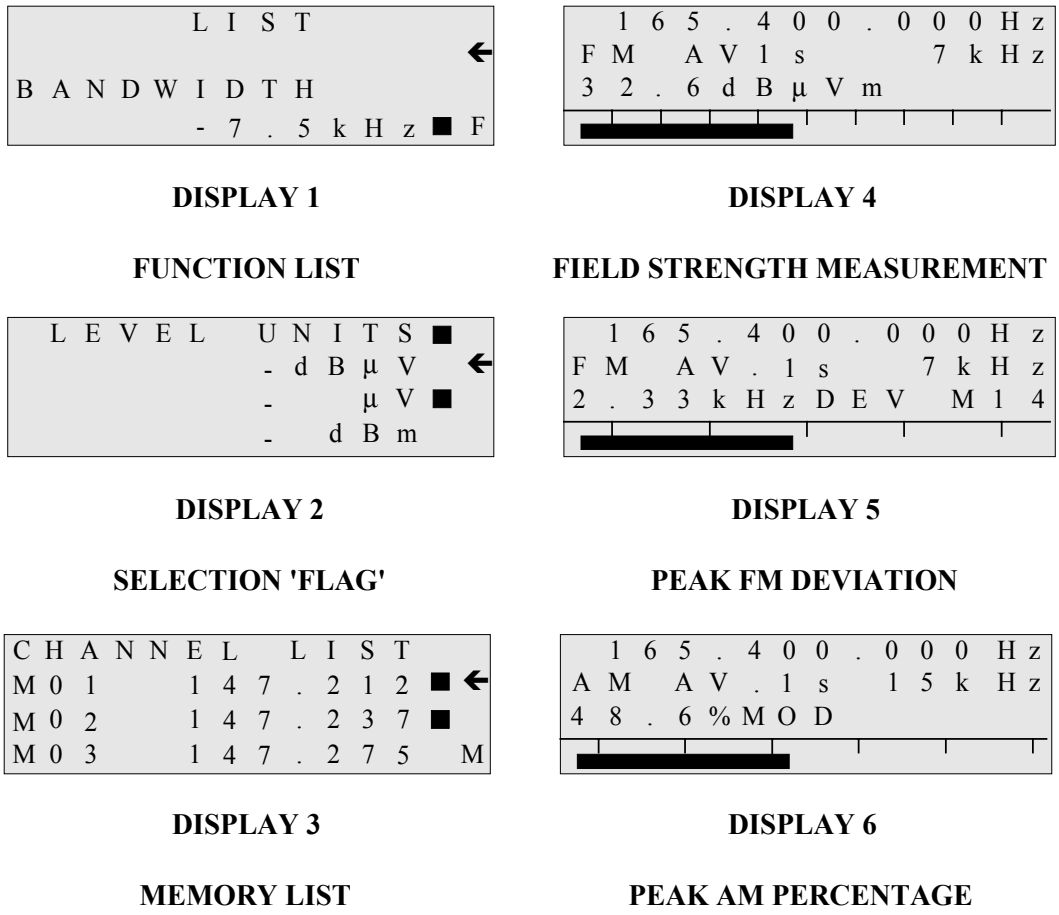


Figure 5-2. DISPLAY TYPES

5.14.4 Scanning

In STANDARD MODE, scanning START and STOP frequencies can be set anywhere within the receiver's range, with the option of two priority channels, each with a variable sample time. Unwanted frequencies can be "locked out" using the CAL/LOCK push-button, and the direction of scan can be reversed using the TUNE/SELECT rotary control.

In MEMORY MODE, all or selected "set up" memories can be scanned, with a separate priority channel if required.

5.14.5 Calibration

The receiver self-calibration feature is maintained at a high level of accuracy by the use of an accurate internal pulse source reference. Calibration can be initiated by a momentary press of the CAL/LOCK push-button, or automatically selected after each change in frequency (see AUTO CAL under FUNCTION LIST in Section 5).

SECTION SIX – PROGRAMMABLE (RS-232-C) OPERATION

6.1 INTRODUCTION

This section provides the specification and examples of use of the command language used to remotely control the 8100 Series receivers over an RS-232-C interface. Also included is advice on programming for commonly used operations and suggestions for error detection and correction.

6.2 RS-232-C GENERAL INFORMATION

The 8100 Series receiver may be remotely controlled over an RS-232-C communications link to a computer or terminal. This is achieved through use of a command language specific to the 8100 Series receiver.

Statements in this language consist of a command word followed by an optional, or sometimes mandatory argument. There must be at least one space separating the command and its arguments, but there may optionally be other spaces before and after both the command and the argument. The statements should be transmitted as ASCII characters and terminated by a carriage return (ASCII character 13) and all commands must be in upper case characters.

Commands that interrogate the receiver receive their replies as ASCII strings without leading or trailing spaces and terminated by a carriage return. (ASCII character 13).

Commands which do not interrogate the receiver, receive an acknowledgement that the command was received and understood. This takes the form of the command string repeated, if the command requires no explicit reply and it was successful. The 8100 Series receiver will always reply to a command, even if incorrect.

Some commands require a numerical argument, and these should be given as strings of digits with an optional leading “-”, but NOT a leading “+”. Decimal parts of real numbers will be ignored unless otherwise stated.

In addition, there may be occasions when errors occur and these are reported by a string consisting of “E” followed by a number. For an explanation of these error numbers, see 6.5.

It is not possible to use the 8100 Series receiver front panel to control the receiver as normal during remote control. However, the user can regain control by sending the LOC command or by turning the set OFF and ON again.

The 8100 Series receiver can support a variety of options with its RS-232-C serial link. These options are accessed from the FUNCTION LIST. A selection of baud rates from 75 to 9600 baud can be selected, several parity combinations and one or two stop bits are available to match the characteristics of host computer or terminal.

Once communication has been established then control can take place by using the command language described in this section.

6.3 SETTING UP THE RS-232-C INTERFACE

6.3.1 Physical Connections

A serial line is connected to the 8100 Series receiver via a 9-way “D”-type connector in the Left Hand Side Panel. The pin connections are listed in Table 6-1.

Table 6-1. Willtek 8100 SERIES: RS-232-C CONNECTIONS

PIN No.	NAME	DIRECTION
2	RXD	into 8100
3	TXD	out of 8100
4	DTR	out of 8100
5	Ground	
7	RTS	out of 8100
8	CTS	into 8100

6.3.2 Electrical Characteristics

Input levels of up to ±30 V are valid, with an input low threshold of typically +0.8 V and an input high threshold of typically +2.4 V. Input impedance is in the range of 3 to 7 kΩ. The output will be ±9 V with a short-circuit output current of ±10 mA.

6.3.3 Data Format

The data format must be selected from the data list on the 8100. To do this, proceed as follows:

(1) Switch the 8100 ON and press the SOFT/LIST push-button for one second (2 beeps). The display should now show the words “FUNCTION LIST”, if it does not, then press the MEM/MODE button for one second (2 beeps).

(2) Use the tuning wheel to scroll through the list until the section headed “SERIAL DATA” is found.

(3) Align the arrow pointer to the line “LIST” and press the SOFT/LIST push-button for one second (2 beeps). The display should now show “DATA LIST”.

(4) Use the tuning wheel to select which option is to be changed by aligning the arrow with it and pressing SOFT/LIST for one beep.

(5) The tuning wheel can now be used to scroll through the various values of each option. When the new value has been selected, press the SOFT/LIST push-button momen-tarily (1 beep).

(6) To return to FREQUENCY MODE, press the SOFT/LIST push-button for one second (2 beeps).

NOTE: A change to any of the communication parameters causes the receiver to flush its output buffer and reset its UART (Universal Asynchronous Receiver Transmitter).

The line "SPEED" allows the baud rate to be altered. The following speeds can be selected by scrolling through them with the tuning wheel, they are 9600, 7200, 4800, 3600, 2400, 2000, 1800, 1200, 600, 300, 200, 150, 134.5, 110 and 75.

NOTE: The baud rate can also be selected remotely, (see paragraph 6.4.5, Baud Rate – BR).

The line "PARITY" allows various combinations of received and transmitted parity to be selected. The selections are again scrolled through by using the tuning wheel. These selections are represented by two letters showing the transmitted and received parities respectively. An "E" indicates even parity and an "O" represents odd parity. Thus "EE" appearing on the "PARITY" line indicates even transmitted and received parity. The character "X" indicates that parity check or generation is disabled.

The line "STOP BITS" allows the tuning wheel to be used to select either one or two stop bits.

The default state, achieved when the receiver is reset, is 9600 baud, received and transmitted parity disabled, two stop bits and 8-bit data. Changes to the baud rate, parity and stop bits are recorded and will remain while the receiver is switched OFF.

In order to open communication with the 8100, the command "REM" must be sent to put the receiver into remote mode. This command forces the receiver into normal mode, turning OFF any scanning, priority or any choice currently being made. All other features are unchanged.

When communication is finished, or when the user is required to manually adjust the receiver, the "LOC" command should be sent. This re-enables the receiver Front Panel. All features remain as they were under remote control, except for the memories. If any of the memory commands: MR, MD or MS have been used, then all the remote memories will now be clear, regardless of what had been stored in them during remote control.

6.4 COMMAND LANGUAGE

Introduction

The commands which form the command language used for remote control of Willtek 8100 Series receivers are described in paragraph 6.4.1 onwards. A full summary of commands is included at the end of this section.

Due to differences between the specifications of different models of receiver in the range, some commands are specific to a particular model or type of receiver. Where this is the case, the command description identifies the correct version to be used for each model or type of receiver, as applicable.

Each commands takes the following form:

Function Abbreviation (argument*) (argument*)

* = when argument is applicable.

NOTES: (1) Commands must be entered with a space between the Function Abbreviation and the argument(s) (if any).

(2) Commands may have an optional argument, a mandatory (compulsory) argument, or no argument, depending upon the particular function.

Example Command. The following example demonstrates how to set Attenuation ("AT") ON ("Y"), with a value of 30 dB ("3"):

AT 3
AT Y

See the Attenuation – AT command (below) for further details.

6.4.1 Attenuation – AT

Function

To control the amount of radio frequency and/or intermediate frequency attenuation. If the argument is "Y", then attenuation is selected and if it is "N", then the attenuation is deselcted, e.g.:

AT Y
or
AT N

An additional command "AT F" may be used to set fixed attenuation (no autoranging).

When "AT Y" is sent, the amount of attenuation applied is dependent on the last issue of an additional command AT n (where n=a number in the following range):

1 – 10 dB	3 – 30 dB
2 – 20 dB	4 – 40 dB
	5 – 50 dB

NOTE: If AT Y is used without a following AT n command, the previously selected amount of attenuation will be switched IN. AT n can be used at any time to immediately change the amount of preset attenuation.

When "AT F" is sent, the attenuation is fixed at the current level, regardless of RF input level. For further information, refer to 5.12, "Selectable Attenuation" in Section 5.

Returned Value

An acknowledgement is returned when the new state has been selected.

Errors

E3 (bad argument) if the argument is not the one applicable to the type of receiver, as defined above. E5 (missing argument) if the argument is not present.

6.4.2 Auto Calibration – AC

Function

To set the auto calibration function. If the argument is "Y" then auto calibration is turned ON, and if the argument is "N", then it is turned OFF.

Returned Value

An acknowledgement is returned once the new auto calibration state has been set up.

NOTE: Turning auto cal ON will immediately cause the receiver to calibrate and for a period of 3 to 10 seconds the level readings can be invalid. In this case the acknowledgement is not returned until calibration is complete.

Errors

E3 (bad argument). If the argument is not as given above.
E5 (missing argument) if the argument is not present.

6.4.3 Audio Detect – AD

Function

To control the audio detector function. If the argument is "A", the Amplitude Modulation is selected; if the argument is "F" then Frequency Modulation is selected.

Returned Value

An acknowledgement is returned once the new detector function has been selected.

Errors

E3 (bad argument) if the argument is not as given above. E5 (missing argument) if the argument is not present.

6.4.4 Audio Filter – AF

Function

To control the state of the audio filter. If the argument is "Y", then the audio filter is selected; if the argument is "N", then the filter is deselcted.

Returned Value

An acknowledgement is returned when the new filter function has been selected.

Errors

E3 (bad argument) if the argument is not given above. E5 (missing argument) if the argument is not present.

6.4.5 Bandwidth – BW

Function

To control the current bandwidth. The argument must be as shown below:

1 – 7.5 kHz	3 – 120 kHz
2 – 15 kHz	4 – 20 kHz

If the argument is "1", "2", "3" or "4", then the appropriate bandwidth will be selected.

NOTES: (1) The arguments "1" and "2" (narrow bandwidths) are valid for all 8100 receivers.

(2) The arguments "3" and "4" can only be valid for receivers with one or more wide bandwidth options fitted.

(3) Refer to the specifications table in Section 8, to determine the available bandwidths of all receivers in the 8100 Series range.

Returned Value

An acknowledgement is returned once the new bandwidth has been selected.

Errors

E3 (bad argument) if the argument is not one of those shown above. E5 (missing argument) if the argument is not present.

6.4.6 Baud Rate – BR

Function

To select the baud rate. This command can be used to reduce the baud rate if communication errors are prevalent. The argument must be present and must be one of the values shown below:

@ – 19200	D – 3600	H – 1200	L – 150
A – 9600	E – 2400	I – 600	M –134.5
B – 7200	F – 2000	J – 300	N – 110
C – 4800	G – 1800	K – 200	O – 75

Returned Value

An acknowledgement is returned BEFORE the new baud rate is selected.

CAUTION **If this command is corrupted, then the receiver may take up a random baud rate.**

If communication appears to fail after this command, try all the baud rates, sending “HS” at each rate until an acknowledgement is received.

Errors

E3 (bad argument) if the argument is not as given above or is not present.

6.4.7 Calibrate – CL

Function

Causes the receiver to calibrate itself. Any arguments are ignored.

Returned Value

Returns an acknowledgement once calibration has been attempted.

NOTE: It may take up to three or more seconds for calibration to be completed.

The “ST” command can be used to see if the calibration has succeeded.

Errors

None.

6.4.8 Channel Offset – CO

Function

The current, and all subsequent frequencies are offset by half the channel spacing, e.g. if the current frequency is 68,000,000 Hz (68 MHz) then when "COY" is sent, the current frequency becomes 68,006,250 Hz, if the current channel spacing is 12.5 kHz. The frequency will always be rounded up, except at the upper limit of the ranges. The argument must be present and can be "Y" to turn channel offset ON, and "N" to turn it OFF.

Returned Value

An acknowledgement is returned when the channel offset has been updated and the current frequency has been altered, if required.

Errors

E3 (bad argument) if the argument is not in the form given above. E5 (missing argument) if the argument is not present.

6.4.9 Dwell Time – DT

Function

This command sets the length of time that the receiver will listen on each frequency while scanning to an active channel (see the "SC" command). The argument must be present and must be a decimal number between 0.0 and 9.9 seconds, only one decimal place is significant. The default value is 3.0 seconds.

Returned Value

An acknowledgement is returned when the new time has been entered.

Errors

E3 (bad argument) if the argument is not in the range given above. E5 (missing argument) if the argument is not present.

6.4.10 Frequency – FR

Function

To determine and set the receiver frequency. If an argument is present, then the frequency is set to that value, rounded down to the nearest step size. If no argument is present then the 8100 reports its current frequency. The argument must be given in Hertz.

Returned Value

The actual current frequency is returned. For example if FR 68005000 was sent and the step size is 12,500 Hz, then 68000000 will be returned as this is 68,005,000 Hz, rounded down by up to the step size of 125,000 Hz. The frequency will now be set at 68,000,000 Hz. If no argument was given, then the current frequency is returned. The returned value is in Hertz, right justified in a nine character field.

Errors

E3 (bad argument) if the requested frequency is out of the range of the receiver.

6.4.11 Handshake – HS

Function

Handshake – confirm that the communication link is functioning.

Returned Value

This command always returns an acknowledgement and has no other effect.

Errors

None.

6.4.12 Level Detect – LD

Function

To control level detect values. The argument must be in the range 1 to 4, representing the values shown below:

1 – Average 5 ms	3 – Average 1 s
2 – Average 100 ms	4 – Peak 1 s

Returned Value

An acknowledgement is sent when the new level detect has been selected.

Errors

E3 (bad argument) if the argument is not one of those given above. E5 (missing argument) if the argument is not present.

6.4.13 Level Units – LU

Function

To control level unit values. The argument must be in the range 1 to 4, representing the values shown below:

1 – dBµV	3 – dBm
2 – µV	4 – dBµV/m

Returned Value

An acknowledgement is sent when the new even units have been selected.

Errors

E3 (bad argument) if the argument is not one of those given above. E5 (missing argument) if the argument is not present.

6.4.14 Local Mode – LOC

Function

To return from remote to local mode. The “REMOTE” warning message is cleared from the display and the Front Panel is re-enabled. All subsequent remote commands will receive an

"E9" error (see paragraph 6.5, Errors and Error Handling). If any of the memory commands ("MS", "MR" or "MD") have been used, then all the remote memories are cleared.

The "REM" command can be used to re-enable remote control.

Returned Value

An acknowledgement is returned when remote mode is enabled.

Errors

None.

6.4.15 Lower Limit – LL

Function

To set the lower scan frequency. The argument must be present and it must be a valid frequency.

Returned Value

The frequency actually entered will be returned. Note that the receiver does not tune to this frequency unless it is outside of the scan range on start of scanning.

Errors

E3 (bad argument) if the frequency is invalid. E5 (missing argument) if the required argument is not present.

6.4.16 Memory Clear – MC

Function

To clear all memories. Any arguments are ignored.

Returned Value

An acknowledgement is returned when the memories have been cleared.

Errors

None.

6.4.17 Memory Delete – MD

Function

To delete the contents of a given memory. The argument must be present and must be a number in the range 1 to 40 representing the memory to be deleted.

NOTE: If the command to delete an empty memory is given, this will not produce an error.

Returned Value

An acknowledgement is returned when the memory has been deleted.

Errors

E3 (bad argument) if the argument is not in the range given above. E5 (missing argument) if the argument is not present.

6.4.18 Memory Recall – MR

Function

To recall a given memory. The argument must be present and it must be a number in the range 1 to 40 representing the memory to recall. If the given memory is empty, then an error is returned.

Returned Value

An acknowledgement is returned when the new memory status, squelch level and frequency have been recalled.

Errors

E3 (bad argument) if the argument is not in the range given above. E5 (missing argument) if the argument is not present. E7 (bad memory) if the requested memory is empty.

6.4.19 Memory Store – MS

Function

To store the complete state of the receiver in one of forty memories. An argument must be present and it must be a number in the range 1 to 40, representing the memory in which the information is to be stored. The memory does not have to be empty.

Returned Value

An acknowledgement is returned when the information has been stored.

Errors

E3 (bad argument) if the argument is not in the range given above. E (missing argument) if the argument is not present.

6.4.20 Readout – RD

Function

To select between modulation and level displays on the bar graph, and also in the signal level string returned from the “SG” command. The argument must be present and must be “L” for level readings, or “M” for modulation readings.

Returned Value

An acknowledgement is returned when the new readout has been selected.

Errors

E3 (bad argument) if the argument is not as given above. E5 (missing argument) if the argument is not present.

6.4.21 Relative Value – RV

Function

To set and control the state of relative value measurements. If the argument is "Y", then the relative value is turned ON, and if it is "N" then the relative value is turned OFF. If the argument is a real number, then this is used as the new relative value.

NOTE: Only one decimal place is significant here and a leading plus sign is optional, but a leading minus sign is NOT.

The relative value must be given in dBµV and will automatically be converted into the currently selected units.

Returned Value

An acknowledgement is returned when the new state or value has been selected.

Errors

E3 (bad argument) if the argument is not as given above or if the requested value is outside of the allowed range of –9.9 to +100.0 dBµV. E5 (missing argument) if the argument is not present.

6.4.22 Remote Mode – REM

Function

To enable remote mode. Without sending this command, all other commands will receive an "E9" error. The 8100 goes to NORMAL OPERATION, FREQUENCY MODE, with no scanning or priority and with the "REMOTE" warning message flashing over the frequency on the display. This mode is cancelled with the "LOC" command.

Returned Value

An acknowledgement is returned when remote mode is enabled.

Errors

None.

6.4.23 Report Status – RS

Function

To report on the operational status of the receiver and determine whether it is functioning correctly. Any arguments to this command are ignored.

Returned Value

A string of characters is returned representing the state of various aspects of the receiver, as follows:

Character Position	Possible Values	Meaning
1	0, 1, 2, 3, 4 and 5.	Attenuation level, in tens of dB
2	-, F	NVRAM battery OK/Battery low.
3	-, L	Battery OK/ Battery low.
4	-, O	Locked OK/Out of lock.
5	-, R	In range/Out of range.
6	-, U	Calibrated/Uncalibrated.
7	-, V	Input normal/Overloaded.

It can be seen that normal, correct operation is represented by a string of the form "0------", if no attenuation is selected. Remember that attenuation can automatically be switched in by the receiver if the signal becomes too great and the occurrence of this can be detected by this command.

Errors

None.

6.4.24 Scan – SC

Function

To cause the receiver to scan up or down in frequency to the next channel having a signal level greater than the set squelch level. "SC +" will cause the receiver to scan upwards, stopping at the first frequency above the squelch level and "SC –" will scan downwards to the next active channel. The scanning DWELL TIME is used to determine how long to monitor each channel, the HOLD and RESUME times are irrelevant since scanning is turned OFF when an active channel is discovered.

NOTE: The scan commands will only scan between the set scan frequency limits. If the receiver is outside this set range when the command is first used, then the lower limit frequency will be tuned to.

When the scan reaches the limit frequency, the string "00" is returned. If the "+" argument is given, this is returned at the upper limit. If the "-" argument was used, "00" is returned at the lower limit.

The reason for returning the string "00" is to prevent the scan running forever if there were no channels above the squelch level. The method of operation is that if the scan was started at the lower limit and "00" is returned, then no active channels were present.

If only one scan between the limits is required it is best to explicitly tune to one limit and scan to the other. A return of "00" will indicate that the scan is complete.

Returned Value

When an active channel has been found, the frequency is returned. If the scan process is not completed within ten seconds, then the string "00" is returned.

Errors

E3 (bad argument) if the argument is not as given above. E5 (missing argument) if the argument is not present.

6.4.25 Signal Level – SG

Function

To enquire about the current signal level. Any arguments are ignored.

Returned Value

A string of digits representing a real number is returned. This is the signal level in the currently selected units.

Errors

None.

6.4.26 Squelch Level – SQ

Function

To determine or set the squelch (mute) level. If an argument is present, then it is assumed to be a squelch level in dBµV between –24 and +59 dBµV. Real values may be used but the decimal part will be ignored. The new squelch level will take immediate effect and will not be altered until a new value is selected.

NOTE: The squelch rotary control is disabled with the pushbuttons and TUNE/SELECT rotary control on the Front Panel.

Returned Value

If no argument is present, the current squelch setting is returned in a right justified string in a four character field, with a leading "-" if appropriate. The value will be in the range given above. If the argument is present then an acknowledgement is returned when the new squelch level has been set.

Errors

E3 (bad argument) if the requested value is not in the given range.

6.4.27 Status – ST

Function

This is a particularly powerful function and as such has some special restrictions attached to its use. It can be used to determine and set the entire status of the receiver in a single command (in a similar fashion to selecting a new memory). The argument should be a string of characters with no intervening spaces with the values as shown below:

CAUTIONS **(1) Because this is a fast change of all the status, no error checking is carried out. If a character position contains a value other than those given below, then that particular part of the status will remain unchanged and no error message will be generated.**

(2) Entries that are not required to change should be filled in with the character "X" and must NOT be filled with spaces.

(3) The values given below may be slightly different for different versions of the receiver, for example values in () are not valid for all models in the Willtek 8100 series.

Character Position	Possible Values	Action	See
1	1, 2, 3, (4)	Select Bandwidth	BW`
2	Y, N	Relative value ON/OFF	RV
3	1, 2, 3, 4	Level units as shown in..	LU
4	1, 2, 3, 4	Level detect as shown in..	LD
5	Y, N	Variable average ON/OFF	VA
6	A, F	Audio detect AM/FM	AD
7	Y, N	Audio filter ON/OFF	AF
8	Y, N	Attenuation ON/OFF	AT
9	Y, N	Auto calibration ON/OFF	AC
10	1, 2, 3, 4, 5, 6, 7 8, 9	Tuning steps as shown in..	TS
11	L, M	Readout level/Modulation	RO RD

Returned Value

If an argument is present then it is scanned and changes are made and an acknowledgement is returned when the changes have taken place. If no argument is present then a string is returned in the same format as that used to set the status.

Errors

None.

6.4.28 Step Memory – SM

Function

To take a signal level measurement on the currently selected memory and automatically step to the next memory in the sequence. When a reading is taken on the highest non-empty memory, the receiver is stepped to the lowest non-empty memory.

If an argument is present, it must be an integer in the range 1 to 40, corresponding to a memory which is currently in use. In this case, the memory specified is selected and the receiver setting recalled. A reading is taken and returned and the receiver is stepped to the next non-empty memory.

Returned Value

A string of digits representing a real number is returned. This is the signal level in the currently selected units for the frequency associated with the memory previously selected.

Errors

E3 (bad argument) if the selected memory is not in the range above. E7 (bad memory) if the requested memory is empty, or there are no memories saved.

NOTE: All remote memories are deleted on exit to local mode.

6.4.29 Tuning Steps – TS

Function

1 – 500 Hz	6 – 12.5 kHz
2 – 1 kHz	7 – 20 kHz
3 – 5 kHz	8 – 25 kHz
4 – 6.25 kHz	9 – 50 kHz*
5 – 10 kHz	

* 8100 models with options M 248 610 and M 248 611 have tuning steps of 30 kHz and 200 kHz respectively for command TS9.

Returned Value

An acknowledgement is returned when the new step has been selected.

Errors

E3 (bad argument) if the argument is not one of the values listed above. E5 (missing argument) if the argument is not present.

6.4.30 Upper Limit – UL

Function

To set the upper scan limit frequency. The argument must be present and must be a valid frequency.

Returned Value

The frequency actually entered is returned.

Errors

E3 (bad argument) if the argument is not a valid frequency. E5 (missing argument) if the required argument is not present.

6.4.31 Variable Average – VA

Function

To control the state of the variable averaging function. If the argument is “Y”, then variable averaging is turned ON; if the argument is “N”, then the variable averaging is turned OFF. See also “VT” for details of how to select the variable average time.

Returned Value

An acknowledgement is returned once the new state has been selected.

Errors

E3 (bad argument) if the argument is not as above. E5 (missing argument) if the argument is not present.

6.4.32 Variable Average Time – VT

Function

This command sets the time over which the signal level data is to be averaged. Once the time is set up, then variable averaging must be selected by using the "VA" command. The argument must be present and must be a number from 1 to 99 seconds.

Returned Value

An acknowledgement is returned when the new time has been entered.

Errors

E3 (bad argument) if the argument is not in the range given above. E5 (missing argument) if the argument is not present.

6.4.33 Version Number – VN

Function

To determine the version number of the current software and also the type of receiver being used.

Returned Value

A string is returned in the format:

XXXX∇YYYY∇ZZZZ

where:

∇	is a space character	
XXXX	is receiver type,	e.g. 4300
YYYY	is software version,	e.g. 1.00
ZZZZ	is unit serial number,	e.g. 1101

Errors

None.

6.5 ERRORS AND ERROR HANDLING

Errors are signalled by returning a string "E?", where "?" is a digit in response to a command. Errors fall broadly into two categories, communication errors and those caused by a mistake in the command string.

6.5.1 Communication Errors

If, during the transmission of a command string, a communication error (parity, framing or overrun error) occurs, then an error message ("EO") is sent when the full command string is received, i.e. after the next carriage return (terminating the command). The error message replaces the normal response from the command.

Similarly, if a string is sent that is too long to fit into the 8100's internal buffer (currently 32 characters long) then "EO" will be sent in reply when the full string is received.

In neither of the above cases is any attempt made to interpret the command string in which the error occurred. Hence if an error of this type is received by the remote controlling device, it is free to retry as many times as is necessary with no ill effects. In this way "glitches" and spurious noise that cause errors can be glossed over, in a manner that is transparent to the user of the remote control program.

A further potential error is the sending of a command before the 8100 has dealt with the previous command. This can occur if acknowledgements from the 8100 are not waited for, or if the remote controlling device is handling serial input and output asynchronously (with different timing). In any event, if this does happen the "E1" (collision error) is sent at the end of every command that is received and the commands are discarded until the input buffer is cleared. However, the command currently in the buffer will be interpreted and carried out.

It is now likely that commands and acknowledgements are out of synchronisation and hence the receipt of the "E1" error should be regarded as a major error. This is in contrast to the "EO" which merely indicates that the controller should send the message again. This error indicates that at least one command has been lost.

The simplest way to recover is to restart the current sequence of commands and send them all again, possibly with a delay between them. If this is not possible then "ST" and "FR" commands can be used to find the current state of the receiver and commands could be issued to take the receiver from the known state to the required state.

Fortunately, the "E1" command should be very rare in most situations, it is only very fast controllers, at fast speeds that will possibly run into this problem. Indeed, if the sequence "send command – wait for acknowledgement" is used then the problem should not occur at all, since for every command there is always an acknowledgement.

The only time this rule may not apply is if the terminating carriage return sent to the 8100 is lost or corrupted, in which case the command may get confused with the following command, or no acknowledgement is sent at all.

If no reply is received after a certain time, the first thing to try is sending a carriage return to check that the previous one did not become corrupted. The "certain time" will depend on the command sent, most commands should return within at most 1/2 second, but "CL" could take up to 3 seconds and "SC" ± could theoretically never return if there was no signal above the given squelch level.

There is a special error "E9" which indicates that the receiver is not in remote mode. This could be because the "REM" command had not been sent, or because the receiver had been turned OFF, and back ON again. If this error does occur then the "REM" command should be used to enable remote mode.

It is unlikely that communication errors will ever occur. During extensive testing, it was found that if remote controllers are situated adjacent to the 8100 (communicating over a short cable), it is perfectly adequate to use no parity, with rudimentary error checking (e.g. retry 5 times on "EO", "E1" is fatal).

Over modem lines or other noisy environments, parity checking could be used. As some commands return an explicit value, comparing the returned acknowledgements with the strings sent, is only useful for specific tests, however simple range checks on the values returned may be quite effective. As a rule of thumb, use rudimentary error checking until experience shows that more sophistication is needed.

6.5.2 Errors Caused by Mistakes in the Argument

These errors should only occur during development of applications since completed applications should hopefully be free from errors (arguments are always checked anyway). It is worthwhile keeping a record of the last command sent in order to re-read it and see what may have caused the error.

There are four relevant errors here. Firstly “E2” indicates that an unknown command has been received. Find out where this error occurs and compare the string sent with those given in this manual.

Secondly, there is “E3” which indicates that an argument is not one of those required. Check the string sent, if an argument was present then its value must be wrong. Again read the part of this section relevant to the command.

Also, there is “E5” which indicates that a compulsory argument was missing. This is similar to ”E3” but in this case it is possible to say that an argument was definitely missing. Again, read the manual for the command in question.

Finally, there is the “E7” which is specific to memories and indicates that an empty memory has been selected. There will have been no change in the state of the receiver if this error occurs.

6.5.3 Summary of Error Messages

Table 6-2 lists the error messages commonly used in firmware for the Willtek 8100 Series receivers.

Table 6-2. Willtek 8100 SERIES: SUMMARY OF ERROR MESSAGES

ERROR	MEANING
E0	Communications error
E1	Buffer overflow/collision error
E2	Unrecognized command
E3	Bad argument
E4	Not used
E5	Compulsory argument missing
E6	Not used
E7	Bad memory
E8	Not used
E9	Access error (receiver in local mode)

6.6 ADVICE ON PROGRAMMING

Almost all of the functions that are available on the Front Panel of the receiver are available remotely, and there are a few extra functions only available remotely. The following paragraphs are a guide to remote control programming, both to simulate Front Panel commands and implement new functions.

Let us consider what functions are not available over remote control lines, and the reasons why not. For example, none of the times associated with memory scanning can be altered, MEMORY MODE cannot be entered and memory scanning cannot be controlled, since these

functions can all be simulated. Only the scan dwell time is of relevance (to the “SC” ±" commands) and so only this can be altered.

Also, there is no control over the priority channels, either the frequencies, or the control times, and priority sampling cannot be carried out. This is because the 8100 has no means of interrupting its controller to inform it that a priority channel is now active. This function could again be simulated in the controller if required by arranging for the priority frequency to be sampled at set intervals of time.

The quickest way to set the receiver up to a desired state is to use a combination of “FR”, “SQ” and “ST”. This duplicates the action of the memories and allows a large number of “memories” to be stored external to the 8100. Applications could be written to duplicate the functions of the 8100 MEMORY MODE, but with a greater number of memories. Although this is of course likely to be slower than using the limited number of internal memories.

The commands which set up individual parts of the status are more appropriate to making minor changes such as only changing the bandwidth than using them all in combination to change the complete status. The other advantage of using the individual commands is that they have full error checking so it may be best to use individual commands during development and to then replace them all by a single “ST” command when the application is known to working.

NOTE: The arguments to individual commands are identical those of the “ST” command, i.e. the letters required are in the same corresponding character positions (e.g. BW 1 and BW 2 are the equivalent of ST 1 and ST 2, respectively).

It is often useful to scan the receiver to take a series of measurements. The 8100 will tune more quickly if the conditions listed below are set up. The adjustments should be carried out with the receiver tuned to a signal with a level above the squelch threshold.

7.5 kHz Bandwidth	“BW 1”
Relative Value OFF	“RV N”
Measuring Units dBµV	“LU 1”
5 ms Average Detector	“LD 1”
Variable Averaging OFF	“VAN”
Audio Detector FM	“AD F”
Attenuation OUT	“AT N”
Level Display	“RD L”

NOTE: The above conditions are automatically assumed by the receiver if the “SC” commands are used to scan.

If you wish to use the “FR+” or “FR-” commands to scan, it is advised to use a special procedure in order to achieve a slightly quicker scan. The procedure is as follows:

(1) With the receiver tuned to a signal with a level above the squelch threshold, set up the conditions as listed above.

(2) Use “FR+” or “FR-” commands to scan for a signal.

(3) When the scan stops on a signal, set up the desired conditions for monitoring.

The following pseudo-code shows how commands can be combined to search between limits for active frequencies using the built-in scanning routines:

NOTES: (1) The scanning will take place with the receiver waiting on each channel for the given dwell time of each frequency.

(2) "send" is used here to mean "transmit over the RS-232-C".

```
Set dwell, hold and resume times as appropriate.
(E.g. all zero for fastest scan)
send "LL lowfreq"
send "UL highfreq"
set freq = lower limit
send "FR freq"
loop
    if there is user input
    process user input
    send "SC +"
    if received string = "00"
    exit loop
    display freq
    send "SG"
    process received data as required
go to loop
```

If a continuous scan is required, then when "00" is received to indicate that the limit has been reached, the receiver can be re-tuned to the other limit and be restarted.

6.7 COMMAND SUMMARY

Table 6-3 lists a summary of the commands included in the firmware of Willtek 8100 Series receivers. Some features are particular to a particular type or model of receiver, and this is indicated, when applicable.

The following syntax conventions are used:

[ ] indicates a mandatory (compulsory) argument.
{ } indicates an optional argument.
: indicates an exclusive choice of values.
- indicates and exclusive choice from a range of values.

Each two-letter command must be followed by a single space, before any argument is sent.

Table 6-3. Willtek 8100 SERIES: FIRMWARE COMMAND SUMMARY

COMMAND SYNTAX	COMMAND FUNCTION
AC ["Y":"N"]	Auto Calibration
AD ["A":"M"]	Audio Detect
AF ["Y":"N"]	Audio Filter
AT ["Y": "N" : "F"]	Attenuation
AT ["Y":"N":"F":"1"-"5"]	Attenuation
BR ["A" -"O"]	Baud Rate
BW ["1":"2":"3":"4"]	Bandwidth*
CL	Calibrate
CO ["Y":"N"]	Channel Offset
DT {real}	Dwell Time
FR {integer:"+":"-"}	Frequency
HS	Handshake
LD ["1":"2":"3":"4"	Level Detect
LOC	Local Mode
LU ["1":"2":"3":"4"]	Level Units
MC	Memory Clear
MD [num]	Memory Delete
MR [num]	Memory Recall
MS [num]	Memory Save
RD ["L":"M"]	Readout
REM	Remote Mode
RS	Report Status
RV ["Y":"N":real]	Relative Value
SC ["+":"-"]	Scan
SG	Signal Level
SM {"1"-"40"}	Step Memory
SQ {real}	Squelch Level
ST {see under ST command}	Status
TS ["1"-"7"]	Tuning Steps
TS ["1"-"9"]	Tuning Steps
VA ["Y":"N"]	Variable Average
VN	Version Number
VT {integer}	Variable Average Time

* Bandwidths "4" is applicable to certain receivers only (refer to paragraph 6.4.5).

SECTION SEVEN - TROUBLESHOOTING

7.1 INTRODUCTION

This section contains basic user fault finding information. If an equipment malfunction is suspected after carrying out the relevant checks, the equipment should be returned for maintenance to the customers workshop, or to Willtek, as appropriate.

7.2 RECEIVED SIGNAL SOUNDS NOISY

(1) Check for local sources of interference (e.g. computers, electrical apparatus, etc.).

(2) Select the 7.5 kHz BANDWIDTH (if not already selected).

(3) Select the AUDIO FILTER.

(4) Select the 15 kHz BANDWIDTH if the signal is heavily deviated.

(5) Change siting or orientation of the antenna.

(6) Switch out the ATTENUATION (if not already deselcted).

(7) Check antenna, associated leads and connectors.

(8) Change AUDIO DETECTOR (AM/FM).

(9) Check that signal is not too weak to produce a good signal-to-noise ratio in the receiver.

7.3 HOWLING NOISE IN LOUDSPEAKER

Reduce the VOLUME control.

7.4 DISTORTION ON RECEIVED SIGNALS

(1) Reduce the VOLUME control.

(2) Select the 15 kHz BANDWIDTH if the signal is heavily deviated.

(3) Change AUDIO DETECTOR (AM/FM).

(4) Check that 5 ms Time Constant is not selected when receiving AM transmissions.

7.5 DISPLAY CORRUPTION

(1) Switch the receiver OFF for a few seconds and switch it back ON again.

(2) Press the RESET button on the Left Hand Side Panel.

(3) Check the charge state of the batteries.

7.6 NOTHING ON DISPLAY

(1) Adjust DISPLAY control.

(2) Check the charge state of the batteries.

(3) Ensure that the receiver is within its operating temperature range.

7.7 NO SOUND FROM THE LOUDSPEAKER

(1) Adjust SQUELCH control.

(2) Adjust VOLUME control.

7.8 RECEIVER DOES NOT RESPOND TO PUSH BUTTONS

(1) Check that the LOCK is OFF.

(2) Check for error messages.

7.9 SIGNAL LEVEL READOUT JITTERS

(1) Check that the signal is not varying.

(2) Check that the signal is not too low in level to give a stable reading.

(3) Select a longer averaging time.

(4) Check that the signal does not have an excessive deviation or modulation.

7.10 HIGH RESIDUAL READING ON AM OR DEVIATION BARGRAPH

(1) Check for interference on the signal.

(2) Check that the signal level is not too low for accurate low AM or deviation measurements.

7.11 DEVIATION GOES OFF SCALE WHEN RECEIVING A SIGNAL

(1) If the BANDWIDTH is set to 7.5 kHz, then change it to 15 kHz.

(2) If the BANDWIDTH is set to 15 kHz, the deviation is probably too high to measure.

(3) Check that this effect is not occurring due to the SQUELCH being open under no signal conditions.

7.12 RECEIVER DOES NOT SCAN

Check the SQUELCH control setting.

7.13 BARGRAPH MOVES BUT LEVEL READOUT DOES NOT RESPOND

Check the VARIABLE AVERAGE IN/OUT and averaging time.

7.14 NO RS-232-C DATA

(1) Check for damage or bad connections on the connecting cable.

(2) Ensure that the DATA is turned ON (FUNCTION LIST).

(3) Ensure that the DATA format (baud rate, parity, etc.) is set correctly on the DATA LIST.

SECTION EIGHT – SPECIFICATIONS AND ACCESSORIES

8.1 INTRODUCTION

This section provides a detailed specification for the equipment, information on any non-standard "customized" features, plus details of standard and optional accessories.

8.2 SPECIFICATION

Table 8-1 lists the available models of the Willtek 8100 Series General Purpose Receivers (previously GPR 4000A series).

Table 8-4 provides specifications for all available Willtek 8100 Series General Purpose Receivers.

Table 8-1. Willtek 8100 SERIES MODELS.

DESCRIPTION	ORDER CODE	PREVIOUS (CHASE) DESIGNATION
8101 General Purpose Receiver	M 100 601	GPR 44x1A
8102 General Purpose Receiver	M 100 602	GPR 44x2A
8103 General Purpose Receiver	M 100 603	GPR 44x3A

8.3 ACCESSORIES AND OPTIONS

A number of accessories are available for use with the equipment; some of these are standard, whereas others are optional and only available on request.

8.3.1 Standard Accessories

The accessories which are supplied as standard with the equipment are detailed in Table 8-2:

Table 8-2. Willtek 8100 SERIES STANDARD ACCESSORIES.

QTY	DESCRIPTION
1	Battery Charger (with appropriate national connector)
1	Telescopic Monitoring Antenna
1	Leather Carrying Case with short-form Operating Guide in Lid.
1	Vehicle Charging Lead (from cigar lighter connector)
1	User's guide (this book)

8.3.2 Optional Accessories and Options

The optional accessories, which may be ordered if required, are detailed in Table 8-3:

Table 8-3. Willtek 8100 SERIES OPTIONS AND ACCESSORIES.

DESCRIPTION	ORDER CODE
30 kHz channel spacing (instead of 50 kHz)	M 248 610
200 kHz channel spacing (instead of 50 kHz)	M 248 611
30 & 200 kHz channel spacing (instead of 10 and 50 kHz)	M 248 612
200 kHz IF bandwidth (instead of 120 kHz, option to 8103)	M 248 613
8181 GPR Down Converter (1.7 to 2.5 GHz)	M 248 618
8010 Hindsite™ RF Propagation Test Software	M 897 825

Table 8-4. Willtek 8100 SERIES SPECIFICATION

PERFORMANCE CHARACTERISTIC	NOMINAL OR TYPICAL VALUE
Frequency:	
Range	100 kHz to 26 MHz*, 26 to 1000 MHz, (*reduced specification)
Uncercainty	2.5 kHz
Tuning Increments	0.5, 1, 5, 6.25, 10, 12.5, 20, 25, 50 kHz steps The 8100 with option M 248 610 has 30 kHz in place of 50 kHz steps The 8100 with option M 248 611 has 200 kHz in place of 50 kHz steps The 8100 with option M 248 612 has 30 kHz in place of 10 kHz and 200 kHz in place of 50 kHz steps
Frequency Offsets	5, 6.25, 10, 12.5, 25 kHz steps
Frequency Scanning	Between user set limits
Lockout Frequencies	Up to 100
Hold Time	Adjustable 0 to 9.9 seconds
Dwell Time	Adjustable 0 to 9.9 seconds
Resume Time	Adjustable 0 to 9.9 seconds and off
Amplitude:	
Measuring Range 7.5 kHz bandwidth average detection	–10 dBµV to +110 dBµV: 26 to 1000 MHz +5 dBµV to +110 dBµV: 100 kHz to 1 MHz 0 dBµV to +110 dBµV: 1 to 26 MHz
Level Readout Resolution	0.1 dB
Displayed Range	84 dB bargraph display
Level Accuracy 7.5 kHz bandwidth	±1.5 dB max., typically ±0.5 dB: 26 to 1000 MHz ±3 dB: 100 kHz to 26 MHz
Inherent Spurious Responses	< 0 dBµV equivalent input voltage: 1 to 1000 MHz < +10 dBµV equivalent input voltage: 100 kHz to 1 MHz
Level Detection	Average, Peak
Level Detection Time Constants	Average 5 ms, 0.1 s, 1 s Peak hold time 1 s

Table 8-4. Willtek 8100 SERIES SPECIFICATION (continued)

PERFORMANCE CHARACTERISTIC	NOMINAL OR TYPICAL VALUE
Amplitude: (Cont)	
Measuring Units	dBµV, µV, dB relative, dB µV/metre, dBm
Relative Level Range	dBµV – 99.9 to –99.9 µV – 0.01 µV to 98.86 mV dBµV/m – –93 to 106.8 dBm – –207 to –7
Squelch Threshold	Adjustable over measuring range. Visually indicated
Internal Cal. Reference	Impulse generator
Calibration Time	Approx 4 s
Selectivity:	
IF Frequencies	301.5 MHz, 21.4 MHz, 455 kHz
3 dB Bandwidth	
8101 8102 8103	7.5 kHz, 15 kHz, 120 kHz* 7.5 kHz, 15 kHz, 20 kHz, 120 kHz* 7.5 kHz, 15 kHz, 25 kHz, 120 kHz*
8103 with option M 248 613	7.5 kHz, 15 kHz, 25 kHz, 200 kHz* *120 kHz/200 kHz not usable 100 to 500 kHz
Adjacent Channel Rejection	Greater than 45 dB (12.5 kHz channel spacing) Greater than 50 dB (25.0 kHz channel spacing) (15 kHz bandwidth, relative response to unmodulated carrier 60 dBµV)
Image Rejection	50 dB minimum. Typically 70 dB (level required to produce an indication of 0 dBµV)
IF Rejection	70 dB minimum (230 to 400 MHz, 50 dB min.). Typically 80 dB (level required to produce an indication of 0 dBµV)
Spurious Response Rejection	Typically 50 dB (level required to produce an indication of 0 dBµV)
Blocking	75 dBµV minimum (1 dB level change, 0 dBµV signal, 2 MHz away)
Intermodulation	55 dB minimum (1 mV p.d. input, 50 kHz separation)

Table 8-4. Willtek 8100 SERIES SPECIFICATION (continued)

PERFORMANCE CHARACTERISTIC	NOMINAL OR TYPICAL VALUE
Input:	
RF Input Impedance	Nominally 50 Ω
Input VSWR	Less than 2:1 without RF attenuation Less than 1.4:1 with RF attenuation selected
Antenna Input	"N"-type connector
RF Attenuation	20 dB
IF Attenuation	10, 20 or 30 dB
Max. Safe Level	3.5 V_{rms} (250 mW) +23 dBm at max. sensitivity
Overload Display	Visual and audible
Audio:	
Audio Demodulation	AM, FM
Typical Signal-to-Noise Ratio (S+N/N, audio filter selected):	
AM:	Typically 10 dB (6 dB < 26 MHz) for 0 dBµV signal, 30% modulation, 1 kHz tone, audio filter in
FM:	Typically 20 dB (14 dB < 26 MHz) for 0 dBµV signal, 1.5 kHz peak deviation, 1 kHz tone, audio filter in
Audio Filter	300 Hz ±50Hz – 1 dB to 2.4 kHz ±300 Hz – 3 dB (switchable)
600 Ω Line Output	Adjustable from front panel. Nominally 0 dBm (600 Ω)
Audio Output	1.0 W to 3.0 W (dependent upon battery state)

Table 8-4. Willtek 8100 SERIES SPECIFICATION (concluded)

PERFORMANCE CHARACTERISTIC	NOMINAL OR TYPICAL VALUE
Modulation Measurement: (with 400 Hz Modulation)	
AM:	
Range	0 to 90% (0 to 126% indicated)
Accuracy	±5%
FM: (7.5 kHz bandwidth)	
Range	0 to 3.7 kHz peak deviation (0 to 4.2 kHz indicated)
Accuracy	±500 Hz
FM: (15 kHz bandwidth)	
Range	0 to 7.5 kHz peak deviation (0 to 8.4 kHz indicated)
Accuracy	±500 Hz
FM: (20 kHz bandwidth, 8102)	
Range	0 to 10 kHz peak deviation (0 to 16.8 kHz indicated)
Accuracy	±500 Hz
FM: (25 kHz bandwidth, 8103)	
Range	0 to 12.5 kHz peak deviation (0 to 16.8 kHz indicated)
Accuracy	±500 Hz
FM: (120 kHz bandwidth)	
Range	0 to 60 kHz peak deviation (0 to 84 kHz indicated)
Accuracy	±5 kHz
Memory:	
Memory	40 memories of receiver status
Memory Scanning	All 40 memories or any selected number
Hold Time	Adjustable 0 to 9.9 seconds
Dwell Time	Adjustable 0 to 9.9 seconds
Resume Time	Adjustable 0 to 9.9 seconds and OFF
Memory Backup	10 years

Table 8-4. Willtek 8100 SERIES RECEIVER SPECIFICATION (continued)

PERFORMANCE CHARACTERISTIC	NOMINAL OR TYPICAL VALUE
Auxiliary Outputs:	
Serial Data	RS-232-C control of all functions
Loudspeaker	1.0 W to 3.0 W into 8 Ω (dependent upon battery state)
Low Level Audio (Line Out)	Variable using Front Panel control but nominally 0 dBm (600 Ω)
Signal Level	Full scale on bargraph 6 V. Noise level approx. 2 V (typical)
Two Squelch Operated Changeover Relay Contacts	Maximum 0.5 A, 28 VDC contacts electrically isolated from receiver
Demodulation	Unfiltered demodulator output
General:	
Screening	60 dB
Spurious Emissions	1 nW maximum
Battery State Indicator	Visual on display plus audible warning
Battery Life	8 hours, dependent upon volume level
Charging Time	16 hours
Weight	6 kg (including case and batteries)
Dimensions	330 x 115 x 240 mm (including case)
Operating Temperature Range	0 to 40°C
Lock	Front Panel control lock

8.4 UPGRADE COMPATIBILITY

Willtek has a policy of continuous improvements to its products. The 8100 series of receivers has been extended and additional features added regularly. It is often possible to upgrade earlier models to include features added to later models. Please contact Willtek to discuss your precise requirements and to determine what is available and feasible for your particular model.

8.4.1 Firmware Upgrades

Where only the firmware of a receiver has been upgraded then the hardware specification for the receiver as published in the original manual will remain unchanged.

The features of firmware version 4.00 are as published in this manual.

8.4.2 Hardware Upgrades

Where the hardware of a receiver has been upgraded then the specification for the receiver will have changed from that published in the original manual. It will not necessarily be the specification as published in this manual. The specification will be that published in the original manual as modified by the upgrade. It is important that you should retain the details of the upgrade with your manual to document completely the specification for the receiver.

SECTION NINE – Willtek 8181 GPR DOWN CONVERTER OPERATING INSTRUCTIONS

9.1 GENERAL INFORMATION

The Willtek 8181 GPR Down Converter (previous product name: GFC 4903 Down Converter) converts frequencies in the range 1700 MHz – 2500 MHz to 200 MHz – 1000 MHz.

A Willtek 8100 Series receiver is used for further processing of the 8181 GPR Down Converter output. Two connecting leads are used between the 8181 GPR Down Converter and its host receiver. A coaxial lead carries the downconverted RF signals from the 8181 to the receiver. The second lead carries power from the 8100 General Purpose Receiver to the 8181 GPR Down Converter. A socket on the 8181 accepts power from a charging source, to charge the receiver batteries.

Because there is no internal RF switching in the 8181 GPR Down Converter, if frequency coverage outside the 8181 range is required (i.e. standard Willtek 8100 Series frequency coverage), the coaxial lead from the 8181 to the 8100 antenna input must be disconnected, and an antenna connected directly to the 8100 antenna input.

If the 8181 GPR Down Converter is not being used, it is advisable to disconnect the power lead from the 8181 to reduce current drain on the 8100 batteries.

9.2 OPERATION

Switch the POWER ON/OFF switch on the Willtek 8100 General Purpose Receiver to ON. Power is automatically supplied to the 8181 GPR Down Converter from the 8100. To select downconverter mode, enter the FUNCTION LIST and scroll through the list until DC GFC 490X is visible. Under this heading are DCS-IN and DCD-OUT. DCS-IN means Down Converter selected, DCD-OUT means Down Coverter deselected.

Select DCS-IN. Immediately the display flashes CHECK GF C4903 CONNECTED. This is a reminder to the operator to ensure that the GPR 8181 Down Converter is hardwired to the 8100 via the connections outlined above. It is absolutely necessary to check that the 8181 is connected properly to the 8100 as the 8100 cannot do this check automatically. Operation in the band 1700 MHz to 2500 MHz can now proceed.

9.3 SYSTEM SPECIFICATION – WILLTEK 8181 GPR DOWN CONVERTER

Frequency range (extended range)	1700 to 2500 MHz
Frequency accuracy (25°C)	2.5 kHz (typically 1.1 kHz)
Frequency accuracy (0 to 40°C)	4 kHz
Level accuracy (0 to 40°C)	5 dB (typically 3 dB)
Level accuracy (25°C)	3.5 dB (typically 1.5 dB)
RF input connector	N-type
RF output connector	N-type
Nominal input impedance	50 Ω
Input VSWR	< 3:1
Image rejection	> 40 dB (typically 50 dB)
Adjacent channel rejection (25 kHz offset, 15 kHz bandwidth)	40 dB
Spurious response rejection	typically 40 dB
LO level at RF input	–30 dBm
Sensitivity 15 kHz bandwidth	–10 dBµV
Maximum RF input level (linear)	90 dBµV
Maximum RF input level (damage)	+10 dBm
Blocking level	typically 80 dB
Battery life	4 hours (typically 6 hrs)
Weight (complete package)	7 kg
Dimensions (including case but excluding interconnections)	315 x 230 x 150 mm

Publication History

Revision	Comment
P4/0116/3	Issue 3 of 17 February, 1998. First available edition.
P4/0116/4	Issue 4 of 27 February, 2002. General corrections, specs corrected. Chapter 8.4.2 (was 8.4.1). GFC 4903 Down Converter operating instructions integrated.
0210-400-A	New company name. Products and options renamed, several options void.
0212-400-A	Improved formatting.

Worldwide Headquarter and Regional Sales Headquarter

West Europe/Middle East/ Africa/Asia Pacific

Willtek Communications GmbH
Gutenbergstr. 2–4
85737 Ismaning
Germany
Tel: +49 (0)89 99641-0
Fax: +49 (0)89 99641 160
info@willtek.com

Regional Sales Headquarters

United Kingdom/Ireland/ Benelux

Willtek Communications Ltd.
Roebuck Place
Roebuck Road
Chessington
Surrey KT9 1EU
United Kingdom
Tel: +44 (0)20 8408 5720
Fax: +44 (0)20 8397 6286
willtek.uk@willtek.com

North America/Latin America

Willtek Communications Inc.
7369 Shadeland Station Way, Suite 200
46256 Indianapolis
Indiana
USA
Tel: +1 317 595 2021
Fax: +1 317 595 2023
willtek.us@willtek.com

To find your local service center and sales office go to: www.willtek.com

Manual ident no. M 290 006
Manual version 0212-400-A
English

will'tek