APPENDIX E

WJ-8607A/DSO DIGITAL SCAN OUTPUT OPTION

P/N 181186-001 Revision C

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LIST OF EFFECTIVE PAGES

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WJ-8607A/DSO DIGITAL SCAN OUTPUT INSTRUCTION MANUAL

REVISION RECORD

Revision	Description	Date
A	Initial issue.	6/94
B	Added WJ part number to the title page. Incorporated a List of Effective Pages. Added page numbers to section cover pages and their back pages. Removed “Intentionally left blank” pages and replaced with “Notes” pages that are formatted with headers and page numbers.	8/97
C	Incorporated ECO 041393.	08/01

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APPENDIX E

TYPE WJ-8607A/DSO DIGITAL SCAN OUTPUT OPTION

E.1 GENERAL DESCRIPTION

The WJ-8607A/DSO Digital Scan Output Option makes available a special serial output from the WJ-8607A Miniceptor which is used to drive a display such as the WJ-9207 RF Panoramic Display Adapter. This interface provides the display with digitized commands and data which allow the presentation of received signal frequency and amplitude information to the operator.

Control commands sent from the WJ-8607A to the display via the DSO interface are used to define sweep start and stop frequencies, unwanted lockout frequencies,- and sectors being swept. Signal frequency information is sent to the display over the same interface, along with signal amplitude information which is derived from the WJ-8607A receiver's log video output.

E.1.1 ELECTRICAL INTERFACE

The WJ-8607A/DSO Option is implemented entirely in software and requires no electrical or mechanical modifications to the WJ-8607A. When a WJ-8607A Miniceptor with this option is interfaced with the WJ-9207 RF Panoramic Display Adapter, only a single cable connection is required between the two units. Both units are then operated normally, and the WJ-9207 will display signal amplitude and frequency information from the WJ-8607A.

E.1.2 WJ-8607A CAPABILITY CHANGES

When the WJ-8607A/DSO Option is installed in the WJ-8607A receiver, two changes occur to the WJ-8607A operational capabilities. The changes are:

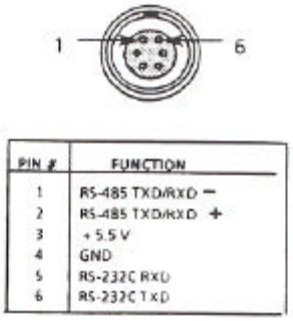
a. Serial Interface 1 becomes the dedicated DSO connector. Serial Interface 2 becomes the only user access to the RS-Type Interfaces.

b. The user may select an eight or nine bit data format.

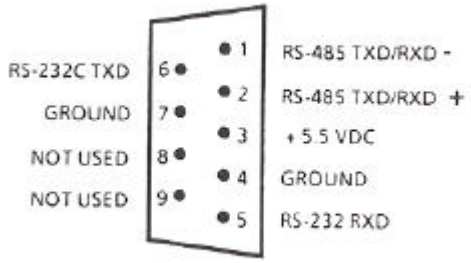
E.2 HARDWARE CONFIGURATION

The WJ-8607A contains a circular 6-pin connector for Serial Interface 1 connection, as illustrated in **Figure E-1(A)**. When the DSO option is installed, pins 4, 5, and 6 provide the DSO interface.

WJ-8607A receivers installed in an Equipment Frame (WJ-9902 or WJ-9908) utilize a 9-pin D-type connector on the rear of the frame for serial interface connection, as illustrated in **Figure E-I(B)**. Pins 4, 5, and 6 will provide the DSO serial interface.



(A) WJ-8607A 6-Pin Circular Connector



(B) WJ-9902 and WJ-9908 9-Pin D Connector

Figure E-1. Serial Interface Connectors

E.2.1 REMOTE OPERATION

The DSO operation may be tuned on or off remotely. Refer to **Table E-1**. This remote command takes affect on the next operation that would cause the receiver to output data. Refer to the WJ-8607A base manual for further information on remote commands. The *OPT? command has been modified to report the presence of the DSO option. Refer to **Table E-1**.

Table E-1. DSO Remote Commands

Command	Response	Description
DSO nrf		Turn DSO operation on or off 0 = DSO off 1 = DSO on
DSO?	DSO nrl	Request status of DSO operation. Reset: DSO1 Default: DSO1 Example: DSO0
*OPT?	*OPT nrl	This command returns a bit mapped value of 16 bits indicating the options installed in the unit. BIT OPTION 0 WJ-860X/FE - 2.0 GHz Frequency Extender 1 WJ-860X/SSB - Single Sideband Filter 2 WJ-860X/WBO - Wideband IF Output 3 Not Used 4 WJ-860X/DSO Digital Scan Output 5-15 Not Used. Def ault: *OPT 00000 Example: *OPT 00001 (Indicates FE option installed)
DBT nrf		Set DSO data format eight or nine bits. 8 = eight bit 9 = nine bit
DBT?	DBT arl	Request status of DSO data format. Reset: NC Default: DBT 9 Example: DBT 8

E.3 INTERFACE DESCRIPTION

The RS-232C interface used, with the DSO Option, is fixed at 9600 baud, transmit only, asynchronous serial format, with no data returned from the receive device (i.e., display). When more than one receive device is connected to the interface, all devices listen to command messages but only the addressed device uses to the data messages. A device will unaddress itself upon receiving a command message for an address other than its own. All devices power up in the unaddressed state.

E.3.1 INTERFACE TRANSMISSION CHARACTERISTICS

The user may select the DSO data format to consist of eight bits or nine bits. With nine-bit format data is transmitted in serial word format, with a word consisting of a start bit, eight data bits (0 through 7), a command bit, and a stop bit. In nine-bit format the command bit indicates the interpretation of the eight data bits, with a mark for the command bit indicating a command message, and a space indicating a data message. In eight-bit format, all command messages are prefixed with a hexadecimal FF byte. An eight-bit word consists of a start bit, eight data bits, and a stop bit.

E.3.2 INTERFACE MESSAGE TYPES

The two types of messages transmitted via the DSO interface are command messages and data messages. Command messages provide initialization and setup information to the display, while data messages provide information such as the data to be displayed at each data point. In eight-bit format, command messages always start with a hexadecimal FF.

The following paragraphs describe the types and structure of the command messages used on the DSO interface.

E.3.2.1 Command Message

Command messages used with the DSO interface fall into four categories:

1. Header: A header command provides the necessary initial set-up information to the display for the operation being performed. For example, a sweep header provides start and stop frequencies, sweep increment, COR level, detection mode, etc.

2. Restart: A restart command is used to initiate operation after a header has been transmitted to the display, and to restart operation after completion of each displayed evolution. For example, during sweep operation, a restart command is sent each time the display completes a displayed frame.

3. Data: A data command (not to be confused with a normal data word) informs the display that all subsequent words transmitted will be data until the next command word is sent.

4. Lockout: A lockout command provides the display with a point count of the number of display data points. to be skipped due to the lockout.

Table E-2 lists the various command messages used with the DSO interface, and includes the bit-mapped state of the four command bits, and the decimal equivalent, for each command. **Paragraph E.3.2.2** details the characteristics of the command message bit map.

Table E-2. DSO Command Messages

Decimal Value	Command Bit c3	c2	cl	C0	Command
0	0	0	0	0	Reserved
1	0	0	0	1	Sweep Restart
2	0	0	1	0	Reserved
3	0	0	1	1	Reserved
4	0	1	0	0	Signal dwell header
5	0	1	0	1	Sweep data
6	0	1	1	0	Reserved
7	0	1	1	1	Sweep lockout points
8	1	0	0	0	Reserved
9	1	0	0	1	Reserved
10	1	0	1	0	Sweep immediate header
11	1	0	1	1	Sweep sector header
12	1	1	0	0	Reserved
13	1	1	0	1	Suspend header
14	1	1	1	0	Manual header
15	1	1	1	1	Not Used

E.3.2.2 **General Command Message Format**

The eight data bits of a command message are bit-mapped as shown below, and include a four-bit device unique command (c0-c3), a one-bit response flag (rsfg), and a three-bit device address (a0-a2).

d7	d6	d5	d4	d3	d2	d1	d0
c3	c2	c1	c0	rsfg	a2	a1	a0

The functions of the command message data bit groups are as follows:

1. Device unique command (bits c0 through c3): Specifies the desired command to the addressed device. Refer to **Table E-2** for definitions of these commands.

2. Response flag (bit rsfg): This bit is not used with the DSO Option.

3. Device address (bits a0 through a2): These bits allow the selection of a device on the interface. Address 0 is reserved for use as an un-address message. The address assigned for external devices used with the WJ-8607A/DSO option is address 4, so all DSO messages will be sent to address 4.

E.3.2.3 Command Message Syntax and Data Format

The following paragraphs provide descriptions of the correct transmission sequences for the different types of command messages listed in **Table E-2**. All Header commands are followed by ASCII-encoded header data fields, and end with an EOL (line feed character). Restart, Data, and Lockout commands use binary representation for the data words which follow them. Note that the syntax diagrams start with a command, and a command should follow the last event shown in the diagram.

E.3.2.3.1 Sweep Header Commands

Sweep Immediate Header and Sweep Sector Header commands -are issued at the start of a sweep, and at power-up in the sweep mode, and are also used when any of the applicable parameters are changed in the receiver. Both commands use the same format for sweep header data, which is ASCII encoded; i.e., it consists of a string of serial words which represent the data as ASCII characters. The data is formatted as follows:

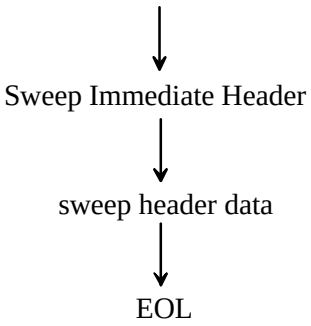
a,bbbbb.bbbbb,cceec.cccec,ddddd.ddddd,e,f ff.fff ff,gggh

where a = Sector number, 0 - 10
b = Start frequency in MHz
c = Stop frequency in MHz
d = Increment size in MHz
e = Sweep direction (I = up, 0 down)
f = IF bandwidth in MHz
g = COR level in dB
h = Detection mode:

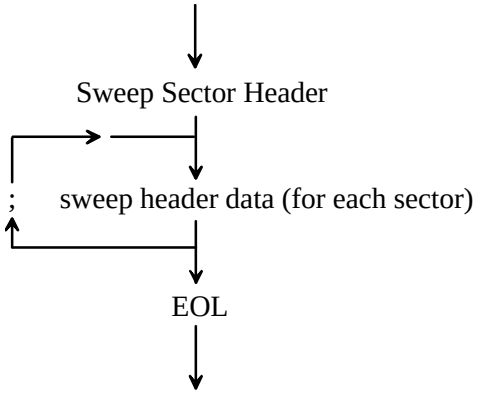
1 = AM	5 = USB
2 = FM	6 = LSB
3 = CW	7 = ISB
4 = Pulse	8 = IFT

NOTE: In Sweep Immediate Header data, the sector number is always 0.

When a Sweep Immediate Header is transmitted, the header is followed ~immediately by the ASCII-encoded data, which in turn is followed by an EOL. The syntax diagram below illustrates the DSO transmission sequence using the Sweep Immediate Header.



When a Sweep Sector Header is transmitted, the, sweep header data which follows may consist of up to ten groups of ASCII-encoded data, each representing the operating parameters for a sector. The last sector data sent is followed by an EOL. The syntax diagram below provides a graphical representation of the correct transmission sequence using the Sweep Sector Header.



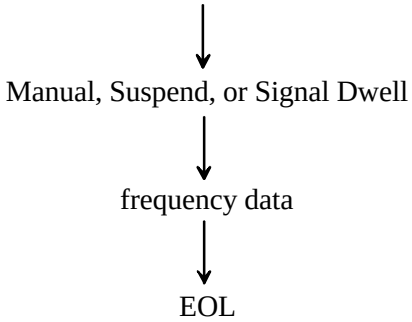
E.3.2.3.2 **Manual, Suspend, and Signal Dwell Headers**

The Manual, Suspend, and Signal Dwell headers are used to provide fixed tuned frequency data to the display. The Manual Header is issued when the receiver powers up in manual mode, or any time the receiver enters the manual mode of operation. The Suspend Header is issued when the receiver powers up in suspend state, or any time the receiver enters the suspend state. It is always preceded by the issuance of a Sweep Header, since suspend is a subfunction within sweep operation. The Signal Dwell Header is issued when the receiver acquires a signal while in the sweep mode. The appropriate header is also issued any time the receiver is tuned or completes an AFC task.

The Manual, Suspend, and Signal Dwell headers are followed by frequency data, which is a binary representation of a discrete frequency point. The transmission always concludes with an EOL. The format used for the data is shown below:

Frequency data format: xxxxx.xxxxx (in MHz)

The following syntax diagram illustrates the correct transmission sequence for the Manual, Suspend, and Signal Dwell headers.

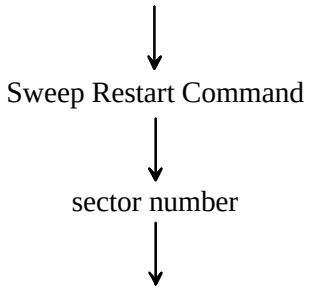


E.3.2.3.3 **Restart Commands**

Restart commands signify the beginning of a new data set, and are issued at the beginning of each pass of a sweep sequence. The Sweep Restart command is followed by a binary-encoded sector number. In Sweep Immediate mode the sector number is zero, while in Sweep Sector operation the sector number identifies the sector of the data which follows.

At power-up, or while in active sweep, the Restart command follows a Header command and is in turn followed by a Data command. Restart commands are a defined length (command word plus one data word), and do not require transmission of an EOL.

The following syntax diagram illustrates the correct transmission sequence using a Sweep Restart Command.

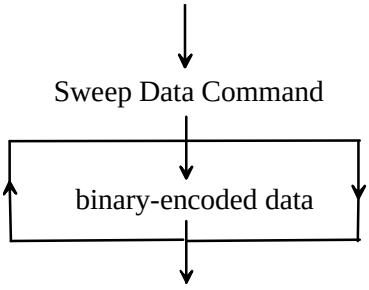


E.3.2.3.4 **Data Command**

A Data command notifies the display that binary-encoded data is to follow, although the data stream may be interrupted by other commands. If the data flow is interrupted, it is restarted by the issuance of another Data command.

It should be noted that the Data command does not indicate the position of the data in the sweep sequence, since this information is derived from the Restart command and a count of data bytes. The Sweep Data byte represents the log video value of the signal at a specific frequency, and this frequency relationship is based on a point count from the last Restart command. The Least Significant Bit (LSB) of the data byte represents 0.5 dB, and the data range is from 0 to 65 dB.

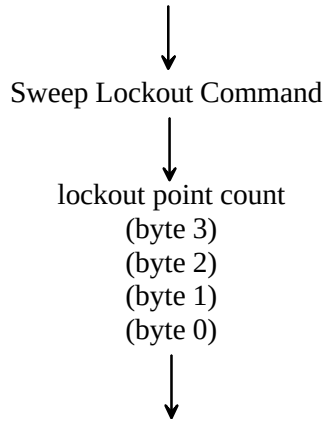
The syn tax diagram below depicts a typical transmission sequence which incorporates a Sweep Data command. As shown by the arrows on the diagram, the data may be skipped or may consist of more than one data byte.



E.3.2.3.5 **Lockout Command**

The Sweep Lockout command is issued to provide the display with the number of data points to be skipped. This command is followed by four binary-encoded data bytes which are combined to define a 32-bit lockout point count in nine-bit mode. In eight-bit mode, the four data bytes are combined to form a 28-bit lockout point count. In eight-bit mode, each byte of the lockout point count is a seven-bit value with bit eight always set to zero. These four seven bit values represent a 28-bit lockout point count. The Lockout command does not include an EOL.

The syntax diagram below illustrates an example of the transmission sequence using the Lockout command.



E.3.3 **DSO INTERFACE OPERATION EXAMPLE**

The diagram shown in **Figure E-2** depicts how information is conveyed to a display via the DSO interface, using the command words, command data words, and data words described above. In this example, two sweep interrupts are shown to illustrate the correct transmission sequence of different operations. In practice, there are limitless different combinations which may be used to control the display of information from the receiver; however, the example may aid the user in understanding the overall concept.

Sequence	Remarks
Sweep Immediate Header Command ↓	Prepare display for receipt of sweep parameters
sweep header data ↓	Transmit sweep parameters to display
EOL ↓	Terminate sweep parameter transmission
Sweep Restart Command ↓	Start sweep operations
sector number ↓	Identify sector being displayed
Sweep Data Command ↓	Notify display that sweep data follows
sweep data ↓	Transmit sweep data
Sweep Lockout Command ↓	Interrupt sweep data to transmit lockout data
lockout point count (4 bytes) ↓	Transmit lockout points
Sweep Data Command ↓	Notify display that sweep data follows
sweep data ↓	Transmit sweep data
Suspend Header ↓	Notify display to suspend sweep operations
Frequency data ↓	Notify display of the stop frequency
EOL ↓	End of suspend transmission
(etc.)	

Figure E-2. Example of DSO Transmission Sequence

E.4 PARTS LIST

No unique devices or components are used with the WJ-8607A/DSO Option. Refer to the WJ-8607A base manual for identification of mechanical and electrical components, manufacturer information, and recommended vendors.