WJ-861X RECEIVER

APPENDIX R

WJ-861XB(S1) RS-232 INTERFACE OPTION

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WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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WJ-861XB(S1) RS-232 INTERFACE OPTION

R.1 GENERAL DESCRIPTION

The RS-232 Remote Interface option provides for the asynchronous transfer of data. Utilizing the mnemonics listed in **Table R-3,** a suitable controller, connected to the REMOTE CONTROL connector, is able to remotely control the WJ-861XB Receiver. Data is transferred via an 11 bit data format. The data structure is automatically controlled by the receiver software. Data is represented either as a mark (+3V to +12V) or a space (-3V to -12V). This 25 pin connector provides for the asynchronous serial transfer of data between the remote controller and the WJ-861X Receiver. **Figure R-1** illustrates the pin configuration used for the REMOTE CONTROL connector.

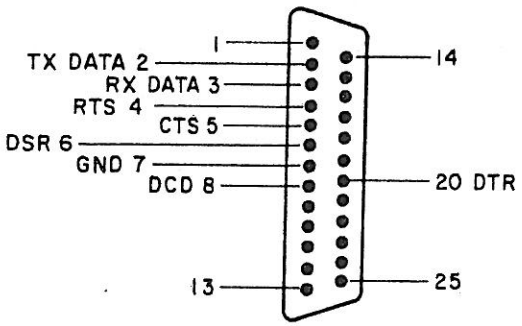

Figure R-1. RS-232 Pin Configuration

This RS-232 interface connector is wired to interface with a standard RS-232 compatible device. This connector provides the signal connections necessary to allow remote control of the receiver. This interface and the associated control software is intended to be used in a one-on-one configuration, consisting of one receiver and one controlling device. The RS-232 interface should not be connected with other devices where addressing is required.

Baud rate for the RS-232 is determined via the switch settings of DIP switch S2, located on the RS-232 module. The data byte structure is determined by the receiver software. Presently the WJ-861X Receiver utilizes an eleven bit data byte. The data structure is as defined below:

Bits	Function
1	Start Bit
8	Data Bits
1	Parity Bit (odd)
1	Stop Bit

Selection of the baud rate is determined via DIP switch S2.

Table R-1 illustrates the switch position settings necessary to select the baud rates listed.

Table R-1. Switch S2 Baud Rate Selection

Switch Position							Baud Rate (in Hz)
7	6	5	4	3	2	1	
1	1	1	1	1	1	0	300
1	1	1	1	1	0	1	600
1	1	1	1	0	1	1	1200
1	1	1	0	1	1	1	2400
1	1	0	1	1	1	1	4800
1	0	1	1	1	1	1	9600
0	1	1	1	1	1	1	19200

1 = OPEN
0 = CLOSED

NOTE

All other switch combinations are invalid.

DIP switch S1, on the RS-232 remote interface, is used to select either the full-duplex or half-duplex mode. Full-duplex allows both devices on the interface bus to transmit data simultaneously. Half-duplex mode allows only one device at a time to transmit data. DIP switch S1, located on the RS-232 module, is utilized to select the duplex mode of operation. Placing S1 switch position 1 to the CLOSED position enables the half-duplex mode. Opening position 1 of switch S1 enables the full-duplex mode.

R.2 INSTALLATION

The WJ-861X/RS-232 Option can be installed in the field. The following list of components are required for installation of the RS-232 Option:

Part No.	Description	Qty.
796617-1	RS-232 Interface	1
290321-1	Cable Assembly (W1)	1

The following procedure describes the steps required to install the RS-232 Option into the receiver.

1. Turn the receiver power off and remove the top protective cover.
2. On the receiver rear panel, remove the six cross head screws from the plate located above the REMOTE CONTROL label.
3. Connect the RS-232 connector cable to J1 of the RS-232 Option module.
4. Install the RS-232 module into Option Slot 4 of the Digital I/O section.
5. Secure the RS-232 cable connector to the receiver rear panel with the six cross head screws and replace the top cover.

R.3 RS-232 INTERFACE OPERATION

Utilizing the mnemonics listed in **Table R-3,** the remote controller can query the status of the receiver. However, only when the receiver is in the remote mode (RMT) can the remote controller change the receiver operating parameters.

Table R-2. Interchange Circuit Categories

Interchange Circuit	CCITT Equipment	Description	Pin
AB	102	Signal Ground/Common Return	7
BA	103	Transmit Data (TxD)	2
BB	104	Receive Data (RxD)	3
CA	105	Request to Send (RTS)	4
CB	106	Clear to Send (CTS)	5
CC	107	Data Set Ready (DSR)	6
CD	108.2	Data Terminal Ready (DTR)	20
CF	109	Receive Line Signal Detector (DLD)	8

R.3.1 PIN FUNCTIONS DESCRIBED

R.3.1.1 Circuit AB - Signal Ground or Common Return

This line establishes the common ground reference potential for all interchange circuits, with the exception of the AA circuit (not used in this configuration), can be connected to the AA circuit, with the data communication device via a wire strap.

R.3.1.2 Circuit BA - Transmit Data (TxD)

Signals on this circuit are generated by the data terminal equipment and are transferred to the local transmitting signal converter for transmission of data to remote data terminal equipment. The static condition of this line is a Mark.

Signals on the BA line are: FROM data terminal equipment
TO local transmitting signal converter for transmission
TO remote data terminal equipment

R.3.1.3 Circuit BB - Receive Data (RxD)

Signals on the BB line are: FROM the receiving signal converter and allows the remote controller to verify or change the receiver operating status. The static condition of this line, from a controller, must be a Mark.

R.3.1.4 Circuit CA - Request to Send (RTS)

The CA line controls the direction of data transmission of the local data transmission communication equipment. This line is always in the ready (space) condition.

R.3.1.5 Circuit CB - Clear to Send (CTS)

Signals on the CB line are: FROM data communication equipment. When this line is not connected or is in the space condition, data from the controller can be transmitted.

R.3.1.6 Circuit CD - Data Terminal Ready (DTR)

Signals on the CD line control switching of the data communication equipment. This line is always in the ready (space) condition, signifying the receiver is ready to accept data.

R.3.1.7 Circuit CF - Received Line Signal Detector (DCD)

Signals on the CF line determine whether the data communication equipment responds to a received signal. This line must be active (space) for the receiver to respond to data on the receive data (RxD) line. If this line is not active, the receiver ignores the RxD line.

Utilizing the pins illustrated in **Figure R-1,** data is transferred between the receiver and the remote controller. RS-232 utilizes voltages more positive than +3V and more negative than -3V to respectively represent spaces and marks. During the transmission of data, the marking condition is used to designate a binary ONE and the spacing condition is used to designate a binary ZERO. Signal levels less than the required mark or space voltages are not reliable and are said to be in transition. The resting state for the TxD or RxD line is the Mark (-12V) condition. At the beginning of data transmission, the start pulse goes to the Space (+12V) condition.

Each of the six signal lines, illustrated in **Figure R-1**, performs a unique function. There are four basic interchange circuits used in RS-232 systems for communication between data terminal equipment and data communication equipment. These basic interchange circuits are:

Ground or Common Return
Data Circuits
Control Circuits
Timing Circuits

Of these four basic interchange circuits, only the timing circuit is not used in this RS-232 configuration. **Table R-2** lists the RS-232 interchange circuit categories and their description.

Data exchanged between the controller and the receiver must be transferred at the same rate and be synchronized. The selected baud rate determines the speed with which data is transferred. **Table R-1** lists the selectable baud rates. Only close one baud rate switch at a time. The data format structure is set automatically by the software.

Data is applied from connector J1 of the RS-232 interface module to the REMOTE CONTROL connector and to the RS-232 Interface bus. **Figure R-2** shows the interconnecting wiring from connector J1 to the REMOTE CONTROL connector. From J1 of the Asynchronous Interface data is applied via W1 to the REMOTE CONNECTOR (J1) on the receiver rear panel.

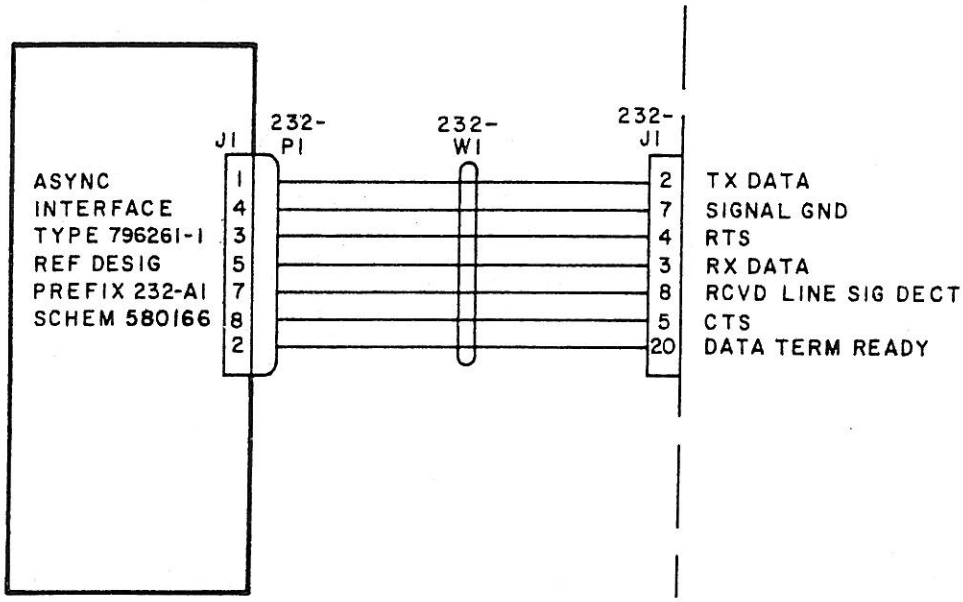

Figure R-2. RS-232 Interconnection

After setting the same baud rates for the receiver and the remote controller, synchronization of data transmission is required. The start bit of the eleven bit data structure synchronizes the data transmission. **Figure R-3** illustrates an RS-232 data transmission byte structure.

Data transmitted is assigned either a Mark (binary 1) or a Space (binary 0) signal level, depending on its binary value. **Figure R-3** illustrates a typical RS-232 data byte. The TX Data line is held in a Mark condition (OFF) until data is to be transmitted. Data on the RxD and TxD lines is indicated by shifting voltage levels. Voltage level changes represent Mark (-Voltage) or Space (+Voltage) data present on the lines.

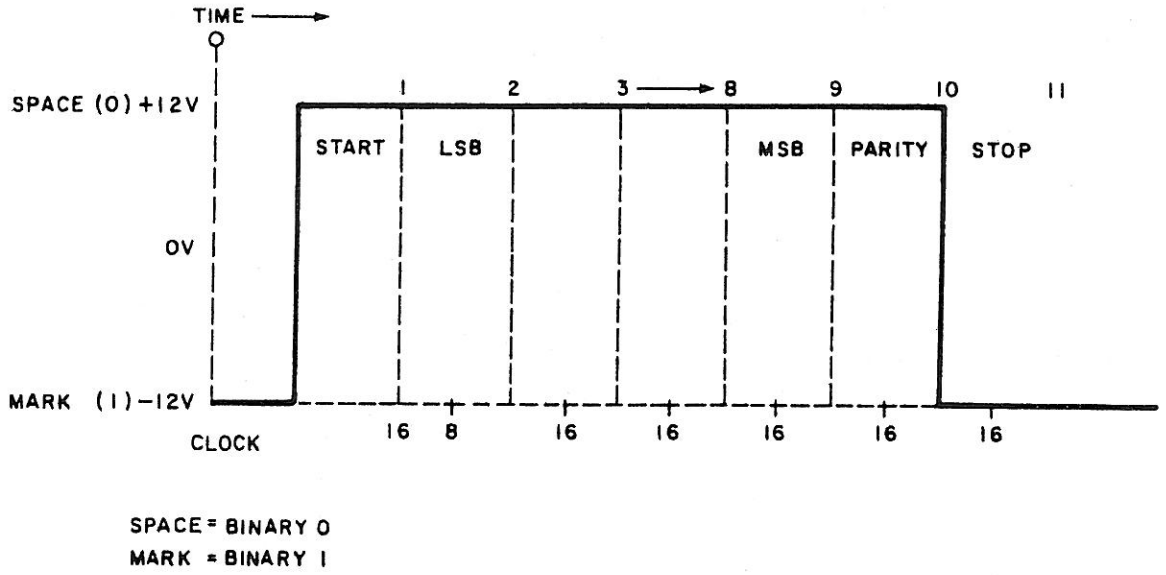

Figure R-3. Typical RS-232 Data Transmission Byte

R.3.2 DUPLEX MODES

When the master receiver wants to transmit data to the slave receiver, the level of connector pin 20 (DTR) is set high. With pin 20 (Data Terminal Ready) set high, the modem (DCE) knows that the receiver (DTE) is requesting a communication link.

If an available data link exists, the DCE (modem) produces a high on pin 6 (Data Set Ready) and on pin 8 (Data Carrier Detect). When the receiver detects the high on pins 6 and 8, it responds by driving pin 4 (Request to Send) high. A high on the RTS line informs the modem (DCE) that it is ready to receive data. If the DCE is ready to receive data, it responds by driving pin 5 (Clear To Send) high. With a high at pin 5, the receiver (DTE) starts transmitting data via the Transmit Data line (TxD), pin 2. The modem receives data via connector pin 3 (RxD) the Receiver Data line.

R.3.2.1 Full-Duplex Mode

When in the full-duplex mode, the Request To Send (RTS) line must always be high. During the time of data transmission, the transmit interrupt must be enabled.

The Clear To Send (CTS) must be low for the IRQ (interrupt request) to be sent.

The Data Carrier Detect (DCD) must be low in order to receive data transmitted from the modem.

A typical terminal-to-modem connection and signal sequence could occur as follows. Signal sequence is indicated in descending order.

DTE	Pin#	Direction	DCE	Pin#
Ground	1		Ground	1
Ground	7		Ground	7
DTR	20	TO DCE	DTR	20
DCD	8	TO DTE	DCD	8
DSR	6	TO DTE	DSR	6
RTS	4	TO DCE	RTS	4
CTS	5	TO DTE	CTS	5
TxD	2	TO DCE	TxD	2
RxD	3	TO DTE	RxD	3

R.3.2.2 Half-Duplex Mode

Half-duplex mode requires that the RTS (Request To Send) line be low for the receiver to output data to the modem. When data is not being sent, the RTS line remains high. The transmit interrupt is disabled, causing the receiver not to send any data. Data is only sent when the RTS line is low and the transmit interrupt is enabled.

Clear To Send is set low in response to the low on the RTS line. When the CTS line is low, an interrupt request (IRQ) is generated. The IRQ is sent to indicate that data is ready to be sent.

R.4 REMOTE OPERATION

Using the mnemonics listed in **Table R-3**, a suitable controller can be used to remotely operate the receiver. When data is sent in ASCII, bit 8 is set to the space condition. The termination for an ASCII command or request is: OD (carriage return), OA (line feed) in HEX. In the Binary mode, the termination is: FF in HEX. Once an input message has been sent to the receiver, another message can not be sent again until the receiver has responded to the first message. The receiver parameter status may be requested by the controller at any time. However, receiver parameter changes can be made via the controller only when the receiver is in the remote (RMT) mode. When a command or query is sent to the receiver, the receiver response is a two byte message: FD FF. The FD FF message returned to the controller indicates that the receiver has processed the query or command and is ready to receive another controller command. If the receiver detects an error in the data from the controller, the receiver outputs a two byte message FE FF and followed by FD FF. Outputting FE FF alerts the controller that an interrupt status exists.

This same hex response (FE FF) is sent to indicate a request for service. The receiver sends a service request to the controller when an error is detected. The following conditions also cause the interrupt status (FE FF) to be sent:

Signal acquisition (if STS1 is set)
power-up
completion of BITE (when installed)

After the request for service has been sent, the controller should send a STS? to determine why the request for service was sent. The receiver responds to the status query (STS?) with a status message. This response is a number between 0 and 254. In ASCII it is a three digit decimal number corresponding to the binary coding of the status. In binary it is a byte corresponding to the binary coding of the status. The binary value of the interrupt is determined by the bits that are set. The interrupt status bits and values are as follows:

Bit	Value	Set Indicates	Cleared Indicates	Cleared By
0	1	Signal above COR	No signal above COR	Non-latched indicator
1	2	Unit Power-up Status		Requesting receiver status (STS?)
2	4	BITE Completed/ error found		Requesting BITE status (BIT?)
3	8	(When status byte previously set with STS8) End of Scan sequence		Requesting Receiver status (STS?)
4	16	Responding to request for data		Non-latched indicator
5	32	Error condition occurred	Error conditioned cleared	(device dependent command) Requesting Error status
6	64	Request for Service (FE FF) Sent	No Interrupt Status	Requesting Receiver status (STS?) or Error status (ERR?)

R.4.1 ERROR CODES

The following error codes are utilized to inform the operator of invalid remote commands.

Remote Error Code	Description
Err 401	Input data buffer is full (message is too long).
Err 402	Less than 2 characters in message.
Err 403	Framing, parity or overrun error.
Err 404	Number is out of range for command.
Err 406	"/" or "?" not valid for this command.
Err 407	Invalid mnemonic or binary code received.
Err 551	All Lock-out channels are in use and the creation of an additional one is attempted.
Err 552	An attempt is made to store data, other than Lock-out data into a channel designated for Lock-out.
Err 810	Attempt to initiate Step or Scan mode and not valid data is stored in the memory locations to be scanned or stepped.
Err 811	Attempt to initiate the Step mode when 00 is displayed in the MEMORY SELECT window. Press the Memory Select Up pushbutton to select a channel greater than 00.
Err 812	Attempt to initiate a Scan and the number of Scan increments required is greater than 65536. The maximum width of a Scan band is equal to the Scan increment times 65536.
Err 813	Scan in initiated and the memory is programmed with the start frequency greater than the stop frequency. The memory must be programmed with the even numbered channel containing the lower frequency with the frequencies in ascending order.
Err 814	An attempt was made to select a non-occupied band width slot.

An error causes the receiver front panel to display ERROR followed by a three digit error code. To remotely request the error code, the controller sends ERR? In response to the error query the receiver returns ERR OXX. The first returned digit of the error code is zero. The next two digits (xx) describe the cause of the error. Attempting an invalid Scan produces ERROR 810 on the receiver front panel. An ERR? from the controller produces a response of ERR 010 on the controller display.

In the binary mode, each command or query is ended with FF and cannot be strung together. In the ASCII mode, commands or queries can be strung together with semicolons (;).

R.4.2 REMOTE MNEMONICS

The following mnemonics tables list the mnemonics utilized to control the receiver remotely. The mnemonics allow the controller to remotely set, change and/or verify the receiver operations.

Table R-3. Table of Remote Mnemonics

Mnemonic	Hex	Dec	Description	Refer to Table
AFC	42	66	Turns AFC on	R-7
AFC/	43	67	Turns AFC off	R-7
AFC?	44	68	Request AFC mode	R-7
AGC	45	69	Turn AGC on	R-7
AGC/	46	70	Turn AGC off	R-7
AGC?	47	71	Request AGC mode	R-7
AM	48	72	Select AM detection mode	R-6
AM?	4A	74	Request AM modulation 0-68	R-9
ANT(a)	4B(b)	75(b)	Select antenna (1,2)	R-7
ANT?	4D	77	Request selected antenna	R-7
AUD(a)	9F(b)	159(b)	Set audio level (0 to 255)*	R-10
AUD?	A1	161	Request audio gain level*	R-10
AUL?	F5	245	Request audio signal level*	R-10
BFO(f)	39(p)	57(p)	Set BFO frequency (±7.99 kHz)*	R-10
BFO?	3B	59	Request BFO frequency*	R-10
BIC?	AA	170	Request reading of error*	R-10
BIN			Causes all future commands to be expected in binary.	R-4
	55	85	Causes all future commands to be expected in ASCII	R-4
BIT	A5	165	Cause BITE to start/continue*	R-10
BIT?	A7	167	Request BITE error number*	R-10
BW(a)	4E(b)	78(b)	Select BW slot (1-5) (1-10)*	R-5
BW?	50	80	Request BW slot selected	R-5
BWC?	9C	156	Request BW size	R-5
CLM	6C	108	Clear receiver & memory	R-7
CLR	51	81	Clear receiver	R-7
COR(a)	57(b)	87(b)	Set COR level 0-40/or NRT level 00-20*	R-7

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.
(f) - Utilized in a command as a group of ASCII numbers representing a frequency. This should not exceed 10 characters, including sign and decimal. Leading and trailing zeroes need not be sent.
(p) - Eight packed BCD digits in four bytes of information.
(*) - Receiver must have appropriate option for command to be supported.
(_) - Represents the default mode.

Table R-3. Table of Remote Mnemonics (Continued)

Mnemonic	Hex	Dec	Description	Refer to Table
COR?	59	89	Request COR level/or NRT level*	R-7
CST?	9B	155	Request COR status	R-7
CW	5A	90	Select CW detection mode	R-6
DET?	5F	95	Request detection mode selected	R-6
DWL(a)	60(b)	96(b)	Select DWELL time period	R-7
DWL?	62	98	Request DWELL number	R-7
ERR?	65	101	Request Error number	R-4
EXC	66	102	Execute current parameters	R-8
FBW	D8	216	Take full bandwidth steps in SCAN	R-5
FBW/	D9	217	Take 1/2 bandwidth steps in SCAN	R-5
FBW?	DA	218	Request selected bandwidth mode	R-5
FM	69	105	Select FM detection mode	R-6
FM?	6B	107	Request FM modulation 0-100	R-9
FMO?	AD	173	Request reading of offset 0-255	R-9
FRQ(a)	3C(p)	60(p)	Set tuned frequency in MHz	R-7
FRQ?	3E	62	Request tuned frequency	R-7
GEN	E1	225	Turn BITE signal generator on*	R-10
GEN/	E2	226	Turn BITE signal generator off*	R-10
GEN?	E3	227	Request status of BITE generator*	R-10
LCK	94	148	Lock-Out current parameters	R-8
LCK?	96	150	Request lockout status	R-8
LGV?	71	113	Request reading of Log Video	R-9
LLO	F9	249	Enable local lockout of front panel	R-4
LLO/	FA	250	Disable local lockout	R-4
LLO?	FB	251	Request local lockout status	R-4
LSB	72	114	Select LSB detection mode*	R-6
MAN	75	117	Select Manual operation	R-8
MOD?	B3	179	Request operation mode	R-8
NRT	B4	180	Select NRT mode*	R-10
NRT/	B5	181	Disable NRT mode*	R-10
NRT?	B6	182	Request NRT status*	R-10

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.
(p) - Eight packed BCD digits in four bytes of information.
(_) - Represents the default mode.
(*) - Receiver must have appropriate option for command to be supported.

Table R-3. Table of Remote Mnemonics (Continued)

Mnemonic	Hex	Dec	Description	Refer to Table
OPT?	DD	221	Request options installed	R-10
PLS	78	120	Select Pulse detection mode	R-6
RCL(a)	7B(b)	123(b)	Select Recall operation	R-8
RCL?	7D	125	Request current channel	R-8
RFG(a)	7E(b)	126(b)	Enter RF Gain (0-255)	R-7
RFG?	80	128	Request RF Gain	R-7
RLG	FC	252	Enable RLOG*	R-10
RLG/	FD	253	Disable RLOG*	R-10
RLG?	FE	254	Request RLOG status*	R-10
RMT	81	129	Select Remote operation	R-4
RMT/	82	130	Disable Remote	R-4
RMT?	83	131	Request control mode	R-4
SCN(a)	84(b)	132(b)	Select Scan operation	R-8
SS?	89	137	Request Signal Strength in dBm	R-9
STO(a)	8A(b)	138(b)	Store current parameters	R-8
STP(a)	8D(b)	141(b)	Select Step operation	R-8
STS(a)	90(b)	144(b)	Sets status byte	R-4
STS?	92	146	Request device status	R-4
TIM(hh:mm)	AE(b)(b)	174(b)(b)	Set Time function*	R-10
TIM?	B0	176	Request Time setting*	R-10
USB	93	147	Select USB detection mode*	R-6
VER?	E0	224	Request Software version	R-7
VID(a)	A2(b)	162(b)	Set Video level (0 to 255)*	R-10
VID?	A4	164	Request Video level*	R-10
VIL?	FB	248	Request Video signal level*	R-10

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.
(_) - Represents the default mode.
(*) - Receiver must have appropriate option for command to be supported.

Table R-4. WJ-861XB(S1) Configuration Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
BIN						Causes all future expected commands to be in binary.
	55	85				Causes all future expected commands to be in ASCII. (default)
ERR?	65	101	ERR(b)	63(b)	99(b)	Returns a number (0-99) representing the two least significant digits of the error code. Zero indicates no error. Reading this register clears it.
LLO	F9	249				Causes front panel to be locked from operator. A power-up or return to local operation will cancel LLO.
LLO/	FA	250				Cancel LLO
LLO?	FB	251	LLO LLO/	F9 FA	249 250	Request Local Lockout status
RMT	81	129				Select remote operation. Allows the receiver to accept commands that change operating parameters.
RMT/	82	130				Activate local operation. Only queries are allowed in this mode.
RMT?	83	131	RMT	81	129	Requests control mode (Remote/Local)
			RMT/	82	130	
STS(a)	90(b)	144(b)				Sets status byte to cause receiver reactions in accordance with the variable (a) sent. Variables are ORED together when multiple STS(a) commands are sent. STS 0 must be sent to reset status byte. STS 0 is the default. a = 0 - Resets all bits of Status byte to 0. a = 1 - Send SRQ on signal acquisition. a = 4 - Cause AGC dump on new frequencies.* a = 8 - Cause receiver to enter into Scan Continue mode at the end of a Scan sequence.

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.
(_) - Represents the default mode.
(*) - Receiver must have appropriate option for this command to be supported.

Table R-4. WJ-861XB(S1) Configuration Commands and Responses (Continued)

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
STS?	92	146	STS(a)	90(b)	144(b)	Request device status command. Note this command does not respond with the values sent in STS. This command provides information contained in the serial poll status byte. Bit — Function 0 Signal above COR level. 1 Unit power-up. 2 BITE activated SRQ. (Cleared by BIT?) 3 Indicates end of scan sequence (Reset by serial poll followed SCN.) 4 Receiver responding to query. 5 Unit error activated SRQ. (Cleared by ERR?) 6 SRQ activated by this unit. (Cleared by serial poll followed by STS?) 7 Not Utilized.

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.

Bandwidths for the receiver are applied utilizing the following commands and responses.

Table R-5. WJ-861XB(S1) Bandwidth Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
BW(a)	4E(b)	78(b)				Select BW slot 1-5. 1-10 in 10 bandwidth receivers.* (WJ-861XB does not allow selection of empty BW slot).
BW?	50	80	BW(a)	4E(b)	78(b)	Request which slot is selected. (BW 1 is default)
BWC?	9C	156	BWC(c)	9A(b)(b)	154(b)(b)	Request size of selected BW. (Number returned in ASCII is in kHz). (Number returned in binary is a 2 byte (16-bit) binary number representing kHz). 6.4 kHz is returned as 6 kHz; 3.2 kHz is returned as 3 kHz.
FBW	D8	216				Select full bandwidth increments in SCAN (truncated to kHz).
FBW/	D9	217				Select 1/2 bandwidth increments in SCAN (truncated to kHz).
FBW?	DA	218	FBW FBW/	D8 D9	216 217	Request bandwidth mode selected

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.
(c) - Utilized in a response as 4 bytes of ASCII data representing a number.
(_) - Represents the default mode.
(*) - Receiver must have appropriate option for this command to be supported.

Detection modes for the receiver are applied utilizing the following commands and responses.

Table R-6. WJ-861XB(S1) Detection Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
AM	48	72				Select AM detection mode.
CW	5A	90				Select CW detection mode.
FM	69	105				Select FM detection mode.
PLS	78	120				Select PULSE detection mode.
LSB	72	114				Select LSB detection mode.*
USB	93	147				Select USB detection mode.*
DET?	5F	95	AM	48	72	Request mode of detection selected.
			CW	5A	90	
			FM	69	105	
			PLS	78	120	
			LSB	72	114	*
			USB	93	147	*

(_) - Represents the default mode.
(*) - Receiver must have appropriate option for command to be supported.

Miscellaneous control of the receiver is applied utilizing the following commands and responses.

Table R-7. WJ-861XB(S1) Miscellaneous Control Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
AFC	42	66				Turn AFC on.
AFC/	43	67				Turn AFC off.
AFC?	44	68	AFC/	42	66	Request AFC mode.
			AFC	43	67	
AGC	45	69				Turn AGC on.
AGC/	46	70				Turn AGC off.
AGC?	47	71	AGC	45	69	Request AGC mode.
			AGC/	46	70	

(_) - Represents the default mode.

Table R-7. WJ-861XB(S1) Miscellaneous Control Commands and Responses (Continued)

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
ANT(a)	4B(b)	75(b)				Select antenna. (1, 2)
ANT?	4D	77	ANT(a)	4B(b)	75(b)	Request the selected antenna. (ANT 1 is default)
CLR	51	81				Clear receiver. All conditions to default. Memory not affected.
CLM	6C	108				Clear receiver. All conditions to default. Memory cleared.
COR(a)	57(b)	87(b)				Set COR level (0-40 = on, 41 = off). Level is ≈ 1 dB steps starting at noise floor of selected BW. (COR 0 is default)
COR?	59	89	COR(a)	57(b)	87(b)	Request the COR level.
CST?	9B	155				What is COR status?
			CST	99	153	Signal is above COR.
			CST/	9A	155	Signal is below COR.
DWL(a)	60(b)	96(b)				Select the Dwell time for scan or step operation. This may be pre or post Dwell based on internal receiver configuration. The range of Dwell is from 0-2 seconds represented by a number from (0-255). Actual time is represented by $2^{a/32}$ x 8) -8 in ms.
DWL?	62	98	DWL(a)	60(b)	96(b)	Request Dwell number. (DWL 0 is default).
FRQ(f)	3C(p)	60(p)				Set the tuned frequency in MHz. (0-1100 in .0001 MHz steps). (Binary mode is packed BCD always 4 bytes.) (Upper limit 500 MHz without FE option.)* (Lower limits is 20 MHz without HFE, LFE or ELF.)*

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

(f) - Utilized in a command as a group of ASCII numbers representing a frequency. This should not exceed 10 characters, including sign and decimal. Leading and trailing zeros need not be sent.

(p) - Eight packed BCD digits in four bytes of information.

(_) - Represents the default mode.

(*) - Receiver must have appropriate option for this command to be supported.

Table R-7. WJ-861XB(S1) Miscellaneous Control Commands and Responses (Continued)

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
FRQ?	3E	62	FRQ(f)	3C(p)	60(p)	Request tuned frequency. (20 MHz is default).
RFG(a)	7E(b)	126(b)				Enter RF Gain number (0-255). 0 = minimum gain, 255 = maximum gain.
RFG?	80	128	RFG(a)	7E(b)	126(b)	Request RF Gain number (0-255). (The RF Gain 0 is default)
VER?	E0	224	VER_ 861XB _ _ _ _ X.X.X _ _ _ _	DE'VER 861XB _ _ _ _ X.X.X. _ _ _ _		The version response includes model and software revision. Response in binary mode is a HEX DE followed by ASCII data string terminated with EOI.
VID(a)	A2(b)	162(b)				Set Video Gain level (0 to 255).*
VID?	A4	164	VID(a)	A2(b)	162(b)	Request Video Gain level.

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

(f) - Utilized in a command as a group of ASCII numbers representing a frequency. This should not exceed 10 characters, including sign and decimal. Leading and trailing zeros need not be sent.

(p) - Eight packed BCD digits in four bytes of information.

(_) - Represents the default mode.

(*) - Receiver must have appropriate option for this command to be supported.

Control of the receiver is applied utilizing the following commands and responses.

Table R-8. WJ-861XB(S1) Receiver Mode Control Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
EXC	66	102				Execute current parameters only valid in Recall mode).
LCK	94	148				Lockout current frequency using bandwidth size for lockout width.
LCK?	96	150	LCK LCK/	94 95	148 149	Request lockout status of last recalled channel. If the recalled channel was a lockout, the response is LCK. If not a lockout, response is LCK/.
MAN	75	117				Select Manual operation (to exit Scan or Step, send MAN command twice.
MOD?	B3	179				Request mode of operation.
			MAN RCL SCN SCM STP STM BIT BIM	75 7B 84 B2 8D B1 A5 A6	117 123 132 178 141 177 165 166	Manual Recall Scanning Scan Continue Stepping Step Continue BITE Mode BITE manual indicates BITE has halted because of a failure.
STO(a)	8A(b)	138(b)				Store current parameters in channel (0-95).
RCL(a)	7B(b)	123(b)				Select Recall operation. Recall parameters in channel (0-95).
RCL?	7D	125	RCL(a)	7B(b)	123(b)	Request current channel number.
SCN	84	132				Cause active scan to be advanced if the receiver has stopped on a signal. If the mode is SCM the SCN command will cause the receiver to return to the SCN mode.

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

(_) - Represents the default mode.

Table R-8. WJ-861XB(S1) Receiver Mode Control Commands and Responses (Continued)

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
SCN(a)	84(b)	132(b)				Scan the channel indicated in the argument. If the channel number is odd, the Scan is from the frequency in the preceeding even channel to the frequency in the specified channel. If the channel number is even, a sector scan is performed for each channel pair starting with zero ending with the specified channel.
STP	8D	141				Cause an active Step to be advanced if the receiver has stopped on a signal. If the mode is STM the STP command will cause the receiver to return to the STP mode.
STP(a)	8D(b)	141(b)				Select Step operation. Start with 0 and step to channel number in STP command.

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

Signal information for the receiver is applied utilizing the following commands and responses.

Table R-9. WJ-861XB(S1) Signal Information Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
AM?	4A	74	AM(a)	48(b)	72(b)	Request reading from AM modulation. 000-068 Range
FM?	6B	107	FM(a)	69(b)	105(b)	Request reading from FM modulation. 000-100 Range
FMO?	AD	173	FMO(a)	AB(b)	171(b)	Request reading of FM offset. 000-255 range.
LGV?	71	113	LGV(a)	6F(b)	111(b)	Request reading of Log Video. 000-080 Range
SS?	89	137	SS(a)	87(b)	135(b)	Request reading of Signal Strength in dBm. (In manual, gain represents % of AM Detector (000-100).

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

Optional commands are applied to the receiver utilizing the following commands and responses.

Table R-10. WJ-861XB(S1) Optional Commands and Responses

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
OPT?	DD	221	OPT (a),(a),(a)	DB (b)(b)(b)		Requests the options in the receiver. The response is returned as 3 byte encoded numbers. Each number has a range from 0 to 255. The bit values are indicated below: Bit / Byte 1 / Byte 2 / Byte 3 / Value 0 RTC LFE PSS 1 1 EM HFE 488 2 2 LCK FEX 232 4 3 TPC FE ASO 8 4 RLOG SSB DAV 16 5 CUR VBFO MX 32 6 M/S BIT - 64 7 SLO NRT - 128
BITE Option						
BIT	A5	165				This command enables BITE mode. It starts BITE if current operating mode is other than BITE. It continues the BITE operation if the current mode is BITE active.
BIT?	A7	167	BIT(a)	A5(b)	165(b)	This command returns the current BITE test number. If a 0 is returned it indicates BITE has completed. Reading this register causes bit 2 of the status byte (STS?) to be cleared.
BIC?	AA	170	BIC(a)	A8(b)	168(b)	This command returns the last A/D reading used for a failed BITE test. Refer to the BITE option manual for the range of the returned number and its meaning.
GEN	E1	225				This command allows the BITE Signal Generator to be turned on while in manual mode.
GEN/	E2	226				Turn Bite Signal generator off.
GEN?	E3	227	GEN GEN/	E1 E2	225 226	Request status of BITE generator.

(a) - Utilized in a command as an ASCII number or a group of numbers.
- Utilized in a response as a space followed by 3 bytes of ASCII data representing a number.

(b) - A single byte of binary information.

(_) - Represents the default mode.

Table R-10. WJ-861XB(S1) Optional Commands and Responses (Continued)

Commands			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
BFO Option						
BFO(f)	39(p)	57(p)				Set BFO frequency in kHz. (-7.99 to +7.99). Binary is sent as four packed BCD bytes. (Sign is bit 3 of second byte.) First and last byte are zeros. Byte 2 is kHz, Byte 3 is 100s of Hz, and 10s of Hz.
BFO?	3B(p)	59	BFO(-)(f)	39(p)	57(p)	Request BFO frequency. (0 kHz is default).
DAV Option						
AUD(a)	9F(b)	159(b)				Set audio gain level (0-255).
AUD?	A1	161	AUD(a)	9F(b)	159(b)	Request audio gain level.
AUL?	F5	245	AUL(a)	F3(b)	243(b)	Request the audio signal level. The number returned is between 0 and 99. Zero represents no audio energy and 99 maximum audio energy.
VID(a)	A2(b)	162(b)				Sets video gain level (0-255).
VID?	A4	164	VID(a)	A2(b)	162(b)	Request video gain level.
VIL?	F8	249	VIL(a)	F6(b)	247(b)	Request the video signal level. The number returned is between 0 and 99. Zero represents no video energy and 99 maximum.
NRT Option						
NRT	B4	180				Enables NRT.
NRT/	B5	181				Disables NRT.
NRT?	B6	182	NRT NRT/	B4 B5	180 181	Requests NRT status.
COR(a)	57(b)	87(b)				Sets NRT level (0-20).
COR?	59	89				Requests set NRT level.

(a) - Utilized in a command as an ASCII number or a group of numbers.
(b) - A single byte of binary information.
(f) - Utilized in a command as a group of ASCII numbers representing a frequency. This should not exceed 10 characters, including sign and decimal. Leading and trailing zeos need not be sent.
(p) - Eight packed BCD digits in four bytes of information.

Table R-10. WJ-861XB(S1) Optional Commands and Responses (Continued)

Commands(a)			Responses			Description
ASCII	Hex	Dec	ASCII	Hex	Dec	
RTC Option						
TIM (HH:MM)	AE(b) (b)	174(b) (b)				Set time in hours and minutes. Seconds are set to 0 upon receiving this command. (ASCII format is HH:MM) (Binary is 2 packed BCD bytes, the first byte is hours and the second byte is minutes.)
TIM?	B0	176	TIM (HH:MM:SS)	AE(b) (b)(b)	174(b) (b)(b)	Request time. Returns hours, minutes, and seconds. (ASCII format is HH:MM:SS) (Binary is 3 packed BCD bytes, hours, minutes and seconds.)
RLOG Option						
*RLG	FC	252				Enables RLOG mode
*RLG/	FD	253				Disables RLOG mode
*RLG?	FE	254	RLG RLG/	FC FC	252 253	Requests RLOG status

(b) - A single byte of binary information.
(*) - Receiver must have appropriate option for this command to be supported.

The response to an AM? mnemonic is a number from 000 to 068 representing the level of AM Video present at the output of the receiver. Each digit represents approximately 13 mV rms of AM Video. For FM?, the response is a number ranging from 000 to 100, representing the percentage of FM modulation. Each digit represents a 1 percent increment with 100 equaling 100% modulation and 000 equaling no modulation. For FMO?, the response is a number from 0-254, representing the FM Discriminator offset. The number 127 represents a signal at tuned frequency, greater than 127 means the signal is greater than the tuned frequency, less than 127 means the signal is less than the tuned frequency. For tuned frequencies above 500 MHz greater than 127 means the signal is lower than the tuned frequency and less than 127 means the signal is greater than the tuned frequency.

LGV? provides a number from 000 to 080 representing the Log video level of the receiver. This number represents the signal level above the theoretical noise floor of the receiver, with each number representing a 0.5 dB change. 000 represents the theoretical noise floor and 080 represents 40 dB above that level. The response to SS? provides a signal strength number in dBm from -125 to -20. In manual gain this number represents the level of the AM detector.

The following tables (**Tables R-11 through R-16**) provide examples of commands and data requests. These examples indicated, bit by bit, the RS-232 interface bus status during the data exchange.

Table R-11. Sending a Tuned Frequency of 25 MHz to the WJ-861XB Using an HP85 (WJ-861XB Device #6)

Message: Send tuned frequency of 25.0000 MHz

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "FRQ25"				
ASCII message may have leading zeros.	1	46	F	
Total none blank character count 15,	2	52	R	DATA TO
for single commands, exponential	3	51	Q	WJ-861XB
format not supported. IE: "FRQ	4	32	2	
0025.0000 is valid message.	5	35	5	
	6	0D	(CR)	
	7	0A	(LF)	TERMINATOR
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 60, 0, 37, 0, 0, 255				
All bytes must be sent with no spaces	1	36	60	FREQ CODE
or terminator characters.	2	00	0	BYTE 1
	3	25	37	BYTE 2
	4	00	0	BYTE 3
	5	00	0	BYTE 4
	6	FF	255	TERMINATOR

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

Table R-12. Sending a COR "OFF" Command

Message: Send COR Off (41)

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "COR 41"	1	43	C	DATA TO
	2	4F	O	WJ-861XB
	3	52	R	
	4	34	4	
	5	31	1	
	6	0D	(CR)	
	7	0A	(LF)	TERMINATOR
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 87, 41, 255	1	57	87	COR CODE
	2	29	41	VALUE
	3	FF	255	TERMINATOR

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

Table R-13. Sending a Frequency Request

Message: Request Frequency (Assume 25 MHz last sent)

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "FRQ?"	1	46	F	
	2	52	R	DATA TO
Instruct WJ-861XB to prepare to output	3	51	Q	WJ-861XB
frequency information when made a talker.	4	3F	?	
	5	0D	CR	
	6	0A	LF	TERMINATOR
Enter 706; A$	7	46	F	
	8	52	R	
	9	51	Q	DATA FROM
A$ will contain "FRQ 0025.0000".	10	20		WJ-861XB
	11	30	0	
	12	30	0	
	13	32	2	
Frequency response is always 15 characters.	14	35	5	
	15	2E	.	
	16	30	0	
	17	30	0	
	18	30	0	
	19	30	0	
	20	0D	CR	
	21	0A	LF	TERMINATOR
	22	FD	253	COMMAND/QUERY
	23	FF	255	PROCESS COMPLETE
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 62, 255	1	3E	62	REQUEST FREQUENCY
	2	FF	255	TERMINATOR
	3	3C	60	FREQ CODE
Enter 706 using "#%, #%K"; A$	4	00	0	BYTE 1
	5	25	37	BYTE 2
Image causes enter to terminate on EOI only.	6	00	0	BYTE 3
	7	00	0	BYTE 4
A$ will contain frequency data in packed BCD.	8	FF	255	TERMINATOR

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

Table R-14. Sending a Bandwidth Size Request

Message: Request size of currently selected bandwidth (Assume 10 kHz)

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "BWC?"	1	42	B	
	2	57	W	DATA TO
Instruct 861XB to output size of selected BW	3	43	C	WJ-861XB
in kHz when made an active talker.	4	3F	?	
	5	0D	(CR)	
	6	0A	(LF)	TERMINATOR
Enter 706; A$	7	42	B	
	8	57	W	DATA TO
A$ will contain "BWC 10".	9	43	C	WJ-861XB
	10	20		
	11	20		
	12	31	1	
	13	30	0	
	14	0D	CR	
	15	0A	LF	TERMINATOR
	16	FD	253	COMMAND/QUERY
	17	FF	255	PROCESS COMPLETE
	(Assume 4 MHz)			
Enter 706; A$	1	42	B	
	2	57	W	DATA FROM
A$ will contain "BWC 4000".	3	43	C	WJ-861XB
	4	34	4	
	5	30	0	
	6	30	0	
	7	30	0	
	8	0D	(CR)	
	9	0A	(LF)	TERMINATOR
	10	FD	253	COMMAND/QUERY
	11	FF	255	PROCESS COMPLETE
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 158, 255	1	9E	158	BW SIZE REQUEST
	2	FF	255	TERMINATOR
Enter 706 using "#%, #%K"; A$	3	9C	156	BW CODE
A$ will contain binary BW size information.	4	00	0	BINARY CODED
	(Assume 4 MHz)			
	5	0A	10	BANDWIDTH IN kHz
	6	FF	255	TERMINATOR
Enter 706 using "#%, #%K"; A$	1	9C	156	BW CODE
	2	0F	15	BINARY CODED
Byte 1, Byte 2	3	A0	160	BANDWIDTH IN kHz
A$ will contain binary BW size information.	4	FF	255	TERMINATOR

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

Table R-15. Sending a Detection Mode Request

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "DET?"	1	44	D	
	2	45	E	DATA TO
	3	54	T	WJ-861XB
	4	3F	?	
	5	0D	(CR)	
	6	0A	(LF)	TERMINATOR
Enter 706; A$	7	41	A	
	8	4D	M	DATA FROM
A$ will contain "AM".	9	20		WJ-861XB
	10	0D	(CR)	
	11	0A	(LF)	TERMINATOR
	12	FD	253	COMMAND/QUERY
	13	FF	255	PROCESS COMPLETE
	(Assume PLS)			
Enter 706; A$	1	50	P	
	2	4C	L	DATA FROM
A$ will contain "PLS".	3	53	S	WJ-861XB
	4	0D	(CR)	
	5	0A	(LF)	TERMINATOR
	6	FD	253	COMMAND/QUERY
	7	FF	255	PROCESS COMPLETE
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 95, 255	1	5F	95	REQUEST DETECTION MODE
	2	FF	255	TERMINATOR
Enter 706 using "#%, #%K"; A$	3	48	72	AM CODE
	4	FF	255	TERMINATOR
A$ will contain 1 byte binary information.				
	(Assume PLS)			
Enter 706 using "#%, #%K"; A$	1	78	120	PLS CODE
	2	FF	255	TERMINATOR
A$ will contain 1 byte binary information.				

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

Table R-16. Sending a COR Level Request

Message: Request COR Level, (assume off)

ASCII Mode	Actual Bus Transfer			
	#	HEX	ASCII	Comment
Output 706 using "K"; "COR?"	1	43	C	
	2	4F	O	DATA TO
	3	52	R	WJ-861XB
	4	3F	?	
	5	0D	(CR)	
	6	0A	(LF)	TERMINATOR
Enter 706; A$	7	43	C	
	8	4F	O	DATA FROM
A $ will contain "COR 041".	9	52	R	WJ-861XB
	10	20		
	11	30	0	
	12	34	4	
	13	31	1	
	14	0D	(CR)	
	15	0A	(LF)	TERMINATOR
	16	FD	253	COMMAND/QUERY
	17	FF	255	PROCESS COMPLETE
Binary Mode	**#**	**HEX**	**DEC**	**Comment**
*Print using "B"; 89, 255	1	59	89	REQUEST COR
	2	FF	255	TERMINATOR
Enter 706 using "#%, #%K"; A$	3	57	87	COR CODE
	4	29	41	VALUE
	5	FF	255	TERMINATOR
A$ will contain 2 bytes binary information.				

*Control Statement: Assumes the controller RS-232 port has been declared the printer (for HP-80 series computers, the printer is 10) and that the CR and LF terminator, associated with the print command, has been suppressed. Printer is 706 (directs print statements to WJ-861XB).

R.5 PARTS LIST

R.5.1 TYPE NUMBER 861X/232 RS-232 INTERFACE

REF DESIG PREFIX **RS-232**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision B				
232-A1	Async Interface	1	796617-1	14632	
232-J1	Connector, Receptacle	1	DBM25S	71468	
232-W1	Cable Assembly	1	290321-1	14632	

R.5.1.1 Type 796617-1 RS-232, Interface

REF DESIG PREFIX **RS-232-A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision C1				
C1	Capacitor, Ceramic, Disc: .1 µF, 20%, 50 V	7	34475-1	14632	
C2	Capacitor, Ceramic, Monolithic: 18 pF, 2%, 50 V	2	100-100-NPO-180G	51642	
C3	Same as C2				
C4	Capacitor, Electrolytic, Tantalum: .47 µF, 10%, 35 V	2	CS13BF474K	81349	
C5	Same as C1				
C6	Same as C4				
C7	Capacitor, Ceramic, Monolithic: 100 pF, 2%, 100 V NPO	1	200-100-NPO-101G	51642	
C8	Capacitor, Ceramic, Monolithic: 30 pF, 2%, 100 V NPO	2	150-100-NPO-300G	51642	
C9	Same as C8				
C10	Capacitor, Ceramic, Disc: 1 µF, 20%, 100 V	3	RPE114-Z5U105M100V	72982	
C11	Capacitor, Electrolytic, Tantalum: 220 µF, 20%, 10 V	1	CS13BC227K	81349	
C12 Thru C16	Same as C1				
C17	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C18 Thru C22	Same as C17				
C23	Same as C10				
C24	Same as C10				
CR1	Diode	2	1N746A	80131	
CR2	Same as CR1				
J1	Header	1	102203-5	00779	
J2	Connector, Receptacle	1	65610-116	22526	
J3	Connector	1	1010-7511-001	19505	
J4	Header	1	102203-1	00779	
JP1	Connector, Plug	1	ML-100S	51167	
JW1*	Wire, Electrolytic, Buss	AR	8021 22 AWG BUSSWIRE	70903	
JW2*	Same as JW1				
JW3*	Not Used				
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R2	Resistor, Fixed, Film: 15 kΩ, 1/8 W	2	CF1/8-15K/J	09021	
R3	Same R2				
R4	Resistor, Fixed, Film: 330 Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R5	Resistor, Fixed, Film: 10 kΩ, 1/8 W	2	CF1/8-10K/J	09021	
R6	Not Used				
R7	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	1	CF1/8-4.7K/J	09021	
R8	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	3	CF1/8-47K/J	09021	
R9	Same as R5				
R10	Resistor, Fixed, Film: 3.9 kΩ, 5%, 1/8 W	1	CF1/8-3.9K/J	09021	
R11	Resistor, Fixed, Film: 56 kΩ, 5%, 1/8 W	2	CF1/8-56K/J	09021	

REF DESIG PREFIX **RS-232-A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R12	Same as R8				
R13	Resistor, Fixed, Film: 68 kΩ, 5%, 1/8 W	1	CF1/8-68K/J	09021	
R14	Resistor, Fixed, Film: 33 kΩ, 5%, 1/8 W	1	CF1/8-33K/J	09021	
R15	Resistor, Fixed, Film: 22 kΩ, 5%, 1/8 W	3	CF1/8-22K/J	09021	
R16	Same as R15				
R17	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	2	CF1/8-100K/J	09021	
R18	Same as R15				
R19	Same as R11				
R20	Same as R8				
R21	Same as R17				
R22	Resistor, Fixed, Film: 100 Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
S1	Switch, Dip	1	76PSB08S	81073	
TP1	Pin, Test Point	8	460-2976-02-0400	71279	
TP2 Thru TP8	Same as TP1				
U1	Integrated Circuit	1	ICM 7209-1-PA	32293	
U2	Integrated Circuit	1	SN75150P	01295	
U3	Integrated Circuit, DCDR	1	MM74HCT139N	27014	
U4	Integrated Circuit, Center	1	MM74HC4040N	27014	
U5	Integrated Circuit, Buffer	1	MM74HCT04N	27014	
U6	Integrated Circuit	1	SN75154N	01295	
U7	Not Used				
U8	Integrated Circuit	1	MC68B50P	04713	
U9	Not Used				
U10	Integrated Circuit	1	MM74HCTOON	27014	
U11	Not Used				
U12	Integrated Circuit, Latch	1	MM74HCT373N	27014	
U13	Resistor, Nework: 47 Ω	1	4310R-101-473	80294	
U14	Integrated Circuit	1	MM80C98N	27014	
U15	Not Used				
U16	Integrated Circuit	1	MC1458N	18324	
Y1	Crystal, Quartz: 4.91520 MHz	1	MP042	75378	
T2	Not Used				

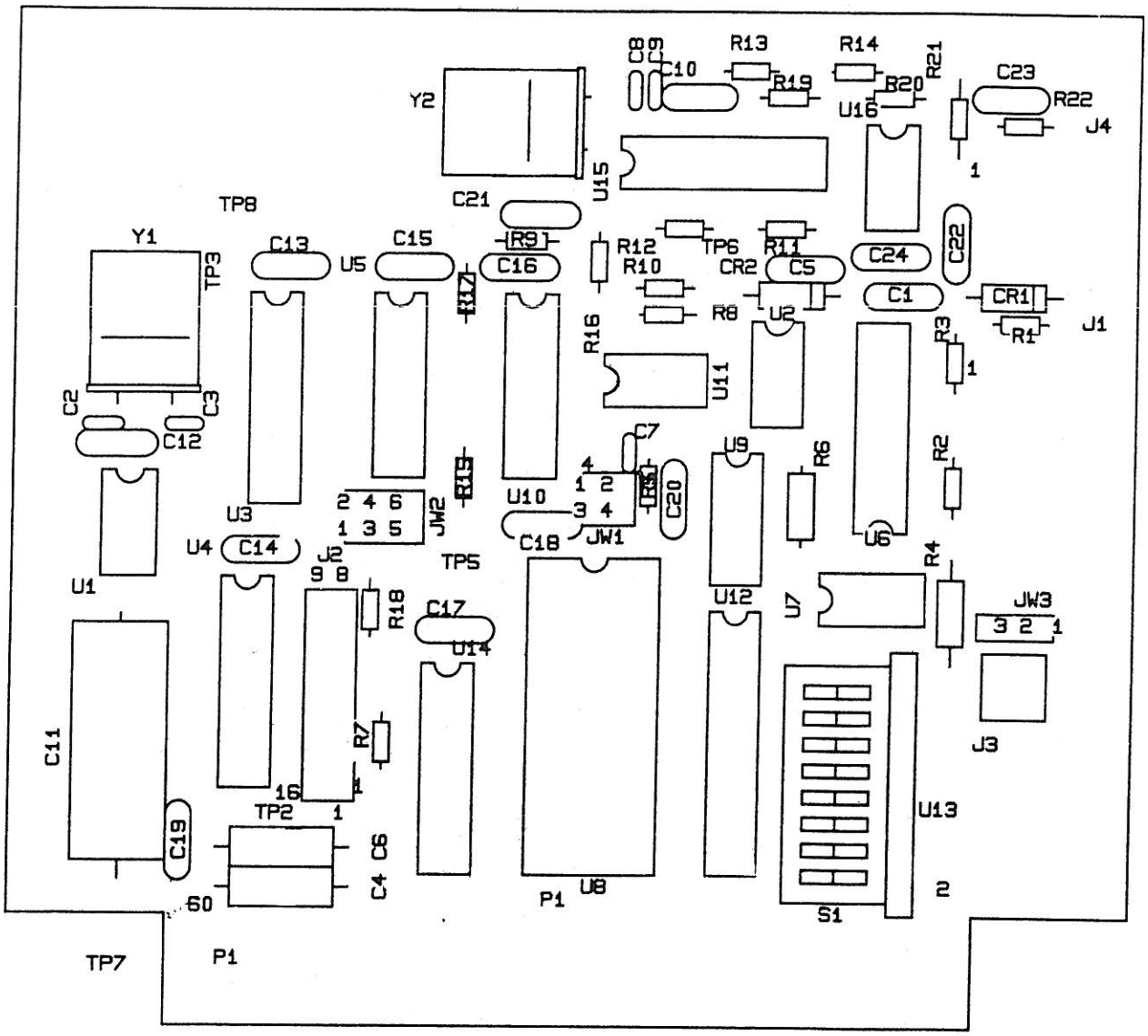

Figure R-4. Type 796617-1 RS-232 Location of Components