

KENWOOD

TS-850 series

**EXTERNAL CONTROL
INSTRUCTION MANUAL**

KENWOOD CORPORATION

1. SPECIFICATIONS

Interface

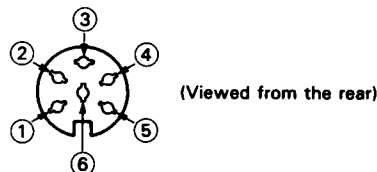
Communication method	Serial interface, full duplex
Transfer rate	4800BPS (bits per second)
Synchronization	Start-stop (Asynchronous)
Bit construction	1 start bit, 8 character bits, 2 stop bits
Parity	None
Signal format	TTL level

Terminal Connections

Pin No.	Signal Name		I/O
1	GND	Signal ground	
2	$\overline{\text{TXD}}$	Transmit data	Output
3	RXD	Receive data	Input
4	CTS	Transmit enable	Input
5	RTS	Receive enable	Output
6	NC	No connection	

- GND:** This is the signal ground terminal.
- $\overline{\text{TXD}}$:** The transmit data is the serial data from the transceiver to the computer. The output utilizes negative logic.
- RXD:** The receive data is the serial data from the computer to the transceiver. The input utilizes negative logic.
- CTS:** This signal is supplied from the computer, and is used to inhibit transmit data from the transceiver when the computer is not ready to receive. The input utilizes positive logic. (Transmit data is stopped by a logic low.)
- RTS:** This signal is applied to the computer, and is used to inhibit transmit data from the computer when the transceiver is not ready to receive it. The output utilizes positive logic. (Inhibit is requested when the level is low.)

Connector pin configuration



2. OPERATION

Caution
Turn the POWER switch OFF before making connections.

2-1. PRECAUTIONS FOR COMPUTER-CONNECTED OPERATION

When connecting the transceiver with a computer, check the following points.

1. Are the connections correct?
The transceiver output should be connected to the computer input and the transceiver input to the computer output.
Example:
Transceiver's transmission data — Computer's receive data
Transceiver's RTS — Computer's CTS
2. Is the computer's transmission rate 4800 BPS (bits per second)?
3. Is the computer's bit configuration correct?
1 start bit, 8 character bits, 2 stop bits, no parity.

2-2. CONTROL OPERATION

Most computers handle data in the form of "bits", and "bytes". A bit is the smallest piece of information that the computer can handle. A byte is composed of 8 bits. This is the most convenient form for most computer data. This data may be sent in the form of either serial or parallel data strings. The parallel mode is faster, but more complicated, while the serial form is slower it requires less complicated equipment, and therefore is less expensive.

Serial transmission of data occurs over a single line using time-division methods. This use of a single line also offers the advantage of reducing the number of errors due to line noise.

For control of the transceiver via the computer only three lines are theoretically required: transmit data (TXD), receive data (RXD), and ground (GND). From a practical standpoint it is also necessary to incorporate some means of controlling when this data transfer will occur. We don't want the computer and transceiver sending information at the same time! This is controlled by the RTS and the CTS lines.

The IF-232C is used in conjunction to provide voltage conversion. RS-232C deals in voltages above and below TTL levels, and must be converted to prevent damage to the transceiver. This interface/conversion is handled by the IF-232C.

The actual command sequence would be similar to those described below:

For example, the radio is placed into the transmit mode whenever the character string "TX;" is sent from the computer. The character string "TX;" is called a command. It tells the transceiver to do something. There are 31 different commands available for control of the transceiver. These commands may be incorporated into a computer

program written in BASIC or any other high level language such as PASCAL, etc. Programming methods vary from computer to computer so please refer to the instruction manuals included with your terminal program, and computer.

2-3. COMMANDS

The illustration below demonstrates that a command is composed of two alphabetical characters, various parameters, and the terminator to signal the end of the command.

Example:
 FA 00007000000 ; Command to set VFO A to 7 MHz.
 ↑ ↑ ↑
 Command Parameters Terminator

2-3-1. Command Description

A command may consist of either lower or upper case alphabetical characters.

2-3-2. Parameter Description (Refer to the parameter list.)

Parameters are used to specify specific information necessary to implement the desired command. The exact number of parameters necessary for each command is predetermined. If a particular parameter is not applicable to the transceiver you are controlling the parameter digits should be filled using any character except the terminator “;”.

For example the MC (Memory channel selector) command uses two parameters, 1 column to specify the memory bank number, and 2 columns to specify the memory channel number. To specify CH9 of memory bank number 1, the command would be:

“MC109;” The memory bank number is not necessary when programming the TS-850 so the command could be as given above “MC109” or as:

“MC_09;” In this case a blank has been used to fill the parameter block for the memory bank number.

The following are examples of bad commands:

“MC09;” No memory bank specification (not enough parameters)

“MC19;” Not enough digits in the memory channel parameter, i.e. CH9 should be given as “09”

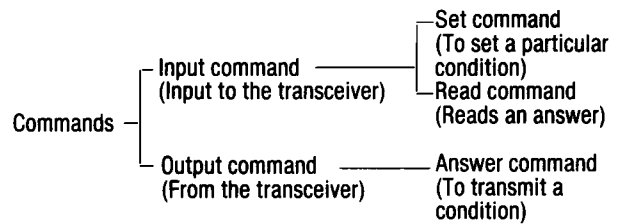
..... between parameters.

..... No terminator

terminator

end of a command it is necessary to use a special character. The character that has been selected for use is the semicolon“;”. This special character must appear as the last character in a command string.

2-3-4. Types of Commands



Commands can be classified as shown in the chart above. For example, with the FA (Frequency of VFO A) command.

- To set the frequency at 7 MHz, the command sent from the computer to the transceiver is: “FA00007000000;” (Set command)
- To read the frequency of VFO A, the command sent from the computer to the transceiver is: “FA;” (Read command)
- When the read command, above, has been sent, the command returned to the computer is: “FA00007000000;” (Answer command)

2-3-5. Error Messages

In addition to the answer command, the transceiver will send one of the following error messages:

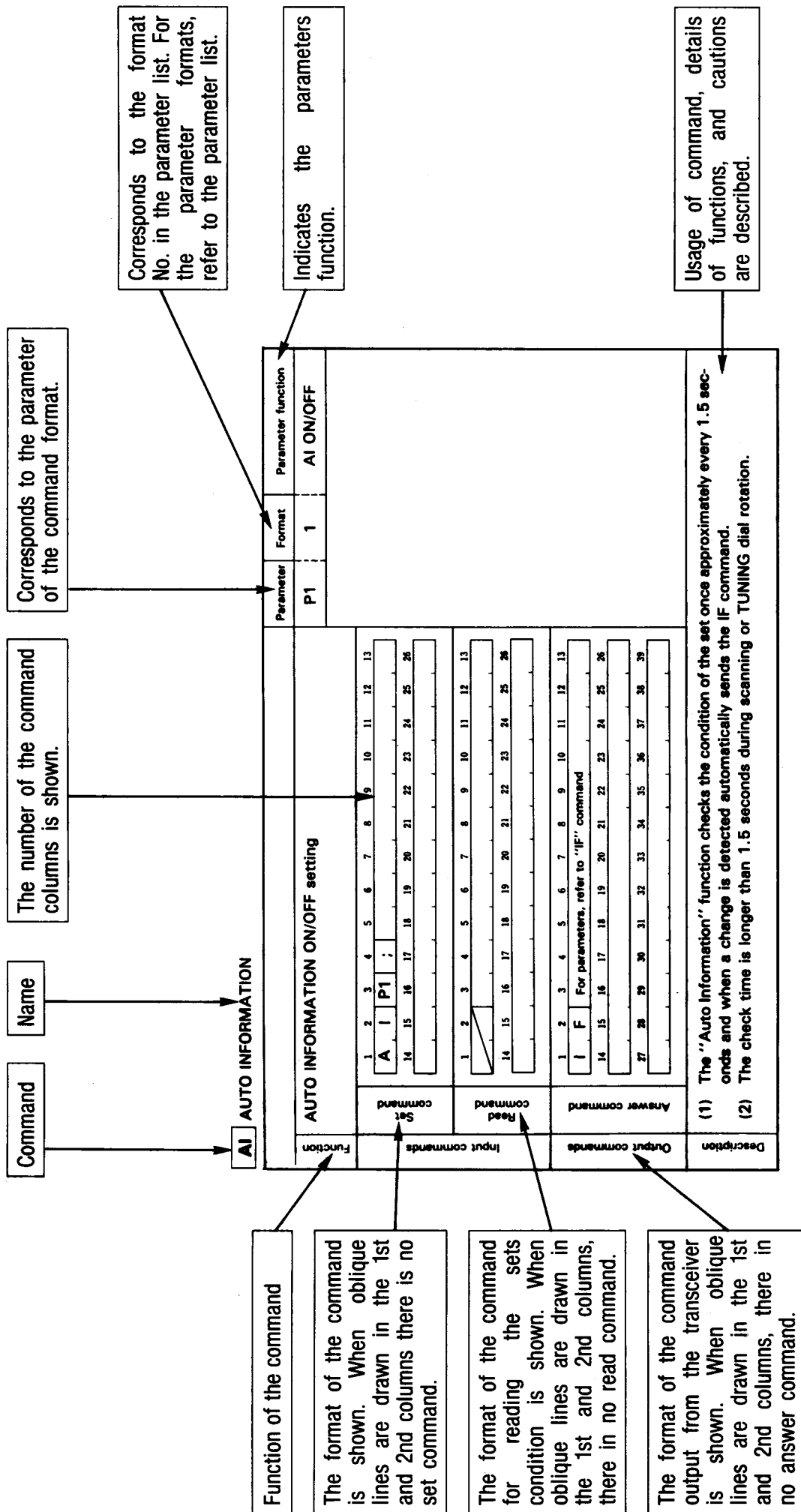
?	<input type="radio"/> When the command syntax is incorrect. <input type="radio"/> When the command was not executed due to the current status of the transceiver, even though the command syntax was correct. Note: Occasionally this message may not appear due to microprocessor transients in the transceiver.
E;	When a communication error occurs, such as an overrun error or framing error occurs during serial data transmissions.
0;	When the receive data is sent but processing cannot be completed.

“MC1009”

2-3-3. Term

To signal the use of a special character selected for use is the semicolon“;”. This special character must appear as the last character in a command string.

2-3-6. How to read the command tables



Command

Name

The number of the command columns is shown.

Corresponds to the parameter of the command format.

Corresponds to the format No. in the parameter list. For the parameter formats, refer to the parameter list.

Function of the command

The format of the command is shown. When oblique lines are drawn in the 1st and 2nd columns there is no set command.

The format of the command for reading the sets condition is shown. When oblique lines are drawn in the 1st and 2nd columns, there is no read command.

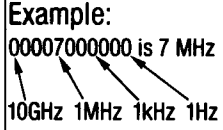
The format of the command output from the transceiver is shown. When oblique lines are drawn in the 1st and 2nd columns, there is no answer command.

Indicates the parameters function.

Usage of command, details of functions, and cautions are described.

AI AUTO INFORMATION		Parameter	Format	Parameter function
		P1	1	AI ON/OFF
AUTO INFORMATION ON/OFF setting				
Function		1 2 3 4 5 6 7 8 9 10 11 12 13		
Set command	A I P1 ;			
Input commands		14 15 16 17 18 19 20 21 22 23 24 25 26		
Read command				
Output commands		1 2 3 4 5 6 7 8 9 10 11 12 13		
	I F			
	For parameters, refer to "IF" command			
		14 15 16 17 18 19 20 21 22 23 24 25 26		
		27 28 29 30 31 32 33 34 35 36 37 38 39		
Description	(1) The "Auto Information" function checks the condition of the set once approximately every 1.5 seconds and when a change is detected automatically sends the IF command. (2) The check time is longer than 1.5 seconds during scanning or TUNING dial rotation.			

2-3-7. Parameter List

Format No.	Name	Number of columns	Format
1	SW	1	0=OFF 1=ON
2	MODE	1	1=LSB, 2=USB, 3=CW, 4=FM, 5=AM, 6=FSK, 7=CW-R, 8=TUNE, 9=FSK-R
3	FUNCTION	1	0=VFO A, 1=VFO B, 2=MEMORY
4	FREQUENCY	11	Represented in Hz, using 11 columns. Example: 00007000000 is 7 MHz 
5	RIT/XIT FREQUENCY	5	The first column is "+" or "-", and the remaining four columns indicate the frequency in Hz. Example: +0830 is +0.83 kHz
6	_____	—	
7	MEMORY CHANNEL	2	Represented in two columns. Example: 02 is CH2
8	_____	—	
9	MEMORY CHANNEL SPLIT SPECIFICATION	1	0=Receive 1=Transmit
10	MEMORY LOCKOUT	1	0=Not locked out 1=Locked out
11	TX/RX	1	0=Receive 1=Transmit
12	PASSBAND	2	Represented using two columns, from 00 to 20. "00" is the normal or wide position and "20" is the narrowest bandwidth.
13	_____	—	
14	tone FREQUENCY	2	Represented using two columns, from 01 to 38.
15	_____	—	

Format No.	Name	Number of columns	Format
16	MODEL NO.	3	Three column number specifying each set.
17	_____	—	
18	_____	—	
19	_____	—	
20	_____	—	
21	_____	—	
22	METER	4	0000(MIN)↔ 0030(MAX)
23	_____	—	
24	METER SW	1	0=NO SELECT, 1=SWR, 2=COMP, 3=ALC
25	PITCH	2	Represented using two columns, from 00 to 12. "00" is the low tone and "12" is the high tone.
26	FILTER	3	000=NO SELECT 002=FM WIDE 003=FM NARROW 005=AM, 007=SSB 009=CW 010=CW NARROW

2-3-8. Command Use Precautions

1. The control characters (00 to 1FH) when included in receive data are ignored.
2. Program execution may be delayed during rapid encoder rotation.
3. Receive data is not processed when directly entering the frequency from the keyboard.
4. To enter the transmitter frequency for split frequency operations using the MW command, enter any number from 1 thru 7, 9 as the mode and either a "0" or a "1" to indicate the memory channel lockout status.

2-3-9. Command List

Command	Function	Page
AI	AUTO INFORMATION	8
DN/UP	DOWN/UP	8
FA/FB	FREQUENCY VFO A/ FREQUENCY VFO B	9
FL	FILTER	9
FR/FT	FUNCTION RX/TX	10
ID	ID	10
IF	INFORMATION	11
LK	LOCK	11
MC	MEMORY CHANNEL	12
MD	MODE	12
MR	MEMORY READ	13
MW	MEMORY WRITE	13
MX	AIP	14
PT	PITCH	14
RC	RIT CLEAR	15
RD/RU	RIT DOWN/RIT UP	15
RM	READ METER	16
RT	RIT	16
RX/TX	RX/TX	17
SC	SCAN	17
SH/SL	SLOPE TUNE HIGH/LOW	18
SM	S METER	18
TN	TONE NUMBER	19
VR	VOICE RECALL	19
XT	XIT	20

AI AUTO INFORMATION

		Parameter	Format	Parameter function																																																																														
Function	AUTO INFORMATION ON/OFF setting			P1 1 AI ON/OFF																																																																														
Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>A</td><td>I</td><td>P1</td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	A	I	P1	;										14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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DN UP DOWN/UP

		Parameter	Format	Parameter function																																																																														
Function	Same function as microphone UP/DOWN switch																																																																																	
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FA **FB** FREQUENCY VFO A/FREQUENCY VFO B

		Parameter	Format	Parameter function																																																																														
Function	VFO A and VFO B frequency selection and readout		P1	4	FREQUENCY																																																																													
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FL FILTER

		Parameter	Format	Parameter function																																																																														
Function	FILTER selection		P1, P2	26	FILTER																																																																													
	Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>F</td><td>L</td><td colspan="2">P1</td><td colspan="2">P2</td><td>:</td><td colspan="6"></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td colspan="13"></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	F	L	P1		P2		:							14	15	16	17	18	19	20	21	22	23	24	25	26																																						
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Function	VFO A, VFO B and MEMORY CHANNEL setting		P1	3	FUNCTION																																																																													
	Input commands	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td colspan="2">FR</td> <td colspan="2">FT</td> <td colspan="2">P1</td> <td colspan="2">;</td> <td colspan="5"></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td colspan="13"> </td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	11	12	13	FR		FT		P1		;							14	15	16	17	18	19	20	21	22	23	24	25	26																																									
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Description																																																																																		

		Parameter	Format	Parameter function																																																																														
Function	Model No. readout transceiver recognition.		P1	16	MODEL No. 009																																																																													
	Input commands	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td colspan="2">/</td> <td colspan="11"></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td colspan="13"> </td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	11	12	13	/													14	15	16	17	18	19	20	21	22	23	24	25	26																																									
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Description																																																																																		

IF INFORMATION

		Parameter	Format	Parameter function	
Function	Display of transceivers current condition		P1	4	DISPLAY FREQUENCY
			P2	-	
Input commands	Set command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
	Read command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
14 15 16 17 18 19 20 21 22 23 24 25 26					
Output commands	Answer command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		27 28 29 30 31 32 33 34 35 36 37 38 39			
Description					

LK LOCK

		Parameter	Format	Parameter function	
Function	LOCK ON/OFF setting and display		P1	1	LOCK ON/OFF
Input commands	Set command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
	Read command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		1 2 3 4 5 6 7 8 9 10 11 12 13			
Output commands	Answer command	1 2 3 4 5 6 7 8 9 10 11 12 13			
		14 15 16 17 18 19 20 21 22 23 24 25 26			
		27 28 29 30 31 32 33 34 35 36 37 38 39			
Description					

MC MEMORY CHANNEL

		Parameter	Format	Parameter function																																																																														
Function	Memory channel setting		P1	—																																																																														
			P2	7	MEMORY CHANNEL																																																																													
Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>M</td><td>C</td><td>—</td><td>P2</td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	M	C	—	P2	;									14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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	Read command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13														14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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Output commands	Answer command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13														14	15	16	17	18	19	20	21	22	23	24	25	26														27	28	29	30	31	32	33	34	35	36	37	38	39													
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Description																																																																																		

MD MODE

		Parameter	Format	Parameter function																																																																														
Function	Mode setting		P1	2	MODE																																																																													
Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>M</td><td>D</td><td>P1</td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	M	D	P1	;										14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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	Read command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13														14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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Output commands	Answer command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13														14	15	16	17	18	19	20	21	22	23	24	25	26														27	28	29	30	31	32	33	34	35	36	37	38	39													
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Description																																																																																		

MR MEMORY READ

		Parameter	Format	Parameter function
Function	Memory display	P1	9	SPLIT SPECIFICATION
		P2	—	
Input commands	Set command	P3	7	MEMORY CHANNEL
		P4	4	FREQUENCY
		P5	2	MODE
		P6	10	MEMORY LOCKOUT
		P7	1	TONE ON/OFF
	Read command	P8	14	TONE FREQUENCY
		P9	—	
Output commands	Answer command			
Description	All parameters are set to OFF when the memory channel is vacant. To recall the lowest operating frequency of the section use P1 = 0, and to recall the highest operating frequency use P1 = 1.			

MW MEMORY WRITE

		Parameter	Format	Parameter function
Function	Memory entry	P1	9	SPLIT SPECIFICATION
		P2	—	
Input commands	Set command	P3	7	MEMORY CHANNEL
		P4	4	FREQUENCY
		P5	2	MODE (Except TUNE)
		P6	10	MEMORY LOCKOUT
		P7	1	TONE ON/OFF
	Read command	P8	14	TONE FREQUENCY
		P9	—	
Output commands	Answer command			
Description	(1) The MW command is valid when all parameters have been correctly entered. (2) When all effective frequency columns are "0", the memory is set to an open channel. (3) When the split channel is open, the transceiver will be set for the same transmit and receive frequencies, i.e. simplex. (4) To recall the lowest operating frequency of the section use P1 = 0, and to recall the highest operating frequency use P1 = 1.			

MX AIP (Advanced Intercept Point)

		Parameter	Format	Parameter function																																																																																
Function	AIP ON/OFF setting		P1	1	AIP ON/OFF																																																																															
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Description	<p>When this command is executed both the RIT and the XIT will be cleared. When using these commands the center frequency point on the RIT control may not coincide with the center point printed on the front panel. The center point will coincide with the position of the RIT control before these commands were initiated.</p>																																																							

RD **RU** RIT DOWN/UP

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Function	RIT/XIT frequency UP/DOWN																																																							
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Description	<p>When this command is executed both the RIT and the XIT will be changed. When using these commands the center frequency point on the RIT control may not coincide with the center point printed on the front panel. The center point will coincide with the position of the RIT control before these commands were initiated.</p>																																																							

RM READ METER

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Output commands	Answer command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>/</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	/													14	15	16	17	18	19	20	21	22	23	24	25	26														27	28	29	30	31	32	33	34	35	36	37	38	39													
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		Parameter	Format	Parameter function																																																																														
Function	RX: For receive operation TX: For transmit operation																																																																																	
Input commands	Set command	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td>RX</td><td>TX</td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	RX	TX	;											14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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Output commands	Answer command	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td colspan="2">/</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	/													14	15	16	17	18	19	20	21	22	23	24	25	26														27	28	29	30	31	32	33	34	35	36	37	38	39													
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Description	Place the REC/SEND switch to REC.																																																																																	

SC **SCAN**

		Parameter	Format	Parameter function																																																																														
Function	Scan ON/OFF setting		P1	1	SCAN ON/OFF																																																																													
Input commands	Set command	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td>S</td><td>C</td><td>P1</td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	S	C	P1	;										14	15	16	17	18	19	20	21	22	23	24	25	26																																							
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Output commands	Answer command	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td> </tr> <tr> <td colspan="2">/</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	/													14	15	16	17	18	19	20	21	22	23	24	25	26														27	28	29	30	31	32	33	34	35	36	37	38	39													
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SH SL SLOPE TUNE HIGH/SLOPE TUNE LOW

		Parameter	Format	Parameter function																																																																																													
Function	Slope tune band setting and readout.		P1	12	PASSBAND																																																																																												
Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>SH</td><td></td><td>P1</td><td></td><td>;</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>SL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13	SH		P1		;									SL													14	15	16	17	18	19	20	21	22	23	24	25	26																																									
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Description	When using these commands the slope tune band point on the SLOPE TUNE control may not coincide with the center point printed on the front panel. The center point will coincide with the position of the SLOPE TUNE control before these commands were initiated.																																																																																																

SM S-METER

		Parameter	Format	Parameter function																																																																																
Function	S-Meter signal output		P1	22	METER level																																																																															
Input commands	Set command	<table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>			1	2	3	4	5	6	7	8	9	10	11	12	13														14	15	16	17	18	19	20	21	22	23	24	25	26																																									
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Description	During transmit, the meter displays the transmitter power output.																																																																																			

TN TONE NUMBER

		Parameter	Format	Parameter function																																																																																
Function	Sub-tone frequency setting		P1	14	TONE FREQUENCY																																																																															
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Description		<table border="1"> <thead> <tr> <th>No.</th> <th>Hz</th> <th>No.</th> <th>Hz</th> </tr> </thead> <tbody> <tr><td>01</td><td>67.0</td><td>20</td><td>131.8</td></tr> <tr><td>02</td><td>71.9</td><td>21</td><td>136.5</td></tr> <tr><td>03</td><td>74.4</td><td>22</td><td>141.3</td></tr> <tr><td>04</td><td>77.0</td><td>23</td><td>146.2</td></tr> <tr><td>05</td><td>79.7</td><td>24</td><td>151.4</td></tr> <tr><td>06</td><td>82.5</td><td>25</td><td>156.7</td></tr> <tr><td>07</td><td>85.4</td><td>26</td><td>162.2</td></tr> <tr><td>08</td><td>88.5</td><td>27</td><td>167.9</td></tr> <tr><td>09</td><td>91.5</td><td>28</td><td>173.8</td></tr> <tr><td>10</td><td>94.8</td><td>29</td><td>179.9</td></tr> <tr><td>11</td><td>97.4</td><td>30</td><td>186.2</td></tr> <tr><td>12</td><td>100.0</td><td>31</td><td>192.8</td></tr> <tr><td>13</td><td>103.5</td><td>32</td><td>203.5</td></tr> <tr><td>14</td><td>107.2</td><td>33</td><td>210.7</td></tr> <tr><td>15</td><td>110.9</td><td>34</td><td>218.1</td></tr> <tr><td>16</td><td>114.8</td><td>35</td><td>225.7</td></tr> <tr><td>17</td><td>118.8</td><td>36</td><td>233.6</td></tr> <tr><td>18</td><td>123.0</td><td>37</td><td>241.8</td></tr> <tr><td>19</td><td>127.3</td><td>38</td><td>250.3</td></tr> </tbody> </table>			No.	Hz	No.	Hz	01	67.0	20	131.8	02	71.9	21	136.5	03	74.4	22	141.3	04	77.0	23	146.2	05	79.7	24	151.4	06	82.5	25	156.7	07	85.4	26	162.2	08	88.5	27	167.9	09	91.5	28	173.8	10	94.8	29	179.9	11	97.4	30	186.2	12	100.0	31	192.8	13	103.5	32	203.5	14	107.2	33	210.7	15	110.9	34	218.1	16	114.8	35	225.7	17	118.8	36	233.6	18	123.0	37	241.8	19	127.3	38	250.3
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VR VOICE RECALL

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Function	Generation of synthesized voice.																																																																																		
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Description		Requires the use of the optional VS-2 Voice Synthesizer.																																																																																	

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