



**FT-450**

**CAT OPERATION**

**REFERENCE BOOK**

**VERTEX STANDARD CO., LTD.**

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

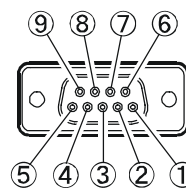
## OVERVIEW

The CAT (Computer Aided Transceiver) System in the **FT-450** provides control of frequency, VFO, memory, and other settings such as dual-channel memories and diversity reception using an external personal computer. This allows multiple control operations to be fully automated as single mouse clicks or keystroke operations on the computer keyboard.

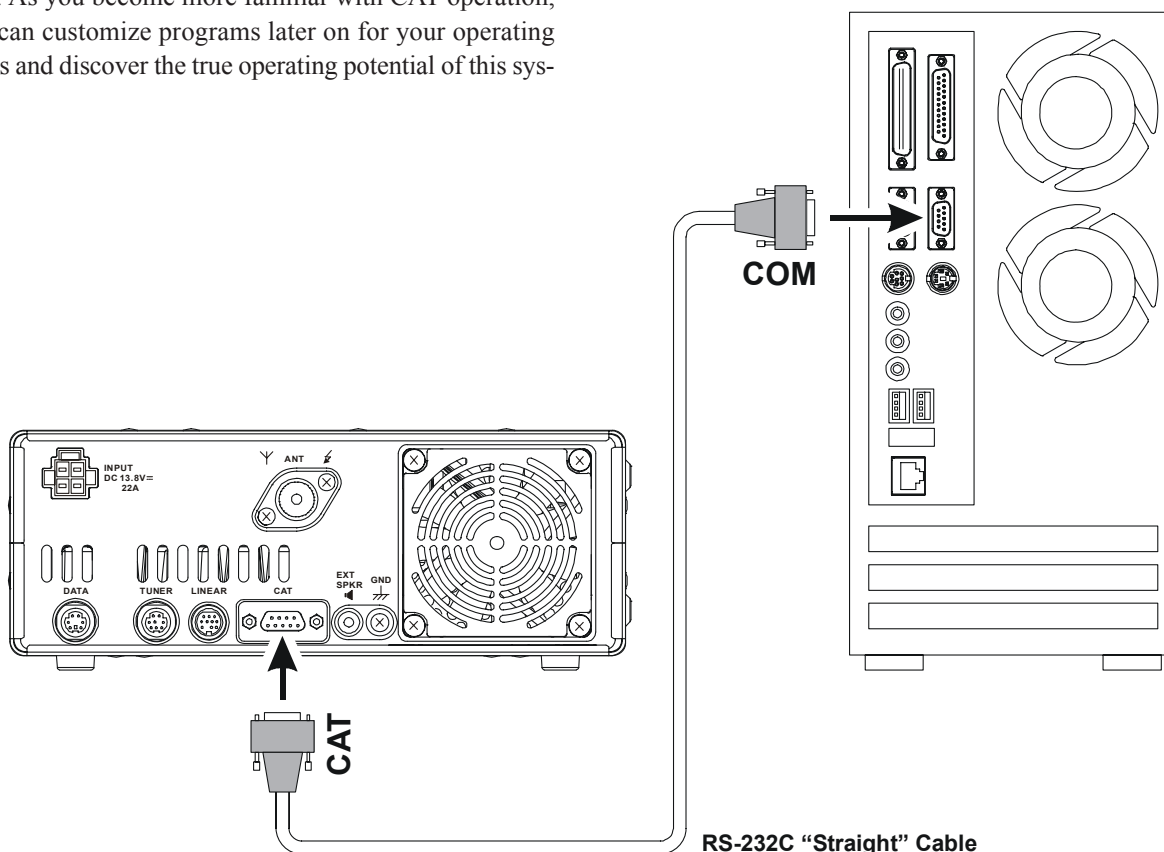
The **FT-450** has a built-in level converter, allowing direct connection from the rear-panel **CAT** jack to the serial port of your computer without the need of any external boxes. You will need a serial cable for connection to the RS-232C (serial or COM port) connector on your computer. Purchase a standard serial cable (not the so-called "null modem" type), ensuring it has the correct gender and number of pins (some serial COM port connectors use a 9-pin rather than 25-pin configuration). If your computer uses a custom connector, you may have to construct the cable. In this case, refer to the technical documentation supplied with your computer for correct data connection.

Vertex Standard does not produce CAT System operating software due to the wide variety of personal computers and operating systems in use today. However, the information provided in this chapter explains the serial data structure and opcodes used by the CAT system. This information, along with the short programming examples, is intended to help you start writing programs on your own. As you become more familiar with CAT operation, you can customize programs later on for your operating needs and discover the true operating potential of this system.

## CAT JACK



PIN No.	PIN NAME	I/O	FUNCTION
①	N/A	—	—
②	SERIAL OUT	Output	Outputs the Serial Data from the transceiver to the computer.
③	SERIAL IN	Input	Inputs the Serial Data from the computer to the transceiver.
④	N/A	—	—
⑤	GND	—	Signal Ground
⑥	N/A	—	—
⑦	RTS	Input	When the computer is not ready to receive data, this port goes "L" to inhibit transmit data from the transceiver.
⑧	CTS	Output	When the transceiver is not ready to receive data, this port goes "L" to inhibit the transmit data from the computer.
⑨	N/A	—	—



# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND

A computer control command is composed of an alphabetical command, various parameters, and the terminator that signals the end of the control command.

**Example:** Set the VFO-A frequency to 14.250000 MHz.

<b>FA</b>	<b>14250000</b>	<b>;</b>
↑	↑	↑
Command	Parameter	Terminator

There are three types of commands for the **FT-450** as shown below:

**Set** command: Set a particular condition  
(to the **FT-450**)

**Read** command: Reads an answer  
(from the **FT-450**)

**Answer** command: Transmits a condition  
(from the **FT-450**)

For example, note the following in the case of the FA command (Set the VFO-A frequency):

- To set the VFO-A frequency to 14.250000 MHz, the following command is sent from the computer to the transceiver:  
“**FA14250000;**” (Set command)
- To read the VFO-A frequency, the following command is sent from the computer to the transceiver:  
“**FA;**” (Read command)
- When the Read command above has been sent, the following command is returned to the computer:  
“**FA14250000;**” (Answer command)

### Alphabetical Commands

A command consists of 2 alphabetical characters.

You may use either lower or upper case characters. The commands available for this transceiver are listed in the “PC Control Command Tables” on the following pages.

### Parameters

Parameters are used to specify information necessary to implement the desired command.

The parameters to be used for each command are predetermined. The number of digits assigned to each parameter is also predetermined. Refer to the “Control Command List” and the “Control Command Tables” to configure the appropriate parameters.

When configuring parameters, be careful not to make the following mistakes.

**For example**, when correct parameter is “**IS0+1000**” (IF SHIFT):

**IS01000;**  
Not enough parameters specified (No direction (+) given for the IF shift)

**IS0+100;**  
Not enough digits (Only three frequency digits given)

**IS0+\_1000;**  
Unnecessary characters between parameters

**IS0+10000;**  
Too many digits (Five frequency digits given)

**Note:** If a particular parameter is not applicable to the **FT-450**, the parameter digits should be filled using any character except the ASCII control codes (00 to 1Fh) and the terminator (;).

### Terminator

To signal the end of a command, it is necessary to use a semicolon (;). The digit where this special character must appear differs depending on the command used.

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND LIST

COMMAND	FUNCTION	SET	READ	ANS.	AI	COMMAND	FUNCTION	SET	READ	ANS.	AI
AC	ANTENNA TUNER CONTROL	0	0	0	0	MW	MEMORY WRITE	0	X	X	X
AG	AF GAIN	0	0	0	0	NA	NARROW	0	0	0	0
AI	AUTO INFORMATION	0	0	0	X	NB	NOISE BLANKER	0	0	0	0
BD	BAND DOWN	0	X	X	X	NR	NOISE REDUCTION	0	0	0	0
BI	BREAK-IN	0	0	0	0	OI	OPPOSITE BAND INFORMATION	X	0	0	X
BP	MANUAL NOTCH	0	0	0	0	OS	OFFSET (REPEATER SHIFT)	0	0	0	0
BS	BAND SELECT	0	X	X	X	PA	PRE-AMP (IPO)	0	0	0	0
BU	BAND UP	0	X	X	X	PB	PLAY BACK	0	0	0	X
BY	BUSY	X	0	0	0	PC	POWER CONTROL	0	0	0	0
CH	CHANNEL UP/DOWN	0	X	X	X	PS	POWER SWITCH	0	0	0	X
CN	CTCSS NUMBER	0	0	0	0	QI	QMB STORE	0	X	X	X
CO	CONTOUR	0	0	0	0	QR	QMB RECALL	0	X	X	X
CS	CW SPOT	0	0	0	0	QS	QUICK SPLIT	0	X	X	X
CT	CTCSS	0	0	0	0	RA	RF ATTENUATOR	0	0	0	0
DA	DIMMER	0	0	0	X	RC	CLAR CLEAR	0	X	X	X
DN	MIC DOWN	0	X	X	X	RD	CLAR DOWN	0	X	X	X
DS	DIMMER SWITCH	0	0	0	0	RG	RF GAIN	0	0	0	0
ED	ENCODER DOWN	0	X	X	X	RI	RADIO INFORMATION	X	0	0	0
EU	ENCODER UP	0	X	X	X	RL	NOISE REDUCTION LEVEL	0	0	0	0
EX	MENU	0	0	0	0	RM	READ METER	X	0	0	0
FA	FREQUENCY VFO-A	0	0	0	0	RP	RESET POWER ON	0	X	X	X
FB	FREQUENCY VFO-B	0	0	0	0	RS	RADIO STATUS	X	0	0	0
FS	FAST STEP	0	0	0	0	RT	CLAR	0	0	0	0
FT	FUNCTION TX	0	0	0	0	RU	CLAR UP	0	X	X	X
GT	AGC FUNCTION	0	0	0	0	SC	SCAN	0	0	0	0
ID	IDENTIFICATION	X	0	0	X	SD	SEMI BREAK-IN DELAY TIME	0	0	0	0
IF	INFORMATION	X	0	0	0	SH	WIDTH	0	0	0	0
IS	IF-SHIFT	0	0	0	0	SM	S METER	X	0	0	0
KM	KEYER MEMORY	0	0	0	X	SQ	SQUELCH LEVEL	0	0	0	0
KP	KEY PITCH	0	0	0	0	ST	STEP	0	0	0	0
KR	KEYER	0	0	0	0	SV	SWAP VFO	0	X	X	X
KS	KEY SPEED	0	0	0	0	TS	TXW	0	0	0	0
KY	CW KEYING	0	X	X	X	TX	TX SET	0	0	0	0
LK	LOCK	0	0	0	0	UL	UNLOCK	X	0	0	0
LM	LOAD MESSAGE	0	0	0	X	UP	MIC UP	0	X	X	X
MC	MEMORY CHANNEL	0	0	0	X	VD	VOX DELAY TIME	0	0	0	0
MD	MODE	0	0	0	0	VG	VOX GAIN	0	0	0	0
MG	MIC GAIN	0	0	0	0	VM	[V/M] KEY FUNCTION	0	X	X	X
MK	MODE KEY	0	X	X	X	VR	VOICE	0	0	0	X
ML	MONITOR LEVEL	0	0	0	0	VS	VFO SELECT	0	0	0	0
MR	MEMORY READ	X	0	0	X	VV	VFO TO VFO	0	0	0	0
MS	METER SW	0	0	0	0	VX	VOX	0	0	0	0

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>AC</b>	<b>ANTENNA TUNER CONTROL</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Fixed	P3	0: Tuner "OFF"
	<b>A</b>	<b>C</b>	P1	P2	P3	;					P2	0: Fixed	1: Tuner "ON"	
Read	1	2	3	4	5	6	7	8	9	10			2: Tuning Start	
	<b>A</b>	<b>C</b>	;											
Answer	1	2	3	4	5	6	7	8	9	10				
	<b>A</b>	<b>C</b>	P1	P2	P3	;								

<b>AG</b>	<b>AF GAIN</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Fixed		
	<b>A</b>	<b>G</b>	P1	P2	P2	P2	;				P2	000 - 255		
Read	1	2	3	4	5	6	7	8	9	10				
	<b>A</b>	<b>G</b>	P1	;										
Answer	1	2	3	4	5	6	7	8	9	10				
	<b>A</b>	<b>G</b>	P1	P2	P2	P2	;							

<b>AI</b>	<b>AUTO INFORMATION</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Auto Information "OFF"		
	<b>A</b>	<b>I</b>	P1	;							1: Auto Information "ON"			
Read	1	2	3	4	5	6	7	8	9	10			This parameter is set to "0" (OFF) automatically when the transceiver is turned "OFF."	
	<b>A</b>	<b>I</b>	;											
Answer	1	2	3	4	5	6	7	8	9	10				
	<b>A</b>	<b>I</b>	P1	;										

<b>BD</b>	<b>BAND DOWN</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: VFO-A		
	<b>B</b>	<b>D</b>	P1	;							1: VFO-B			
Read	1	2	3	4	5	6	7	8	9	10				
Answer	1	2	3	4	5	6	7	8	9	10				

<b>BI</b>	<b>BREAK-IN</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Break-in "OFF"		
	<b>B</b>	<b>I</b>	P1	;							1: Break-in "ON"			
Read	1	2	3	4	5	6	7	8	9	10				
	<b>B</b>	<b>I</b>	;											
Answer	1	2	3	4	5	6	7	8	9	10				
	<b>B</b>	<b>I</b>	P1	;										

<b>BP</b>	<b>MANUAL NOTCH</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Fixed	P3	When P2=0
	<b>B</b>	<b>P</b>	P1	P2	P3	P3	P3	;			P2	0: Manual NOTCH "ON/OFF"	000: OFF	
Read	1	2	3	4	5	6	7	8	9	10	1: Manual NOTCH Position	001: ON		
	<b>B</b>	<b>P</b>	P1	P2	;						When P2=1	001 - 199: NOTCH position move to left		
Answer	1	2	3	4	5	6	7	8	9	10			200: NOTCH position move to center	
	<b>B</b>	<b>P</b>	P1	P2	P3	P3	P3	;					201 - 400: NOTCH position move to right	

<b>BS</b>	<b>BAND SELECT</b>												
Set	1	2	3	4	5	6	7	8	9	10	P1	00: 1.8 MHz	06: 18 MHz
	<b>B</b>	<b>S</b>	P1	P1	;						01: 3.5 MHz	07: 21 MHz	
Read	1	2	3	4	5	6	7	8	9	10		02: Invalid	08: 24.5 MHz
											03: 7 MHz	09: 28 MHz	
Answer	1	2	3	4	5	6	7	8	9	10		04: 10 MHz	10: 50 MHz
											05: 14 MHz	11: GEN	

<b>BU</b>	<b>BAND UP</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: Fixed		
	<b>B</b>	<b>U</b>	P1	;										
Read	1	2	3	4	5	6	7	8	9	10				
Answer	1	2	3	4	5	6	7	8	9	10				

<b>BY</b>	<b>BUSY</b>													
Set	1	2	3	4	5	6	7	8	9	10	P1	0: BUSY "OFF"		
											1: BUSY "ON"			
Read	1	2	3	4	5	6	7	8	9	10	P2	0: Fixed		
	<b>B</b>	<b>Y</b>	;											
Answer	1	2	3	4	5	6	7	8	9	10				
	<b>B</b>	<b>Y</b>	P1	P2	;									

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

CH	CHANNEL UP/DOWN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Memory Channel "UP" 1: Memory Channel "DOWN"
	C	H	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

CN	CTCSS TONE FREQUENCY										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 00 - 49: Tone Frequency Number (See Table 1)
	C	N	P1	P2	P2	;					
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	C	N	P1	P2	P2	;					

CO	CONTOUR										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: CONTOUR "ON/OFF" 1: CONTOUR Frequency P3 When P2=0, -2: CONTOUR "ON" -12 dB -1: CONTOUR "ON" -6 dB 00: CONTOUR "OFF" +1: CONTOUR "ON" +6 dB +2: CONTOUR "ON" +12 dB When P2=1, 01 ~ 07: 250 Hz 08 ~ 13: 500 Hz 14 ~ 19: 1 kHz 20 ~ 25: 2 kHz 26 ~ 32: 4 kHz
	C	O	P1	P2	P3	P3	;				
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	C	O	P1	P2	P3	P3	;				

CS	CW SPOT										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: OFF 1: ON
	C	S	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	C	S	P1	;							

CT	CTCSS										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: CTCSS "OFF" 1: CTCSS ENC/DEC "ON" 2: CTCSS ENC "ON"
	C	T	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	C	T	P1	P2	;						

DA	DIMMER										
Set	1	2	3	4	5	6	7	8	9	10	P1 00 - 04 P2 00: Fixed
	D	A	P1	P1	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	D	A	P1	P1	P2	P2	;				

DN	MIC DWN										
Set	1	2	3	4	5	6	7	8	9	10	
	D	N	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

DS	DIMMER SWITCH										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: DIMMER "OFF" 1: DIMMER "ON"
	D	S	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	D	S	P1	;							

TABLE 1

CTCSS TONE CHART											
00	67.0 Hz	09	91.5 Hz	18	123.0 Hz	27	162.2 Hz	36	189.9 Hz	45	229.1 Hz
01	69.3 Hz	10	94.8 Hz	19	127.3 Hz	28	165.5 Hz	37	192.8 Hz	46	233.6 Hz
02	71.9 Hz	11	97.4 Hz	20	131.8 Hz	29	167.9 Hz	38	196.6 Hz	47	241.8 Hz
03	74.4 Hz	12	100.0 Hz	21	136.5 Hz	30	171.3 Hz	39	199.5 Hz	48	250.3 Hz
04	77.0 Hz	13	103.5 Hz	22	141.3 Hz	31	173.8 Hz	40	203.5 Hz	49	254.1 Hz
05	79.7 Hz	14	107.2 Hz	23	146.2 Hz	32	177.3 Hz	41	206.5 Hz	--	--
06	82.5 Hz	15	110.9 Hz	24	151.4 Hz	33	179.9 Hz	42	210.7 Hz	--	--
07	85.4 Hz	16	114.8 Hz	25	156.7 Hz	34	183.5 Hz	43	218.1 Hz	--	--
08	88.5 Hz	17	118.8 Hz	26	159.8 Hz	35	186.2 Hz	44	225.7 Hz	--	--

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>ED</b>		<b>ENCODER DOWN</b>										
Set		1	2	3	4	5	6	7	8	9	10	P1 0:Fixed P2 01-99: Steps
	<b>E</b>	<b>D</b>	P1	P2	P2	;						
Read		1	2	3	4	5	6	7	8	9	10	
Answer		1	2	3	4	5	6	7	8	9	10	

<b>EU</b>		<b>ENCODER UP</b>										
Set		1	2	3	4	5	6	7	8	9	10	P1 0:Fixed P2 01-99: Steps
	<b>E</b>	<b>U</b>	P1	P2	P2	;						
Read		1	2	3	4	5	6	7	8	9	10	
Answer		1	2	3	4	5	6	7	8	9	10	

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

EX	MENU										P1 001-064 (MENU Number) P2 Parameter (See Table 2)
Set	1	2	3	4	5	6	7	8	nn	**	
	E	X	P1	P1	P1	P2	P2	~	P2	;	
Read	1	2	3	4	5	6	7	8	9	10	
	E	X	P1	P1	P1	;					
Answer	1	2	3	4	5	6	7	8	nn	**	
	E	X	P1	P1	P1	P2	P2	~	P2	;	

TABLE 2

P1	FUNCTION	P2
001	EXT MNU	0: OFF 1: ON
002	AM & FMDIAL	0: DISABLE 1: ENABLE
003	APO TIME	00 (OFF) ~ 01 (hour) ~ 12 (hour)
004	BEACON TIME	000 (OFF) ~ 001 (sec) ~ 255 (sec)
005	BEACON TEXT	---
006	BEEP TONE	0: 440 Hz 1: 880 Hz 2: 1760 Hz
007	BEEPVOL	000 (FIX 0) ~ 100 (FIX100) or 101 (LNK-50) ~ 151 (LNK0) ~ 201 (LNK+50)
008	CAT RTS	0: DISABLE 1: ENABLE
009	CAT TIME OUT TIME	0: 10 msec 1: 100 msec 2: 1000 msec 3: 3000 msec
010	CATRATE	1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: DATA
011	CLAR DIAL / SEL	0: DIAL 1: SEL
012	CLOCK SHIFT	0: OFF 1: ON
013	DISP CONTRAST	01 ~ 24
014	CW AUTO MODE	0: OFF 1: ON
015	CW BFO	0: USB 1: LSB 2: AUTO
016	CW DELAY	0000 (FULL) / 0030 (msec) ~ 3000 (msec)
017	CW KEY REVERSE	0: NORMAL 1: REVERSE
018	CW QSK	0: 15 msec 1: 20 msec 2: 25 msec 3: 30 msec
019	CW PADDLE	0: KEY 1: MIC
020	CWPITCH	00 - 02: 400 Hz 03 - 04: 500 Hz 05 - 06: 600 Hz 07 - 08: 700 Hz 09 - 15: 800 Hz
021	CWSPEED	04 (wpm) ~ 60 (wpm)
022	CW SIDE TONE	000 (FIX 0) ~ 100 (FIX100) or 101 (LNK-50) ~ 151 (LNK0) ~ 201 (LNK+50)
023	CW TRAINING	0: N (Numeric Character Only) 1: A (Alphabet Character Only) 2: M (Mixed: Numeric and Alphabet Character)
024	CW WEIGHT	25 (1:2.5) ~ 45 (1:4.5)
025	DATA DISP	-300 (-3000 Hz) ~ +000 (0 Hz) ~ +300 (+3000 Hz)
026	DATA MODE	0: RTTY 1: USER-L 2: USER-U
027	Not Used	---
028	Not Used	---
029	DIAL STEP	0: 1 Hz 1: 10 Hz 2: 20 Hz 3: 100 Hz 4: 200 Hz
030	DIG VOX	000 (OFF) ~ 100
031	EMERGENCY	0: OFF 1: ON
032	KEY HOLD TIME	0: 0.5 sec 1: 1.0 sec 2: 1.5 sec 3: 2.0 sec
033	LOCK MODE	0: FREQ 1: PANEL 2: ALL
034	M-TUNE	0: OFF 1: ON
035	MEMORY GROUP	0: OFF 1: ON
036	MEMORY TAG	0: TAG-OFF 1: TAG NAME
037	MIC EQ	0 ~ 9
038	MIC GAIN	0: LOW 1: NOR 2: HIGH
039	MIC AUTO SCAN	0: OFF 1: ON
040	MY BAND	See Table 3
041	MY MODE	See Table 4
042	MIC-DOWN PG	See Table 5
043	MIC-FAST PG	See Table 5
044	MIC-UP PG	See Table 5
045	METER PEAK HOLD	0: OFF 1: ON
046	PANEL'S CUSTOM SWITCH	See Table 5
047	QUICK SPLIT FREQ	-20 (kHz) ~ +00 (kHz) ~ +20 (kHz)
048	RF POWER SET	005 ~ 100
049	REPEATER SHIFT DIRECTION	0: SIMPLEX 1: +SHIFT 2: - SHIFT
050	REPEATER SHIFT OFFSET	000 (0 MHz) ~ 999 (99.9 MHz)
051	RTTY SHIFT	1: 170 Hz 2: 200 Hz 3: 425 Hz 4: 850 Hz
052	RTTY TONE	1: 1275 Hz 2: 2125 Hz
053	RTTY RX POLARITY	0: NORMAL 1: REVERSE
054	RTTY TX POLARITY	0: NORMAL 1: REVERSE
055	SCAN RESUME	00: BUSY 01 (TIME: 1 sec) ~ 10 (TIME: 10 sec)
056	SEL DIAL MODE	0: CW Sidetone Level 1: CW KEYER Speed 2: 100kHz Step 3: 1MHz Step 4: MIC GAIN Set 5: RF Power Set
057	SQL TYPE	0: OFF 1: ENC 2: ENC DEC
058	SQL/RF GAIN	0: SQL 1: RF GAIN
059	STBY BEEP	0: OFF 1: ON
060	TONE FREQ	See Table 6
061	TOT TIME	00 (OFF) ~ 01 (minute) ~ 20 (minute)
062	TUNER/ATAS	0: ATAS 1: EXT ATU 2: INT ATU 3: INTRATU 4: F TRANS
063	VOX DELAY	01 (100 msec) ~ 30 (300 msec)
064	VOXGAIN	001 ~ 255



# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

TABLE 3

MY BAND			
P2	FUNCTION	P2	FUNCTION
000	1.8 MHz "OFF"	100	1.8 MHz "ON"
001	3.5 MHz "OFF"	101	3.5 MHz "ON"
003	7 MHz "OFF"	103	7 MHz "ON"
004	10 MHz "OFF"	104	10 MHz "ON"
005	14 MHz "OFF"	105	14 MHz "ON"
006	18 MHz "OFF"	106	18 MHz "ON"
007	21 MHz "OFF"	107	21 MHz "ON"
008	24.5 MHz "OFF"	108	24.5 MHz "ON"
009	28 MHz "OFF"	109	28 MHz "ON"
010	50 MHz "OFF"	110	50 MHz "ON"

TABLE 4

MY MODE			
P2	FUNCTION	P2	FUNCTION
01	LSB "OFF"	11	LSB "ON"
02	USB "OFF"	12	USB "ON"
03	CW "OFF"	13	CW "ON"
04	FM "OFF"	14	FM "ON"
05	AM "OFF"	15	AM "ON"
06	DATA (RTTY-LSB) "OFF"	16	DATA (RTTY-LSB) "ON"
07	CW-R "OFF"	17	CW-R "ON"
08	USER-L "OFF"	18	USER-L "ON"
09	DATA (RTTY-USB) "OFF"	19	DATA (RTTY-USB) "ON"
0A	N.A.	1A	N.A.
0B	FM-N "OFF"	1B	FM-N "ON"
0C	USER-U "OFF"	1C	USER-U "ON"

TABLE 5

P2	FUNCTION	
01	MONI	Activates the Monitor function.
02	N/A	No Function.
03	P/B	Activates the Digital Voice Recorder.
04	PLAY1	Send the CW message, which is memorized in BEACON TEXT 1.
05	PLAY2	Send the CW message, which is memorized in BEACON TEXT 2.
06	PLAY3	Send the CW message, which is memorized in BEACON TEXT 3.
07	QSPL	Activates Quick Split Operation
08	SPOT	Generates a CW Spot Tone when using CW mode.
09	SQLOFF	Opens the noise squelch.
10	SWR	Transmits a 10 watts carrier (CW mode) to measure the SWR ratio.
11	TXW	Monitor the transmit frequency when Split Frequency operation is engaged.
12	VCC	Display the DC supply voltage.
13	VOICE2	Announces the current S-meter reading, operating frequency (with resolution to the displayed 100 Hz digit), and operating mode.
14	VM1MONI	Play back the voice message, which is memorized in Voice Memory 1.
15	VM1REC	Store the voice message into Voice Memory 1.
16	VM1TX	Send the voice message, which is memorized in Voice Memory 1.
17	VM2MONI	Play back the voice message, which is memorized in Voice Memory 2.
18	VM2REC	Store the voice message into Voice Memory 2.
19	VM2TX	Send the voice message, which is memorized in Voice Memory 2.
20	DOWN	Decreases the VFO frequency by one step or moves the memory channel to the next-lowest channel.
21	FAST	Set to the same function as the front panel's [FAST] button.
22	UP	Increases the VFO frequency by one step or moves the memory channel to the next-highest channel.
23	DSP	Set to the same function as the front panel's [DSP] button.
24	ATT/IPO	Set to the same function as the front panel's [ATT/IPO] button.
25	NB	Set to the same function as the front panel's [NB] button.
26	AGC	Set to the same function as the front panel's [AGC] button.
27	MODEDN	Set to the same function as the front panel's [MODE▼] button.
28	MODEUP	Set to the same function as the front panel's [MODE▲] button.
29	DSP/SEL	Set to the same function as the front panel's [DSP/SEL] button.
30	KEYER	Set to the same function as the front panel's [KEYER] button.
31	CLAR	Set to the same function as the front panel's [CLAR] button.
32	BANDDN	Set to the same function as the front panel's [BAND▼] button.
33	BANDUP	Set to the same function as the front panel's [BAND▲] button.
34	A=B	Set to the same function as the front panel's [A=B] button.
35	A/B	Set to the same function as the front panel's [A/B] button.
36	LOCK	Set to the same function as the front panel's [LOCK] button.
37	TUNE	Set to the same function as the front panel's [TUNE] button.
38	VOICE	Announce the current operating frequency (with resolution to the displayed 100 Hz digit) and operating mode.
39	MW	Copies the current operating data from the VFO into the currently selected memory channel.
40	V/M	Toggles frequency control between VFO and memory system.
41	HOME	Recall the "Home" (favorite frequency) channel.
42	RCL	Recall the QMB (Quick Memory Bank) memory.
43	VOX	Activate the VOX (automatic voice-actuated transmitter switching) feature.
44	STO	Copies operating data into QMB (Quick Memory Bank) Memory.
45	STEP	Enables the setting of the frequency step of the [DSP/SEL] knob by the [DSP/SEL] knob.
46	SPLIT	Activates split frequency operation between VFO-A and VFO-B.
47	PMS	Engages Programmable Memory Scan (PMS).
48	SCAN	Initiates the upward scanning of VFO frequencies or memory channels.
49	MENU	Engage the "Menu" mode.
50	DIMMER	Enables adjustment of the display dimmer level by the [DSP/SEL] knob.
51	MTR	Change the meter function in the transmit mode.

TABLE 6

CTCSS TONE CHART											
00	67.0 Hz	09	91.5 Hz	18	123.0 Hz	27	162.2 Hz	36	189.9 Hz	45	229.1 Hz
01	69.3 Hz	10	94.8 Hz	19	127.3 Hz	28	165.5 Hz	37	192.8 Hz	46	233.6 Hz
02	71.9 Hz	11	97.4 Hz	20	131.8 Hz	29	167.9 Hz	38	196.6 Hz	47	241.8 Hz
03	74.4 Hz	12	100.0 Hz	21	136.5 Hz	30	171.3 Hz	39	199.5 Hz	48	250.3 Hz
04	77.0 Hz	13	103.5 Hz	22	141.3 Hz	31	173.8 Hz	40	203.5 Hz	49	254.1 Hz
05	79.7 Hz	14	107.2 Hz	23	146.2 Hz	32	177.3 Hz	41	206.5 Hz	—	—
06	82.5 Hz	15	110.9 Hz	24	151.4 Hz	33	179.9 Hz	42	210.7 Hz	—	—
07	85.4 Hz	16	114.8 Hz	25	156.7 Hz	34	183.5 Hz	43	218.1 Hz	—	—
08	88.5 Hz	17	118.8 Hz	26	159.8 Hz	35	186.2 Hz	44	225.7 Hz	—	—

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>FA</b>	<b>FREQUENCY VFO-A</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 30000 - 60000000 (Hz)
	<b>F</b>	<b>A</b>	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	:										
Read	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>A</b>	:								
	11	12	13	14	15	16	17	18	19	20	
	:										
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>A</b>	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	:										

<b>FB</b>	<b>FREQUENCY VFO-B</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 300000 - 60000000 (Hz)
	<b>F</b>	<b>B</b>	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	:										
Read	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>B</b>	:								
	11	12	13	14	15	16	17	18	19	20	
	:										
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>B</b>	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	:										

<b>FS</b>	<b>FAST STEP</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: FAST Key "OFF" 1: FAST Key "ON"
	<b>F</b>	<b>S</b>	P1	:							
	11	12	13	14	15	16	17	18	19	20	
	:										
Read	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>S</b>	:								
	11	12	13	14	15	16	17	18	19	20	
	:										
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>S</b>	P1	:							
	11	12	13	14	15	16	17	18	19	20	
	:										

<b>FT</b>	<b>FUNCTION TX</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Transmit the Displayed Band 1: Transmit the Opposite Band
	<b>F</b>	<b>T</b>	P1	:							
	11	12	13	14	15	16	17	18	19	20	
	:										
Read	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>T</b>	:								
	11	12	13	14	15	16	17	18	19	20	
	:										
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>F</b>	<b>T</b>	P1	:							
	11	12	13	14	15	16	17	18	19	20	
	:										

<b>GT</b>	<b>AGC FUNCTION</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed      P2 0: AGC "OFF" 1: AGC "FAST" 2: AGC "SLOW" 3: AGC "SLOW" 4: AGC "AUTO"
	<b>G</b>	<b>T</b>	P1	P2	:						
	11	12	13	14	15	16	17	18	19	20	
	:										
Read	1	2	3	4	5	6	7	8	9	10	
	<b>G</b>	<b>T</b>	P1	:							
	11	12	13	14	15	16	17	18	19	20	
	:										
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>G</b>	<b>T</b>	P1	P2	:						
	11	12	13	14	15	16	17	18	19	20	
	:										

<b>ID</b>	<b>IDENTIFICATION</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0241 (Fixed value)
	11	12	13	14	15	16	17	18	19	20	
Read	1	2	3	4	5	6	7	8	9	10	
	<b>I</b>	<b>D</b>	:								
	11	12	13	14	15	16	17	18	19	20	
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>I</b>	<b>D</b>	P1	P1	P1	P1	:				
	11	12	13	14	15	16	17	18	19	20	

<b>IF</b>	<b>INFORMATION</b>											
Set	1	2	3	4	5	6	7	8	9	10	P1 000-510 (Memory Channel)    P2 VFO-A Frequency (Hz) P3 Clarifier Direction +: Plus Shift, -: Minus Shift Clarifier Offset: 0000 - 9999 (Hz) P4 0: RX CLAR "OFF"    1: RX CLAR "ON" P5 0: TX CLAR "OFF"    1: TX CLAR "ON" P6 MODE 1: LSB    2: USB    3: CW    4: FM    5: AM    6: DATA (RTTY-LSB) 7: CW-R    8: USER-L    9: DATA (RTTY-USB) B: FM-N    C: USER-U P7 0: VFO    1: Memory    2: Memory Tune    3: Quick Memory Bank (QMB) P8 0: CTCSS "OFF"    1: CTCSS ENC/DEC    2: CTCSS ENC P9 Tone Number (See Table 1) P10 0: Simplex    1: Plus Shift    2: Minus Shift	
	11	12	13	14	15	16	17	18	19	20		
Read	1	2	3	4	5	6	7	8	9	10		
	<b>I</b>	<b>F</b>	:									
	11	12	13	14	15	16	17	18	19	20		
Answer	1	2	3	4	5	6	7	8	9	10		
	<b>I</b>	<b>F</b>	P1	P1	P1	P2	P2	P2	P2	P2		
	11	12	13	14	15	16	17	18	19	20		
	P2	P2	P2	P3	P3	P3	P3	P3	P4	P5		
	21	22	23	24	25	26	27	28	29	30		
	P6	P7	P8	P9	P9	P10	:					

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>IS</b>	<b>IF-SHIFT</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed
	<b>I</b>	<b>S</b>	P1	-/+	P2	P2	P2	P2	;		P2 0000 ~ 1000 (Hz)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>I</b>	<b>S</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>I</b>	<b>S</b>	P1	-/+	P2	P2	P2	P2	;		

<b>KM</b>	<b>KEYER MEMORY</b>										
Set	1	2	3	4	5	6	7	~	43	**	P1 1 - 3 : Beacon Text Channel Number
	<b>K</b>	<b>M</b>	P1	P2	P2	P2	P2	~	P2	;	P2 Message Characters (up to 40 characters)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>K</b>	<b>M</b>	P1	;							
Answer	1	2	3	4	5	6	7	~	43	**	
	<b>K</b>	<b>M</b>	P1	P2	P2	P2	P2	~	P2	;	

<b>KP</b>	<b>KEY PITCH</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 02: 400 Hz
	<b>K</b>	<b>P</b>	P1	P1	;						04: 500 Hz
Read	1	2	3	4	5	6	7	8	9	10	06: 600 Hz
	<b>K</b>	<b>P</b>	;								08: 700 Hz
Answer	1	2	3	4	5	6	7	8	9	10	10: 800 Hz
	<b>K</b>	<b>P</b>	P1	P1	;						

<b>KR</b>	<b>KEYER</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: KEYER "OFF"
	<b>K</b>	<b>R</b>	P1	;							1: KEYER "ON"
Read	1	2	3	4	5	6	7	8	9	10	
	<b>K</b>	<b>R</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>K</b>	<b>R</b>	P1	;							

<b>KS</b>	<b>KEY SPEED</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 004 - 060 (WPM)
	<b>K</b>	<b>S</b>	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	<b>K</b>	<b>S</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>K</b>	<b>S</b>	P1	P1	P1	;					

<b>KY</b>	<b>CW KEYING</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 6: Beacon Text "1" Playback
	<b>K</b>	<b>Y</b>	P1	;							7: Beacon Text "2" Playback
Read	1	2	3	4	5	6	7	8	9	10	8: Beacon Text "3" Playback
Answer	1	2	3	4	5	6	7	8	9	10	

<b>LK</b>	<b>LOCK</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: DIAL Lock "OFF"
	<b>L</b>	<b>K</b>	P1	;							1: DIAL Lock "ON"
Read	1	2	3	4	5	6	7	8	9	10	
	<b>L</b>	<b>K</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>L</b>	<b>K</b>	P1	;							

<b>LM</b>	<b>LOAD MESSAGE</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VOICE MEMORY
	<b>L</b>	<b>M</b>	P1	P2	;						P2 When P1=0
Read	1	2	3	4	5	6	7	8	9	10	0: VOICE MEMORY RECORDING STOP
	<b>L</b>	<b>M</b>	P1	;							1: VOICE MEMORY 1 RECORDING
Answer	1	2	3	4	5	6	7	8	9	10	2: VOICE MEMORY 2 RECORDING
	<b>L</b>	<b>M</b>	P1	P2	;						When P1=1
											0: DIGITAL VOICE RECORDER STOP
											1: DIGITAL VOICE RECORDER START

<b>MC</b>	<b>MEMORY CHANNEL</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 001 - 504: Memory Channel Number
	<b>M</b>	<b>C</b>	P1	P1	P1	;					001 - 500: Regular Memory Channel
Read	1	2	3	4	5	6	7	8	9	10	501: P1L Channel
	<b>M</b>	<b>C</b>	;								502: P1U Channel
Answer	1	2	3	4	5	6	7	8	9	10	503: P2L Channel
	<b>M</b>	<b>C</b>	P1	P1	P1	;					504: P2U Channel

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

MD	OPERATING MODE										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 MODE 1: LSB 2: USB 3: CW 4: FM 5: AM 6: DATA (RTTY-LSB) 7: CW-R 8: USER-L 9: DATA (RTTY-USB) B: FM-N C: USER-U
	<b>M</b>	<b>D</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>D</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>D</b>	P1	P2	;						

MG	MIC GAIN										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 085: MIC GAIN "L" 086 - 170: MIC GAIN "M" 171 - 255: MIC GAIN "H"
	<b>M</b>	<b>G</b>	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>G</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>G</b>	P1	P1	P1	;					

MK	MODE KEY										
Set	1	2	3	4	5	6	7	8	9	10	P1 KEY 7: MODE UP 8: MODE DOWN 9: REVERSE (@CW MODE)
	<b>M</b>	<b>K</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

ML	MONITOR LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000: MONITOR "OFF" 001: MONITOR "ON"
	<b>M</b>	<b>L</b>	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>L</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>L</b>	P1	P2	P2	P2	;				

MR	MEMORY CHANNEL READ										
Set	1	2	3	4	5	6	7	8	9	10	P1 Memory Channel Number P2 Memory Channel Frequency (Hz) P3 Clarifier Direction +: Plus Shift, -: Minus Shift Clarifier Offset: 0000 - 9999 (Hz) P4 0: RX CLAR "OFF" 1: RX CLAR "ON" P5 0: TX CLAR "OFF" 1: TX CLAR "ON" P6 MODE 1: LSB 2: USB 3: CW 4: FM 5: AM 6: DATA (RTTY-LSB) 7: CW-R 8: USER-L 9: DATA (RTTY-USB) B: FM-N C: USER-U P7 0: VFO 1: Memory P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9: Tone Number (See Table 1) P10 0: Simplex 1: Plus Shift 2: Minus Shift
Read	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>R</b>	P1	P1	P1	;					
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>R</b>	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P3	P3	P3	P3	P3	P4	P5	
	21	22	23	24	25	26	27	28	29	30	
	P6	P7	P8	P9	P9	P10	;				

MS	METER SW										
Set	1	2	3	4	5	6	7	8	9	10	P1 1: ALC 2: PO 3: SWR
	<b>M</b>	<b>S</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>S</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>M</b>	<b>S</b>	P1	;							

MW	MEMORY CHANNEL WRITE										
Set	1	2	3	4	5	6	7	8	9	10	P1 Memory Channel Number P2 Memory Channel Frequency (Hz) P3 Clarifier Direction +: Plus Shift, -: Minus Shift Clarifier Offset: 0000 - 9999 (Hz) P4 0: RX CLAR "OFF" 1: RX CLAR "ON" P5 0: TX CLAR "OFF" 1: TX CLAR "ON" P6 MODE 1: LSB 2: USB 3: CW 4: FM 5: AM 6: DATA (RTTY-LSB) 7: CW-R 8: USER-L 9: DATA (RTTY-USB) B: FM-N C: USER-U P7 0: Fixed P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9: Tone Number (See Table 1) P10 0: Simplex 1: Plus Shift 2: Minus Shift
	<b>M</b>	<b>W</b>	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P3	P3	P3	P3	P3	P4	P5	
	21	22	23	24	25	26	27	28	29	30	
	P6	P7	P8	P9	P9	P10	;				
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

NA	NARROW										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Bandwidth Middeum 1: Bandwidth Narrow
	<b>M</b>	<b>A</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>A</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>A</b>	P1	P2	;						

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>NB</b>	<b>NOISE BLANKER STATUS</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Noise Blanker "OFF" 1: Noise Blanker "ON"
	<b>N</b>	<b>B</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>B</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>B</b>	P1	P2	;						

<b>NR</b>	<b>NOISE REDUCTION</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Noise Reduction "OFF" 1: Noise Reduction "ON"
	<b>N</b>	<b>R</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>R</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>N</b>	<b>R</b>	P1	P2	;						

<b>OI</b>	<b>OPPOSITE BAND INFORMATION</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 Current Memory Channel P2 VFO-B Frequency (Hz) P3 Clarifier Direction +: Plus Shift, -: Minus Shift Clarifier Offset: 0000 - 9999 (Hz) P4 0: RX CLAR "OFF" 1: RX CLAR "ON" P5 0: TX CLAR "OFF" 1: TX CLAR "ON" P6 MODE 1: LSB 2: USB 3: CW 4: FM 5: AM 6: DATA (RTTY-LSB) 7: CW-R 8: USER-L 9: DATA (RTTY-USB) B: FM-N C: USER-U P7 0: VFO 1: Memory 2: Memory Tune 3: Quick Memory Bank (QMB) P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9: Tone Number (See Table 1) P10 0: Simplex 1: Plus Shift 2: Minus Shift
Read	1	2	3	4	5	6	7	8	9	10	
	<b>O</b>	<b>I</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>O</b>	<b>I</b>	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P3	P3	P3	P3	P3	P4	P5	
	21	22	23	24	25	26	27	28	29	30	
	P6	P7	P8	P9	P10	;					

<b>OS</b>	<b>OFFSET (REPEATER SHIFT)</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Simplex 1: Plus Shift 2: Minus Shift *: FM mode only
	<b>O</b>	<b>S</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>O</b>	<b>S</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>O</b>	<b>S</b>	P1	P2	;						

<b>PA</b>	<b>PRE-AMP (IPO)</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: IPO "ON" 1: IPO "OFF"
	<b>P</b>	<b>A</b>	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>A</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>A</b>	P1	P2	;						

<b>PB</b>	<b>PLAY BACK</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: STOP 1: VOICE MEMORY 1 PLAYBACK 2: VOICE MEMORY 2 PLAYBACK 6: DIGITAL VOICE RECORDER PLAYBACK
	<b>P</b>	<b>B</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>B</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>B</b>	P1	;							

<b>PC</b>	<b>POWER CONTROL</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 255
	<b>P</b>	<b>C</b>	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>C</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>C</b>	P1	P1	P1	;					

<b>PS</b>	<b>POWER SWITCH</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: POWER "OFF" 1: POWER "ON"  This command requires dummy data be initially sent. Then after one second and before two seconds the command is sent.
	<b>P</b>	<b>S</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>S</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>P</b>	<b>S</b>	P1	;							

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

QI	QMB STORE										
Set	1	2	3	4	5	6	7	8	9	10	
	Q	I	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

QR	QMB RECALL										
Set	1	2	3	4	5	6	7	8	9	10	
	Q	R	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

QS	QUICK SPLIT										
Set	1	2	3	4	5	6	7	8	9	10	
	Q	S	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RA	RF ATTENUATOR										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: OFF 1: ON
	R	A	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RC	CLAR CLEAR										
Set	1	2	3	4	5	6	7	8	9	10	
	R	C	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RD	CLARIFIER MINUS OFFSET										
Set	1	2	3	4	5	6	7	8	9	10	P1 0000 - 9999 (Hz)
	R	D	P1	P1	P1	P1	;				
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RG	RF GAIN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000 - 255
	R	G	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RI	RADIO INFORMATION										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Hi-SWR 1: MIC-EQ 3: REC 4: PLAY P2 0: OFF 1: ON
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

RL	NOISE REDUCTION LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 01 - 11
	R	L	P1	P2	P2	;					
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>RM</b>	<b>READ METER</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Depends of the Front Panel's METER Switch 1: S Meter 4: ALC Meter 5: PO Meter 6: SWR Meter P2 000 - 255
Read	1	2	3	4	5	6	7	8	9	10	
	<b>R M</b>	P1	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>R M</b>	P1	P2	P2	P2	;					

<b>RP</b>	<b>RESET POWER ON</b>										
Set	1	2	3	4	5	6	7	8	9	10	Resetting the Microprocessor (Full Reset)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>R P</b>	;									
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>R P</b>	;									

<b>RS</b>	<b>RADIO STATUS</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: NORMAL MODE 1: MENU MODE
Read	1	2	3	4	5	6	7	8	9	10	
	<b>R S</b>	;									
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>R S</b>	P1	;								

<b>RT</b>	<b>CLAR</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: RX Clarifier "OFF" 1: RX Clarifier "ON"
Read	1	2	3	4	5	6	7	8	9	10	
	<b>R T</b>	P1	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>R T</b>	P1	;								

<b>RU</b>	<b>CLARIFIER PLUS OFFSET</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0000 - 9999 (Hz)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>R U</b>	P1	P1	P1	P1	;					
Answer	1	2	3	4	5	6	7	8	9	10	

<b>SC</b>	<b>SCAN</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Scan "OFF" 1: Scan "ON" (Upward) 2: Scan "ON" (Downward)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S C</b>	P1	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S C</b>	P1	;								

<b>SD</b>	<b>CW BREAK-IN DELAY TIME</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0000: Full Break-in 0030 - 3000 (msec)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S D</b>	P1	P1	P1	P1	;					
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S D</b>	P1	P1	P1	P1	;					

<b>SH</b>	<b>WIDTH</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0:Fixed P2 00 - 10 (Narrow) 11 - 21 (Normal) 22 - 31 (Wide) P3 00 (Narrow) 16 (Normal) 31 (Wide)
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S H</b>	P1	P2	P2	;						
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S H</b>	P1	P3	P3	;						

<b>SM</b>	<b>S-METER READING</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000 - 255
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S M</b>	P1	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S M</b>	P1	P2	P2	P2	;					

# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>SQ</b>	<b>SQUELCH LEVEL</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000 - 255
	<b>S</b>	<b>Q</b>	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S</b>	<b>Q</b>	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S</b>	<b>Q</b>	P1	P2	P2	P2	;				

<b>ST</b>	<b>STEP</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 FM AM LSB/USB/CW FM 0: 5.0 kHz 2.5 kHz 1.0 kHz P1 6: 25.0 kHz 1: 6.25 kHz 5.0 kHz 2.5 kHz 7: 50.0 kHz 2: 10.0 kHz 9.0 kHz 5.0 kHz 3: 12.5 kHz 10.0 kHz 4: 15.0 kHz 12.5 kHz 5: 20.0 kHz 25.0 kHz
	<b>S</b>	<b>T</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>S</b>	<b>T</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>S</b>	<b>T</b>	P1	;							

<b>SV</b>	<b>SWAP VFO</b>										
Set	1	2	3	4	5	6	7	8	9	10	
	<b>S</b>	<b>V</b>	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

<b>TS</b>	<b>TXW</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: TXW "OFF" 1: TXW "ON"
	<b>T</b>	<b>S</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>T</b>	<b>S</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>T</b>	<b>S</b>	P1	;							

<b>TX</b>	<b>TX SET</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: RADIO TX "OFF" CAT TX "OFF" 1: RADIO TX "OFF" CAT TX "ON" 2: RADIO TX "ON" CAT TX "OFF" (Answer)
	<b>T</b>	<b>X</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>T</b>	<b>X</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>T</b>	<b>X</b>	P1	;							

<b>UL</b>	<b>PLL UNLOCK STATUS</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: PLL "Lock" 1: PLL "Unlock"
Read	1	2	3	4	5	6	7	8	9	10	
	<b>U</b>	<b>L</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>U</b>	<b>L</b>	P1	;							

<b>UP</b>	<b>MIC UP</b>										
Set	1	2	3	4	5	6	7	8	9	10	
	<b>U</b>	<b>P</b>	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

<b>VD</b>	<b>VOX DELAY TIME</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0100 - 3000 msec (100 msec multiples)
	<b>V</b>	<b>D</b>	P1	P1	P1	P1	;				
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>D</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>D</b>	P1	P1	P1	P1	;				

<b>VG</b>	<b>VOX GAIN</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 255
	<b>V</b>	<b>G</b>	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>G</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>G</b>	P1	P1	P1	;					



# CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

## CONTROL COMMAND TABLES

<b>VM</b>	<b>[V/M] KEY FUNCTION</b>										
Set	1	2	3	4	5	6	7	8	9	10	Toggles frequency control between the VFO and Memory System.
	<b>V</b>	<b>M</b>	;								
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>M</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>M</b>	;								

<b>VR</b>	<b>VOICE</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VOICE "OFF" 1: VOICE 1 "ON" 2: VOICE 2 "ON"
	<b>V</b>	<b>R</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>R</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>R</b>	P1	;							

<b>VS</b>	<b>VFO SELECT</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VFO-A 1: VFO-B
	<b>V</b>	<b>S</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>S</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>S</b>	P1	;							

<b>VV</b>	<b>VFO TO VFO</b>										
Set	1	2	3	4	5	6	7	8	9	10	Copy the displayed VFO data to the opposite VFO.
	<b>V</b>	<b>V</b>	;								
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>V</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>V</b>	;								

<b>VX</b>	<b>VOX STATUS</b>										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VOX "OFF" 1: VOX "ON"
	<b>V</b>	<b>X</b>	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>X</b>	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	<b>V</b>	<b>X</b>	P1	;							



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