

YAESU
The radio

FT-991
CAT OPERATION
REFERENCE BOOK

YAESU MUSEN CO., LTD.

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

OVERVIEW

The CAT (Computer Aided Transceiver) System in the **FT-991** transceiver 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 with single mouse clicks, or keystroke operations on the computer keyboard.

Using the RS-232C Cable (Refer to figure 1)

The **FT-991** transceiver 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.

When using the RS-232C cable, set Menu item “028 GPS/232C SELECT” to “RS232C”.

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.

Using the USB Cable (Refer to figure 2)

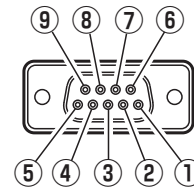
Note: A USB driver is required for remote control from a computer. Download the driver from the Yaesu website (<http://www.yaesu.com>).

The **FT-991** transceiver has a built-in USB to Dual UART Bridge, allowing direct connection from the rear-panel USB jack to the USB jack of your computer without the need of any external boxes.

You will need a USB cable to connect to the USB jack on your computer.

YAESU MUSEN 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 for your operating needs and utilize the full operating potential of this system.

CONNECTION



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 to “L” to inhibit the transmit data from the transceiver.
⑧	CTS	Output	When the transceiver is not ready to receive data, this port goes to “L” to inhibit the transmit data from the computer.
⑨	N/A	---	---

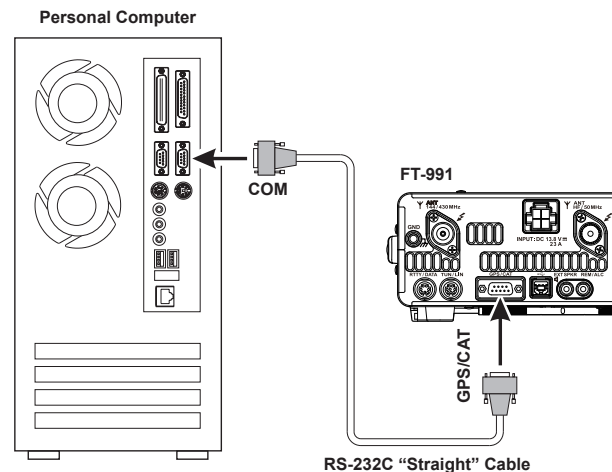


Figure 1

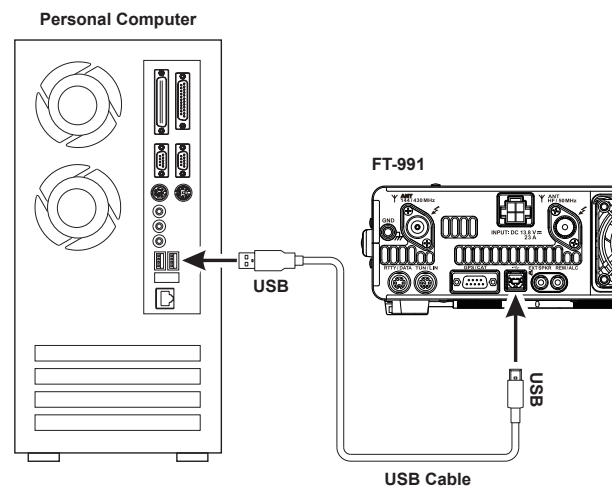


Figure 2

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.

FA	14250000	;
↑	↑	↑
Command	Parameter	Terminator

There are three commands for the **FT-991** as shown below:

Set command: Set a particular condition
(to the **FT-991**)

Read command: Reads an answer
(from the **FT-991**)

Answer command: Transmits a condition
(from the **FT-991**)

For example, note the following 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 the correct parameter is “**ISO+1000**” (IF SHIFT):

- ISO1000;**
Not enough parameters specified (No direction (+) given for the IF shift)
- ISO+100;**
Not enough digits (Only three frequency digits given)
- ISO+_1000;**
Unnecessary characters between parameters
- ISO+10000;**
Too many digits (Five frequency digits given)

Note: If a particular parameter is not applicable to the **FT-991**, 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.

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Command	Function	Set	Read	Ans.	AI
AB	VFO-A TO VFO-B	0	X	X	X
AC	ANTENNA TUNER CONTROL	0	0	0	0
AG	AF GAIN	0	0	0	0
AI	AUTO INFORMATION	0	0	0	X
AM	VFO-A TO MEMORY CHANNEL	0	X	X	X
BA	VFO-B TO VFO-A	0	X	X	X
BC	AUTO NOTCH	0	0	0	0
BD	BAND DOWN	0	X	X	X
BI	BREAK-IN	0	0	0	0
BP	MANUAL NOTCH	0	0	0	0
BS	BAND SELECT	0	X	X	X
BU	BAND UP	0	X	X	X
BY	BUSY	X	0	0	0
CH	CHANNEL UP/DOWN	0	X	X	X
CN	CTCSS NUMBER	0	0	0	0
CO	CONTOUR	0	0	0	0
CS	CW SPOT	0	0	0	0
CT	CTCSS	0	0	0	0
DA	DIMMER	0	0	0	X
DN	DOWN	0	X	X	X
DT	DATE AND TIME	0	0	0	X
ED	ENCORDER DOWN	0	X	X	X
EK	ENT KEY	0	X	X	X
EU	ENCORDER UP	0	X	X	X
EX	MENU	0	0	0	0
FA	FREQUENCY VFO-A	0	0	0	0
FB	FREQUENCY VFO-B	0	0	0	0
FS	FAST STEP	0	0	0	0
FT	FUNCTION TX	0	0	0	0
GT	AGC FUNCTION	0	0	0	0
ID	IDENTIFICATION	X	0	0	X
IF	INFORMATION	X	0	0	0
IS	IF-SHIFT	0	0	0	0
KM	KEYER MEMORY	0	0	0	X
KP	KEY PITCH	0	0	0	0
KR	KEYER	0	0	0	0
KS	KEY SPEED	0	0	0	0
KY	CW KEYING	0	X	X	X
LK	LOCK	0	0	0	0
LM	LOAD MESSEGE	0	0	0	X
MA	MEMORY CHANNEL TO VFO-A	0	X	X	X
MC	MEMORY CHANNEL	0	0	0	X
MD	MODE	0	0	0	0
MG	MIC GAIN	0	0	0	0
ML	MONITOR LEVEL	0	0	0	0
MR	MEMORY READ	X	0	0	X
MS	METER SW	0	0	0	0
MW	MEMORY WRITE	0	X	X	X
MX	MOX SET	0	0	0	0
NA	NARROW	0	0	0	0
NB	NOISE BLANKER	0	0	0	0
NL	NOISE BLANKER LEVEL	0	0	0	0
NR	NOISE REDUCTION	0	0	0	0
OI	OPPOSITE BAND NFORMATION	X	0	0	0
OS	OFFSET (Repeater Shift)	0	0	0	0
PA	PRE-AMP (IPO)	0	0	0	0
PB	PLAY BACK	0	0	0	X
PC	POWER CONTROL	0	0	0	0
PL	SPEECH PROCESSOR LEVEL	0	0	0	0

Command	Function	Set	Read	Ans.	AI
PR	SPEECH PROCESSOR	0	0	0	0
PS	POWER SWITCH	0	0	0	X
QI	QMB STORE	0	X	X	X
QR	QMB RECALL	0	X	X	X
QS	QUICK SPLIT	0	X	X	X
RA	RF ATTENUATOR	0	0	0	0
RC	CLAR CLEAR	0	X	X	X
RD	CLAR DOWN	0	X	X	X
RG	RF GAIN	0	0	0	0
RI	RADIO INFORMATION	X	0	0	0
RL	NOISE REDUCTION LEVEL	0	0	0	0
RM	READ METER	X	0	0	0
RS	RADIO STATUS	X	0	0	X
RT	CLAR	0	0	0	0
RU	CLAR UP	0	X	X	X
SC	SCAN	0	0	0	0
SD	SEMI BREAK-IN DELAY TIME	0	0	0	0
SH	WIDTH	0	0	0	0
SM	S METER	X	0	0	X
SQ	SQUELCH LEVEL	0	0	0	0
SV	SWAP VFO	0	X	X	X
TS	TXW	0	0	0	0
TX	TX SET	0	0	0	0
UL	UNLOCK	X	0	0	0
UP	UP	0	X	X	X
VD	VOX DELAY TIME	0	0	0	0
VG	VOX GAIN	0	0	0	0
VM	[V/M] KEY FUNCTION	0	X	X	X
VX	VOX	0	0	0	0
XT	TX CLAR	0	0	0	0
ZI	ZERO IN	0	X	X	X

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AB		VFO-A TO VFO-B									
Set	1	2	3	4	5	6	7	8	9	10	
	A	B	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

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

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

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

AM		VFO-A TO MEMORY CHANNEL									
Set	1	2	3	4	5	6	7	8	9	10	
	A	M	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

BA		VFO-B TO VFO-A									
Set	1	2	3	4	5	6	7	8	9	10	
	B	A	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

BC		AUTO NOTCH									
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Auto Notch "OFF" 1: Auto Notch "ON"
	B	C	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	B	C	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	B	C	P1	P2	;						

BD		BAND DOWN									
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed
	B	D	P1	;							
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

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

BP	MANUAL NOTCH										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Manual NOTCH "ON/OFF" 1: Manual NOTCH LEVEL P3 P2=0 000: "OFF" 001: "ON" P2=1 001 - 320 (NOTCH Frequency : x 10 Hz)
	B	P	P1	P2	P3	P3	;				
Read	1	2	3	4	5	6	7	8	9	10	
	B	P	P1	P2	;						
Answer	1	2	3	4	5	6	7	8	9	10	
	B	P	P1	P2	P3	P3	;				

BS	BAND SELECT										
Set	1	2	3	4	5	6	7	8	9	10	P1 00: 1.8 MHz 06: 18 MHz 12: MW 01: 3.5 MHz 07: 21 MHz 13: - 02: - 08: 24.5 MHz 14: AIR 03: 7 MHz 09: 28 MHz 15: 144 MHz 04: 10 MHz 10: 50 MHz 16: 430 MHz 05: 14 MHz 11: GEN
	B	S	P1	P1	;						
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

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

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

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 0 - 49: Tone Frequency Number (See Table 1)
	C	N	P1	P2	P2	;					
Read	1	2	3	4	5	6	7	8	9	10	
	C	N	P1	;							
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 FREQ 2: APF "ON/OFF" 3: APF FREQ P3 P2=0 0000: CONTOUR "OFF" 0001: CONTOUR "ON" P2=1 0010 - 3200 (CONTOUR Frequency: 10 - 3200Hz) P2=2 0000: APF "OFF" 0001: APF "ON" P2=3 0000 - 0050 (APF Frequency: -250 - 250 Hz)
	C	O	P1	P2	P3	P3	P3	;			
Read	1	2	3	4	5	6	7	8	9	10	
	C	O	P1	P2	;						
Answer	1	2	3	4	5	6	7	8	9	10	
	C	O	P1	P2	P3	P3	P3	;			

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

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	
	C	S	;								
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" 3: DCS "ON"
	C	T	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	C	T	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	C	T	P1	P2	;						

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	-	-

DA	DIMMER										
Set	1	2	3	4	5	6	7	8	9	10	P1 00: Fixed P2 01 - 02: LED Indicators Brightness Level P3 00 - 15: TFT Display Brightness Level
	D	A	P1	P1	P2	P2	P3	P3	;		
Read	1	2	3	4	5	6	7	8	9	10	
	D	A	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	D	A	P1	P1	P2	P2	P3	P3	;		

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	

DT	DATE AND TIME										
Set	1	2	3	4	5	6	7	~	n-1	n	P1 0: Date 1: Time (UTC) 2: Time differential (Time Zone) P2 P1=0 yyyyymmdd (Year/Month/Date) P1=1 hhmmss (Hour/Minute/Second, 24 hour time system) P1=2 hhmm (Hour/Minute, 30 minute increments)
	D	T	P1	P2	P2	P2	~	P2	;		
Read	1	2	3	4	5	6	7	8	9	10	
	D	T	P1	;							
Answer	1	2	3	4	5	6	7	~	n-1	n	
	D	T	P1	P2	P2	P2	~	P2	;		

ED	ENCORDER DOWN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCORDER 1: SUB ENCORDER 8: MULTI ENCORDER P2 01 - 99: Steps
	E	D	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	

EK	ENT KEY										
Set	1	2	3	4	5	6	7	8	9	10	
	E	K	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

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EU		ENCORDER UP									
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCORDER 1: SUB ENCORDER 8: MULTI ENCORDER P2 01 - 99: Steps
	E	U	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	

EX		MENU										
Set	1	2	3	4	5	6	7	~	n-1	n	P1 : 001 - 151 (MENU Number) P2 : Parameter (See Table)	
	E	X	P1	P1	P1	P2	P2	~	P2	;		
Read	1	2	3	4	5	6	7	8	9	10		
Answer	1	2	3	4	5	6	7	~	n-1	n		
	E	X	P1	P1	P1	P2	P2	~	P2	;		

P1	Function	P2	Digits
001	AGC FAST DELAY	20 ~ 4000 msec (P2= 0020 ~ 4000, 20 msec/step)	4
002	AGC MID DELAY	20 ~ 4000 msec (P2= 0020 ~ 4000, 20 msec/step)	4
003	AGC SLOW DELAY	20 ~ 4000 msec (P2= 0020 ~ 4000, 20 msec/step)	4
004	HOME FUNCTION	0: SCOPE 1: FUNCTION	1
005	MY CALL INDICATION	0 ~ 5 sec	1
006	DISPLAY COLOR	0: BLUE 1: GRAY 2: GREEN 3: ORANGE 4: PURPLE 5: RED 6: SKY BLUE	1
007	DIMMER LED	0: 1 1: 2	1
008	DIMMER TFT	00 ~ 15	2
009	BAR MTR PEAK HOLD	0: OFF 1: 0.5 sec 2: 1.0 sec 3: 2.0 sec	1
010	DVS RX OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
011	DVS TX OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
012	KEYER TYPE	0: OFF 1: BUG 2: ELEKEY-A 3: ELEKEY-B 4: ELEKEY-Y 5: ACS	1
013	KEYER DOT/DASH	0: NORNAL 1: REVERSE	1
014	CW WEIGHT	2.5 ~ 4.5 (P2 = 25 ~ 45)	2
015	BEACON INTERVAL	OFF / 1 ~ 690 sec (P2 = 000 ~ 690, 000: OFF)	3
016	NUMBER STYLE	0: 1290 1: AUNO 2: AUNT 3: A2NO 4: A2NT 5: 12NO 6: 12NT	1
017	CONTEST NUMBER	0000 ~ 9999	4
018	CW MEMORY 1	0: TEXT 1: MESSAGE	1
019	CW MEMORY 2	0: TEXT 1: MESSAGE	1
020	CW MEMORY 3	0: TEXT 1: MESSAGE	1
021	CW MEMORY 4	0: TEXT 1: MESSAGE	1
022	CW MEMORY 5	0: TEXT 1: MESSAGE	1
023	NB WIDTH	0: 1 ms 1: 3 ms 2: 10 ms	1
024	NB REJECTION	0: 10 dB 1: 30 dB 2: 50 dB	1
025	NB LEVEL	0 ~ 10 (P2 = 00 ~ 10)	2
026	BEEP LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
027	TIME ZONE	UTC -12:00 ~ +14:00	5
028	GPS/232C SELECT	0: GPS 1: RS232C	1
029	232C RATE	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	1
030	232C TOT	0: 10 msec 1: 100 msec 2: 1000 msec 3: 3000 msec	1
031	CAT RATE	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	1
032	CAT TOT	0: 10 msec 1: 100 msec 2: 1000 msec 3: 3000 msec	1
033	CAT RTS	0: DISABLE 1: ENABLE	1
034	MEM GROUP	0: DISABLE 1: ENABLE	1
035	QUICK SPLIT FREQ	-20 kHz ~ +00 (or -00) ~ +20 kHz (P2= -20 ~ +00 or -00 ~ +20)	3
036	TX TOT	0 (OFF) ~ 30 min (P2= 00 ~ 30)	2
037	MIC SCAN	0: DISABLE 1: ENABLE	1
038	MIC SCAN RESUME	0: PAUSE 1: TIME	1
039	REF FREQ ADJ	-25 ~ +00 (or -00) ~ +25 (P2= -25 ~ +00 or -00 ~ +25)	3
040	CLAR MODE SELECT	0: RX 1: TX 2: TRX	1
041	AM LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000 Hz (50 Hz steps)	2
042	AM LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
043	AM HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000 Hz (50 Hz steps)	2
044	AM HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
045	AM MIC SELECT	0: MIC 1: REAR	1
046	AM OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
047	AM PTT SELECT	0: DAKY 1: RTS 2: DTR	1
048	AM PORT SELECT	0: DATA 1: USB	1
049	AM DATA GAIN	0 ~ 100 (P2 = 000 ~ 100)	3
050	CW LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000 Hz (50 Hz steps)	2
051	CW LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
052	CW HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000 Hz (50 Hz steps)	2
053	CW HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
054	CW OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
055	CW AUTO MODE	0: OFF 1: 50 MHz 2: ON	1
056	CW BK-IN TYPE	0: SEMI BREAK-IN 1: FULL BREAK-IN	1
057	CW BK-IN DELAY	30 ~ 3000 msec (P2 = 0030 ~ 3000, 10 msec/step)	4
058	CW WAVE SHAPE	0: 1 msec 1: 2 msec 2: 4 msec 3: 6 msec	1
059	CW FREQ DISPLAY	0: DIRECT FREQ 1: PITCH OFFSET	1
060	PC KEYING	0: OFF 1: DAKY 2: RTS 3: DTR	1
061	QSK DELAY TIME	0: 15 msec 1: 20 msec 2: 25 msec 3: 30 msec	1

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

P1	Function	P2	Digits
062	DATA MODE	0: PSK 1: OTHER	1
063	PSK TONE	0: 1000 Hz 1: 1500 Hz 2: 2000 Hz	1
064	OTHER DISP (SSB)	-3000 Hz ~ 0 ~ +3000 Hz (P2 = -3000 ~ -0000 or +0000 ~ +3000, 10 Hz steps)	5
065	OTHER SHIFT (SSB)	-3000 Hz ~ 0 ~ +3000 Hz (P2 = -3000 ~ -0000 or +0000 ~ +3000, 10 Hz steps)	5
066	DATA LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000 Hz (50 Hz steps)	2
067	DATA LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
068	DATA HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000 Hz (50 Hz steps)	1
069	DATA HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	2
070	DATA IN SELECT	0: MIC 1: REAR	1
071	DATA PTT SELECT	0: DAKY 1: RTS 2: DTR	1
072	DATA PORT SELECT	1: DATA 2: USB	1
073	DATA OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
074	FM MIC SELECT	0: MIC 1: REAR	1
075	FM OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
076	FM PKT PTT SELECT	0: DAKY 1: RTS 2: DTR	1
077	FM PKT PORT SELECT	1: DATA 2: USB	1
078	FM PKT TX GAIN	0 ~ 100 (P2 = 000 ~ 100)	3
079	FM PKT MODE	0: 1200 1: 9600	1
080	RPT SHIFT 28MHz	0 ~ 1000 kHz (P2 = 0000 ~ 1000, 10 kHz/step)	4
081	RPT SHIFT 50MHz	0 ~ 4000 kHz (P2 = 0000 ~ 4000, 10 kHz/step)	4
082	RPT SHIFT 144MHz	0 ~ 4000 kHz (P2 = 0000 ~ 4000, 10 kHz/step)	4
083	RPT SHIFT 430MHz	0 ~ 10000 kHz (P2 = 0000 ~ 10000, 10 kHz/step)	5
084	ARS 144MHz	0: OFF 1: ON	1
085	ARS 430MHz	0: OFF 1: ON	1
086	DCS POLARITY	0: Tn-Rn 1: Tn-Riv 2: Tiv-Rn 3: Tiv-Riv	1
087	RADIO ID	-----	-
088	DIGITAL SQL TYPE	0: OFF 1: CODE 2: BREAK	1
089	DIGITAL SQL CODE	001 ~ 126	3
090	GM DISPLY	0: DISTANCE 1: STRENGTH	1
091	DISTANCE	0: km 1: mile	1
092	AMS TX MODE	0: AUTO 1: MANUAL 2: DN 3: VW 4: ANALOG	1
093	STANDBY BEEP	0: OFF 1: ON	1
094	RTTY LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000Hz (50 Hz steps)	2
095	RTTY LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
096	RTTY HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000Hz (50 Hz steps)	2
097	RTTY HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
098	RTTY SHIFT PORT	0: SHIFT 1: DTR 2: RTS	1
099	RTTY POLARITY-RX	0: NORNAL 1: REVERSE	1
100	RTTY POLARITY-TX	0: NORNAL 1: REVERSE	1
101	RTTY OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
102	RTTY SHIFT FREQ	1: 170 Hz 1: 200 Hz 2: 425 Hz 3: 850 Hz	1
103	RTTY MARK FREQ	1: 1275 Hz 2: 2125 Hz	1
104	SSB LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000 Hz (50 Hz steps)	2
105	SSB LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
106	SSB HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000 Hz (50 Hz steps)	2
107	SSB HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
108	SSB MIC SELECT	0: MIC 1: REAR	1
109	SSB OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
110	SSB PTT SELECT	0: DAKY 1: RTS 2: DTR	1
111	SSB PORT SELECT	0: DATA 1: USB	1
112	SSB TX BPF	0: 50 ~ 3000 1: 100 ~ 2900 2: 200 ~ 2800 3: 300 ~ 2700 4: 400 ~ 2600	1
113	APF WIDTH	0: NARROW 1: MEDIUM 2: WIDE	1
114	CONTOUR LEVEL	-40 ~ 0 ~ +20 (P2 = -40 ~ -00 or +00 ~ +20)	3
115	CONTOUR WIDTH	01 ~ 11	2
116	IF NOTCH WIDTH	0: NARROW 1: WIDE	1
117	SCP DISPLAY MODE	0: SPECTRAM 1: WATER FALL	1
118	SCP START CYCLE	0: OFF 1: 3 sec 2: 5 sec 3: 10 sec	1
119	ASC DIAL SPEED	0: 0.25 kHz/sec 1: 0.5 kHz/sec 2: 1 kHz/sec 3: 2 kHz/sec 4: 4 kHz/sec 5: DISABLE	1
120	SCP SPAN FREQ	03: 50 kHz 04: 100 kHz 05: 200 kHz 06: 500 kHz 07: 1000 kHz	2
121	PRMTRC EQ1 FREQ	00: OFF 01: 100 02: 200 03: 300 04: 400 05: 500 06: 600 07: 700 Hz	2
122	PRMTRC EQ1 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
123	PRMTRC EQ1 BWTH	01 ~ 10	2
124	PRMTRC EQ2 FREQ	00: OFF 01: 700 02: 800 03: 900 04: 1000 05: 1100 06: 1200 07: 1300 08: 1400 09: 1500 Hz	2
125	PRMTRC EQ2 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
126	PRMTRC EQ2 BWTH	01 ~ 10	2
127	PRMTRC EQ3 FREQ	00: OFF 01: 1500 02: 1600 03: 1700 04: 1800 05: 1900 06: 2000 ~ 18: 3200 Hz	2
128	PRMTRC EQ3 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
129	PRMTRC EQ3 BWTH	01 ~ 10	2
130	P-PRMTRC EQ1 FREQ	00: OFF 01: 100 02: 200 03: 300 04: 400 05: 500 06: 600 07: 700 Hz	2
131	P-PRMTRC EQ1 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
132	P-PRMTRC EQ1 BWTH	01 ~ 10	2
133	P-PRMTRC EQ2 FREQ	00: OFF 01: 700 02: 800 03: 900 04: 1000 05: 1100 06: 1200 07: 1300 08: 1400 09: 1500 Hz	2
134	P-PRMTRC EQ2 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
135	P-PRMTRC EQ2 BWTH	01 ~ 10	2
136	P-PRMTRC EQ3 FREQ	00: OFF 01: 1500 02: 1600 03: 1700 04: 1800 05: 1900 06: 2000 ~ 18: 3200 Hz	2
137	P-PRMTRC EQ3 LEVEL	-20 ~ 0 ~ +10 (P2 = -20 ~ -00 or +00 ~ +10)	3
138	P-PRMTRC EQ3 BWTH	01 ~ 10	2
139	HF TX MAX POWER	5 ~ 100 (P2 = 005 ~ 100)	3
140	50M TX MAX POWER	5 ~ 100 (P2 = 005 ~ 100)	3
141	144M TX MAX POWER	5 ~ 50 (P2 = 005 ~ 050)	3
142	430M TX MAX POWER	5 ~ 50 (P2 = 005 ~ 050)	3
143	TUNER SELECT	0: OFF 1: INTERNAL 2: EXTERNAL 3: ATAS 4: LAMP	1

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

P1	Function	P2	Digits
144	VOX SELECT	0: MIC 1: DATA	1
145	VOX GAIN	000 ~ 100	3
146	VOX DELAY	30 ~ 3000 msec (P2 = 0030 ~ 3000, 10 msec/step)	4
147	ANTI VOX GAIN	000 ~ 100	3
148	DATA VOX GAIN	000 ~ 100	3
149	DATA VOX DELAY	30 ~ 3000 msec (P2 = 0030 ~ 3000)	4
150	ANTI DVOX GAIN	000 ~ 100	3
151	EMERGENCY FREQ TX	0: DISABLE 1: ENABLE	1

FA	FREQUENCY VFO-A										
Set	1	2	3	4	5	6	7	8	9	10	P1 000030000 - 560000000 (Hz)
	F	A	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
Read	P1	;									
	1	2	3	4	5	6	7	8	9	10	
	F	A	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	A	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	;									

FB	FREQUENCY VFO-B										
Set	1	2	3	4	5	6	7	8	9	10	P1 000030000 - 560000000 (Hz)
	F	B	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
Read	P1	;									
	1	2	3	4	5	6	7	8	9	10	
	F	B	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	B	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	;									

FS	FAST STEP										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VFO-A FAST Key "OFF" 1: VFO-A FAST Key "ON"
	F	S	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	F	S	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	S	P1	;							

FT	FUNCTION TX										
Set	1	2	3	4	5	6	7	8	9	10	P1 2: VFO-A Band Transmitter: TX 3: VFO-B Band Transmitter: TX P2 0: VFO-A Band Transmitter: TX 1: VFO-B Band Transmitter: TX
	F	T	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	F	T	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	F	T	P2	;							

GT	AGC FUNCTION										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: AGC "OFF" 1: AGC "FAST" 2: AGC "MID" 3: AGC "SLOW" 4: AGC "AUTO" P3 0: AGC "OFF" 1: AGC "FAST" 2: AGC "MID" 3: AGC "SLOW" 4: AGC "AUTO-FAST" 5: AGC "AUTO-MID" 6: AGC "AUTO-SLOW"
	G	T	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	G	T	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	G	T	P1	P3	;						

ID	IDENTIFICATION										
Set	1	2	3	4	5	6	7	8	9	10	P1 0570: FT-991
Read	1	2	3	4	5	6	7	8	9	10	
	I	D	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	I	D	P1	P1	P1	P1	;				

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

IF	INFORMATION										
Set	1	2	3	4	5	6	7	8	9	10	P1 000-117 (Memory Channel) P2 VFO-A Frequency (Hz) P3 Clarifier Direction +: Plus Shift, -: Minus Shift Clarifier Offset: 0000 - 9999 (Hz)
Read	1	2	3	4	5	6	7	8	9	10	P4 0: RX CLAR "OFF" 1: RX CLAR "ON" P5 0: TX CLAR "OFF" 1: TX CLAR "ON"
Answer	1	2	3	4	5	6	7	8	9	10	P6 MODE 1: LSB 2: USB 3: CW 4: FM 5: AM 6: RTTY-LSB 7: CW-R 8: DATA-LSB 9: RTTY-USB A: DATA-FM B: FM-N C: DATA-USB D: AM-N E: C4FM P7 0: VFO 1: Memory 2: Memory Tune 3: Quick Memory Bank (QMB) 4: QMB-MT 5: PMS 6: HOME P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9 00: (Fixed) P10 0: Simplex 1: Plus Shift 2: Minus Shift
	I	F	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P2	P3	P3	P3	P3	P3	P4	
	21	22	23	24	25	26	27	28	29	30	
	P5	P6	P7	P8	P9	P9	P10	;			

IS	IF-SHIFT										
Set	1	2	3	4	5	6	7	8	9	10	P1 0:Fixed P2 -1000 ~ +1000 Hz (20 Hz steps)
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	I	S	P1	-/+	P2	P2	P2	P2	;		

KM	KEYER MEMORY										
Set	1	2	3	4	5	6	7	~	53	n	P1 1 - 5 : Keyer Memory Channel Number P2 Message Characters (up to 50 characters)
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	~	n-1	n	
	K	M	P1	P2	P2	P2	P2	~	P2	;	

KP	KEY PITCH										
Set	1	2	3	4	5	6	7	8	9	10	P1 00: 300 Hz - 75: 1050 Hz (10Hz steps)
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	K	P	P1	P1	;						

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

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

KY	CW KEYING										
Set	1	2	3	4	5	6	7	8	9	10	P1 1: Keyer Memory "1" Playback 6: Message Keyer "1" Playback 2: Keyer Memory "2" Playback 7: Message Keyer "2" Playback 3: Keyer Memory "3" Playback 8: Message Keyer "3" Playback 4: Keyer Memory "4" Playback 9: Message Keyer "4" Playback 5: Keyer Memory "5" Playback A: Message Keyer "5" Playback
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	
	K	Y	P1	;							

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

LK	LOCK										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: VFO-A DIAL Lock "OFF" 1: VFO-A DIAL Lock "ON"
	L	K	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	L	K	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	L	K	P1	;							

LM	LOAD MESSAGE										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: DVS P2 0: DVS (Recording Stop) 1: DVS (CH "1" Recording Start/Stop) 2: DVS (CH "2" Recording Start/Stop) 3: DVS (CH "3" Recording Start/Stop) 4: DVS (CH "4" Recording Start/Stop) 5: DVS (CH "5" Recording Start/Stop)
	L	M	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	L	M	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	L	M	P1	P2	;						

MA	MEMORY CHANNEL TO VFO-A										
Set	1	2	3	4	5	6	7	8	9	10	
	M	A	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

MC	MEMORY CHANNEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 117: Memory Channel Number 000 - 099: Regular Memory Channel 100: P-1L 101: P-1U ~ 116: P-9L 117: P-9U
	M	C	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	M	C	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	M	C	P1	P1	P1	;					

MD	OPERATING MODE										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN RX P2 MODE 1: LSB 2: USB 3: CW-U 4: FM 5: AM 6: RTTY-LSB 7: CW-L 8: DATA-LSB 9: RTTY-USB A: DATA-FM B: FM-N C: DATA-USB D: AM-N E: C4FM
	M	D	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	M	D	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	M	D	P1	P2	;						

MG	MIC GAIN										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 100
	M	G	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	M	G	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	M	G	P1	P1	P1	;					

ML	MONITOR LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MONI "ON/OFF" 1: MONI Level P2 P1=0 000: MONI "OFF" 001: MONI "ON" P1=1 000 - 100
	M	L	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
	M	L	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	M	L	P1	P2	P2	P2	;				

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

MR	MEMORY CHANNEL READ										
Set	1	2	3	4	5	6	7	8	9	10	P0/1 000-117 (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: RTTY-LSB 7: CW-R 8: DATA-LSB 9: RTTY-USB A: DATA-FM B: FM-N C: DATA-USB D: AM-N E: C4FM P7 0: VFO 1: Memory P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9 00: (Fixed) P10 0: Simplex 1: Plus Shift 2: Minus Shift
Read	1	2	3	4	5	6	7	8	9	10	
	M	R	P0	P0	P0	;					
Answer	1	2	3	4	5	6	7	8	9	10	
	M	R	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P2	P3	P3	P3	P3	P3	P4	
	21	22	23	24	25	26	27	28	29	30	
	P5	P6	P7	P8	P9	P9	P10	;			

MS	METER SW										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: COMP 1: ALC 2: PO 3: SWR 4: ID 5: VDD
		M	S	P1	;						
Read	1	2	3	4	5	6	7	8	9	10	
	M	S	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	M	S	P1	;							

MW	MEMORY CHANNEL WRITE										
Set	1	2	3	4	5	6	7	8	9	10	P1 000-117 (Memory Channel) P2 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: RTTY-LSB 7: CW-R 8: DATA-LSB 9: RTTY-USB A: DATA-FM B: FM-N C: DATA-USB D: AM-N E: C4FM P7 00: (Fixed) P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9 00: (Fixed) P10 0: Simplex 1: Plus Shift 2: Minus Shift
	M	W	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P2	P3	P3	P3	P3	P3	P4	
	21	22	23	24	25	26	27	28	29	30	
	P5	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	

MX	MOX SET										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MOX "OFF" 1: MOX "ON"
		M	X	P1	;						
Read	1	2	3	4	5	6	7	8	9	10	
	M	X	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	M	X	P1	;							

NA	NARROW										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: OFF 1: ON
		M	A	P1	P2	;					
Read	1	2	3	4	5	6	7	8	9	10	
	M	A	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	M	A	P1	P2	;						

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

NL	NOISE BLANKER LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000 - 010
		N	L	P1	P2	P2	P2	;			
Read	1	2	3	4	5	6	7	8	9	10	
	N	L	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	N	L	P1	P2	P2	P2	;				

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

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

OI	OPPOSITE BAND INFORMATION										
Set	1	2	3	4	5	6	7	8	9	10	P1 000-117 (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: RTTY-LSB 7: CW-R 8: DATA-LSB 9: RTTY-USB A: DATA-FM B: FM-N C: DATA-USB D: AM-N E: C4FM P7 0: VFO 1: Memory P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC P9 00: (Fixed) P10 0: Simplex 1: Plus Shift 2: Minus Shift
Read	1	2	3	4	5	6	7	8	9	10	
	O	I	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	O	I	P1	P1	P1	P2	P2	P2	P2	P2	
	11	12	13	14	15	16	17	18	19	20	
	P2	P2	P2	P2	P3	P3	P3	P3	P3	P4	
	21	22	23	24	25	26	27	28	29	30	
	P5	P6	P7	P8	P9	P9	P10	;			

OS	OFFSET (REPEATER SHIFT)										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 0: Simplex 1: Plus Shift 2: Minus Shift *: This command can be activated only with an FM mode.
	O	S	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	O	S	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	O	S	P1	P2	;						

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

PB	PLAY BACK										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: DVS P2 0: DVS (Playback Stop) 1: DVS (CH "1" Playback Start) 2: DVS (CH "2" Playback Start) 3: DVS (CH "3" Playback Start) 4: DVS (CH "4" Playback Start) 5: DVS (CH "5" Playback Start)
	P	B	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	P	B	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	P	B	P1	P2	;						

PC	POWER CONTROL										
Set	1	2	3	4	5	6	7	8	9	10	P1 005-100
	P	C	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	P	C	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	C	P1	P1	P1	;					

PL	SPEECH PROCESSOR LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 000-100
	P	L	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	P	L	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	L	P1	P1	P1	;					

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

PR	SPEECH PROCESSOR LEVEL										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Speech Processor 1: Parametric Microphone Equalizer P2 1: "OFF" 2: "ON"
	P	R	P1	P2	;						
Read	1	2	3	4	5	6	7	8	9	10	
	P	R	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	P	R	P1	P2	;						

PS	POWER SWITCH										
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.
	P	S	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	P	S	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	P	S	P1	;							

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	
	R	A	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	R	A	P1	P2	;						

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	CLAR DOWN										
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	

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

SD		CW BREAK-IN DELAY TIME									
Set	1	2	3	4	5	6	7	8	9	10	P1 0030 - 3000 msec
	S	D	P1	P1	P1	P1	;				
Read	1	2	3	4	5	6	7	8	9	10	
	S	D	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	S	D	P1	P1	P1	P1	;				

SH		WIDTH									
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 00 (See Table)
	S	H	P1	P2	P2	;					
Read	1	2	3	4	5	6	7	8	9	10	
	S	H	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	S	H	P1	P2	P2	;					

Command	Bandwidth						
	P2	SSB (Narrow)	SSB (Wide)	CW (Narrow)	CW (Wide)	RTTY/PSK (Narrow)	RTTY/PSK (Wide)
00 (Default)		1500 Hz	2400 Hz	500 Hz	2400 Hz	300 Hz	500 Hz
01		200 Hz	-	50 Hz	-	50 Hz	-
02		400 Hz	-	100 Hz	-	100 Hz	-
03		600 Hz	-	150 Hz	-	150 Hz	-
04		850 Hz	-	200 Hz	-	200 Hz	-
05		1100 Hz	-	250 Hz	-	250 Hz	-
06		1350 Hz	-	300 Hz	-	300 Hz	-
07		1500 Hz	-	350 Hz	-	350 Hz	-
08		1650 Hz	-	400 Hz	-	400 Hz	-
09		1800 Hz	1800 Hz	450 Hz	-	450 Hz	-
10		-	1950 Hz	500 Hz	500 Hz	500 Hz	500 Hz
11		-	2100 Hz	-	800 Hz	-	800 Hz
12		-	2200 Hz	-	1200 Hz	-	1200 Hz
13		-	2300 Hz	-	1400 Hz	-	1400 Hz
14		-	2400 Hz	-	1700 Hz	-	1700 Hz
15		-	2500 Hz	-	2000 Hz	-	2000 Hz
16		-	2600 Hz	-	2400 Hz	-	2400 Hz
17		-	2700 Hz	-	3000 Hz	-	3000 Hz
18		-	2800 Hz	-	-	-	-
19		-	2900 Hz	-	-	-	-
20		-	3000 Hz	-	-	-	-
21		-	3200 Hz	-	-	-	-

SM		S-METER READING									
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	
	S	M	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	S	M	P1	P2	P2	P2	;				

SQ		SQUELCH LEVEL									
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Fixed P2 000 - 100
	S	Q	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
	S	Q	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	S	Q	P1	P2	P2	P2	;				

SV		SWAP VFO									
Set	1	2	3	4	5	6	7	8	9	10	
	S	V	;								
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

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

TX	TX SET										
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)
	T	X	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	T	X	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	T	X	P1	;							

UL	PLL UNLOCK STATUS										
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	
	U	L	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	U	L	P1	;							

UP	UP										
Set	1	2	3	4	5	6	7	8	9	10	
	U	P	;								
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

VD	VOX DELAY TIME										
Set	1	2	3	4	5	6	7	8	9	10	P1 0030 - 3000 msec (10 msec multiples)
	V	D	P1	P1	P1	P1	;				
Read	1	2	3	4	5	6	7	8	9	10	
	V	D	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	V	D	P1	P1	P1	P1	;				

VG	VOX GAIN										
Set	1	2	3	4	5	6	7	8	9	10	P1 000 - 100
	V	G	P1	P1	P1	;					
Read	1	2	3	4	5	6	7	8	9	10	
	V	G	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	V	G	P1	P1	P1	;					

VM	VFO-A TO MEMORY CHANNEL										
Set	1	2	3	4	5	6	7	8	9	10	
	V	M	;			;					
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	

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

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

XT	TX CLAR										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: TX CLAR "OFF" 1: TX CLAR "ON"
	X	T	P1	;		;					
Read	1	2	3	4	5	6	7	8	9	10	
	X	T	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	X	T	P1	;							

ZI	ZERO IN										
Set	1	2	3	4	5	6	7	8	9	10	(CW AUTO ZERO IN Function)
	Z	I	;			;					
Read	1	2	3	4	5	6	7	8	9	10	
Answer	1	2	3	4	5	6	7	8	9	10	



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