YAESU
The radio

HF / VHF / UHF ALL MODE TRANSCEIVER

FT-991A

CAT Operation Reference Manual

YAESU MUSEN CO., LTD.

CAT (COMPUTER AIDED TRANSCEIVER) OPERATION

OVERVIEW

The CAT (Computer Aided Transceiver) System in the **FT-991A** 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-991A** 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)

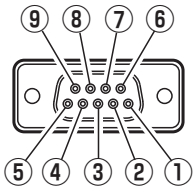
Note: A USB driver is required for remote control from a computer. Download the driver from the Yaesu website (http://www.yaesu.com).

The **FT-991A** 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	---	---
⑧	CTS	---	---
⑨	N/A	---	---

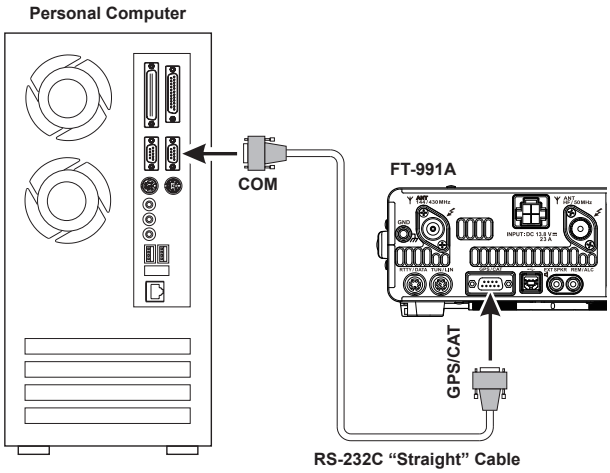


Figure 1

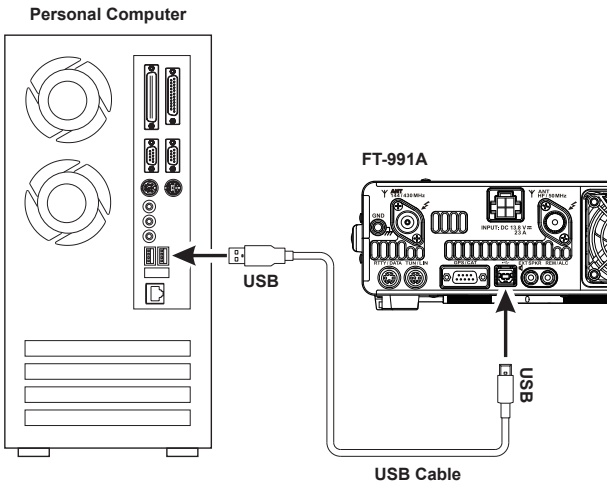


Figure 2

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	**014250000**	**;**
↑	↑	↑
Command	Parameter	Terminator

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

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

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

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

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:
  "**FA014250000;**" (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:
  "**FA014250000;**" (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 "**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-991A**, 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.

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

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

AB — VFO-A TO VFO-B

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

AC — ANTENNA TUNER CONTROL

	1	2	3	4	5	6	7	8	9	10
Set	A	C	P1	P2	P3	;				
Read	A	C	;							
Answer	A	C	P1	P2	P3	;				

P1 0: Fixed
P2 0: Fixed
P3 0: Tuner "OFF"
1: Tuner "ON"
2: Tuning Start / Tuning Stop

AG — AF GAIN

	1	2	3	4	5	6	7	8	9	10
Set	A	G	P1	P2	P2	P2	;			
Read	A	G	P1	;						
Answer	A	G	P1	P2	P2	P2	;			

P1 0: Fixed
P2 000 - 255

AI — AUTO INFORMATION

	1	2	3	4	5	6	7	8	9	10
Set	A	I	P1	;						
Read	A	I	;							
Answer	A	I	P1	;						

P1 0: Auto Information "OFF"
1: Auto Information "ON"

This parameter is set to "0" (OFF) automatically when the transceiver is turned "OFF".

AM — VFO-A TO MEMORY CHANNEL

	1	2	3	4	5	6	7	8	9	10
Set	A	M	;							
Read										
Answer										

BA — VFO-B TO VFO-A

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

BC — AUTO NOTCH

	1	2	3	4	5	6	7	8	9	10
Set	B	C	P1	P2	;					
Read	B	C	P1	;						
Answer	B	C	P1	P2	;					

P1 0: Fixed
P2 0: Auto Notch "OFF"
1: Auto Notch "ON"

BD — BAND DOWN

	1	2	3	4	5	6	7	8	9	10
Set	B	D	P1	;						
Read										
Answer										

P1 0: Fixed

BI — BREAK-IN

	1	2	3	4	5	6	7	8	9	10
Set	B	I	P1	;						
Read	B	I	;							
Answer	B	I	P1	;						

P1 0: Break-in "OFF"
1: Break-in "ON"

BP — MANUAL NOTCH

	1	2	3	4	5	6	7	8	9	10
Set	B	P	P1	P2	P3	P3	P3	;		
Read	B	P	P1	P2	;					
Answer	B	P	P1	P2	P3	P3	P3	;		

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)

BS — BAND SELECT

	1	2	3	4	5	6	7	8	9	10
Set	B	S	P1	P1	;					
Read										
Answer										

P1 00: 1.8 MHz
01: 3.5 MHz
02: 5 MHz
03: 7 MHz
04: 10 MHz
05: 14 MHz
06: 18 MHz
07: 21 MHz
08: 24.5 MHz
09: 28 MHz
10: 50 MHz
11: GEN
12: MW
13: -
14: AIR
15: 144 MHz
16: 430 MHz

BU — BAND UP

	1	2	3	4	5	6	7	8	9	10
Set	B	U	P1	;						
Read										
Answer										

P1 0: Fixed

BY — BUSY

	1	2	3	4	5	6	7	8	9	10
Set										
Read	B	Y	;							
Answer	B	Y	P1	P2	;					

P1 0: RX BUSY "OFF"
1: RX BUSY "ON"
P2 0: Fixed

CH — CHANNEL UP/DOWN

	1	2	3	4	5	6	7	8	9	10
Set	C	H	P1	;						
Read										
Answer										

P1 0: Memory Channel "UP"
1: Memory Channel "DOWN"

CN — CTCSS TONE FREQUENCY

	1	2	3	4	5	6	7	8	9	10
Set	C	N	P1	P2	P3	P3	P3	;		
Read	C	N	P1	P2	;					
Answer	C	N	P1	P2	P3	P3	P3	;		

P1 0: Fixed
P2 0: CTCSS
1: DCS
P3 P2=0 000 - 049: Tone Frequency Number (See Table 1)
P2=1 000 - 103: DCS Code Number (See Table 2)

CO — CONTOUR

	1	2	3	4	5	6	7	8	9	10
Set	C	O	P1	P2	P3	P3	P3	P3	;	
Read	C	O	P1	P2	;					
Answer	C	O	P1	P2	P3	P3	P3	P3	;	

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)

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 2: CTCSS ENC 3: DCS ENC/DEC 4: DCS ENC
	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	;						

Table 1 (CTCSS Tone Chart)

000	67.0 Hz	009	91.5 Hz	018	123.0 Hz	027	162.2 Hz	036	189.9 Hz	045	229.1 Hz
001	69.3 Hz	010	94.8 Hz	019	127.3 Hz	028	165.5 Hz	037	192.8 Hz	046	233.6 Hz
002	71.9 Hz	011	97.4 Hz	020	131.8 Hz	029	167.9 Hz	038	196.6 Hz	047	241.8 Hz
003	74.4 Hz	012	100.0 Hz	021	136.5 Hz	030	171.3 Hz	039	199.5 Hz	048	250.3 Hz
004	77.0 Hz	013	103.5 Hz	022	141.3 Hz	031	173.8 Hz	040	203.5 Hz	049	254.1 Hz
005	79.7 Hz	014	107.2 Hz	023	146.2 Hz	032	177.3 Hz	041	206.5 Hz	-	-
006	82.5 Hz	015	110.9 Hz	024	151.4 Hz	033	179.9 Hz	042	210.7 Hz	-	-
007	85.4 Hz	016	114.8 Hz	025	156.7 Hz	034	183.5 Hz	043	218.1 Hz	-	-
008	88.5 Hz	017	118.8 Hz	026	159.8 Hz	035	186.2 Hz	044	225.7 Hz	-	-

Table 2 (DCS Code Chart)

000	023	015	074	030	165	045	261	060	356	075	462	090	627
001	025	016	114	031	172	046	263	061	364	076	464	091	631
002	026	017	115	032	174	047	265	062	365	077	465	092	632
003	031	018	116	033	205	048	266	063	371	078	466	093	654
004	032	019	122	034	212	049	271	064	411	079	503	094	662
005	036	020	125	035	223	050	274	065	412	080	506	095	664
006	043	021	131	036	225	051	306	066	413	081	516	096	703
007	047	022	132	037	226	052	311	067	423	082	523	097	712
008	051	023	134	038	243	053	315	068	431	083	526	098	723
009	053	024	143	039	244	054	325	069	432	084	532	099	731
010	054	025	145	040	245	055	331	070	445	085	546	100	732
011	065	026	152	041	246	056	332	071	446	086	565	101	734
012	071	027	155	042	251	057	343	072	452	087	606	102	743
013	072	028	156	043	252	058	346	073	454	088	612	103	754
014	073	029	162	044	255	059	351	074	455	089	624	-	-

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 yyyymmdd (Year/Month/Date) P1=1 hhmmss (Hour/Minute/Second, 24 hour time system) P1=2 -hhmm or +hhmm (Hour/Minute, -12:00 - +14:00, 30 minute increments)
	D	T	P1	P2	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	~	P2	;	

ED	ENCORDER DOWN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCODER 1: SUB ENCODER 8: MULTI ENCODER P2 01 - 99: Frequency Steps 01 : (Fixed) Step (Except when encoder function is set to "frequency")
	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

EU	ENCORDER UP										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCODER 1: SUB ENCODER 8: MULTI ENCODER P2 01 - 99: Frequency Steps 01 : (Fixed) Step (Except when encoder function is set to "frequency")
	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 - 153 (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	
	E	**X**	P1	P1	P1	;					
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: NORMAL 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: GPS1 1: GPS2 3: 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

P1	Function	P2	Digits
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 mesc 3: 30 msec	1
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	GM DISPLY	0: DISTANCE 1: STRENGTH	1
089	DISTANCE	0: km 1: mile	1
090	AMS TX MODE	0: AUTO 1: MANUAL 2: DN 3: VW 4: ANALOG	1
091	STANDBY BEEP	0: OFF 1: ON	1
092	RTTY LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000Hz (50 Hz steps)	2
093	RTTY LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
094	RTTY HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000Hz (50 Hz steps)	2
095	RTTY HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
096	RTTY SHIFT PORT	0: SHIFT 1: DTR 2: RTS	1
097	RTTY POLARITY-RX	0: NORMAL 1: REVERSE	1
098	RTTY POLARITY-TX	0: NORMAL 1: REVERSE	1
099	RTTY OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
100	RTTY SHIFT FREQ	1: 170 Hz 1: 200 Hz 2: 425 Hz 3: 850 Hz	1
101	RTTY MARK FREQ	1: 1275 Hz 2: 2125 Hz	1
102	SSB LCUT FREQ	00: OFF 01: 100 Hz ~ 19: 1000 Hz (50 Hz steps)	2
103	SSB LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
104	SSB HCUT FREQ	00: OFF 01: 700 Hz ~ 67: 4000 Hz (50 Hz steps)	2
105	SSB HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
106	SSB MIC SELECT	0: MIC 1: REAR	1
107	SSB OUT LEVEL	0 ~ 100 (P2 = 000 ~ 100)	3
108	SSB PTT SELECT	0: DAKY 1: RTS 2: DTR	1
109	SSB PORT SELECT	0: DATA 1: USB	1
110	SSB TX BPF	0: 50 ~ 3000 1: 100 ~ 2900 2: 200 ~ 2800 3: 300 ~ 2700 4: 400 ~ 2600	1
111	APF WIDTH	0: NARROW 1: MEDIUM 2: WIDE	1
112	CONTOUR LEVEL	–40 ~ 0 ~ +20 (P2 = –40 ~ –00 or +00 ~ +20)	3
113	CONTOUR WIDTH	01 ~ 11	2
114	IF NOTCH WIDTH	0: NARROW 1: WIDE	1
115	SCP DISPLAY MODE	0: SPECTRUM 1: WATER FALL	1
116	SCP SPAN FREQ	03: 50 kHz 04: 100 kHz 05: 200 kHz 06: 500 kHz 07: 1000 kHz	2
117	SPECTRUM COLOR	0: BLUE 1: GRAY 2: GREEN 3: ORANGE 4: PURPLE 5: RED 6: SKY BLUE	1
118	WATER FALL COLOR	0: BLUE 1: GRAY 2: GREEN 3: ORANGE 4: PURPLE 5: RED 6: SKY BLUE 7: MULTI	1
119	PRMTRC EQ1 FREQ	00 : OFF 01: 100 02: 200 03: 300 04: 400 05: 500 06: 600 07: 700 Hz	2
120	PRMTRC EQ1 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
121	PRMTRC EQ1 BWTH	01 ~ 10	2
122	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
123	PRMTRC EQ2 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
124	PRMTRC EQ2 BWTH	01 ~ 10	2

P1	Function	P2	Digits
125	PRMTRC EQ3 FREQ	00 : OFF 01: 1500 02: 1600 03: 1700 04: 1800 05: 1900 06: 2000 ~ 18: 3200 Hz	2
126	PRMTRC EQ3 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
127	PRMTRC EQ3 BWTH	01 ~ 10	2
128	P-PRMTRC EQ1 FREQ	00 : OFF 01: 100 02: 200 03: 300 04: 400 05: 500 06: 600 07: 700 Hz	2
129	P-PRMTRC EQ1 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
130	P-PRMTRC EQ1 BWTH	01 ~ 10	2
131	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
132	P-PRMTRC EQ2 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
133	P-PRMTRC EQ2 BWTH	01 ~ 10	2
134	P-PRMTRC EQ3 FREQ	00 : OFF 01: 1500 02: 1600 03: 1700 04: 1800 05: 1900 06: 2000 ~ 18: 3200 Hz	2
135	P-PRMTRC EQ3 LEVEL	–20 ~ 0 ~ +10 (P2 = –20 ~ –00 or +00 ~ +10)	3
136	P-PRMTRC EQ3 BWTH	01 ~ 10	2
137	HF TX MAX POWER	5 ~ 100 (P2 = 005 ~ 100)	3
138	50M TX MAX POWER	5 ~ 100 (P2 = 005 ~ 100)	3
139	144M TX MAX POWER	5 ~ 50 (P2 = 005 ~ 050)	3
140	430M TX MAX POWER	5 ~ 50 (P2 = 005 ~ 050)	3
141	TUNER SELECT	0: OFF 1: INTERNAL 2: EXTERNAL 3: ATAS 4: LAMP	1
142	VOX SELECT	0: MIC 1: DATA	1
143	VOX GAIN	000 ~ 100	3
144	VOX DELAY	30 ~ 3000 msec (P2 = 0030 ~ 3000, 10 msec/step)	4
145	ANTI VOX GAIN	000 ~ 100	3
146	DATA VOX GAIN	000 ~ 100	3
147	DATA VOX DELAY	30 ~ 3000 msec (P2 = 0030 ~ 3000)	4
148	ANTI DVOX GAIN	000 ~ 100	3
149	EMERGENCY FREQ TX	0: DISABLE 1: ENABLE	1
150	PRT/WIRES FREQ	0: MANUAL 1: PRESET	1
151	PRESET FREQUENCY	00030000 ~ 47000000	8
152	SEARCH SETUP	0: HISTORY 1: ACTIVITY	1
153	WIRES DG-ID	00: AUTO 01: DG-ID 01 ~ 99: DG-ID 99	2

FA	**FREQUENCY VFO-A**										
Set	1	2	3	4	5	6	7	8	9	10	P1 000030000 - 470000000 (Hz)
	F	**A**	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	;									
Read	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 - 470000000 (Hz)
	F	**B**	P1	P1	P1	P1	P1	P1	P1	P1	
	11	12	13	14	15	16	17	18	19	20	
	P1	;									
Read	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”
	F	**S**	P1	;							1: VFO-A FAST Key “ON”
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
	F	**T**	P1	;							3: VFO-B Band Transmitter: TX
Read	1	2	3	4	5	6	7	8	9	10	P2 0: VFO-A Band Transmitter: TX
	F	**T**	;								1: VFO-B Band Transmitter: TX
Answer	1	2	3	4	5	6	7	8	9	10	
	F	**T**	P2	;							

GT AGC FUNCTION

	1	2	3	4	5	6	7	8	9	10
Set	G	T	P1	P2	;					
Read	G	T	P1	;						
Answer	G	T	P1	P3	;					

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"

ID IDENTIFICATION

	1	2	3	4	5	6	7	8	9	10
Set										
Read	I	D	;							
Answer	I	D	P1	P1	P1	P1	;			

P1 0670: FT-991A

IF INFORMATION

	1	2	3	4	5	6	7	8	9	10
Set										
Read	I	F	;							
Answer	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	;		

P1 001-117 (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 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 3: DCS ENC/DEC
4: DCS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift

IS IF-SHIFT

	1	2	3	4	5	6	7	8	9	10
Set	I	S	P1	-/+	P2	P2	P2	P2	;	
Read	I	S	P1	;						
Answer	I	S	P1	-/+	P2	P2	P2	P2	;	

P1 0:Fixed
P2 -1200 ~ +1200 Hz (20 Hz steps)

KM KEYER MEMORY

	1	2	3	4	5	6	7	~	n-1	n
Set	K	M	P1	P2	P2	P2	P2	~	P2	;
Read	K	M	P1	;						
Answer	K	M	P1	P2	P2	P2	P2	~	P2	;

P1 1 - 5 : Keyer Memory Channel Number
P2 Message Characters (up to 50 characters)

KP KEY PITCH

	1	2	3	4	5	6	7	8	9	10
Set	K	P	P1	P1	;					
Read	K	P	;							
Answer	K	P	P1	P1	;					

P1 00: 300 Hz - 75: 1050 Hz (10Hz steps)

KR KEYER

	1	2	3	4	5	6	7	8	9	10
Set	K	R	P1	;						
Read	K	R	;							
Answer	K	R	P1	;						

P1 0: KEYER "OFF"
1: KEYER "ON"

KS KEY SPEED

	1	2	3	4	5	6	7	8	9	10
Set	K	S	P1	P1	P1	;				
Read	K	S	;							
Answer	K	S	P1	P1	P1	;				

P1 004 - 060 (WPM)

KY CW KEYING

	1	2	3	4	5	6	7	8	9	10
Set	K	Y	P1	;						
Read										
Answer										

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

LK LOCK

	1	2	3	4	5	6	7	8	9	10
Set	L	K	P1	;						
Read	L	K	;							
Answer	L	K	P1	;						

P1 0: VFO-A DIAL Lock "OFF"
1: VFO-A DIAL Lock "ON"

LM LOAD MESSEGE

	1	2	3	4	5	6	7	8	9	10
Set	L	M	P1	P2	;					
Read	L	M	P1	;						
Answer	L	M	P1	P2	;					

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)

MA MEMORY CHANNEL TO VFO-A

	1	2	3	4	5	6	7	8	9	10
Set	M	A	;							
Read										
Answer										

MC MEMORY CHANNEL

	1	2	3	4	5	6	7	8	9	10
Set	M	C	P1	P1	P1	;				
Read	M	C	;							
Answer	M	C	P1	P1	P1	;				

P1 001 - 117: Memory Channel Number
001 - 099: Regular Memory Channel
100: P-1L 101: P-1U ~ 116: P-9L 117: P-9U

MD OPERATING MODE

	1	2	3	4	5	6	7	8	9	10
Set	M	D	P1	P2	;					
Read	M	D	P1	;						
Answer	M	D	P1	P2	;					

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

MG MIC GAIN

	1	2	3	4	5	6	7	8	9	10
Set	M	G	P1	P1	P1	;				
Read	M	G	;							
Answer	M	G	P1	P1	P1	;				

P1 000 - 100

ML — MONITOR LEVEL

	1	2	3	4	5	6	7	8	9	10
Set	**M**	**L**	P1	P2	P2	P2	;			
Read	**M**	**L**	P1	;						
Answer	**M**	**L**	P1	P2	P2	P2	;			

P1 0: MONI "ON/OFF"
1: MONI Level
P2 P1=0
000: MONI "OFF"
001: MONI "ON"
P1=1
000 - 100

MR — MEMORY CHANNEL READ

	1	2	3	4	5	6	7	8	9	10
Set										
Read	**M**	**R**	P0	P0	P0	;				
Answer	**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	;		

P0/1 001-117 (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 3: DCS ENC/DEC
4: DCS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift

MS — METER SW

	1	2	3	4	5	6	7	8	9	10
Set	**M**	**S**	P1	;						
Read	**M**	**S**	;							
Answer	**M**	**S**	P1	;						

P1 0: COMP
1: ALC
2: PO
3: SWR
4: ID
5: VDD

MT — MEMORY CHANNEL WRITE/TAG

	1	2	3	4	5	6	7	8	9	10
Set	**M**	**T**	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	P11	P12	P12
	31	32	33	34	35	36	37	38	39	40
	P12	P12	P12	P12	P12	P12	P12	P12	P12	P12
	41	42	43	44	45	46	47	48	49	50
	;									
Read	**M**	**T**	P0	P0	P0	;				
Answer	**M**	**T**	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	P11	P12	P12
	31	32	33	34	35	36	37	38	39	40
	P12	P12	P12	P12	P12	P12	P12	P12	P12	P12
	41	42	43	44	45	46	47	48	49	50
	;									

P0/1 001-117 (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 Set: 0: (Fixed) / Read: 0: VFO 1: Memory
P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC 3: DCS ENC/DEC
4: DCS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift
P11 0: (Fixed)
P12 TAG Characters (up to 12 characters) (ASCII)

MW — MEMORY CHANNEL WRITE

	1	2	3	4	5	6	7	8	9	10
Set	**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										
Answer										

P1 001-117 (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 3: DCS ENC/DEC
4: DCS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift

MX	MOX SET									
Set	1	2	3	4	5	6	7	8	9	10
	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	;						

P1 0: MOX "OFF"
1: MOX "ON"

NA	NARROW									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: Fixed
P2 0: OFF
1: ON

NB	NOISE BLANKER STATUS									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: Fixed
P2 0: Noise Blanker "OFF"
1: Noise Blanker "ON"

NL	NOISE BLANKER LEVEL									
Set	1	2	3	4	5	6	7	8	9	10
	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	;			

P1 0: Fixed
P2 000 - 010

NR	NOISE REDUCTION									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: Fixed
P2 0: Noise Reduction "OFF"
1: Noise Reduction "ON"

OI	OPPOSITE BAND INFORMATION									
Set	1	2	3	4	5	6	7	8	9	10
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	;		

P1 001-117 (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 3: DCS ENC/DEC
4: DCS ENC
P9 0: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift

OS	OFFSET (REPEATER SHIFT)									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: Fixed
P2 0: Simplex
1: Plus Shift
2: Minus Shift
*: This command can be activated only with an FM mode.

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	;					

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

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

RA — RF ATTENUATOR

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

P1 0: Fixed
P2 0: OFF
1: ON

RC — CLAR CLEAR

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

RD — CLAR DOWN

	1	2	3	4	5	6	7	8	9	10
Set	**R**	**D**	P1	P1	P1	P1	;			
Read										
Answer										

P1 0000 - 9999 (Hz)

RG — RF GAIN

	1	2	3	4	5	6	7	8	9	10
Set	**R**	**G**	P1	P2	P2	P2	;			
Read	**R**	**G**	P1	;						
Answer	**R**	**G**	P1	P2	P2	P2	;			

P1 0: Fixed
P2 000 - 255

RI — RADIO INFORMATION

	1	2	3	4	5	6	7	8	9	10
Set										
Read	**R**	**I**	P1	;						
Answer	**R**	**I**	P1	P2	;					

P1 0: Hi-SWR
3: REC
4: PLAY
5: VFO-A TX
6: VFO-B TX
7: VFO-A RX
A: TX LED
P2 0: OFF
1: ON

RL — NOISE REDUCTION LEVEL

	1	2	3	4	5	6	7	8	9	10
Set	**R**	**L**	P1	P2	P2	;				
Read	**R**	**L**	P1	;						
Answer	**R**	**L**	P1	P2	P2	;				

P1 0: Fixed
P2 01 - 15

RM — READ METER

	1	2	3	4	5	6	7	8	9	10
Set										
Read	**R**	**M**	P1	;						
Answer	**R**	**M**	P1	P2	P2	P2	;			

P1 0: Depends on the front panel METER
1: S
2: Depends on the front panel METER
(PO / COMP / ALC / SWR / ID / VDD)
3: COMP
4: ALC
5: PO
6: SWR
7: ID
8: VDD
P2 0 - 255

RS	RADIO STATUS										
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	
	R	S	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	R	S	P1	;							

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

RU	RX CLARIFIER PLUS OFFSET										
Set	1	2	3	4	5	6	7	8	9	10	P1 0000 - 9999 (Hz)
	R	U	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	

SC	SCAN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: Scan "OFF" 1: Scan "ON" (UP ward) 2: Scan "ON" (DOWN ward)
	S	C	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	S	C	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	S	C	P1	;							

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	SQUELCLH 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	

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 / DATA VOX DELAY TIME										
Set	1	2	3	4	5	6	7	8	9	10	P1 0030 - 3000 msec (10 msec multiples) VD command has different parameters to be changed according to the setting of Menu item “142 VOX SELECT”. “MIC”: VOX DELAY “DATA”: DATA VOX DELAY
	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	;							

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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