YAESU
The radio

FT-891

CAT Operation

Reference Book

YAESU MUSEN CO., LTD.

CAT (Computer Aided Transceiver) Operation

Overview

The CAT (Computer Aided Transceiver) System in the **FT-891** 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 USB Cable (Refer to figure 1)

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-891** 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

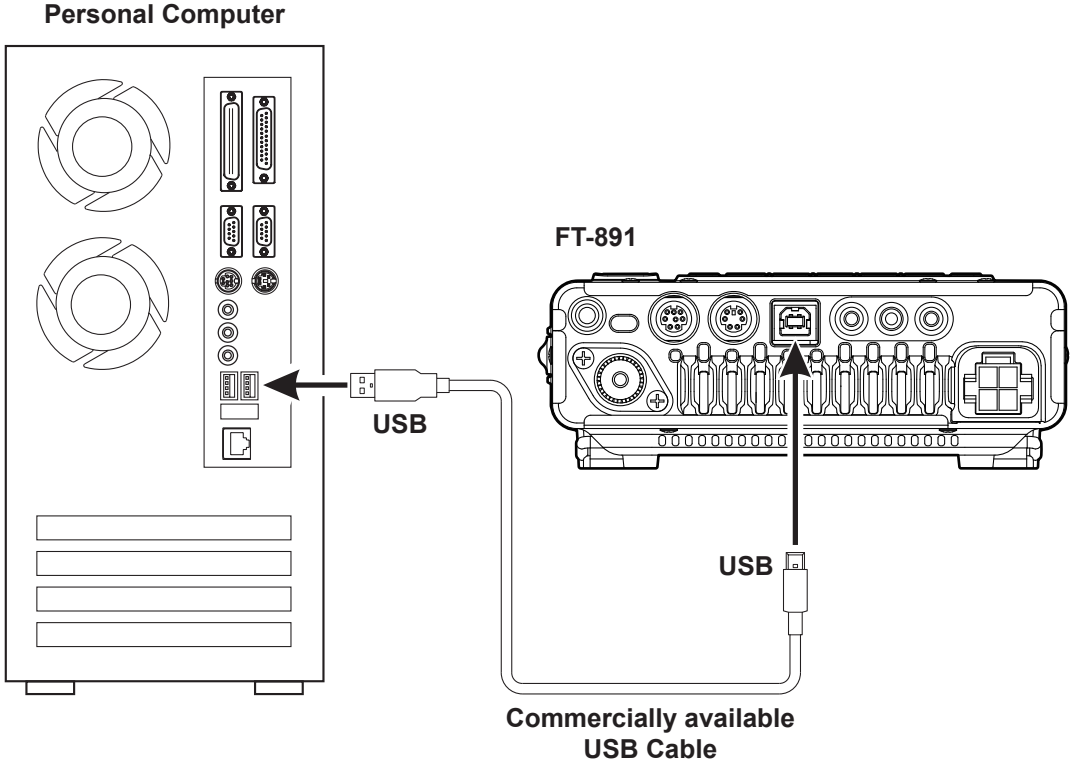

Figure 1

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-891** as shown below:

Set command: Set a particular condition (to the **FT-891**)

Read command: Reads an answer (from the **FT-891**)

Answer command: Transmits a condition (from the **FT-891**)

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-891**, 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	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
CF	CLAR	O	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
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	X
FB	FREQUENCY VFO-B	O	O	O	X
FS	FAST STEP	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 MESSAGE	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 WRITE & TAG	O	X	X	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
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

Command	Function	Set	Read	Ans.	AI
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	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
ST	SPLIT	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
ZI	ZERO IN	O	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
	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	;				

P1 0: (Fixed)
P2 0: (Fixed)
P3 0: Tuner "OFF"
1: Tuner "ON"
2: Tuning Start

AG	AF GAIN									
Set	1	2	3	4	5	6	7	8	9	10
	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	;			

P1 0: (Fixed)
P2 000 - 255

AI	AUTO INFORMATION									
Set	1	2	3	4	5	6	7	8	9	10
	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	;						

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									
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
	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	;					

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

BD	BAND DOWN									
Set	1	2	3	4	5	6	7	8	9	10
	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

P1 0: (Fixed)

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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: -
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

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)

CF — CLAR

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

P1 0: (Fixed)
P2 0: CLAR "OFF"
1: CLAR "ON"
P3 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, page 6)
P2=1 000 - 103: DCS Code Number (See Table 2, page6)

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CO	CONTOUR									
Set	1	2	3	4	5	6	7	8	9	10
	C	**O**	P1	P2	P3	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	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 - 3200 Hz)
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
	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	;						

P1 0: OFF
1: ON

CT	CTCSS									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: (Fixed)
P2 0: CTCSS "OFF"
1: CTCSS ENC/DEC "ON"
2: CTCSS ENC "ON"
3: DCS "ON"

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
	D	**A**	P1	P1	P2	P2	P3	P3	P4	P4
	11	12	13	14	15	16	17	18	19	20
	;									
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	P4	P4
	11	12	13	14	15	16	17	18	19	20
	;									

P1 01 - 15: LCD Contrast Level
P2 01 - 15: Dimmer Backligt Level
P3 00 - 15: Dimmer LCD Level
P4 00 - 15: Dimmer TX/BUSY Level

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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

ED	ENCORDER DOWN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCORDER 8: MULTI FUNCTION KNOB 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

EU	ENCORDER UP										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: MAIN ENCORDER 8: MULTI FUNCTION KNOB 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 : 0101 - 1803 (MENU Number) P2 : Parameter (See Table below)
	E	**X**	P1	P1	P1	P1	P2	~	P2	**;**	
Read	1	2	3	4	5	6	7	8	9	10	
	E	**X**	P1	P1	P1	P1	;				
Answer	1	2	3	4	5	6	7	~	n-1	n	
	E	**X**	P1	P1	P1	P1	P2	~	P2	**;**	

P1	Function	P2	Digits
0101	AGC FAST DELAY	20 - 4000 (msec) (P2= 0020 - 4000, 20 msec/step)	4
0102	AGC MID DELAY	20 - 4000 (msec) (P2= 0020 - 4000, 20 msec/step)	4
0103	AGC SLOW DELAY	20 - 4000 (msec) (P2= 0020 - 4000, 20 msec/step)	4
0201	LCD CONTRAST	01 - 15	2
0202	DIMMER BACKLIT	01 - 15	2
0203	DIMMER LCD	01 - 15	2
0204	DIMMER TX/BUSY	01 - 15	2
0205	PEAK HOLD	0: OFF 1: 0.5 sec 2: 1.0 sec 3: 2.0 sec	1
0206	ZIN LED	0: DISABLE 1: ENABLE	1
0207	POP-UP MENU	0: UPPER 1: LOWER	1
0301	DVS RX OUT LVL	000 - 100 (P2= 000 - 100)	3
0302	DVS TX OUT LVL	000 - 100 (P2= 000 - 100)	3
0401	KEYER TYPE	0: OFF 1: BUG 2: ELEKEY-A 3: ELEKEY-B 4: ELEKEY-Y 5: ACS	1
0402	KEYER DOT/DASH	0: NOR 1: REV	1
0403	CW WEIGHT	2.5 - 4.5 (P2= 25 - 45)	2
0404	BEACON INTERVAL	OFF/1 - 690 sec (P2= 000 - 690, 000: OFF)	3
0405	NUMBER STYLE	0: 1290 1: AUNO 2: AUNT 3: A2NO 4: A2NT 5: 12NO 6: 12NT	1
0406	CONTEST NUMBER	0000 - 9999	4
0407	CW MEMORY 1	0: TEXT 1: MESSAGE	1
0408	CW MEMORY 2	0: TEXT 1: MESSAGE	1
0409	CW MEMORY 3	0: TEXT 1: MESSAGE	1
0410	CW MEMORY 4	0: TEXT 1: MESSAGE	1
0411	CW MEMORY 5	0: TEXT 1: MESSAGE	1
0501	NB WIDTH	0: 1 msec 1: 3 msec 2: 10 msec	1
0502	NB REJECTION	0: 10 dB 1: 30 dB 2: 50 dB	1
0503	NB LEVEL	0 - 10 (P2= 00 - 10)	2
0504	BEEP LEVEL	0 - 100 (P2= 000 - 100)	3
0505	RF/SQL VR	0: RF 1: SQL	1
0506	CAT RATE	0: 4800 bps 1: 9600 bps 2: 19200 bps 3: 38400 bps	1
0507	CAT TOT	0: 10 msec 1: 100 msec 2: 1000 msec 3: 3000 msec	1
0508	CAT RTS	0: DISABLE 1: ENABLE	1

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P1	Function	P2	Digits
0509	MEM GROUP	0: DISABLE 1: ENABLE	1
0510	FM SETTING	0: DISABLE 1: ENABLE	1
0511	REC SETTING	0: DISABLE 1: ENABLE	1
0512	ATAS SETTING	0: DISABLE 1: ENABLE	1
0513	QUICK SPL FREQ	-20 kHz - +00 (or -00) - +20 kHz (P2= -20 - +00 or -00 - +20)	3
0514	TX TOT	00 - 30 min (P2= 00 - 30, 00: OFF)	2
0515	MIC SCAN	0: DISABLE 1: ENABLE	1
0516	MIC SCAN RESUME	0: PAUSE 1: TIME	1
0517	REF FREQ ADJ	-25 - +00 (or -00) - +25 (P2= -25 - +00 or -00 - +25)	3
0518	CLAR SELECT	0: RX 1: TX 2: TRX	1
0519	APO	0: OFF 1: 1 h 2: 2 h 3: 4 h 4: 6 h 5: 8 h 6: 10 h 7: 12 h	1
0520	FAN CONTROL	0: NORMAL 1: CONTEST	1
0601	AM LCUT FREQ	00: OFF 01: 100 Hz - 19: 1000 Hz (50 Hz steps)	2
0602	AM LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0603	AM HCUT FREQ	00: OFF 01: 700 Hz - 67: 4000 Hz (50 Hz steps)	2
0604	AM HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0605	AM MIC SELECT	0: MIC 1: REAR	1
0606	AM OUT LEVEL	0 - 100 (P2= 000 - 100)	3
0607	AM PTT SELECT	0: DAKY 1: RTS 2: DTR	1
0701	CW LCUT FREQ	00: OFF 01: 100 Hz - 19: 1000 Hz (50 Hz steps)	2
0702	CW LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0703	CW HCUT FREQ	00: OFF 01: 700 Hz - 67: 4000 Hz (50 Hz steps)	2
0704	CW HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0705	CW OUT LEVEL	0 - 100 (P2= 000 - 100)	3
0706	CW AUTO MODE	0: OFF 1: 50M 2: ON	1
0707	CW BFO	0: USB 1: LSB 2: AUTO	1
0708	CW BK-IN TYPE	0: SEMI 1: FULL	1
0709	CW BK-IN DELAY	30 - 3000 msec (P2= 0030 - 3000) (10 msec/step)	4
0710	CW WAVE SHAPE	1: 2 msec 2: 4 msec	1
0711	CW FREQ DISPLAY	0: FREQ 1: PITCH	1
0712	PC KEYING	0: OFF 1: DAKY 2: RTS 3: DTR	1
0713	QSK DELAY TIME	0: 15 msec 1: 20 msec 2: 25 msec 3: 30 msec	1
0801	DATA MODE	0: PSK 1: OTHERS	1
0802	PSK TONE	0: 1000 Hz 1: 1500 Hz 2: 2000 Hz	1
0803	OTHER DISP	-3000 Hz - 0 - +3000 Hz (P2= -3000 - -0000 or +0000 - +3000) (10 Hz/steps)	5
0804	OTHER SHIFT	-3000 Hz - 0 - +3000 Hz (P2= -3000 - -0000 or +0000 - +3000) (10 Hz/steps)	5
0805	DATA LCUT FREQ	00: OFF 01: 100 Hz - 19: 1000 Hz (50 Hz steps)	2
0806	DATA LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0807	DATA HCUT FREQ	00: OFF 01: 700 Hz - 67: 4000 Hz (50 Hz steps)	2
0808	DATA HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
0809	DATA IN SELECT	0: MIC 1: REAR	1
0810	DATA PTT SELECT	0: DAKY 1: RTS 2: DTR	1
0811	DATA OUT LEVEL	0 - 100 (P2= 000 - 100)	3
0812	DATA BFO	0: USB 1: LSB	1
0901	FM MIC SELECT	0: MIC 1: REAR	1
0902	FM OUT LEVEL	0 - 100 (P2= 000 - 100)	3
0903	PKT PTT SELECT	0: DAKY 1: RTS 2: DTR	1
0904	RPT SHIFT 28MHz	0 - 1000 kHz (P2= 0000 - 1000) (10 kHz/step)	4
0905	RPT SHIFT 50MHz	0 - 4000 kHz (P2= 0000 - 4000) (10 kHz/step)	1
0906	DCS POLARITY	0: Tn-Rn 1: Tn-Riv 2: Tiv-Rn 3: Tiv-Riv	1
1001	RTTY LCUT FREQ	00: OFF 01: 100 Hz - 19: 1000 Hz (50 Hz steps)	2
1002	RTTY LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
1003	RTTY HCUT FREQ	00: OFF 01: 700 Hz - 67: 4000 Hz (50 Hz steps)	2
1004	RTTY HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
1005	RTTY SHIFT PORT	0: SHIFT 1: DTR 2: RTS	1
1006	RTTY POLARITY-R	0: NOR 1: REV	1
1007	RTTY POLARITY-T	0: NOR 1: REV	1
1008	RTTY OUT LEVEL	0 - 100 (P2= 000 - 100)	3
1009	RTTY SHIFT FREQ	0: 170 Hz 1: 200 Hz 2: 425 Hz 3: 850 Hz	1
1010	RTTY MARK FREQ	0: 1275 Hz 1: 2125 Hz	1
1011	RTTY BFO	0: USB 1: LSB	1
1101	SSB LCUT FREQ	00: OFF 01: 100 Hz - 19: 1000 Hz (50 Hz steps)	2
1102	SSB LCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
1103	SSB HCUT FREQ	00: OFF 01: 700 Hz - 67: 4000 Hz (50 Hz steps)	2
1104	SSB HCUT SLOPE	0: 6 dB/oct 1: 18 dB/oct	1
1105	SSB MIC SELECT	0: MIC 1: REAR	1
1106	SSB OUT LEVEL	0 - 100 (P2= 000 - 100)	3
1107	SSB BFO	0: USB 1: LSB 2: AUTO	1
1108	SSB PTT SELECT	0: DAKY 1: RTS 2: DTR	1
1109	SSB TX BPF	0: 100-3000 1: 100-2900 2: 200-2800 3: 300-2700 4: 400-2600	1
1201	APF WIDTH	0: NARROW 1: MEDIUM 2: WIDE	1
1202	CONTOUR LEVEL	-40 - 0 - +20 (P2= -40 - -00 or +00 - +20)	3
1203	CONTOUR WIDTH	01 - 11	2
1204	IF NOTCH WIDTH	0: NARROW 1: WIDE	1
1301	SCP START CYCLE	0: OFF 1: 3 sec 2: 5 sec 3: 10 sec	1
1302	SCP SPAN FREQ	0: 37.5 kHz 1: 75 kHz 2: 150 kHz 3: 375 kHz 4: 750 kHz	1
1401	QUICK DIAL	0: 50 kHz 1: 100 kHz 2: 500 kHz	1
1402	SSB DIAL STEP	0: 2 Hz 1: 5 Hz 2: 10 Hz	1
1403	AM DIAL STEP	0: 10 Hz 1: 100 Hz	1
1404	FM DIAL STEP	0: 10 Hz 1: 100 Hz	1
1405	DIAL STEP	0: 2 Hz 1: 5 Hz 2: 10 Hz	1
1406	AM CH STEP	0: 2.5 kHz 1: 5 kHz 2: 9 kHz 3: 10 kHz 4: 12.5 kHz 5: 25 kHz	1

CAT (Computer Aided Transceiver) Operation

P1	Function	P2	Digits
1407	FM CH STEP	0: 5 kHz 1: 6.25 kHz 2: 10 kHz 3: 12.5 kHz 4: 15 kHz 5: 20 kHz 6: 25 kHz	1
1501	EQ1 FREQ	00: OFF 01: 100 Hz 02: 200 Hz 03: 300 Hz 04: 400 Hz 05: 500 Hz 06: 600 Hz 07: 700 Hz	2
1502	EQ1 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1503	EQ1 BWTH	01 - 10	2
1504	EQ2 FREQ	00: OFF 01: 700 Hz 02: 800 Hz 03: 900 Hz 04: 1000Hz 05: 1100 Hz 06: 1200 Hz 07: 1300 Hz 08: 1400 Hz 09: 1500 Hz	2
1505	EQ2 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1506	EQ2 BWTH	01 - 10	2
1507	EQ3 FREQ	00: OFF 01: 1500 Hz 02: 1600 Hz 03: 1700 Hz 04: 1800 Hz 05: 1900 Hz 06: 2000 Hz -18: 3200 Hz	2
1508	EQ3 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1509	EQ3 BWTH	01 - 10	2
1510	P-EQ1 FREQ	00: OFF 01: 100 Hz 02: 200 Hz 03: 300 Hz 04: 400 Hz 05: 500 Hz 06: 600 Hz 07: 700 Hz	2
1511	P-EQ1 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1512	P-EQ1 BWTH	01 - 10	2
1513	P-EQ2 FREQ	00: OFF 01: 700 Hz 02: 800 Hz 03: 900 Hz 04: 1000Hz 05: 1100 Hz 06: 1200 Hz 07: 1300 Hz 08: 1400 Hz 09: 1500 Hz	2
1514	P-EQ2 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1515	P-EQ2 BWTH	01 - 10	2
1516	P-EQ3 FREQ	00: OFF 01: 1500 Hz 02: 1600 Hz 03: 1700 Hz 04: 1800 Hz 05: 1900 Hz 06: 2000 Hz -18: 3200 Hz	2
1517	P-EQ3 LEVEL	-20 - 0 - +10 (P2= -20 - -00 or +00 - +10)	3
1518	P-EQ3 BWTH	01 - 10	2
1601	HF SSB PWR	5 - 100 (P2= 005 - 100)	3
1602	HF AM PWR	5 - 40 (P2= 005 - 040)	3
1603	HF PWR	5 - 100 (P2= 005 - 100)	3
1604	50M SSB PWR	5 - 100 (P2= 005 - 100)	3
1605	50M AM PWR	5 - 40 (P2= 005 - 040)	3
1606	50M PWR	5 - 100 (P2= 005 - 100)	3
1607	SSB MIC GAIN	0 - 100 (P2= 000 - 100)	3
1608	AM MIC GAIN	0 - 100 (P2= 000 - 100)	3
1609	FM MIC GAIN	0 - 100 (P2= 000 - 100)	3
1610	DATA MIC GAIN	0 - 100 (P2= 000 - 100)	3
1611	SSB DATA GAIN	0 - 100 (P2= 000 - 100)	3
1612	AM DATA GAIN	0 - 100 (P2= 000 - 100)	3
1613	FM DATA GAIN	0 - 100 (P2= 000 - 100)	3
1614	DATA DATA GAIN	0 - 100 (P2= 000 - 100)	3
1615	TUNER SELECT	0: OFF 1: EXTERNAL 2: ATAS 3: LAMP	1
1616	VOX SELECT	0: MIC 1: DATA	1
1617	VOX GAIN	0 - 100 (P2= 000 - 100)	3
1618	VOX DELAY	30 - 3000 msec (P2= 0030 - 3000) (10 msec/step)	4
1619	ANTI VOX GAIN	0 - 100 (P2= 000 - 100)	3
1620	DATA VOX GAIN	0 - 100 (P2= 000 - 100)	3
1621	DATA VOX DELAY	30 - 3000 msec (P2= 0030 - 3000)	4
1622	ANTI DVOX GAIN	0 - 100 (P2= 000 - 100)	3
1623	EMERGENCY FREQ	0: DISABLE 1: ENABLE	1
1701	RESET	0: ALL 1: DATA 2: FUNC	1
1801	MAIN VERSION	0000 - 9999 (V01-23 = 0123)	4
1802	DSP VERSION	0000 - 9999 (V01-23 = 0123)	4
1803	LCD VERSION	0000 - 9999 (V01-23 = 0123)	4

FA	**FREQUENCY VFO-A**										
Set	1	2	3	4	5	6	7	8	9	10	P1 000030000 - 056000000 (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 - 056000000 (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	;									

CAT (Computer Aided Transceiver) Operation

FS — FAST STEP

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

P1 0: VFO-A FAST Key "OFF"
1: VFO-A FAST Key "ON"

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 0650: FT-891

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	P4
	21	22	23	24	25	26	27	28	29	30
	P5	P6	P7	P8	P9	P9	P10	;		

P1 001 - 099 (Regular Memory Channel)
P1L - P9U (PMS)
501 - 510 (5 MHz, U.S. and U.K. version only)
EMG (Emergency)
P2 VFO-A Frequency (Hz)
P3 Clarifier Direction +: Plus Shift, -: Minus Shift
Clarifier Offset: 0000 - 9999 (Hz)
P4 0: CLAR "OFF" 1: CLAR "ON"
P5 0: (Fixed)
P6 MODE 1: SSB (SSB BFO) 2: SSB (SSB BFO) 3: CW 4: FM 5: AM
6: RTTY (RTTY BFO) 7: CW (CW BFO) 8: DATA (DATA BFO)
9: RTTY (RTTY BFO) A: - B: FM-N C: DATA (DATA BFO)
D: AM-N
P7 0: VFO 1: Memory 2: Memory Tune 3: - 4: - 5: PMS
P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS 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	-/+	P3	P3	P3	P3	;
Read	**I**	**S**	P1	;						
Answer	**I**	**S**	P1	P2	-/+	P3	P3	P3	P3	;

P1 0:(Fixed)
P2 0: OFF
1: ON
P3 0 ~ 1200 Hz (20 Hz steps)

KM — KEYER MEMORY

	1	2	3	4	5	6	7	~	53	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)

CAT (Computer Aided Transceiver) Operation

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

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

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

P1 004 - 060 (WPM)

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

P1 1: Keyer Memory "1" Playback
2: Keyer Memory "2" Playback
3: Keyer Memory "3" Playback
4: Keyer Memory "4" Playback
5: Keyer Memory "5" Playback
6: Message Keyer "1" Playback
7: Message Keyer "2" Playback
8: Message Keyer "3" Playback
9: Message Keyer "4" Playback
A: Message Keyer "5" Playback

LK	LOCK									
Set	1	2	3	4	5	6	7	8	9	10
	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	;						

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

LM	LOAD MESSAGE									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

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									
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
	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	;				

P1 001 - 099: Regular Memory Channel
P1L - P9U (PMS)

MD	OPERATING MODE									
Set	1	2	3	4	5	6	7	8	9	10
	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	;					

P1 0: MAIN RX
P2 MODE 1: SSB (SSB BFO)* 2: SSB (SSB BFO)* 3: CW (CW BFO)*
4: FM 5: AM 6: RTTY (RTTY BFO)* 7: CW (CW BFO)*
8: DATA (DATA BFO)* 9: RTTY (RTTY BFO)* A: - B: FM-N
C: DATA (DATA BFO)* D: AM-N
*The BFO of each MODE depends on the BFO setting of MENU MODE. See the EX command and the following parameters on page 7 to 9.
1107: SSB BFO, 0707: CW BFO, 0812: DATA BFO, 1011: RTTY BFO

CAT (Computer Aided Transceiver) Operation

MG — MIC GAIN

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

P1 000 - 100

ML — MONITOR LEVEL

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

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	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	P4
	21	22	23	24	25	26	27	28	29	30
	P5	P6	P7	P8	P9	P9	P10	;		

P0/1 001 - 099 (Regular Memory Channel)
P1L - P9U (PMS)
501 - 510 (5 MHz, U.S. and U.K. version only)
EMG (Emergency)
P2 VFO-A Frequency (Hz)
P3 Clarifier Direction +: Plus Shift, -: Minus Shift
Clarifier Offset: 0000 - 9999 (Hz)
P4 0: CLAR "OFF" 1: CLAR "ON"
P5 0: (Fixed)
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: - B: FM-N C: DATA-USB
D: AM-N
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

MS — METER SW

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

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

MT — MEMORY 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	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									
	;									
Read	1	2	3	4	5	6	7	8	9	10
	M	**T**	P0	P0	P0	;				
Answer	1	2	3	4	5	6	7	8	9	10
	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	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									
	;									

P1 001 - 099 (Regular Memory Channel)
P1L - P9U (PMS)
P2 Frequency (Hz)
P3 Clarifier Direction +: Plus Shift, -: Minus Shift
Clarifier Offset: 0000 - 9999 (Hz)
P4 0: CLAR "OFF" 1: CLAR "ON"
P5 0: (Fixed)
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: - B: FM-N C: DATA-USB
D: AM-N
P7 0: (Fixed)
P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift
P11 0: TAG "OFF" 1: TAG "ON"
P12 TAG Characters (up to 12 characters) (ASCII)

CAT (Computer Aided Transceiver) Operation

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	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

P1 001 - 099 (Regular Memory Channel)
P1L - P9U (PMS)
P2 Frequency (Hz)
P3 Clarifier Direction +: Plus Shift, -: Minus Shift
Clarifier Offset: 0000 - 9999 (Hz)
P4 0: CLAR "OFF" 1: CLAR "ON"
P5 0: (Fixed)
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: - B: FM-N C: DATA-USB
D: AM-N
P7 0: (Fixed)
P8 0: CTCSS "OFF" 1: CTCSS ENC/DEC 2: CTCSS ENC
P9 00: (Fixed)
P10 0: Simplex 1: Plus Shift 2: Minus Shift

MX — MOX SET

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

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

P1 0: (Fixed)
P2 0: OFF
1: ON

NB — NOISE BLANKER STATUS

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

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

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

CAT (Computer Aided Transceiver) Operation

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	P4
	21	22	23	24	25	26	27	28	29	30
	P5	P6	P7	P8	P9	P9	P10	;		

P1 001 - 099 (Regular Memory Channel)
P1L - P9U (PMS)
501 - 510 (5 MHz, U.S. and U.K. version only)
EMG (Emergency)
P2 VFO-B Frequency (Hz)
P3 Clarifier Direction +: Plus Shift, -: Minus Shift
Clarifier Offset: 0000 - 9999 (Hz)
P4 0: CLAR "OFF" 1: CLAR "ON"
P5 0: (Fixed)
P6 MODE 1: SSB (SSB BFO) 2: SSB (SSB BFO) 3: CW 4: FM 5: AM
6: RTTY (RTTY BFO) 7: CW (CW BFO) 8: DATA (DATA BFO)
9: RTTY (RTTY BFO) A: - B: FM-N C: DATA (DATA BFO)
D: AM-N
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

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
	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	;					

P1 0:(Fixed)
P2 0: IPO
1: AMP

PB — PLAY BACK

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

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)

PC — POWER CONTROL

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

P1 005 -100

PL — SPEECH PROCESSOR LEVEL

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

P1 000 -100

PR — SPEECH PROCESSOR

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

P1 0: Speech Processor
1: Parametric Microphone Equalizer
P2 0: "OFF"
1: "ON"

CAT (Computer Aided Transceiver) Operation

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	

RG	RF GAIN										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: (Fixed) P2 000 - 030
	R	**G**	P1	P2	P2	P2	;				
Read	1	2	3	4	5	6	7	8	9	10	
	R	**G**	P1	;							
Answer	1	2	3	4	5	6	7	8	9	10	
	R	**G**	P1	P2	P2	P2	;				

CAT (Computer Aided Transceiver) Operation

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

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

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

P1 0: (Fixed)
P2 01 - 15

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

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

RS	RADIO STATUS									
Set	1	2	3	4	5	6	7	8	9	10
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	;						

P1 0: NORMAL MODE
1: MENU MODE

RU	RX CLARIFIER PLUS OFFSET									
Set	1	2	3	4	5	6	7	8	9	10
	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

P1 0000 - 9999 (Hz)

SC	SCAN									
Set	1	2	3	4	5	6	7	8	9	10
	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	;						

P1 0: Scan “OFF”
1: Scan “ON” (UP ward)
2: Scan “ON” (DOWN ward)

SD	CW BREAK-IN DELAY TIME									
Set	1	2	3	4	5	6	7	8	9	10
	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	;			

P1 0030 - 3000 msec

SH	WIDTH									
Set	1	2	3	4	5	6	7	8	9	10
	S	**H**	P1	P2	P3	P3	;			
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	P3	P3	;			

P1 0: (Fixed)
P2 0: OFF
1: ON
P3 00 (See Table below)

CAT (Computer Aided Transceiver) Operation

Command	Bandwidth					
P3	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	;				

ST	**SPLIT**										
Set	1	2	3	4	5	6	7	8	9	10	P1 0: SPLIT “OFF” 1: SPLIT “ON” 2: SPLIT “ON” + 5 kHz up
	S	**T**	P1	;							
Read	1	2	3	4	5	6	7	8	9	10	
	S	**T**	;								
Answer	1	2	3	4	5	6	7	8	9	10	
	S	**T**	P1	;							

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	;							

CAT (Computer Aided Transceiver) Operation

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	;							

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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1909-C