

Optoelectronics, Inc.
Xplorer™
Serial Interface Specification
Interface Version 3.0

February 25, 1998

INTRODUCTION

This document describes the serial interface of the Xplorer™, a hand-held test receiver capable of sweeping and locking onto near field FM VHF and UHF transmissions. The Xplorer™ is capable of capturing and storing up to 500 frequencies, along with the number of occurrences, or hits, of each frequency, the time and date the frequency was last detected, signal strength, deviation, CTCSS tone, DCS code, DTMF digits, and LTR data. This data can then be downloaded to a personal computer for logging and analysis.

This document was written to assist the programmer in developing software applications for the Xplorer™.

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ABOUT CI-5

The command structure of the Xplorer™ serial interface conforms to the Icom CI-5 interface standard. However, unlike the original Icom CI-5 interface, the Xplorer™ serial interface is full-duplex with RS-232C compatible voltage levels. The communications parameters for the serial interface are listed in Table 1 below.

Table 1. Communications Parameters.

DATA RATE	9600 bps
START BITS	1
DATA BITS	8
PARITY	NONE
STOP BITS	1

To connect the Xplorer™ to a personal computer, an 8-pin mini DIN connector is provided on the top panel. The Xplorer™ receives commands on pin 4 and transmits responses on pin 3 of the DIN connector. Signal ground is provided on pins 7 and 8. Since the Xplorer™ serial interface is compatible with RS-232C voltage levels, no external interface converter box is required to connect the Xplorer™ to a standard personal computer COM port. An interface cable for connecting the Xplorer™ to a PC is available.

COMMAND REFERENCE

As mentioned earlier, the Xplorer™ serial interface command structure conforms to the Icom CI-5 interface standard. In this section, all CI-5 command and response bytes are expressed in hexadecimal notation.

The Xplorer™ recognizes 12 different commands, which are summarized in Table 2 below.

Following the table is a detailed description of each of the commands, including examples illustrating their use. In the command descriptions, "ra" refers to the RECEIVE ADDRESS, and "ta" refers to the TRANSMIT ADDRESS.

The RECEIVE ADDRESS is the address of the Xplorer™, which is fixed at B0. The Xplorer™ will not process any command in which the RECEIVE ADDRESS is not B0.

The TRANSMIT ADDRESS is the address of the device which is transmitting the command to the Xplorer™. In most cases, this device is a personal computer executing application software, usually referred to as the CONTROLLER. The standard address for the CONTROLLER is E0, but any address can be used for the TRANSMIT ADDRESS. However, the TRANSMIT ADDRESS must be in the range 01 to EF. Also, the Xplorer™ will not process any command in which the TRANSMIT ADDRESS matches its own address, B0.

It is important to remember that the values specified are not ASCII characters, but are bytes expressed in hexadecimal notation. For example, "FE" represents a single byte with a value of 0xFE (hexadecimal), or 254 (decimal). It does not represent the ASCII character "F" followed by the ASCII character "E", a two-byte sequence.

Table 2. Xplorer™ CI-5 Interface Command Summary.

COMMAND	SUB-COMMAND	DESCRIPTION
7F	09	Read Identification
7F	40	Read Memory Frequency
7F	41	Read Memory Hits
7F	42	Read Memory Time
7F	43	Read Memory Date
7F	44	Read Memory Status
7F	47	Read Memory Signal Strength
7F	48	Read Memory Deviation
7F	49	Read Memory CTCSS
7F	4A	Read Memory DCS
7F	4B	Read Memory DTMF
7F	4C	Read Memory LTR

READ IDENTIFICATION

Command:

FE	FE	ra	ta	7F	09	FD
----	----	----	----	----	----	----

Example:

FE	FE	B0	E0	7F	09	FD
----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	09	id	sv	rv	iv	FD
----	----	----	----	----	----	----	----	----	----	----

Example:

Xplorer™, software version 3.0, RF board version 2.2, interface version 3.0

FE	FE	E0	B0	7F	09	58	50	52	30	22	30	FD
----	----	----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the identification information.

The identification data is in the form of six bytes, each consisting of two BCD digits. The first six BCD digits uniquely identify the device. The next two BCD digits indicate the current software version. The next two BCD digits indicate the current RF board version. The last two BCD digits indicate the current interface version.

If the command length is incorrect, then the command is ignored, and the error response is returned.

READ MEMORY FREQUENCY

Command:

FE	FE	ra	ta	7F	40	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	40	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	40	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	40	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	40	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	40	frequency	FD
----	----	----	----	----	----	-----------	----

Examples:

162.550000 MHz

FE	FE	E0	B0	7F	40	00	00	55	62	01	FD
----	----	----	----	----	----	----	----	----	----	----	----

1045.725000 MHz

FE	FE	E0	B0	7F	40	00	50	72	45	10	FD
----	----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the frequency stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The frequency data is in the form of five bytes, each consisting of two BCD digits. The order of the ten BCD digits is as follows: 10 Hz digit, 1 Hz digit, 1 kHz digit, 100 Hz digit, 100 kHz digit, 10 kHz digit, 10 MHz digit, 1 MHz digit, 1 GHz digit, 100 MHz digit. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY HITS

Command:

FE	FE	ra	ta	7F	41	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	41	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	41	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	41	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	41	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	41	hits	FD
----	----	----	----	----	----	------	----

Examples:

37 hits

FE	FE	E0	B0	7F	41	00	00	37	FD
----	----	----	----	----	----	----	----	----	----

214 hits

FE	FE	E0	B0	7F	41	00	02	14	FD
----	----	----	----	----	----	----	----	----	----

42,784 hits

FE	FE	E0	B0	7F	41	04	27	84	FD
----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the number of hits of the frequency stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The hits data is in the form of three bytes, each consisting of two BCD digits. The number of hits will be in the range 0 to 65,535. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY TIME

Command:

FE	FE	ra	ta	7F	42	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	42	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	42	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	42	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	42	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	42	h	m	s	FD
----	----	----	----	----	----	---	---	---	----

Examples:

2:14:45 a.m.

FE	FE	E0	B0	7F	42	02	14	45	FD
----	----	----	----	----	----	----	----	----	----

4:23:06 p.m.

FE	FE	E0	B0	7F	42	16	23	06	FD
----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the time stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The time data is in the form of three bytes, each consisting of two BCD digits. The time is stored in 24 hour format. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY DATE

Command:

FE	FE	ra	ta	7F	43	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	43	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	43	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	43	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	43	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	43	m	d	y	FD
----	----	----	----	----	----	---	---	---	----

Examples:

October 21, 1996

FE	FE	E0	B0	7F	43	10	21	19	96	FD
----	----	----	----	----	----	----	----	----	----	----

March 17, 1997

FE	FE	E0	B0	7F	43	03	17	19	97	FD
----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the date stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The date data is in the form of four bytes, each consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY STATUS

Command:

FE	FE	ra	ta	7F	44	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	44	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	44	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	44	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	44	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	44	sd	FD
----	----	----	----	----	----	----	----

Examples:

Audio ON, DTMF ON

FE	FE	E0	B0	7F	44	00	FD
----	----	----	----	----	----	----	----

Audio OFF, DTMF ON

FE	FE	E0	B0	7F	44	01	FD
----	----	----	----	----	----	----	----

Audio ON, DTMF OFF

FE	FE	E0	B0	7F	44	02	FD
----	----	----	----	----	----	----	----

Audio OFF, DTMF OFF

FE	FE	E0	B0	7F	44	03	FD
----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the status data stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The status data is in the form of one byte, consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY SIGNAL STRENGTH

Command:

FE	FE	ra	ta	7F	47	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	47	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	47	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	47	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	47	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	47	ss	FD
----	----	----	----	----	----	----	----

Examples:

0 bargraph segments

FE	FE	E0	B0	7F	47	00	FD
----	----	----	----	----	----	----	----

27 bargraph segments

FE	FE	E0	B0	7F	47	27	FD
----	----	----	----	----	----	----	----

50 bargraph segments

FE	FE	E0	B0	7F	47	50	FD
----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the signal strength stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The signal strength data is in the form of one byte, consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY DEVIATION

Command:

FE	FE	ra	ta	7F	48	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	48	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	48	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	48	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	48	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	48	dev	FD
----	----	----	----	----	----	-----	----

Examples:

4.3 kHz

FE	FE	E0	B0	7F	48	00	43	FD
----	----	----	----	----	----	----	----	----

25.9 kHz

FE	FE	E0	B0	7F	48	02	59	FD
----	----	----	----	----	----	----	----	----

102.7 kHz

FE	FE	E0	B0	7F	48	10	27	FD
----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the deviation stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The deviation data is in the form of two bytes, each consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY CTCSS

Command:

FE	FE	ra	ta	7F	49	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	49	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	49	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	49	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	49	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	49	CTCSS	FD
----	----	----	----	----	----	-------	----

Examples:

103.5 Hz

FE	FE	E0	B0	7F	49	10	35	FD
----	----	----	----	----	----	----	----	----

85.4 Hz

FE	FE	E0	B0	7F	49	08	54	FD
----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the CTCSS tone stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The CTCSS data is in the form of two bytes, each consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY DCS

Command:

FE	FE	ra	ta	7F	4A	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	4A	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	4A	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	4A	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	4A	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	4A	DCS	FD
----	----	----	----	----	----	-----	----

Examples:

047

FE	FE	E0	B0	7F	4A	00	47	FD
----	----	----	----	----	----	----	----	----

732

FE	FE	E0	B0	7F	4A	07	32	FD
----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the DCS code stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The DCS data is in the form of two bytes, each consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY DTMF

Command:

FE	FE	ra	ta	7F	4B	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	4B	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	4B	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	4B	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	4B	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	4B	DTMF digits (31)										FD
----	----	----	----	----	----	------------------	--	--	--	--	--	--	--	--	--	----

Examples:

7712050

FE	FE	E0	B0	7F	4B	07	07	01	02	00	05	00	99	99	...	99	FD
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	----	----

ABCD*#

FE	FE	E0	B0	7F	4B	10	11	12	13	14	15	99	99	99	...	99	FD
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the DTMF digits stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The DTMF data is in the form of 31 bytes, each consisting of two BCD digits. A numeric code is assigned to each of the 16 DTMF digits. The code 99 is used to represent empty DTMF digit locations. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

READ MEMORY LTR

Command:

FE	FE	ra	ta	7F	4C	memory	FD
----	----	----	----	----	----	--------	----

Examples:

Memory location 0

FE	FE	B0	E0	7F	4C	00	00	FD
----	----	----	----	----	----	----	----	----

Memory location 19

FE	FE	B0	E0	7F	4C	00	19	FD
----	----	----	----	----	----	----	----	----

Memory location 247

FE	FE	B0	E0	7F	4C	02	47	FD
----	----	----	----	----	----	----	----	----

Memory location 499

FE	FE	B0	E0	7F	4C	04	99	FD
----	----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	4C	LTR data	FD
----	----	----	----	----	----	----------	----

Examples:

Area 0, Goto 15, Home 07, ID 136, Free 11

FE	FE	E0	B0	7F	4C	01	50	71	36	11	FD
----	----	----	----	----	----	----	----	----	----	----	----

Area 1, Goto 28, Home 16, ID 094, Free 31

FE	FE	E0	B0	7F	4C	12	81	60	94	31	FD
----	----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	B0	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the LTR data stored in the specified memory location.

The specified memory location data is in the form of two bytes, each consisting of two BCD digits. The specified memory location must be in the range 0 to 499. The LTR data is in the form of five bytes, each consisting of two BCD digits. See the examples shown above.

If the command length is incorrect, or if the specified memory location is not in the range 0 to 499, then the command is ignored, and the error response is returned.

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