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.

<p>| | |</p>
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<td><strong>DATA RATE</strong></td>
<td>9600 bps</td>
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<tr>
<td><strong>START BITS</strong></td>
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<tr>
<td><strong>DATA BITS</strong></td>
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<td><strong>PARITY</strong></td>
<td>NONE</td>
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<td><strong>STOP BITS</strong></td>
<td>1</td>
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</table>

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.
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.

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<th>DESCRIPTION</th>
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<td>7F</td>
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<tr>
<td>7F</td>
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</tr>
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<tr>
<td>7F</td>
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</table>
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:

\[
\text{FE FE ra ta 7F 40 memory FD}
\]

Examples:

Memory location 0

\[
\text{FE FE B0 E0 7F 40 00 00 FD}
\]

Memory location 19

\[
\text{FE FE B0 E0 7F 40 00 19 FD}
\]

Memory location 247

\[
\text{FE FE B0 E0 7F 40 02 47 FD}
\]

Memory location 499

\[
\text{FE FE B0 E0 7F 40 04 99 FD}
\]

Response:

\[
\text{FE FE ta ra 7F 40 frequency FD}
\]

Examples:

162.550000 MHz

\[
\text{FE FE E0 B0 7F 40 00 00 55 62 01 FD}
\]

1045.725000 MHz

\[
\text{FE FE E0 B0 7F 40 00 50 72 45 10 FD}
\]

Error

\[
\text{FE FE E0 B0 FA FD}
\]

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.