

Optoelectronics, Inc.
MiniScout™
Serial Interface Specification
Interface Version 1.0

June 12, 1998

INTRODUCTION

This document describes the serial interface of the MiniScout™, a miniature hand-held frequency counter capable of measuring the frequency of VHF and UHF transmitters and other signal sources. The MiniScout™ can be connected to a scanning receiver, such as the Realistic PRO-2042 equipped with an OptoScan535™ board, or an AOR AR8000, to automatically Reaction Tune the receiver to captured frequencies in real time. In this configuration, frequencies captured by the MiniScout™ can be monitored immediately. Alternatively, the MiniScout™ can be connected to a PC for data logging applications.

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

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ABOUT CI-5

The serial interface on the MiniScout™ conforms to the Icom CI-V interface standard. However, Optoelectronics has added enhancements in the form of additional commands and features, such as Reaction Tuning. Optoelectronics has, therefore, modified the name of this new enhanced interface to CI-5.

The CI-5 interface is an asynchronous, half-duplex, Transistor Transistor Logic (TTL) serial interface connected in a wire-OR (bussed) configuration. Several different devices can be connected to the bus simultaneously, and each device has its own unique address. Software developers are strongly encouraged to obtain a copy of the *Icom Communication Interface - V Reference Manual* from Icom, Inc. for detailed information on the CI-V interface protocol. 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

One important thing to note about the CI-5 interface is that, as mentioned above, it is connected in a wire-OR configuration. This means that the transmit data signal and the receive data signal are connected together. Therefore, when a command is transmitted by the computer, it is automatically echoed back as received data, followed by the response to the command, if any. For example, if an 11-byte command is transmitted to a device on the bus, which returns a 6-byte response, the computer will receive a total of 17 bytes. This configuration allows devices on the bus to monitor their own transmissions in order to detect interface collisions. A collision occurs when two or more devices transmit simultaneously. If a collision occurs, the command must be re-transmitted.

To connect the MiniScout™ to a computer, a subminiature phone jack is provided on the top panel. An external interface converter box, such as the Optoelectronics Optolinx™, is required to connect the MiniScout™ to an RS-232C computer interface. Its purpose is to convert the CI-5 interface voltage levels to RS-232C levels compatible with most personal computers.

COMMAND REFERENCE

When NORMAL mode is selected, the MiniScout™ accepts commands over the CI-5 interface. In this section, all CI-5 command and response bytes are expressed in hexadecimal notation.

The MiniScout™ recognizes 5 different commands. The commands are summarized in Table 2 below. The MiniScout™ only responds to commands when NORMAL mode is selected (FILTER switch in the OFF position). In FILTER mode (FILTER switch in the ON position), the MiniScout™ will automatically Reaction Tune a receiver connected to the CI-5 interface, and, therefore, cannot accept commands. However, a computer can be connected to the MiniScout™ in place of, or in addition to, a receiver to record captured frequencies.

Following the command summary 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 MiniScout™, which is fixed at 94. Each device on the CI-5 bus must have its own unique address. The MiniScout™ will not process any command in which the RECEIVE ADDRESS is not 94. However, the MiniScout™ will process commands with a RECEIVE ADDRESS of 00, but all command responses will be suppressed. A RECEIVE ADDRESS of 00 has special meaning. It provides a means for a device on the CI-5 bus to transmit a command to all other devices simultaneously. However, since several simultaneous responses would cause a collision, the responses are suppressed.

The TRANSMIT ADDRESS is the address of the device which is transmitting the command to the MiniScout™. 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 MiniScout™ will not process any command in which the TRANSMIT ADDRESS matches its own address, 94.

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. MiniScout™ CI-5 Interface Command Summary.

COMMAND	SUB-COMMAND	DESCRIPTION
03	-	Read frequency.
15	02	Read signal strength.
7F	09	Read identification
7F	20	Read gate setting.
7F	21	Write gate setting.

READ FREQUENCY

Command:

FE	FE	ra	ta	03	FD
----	----	----	----	----	----

Example:

FE	FE	94	E0	03	FD
----	----	----	----	----	----

Response:

FE	FE	ta	ra	03	frequency	FD
----	----	----	----	----	-----------	----

Examples:

162.550000 MHz

FE	FE	E0	94	03	00	00	55	62	01	FD
----	----	----	----	----	----	----	----	----	----	----

1045.725000 MHz

FE	FE	E0	94	03	00	50	72	45	10	FD
----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	94	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the current counter frequency measurement result.

The frequency data is in the form of 5 bytes, each consisting of 2 BCD digits. The order of the 10 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, the command is ignored, and the error response is returned.

READ SIGNAL STRENGTH

Command:

FE	FE	ra	ta	15	02	FD
----	----	----	----	----	----	----

Example:

FE	FE	94	E0	15	02	FD
----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	15	02	sd	FD
----	----	----	----	----	----	----	----

Examples:

0 bargraph segments

FE	FE	E0	94	15	02	00	00	FD
----	----	----	----	----	----	----	----	----

5 bargraph segments

FE	FE	E0	94	15	02	00	05	FD
----	----	----	----	----	----	----	----	----

16 bargraph segments

FE	FE	E0	94	15	02	00	16	FD
----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	94	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the current signal strength.

The signal strength data is in the form of 2 bytes, each consisting of 2 BCD digits. The signal strength is reported as the number of bargraph segments active. The reported signal strength ranges from a minimum signal of 0 bargraph segments active to a maximum signal of 16 bargraph segments active. See the examples shown above.

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

READ IDENTIFICATION

Command:

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

Example:

FE	FE	94	E0	7F	09	FD
----	----	----	----	----	----	----

Response:

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

Example:

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FE	FE	E0	94	7F	09	53	43	55	10	10	FD
----	----	----	----	----	----	----	----	----	----	----	----

Error

FE	FE	E0	94	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the identification information.

The identification data is in the form of 5 bytes, each consisting of 2 BCD digits. The first 6 BCD digits uniquely identify the device. The next 2 BCD digits indicate the current software version. The last 2 BCD digits indicate the current interface version.

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

READ GATE SETTING

Command:

FE	FE	ra	ta	7F	20	FD
----	----	----	----	----	----	----

Example:

FE	FE	94	E0	7F	20	FD
----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	7F	20	gs	FD
----	----	----	----	----	----	----	----

gs

 is a BCD value representing the selected gate setting. BCD values are encoded as follows:

- 00: 10 kHz resolution gate setting
- 01: 1 kHz resolution gate setting
- 02: 100 Hz resolution gate setting
- 03: 10 Hz resolution gate setting

Examples:

10 kHz resolution

FE	FE	E0	94	7F	20	00	FD
----	----	----	----	----	----	----	----

100 Hz resolution

FE	FE	E0	94	7F	20	02	FD
----	----	----	----	----	----	----	----

Error

FE	FE	E0	94	FA	FD
----	----	----	----	----	----

Description:

This command instructs the unit to send the current gate setting.

The gate setting specifies the counter gate time, and, hence, the resolution of the frequency counter. The gate setting data is in the form of 1 byte, consisting of 2 BCD digits. See the examples shown above.

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

WRITE GATE SETTING

Command:

FE	FE	ra	ta	7F	21	gs	FD
----	----	----	----	----	----	----	----

gs

 is a BCD value representing the selected gate setting. BCD values are encoded as follows:

- 00: 10 kHz resolution gate setting
- 01: 1 kHz resolution gate setting
- 02: 100 Hz resolution gate setting
- 03: 10 Hz resolution gate setting

Examples:

1 kHz resolution

FE	FE	94	E0	7F	21	01	FD
----	----	----	----	----	----	----	----

10 Hz resolution

FE	FE	94	E0	7F	21	03	FD
----	----	----	----	----	----	----	----

Response:

FE	FE	ta	ra	FB or FA	FD
----	----	----	----	----------	----

Examples:

OK

FE	FE	E0	94	FB	FD
----	----	----	----	----	----

Error

FE	FE	E0	94	FA	FD
----	----	----	----	----	----

Description:

This command selects the gate setting.

The gate setting specifies the counter gate time, and, hence, the resolution of the frequency counter. The gate setting data is in the form of 1 byte, consisting of 2 BCD digits. See the examples shown above.

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

REACTION TUNING

When FILTER mode is selected, the MiniScout™ automatically transmits a tuning command to a connected receiver and/or computer each time a new frequency is captured. This feature is called Reaction Tuning.

The MiniScout™ issues tuning commands in 1 of 2 different formats, selected by a switch on the front panel. The 2 formats are described in detail below. The MiniScout™ only issues Reaction Tuning commands when FILTER mode is selected (FILTER switch in the ON position). In NORMAL mode (FILTER switch in the OFF position), the MiniScout™ responds to commands as described earlier.

CI-5 FORMAT

Command:

FE	FE	00	94	00	frequency	FD
----	----	----	----	----	-----------	----

Examples:

162.550000 MHz

FE	FE	00	94	00	00	00	55	62	01	FD
----	----	----	----	----	----	----	----	----	----	----

1045.725000 MHz

FE	FE	00	94	00	00	50	72	45	10	FD
----	----	----	----	----	----	----	----	----	----	----

The frequency data is in the form of 5 bytes, each consisting of 2 BCD digits. The order of the 10 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.

When FILTER mode and CI-5 format are both selected, a 2-command receiver initialization sequence is transmitted at power-up. The initialization sequence is also transmitted when either the mode or Reaction Tune format is changed, resulting in both FILTER mode and CI-5 format being selected. The 2 commands of the initialization sequence are as follows:

Select Remote Control:

FE	FE	00	94	7F	02	FD
----	----	----	----	----	----	----

Transfer Mode Narrowband FM:

FE	FE	00	94	01	05	FD
----	----	----	----	----	----	----

The CI-5 format is compatible with the Realistic PRO-2005 or PRO-2006 equipped with an OptoScan456™ board, the Realistic PRO-2035 or PRO-2042 equipped with an OptoScan535™ board, and many of the Icom receivers, such as the R-7000 or R-7100.

AR8000 FORMAT

Command:

"R"	"F"	frequency	<CR>	<LF>
-----	-----	-----------	------	------

Examples:

162.550000 MHz

"R"	"F"	"0"	"1"	"6"	"2"	"5"	"5"	"0"	"0"	"0"	"0"	<CR>	<LF>
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------

1045.725000 MHz

"R"	"F"	"1"	"0"	"4"	"5"	"7"	"2"	"5"	"0"	"0"	"0"	<CR>	<LF>
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------

Description:

The AR8000 format is composed of a string of ASCII characters, terminated by a carriage return character, followed by a line feed character. This differs from the CI-5 format, in which the transmitted data are not ASCII characters, but hexadecimal bytes. The communications parameters for the AR8000 format are the same as shown in Table 1.

The frequency data is in the form of 10 ASCII characters representing numerical digits. The order of the 10 ASCII digits is as follows: 1 GHz digit, 100 MHz digit, 10 MHz digit, 1 MHz digit, 100 kHz digit, 10 kHz digit, 1 kHz digit, 100 Hz digit, 10 Hz digit, 1 Hz digit. See the examples shown above.

Unlike the CI-5 format, no receiver initialization commands are transmitted when the AR8000 format is selected.

The AR8000 format is compatible with the AR8000, AR8200, and AR2700 receivers. This format is also convenient for viewing the Reaction Tuning commands with a PC running a terminal emulator program, such as HyperTerminal.

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