

Tira-2 serial protocol.

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Protocol parameters	
Byte Length	8 bits
Stop Bits	1
Parity Bits	None
Baud rate	100000 baud (On Windows platform this speed is mapped to 9600)
Flow control, Tira	CTS/RTS

Ira/Tira can operate in two modes, "six bytes" and "timing". These modes differ only in how incoming IR data is processed. In both modes Tira will respond to the commands from a PC in the same way.

Six bytes

In this mode the IR data is represented by a six bytes word. The encoding algorithm used by Tira-2 is designed to produce unique words for most common IR codes, including NEC and RC-5. Latest addition to this mode introduce support for wireless IR keyboards. Tira-2 will also generate unique word when used with an IR keyboard.

This mode is very convenient for applications there exact information about IR data is not required and it is only necessary to distinguish codes corresponding to different buttons on the remote control. Thus application does not have to decode protocol used by the remote and extract data from the signal. *The data received in this mode is not suitable for transmission.*

Timing

In this mode Tira-2 captures and returns complete timing information about received IR signal required to reproduce it. It is returned in the form <duration of burst>, <duration of space>, <duration of burst> etc. This mode is used to capture IR codes for subsequent playback.

In Tira-2 Timing mode employs short range sensor that allows to capture IR codes with great precision. When using Tira-2 in this mode the remote should be held at about 1cm from the Tira-2 and the emitter on the remote must point directly to the center of Tira's front window.

The information returned by Ira/Tira in timing mode has the following format:

$P_0 S_0 P_1 S_1 \dots P_n 0x00 0x00 CW 0xB2$

The P fields represent length of pulses, and S fields represent length of spaces.

Each of the P and S fields consists of two bytes:

$$P_i = H_i L_i$$

The time represented by this field is calculated as following:

$$T_i = (H_i * 256 + L_i) * 8\mu S$$

CW (Clock word) represents duration of a single pulse of the incoming IR signal. It is one byte value, with each unit equal to $0.5\mu S$. Modulation frequency thus can be calculated as following:

$$F = 2000000 / CW$$

For example if CW is equal to 0x46 (70 decimal) then pulse period is 35 μ S and modulation frequency is 28.571KHz.

Command ASCII	Command HEX		Support
“IR”	49 52		
<p>This command switches Ira/Tira into “Six bytes” mode. Ira/Tira will respond with “OK” (4F 4B). This command can be used to verify basic operation of Ira/Tira.</p>			Ira, Ira-2, Tira-1, Tira-2
“IC”	49 43 00 00		
<p>This command switches Tira-2 into timing mode. Timing mode is described above. Tira-2 will respond with “OIC” (4F 49 43)</p>			Tira-2
“ISW”	49 53 57 <RW0 (6 bytes)> <RW1 (6 bytes)>		
<p>This command sets the value for remote wake up feature (RW0, RW1). When Tira is in “Six bytes” mode before sending data to the PC it compares the data to the values of RW0 and RW1. If there is a match, Tira triggers “remote wake up”. USB bases devices wakes up a PC by means of the USB protocol, while RS-232 based devices wakes up a PC by triggering WOL or similar input. Tira responds to this command with “OIS” (4F 49 53). In Tira-2 these registers are non-volatile, they will be preserved even Tira is disconnected from a PC.</p>			Tira-2
“IX”	49 58 <CW (1bt)> <MODE (1 bt)> <BSA(24 bts)> <IR Data(n bts)>		
<p>This command transmit IR Data.</p> <p>CW (1 byte) sets period of a single pulse for the transmitted IR signal. One unit is equal to 0.5μS.</p> <p>MODE (1 byte) is currently reserved and should be set to 0.</p> <p>BSA (24 bytes) Burst, Space Array</p> <p>T₀ T₁ T₂ T₃ T₄ T₅ T₆ T₇ T₈ T₉ T₁₀ T₁₁</p> <p>Although the IR data may be arbitrarily long, it can only consist of up to twelve different periods of time. That is enough for most of the applications. Until now we have not seen a remote control that uses more that 7 different periods of time.</p> <p>Each period is specified with two bytes, forming a 16 bit value.</p> <p>T_i = Byte0_i Byte1_i</p>			Tira-2

Single unit is equal to $8\mu\text{S}$, just as in data received in timing mode.
 In order to build BSA you need to sort all periods captured in Timing mode into 12 groups. Although times can be specified (and captured) with $8\mu\text{S}$ resolution, in practice for duration of burst minimum unit that makes sense is a period of modulation frequency, which is normally in the range $17\text{-}56\mu\text{S}$. So close values in received IR data corresponds to equal periods of time.

For example, if the following data is received from Tira-2 in timing mode

```
0x04, 0x51, 0x02, 0x2A, 0x00, 0x43, 0x00, 0x45, 0x00, 0x47, 0x00, 0x44
0x00, 0x47, 0x00, 0x44, 0x00, 0x44, 0x00, 0x47, 0x00, 0xCD
0x00, 0x47, 0x00, 0xCF, 0x00, 0x44, 0x00, 0xCF, 0x00, 0x47
0x00, 0x00, 0x34, 0xB2
```

The following BSA should be built:

```
0x04, 0x51, 0x02, 0x2A, 0x00, 0x43, 0x00, 0xCF
```

In this case only 4 first entries are used. Remaining 8 entries should be set to 0.

IR Data (n bytes)

Each byte of the IR Data defines a pair of a burst and space. High portion of a byte corresponds to a burst, lower portion of a byte correspond to a space:

```
0 0 0 1      0 0 1 0 (binary representation of a byte)
Burst index  Space Index
```

Both upper and lower parts of a byte are indexes of a corresponding entry in the BSA. In this example Tira-2 will generate a burst with a duration of $0x22A * 8$ (4432mS) and a space of $0x43 * 8$ (536mS).

Space index $0xF$ indicates that it is the last entry in the sequence. After receiving a byte with space index set to $0xF$ Tira will not expect any further data.

In order to reproduce complete IR signal in the above example the following command must be sent to Tira-2:



Note that **F** in the end indicates end of the sequence.
 Upon successful transmission Tira-2 responds with "OIX" (4F 49 58)

“IV”	49 56	
<p>You can use this command to retrieve firmware version</p> <p>In response to this command Tira-2 will return ASCII string describing version info. Current version is “1.10”</p>		Tira-2
“IP”	49 50	
<p>**This command were used to switch into “timing” mode on Tira-1. Tira-2 also supports this command, however it <i>does not switch Tira-2 into Timing mode</i>. The reason for this is that Tira-2 provides additional features, such as higher resolution and frequency detection in Timing mode.</p> <p>Ira/Tira will respond with the following 5 byte long string (hex)</p> <p>4F 49 50 XX YY</p> <p>XX is a calibration value, which can be safely ignored in most cases.</p> <p>YY is version word, which has the following format:</p> <p>YY[0] This bit is set if the device supports transmitting IR codes YY[1] This bit is set if the device supports remote wake up (“IW” command). YY[2:3] These two bits are reserved. YY[4:7] Firmware version</p> <p>Tira-2 has a new command for retrieving firmware version. (see “IV” below) For Tira-2 all bits YY[4:7] are set to 1. This can be used to distinguish between Tira-1 and Tira-2.</p>		Ira-2 Tira-1, Tira-2**