1 Greeting

Hello world!

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2 Commands

All commands are human-readable, start with a single ASCII character and are termianted with a line ending. If the command takes no parameters then the line ending is optional. Comments may be added by inserting a hash sign ('#'). This causes the rest of the line to be ignored (characters are consumed and discarded until end-of-line). Parameter parsing is handled by sscanf(), which allows for the same command character to take a varying number of parameters. An example of this is the 'M' command which exists in two-parameter and three-parameter forms:

```
M0 10         # Set speed of motor 0 to 10
M10 10 10     # Set speed of all motors to 10
```

Line endings can either be carriage return ('\r', ASCII code 13) or linefeed ('\n', ASCII code 10), but never both in the same line. In other words both Unix and Mac line endings are OK, but Windows line endings ("\r\n") are not. This ensures both *echo* and *minicom* works as expected. Output from the instrument is terminated by Windows line endings however, in order to work well with *minicom*.

Table 1 on the following page summarizes all commands and their parameters. More detailed descriptions of each command are given in the subsections that follow.

Command	**Parameter count**	**Parameter syntax**	**Description**
m	0		Read motor speeds
M	2	ID spd	Set motor speed
M	3	spd spd spd	Set motor speeds
	0		Stop all motors
	1	ID	Stop specific motor
	0		Measure motor speeds in RPM
	1		Measure specific motor speed in RPM
			Measure temperatures
			Configure ADC
			Read ADC configuration
			Read registers ($0000 - $00FF)
			Write registers ($0000 - $00FF)
			Read RAM ($0100 - $FFFF)
			Write RAM ($0100 - $FFFF)
			Read EEPROM ($000 - $FFF)
			Write EEPROM ($000 - $FFF)
			Read ROM ($00000 - $1FFFF)
			Read fuses
			Read clock
			Set clock
			Configure measurement (block size + gap)
			Read measurement configuration
			Start measurement
\x1B (ESC)			Stop measurement

Table 1: Command table

2.1 Read motor speed ('m')

Prints three integers containing OCR1A, OCR1B and OCR1C respectively. 0 - 255 roughly corresponding to 0 - 100% or 0 - 6000 RPM.

2.2 Set motor speed(s) ('M')

Hardware will refuse if values are so low that they risk turning the motors off.

3 Listing

```
// Overview of the sample packet format:
```

```
//
// +----------------------------------------+
// | Header                 (17 bytes)      |
// +----------------------------------------+
// | Tachometer timestamps (variable size) |
// +----------------------------------------+
// | Sample data            (variable size) |
// +----------------------------------------+
//
// The size of the packet can be summarized as:
//
//   packet_size = 17 + sum(num_tachs)*3 +
//     num_frames*popcount(channel_conf)*
//     bytes_per_sample(sample_fmt)
//
// A more detailed view follows, in the form of C
// structs which are shared between code and manual.

// Sample packet header. Fixed size.
typedef struct sample_packet_header_s {
  char       header[2];     // "SP"
  uint24_t   first_frame;  // timestamp of first frame
  uint16_t   num_tachs[3]; // tach impulses per channel
  uint16_t   num_frames;   // number of frames
  uint16_t   gap;          // gap between packets
  uint16_t   channel_conf; // channel bitmap. 3 nybbles

  // Sample format. There are currently several ideas
  // for sample formats:
  //
  // * 16-bit signed integer
  // * 24-bit signed integer
  // * 16-bit half-float with 3- or 4-bit exponent
  //
  // 16-bit integers will likely not have enough
  // dynamic range to be useful. Companding 24-bit to
  // less than 16-bit may also be possible, say 12-bit.
  // This complicates packet formatting somewhat, but
  // may be worth it for somewhat higher sample rates.
  // Finally, A-law and mu-law are 8-bit compandings
  // which may be useful if we need to sample around
  // 8 kHz or more continuously.
  uint8_t    sample_fmt;

  // For some sample formats it might be useful to
  // rescale the data. This value says what the full
  // scale of the data is. In other words, where 0 dB
  // is.
  //
  // To decode say an 8-bit sample to its original
  // 24-bit range you would do this:
  //
  //   out24 = in8 * scale / 128
  //
  // You would have to be careful to use appropriate
  // data types so the computation doesn't overflow.
  //
  // Whether or not scale is used should be indicated
  // in sample_fmt.
  //
  // The maximum value of scale is 2^23.
  uint24_t  scale;
} sample_packet_header_s;

// Sample packet itself is variable size.
typedef struct sample_packet_s {
  // Header defined above
  sample_packet_header_s header;

  // Tachometer timestamps.
  // Number of entries is sum(num_tachs).
  // Values are stored one channel after the other,
  // NOT interleaved. If num_tachs = {3, 5, 4} then
  // the order will be like this:
  //
  //   0 0 0 1 1 1 1 1 2 2 2 2
  //
  // Keep in mind num_tachs can be zero for one or more
  // channel. num_tachs = {3, 0, 4} would look like:
  //
  //   0 0 0 2 2 2 2
  //
  uint24_t  *tachs;

  // Sample data is stored as a series of frames.
  // Each frame is built up of samples, and the number
  // of samples is the same as the number of bits in
  // channel_conf. Or: popcount(channel_conf).
  // The order of the samples is the same as the order
  // of ones in channel_conf.
  //
  // If all three ADCs are used, but only the first
  // three channels in each ADC, then channel_conf will
  // be "0000 0111 0111 0111" (most significant bit
  // first). Each frame will consist of 9 samples.
  //
  // The size of each sample depends on sample_fmt.
  // If 24-bit samples are used then the total amount
  // of sample data is:
  //
  //   num_frames * popcount(channel_conf) * 3  (bytes)
  //
  // In the example above, if we have 1000 frames then
  // the size of the sample data is 1000*9*3 = 27000 B.
  uint8_t   *sample_data;

} sample_packet_s;
```