MERG

Model Electronic Railway Group

MERG DCC System Technical Note
Software for the locomotive decoders.

The MERG DCC system has two designs of locomotive decoders, decod 10/11 and decod 12/13 the latter being a more advanced design including feedback and high frequency PWM. This technical note describes software written by Gil Fuchs for the decod 10/11 and compares it where appropriate with the earlier software based on designs by Dean Probst.

MERG offered kits for these decoders for a few years but as commercial decoders reduced in price the savings from kit building became minimal and the kits were discontinued.

Here is Gil's description of the new software.
  Decoder software
  Date: 03 February 2001 Gil Fuchs.

The following is a short list of features and comparison:

MBINT103 uses a different approach for detecting DCC than the Dean Probst based software (decod10x); it utilizes the interrupt capabilities of the PIC to sample the signal every 22us, thus allowing to differentiate between short DCC half-bits '1' and long ones '0' by counting the number of signals between polarity changes. Once a series of at least 18 short half bits followed by a long half-bit is detected (preamble) it synchronizes on the beginning of the packet. The sample rate is now dropped to 1/44us and full bits are detected, assembled to bytes and packets which are buffered. Since interrupts are used, this entire detection procedure occurs interpendently of the main execution thread - processing DCC commands, and both threads continuously run in parallel. This wastes less resources in polling for bit changes, and allows for simplified code maintenance. In the Probst code, during packet detection a close count of instructions must be kept to start the next sample iteration exactly at the next 22us slot (this makes code changes a challenge); once a packet is fully detected, instruction counting is stopped and bits are dropped until that packet processing is completed.

MBINT103 supports a larger number of Configuration Variables (CVs). Documentation is provided with the software. All CV29 (control 1) bits are supported.

2 and 4 digit addressing, advanced consisting, automatic analog conversion (which can be disabled) are supported.

14, 27 and 128 speed step modes are fully supported. Speed is controlled either by a splined curve calculated by 3 points: (VMin (CV2), VMax (CV5) and VMid(CV6)) or by a 28 entry speed table. The curve is independent of the number of speed steps, which is not the case with most commercial decoders. (Decod10x allows for straight-line speed control or a 28 entry speed table).

Acceleration and Deceleration are supported and the rate is per NMRA specifications (CV3, CV4).

Control of 5 outputs and logical functions, including a mapping of logical functions to outputs that conforms to NMRA specifications (decod10x has this capability but does not comply with NMRA specs since they did not exist at the time it was developed; hence it uses vendor defined CVs rather than the standard ones).

Support for special effects is similar to decod10x; any combination of effects can be applied to any logical function, and controlled by CVs. Added a special effect which is a pulse at a rate dependent on speed; used for chuff sound timing.

All programming methods, including programming on-the-main, are supported.

PWM maximum rate is lower than decod10x; this is a tradeoff to allow for improved performance of the main code. Both programs provide control of PWM frequency.

Both programs support motor damping via CV29.

Due to the added functionality, program memory is almost completely used. There is little room for addition unless a different PIC is to be used, which has a larger program space.

The CVs available are listed in 'INTDEC10version103.pdf'

Update: 26 February 2001
A new version is now available (MBINT104). Fixes in this version:

Adapted to handle higher frequency processors (compile time, by setting the preprocessor constant FREQ to the desired frequency and assembling).

CV7-8 fixed protection (so they cannot be overwritten).

CV1 addresses (short) are truncated to the range 0-127

CV17-18 limited to 0xC000 - 0xE7FF

Optimized code, now has 8 words of program space free.

Update: 27 January 2004
A new version is now available (MBINT105). Fixes in this version:

error in Func_1 corrected.

This is the version available for download.