

Digital Signal Generator Project Summary

This document provides a detailed overview of the Digital Signal Generator (DSG) project, highlighting its core features, encoding/decoding capabilities, usage instructions, and build procedures. The application is developed in Java 8+, using Swing and Java2D for the user interface, and Apache Maven for building the project.

Key Features and Extensions

Line Codes and Decoders:

- NRZ-L (Non-Return-to-Zero-Level)
- NRZ-I (Non-Return-to-Zero-Invert)
- Manchester - Differential Manchester
- AMI (Alternate Mark Inversion)

Decoding Methodology:

- Decoders operate on the rendered waveform, not the original data.
- Sampling rate: 100 samples/bit.
- Bit recovery methods:
 - NRZ-L: Average signal level per bit ($>0 \rightarrow 1$, $<0 \rightarrow 0$).
 - NRZ-I: Transition at bit boundary $\rightarrow 1$; no transition $\rightarrow 0$.
 - Manchester: High-to-low mid-bit transition $\rightarrow 1$; Low-to-high $\rightarrow 0$.
 - Differential Manchester: Mid-bit transition always occurs; start-of-bit transition $\rightarrow 0$; absence $\rightarrow 1$.
 - AMI: Non-zero magnitude $\rightarrow 1$; zero $\rightarrow 0$. Polarity ignored.
 - AMI Scrambling (B8ZS/HDB3): Decoding uses level analysis only, ignoring descrambling.

Application Usage:

1. Select Input: Digital or Analog. For Analog, choose a modulation (PCM or Delta) to convert into a bitstream.
2. Choose Encoding: NRZ-L, NRZ-I, Manchester, Differential Manchester, or AMI.
3. Optional Scrambling: Apply B8ZS or HDB3 to AMI signals.
4. Generate: Click "Generate Signal" to render the waveform and display results.
5. Decode: Optionally decode the rendered waveform to recover the original bitstream.

Build and Run Instructions: -

Using Apache Maven:

1. Install dependencies: `mvn install`
2. Compile: `mvn compile`
3. Run: `mvn exec:java` (ensure `dsg.ui.DigitalSignalGenerator` is set as `exec.mainClass` in `pom.xml`)

- Using Provided Windows Scripts:

1. Build: `compile-simple.bat`
2. Run: `run-simple.bat`

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