

Proposal for automatic polarity detection and correction using the start-up protocol

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Introduction

- The concept of automatic polarity correction in electrical interfaces using training was initially presented in the ad hoc presentation [ran_3dj_elec_01_240208](#).
- The training frame format enables detection of any polarity inversion, whether it is in the transmitter, in the receiver, or in the interconnect.
- Benefits are in reduction of overhead in configuring systems and enabling flexibility in modular systems – significant time-saving especially in high-radix systems with dense routing.
 - Time is money!

Details

- When training is used, polarity detection is possible simply by inspecting the received frame marker:
 - Sixteen “3” followed by sixteen “0” è not inverted
 - Sixteen “0” followed by sixteen “3” è inverted
- A receiver that uses training can easily identify and correct the polarity for the data path.
 - If training is not enabled on a specific segment, this feature will not be available, and polarity inversion will require manual configuration (as done today).
- **To allow polarity inversion on Tx pairs, detection and automatic correction must be a mandatory function in the Rx.**

Proposal

- Define detection and automatic correction of polarity by the receiver as a mandatory function in the training protocols for PMAs / PMDs.
- Possible language in Annex 176A:

176A.1.1 Frame marker

Training frames are delimited by a specific sequence of PAM4 symbols. The training frame marker is sent as a run of 16 consecutive “3” PAM4 symbols followed by a run of 16 consecutive “0” PAM4 symbols. This sequence is not found in the control field, status field, or training pattern and it uniquely identifies the beginning of a training frame.

The PMD control function shall identify received training frames with either the marker described above or its inverse, 16 consecutive “0” PAM4 symbols followed by a run of 16 consecutive “1” PAM4 symbols. If inverted markers are received, the PMD control function shall correct the polarity by mapping the received PAM4 symbols 0, 1, 2, and 3 to PAM4 symbols 3, 2, 1, and 0, respectively, before any other processing (see 120.5.7). The same mapping shall be applied when delivering the PAM4 symbols to the PMA.

NOTE—Polarity detection and correction is not available when training is disabled.

- With adequate changes to the text if training becomes a PMA function.

Thanks!