

CFI “Reduced Pair Gigabit Ethernet PHY” Industrial Environment



- Wiring tailored to machinery, therefore limited use of terminated cables
- Installation of cables and connectors by low-skilled workers
- Installation location may be difficult to access
- Re-use of existing cabling due to high plant lifetime
- Long distances to be covered,
e.g. between production and foreman’s office
- Industrial environmental requirements to be fulfilled,
e.g. temperature range, EMC (provide a CESD robustness > 4kV), etc.
- Energy and Data on same cable, therefore PoE to be supported
- For railway applications, the following standards apply:
 - EMC according to DIN EN 50121
 - Fire protection requirements according to DIN 5510
 - Shock and vibration according to DIN EN 50155

CFI “Reduced Pair Gigabit Ethernet PHY” Industry Requirements



New PHY to support

- Gigabit on 4-wire plus Gigabit on 8-Wire and Fast Ethernet on 4-wire, full duplex operation (10MBit und 100MBit half duplex not required)
- Full integration into Auto-negotiation to automatically select connection params, fixed setting of the 4-Wire Gigabit mode shall also be possible
- Standard properties according to IEEE Std 802.3-2008 1000BASE-X
 - Support operation over 100 meters of copper balanced cabling with Bit Error Ratio of less than or equal to 10^{-10} (CAT 5e STP)
- PHY delay constraints to support high precision time synchronization
 - Constant delay, so that no Link Up Event or Restart of the system shall change the receive neither the transmit delay of the PHY
 - TX Delay (MII) < 80ns, RX Delay (MII) < 120ns
- Fast Link Down Detection <1ms including unidirectional links for non-seamless redundancy
- Power Consumption equal or below 8-wire GBit PHY

CFI “Reduced Pair Gigabit Ethernet PHY” Train Environment (Railway applications)



In addition to the industrial requirements following requirements need to be fulfilled in the train environment:

- Maximum cable length of 300m

Reason: In order to avoid the outage of the network due to switch breakdowns while reducing the switch and cabling cost it is required to support a max. cable length of 300m in the train.

- Fire protection standard: EN CTS/TS 45545
- EMC standard: EN 50121-3-2
- Robustness against train vibrations and shock: EN 50155
- Temperature standard: EN 50155, Class Tx
- Climate standard: EN 50155