IA1 - CAN bus

This course covers all CAN specifications: CAN 2.0, TT-CAN and FD-CAN

Objectives

- Becoming familiar with CAN 2A & 2B specifications through implementation examples.
- Explaining the benefits and implementation of TT-CAN.
- Highlighting the differences between CAN 2.0 and FD-CAN.
- Describing the M-TTCAN IP designed by Bosch, as an implementation example of the CAN 2.0, TT-CAN and FD-CAN specifications.
- This course also details the physical layer.
- Testing a CAN system and optimising the hardware parameters with the assistance of a IXXAT CAN Analyser.

A more detailed course description is available on request at training@ac6-training.com

Prerequisites

- Basic knowledge of processor.

Environnement du cours

- Cours théorique
  - Support de cours au format PDF (en anglais) et une version imprimée lors des sessions en présentiel
  - Cours dispensé via le système de visioconférence Teams (si à distance)
  - Le formateur répond aux questions des stagiaires en direct pendant la formation et fournit une assistance technique et pédagogique
- Au début de chaque demi-journée une période est réservée à une interaction avec les stagiaires pour s'assurer que le cours répond à leurs attentes et l'adapter si nécessaire

Audience visée

- Tout ingénieur ou technicien en systèmes embarqués possédant les prérequis ci-dessus.

Course Outline

INTRODUCTION

- History
- Compliance with the OSI model
- PHY and Link layers features

FRAME ANALYSIS

- 2.0A and 2.0B frame description
- Compatibility between both formats
- Relationship between label and priority

ARBITRATION

- Point to multipoint communication model
- Dominant and recessive states

- Frame priority selection through the label value

TIMING AND SYNCHRONIZATION

- Bit time phases
- Hardware and software resynchronization
- RJW determination

ERROR MANAGEMENT

- The error counter registers
- Error detection areas inside a transmit frame and a receive frame
- Fault confinement : counter increment / decrement rules
- The 3 states of a CAN node

CAN NETWORK PERFORMANCE

- The parameters that determine network performance
- Distance between both farthest stations
- Connection establishment time

SETTING UP A CAN BUS SYSTEM

- Set up of many communications between all CAN stations
- Labs to show the error counter management
- Labs to show the impact of the RJW parameter

CAN SOFTWARE DRIVER DEVELOPMENT

- STM32 CAN controller description
- Label filters configuration through the mask registers
- Bit time phases initialization
- Automatique reply

TIME-TRIGGERED CAN

- Transmitting messages in specific time slots
- System matrix, time windows
- Frame synchronisation entity, global system time
- Merged arbitrating windows
- Reference message
- Generation of Local time
- Initialisation and fault tolerance of time masters
- Failure handling
- Interrupt status vector
- Message status count

CAN WITH FLEXIBLE DATA RATE (FD-CAN)

- Two bit-rate scheme
- New MAC and LLC layers
- New frame format
- Extended Data Length, up to 64 Bytes
- Bit Rate Switch
- Error State Indicator

M_TTCAN BOSCH IP

- Clocking
- Power-down support
- Message RAM organization
- RxBuffer and TxBuffer elements
- Parameterizing the frame filters
- Interrupt management
- Loopback test mode
- Bus monitoring mode
- Programming, describing control and status registers
- Monitoring the CAN communication state
- Activating FD operation
- TT synchronization state
- Cycle time, Global time and Local time
- Message scheduling