



# ISOBUS Diagnostics

# Functional Overview

(ISO11783 Part 12)

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# Topics



- General Description
- Diagnostic Connector
- 3 Levels of Diagnostics
- Level 1 Diagnostic Requirements
  - Controller Application perspective
  - Service Tool perspective
- Diagnostic Services covered
- Scope of Enhanced Diagnostics

# General Description



ISO11783 Part 12 specifies the requirements of a standard diagnostic system for the open ISOBUS network.

Any unit connected to this network shall provide the information specified in this part of the standard!

Implementation Level 4 (September 2008) makes this mandatory requirement for parsing the ISOBUS Certification.

# ISO11783 – Documents

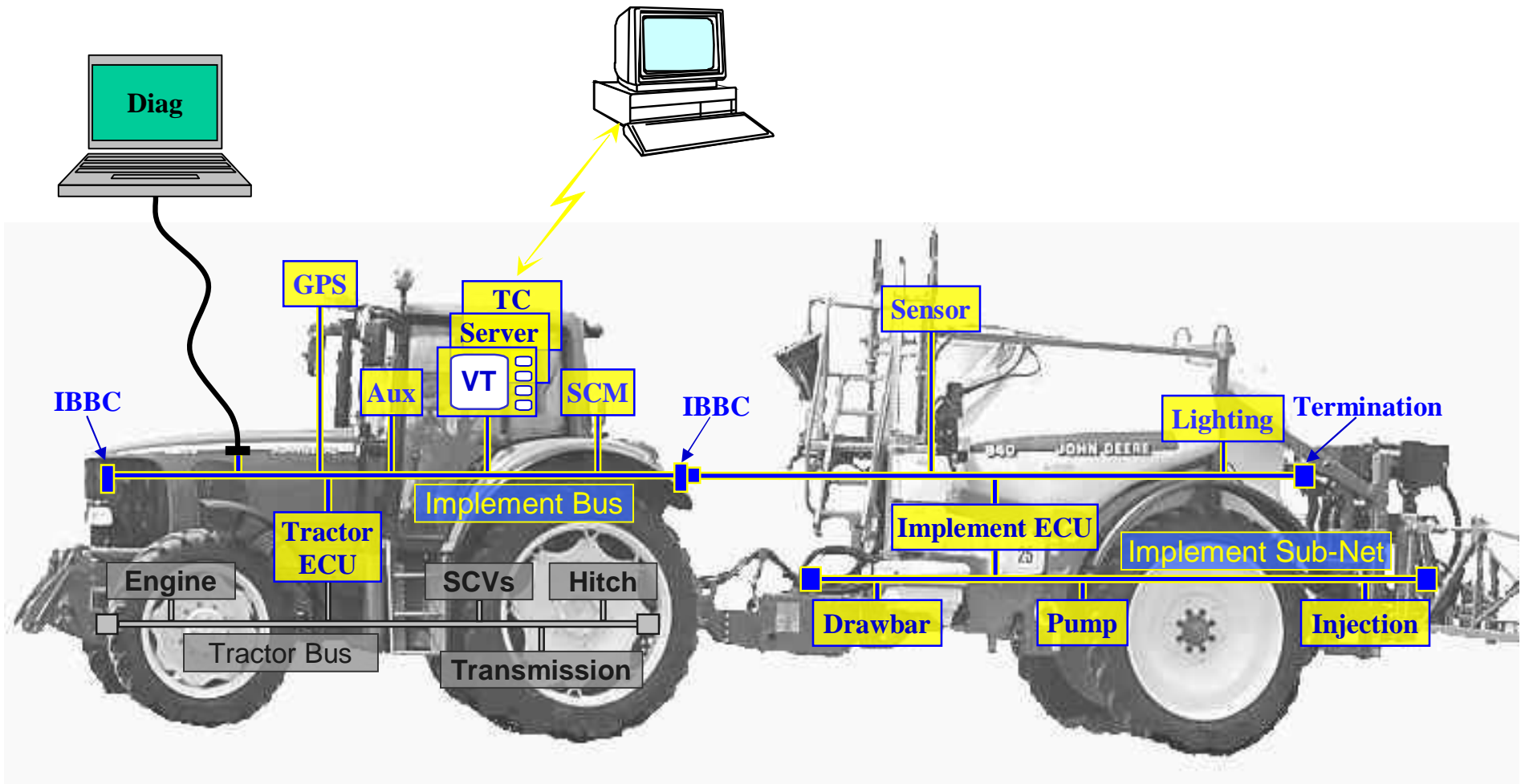
## - 14 Parts or Subdocuments -



• Part 1 (complete) – General Standard	• Part 8 (complete) – Drive Train
• Part 2 (complete) – Physical Layer	• Part 9 (complete) – Tractor ECU
• Part 3 (complete) – Data Link Layer	• Part 10 (complete) – Task Controller
• Part 4 (complete) – Network Layer	• Part 11 (complete) – Mobile Ag Database
• Part 5 (complete) – Network Management Layer	• <b>Part 12 (complete) – Diagnostic Services</b>
• Part 6 (complete) – Virtual Terminal	• Part 13 (complete) – File Server
• <b>Part 7 (complete) – Implement Messages</b>	• Part 14 (draft) – Sequence Control

***The standard is a “work in progress”***

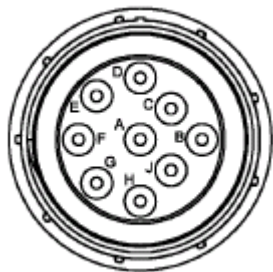
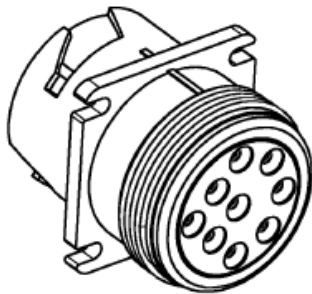
# Functionality covered by ISOBUS



# Diagnostic Connector



Table 13 — Diagnostic connector pin allocations



Pin no.	Allocation
A	ECU_GND
B	Unswitched power <sup>a</sup>
C	Tractor bus CAN_H
D	Tractor bus CAN_L
E	Not specified <sup>b</sup>
F	Not specified <sup>c</sup>
G	Not specified <sup>c</sup>
H	Implement bus CAN_H
J	Implement bus CAN_L

<sup>a</sup> A direct connection to positive battery power through a 10A fuse.  
<sup>b</sup> Used for the shield of an SAE J1939 network in an SAE diagnostic connector.  
<sup>c</sup> Used for SAE J1708 [3] network in an SAE diagnostic connector.

For details see ISO11783 Part 2

# Functionality covered



## **The standard defines three level of diagnostics:**

0. Non standard diagnostic features like special screens in the Object pool of an implement allowing to test its inputs and outputs.
1. Basic system diagnostics (mandatory for all controller applications)
2. Advanced more detailed diagnostics  
(may proprietary, optional implementation)

# Functionality covered



## For Level 1 Diagnostics Controllers shall provide

- Network information
  - NAME information (as defined in Part 5)
    - Industry Group
    - Device Class (e.g. Planter, Sprayer, etc)
    - Function (e.g. Implement Controller, VT, TC, etc)
    - Manufacturer Code
    - Identity Number
  - ECU identification information
    - Part#
    - Serial#
    - Manufacturer name in text
  - Software version
  - Compliance test data including date and laboratory

# Functionality covered



## For Level 1 Diagnostics Controllers shall provide

- Controller diagnostics information
  - ECU specific diagnostic protocol supported for detailed level 2 diagnostics (none, J1939, KWP2000, etc)
  - Active diagnostic trouble codes (SPNs and DM1)
  - Previously active diagnostic trouble codes (DM2)
  - Fault occurrences (if available)
  - Member of working set (if a member)
  
- Clear/Reset Previously Active Diagnostic Trouble Code (DM3)

# Functionality covered



## For Level 1 Diagnostics Service Tools shall

- Display the Network information per controller
- Display the Diagnostics information per controller
- Display the Network statistics
  - bus voltage
  - bus load
  - CAN error information
- The tool doesn't need to support all level 2 type diagnostics (J1939, KWP2000), it's enough to just display the protocol supported by the diagnosed device

# Diagnostic Services



## DM1 – Active Diagnostic Trouble Codes

- o Originally defined in SAE J1939-73
- o Send by any logic unit on the bus whenever a DTC becomes an active fault or on request
- o Repeated once per second while error stays active
- o Send once when the error becomes inactive
- o Send as Transport Protocol when multiple DTC's are active in parallel
- o In case of multiple DTC state changes within one second it's recommended that not more than one DM1 gets send per second to avoid high bus loads

# Diagnostic Services



## DM2 – Previously Active DTC's

- o Originally defined in SAE J1939-73
- o Provides on request a list of previously active DTC's (DTC occurrence counter > 0)
- o All previously active DTC's in one message (TP required for more than 1 DTC)
- o Allows to analyze for error dependencies

## DM3 – Clear/Reset Previously Active DTC's

- o Originally defined in SAE J1939-73
- o Isn't included in ISO11783 Part 12 yet => will be required by IL4 document
- o Allows the Service Tool to clear the DTC counters in a particular application/controller

# Diagnostic Services



## DTC – Diagnostic Trouble Codes

- o A DTC includes
  - SPN – Suspect Parameter Number
  - FMI – Fault Mode Indicator
  - Fault Occurrence Counter (optional)

## SPN – Suspect Parameter Number

- o Identifies the least repairable subsystem that has failed
- o Information in most of the ISOBUS message have SPN's assigned
- o 19 bit number
- o Example: Ground Based Speed and Distance Message (Part 7)

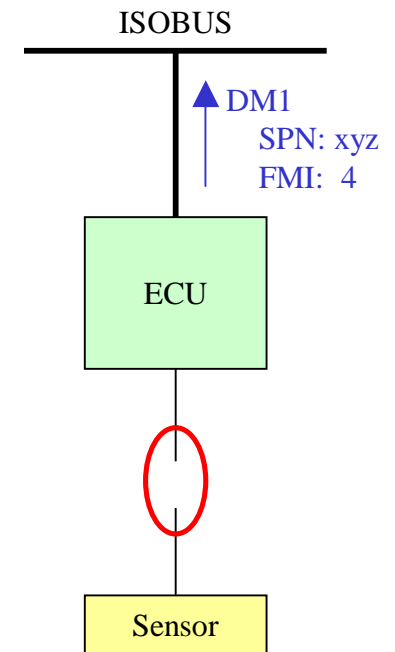
PGN	65097 (0xFE49)	
Byte 1-2	Ground based Speed	SPN _ _ _ _
Byte 3-6	Ground based Distance	SPN _ _ _ _
Byte 7	Reserved	
Byte 8	Ground based Direction, etc	SPN _ _ _ _

# Diagnostic Services



## FMI – Failure Mode Identifier

- o Identifies the type of failure in the subsystem
- o FMI Descriptions (details in J1939-73 Annex A):
  - 0 Data valid but above normal operation range
  - 1 Data valid but below normal operational range
  - 2 Data erratic, intermittent or incorrect
  - 3 Voltage above normal, or shorted to high source
  - 4 Voltage below normal, or shorted to low source**
  - 5 Current above normal or open circuit
  - 6 Current below normal or grounded circuit
  - 7 Mechanical system not responding or out of adjustment
  - 8 Abnormal frequency or pulse width or period
  - 9 Abnormal update rate
  - 10 Abnormal rate of change
  - 11 Failure code not identifiable
  - 12 Bad intelligent device identifiable
  - 13 Out of Calibration
  - 14 Special Instructions
  - 15-30 Reserved
  - 31 Not Available



# Scope of Enhanced Diagnostics



- o Enhanced Diagnostics allow more application specific testing
- o Today enhanced diagnostics are proprietary to the manufacturer (not defined in Part 12)
- o Goal is to define Optional Level 2 diagnostics in part 12 AMD
- o Manufacturers will be able to define in a kind of Object Pool (Diag. OP) their “guided diagnostics”
- o Diag. OP will provide interpretation for DTC’s or output levels of a sensor for instance.
- o Diag. OP will provide valid data range for sensor output readings
- o Diag. OP will support drawings, schematics, etc.
- o Diag. OP can be read by any Service Tool
- o Diag. OP distribution via CAN, CD, Internet, etc.



# ISOBUS Diagnostics

# Functional Overview

(ISO11783 Part 12)

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? Questions ?



# ISOBUS Sequence Control

## Functional Overview

(ISO11783 Part 14)

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# Topics



- General Description
- Sequence Control Functionality
- Sequence Control Object Pool
- Sequence Control Teach-in
- Sequence Control Replay

# General Description



ISO11783 Part 14 specifies a Sequence Control System (SC), also known as headland management system, which includes tractor and implement functions in one system/set of sequences.

The Goal is to release the operator from recurring sequences of operation steps (e.g. while approaching or leaving the headland).

The support of this functionality will be optional.

CD ballot closed at February 18th, 2008

DIS ballot will start April 1st, 2008

Release of IS document is expected for 2010

# ISO11783 – Documents

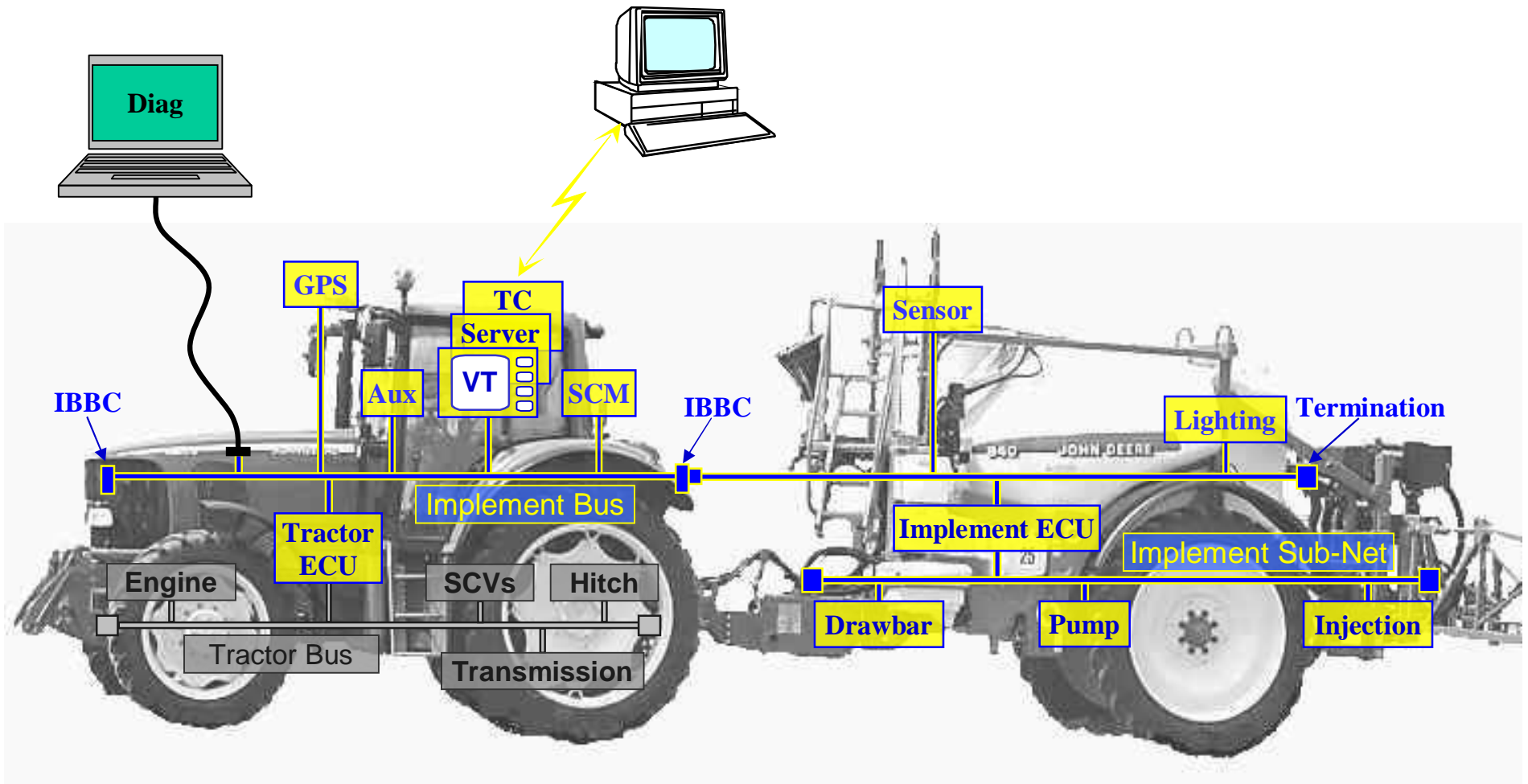
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***The standard is a “work in progress”***

# Functionality covered by ISOBUS



# Sequence Control Functionality



## Sequence Control (SC)

- Defines one system wide Sequence Control Master (SCM)
- Tractor and any other controller/application are considered Sequence Control Clients (SCC)
- A Sequence of operation commands can be either
  - recorded while manually performing them (Teach-in) or
  - manually defined in an edit screen
- A once defined Sequence can be replayed multiple times
- Includes Visualization of the sequence
- Operator can edit recorded sequences
- Visualization and the Edit functionality require that the SCM has appropriate definitions of all functions (icons, text, etc)  
=> SCC load an Object Pool into the active SCM on start-up
- SCM includes the information of these OP's into his Screen-Layouts

# Sequence Control Object Pool



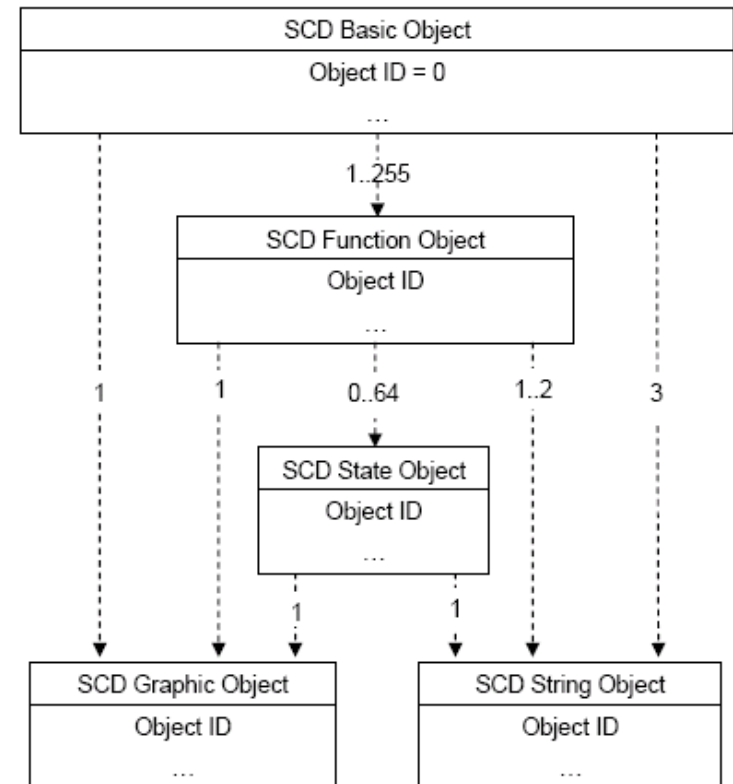
- SCD basic Object includes information on
  - owner of the OP
  - Object Pool Version
  - Machine configuration represented

- up to 255 Functions per Client

Example Tractor:

- x SCV
- rear Hitch
- front Hitch
- rear PTO
- front PTO, etc

- Each Function can have either
  - number value (e.g. % of hitch height)
  - up to 64 discrete states associated
- Each object has
  - a graphical representation (icon)
  - a text representation



# Sequence Control - Teach-in -

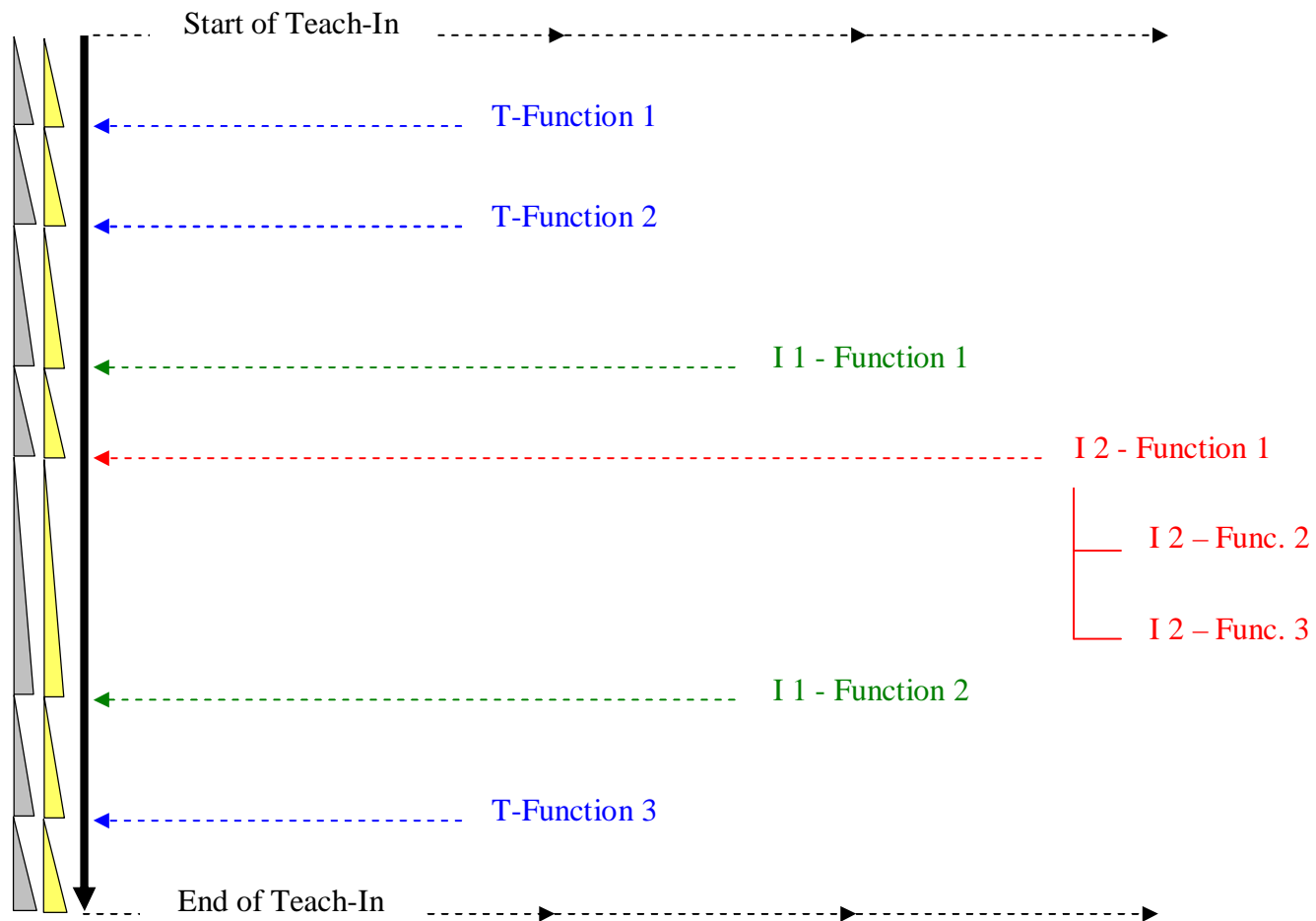


SC Master  
Time & Distance  
Measurement

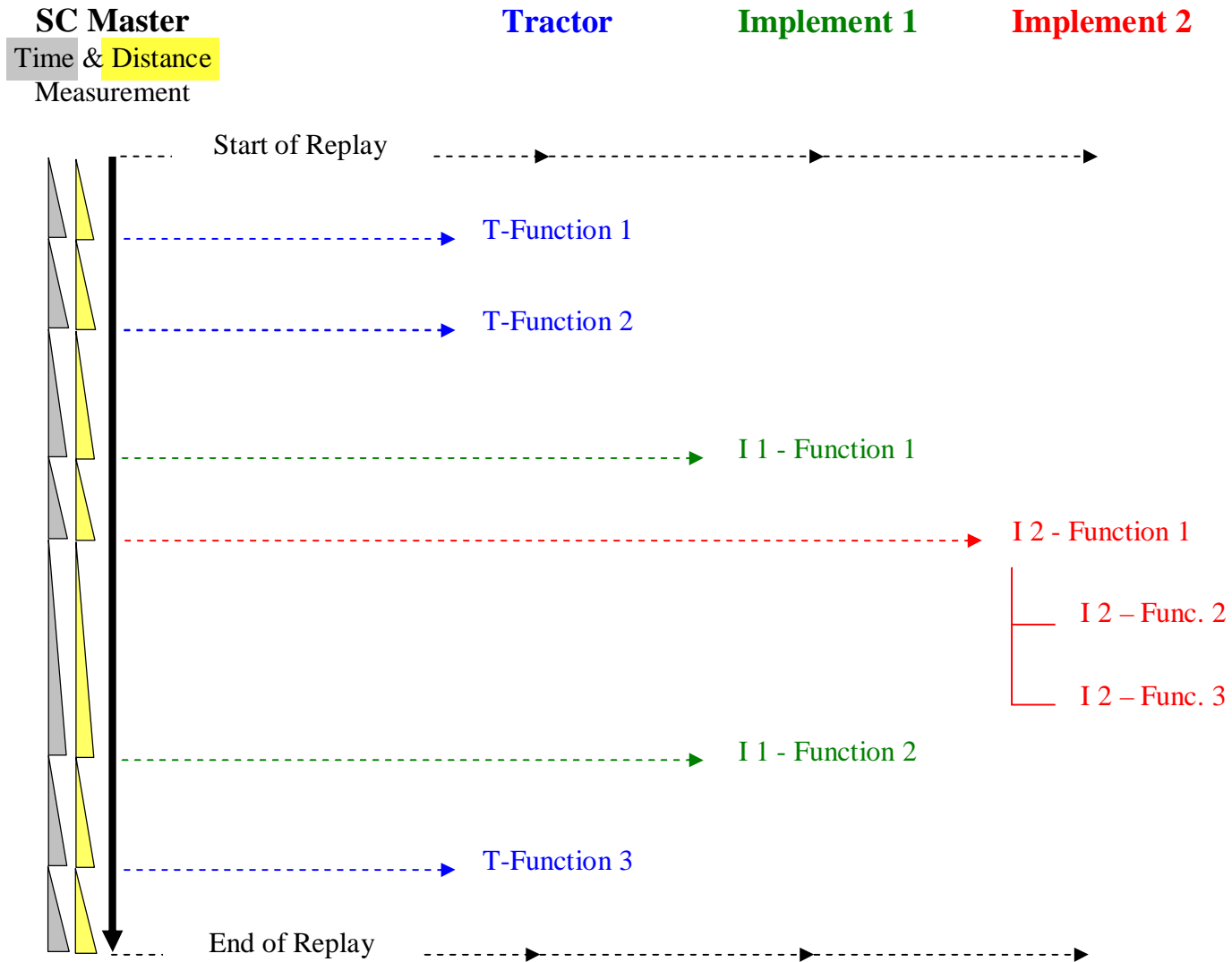
Tractor

Implement 1

Implement 2



# Sequence Control - Replay -





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