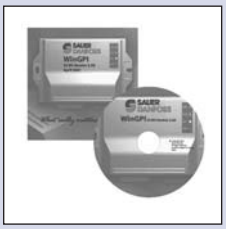
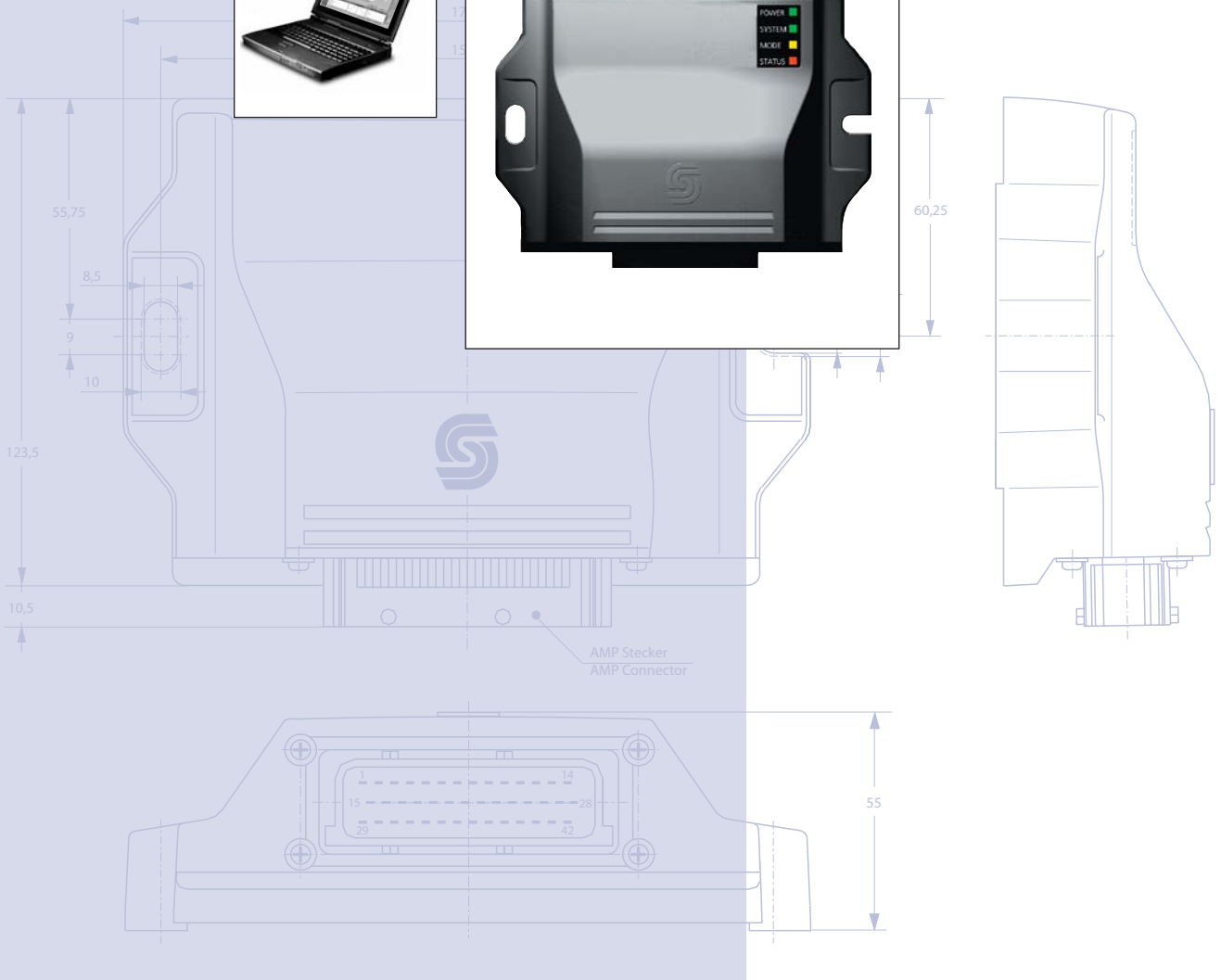
SAUER DANFOSS

S1X
Shift Control System

System Description





S1X Shift Control System
System Description
Overview

DESCRIPTION

The Sauer-Danfoss Shift Control Concept for tractors combines the capabilities of modern digital electronics with worldwide proven knowledge of Sauer-Danfoss in hydrostatics to enhance the machine performance and operation.

The microprocessor-based S1X provides flexibility and future oriented control concept. With easy-to-change parameters (in software) and the variety of user-friendly service tools, it is possible to make an individual setup for different machine types.

FEATURES

- Environmentally hardened for mobile applications.
- Supply voltage $12V_{DC}$ or $24V_{DC}$ (one unit).
- Software changes without hardware operations.
- Full closed-loop control of clutches until fully engaged.
- Highly integrated comprehensive logic and control systems.
- Extensive set of operation modes:
  - Clutch Off
  - Clutch Disengaged
  - Manual Slip Control
  - Auto Start Speed Control
  - Auto Declutch Speed Control
  - Reversal Deceleration Speed Control
  - Reversal Acceleration Speed Control
  - Power-crossing.
- Two complementing control concepts:
  - Slip Control
  - Speed Control.
- Power-crossing to allow smooth transition and uninterrupted delivery of torque when switching clutches.
- Closed-loop control compensating the effects of:
  - Gear setting
  - Load condition
  - Temperature changes.
  - Mechanical and hydraulic tolerances.
- Highly optimised solution achieved with the combination of parameter sets for each specifically defined operation mode.
- Automatic calibration of valve thresholds and settings.
- Closed-loop regulated current output to valves provides further compensation for temperature changes and valve tolerance.

SYSTEM COMPONENTS

- S1X-45/46 G2 AMP K164C Shift Control

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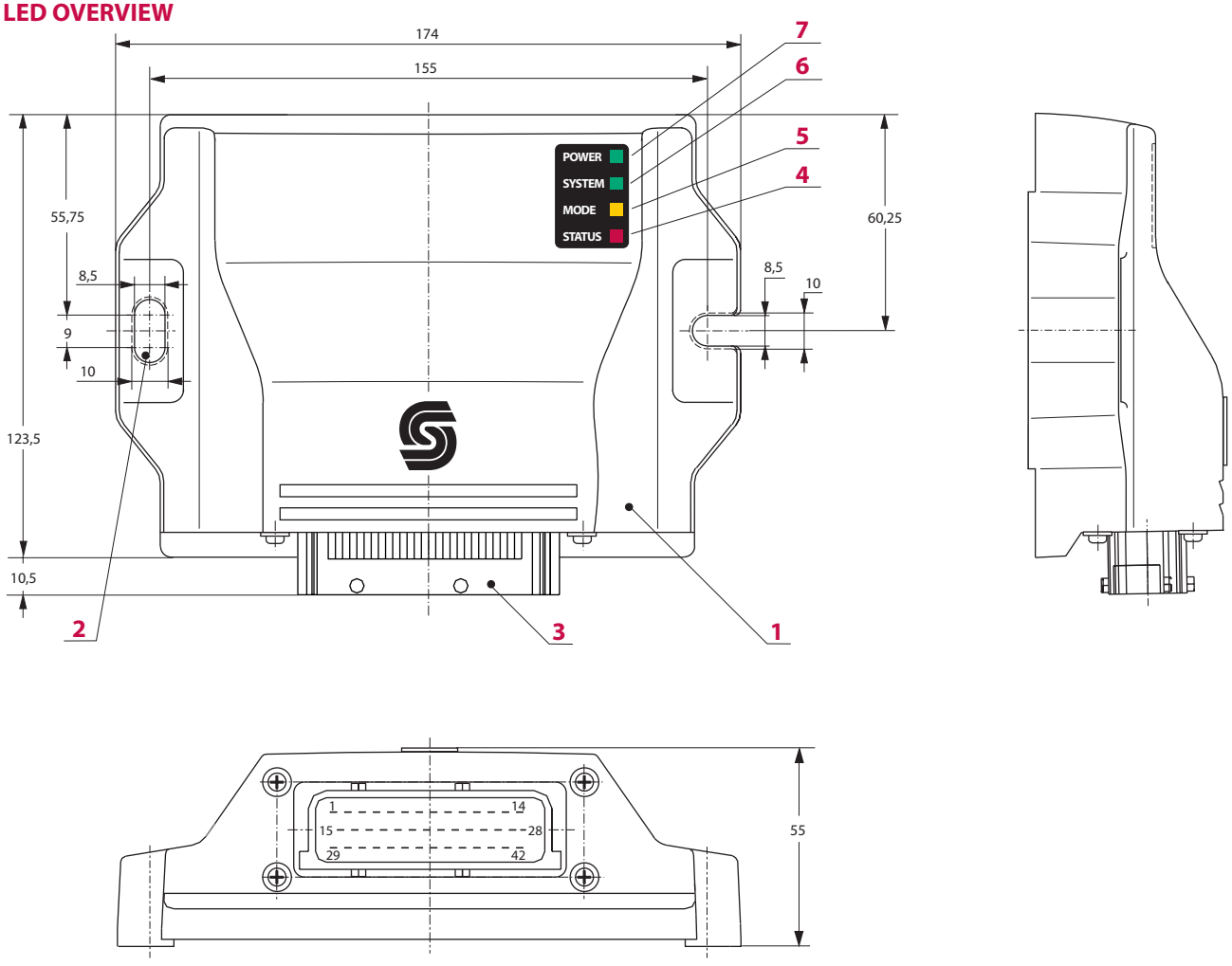
LED OVERVIEW



1	**S1X**	
2	**Mounting slots**	
3	**AMP connector**	
4	**Diagnostic LED red (STATUS)**	**Error check** Lights up if an error is detected.
5	**Diagnostic LED yellow (MODE)**	**Software check** Flashes with approx. 0.5Hz (slow) if the program is running fine. Flashes with approx. 5Hz (fast) if no program is loaded. No flashing if in setup mode.
6	**Diagnostic LED green (SYSTEM)**	**$5V_{DC}$ internal** Lights up if $5V_{DC}$ internal is O.K.
7	**Diagnostic LED green (POWER)**	**Battery after ignition switch** Lights up if the battery voltage is connected after ignition.

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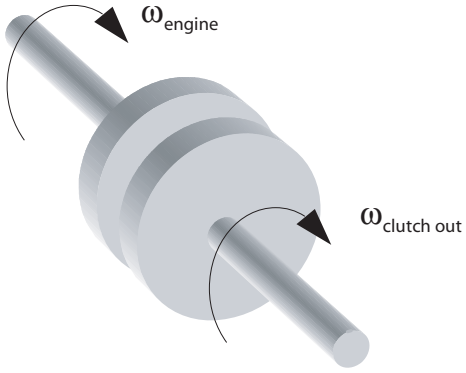
THEORY OF OPERATION

System Logic

Establish overall system operating mode based on operator's input.

Slip Detection

Clutch slippage is defined as the difference between the clutch and the engine rotational speed as a percentage of the engine speed:



$$\text{Slip (\%)} = \frac{\omega_{engine} - \omega_{clutch\ out}}{\omega_{engine}} \times 100\ \%$$

$$= \left(1 - \frac{\omega_{clutch\ out}}{\omega_{engine}} \right) \times 100\ \%$$

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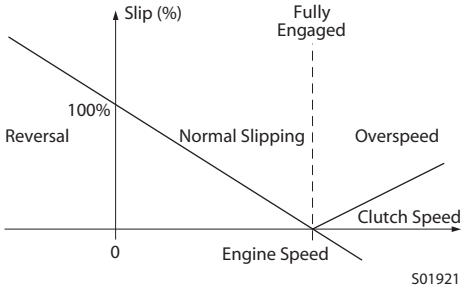
One universal measurement to describe different clutch conditions.



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Clutch Logic

Establish clutch operation mode based on system state, detected slip, vehicle condition and operator's input (refer to *Clutch Logic Block Diagram*).

- Clutch Off
- Clutch Disengaged
- Manual Slip Control
- Auto Start Speed Control
- Auto Declutch Speed Control
- Reversal Deceleration Speed Control
- Reversal Acceleration Speed Control

From the established operation mode, a relevant slip or speed setpoint is generated.

Clutch Control

Regulate the clutch condition to the setpoint with highly customisable closed-loop control systems (refer to *Speed and Slip Control Block Diagram*).

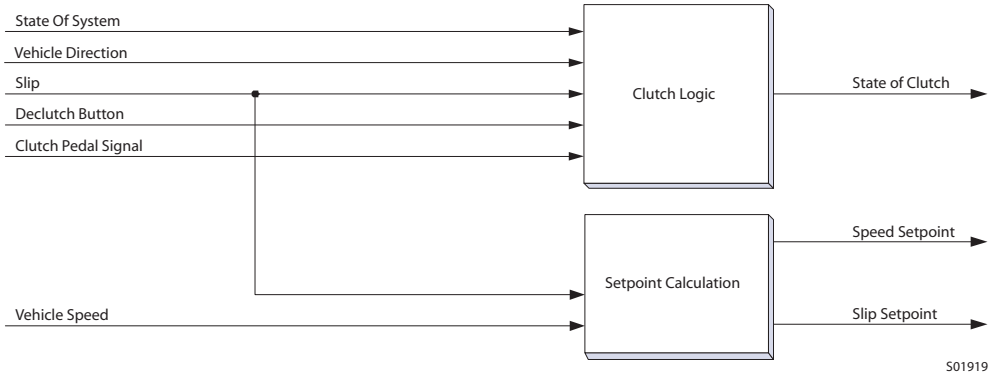
THEORY OF OPERATION (continued)

Slip Control
Control of precise clutch slippage to achieve consistent and accurate slow motion.

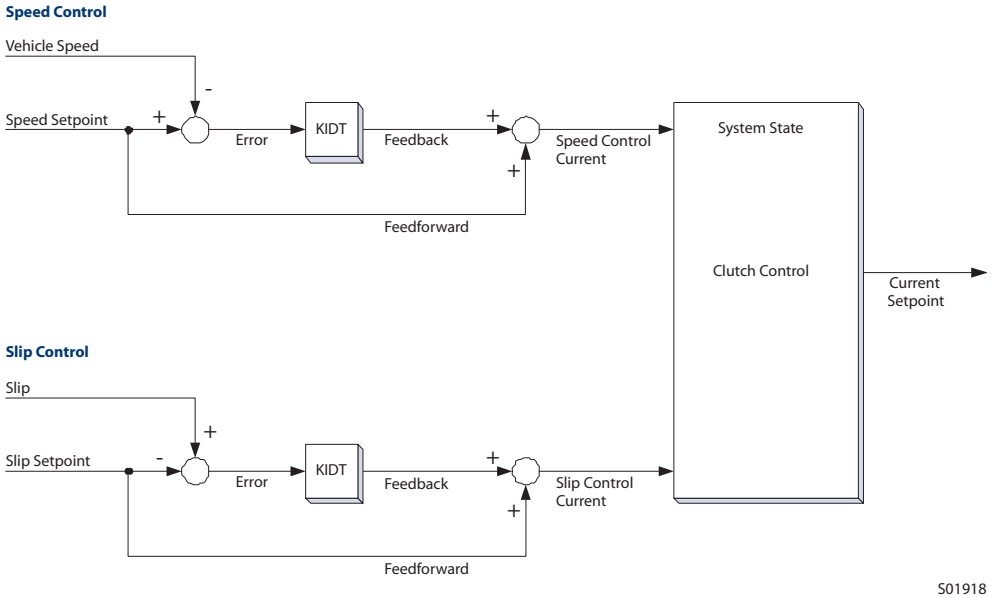
Speed Control
Control of vehicle speed to achieve the optimal condition for responsiveness, smoothness and comfort level during start, gear shifting and reversal

Auxiliary Speed-shift Control
The application is capable of providing additional control for other electronically actuated speed-shift systems with the spare input and output channels. The overall solution can be integrated into one single controller providing synergetic advantage in performance and cost.

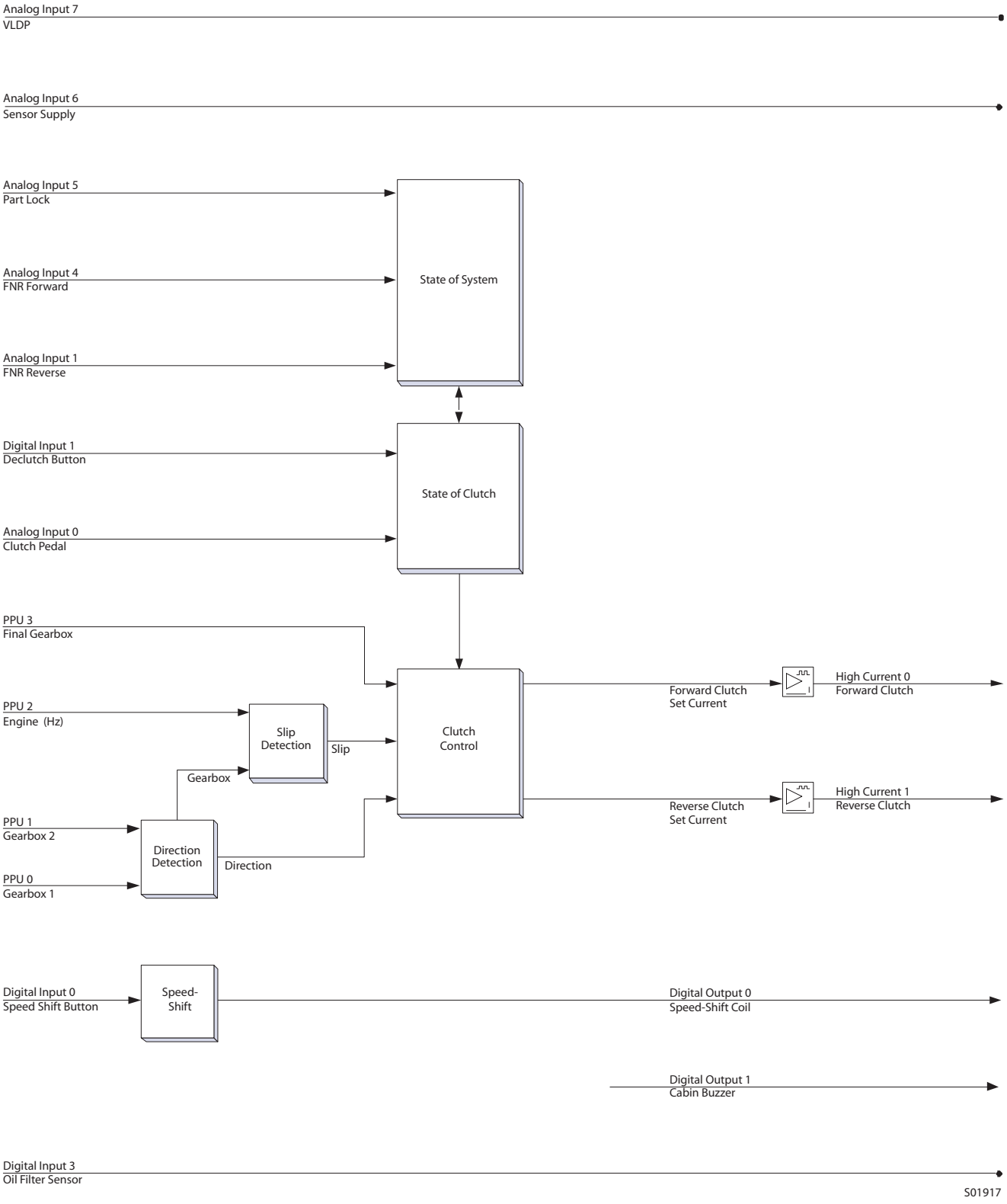
CLUTCH LOGIC BLOCK DIAGRAM



SPEED AND SLIP CONTROL BLOCK DIAGRAM

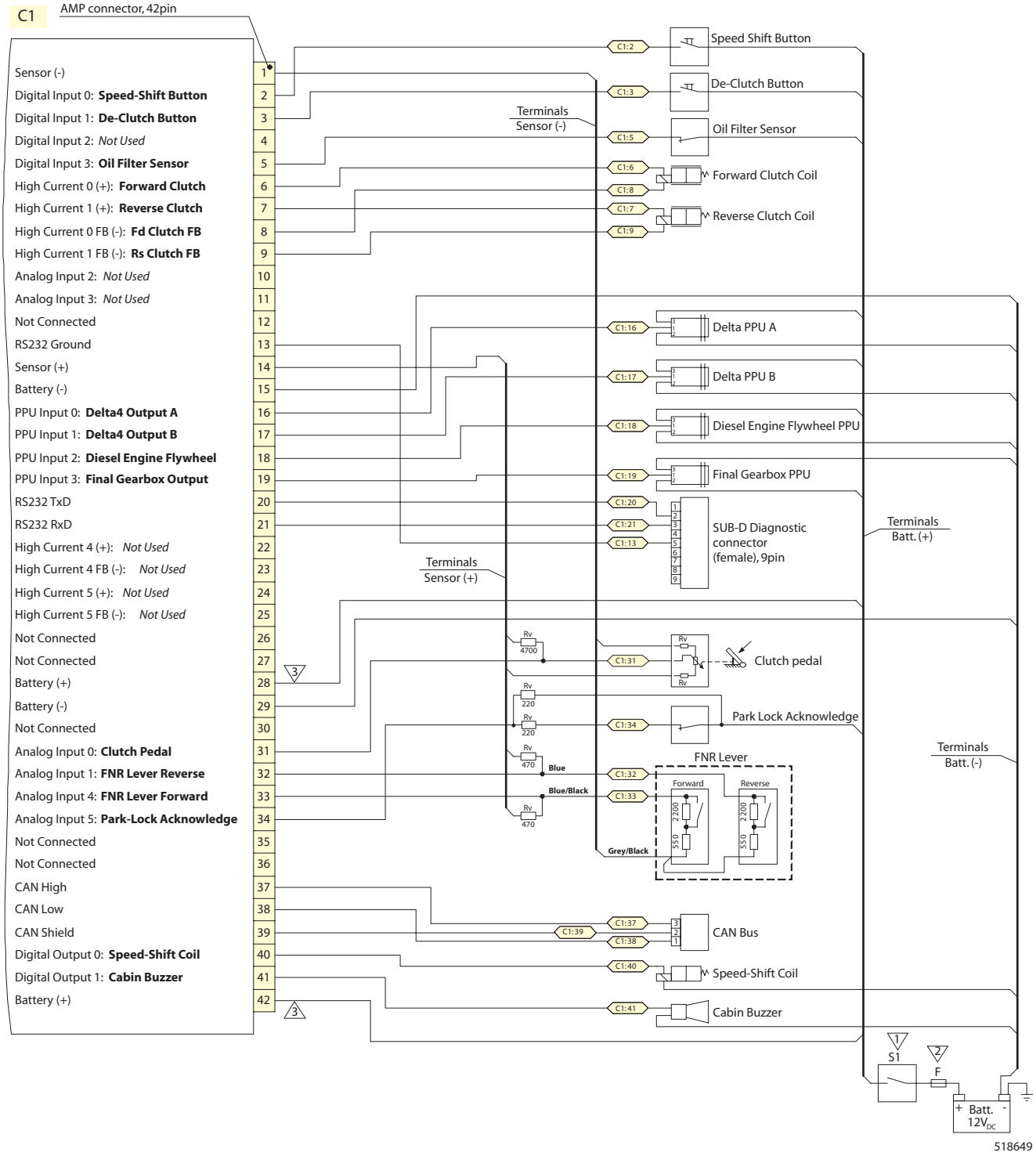


SYSTEM BLOCK DIAGRAM



SYSTEM CONNECTION DIAGRAM

1. Contact capability min. 6A
2. Malting fuse 10A
3. Max. 3,25A each pin



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