Technical Publication

ADEC
for series 2000 PLD
and series 4000

Application: Genset

Functional Description
Operating Instructions
Workshop Manual
Installation and Initial Operation

E532233/00E

Wichtig – Important – Importante

Bitte die Karte „Inbetriebnahmemeldung“ abtrennen und ausgefüllt an MTU Friedrichshafen GmbH zurücksenden.

Die Informationen der Inbetriebnahmemeldung sind Grundlage für den vertraglich vereinbarten Logistik-Support (Gewährleistung, Ersatzteile etc.).

Please complete and return the “Commissioning Note” card below to MTU Friedrichshafen GmbH.

The Commissioning Note information serves as a basis for the contractually agreed logistic support (warranty, spare parts, etc.).

Veuillez séparer la carte “Signalisation de mise en service“ et la renvoyer à la MTU Friedrichshafen GmbH.

Les informations contenues dans la signalisation de mise en service constituent la base pour l'assistance en exploitation contractuelle (garantie, rechanges, etc.).

Rogamos separen la tarjeta “Aviso de puesta en servicio“ y la devuelvan rellenada a MTU Friedrichshafen GmbH.

Las informaciones respecto al aviso de puesta en servicio constituyen la base para el soporte logístico contractual (garantía, piezas de repuesto, etc.).

Ritagliare “Avviso di messa in servizio“ e rispedirlo debitamente compilato alla MTU Friedrichshafen GmbH.

Le informazioni ivi registrate sono la base per il supporto logistico contrattuale (garanzia, ricambi, ecc.).

É gentileza cortar o cartão "Participação da colocação em serviço", preenché-lo e devolvé-lo a MTU Friedrichshafen.

Os dados referentes à colocação em serviço representam a base para o suporte logístico (garantia, peças sobressalentes, etc.) estabelecido contratualmente.

Postcard

MTU Friedrichshafen GmbH
Department SCSD
88040 Friedrichshafen
GERMANY

Bitte in Blockschrift ausfüllen!
Please use block capitals!
Prière de remplir en lettres capitales!
¡A rellenar en letras de imprenta!
Scrivere in stampatello!
Favor preencher com letras de forma!

Motornr.: Engine No.: N° du moteur: N° de motor: Motore N.: No. do motor:	Auftragsnr.: MTU works order No.: N° de commande: N° de pedido: N. commessa: No. do pedido:
Motortyp: Engine model: Type du moteur: Tipo de motor: Motore tipo: Tipo do motor:	Inbetriebnahmedatum: Date put into operation: Mise en service le: Fecha de puesta en servicio: Messa in servizio il: Data da colocação em serviço:
Eingebaut in: Installation site: Lieu de montage: Lugar de montaje: Installato: Incorporado em:	Schiffstyp / Schiffshersteller: Vessel/type/class / Shipyard: Type du bateau / Constructeur: Tipo de buque / Constructor: Tipo di barca / Costruttore Tipo de embarcação/estaleiro naval:
Endabnehmer/Anschrift: End user`s address: Adresse du client final: Dirección del cliente final: Indirizzo del cliente finale: Usuário final/endereço:	
Bemerkung: Remarks: Remarques: Observaciones: Commento: Observações:	

Inbetriebnahme-meldung

Commissioning Note

Notice de mise en service

Aviso de puesta en servicio

Avviso di messa in servizio

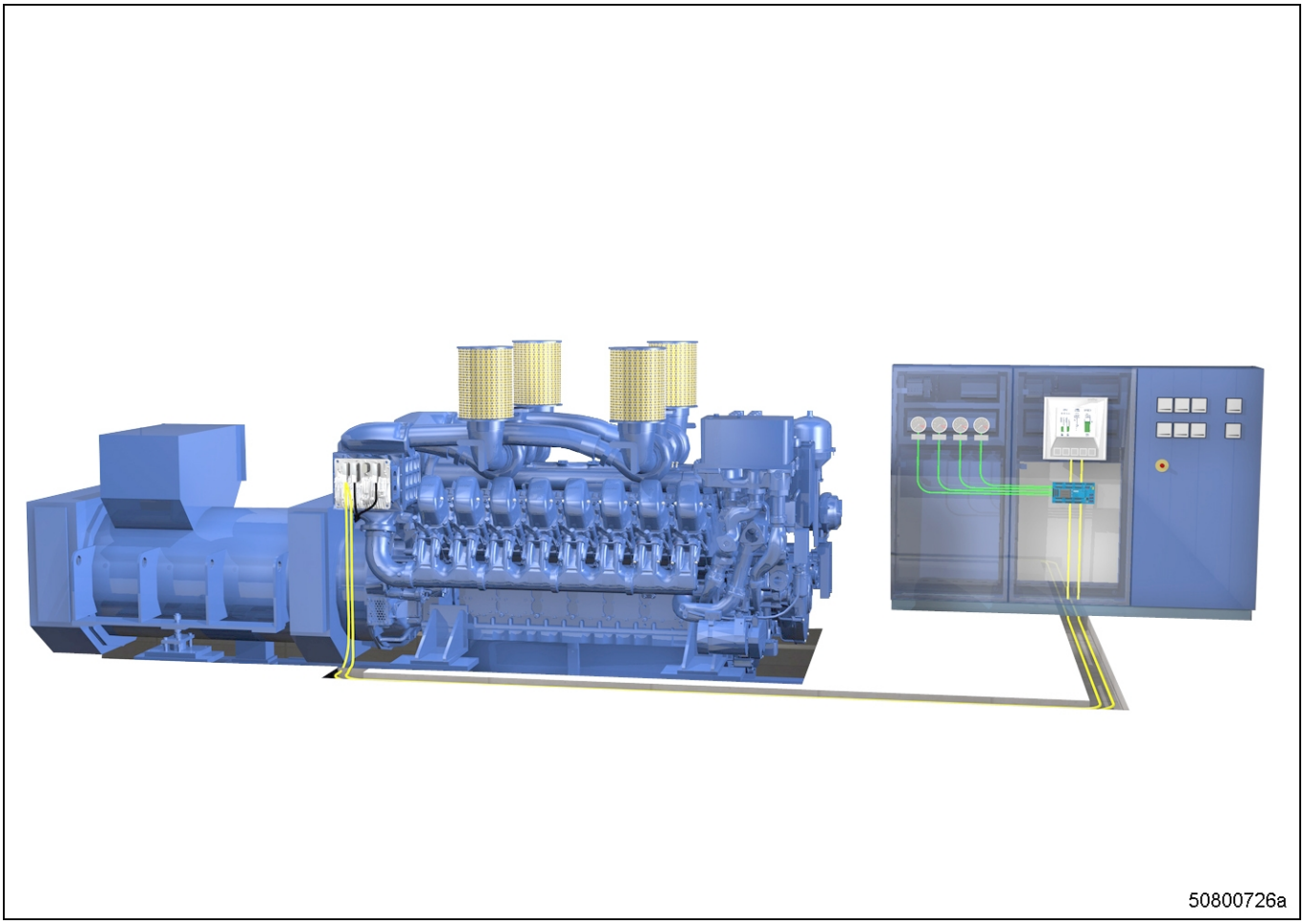
Participação da colocação em serviço

Functional Description

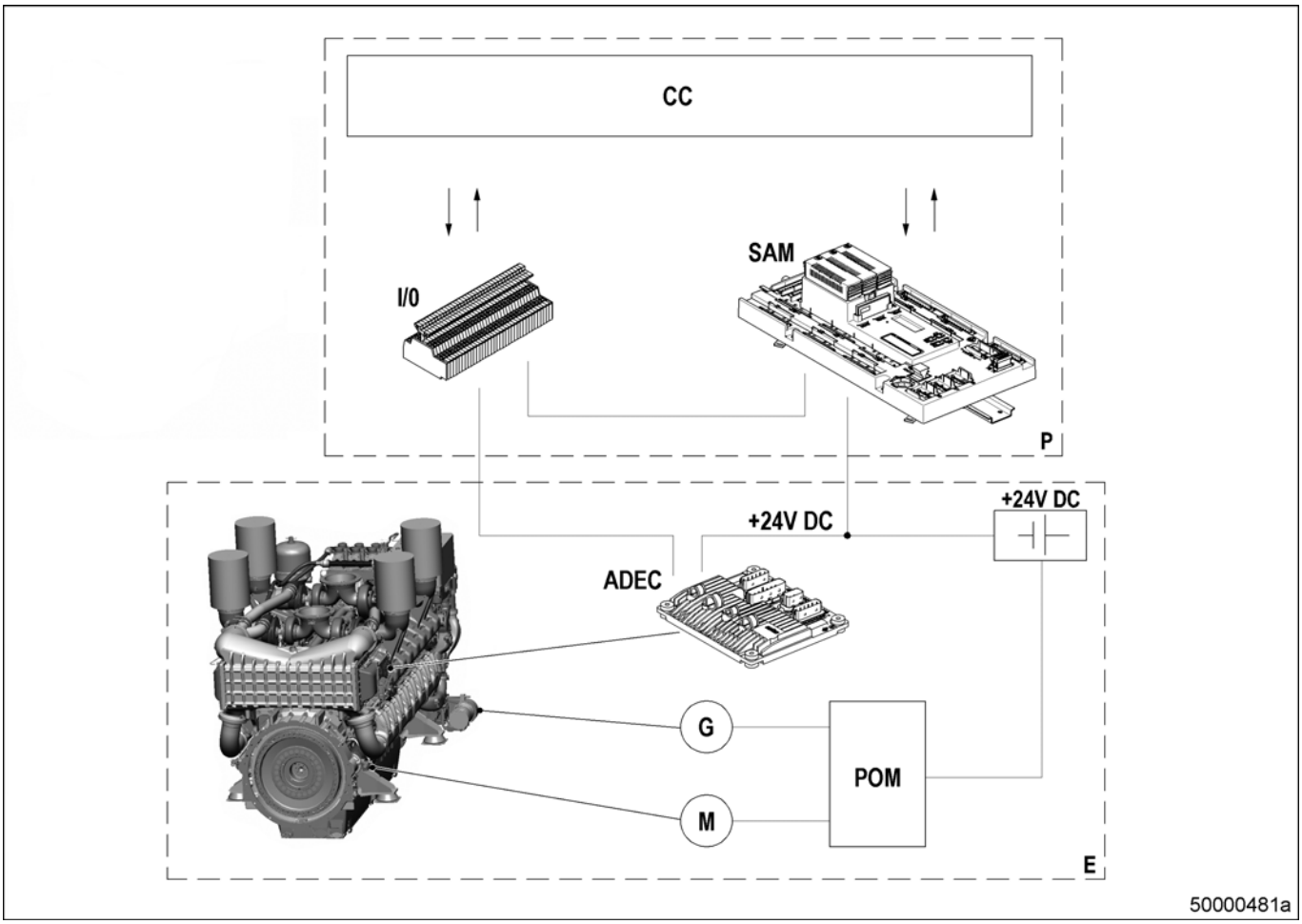
1 Use, Structure and Function

1.1 Use

Functions



- Control of the engine.
- Monitoring of operating states.
- Closed-loop control of fuel injection and engine speed (depending on operating state).
- Indication of faulty operating states (display SAM).



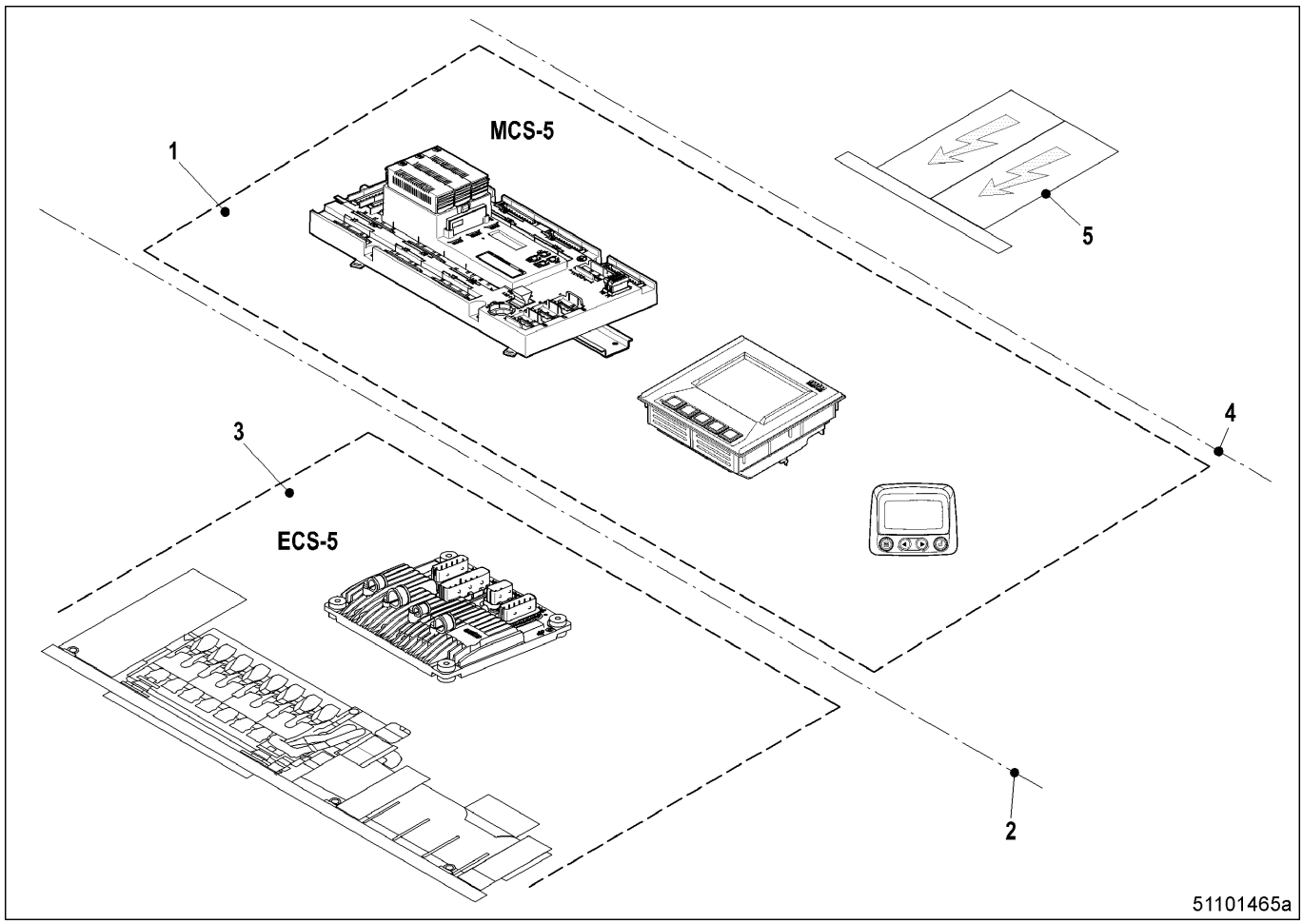
CC Customer Controller — System
I/O Terminal block (OEM) for inputs and outputs
SAM Service and Automation Module (SAM)
P Plant
E Engine
ADEC Engine governor
G Battery-charging generator
M Starter
POM Power Output Module — controller for starter and generator (available from 12/2006)

Features

- Electronic engine governing and control.
- Monitoring of inadmissible engine operating states.
- Display of fault messages and fault codes.
- Connecting cable for power supply to engine governor.
- Connecting cable for connection to a higher-level genset control system.
- Hardware interfaces to a higher-level control system (option).
- Inputs for plant sensors (option).
- Engine safety features including engine shutdown.
- Integral fault diagnosis system ITS.
- Integral load profile recorder.
- Speed droop switching possible with engine running.
- Straightforward engine governor replacement.
  - Engine and interface data stored in SAM.
  - Complete automatic software download following connection of a new, unprogrammed engine governor.
- ECMS — Engine Side Condition Management System

  Automatic engine power reduction as a function of:
  - Intake air temperature
  - Operating site (e.g. altitude above sea level)
  - Other parameters

Design of the overall system



1 Monitoring and Control System MCS-5 (DIS 10/PowerView optional)
2 CAN bus between ECS-5 and MCS-5
3 Engine Control System ECS-5
4 Interface for external control
5 External controller

The design of the overall system comprising the ECS-5 and MCS-5 subsystems depends on customer requirements and the higher-level control system.

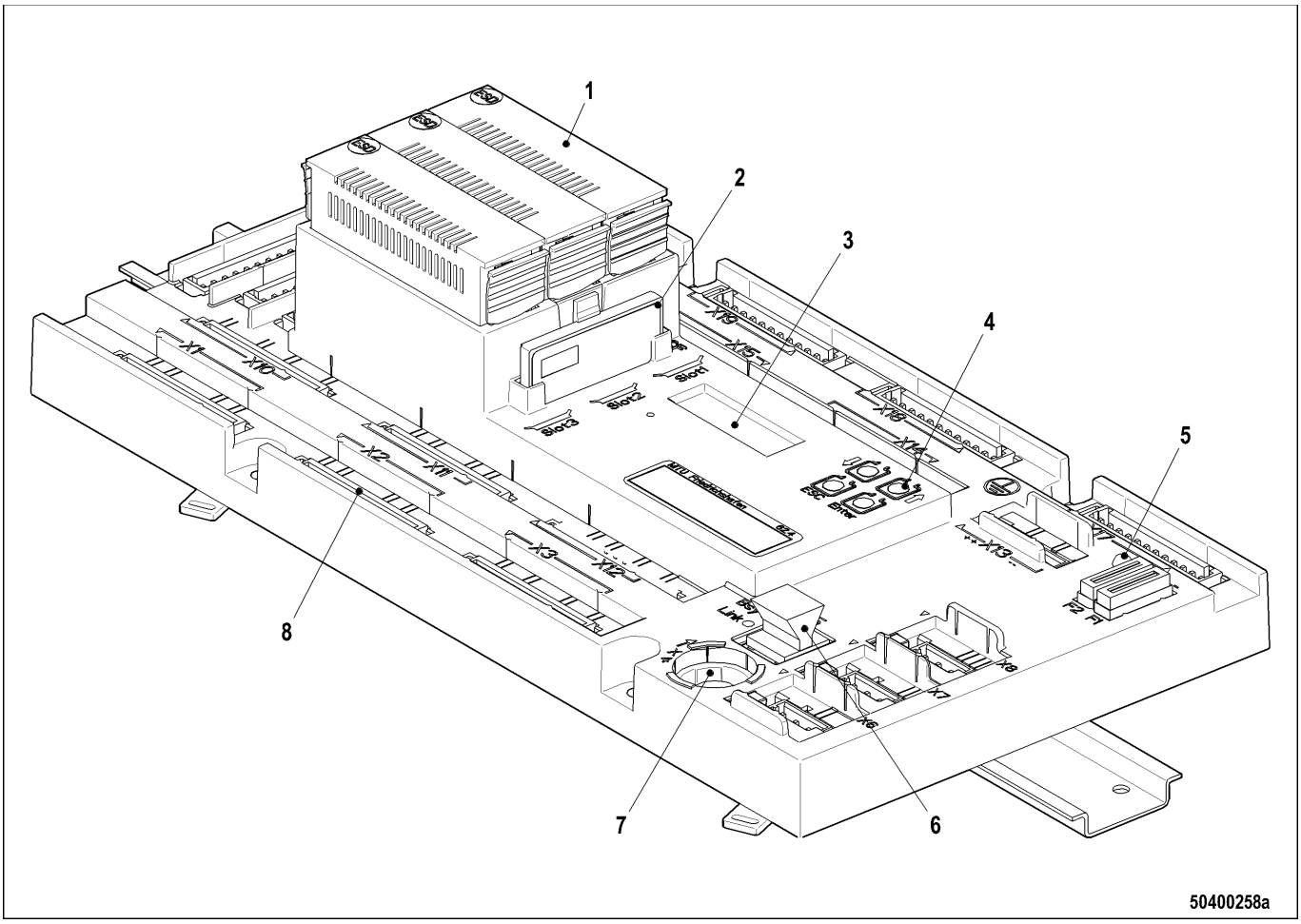
Design of Engine Control System ECS-5

The Engine Control System comprises the following devices:

- Engine governor
- Sensors on engine
- Actuators on engine
- Injectors on engine
- Wiring harnesses on engine

Basic scope of Monitoring and Control System MCS-5

Service and Automation Module (SAM)



1 Module cassette, slots for additional I/O PIM cards (CCB2 for CANOpen and J1939, optional)
2 Compact flash memory card
3 Display for fault codes and minidialog
4 Control keys for minidialog
5 Diagnostic lamp
6 Ethernet (with protective cap)
7 Interface for dialog unit
8 Connector with spring design

Functions

SAM functions

- Display of fault codes from engine governor and SAM (3).
- Backup function, engine life data are stored
  - every hour,
  - after every engine stop
  - after every emergency engine stop.
- Interface for dialog unit.

Diagnosis

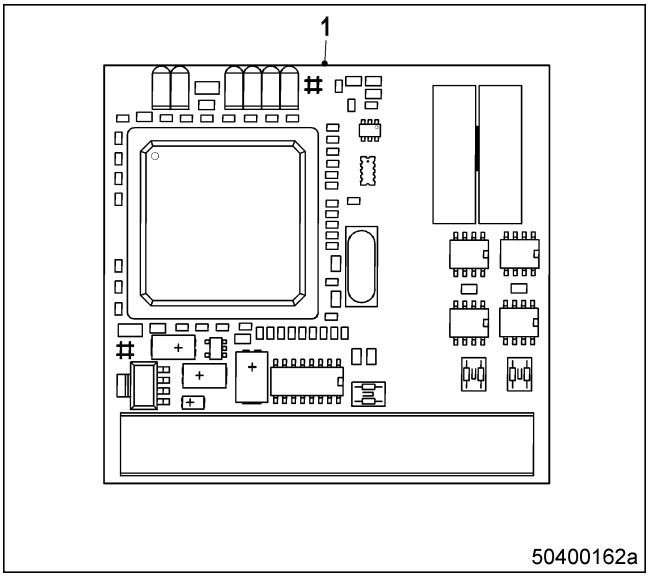
- Straightforward diagnosis by fault code display.
- Self-diagnosis by diagnostic lamp (5).
  - Steady = SAM is OK.
  - Flashing = SAM is faulty, contact Service. The flashing codes mean:
    -
  - Dark = Supply voltage missing.

Customer interface

- 24 binary outputs
- 3 PWM outputs
- 8 display outputs

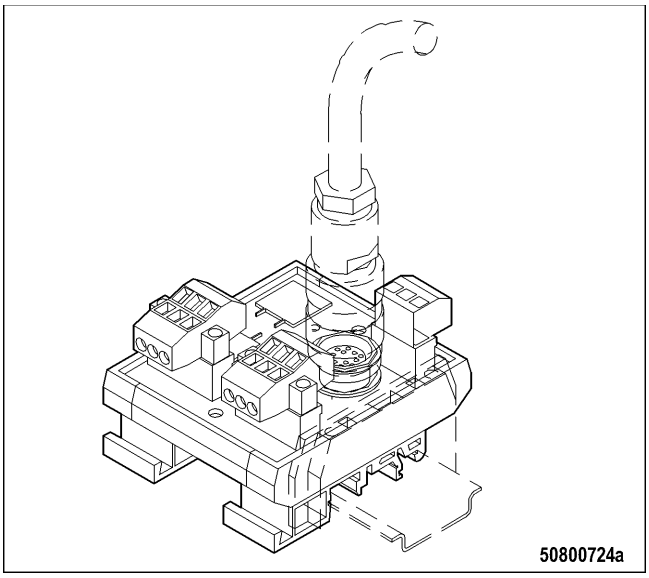
- 28 channel binary input
- 10 analog inputs (e.g. PT100, 4–20 mA, 0-10 V, etc.)
- 4 frequency inputs
- 1 dialog interface
- Extendable with MCS-5 PIM I/O cards

CANOpen and J1939



A CANOpen and J1939 interface is available as an option. A CCB2 (1) printed circuit board is inserted in a slot in the SAM in this case.

Interface MAU



Design

- Printed circuit board with soldered connectors
- Housing for top-hat rail mounting

Function

- Diagnostic connector for notebook with MTU DiaSys software
- Adaptation to the redundant CAN bus
- 24V supply for connected devices

Display instruments

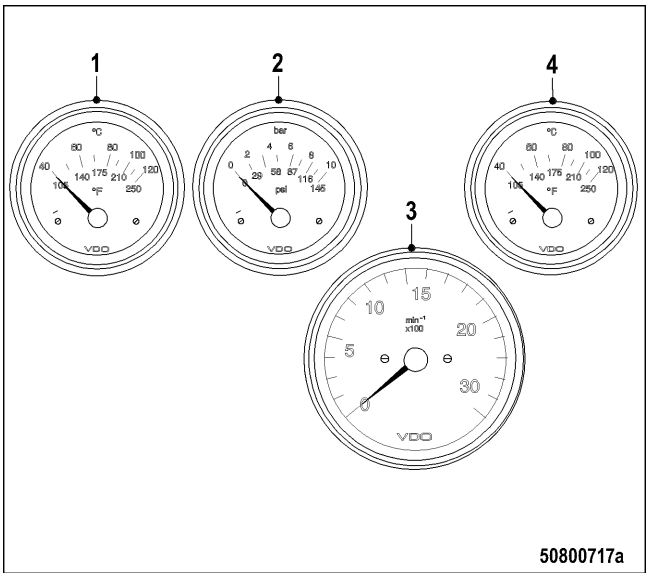
Purpose and structure

Display instruments are used to indicate the following engine operating data:

- Engine speed
- Oil temperature
- Oil pressure
- Coolant temperature

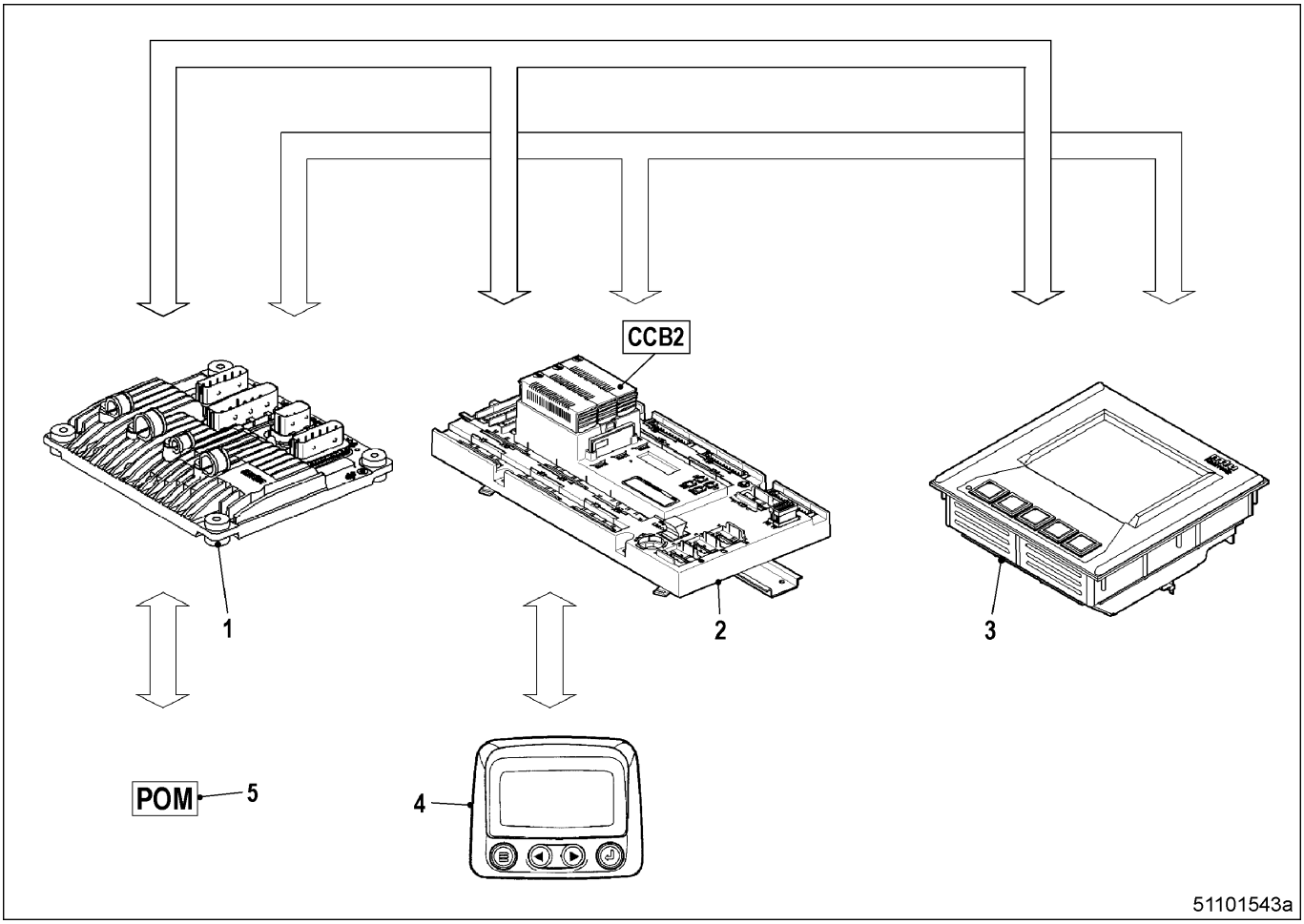
Three different VDO pointer instruments are used. They all feature white numbers on a black background and are illuminated from behind (backlit/red). The speed instrument comes from the Ø85 mm series, the other three come from the Ø52 mm series.

Display instrument functions (optional)



Pos. no.	Function name	Meaning
1	Coolant temperature	Coolant temperature display.
2	Lube oil pressure	Engine lube oil pressure display.
3	Engine speed	Engine speed and runtime display.
4	Lube oil temperature	Lube oil temperature display

Data connections



1 Engine governor on CAN bus
2 SAM on CAN bus, option with printed circuit board CCB2 (J1939 Bus)
3 DIS 10 (option) on CAN bus
4 PowerView display (option), via J1939 bus
5 Power Output Module

Data transmission

The devices are equipped with a CAN bus for transmitting data between the individual subsystems. This CAN bus is in redundant design.

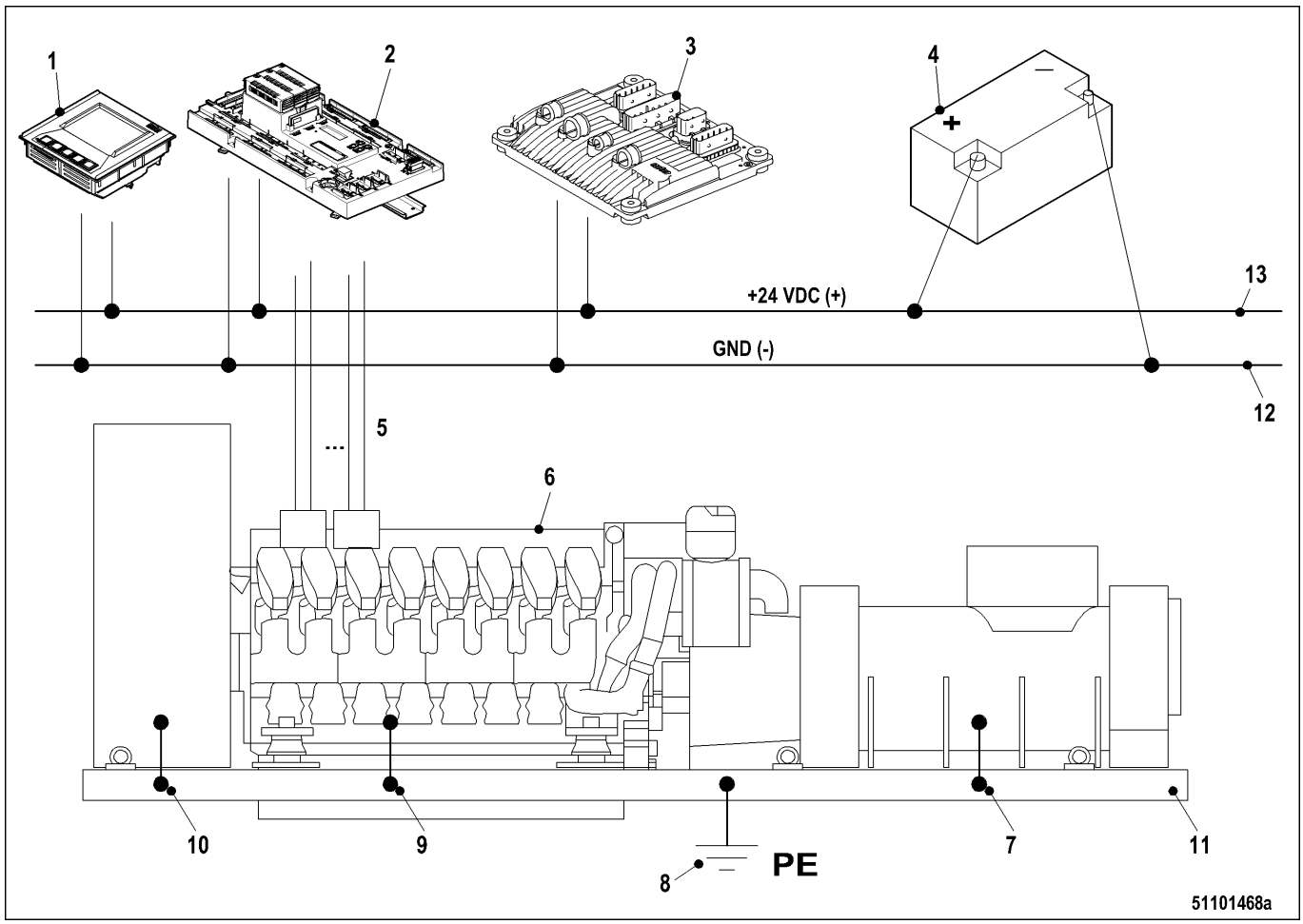
The CAN bus is a standardized automation technology field bus which allows various systems and devices to communicate with each other providing they are equipped with a CAN bus interface.

CAN bus

Tasks:

- Receiving plant signals (desired speed) and commands from higher-level control systems.
- Outputting all measured values/limit values for the Monitoring and Control System.
- Outputting alarms for signaling and evaluation in the Monitoring and Control System.
- Outputting relevant signals for engine control.

Grounding



1 DIS 10 (option)
2 SAM
3 Engine governor
4 Battery
5 To engine sensors
6 Generating set
7 Equipotential bonding strip
8 Grounding
9 Equipotential bonding strip
10 Equipotential bonding strip
11 Mounting frame
12 GND (-)
13 +24 VDC (+)

Grounding

Both the engine and the generator are connected to ground (8) via equipotential bonding strips (7, 9, 10) on the mounting frame (11).

EMC

EMC design of the overall system is based on a two-pole ungrounded power supply. This is particularly relevant to CE labeling as per EMC directive.

Ground connection

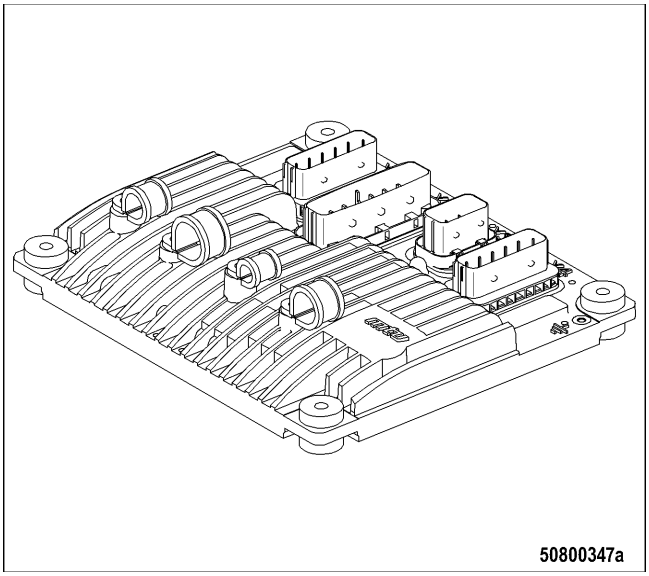
The ground of the power supply (battery negative) and all electronic devices (-) should not be connected to ground (8). The entire electronic system is electrically isolated from ground. This also applies to the sensors (5). All sensor signal lines and/or supply lines are not connected to the corresponding sensor housings.

Signal-to-noise ratio

Electrical isolation of the mechanical and electronic components significantly increases the signal-to-noise ratio. This high signal-to-noise ratio on all electrical lines is necessary for satisfactory transmission of all data on the CAN bus and also all analog and binary sensor signals.

1.2 ECS-5 – Use of devices

Engine governor



Central control and monitoring device for the engine

- Communication with other devices and higher-level systems via CAN bus.
- Control of injection system.
- Up to 20 injectors can be controlled.
- Acquisition and evaluation of engine operating states.
- Monitoring of limit values.
- Self-monitoring and diagnosis,
  - integral status/fault display
  - fault memory
- Extensive I/O features:
  - Plant side 14 inputs, 7 outputs, 2 serial interfaces,
  - Engine side 39 inputs, 28 outputs, 1 serial interface
- Engine and plant related settings in Flash memory
- In case of inadmissible states and limit value violations: Initiation of power reduction, engine stop and emergency engine stop (configurable).
- Diagnosis via CAN interface (default CAN1, connection facility for dialog unit).

Software structure:

- One data record for engine software
- One data record for plant software

1.3 ADEC – Functions

Control functions

Following engine functions are controlled:

- Engine start
- Engine stop
- Sequences when “Override” feature is activated (safety system override), engine start with start interlock interrogation deactivated (“emergency start”).
- Nominal speed switching between two set values (optional operation as 50 Hz or 60 Hz genset).
- Injection quantity as a function of engine loading and speed.
- Torque regulation

Engine start

The starting sequence is controlled by the software integrated in the engine governor as follows.

Starting sequence activation

The SAM takes a few seconds to boot up. It signals operational availability on the CAN bus by an appropriate PV. Only then may starting be initialized. Under normal operating conditions bothe the SAM and the engine governor are constantly switched on (standby mode).

Start request

The engine is started by a so-called “non-stored start”, i.e. the start signal must be applied until the engine has reached idling speed. The actual starting sequence itself is executed automatically.

Furthermore, starting can be requested via the CAN bus. There are correspondingly three CAN receive variables. The start requests are OR operations.

Stop request

Starting is terminated if an external (manual) or internal (automatic) stop request from another part of the software is received. A stop request resets the start interlock time thus allowing immediate restarting in case of internal start termination providing that the engine is at a standstill and no other start request was active.

Coolant temperature monitoring – Start termination

The engine may suffer mechanical damage if started at too low a temperature. The coolant temperature is used to determine the engine temperature.

Excessively low coolant temperature is indicated by a lamp. Indication by the lamp is independent of any alarm signal. Usually the alarms “LO T-Preheat” (for the first limit value) or “SS T-Preheat” (for the second limit value) are tripped when the corresponding limits are violated; even when the engine is at a standstill.

When the second limit value is violated the internal “Stop starting sequence” signal is set providing that Override is not active. This trips a stop and the engine does not start.

The alarm is reset again when the coolant limit value is reached (plus hysteresis).

Starting

The starter is activated via engine governor binary output TOP 4. The engine runs up to starting speed on the starter within a configurable period. If this is not the case starting is terminated and the “SS Starter Speed Not Reached” alarm is output. The starter disengages and a new starting sequence is automatically attempted after a configurable pause.

The starter disengages when the disengagement speed (300 rpm) is reached. The start button may be released once the disengagement speed has been reached. Pressing the start button has no effect from this point on and only takes effect again when the engine has come to a standstill. The “SS Starter Speed Not Reached” alarm is set if the disengagement speed is not reached within a set time and “terminate start” is activated. Starting is also terminated if the starting signal is no longer received.

Engine start with Override (“emergency start”)

Various configurable start interlock criteria are bypassed when override is active on starting the engine:

Engine stop

An engine stop is tripped by interrupting the 24V supply at the binary input of the engine governor or by the engine protection system. Fuel is no longer injected as injector activation is disrupted.

Any starting procedure which has been initiated is interrupted.

Override (safety system bypass)

The “Override” feature is used to bypass safety functions tripped by limit value violations or sensor faults and to bypass start interlocks (see above).

Operating states which would normally lead to engine shutdown are ignored when the “Override” function is activated. The following operational data can be configured to trip engine shutdown in case of limit value violation even in Override mode:

- Coolant level
- Coolant temperature
- Coolant pressure
- Charge air coolant level
- Lube oil pressure
- Lube oil temperature

50 Hz/60 Hz switching on bifrequency engines

To increase the genset application scope the network frequency can be adjusted prior to engine start. The nominal speed is set as follows:

- Network frequency 50 Hz: Nominal speed 1500 rpm
- Network frequency 60 Hz: Nominal speed 1800 rpm

Caution!

Switching is only possible when the engine is at a standstill! Switching requires programming of corresponding performance maps and parameters in the governor and appropriate engine hardware.

Monitoring functions

The engine management system fulfils the following monitoring tasks:

- Control of analog instruments;
  - Engine lube oil pressure
  - Engine coolant temperature
- Transmission of all measurands, warnings and alarms to monitoring system via CAN bus.
- Automatic shutdown in case of limit value violations.

Refer to the measuring-point list for order-specific configuration data.

Engine monitoring can basically be divided into two different areas:

- Engine protection system, monitors the engine during operation,
- Safety system, generates automatic engine shutdown in case of limit value violation.

These two functional areas are constantly monitored by the internal “Integral Test System (ITS)” to ensure operational availability.

Oil priming pump option

An optional oil priming pump may be integrated in the system. The pump is activated manually via a binary input on the SAM.

Closed-loop control functions

Closed-loop engine control functions:

- Speed regulation
- Injection control with mapped commencement of injection.
- Two adjustable speed droops.
- Setpoint speed regulation
  - Analog or binary speed demand on CAN bus, CANopen and SDE J1939
  - Analog speed setting 0 V to 10 VDC / 0 V to 5 VDC / 4 mA to 20 mA.
  - Binary speed demand via Up/Down signal
  - Frequency speed setting.
- HP fuel governor.
- Torque control

Speed - injection control

Functions of the closed-loop engine speed control integrated in the engine governor:

- Maintaining the desired engine speed under changing load conditions.
- Adjusting the engine speed when the setting is changed by the operator.

Fuel quantity control during engine start

The quantity of fuel injected during engine start increases along a time ramp from a set initial value to a specified value. This ensures that the engine starts reliably. This fuel quantity control is effective until idling speed has been reached.

Desired speed handling

The desired speed is the command variable for the engine speed control loop.

Providing that speed demand is set by Up/Down signals, the engine runs up to an internally programmed nominal speed when started (for 50 Hz network frequency: 1500 rpm, for 60 Hz network frequency: 1800 rpm). The engine runs up to the set value in case of analog speed demand.

The starting sequence is completed when idling speed has been reached ("open-loop control" mode) and switching over to "closed-loop control" mode is effected.

The following speed setting variants are possible:

- Desired speed setting via an analog input:

  The setpoint speed may be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency) (relative speed control, the voltage/current or frequency controls the speed window only).

  Absolute speed control is also possible (the voltage/current or frequency can cover the entire speed range).

  The internal setpoint speed follows the applied speed setting value along a configurable acceleration/deceleration curve (speed ramp). The setting value last applied is maintained or the engine is set to a default speed should the applied signal fail.

  The response can be configured as desired:
  - Speed setting via CAN bus.
  - Speed setting via an analog speed setting input (0 V to 10 V).
  - Speed setting via an analog speed setting input (4 mA to 20 mA).
  - Frequency input.
- Setpoint processing via binary inputs "Setpoint speed up"/"Setpoint speed down":

  The setpoint speed can be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency). Briefly actuating the appropriate optocoupler input for less than 0.3 s increases or decreases the setpoint speed by 1 rpm.

  The setpoint speed is automatically adjusted at a configurable rate if the input is activated for longer than 0.3 seconds.

Speed droop

Speed droop calculation

Speed droop influences the effective setpoint speed depending on engine power. Maximum, speed-dependent engine power is limited by the MCR curve. The setpoint speed is not influenced by speed droop at 100% power. The effective setpoint speed increases at lower power. This allows power to be balanced when operating a number of engines in a network.

Switchable speed droop

Two different speed droop settings can be selected at the engine governor.

The speed droop is selected by a binary input at the engine governor.

Speed droop is required to balance the load of coupled prime movers. Speed droop can be adjusted to meet plant requirements via the dialog unit.

Quantity limitations

Dynamic quantity limitation

Dynamic quantity limits protect the engine against overloading and optimize exhaust emission values. The engine governor determines the maximum injection quantity based on preset and stored engine performance maps.

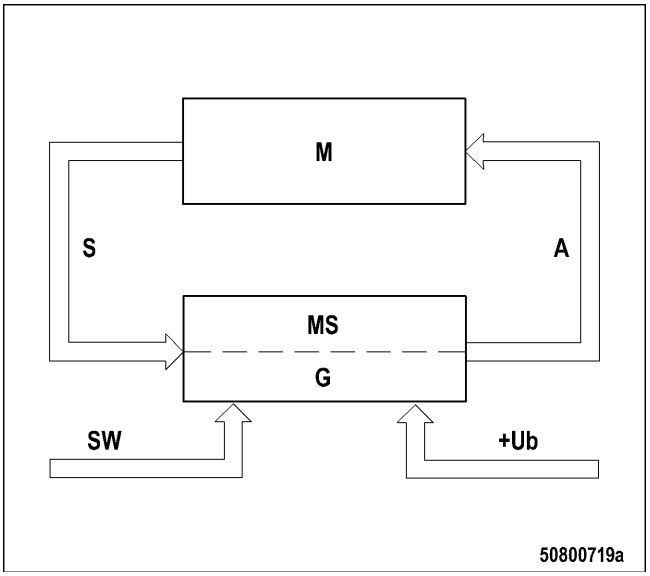
Fuel quantity is limited as a function of speed (DBR).

Fixed quantity limitation

Fixed quantity limitations are used for power limitation and power reduction to protect the engine from sustained overload sustained overload.

Engine protection features

Engine protection system



M Engine
MS Engine protection system
G Engine governor
S Sensors
A Actuators
SW Set-point value
+Ub Power supply

The engine governor incorporates an integral engine protection system. It monitors the operational data of the engine.

Tasks of the engine protection system are:
- Safeguarding the engine from critical operating states
- Signaling alarms to operating personnel
- Restricting engine operation to remain within admissible operating values

Action is taken such as warning, start interlock, power reduction or engine shutdown by reducing fuel feeding depending on the values measured.

Shutdown for engine protection

Shutdowns are initiated by the engine protection system in case of:
- Limit value violations signalled by engine governor monitoring features, e.g.
  - Engine speed/overspeed
  - Coolant level (configurable)
- Sensor faults (depending on individual configuration) signalled by the ITS. This applies to the following measuring points:
  - Coolant temperature (configurable)
  - Charge-air temperature (configurable)
  - Engine lube oil temperature (configurable)
  - Engine lube oil pressure (configurable)
  - Fuel pressure (configurable)

All safety shutdowns can be suppressed by activating the “Override” input.

The occurrence of safety-relevant alarms is still logged when the “Override” input has been activated.

Integral Test System (ITS)

Functions

The ITS executes a wide range of internal tests when the supply voltage is switched on. It monitors all important functions of the engine governor and connected electrical components:
- Electronics inside the engine governor itself
- Sensors
- Actuators
- Bus communication
- Power supply

The ITS detects any faults which occur, pinpoints them and signals accordingly by combined alarms. Furthermore, a fault message is output via the CAN bus to a higher-level monitoring system (if applicable) and can visualized there for the operator.

fault memory

Fault messages are stored in two memories:

- Chronological memory

  The fault message numbers are stored in a ring memory in chronological order of their occurrence or cancellation together with the hour meter reading. The ring memory stores the last 80 setting and cancellation procedures.
- Statistical memory

  Fault message occurrences are counted in a statistical memory.

  A counter counting up to max. 10 000 is set up for each fault message number .

Overspeed test

Activating this input lowers the overspeed threshold such that the engine shuts down at any speed. This makes it possible to check that the overspeed shutdown function operates correctly.

Monitoring of sensors and actuators

The various sensor and actuator channels of the engine governor system are designed to tolerate faults to a large extent (e.g. short-circuit withstandability).

Faults such as broken wires, short circuit etc. are detected by plausibility checking (configurable) and are output to a higher-level monitoring system (if applicable) or external system in the form of a combined alarm.

Monitoring of bus communication

Bus communication is monitored by plausibility checking and timeout monitoring. Detected faults are output in the form of a combined alarm and, if possible, to a higher-level monitoring system (if applicable) via the CAN bus.

ECMS — Engine Side Condition Management System

- Automatic engine power reduction as a function of:
  - Intake air temperature
  - Operating site (e.g. altitude above sea level)
  - Other parameters

Idling speed governor – maximum-speed governor – feeding governor

Depending on the current operating state the regulating section of the engine governor operates as:

- Variable-speed governor (after engine start only)
- Idling speed governor
- Feeding governor
- Maximum-speed governor

After engine starting, the speed runs up along a (programmed) speed ramp (variable-speed governor), when the feeding quantity Q_{Input} set at IUE1 is less than the feeding quantity Q_{Spdgov} calculated by the governor. When the feeding quantity Q_{Spdgov} is greater than Q_{Input}, Q_{Input} is active.

Note: If the engine is started in the absence of a signal at IUE1 switching to idling speed governor is initially effected after the engine speed has ramped up.

If the feeding quantity Q_{Input} set at IUE 1 exceeds the sum total of the feeding quantity Q_{Spdgov} calculated by the idling speed governor and a hysteresis quantity $Hyst_{Idling\ gov}$, the engine governor automatically switches over to feeding governor operation whereby feeding Q is equal to Q_{Input}.

If the actual speed n_{ACT} exceeds the effective maximum speed in operation (maximum speed + speed droop), the regulating section of the engine governor changes to a maximum-speed governor.

If the feeding quantity Q_{Input} preset at IUE 1 decreases in maximum speed governor mode to a value below the difference between the calculated feeding quantity Q_{Spdgov} and a hysteresis quantity $Hyst_{Maxgov}$, the engine governor automatically switches back to operation as a feeding governor whereby feeding Q is equal to Q_{Input}.

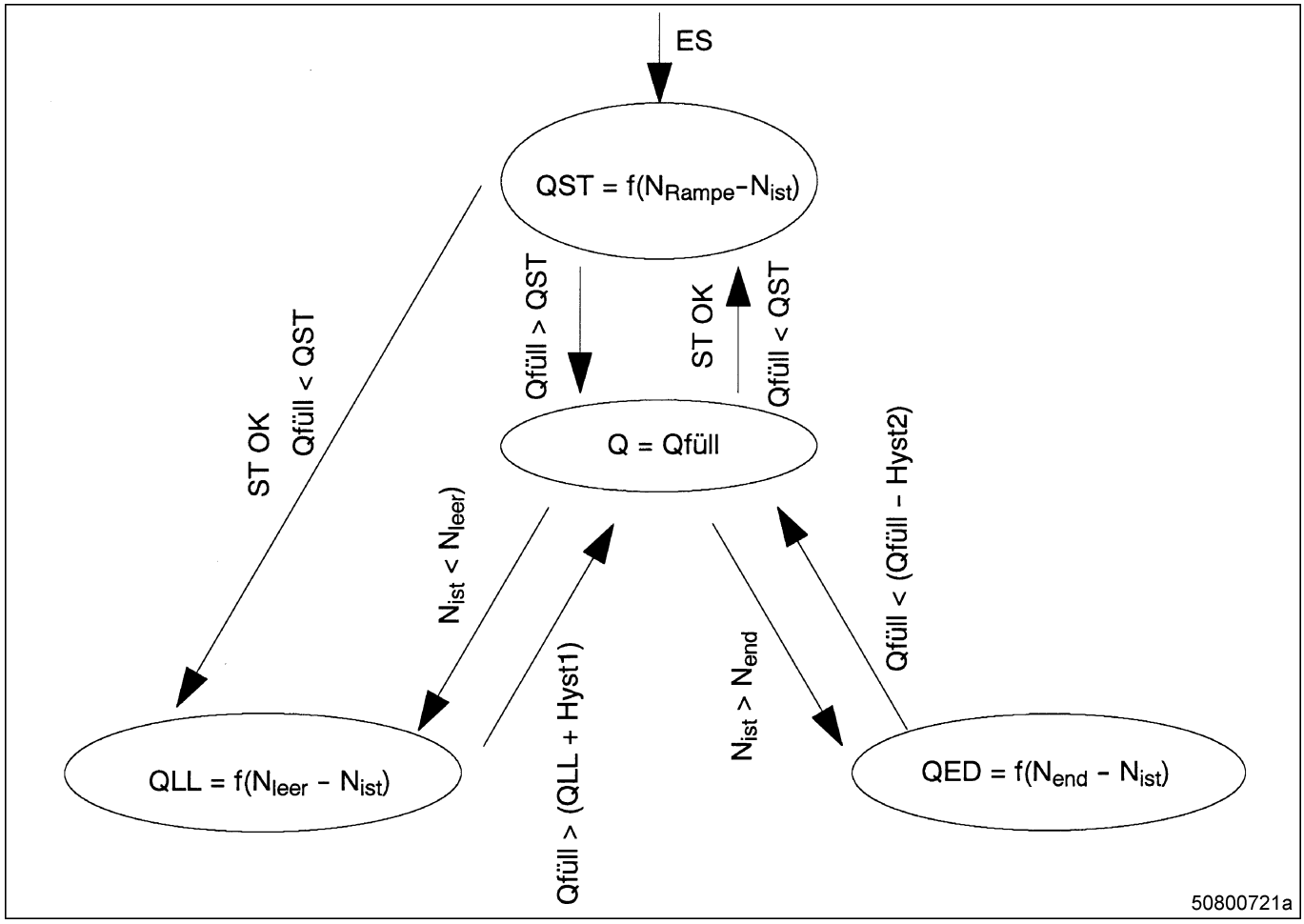
Now if the actual speed n_{ACT} falls below the effective idling speed (idling speed + speed droop) in operation, the regulating section of the engine governor changes to an idling speed governor and regulates the idling speed.

Note: The transitions between the various governing modes are automatic when the generator is running and cannot be influenced. Presetting criteria are set via measuring point 178:

- Idling speed for 50 Hz operation
- Idling speed for 60 Hz operation
- Maximum speed for 50 Hz operation

- Maximum speed for 60 Hz operation
- Idling – Maximum-speed governor activation

Measuring point 179 can indicate which operating mode is presently active.



ES Engine start ST OK Engine start completed

Customer setting parameters 2D curves:

- 2.0401.027: “Fuel Input Idle/End” = Voltage [digits] <=> Set injection quantity [%]
- 2.0401.026: “Fuel Input Idle/End” = Current [digits] <=> Set injection quantity [%]

Customer display parameters:

- 2.1010.001: “Idle/End-Governor Active” = Indication of present governor operating mode:
  - 1 Idling speed governor mode
  - 2 Feeding governor mode

- 3 Maximum-speed governor mode

OST	Set injection quantity calculated by the governor during the starting sequence, i.e. until idling speed is reached.
QLL	Set injection quantity calculated by the idling speed governor when it is active.
QED	Set injection quantity calculated by the maximum speed governor when it is active.
Qfüll	Injection quantity set by the plant in the form of a voltage or current setting (analog input IUE1).
N_{Rampe}	Runup ramp (setpoint speed during engine start)
N_{ist}	Present actual engine speed
N_{leer}	Idling speed • 50 Hz: Mp 178.00 “Idle Speed 50 Hz” • 60 Hz: Mp 178.01 “Idle Speed 60 Hz”
N_{end}	Maximum speed • 50 Hz: Mp 178.02 “End Speed 50 Hz” • 60 Hz: Mp 178.03 “End Speed 60 Hz”
Hyst1	Injection quantity hysteresis (transition from idling speed governor → feeding setting) Mp 208.00 “Hyst. Idle Governor”
Hyst2	Injection quantity hysteresis (transition from maximum speed governor → feeding setting) Mp 208.00 “Hyst. Idle Governor”

Common Rail injection system

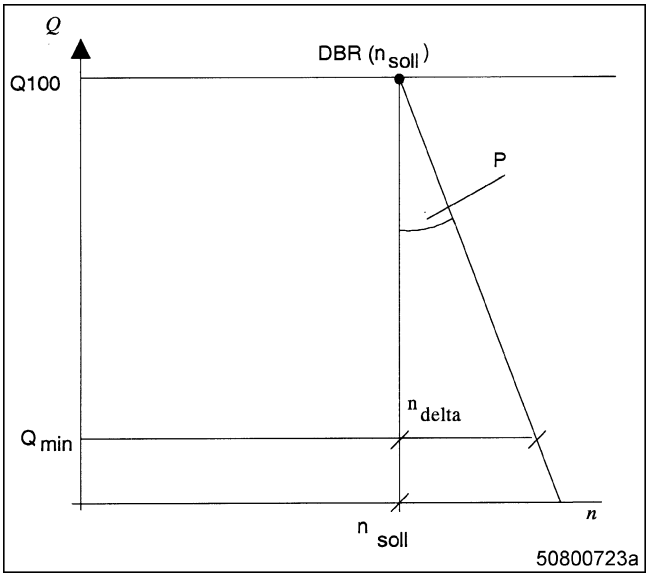
The governor compares the speed setting with the current engine speed. In case of deviation it adapts its output signal (set injection quantity) in accordance with the difference. PID characteristics ensure a rapid response to any changes a precise speed adjustment.

Operating point dependent dynamic quantity limitation protects the engine from overloading.

The set quantity after quantity limitation is the input signal for the map-controlled injection start/injection end governor. The power electronics control the injectors of the individual cylinders in accordance with these settings. The engine governor also regulates the injection pressure of the Common Rail system.

Speed droop

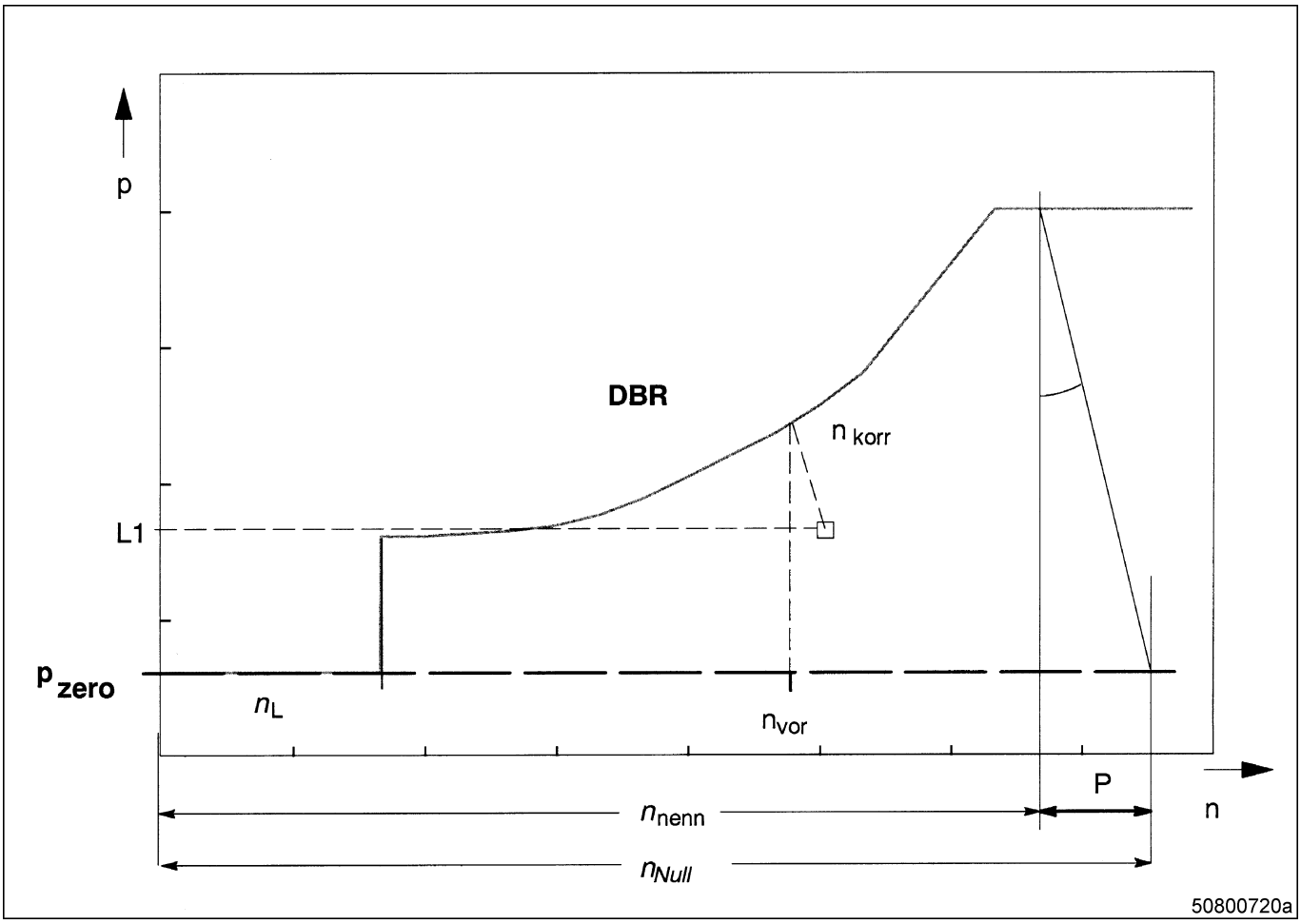
Speed droop calculation



Q Feeding
P P-Grad
n Speed, n_{delta} speed deviation, n_{set} setpoint speed

Speed droop influences the effective setpoint speed depending on engine power. Maximum, speed-dependent engine power is limited by the DBR curve. The setpoint speed is not influenced by speed droop at 100% power. The effective setpoint speed increases at lower power. This allows power to be balanced when operating a number of engines in a network.

Switchable speed droop



p Load, p_{zero} zero load
n Speed, n_{nom} nominal speed, n_{zero} idling speed at zero load, n_{set} set speed, n_{corr} resultant speed at load L1
P Speed droop

Two different speed droop settings can be selected at the engine governor. Which speed droop should be active depends on whether the genset is operated in “isolation” (i.e. the genset runs alone), or in conjunction with other gensets in a parallel network supplying a common busbar.

The speed droop is selected by a binary input (BE 4) at the engine governor.

The figure below shows the principle control range of the engine governor and the effects of adjustable speed droop (load-dependent change in nominal speed).

Speed droop is required to balance the load of coupled prime movers. Speed droop can be modified to meet plant requirements via the dialog unit.

Definiert ist der P-Grad als relative Drehzahländerung bei Entlastung des Motors. Speed droop is referenced to rated speed (= maximum speed at maximum power output). Every point in the operating range is influenced by a change in load.

Speed droop is calculated by dividing the maximum speed (zero load) n_{Zero} minus nominal speed n_{nom} by the nominal speed n_{nom} and multiplying the result by 100 %.

Note: Sudden changes in speed when speed droop is switched over are prevented by the “Switch constant speed” function .

Power limitation (quantity limitation)

Dynamic quantity limitation

Dynamic quantity limitations, i.e variable fuel injection limitations, protect the engine from overloading and optimize exhaust emission values. The engine governor determines the maximum injection quantity based on preset and stored engine performance maps.

Following limits are applied:

- Speed-sensitive fuel quantity limitation (DBR)
- Fuel quantity limitation as a function of fuel temperature

Fixed quantity limitation

Fixed quantity limitations are used for power limitation and power reduction to protect the engine in case of

- Electronic fault
- Supply voltage out of tolerance

Fuel quantity control during engine start

The quantity of fuel injected during engine start increases along a time ramp from a set initial value to a specified value. This value is calculated by the function $q_{inject} = f_{(speed)}$. This limits the quantity of fuel injected as a function of speed. This fuel quantity limitation is effective until idling speed has been reached for the first time.

Cylinder cutout

Only half of the injectors are activated when cylinder cutout is active. The other half of the injectors are activated on expiry of a switchover time. This prevents white smoke being emitted when the engine is running.

Desired speed handling

The speed demand (= desired speed) is the command variable for the engine speed control circuit.

When the engine is started it runs up to an internally programmed desired speed (for 50 Hz network frequency: 1500 rpm, for 60 Hz network frequency: 1800 rpm). Switching to an external speed setting takes place automatically once the nominal speed has been reached.

The following speed setting variants are possible:

- Desired speed setting via an analog input:

  The setpoint speed can be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency).

  The voltage can thereby either control the speed window only (e.g. 0 V to 10 V changes the speed between 1400 rpm and 1600 rpm) or cover the entire speed range (e.g. 0 V to 10 V would change the speed between 800 rpm and 2000 rpm, however, in this case all values which would lead to speeds below the lower limit or above the upper limit are ignored, i.e. in this case the speed is changed between 1400 rpm and 1600 rpm by a 5.0 V and 6.66 V voltage).

  The internal setpoint speed follows the applied speed setting value along a configurable acceleration/deceleration curve (speed ramp). The setting value last applied is maintained or the engine is throttled back to idling speed should the applied signal fail. The response can be configured as desired.
  - Speed setting via CAN bus
  - Speed setting via an analog speed setting input (0 V ... 10 V), (0 ... 5 V)
  - Speed setting via an analog speed setting input (4 mA ... 20 mA).
  - Frequency input
- Setpoint processing via binary inputs “Setpoint speed up” (BE 5)/ “Setpoint speed down” (BE 6):

  The setpoint speed can be adjusted within a (configurable) range around the preset synchronous speed (depending on the set network frequency) in this case as well. Briefly activating the corresponding optocoupler input for less than 0.3 s increases or decreases the setpoint speed by 1 rpm. If the input is activated for more than 0.3 s, the setpoint speed is automatically adjusted at a configurable rate (e.g. at approx. 10 rpm per second).

Safety functions

Safety shutdowns

Safety shutdowns are initiated by the engine protection system in case of

- Limit value violations
- Sensor faults (depending of specific configuration)

This applies to the following measuring points:

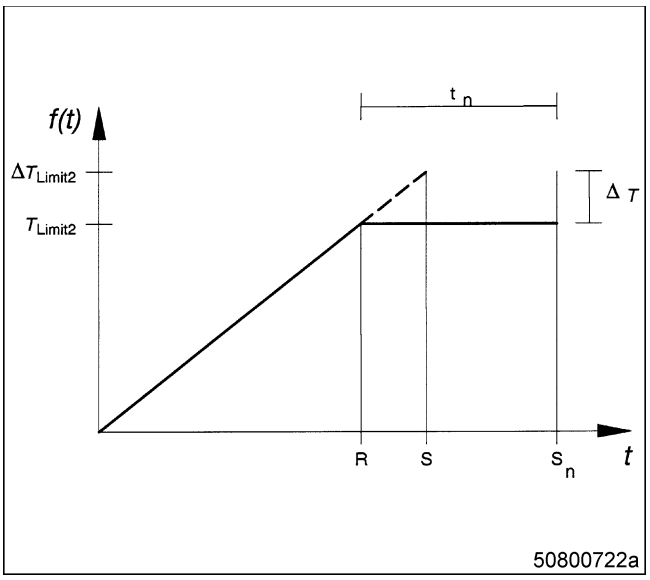
- Engine speed/overspeed (configurable)

- Engine lube oil pressure (configurable)
- Coolant level (configurable)
- Charge-air coolant temperature (configurable)
- Coolant temperature (configurable)
- Charge-air temperature (configurable)
- Lube oil temperature (configurable)

The scope of measuring points may vary from the standard settings for specific orders.

Note: All safety shutdowns can be suppressed by activating the “Override” input. The occurrence of safety-relevant alarms is still logged when the “Override” input has been activated.

Engine governor response to coolant overtemperature (HT circuit)



t Time
R Red alarm
S Red alarm with immediate shutdown
S_n Shutdown with rundown time
t_n Rundown time
ΔT Temperature difference

The “coolant temperature alarm” output is activated if the coolant temperature exceeds a limit value T_{Limit2} and a “red combined alarm” is tripped.

Note: The switchgear controller must open the generator breaker via the “red combined alarm” (order configuration).

The engine can now cool down over a defined (configurable) period. The engine is shut down when this period has expired. The temperature is also monitored for any steady increase in temperature during the cooling phase. The engine is shut down immediately if a (configurable) difference in temperature is exceeded.

The “red combined alarm” output is activated in case of sensor fault. The cooling phase then starts and the engine is subsequently shut down.

The engine is immediately shut down if the coolant temperature exceeds a limit value T_{Limit2}.

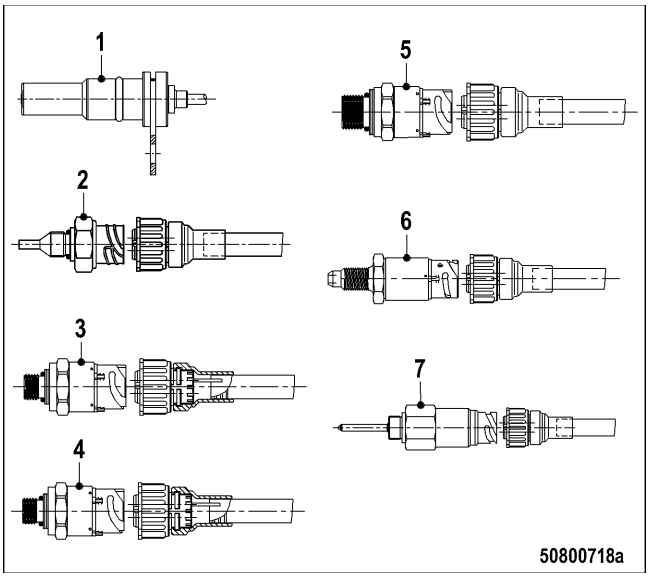
Engine signals

Sensors

The following engine signals are acquired by the engine governor of the engine management system ADEC for stationary genset engines:

Sensor	Signal	BR 2000	BR 4000
B1	Camshaft speed	x	x
B5	Lube oil pressure	x	x
B6	Coolant temperature	x	x
B7	Lube oil temperature	x	x
B9	Charge-air temperature	x	x
B10	Charge-air pressure	x	x
B13	Crankshaft speed	x	x
B26	Intercooler coolant temperature	—	x
B34	Fuel pressure LP side	—	x
F57	Intercooler coolant level	—	x
B33	Fuel temperature HP side	x	x
B48	Fuel pressure HP side	—	x
F33	Engine coolant level	x	x

Sensors on engine



	2000	4000	Measur-and	L_1 (Limit 1) 2000	L_2 (Limit 2) 2000	L_1 (Limit 1) 4000	L_2 (Limit 2) 4000	Pos. no.
Engine coolant temperature	B6 at TE1	B6 at TE1	Temperature	97 °C	102 °C	97 °C	99 °C	2
Charge-air temperature	B9 at TE2	B9 at TE2	Temperature	****	****	71 °C	73 °C	2
Intercooler coolant temperature	—	B26 at TE6	Temperature	—	—	70 °C	—	2
Lube oil temperature	B7 at TE7	B7 at TE7	Temperature	103 °C	108 °C	97 °C	—	2
Low-pressure fuel	—	B34 at DE3	Pressure	—	—	***	—	4
Lube oil pressure	B5 at DE5	B5 at DE5	Pressure	5.5 bar*	5.0 bar*	3.5 to 3.9 bar*	3.2 to 3.6 bar*	3
Charge-air pressure	B10 at DE7	B10 at DE7	Pressure	—	—	—	—	5
Intercooler coolant level	—	F57 at NSE2	Level	—	—	—	—	—
Fuel temperature	B33 at TE6	B33 at TE3	Temperature	—	—	—	—	2

	2000	4000	Measur-and	L_1 (Limit 1) 2000	L_2 (Limit 2) 2000	L_1 (Limit 1) 4000	L_2 (Limit 2) 4000	Pos. no.
Fuel high pressure	—	B48 at DEH	Pressure	—	—	—	—	6
Engine coolant level	F33 at NSE1	F33 at NSE1	Level	—	—	—	—	7
Crank-shaft speed	B13 at KW1	B13 at KW1	Speed	**	**	**	**	1
Camshaft speed	B1 at NW1	B1 at NW1	Speed	**	**	**	**	1

Note:

*	Speed-dependent, see oil pressure monitoring curve 17.	
**	Limit values:	BR2000 50 Hz: Limit value 2 at 1800 rpm BR2000 60 Hz: Limit value 2 at 2100 rpm BR4000 50 Hz: Limit value 2 at 1800 rpm BR4000 60 Hz: Limit value 2 at 2100 rpm
***	Speed-dependent, see curve 15	
****	at 1500 rpm limit value 1 at 70 °C; fuel-optimized limit value 1 at 75 °C, limit value 2 at 80 °C	

Speed sensors

Use	Type	Sensor range	Electr. signal	Number
Camshaft speed	Type 1	80 - 2800 rpm	0 - 80 V_{pp} AC	1
Crankshaft speed	Type 1	80 - 2800 rpm	0 - 80 V_{pp} AC	1

Temperature sensors

Use	Type	Sensor range	Electr. signal	Number
Coolant temperature	Type 1	-40 °C to +150 °C	PT 1000	1
Charge-air temperature	Type 1	-40 °C to +150 °C	PT 1000	1
Lube oil temperature	Type 1	-40 °C to +150 °C	PT 1000	1
Fuel temperature	Type 1	-40 °C to +150 °C	PT 1000	1

Pressure sensors

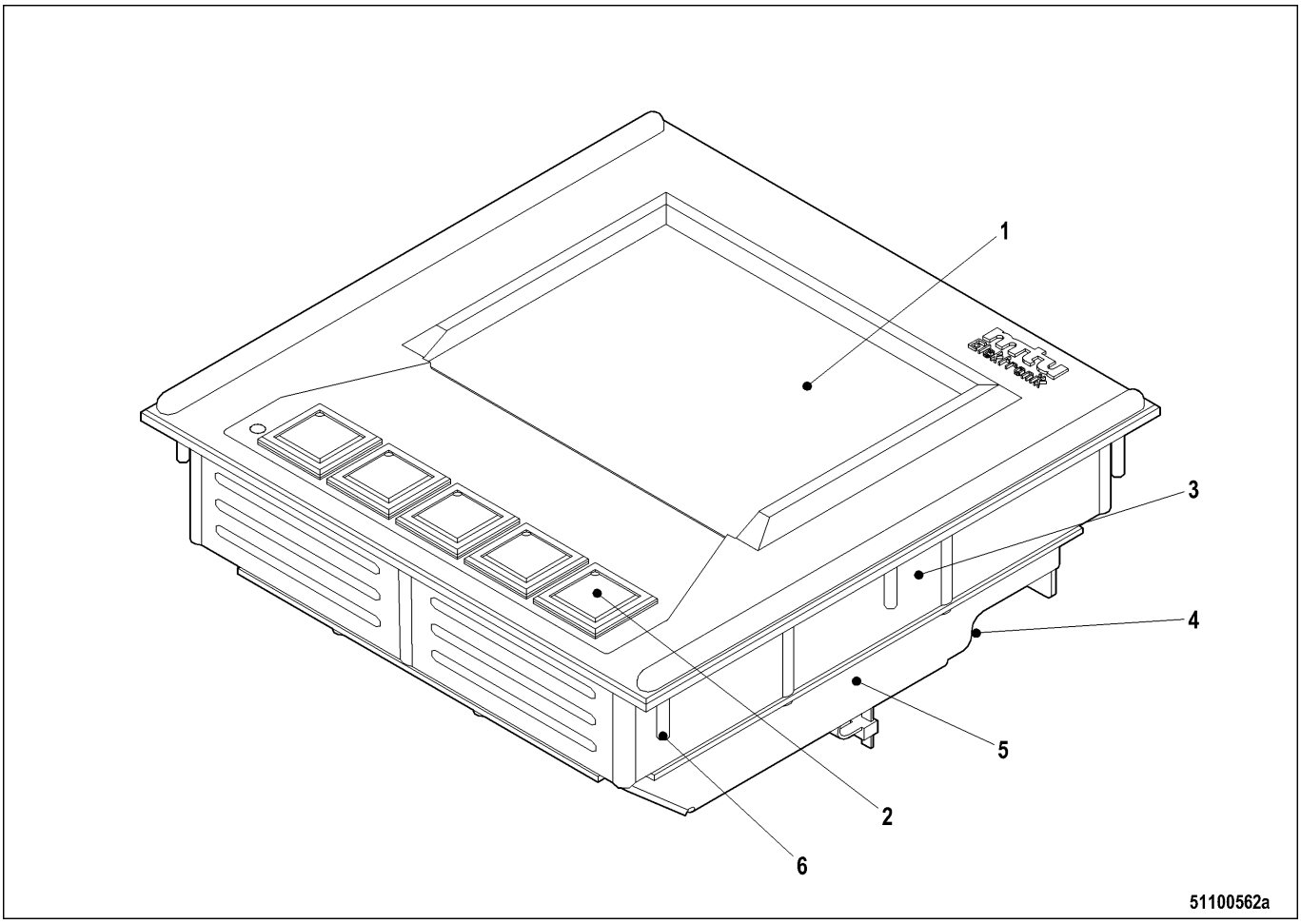
Use	Type	Sensor range	Electr. signal	Number
Lube oil pressure	Type 1	0 - 10 bar relative	0.5 - 4.5 VDC	1
Charge-air pressure	Type 2	0.5 - 4.5 bar absolute	0.5 - 4.5 VDC	1
Fuel pressure after filter	Type 4	0 - 15 bar relative	0.5 - 4.5 VDC	1
Fuel high pressure	Type 6	0 - 1600 bar relative	0.5 - 4.5 VDC	1
Fuel high pressure	Type 6	0 - 2000 bar relative	0.5 - 4.5 VDC	1

Monitor

Use	Type	Sensor range	Electr. signal	Number
Coolant level	Type 3	—	Binary (/ GND)	1

1.4 Display DIS 10 – Structure

External structure



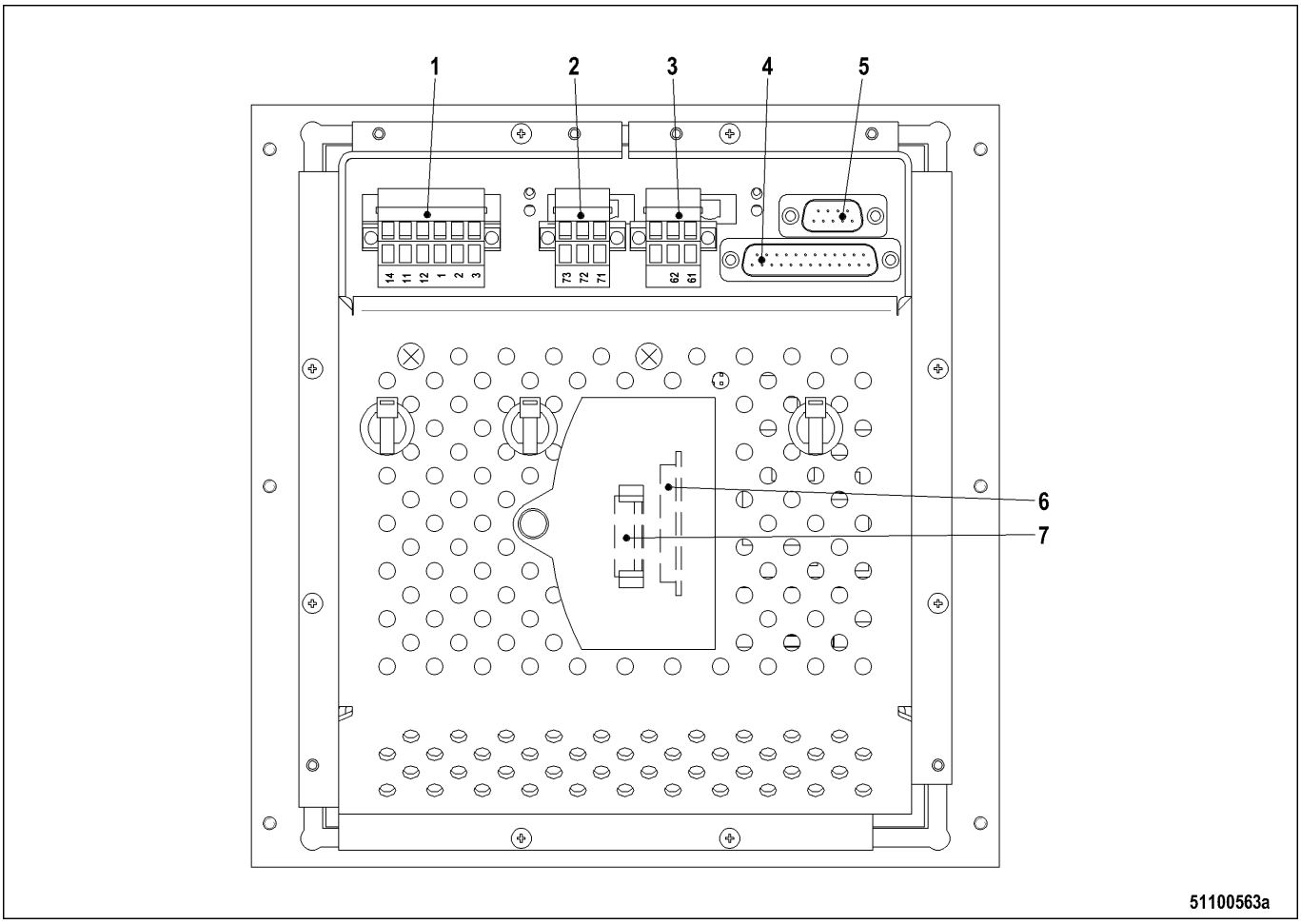
1 Display
2 Function keys F1 to F5
3 Housing upper section
4 Opening for connectors
5 Housing lower section
6 Stud M4

The display complies with ISO standard 9001 (quality assurance in design, development, production, installation and service).

Furthermore, the equipment provides CE conformity according to the following guidelines:

- Directive 89/336/EEC - Directive on electromagnetic compatibility- dated May 3, 1989 with amendment dated April 28, 1992 (guideline 92/31/EEC)
- Directive 73/23/EEC - Low voltage guideline - dated February 19, 1973 with amendment dated July 22, 1993 (directive 93/68/EEC)

The plug-in connections are accessible from the rear side of the unit. The battery compartment and the memory module MEM are arranged under a cover at the back side of the unit.



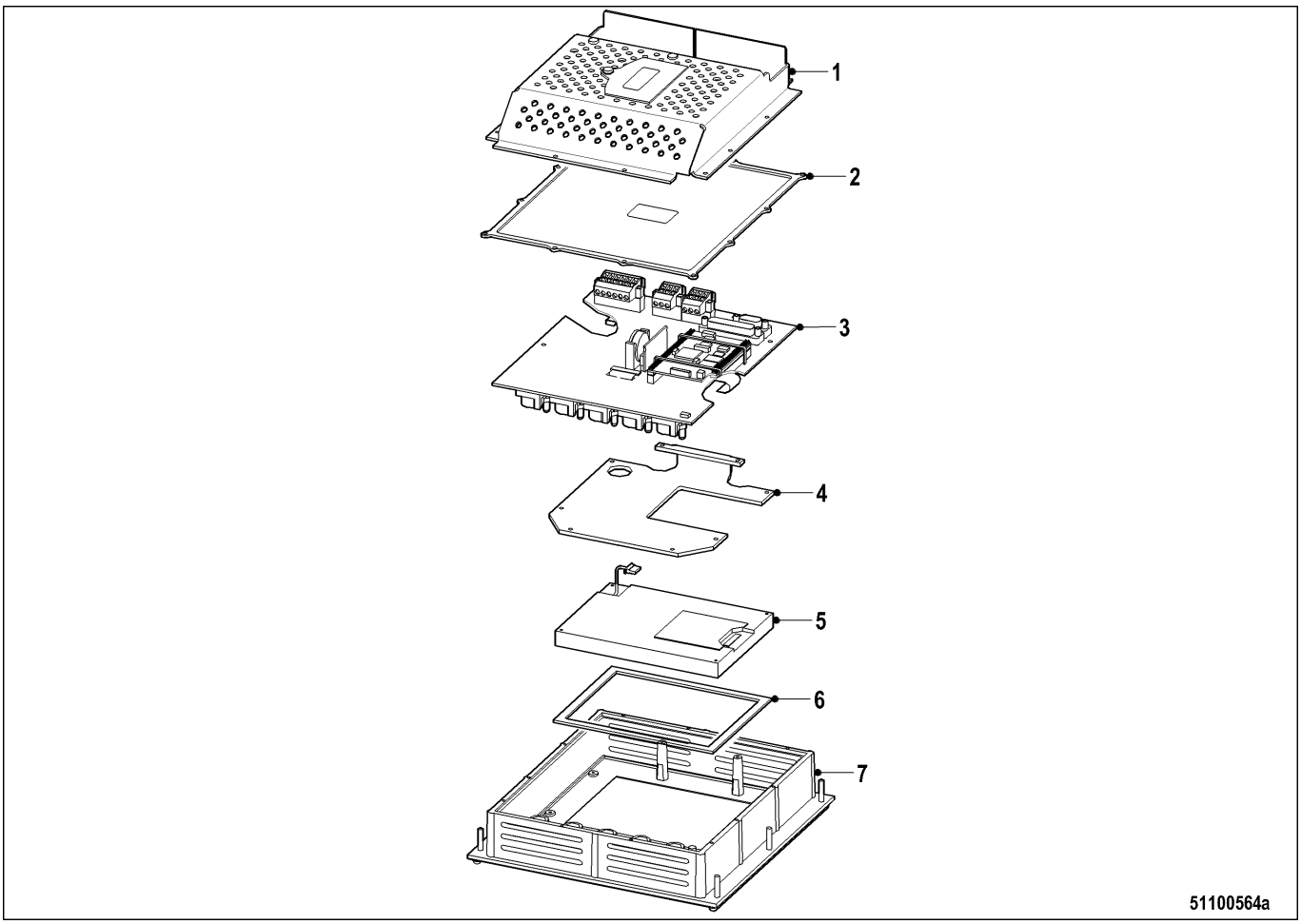
1 Terminal block ST 1
2 Terminal block CAN 2
3 Terminal block CAN 1
4 Sub-D pin connector COM 1 (25–pole) , RS 232 / RS 422
5 Sub-D pin connector COM 1 (9–pole) , RS 232 / RS 422
6 Memory module MEM
7 Battery

Connections and interfaces

Three terminal blocks (1), (2) and (3) as well as the two D-Sub multiple pin connectors (4) and (5) are located on the rear side of the display.

- Terminal block ST 1 (1) for operating voltage connection (+24 VDC), floating relay output for horn
- Terminal block CAN 2 (2) for CAN 2 (redundant bus) connection
- Terminal block CAN 1 (3) for CAN 1 (default bus) connection
- Sub-D multiple pin connectors (4), RS 422 interface for connection of modem or of a cable for a direct connection to a service PC
- Sub-D multiple pin connectors (5) 9-pole, RS 232 interface for connection of modem or of a cable for a direct connection to a service PC

Display DIS 10 assemblies



1 Housing lower section
2 Gasket
3 Printed circuit board IDB
4 Adapter plate
5 Display 5,7‘
6 Gasket
7 Housing upper section

2 Technical Data

2.1 SAM – Technical data

Use

- Installation in enclosed control cabinets.
- Suitable for installation on mounting rails or screw-mounting on cabinet rear wall (fixed installation).
- Suitable for connecting wires or litz wires up to AWG16 (US) (1.5 mm^2).

Technical data

Term	Unit	Value
Installation position		As desired, however integral fault display should be legible.
Operating voltage	VDC	24 rated value (-30%; +30%, kurzzeitig -50%)
Power consumption	W	Under 7 (0.25A at 24V) without additional load.
Degree of protection:		IP 40 as per DIN 40 050
Shock: Rail mounting Fixed installation		 10g, 11ms 30g, 11ms
Vibration: Rail mounting Fixed installation	 Hz Hz	 2 - 12.8:Xpp < ± 3mm 12.8 - 1000:a < 1g [rms] 2 - 12.8: Xpp < ± 3mm 12.8 - 100:a < 4g [rms]
Ambient temperature:	°C	-40 - +70 in circulating ambient air.
Storage temperature:	°C	-40 - +100
Relative humidity	%	5 - 97, no condensation.
Color:		Blue (RAL5015)
Material:	%	Polycarbonate reinforced with 10% fiberglass.
Dimensions:	mm	L x W x H (295 x 151 x 75)
Weight:	kg	Approx. 1.6

Note: Values stated above may be restricted when MCS 5 extension modules are used.

EMI/EMC - Electromagnetic interference (general)

The SAM has been tested according to the following standards and meets the relevant limit values:

Standard	Testing
EN 55011	(Conducted Emission) 10 kHz - 30 MHz Class A
EN 55011	(Radiated Emission) 30 MHz - 1 GHz
IEC-60533:1999	(Conducted Emission) 10 kHz - 30 MHz (type test)
EC-60533:1999	(Radiated Emission) 150 kHz - 2 GHz (type test)
EN 61000-4-2	(ESD interference immunity) ±8kV
EN 61000-4-3	(Radiated interference immunity) 80MHz - – 2GHz
EN 61000-4-4	(Burst interference immunity) ±2kV
EN 61000-4-5	(Surge interference immunity) ±1kV/±2kV
EN 50155	(Surge interference immunity) ±1.8kV
EN 61000-4-17	(LF conducted interference) 0.03 – 10 kHz / 3Veff
EN 61000-4-29	(Mains fluctuation / STANAG 1008)
IEC 60092-504	(Dielectric strength) 550VAC / 10mA
EN 50155	(Isolation) 500V / 10MOhm

Requirements for fulfillment of EMI/EMC limit values are as follows:

- The housing of the SAM must be connected to housing ground e.g. by a cable with a minimum cross-section of 2.5 mm^2. Cable length shall not exceed 10 cm.
- Twisted-conductor cables only shall be used to connect sensors and actuators. Maximum length of shall not exceed 5 m for unshielded cables and 50 m for shielded cables (providing that cable harness impedance allows).

Electrical requirements

Term	Unit	Value
Operating voltage:	V	24, -30% to +30% (+16.8 - +32) Admissible residual ripple less than 5% as per STANAG 1008. Note: The processor is automatically reset if the voltage falls below 7 V.
Power supply:	W	Below 7 W. Without activated loads at SAM outputs Additional output current on positive or negative conductor shall not exceed 10 A DC in total.
Current terminals:	mm	5.08 terminals (spring-cage terminals) • Wire diameter AWG14 (US) or 2.5 mm^2 recommended.
Electrical isolation:	V	• Supply ground is common reference potential (Common Ground) for all SAM electronics. This applies to the entire I/O range with the exception of certain electrically isolated channels. • SAM electronics ground is not connected to housing ground. • Signal cable shields must be connected to housing ground if applicable. • Maximum direct current isolating voltage is 500 unless otherwise stated.

Mechanical design

Term	Unit	Value
Installation position:		• Horizontal (to facilitate legibility of fault display and inscriptions on SAM housing). • Note that space is required to connect cabling at the top and bottom when installing the SAM in control cabinets. • The device heats up as a result of power loss. Heat from the SAM dissipates through the back wall. Ensure that heat can be conducted away from the back wall of the SAM to the mounting frame. Do not allow neighboring devices to additionally heat up the SAM.

Signal connections

The SAM module is easily replaced. The input and output signal cables are equipped with modular connectors. Common function channels are combined in groups.

The wires are connected using spring-cage terminal technology.

Two wires may be connected to one terminal when the wires are crimped in a double-wire ferrule. For example, a Phoenix AL-TWIN 2* 0.75-10 may be used.

Connector modules are plugged together. The connector modules are equipped with coding pins to preclude polarity reversal.

Terminals

Term	Unit	Value
Terminal strip modules:		WAGO spring-cage terminals
Current-carrying capacity (at 70 °C):	A	10 per contact
Measuring voltage:	V	250
Measuring surge voltage:	V	2500
Wire cross-sections:	mm^2	Up to 1.5 or AWG15
Clamping range:	mm^2	0.08 – 1.5 or AWG15

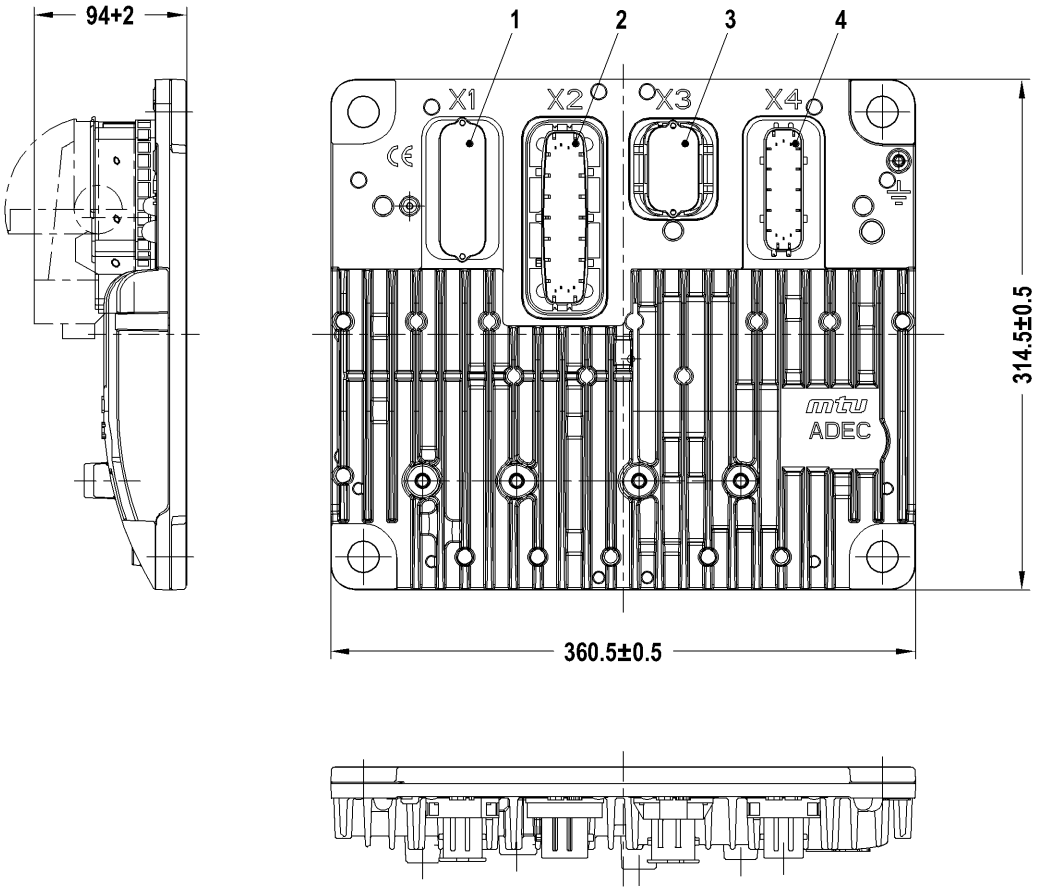
Other terminals (RM 5,08) are used for power supply and CAN bus connections.

Additional printed circuit boards in slots 1 ... 3

Observe the relevant technical data applicable to the printed circuit boards concerned when additional boards are used in the SAM.

2.2 Engine governor

Engine governor



Term	Unit	Value
Dimensions (width x height x depth)	mm	360 x 314 x 65 Draw-out clearance: +135
Weight	kg	5.5
Operating voltage	VDC	Rated voltage: 24 Continuous voltage: 20 to 32 Temporarily restricted operation: 16.8 to 20 Interactive mode: 11 to 16.8
Power consumption	A	Max. 24
Heat loss	W	Max. 35
Operating temperature range	°C	–40 to +75
Storage temperature range	°C	–40 to +85

Term	Unit	Value
Max. housing temperature	°C	105
Relative air humidity	% condensing	0 to 95 condensing
Degree of protection		IP 69K (DIN 40 050)
Shock	g/ms	15/11 semi-sinusoidal shock
Vibration		31.5 Hz to 150 Hz: a= ±3.7 g 5 Hz: 0.00057 g^2/Hz 31.5 Hz: 0.06 g^2/Hz 150 Hz: 0.06 g^2/Hz 1000 Hz: 0.00057 g^2/Hz 1500 Hz: 0.00057 g^2/Hz
EMC		EN 61000-6-2: 2002 EN 61000-6-4: 2004 IEC 60533: 1999 EN 50121-3-2: 2001 EN 50155: 2004 EN 55025: 2003 DIN-ISO 7637-2: 2002 DIN-ISO 7637-3-1995 EN 13309: 2000

2.3 Analog display instruments

Instruments for engine operating data

Term	Unit	Value
Dimensions (diameter x D)	mm	Speed instrument: 105 x 71 Pressure and temperature instruments: 62 x 60
Operating voltage illumination	VDC	24, -25 %/+30 %
Power consumption works	mA	4 ... 20 (pressure and temperature)
Speed instrument	V	Input 0 ... 10
Operating temperature range	°C	-20...+70
Storage temperature range	°C	-30...+85
Installation position	°	0 ... 90 as desired, preferably horizontal
Relative air humidity	%	5 ... 98 at 55 °C, condensation admissible
Degree of protection		Front IP 65 DIN 40 050
Color		Black

2.4 CCB 2 – Technical Data

Technical data CCB2

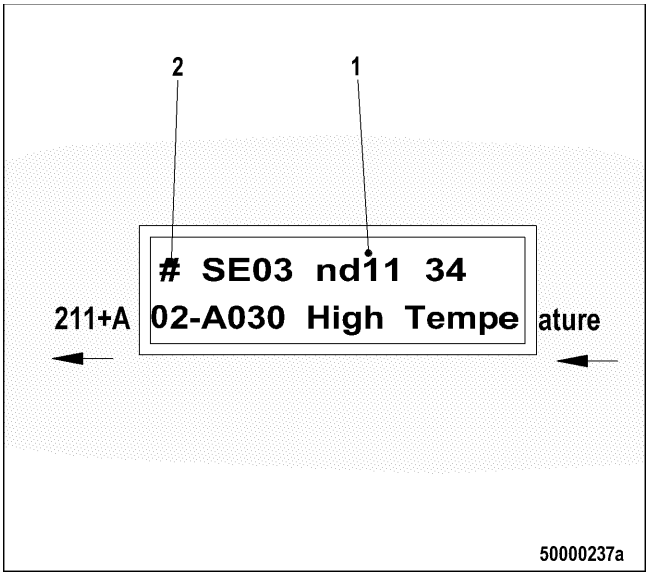
Term	Unit	Value
Input voltage	VDC	+5 (–5 %, +3%) from SAM +24V (±5 %) from SAM
Power consumption	mA	at 5 VDC – less than 600 at 24 VDC – less than 60
Power loss	W	Approx. 4

Operating Instructions

3 Troubleshooting

3.1 Fault indication on SAM display – Genset applications

SAM fault messages
SAM display



1 2-line LC display
2 Time indicator for alarms

The structure of the display (1) is as follows:

- First line
  - Fault indication
    - # (2) = Alarm is no longer active, does not appear on next power-up,
      - A = Currently active alarms,
      - B = Alarm was active during the last hour,
      - C = Alarm was active during the last four hours,
      - C = Alarm was active during the last four to twelve hours,
      - E = Alarm was active more than twelve hours ago.

      .
    - Fault type (e.g. SE03).
    - Node number at which the fault occurred (e.g. nd05).
- Second line (option)
  - Running text, providing more information about the fault currently displayed

Proceed to the next alarm by pressing key (↓ ↑).

Fault type – fault message text

SE No.	Fault message text
0	Sensor Temperature Defect
1	Temperature failure
2	Sensor Voltage Defect
3	Voltage failure
4	CAN Bus- 1 Error/Bus Defec
5	CAN Bus- 1 Overrun
6	CAN Bus- 2 Error/Bus Defec
7	CAN Bus- 2 Overrun
8	Temperature Compensation Error
9	I/O-Module Slot2 Defect
10	I/O-Module Slot3 Defect
11	I/O-Module Slot4 Defect
12	Serial Connection Lost
13	CAN Bus- 3 Error/Bus Defec
14	CAN Bus- 3 Overrun
15	S/A Bus Faulty
16	PAN 1 Defect
17	PAN 2 Defect
18	PAN 3 Defect
19	PAN 4 Defect
20	PAN 5 Defect
21	PAN 6 Defect
22	I/O-Module Slot1 Defect
23	I/O-Module Slot5 Defect
24	I/O-Module Slot6 Defect
25	I/O-Module Slot7 Defect
26	I/O-Module Slot8 Defect
27	Download Server Collision
28	not projected node

Engine governor messages for Series 4000
Recommended action in case of alarm

Yellow alarm:

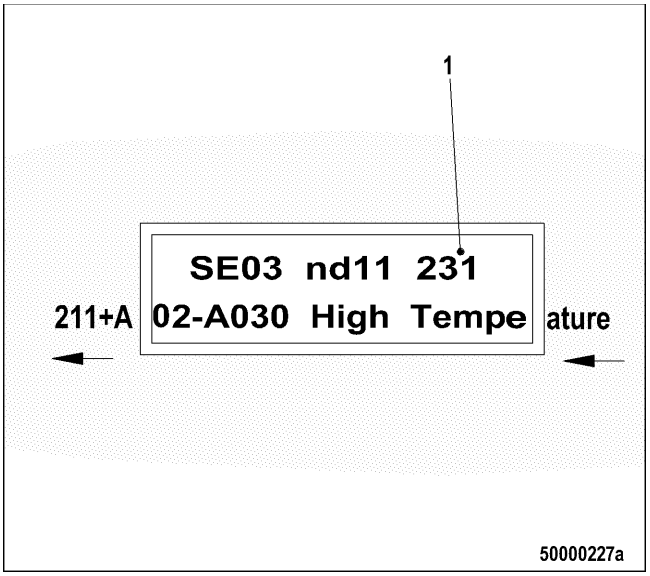
The engine can still be operated providing that automatic engine shutdown to protect the engine has not been configured or is not tripped. Contact Service immediately/benachrichtigen/start fault rectification.

Red alarm:

Caution, the engine is running at its limits. Shut down manually without further delay if the engine does not shut itself down immediately after a red alarm is signalled.

Fault and alarm messages

The fault code numbers are generated by the Engine Control Unit and transmitted to the following display.



The fault code (1) comprises three numbers.

Fault messages may also be caused by faulty sensors/actuators. Contact Service to have sensors/actuators checked and replaced as necessary should troubleshooting as prescribed in the table below prove unsuccessful.

IMPORTANT NOTE:

The information provided in the columns “Meaning” and “Action” applies to the standard default state of the genset on delivery. Differing system responses requiring different action may result when settings are changed by the OEM. The OEM is responsible for documenting any changes and defining appropriate counteraction.

The table below lists possible fault codes:

Fault code no.	Designation	Meaning	Action	Setting parameter no.
003	HI T-Fuel	Prewarning fuel temperature too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check tank temperature, contact Service if no fault detected.	2.0122931
004	SS T-Fuel	Main warning fuel temperature too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check tank temperature, contact Service if no fault detected.	2.0122932
005	HI T-Charge Air	Prewarning charge-air temperature too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cooler, check intercooler, contact Service if no fault detected.	2.0121.931

Fault code no.	Designation	Meaning	Action	Setting parameter no.
006	SS T-Charge Air	Main warning charge-air temperature too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cooler, check intercooler, contact Service if no fault detected.	2.0121.932
009	HI T-Coolant Intercooler	Prewarning coolant temperature in intercooler too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cooler, contact Service if no fault detected.	2.0124.931
010	SS T-Coolant Intercooler	Main warning coolant temperature in intercooler too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cooler, contact Service if no fault detected.	2.0124.932
015	LO P-Lube Oil	Prewarning lube oil pressure too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Check oil level, contact Service if no fault detected.	2.0100.921
016	SS P-Lube Oil	Main warning lube oil pressure too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Check oil level, contact Service.	2.0100.922
024	SS Coolant Level	Coolant level too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Check coolant level in expansion tank, check for leakage and seal any leaks as necessary.	2.0152.912
030	SS Engine Overspeed	Engine overspeed (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Attempt to restart engine.	2.2510.932
044	LO Coolant Level Intercooler	Intercooler coolant level too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Check coolant level in expansion tank, check for leakage and seal any leaks as necessary.	2.0153.921
051	HI T-Lube Oil	Lube oil temperature too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check cooling system.	2.0125.931

Fault code no.	Designation	Meaning	Action	Setting parameter no.
052	SS T-Lube Oil	Lube oil temperature too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Check cooling system, contact Service if cooling system is in order.	2.0125.932
065	LO P-Fuel	Fuel inlet pressure too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check filter, check genset fuel supply.	2.0102.921
066	SS P-Fuel	Fuel inlet pressure too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check filter, check genset fuel supply.	2.0102.922
067	HI T-Coolant	Coolant temperature too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check cooling system.	2.0120.931
068	SS T-Coolant	Coolant temperature too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Automatic engine shutdown.	Check cooling system. Contact Service if cooling system is in order.	2.0120.932
081	AL Rail Leakage	Pressure gradient in rail too low on starting or too high on stopping, HP system leaking (alarm configuration parameter, see PR 2.8008.100 for explanation).	On stopping: Seal off system, contact Service; On starting: Check engine for leakage, if none found, attempt restarting as per operating instructions (air in system).	1.8004.046
082	HI P-Fuel (Common Rail)	Rail pressure is greater than set value (alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check HP fuel control block cabling, if no fault detected, contact Service.	2.0104.931
083	LO P-Fuel (Common Rail)	Rail pressure is less than set value (alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check HP fuel control block cabling, check HP system for leakage, if no fault detected, contact Service.	2.0104.921
089	SS Engine Speed too Low	Engine speed too low (alarm configuration parameter, see PR 2.8008.100 for explanation). Engine stop.	Check for additional messages.	2.2500.030

Fault code no.	Designation	Meaning	Action	Setting parameter no.
090	SS Idle Speed Not Reached	Idling speed not reached (alarm configuration parameter, see PR 2.8008.100 for explanation). Start terminated.	Check for additional messages.	2.1090.925
091	SS Release Speed Not Reached	Runup speed not reached (alarm configuration parameter, see PR 2.8008.100 for explanation). Start terminated.	Check for additional messages. Recharge battery. Engine under load: Check fuel supply; if no fault detected, contact Service.	2.1090.924
092	SS Starter Speed Not Reached	Starter speed not reached (alarm configuration parameter, see PR 2.8008.100 for explanation). Start terminated. Starter does not turn or turns slowly.	Check for additional messages. Recharge battery. Engine under load: Check fuel supply; if no fault detected, contact Service.	2.1090.923
093	SS T-Preheat	Preheating temperature too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Engine start interlock is active as coolant temperature is too low for engine start, preheating necessary.	2.1090.922
094	LO T-Preheat	Preheating temperature too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Engine start interlock is active as coolant temperature is too low for engine start, preheating necessary.	2.1090.921
095	AL Prelubrication Fault	Priming oil pressure not reached (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.1090.920
102	AL Fuel Cons. Counter Defect	Electronic fault: Consumption counter faulty (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace engine governor at next opportunity.	1.8004.624
104	AL Eng Hours Counter Defect	Electronic fault: Hour meter faulty (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace engine governor at next opportunity.	1.8004.623
118	LO ECU Power Supply Voltage	Supply voltage too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check batteries and charge as necessary; check generator.	2.0140.921

Fault code no.	Designation	Meaning	Action	Setting parameter no.
119	LOLO ECU Power Supply Voltage	Supply voltage too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check batteries and charge as necessary; check generator.	2.0140.922
120	HI ECU Power Supply Voltage	Supply voltage too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check batteries and generator.	2.0140.931
121	HIHI ECU Power Supply Voltage	Supply voltage too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check batteries and generator.	2.0140.932
122	HI T-ECU	Electronics temperature too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation). Warning.	Check engine room ventilation.	2.0132.921
176	AL LifeData not available	No (suitable) LifeData backup system available, backup system has no LifeData function when timeout following engine governor reset expires or CAN bus to backup system is disrupted (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.4000.004
177	AL LifeData restore incomplete	This fault message is generated when a CRC is faulty (stated for each module) or upload is incomplete during a restore data upload process (into ADEC) (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.4000.006
180	AL CAN1 Node Lost	Connection to a station on CAN bus 1 has failed (alarm configurations parameter, see PR 2.8008.100 for explanation).	Test devices connected to CAN, test cabling.	2.0500.680
181	AL CAN2 Node Lost	Connection to a station on CAN bus 2 has failed (alarm configurations parameter, see PR 2.8008.100 for explanation).	Check devices connected to CAN.	2.0500.681
182	AL CAN Wrong Parameters	Incorrect parameter values entered in data record (alarm configuration parameter, see PR 2.8008.100).		2.0500.682

Fault code no.	Designation	Meaning	Action	Setting parameter no.
183	AL CAN No PU-Data	A CAN mode has been selected in which communication with the PU data module is initialized. However, the required PU data module is unavailable or invalid (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check devices connected to CAN.	2.0500.683
184	AL CAN PU-Data Flash Error	Programming error on attempting to copy a received PU data module into the Flash module (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0500.684
186	AL CAN1 Bus Off	CAN controller 1 is in "Bus Off" state, automatic switching to CAN2 results. Causes are e.g. Ursachen sind z. B. short circuit, massive disruptions or baud rate incompatibility (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0500.686
187	AL CAN1 Error Passive	CAN controller 1 has signalled a warning. Causes are e.g. missing listening nodes, minor disruptions and temporary bus overload (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0500.687
188	AL CAN2 Bus Off	CAN controller 2 is in "Bus Off" state, automatic switching to CAN1 results. Causes are e.g. short circuit, massive disruptions or baud rate incompatibility (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0500.688
189	AL CAN2 Error Passive	CAN controller 2 has signalled a warning. Causes are e.g. missing listening nodes, minor disruptions and temporary bus overload (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0500.689
201	SD T-Coolant	SD alarm configuration, coolant temperature sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B6), replace as necessary.	1.8004.570

Fault code no.	Designation	Meaning	Action	Setting parameter no.
202	SD T-Fuel	SD alarm configuration, fuel temperature sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B33), replace as necessary.	1.8004.572
203	SD T-Charge Air	SD alarm configuration, charge-air temperature sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B9), replace as necessary.	1.8004.571
205	SD T-Coolant Intercooler	SD alarm configuration, coolant temperature sensor of intercooler faulty, short circuit or cabling damage.	Check sensor and cabling (B26), replace as necessary.	1.8004.574
208	SD P-Charge Air	SD alarm configuration, charge-air pressure sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B10), replace as necessary.	1.8004.566
211	SD P-Lube Oil	SD alarm configuration, lube oil pressure sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B5), replace as necessary.	1.8004.563
215	SD P-HD	SD alarm configuration, rail pressure sensor faulty, HP controller in emergency mode, short circuit or cabling damage.	Check sensor and cabling (B48), replace as necessary.	1.8004.567
216	SD T-Lube Oil	SD alarm configuration, lube oil temperature sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B7), replace as necessary.	1.8004.575
219	SD T-Intake Air	SD alarm configuration, intake air temperature sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B3), replace as necessary.	1.8004.573
220	SD Level Coolant Water	SD alarm configuration, coolant level sensor faulty, short circuit or cabling damage.	Check sensor and cabling (F33), replace as necessary. Fault is rectified when electronics are switched back on	1.8004.584
223	SD Level Coolant Intercooler	SD alarm configuration, coolant level sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B57), replace as necessary. Fault is rectified when electronics are switched back on.	1.8004.583

Fault code no.	Designation	Meaning	Action	Setting parameter no.
229	AL Stop Camshaft Sensor Defect	Engine stop due to camshaft sensor fault (and a prior crankshaft sensor fault in the same operating cycle). Alarm configuration parameter, see PR 2.8008.100 for explanation.	Check connector and cabling to sensor B1, replace as necessary. Fault is rectified when engine is restarted. If camshaft and crankshaft sensor are both faulty check connector and cabling to sensor B1 and B13. Restart. Fault is rectified when engine is restarted, contact Service if this is not the case.	1.8004.562
230	SD Crankshaft Speed	SD alarm configuration, crankshaft sensor faulty, short circuit or cabling damage, engine remains operational.	Check sensor and cabling (B13), attempt restart, fault may be rectified when engine is restarted. Contact Service if this is not the case	1.8004.498
231	SD Camshaft Speed	SD alarm configuration, camshaft sensor faulty, short circuit or cabling damage, engine remains operational.	Check sensor and cabling (B1), attempt restart, fault may be rectified when engine is restarted. Contact Service if this is not the case.	1.8004.499
240	SD P-Fuel	SD alarm configuration, engine remains operational, fuel pressure sensor faulty, short circuit or cabling damage.	Check sensor and cabling (B34), replace as necessary.	1.8004.565
245	SD ECU Power Supply Voltage	SD alarm configuration, internal engine governor fault.	Execute engine governor self-test, replace engine governor in case of fault.	2.8006.589
266	SD Speed Demand	SD alarm configuration, analog speed setting faulty, short circuit or cabling damage.	Check speed setting transmitter and cabling, replace as necessary. Fault is rectified when engine is restarted.	2.8006.586
269	SD Loadp.Analog filt	SD alarm configuration, filtered analog signal of load pulse not available, short circuit or cabling damage	Check cabling, replace as necessary. Fault is rectified when engine is restarted.	2.8006.588
270	SD Frequency Input	SD alarm configuration, frequency input faulty, short circuit or cabling damage.	Contact Service.	2.8006.590

Fault code no.	Designation	Meaning	Action	Setting parameter no.
301	AL Timing Cylinder A1	Time-of-flight measuring fault injector cylinder A1: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.500
302	AL Timing Cylinder A2	Time-of-flight measuring fault injector cylinder A2 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.501
303	AL Timing Cylinder A3	Time-of-flight measuring fault injector cylinder A3: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.502
304	AL Timing Cylinder A4	Time-of-flight measuring fault injector cylinder A4 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.503
305	AL Timing Cylinder A5	Time-of-flight measuring fault injector cylinder A5 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.504
306	AL Timing Cylinder A6	Time-of-flight measuring fault injector cylinder A6 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.505
307	AL Timing Cylinder A7	Time-of-flight measuring fault injector cylinder A7 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.506

Fault code no.	Designation	Meaning	Action	Setting parameter no.
308	AL Timing Cylinder A8	Time-of-flight measuring fault injector cylinder A8 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.507
309	AL Timing Cylinder A9	Time-of-flight measuring fault injector cylinder A9 Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.508
310	AL Timing Cylinder A10	Time-of-flight measuring fault injector cylinder A10: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.509
311	AL Timing Cylinder B1	Time-of-flight measuring fault injector cylinder B1: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.510
312	AL Timing Cylinder B2	Time-of-flight measuring fault injector cylinder B2: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.511
313	AL Timing Cylinder B3	Time-of-flight measuring fault injector cylinder B3: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	18004.512
314	AL Timing Cylinder B4	Time-of-flight measuring fault injector cylinder B4: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.513

Fault code no.	Designation	Meaning	Action	Setting parameter no.
315	AL Timing Cylinder B5	Time-of-flight measuring fault injector cylinder B5: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.514
316	AL Timing Cylinder B6	Time-of-flight measuring fault injector cylinder B6: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.515
317	AL Timing Cylinder B7	Time-of-flight measuring fault injector cylinder B7: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.516
318	AL Timing Cylinder B8	Time-of-flight measuring fault injector cylinder B8: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.517
319	AL Timing Cylinder B9	Time-of-flight measuring fault injector cylinder B9: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.518
320	AL Timing Cylinder B10	Time-of-flight measuring fault injector cylinder B10: Time-of-flight value measured extremely small or large (alarm configuration parameter, see PR 2.8008.100 for explanation).	Replace plug-in pump if this occurs frequently.	1.8004.519
321	AL Wiring Cylinder A1	Cabling fault in injector cabling cylinder A1. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.520

Fault code no.	Designation	Meaning	Action	Setting parameter no.
322	AL Wiring Cylinder A2	Cabling fault in injector cabling cylinder A2. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.521
323	AL Wiring Cylinder A3	Cabling fault in injector cabling cylinder A3. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.522
324	AL Wiring Cylinder A4	Cabling fault in injector cabling cylinder A4. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.523
325	AL Wiring Cylinder A5	Cabling fault in injector cabling cylinder A5. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.524
326	AL Wiring Cylinder A6	Cabling fault in injector cabling cylinder A6. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.525
327	AL Wiring Cylinder A7	Cabling fault in injector cabling cylinder A7. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.526

Fault code no.	Designation	Meaning	Action	Setting parameter no.
328	AL Wiring Cylinder A8	Cabling fault in injector cabling cylinder A8. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.527
329	AL Wiring Cylinder A9	Cabling fault in injector cabling cylinder A9. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.528
330	AL Wiring Cylinder A10	Cabling fault in injector cabling cylinder A10. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.529
331	AL Wiring Cylinder B1	Cabling fault in injector cabling cylinder B1. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.530
332	AL Wiring Cylinder B2	Cabling fault in injector cabling cylinder B2. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.531
333	AL Wiring Cylinder B3	Cabling fault in injector cabling cylinder B3. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.532

Fault code no.	Designation	Meaning	Action	Setting parameter no.
334	AL Wiring Cylinder B4	Cabling fault in injector cabling cylinder B4. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.533
335	AL Wiring Cylinder B5	Cabling fault in injector cabling cylinder B5. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.534
336	AL Wiring Cylinder B6	Cabling fault in injector cabling cylinder B6. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004535
337	AL Wiring Cylinder B7	Cabling fault in injector cabling cylinder B7. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.536
338	AL Wiring Cylinder B8	Cabling fault in injector cabling cylinder B8. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.537
339	AL Wiring Cylinder B9	Cabling fault in injector cabling cylinder B9. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004.538

Fault code no.	Designation	Meaning	Action	Setting parameter no.
340	AL Wiring Cylinder B10	Cabling fault in injector cabling cylinder B10. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, rectify injector solenoid valve short circuit (positive to negative) (e.g. by exchanging injectors). Fault rectification: When engine is restarted.	1.8004539
341	AL Open Load Cylinder A1	Disruption fault in injector cabling cylinder A1. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.540
342	AL Open Load Cylinder A2	Disruption fault in injector cabling cylinder A2. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.541
343	AL Open Load Cylinder A3	Disruption fault in injector cabling cylinder A3. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.542
344	AL Open Load Cylinder A4	Disruption fault in injector cabling cylinder A4. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.543
345	AL Open Load Cylinder A5	Disruption fault in injector cabling cylinder A5. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.544
346	AL Open Load Cylinder A6	Disruption fault in injector cabling cylinder A6. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.545

Fault code no.	Designation	Meaning	Action	Setting parameter no.
347	AL Open Load Cylinder A7	Disruption fault in injector cabling cylinder A7. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.546
348	AL Open Load Cylinder A8	Disruption fault in injector cabling cylinder A8. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.547
349	AL Open Load Cylinder A9	Disruption fault in injector cabling cylinder A9. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.548
350	AL Open Load Cylinder A10	Disruption fault in injector cabling cylinder A10. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.549
351	AL Open Load Cylinder B1	Disruption fault in injector cabling cylinder B1. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.550
352	AL Open Load Cylinder B2	Disruption fault in injector cabling cylinder B2. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.551
353	AL Open Load Cylinder B3	Disruption fault in injector cabling cylinder B3. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.552

Fault code no.	Designation	Meaning	Action	Setting parameter no.
354	AL Open Load Cylinder B4	Disruption fault in injector cabling cylinder B4. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.553
355	AL Open Load Cylinder B5	Disruption fault in injector cabling cylinder B5. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.554
356	AL Open Load Cylinder B6	Disruption fault in injector cabling cylinder B6. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.555
357	AL Open Load Cylinder B7	Disruption fault in injector cabling cylinder B7. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.556
358	AL Open Load Cylinder B8	Disruption fault in injector cabling cylinder B8. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.557
359	AL Open Load Cylinder B9	Disruption fault in injector cabling cylinder B9. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.558
360	AL Open Load Cylinder B10	Disruption fault in injector cabling cylinder B10. Result: Misfiring (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check injector cabling, exclude disruption in solenoid valve (e.g. by injector replacement). Fault rectification: After each working cycle.	1.8004.559

Fault code no.	Designation	Meaning	Action	Setting parameter no.
361	AL Power Stage Low	Internal electronic fault (electronics may be defective). If parameter 1.1020.021 (Power Stage Failure: Stop Engine) is set, engine is stopped here additionally (alarm configuration parameter, see PR 2.8008.100 for explanation).	Start engine governor self-test. Replace engine governor in case of fault; if self-test diagnoses "Electronics OK" check for additional fault messages (e.g. cabling fault).	1.8004.496
362	AL AL Power Stage High	Internal electronic fault (electronics may be defective). If parameter 1.1020.021 (Power Stage Failure: Stop Engine) is set, engine is stopped here additionally (alarm configuration parameter, see PR 2.8008.100 for explanation).	Start engine governor self-test. Replace engine governor in case of fault; if self-test diagnoses "Electronics OK" check for additional fault messages (e.g. cabling fault).	1.8004.497
363	AL Stop Power Stage	Internal electronic fault (electronics may be defective). If parameter 1.1020.021 (Power Stage Failure: Stop Engine) is set, engine is stopped here additionally (alarm configuration parameter, see PR 2.8008.100 for explanation).	Start engine governor self-test. Replace engine governor in case of fault; if self-test diagnoses "Electronics OK" check for additional fault messages (e.g. cabling fault).	1.8004.560
365	AL Stop MV-Wiring Ground	Injector cabling fault. Engine stop configurable (alarm configuration parameter, see PR 2.8008.100 for explanation). Possible causes: 1. Injector positive connection of one or more injectors shorting to ground. 2. Injector negative connection of one or more injectors shorting to ground.	Check cabling, replace wiring harness as necessary.	1.8004.561
381	AL Wiring TOP 1	Short circuit or line break at transistor output 1 plant side (TOP 1, alarm configurations parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.638
382	AL Wiring TOP 2	Short circuit or line break at transistor output 2 plant side (TOP 2, alarm configurations parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.639
383	AL Wiring TOP 3	Short circuit or line break at transistor output 3 plant side (TOP 3, alarm configurations parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.640

Fault code no.	Designation	Meaning	Action	Setting parameter no.
384	AL Wiring TOP 4	Short circuit or line break at transistor output 4 plant side (TOP 4, alarm configurations parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.641
390	AL MCR exceeded	DBR/MCR function: MCR (maximum continuous rate) exceeded. Engine power is limited to admissible continuous power (alarm configuration parameter, see PR 2.8008.100 for explanation).	None.	1.1085.009
400	AL Open Load Digital Input 1	Line disruption at digital input 1, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.625
401	AL Open Load Digital Input 2	Line disruption at digital input 2, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.626
402	AL Open Load Digital Input 3	Line disruption at digital input 3, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006627
403	AL Open Load Digital Input 4	Line disruption at digital input 4, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.628
404	AL Open Load Digital Input 5	Line disruption at digital input 5, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.629
405	AL Open Load Digital Input 6	Line disruption at digital input 6, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.630
406	AL Open Load Digital Input 7	Line disruption at digital input 7, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.631

Fault code no.	Designation	Meaning	Action	Setting parameter no.
407	AL Open Load Digital Input 8	Line disruption at digital input 8, cabling faulty or no resistance via switch, (alarm configuration parameter, see PR 2.8008.100 for explanation).	Check cabling	2.8006.632
408	AL Open Load Emerg. Stop Input ESI	Line disruption at input for emergency stop, cabling faulty or no resistance via switch	Check cabling	2.8006.633
410	LO U-PDU	Injector voltage too low (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Execute engine governor self-test, replace engine governor in case of fault.	2.0141.921
411	LOLO U-PDU	Injector voltage too low (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Execute engine governor self-test, replace engine governor in case of fault.	2.0141.922
412	HI U-PDU	Injector voltage too high (limit value 1, alarm configuration parameter, see PR 2.8008.100 for explanation).	Execute engine governor self-test, replace engine governor in case of fault.	2.0141.931
413	HIHI U-PDU	Injector voltage too high (limit value 2, alarm configuration parameter, see PR 2.8008.100 for explanation).	Execute engine governor self-test, replace engine governor in case of fault.	2.0141.932
444	SD U-PDU	SD alarm configuration, sensor fault at injector output stage. Engine governor internal fault. Engine governor replacement.	Replace engine governor.	1.8004.578
450	SD Idle/End-Torque Input [%]	SD alarm configuration, input signal for initial/final torque faulty, short circuit or cabling damage	Check signal transmitter and cabling, replace as necessary. Fault is rectified when engine is restarted.	2.8006.592
454	SS Power Reduction Active	Power reduction activated, engine operating outside standard limits. The following variables may also combine to lead to this message: Intake depression, exhaust back pressure, charge-air coolant temperature, intake air temperature. Alarm configuration parameter, see PR 2.8008.100 for explanation.	None.	2.7000.011

Fault code no.	Designation	Meaning	Action	Setting parameter no.
463	SD AUX 2	SD alarm configuration, analog input signal for Aux 2 faulty, short circuit or cabling damage.	Check signal transmitter and cabling, replace as necessary.	1.8004.591
464	SD P-AUX 1	SD alarm configuration, analog input signal for pressure Aux 1 faulty, short circuit or cabling damage.	Check pressure transmitter and cabling, replace as necessary.	1.8004.589
468	SD T-AUX 1	Analog input for temperature Aux 1 faulty, short circuit or cabling damage	Check signal transmitter and cabling, replace as necessary.	1.8004.579
469	SD AUX 1	SD alarm configuration, analog input signal for Aux 1 faulty, short circuit or cabling damage.	Check signal transmitter and cabling, replace as necessary.	1.8004.590
470	SD T-ECU	Engine governor faulty.	Replace engine governor at next opportunity.	1.8004.587
471	SD Coil Current	SD alarm configuration, HP fuel control block activation, short circuit or cabling damage.	Check sensor and cabling, replace as necessary. Fault is rectified when engine is restarted.	1.8004.592
472	AL Stop SD	Engine stop as shutdown channels have "sensor fault" (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.8006.593
474	AL Wiring FO	Line break or short circuit at channel FO (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.8006.655
475	AL CR Trigger Engine Stop	Tripped by crash recorder triggering due to engine shutdown.	Replace engine governor at next opportunity.	1.8010.009
476	AL Crash Rec. Init. Error	Crash recorder initialization error.	Contact Service.	1.8010.007
478	AL Comb. Alarm Yel (Plant)	YELLOW combined alarm from plant (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.8006.001
479	AL Comb. Alarm Red (Plant)	RED combined alarm from plant (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.8006.002

Fault code no.	Designation	Meaning	Action	Setting parameter no.
480	AL Ext. Engine Protection	External engine protection feature active (alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0291.921
555	AL Call MTU Field Service	Power reduction caused by maintenance feature (maintenance concept, alarm configuration parameter, see PR 2.8008.100 for explanation).	Contact Service.	2.0555.001

4 View of Windows Web Page

4.1 Engine governor web feature

Preconditions

- Connected SAM incorporates software version Var_1 Ed_1_24 or higher.
- Crossed Ethernet CAT5 network cable available.
- PC/notebook with MS Windows Explorer© web browser and Ethernet network interface available.

Connecting

1. Remove connector cap on SAM connector X5.
2. Plug in network cable.
3. Plug network cable into PC/notebook network interface.

Determine necessary data

1. Open “View Config. Page” in minidialog on SAM.
2. Scroll through the page with the “↓” and “↑” keys until the IP address is displayed.
3. Note down the IP address now displayed; e.g. “130.20.50.200”.

   Note: The SAM does not yet have an IP address if the address now shown is 0.0.0.0.

4. Contact MTU Service in this case. The web feature is not available.

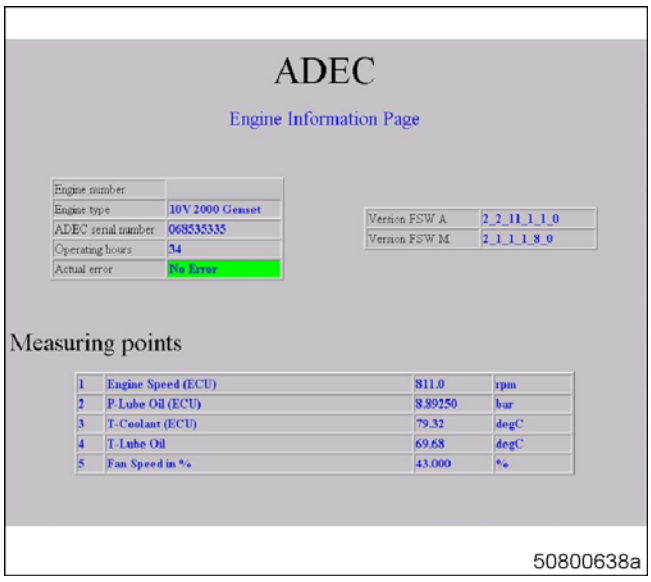
Opening the web page

1. Start Windows Explorer©.
2. Enter the following text in the command line: “http://<IP address>/vfs/adec1.cgi”, entering the address determined in step → 3. in place of <IP address>. In the example the text would read: “http://130.20.50.200/vfs/adec1.cgi”

   Result: The web page with the transmitted information is displayed.

   Note: The top of the page shows engine/plant-specific information and the software versions of the associated function software for the engine (FSW-M) and plant (FSW-A). Not all information is transmitted for some software versions; affected fields show “—MD—”. The web feature is not programmed at all if all fields show “—MD—”. It is then not possible to display measuring points/values. Application engineering defines which measuring points are displayed at the bottom. The representation cannot be changed.

3. If the measured values are not updated dynamically they can be updated with the browser “Update” button.



5 Tasks

5.1 Engine wiring check

Preconditions

- Engine is stopped and starting disabled.

Material

Designation / Use	Part No.	Qty.
Isopropyl alcohol		

Engine wiring check

1. Check securing screws of cable clamps on the engine and tighten loose screw connections.
2. Make certain that cables are securely seated in clamps and cannot move freely.
3. Check cable binders for secure seating, tighten loose cable binders.
4. Replace defective cable binders.
5. Inspect electrical components visually for damage:
   - connector housings;
   - contacts;
   - connector sockets;
   - cables and terminals;
   - plug-in contacts.
6. If conductors are damaged, contact Service.
7. Clean dirty connector housings, sockets and contacts with isopropyl alcohol.

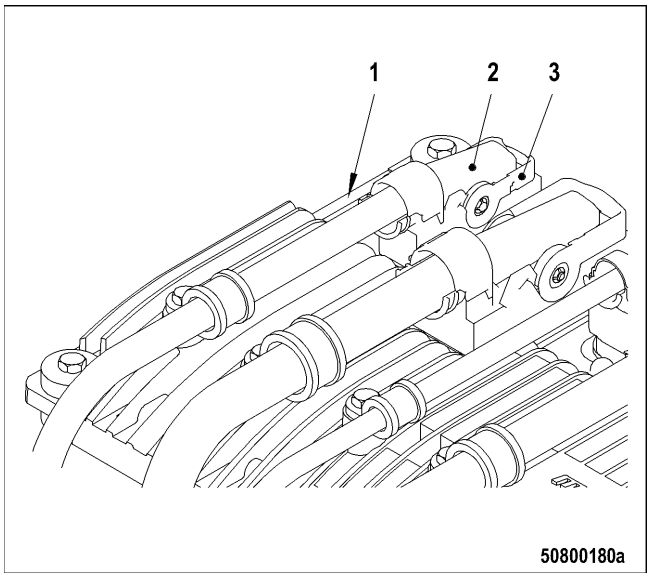
5.2 ECU – Self-test implementation

DANGER

Electrical voltage.
Risk of serious injury - danger to life!
- Make certain that the power supply to the engine is switched off before starting to work. Ensure that the power supply cannot be switched on unintentionally!

Self-test implementation

1. Switch off power supply to system.
2. Remove connectors X1, X2 and X4 from the engine governor.
   2.1. Release lock (3) of connectors (2).
   2.2. Withdraw connectors (2).
3. Switch on power supply.
   Result:
   - The engine governor is operable if the diagnostic lamp (1) changes to continuous illumination within 30 seconds after power has been switched on.
   - If the diagnostic lamp (1) flashes after 30 seconds, replace engine governor (→Contact Service).
   - If the diagnostic lamp stays dark, check power supply.
4. Switch off power supply.
5. Refit connectors X1, X2 and X4 on engine governor.
   5.1. Plug in connector (2).
   5.2. Lock connectors.



5.3 SAM – Self-test

DANGER	Electrical voltage. **Risk of serious injury - danger to life!** • Make certain that the power supply to the engine is switched off before starting to work. Ensure that the power supply cannot be switched on unintentionally!

DANGER	Electrical voltage. **Risk of serious injury - danger to life!** • Make certain that the power supply to the engine is switched off before starting to work. Ensure that the power supply cannot be switched on unintentionally!

Self-testing

1. De-energize the plant.
2. Disconnect all connectors on the SAM except for X13.
   2.1. Undo screws.
   2.2. Disconnect connectors.
3. Switch on supply voltage
   Result:
   - SAM is in order when the diagnostic lamp assumes a “steady lit” state within 30 seconds of switching on.
   - Replace SAM if the diagnostic lamp (1) flashes when 30 seconds have passed.
   - Check the power supply if the diagnostic lamp remains dark.
4. Switch off supply voltage.
5. Connect all connectors to SAM.
   5.1. Plug in connectors.
   5.2. Tighten the screws.

Workshop Manual

6 Repair Work

6.1 SAM – Replacement

Preconditions

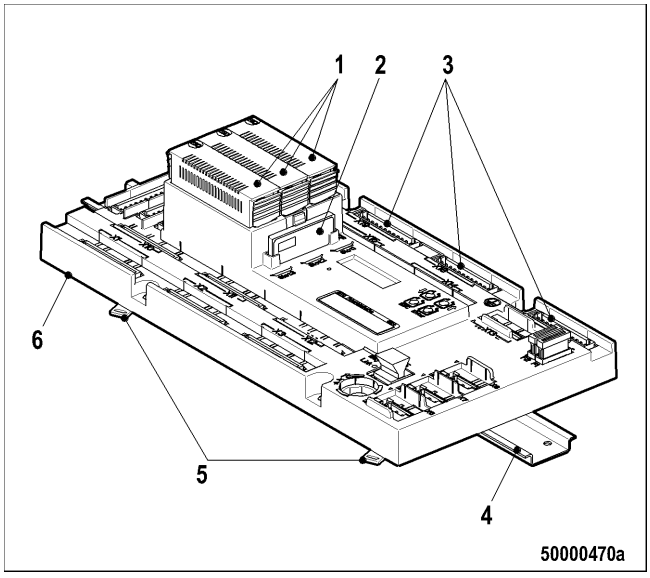
- Engine is stopped and starting disabled.
- Operating voltage is not applied.

Spare parts

Designation / Use	Part No.	Qty.
SAM		

Removing SAM

1. Disconnect all connectors (3) on SAM (6).
2. Slide the two levers (5) to the side in the direction indicated by the arrow to release the lock.
3. Remove SAM from the top-hat rail (4).
4. Remove the CF board (2) from the SAM.
5. As necessary. Remove cassettes with printed circuit boards (1) from SAM (note installation positions).



Installing a new SAM

1. Place the new SAM on the top-hat rail (4).
2. Slide the two levers (5) to the side to engage the lock (position shown in fig.).
3. Connect all cables to SAM (6).
4. Insert CF board (2).
5. If applicable, insert cassettes with printed circuit boards (1) in new SAM.

6.2 SAM fuse – Replacement

Preconditions

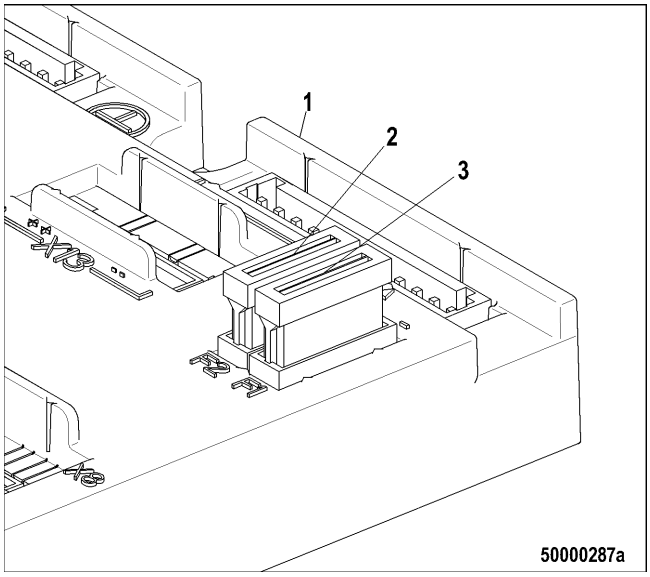
- Engine is shut down.
- Operating voltage is not applied.

Spare parts

Designation / Use	Part No.	Qty.
Fuse 15 A		

Locating a fuse

1. Pinpoint the appropriate fuse.
2. Grasp the faulty fuse between finger and thumb and pull it out.



1 SAM
2 F2 for SAM supply —
3 F1 for SAM supply +

Inserting a new fuse

1. Place the new fuse carefully on the socket.
2. Press the fuse into the socket with one finger as far as it will go.

Installation and Initial Operation

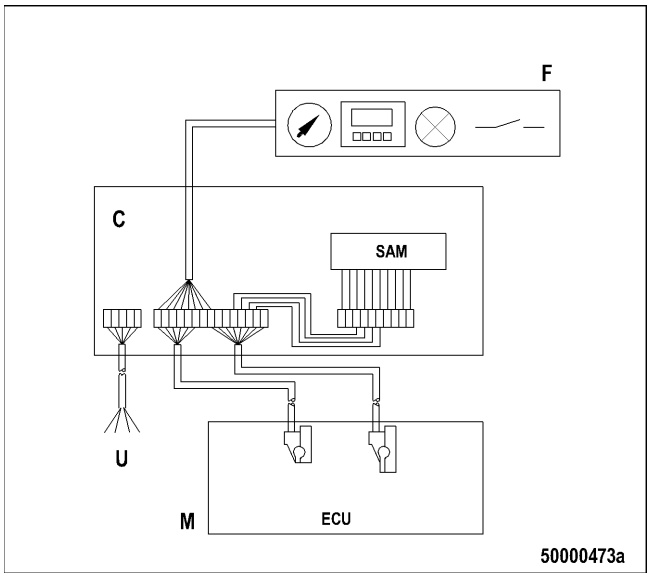
7 Mechanical Installation

7.1 Routing cables between the installation locations

Preconditions

- Cable openings exist.
- Devices are not yet installed.

Cables between installation locations



Designation	Description	Comments
M	Engine	Installation location for engine governor.
C	Switchgear cabinet (OEM)	Installation location for terminal blocks (OEM and SAM).
F	Operator console, possibly also third-party system with controller	Installation location for all control units, controls and indicators.
SAM	Module	
U	Power supply	Cable is shipyard's supply.

1. Route both cables between engine governor (engine-mounted) and terminal block in switchgear cabinet (OEM).
2. Route cables (alarm lamps, instruments, controls, display, if applicable) between terminal block in switchgear cabinet (OEM) and user interface.
3. Route cables between terminal blocks and power supply.
4. If applicable, route further plant-specific cables between SAM and corresponding devices/assemblies (depending on application) in accordance with diagram.
5. If necessary (application-specific), route CAN bus cables between terminal block in switchgear cabinet (OEM) and third-party system.

7.2 SAM – Installation

Preconditions

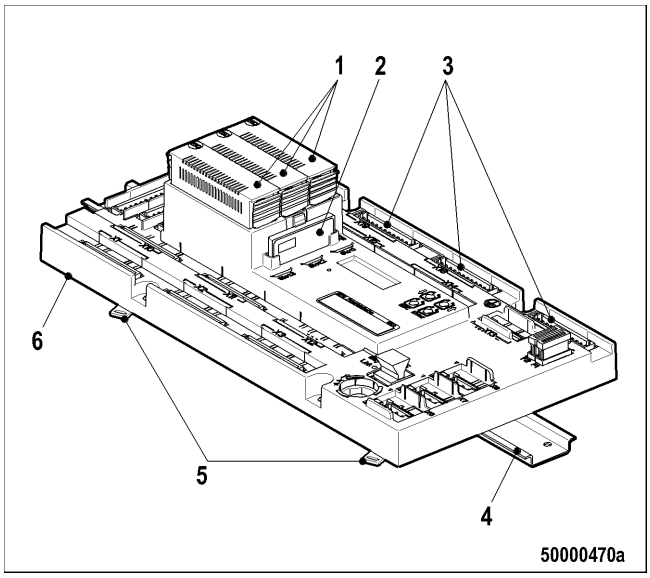
- Operating voltage is not applied.
- Switchgear cabinet with grounded horizontal top-hat rail available.

Selecting the installation location

1. Install in a switchgear cabinet (OEM) with horizontal top-hat rails. Maintain adequate distance to neighbouring top-hat rails. Furthermore, the terminal blocks to which the signal cables are connected should be in the immediate vicinity.
2. Check that draw-out clearances are observed at the front.
3. Check that the covers/doors of the switchgear cabinet can also still be closed once SAM has been installed. There must be sufficient space between the door/flap of the switchgear cabinet and the cassettes (1) of the SAM (6). Ensure that cables or assemblies installed in the flap/door do not exert pressure on the various assemblies of the SAM (CF board (2), plug connectors (3)).

Installing SAM

1. Slide the two lugs (5) on SAM (6) to the left stop.
   Result: The lock is released.
2. Clip SAM (6) onto the top-hat rail (4) from top to bottom (inscription legible).
3. Slide the two lugs to the right stop.
   Result: The lock is engaged and grounding is established via the top-hat rail.



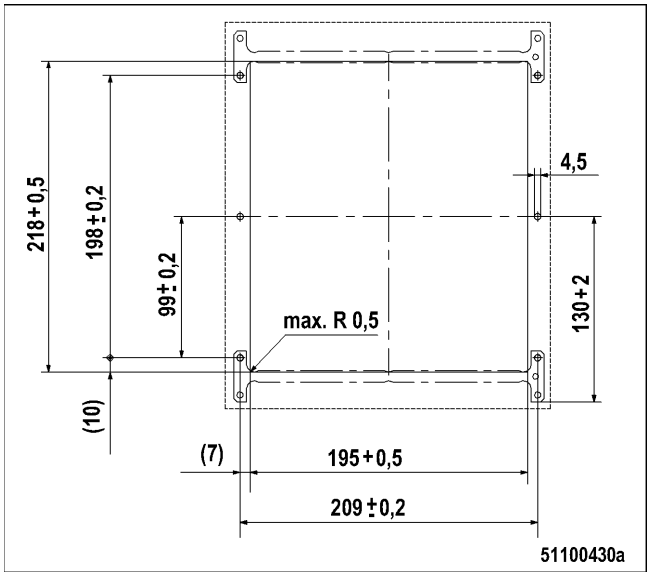
7.3 DIS – Installation

Preconditions

- Ensure that the seating surface (broken line in figure below) of 230 mm x 245 mm is level to ensure tight sealing between command unit and console surface. This surface may also have to be sealed with silicone.
- Select an installation location in the console which offers adequate space for the connectors at the back of the display.

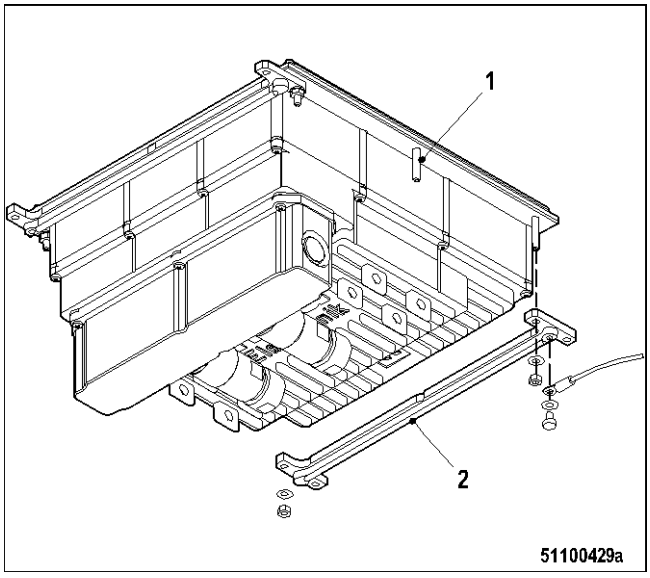
Making bores and installation opening

1. Mark out the six bores and the installation opening for the display at the appropriate place on the control stand or console in accordance with the drilling and cutout pattern. The tolerances for the spaces between the mounting bores are specified in the drilling pattern.
2. Make 5 mm bores with a drill.
3. Cut out the opening with a jigsaw.



Installing display

1. Insert the display into the installation opening from the top.
2. Screw a nut with a plain washer and a spring washer onto the two stay bolts (1) in the middle.
3. Tighten the nuts by hand.
4. Tighten the nuts. Ensure that the display is aligned straight in so doing.
5. Fit a bracket (2) over each of the stay bolts on both sides of the display one after the other.
6. Screw on nuts with spring washers and tighten by hand.
7. Tighten the nuts evenly with a socket wrench when the brackets touch the underside of the console surface.



Fitting grounding cable

1. Route a cable with a cross-section of at least 2.5 mm^2 from each display to the grounding point.
2. Fit a cable ring (diameter 3 mm) on the device end.
3. Secure the cable ring to one of the brackets with a screw.
4. Secure the grounding cable such as to establish an electrical connection at the common grounding point (specifics vary from case to case).

8 Electrical Installation

8.1 Electrical installation

Information about electrical installation of the plant

General information

The information and proposals for power cables, supply lines and control lines listed below cannot claim completeness, rather they are intended as a guide to facilitate the estimation of cabling and control line requirements.

Order-specific circuit and cabling diagrams shall apply.

Cabling of a diesel-driven three-phase generator can be divided into two groups:

- Lines supplying consumers.
- Control section for starter, auxiliary drives, genset operational and fault messages.

In particular VDE specifications 0298, 0100, 0101, 0271 and 250 shall to power cable selection.

Generally PVC-isolated NYY/H07RNF-O cables shall be used for low-voltage generators and NYSY-2XSY cables for high-voltage generators.

Ölflex cables shall be used for gensets on double resilient mountings.

The tables below show admissible continuous loading for synthetically-isolated single and multiple-core cables depending on ambient temperature as per VDE 0298 and 0100, suggested cables depending on genset power, cross-sections for starting cables and a selection of possible control lines for one or more gensets.

When choosing cables ensure that extremely flexible ones are used in order to absorb vibration from the genset. Never use magnetic cable sealing ends. Covers should be made of nonmagnetic metal or plastic.

Never route control lines directly next to power cables.

Cable clamps must be used for strain relief in the cable ducts under the switchgear.

Never route extra-low voltage and low voltage in the same cable.

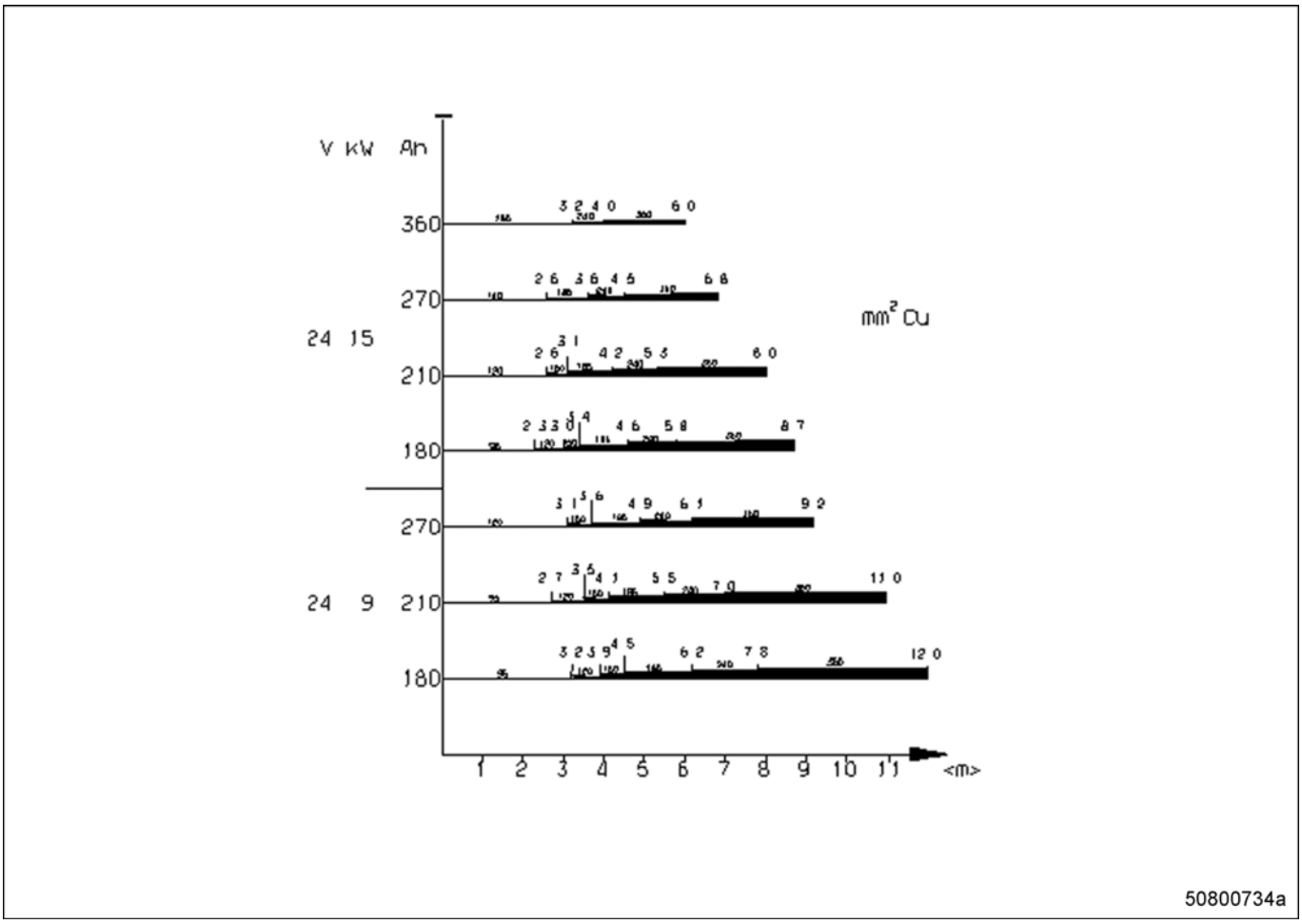
Install an emergency torch and an emergency stop button in the room, preferably next to the emergency exit, when designing the plant as per VDE 0108.

Cable cross-sections for connections between starter batteries and starter

The length of the return line must not exceed that of the supply line (same cross-section).

The required cross-section may have to be realized by means of parallel cabling for satisfactory connection at the starter and the battery (size of terminal rings).

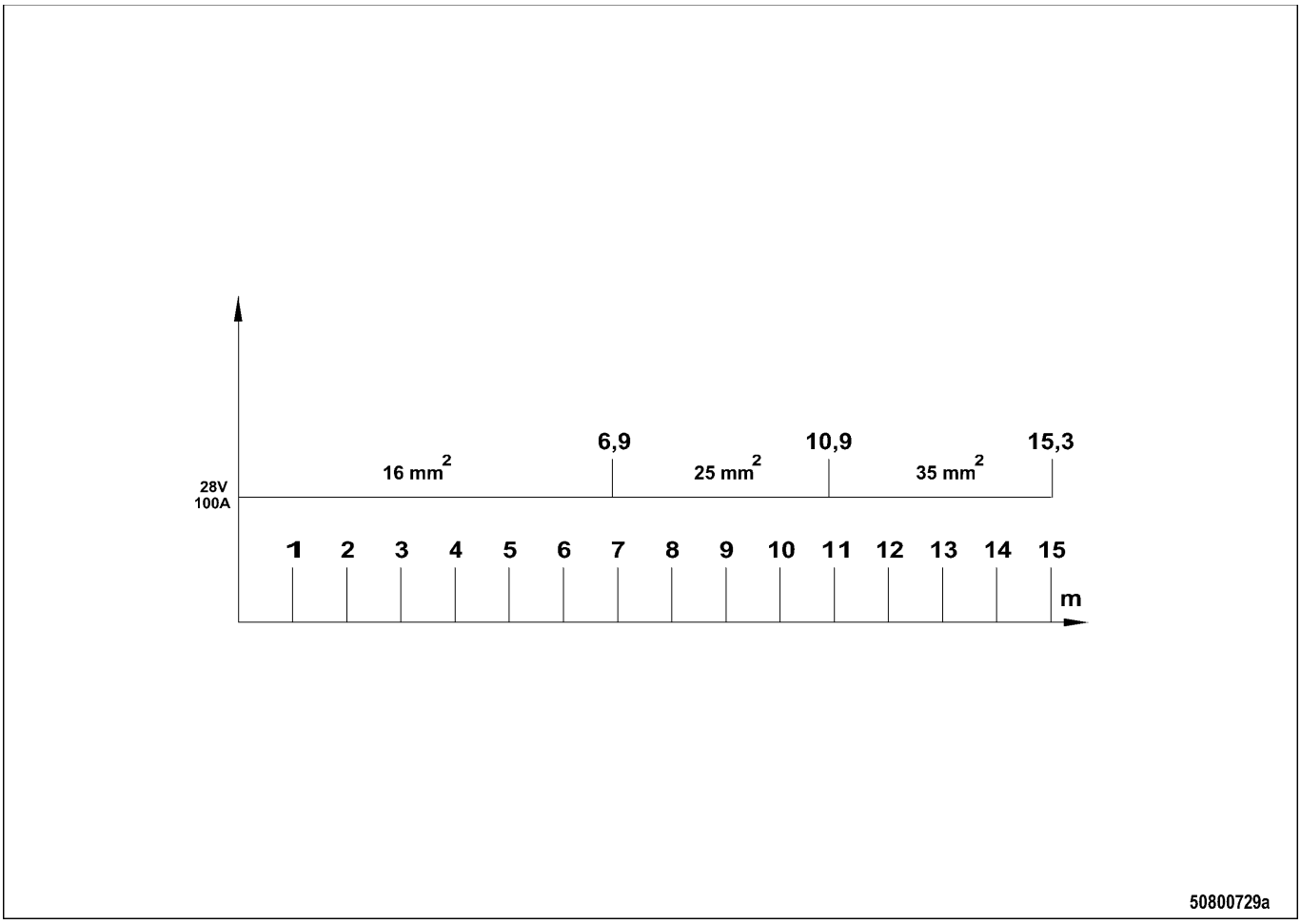
The cross-section of the starter line must be such that voltage drop does not exceed 8 % of the rated battery voltage.



Distance applies to one line (supply or return line)

Cable cross-sections between battery-charging generator and battery (option)

Battery-charging generator



The cable cross-section depends on the rated voltage (V) and the maximum current (A) of the battery-charging generator and the cable length (L) of supply and return line. Maximum admissible voltage drop (UVE) = 0.8 Volt

A= p I L max/UVE = ...mm^2; p for CU = 0.0183 Ohm mm^2/m

Proposals for type NYY genset power cables as a function of genset power for U = 400 V, ambient temperature up to 30 degrees excluding routing factors.

Routing: Distance from walls, floor or ceiling at least 2 cm, horizontal distance between neighboring cables at least 1x cable diameter. A distance of 2x cable bundle diameter must be observed when routing triangular bundled single-core cables. Protect from radiated heat.

kVA	I_{Rated} in Ampere	Number of cables multiple-core cable	Transmittable current in A	Number of cables single-core cable	Transmittable current in A
400	577	2x(3x150/70)	648	2x(3x1x120)+1x120	628
500	721	3x(3x120/70)	846	2x(3x1x185)+1x185	824
600	866	3x(3x150/70)	972	3x(3x1x120)+1x95 4x(3x1x95)+2x95	942 1084
700	1010	4x(3x120/70)	1128	4x(3x1x95)+2x95 3x(3x1x150)+2x120	1084 1083
800	1154	4x(3x150/70) 3x(3x240/120)	1296 1308	3x(3x1x185)+2x150 4x(3x1x150)+2x150	1236 1444
900	1299	4x(3x185/95)	1484	3x(3x1x240)+2x185 4x(3x1x185)+2x185	1452 1648
1000	1443	4x(3x185/95) 5x(3x150/70)	1484 1620	3x(3x1x240)+2x185 4x(3x1x185)+2x185	1452 1648
1100	1587	5x(3x150/70) 4x(3x240/120)	1620 1744	4x(3x1x240)+2x240 6x(3x1x120)+3x120	1936 1884
1200	1732	5x(3x185/95)	1855	4x(3x1x240)+2x240 5x(3x1x185)+3x150	1936
1300	1876	6x(3x150/70) 5x(3x240/120)	1944 2180	5x(3x1x185)+3x150	2060
1400	2020	5x(3x240/120) 6x(3x185/95)	2180 2226	7x(3x1x120)+4x120 6x(3x1x150)+3x150	2198 2166
1500	2165	6x(3x185/95) 7x(3x150/70)	2226 2268	7x(3x1x120)+4x120 6x(3x1x185)+3x185	2198 2472
1600	2309	8x(3x150/70)	2592	7x(3x1x150)+3x185 8x(3x1x120)+4x120	2527 2512
1800	2598	10x(3x120/90) 8x(3x185/95)	2820 2968	7x(3x1x195)+4x185 8x(3x1x150)+4x150 6x(3x1x240)+3x240	2884 2888 2904
2000	2886	8x(3x185/95) 7x(3x240/120) 10x(3x150/70)	2968 3052 3240	8x(3x1x185)+4x185 9x(3x1x150)+5x150 8x(3x1x150)+4x150 6x(3x1x240)+3x240	3296 3249 2888 2904

Note: Neutral conductor cross-sections specified apply to three-phase current loading only without harmonic loading by frequency rectifiers etc. The cross-section must be increased appropriately as required.

Listed cables are noncommittal proposals intended as an aid to application engineering.
Execution is governed by DIN VDE 0298-4.

Conversion factors for increased numbers of multiple-conductor cables or lines in trays and racks. Excerpt from DIN VDE 0298-4 table 22:

1		2	3	4	5	6	7	8
Routing arrangement		Number of trays or racks	Number of multiple-conductor cables or lines					
			1	2	3	4	6	9
			Conversion factors					
Unperforated cable trays	With contact	1	0.97	0.84	0.78	0.75	0.71	0.68
		2	0.97	0.83	0.76	0.72	0.68	0.63
		3	0.97	0.82	0.75	0.71	0.66	0.61
		6	0.97	0.81	0.73	0.69	0.63	0.58

Conversion factors for increased numbers of single-conductor cables or lines in trays and racks. Excerpt from DIN VDE 0298-4 table 23:

1		2	3	4	5	6
Routing arrangement		Number of trays or racks	Number of three-pole current circuits with single-conductor cables or lines			To be used as a multiplier for the rated value of:
			1	2	3	
			Conversion factors			
Perforated cable trays	With contact	1	0.98	0.91	0.87	Three cables or lines in horizontal level arrangement
		2	0.96	0.87	0.81	
		3	0.95	0.85	0.78	
	With contact	1	0.96	0.86	—	Three cables or lines in vertical level arrangement
		2	0.95	0.84	—	

Ambient temperatures must also be taken into consideration when defining cables and lines. Refer to DIN VDE 0298-4, tables 16 to 20 for reduction factors.

Minimum cross-section and number of cores for connections between genset/genset components and the switchgear.

Connection		**Minimum number of cores**	**Min. cross-section (depending on cable length)**	**Comments**
From	**To**			
Starter battery	Starter	2	See table p. 6	Electric start only
Starter battery	Switchgear	2	See fig. p. 7	Starter battery charger
Genset terminal box	Switchgear	2	2.5 mm^2	Coolant preheating
Genset terminal box	Switchgear	2	2.5 mm^2	Preheating thermostat
Genset terminal box	Switchgear	4	2.5 mm^2	Heating preheating

Connection		Minimum number of cores	Min. cross-section (depending on cable length)	Comments
From	To			
Genset terminal box	Switchgear	4	1.5 mm^2	Circulating pump preheating
Engine governor connector X3	Switchgear	System cable 8x2.5+2x0.75 mm^2		Engine management power supply MTU supply 10 m (optionally 15 m or 25 m)
Engine governor connector X1	Switchgear	System cable 21x2x0.5mm^2		Engine management interface cable MTU supply 10 m (optionally 15 m or 25 m)
Fuel cooler	Switchgear	4	1.5 mm^2	BR 4000 only
Generator cabling				
Generator terminal block	Switchgear	2	2.5 mm^2	Exciter boosting
Generator terminal block	Switchgear	4	2.5 mm^2	Rapid de-excitation
Generator terminal block	Switchgear	2	2.5 mm^2	Static on/off
Generator terminal block	Switchgear	3+shield	1.5 mm^2	Voltage setpoint adjuster
Generator terminal block	Switchgear	3	1.5 mm^2	Anti-condensation heating
Generator terminal block	Switchgear	4	2.5 mm^2	Per current transformer core
Generator terminal block	Switchgear	4	1.5 mm^2	Per winding temperature monitor
For heat exchanger cooling				
Coolant pump	Switchgear	4	2.5 mm^2 - 10 mm^2	Depending on pump power
Expansion Tank	Switchgear	2	1.5 mm^2	Low coolant
Heat exchanger	Switchgear	4	2.5 mm^2 - 10 mm^2	Depending on distance and fan motor power
For air start				
Genset terminal box	Switchgear	2	2.5 mm^2	Starting-air valve
Compressor	Switchgear	2	1.5 mm^2	Pressure monitor (on/off)
Compressor	Switchgear	2	1.5 mm^2	Pressure monitor (alarm)

Connection		Minimum number of cores	Min. cross-section (depending on cable length)	Comments
From	To			
Compressor	Switchgear	4	2.5 mm^2 - 10 mm^2	Compressor power supply, depending on power
Compressor	Switchgear	3	1.5 mm^2	Drain valve
For fan cooler with electric motor				
Fan cooler	Switchgear	4	Depending on power and number of motors	
Expansion tank	Switchgear	3	1.0 mm^2	MTU supply 15 m (optionally 25 m)
Air intake louvers	Switchgear	3	1.5 mm^2	Per louver
Air outlet louvers	Switchgear	3	1.5 mm^2	Per louver

Minimum cross-section and number of cores for connections between genset and the switchgear.

Connection		Minimum number of cores	Min. cross-section (depending on cable length)	Comments
From	To			
Fuel supply				
Day tank	Switchgear	4	1.5 mm^2	Pump on/off; low
Day tank	Switchgear	5	1.5 mm^2	For leakage monitoring only
Fuel pump	Switchgear	4	1.5 mm^2	Pump power supply
Monitor	Switchgear	5	1.5 mm^2	For Flexwell monitoring
Switchgear power section for auxiliary drives				
LV distribution	Switchgear	4	1.5 mm^2	
LV distribution	Switchgear	4	1.5 mm^2	MTU supply 15 m (optionally 25 m)
LV distribution	Switchgear	8	1.5 mm^2	Per louver
LV distribution	Switchgear	4	10 mm^2 - 50 mm^2	Per louver
Miscellaneous				
Emergency stop button	Switchgear	2	1.5 mm^2	If necessary in room
Leakage monitoring	Switchgear	5	1.5 mm^2	Per oil/water warning device

Special characteristics as per DIN VDE 0108

Observe the following aspects when executing a plant as per DIN VDE 0108:

- Cables described on page 5 may be used for cabling within one fire section. Only use special plugs and (metal) mounting clamps installed as per manufacturers' instructions to fulfill the required fire rating.

- Observe the following aspects when routing cables from on fire section to another: Cables and lines must be protected from fire to ensure that functionality is maintained when the emergency power genset supplies mandatory safety equipment prescribed by the building supervisory authority.
- Functionality must be maintained for
  - 30 minutes for
    - Fire alarm systems
    - Alarm signaling and information systems for visitors and employees
    - Safety lighting and other auxiliary lighting excepting branch circuits
    - Elevator systems with evacuation circuits
  - 90 minutes for
    - Water pressure booster systems for firefighting water supply (sprinkler systems)
    - Ventilation systems for emergency stairwells, enclosed stairwells
    - Smoke and heat extractor systems
    - Fire department elevators and the associated wells and machinery rooms
- When installing use only certified safety cables with the appropriate supporting appliances and fixing materials.

Engine governor integration in an external emergency power control system

The standard scope of delivery for the MTU engine is 1 SAM and 2 connecting cables:
- W005: Operating voltage, ignition (8x2.5mm^2+2x0.75mm^2)
- W001: CAN, I/O signals (21x2x0.5mm^2)

The engine governor should be protected by a 25 A automatic cutout via cable W005 connector X3. The SAM and the DC/DC converter should be connected via a separate fuse with 20 A or 6 A. Refer to the MTU wiring diagram.

Note: The DC/DC converter is only required when display instruments from the option price list are ordered.

All control, display and communication signals are in interface cable W001 engine governor connector X1. CAN 1 is connected to the SAM, the MAU and a DIS 10 display if applicable via conductors 1, 2, 3, CAN 2 is connected similarly via conductors 4, 5, 6. A 121 ohm CAN bus terminal resistor must be installed for CAN 1 and CAN 2 respectively at the last bus station. The terminal resistors for the engine governor are already fitted in cable W001 in connector X1.

Digital inputs DI 1 to DI 8 Note: Ensure correct polarity.	
DI 1 Stop input	This input is inverted (line disruption failsafe), i.e. 24 VDC must always be applied to BE 1 for engine operation.
DI 2 Selection speed droop 1 / speed droop 2	This makes it possible to switch the speed droop with the engine running/at a standstill. The default speed droop 1 setting in the engine governor is 4 % and speed droop 2 is 0 %.
DI 3 Fixed speed	Activating this input sets the speed to a certain value.
DI 4 Alarm reset	Stored alarm is reset when 24 V is applied to the DI 4 input.
DI 5 Speed Up	Binary input for speed up
DI 6 Speed down	Binary input for speed down

DI 7 Engine start	The start command is transmitted to the engine governor via this input. See functional description for details of starting sequence.
DI 8 SISY override	Actuating DI 8 suppresses all messages leading to shutdown in VDS operation, e.g. lube oil pressure too low or coolant temperature too high. The corresponding outputs such as Combined alarm red are still set.

Digital outputs TOP 1 to TOP 4 Note: Observe max. output current-carrying capacity.	
TOP 1 Combined alarm yellow	All warning messages (Limit1) are indicated here as a combined alarm.
TOP 2 Combined alarm red	All shutdown messages (Limit2) are indicated here as a combined alarm.
TOP 3 SS P-Lube oil	Shutdown, lube oil pressure too low.
TOP 4 Starter on/engine running/speed window	Configurable: Control signal for the starter Engine speed above 300 rpm Engine running in a defined speed range

Analog inputs:	
AI 1 = 0 - 10 V or 4 - 20 mA	Different analog speed setpoints may be activated for the engine governor. Connection is shown in the diagram. Characteristic curve 71 50 Hz 0 - 10 V is activated by default in the engine governor. However, the parameters of this characteristic curve can be reprogrammed if speed setpoint adjustment by 4 - 20 mA is desired. The same applies to characteristic curve 72 60 Hz.

8.2 Engine governor signals

General information

This part of the document provides the following information about connection and configuration of the inputs and outputs of the engine governor:

- Channel specification
- Possible channel circuitry (MTU recommendation)
- Parameters which are set with the dialog unit
- Interrelationships of functions in block circuit diagrams

It is assumed that the signals transmitted via cable W001 as per (→ Page 79) are connected to one or more terminal blocks in an OEM switchgear cabinet.

Channel assignment overview

Input/output	Signal
IGI	Emergency stop (via IGI switch-off)
ESI	Not used
DI1	Engine stop
DI2	Speed droop 2
DI3	Fixed speed
DI4	Alarm reset
DI5	Speed increase
DI6	Speed decrease
DI7	Engine start
DI8	Override
AI1	Speed setting current/voltage
AI2	Torque setting
FIP	Speed setting frequency
TOP1	Yellow alarm
TOP2	Red alarm
TOP3	Shutdown due to low lube oil pressure
TOP4	Configurable: “Engine running” or “Speed window”
FO	Not used
AO1	Coolant temperature
AO2	Lube oil pressure
LSI1	Engine coolant
LSI2	Not used
LSI3	Intercooler coolant level
TI1	Coolant temperature

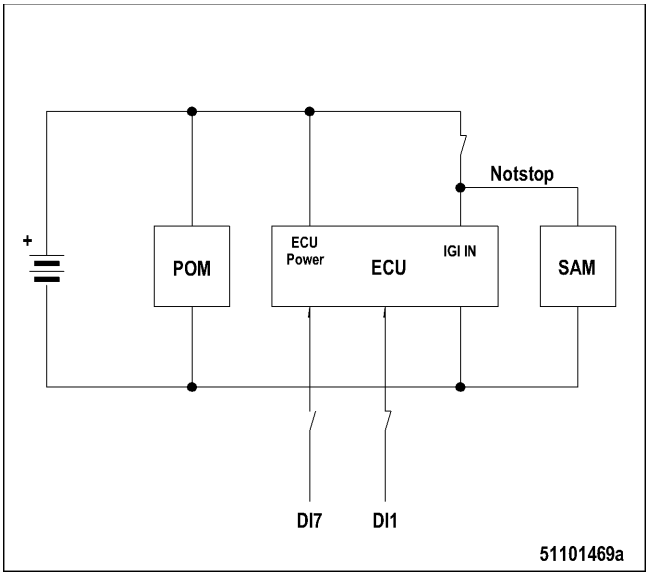
Input/output	Signal
TI2	Charge-air temperature
TI3	Rail fuel temperature
TI4	Not used
TI5	Not used
TI6	Intercooler coolant temperature
TI7	Lube oil temperature
TI8	Not used
TI9	Not used
TI10	Not used
TI11	Not used
TI12	Not used
PI1	Not used
PI2	Not used
PI3	Fuel pressure after filter
PI4	Fuel high pressure
PI5	Lube oil pressure
PI6	Not used
PI7	Charge-air pressure
PI8	Not used
PI9	Not used
PI9	Not used
PI10	Not used
PI11	Not used
PI12	Not used
PI13	Not used
PI14	Not used
PTI1	Not used
PFI1	Not used
PFI2	Not used
PFI3	Not used
FI1	Not used
FI2	Not used
FI3	Not used

Input/output	Signal
FI4	Not used
ASI1	Crankshaft speed
ASI2	Camshaft speed
TO1	Not used
TO2	Not used
TO3	Not used
TO4	Not used
PWM_CM1	Common Rail pump
PWM_CM2	Not used
PWM1	Not used
PWM2	Not used
IO1...20	Injectors

Supply and input ignition IGI/emergency stop

The supply is connected at connector X3.

- Schematic circuit diagram



POM Power Output Module (available as of 12/06)
ECU Engine governor ADEC
IGI Input “Ignition”
SAM System Automation Module, device interfacing with OEM

The power supply must meet the following requirements:

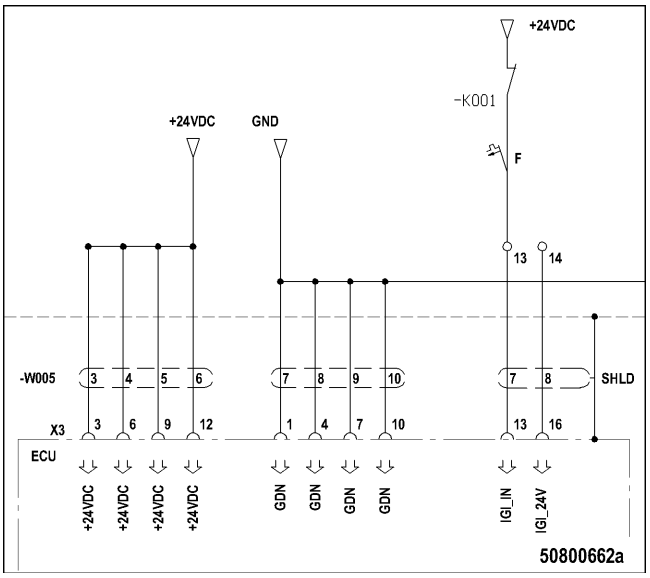
- STANAG 1008
- EN 50155
- Power consumption max. 17 A (without load at SAM)
- Control by:
  - +24 VDC supply, $+U_{bat}$
- Channel specification IGI (ignition)
  - Voltage: 0 ... 32 VDC
  - Current: Approx. 4.8 mA at 24 VDC

- Electrical isolation: No
- Pin not connected or U_{in} < 4 V: Ignition off; U_{in} > 11 V: Ignition on

• Required settings:
- None

Input IGI IN must always be wired up.

Connection:



Ignition input IGI

Input IGI switches on the engine governor. Switching off input IGI leads to engine stop by cutting out the injectors. The engine governor goes into “Sleep Mode” after a certain time.

Emergency stop via IGI

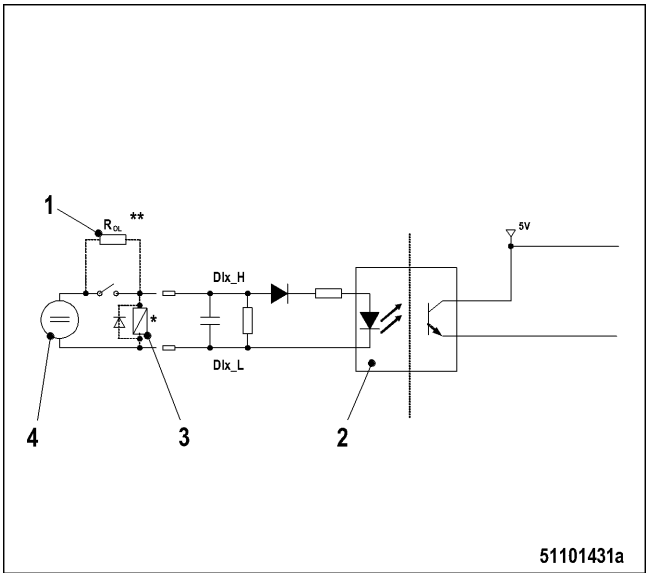
A special feature of input IGI is that it may be used as an emergency stop input. In this case an NC contact (K001) is connected upstream of the input. If the level at the input falls to LOW (below 4 V), the output amplifier for the injectors is switched off by the hardware. The engine stops immediately.

Emergency stop input ESI

This input is not used in genset applications. The channel offers a further possibility for tripping an emergency stop. In genset applications this input should not be connected or applied to GND.

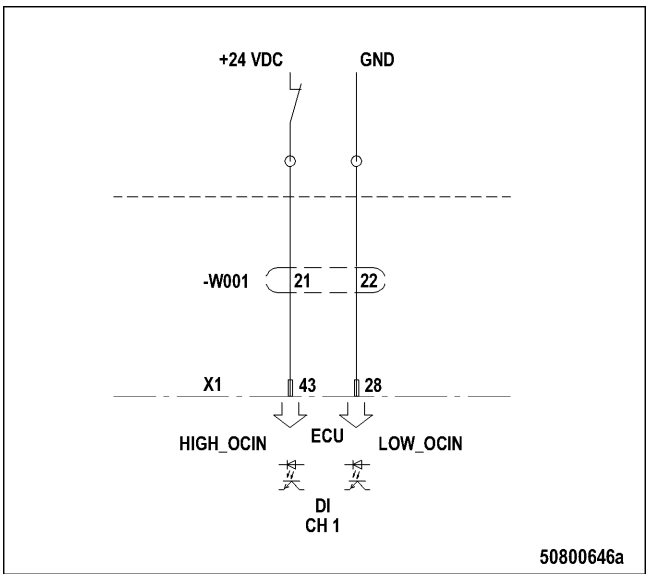
Binary inputs DI 1 ... 8

- Channel specification
  - Switches: External voltage or +U_{bat}
  - Input voltage 0 ... 32 VDC
  - Low detection: U_{in} < 4 V
  - High detection: U_{in} > 8 V
  - Input impedance: 12.1 kΩ
  - Input filter: f < 19 Hz
  - Electrical isolation: 50 VDC
  - Cable damage monitoring: Current monitoring with R_{OL} = 33 kΩ ± 10 %, see figure
- Required settings:
  - Open line (cable damage monitoring active)
  - Logic: “Active High” or “Active Low”
- Schematic circuit diagram



1 Resistor for cable damage monitoring
2 Optocoupler
3 Inductive load
4 Voltage source
* A free-wheeling diode must be provided for inductive loads.
** Cable damage monitoring is only possible when no load is connected parallel to input DI.

DI 1 – Engine stop

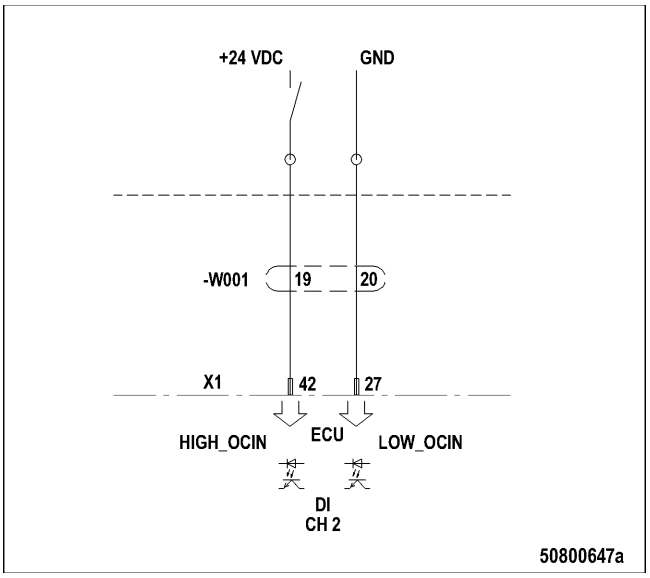


The engine stop signal is activated as soon as this input is switched off. The signal is stored until the engine has come to a standstill. The input must be connected to 24 V to allow the engine to be started. This is for reasons of safety in order to stop the engine in case of cabling damage at stop input DI 1.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Cable damage monitoring DI 1: 2.9902.001
- Logic DI 1: 2.9910.015 (Preset: Logic 0, i.e. the input must be supplied with 24 V in order to operate the engine; the 24 V supply must be interrupted to stop the engine)
- Stop saved: 2.7001.009

DI 2 – Speed droop 2



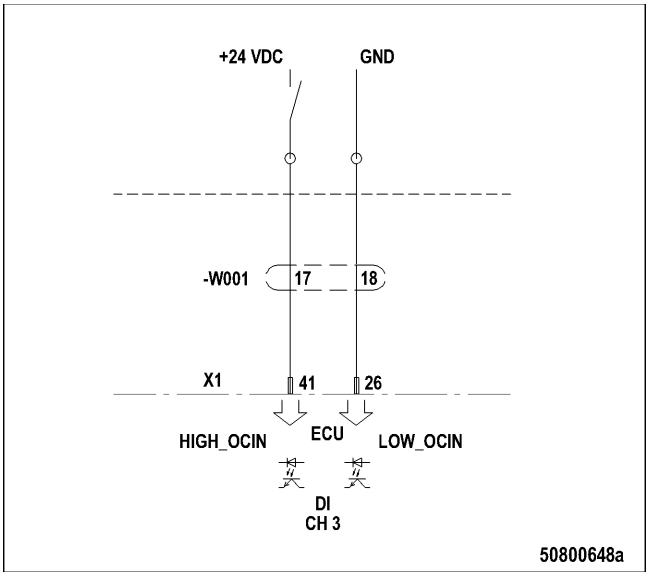
Two different speed droop settings can be selected at the engine governor. Which speed droop should be active depends on whether the genset is operated in “isolation” (i.e. the genset runs alone), or in conjunction with other gensets in a parallel network supplying a common busbar.

Speed droop is selected vial input DI 2.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Cable damage monitoring DI 2: 2.9902.011
- Logic DI 2: 2.9910.025
- Enable speed droop switching: 2.1060.217
- Switching at fixed speed: 2.1060.214
- Speed droop
  - Speed droop 1 (4 %): 2.1060.202
  - Speed droop 2 (0 %): 2.1060.204
- Speed on switching:
  - From 1 to 2: 2.1060.215
  - From 2 to 1: 2.1060.216

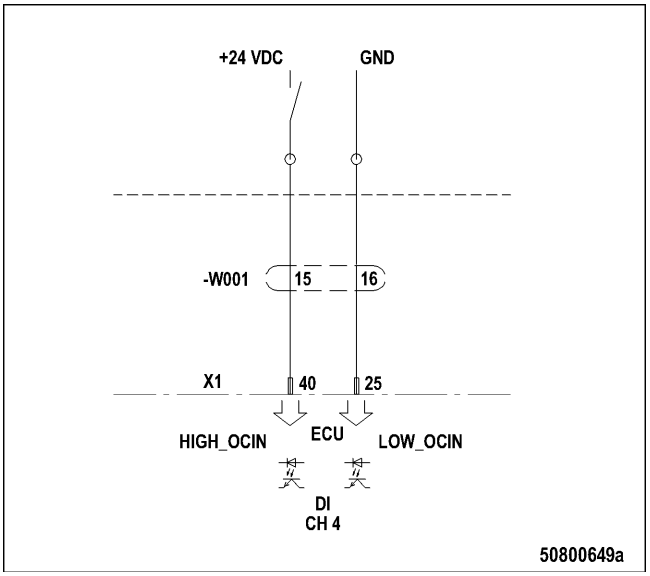
DI 3 – Fixed speed



The nominal speed is reduced to idling speed when this input is switched on.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):
- Cable damage monitoring DI 3: 2.9902.021
- Logic DI 3: 2.9910.035

DI 4 – Alarm reset

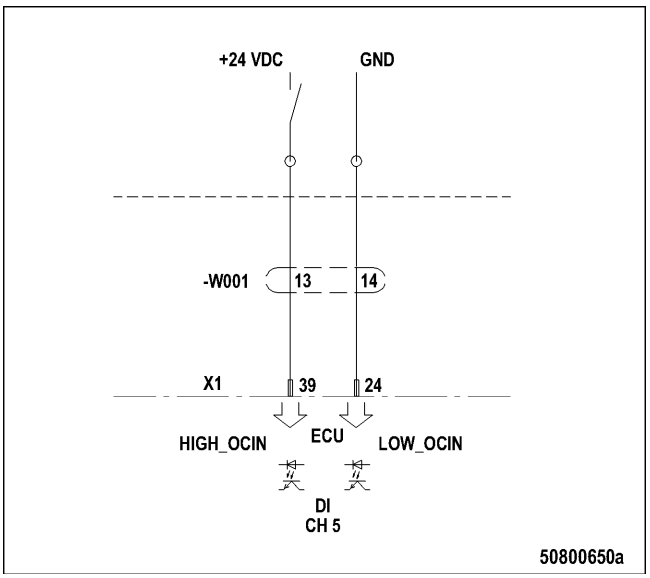


Stored alarms are reset by activating this input.

Alarms leading to a red alarm are saved. Signaling via the corresponding binary output remains unchanged until canceled via the “Alarm reset” input.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):
- Cable damage monitoring DI 4: 2.9902.031
- Logic DI 4: 2.9910.045

DI 5 – Speed “Up”

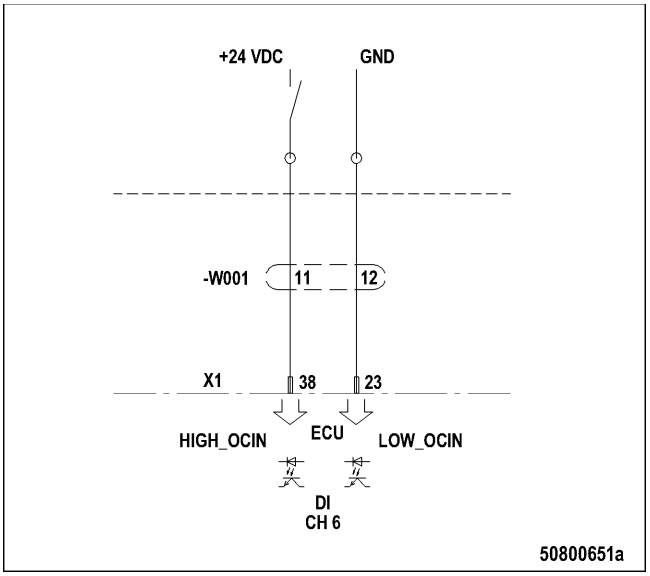


The speed is increased by activating input DI 5 providing that speed setting is adjusted via pushbutton signals. Briefly activating the input changes the speed by 1 rpm. Longer activation changes the speed in accordance with a speed ramp.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):
- Cable damage monitoring DI 5: 2.9902.041

- Logic DI 5: 2.9910.055
- Speed ramp:
  - Speed ramp 1 up: 2.1060.122
  - Speed ramp 2 up: 2.1060.123
  - Speed ramp 3 up: 2.1060.124
- Speed ramp switching
  - From 1 to 2: 2.1060.128
  - From 2 to 3: 2.1060.129

DI 6 – Speed “Down”

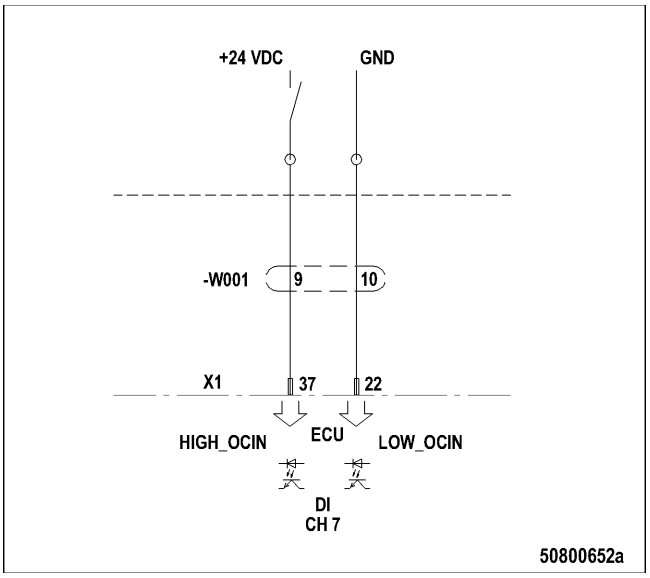


The speed is decreased by activating input DI 6 providing that speed setting is adjusted via pushbutton signals. Briefly activating the input changes the speed by 1 rpm. Longer activation changes the speed in accordance with a speed ramp.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Cable damage monitoring DI 6: 2.9902.051
- Logic DI 6: 2.9910.065
- Speed ramp:
  - Speed ramp 1 down: 2.1060.125
  - Speed ramp 2 down: 2.1060.126
  - Speed ramp 3 down: 2.1060.127
- Speed ramp switching
  - From 1 to 2: 2.1060.128
  - From 2 to 3: 2.1060.129

DI 7 – Engine start

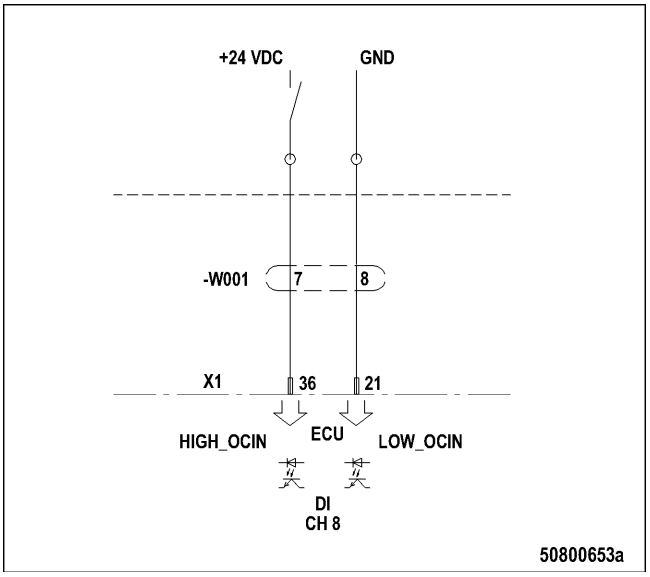


Activating this input initiates the automatic engine start sequence.

Parameters (information about settings and values are available by actuating key combination "Ctrl+Alt+P" in the "DiaSys" program):

- Cable damage monitoring DI 7: 2.9902.061
- Logic DI 7: 2.9910.075

DI 8 – Override



The "Override" function is used to bypass safety features which would normally lead to automatic engine shutdown in case of violation, or to disable start interlocks. Internal performance maps cannot be bypassed.

Operating states which would normally lead to engine shutdown are ignored when the "Override" function is switched on (exception: Overspeed always leads to engine shutdown).

Parameters (information about settings and values are available by actuating key combination "Ctrl+Alt+P" in the "DiaSys" program):

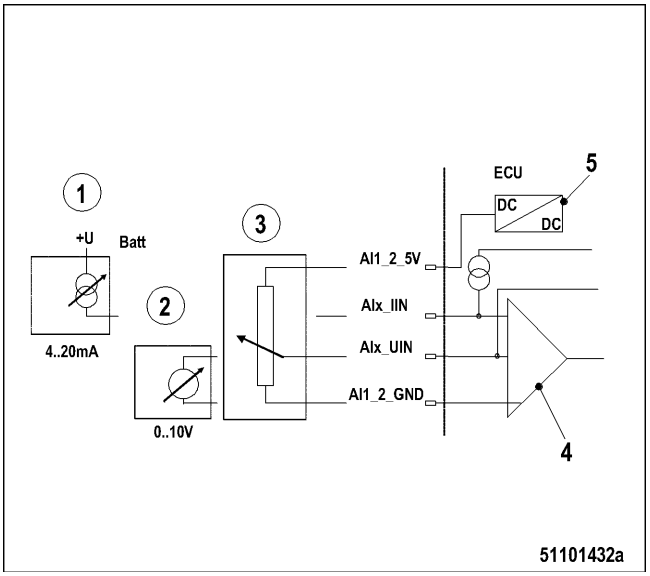
- Cable damage monitoring DI 1: 2.9902.071
- Logic DI 1: 2.9910.085

Analog inputs AI 1 ... 2

- Channel specification
  - Sensors: Current sources, voltage sources or potentiometers (impedance value 1 ... 5 kΩ)

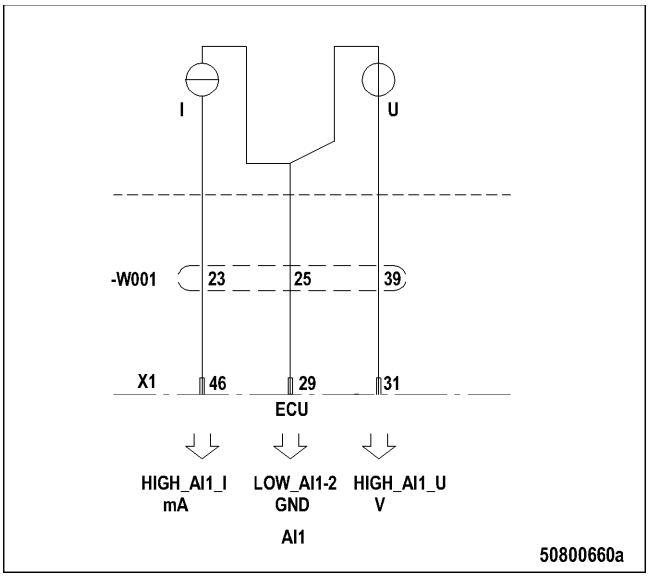
- Sensor supply: 5 V ± 3 %, max. 25 mA (AI 1_2_5V)
- Voltage input: 0 ... 10 VDC, input impedance 100 kΩ, filter 200 Hz
- Current: 0 ... 20 mA nom., 0 ... 25 mA max.; Load 4.5 V at 20 mA
- Electrical isolation: 50 VDC
- Fault detection voltage input: U > 10 V
- Fault detection current input: I < 4 mA, I > 20 mA
- Power supply protection: Short circuit to GND, overvoltage 36 VDC

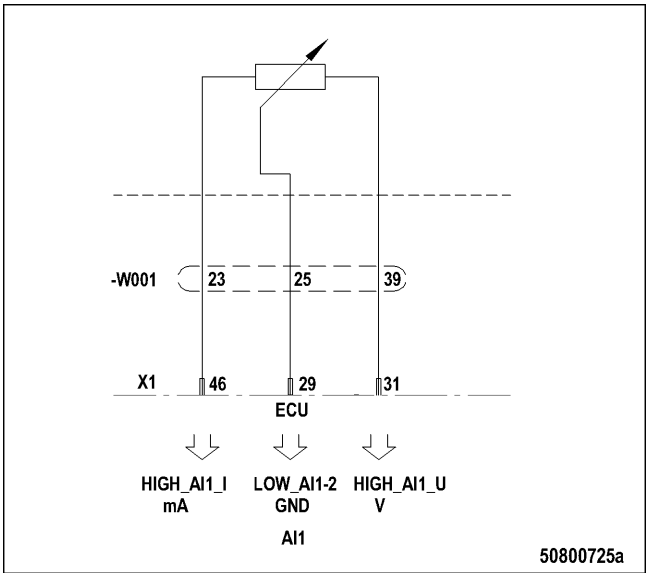
- Required settings:
  - Configuration voltage input/current input via connection
  - Scaling
  - Function
- Schematic circuit diagram



1 Control via current source
2 Control via voltage source
3 Control via resistor
4 Input amplifier
5 Supply voltage for potentiometer connection

AI 1 – Speed setting



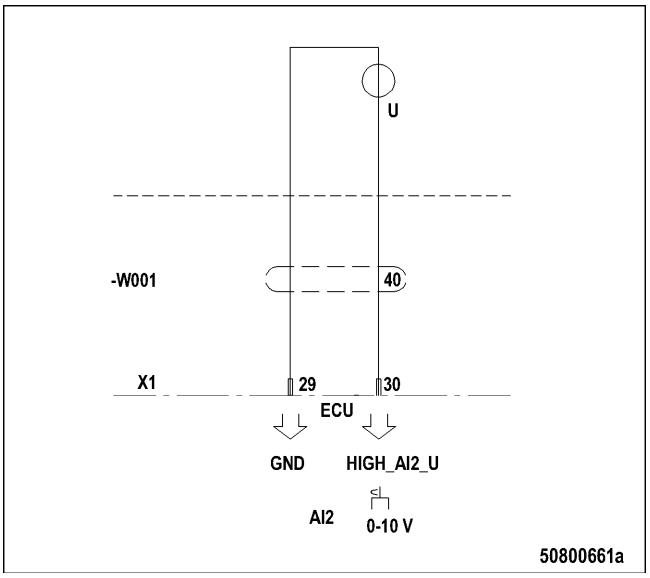


The engine speed can be set between idling speed and nominal speed (maximum speed). This is effected via an analog signal (voltage U or current I, figure shows both variants and their respective connections, however only one variant may be connected). This analog signal allows the speed to be set at a certain value whereby e.g. 4 mA/0 V corresponds to idling speed and 20 mA/10 V to rated speed. Sudden changes in speed are executed along a programmable speed ramp (acceleration ramp or deceleration ramp).

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Configuration: 2.9900.001
- Curves:
  - Voltage: 2.0401.010
  - Current: 2.0401.012
  - Frequency: 2.0401.014
- Speed setting window “Up” ramp: 2.1060.130
- Speed setting window “Down” ramp: 2.1060.131

AI 2 – Torque setting



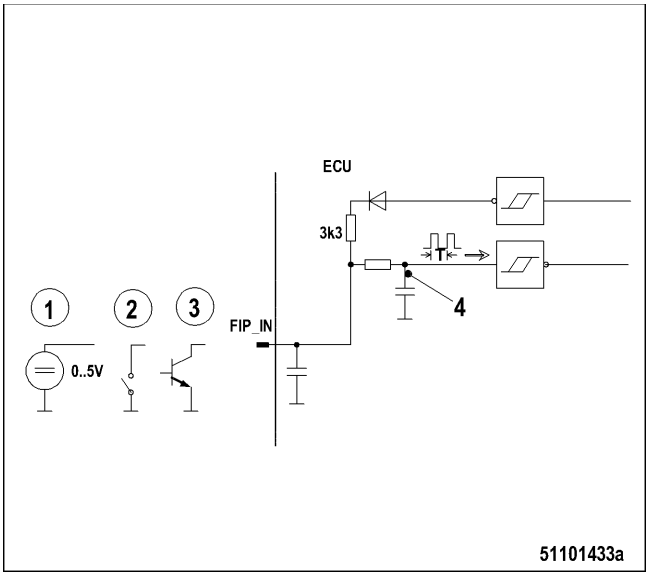
This signal corresponds to the torque setting in torque-controlled plants (input for the feeding governor, see functional description).

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Configuration: 2.9900.011
- Reference value: 2.1010.004

Frequency input FIP

- Channel specification
  - Sensor: 0 ... 5 VDC
  - High/Low hysteresis: High for U_{in} > 2.1 V, Low for U_{in} < 0.7 V
  - Measuring range: 10 ... 500 Hz
  - Pullup resistor: 3.3 kΩ (adjustable)
  - Filter: 14.5 kHz
  - Electrical isolation: None
  - Overvoltage protection: ± 32 VDC
- Required settings:
  - Source
  - Pullup resistor on/off
- Schematic circuit diagram



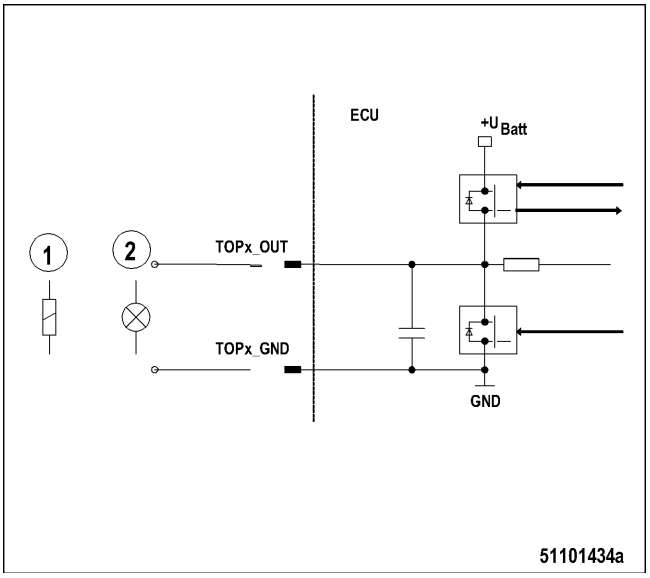
1 Control via voltage source
2 Control via switch/relay
3 Control via transistor switch
4 Filter with f_g = 14.5 kHz

This input may be used optionally for speed setting using a frequency. The engine speed can be set e.g. between idling speed and nominal speed (maximum speed). This frequency input allows speed adjustment. The correlation between frequency and associated speed can be adjusted via a curve.

Parameter:
- Frequency: 2.0401.014

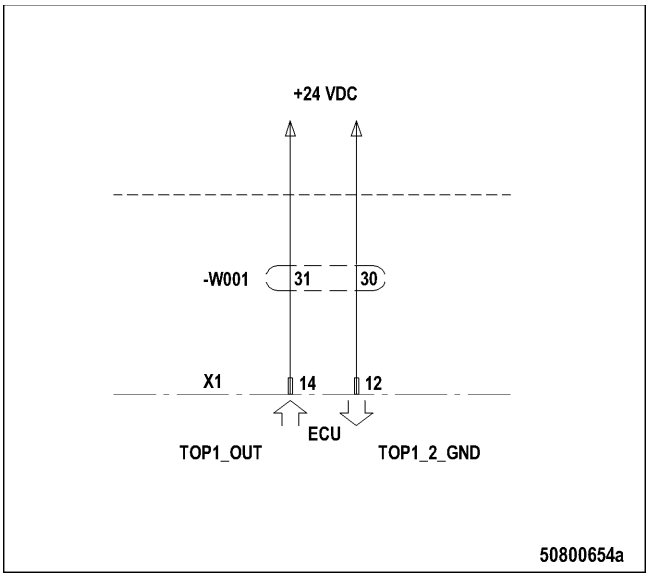
Transistor outputs TOP 1 ... 4

- Control of:
  - Lamps
  - Relays
  - Digital inputs
- Channel specification
  - I_{Load} of an input: 1.5 A at 32 V
  - Sum total output current of TOP 1 ... 4 must not exceed 3 A at 32 V
  - Output voltage without load: Off “Low Switch” approx. 5 V, off “High Switch” approx. 0 V
  - Max. inductivity of load: 140 mH
  - Electrical isolation: None
  - Short-circuit protection: Yes
  - Fault detection: Voltage monitoring
  - Cable damage monitoring: R_L less than 25 kΩ
- Required settings:
  - “Low Switch” or “High Switch”
  - Cable damage monitoring on/off
- Schematic circuit diagram



1 Inductive load
2 Resistive load

TOP 1 – Yellow alarm

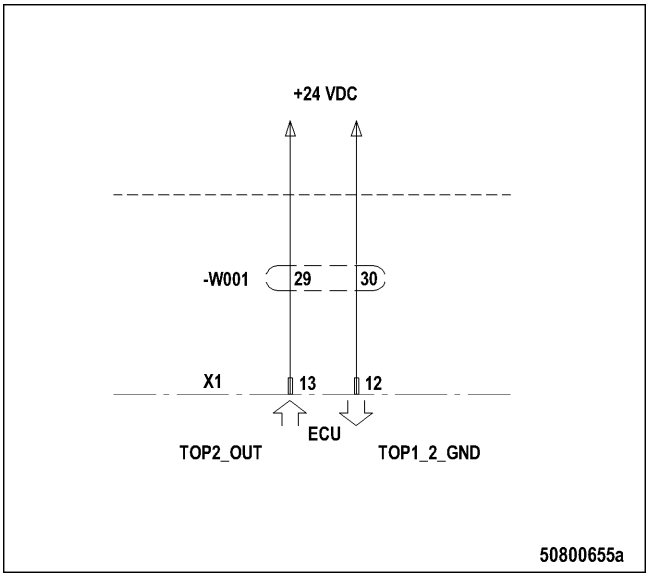


This output is switched on as soon as a yellow alarm (warning) is signaled. The output is briefly switched off and then back on again should another alarm occur.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Active level: 2.1050.005
- “Low Switch” or “High Switch”: 2.1050.010

TOP 2 – Red alarm

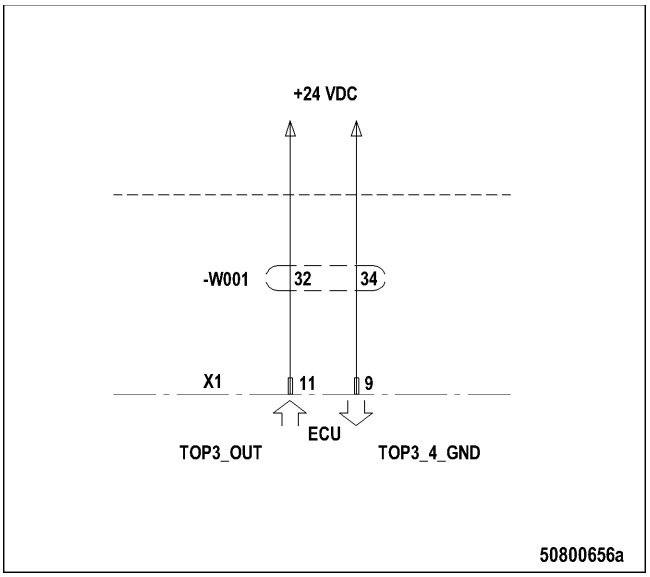


This output is switched on as soon as a red alarm is signaled. The output is briefly switched off and then back on again should another alarm occur.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Active level: 2.1050.006
- “Low Switch” or “High Switch”: 2.1050.011

TOP 3 – Signal “Single-point alarm: Shutdown due to low lube oil pressure”

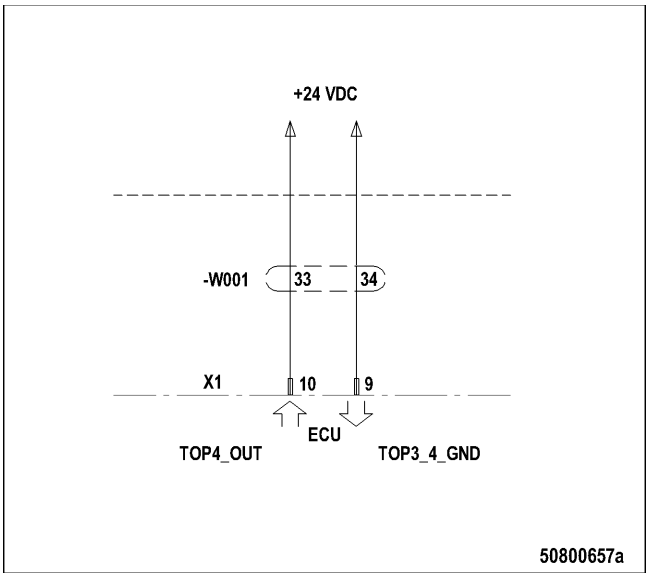


This output is switched on when the engine has been shut down due to violation of the 2nd lube oil low pressure limit value.

Parameters (information about settings and values are available by actuating key combination “Ctrl+Alt+P” in the “DiaSys” program):

- Active level: 2.1050.007
- “Low Switch” or “High Switch”: 2.1050.012

TOP 4 – Starter on/speed window



The function of this output is adjustable:
- Starter on: The output is used to switch on the starter (internal starting sequence only, initialized via DI)
- Speed window: The output is switched on when the engine speed is between two (programmable) speed values (e.g. for engagement/disengagement)

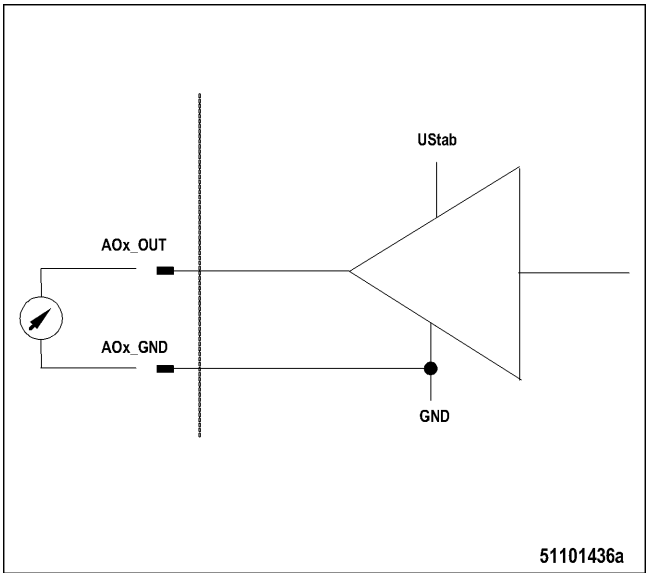
Parameters (information about settings and values are available by actuating key combination "Ctrl+Alt+P" in the "DiaSys" program):
- Active level: 2.1050.008
- "Low Switch" or "High Switch": 2.1050.013

Frequency output FO

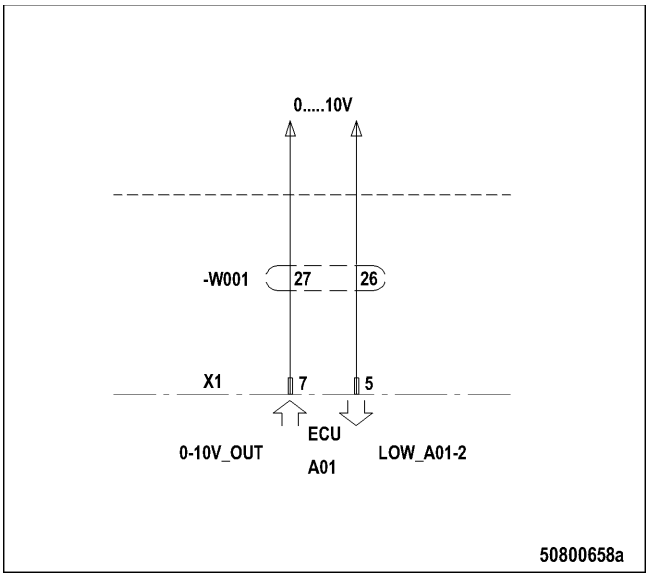
This output is not used in genset applications.

Analog outputs AO 1 ... 2

- Control of:
  - Display instruments
  - Analog inputs
- Channel specification
  - Output voltage: 0 ... 10 V
  - Output voltage without load: Approx. 0 V
  - Short-circuit current: 17 mA
  - I_{max}: 0 ... 8 mA at 10 V
  - Settling time: 45 ms
  - Electrical isolation: None
  - Cable damage monitoring: No
  - Overvoltage protection: 36 VDC
- Required settings:
  - —
- Schematic circuit diagram

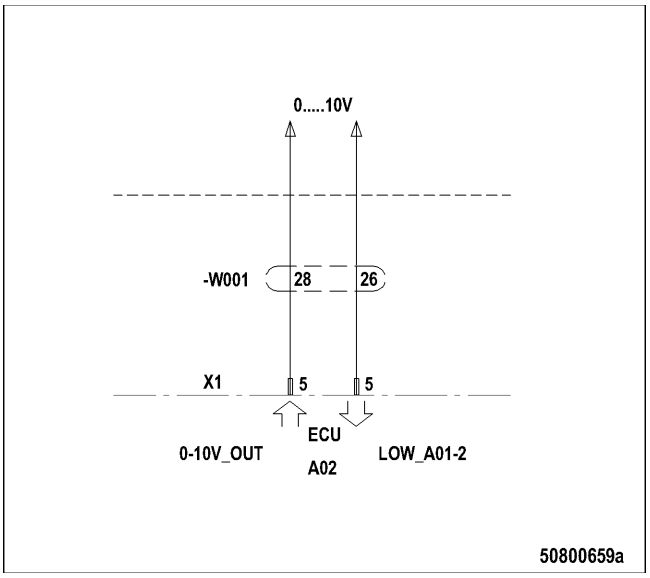


AO 1 – Coolant temperature



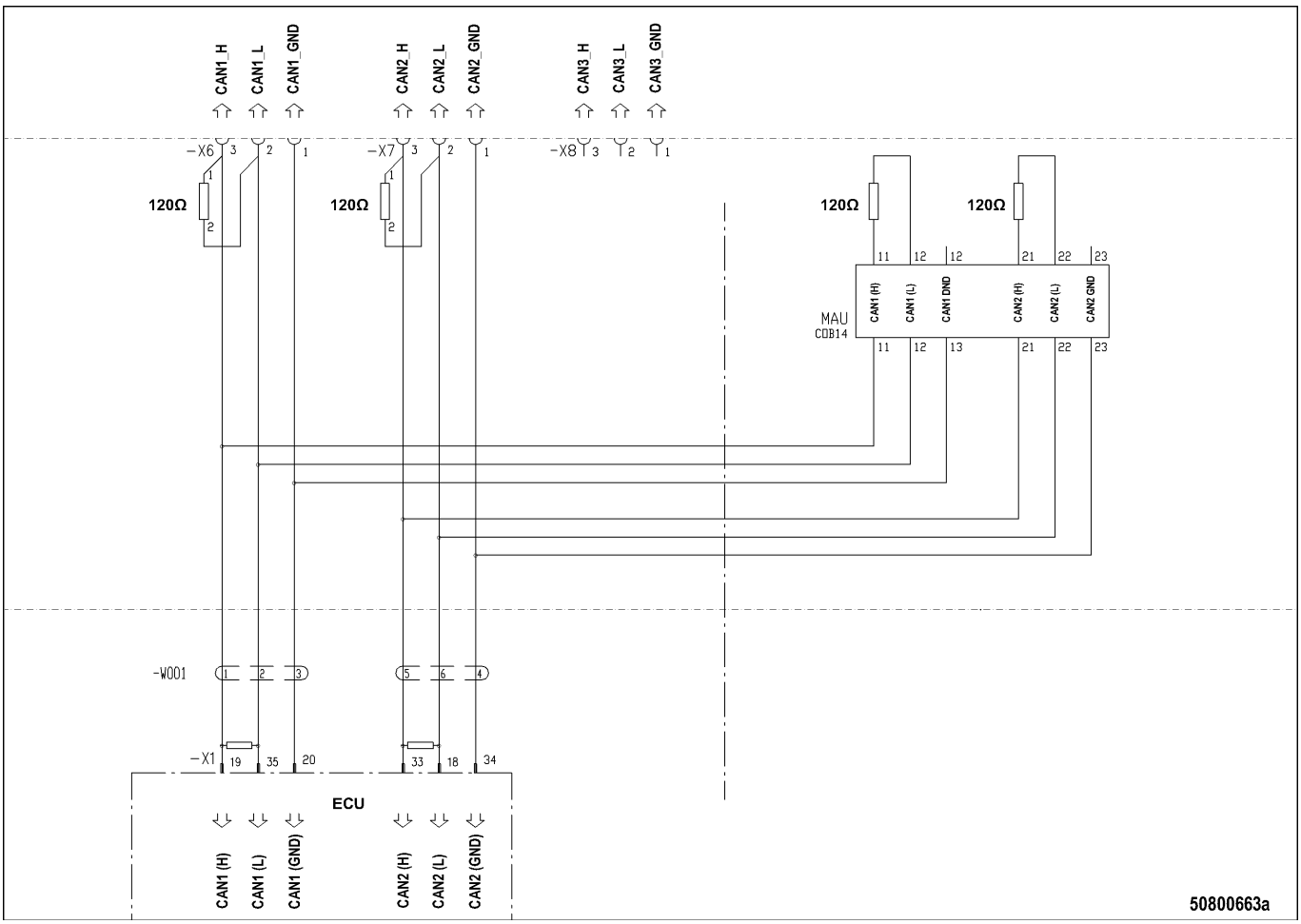
This output signal is proportional to the coolant temperature (0 to 10 V corresponding to 0 to 120 °C) and is used to control a display instrument.

AO 2 – Lube oil pressure



This output signal is proportional to the engine lube oil pressure (0 to 10 V corresponding to 0 to 10 bar) and is used to control a display instrument.

CAN interfaces 1 ... 2

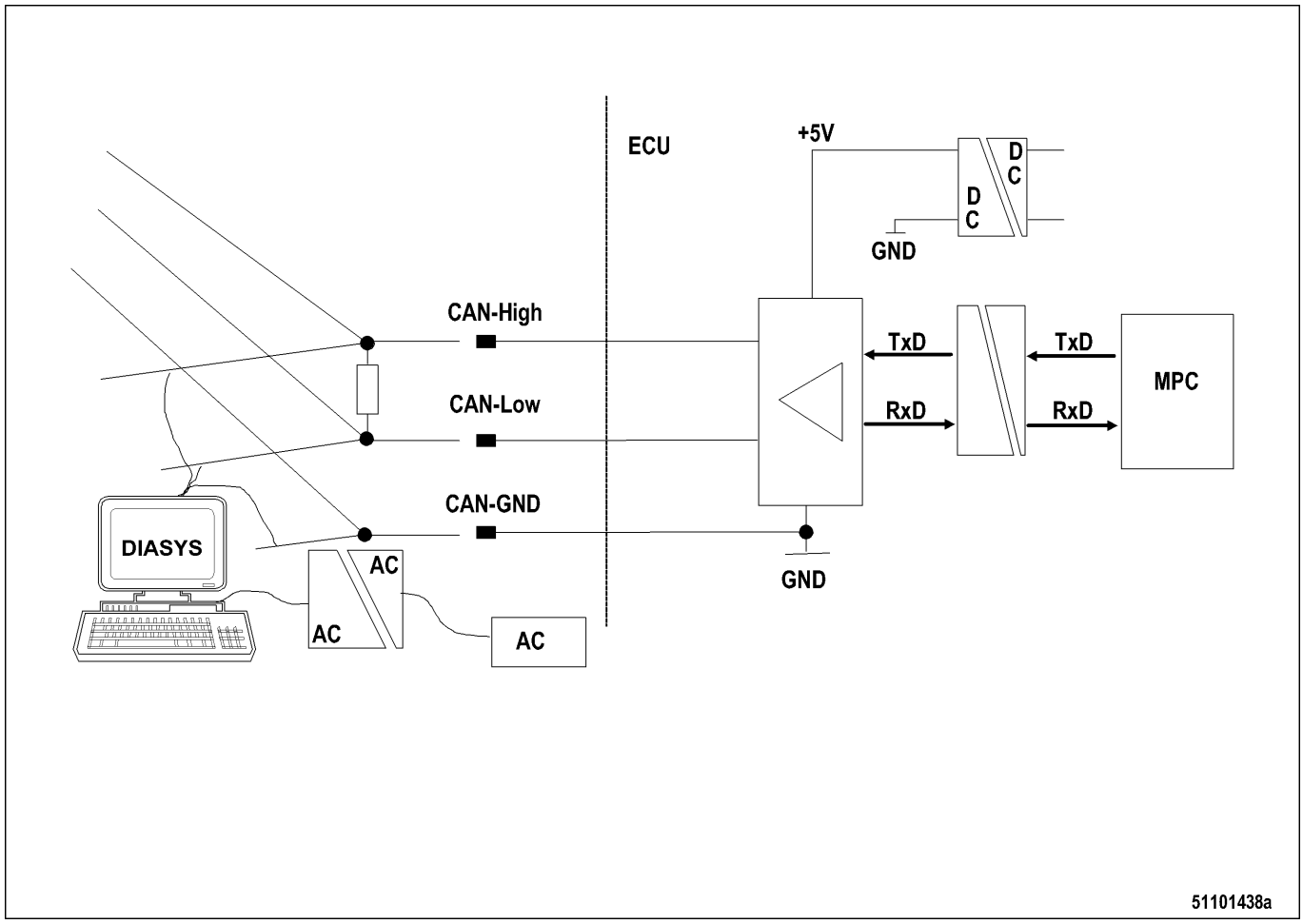


The 120 Ω resistors at X6 and X7 (SAM) are only installed when the bus terminates here. These resistors must not be installed if the bus continues (e.g. to a DIS 10 display). They must then be connected at the last bus station (e.g. DIS 10) instead. The MAU interface is optional, it is used to connect the dialog unit (laptop) with the DiaSys diagnostic software.

IMPORTANT: The resistors shown in the figure may be installed EITHER at the SAM OR at the MAU, i.e. NOT at both devices.

The tap line must not exceed 1m in length (e.g. to MAU). The bus must be looped on from one device to the next to cover greater distances.

- Channel type: Serial interface Controller Area Network (CAN)
- Control of:
  - CAN bus
- Channel specification
  - High-Speed CAN as per ISO 11898 (24 V)
  - PCS-5 protocol
  - CAN specification 2.0B 11/29-bit identifier
  - Electrical isolation to ECU-GND
- Required settings:
  - —
- Schematic circuit diagram



CAN 1 – PCS-5

This CAN interface is used to connect the engine governor to all other MTU devices and customer-specific systems via the PCS-5 bus. This is the default bus.

CAN 2 – PCS-5

This CAN interface is also used to connect the engine governor to all other MTU devices and customer-specific systems via the PCS-5 bus. This is the redundant bus.

8.3 SAM signals

General information

This part of the document provides the following information about connection and configuration of the inputs and outputs of adapter module SAM:

- Channel specification
- Channel circuitry
- Parameters which are set with the dialog unit
- Interrelationships of functions in block circuit diagrams

It is assumed that the signals are applied to one or more terminal strips in an OEM switchgear cabinet.

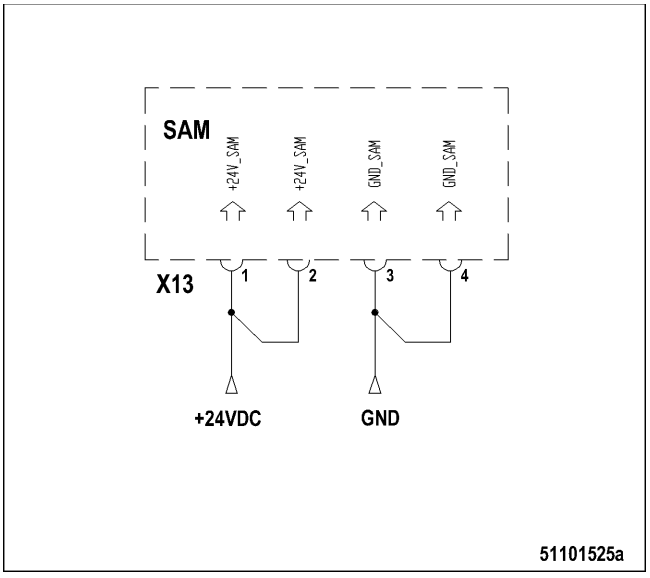
Channel assignment overview

Input/output	Signal
A_IN_ISO1	Not used
A_IN_ISO2	Day tank level
A_IN_ISO3	Not used
A_IN_ISO4	Storage tank level
B_IN1	Cylinder cutout off
B_IN2	Test binary outputs
B_IN3	Test overspeed
B_IN4	Priming on
B_IN5	Not used
B_IN6	Operating mode switch
B_IN7	Water in fuel prefilter 1
B_IN8	Water in fuel prefilter 2
B_IN9	Not used
B_IN10	Fan manual/louvers open
B_IN11	Parameter switching governor
B_IN12	Not used
B_IN13	Not used
B_IN14	Not used
B_IN15	Not used
B_IN16	Not used
B_IN17	Not used
B_IN18	Not used
B_IN19	Rating switch 1
B_IN20	Rating switch 2

Input/output	Signal
V_OUT1	Engine speed
V_OUT2	Coolant temperature
V_OUT3	Lube oil temperature
V_OUT4	Fuel pressure after filter
V_OUT5	Charge-air pressure
V_OUT6	Charge-air temperature
V_OUT7	Fuel temperature
V_OUT8	Fan control fan 1
A_IN1	Exhaust gas temperature A
A_IN2	Exhaust gas temperature B
A_IN3	Pressure 1
A_IN4	Pressure 2
A_IN5	Winding temperature 1
A_IN6	Winding temperature 2
A_IN7	Winding temperature 3
A_IN8	Room temperature
F_IN1	Not used
F_IN2	Not used
P_IN1	Not used
P_IN2	Not used
P_IN3	Not used
P_IN4	Not used
P_IN5	Not used
P_IN6	Not used
P_IN7	Turn engine
P_IN8	Not used
BR_OUT1	Oil priming pump on
BR_OUT2	Fuel pump on
BR_OUT3	Fan 1 on
BR_OUT4	Louvers open/close
BT_OUT1	Overspeed
BT_OUT2	Coolant temperature warning
BT_OUT3	Coolant temperature shutdown

Input/output	Signal
BT_OUT4	Charge-air temperature warning
BT_OUT5	Charge-air temperature alarm
BT_OUT6	Shutdown due to lack of coolant in intercooler
BT_OUT7	Shutdown due to lack of coolant
BT_OUT8	Fan 2 on
BT_OUT9	Preheating temperature not reached
BT_OUT10	Lube oil pressure warning
BT_OUT11	Engine running
BT_OUT12	Fuel pressure alarm
BT_OUT13	Load acceptance ready
BT_OUT14	Priming pressure reached
BT_OUT15	Engine governor overtemperature
BT_OUT16	Exciter boosting on
BT_OUT17	Generator voltage
BT_OUT18	Circulating pump on
BT_OUT19	Anti-condensation heating on
BT_OUT20	Alarm day tank minimum
PWM_OUT1	Fan control
PWM_OUT2	Not used

Supply voltage



The operating voltage is supplied at X13. See also (→ Page 92).

CAN interfaces 1 ... 3

CAN1 – PCS5 CAN

The hardware of the CAN interface corresponds to the definition in ISO 11998. The controller supports CAN version 2.0B (11/29-bit identifier). All interfaces are electrically isolated from each other and from the SAM electronics. The interface operates on 5 V level.

CAN communication is not disrupted if a connector is unplugged at the SAM. A terminator (121 Ω, see wiring diagram) must be fitted on the cable connector if the SAM is the last assembly on the bus.

- Online selftest: Yes (by bus timeout monitoring application software)
- Offline diagnosis: Yes (by offline test software: Feedback from transmitted messages)

This interface is used for the default bus.

CAN2 – PCS5 CAN

See “CAN1 – PCS5 CAN”. This interface is used for the redundant bus.

CAN3 – N.c.

This interface is not used.

CAN interfaces CANOpen and SAE-J1939 (option)

CANOpen and SAE-J1939

Printed circuit board CCB2 may be inserted in slot 3 as an option. This provides interfaces as per CANOpen standard and SAE-J1939.

Parameters

The interface concerned must be activated (this is possible by minidialog (see (→ Page 186)). It is also necessary to state which signals are to be available on the bus.

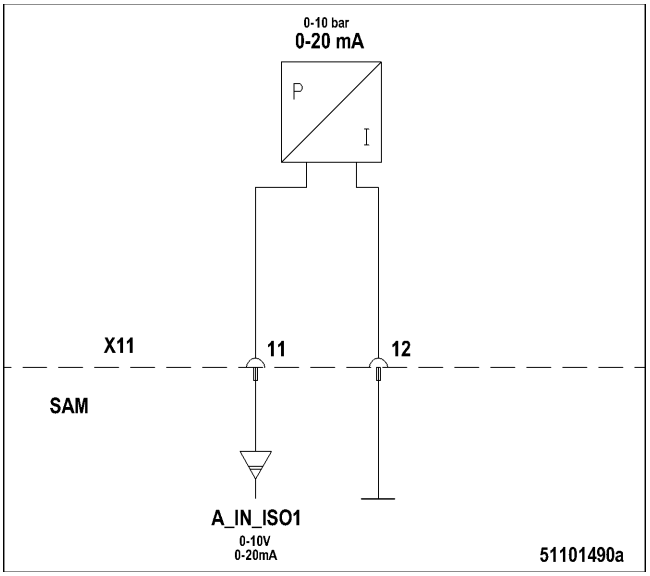
No.	Presetting	Unit	Designation	Settings
PR500	0	Digital	Speed Demand Options	0 - Default Dataset ADEC 1 - ADEC Increase/Decrease Input 2 - CAN Increase/Decrease Input 3 - ADEC Analog Absolute 4 - ADEC Analog Relative 5 - ADEC Frequency Input 6 - CAN Analog 7 - CAN Speed Demand Switch
PR501	0	Digital	Speed Setting Limit Mode	0 - Default Dataset ADEC 1 - Speed Setting Limit Signal via CAN Active
PR510	0	Digital	Torque Demand Signal Mode	0 - Default Dataset ADEC 1 - Torque Demand via CAN Active
PR511	1	Digital	Rating Switch Mode	0 - Rating Switches not Active 1 - Rating Switches via Binary Input Active 2 - Rating Switches via CAN Active
PR520	0	Digital	Load Signal Mode	0 - Load Signal not Active 1 - Load Signal via CAN Active
PR530	0	Digital	Engine Start Signal Mode	0 - Default Dataset ADEC 1 - Additional Start Signal via CAN Active

No.	Presetting	Unit	Designation	Settings
PR531	0	Digital	Engine Stop Signal Mode	0 - Default Dataset ADEC 1 - Additional Stop Signal via CAN Active
PR532	0	Digital	Alarm Reset Mode	0 - Default Dataset ADEC 1 - Additional Alarm Reset Signal via CAN Active
PR533	1	Digital	Gov. Para. Set Signal Mode	0 - Default Dataset ADEC 1 - Governor Parameter Set Selection via Binary Input Active 2 - Governor Parameter Set Selection via CAN Active 3 - Governor Parameter Set Selection via CAN or Binary Input Active
PR534	0	Digital	Override Signal Mode	0 - Default Dataset ADEC 1 - Additional Override Signal via CAN Active
PR536	0	Digital	Monitored Nodes Signal Mode	0 - Default Dataset ADEC 1 - Demand Monitored Nodes Signal via CAN Active
PR537	0	Digital	Droop 2 Signal Mode	0 - Default Dataset ADEC 1 - Droop 2 Signal via CAN Active
PR538	1	Digital	Mode Switch Mode	0 - Mode Switch not Active 1 - Mode Switch via Binary Input Active
PR540	1	Digital	Disable Cyl. Cut Out Mode	0 - Disable Cylinder Cut Out not Active 1 - Disable Cylinder Cut Out Signal via Binary Input Active 2 - Disable Cylinder Cut Out Signal via CAN Active 3 - Disable Cylinder Cut Out Signal via Binary Input or CAN is Active
PR542	1	Digital	Test Overspeed Signal Mode	0 - Default Dataset ADEC 1 - Test Overspeed Signal via Binary Input Active 2 - Test Overspeed Signal via CAN Active 3 - Test Overspeed Signal via CAN or Binary Input Active
PR543	1	Digital	Manual Fan On Signal Mode	0 - Manual Fan ON not Active 1 - Manual Fan ON Signal via Binary Input Active 2 - Manual Fan ON Signal via CAN Active 3 - Manual Fan ON Signal via CAN or Binary Input Active

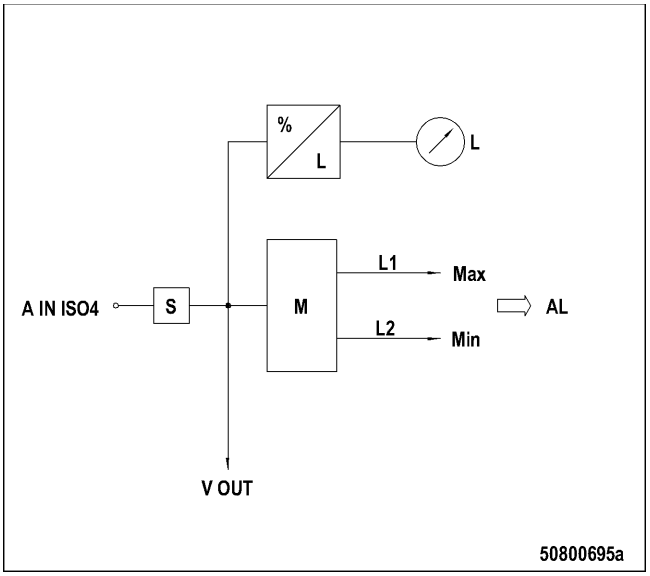
No.	Presetting	Unit	Designation	Settings
PR544	1	Digital	Priming Pump On Signal Mode	0 - Priming Pump ON not Active 1 - Priming Pump ON Signal via Binary Input Active 2 - Priming Pump ON Signal via CAN Active 3 - Priming Pump ON Signal via CAN or Binary Input Active
PR545	1	Digital	Binary Out Test Signal Mode	0 - Output Test not Active 1 - Output Test via Binary Output Active 2 - Output Test via CAN Active 3 - Output Test via Binary Output or CAN Active
PR546	1	Digital	Manual Turning Signal Mode	0 - Manual Turning not Active 1 - Manual Turning via Binary Output Active
PR990	0	Digital	CANopen Error Switch Off	Normal 0. Each Bit corresponds with the related error code. This parameter will be XOR'ed with the error code of the CCB-Gateway
PR991	0	Digital	J1939 Error Switch Off	Normal 0. Each Bit corresponds with the related error code. This parameter will be XOR'ed with the error code of the CCB-Gateway
PR992	0	Digital	CCB Error Switch Off	Normal 0. Each Bit corresponds with the related error code. This parameter will be XOR'ed with the error code of the CCB-Gateway

Analog inputs A_IN ISO 1 ... 4

A_IN_ISO 1 — Storage tank level
Function



The storage tank level is acquired via this input.



A tank level indicator (storage tank) can be realized via display “L”. The two outputs have the following functions:

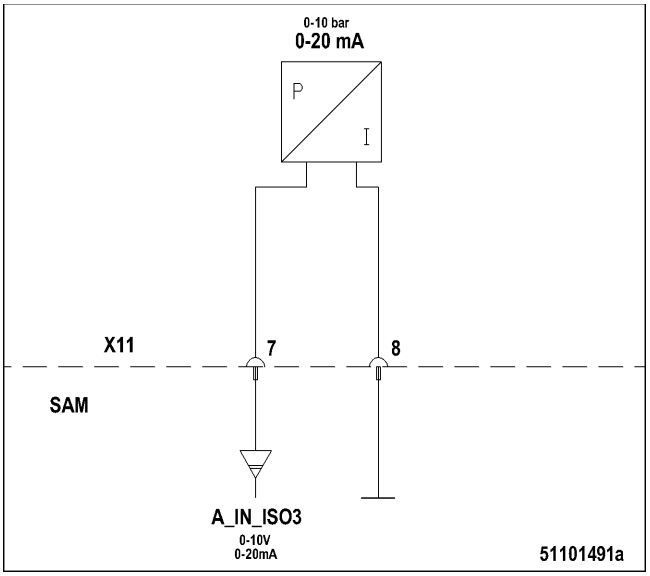
- L1: Alarm on overshooting maximum level.
- L2: Alarm on undershooting minimum level.

Parameters

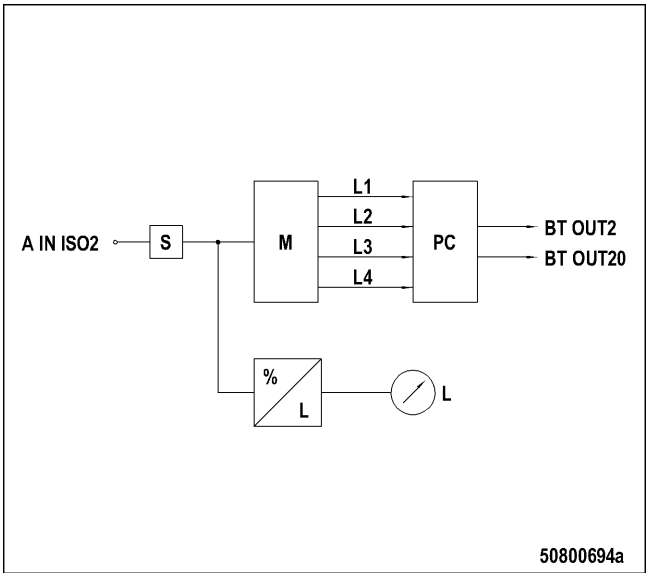
Curve and alarm signaling must be set (with limit values and delay times).

No.	Presetting	Unit	Designation	Settings
PR270	4	mA	Curve Holding Tank	Grid Points for Holding Tank Level Calculation
PR271	0	Binary	Holding Tank Control Active	1 - Holding Tank Control is Activated 0 - Holding Tank Control is Deactivated
PR272	95	%	Holding Tank Level HI	Tank Level For Alarm HI
PR273	2	%	Holding Tank Level HI Hyst	Tank Level Hysteresis For Alarm HI Off
PR274	40	%	Holding Tank Level LO	Tank Level For Alarm LO
PR275	2	%	Holding Tank Level LO Hyst	Tank Level Hysteresis For Alarm LO Off
PR278	0	s	Hold-Tank HI Del-Time Risen	Delay Time for Rising Levels at HI Level
PR279	20	s	Hold-Tank HI Del-Time Fall	Delay Time for Falling Levels at HI-Level
PR280	20	s	Hold-Tank LO Del-Time Risen	Delay Time for Rising Levels at LO Level
PR281	20	s	Hold-Tank LO Del-Time Fall	Delay Time for Falling Levels LO-Level

A_IN_ISO 3 — Day tank level
Function



The day tank level is acquired via this input.



A tank level indicator (day tank) can be realized via display “L”. The four outputs L1 to L4 have the following functions:

- L1: Alarm on overshooting maximum level.
- L2: Fuel transfer pump deactivation when level overshot
- L3: Fuel transfer pump activation when level undershot
- L4: Alarm on undershooting minimum level.

These four (internal) outputs switch the two outputs BR_OUT 2 (→ Page 158) and BT_OUT20 (→ Page 175).

Parameters

Curve and alarm signaling must be set (with limit values and delay times).

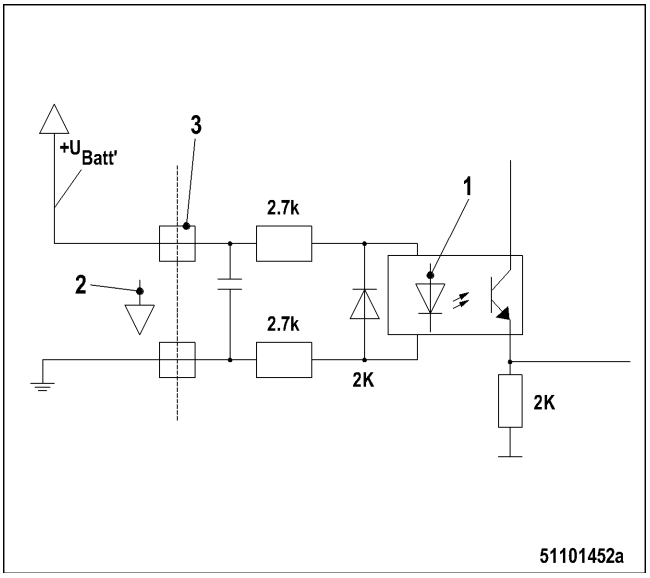
No.	Presetting	Unit	Designation	Settings
PR250	4	mA	Curve Day Tank	Grid Points for Day Tank Level Calculation
PR251	0	Binary	Day Tank Control Active	1 - Day Tank Control is Active 0 - Day Tank Control is Deactivated
PR252	95	%	Day Tank Level HIHI	Tank Level For Alarm HI
PR253	2	%	Day Tank Level HIHI Hyst	Tank Level Hysteresis For Alarm HI Off
PR254	90	%	Day Tank Level HI	Tank Level For Fuel Pump OFF
PR255	60	%	Day Tank Level LO	Tank Level For Fuel Pump ON
PR256	40	%	Day Tank Level LOLO	Tank Level For Alarm LOLO
PR257	2	%	Day Tank Level LOLO Hyst	Tank Level Hysteresis For Alarm LOLO Off
PR258	0	s	Day Tank HIHI Del-Time Risen	Delay Time for Rising Levels at HIHI Level
PR259	20	s	Day Tank HIHI Del-Time Fallen	Delay Time for Falling Levels at HIHI-Level
PR260	0	s	Day Tank HI Del-Time Risen	Delay Time for Rising Levels at HI Level
PR261	20	s	Day Tank LO Del-Time Fallen	Delay Time for Falling Levels LO-Level
PR262	20	s	Day Tank LOLO Del-Time Risen	Delay Time for Rising Levels at LOLO Level
PR263	20	s	Day Tank LOLO Del-Time Fallen	Delay Time for Falling Levels at LOLO-Level

Unused A_IN_ISO-inputs

The two inputs A_IN_ISO 2 and A_IN_ISO 4 are not used at present.

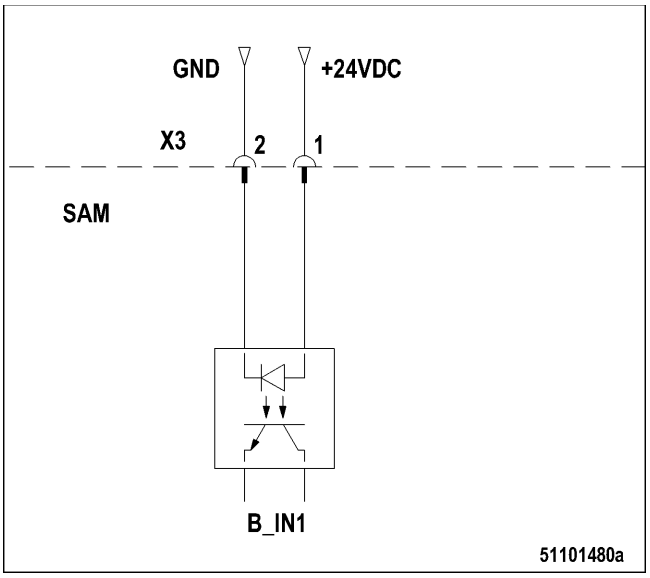
Binary inputs B_IN 1 ... 20

- Control by:
  - External supply
  - 24 V $+U_{bat}$
- Channel specification:
  - Voltage: $+U_{bat\_GND}$ ... $+U_{bat}$
  - Low detection: $U_{in} < 9$ V
  - High detection: $U_{in} > 12$ V
  - Input impedance: Approx. 5.5 kΩ
  - Current: To U_{bat}: 5 mA; to GND: 0 mA
  - DC isolation: Yes, 500 VDC
  - Input filter: Low-pass 500 Hz
- Schematic circuit diagram



1 Optocoupler
2 Input U_{in}
3 Input I_{in}

B_IN 1 – Cylinder cutout off



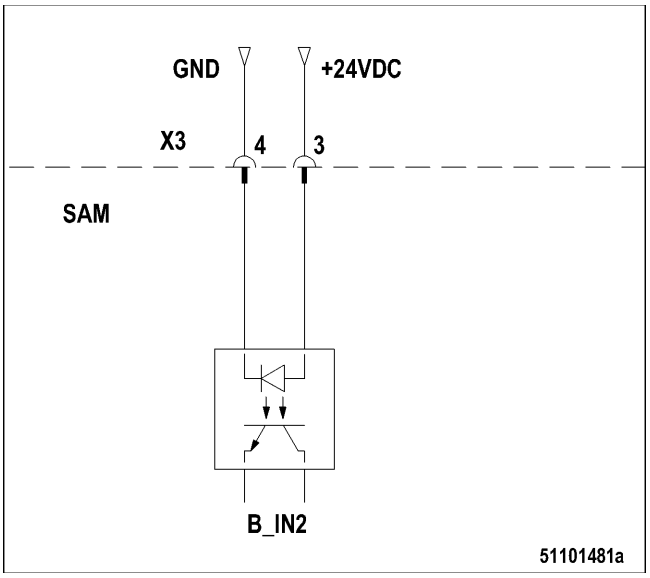
Function

When this input is activated the system suppresses the cylinder cutout request from the engine governor. The engine runs constantly on all cylinders. This function can also be switched by CANOpen or SAE-J1939 (→ Page 114).

Parameters

No.	Presetting	Unit	Designation	Settings
PR540	1	Digital	Disable Cyl. Cut Out Mode	0 - Disable Cylinder Cut Out not Active 1 - Disable Cylinder Cut Out Signal via Binary Input Active 2 - Disable Cylinder Cut Out Signal via CAN Input Active 3 - Disable Cylinder Cut Out Signal via Binary Input or CAN is Active

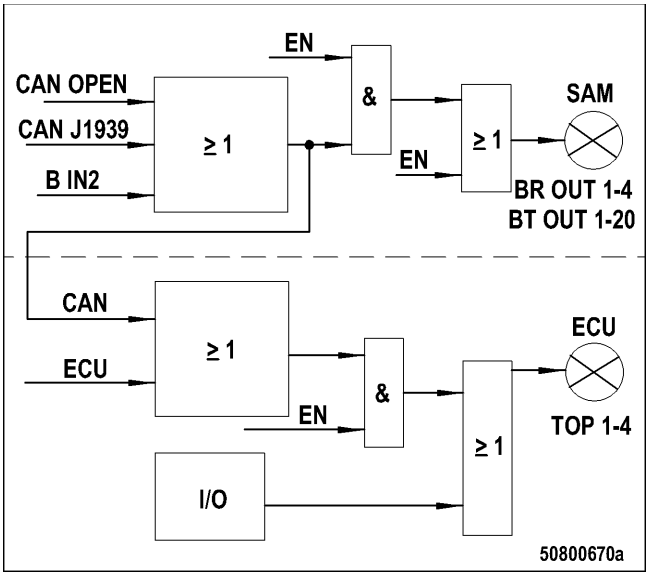
B_IN 2 – Test binary outputs



Function

When this input is activated all (programmed) outputs are activated for testing.

- Transistor outputs BT-OUT 1 ... 20 of SAM
- Relay outputs BR-OUT 1 ... 4 of SAM
- All transistor outputs TOP of the engine governor
- Required settings:
  - Activation of outputs which are activated when this input is activated



Parameters

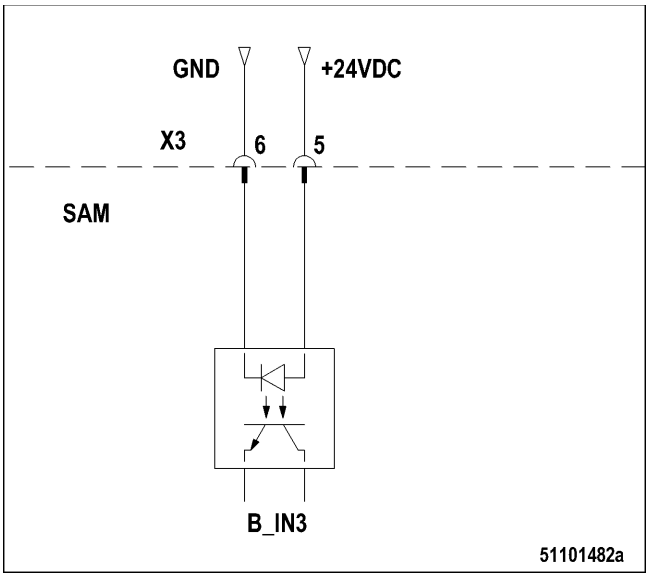
In addition to those channels which are to be activated during a test, it is also necessary to specify which source is to be active to trigger the test. A test can also be initiated via the CAN bus (CANOpen or J1939)

No.	Presetting	Unit	Designation	Settings
PR545	1	Digital	Binary Out Test Signal Mode	0 - Output Test not Active 1 - Output Test via Binary Output Active 2 - Output Test via CAN Active 3 - Output Test via Binary Output or CAN Active
PR050	1	Binary	BIN_OUT_TEST Overspeed Alarm	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR051	1	Binary	BIN_OUT_TEST T-Coolant Warning	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR052	1	Binary	BIN_OUT_TEST T-Coolant Stop	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR053	1	Binary	BIN_OUT_TEST T-Charge Air Warn	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR054	1	Binary	BIN_OUT_TEST T-Charge Air Stop	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR055	1	Binary	BIN_OUT_TEST Level Charge-Air Coolant Alarm	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR056	1	Binary	BIN_OUT_TEST Coolant Lev. Stop	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR057	0	Binary	BIN_OUT_TEST Fan 2 On	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR058	1	Binary	BIN_OUT_TEST T-Preheat N.Reach	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output

No.	Presetting	Unit	Designation	Settings
PR059	1	Binary	BIN_OUT_TEST P-Lube-Oil Warn.	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR060	0	Binary	BIN_OUT_TEST Engine Running	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR061	1	Binary	BIN_OUT_TEST P-Fuel Alarm	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR062	0	Binary	BIN_OUT_TEST Load Assumpt. Rdy	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR063	1	Binary	BIN_OUT_TEST Warn. P-Priming	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR064	1	Binary	BIN_OUT_TEST T-Generator Warn.	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR065	0	Binary	BIN_OUT_TEST Subsidiary Exci.On	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR066	0	Binary	BIN_OUT_TEST Generator Voltage	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR067	0	Binary	BIN_OUT_TEST Circulat. Pump On	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR068	0	Binary	BIN_OUT_TEST Downtime Heat. ON	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR069	1	Binary	BIN_OUT_TEST Day Tank Min Al.	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output

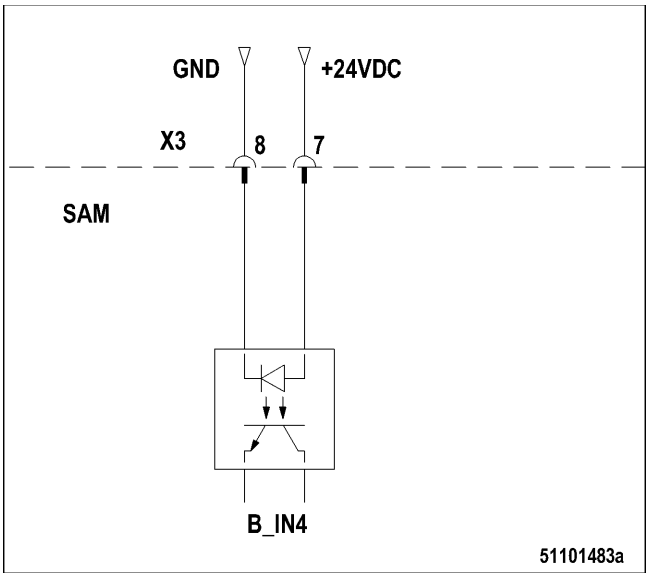
No.	Presetting	Unit	Designation	Settings
PR070	0	Binary	BIN_OUT_TEST Priming Pump ON	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR071	0	Binary	BIN_OUT_TEST Fuel Pump ON	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR072	0	Binary	BIN_OUT_TEST Fan 1 On	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output
PR073	0	Binary	BIN_OUT_TEST Shutter Open	0 - Binary Out Test is Deactivated For This Output 1 - Binary Out Test is Activated For This Output

B_IN 3 – Overspeed test



Activating this input reduces the overspeed limit value. The engine is stopped by an overspeed shutdown if the engine speed reaches this (lower) value or if it is already above this value when this input is switched on. An alarm is signaled simultaneously via the corresponding alarm output and on DIS 10 (if applicable). The alarm is stored in the SAM fault memory.

B_IN 4 — Priming on



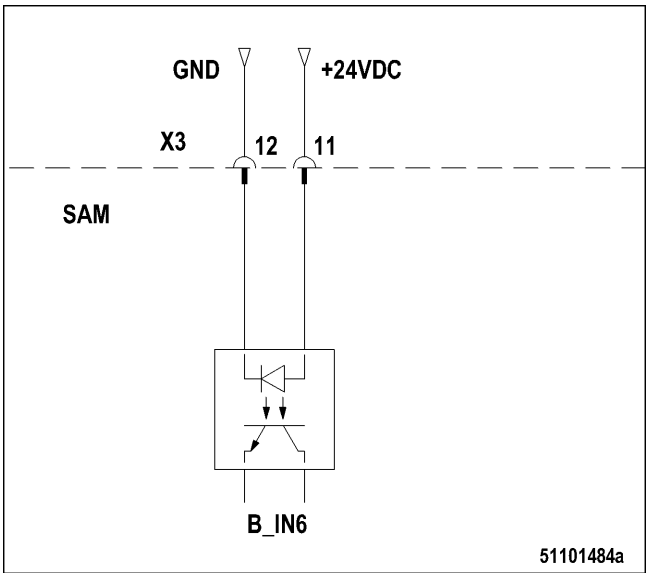
Function

This input switches on the oil priming pump once manually. This function can also be switched by CANOpen or SAE-J1939 (→ Page 114).

Parameters

No.	Presetting	Unit	Designation	Settings
PR544	1	Digital	Priming Pump On Signal Mode	0 - Priming Pump ON not Active 1 - Priming Pump ON Signal via Binary Input Active 2 - Priming Pump ON Signal via CAN Active 3 - Priming Pump ON Signal via CAN or Binary Input Active

B_IN 6 – Parameter switching



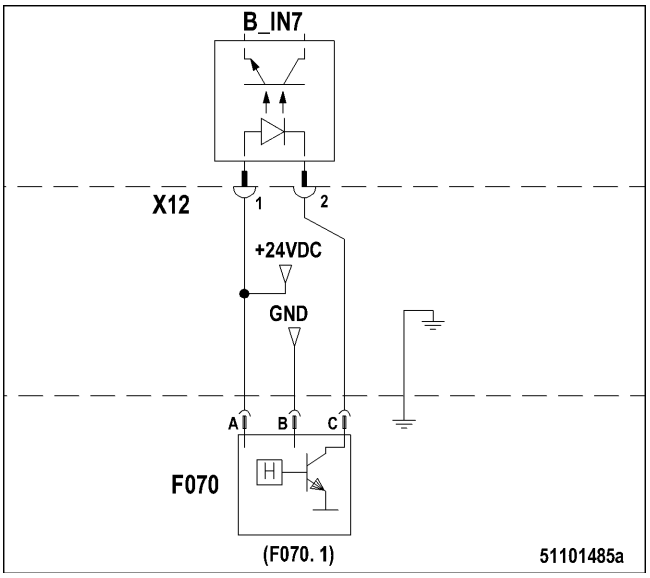
Function

This switch is used to set engine operation in Mode 1 or Mode 2.

Parameters

No.	Presetting	Unit	Designation	Settings
PR538	1	Digital	Mode Switch Mode	0 - Mode Switch not Active 1 - Mode Switch via Binary Input Active

B-IN 7 – Water in fuel prefilter 1



Function

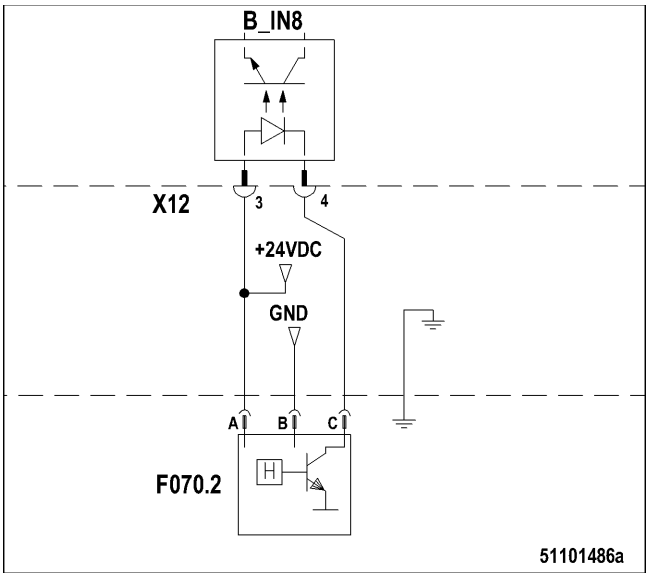
Sensor F070 (or F070.1 if two filters are provided) of fuel prefilter 1 is connected to this input. This detects water in the fuel prefilter.

Parameters

Set whether this signal is to be monitored or not, and, if so, what system response is desired. Furthermore, the delay time for alarm signaling and cancellation must also be specified.

No.	Presetting	Unit	Designation	Settings
PR380	0	Binary	Water Fuel Filter 1 Monitor ON	1 -Water in Fuel Prefilter Monitoring and Alarm ON 0 - Water in Fuel Prefilter Monitoring and Alarm OFF
PR381	2	Digital	Sel. Alarm Water Fuel Filter 1	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR384	2	s	Delay Time W. Fuel Filter 1 ON	Delay Time for Alarm ON
PR385	2	s	Delay Time W Fuel Filter 1 OFF	Delay Time for Alarm OFF

B-IN 8 – Water in fuel prefilter 2



Function

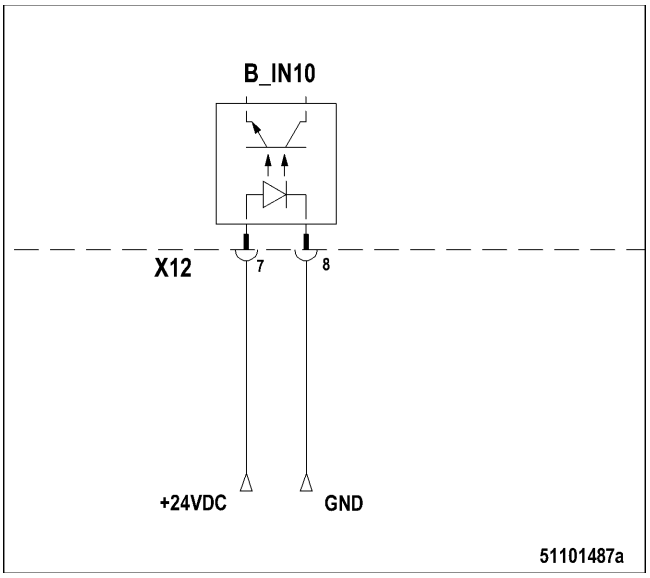
Sensor F070.2 of the second fuel prefilter is connected to this input. This detects water in the fuel prefilter.

Parameters

Set whether this signal is to be monitored or not, and, if so, what system response is desired. Furthermore, the delay time for alarm signaling and cancellation must also be specified.

No.	Presetting	Unit	Designation	Settings
PR390	0	Binary	Water Fuel Filter 1 Monitor ON	1 -Water in Fuel Prefilter Monitoring and Alarm ON 0 - Water in Fuel Prefilter Monitoring and Alarm OFF
PR391	2	Digital	Sel. Alarm Water Fuel Filter 1	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR394	2	s	Delay Time W. Fuel Filter 1 ON	Delay Time for Alarm ON
PR395	2	s	Delay Time W Fuel Filter 1 OFF	Delay Time for Alarm OFF

B_IN 10 – Fan manual on/louvers open



Function

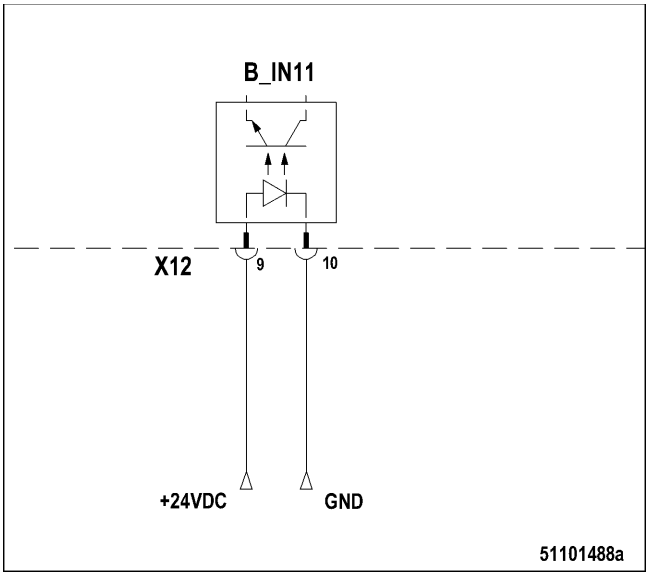
The input switches on the connected fan(s) (up to two possible) manually and opens the associated louvers.

Parameters

The control signal source must be specified. Furthermore, the number of fans must be stipulated (see also parameter PR151 under BR_OUT3, (→ Page 158)).

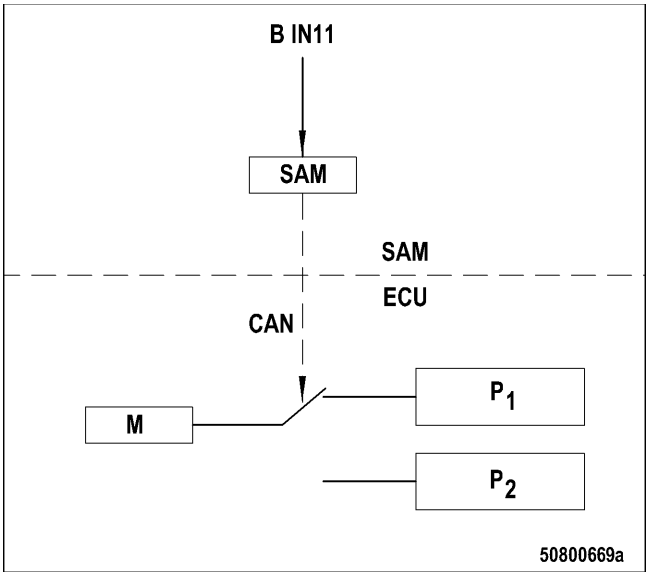
No.	Presetting	Unit	Designation	Settings
PR543	1	Digital	Manual Fan On Signal Mode	0 - Manual Fan ON not Active 1 - Manual Fan ON Signal via Binary Input Active 2 - Manual Fan ON Signal via CAN Active 3 - Manual Fan ON Signal via CAN or Binary Input Active

B_IN 11 – Parameter switching



Function

The governor incorporates two different parameter records (PID response). This input facilitates switching between these two parameter records. The information about the parameter record to be selected is transmitted on the CAN bus. This function can also be switched by CANOpen or SAE-J1939 (→ Page 114).



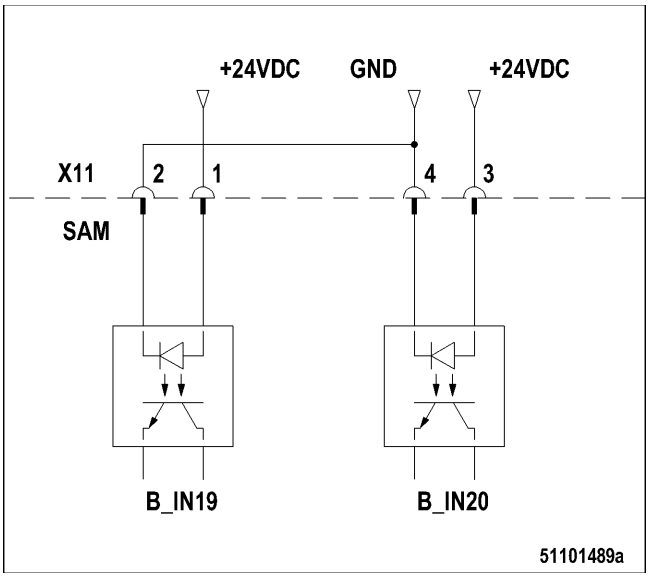
M Engine governor
P_1 Parameter record 1
P_2 Parameter record 2

Parameters

The control signal source must be specified.

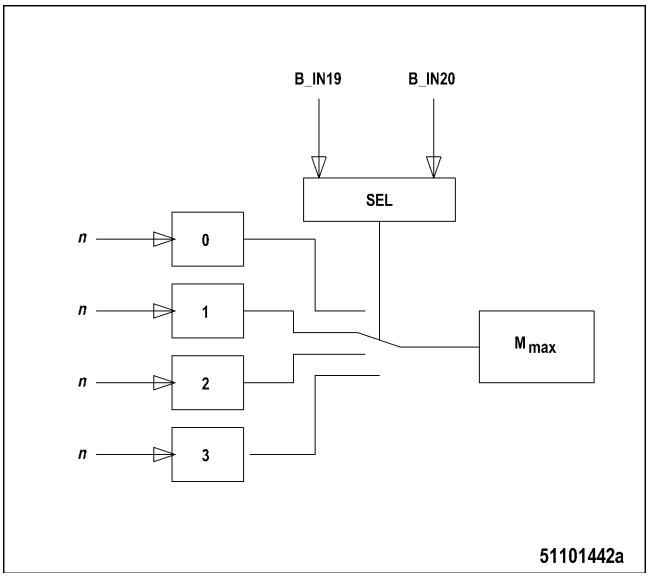
No.	Presetting	Unit	Designation	Settings
PR533	1	Digital	Gov. Para. Set Signal Mode	0 - Default Dataset ADEC 1 - Governor Parameter Set Selection via Binary Input Active 2 - Governor Parameter Set Selection via CAN Active 3 - Governor Parameter Set Selection via CAN or Binary Input Active

B_IN 19 and B_IN 20



Function

These inputs are used to select one of three lower power settings. B_IN 19 is the LSB (Least Significant Bit) for selection, B_IN 20 is the MSB (Most Significant Bit).



SEL Select
n Engine speed
M_{max} Maximum torque
0 Rating 0: No power reduction
1 Rating 1
2 Rating 2
3 Rating 3

Rating selection

Rating	B_IN20	B_IN19
0	0	0
1	0	1
2	1	0
3	1	1

Parameters

No.	Presetting	Unit	Designation	Settings
PR511	1	Digital	Rating Switch Mode	0 - Rating Switches not Active 1 - Rating Switches via Binary Input Active 2 - Rating Switches via CAN Active

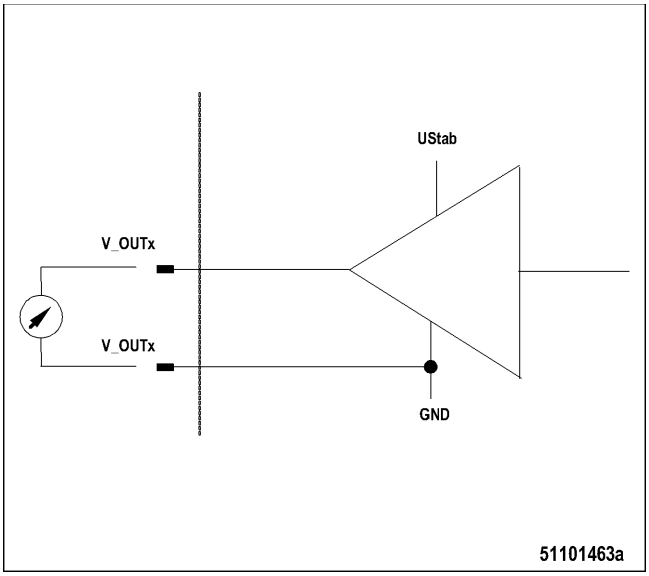
Unused B_IN channels

The following channels are not used:

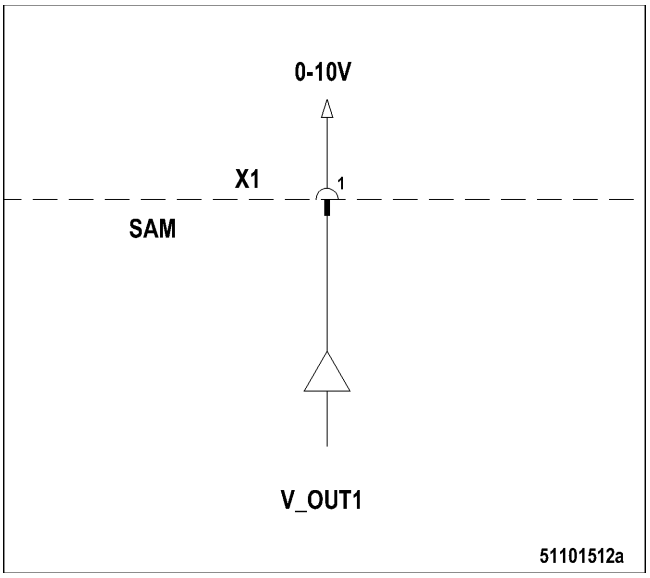
- B_IN 5
- B_IN 9
- B_IN 12 to B_IN 18

Analog outputs V_OUT 1 ... 8

- Control of:
  - Analog display instruments
  - Analog inputs
- Channel specification:
  - Output voltage: 0 ... 10 V
  - Voltage output current-carrying capacity: I_{max}: 0 ... 8 mA at 10 V
  - Potential: U_{batt_GND}
  - Short-circuit protection: Yes
- Schematic circuit diagram:



V_OUT 1 – engine speed



Function

This output provides a voltage which is proportional to engine speed (default setting, other values may be displayed as an alternative, e.g. the speed demand setting).

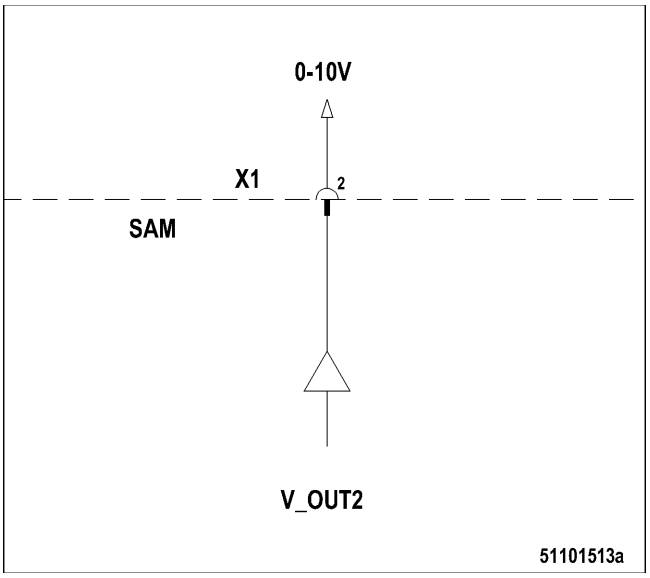
Parameters

Required settings:

- Source
- Scaling (0 ... n_{max}, standard: 0 ... 10V)
- Displayed value

No.	Presetting	Unit	Designation	Settings
PR101	0	Digital	Selection Instrument 1	0 - Engine Speed 1 - Nominal Speed 2 - Feedback Speed Demand 3 - Feedback Speed Demand Eff. 4 - Engine Speed Crankshaft
PR111	2000	rpm	Scale Instrument Output 1	Grid Point For End of Scale (100%) in RPM

V_OUT 2 – Coolant temperature



Function

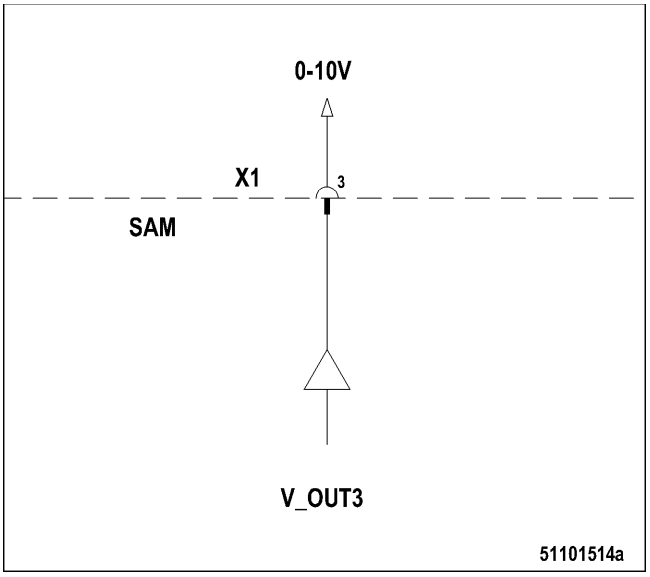
This output provides a voltage which is proportional to coolant temperature.

Parameters

- Scaling (0 ... U_{max}, standard: 0 ... 10 V equivalent to 0 ... n_{max})

No.	Presetting	Unit	Designation	Settings
PR112	120	DegC	Scale Instrument Output 2	Grid Point For End of Scale (100%) In °C

V_OUT 3 – Lube oil temperature



Function

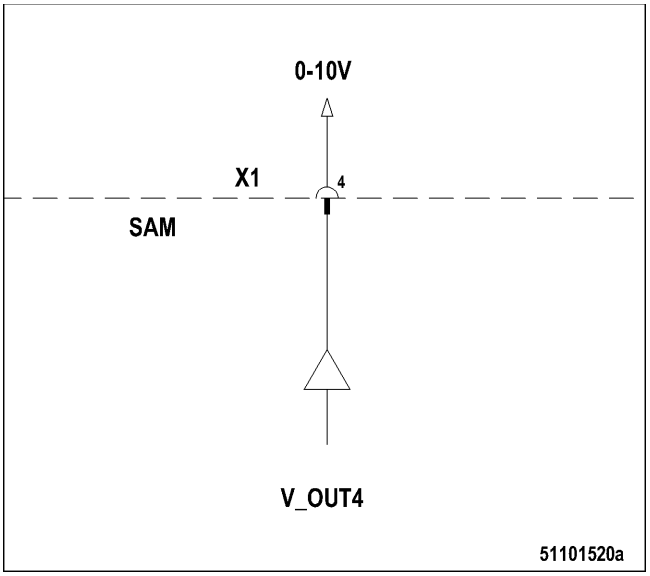
This output provides a voltage which is proportional to lube oil temperature.

Parameters

- Scaling (0 ... t_{max}, standard: 0 ... 120 °C)

No.	Presetting	Unit	Designation	Settings
PR113	120	DegC	Scale Instrument Output 3	Grid Point For End of Scale (100%) In °C

V_OUT 4 – Fuel pressure after filter



Function

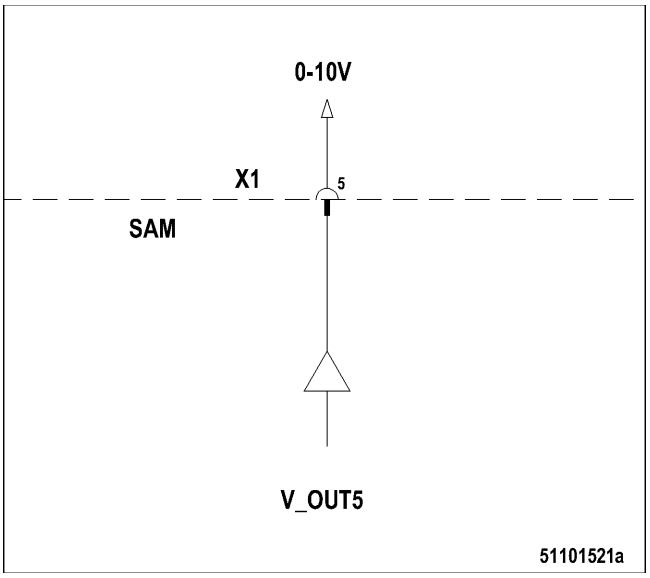
This output provides a voltage which is proportional to the fuel pressure measured after the fuel filter (default; other values may be displayed as an alternative).

Parameters

- Measuring point
- Scaling (0 ... p_{max}, standard: 0 ... 10bar)
- Which pressure value is to be displayed

No.	Presetting	Unit	Designation	Settings
PR104	0	Digital	Selection Instrument 4	0 - Fuel Pressure After Filter 1 - Pressure_1 2 - Pressure_2
PR120	15	bar	Scale P-Fuel After Filter	Grid Point For End of Scale (100%) In BAR

V_OUT 5 – Charge-air pressure 0 to 5 bar



Function

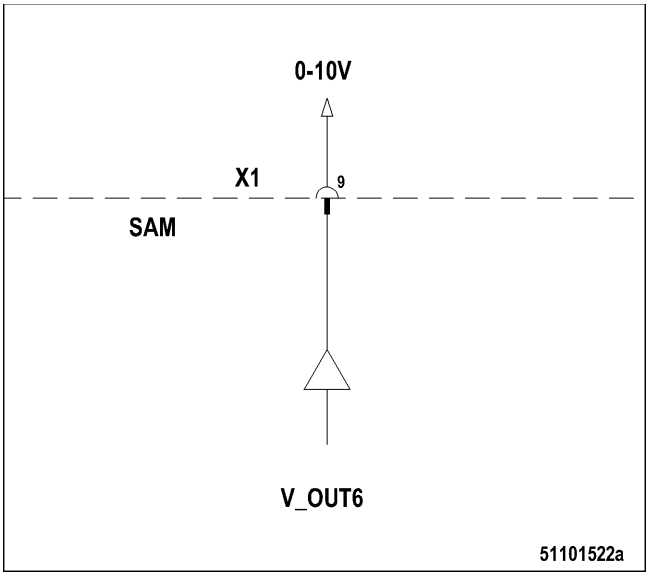
This output provides a voltage which is proportional to the charge-air pressure.

Parameters

- Scaling (0 ... p_{max}; standard 0 ... 5bar)

No.	Presetting	Unit	Designation	Settings
PR114	5	bar	Scale Instrument Output 5	Grid Point For End of Scale (100%) In BAR

V_OUT 6 – Charge-air temperature/Intercooler coolant temperature



Function

This output provides a voltage which is proportional to the charge-air temperature or intercooler coolant temperature (adjustable).

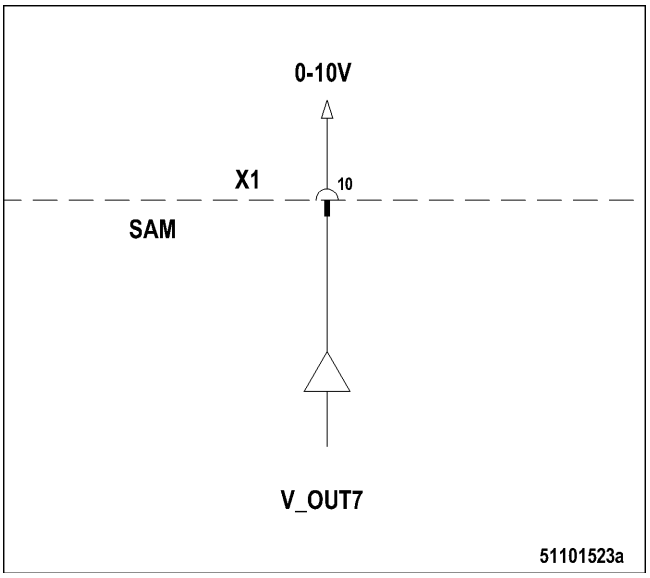
Parameters

- Measuring point charge-air temperature or intercooler coolant temperature

- Scaling (0 ... t_{max}; standard 0 ... 120 °C)

No.	Presetting	Unit	Designation	Settings
PR106	0	Digital	Selection Instrument 6	0 - Charge Air Temperature 1 - T-Coolant Intercooler
PR115	120	DegC	Scale Instrument Output 6	Grid Point For End of Scale (100%) In °C

V_OUT 7 – Fuel temperature



Function

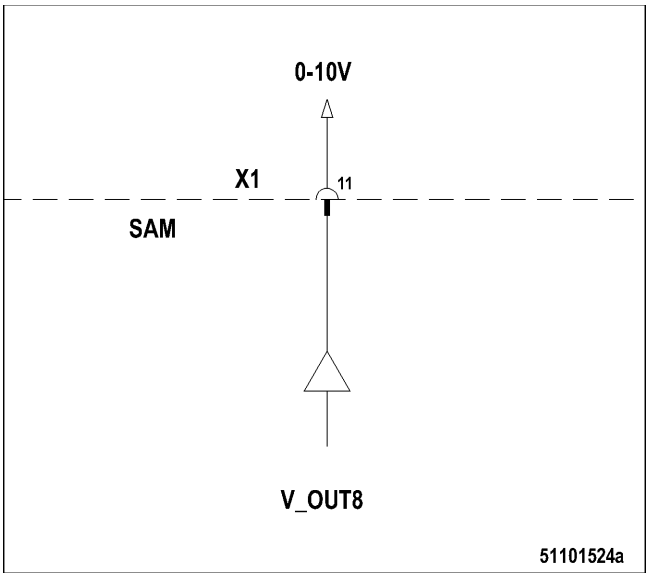
This output provides a voltage which is proportional to fuel temperature.

Parameters

- Scaling (0 ... t_{max}; standard 0 ... 120 °C)

No.	Presetting	Unit	Designation	Settings
PR116	120	DegC	Scale Instrument Output 7	Grid Point For End of Scale (100%) In °C

V_OUT 8 – Fan speed — Universal



Function

In the default setting, this output provides a voltage which can activate a fan between 0 and full power. Other signals may also be output as an alternative.

Parameters

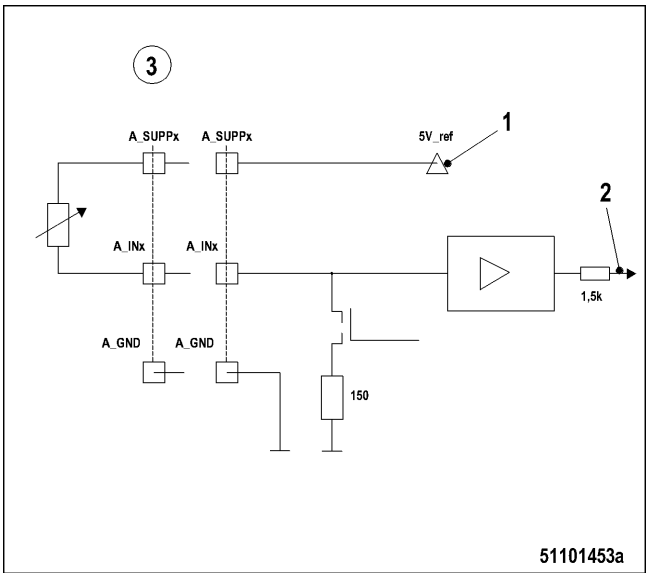
- Signal source

- Scaling (0 ... U_{max}; standard 0 ... 10V, or 100%)

No.	Presetting	Unit	Designation	Settings
PR108	0	Digital	Selection Instrument 8	0 - Fan Speed 1 - Engine Power Reserve 2 - Injection Quantity Actual DBR 3 - Nominal Power 4 - Level Day Tank 5 - Level Holding Tank 6 - T-Exhaust A 7 - T-Exhaust B 8 - T-Winding_1 9 - T-Winding_2 10 - T-Winding_3
PR130	100	%	Scale Fan Control	Grid Point For End of Scale (100%) In %
PR131	100	%	Scale Engine Power Reserve	Grid Point For End of Scale (100%) In %
PR132	100	%	Scale Inject. Quant. Act.DBR %	Grid Point For End of Scale (100%) In %
PR133	10000	kW	Scale Nominal Power	Grid Point For End of Scale (100%) In kW
PR134	100	%	Scale Level Day Tank	Grid Point For End of Scale (100%) In %
PR135	100	%	Scale Level Holding Tank	Grid Point For End of Scale (100%) In %
PR136	800	DegC	Scale Exhaust Temp. A	Grid Point For End of Scale (100%) In °C
PR137	800	DegC	Scale Exhaust Temp. B	Grid Point For End of Scale (100%) In °C
PR138	200	DegC	Scale Winding Temperature 1	Grid Point For End of Scale (100%) In °C
PR139	200	DegC	Scale Winding Temperature 2	Grid Point For End of Scale (100%) In °C
PR140	200	DegC	Scale Winding Temperature 3	Grid Point For End of Scale (100%) In °C

Analog inputs A_IN 1 ... 8

A_IN 1 – Exhaust gas temperature A
Channel specification

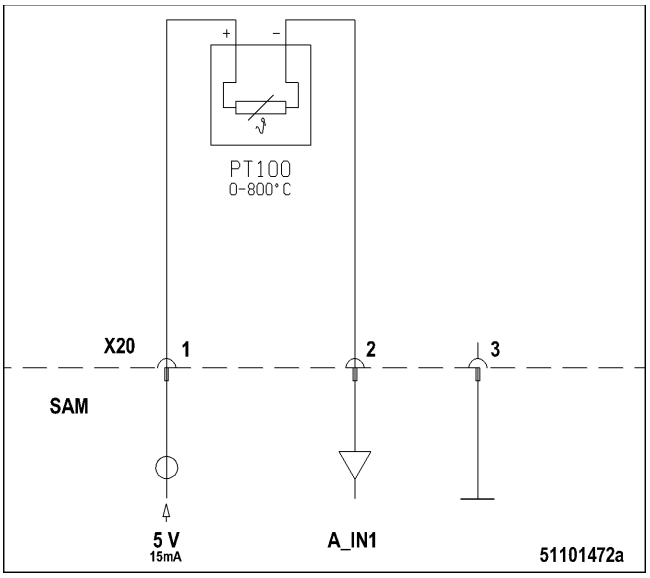


1 U_{ref}
2 A/D channel
3 Pt100 input

Input:

- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100, extended
- Function:

  The channel is used to acquire the combined exhaust gas temperature of engine bank A. The temperature ranges between 0 ... 850 °C. The present temperature is shown on DIS 10 (option, if applicable).

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm

- Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

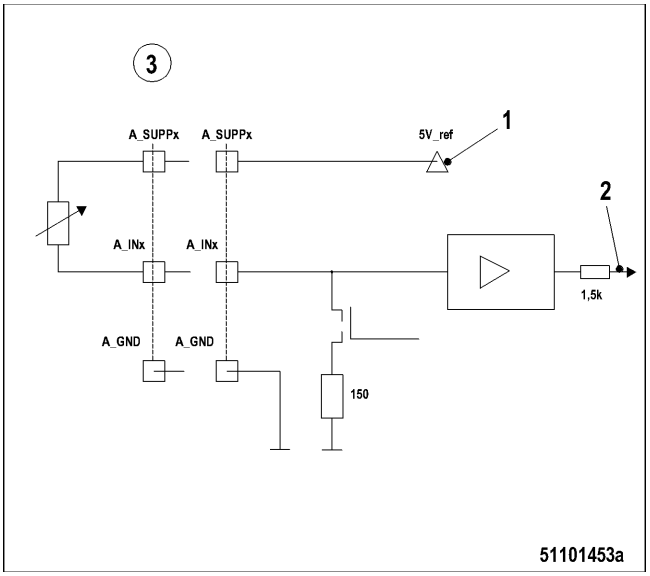
Parameters

Required settings:

- Activation of temperature monitoring
- System response in case of limit value violation
- Limit value
- Hysteresis
- Delay times

No.	Presetting	Unit	Designation	Settings
PR300	0	Binary	T-Exhaust_A Monitoring ON	1 - Exhaust Temp. Monitoring and Alarm ON 0 - Exhaust Temp. Monitoring and Alarm OFF
PR301	2	Digital	Selector Alarm T-Exhaust_A	0 No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR302	700	DegC	Level T-Exhaust_A HI	Protection Level for HI Alarm
PR303	10	DegC	Hysteresis T-Exhaust_A HI	Hysteresis for HI Alarm Protection Level
PR304	2	s	Delay Time T-Exhaust_A HI Rise	Delay Time for crossing the HI Level
PR305	2	s	Delay Time T-Exhaust_A HI Fall	Delay Time for under-run the HI Level

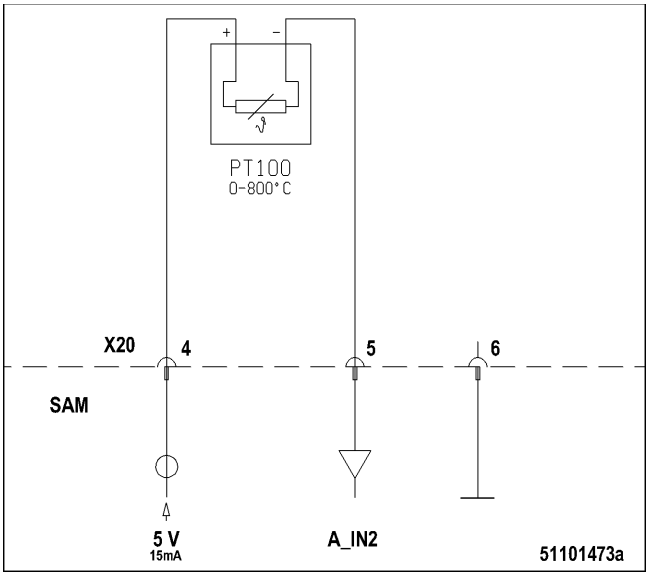
A_IN 2 – Exhaust gas temperature B
Channel specification



1 U_{ref}
2 A/D channel
3 Pt100 input

Input:
- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100, extended
- Function:

  The channel is used to acquire the combined exhaust gas temperature of engine bank B. The temperature ranges between 0 ... 850 °C. The present temperature is shown on DIS 10 (option, if applicable).

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

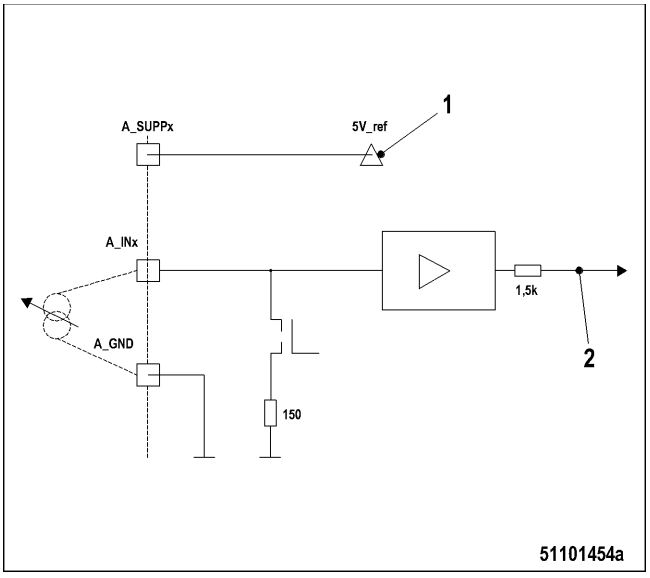
Parameters

Required settings:
- Activation of temperature monitoring
- System response in case of limit value violation
- Limit value
- Hysteresis

- Delay times

No.	Presetting	Unit	Designation	Settings
PR310	0	Binary	T-Exhaust_B Monitoring ON	1 - Exhaust Temp. Monitoring and Alarm ON 0 - Exhaust Temp. Monitoring and Alarm OFF
PR311	2	Digital	Selector Alarm T-Exhaust_B	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR312	700	DegC	Level T-Exhaust_B HI	Protection Level for HI Alarm
PR313	10	DegC	Hysteresis T-Exhaust_B HI	Hysteresis for HI Alarm Protection Level
PR314	2	s	Delay Time T-Exhaust_B HI Rise	Delay Time for crossing the HI Level
PR315	2	s	Delay Time T-Exhaust_B HI Fall	Delay Time for under-run the HI Level

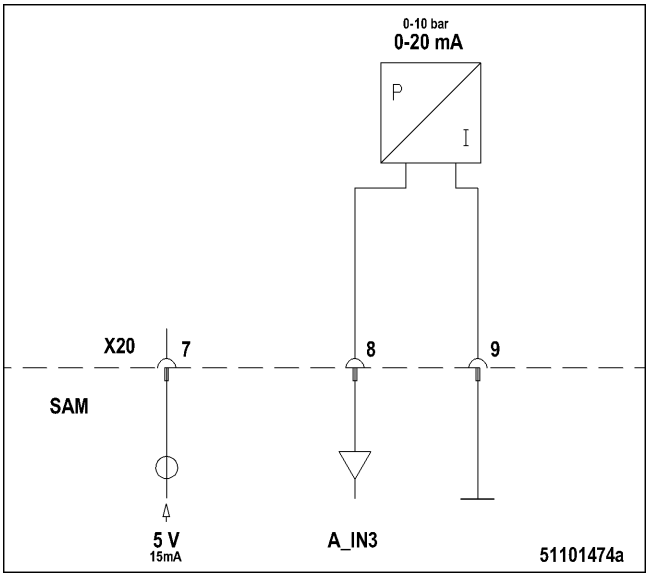
A_IN 3 – Pressure 1
Channel specification



1 U_{ref}
2 A/D channel
3 Input 0 ... 24 mA

Input:
- Current measuring 0 .. 20 mA
- Temperature input impedance: 100 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pressure sensor 4 ... 20 mA
- Function:

  The channel is used to acquire a (random) pressure value with a 4 ... 20 mA sensor. The present value is displayed on DIS 10 (option, if applicable).

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

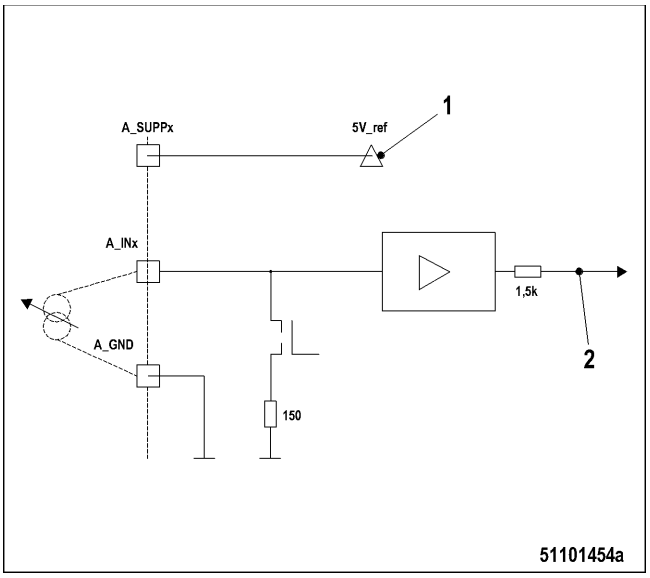
Parameters

Required settings:
- Activation of pressure monitoring
- Maximum value (bar), default setting is 10 bar
- System response in case of limit value violation
- Limit value
- Hysteresis

- Delay times

No.	Presetting	Unit	Designation	Settings
PR121	10	bar	Scale Pressure 1	Grid Point For End of Scale (100%) In BAR
PR320	0	Binary	Pressure 1 Monitoring ON	1 -Pressure Monitoring and Alarm ON 0 - Pressure Monitoring and Alarm OFF
PR321	2	Digital	Selector Alarm Pressure 1	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR322	9.5	bar	Level Pressure 1 HI	Protection Level for HI Alarm
PR323	1	bar	Hysteresis Pressure 1 HI	Hysteresis for HI Alarm Protection Level
PR324	2	s	Delay Time Pressure 1 HI Rise	Delay Time for crossing the HI Level
PR325	2	s	Delay Time Pressure 1 HI Fall	Delay Time for under-run the HI Level

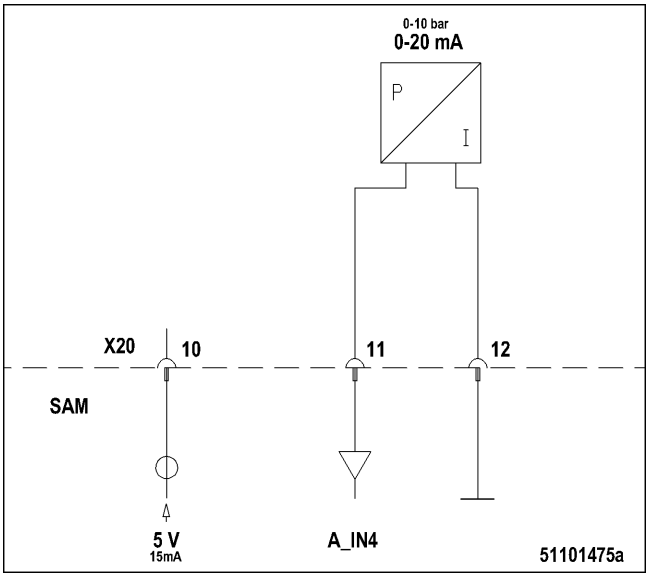
A_IN 4 – Pressure 2
Channel specification



1 U_{ref}
2 A/D channel
3 Input 0 ... 24 mA

Input:
- Current measuring 0 .. 20 mA
- Temperature input impedance: 100 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pressure sensor 4 ... 20 mA
- Function:

  The channel is used to acquire a (random) pressure value with a 4 ... 20 mA sensor. The present value is displayed on DIS 10 (option, if applicable).

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

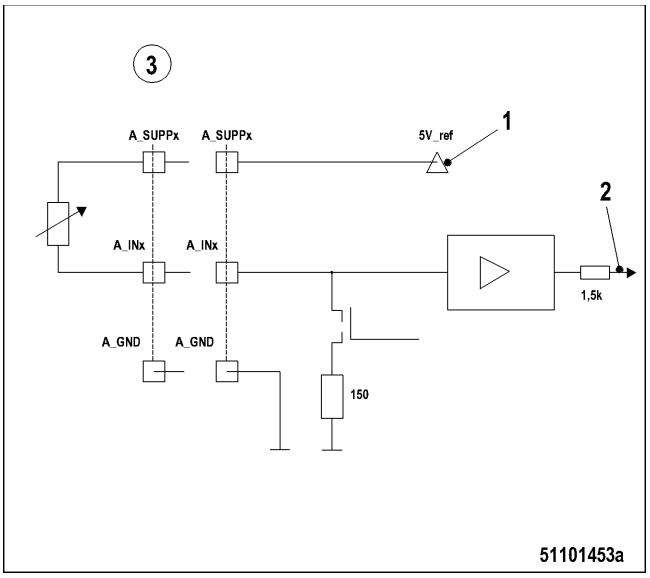
Parameters

Required settings:
- Activation of pressure monitoring
- Maximum value (bar), default setting is 10 bar
- System response in case of limit value violation
- Limit value
- Hysteresis

- Delay times

No.	Presetting	Unit	Designation	Settings
PR122	10	bar	Scale Pressure 2	Grid Point For End of Scale (100%) In BAR
PR330	0	Binary	Pressure 2 Monitoring ON	1 -Pressure Monitoring and Alarm ON 0 - Pressure Monitoring and Alarm OFF
PR331	2	Digital	Selector Alarm Pressure 2	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR332	9.5	bar	Level Pressure 2 HI	Protection Level for HI Alarm
PR333	1	bar	Hysteresis Pressure 2 HI	Hysteresis for HI Alarm Protection Level
PR334	2	s	Delay Time Pressure 2 HI Rise	Delay Time for crossing the HI Level
PR335	2	s	Delay Time Pressure 2 HI Fall	Delay Time for under-run the HI Level

A_IN 5 – Winding temperature 1 generator
Channel specification

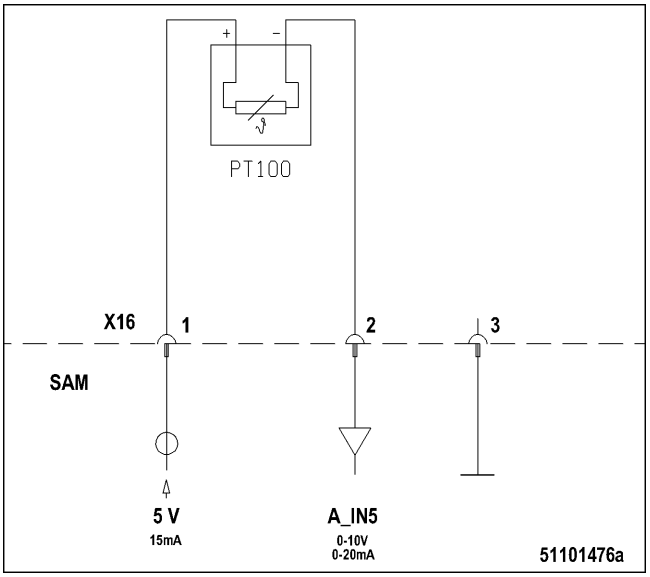


1 U_{ref}
2 A/D channel
3 Pt100 input

Input:

- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100 temperature sensor
- Function:

  The channel is used to acquire the winding temperature of generator winding L1.

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

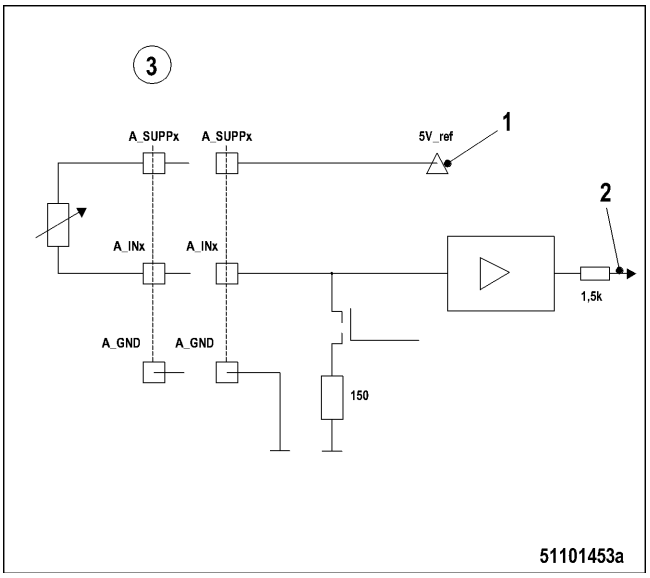
Parameters

Required settings:
- Activation of temperature monitoring
- System response
- Limit value
- Hysteresis values

- Delay times

No.	Presetting	Unit	Designation	Settings
PR340	0	Binary	Winding Temp. 1 Monitoring ON	1 -Winding Temp. Monitoring and Alarm ON 0 - Winding Temp. Monitoring and Alarm OFF
PR341	2	Digital	Selector Alarm T-Winding 1	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR342	140	DegC	Level T-Winding 1 HI	Protection Level for HI Alarm
PR343	5	DegC	Hysteresis T-Winding 1 HI	Hysteresis for HI Alarm Protection Level
PR344	2	s	Delay Time T-Winding 1 HI Rise	Delay Time for crossing the HI Level
PR345	2	s	Delay Time T-Winding 1 HI Fall	Delay Time for under-run the HI Level

A_IN 6 – Winding temperature 2 generator
Channel specification

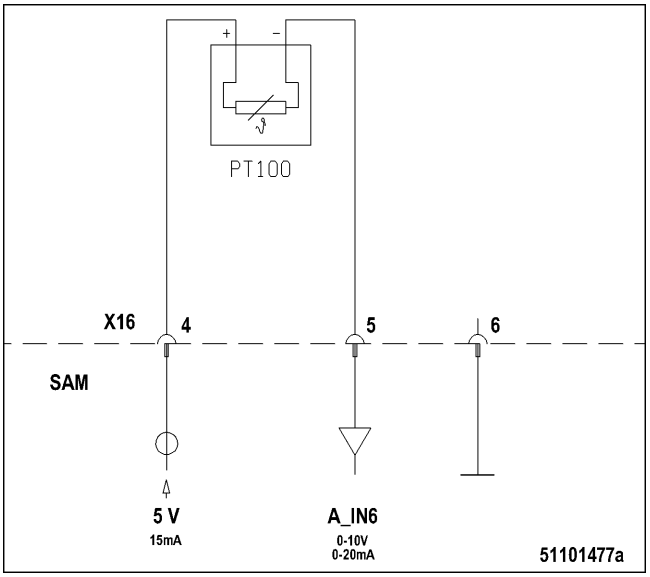


1 U_{ref}
2 A/D channel
3 Pt100 input

Input:

- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100 temperature sensor
- Function:

  The channel is used to acquire the winding temperature of generator winding L2.

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

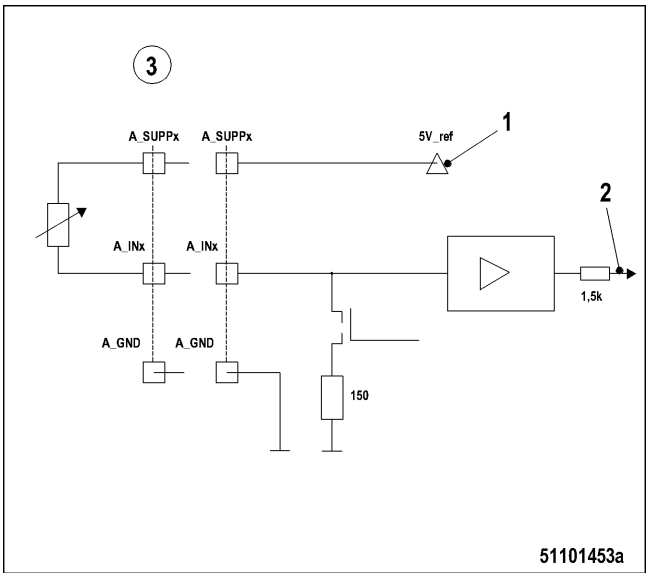
Parameters

Required settings:
- Activation of temperature monitoring
- System response
- Limit value
- Hysteresis values

- Delay times

No.	Presetting	Unit	Designation	Settings
PR350	0	Binary	Winding Temp. 2 Monitoring ON	1 -Winding Temp. Monitoring and Alarm ON 0 - Winding Temp. Monitoring and Alarm OFF
PR351	2	Digital	Selector Alarm T-Winding 2	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR352	140	DegC	Level T-Winding 2 HI	Protection Level for HI Alarm
PR353	5	DegC	Hysteresis T-Winding 2 HI	Hysteresis for HI Alarm Protection Level
PR354	2	s	Delay Time T-Winding 2 HI Rise	Delay Time for crossing the HI Level
PR355	2	s	Delay Time T-Winding 2 HI Fall	Delay Time for under-run the HI Level

A_IN 7 – Winding temperature 3 generator
Channel specification

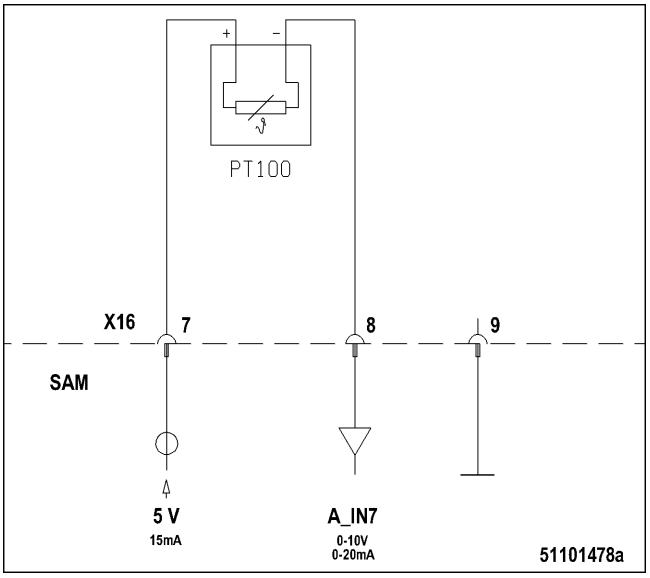


1 U_{ref}
2 A/D channel
3 Pt100 input

Input:

- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100 temperature sensor
- Function:

  The channel is used to acquire the winding temperature of generator winding L3.

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

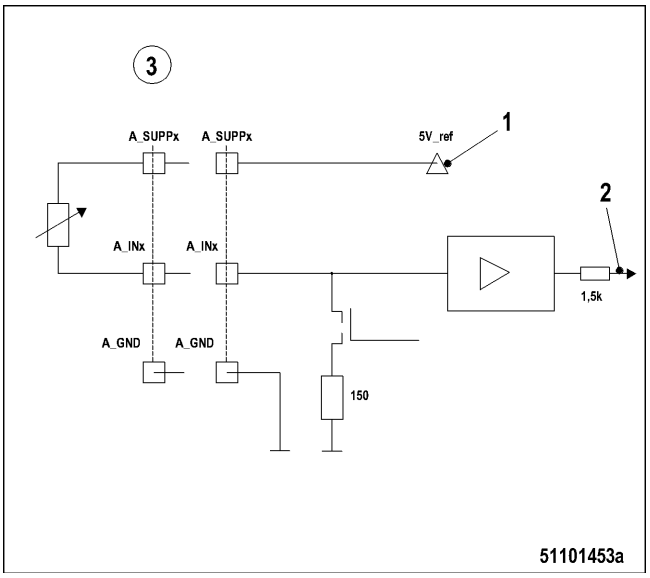
Parameters

Required settings:
- Activation of temperature monitoring
- System response
- Limit value
- Hysteresis values

- Delay times

No.	Presetting	Unit	Designation	Settings
PR360	0	Binary	Winding Temp. 3 Monitoring ON	1 -Winding Temp. Monitoring and Alarm ON 0 - Winding Temp. Monitoring and Alarm OFF
PR361	2	Digital	Selector Alarm T-Winding 3	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR362	140	DegC	Level T-Winding 3 HI	Protection Level for HI Alarm
PR363	5	DegC	Hysteresis T-Winding 3 HI	Hysteresis for HI Alarm Protection Level
PR364	2	s	Delay Time T-Winding 3 HI Rise	Delay Time for crossing the HI Level
PR365	2	s	Delay Time T-Winding 3 HI Fall	Delay Time for under-run the HI Level

A_IN 8 – Room temperature
Channel specification

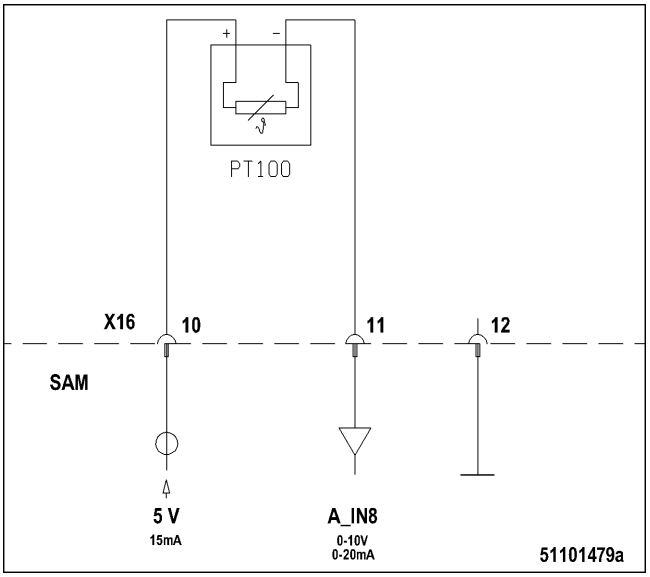


1 U_{ref}
2 A/D channel
3 Pt100 input

Input:

- Temperature measuring current: Pt100 4 mA
- Temperature input impedance: 1 kΩ
- Sensor supply: 5 V, max. 20 mA

Function



- Acquisition of:
  - Pt100 temperature sensor
- Function:

  The channel is used to acquire the room temperature in the generator room.

  Programmable system responses:
  - No alarm
  - Message
  - Yellow alarm
  - Red alarm
  - Red alarm with shutdown
- The alarm is stored in the SAM and displayed on the fault code monitor. It is also displayed on DIS 10 (option, if applicable).

Parameters

Required settings:
- Activation of temperature monitoring
- System response
- Limit value
- Hysteresis values

- Delay times

No.	Presetting	Unit	Designation	Settings
PR370	0	Binary	T-Ambient Monitoring ON	1 -Temperature Monitoring and Alarm ON 0 - Temperature Monitoring and Alarm OFF
PR371	2	Digital	Selector Alarm T-Ambient	0 - No Protection 1 - Message 2 - Yellow Alarm 3 - Red Alarm 4 - Red Alarm with Security Stop
PR372	140	DegC	Level T-Ambient HI	Protection Level for HI Alarm
PR373	5	DegC	Hysteresis T-Ambient HI	Hysteresis for HI Alarm Protection Level
PR374	2	s	Delay Time T-Ambient HI Rise	Delay Time for crossing the HI Level
PR375	2	s	Delay Time T-Ambient HI Fall	Delay Time for under-run the HI Level

Frequency inputs F_IN 1 ... 2

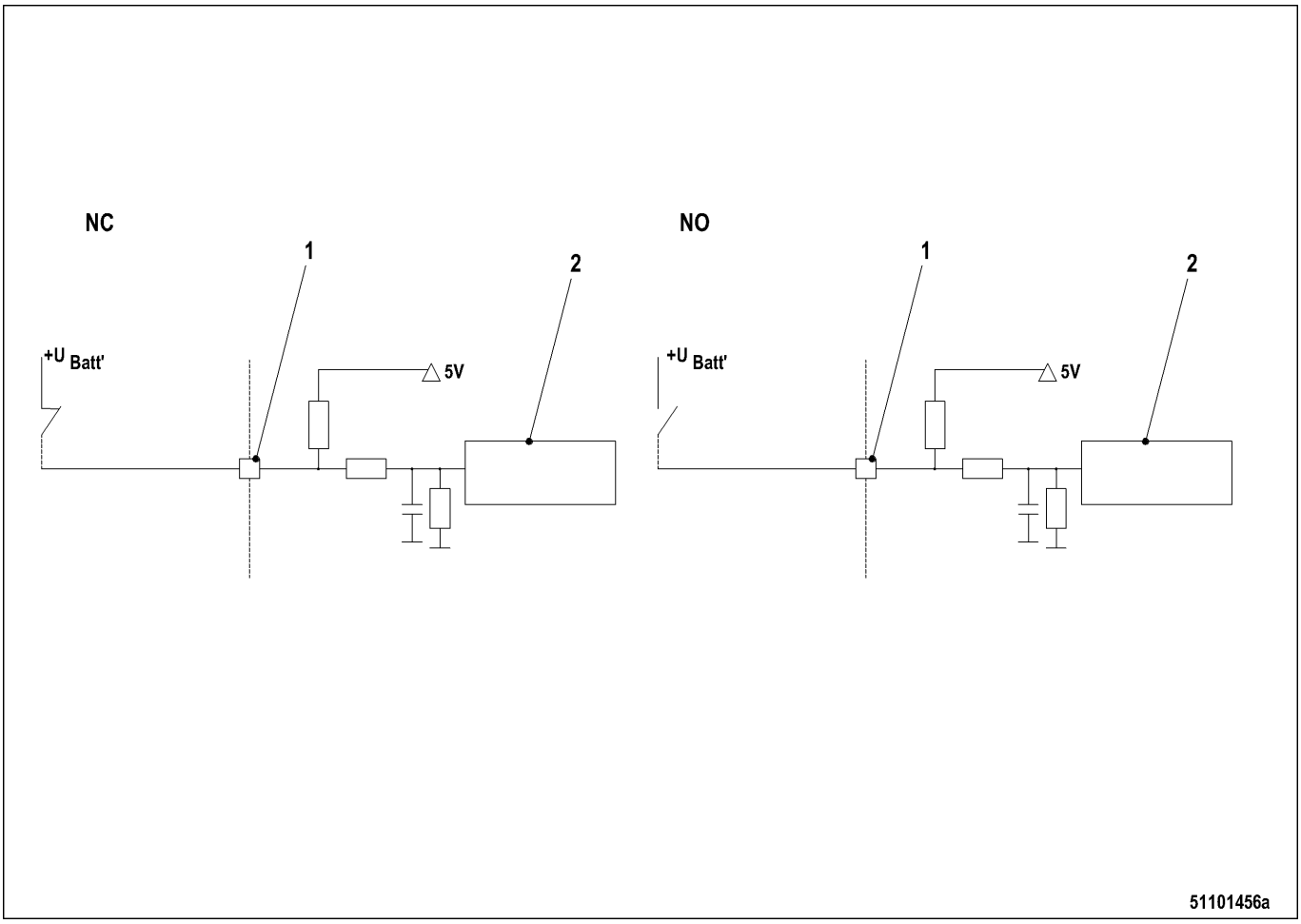
Frequency inputs are not used:
- F_IN 1
- F_IN 2

Binary inputs with common ground P_IN 1 ... 8

- Control by:
  - Switch to $+U_{bat}$
- Channel specification:
  - Voltage range: U_{bat_GND} ... $+U_{bat}$
  - Impedance: Approx. 6.9 kΩ
  - Input current to $+U_{bat}$: 3.5 mA
  - Input current to U_{bat_GND}: 22 µA
  - Switching to $+U_{bat}$

    U_{in} > 10 V: Closed (high)

    U_{in} < 9 V: Open (low)
  - Electrical isolation: No
- Required settings:
  - None
- Schematic circuit diagram:



NC Normally Closed
NO Normally Open

1 Input
2 Evaluation

P_IN 7 – Turn engine without starting

Function

Input is NO (normally open):

The starter is activated as soon as the switch is closed (+24 VDC applied), without injecting fuel. This turns the engine without starting.

Parameters

The function must be switched on or off.

No.	Presetting	Unit	Designation	Settings
PR546	1	Digital	Manual Turning Signal Mode	0 - Manual Turning not Active 1 - Manual Turning via Binary Output Active

Unused P_IN channels

The following channels are not used:

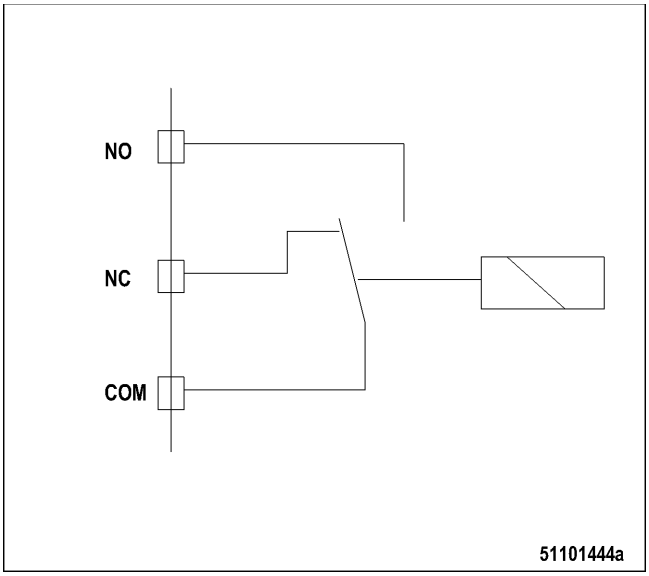
- P_IN 1 to 6
- P_IN 8

Relay outputs BR_OUT 1 ... 4

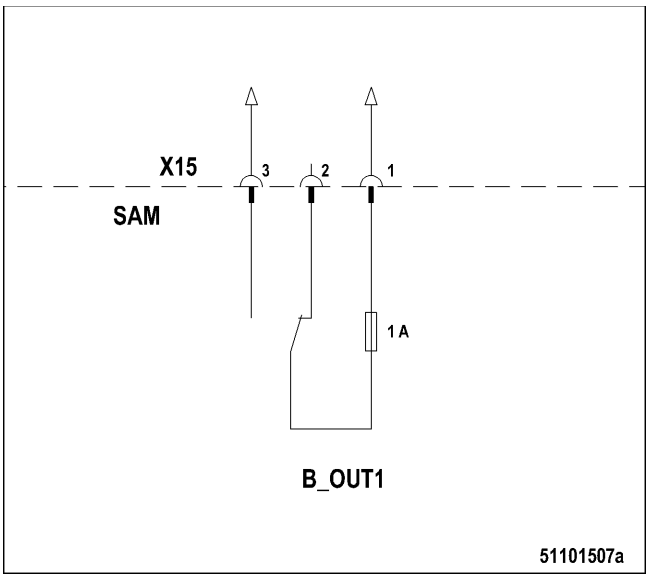
- Control of:
  - Load
- Channel specification:

- Voltage range: U < 36 V
- NO — COM — NC (changeover contact)
- Impedance “On”: R < 20 mΩ
- I_{max}: 1 A
- DC isolation: < 300 V

• Required settings:
  - Reason for switching

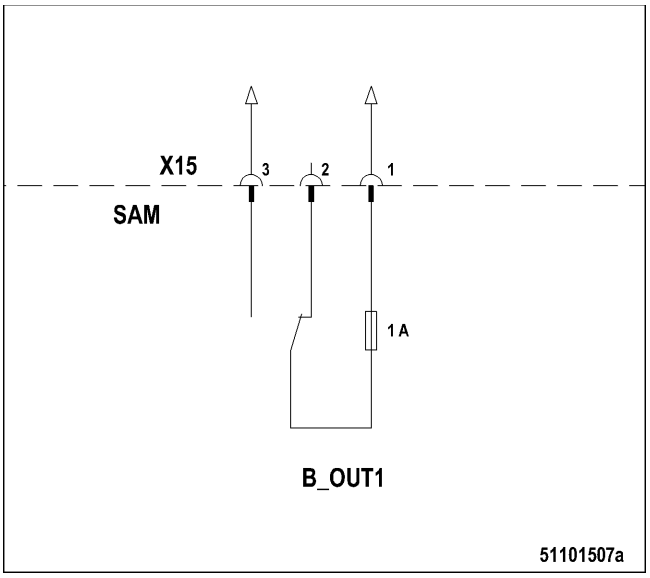


BR_OUT 1 – Oil priming pump on
Function



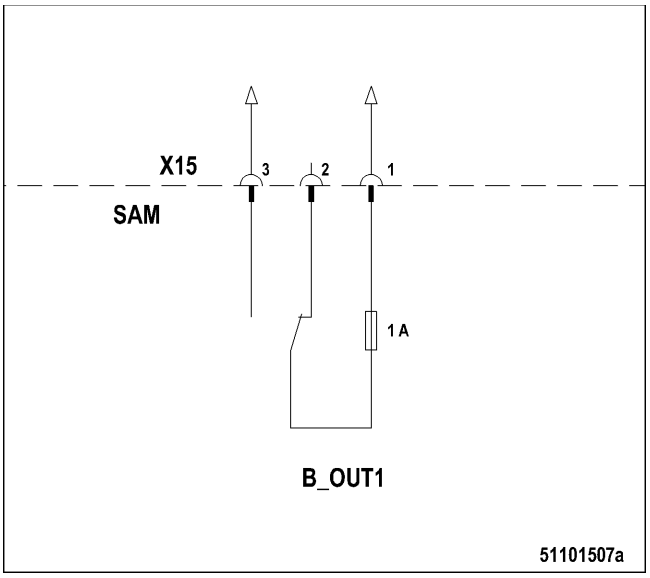
This output switches on the oil priming pump.
Parameters
None.

BR_OUT 2 – Fuel pump on
Function

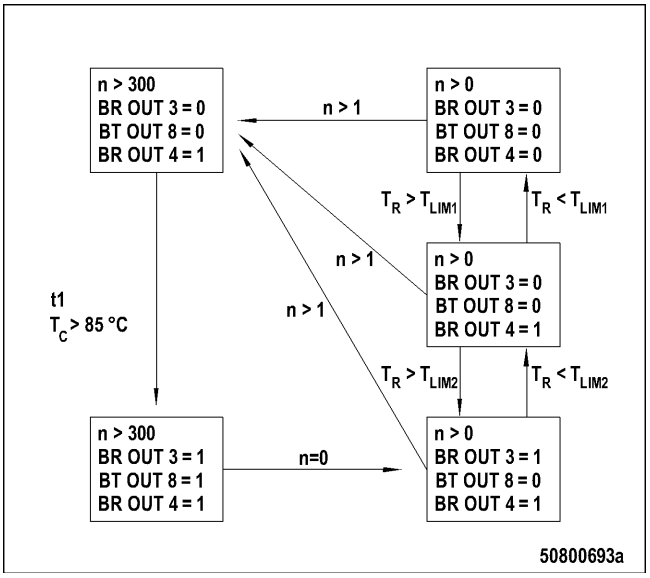


This output switches on the fuel pump. The level at which the pump is switched on/off can be adjusted.
Parameters
The parameters of input A_IN_ISO3 influence the response of output (→ Page 118).

BR_OUT 3 – Fan 1 on
Function



This output switches on fan 1. It is also possible to control the louvers (BR-OUT 4). The schematic illustrates activation of the three outputs associated with fan control. The abbreviations mean:
- BR_OUT 3: Fan 1
- BT_OUT 8: Fan 2
- BR_OUT 4: Louvers
- n > 1: Engine running
- n 0: Engine at a standstill
- n > 300: Engine speed above 300 rpm
- T_C: Coolant temperature
- T_R: Room temperature
- T_{LIM1} and T_{LIM2}: Limit values



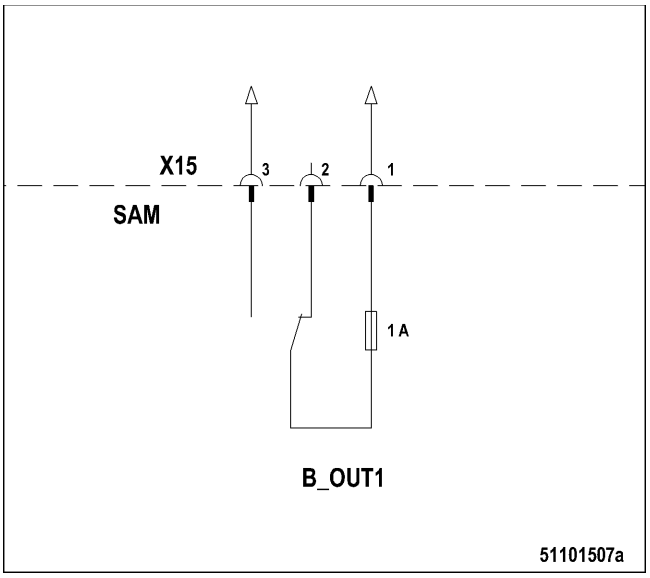
Parameters

Required settings:

- Activation of fan control
- Number of fans
- Louvers
- Hysteresis values
- Delay times
- Coolant temperature tripping value

No.	Presetting	Unit	Designation	Settings
PR150	0	Binary	Fan Control Activation	0 - Fan1 and Shutter are controlled, 1 - Fan Control Enable
PR151	0	Binary	Fan Control Mode Select	1 - Fan1+2 and Shutter are controlled
PR152	120	s	Fan Control Delay Time	Fan Control Delay Time After Engine Start in Seconds
PR154	32	DegC	Fan Control Temperature Level 2	Fan Control Temperature Level for Switch On FAN 1
PR156	3	DegC	Fan Control Temp. Hysteresis 2	Fan Control Temp. Hysteresis for Switch Off FAN 1
PR157	85	DegC	Fan Control T-Coolant Level	T-Coolant Level for Switch Off FAN(s) after Engine Start

BR_OUT 4 – Louvers open/closed
Function



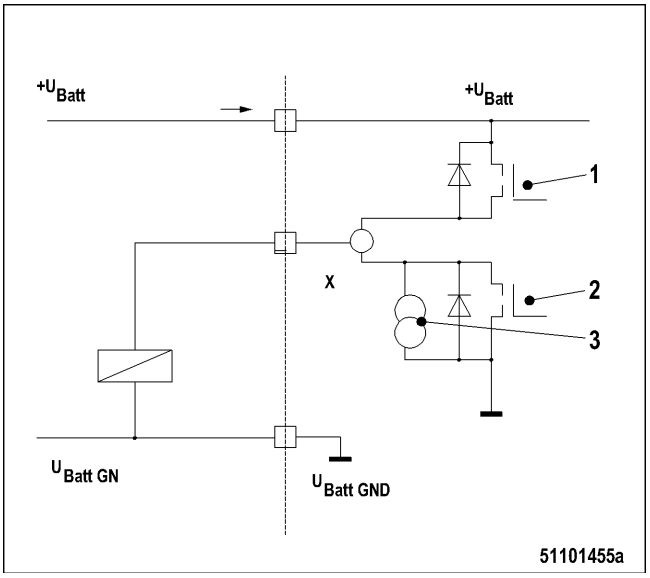
This output controls the louvers. See also .
Parameters

Required settings:
- Coolant temperature tripping value
- Hysteresis values

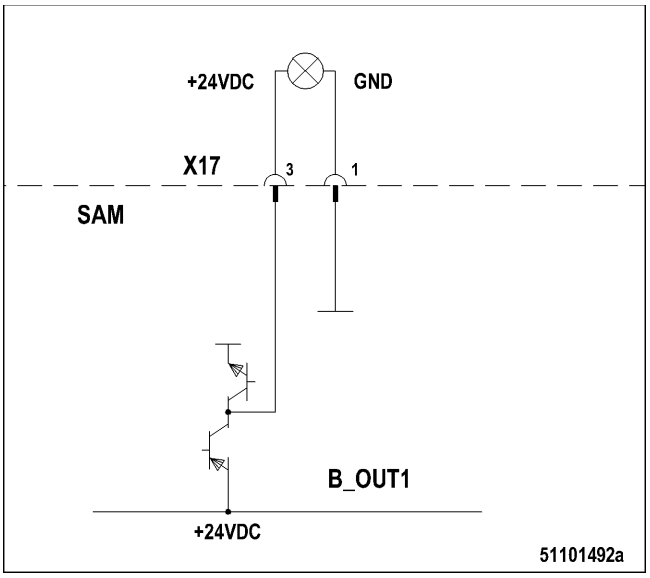
No.	Presetting	Unit	Designation	Settings
PR153	28	DegC	Fan Control Temperature Level 1	Fan Control Temperature Level for Open Shutters
PR155	3	DegC	Fan Control Temp. Hysteresis 1	Fan Control Temp. Hysteresis for Close Shutters

Binary transistor outputs BT_OUT 1 ... 20

- Control of:
  - Loads
- Channel specification:
  - I_{max}: 0.5 A
  - I_{max} when channel switched off: 50 ... 150 µA
  - High active
  - DC isolation: No
  - Short-circuit protection: Yes
- Required settings:
  - System response
- Schematic circuit diagram:



BT_OUT 1 – Overspeed
Function



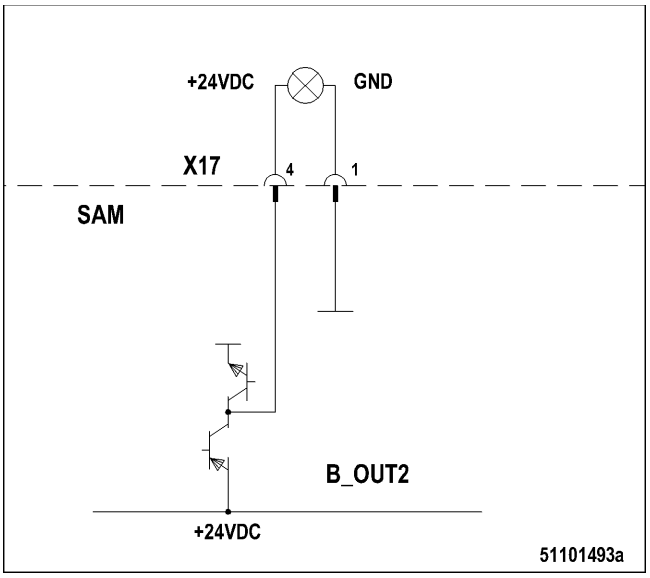
The output is activated when the overspeed limit is exceeded.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 2 – Coolant temperature too high
Function



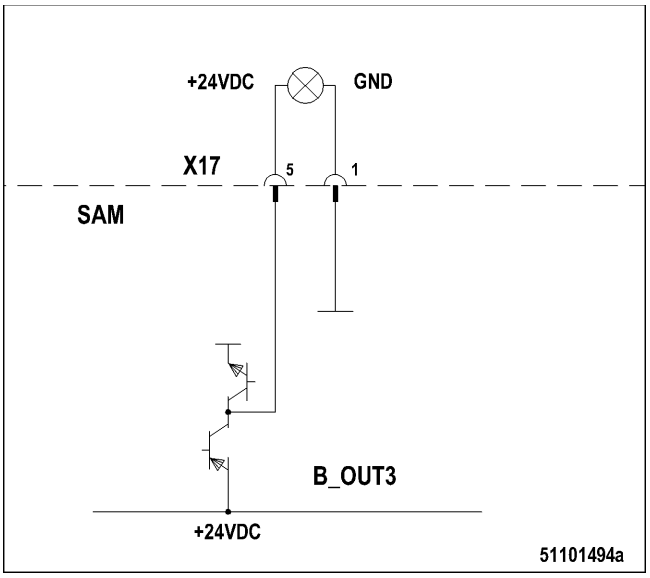
The output is activated when the coolant temperature has violated the first limit value.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 3 – Coolant temperature too high — Engine stop
Function



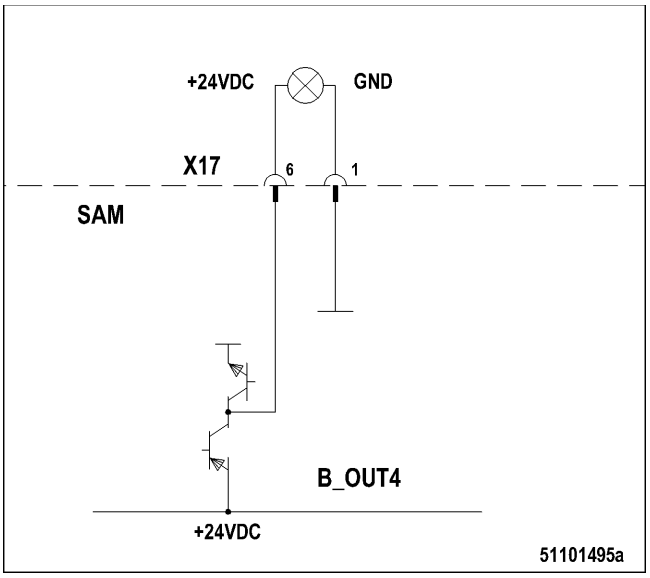
The output is activated when the coolant temperature has violated the second limit value thus leading to engine shutdown.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 4 – Charge-air temperature too high
Function



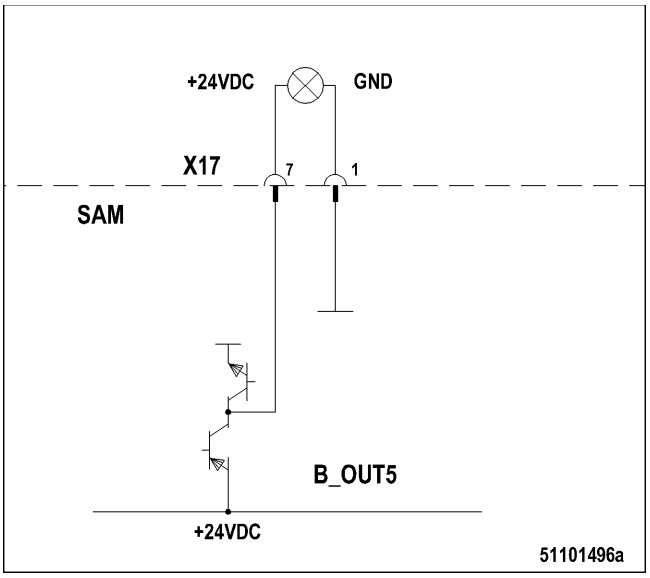
The output is activated when the charge-air temperature has violated the first limit value.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 5 – Charge-air temperature too high
Function



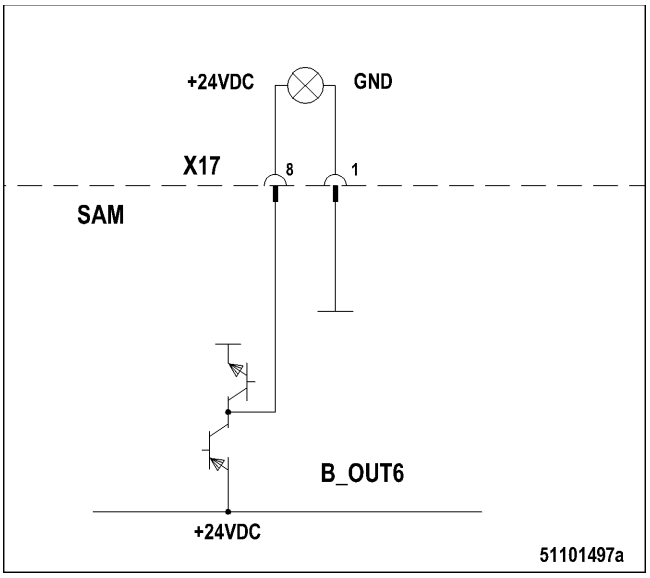
The output is activated when the charge-air temperature has violated the second limit value.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 6 – Charge-air coolant level too low
Function



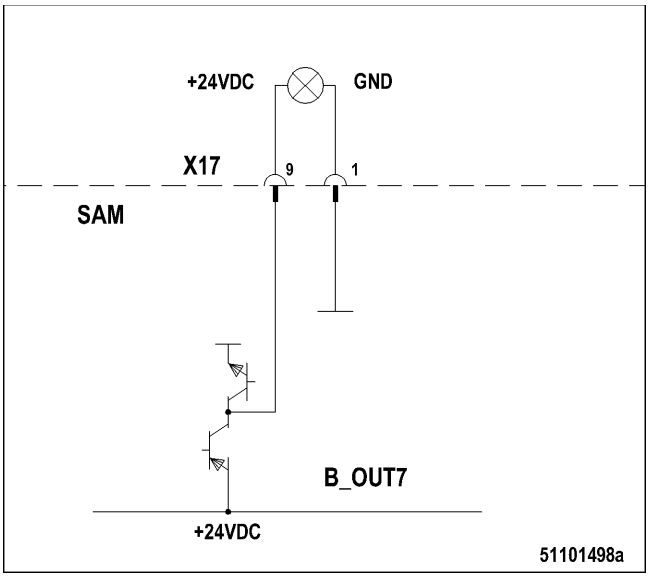
The output is activated when the charge-air coolant level is too low thus leading to engine shutdown.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 7 – Coolant level too low
Function



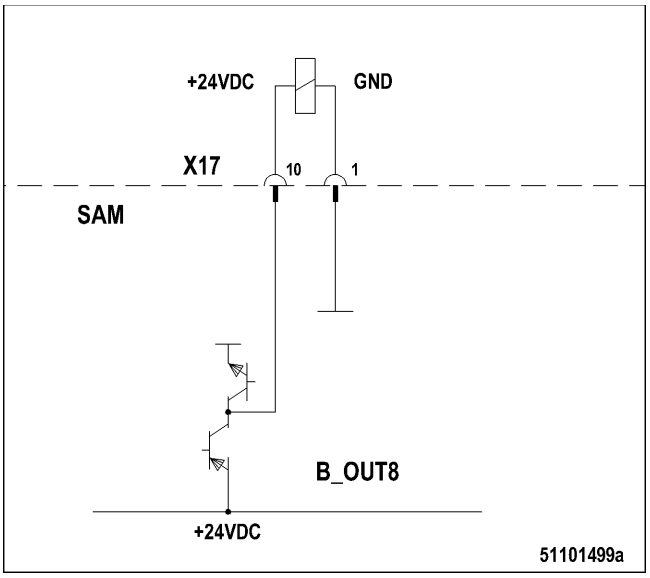
The output is activated when the coolant level is too low thus leading to engine shutdown.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

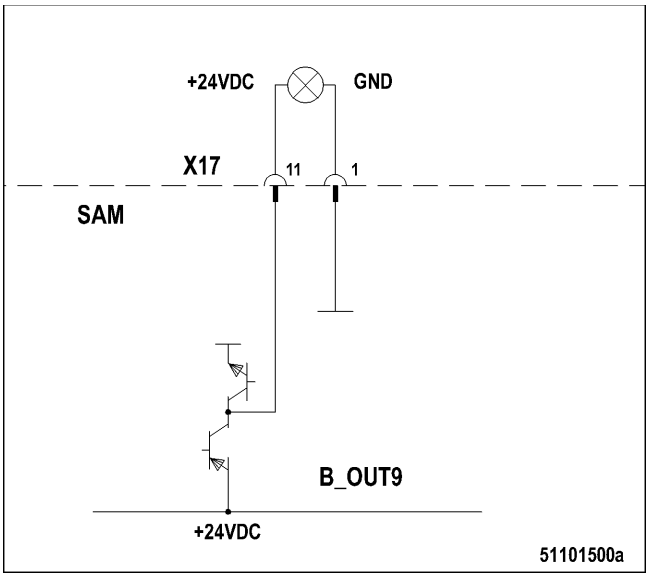
None.

BT_OUT 8 – Fan 2 on
Function



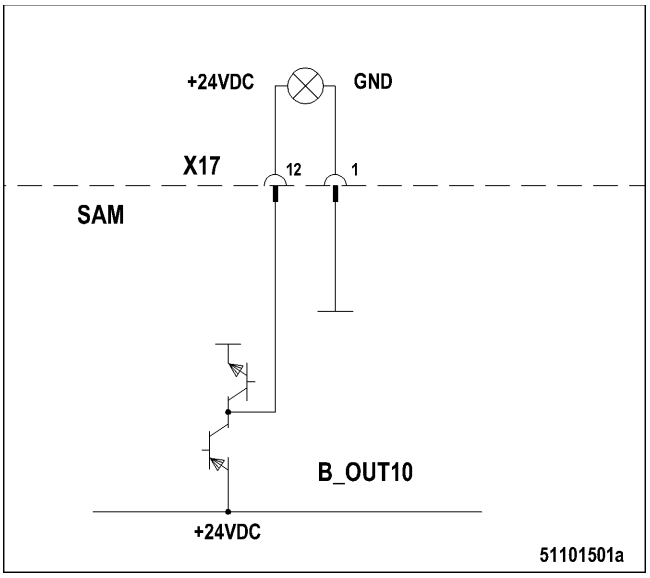
The output is used to control a second fan. See also .
Parameters
This output is influenced by the parameters of output BR_OUT3 (see (→ Page 158)).

BT_OUT 9 – Preheating temperature not reached
Function



The output is activated when the preheating temperature has not been reached within the specified time.
This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.
Parameters
None.

BT_OUT 10 – Lube oil pressure too low
Function



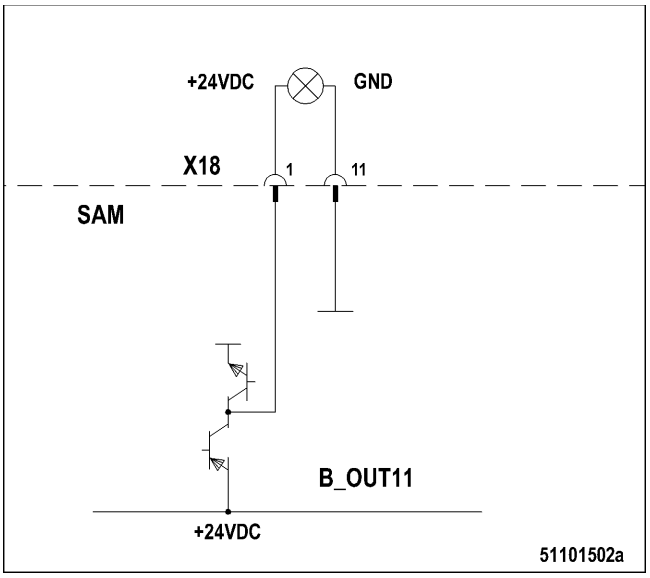
The output is activated when the lube oil pressure has fallen below the first limit value.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 11 – Engine running
Function



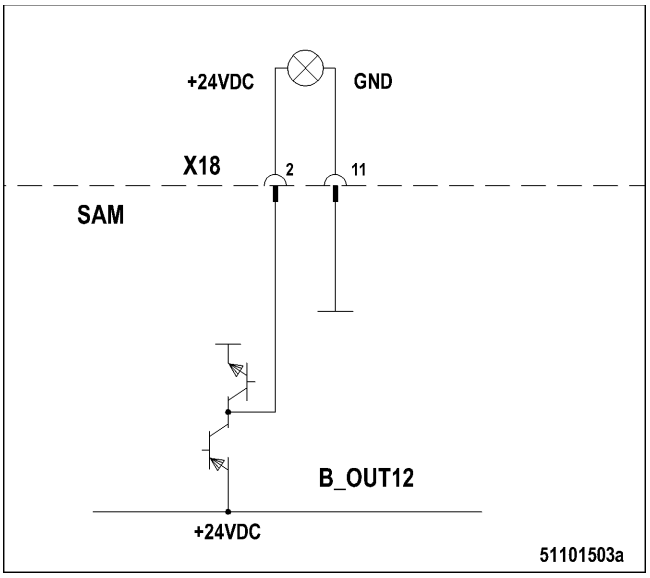
The output is activated when the engine speed is above 300 rpm.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

None.

BT_OUT 12 – Fuel pressure too low — Alarm
Function



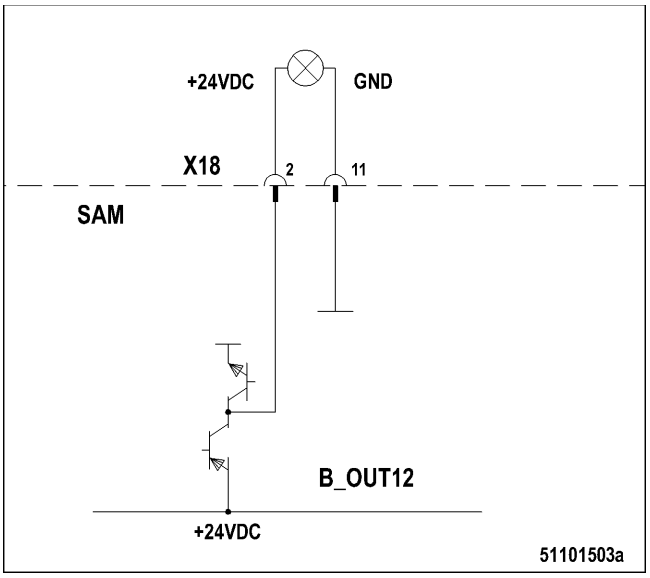
The output is activated if the fuel pressure is below the second limit value.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

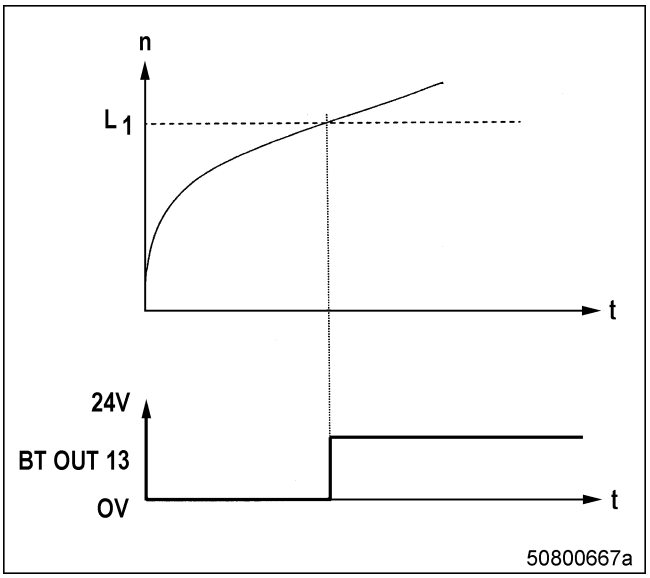
Parameters

None.

BT_OUT 13 – Load acceptance ready
Function



The output is activated as soon as the generator is ready for load (speed limit value exceeded).

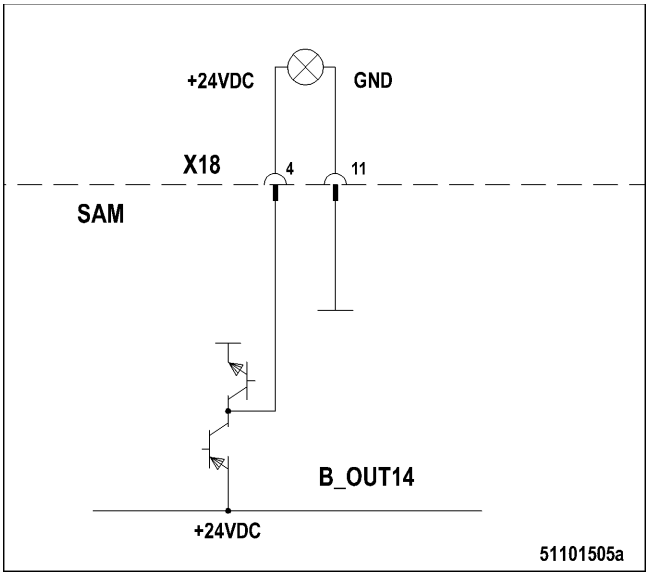


Parameters

Limit values for ON and OFF must be specified.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

BT_OUT 14 – Priming pressure reached
Function



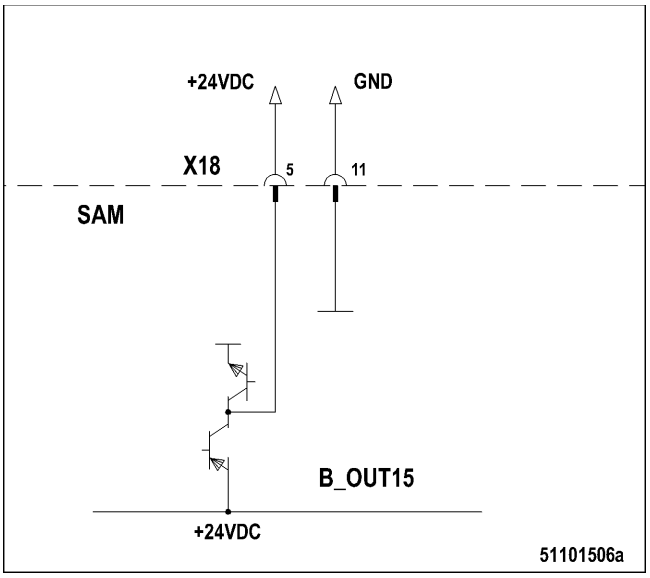
The output is activated as soon as the priming pressure has been reached.

This function is monitored/controlled by the engine governor. The necessary settings must therefore be made at the engine governor ((→ Page 92)). The SAM output only makes the CAN signal available at a binary output.

Parameters

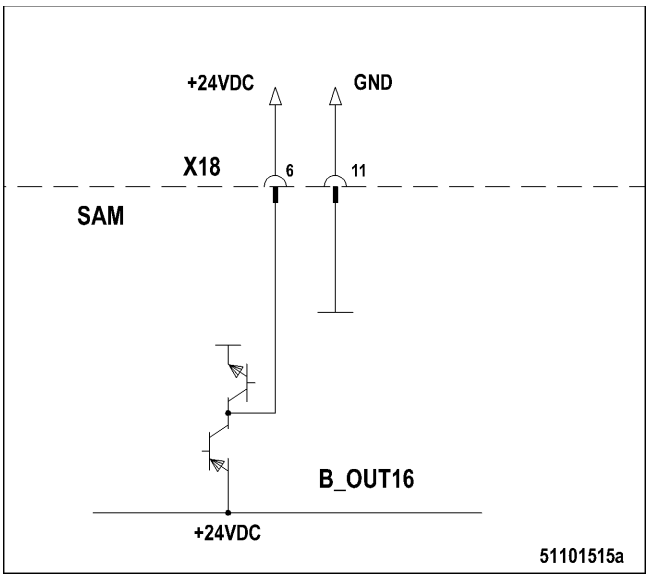
CAN parameter, must be set in engine governor.

BT_OUT 15 – Generator overtemperature
Function

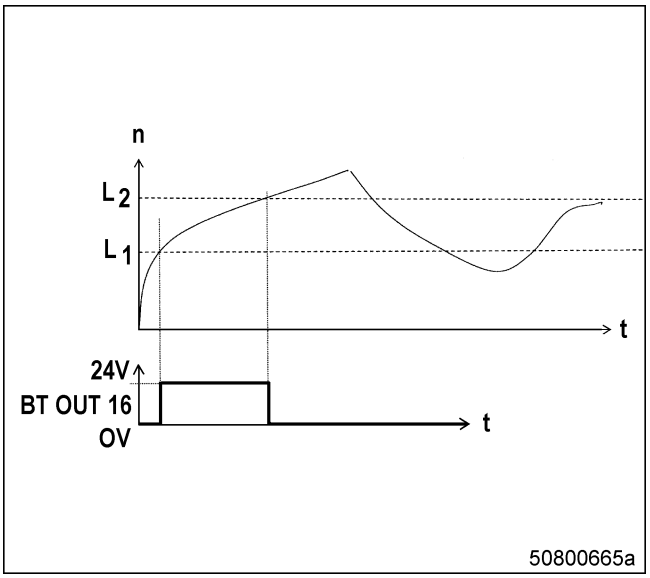


The output is activated when one of the generator windings is too hot.
Parameters
None. Limit values and response: See:
- A_IN5: (→ Page 147)
- A_IN6: (→ Page 149)
- A_IN7: (→ Page 151)

BT_OUT 16 – Exciter boosting on
Function



The output is activated to switch on exciter boosting for generator runup (control signal only, a booster must be connected to switch the load). This signal is only output once following engine start when the engine speed is between the two values L1 and L2. Can only be re-triggered after prior detection of the “engine stopped” signal.



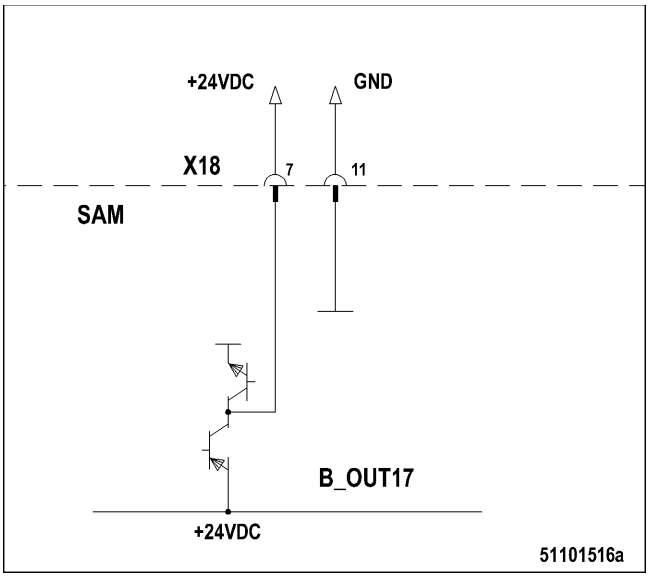
Parameters

Required settings:

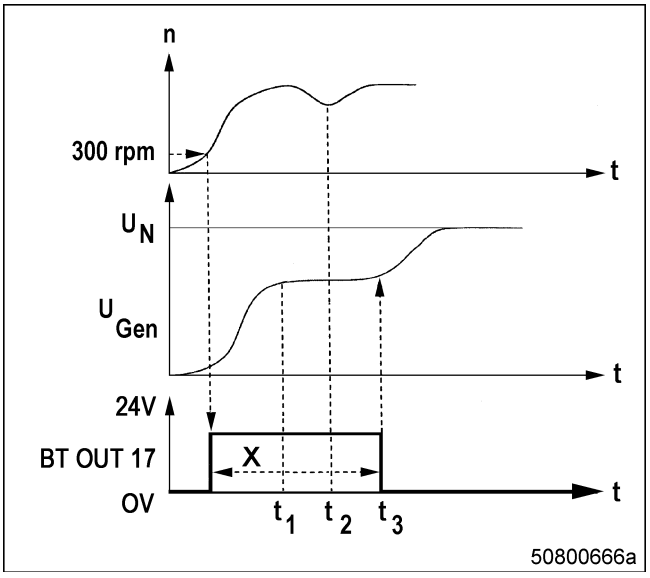
- Activation of the function
- Switching thresholds at which the signal is switched on/off

No.	Presetting	Unit	Designation	Settings
PR201	0	Binary	Subsidiary Excitation Funct. ON	0 - Subsidiary Excitation Function is Deactivated 1 - Subsidiary Excitation Function is Activated
PR202	600	rpm	Subsidiary Excitation Level ON	Engine Speed Level for Switch On Subsidiary Excitation
PR203	1480	rpm	Subsidiary Excitation Level OFF	Engine Speed Level for Switch Off Subsidiary Excitation

BT_OUT 17 – Generator voltage
Function



This signal is only output once following engine start when the engine speed is above a configurable value and the generator voltage has not yet reached the nominal voltage U_N. Can only be re-triggered after prior detection of the “engine stopped” signal.



Parameters

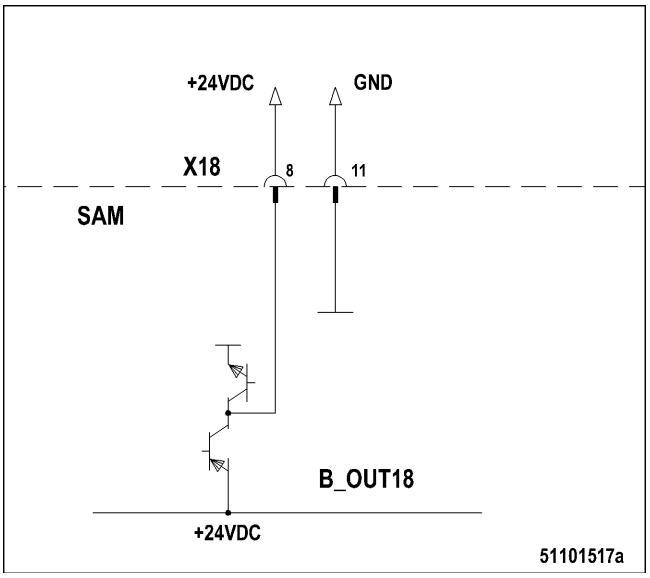
Required settings:

- Activate function
- Time X

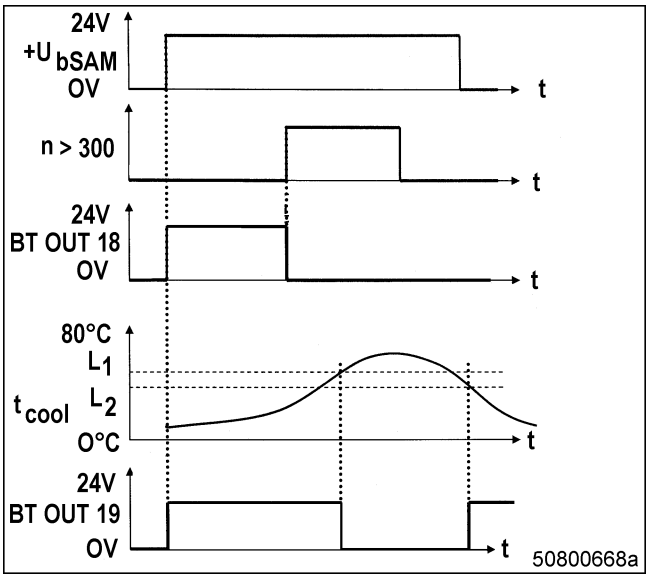
- Speed switching threshold

No.	Presetting	Unit	Designation	Settings
PR205	0	Binary	Generator Voltage Function ON	0 - Generator Voltage Function is Deactivated 1 - Generator Voltage Function is Activated
PR206	20	s	Generator Voltage Time OFF	Time for Switch Off Generator Voltage
PR207	300	rpm	Generator Voltage Level ON	Engine Speed Level for Switch On Generator Voltage

BT_OUT 18 – Circulating pump on Function



The output is activated to switch on the coolant circulating pump (preheating). This is effected as soon as SAM is connected to operating voltage and the engine is at a standstill.



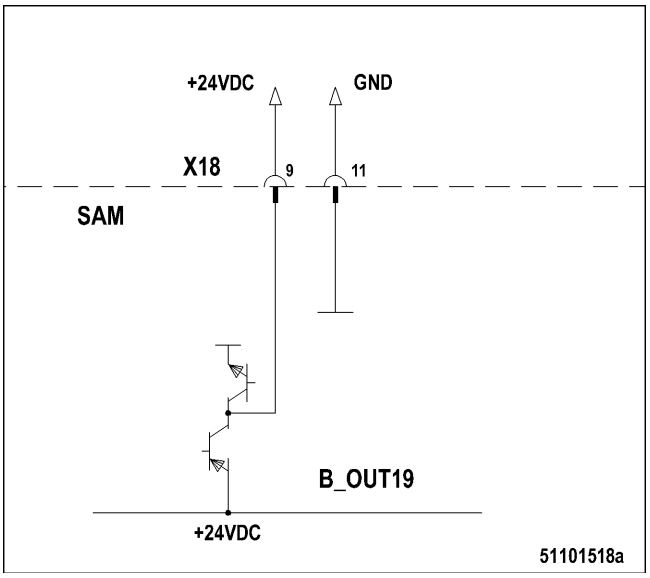
Parameters

Required settings:

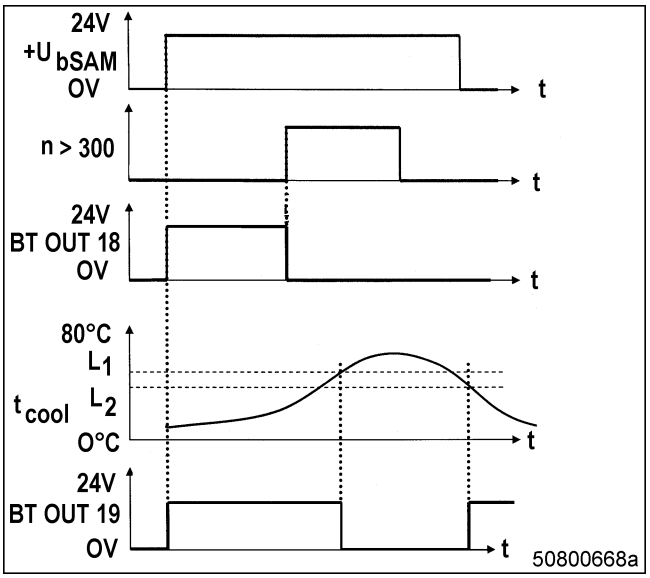
- Activate function

No.	Presetting	Unit	Designation	Settings
PR210	0	Binary	Circulation Pump Function ON	0 - Circulation Pump is Deactivated 1 - Circulation Pump is Activated

BT_OUT 19 – Anti-condensation heating on Function



The output is activated to switch on the anti-condensation heating. This is effected as soon as the coolant temperature falls below value L2. The anti-condensation heating is switched off when the coolant temperature rises above value L1.



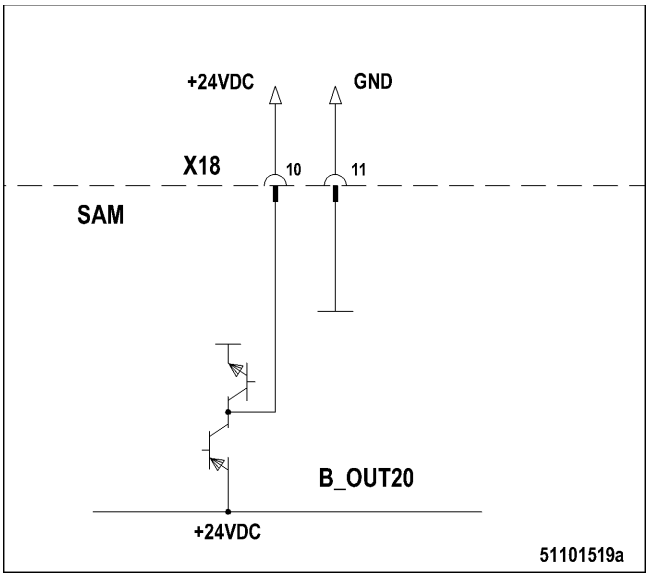
Parameters

Required settings:

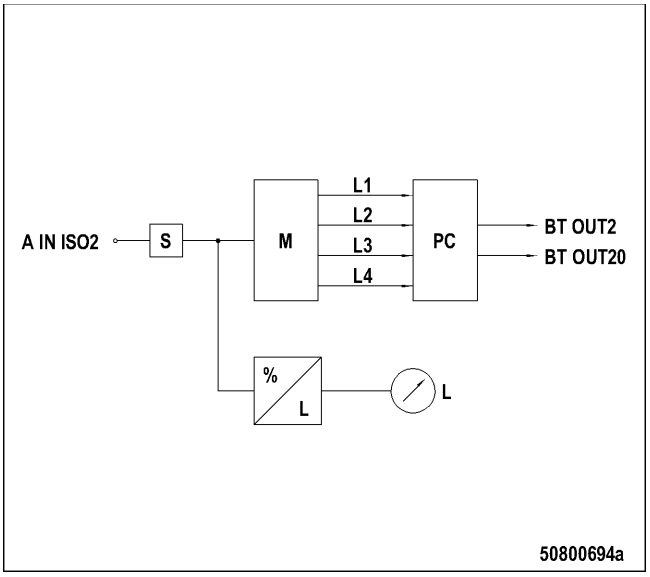
- Activate function
- Switching thresholds L1 and L2

No.	Presetting	Unit	Designation	Settings
PR211	0	Binary	Downtime Heating Function ON	0 - Downtime Heating is Deactivated 1 - Downtime Heating is Activated
PR212	40	DegC	Downtime Heating Temp. ON	Coolant Temperature Level for Switch On Downtime Heating
PR213	45	DegC	Downtime Heating Temp. OFF	Coolant Temperature Level for Switch Off Downtime Heating

BT_OUT 20 – Day tank below minimum — Alarm Function



The output is activated when the fuel level in the day tank falls below the limit value.

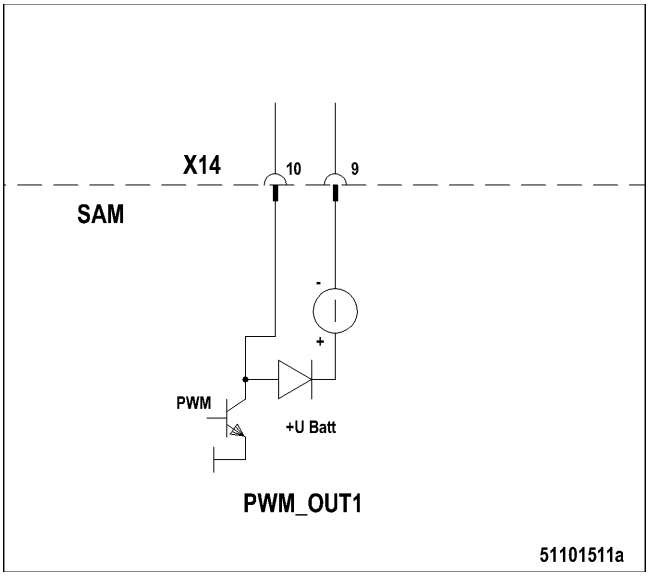


Parameters

This output is influenced by the parameters of output A_IN_ISO3 (see (→ Page 118)).

Pulse-width-modulated outputs PWM_OUT 1 ... 2

PWM_OUT 1 — Fan control 1
Function



This output is used to control a pulse-width-modulated fan (fan 2).
Parameters
Required settings:

- Activation of the function
- Frequency
- Delay times

- Curves

No.	Presetting	Unit	Designation	Settings
PR040	3	Digital	Config PWM_OUT1	0 - Output is Deactivated 1 - PWM Output 2 - Binary Output 3 - PWM Current Output
PR041	250	Hz	Frequency PWM_OUT1	Frequency PWM_OUT1 in Hz
PR0041	250	Hz	Frequency PWM_OUT1	Frequency PWM_OUT1
PR160	0	%	Curve Fan Control Fan 3	Conversion of Rockford Fan Control Signal - IN: 0-100%
PR161	10	s	T-Delay WB Fan Control Fan 3	Delay Time for Wire Break Detection Fan 3.
PR162	0	Binary	PWM Output FAN 3 ON	0 - PWM Output FAN 3 is Deactivated 1 - PWM Output FAN 3 is Activated
PR163	0	%	WB Fan Detection Limit	Current difference in % for WB detection in reference to the actual current demand.

Unused PWM_OUT outputs

Output PWM_OUT 2 is not used.

Serial interfaces

RS232/RS422

This interface is not used at present.

Ethernet

This interface is used to connect a PC to use the Web function to display the ADEC Web page. In future applications this will make it possible to connect a modem for remote diagnosis.

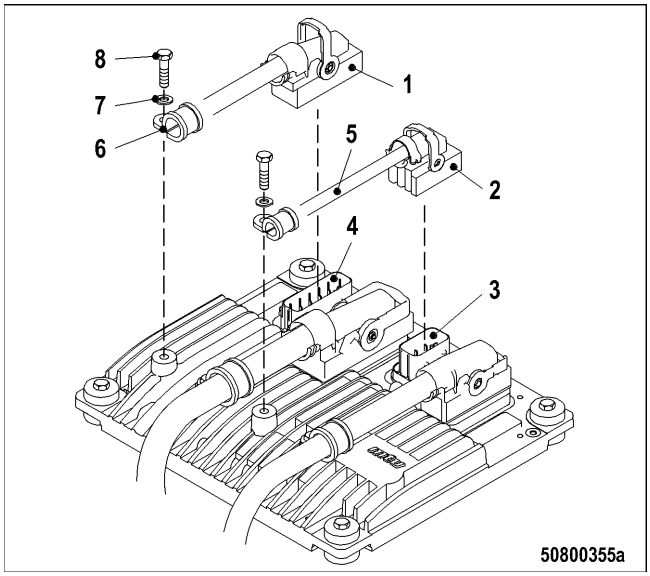
8.4 Engine governor - Connection

Preconditions

- Cables are properly routed.
- Cables are long enough.

Connection

1. Remove cable clamps (6).
2. Unlatch the levers on the two connectors (1) and (2) (lift up).
3. Plug connector X1 (1) into socket X1 (4) and engage the lever (latch down).
4. Plug connector X3 (2) into socket X3 (3) and engage the lever (latch down).
5. Route cables over and away from the engine governor.
6. Secure cables (5) with cable clamps (6).
7. Install screws (8) with washers (7) and tighten.



9 Initial Operation

9.1 Checks prior to startup

Checking system installation

Note: The tasks listed below must be carried out in the given order prior to initial power-up:

1. Check that all cables are correctly connected at the starter; ensure that cables, spade lugs etc. are not touching and that rubber caps are fitted at all terminals.
2. Check that the plug connectors are properly plugged in at the engine governor and the locking mechanism is properly engaged.
3. Check that all cables have been correctly connected to the batteries and do not cause short circuits.
4. Check that the engine and all devices are connected to ground.
5. Check that all plug connectors are properly plugged in at the SAM (check connector designations and firm seating, connector housing must be fully pressed in and engaged).
6. Check that all connectors are properly connected to user interface devices (check connector designations and firm seating).
7. Check that all cables are properly secured at suitable points in the switchgear cabinet and on the installation site.
8. Check that all cables are suitably secured on the engine. These cables (to the starter and to the engine governor on the engine) must not be allowed to hang loose, they must be secured to the engine.
9. Check that all cables (in switchgear cabinets, housings, cable channels) are routed neatly. Connector and cable designations should still be legible when installed if at all possible.
10. Ensure that cables are never routed over sharp edges unless suitably protected against chafing.
11. Ensure that none of the cables can be sheared through when switchgear cabinet doors or flaps etc. are closed.
12. Ensure that the terminating resistor (121 Ω) is installed at the end of each CAN bus .

Checking SAM supply voltage (→ Page 181)**.**

9.2 Operating voltage – Initial application

Preconditions

- Checks prior to initial operation have been carried out.

Preparatory steps

1. Gain access to SAM.
2. Remove both fuses F1 and F2 on SAM.
3. Disconnect connector X1 on the engine governor.

Applying the operating voltage

1. Apply operating voltage.
   Result: Operating voltage is switched on, but is only applied to the input of the SAM. No current flow.
2. Switch off operating voltage.
3. Insert both fuses F1 and F2 on SAM.
4. Switch on operating voltage.
5. Watch the SAM carefully!
   Result: The engine governor may be taken into operation providing that SAM does not assume inadmissible operating status.
6. Switch off operating voltage.
   Result: Operating voltage is not applied.
7. Plug connector X3 in at the engine governor and engage the clip.
8. Switch on operating voltage.
   Result: Operating voltage is applied to SAM and engine governor.
9. Observe the SAM and the engine governor!
   Result:
   - Check the the diagnostic LED on the SAM and the diagnostic LED on the engine governor light up steady.
   - Proceed with initial startup if this is the case.
   - The device concerned may be defective if the LED flashes. Test engine governor and SAM.
10. Switch off operating voltage.

9.3 SAM power supply – Check

Preconditions

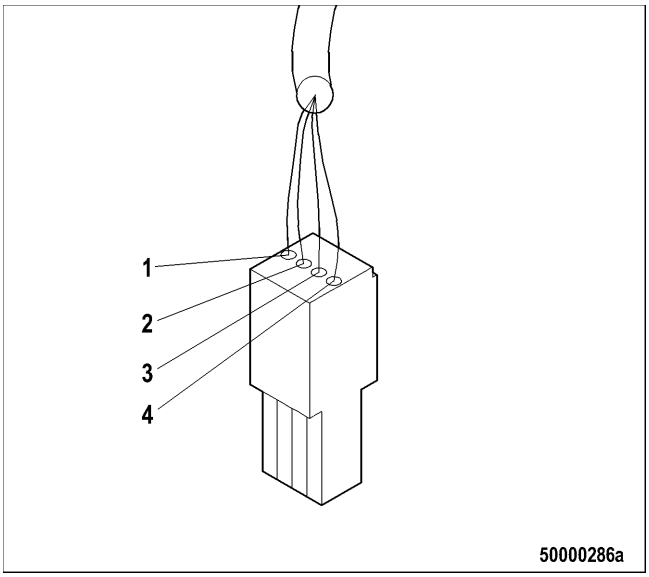
- Supply voltage is available.

Special tools

Designation / Use	Part No.	Qty.
Multimeter	0005362539	1
Test prod, red	0005385230	2
Test prod, black	0005385130	2
Test prod, red	0005385430	2
Test prod, black	0005385330	2
Assembly tool	0005385530	3
Assembly tool	0005385630	3
Cable set	0025314380	1
Insulating bushing	0005316682	2
Insulating bushing	0005316782	2

Checking plant supply voltage

1. Switch off plant supply voltage.
2. Disconnect connector X13 from SAM.
3. Prepare the multimeter for voltage measuring:
   3.1. Plug the leads into the appropriate jacks
   3.2. Set the voltage measuring range to min. 30 V
4. Switch on plant supply voltage.
5. Measure voltage between positive pins (1 and 2) and negative pins (3 and 4) of connector X13. Specified value: Voltage must be between 19.5 V and 30 V.
   5.1. If the measured value deviates from the specification, check plant power supply.
   5.2. If no voltage is present, check wiring.
   5.3. Correct wiring if polarity is reversed, see wiring diagram.
6. Plug connector into socket X13 on SAM.



10 Settings

10.1 CAN node – Configuration

Devices with CAN connection

The following devices are equipped with a CAN interface and are therefore defined by a CAN node:

- Engine governor
- SAM
- DIS 10 (if applicable)

Node numbers

Each node number can only be allocated once on a given bus.

Device	Node number
Engine governor	2
SAM	5
DIS 10 (option)	4

10.2 Parameters – Setting with dialog unit

Preconditions

- Notebook with “DiaSys” software, version 2.41 or higher installed
- CAN interface available on PC (USB to CAN2 or PCMCIA card TIN-CAN 161 with accessories)
- Dongle (hardware key) for USB port or parallel interface available
- Connecting cable between CAN interface PC and SAM, connector X4 (9-pole SUB-D on circular connector) available
- Current “ECU7INFO.DAT” file available
- “DIASYS.DAT” file available

Starting DiaSys and preparation

1. Establish connection between notebook and SAM (connect CAN interface of notebook with 9-pole SUB-D cable on circular connector to X4 on SAM)
2. Plug in the dongle (hardware key) at the appropriate interface (USB port or parallel interface)
3. Start the “DiaSys” program.
4. Set the language:
   4.1. Open the “Tools” menu in the “DiaSys” program.
   4.2. Set the user interface language of the program and the language of the parameters under the “Language” option.
   4.3. Close the “DiaSys” program and restart.
   Result: The selected languages are used.
5. Log on as “Customer” or “Service” depending on the dongle used.
6. Select the device to be programmed (“ECU 7” for the governor or “MCS-5/RCS-5” for SAM).
7. Save the “DIASYS.DAT” file (device description, stored on CF card) in a directory of your choice.
8. Read the device description “DIASYS.DAT”:
   8.1. Select “File open”
   8.2. Select and confirm the directory
9. Create a new engine number (enter the engine number where the devices to be programmed are installed). Enter a random number if the number is not known.
10. Include the engine governor in the “project”.

Selecting a device and editing parameters

1. Establish connection to CAN bus.
2. Select device.
3. Select parameters from the list and transfer to the editing list.
4. Edit parameters as specified (application, connection, requirement profile etc.).

Transmitting new parameters to the device

Note: The parameters are written into different types of memory depending on the device concerned. The following applies:
- Active: Parameters are written into the device RAM. This means that these parameters are only used in currently running operations, the original values are restored when the device is switched off.
- Start value: The data is written into the read-only memory and loaded on switching off and back on again.
- Backup: Some devices have a second read-only memory for redundant parameter storage. Data in the second read-only memory (backup memory) may vary from the data in the first read-only memory in this case. Data must therefore be saved separately.

1. For engine governor: Send data to engine governor.
   Result: All parameters are updated.
2. For SAM:
   2.1. Send data SAM.
   Result: All parameters goe to the device.
   2.2. Accept data as: “Active”
   Result: All parameters are written into the RAM.
   2.3. Accept data as: “Start value”.
   Result: All parameters are written into the read-only memory.
   2.4. Accept data as: “Backup”.
   Result: All parameters are written into the second read-only memory (backup memory).

10.3 SAM MINIDIALOG settings

Preconditions

- Operating voltage is available.

Enter password (contact Service)

Setting the engine type

1. Press key ↑ or ↓ on SAM 2 repeatedly until “Select Parameter page” appears on the display.
2. Press the ENTER key.
   Result: The engine model is displayed in the second line.
3. Press key ↑ or ↓ on printed circuit board SAB 2 repeatedly until the desired engine model is displayed.
   Possible values:
   - 12 V 2000 G 24
   - 12 V 2000 G 44
   - 12 V 2000 G 64
   - 12 V 2000 G 73
   - 12 V 2000 G 84
   - 16 V 2000 G 24
   - 16 V 2000 G 3X
   - 16 V 2000 G 44
   - 16 V 2000 G 64
   - 16 V 2000 G 73
   - 16 V 2000 G 84
   - 18 V 2000 G 24
   - 18 V 2000 G 3X
   - 18 V 2000 G 44
   - 18 V 2000 G 64
   - 18 V 2000 G 73
   - 18 V 2000 G 84
   - 12 V 4000 G 24
   - 12 V 4000 G 44
   - 12 V 4000 G 64
   - 12 V 4000 G 84
   - 16 V 4000 G 24
   - 16 V 4000 G 44
   - 16 V 4000 G 64
   - 16 V 4000 G 84
   - 20 V 4000 G 24
   - 20 V 4000 G 44
   - 20 V 4000 G 64
   - 20 V 4000 G 84
4. Press the ENTER key.
   Result: The engine model selected is displayed, e.g.: 20 V 4000 G 24 is display
5. Press the ENTER key until “Save Changes? Exit-Yes” is displayed, confirm with Yes (Enter).

Setting the display start page

1. Press key ↑ or ↓ on SAM 2 repeatedly until “Select Parameter page” appears on the display.
2. Press the ENTER key.
   Result: The engine model is displayed in the second line.
3. Press key ↑ or ↓ on SAM 2 repeatedly until “Display Start Page” appears on the display. The page presently set is displayed in the second line.
4. Press the ENTER key.
   Result: The page presently set is displayed in the second line.

5. Set the desired page with keys ↑ or ↓ on SAM 2 as follows:
   - ECU Overview
   - ECU Pressure
   - ECU Temp.
   - AUX Page
6. Press the ENTER key.

   Note: After completing all settings, proceed with step 7.

7. Press the ENTER key until “Save Changes? Exit-Yes” is displayed, confirm with Yes (Enter).

Setting the interface

1. Press key ↑ or ↓ on SAM 2 repeatedly until “Select Parameter page” appears on the display.
2. Press the ENTER key.
   Result: The engine model is displayed in the second line.
3. Press key ↑ or ↓ on SAM 2 repeatedly until “Interface Configuration” appears on the display.
4. Press the ENTER key.
   Result: The value presently set is displayed in the second line.
5. Use key ↑ or ↓ on the printed circuit board SAB 2 to set the configuration. Possible values:
   - No
   - SAE-J1939
   - CANOpen

10.4 Additional SAM parameters and options

SAM parameters – General

The following parameters are required to make basic settings in the SAM.

No.	Presetting	Unit	Designation	Settings
PR0001	1	Digital	Conf. SAM Alarm Page Line1	Bit-coded Value: Bit 0: 1, no 2. Line in Initial Page Bit 1: 1, no 2. Line in Service Page Bit 2: 1, no ECU Error Code Text in Initial Page Bit 3: 1, no ECU Error Code in Service Page Bit 4: 1, no Al Prio in Initial Page Bit 5: 1, no Al Prio Service
PR0002	1	Digital	Conf. SAM Alarm Page Line2	Bit-coded Value: Bit 0: 1, no 2. Line in Initial Page, Bit 1: 1, no 2. Line in Service Page Bit 2: 1, no ECU Error Code Text in Initial Page Bit 3: 1, no ECU Error Code in Service Page Bit 4: 1, no Al Prio in Initial Page Bit 5: 1, no Al Prio Service
PR0003	1	Digital	Select Initial Page	1, Alarm Page 2, Error Page
PR0004	2	Digital	Select Change to Service Page	1, Press ESC 2, Press ESC & ENTER (5s)
PR0005	300	s	Time Back to Initial Page	Time Back to Initial Page in Seconds
PR0006	300	s	Time Back to Alarm Auto Disp	Time Back to Alarm Auto Disp in Seconds
PR0007	3	s	Time Next Alarm	Time Next Alarm in Seconds
PR0008	1	s	Time Next Alarm After Scroll	Time Next Alarm After Scroll in Seconds
PR0009	2	Digital	Clear Alarm Page	Bit-coded Value: Bit 0: 1 Page "Clear Alarm Page" existing Bit 1: 1 "Clear Alarm Page" in restricted Area

SAM parameters – System extension

Additional parameters must be set depending on which SAM channels are assigned and whether extension slots are assigned:

No.	Presetting	Unit	Designation	Settings
PR0020	0	Digital	Channel Deactivation C1-16	Bit-coded Value which deactivates SAM Channels 1..16 . Setting the Bit inverts present Channel Deactivation.
PR0021	0	Digital	Channel Deactivation C17-32	Bit-coded Value which deactivates SAM Channels 17..32 . Setting the Bit inverts present Channel Deactivation.
PR0022	0	Digital	Channel Deactivation C33-48	Bit-coded Value which deactivates SAM Channels 33..48 . Setting the Bit inverts present Channel Deactivation.
PR0023	0	Digital	Channel Deactivation C49-64	Bit-coded Value which deactivates SAM Channels 49..64 . Setting the Bit inverts present Channel Deactivation.
PR0024	0	Digital	Channel Deactivation C65-80	Bit-coded Value which deactivates SAM Channels 65..80 . Setting the Bit inverts present Channel Deactivation.
PR0025	0	Digital	Channel Deactivation C81-96	Bit-coded Value which deactivates SAM Channels 81..96 . Setting the Bit inverts present Channel Deactivation.
PR0026	0	Digital	Channel Deactivation C97-112	Bit-coded Value which deactivates SAM Channels 97..112 . Setting the Bit inverts present Channel Deactivation.
PR0027	0	Digital	Channel Deactivation C113-116	Bit-coded Value which deactivates SAM Channels 113..116 . Setting the Bit inverts present Channel Deactivation.
PR0028	0	Digital	Slot 1 Channel Deactivation	Bit-coded Value which deactivates Channels 1..16 of Slot 1. Setting the Bit inverts present Channel Deactivation.
PR0029	0	Digital	Slot 2 Channel Deactivation	Bit-coded Value which deactivates Channels 1..16 of Slot 2. Setting the Bit inverts present Channel Deactivation.
PR0030	0	Digital	Slot 3 Channel Deactivation	Bit-coded Value which deactivates Channels 1..16 of Slot 3. Setting the Bit inverts present Channel Deactivation.

Parameters for monitoring

The following parameters must be set for node monitoring and suppressing system faults:

No.	Presetting	Unit	Designation	Settings
PR031	2	Digital	NMT Switch Off N1-N16	Bit 0 - Node is guarded Bit 1 Node is non guarded
PR032	0	Digital	NMT Switch Off N17-N32	Bit 0 - Node is guarded Bit 1 Node is non guarded
PR033	0	Digital	ECU monitored CAN node	Bit 0 - Node is guarded Bit 1 Node is non guarded
PR035	8192	Digital	SE-Fault Suppression	Bit 0 - Failure is deactivated Bit 1 Failure is activated

Display

The following parameters are required when a display is connected:

No.	Presetting	Unit	Designation	Settings
PR080	0	Digital	Display Acknowl.Configuration	0: All Alarms are Acknowledged 1: Individual Alarms are Acknowledged
PR081	36	Digital	Display Node Number	Display Node Configuration
PR900	0	l/h	Scale End Value for Fuel Consumption Barcharts	Scale End Value for Fuel Consumption Barcharts on the Display. Used when <> 0

Miscellaneous

No.	Presetting	Unit	Designation	Settings
PR042	8	Digital	Trolling Gov Para 1 PWM_OUT1	Trolling Parameter
PR043	8	Digital	Trolling Gov Para 2 PWM_OUT1	Trolling Parameter
PR044	100000	Digital	Trolling Gov Para 3 PWM_OUT1	Trolling Parameter
PR045	100000	Digital	Config BT_OUT7	=0 - Output is Deactivated
				=1 - PWM Output
				=2 - No Function
				=3 - No Function
				=4 Transistor Low Side
				=5 Transistor High Side
PR046	100000	Digital	Config BT_OUT8	=0 - Output is Deactivated
				=1 - PWM Output
				=2 - No Function
				=3 - No Function

No.	Presetting	Unit	Designation	Settings
				=4 Transistor Low Side
				=5 Transistor High Side
PR090	0	s	Delay SAM Ready for Start	Delay Time for SAM Startup
PR500	0	Digital	Speed Demand Options	=0- Default Dataset ECU
				=1- ECU Increase/Decrease Input
				=2- CANopen Increase/Decrease Input
				=3- ECU Analog Absolute
				=4- ECU Analog Relative
				=5- ECU Frequency Input
				=6- CANopen Analog
				=7- CANopen Speed Demand Switch
PR501	0	Digital	Speed Setting Limit Mode	=0- Default Dataset ECU
				= 1 - Speed Setting Limit Signal via CANopen Active
PR510	0	Digital	Torque Demand Signal Mode	=0- Default Dataset ECU
				= 1 - Torque Demand via CANopen Active
PR520	0	Digital	Load Signal Mode	= 0 - Load Signal not Active
				= 1 - Load Signal via CANopen Active
PR530	0	Digital	Engine Start Signal Mode	=0- Default Dataset ECU
				= 1 - Additional Start Signal via CANopen Active
PR531	0	Digital	Engine Stop Signal Mode	= 0 - Default Dataset ECU
				= 1 - Additional Stop Signal via CANopen Active
PR532	0	Digital	Alarm Reset Mode	= 0 - Default Dataset ECU
				= 1 - Additional Alarm Reset Signal via CANopen Active
PR534	0	Digital	Override Signal Mode	= 0 - Default Dataset ECU
				= 1- Additional Override Signal via CANopen Active
PR535	0	Digital	Switch 50/60Hz Mode	= 0 - Switch 50/60Hz not Active
				= 1- Switch 50/60Hz via Binary Input Active

No.	Presetting	Unit	Designation	Settings
				= 2- Switch 50/60Hz via CANopen Active
PR536	0	Digital	Monitored Nodes Signal Mode	= 0 - Default Dataset ECU
				= 1- Demand Monitored Nodes Signal via CANopen Active
PR537	0	Digital	Droop 2 Signal Mode	= 0 - Default Dataset ECU
				= 1- Droop 2 Signal via CANopen Active
PR542	1	Digital	Test Overspeed Signal Mode	= 0 - Default Dataset ECU
				= 1 - Test Overspeed Signal via Binary Input Active
				= 2 - Test Overspeed Signal via CANopen Active
				= 3 - Test Overspeed Signal via CANopen or Binary Input Active

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