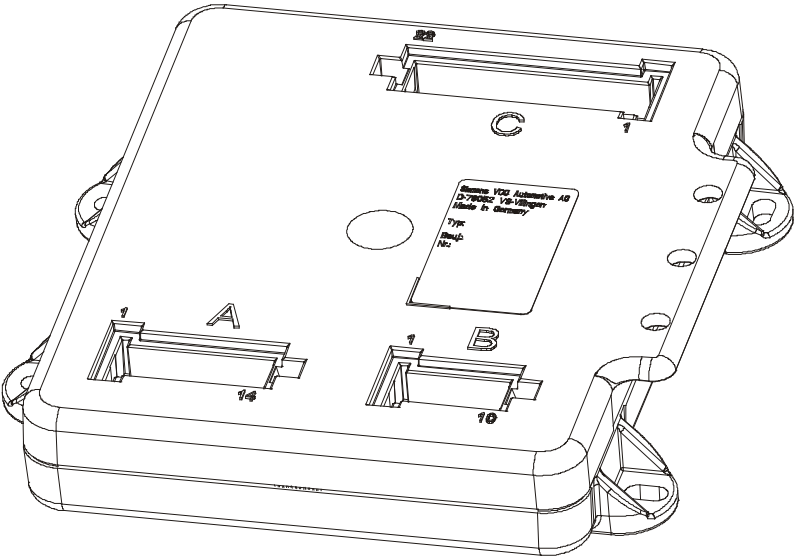


Central Computers ZR2-B and ZR2-BD

Hardware Documentation

From version 3.0



File name: HW_ZR2-B_BD_V020000_en.doc

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3 Revision index

Version	Date	Revision	Name
00.01.00	30.04.98	Initial version	T. Schupp
00.02.00	11.12.98	General revision	T. Schupp
01.00.00	22.11.99	Termination resistance defined. Designation C3/C4 updated (v pulse/ 4I/pulse). Storage temperature increased to +90°	T. Schupp
02.00.00	19.06.02	Redesign HW compatible to ZR2-B and ZR2-BD Version ZR2-B and ZR2-BD up-graded to V0.3 (rating plate).	S. Dönmez

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4 Introduction

4.1 Terms

KIBES-2 Key to on Board Electronic Systems
second generation
DWP (or FAP) Driver Work Place by Siemens VDO
(German: **F**ahrer-**A**rbeits-**P**latz)

4.2 Acronyms

ESD Electro Static Discharge

PCB Printed Circuit Board

ZR2 Central computer 2 (German: **Z**entral **R**echner)

MUX2 MultipleX node for ZR2

EOL End Of Line Programming

HS HighSide
HSS HighSide Switch
LS LowSide
LSS LowSide Switch

PLC Programmable Logic Control

TBD To Be Defined
CAN Controller Area Network
IBIS Integrierted Board Infomation System

KBps KBaud, Kilobit per second

MOKI Module Combi, Modular cluster family

DMUX Display MultipleX Node
SMUX Switch MultipleX Node

ZI-1366 Central Informator, Instrument Node within DWP

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5 Scope

The distributed multiplex system consists of a central computer and several multiplex nodes, which can be split to 2 multiplex branches. Depending on the configuration of the nodes, a maximum of between 5 and 8 multiplex nodes per branch can be used.

For a description of the multiplex nodes see separate product information.

Operation safety

When using conventional vehicle electric systems, self-supporting individual systems (such as wiper system, illumination, air conditioning system etc.) are driven independently from one another. A failure of the individual system does not influence the total system.

A look at a modular system linked via a data bus such as the KIBES-2 shows, that there are no disadvantages compared to self-supporting individual systems when designed appropriately. Additional system advantages, which did not exist before, can be used:

- diagnostic capable output signals (recognition of defective lamps etc.)
- simple logic connections that can be easily changed
- power is switched at the location of the load (savings in cables and weight)
- short circuit protected and overload secure electronic power switches
- central programming and documentation of all functions
- integrated diagnostic system with the respective tools
- vehicle configuration through End-Of-Line (EOL) programming

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Master-Slave-Principle

Through a proven Master-Slave principle, possible priority conflicts, time variants and collision situations are avoided in the network. This is the difference between KIBES and the so-called Multi-Master systems, where partners with equal opportunities to communicate with each other may cause conflicts.

A high priority during the KIBES design was the failure proof 'master'. This is achieved through the fact that all power switches, which generate higher temperatures and interfering emissions due to their physical properties, are eliminated from the central computer and moved to the remote multiplex node. This creates optimal conditions in the ZR2 for the central microprocessor and control electronics.

The multiplex node is designed to switch high loads and contains emergency operation properties, which lead to defined switching characteristics in case of communication failures between the ZR2 and the MUX2 nodes. All multiplex nodes have the same layout and can therefore be easily exchanged in case of service. The configuration of the multiplex node is automatically done with the first operation in the network.

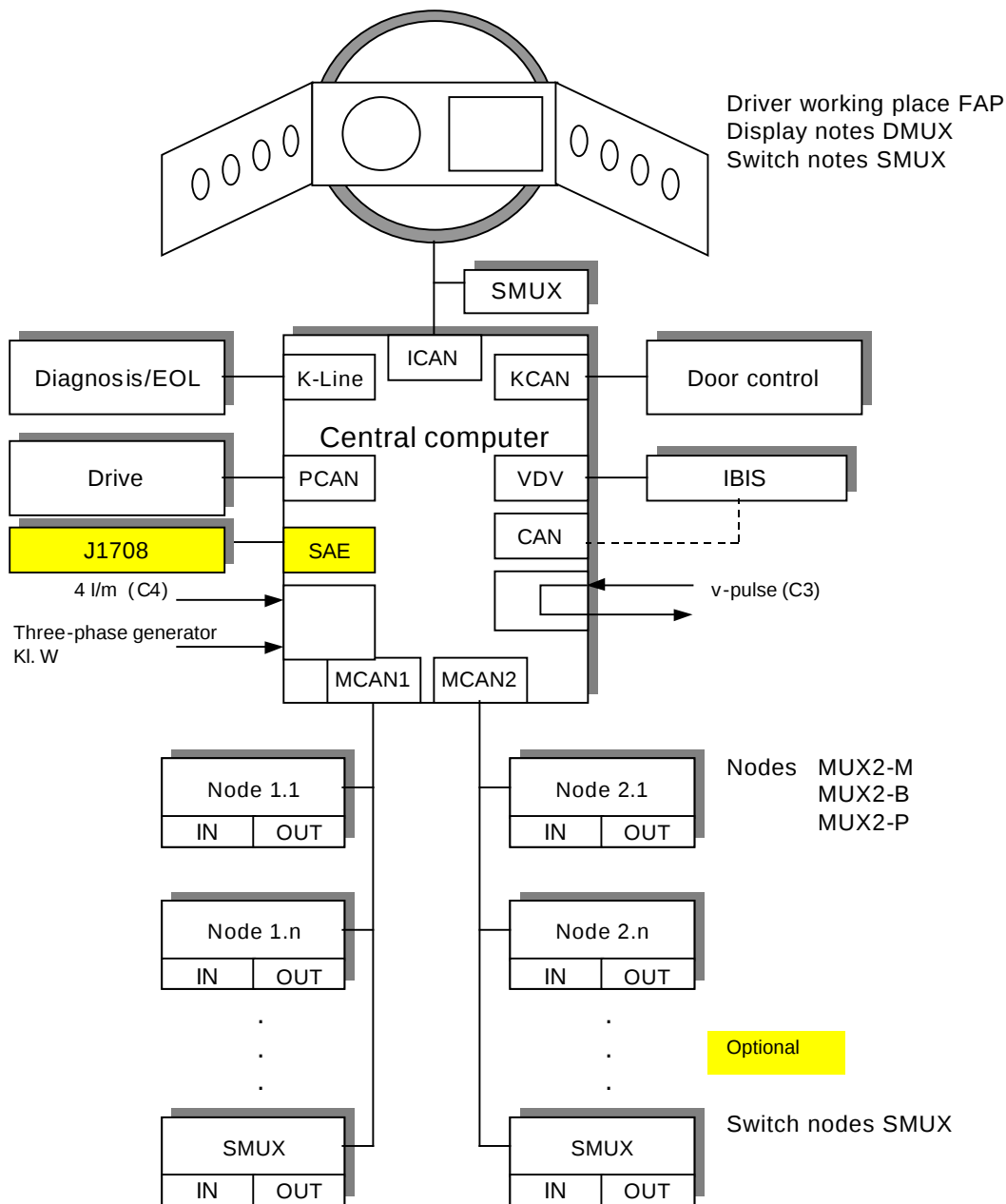
Due to the high failure safety, automatic self-diagnosis and very simple error elimination through the exchange of components, KIBES also meets the requirements to operate safely in very remote areas.

Restrictions

- KIBES is not designed to control safety related systems.
- KIBES is not designed to operate in explosion areas.
- Assembly or connection of KIBES components while operating voltage is connected is not admitted.

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5.1 Technical system structure



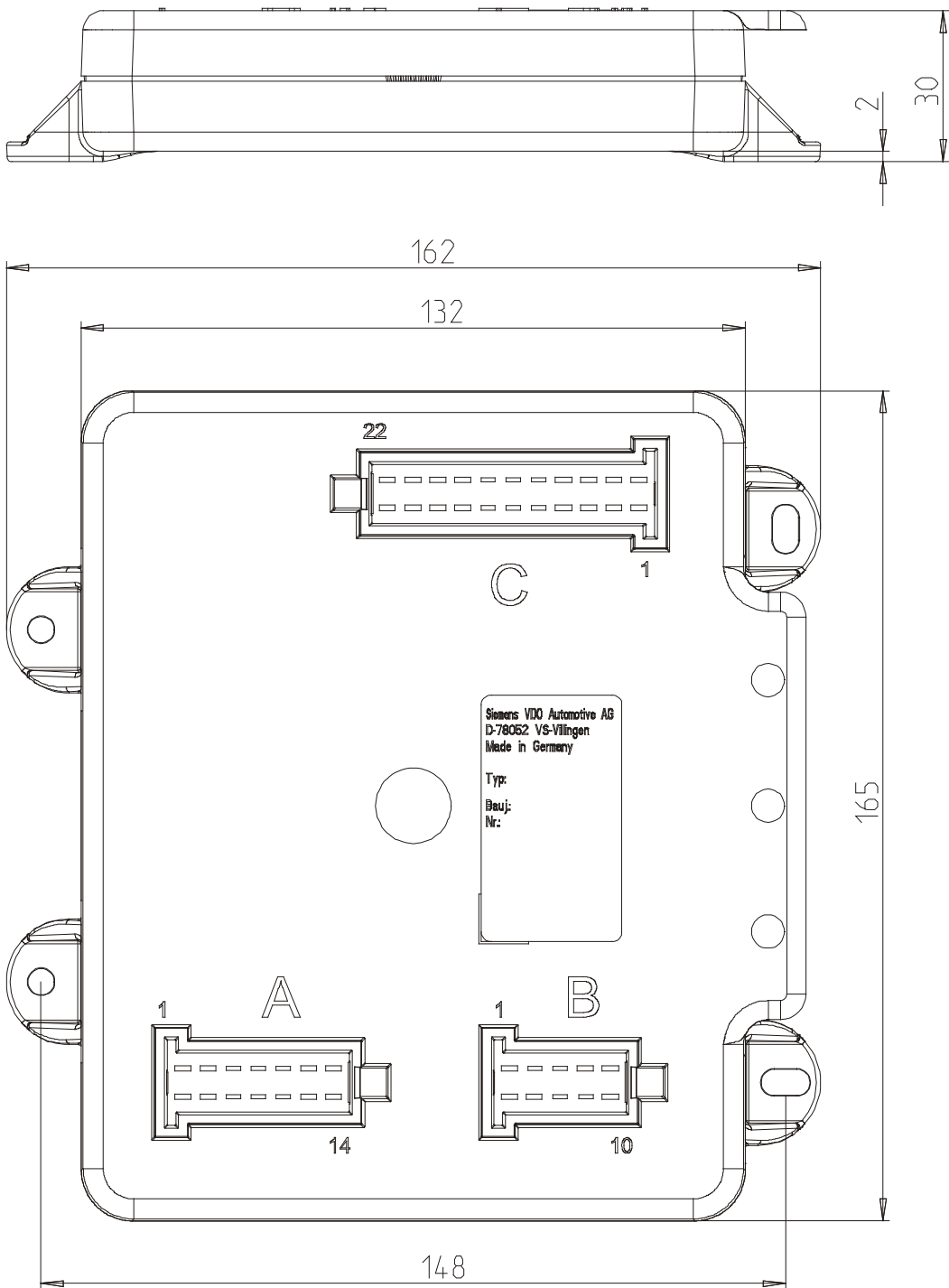
The number of supported nodes depends on the types of the connected nodes. The maximum number of notes to be operated on a single branch is limited to 8 (details see software description)

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6 Housing



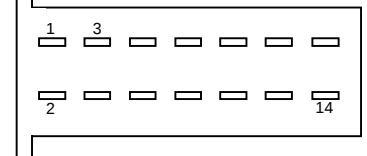
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6.1 Connector assignment

EXT_WAKE_UP01	2	1	MINUS
EXT_WAKE_UP02	4	3	PLUS
CAN_L1_MX1	6	5	CAN_H1_MX1
CAN_L2_MX1	8	7	CAN_H2_MX1
CAN_L_MX1_AB	10	9	CAN_GND_ANT
CAN_L2_ANT	12	11	CAN_H2_ANT
CAN_L1_ANT	14	13	CAN_H1_ANT

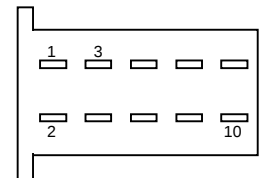
Connector A

AMP-No. 928162-5



Connector B

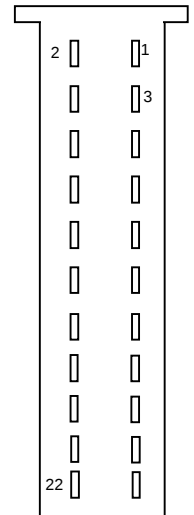
AMP-No. 929504-4



CAN_L1_KAR	2	1	CAN_H1_KAR
CAN_L2_KAR	4	3	CAN_H2_KAR
CAN_L_MX2_AB	6	5	CAN_H_KAR_AB
CAN_L2_MX2	8	7	CAN_H2_MX2
CAN_L1_MX2	10	9	CAN_H1_MX2

Connector C

AMP-No. 928162-7



CAN_L_FAP	2	1	CAN_H_FAP
CAN_L_IBIS	4	3	CAN_H_IBIS
IBIS_RX_GND	6	5	IBIS_RX
IBIS_TX_GND	8	7	IBIS_TX
EIN_KL.W	10	9	EIN_C4
AUS_02_G1_LS	12	11	AUS_01_G1_LS
reserved	14	13	K_LINE
J1708_BUS+	16	15	J1708_BUS-
AUS_C3_01	18	17	EIN_C3
AUS_C3_03	20	19	AUS_C3_02
AUS_C3_05	22	21	AUS_C3_04

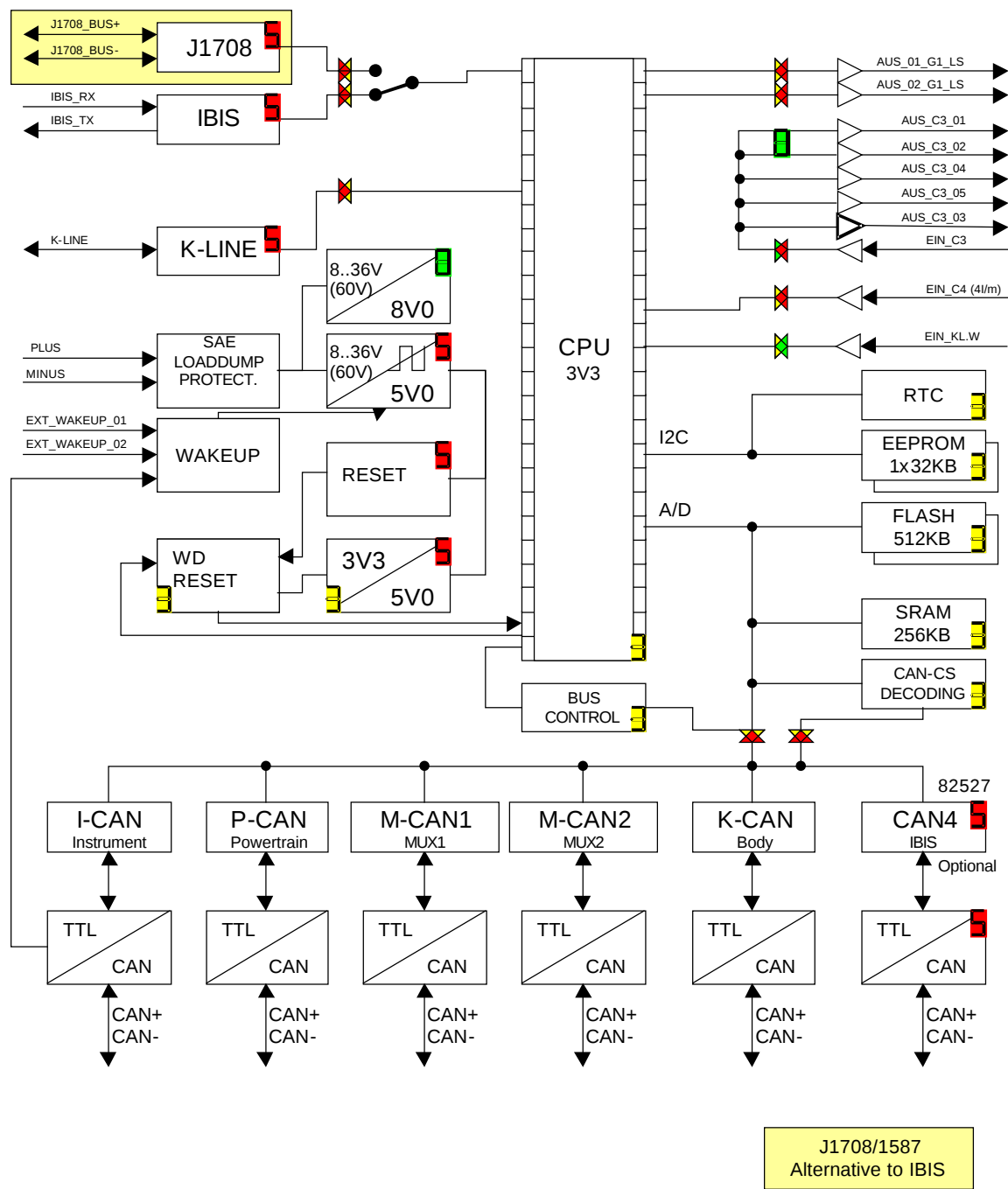
Available types of contacts "Junior Power Timer" according to cross section:

1.0 mm ²	2.5 mm ²	Material / contact
927 771-3	927 768-3	CuSn4 / pretinned
927 771-1	927 768-1	CuFe2 / pretinned
927 771-6	927 768-6	CuSn4 / presilvered

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7 Hardware

7.1 Block circuit diagram



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7.2 Supply voltage

The system is supplied by constant power supply. It is awakened through activities on the CAN bus (to the unit) or via the external wake-up inputs. If there is no more CAN activity and if the wake-up input is inactive, the system switches to a power down condition.

7.3 Computer core

The microprocessor is microcode compatible to INTEL 8086. A flash EEPROM of 512Kbyte serves as programming memory for the operating system as well as for the user program. A RAM of 256Kbytes serves as data memory.

7.4 Sensors and actuators

7.4.1 Inputs

- Speed signal input for the 4l/m signal of the Tachograph.
- Speed signal input for the v-pulse signal of the Tachograph
- Rpm input of the connection to "Terminal W"
- 2 external wake-up inputs (high active) to turn on the unit

7.4.2 Outputs

- 2 LOWSIDE switch with 100mA each

7.5 Interfaces

- I-CAN by SW configurable
 - a) for Display ZI-1366, baud rate 125 KBaud, wakeup capable
 - b) for Display DMUX, baud rate 250 KBaud, wakeup capable
- M-CAN multiplex branch 1, baud rate 125 KBaud
- M-CAN multiplex branch 2, baud rate 125 KBaud
- K-CAN body bus, baud rate 125 KBaud
- P-CAN power train bus, baud rate 250 KBaud

All CAN interfaces according to ISO 11898.

- IBIS according to VDV-specification
- K-Line according to ISO 9141 for diagnosis according to KWP2000
- (optional physical interface according to SAE J1708)

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7.6 Firmware

The firmware is divided into the following partial programs:

- Operating system
- Basic program
- PLC user program

7.6.1 Operating system

The operating system is loaded in production. It can **not** be reprogrammed or changed in the field. In addition, it contains the function for loading further programs or files via the K-Line (EOL).

7.6.2 Basic program

The basic program controls the complete process in the system. The error administration (diagnosis) is integrated.

7.6.2.1 Diagnosis for service ZR2-BD

The central computer ZR2-BD supports diagnosis according to KWP2000 via K-Line. Special error memories are provided for this.

The service units necessary for this have to be provided and programmed by the vehicle manufacturer.

7.6.3 PLC user program

The final function of the central computer (and therefore of the multiplex system) is programmed by the vehicle manufacturer. This includes control of the vehicle electrical system and screens on the Driver's Workplace.

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7.7 PLC programming and test environment

7.7.1 Development environment for PLC programs

The tool used for development of the user programs is a standard PC running the KIBES-2 software.

After the PLC user program is generated and tested via the KIBES-2 software by the vehicle manufacturer, it is converted into a machine code and compiled so that the controller can understand it.

Afterwards the user program is loaded into the central computer by the PC via a downloading process via the K-Line. This makes a fast and easy end-of-line programming (EOL) possible.

To operate the KIBES-Software-Tool, a license (Dongle/Hardlock) and a corresponding license contract is required. Siemens VDO provides regularly training classes to get a basic startup knowledge.

7.7.2 Testing possibilities

The central computer (and therefore the multiplex system) can be tested via the PC together with the PLC user program during and after the program is written (KIBES Online Test).

For this purpose, the files are transmitted between the PC and the central computer via the K-Line. KWP2000 serves as protocol.

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8 Technical data

8.1 Scope

Designation	Description	Min.	Typ.	Max.	Unit
Operational temperature	Temperature range	-30		+70	C°
Storage temperature		-40		+90	C°
Protection type	IP40 With connected plugs				

To protect the unit and the wire harness (contacts), assembly and disassembly may only be done with power disconnected.

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8.2 Current supply

Name	Connector pin
PLUS	A3
MINUS	A1

Designation	Description	Min	Typ.	Max.	Unit
PLUS	Nominal voltages		+12 +24		Volt
Operating voltage	Functional range	8 16		16 32	Volt
	Limited functional range 4I/m	8		9	Volt
	1h at 40°C environmental temperature			36	Volt
Operational voltage	At 12V			180	mA
	At 24V			100	mA
Stand-by current consumption	At 12V			6	mA
	At 24V			9	mA

8.3 Unit activation

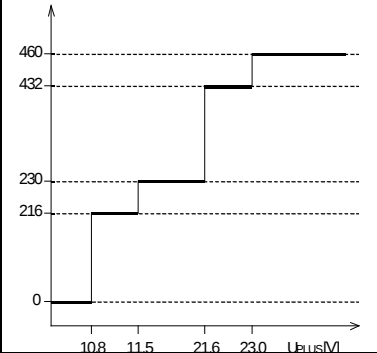
The central computer is awakened via activities at the CAN bus (to the unit) or via one of the two external wake up inputs.

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8.4 Undervoltage recognition

	Measurement range [V]	Resolution [mV]
EIN_BORDVOLTAGE	0..23	50

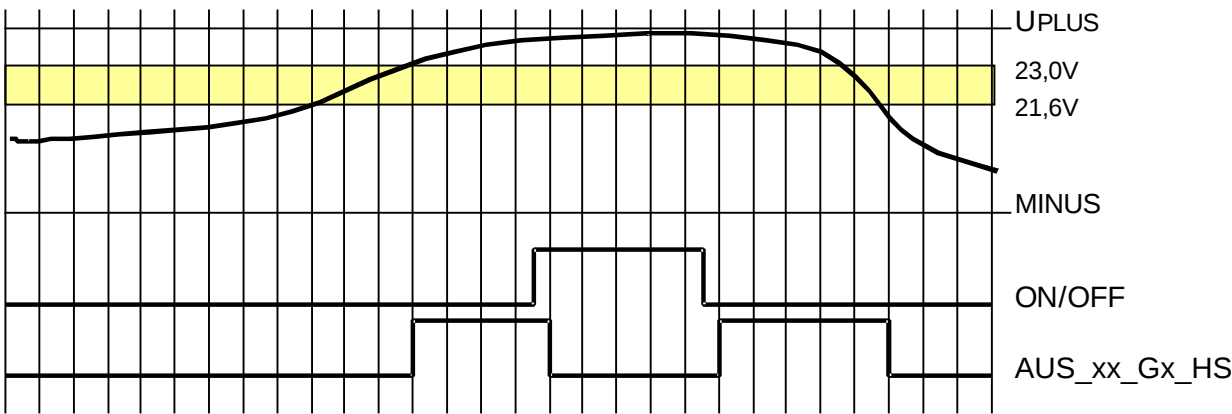
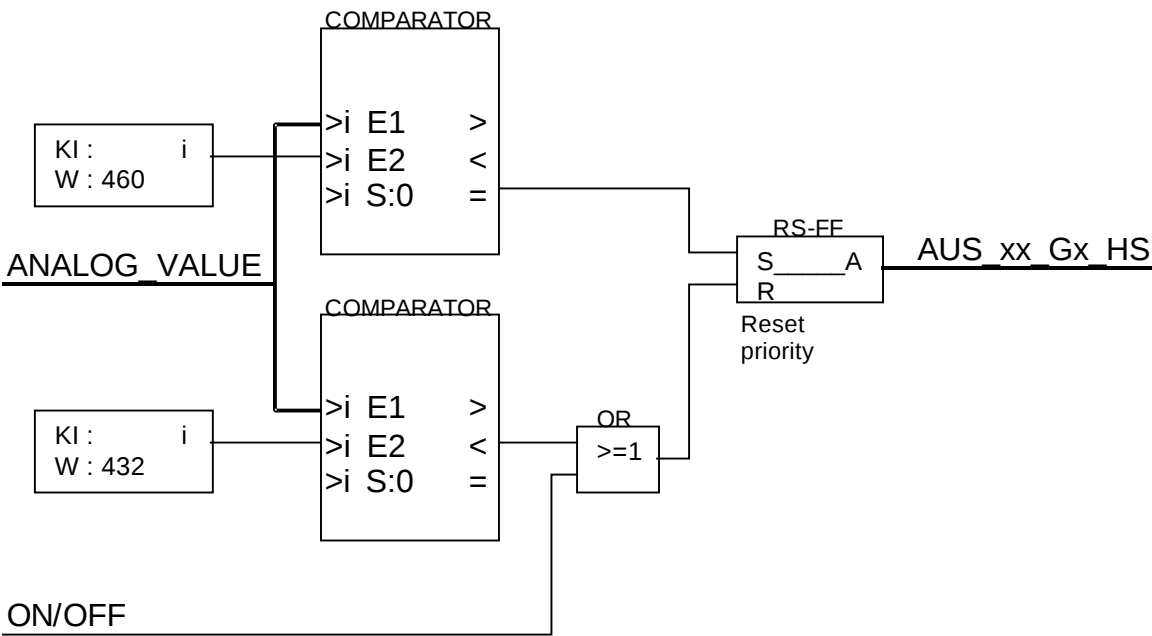
The board voltage is monitored via comparators in fixed thresholds. The exceeded voltage threshold is provided to the PLC as voltage value.

	Voltage [V]	Binary voltage value (PLC)	
EIN_BORDVOLTAGE			
	≥ 23.0	460	
	≥ 21.6	432	
	≥ 11.5	230	
	≥ 10.8	216	
	< 10.8	0	

The voltage thresholds are selected in such a way, that a undervoltage shut-off is possible via hysteresis with the help of two voltage thresholds each for 12V- and 24V-systems.

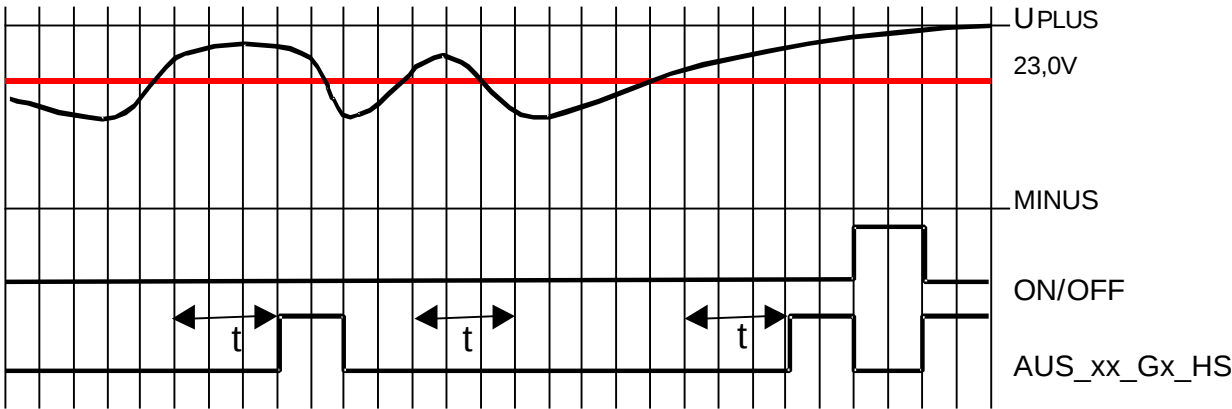
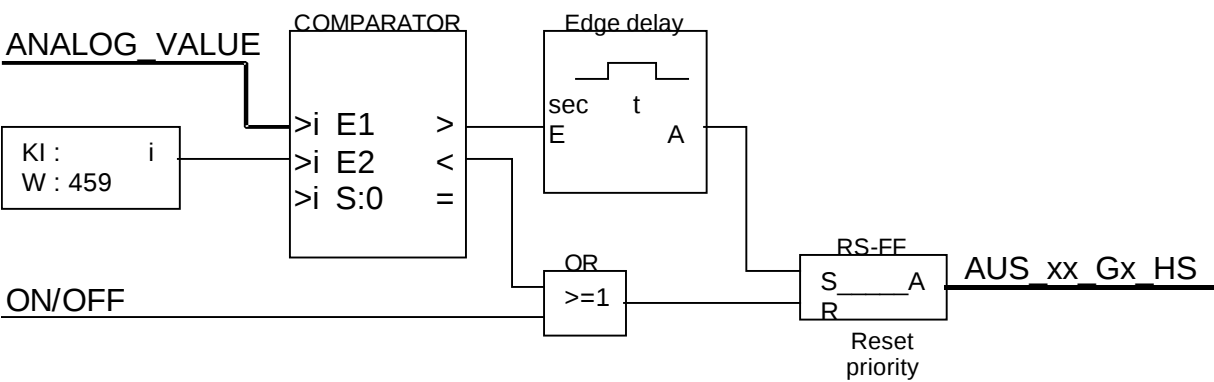
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Example:
Undervoltage shut-off with hysteresis while using two voltage thresholds. Via an additional ON/OFF signal, the output can be deactivated independently from the voltage threshold, for example during turning on.



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Example:
Proposal for undervoltage shut-off via a voltage threshold and an additional EDGE DELAY module for debouncing the settling process during turning on. Via an additional ON/OFF signal the output can be deactivated independently from the voltage level, for instance during turning on.



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8.5 Interfaces

8.5.1 CAN to instrument panel (e.g. driver workplace public bus)

Name	Connector pin
CAN_H_FAP	C1
CAN_L_FAP	C2

a) for Display ZI-1366, wakeup capable, baud rate 125 kBaud

b) for Display DMUX, wakeup capable, baud rate 250 kBaud

CAN according to ISO 11898

For detailed specification reference to the corresponding hardware documentation. The configuration will be done in the KIBES allocation editor (part of KIBES Software Tool).

The necessary termination resistance is integrated in the unit.

8.5.2 Multiplex branch 1 (MCAN-1)

Name	Connector pin
CAN_H1_MX1	A5
CAN_L1_MX1	A6
CAN_H2_MX1	A7
CAN_L2_MX1	A8
CAN_L_MX1_AB	A10

CAN according to ISO 11898, baud rate 125 KBAUD.

The CAN-interface exists twice at the connector. The connector pins with the names CAN_L1_MX1 and CAN_L2_MX1, as well as CAN_H1_MX1 and CAN_H2_MX1 are connected internally and therefore equivalent.

The necessary termination resistances are integrated in the units. They are activated via jumpers (*) at the end of the lines.

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8.5.3 Multiplex branch 2 (MCAN-2)

Name	Connector pin
CAN_H1_MX2	B9
CAN_L1_MX2	B10
CAN_H2_MX2	B7
CAN_L2_MX2	B8
CAN_L_MX2_AB	B6

CAN according to ISO 11898, baud rate 125 KBAUD.

The CAN-interface exists twice at the connector. The connector pins with the names CAN_L1_MX2 and CAN_L2_MX2, as well as CAN_H1_MX2 and CAN_H2_MX2 are connected internally and therefore equivalent.

The necessary termination resistances are integrated in the units. They are activated via jumpers (*) at the end of the lines.

* CAN termination resistance

The following note refers to the block circuit diagrams on the following page.

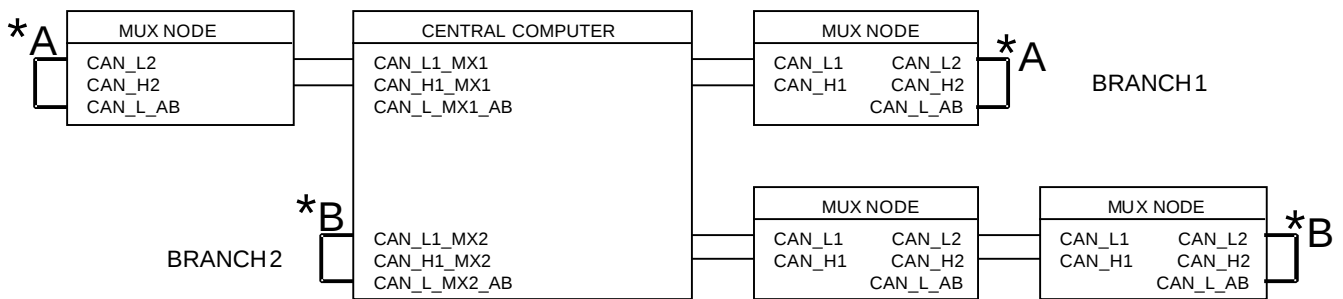
The necessary CAN termination resistance at the first and the last unit exists inside each multiplex node and in the central computer ZR2. It is activated via a jumper (*) at the respective end of the branch. Both ends of a branch have to be terminated with a resistor.

***A** The CAN termination resistance is activated at the first and last multiplex node in the branch.

***B** The CAN termination resistance is activated at the central computer and at the last multiplex node.

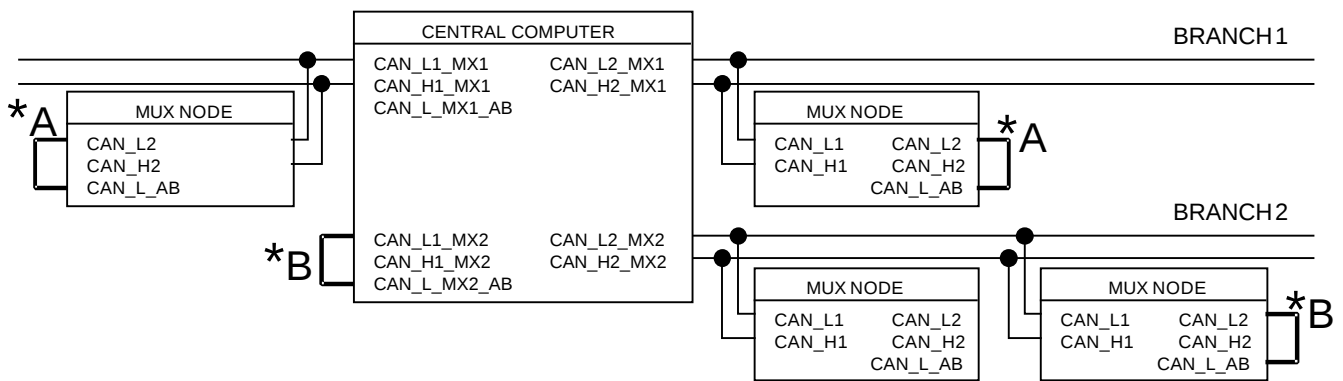
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The CAN-interface exists twice at the connector. The connector pins with the names CAN_L1 and CAN_L2, as well as CAN_H1 and CAN_H2 are connected internally and therefore equivalent. This is valid for multiplex nodes and the central computer.



Note: If a multiplex node is removed from the center of the branch on this connection diagram, all following multiplex nodes are separated from the branch (CAN bridge is located in the multiplex node). The central computer recognizes a defective or non-existent multiplex node. The message can be evaluated via the PLC program.

Through the integration of a “T- piece” in the wire harness, this connection diagram can be realized, in which a removal of a multiplex node does not have any influence on the other components of the branch.



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8.5.4 Body bus (K-CAN)

Name	Connector pin
CAN_H1_KAR	B1
CAN_L1_KAR	B2
CAN_H2_KAR	B3
CAN_L2_KAR	B4
CAN_H_KAR_AB	B5

CAN according to ISO 11898, baud rate 125 KBAUD.

The CAN-interface exists twice at the connector. The connector pins with the names CAN_L1_KAR and CAN_L2_KAR, as well as CAN_H1_KAR and CAN_H2_KAR are connected internally and therefore equivalent.

The necessary termination resistance is integrated in the unit. It is activated via a jumper.

8.5.5 Power train bus (P-CAN)

Name	Connector pin
CAN_H1_ANT	A13
CAN_L1_ANT	A14
CAN_H2_ANT	A11
CAN_L2_ANT	A12
CAN_ANT_GND	A9

CAN according to ISO 11898, baud rate 250 KBAUD.

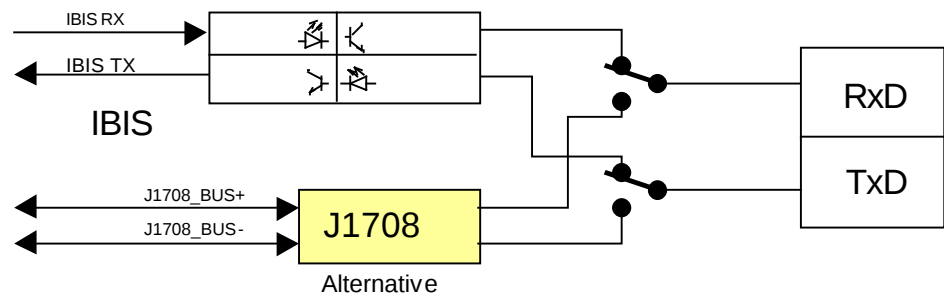
The CAN-interface exists twice at the connector. The connector pins with the names CAN_L1_ANT and CAN_L2_ANT, as well as CAN_H1_ANT and CAN_H2_ANT are connected internally and therefore equivalent.

The necessary termination resistance is not integrated in the unit.

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8.5.6 IBIS / J1708

For additional data transfer, either the "physical layer" of the IBIS (electrically isolated) or the "physical layer" of the J1708 can be used.
As standard, the ZR2-B and the ZR2-BD are equipped with the IBIS.



8.5.7 IBIS

Name	Connector pin	Note
IBIS_RX	C5	Request bus data (WBSD)
IBIS_RX_GND	C6	Request bus ground (WBSM)
IBIS_TX	C7	Answer bus data (WBED)
IBIS_RX_GND	C8	Answer bus ground (WBEM)

Interface according to VDV-specification

8.5.7.1 J1708 (optional)

Name	Connector pin
res. J1708_BUS-	C15
res. J1708_BUS+	C16

Interface according to SAE J1708/1587.
A respective interface converter is necessary for the connection to a PC with serial RS232 interface.

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8.5.7.2 K-Line

Name	Connector pin
K_LINE	C13

Interface according to ISO 9141.
A respective interface converter is necessary for the connection to a PC with serial RS232-interface.

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8.6 Sensors and actuators

8.6.1 Inputs

8.6.1.1 4I/m inputs

Name	Connector pin
EIN_C4	C9

Signal input (C4) 4I/m of the Tachograph output signal (4 pulses per meter).
In the European localization, the 4I/m signal (C4) corresponds to the signal "Distance Signal 4 pulse/m" according to ISO 16844 Part 2.

Voltage $U_{I\max} = 1.2V$
 $U_{h\min} = 5.9V$
 Frequency $F_{\max} = 1.45KHz$
 Pulse period $T_{\min} = 207\mu s$

8.6.1.2 KL. W input (three-phase generator "Terminal W")

Name	Connector pin
EIN_KL.W	C10

Rpm input (n) of "Terminal W" of the three-phase generator.

Voltage $U_{I\max} = 2.2V$
 $U_{h\min} = 3.5V$
 Frequency $F_{\max} = 1.5KHz$
 Pulse period $T_{\min} = 125\mu s$

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8.6.1.3 V pulse input C3

Name	Connector pin
EIN_C3	C17

The V pulse output of the Tachograph is amplified and is again available as V-pulse (C3 output). The V pulse cannot be evaluated within the PLC program.
In the European localization, the V-pulse signal (C3) corresponds to the signal "Speed Pulse B7" according to ISO 16844 Part 2

Voltage $U_{I \max} = 1.2V$
 $U_{h \min} = 5.9V$
 Frequency $F_{\max} = 1.45KHz$
 Pulse period $T_{\min} = 207\mu s$

8.6.1.4 External Wake_Up inputs

Name	Connector pin
EXT_WAKEUP_01	A2
EXT_WAKEUP_02	A4

Two external Wake_Up inputs (high active) to turn on the unit.

Voltage $U_{on \min} = 5V$
 $U_{on \max} = 36V$
 $U_{off \max} = 1V$ or open input

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8.6.2 Outputs

For wiring use cables approved for automotive usage with a minimum nominal wire cross-section of 1mm². Voltage drop and warming have to be taken into account when specifying the wire cross-section.

8.6.2.1 LOWSIDE switch

	Name	Connector pin	Switching current	Note
Group 1	AUS_01_G1_LS	C11	100mA	Fire protection via ext. fuse
	AUS_02_G1_LS	C12	100mA	

8.6.2.1.1 Specification

$I_N = 100\text{mA}$; nominal current

$E_{AS} = \frac{1}{2} * L * i^2 < 0.1 \text{ J}$; switch-off energy of inductive loads

	Input level	Status
Normal operation	Turned off	O.K.
	Turned on	O.K.
Open load	Turned off	Error
	Turned on	O.K.
Short circuit to ground	Turned off	Error
	Turned on	O.K.
Short circuit to V_{bb}	Turned off	O.K.
	Turned on	O.K. / error ²⁾
Overtemperature	Turned off	O.K.
	Turned on	Error

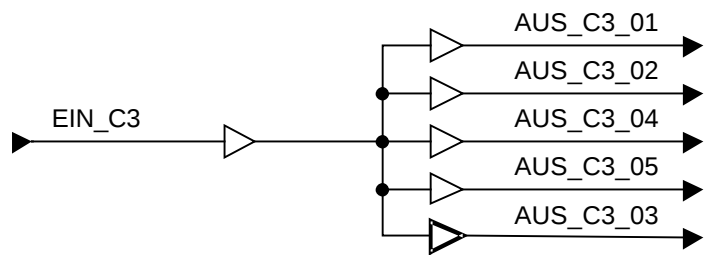
²⁾ The short circuit and excess temperature protection is done through the power dissipation in the component, which leads to a temperature increase and therefore to a shut-off.

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8.6.2.2 V-pulse outputs

A total of 5 amplified speed signals are available synchronous to the speed signal input (V pulse, EIN_C3).

AUS_C3_03 has an increased driver performance.



a)

Name	Connector pin
AUS_C3_01	C18
AUS_C3_02	C19
AUS_C3_04	C21
AUS_C3_05	C22

4 speed signal outputs equivalent to the KTCO - output driver.

Voltage $U_{I\max} = 1.5V$ $I = 1mA$
 $U_{h\min} = 5.5V$ $I = 1mA$
Frequency $F_{\max} = 1.45KHz$ synchronous to the V-pulse input (from Tachograph)

b)

Name	Connector pin
AUS_C3_03	C20

Voltage $U_{I\max} = 1.5V$ $I = 3.2mA$
 $U_{h\min} = 5.5V$ $I = 3.2mA$
Frequency $F_{\max} = 1.45KHz$ synchronous to the V-pulse input (from Tachograph)

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