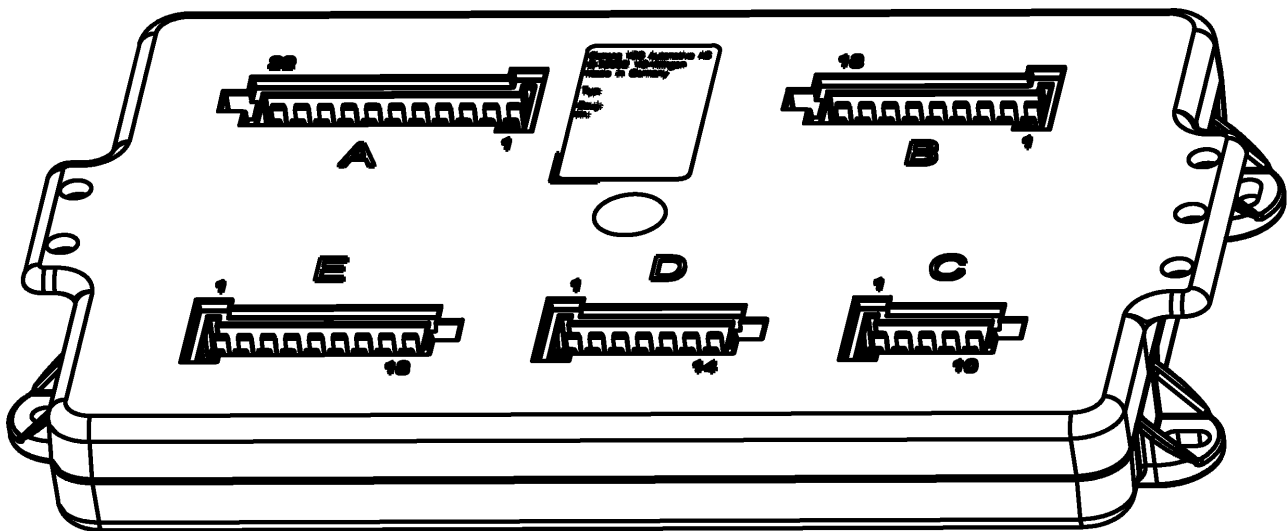


Observe
Protection marks for restricting the use of documents and products
(DIN 34; 1998-01)

Multiplex Node MUX2-B

Hardware Documentation

From version 3.0



The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

File name: HW_MUX2-B_V020001_en.doc

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 1/53
SiemensVDO Automotive AG					

0 Copyright

This documentation is protected by copyright fully owned by the Siemens VDO Automotive AG. This documentation must not be reproduced without prior written consent of the Siemens VDO Automotive AG nor used in contravention of its legitimate interests. It exclusively serves the internal use for product selection; any other use is not permitted. Any disclosure of this documentation to third parties only by prior written consent of the Siemens VDO Automotive AG.

Siemens VDO Automotive AG
Information Systems Commercial Vehicles
Postfach 1640
D-78006 Villingen-Schwenningen

DISCLAIMER

The text and downloadable software on the corresponding CD ROM were prepared with great care and diligence. However, Siemens VDO Automotive AG cannot assume legal responsibility or liability for any residual errors or their consequences.

Any manually modification at system files of the operating system are under full responsibility of the person involved. Therefore it is highly recommended that only PC-trained persons should do required enhancements.

All of the software, hardware and trademark names used on this documentation or on the concerning CD ROM are subject to general copyright protection of trade names, trade marks and patent rights.

© 2002 Siemens VDO Automotive AG

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 2/53
SiemensVDO Automotive AG					

1 Contents

0	Copyright	2
1	Contents.....	3
2	Revision index	5
2.1	History.....	5
2.2	Summary of important modifications of the MUX2-B starting from version 3.0	6
3	Introduction	7
3.1	Terms.....	7
3.2	Acronyms	7
4	Scope	8
4.1	Technical system structure	8
4.2	Housing.....	9
4.3	Connector assignment	10
4.4	Block circuit diagram	11
4.5	Supply voltage	12
4.6	Computer core	12
4.7	Inputs and outputs.....	12
4.7.1	Inputs	12
4.7.2	Outputs	12
4.7.2.1	High side outputs	12
4.7.2.2	Low side outputs	12
4.8	Interfaces	12
4.9	Firmware	13
5	Technical data	14
5.1	Scope.....	14
5.2	Current supply.....	15
5.3	Unit activation	15
5.4	Interfaces	16
5.4.1	CAN to the central computer.....	16
5.4.2	Unit number (ID)	18

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 3/53
SiemensVDO Automotive AG					

5.4.2.1 External node diagnosis 19

5.5 Inputs and outputs..... 20

5.5.1 INPUTS..... 20

5.5.1.1 Status inputs 20

5.5.1.2 Analog inputs 25

5.5.2 OUTPUTS..... 33

5.5.2.1 HIGHSIDE - switch 35

5.5.2.2 LOWSIDE - switch 1A (3A) 41

5.5.2.3 HALF-BRIDGES 1A (3A) 51

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 4/53
SiemensVDO Automotive AG					

2 Revision index

2.1 History

Version	Date	Revision	Name
00.01.00	22.07.97	Initial version, MUX2-N modified	T. Schupp
00.02.00	30.04.98	Initial version, MUX2-B	T. Schupp
00.03.00	23.06.98	More details pertaining to the specification "reverse battery protection"	T. Schupp
00.04.00	25.11.98	More details pertaining to the specification LSS with PWM LSS specification changed in the short circuit Description of half-bridges extended Description of EIN_STATUS extended Description of EIN_ANALOG extended	T. Schupp
01.00.00	22.11.99	Storage temperature increased to +90°	T. Schupp
02.00.00	14.05.02	Printed circuit board redesign, SW revision: Latching behavior of the HSS and delayed activation of LSS. Version MUX2-B up-graded to V0.3 (rating plate).	R. Christein
02.00.01	09.09.02	Additional description of the necessary circuit protection of the LS-loads.	R. Christein

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e		Designation Multiplex Node MUX2-B			
		Documentkey 1364.70.023.00 EAD 002 0A			
SiemensVDO Automotive AG					Pages 5/53

2.2 Summary of important modifications of the MUX2-B starting from version 3.0

- Improved load-dump protection; suited for operation without central load-dump protection.
- Slightly modified switch-on behavior of low-side switch.
- Modifications regarding the high-side switches:
 - Lower currents with short circuit to ground
 - Better protection in case of short circuit because the HSS is not automatically switched on after cooling down (overload latch). Same behavior as with LSS.
 - For the open-load recognition, a pull-up resistors of 330kΩ per output pin (typ. 80μA with 24V mode) is used instead of a current source (typ. 30...60μA / 3A channel). The resistors are switched off in the stand-by mode.
 - When the HSS is in on-position, the output is no longer switched off in case of overvoltage (so far at 34-43V). In case of voltages higher than the typical 47V, the output is on the difference voltage (PLUS_Gx – 47V) as usual.
- Reduced E_{AS} values are applicable for switching off of inductive loads.

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 6/53				

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

3 Introduction

3.1 Terms

KIBES-2	<u>K</u> ey to on <u>B</u> oard <u>E</u> lectronic <u>S</u> ystems second generation
DWP (or FAP)	<u>D</u> river <u>W</u> ork <u>P</u> lace by Siemens VDO (German: F ahrer- A rbeits- P latz)

3.2 Acronyms

ADC	<u>A</u> nalog <u>d</u> igital <u>c</u> onverter
ZR2	Central computer 2 (German: Z entral R echner)
MUX2	<u>M</u> ultiple <u>X</u> node for ZR2
EOL	<u>E</u> nd <u>O</u> f <u>L</u> ine Programming
HB	<u>H</u> alf <u>b</u> ridge
HS	<u>H</u> igh <u>s</u> ide
HSS	<u>H</u> igh <u>s</u> ide <u>s</u> witch
LS	<u>L</u> ow <u>s</u> ide
LSS	<u>L</u> ow <u>s</u> ide <u>s</u> witch
PLC	<u>P</u> rogrammable <u>L</u> ogic <u>C</u> ontrol (German: SPS)
GND	G round, battery minus
CAN	<u>C</u> ontroller <u>A</u> rea <u>N</u> etwork
PCAN	<u>P</u> owertrain CAN
ICAN	<u>I</u> nstrumentation CAN
KCAN	<u>B</u> ody CAN
MCAN	<u>M</u> ultiplex CAN

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 7/53
SiemensVDO Automotive AG					

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

4 Scope

The distributed multiplex system consists of a central computer and several multiplex nodes, which can be split to 2 multiplex branches.

Restrictions

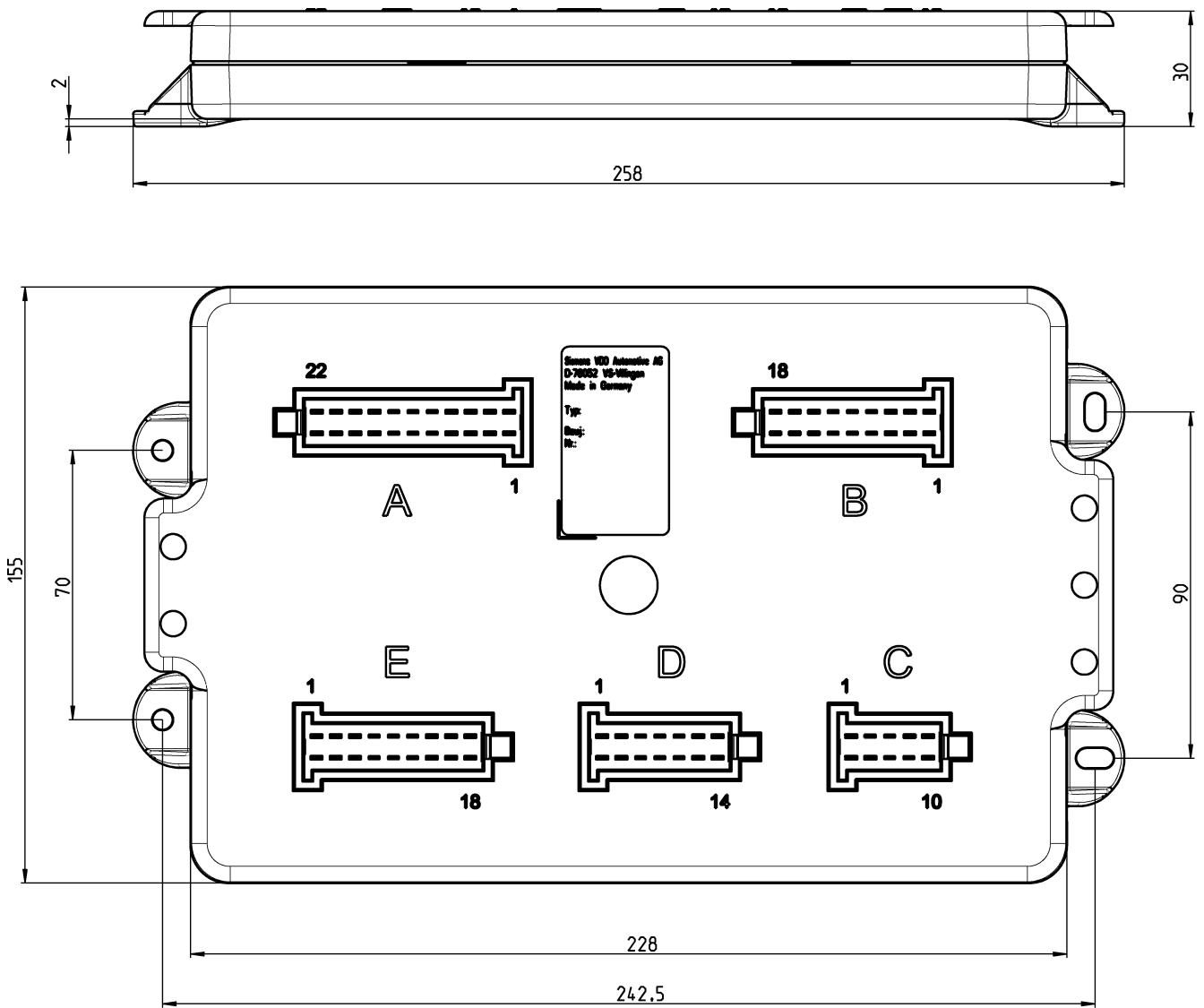
- KIBES is not designed to control safety related systems.
- There is no approval available for the operation in the EX-protection area.
- Assembly or connection of KIBES components while operating voltage is connected is not admitted.

4.1 Technical system structure

See HW documentation of the relevant central computer.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 8/53
SiemensVDO Automotive AG					

4.2 Housing



Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 9/53
SiemensVDO Automotive AG					

4.3 Connector assignment

E

AUS_31_G5_HS	2	1	AUS_32_G5_LS
AUS_29_G5_HS	4	3	AUS_30_G5_LS
AUS_27_G5_HS	6	5	AUS_28_G5_LS
AUS_25_G5_HS	8	7	AUS_26_G5_LS
PLUS_G5	10	9	MINUS
AUS_23_G5_HS	12	11	AUS_24_G5_LS
AUS_21_G5_HS	14	13	AUS_22_G5_LS
AUS_19_G5_HS	16	15	AUS_20_G5_LS
AUS_17_G5_HS	18	17	AUS_18_G5_LS

alle

A

EIN_STATUS_13	21	22	AUS_01_G1_HS
EIN_STATUS_14	19	20	AUS_02_G1_HS
EIN_STATUS_15	17	18	AUS_03_G1_HS
EIN_STATUS_16	15	16	AUS_04_G1_HS
EIN_STATUS_17	13	14	AUS_05_G1_HS
EIN_STATUS_18	11	12	AUS_06_G1_HS
MINUS	9	10	PLUS_G1
MINUS	7	8	PLUS_G2
EIN_STATUS_19	5	6	AUS_07_G2_HS
EIN_STATUS_20	3	4	AUS_08_G2_HS
EIN_STATUS_21	1	2	AUS_09_G2_HS

D

EIN_STATUS_02	2	1	EIN_STATUS_01
EIN_STATUS_04	4	3	EIN_STATUS_03
EIN_STATUS_06	6	5	EIN_STATUS_05
EIN_STATUS_08	8	7	EIN_STATUS_07
EIN_STATUS_10	10	9	EIN_STATUS_09
EIN_STATUS_12	12	11	EIN_STATUS_11
EIN_ANALOG_02	14	13	EIN_ANALOG_01

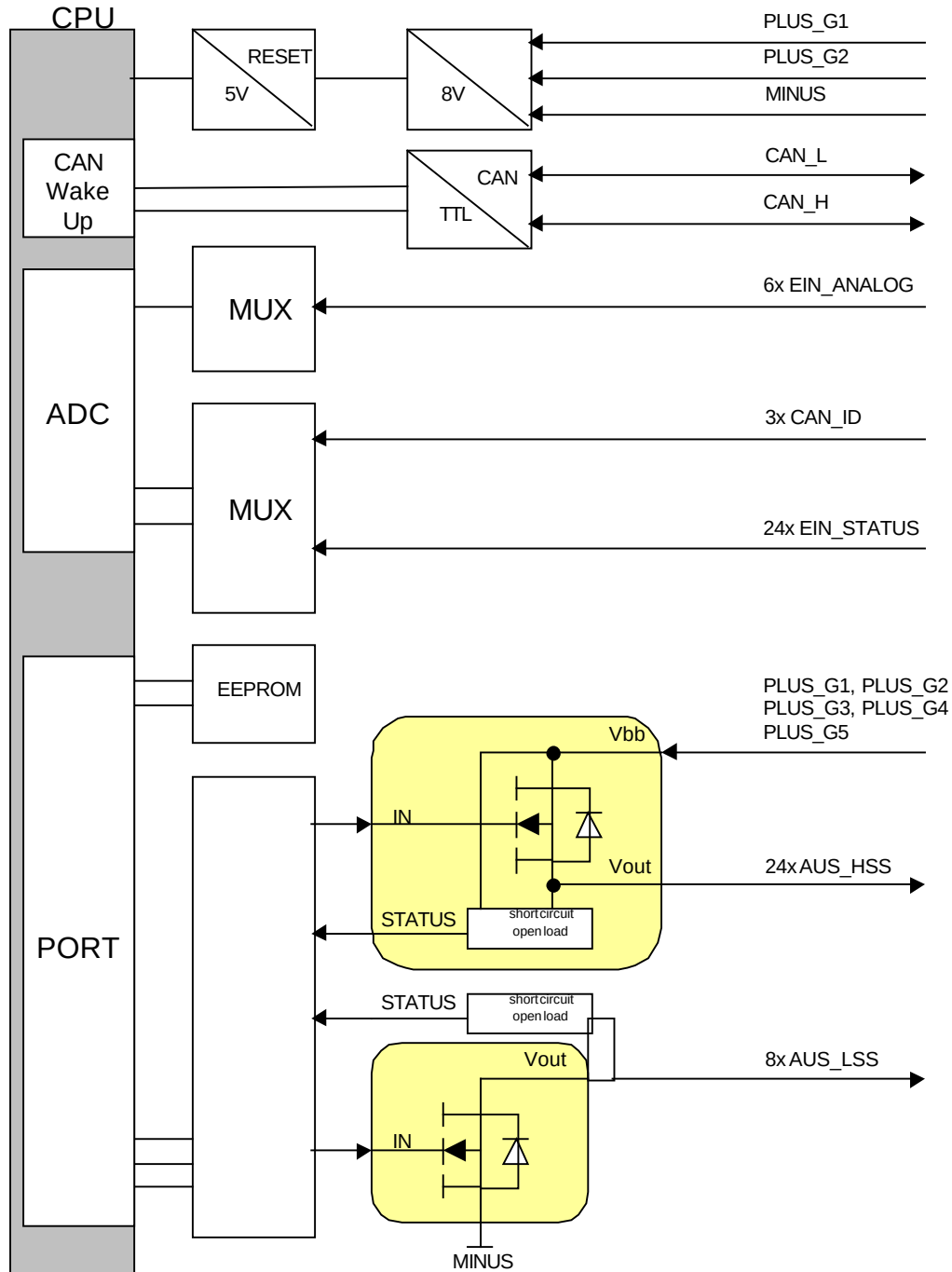
C

CAN_H1	2	1	CAN_L1
CAN_H2	4	3	CAN_L2
EIN_ID_01	6	5	CAN_L_AB
EIN_ID_03	8	7	EIN_ID_02
AUS_ID_PLUS	10	9	AUS_ID_MINUS

B

EIN_STATUS_22	17	18	AUS_10_G3_HS
EIN_STATUS_23	15	16	AUS_11_G3_HS
EIN_STATUS_24	13	14	AUS_12_G3_HS
EIN_ANALOG_03	11	12	AUS_13_G3_HS
MINUS	9	10	PLUS_G3
MINUS	7	8	PLUS_G4
EIN_ANALOG_04	5	6	AUS_14_G4_HS
EIN_ANALOG_05	3	4	AUS_15_G4_HS
EIN_ANALOG_06	1	2	AUS_16_G4_HS

4.4 Block circuit diagram



4.5 Supply voltage

The system is supplied by constant power supply from PLUS_G1 and/or PLUS_G2. It is awakened through activities at the CAN-Bus (by the central computer ZR2).

4.6 Computer core

The computer core consists of an 8-bit microprocessor with peripheral extensions. The program is located in a read only memory (ROM).

4.7 Inputs and outputs

4.7.1 Inputs

- 24 quasi-analog status inputs
- 6 analog inputs
- 3 unit address bits (unit number 1...8)

4.7.2 Outputs

The outputs are split into 5 groups, which are supplied with separate external voltage supplies. Each of these voltage supplies has to have a fuse protection of a maximum of 15A.

4.7.2.1 High side outputs

- 10 HIGHSIDE switches with 3A each
- 4 HIGHSIDE switches with 5A each
- 2 HIGHSIDE switches with 10A each
- 8 HIGHSIDE switches with 1A (3A at 10% duty) each

4.7.2.2 Low side outputs

- 8 LOWSIDE switches with 1A (3A at 10% duty) each

4.8 Interfaces

- 1 CAN according to ISO 11898
Point to point connection to the central computer and other multiplex nodes.
Signals on the CAN awaken the system (wakeup capable).

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 12/53
SiemensVDO Automotive AG					

4.9 Firmware

The multiplex node is controlled by a processor with its own program, which can not be changed by the user. The central computer ZR2 controls the complete system. For the INPUTS and OUTPUTS, individual parameters can be selected in the allocation editor of the PLC program.

Initialization of the multiplex nodes

When starting the system the central computer ZR2 executes a self-test of the system. All connected multiplex nodes are checked for a valid allocation code. Multiplex nodes that do not function are reported to the PLC and eliminated from the current processing. If the ZR2 recognizes a new or exchanged multiplex node during the self-test (unknown allocation code), then a new distinctive code is generated for this multiplex node and stored together with the „fail safe“ operation parameters defined in the PLC program in the EEPROM of the multiplex node.

An inadmissible exchange of the multiplex node while the system is running causes the multiplex nodes to be turned off with unknown allocation code. A new initialization with the defined „fail safe“ operation parameters and a new allocation code takes place at the next system start.

If a multiplex node defined via allocation code is missing, it is reported to the PLC program. The ZR2 tries cyclically to contact this multiplex node.

If this happens during the operating phase, then the error code is reset and the multiplex node is integrated again into the normal process.

Characteristics of a multiplex node in case of an error

If the multiplex node does not establish a connection to the ZR2 during the self-test, then all outputs are switched to logically inactive.

If a multiplex node detects a missing connection to the ZR2 during operation, then it switches in the „fail safe“ operation mode. The outputs of the multiplex node are switched as defined in the „fail safe“ operation parameters that can be programmed in the PLC program and as stored during the initialization.

The status of the outputs during „fail safe“ operation can be programmed as follows:

- output turned off
- output turned on
- output is kept in the last logic status
- output flashes

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 13/53
SiemensVDO Automotive AG					

5 Technical data

5.1 Scope

Operational temperature	:	-30°C ... +70°C
Storage temperature	:	-40°C ... +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.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 14/53
SiemensVDO Automotive AG					

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

5.2 Current supply

	Name	Connector pin
Group 1	PLUS_G1	A10
Group 2	PLUS_G2	A8
	MINUS	A7
	MINUS	A9
	MINUS	B7
	MINUS	B9
	MINUS	E9

The internal logic system of the multiplex node is supplied via PLUS_G1 or PLUS_G2 and MINUS. The MINUS connectors are linked internally and are mainly used to provide power to the node.

Using LS-switches, it is recommended to connect pin E9 and at least one more MINUS connector (see also chapter 5.5.2). The remaining MINUS connector pins can be used as reference-GND.

Nominal voltages	12V 24V	
Functional range	8V - 16V 16V - 32V 36V for 1h at max. 40°C environmental temperature	
Operational voltage	40mA / 12V 60mA / 24V	PLUS_G1, PLUS_G2, MINUS
Stand-by current	2.5mA / 12V 3.0mA / 24V	PLUS_G1,2,3,4,5

5.3 Unit activation

The multiplex node is activated through an incoming CAN message (wake-up).

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 15/53
SiemensVDO Automotive AG					

5.4 Interfaces

5.4.1 CAN to the central computer (MCAN)

Name	Connector pin
CAN_L1	C1
CAN_H1	C2
CAN_L2	C3
CAN_H2	C4
CAN_L_ABSCHL	C5

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 node and central computer.

CAN according to ISO 11898, baud rate 125 kBaud, wakeup capable.

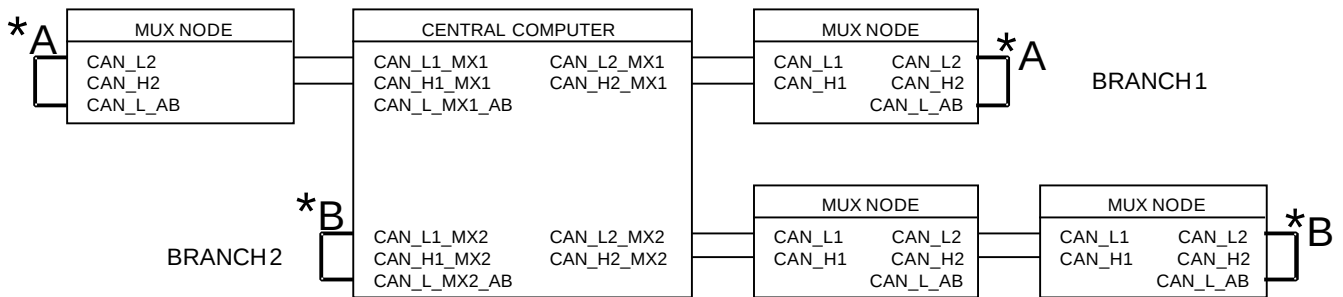
* CAN termination resistance

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.

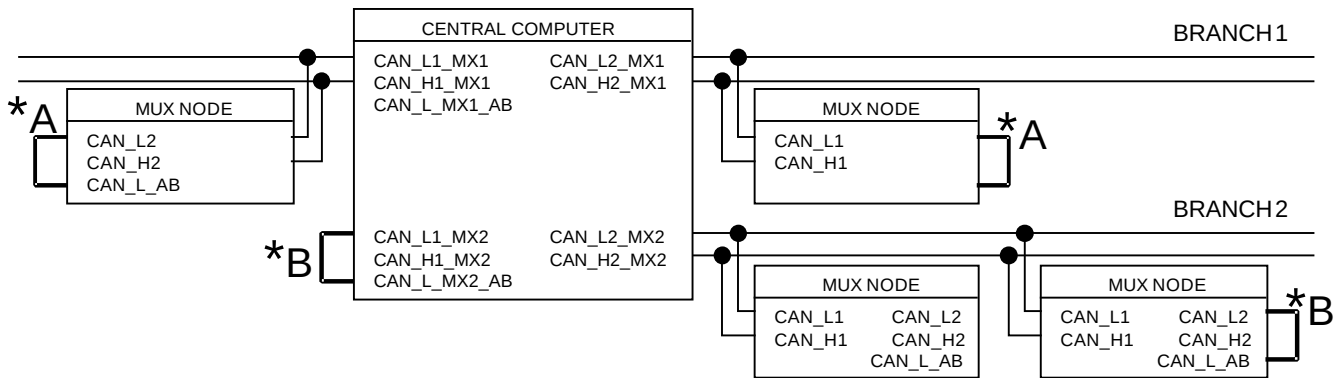
- *A** The CAN termination resistance is activated at the first and last multiplex node in the branch.
- *B** The CAN termination resistance is activated at the central computer and at the last multiplex node.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 16/53
SiemensVDO Automotive AG					



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.



Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 17/53
	SiemensVDO Automotive AG				

5.4.2 Unit number (ID)

Name	Connector pin
EIN_ID_01	C6
EIN_ID_02	C7
EIN_ID_03	C8
AUS_ID_MINUS	C9
AUS_ID_PLUS	C10

The unit number (1..8) is specified via the unit address bits EIN_ID_01, EIN_ID_02 and EIN_ID_03.

The unit address bits are detected via analog signals and are internally diagnosis capable. A contact current of about 5mA against AUS_ID_PLUS or AUS_ID_MINUS is provided.

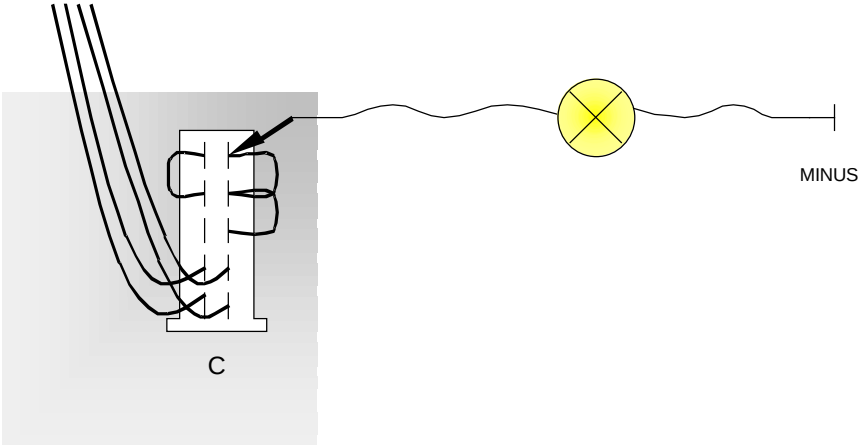
Unit No.	EIN_ID_03	EIN_ID_02	EIN_ID_01
1	AUS_ID_MINUS	AUS_ID_MINUS	AUS_ID_MINUS
*) 2	AUS_ID_MINUS	AUS_ID_MINUS	AUS_ID_PLUS
3	AUS_ID_MINUS	AUS_ID_PLUS	AUS_ID_MINUS
4	AUS_ID_MINUS	AUS_ID_PLUS	AUS_ID_PLUS
5	AUS_ID_PLUS	AUS_ID_MINUS	AUS_ID_MINUS
6	AUS_ID_PLUS	AUS_ID_MINUS	AUS_ID_PLUS
7	AUS_ID_PLUS	AUS_ID_PLUS	AUS_ID_MINUS
8	AUS_ID_PLUS	AUS_ID_PLUS	AUS_ID_PLUS

*) Example: In order to set the unit number 2, jumpers have to be placed on the connector from AUS_ID_MINUS to EIN_ID_03 and EIN_ID_02, as well as from AUS_ID_PLUS to EIN_ID_01.

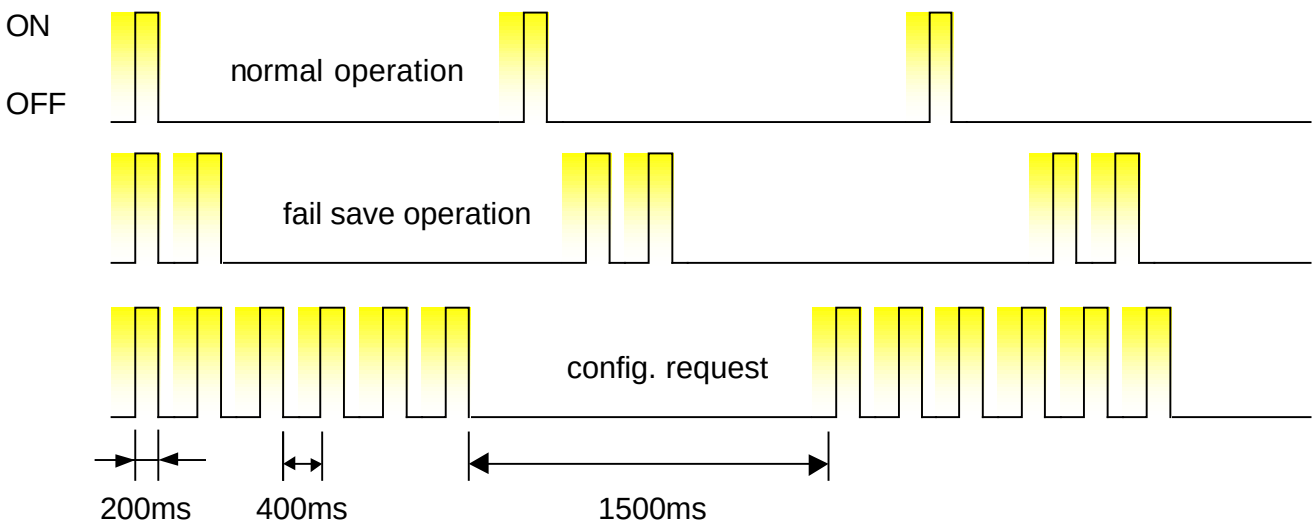
Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 18/53
SiemensVDO Automotive AG					

5.4.2.1 External node diagnosis

To AUS_ID_PLUS, a 2W bulb in connection with a 24V power supply (or 1W with 12V power supply) can be connected for functional checks.



Error conditions	Cause of the failure
„FAIL SAFE“ OPERATION	CAN – connection failed during operation
CONFIGURATION REQUEST	Incorrect node - ID, incorrect node type (MUX2-N,M,B) or new node (node not yet programmed→short term only, until programming is completed)
OFF	Voltage supply or CAN already defective or not present when turning on or node defective
ON	Node defective, voltage supply O.K.



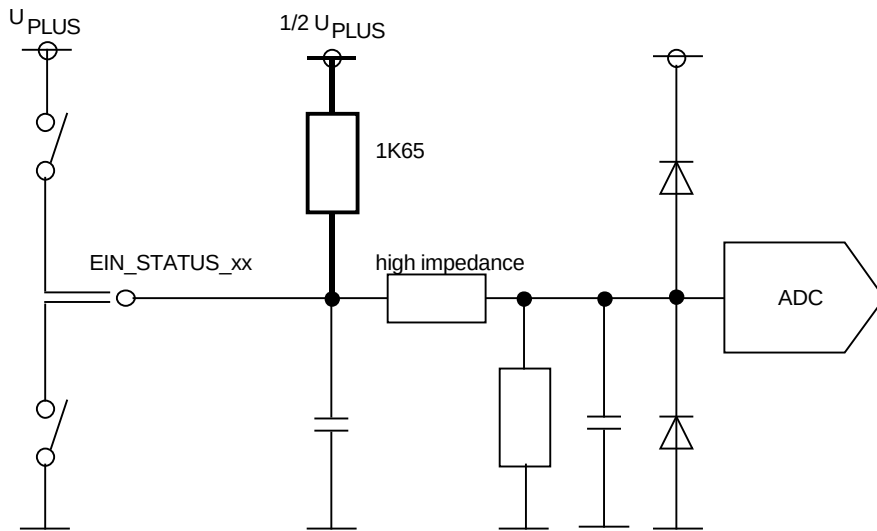
Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 19/53
SiemensVDO Automotive AG					

5.5 Inputs and outputs

5.5.1 INPUTS

5.5.1.1 Status inputs

Name	Connector pin	Contact current at $U_N = 24V$	Contact current at $U_N = 12V$
EIN_STATUS_01	D1	7mA	3.5mA
EIN_STATUS_02	D2	7mA	3.5mA
EIN_STATUS_03	D3	7mA	3.5mA
EIN_STATUS_04	D4	7mA	3.5mA
EIN_STATUS_05	D5	7mA	3.5mA
EIN_STATUS_06	D6	7mA	3.5mA
EIN_STATUS_07	D7	7mA	3.5mA
EIN_STATUS_08	D8	7mA	3.5mA
EIN_STATUS_09	D9	7mA	3.5mA
EIN_STATUS_10	D10	7mA	3.5mA
EIN_STATUS_11	D11	7mA	3.5mA
EIN_STATUS_12	D12	7mA	3.5mA
EIN_STATUS_13	A21	7mA	3.5mA
EIN_STATUS_14	A19	7mA	3.5mA
EIN_STATUS_15	A17	7mA	3.5mA
EIN_STATUS_16	A15	7mA	3.5mA
EIN_STATUS_17	A13	7mA	3.5mA
EIN_STATUS_18	A11	7mA	3.5mA
EIN_STATUS_19	A5	7mA	3.5mA
EIN_STATUS_20	A3	7mA	3.5mA
EIN_STATUS_21	A1	7mA	3.5mA
EIN_STATUS_22	B17	7mA	3.5mA
EIN_STATUS_23	B15	7mA	3.5mA
EIN_STATUS_24	B13	7mA	3.5mA



The status inputs are detected via analog signals. A digital conversion is done in the unit.

Programming possibilities in the PLC program (allocation editor, parameter editor) for **EIN_STATUS_xx**

- Upper threshold value
- Lower threshold value
- Type (order of the ranges „ON(1)“, „OFF(0)“, „ERROR(E)“)
- Error time (can only be set globally for each multiplex node)

The parameter upper and lower **threshold value** are specified relative to the board voltage in percent (0...100% U_{PLUS}). The range of the board voltage is divided into three areas through the two threshold values.

The **type** parameter specifies, which conditions are allocated to the three areas.

- Area above the upper threshold value (1,0 or E)
- Area in the middle (1,0,E or -)
- Area below the lower threshold value (1,0 or E)

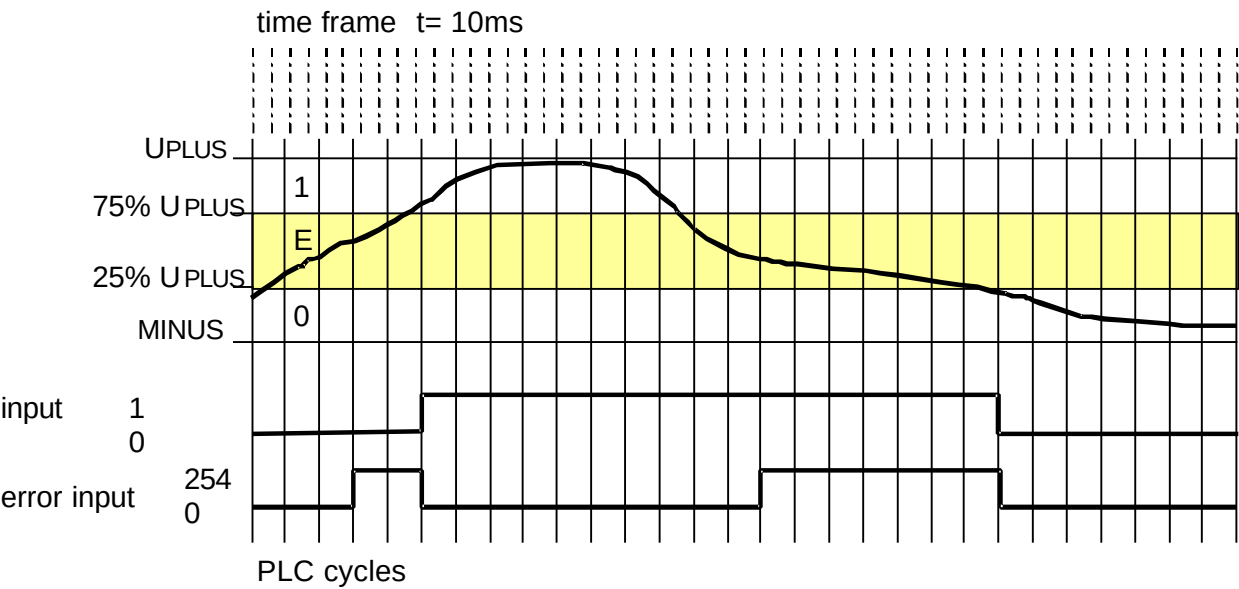
The **error time** parameter specifies the time t after which an error is reported. The time is entered in steps of 10ms in the range of value from 0...250 ($t = 0...2500\text{ms}$). The error time is valid for all status inputs of a multiplex node.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e		Designation Multiplex Node MUX2-B			
		Documentkey 1364.70.023.00 EAD 002 0A			
SiemensVDO Automotive AG					Pages 21/53

Examples:
(upper threshold value = 75%, lower threshold value = 25%, board voltage = 24V)

0-1 →	voltages above 18V voltages between 6 and 18V or voltages below 6V	→condition „inactive“ →condition „active“ →condition „inactive“ →condition „active“
01E →	voltages above 18V voltages between 6 and 18V voltages below 6V	→condition „inactive“ →condition „active“ →condition „active error“
1E0 →	voltages above 18V voltages between 6 and 18V or voltages below 6V	→condition „active“ →condition „active error“ →condition „inactive error“ →condition „inactive“

Example: (error time: 3 → t = 30ms)



Note:

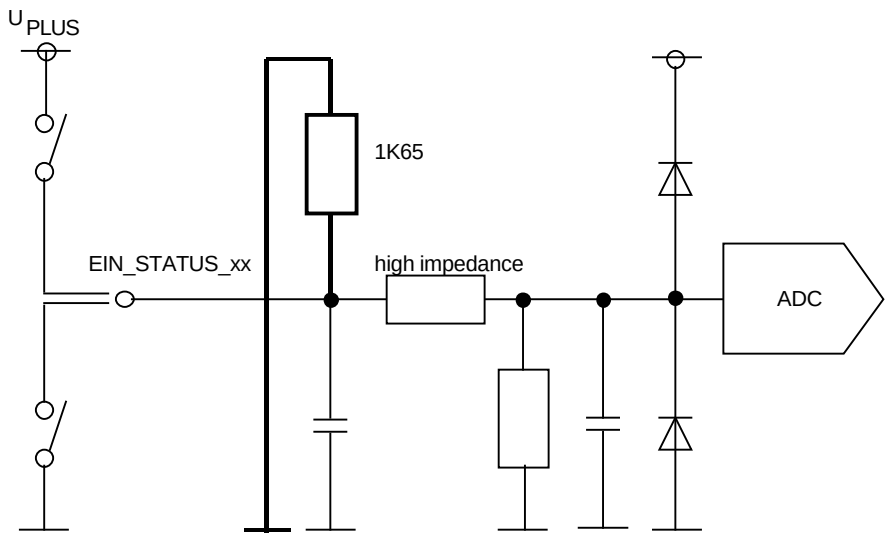
The status inputs are supplied to the PLC directly, that means without SW filtering. Interference voltages at the input are effectively suppressed by setting a hysteresis. From the standard setting of the status inputs (lower threshold value 33%, upper threshold value 66%, type 1E0, error time 50(=500ms)), a hysteresis range of 33% U_{PLUS} results (corresponds to the error range in this example). Through the definition of the error time, sporadic error messages are suppressed at the same time (for signals with slow condition change, the error time also prevents the reporting of an error). Additional protection can be programmed with a respective time filter in the PLC program.

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 23/53
SiemensVDO Automotive AG					

5.5.1.1.1 Characteristics during power down



Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 24/53				

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

5.5.1.2 Analog inputs

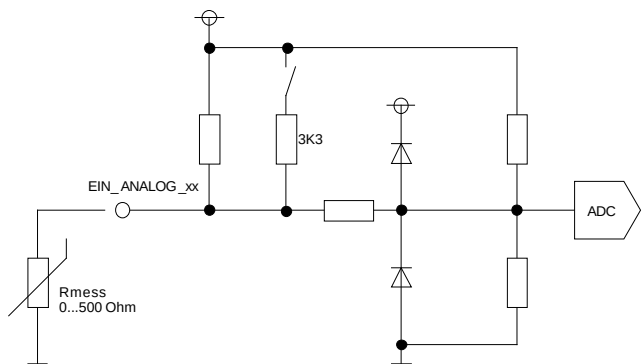
Name	Connector pin
EIN_ANALOG_01	D13
EIN_ANALOG_02	D14
EIN_ANALOG_03	B11
EIN_ANALOG_04	B5
EIN_ANALOG_05	B3
EIN_ANALOG_06	B1

For the analog inputs, there are different measurement methods available.

5.5.1.2.1 Parameter setup

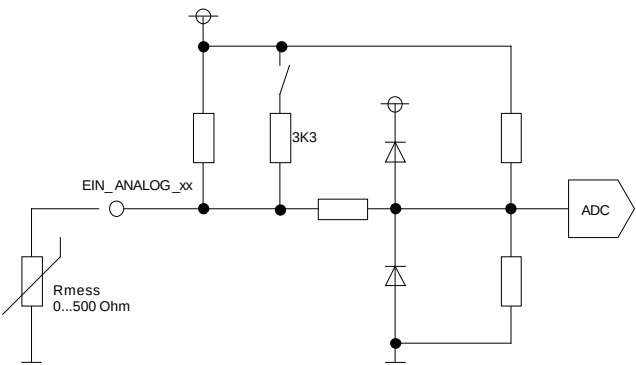
Programming possibilities in the PLC program (allocation editor) for **EIN_ANALOG_xx**

- Type0: **R OFF** **Resistance measurement** in the range 0..500Ω.
Linear transmission of the measured value, that means consistent resolution over the complete measuring range,
compensation of a possible **ground offset**.

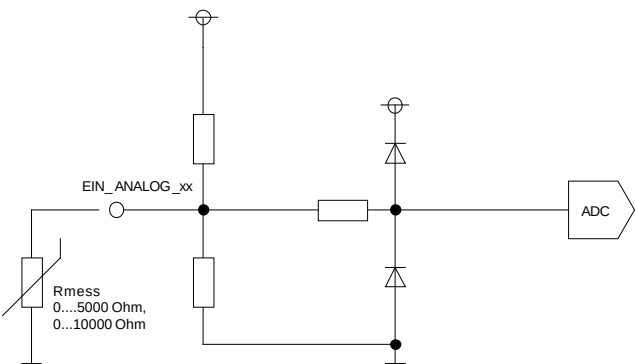


Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 25/53				

- Type1 : R **Resistance measurement** in the range 0...500Ω, 0..5000Ω or 0...10000Ω.
Linear transmission of the measured value, that means consistent resolution over the complete measuring range.
No compensation of a possible ground offset.



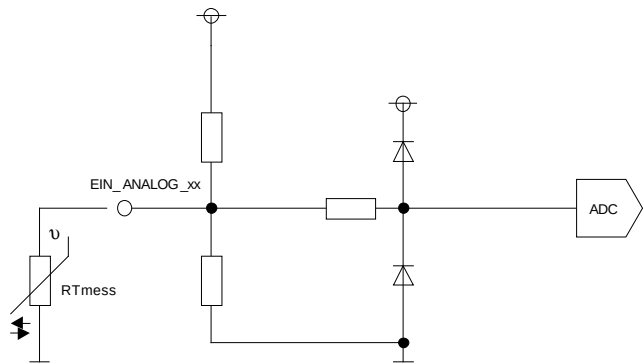
0...500Ω



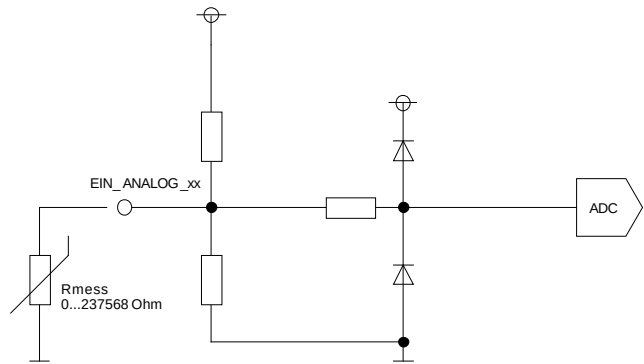
0...5000Ω and 0...10000Ω

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 AUTOMOTIVE		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 26/53				

- **Type2 : NTC** **Temperature measurement** via thermal resistor with NTC characteristic, in the range $-35...90^{\circ}\text{C}$ or $-40...210^{\circ}\text{C}$.
Linear transmission of the measured value, that means consistent resolution over the complete measuring range.
No compensation of a possible ground offset.



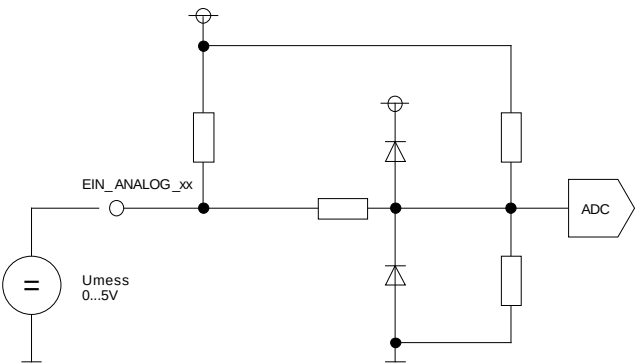
- **Type3 : R n.lin** **Resistance measurement** in the range $0..237568\Omega$.
Non-linear transmission of the measured value, that means a resolution adjusted in steps to the measured variable.
No compensation of a possible ground offset.



Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 27/53				

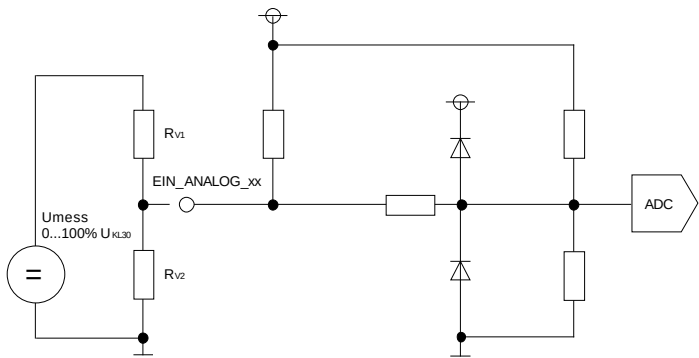
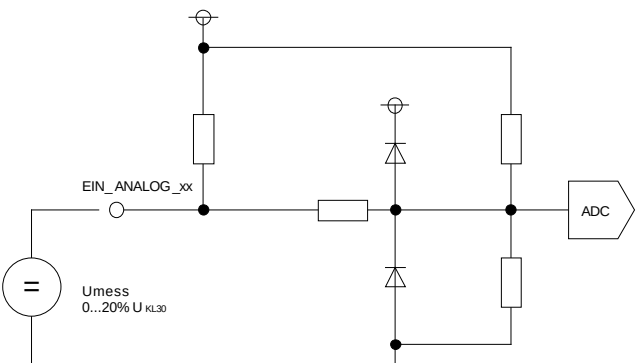
• Type4 : U absolute

Voltage measurement in the range 0...5V.
Linear transmission of the measured value, that means consistent resolution over the complete measuring range.
No compensation of a possible ground offset.



• Type5: U relative **Voltage measurement relative** to U_{PLUS} in the range 0...U_{PLUS} with external voltage divider.

Linear transmission of the measured value, that means consistent resolution over the complete measuring range.
No compensation of a possible ground offset.



Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 28/53				

5.5.1.2.2 Specification

	PARAMETER			Measuring range	Resolution	
	Value1	Value2	Value3			
R OFF	0	500	-	0...500Ω	2Ω	
R	0	500	-	0...500Ω	2Ω	
	0	5000	-	0...5000Ω	20Ω	
	0	10000	-	0...10000Ω	40Ω	
NTC	R ₂₅	B value	0.5°C	-35...90°C	0.5°C	
	R ₂₅	B value	1°C	-40...210°C	1°C *)	
$R_T = R_{25} * \exp[B * (1/T - 1/T_0)]$ with To = 298K (25°C)						
R n.lin	-	-	-	0...237568Ω	64Ω for 0Ω ≤ R ≤ 4096Ω 128Ω für 4096Ω ≤ R ≤ 8192Ω 256Ω for 8192Ω ≤ R ≤ 16384Ω 512Ω for 16384Ω ≤ R ≤ 32768Ω 1024Ω for 32768Ω ≤ R ≤ 65536Ω 2048Ω for 65536Ω ≤ R ≤ 131072Ω 4096Ω for 131072Ω ≤ R ≤ 237568Ω	
U absolute	0	5000	-	0...5V	20mV	for U _{PLUS} = 23..32V
				0...2V		for U _{PLUS} = 10..32V
U relative	0	20	-	0...20% U _{PLUS}	0.08% U _{PLUS}	
				0...100% U _{PLUS}	0.4% U _{PLUS}	with ext. voltage divider R _{V1} = 5K6 and R _{V2} = 1K5

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 29/53
SiemensVDO Automotive AG					

*) In the PLC program, all analog values are processed in the range 0..500. However, the resolution is determined by the transmission. The transmission takes place in the range 0...250. The analog value changes by 2 digits/resolution (500/250 = 2 digits). In the measuring range -40...210°C, the analog value changes by 2 digits/1°C.

Example:

Analog value	0	→	T = -40°C
Analog value	2	→	T = -39°C
	:		
Analog value	100	→	T = +10°C
Analog value	498	→	T = +209°C
Analog value	500	→	T = +210°C

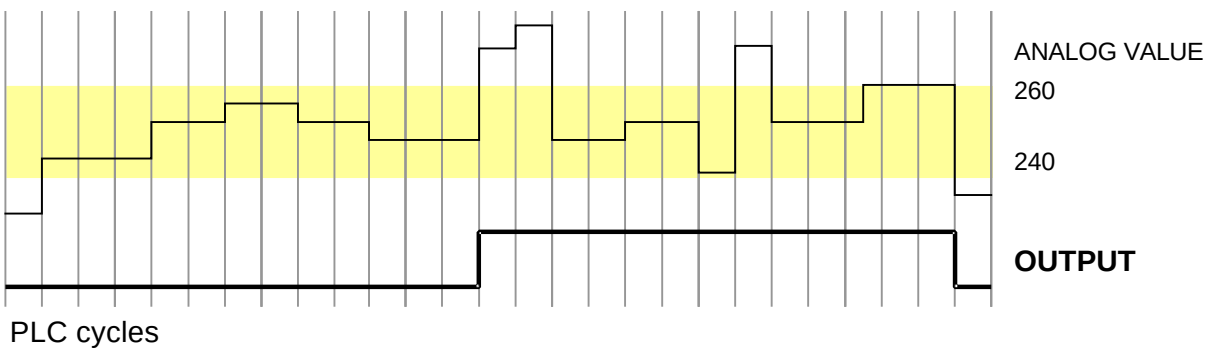
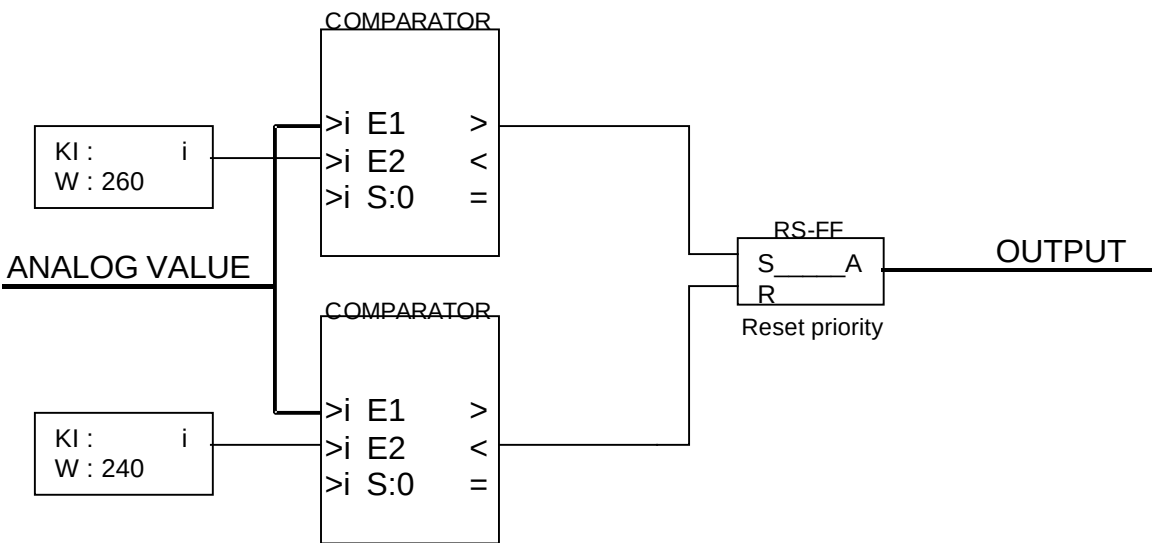
Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 30/53				

Note:

The analog inputs are directly provided to the PLC, which means without SW filtering. For the display of analog values, for example as bar graph, the use of an average value module is generally recommended in the PLC program. For the monitoring of the threshold value of analog values, an average value module is recommended as well and/or the use of a comparator with programmable hysteresis (s. example 1). Exceeding the threshold value for a short time can also be suppressed by a edge delay module (see example 2).

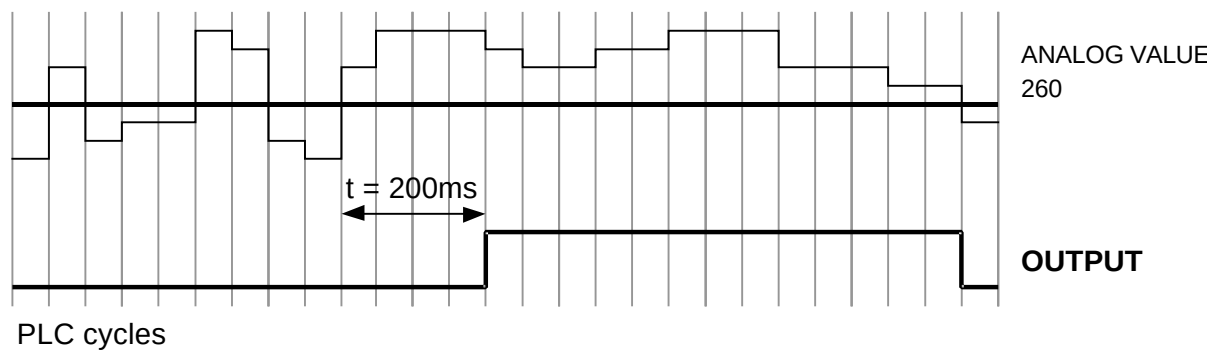
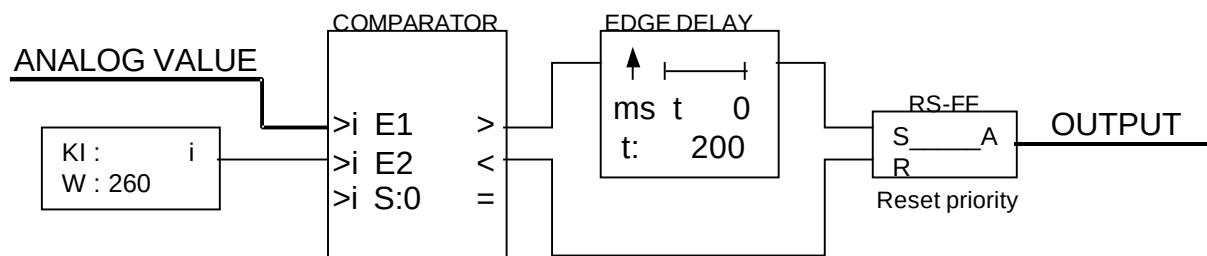
Example 1 :

Monitoring of the threshold value of an analog value (250) by a window discriminator with a hysteresis range of 20 (between the analog values 240 and 260).



Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 31/53
SiemensVDO Automotive AG					

Example 2 :
Brief deviations from the threshold value are filtered by a edge delay module. With an additional edge delay module, resetting of the output can be filtered as well.



Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 AUTOMOTIVE		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 32/53				

5.5.2 OUTPUTS

For wiring, use cables approved for automotive usage with a minimum nominal wire cross-section of 1mm².

At least 2.5mm² are recommended for the power supply PLUS_Gx and Minus as well as the 10A outputs (HS).

Voltage drop, load current and heating have to be taken into account when specifying the wire cross-section.

Use the tinned or silver-plated "Junior Power Timer" contact by Tyco (AMP). Following types of contacts are available:

Tyco (AMP) order no. 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

The theoretical overall switching current of the multiplex node amounts to 86A.

IMPORTANT : For thermal reasons, the switching current available at the same time is in the "worst case" **max. 30A** (based on the upper limit of the supply voltage range of U = 16V or U = 32V).

"Worst case" means that few outputs are operated with the max. admitted switching current. In this case, distribute the load possibly to at least two connectors. The occurring power dissipation quadruples with the switching current ($P_V = I^2 \cdot R_{DS(on)}$). This means if the switched current of an output is reduced by 10%, the power dissipation is reduced by 19% ($0.9^2 = 0.81$).

This means that the switching current available at the same time increases by 10%, if the switching currents admitted in each case are only utilized by 90%.

Example: Instead of 4 x 5A and 1 x 10A

4 x 4.5A, 1x 9A and 2 x 3A can be switched.

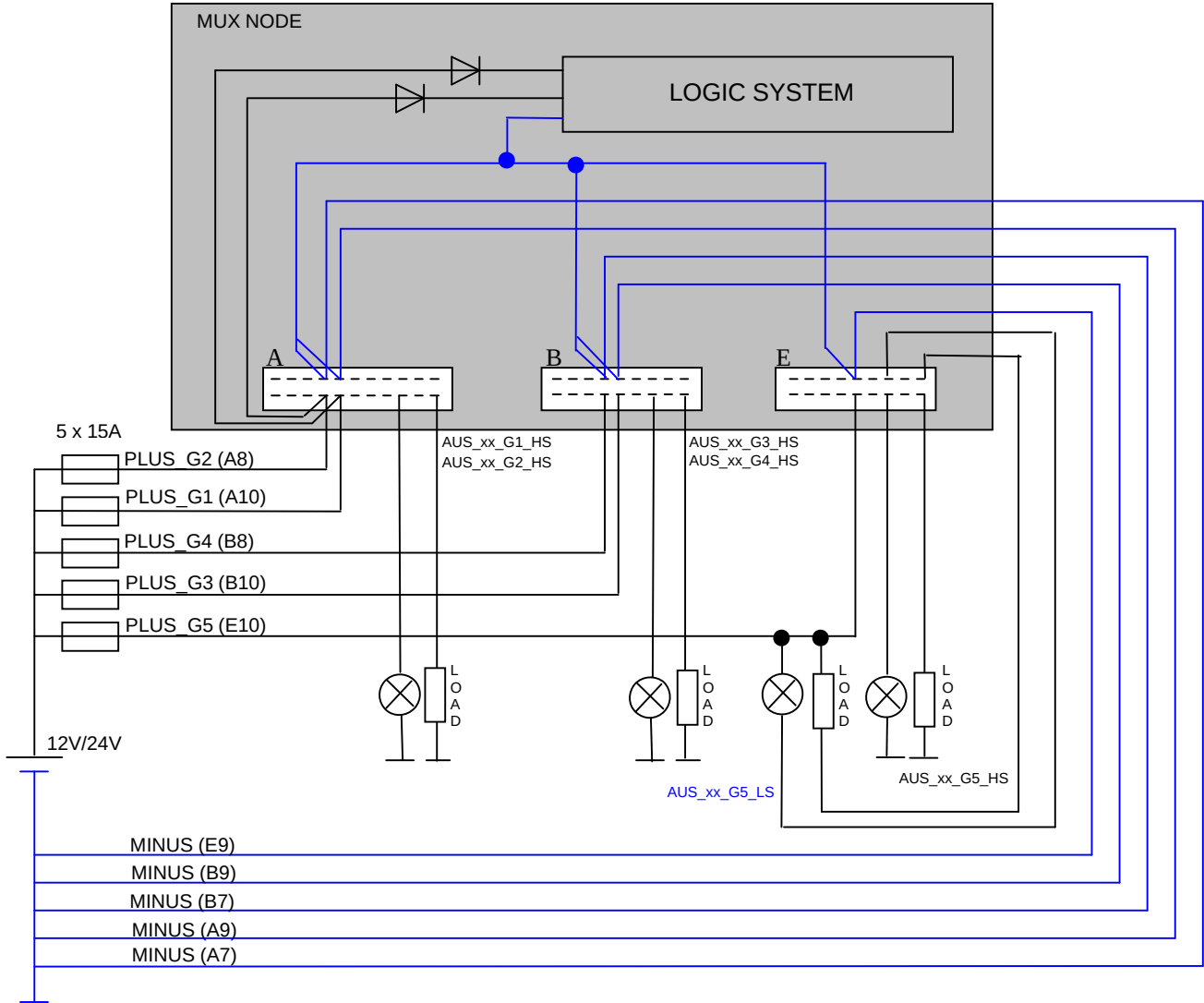
Within one supply group (group 1, 2, 3, 4, 5) a max. of 15A may be switched. The supply groups have to be fused with a max. of 15A each.

To protect the circuit of the LS-loads, group 5 (PLUS_G5) must be fuse protected. As an alternative solution, the current to the LS-loads can be provided using a common shared 15A fuse on their plus sides. It is recommended to connect pin E9 and at least one more MINUS connector.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e		Designation Multiplex Node MUX2-B			
		Documentkey 1364.70.023.00 EAD 002 0A			
SiemensVDO Automotive AG					Pages 33/53

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

	Name	Connector pin	Note
Group 1	PLUS_G1	A10	Fusing via 15A
Group 2	PLUS_G2	A8	Fusing via 15A
Group 3	PLUS_G3	B10	Fusing via 15A
Group 4	PLUS_G4	B8	Fusing via 15A
Group 5	PLUS_G5	E10	Fusing via 15A
	MINUS	A7	The MINUS connectors are linked internally.
	MINUS	A9	
	MINUS	B7	
	MINUS	B9	
	MINUS	E9	



The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

5.5.2.1 HIGHSIDE - switch

	Name	Connector pin	Switching current	Note
Group 1	AUS_01_G1_HS	A22	3A	Circuit protection via ext. 15A fuse
	AUS_02_G1_HS	A20	3A	
	AUS_03_G1_HS	A18	3A	
	AUS_04_G1_HS	A16	3A	
	AUS_05_G1_HS	A14	3A	
	AUS_06_G1_HS	A12	3A	
Group 2	AUS_07_G2_HS	A6	3A	Circuit protection via ext. 15A fuse
	AUS_08_G2_HS	A4	3A	
	AUS_09_G2_HS	A2	10A	
Group 3	AUS_10_G3_HS	B18	5A	Circuit protection via ext. 15A fuse
	AUS_11_G3_HS	B16	5A	
	AUS_12_G3_HS	B14	5A	
	AUS_13_G3_HS	B12	5A	
Group 4	AUS_14_G4_HS	B6	3A	Circuit protection via ext. 15A fuse
	AUS_15_G4_HS	B4	3A	
	AUS_16_G4_HS	B2	10A	
Group 5	AUS_17_G5_HS	E18	1A (3A) *)	Circuit protection via ext. 15A fuse
	AUS_19_G5_HS	E16	1A (3A) *)	
	AUS_21_G5_HS	E14	1A (3A) *)	
	AUS_23_G5_HS	E12	1A (3A) *)	
	AUS_25_G5_HS	E8	1A (3A) *)	
	AUS_27_G5_HS	E6	1A (3A) *)	
	AUS_29_G5_HS	E4	1A (3A) *)	
	AUS_31_G5_HS	E2	1A (3A) *)	

*) The constant current of these switches is 1A. They can be operated with a maximum of 3A for a short time.

The 3A on-time must be below 10% of the operation time and must not exceed 10 minutes (total no more than 15A at any time).

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 35/53
SiemensVDO Automotive AG					

By connecting (jumper to the connector) of 2 outputs, the switching current can be increased. The open-load recognition in the on-condition is not possible any more for parallel connections.

It is not allowed to supply the same load with HS-outputs of different groups, because the separate groups shall also be fuse protected separately.

The connection has to be done within the same group using neighboring channels.

For example:

AUS_01_G1_HS + AUS_02_G1_HS,
AUS_03_G1_HS + AUS_04_G1_HS, etc.

Take care, that the output pins don't get current from outside.

5.5.2.1.1 Parameter setup

Programming possibilities in the PLC program (allocation editor) for **AUS_xx_Gx_HS**

- **„fail safe“ operation**

A: output turned off
E: output turned on
H: maintain condition
B: output flashes

- **OpenLoad in ON**

For the open-load recognition in the on-condition, the power switch is turned off for $t = 1\text{ms}$.

- **Overload latch**

With activated “overload latch”, the HSS output remains switched off after detection of an overload until it is switched on again by ZR2. At “overload latch = off”, the output remains switched on logically, if it is not switched off by ZR2.

During this time, the output will automatically switched on again but thermally controlled.

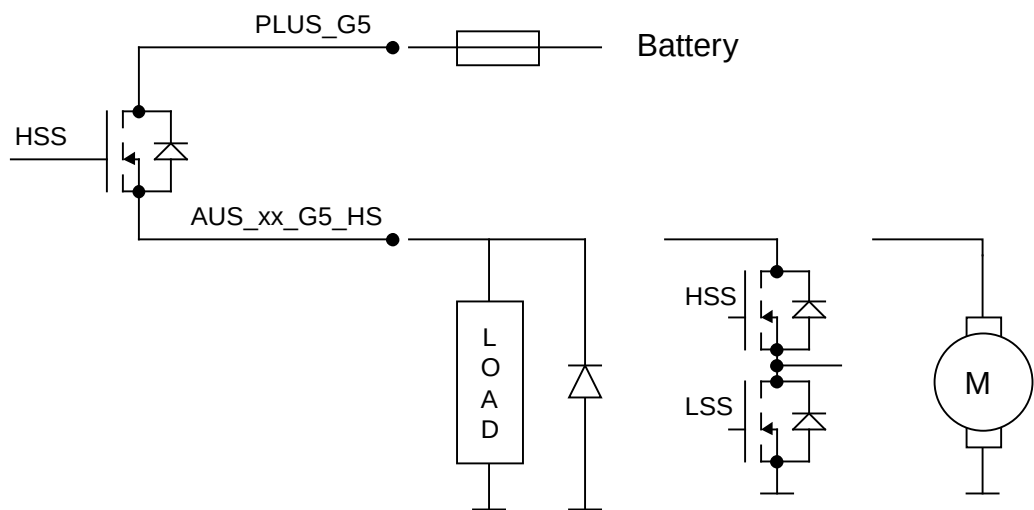
In both cases, the output transmits an error message to ZR2. In general, the PLC program should be structured such that the error messages are evaluated. This is especially important in case of frequently or periodically controlled outputs (e.g. for flash indicator applications) because otherwise an output may always be short-circuited despite activated “overload latch”.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 36/53
SiemensVDO Automotive AG					

5.5.2.1.2 Specification : Reverse battery protection

At reverse battery protection the HSS are sufficiently protected for a short time through the load.
However, in special cases there is no reverse battery protection through the external wiring.

For example: - the load has an integrated or external freewheeling diode
- the load consists of an MOSFET- half bridge (for example HSS, LSS)
- a connected motor does block and the load current is no more limited



In addition it has to be taken into account that certain loads have to be reverse battery protected themselves.

For example: - electronic components, valves
- a motor that may not to be turned in the wrong direction

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 AUTOMOTIVE		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 37/53				

5.5.2.1.3 Specification : Diagnosis

	Input level	Status
Normal operation	Turned off	O.K.
	Turned on	O.K.
Short circuit to ground (clean short circuit ¹⁾)	Turned off	O.K.
	Turned on	Error
Overtemperature	Turned off	O.K.
	Turned on	Error
Open load	Turned off	Error
	Turned on	O.K.
	Turned on	Error ²⁾

¹⁾ Short circuit to ground:
(typ. values)

short circuit current = 30A for t < 3ms (3A switch)

short circuit current = 60A for t < 3ms (5A switch)

short circuit current = 120A for t < 3ms (10A switch)

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

If the "overload latch" is inactive, the subsequent cooling leads to repeated turning on at lower short circuit currents.

With activated overload latch, the HSS output remains switched off after detection of an overload until it is switched on again by ZR2.

The short circuit operation may trip or damage the external fuse.

²⁾ open-load recognition for ohmic loads.

This function has to be enabled in the allocation editor.

For the open-load recognition, a pull-up resistor with 330 kΩ is connected to Plus_Gx for each output. Take this into account for high-ohmic loads with regard to output voltage in off-condition.

For the open-load recognition in the on-condition the power switch is turned off for t = 1ms.

The open-load recognition of the individual outputs is done with different time offset. Therefore no open-load recognition is possible in the on-condition when connecting (jumper at the connector) 2 outputs in parallel.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 38/53
SiemensVDO Automotive AG					

5.5.2.1.4 Specification : Inductive loads

E_{AS} : energy absorbed by the PROFET when an inductive resistor is switched off.

$E_{AS} < 0.28 \text{ J}$ (3A switch)

$E_{AS} < 0.65 \text{ J}$ (5A switch)

$E_{AS} < 1.30 \text{ J}$ (10A switch)

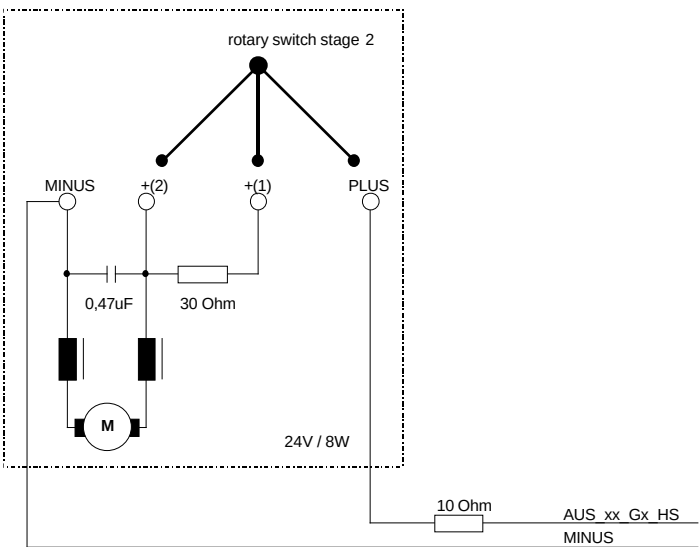
The specification is valid for pure inductive loads (for example relay).

At direct-current motors it also has to be taken into account that they change to generator operation when turned off and that they return energy.

In applications with direct-current motors, which are not switched directly via the HSS but via a mechanical contact (for example: fan with integrated 2-stage rotary switch), additional protection measures may be required (external series resistor). These protection measures are necessary in particular, if the direct-current motor has an integrated interference-suppression capacitor. The resulting parallel LC- oscillating circuit in connection with the spark-discharge gap at the contact can lead to extreme current and voltage peaks.

However, these protection measures are application specific and only practical for motors with low power consumption due to power dissipation. Through the series resistor, the supply voltage of the direct-current motor is reduced, too.

Example:

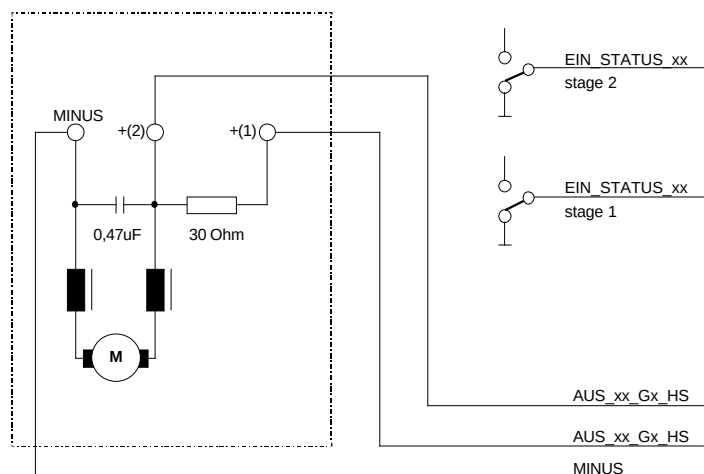


Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 39/53				

Product description

In general, the direct control of each stage with one HSS each has to be given preference in these cases.

Example:



5.5.2.2 LOWSIDE - switch 1A (3A)

	Name	Connector pin	Switching current Power switch	Note
Group 5	AUS_18_G5_LS	E17	1A (3A) *)	Circuit protection via ext. User protection
	AUS_20_G5_LS	E15	1A (3A) *)	
	AUS_22_G5_LS	E13	1A (3A) *)	
	AUS_24_G5_LS	E11	1A (3A) *)	
	AUS_26_G5_LS	E7	1A (3A) *)	
	AUS_28_G5_LS	E5	1A (3A) *)	
	AUS_30_G5_LS	E3	1A (3A) *)	
	AUS_32_G5_LS	E1	1A (3A) *)	

*) The constant current of these switches is 1A. They can be operated with a maximum of 3A for a short time. The 3A on-time must be below 10% of the operation time and must not exceed 10 minutes (total no more than 15A at any time).

(e.g.: 1 min at 3 A è 9 min off or 10 min at 3 A è 90 min off)

To protect the circuit of the LS-loads, group 5 (PLUS_G5) must be fuse protected. As an alternative solution, the current to the LS-loads can be provided using a common shared 15A fuse on their plus sides. It is recommended to connect pin E9 and at least one more MINUS connector.

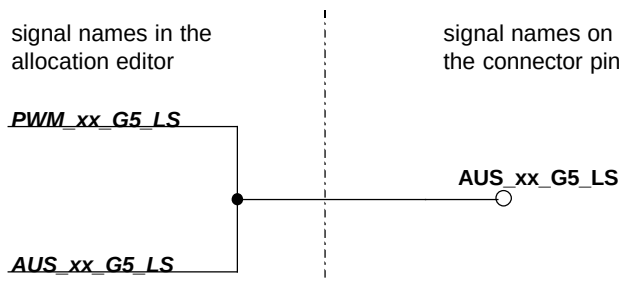
Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e		Designation Multiplex Node MUX2-B			
		Documentkey 1364.70.023.00 EAD 002 0A			
SiemensVDO Automotive AG					Pages 41/53

The outputs can be configured in various modes with different output stages. All outputs have a low-ohmic power switch. The various modes are not available in all outputs AUS_xx_G5_LS (see following pages).

The power switch can be operated as switch output (*AUS_xx_G5_LS*), PWM – output (*PWM_xx_G5_LS*) or MONOFLOP – output (*PWM_xx_G5_LS*). During switch and Monoflop mode, the switching-on of the LS power switch is delayed by $t = 1\text{ms}$ relative to the PLC cycle.

The logic switch can be operated as PWM – output (*PWM_xx_G5_LS*) or MONOFLOP – output (*PWM_xx_G5_LS*). During the Monoflop mode, the switching-on of the logic switch is delayed by $t = 1\text{ms}$ relative to the PLC cycle.

AUS_xx_G5_LS and *PWM_xx_G5_LS* are using a common connector pin (*AUS_xx_G5_LS*). This means that the *AUS_xx_G5_LS* should not be allocated or turned off when the PWM / MONOFLOP – function is used.



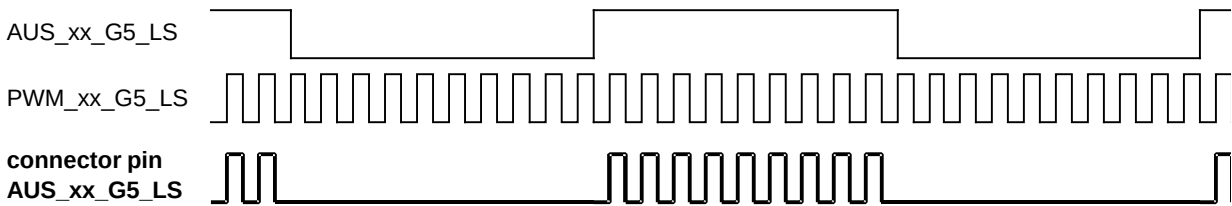
Note:
The outputs *AUS_xx_G5_LS* and *PWM_xx_G5_LS* are operated in parallel (according to the definitions in the allocation editor and the PLC program). This means that the outputs are connected by a logic OR in normal operation as well as during „fail safe“ operation.

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 SIEMENS VDO AUTOMOTIVE		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
		Pages 42/53				
SiemensVDO Automotive AG						

Example:

- „fail safe“ operation B: output flashes (AUS_xx_G5_LS)
- „fail safe“ operation N: take over „fail safe“ operation value (125) (PWM_xx_G5_LS)

The result of this „fail safe“ operation definition is the following signal curve at the output.



5.5.2.2.1 Parameter setup

- ◆ Four outputs can be operated as *AUS_xx_G5_LS*.



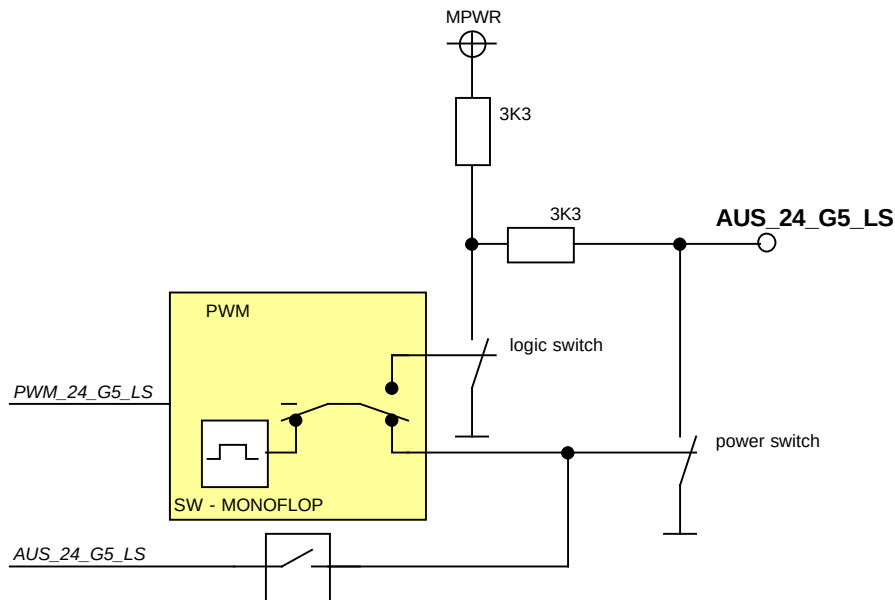
Programming possibilities in the PLC program (allocation editor) for:

AUS_26_G5_LS, AUS_28_G5_LS, AUS_30_G5_LS, AUS_32_G5_LS

- „fail safe“ operation A: output turned off
E: output turned on
H: maintain condition
B: output flashes
- **OpenLoad in ON** For the open-load recognition in the turned on condition the power switch is turned off for t = 1ms. The diagnosis for the power switch is only available, if the output PWM_xx_G5_LS is not allocated.

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A U T O M O T I V E		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 43/53				

- Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)



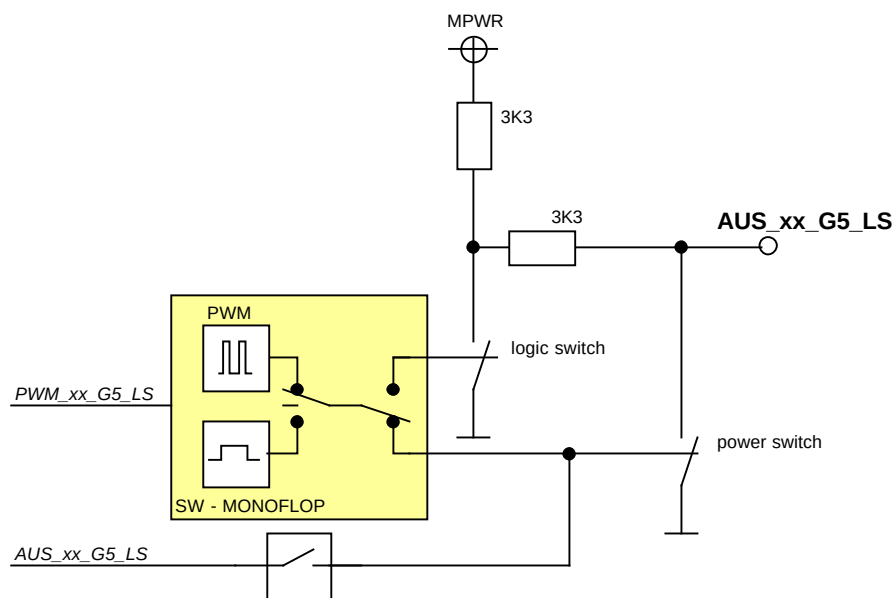
AUS 24 G5 LS

- PWM_24_G5_LS**

- **Type3 : Monoflop on power switch**

- „fail safe“ operation A: output turned off

- **Type4 : Monoflop on logic switch**
With each PLC-cycle the logic switch is turned on for $t = 0..250\text{ms}$. The output remains active at $t > T_{\text{ZYKLUS}}$, but is switched off during each PLC cycle for 1 ms.
- „fail safe“ operation A: output turned off
- ◆ Three outputs can be operated as *AUS_xx_G5_LS* or as *PWM_xx_G5_LS* (PWM, SW-MONOFLOP). The basic PWM frequency is the same for all outputs.



Programming possibilities in the PLC program (allocation editor) for:

- AUS_18_G5_LS, AUS_20_G5_LS, AUS_22_G5_LS,***
- **„fail safe“ operation**
A: output turned off
E: output turned on
H: maintain condition
B: output flashes
 - **OpenLoad in ON**
For the open-load recognition in the on condition, the power switch is turned off for $t = 1\text{ms}$. The diagnosis for the power switch is only available, if the output *PWM_xx_G5_LS* is not allocated.

Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
		Designation Multiplex Node MUX2-B				
		Documentkey 1364.70.023.00 EAD 002 0A				
SiemensVDO Automotive AG		Pages 45/53				

PWM_18_G5_LS, PWM_20_G5_LS, PWM_22_G5_LS,

For the monoflop / PWM – function *AUS_xx_G5_LS* should not be allocated or turned off.

- **Type1 : PWM-output at power switch**

PWM signal on power switch. For EMC reasons the control of peripheral equipment (for example fans) has to be given preference over the logic switch.

- „fail safe“ operation

H: maintain condition

N: take over „fail safe“ operation value (PWM)

- **Type2 : PWM-output at logic switch**

PWM signal on logic switch.

- „fail safe“ operation

H: maintain condition

N: take over „fail safe“ operation value (PWM)

- **Type3 : Monoflop on power switch**

With each PLC-cycle the power switch is turned on for $t = 0..250\text{ms}$. The output remains active at $t > T_{\text{ZYKLUS}}$, but is switched off during each PLC cycle for 1 ms.

- „fail safe“ operation

A: output turned off

- **Type4 : Monoflop on logic switch**

With each PLC-cycle the logic switch is turned on for $t = 0..250\text{ms}$. The output remains active at $t > T_{\text{ZYKLUS}}$, but is switched off during each PLC cycle for 1 ms.

- „fail safe“ operation

A: output turned off

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 46/53
SiemensVDO Automotive AG					

5.5.2.2.2 Specification LOWSIDE - switch

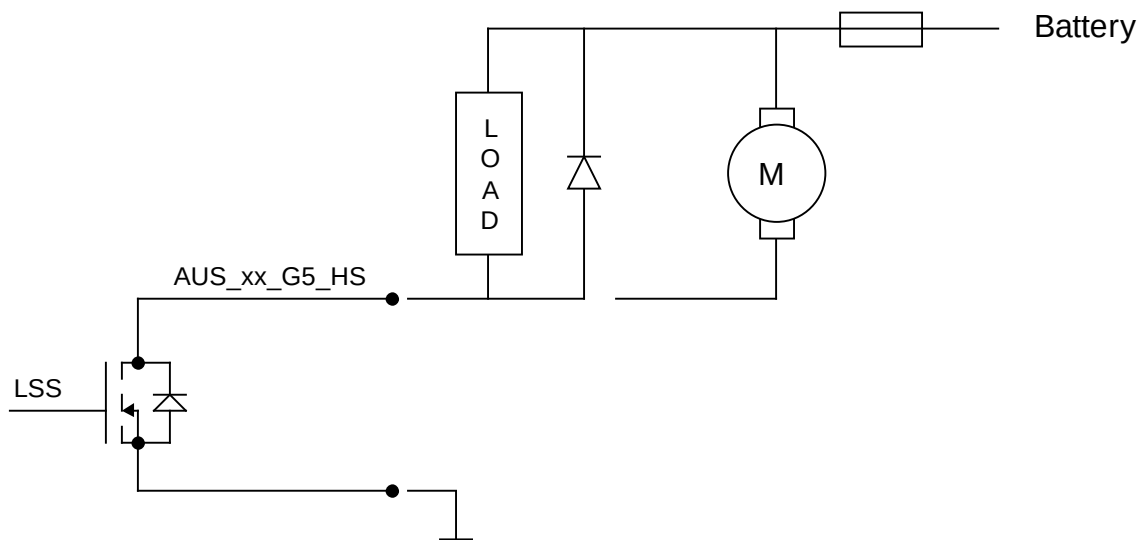
SELECTION	Parameter		Current	Note
in the PLC - program	T _{ON}	Frequency		
AUS_xx_G5_LS			1A	
OpenLoad in ON				
PWM_xx_G5_LS				
PWM-output at power switch	0...100%	20... 30000Hz	1A	Resolution(T _{ON}) = 1/250%
PWM-output at logic switch	0...100%	20... 30000Hz	R _{IL} = 3K3 R _{IH} = 6K6	Resolution(T _{ON}) = 1/250%
Software monoflop at power switch	0...250ms	-	1A	
Software monoflop at logic switch	0...250ms	-	R _{IL} = 3K3 R _{IH} = 6K6	

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

5.5.2.2.3 Specification : Reverse battery protection

At reverse battery protection the LSS are sufficiently protected through the load for a short time.
However, in special cases there is no reverse battery protection through the external wiring.
For example: - the load has an integrated or external freewheeling diode
- a connected motor does not block and limit the load current any more



In addition it has to be taken into account that certain loads have to be reverse battery protected themselves.
For example: - electronic components, valves
- a motor that may not to be turned in the wrong direction

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 48/53
SiemensVDO Automotive AG					

5.5.2.2.4 Specification : Diagnosis

The diagnosis for the power switch is only available, if the output *PWM_xx_G5_LS* is not allocated.

	Input level	Status
Normal operation	Turned off	O.K.
	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	Error ¹⁾
Overtemperature	Turned off	O.K.
	Turned on	Error
open load	Turned off	Error
	Turned on	O.K.
	Turned on	Error ²⁾

¹⁾ short circuit to V_{bb} is recognized via the power dissipation occurring in the component

²⁾ open-load recognition for ohmic loads.

This function has to be enabled in the allocation editor.

For the open-load recognition in the on condition, the power switch is turned off for $t = 1\text{ms}$.

The open-load recognition of the individual outputs is done with different time offset. Therefore no open-load recognition is possible in the on-condition when connecting (jumper at the connector) 2 outputs in parallel.

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

An error message is displayed and the output remains switched off until it is switched on again by ZR2.

However, in the PWM mode, the LSS is switched on periodically so that no long term short circuit protection is given.

Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
 A u t o m o t i v e	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 49/53
SiemensVDO Automotive AG					

I _{SHORT CIRCUIT}	t _{SHORT CIRCUIT}	U _{BAT}	Note
80A	375µs	28V	with R _{LOAD} = 0Ω
28A	10ms	28V	with R _{LOAD} = 1Ω

The data are typical values at room temperature.

5.5.2.2.5 Specification : Inductive loads

E_{AS}: energy that the LSS absorbs when an inductive resistor is switched off.

E_{AS} < 0.2 J

The specification is valid for pure inductive loads (for example relay).

At direct-current motors it also has to be taken into account that they change to generator operation when turned off and that they return energy.

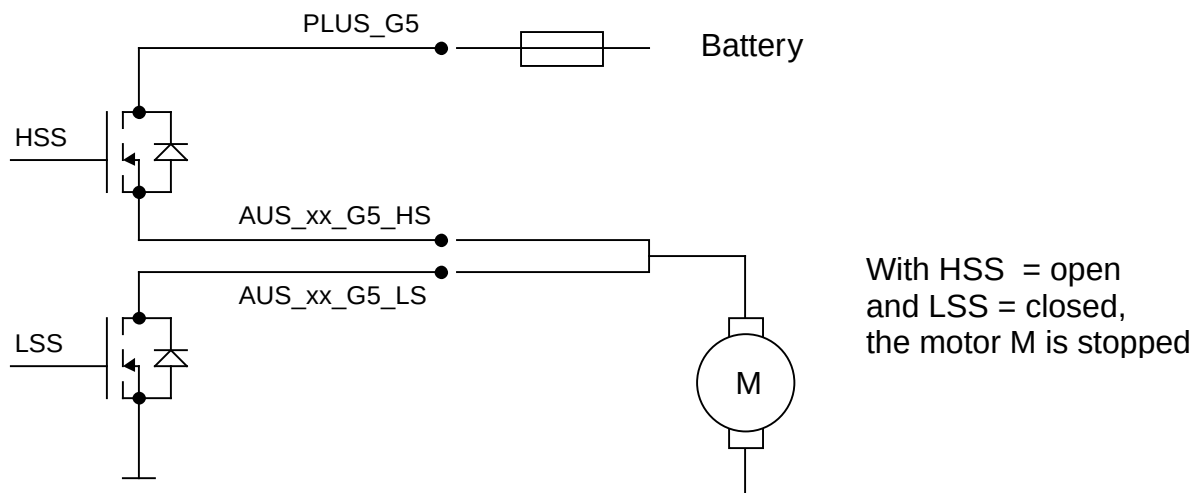
Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B					
	Documentkey 1364.70.023.00 EAD 002 0A					Pages 50/53
	SiemensVDO Automotive AG					

5.5.2.3 HALF-BRIDGES 1A (3A)

By connecting (jumper at the connector) of a HSS and a LSS a half-bridge is formed. The half-bridges are formed with HSS and LSS of group 5. Simultaneous switching-on of LSS and HSS must be avoided within the PLC program. The switching-on of the LSS is delayed by $t = 1\text{ms}$ with regard to the PLC cycle (and herewith, to the HSS) in order to avoid cross currents due to different switch delay times.

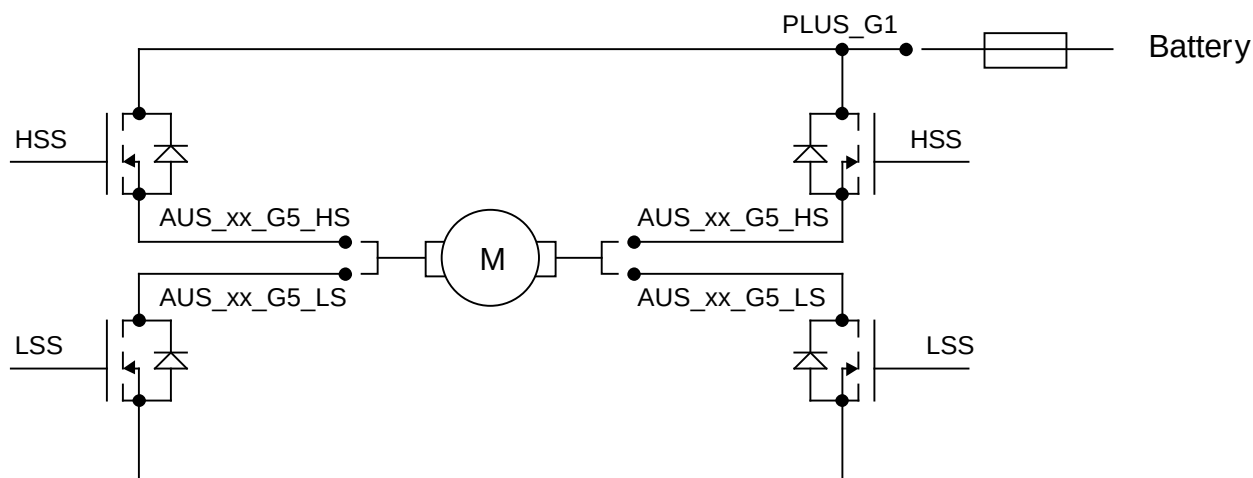
The constant current of these switches is 1A. They can be operated with a maximum of 3A for a short time. The on-time has to be below 10% of the operation time and may not exceed 10 minutes.
(for example: 1 min “on” at 3 A è 9 min “off” or max. 10 min “on” at 3 A è 90 min “off”).

The half-bridges (and full-bridges) are not sufficiently reverse battery protected by the external fuse at the PLUS - side!



Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 51/53
SiemensVDO Automotive AG					

Observe
Protection marks for restricting the use of documents and products
(DIN 34: 1998-01)



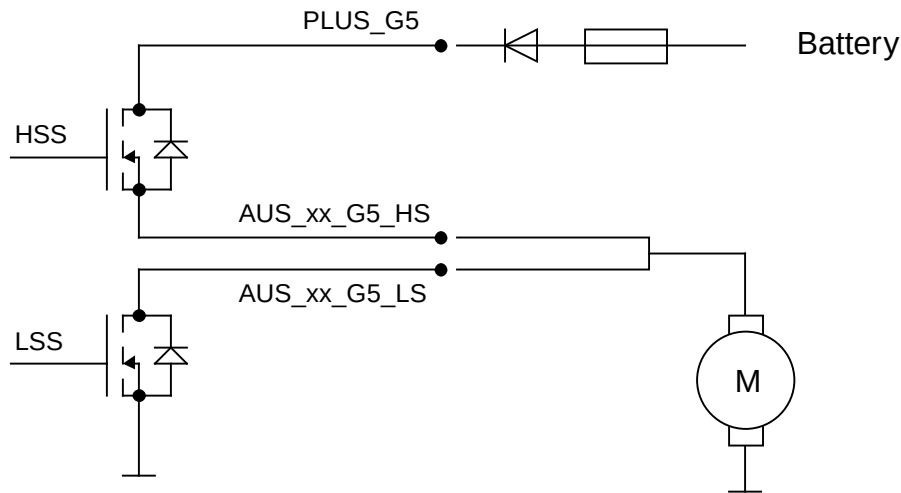
A full-bridge consists of 2 half-bridges. They can control the direction of rotation of a motor M for example.

The copying, distribution and utilization of this document as well as the communication of its contents to others without expressed authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or ornamental design registration.

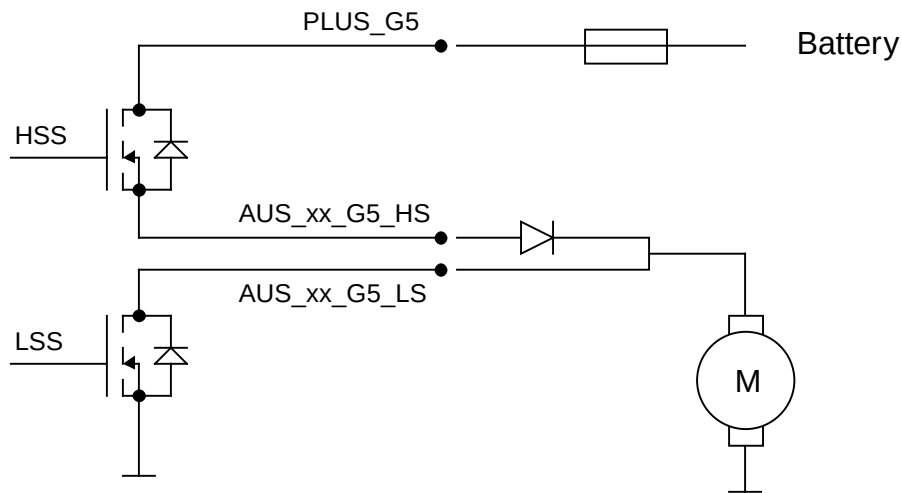
Designed by Schupp/Christein	Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B				
	Documentkey 1364.70.023.00 EAD 002 0A				Pages 52/53
SiemensVDO Automotive AG					

External measures are necessary to protect the outputs.

- An external diode (preferably Schottky diode) in the voltage supply prevents the current flow. The diode operated by the current of the whole group and therefore has to be designed appropriately (current, power dissipation).



- An external diode at the output of the respective HB has the advantage, that not the complete group current is lead through the diode.



Designed by Schupp/Christein		Date 09.09.2002	Department	Released by	Date	Department LE/BE
	Designation Multiplex Node MUX2-B					Pages 53/53
	Documentkey 1364.70.023.00 EAD 002 0A					
	SiemensVDO Automotive AG					