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Product Specification

Modular Control System

for Pneumatically Controlled Vehicle Doors

MTS-P

(Full Version)

from Rev.: MTSPD104

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1 General description

The WABCO modular door control system (MTS) is an electronic control system to operate vehicle doors in buses, mainly in vehicles of public urban passenger transport (ÖPNV).

The MTS controls inward swinging doors (IST), outward swinging doors (AST) and hinged sliding doors (SST).

Two different **kinds of control** are distinguished:

- **MTS-P** : Variation for **pneumatically controlled doors**, i. e. control of air-operated vehicle doors by means of solenoid valves and cylinders.
- **MTS-E** : Variation for **electrically controlled doors**, i. e. direct control of the electric motors for the door control.

Mixed application of MTS-P and MTS-E in one vehicle is possible.

MTS-P is the continued development of the WABCO-ETS and uses mainly the same functional principles as ETS (squeezing protection, sensors, valves, etc.).

Remark:

Besides the MTS-P control device (full version), an underequipped control device (MTS-P-EM) with the WABCO no. **446 190 002 0** is available only for application as extension module at the doors 2 to 5. This control device can control only one door valve.
This control device variation is described in a separate specification.

The MTS-E control device has the WABCO no. **446 190 010 0** and can be used for all doors.

This specification describes the full version of MTS-P **446 190 000 0**
starting with software status MTSPD104.

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2 System structure

The MTS consists of modular control devices and controls up to five single- or double-wing doors in one vehicle. Each door is equipped with one control device.

The MTS control device at **door 1** is called **basic module**. The MTS control devices at the **doors 2 to 5** are **extension modules**. The MTS-P 446 190 000 0 can be used at all doors.

2.1 Function of the modules

2.1.1 Basic module

- Control of door 1 with drive, sensors and door periphery incl. outside button; the basic module can control one or two valves, consequently single-wing control or door-wing blocking is possible.
- Data link to the vehicle via CAN-vehiclebus.
- Data link to the extension modules at doors 2...5 via a CAN-systembus.
- Connection to the vehicle electric system (driver's place, E-box, etc.) by direct wiring.
- Diagnosis of MTS preferably via CAN vehiclebus (or K-line) .
- Parameter setting of the MTS system data via CAN vehiclebus (or K-line).

2.1.2 Extension modules

- Control of the doors 2 to 5 with drive, sensors and corresponding door periphery;
- Data link with the basic module at door 1 via CAN systembus.

The installation place is identified by a plug code (address identification) on the 9-pin plug. The full version of the control device allows separate door-wing blocking in 2-valves-operation also at the doors 2 to 5.

The control device is **not** equipped with any control buttons or warning lamps.

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3 System parameter setting

In order to adapt the MTS perfectly to the vehicle according to different customers' requirements, **a set of parameters** for the whole door system of a vehicle is permanently stored in the basic module at door 1. This set of parameters includes the adjustments for the door systems regarding handling, door designs, operating types, etc. After each ignition on, the basic module transmits these data to the other doors. Consequently parameters need not be stored again in an extension module at the doors 2 to 5 when replaced. In case the basic module at door 1 is replaced, the vehicle-specific MTS parameters of the vehicle manufacturer must be loaded in the new control device before. Only the vehicle manufacturer can load these parameters as he defines the parameters in accordance with the customer's order. Therefore new control devices for door 1 must be delivered together with the vehicle-specific parameters by the vehicle manufacturer. The basic modules at door 1 must be separately marked by the vehicle manufacturer. It must be possible to identify the loaded set of parameters by the marking.

3.1 Initialization, learning processes and diagnosis of MTS

3.1.1 General

For initializing the MTS system in a vehicle, the MTS control devices at all doors must be completely connected. Local initialization of the doors 2 to 5 (i. e. without CAN-systembus / 9-pin plug) is not possible. MTS-initialization includes individual learning processes at each door. Doing so the values of the door-wings' end-positions (OPEN, CLOSED) and the number of MTS-valves (1 or 2) are learned-in and permanently stored locally in the corresponding control devices. In addition the basic module at door 1 learns how the vehicle electric system is connected to the MTS control device and how many door control devices (extension modules) in the vehicle are connected via the systembus to the basic module at door 1. For the vehicle electric system two different connections are possible, either a conventional link via 6- or 12-pin plug for the vehicle signals or CAN-link via the vehiclebus. The control devices are delivered with learned-in status „vehiclebus“.

The tools for the learning process are workshop button (WFAT) and entrance illumination (ESB).

3.1.2 Conditions for initialization

1. The MTS control device at door 1 must include the vehicle-specific parameter-set. This includes also the parameters for all other doors. The basic module at door 1 must be marked.
2. The vehicle must stand still, i. e. ground potential on pin 12/18 at the control device of door 1.
3. Ignition must be on, i. e. 24 V on pin 3/12 at the control device of door 1 or ignition signal on the vehicle CAN bus.
4. Operating voltage and pressure ok.

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The **learning process** is realized in the following way at each door for OPEN and for CLOSED position:

- close the door
- push the workshop button permanently
- the door moves into OPEN position
- after ca. 7 seconds the entrance illumination of the learned-in door starts flashing: once at door 1, twice at door 2, three times at door 3, etc.
- after flashing release the workshop button
- flashing signalizes the end of the learning process

then

- open the door
- push the workshop button permanently
- the door moves into CLOSED position
- after ca. 7 seconds the entrance illumination of the learned-in door starts flashing: once at door 1, twice at door 2, three times at door 3, etc.
- after flashing release the workshop button
- flashing signalizes the end of the learning process

The flashing entrance illumination confirms the learning process only if the door moved without disturbance and reached the end-position of the position sensor.

3.1.3 Initialization of the whole MTS-system

1. Ignition off
2. Ignition on
3. Learning process at door 1
4. Ignition off
5. Ignition on
6. Learning process at door 2
7. Learning process at all other doors

3.1.4 Identification of standstill and ignition

Standstill identification and ignition-on are signalized by door 1 (basic module) to the extension modules at the doors 2 to 5 via the CAN-systembus.

3.1.4.1 Validity for the signal „vehicle running“ on systembus

The doors 2 to 5 evaluate the standstill signal with a time delay of 2 seconds after switching-on the supply voltage. After this time the standstill signal on the CAN-systembus is valid.

3.1.4.2 Plausibility for the ignition signal (ZUN)

The ignition signal (ZUN) has a plausibility check. The status of the ignition signal is set by an external signal but not reset. The consequence is that operation with outside button at door 1 (without considering the standstill signal) works only once before ignition is on. After ignition is on, the outside button is handled like a driver-button with corresponding monitoring.

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3.1.4.3 Link of C3-status with the CAN-message „driving“

The CAN-message „driving“ is logically linked with the pin-signal „C3“. The C3-signal at pin 12/18 must be identified as being valid. If after switching on the supply voltage the MTS receives once a valid CAN-message „vehicle standing“ or „vehicle driving“, this information is always linked with the C3 status. In that case always both signals must have a „vehicle standing“-status in order that the doors can be opened. If once a valid message „vehicle standing“ or „vehicle driving“ was received, the status „vehicle driving“ is set for the messages „not defined“ and „signal not available“.

3.1.5 Further information about initialization

All MTS-P series control devices have a standard parameter set in the factory. It includes the functionality (1) for 2-wings inward swinging doors (IST) at all doors. For all other doors which are not IST, local initializations at single doors (also door 1) can only be done with control devices containing special parameter settings. These must include the corresponding parameters for the corresponding kind of door (AST, IST) including the appropriate damping parameters. This applies also to end-of-line tests in the factory!

3.1.6 Diagnostic link

For the connection of the vehicle electric system via vehiclebus the MTS-diagnosis is also done via this bus. The diagnostic devices are connected either directly to the vehiclebus or the diagnostic data are transferred by other control devices (e. g. central vehicle computer) in the K-line protocol. On the other hand, with conventional connection via plug the K-line is used for MTS diagnosis. For this the diagnostic device can be connected directly to the K-line (pin 7/9).

3.1.6.1 Special feature of direct K-line diagnosis and vehiclebus link

In vehicles with vehiclebus and direct diagnosis via the K-line of the MTS (pin 7/9) the following proceeding must be done for temporary diagnosis:

1. Ignition off
2. Disconnect vehiclebus from MTS control device
3. Ignition on
4. Learning process at door 1
5. Ignition off
6. Re-connect vehiclebus to the MTS control device (optional)
7. Ignition on

When learning-in was correct, diagnosis of the system can now be done via the K-line. The signals from the vehiclebus can also be diagnosed; however, except of the „DRIVING“-signal they have no influence on the MTS. Before diagnosis is finished, the diagnostic memory should be cleared. After that the previous status must be restored by the following procedure:

1. Ignition off
2. Re-connect vehiclebus to the MTS control device
3. Ignition on
4. Learning process at door 1
5. Ignition off
6. Ignition on

The re-initialization of the vehiclebus must be checked by opening a door via the driver-button.

From program status MTSPD104 direct diagnosis via K-line is possible when the vehiclebus is used!

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4 Functional groups of the control device

MTS-P and MTS-E only differ in the drive-specific functions.
All other functional groups are principally the same.

4.1 Vehicle-specific functions

- Driver-place signals and vehicle-signals via CAN-vehiclebus or discrete wiring,
- Diagnosis via K-line or CAN-vehiclebus,
- Parameter setting of MTS via diagnosis K-line or CAN-vehiclebus,
- Address input for definition of the installation place (doors 1 to 5).

4.2 Drive-specific functions

- Solenoid valve control (OPEN, CLOSE, POWERLESS, end-position damping),
- Pressure switch at the solenoid valve (OPEN, CLOSED) for pressure and function monitoring
- Position sensing of the door-wings via potentiometer.

4.3 Door-specific functions

Inputs for ...

- workshop button,
- emergency control device,
- reversing- and keeping-open equipment (feeling wing edge, light barrier, etc.),
- blocking of front/rear door-wing,
- halt demand message (also without automatic function),
- automatic switch for automatic mode,
- baby-buggy function in automatic mode,
- door blocking (e. g. by the ramp),
- door-specific functions (e. g. lifting lock...)

Outputs for ...

- direct control of entrance illumination up to max. 40 W per door,
- door closing warning (door buzzer),
- halt demand display at the door (also without automatic function),
- release indication in automatic mode,
- ramp control

4.4 Other functions

- CAN-systembus for interlinking the MTS control devices,
- voltage supply with 24 V,
- reference voltage for position sensing (15 V output, separate ground),
- C3 (B7) signal evaluation for standstill identification (ca. 3 km/h threshold).

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5 Description of plugs

5.1 9-pin plug

On this plug the databus-interfaces of the vehicle- and systembus as well as the diagnostic interface and the address inputs are installed.

5.2 18-pin plug

On this plug the voltage supply, the C3-speedometer signal and the drive outputs are installed, as well as the position identification of the door-wings. For electric drive of the MTS-E the pinning changes only on this drive-specific plug. The 1- or 2-valve operation of the MTS-P is automatically learned-in during the learning process by permanently pushing the workshop-button ($t > 5$ s).

5.3 15-pin plug

Only door-specific functions are installed on this plug.

5.4 12-pin plug and 6-pin plug

On this plug vehicle-specific functions are installed. Exception: blocking of front/rear wings as blocking function at the corresponding door. All functions of the basic module at door 1 are alternatively transmitted also via the CAN-vehiclebus.

5.5 General remarks about inputs and outputs

Inputs:

All digital logic-inputs are activated by 24 V-level (1-signal). Exceptions: The three address inputs of the 9-pin plug have internal pull-up resistors and are activated by ground signal! The C3 input has the C3-level specification!

Outputs:

All switching outputs are positive switching outputs.

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5.6 Pinning of the MTS-P control device 446 190 000 0

pin	MTS-abbr.	pin-name	character	remarks
1/9	CANHF	CAN H vehiclebus	bus	125 kBit/s
2/9	CANGF	CAN GND vehiclebus	bus-ground	only for vehiclebus
3/9	CANLF	CAN L vehiclebus	bus	125 kBit/s
4/9	CANHS	CAN H systembus	bus	125 kBit/s
5/9	CANRS	CAN systembus	bus connection	each bus-end to be bridged to 6/9
6/9	CANLS	CAN L systembus	Bus	125 kBit/s
7/9	DIAK /ADR3	diagnosis K-line (door 1)/ address 3	diagnosis	ISO diagnosis/ switching to ground
8/9	ADR2	address 2	dig. input	switching to ground
9/9	ADR1	address 1	dig. input	switching to ground

1/18	UB	Cl.15	supply	24 V supply
2/18	VBGND	valve block ground	sep. ground	ground for the MTS-valves
3/18	GND	Cl. 31 / ground	supply	chassis ground
4/18	AUFV	valve OPEN front	switching output	
5/18	ZUV	valve CLOSE front	switching output	
6/18	KLV	valve POWERLESS front	switching output	
7/18	AUFH	valve OPEN rear	switching output	only if two valves are used
8/18	ZUH	valve CLOSE rear	switching output	only if two valves are used
9/18	KLH	valve POWERLESS rear	switching output	only if two valves are used
10/18	UREF	reference voltage for sensors	15 V output	to be used for the sensors only
11/18	ANGND	analogous ground for sensors	sep. ground	to be used for the sensors only
12/18	C3	C3	dig. input	speedometer signal to be connected only to door 1
13/18	POSV	position sensor front	ana. input	analogous potentiometer
14/18	DSAV	pressure switch OPEN front	dig. input	
15/18	DSZV	pressure switch CLOSED front	dig. input	
16/18	POSH	position sensor rear	ana. input	analogous potentiometer
17/18	DSAH	pressure switch OPEN rear	dig. input	only if two valve are used
18/18	DSZH	pressure switch CLOSED rear	dig. input	only if two valve are used

1/15	TSW	door closing warning signal	switching output	buzzer at the door
2/15	WFAT	workshop button	dig. input	learning, FAT, forced closing
3/15	DW	feeling wing edge	dig. input	reversing equipment
4/15	ESB	entrance illumination	switching output	add. acknowl. signal for learning
5/15	NHB	emergency control	dig. input	identif. of actuated emergency control
6/15	LS	light barrier	dig. input	reversing and keeping-open
7/15	RMPST	ramp control	switching output	parameter setting possible
8/15	TBL	door blocking	dig. input	parameter setting possible
9/15	EIN1	input 1 for door-specific functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for inside display
11/15	HW	halt demand	dig. input	possible also via vehiclebus
12/15	AUTO	automatic mode	dig. input	switch in the door-frame
13/15	FGA	door-release indicator	switching output	also outside-HW/KW-button
14/15	KW	baby-buggy	dig. input	possible also via vehiclebus
15/15	EIN2	input 2 for door-specific functions	dig. input	depending on function and design

1/12	FAT1 (V)	driver-button door 1 / FAT1 front	dig. input	FAT 1 front in case of sep. operation
2/12	FAT2	driver-button door 2	dig. input	
3/12	ZUN	ignition identification	dig. input	to be connected to Cl. 15
4/12	ST1	fault warning lamp door 1	switching output	door not closed under pressure
5/12	ST2	fault warning lamp door 2	switching output	door not closed under pressure
6/12	RTGN	red/green indicator	switching output	all doors closed under pressure
7/12	SPH/FAT1H	blocking of wing rear / FAT1 rear	dig. input	FAT 1 rear in case of sep. operation
8/12	SUM	pressureless buzzer	switching output	buzzer at driver's place
9/12	HB	haltbrake	switching output	direct control of haltbrake possible
10/12	SPV	blocking of wing front	dig. input	
11/12	LICHT	release of entrance illumination	dig. input	identification of entrance illumination
12/12	HBAB	deactivation of haltbrake	dig. input	

1/6	HWA2	halt demand announcement	switching output	bell / display
2/6	KWA	baby-buggy announcement	switching output	annouce KW function at the door
3/6	ST3	fault warning lamp door 3	switching output	4. and 5. lamp via vehiclebus only
4/6	FG	door-release	dig. input	
5/6	KWFA	baby-buggy function driver	dig. input	clearing button or release switch
6/6	FAT3	driver-button door 3	dig. input	4. / 5. FAT via vehiclebus only

6 Functional description of the plugs

6.1 9-pin plug

On this plug are installed the databus interfaces of the vehicle- and systembus as well as the diagnostic interface and the address inputs. The vehiclebus is connected only to the basic module at door 1.

Short survey

pin	MTS-abbr.	pin-name	character	remark
1/9	CANHF	CAN H vehiclebus	bus	125 kBit/s
2/9	CANGF	CAN GND vehiclebus	bus-ground	for vehiclebus only
3/9	CANLF	CAN L vehiclebus	bus	125 kBit/s
4/9	CANHS	CAN H systembus	bus	125 kBit/s
5/9	CANRS	CAN systembus	bus-end	each bus-end to be bridged to 6/9!
6/9	CANLS	CAN L systembus	bus	125 kBit/s
7/9	DIAK /ADR3	diagnosis K-line (door 1)/ address 3	diagnosis	ISO diagnosis/switching to ground
8/9	ADR2	address 2	dig. input	switching to ground
9/9	ADR1	address 1	dig. input	switching to ground

6.1.1 CAN vehiclebus

It is important that when using the CAN-vehiclebus, external termination resistors must be connected to the vehiclebus (pin 1/9, pin 3/9). Normally this is done by two 120 Ohm-resistors at the bus-ends.

If necessary a bus-ground can be connected to pin 2/9 which is internally connected to ground pin 3/18 via a 100 nF-capacitor.

6.1.2 CAN-systembus

This databus must be equipped with a short bridge at each of the pins 5/9 and 6/9 at the bus-ends **(door 1 and last door)** to activate internal120 Ohm termination resistors.

6.1.3 Address identification in the MTS-system

Ground The three address inputs are low-active, i. e. an address line to be activated must be connected to ground.

nc not connected

Pin 9/9 ADR1 = address input 1
 Pin 8/9 ADR2 = address input 2
 Pin 7/9 ADR3 = address input 3
 (function diagnosis K-line only on basic module at door 1)

addressed door	ADR3	ADR2	ADR1
door 1	(diagnosis)	nc	nc
door 2	nc	nc	ground
door 3	nc	ground	nc
door 4	nc	ground	ground
door 5	ground	nc	ground

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6.2 18-pin plug

On this plug are installed the voltage supply, the valve drive outputs, identification of the door-wings position and pressure monitoring of the cylinders. The **C3-speedometer-signal** is connected to the basic module at door 1 only.

In case of **1-valve-operation** the ports of the front door-wing must be used.

The number of valves is automatically learned-in by the control device after permanently pushing the workshop button (t > 5 s).

Short survey

pin	MTS-abbr.	pin-name	character	remark
1/18	UB	Cl.15	supply	24 V supply
2/18	VBGND	valve block ground	sep. ground	ground for MTS-valves
3/18	GND	Cl. 31 / ground	supply	chassis ground
4/18	AUFV	valve OPEN front	switching output	
5/18	ZUV	valve CLOSE front	switching output	
6/18	KLV	valve POWERLESS front	switching output	
7/18	AUFH	valve OPEN rear	switching output	only if two valves are used
8/18	ZUH	valve CLOSE rear	switching output	only if two valves are used
9/18	KLH	valve POWERLESS rear	switching output	only if two valves are used
10/18	UREF	reference voltage for sensors	15 V output	to be used for sensor system only
11/18	ANGND	analogous ground for sensors	sep. ground	to be used for sensor system only
12/18	C3	C3	dig. input	speedometer signal to be connected at door 1 only
13/18	POSV	position sensor front	ana. input	analogous potentiometer
14/18	DSAV	pressure switch OPEN front	dig. input	
15/18	DSZV	pressure switch CLOSED front	dig. input	
16/18	POSH	position sensor rear	ana. input	analogous potentiometer
17/18	DSAH	pressure switch OPEN rear	dig. input	only if two valves are used
18/18	DSZH	pressure switch CLOSED rear	dig. input	only if two valves are used

6.2.1 Supply voltage

Operating voltage (22 V - 30 V) and vehicle ground are connected to the following pins:

1/18	UB	Cl. 15	supply
3/18	GND	Cl. 31 / ground	supply

Attention must be paid that the supply voltage is definitely switched-off after „ignition OFF“ (Cl. 15). If several MTS control devices with internal CAN-link are used at the doors 1 to 5, the supply voltages of the control devices must be available at all control devices at the **same time**.

6.2.2 Standstill identification

For safety reasons all doors in the MTS network can only be opened when the system identifies „vehicle standing“ (except of emergency control).

Three alternatives are possible:

1. Binary „vehicle standing“-signal via the vehicle-CAN-Bus.
2. C3-signal at pin 12/18 of the MTS control device at door 1.

The MTS control device at door 1 evaluates the C3-speedometer signal directly.

The speed threshold for „vehicle standing“ is lower than 3 km/h.

3. „Ground“-signal (0 V) at pin 12/18 of the MTS control device at door 1.

No permanent signal must be used for this, as otherwise the doors could be opened while the vehicle is driving.

If after switching on the supply voltage for the MTS control device the ignition signal **ZUN** is **not active** (pin or CAN), the standstill-signal at the C3-pin 12/18 and in the CAN-message (FAHRT, driving) at door 1 are not evaluated.

6.2.3 Drive-specific functions

- Solenoid valve control (OPEN, CLOSE, POWERLESS, end-position damping),
- Pressure switch at the solenoid valve (OPEN, CLOSE) for monitoring pressure and function,
- Sensing of door-wing positions via potentiometer.

MTS-P and MTS-E differ only in the drive-specific functions. All other functional groups are principally the same.

6.2.4 Valve connection: operation with 1 valve or 2 valves

The MTS-P control device 446 190 000 0 can control 1 or 2 MTS control valves (WABCO-no. 422 812 000 0).

Three principle configurations are possible:

1. One valve with one cylinder and one position sensor (potentiometer).
2. One valve with two cylinders and two position sensors (potentiometers).
3. Two valves with two cylinders and two position sensors (potentiometers) for separate control of the door-wings.

In **operation with 1 valve** the valve solenoids are connected to the following pins:

4/18	AUFV	valve OPEN front	switching output
5/18	ZUV	valve CLOSE front	switching output
6/18	KLV	valve POWERLESS front	switching output
2/18	VBGND	valve block ground	sep. ground

The two pressure switches in the valve (e. g. WABCO no. 441 014 017 0 – closing at a pressure of 4 bar) are powered with 24 V and connected to the following inputs:

14/18	DSAV	pressure switch OPEN front	dig. input
15/18	DSZV	pressure switch CLOSED front	dig. input

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For **operation with 2 valves** the valve solenoids and pressure switches of the front door-wing (in driving direction) are connected like for 1-valve-operation. The valve solenoids of the rear door wing are connected to the following pins:

7/18	AUFH	valve OPEN rear	switching output
8/18	ZUH	valve CLOSE rear	switching output
9/18	KLH	valve POWERLESS rear	switching output
2/18	VBGND	valve block ground	sep. ground

The two pressure switches in the rear valve (e. g. WABCO no. 441 014 017 0 - closing at a pressure of 4 bar) are powered with 24 V and connected to the following inputs:

17/18	DSAH	pressure switch OPEN rear	dig. input
18/18	DSZH	pressure switch CLOSED rear	dig. input

Remark:
When learning-in at one door also the number of the installed valves is automatically learned-in by load identification at the outputs. Therefore the pins 7/18, 8/18 and 9/18 must not be connected for 1-valve-operation (not even measuring equipment or similar).

6.2.5 Solenoid valve control

6.2.5.1 Active keeping-closed

With active „keeping-closed“ the CLOSE-solenoid is permanently controlled when the door is closed.

6.2.5.2 Automatic switching-on

The CLOSE-powerstage is automatically controlled, if the following condition is fulfilled:

1. the door-wings are in their end-position **CLOSED and**
2. do not move in opening direction **and**
3. there are no actual sensor faults of the potentiometer **and**
4. the pressure switches do not signalize pressurelessness **and**
5. the pressure switches do not signalize powerlessness **and**
6. ignition (ZUN) is ON **and**
7. the workshop button is not permanently pushed **and**
8. there is no powerstage fault.

6.2.5.3 Automatic deactivation

The CLOSE-solenoid valves are deactivated, if the following conditions are fulfilled:

1. regular opening of the door **or**
2. powerstage fault identified **or**
3. the latest movement was closing **and** the door-wings are not in their end-position **CLOSED and** pressurelessness or powerlessness was identified **and** the emergency valve was not operated **or**
4. the latest movement was closing **and** the door was closed **and** a potentiometer fault was identified.

6.2.5.4 CLOSE-pulsing with emergency control

When the emergency valve is activated in the door-closed area, the CLOSE-powerstage is controlled in pulses for max. two minutes.

6.2.5.5 Extension of OPEN-valve-control

After the POWERLESS-solenoid switched-off, the OPEN-solenoid remains switched-in for another 200 ms (i. e. end of damping in OPEN door position).

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6.2.5.6 Extension of end-position damping

The deactivation of each end-position damping was extended by 150 ms, i. e. the POWERLESS-solenoid is switched-off 150 ms after the door reached the corresponding end-position.

6.2.6 Connection of position sensors

For both, operation with 1 valve or 2 valves, the potentiometers are connected to the following pins:

10/18	UREF	reference voltag sensors	15 V output
11/18	ANGND	analogous ground sensors	sep. ground
13/18	POSV	position sensor front	ana. input
16/18	POSH	position sensor rear	ana. input

With doors with **one door-wing and one position sensor** the pins 13/18 (POSV) and 16/18 (POSH) must be **bridged**.

6.2.6.1 Acceptance limits of sensor voltages

The DOOR-CLOSED-value should be **1.5 - 3.5 V!**
The DOOR-OPEN-value should be **9.0 - 13.5 V!**

The voltage tolerance limits for the doors' end-positions are 400 mV each, i. e. learned-in OPEN-value minus 400 mV and learned-in CLOSED-value plus 400 mV. The result is earlier deactivation of the safety equipment.

6.2.6.2 Door function after sensor faults

If a sensor fault (e. g. voltage at the potentiometer too low or too high) is no longer actual and the measured voltage returned into the specified limits, the door can be operated again. The fault is stored in the diagnostic memory.

In case of a fault „reference voltage sensors“ at pin 15/18 the opening pulses from the driver-button, halt demand button, baby-buggy button and light barrier are automatically cleared.

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6.3 15-pin plug

Only **door-specific functions** are installed on this plug.
The automatic functions can be activated at all doors.

Attention: The automatic pin (12/15) at door 1 has an alternative function which can be set by parameter: Automatic mode of door 1 is not possible with this setting. A 24 V-signal at pin 12/15 at door 1 then means, that the haltbrake is NOT activated when door 1 opens.
The functions of the inputs EIN1 and EIN2 are different with each door-drive. The pinning of these optional inputs is described in the corresponding door specification.

Short survey

pin	MTS-abbr.	pin-name	character	remark
1/15	TSW	door closing warning	switching output	buzzer at the door
2/15	WFAT	workshop button	dig. input	learning, FAT, forced closing
3/15	DW	feeling wing edge	dig. input	reversing equipment
4/15	ESB	entrance illumination	switching output	add. acknowl. signal for learning
5/15	NHB	emergency control	dig. input	identification of emergency control
6/15	LS	light barrier	dig. input	reversing- and keeping-open equipm.
7/15	RMPST	ramp control	switching output	parameter-setting possible
8/15	TBL	door blocking	dig. input	parameter-setting possible
9/15	EIN1	input 1 for door-specific functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for inside display
11/15	HW	halt demand	dig. input	possible also via vehiclebus
12/15	AUTO	automatic mode	dig. input	switch in the door frame
13/15	FGA	door-release indicator	switching output	also outside-HW/KW-button
14/15	KW	baby-buggy	dig. input	possible also via vehiclebus
15/15	EIN2	input 2 for door-specific funtions	dig. input	depending on function and design

6.3.1 Door-specific inputs

6.3.1.1 Workshop button (WFAT) pin 2/15

The input „workshop button“ is normally used for initialization and maintenance. It must not be used by passengers. The workshop button has a closing function, is powered with 24 V and connected to input pin 2/15.

Opening a door is not possible while driving is identified (C3> 3 km/h). Closing a door is always possible. A door which is out or order can be closed by permanently pressing the workshop button (so-called emergency closing, e. g. in case of a sensor fault). After (external) pneumatic activation of the MTS valve the workshop button is working. The workshop button is effective on all doors also with sensed pressurelessness. So the doors can even be closed when the pressure periphery is disturbed.

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6.3.1.2 Feeling wing edge (DW) pin 3/15

The input „feeling wing edge“ is a reversing input. It is active while a door is closing. A signal which is identified as active at this input changes the door from closing direction into opening direction (so-called feeling wing edge reversing). Normally the „feeling edge“ (pressure switch, el. switching board, etc.) is connected to this input. If in double-wing doors two feeling wing edge switches are installed, both signal lines must be connected to this input. The feeling wing edge switches are powered with 24 V and connected to the input pin 3/15. A permanent signal keeps the door open.

Simple test of the feeling wing edge:

- The open door is closed with the workshop button.
- During the closing movement the door blocks and reverses automatically.
- If the entrance illumination (ESB pin 4/15) flashes once for a short time then, the reason was a signal at the input „feeling wing edge“.

This way the complete reversing function can easily be checked. When a door-wing reverses, ESB does not flash!

Effective parameters:

- Parameter T02 (feeling wing edge type)
This parameter defines whether the feeling wing edge switch DW at pin 3/15 works as closing or opening contact.
Preset: closing contact
- Parameter T30 (deactivation of feeling wing edge)
This parameter defines from which door position the input „feeling wing edge“ (DW) is no longer active when the door is closing.
0 % = door closed
100 % = door open
The value is defined in the door specification.
Preset: 0%
- Parameter T09 (keeping-open time after feeling wing edge reversing)
This parameter defines the keeping-open time of an automatic door after feeling wing edge reversing or door-wing reversing.
Relevant only for automatic doors.
Preset: 3 seconds
- Parameter T33 (feeling wing edge test)
This parameter defines whether the feeling wing edge test at the input „feeling wing edge“ (DW) is activated.
Preset: not active

6.3.1.3 Emergency control (NHB) pin 5/15

The input „emergency control“ is a signal input which identifies an active emergency control device at a door. A signal which is identified as active at this input signalizes the driver and possibly also the passenger that a door is emergency-controlled. The drive (cylinder via MTS-valve) is not controlled anymore then.

A switch which is installed on the emergency valve must be connected with this input. As an alternative, a pressure switch (2-bar-closer) can be installed between emergency valve and MTS-valve. The switch is powered with 24 V and connected to the input pin 5/15.

Effective parameters:

- Parameter T16 (warning buzzer mode)
This parameter defines whether the buzzer-output TSW is active at the door on emergency control.
Preset: yes

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- Parameter T22 (sound pattern NHB)
This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern in case of emergency control.
Preset: sound pattern
- Parameter T23 (sound pattern selection for T17 ... T22)
This parameter defines the kind of sound pattern (1, 2 or 3).
Preset: sound pattern 1 (2x long)

6.3.1.4 Light barrier (LS) pin 6/15

The input „light barrier“ is a keeping-open and reversing input. It is active when the door is open and while the door is closing. A signal identified as active at this input keeps the open door open. When the door is closing the door reverses from closing direction into opening direction (so-called light barrier reversing).

Normally the optionally installed light barrier is connected to this input. If two light barriers are installed, both signal lines must be connected to this pin. The light barrier is powered with 24 V and connected to pin 6/15. A permanent signal keeps the door open. The input works in manual mode as well as in automatic mode.

Effective parameters:

- Parameter T01 (light barrier type)
This parameter defines whether the light barrier LS at pin 6/14 works with a closing or an opening contact.
Preset: closing
- Parameter T31 (deactivation of light barrier)
This parameter defines from which position of the door the input „light barrier“ (LS) is no longer active when the door is closing
0 % = door closed
100 % = door open
Preset: 0%.
- Parameter T03 (skipping the light barrier)
This parameter defines whether forced closing by permanently pushing the driver-button is possible after deactivating the door-release.
In this case the light barrier LS is skipped (pin 6/15).
Preset: no
- Parameter T08 (keeping-open time standard or after light barrier)
This parameter defines the (standard-) keeping-open time after a light barrier signal or after a regular opening impulse at an automatic door.
Preset: 3 seconds
Further impulses while the door is open re-start this period of time.
- Parameter 009 (opening by light barrier)
This parameter defines whether the corresponding automatic door opens on activating the door-specific light barrier when door is released.
Preset: no
Relevant only for doors in automatic mode.

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6.3.1.5 Door blocking (TBL) pin 8/15

The pin „door blocking“ is a universal signal input for different peripheral switches at a door (e. g. key switch, luggage compartment lid switch, ramp, etc.). A switch is powered with 24 V and connected to pin 8/15. Parameters define whether a signal at this input prevents a movement of the door. A started door movement is not interrupted. The door blocking (TBL) is still active after deactivating the wing-specific blocking input SPV / SPH.

Blocking of the door (TBL) is effective on doors with separate door-wing activation and two driver-buttons according to the parameter setting, also if both wings are in different end-positions.

Effective parameters:

- Parameter T26 (opening is blocked)

This parameter defines whether an active door-blocking input (TBL) prevents the door from opening. Also the CAN-signal is evaluated.

Preset: yes
- Parameter T27 (closing is blocked)

This parameter defines whether an active door-blocking input (TBL) prevents the door from closing. Also the CAN-signal is evaluated.

Preset: yes
- Parameter T15 (warning buzzer mode)

This parameter defines whether the buzzer output TSW is active when the door is blocked.

Preset: yes
- Parameter T21 (sound pattern TBL)

This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door is blocked.

Preset: sound pattern
- Parameter T23 (sound pattern selection for T17 ... T22)

This parameter defines the kind of sound pattern (1, 2 or 3).

Preset: sound pattern 1 (2x long)

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6.3.1.6 Automatic mode (AUTO) pin 12/15

A 24 V-signal at this signal input activates the „automatic mode“ of the door. In this case the passenger can open the door directly by a stop-button or a baby-buggy button, when the driver activated the door-release. After a certain keeping-open time the door closes automatically. When baby-buggy function is active, the door remains open (= closing blocked) until the driver clears this function.

!!! Alternative function at door 1 see parameter 013 !!!

If a door was opened with the driver-button in driver-button mixed operation (par. 010) and door-release is activated, the door closes automatically after a certain keeping-open period. If door-release is not active, the door must be closed manually with the driver-button.

Effective parameters:

- Parameter 001 (door-release mode)
This parameter defines whether door-release is activated by two buttons (setting, clearing) or one switch. Two buttons is only possible with CAN.
Preset: switch
- Parameter 002 (baby-buggy mode)
This parameter defines whether baby-buggy function is activated at the driver's place (KWFA) with setting/clearing buttons or with release-switch.
Preset: buttons
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function can additionally be cleared by deactivating the door-release.
Preset: no clearing
- Parameter 005 (FAT 2 mode)
This parameter defines whether pushing the driver-button for door 2 opens all automatic doors.
Preset: no
- Parameter 006 (stadium circuit)
This parameter defines whether the corresponding automatic door opens on activating the door-specific driver-button. This parameter is only evaluated if the driver-button mixed operation is not active (par. 010).
Preset: no
- Parameter 008 (AUTO-deactivation mode)
This parameter defines whether deactivating the automatic function via CAN-bus deactivates all other automatic doors besides the doors 1 and 2.
Preset: no
- Parameter 009 (opening by light barrier)
This parameter defines whether the corresponding automatic door opens on activating the door-specific light barrier while the door is released.
Preset: no
- Parameter 010 (driver-button mixed operation)
This parameter defines whether the driver-buttons are additionally active with automatic doors.
Preset: no
- Parameter 011 (quick-closing after release was cleared)
This parameter defines whether the doors close immediately after deactivating the door-release without waiting for the keeping-open time.
Preset: no

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- Parameter 013 (selection of alternative function)
 This parameter defines whether at door 1 the haltbrake logic for door 1 is additionally active instead of automatic mode (AUTO).
 Preset: haltbrake logic door 1

 Depending on this parameter, pin 12/15 has the following **alternative function**:
 haltbrake logic door 1
 general: manual mode (automatic mode is not possible)

 Pin 12/15 open (0 Volt) → deactivation of haltbrake under the condition "all doors CLOSED" and if necessary by external deactivation signal (see 012).
 Pin 12/15 active (+Ub) → deactivation of haltbrake under the condition "all doors CLOSED except of door 1" and if necessary by external deactivation signal (see 012).
- Parameter T04 (opening impulse / -storage HW)
 This parameter defines whether the corresponding automatic door opens (storing the opening impulse) on activating the halt demand button (HW). This parameter refers only to the control device input HW (pin 11/15), but not to the CAN-signal.
 Preset: yes
- Parameter T05 (opening impulse / -storage KW)
 This parameter defines whether the corresponding automatic door opens (storing the opening impulse) on activating the baby-buggy button (KW). This parameter refers only to the control device input KW (pin 14/15), but not to the CAN-signal.
 Preset: yes
- Parameter T06 (opening impulse KW-driver)
 This parameter defines whether the corresponding automatic door opens on activating the baby-buggy setting button at the driver's place. This parameter refers only to the CAN-signal, but not to the input KWFA.
 Preset: no
- Parameter T08 (keeping-open time standard and after light barrier)
 This parameter defines the (standard-) keeping-open time after a light-barrier signal or after a regular opening impulse at an automatic door.
 Preset: 3 seconds
- Parameter T09 (keeping-open time DW)
 This parameter defines the keeping-open time of an automatic door after a feeling wing edge reversing or a door-wing reversing.
 Preset: 3 seconds

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6.3.1.7 Halt demand (HW) pin 11/15

The input „halt demand“ is a signal input for peripheral buttons at a door (halt demand button inside/ outside). The input works in manual mode and in automatic mode.

The inside buttons are powered directly with 24 V and connected to the input pin 11/15, while the outside buttons are normally powered from the pin „release indicator“ (FGA 13/15). Consequently the outside buttons are active in automatic mode only if door-release is activated.

Effective parameter:

- Parameter T04 (opening impulse / -storing HW)

This parameter defines whether the corresponding automatic door opens (incl. storage of opening impulse) when the halt demand button (HW) is activated.

This parameter refers only to the control device input HW, but not to the CAN-signal. Relevant only for doors in automatic mode.

Preset: yes

Remark:

At an automatic door with storage of opening impulse and active door-release the signal HW acts as follows: With the open door the keeping-open time re-starts immediately without starting a closing movement. When the door is closing it will reverse.

6.3.1.8 Baby-buggy (KW) pin 14/15

The input „baby-buggy“ is a signal-input for peripheral buttons at a door (baby-buggy button inside / outside), which works only in automatic mode (AUTO).

The inside buttons are directly powered with 24 V and connected to pin 14/15, while the outside buttons normally are powered by the pin „release indicator“ (FGA 13/15). Consequently the outside buttons are only active when door-release is activated.

Effective parameter:

- Parameter T05 (opening impulse /-storage KW)

This parameter defines whether the corresponding automatic door opens (incl. storage of opening impulse) when activating the baby-buggy button (KW).

This parameter refers only to the control device input KW (pin 14/15), but not to the CAN-signal.

Preset: yes

6.3.1.9 Input 1 for door-specific functions (EIN1) pin 9/15

6.3.1.10 Input 2 for door-specific functions (EIN2) pin 15/15

The 24 V-signal inputs „Input 1“ and „Input 2“ evaluate door-specific additional signals at each corresponding door. These are optional inputs. Their application depends on function and design. Connection and signals are described in the door specification.

Effective parameter:

- T32 (door functionality)

This parameter defines the functionality of the door.

The value is fixed in the door specification!

This parameter adjusts the complete door function.

Preset: 1

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6.3.2 Door-specific outputs

6.3.2.1 Door closing warning (TSW) pin 1/15

A door-specific warning-buzzer can be connected to the signal output „door closing warning“. The output works in manual mode as well as in automatic mode. The output switches to supply voltage. The load is connected to vehicle ground. Depending on the parameters the warning buzzer has different functions and sound patterns.

Effective parameters:

- Parameters T11 to T23 (warning buzzer mode)

(Preset = ➔)

T11	Acoustic warning signal (TSW) when door opens	This parameter defines whether the buzzer-output TSW is active when the door opens.	➔ no yes
T12	Acoustic warning signal (TSW) when door closes	This parameter defines whether the buzzer-output TSW is active when the door closes.	➔ no yes
T13	Acoustic warning signal (TSW) before door opens	This parameter defines whether the buzzer-output TSW is active before the door opens.	➔ no yes
T14	Acoustic warning signal (TSW) before door closes	This parameter defines whether the buzzer-output TSW is active before the door closes.	➔ no yes
T15	Acoustic warning signal (TSW) when door is blocked (TBL)	This parameter defines whether the buzzer-output TSW is active when the door is blocked.	➔ yes no
T16	Acoustic warning signal (TSW) in case of emergency control (NHB)	This parameter defines whether the buzzer-output TSW is active in case of emergency control.	➔ yes no
T17	Permanent sound or sound pattern when door opens (T11)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern when the door opens.	➔ Perm. sound Sound pattern
T18	Permanent sound or sound pattern when door closes (T12)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern when the door closes.	➔ Perm. sound Sound pattern
T19	Permanent sound or sound pattern before door opens (T13)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern before the door opens.	➔ Sound pattern Perm. sound
T20	Permanent sound or sound pattern before door closes (T14)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern before the door closes.	➔ Sound pattern Perm. sound

T21	Permanent sound or sound pattern when door is blocked (T15)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern when the door is blocked.	➔ Sound pattern Perm. sound
T22	Permanent sound or sound pattern in case of emergency control (T16)	This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern in case of emergency control.	➔ Sound pattern Perm. sound
T23	Sound pattern selection for the parameters T17 ... T 22	This parameter defines the kind of sound pattern (1, 2 or 3).	➔ Sound pattern 1 (2x long) Sound pattern 2 (4x medium) Sound pattern 3 (6x short)

6.3.2.2 Entrance illumination (ESB) pin 4/15

A door-specific illumination is connected to the signal output „entrance illumination The output switches to supply voltage. The load (max. 40 W) is connected to vehicle ground.

As the entrance illumination does not only illuminate but supplies also signals (e. g. acknowledgement flashing after learning-in), it should be controlled directly from the MTS. The entrance illumination is activated immediately after the order for opening the door was given, if a 24 V-signal is available at the input „entrance illumination“ (pin 11/12 LICHT).

Effective parameter:

- Parameter T10 (illumination off delay time)
This parameter defines the period of time in which the entrance illumination remains on after the door-CLOSED-position is reached.
Preset: 2 seconds

Special feature at door 1: Outside button can be activated with ignition off:
For this a (driver-) outside-button supplied with Cl. 30 is connected to input FAT1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes door 1 on pushing the outside button and immediately activates the output „entrance illumination“ ESB (pin 4/15) at door 1 (24 V) when ignition off is detected (0 V at ZUN ==> pin 3/12). A relay controlled by the output ESB powers UB (pin 1/18) via clamp 30 (continuous plus). When the door reached its end-position or powerless status, output ESB and consequently the relay are deactivated. The control device is without supply voltage again. This enables door movement monitoring also when ignition is off.

Attention: Decoupling diodes are necessary!

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6.3.2.3 Ramp control (RMPST) pin 7/15

A control wire to a door-specific ramp can be connected to the 24 V-signal output „ramp control“.

Effective parameters:

- Parameter T24 (timing selection)
This parameter defines whether the signal „ramp control“ is active when the door starts to close or when the door is already CLOSED.
Preset: when the door starts closing
- Parameter T25 (impulse type)
This parameter defines whether the signal ramp control is a 5-seconds deactivating impulse or a 0.5 seconds activating impulse.
Preset: deactivating impulse (5 seconds)

6.3.2.4 Halt demand indicator (HWA1) pin 10/15

Automatic mode:

A door-specific halt demand indicator, e. g. for a passenger information display, can be connected to the signal output „halt demand indicator 1“. The output switches to supply voltage. The load is connected to vehicle ground.

The display is activated by pushing the halt demand button (via input HW) and cleared by opening the door (e. g. via driver-button or release). Only the halt demand stored locally for this door is displayed. A summarized display of all doors is done via HWA2 (pin 1/6). Special features: manual operation at door 1. This output then has the same function at door 1 as pin 1/6 (HWA2): summarized display of all doors.

6.3.2.5 Door-release indicator (FGA) pin 13/15

A release display is connected to the signal output „door-release indicator“. The output indicates a door-release activated by the driver only in automatic mode The output switches to supply voltage. The load is connected to vehicle ground.

The outside-button „halt demand“ and „baby-buggy“ are normally also powered by this output. Consequently the outside-buttons are active only if door-release is activated.

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6.4 12-pin plug and 6-pin plug

Only vehicle-specific functions are installed on these plugs.

These plugs are used **for the basic module of door 1 only**.

Exception : The pin 7/12 - blocking front wing (SPV) and pin 10/12 - blocking rear wing (SPH) can optionally block the door-wings of the doors 2 to 5 separately in 2-valve-mode. Alternative functions can be set by parameters at the pins FAT1 (1/12) and SPH (7/12) at door 1: Separate control of the door-wings at door 1 via parameter 007. Doing so both door-wings are controlled by two driver-buttons (FAT1V) and (FAT1H) independent of each other:

- button-signal at pin 1/12 (FAT1V) controls only the front wing of door 1.
- button-signal at pin 7/12 (FAT1H) controls only the rear wing of door 1.

All functions except of the blocking function of doors 2 to 5 (SPV/SPH) can alternatively be transmitted via CAN-vehiclebus.

Short survey

pin	MTS-abbr.	pin-name	character	remark
1/12	FAT1 (V)	driver-button door 1 / FAT1 front	dig. input	FAT 1 front in case of sep. operation
2/12	FAT2	driver-button door 2	dig. input	
3/12	ZUN	ignition identification	dig. input	to be connected to Cl. 15
4/12	ST1	fault warning lamp door 1	switching output	door not closed under pressure
5/12	ST2	fault warning lamp door 2	switching output	door not closed under pressure
6/12	RTGN	red/green indicator	switching output	all doors closed under pressure
7/12	SPH/FAT1H	blocking rear wing / FAT1 rear	dig. input	FAT 1 rear in case of sep. operation
8/12	SUM	pressureless buzzer	switching output	buzzer at driver place
9/12	HB	haltbrake	switching output	direct control of haltbrake possible
10/12	SPV	blocking front wing	dig. input	
11/12	LICHT	release of entrance illumination	dig. input	identification of illumination
12/12	HBAB	deactivation of haltbrake	dig. input	

1/6	HWA2	halt demand announcement	switching output	bell / display
2/6	KWA	baby-buggy announcement	switching output	announce KW-function at the door
3/6	ST3	fault warning lamp door 3	switching output	4. and 5. lamp via vehiclebus only
4/6	FG	door-release	dig. input	
5/6	KWFA	baby-buggy function driver	dig. input	clearing button or release switch
6/6	FAT3	driver-button door 3	dig. input	4. and 5. FAT via vehiclebus only

6.4.1 Vehicle-specific inputs

6.4.1.1 Driver-button door 1 (FAT1)

6.4.1.2 alternative: driver-button 1 front wing (FAT1V) pin 1/12

6.4.1.3 Driver-button door 2 (FAT2) pin 2/12

6.4.1.4 Driver-button door 3 (FAT3) pin 6/6

The driver-buttons in the dashboard are connected to these signal inputs. When the vehicle is standing still, the corresponding vehicle door is opened or closed by a 24 V-signal. If the door is in powerless status, the next impulse from the driver-button always starts closing movement (exceptions see door specifiction).

A permanent activation of the driver-button has no influence on the door-wing or feeling wing edge monitoring (light barrier see parameter T03). Closing is possible while driving (e. g. after reset of emergency control). If undervoltage is detected (U < 20 V) the driver-button has no function.

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After an (external) pneumatic control of the MTS-valve the driver-button is functioning. If a pressureless door is detected ($p < 4$ bar), the driver-button remains without function.
 Exception: at door 1 the driver-button works also below 4 bar in order to enable opening by outside button.

At door 1 an alternative function for input FAT1 (pin 1/12) can be set by parameters.

Driver-button 1 front wing (FAT1V):

If separate door-wing operation is selected by parameters, this 24 V-input acts like an independent driver-button input which activates only the front door-wing.

Special feature at door 1: Outside button can be activated with ignition off:

For this a (driver-) outside-button supplied with Cl. 30 is connected to input FAT1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes door 1 on pushing the outside button and immediately activates the output „entrance illumination“ ESB (pin 4/15) at door 1 (24 V) when ignition off is detected (0 V at ZUN ==> pin 3/12). A relay controlled by the output ESB powers UB (pin 1/18) via clamp 30 (continuous plus). When the door reached its end-position or powerless status, output ESB and consequently the relay are deactivated. The control device is without supply voltage again. This enables door movement monitoring also when ignition is off.

Attention: Decoupling diodes are necessary!

The driver-button signals for a fourth and fifth door (FAT4 / FAT5) are transmitted only via the CAN vehiclebus. Inputs at the control device are not provided.

Effective parameters:

- Parameter 004 (outside button door 1 front/both wings)
 This parameter defines, whether the outside button at door 1 pushed by the driver operates only the front door-wing or both wings.
 Preset: both wings
- Parameter 005 (FAT 2 mode)
 This parameter defines whether all automatic doors open on pushing the driver-button for door 2.
 Preset: no
- Parameter 006 (stadium circuit)
 This parameter defines whether the corresponding automatic door opens on pushing the door-specific driver-switch. This parameter is evaluated only if driver-button mixed operation (par. 010) is not active.
 Preset: no
- Parameter 007 (separate operation of door-wings for door 1)
 This parameter defines whether at door 1 the front and the rear door-wing are operated separately by two driver-buttons.
 Preset: no
- Parameter 010 (driver-button mixed operation)
 This parameter defines whether the driver-buttons are additionally in function with automatic doors.
 Preset: no
- Parameter T03 (skipping the light barrier)
 This parameter defines whether, after deactivating the release, forced closing of the door is possible by permanently pushing the driver-button. In this case the light barrier LS (pin 6/15) is skipped.
 Preset: no

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6.4.1.5 Blocking of rear-wings (SPH)

6.4.1.6 alternative: driver-button 1 rear-wing (FAT1H) pin 7/12

This signal input at pin 7/12 is active only in operation with two valves. At door 1 the alternative functions „blocking of rear-wing“ or „driver-button 1 rear-wing“ can be installed on this pin.

Blocking of rear-wing (with blocking-switch):

A 24 V-signal at this input makes that a closed door-wing is blocked and does not open. If the signal SPH changes to 0 V while the rear door-wing is blocked and the front door-wing is open, the rear door-wing opens as well. A subsequent closing impulse makes both door-wings closing at the same time. This function can be used for all doors in 2-valve-operation, e. g. as blocking input for luggage compartment lids.

Driver-button 1 rear-wing (with two driver-buttons):

If separate door-wing operation is set by parameters, this 24 V-input acts like an independent driver-button input which activates only the rear door-wing. When the vehicle is standing still, the rear door-wing is opened and closed by a 24 V-signal. If the door-wing is powerless, the next driver-button impulse always starts a closing impulse (exceptions see door specification).

Effective parameter:

- Parameter 007 (separate operation of door-wings for door 1)

This parameter defines whether at door 1 the front door-wing and the rear door-wing are separately operated by two driver-buttons.

Preset: no

6.4.1.7 Blocking of front door-wing (SPV) pin 10/12

The signal-input „blocking of front door-wing“ at pin 10/12 is active only in 2-valve operation.

Blocking of front-wing (with blocking-switch):

A 24 V-signal at this input makes that a closed door-wing is blocked and does not open. If the signal SPV changes to 0 V while the front door-wing is blocked and the rear door-wing is open, the front door-wing opens as well. A subsequent closing impulse makes both door-wings closing at the same time. This function can be used for all doors in 2-valve-operation, e. g. as blocking input for luggage compartment lids.

If parameter 007 has got the function „separate door-wing operation for door 1“ (with two driver-switches!), this input is not active.

6.4.1.8 Ignition detection (ZUN) Pin 3/12

The signal-input „ignition detection“ at pin 3/12 is connected to the vehicle voltage after ignition (clamp 15). If ignition is off, only door 1 can be operated via outside switch. Learning processes are not realized anymore.

Learned-in pin-operation (no CAN-vehiclebus):

If no ignition signal (24 V) applies at pin 3/12, the standstill signal C3 (pin 12/18) at door 1 is not evaluated.

Special feature at door 1: Outside button can be activated with ignition off:

For this a (driver-) outside-button supplied with Cl. 30 is connected to input FAT1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes door 1 on pushing the outside button and immediately activates the output „entrance illumination“ ESB (pin 4/15) at door 1 (24 V) when ignition off is detected (0 V at ZUN ==> pin 3/12). A relay controlled by the output ESB powers UB (pin 1/18) via clamp 30 (continuous plus). When the door reached its end-position or powerless

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status, output ESB and consequently the relay are deactivated. The control device is without Supply voltage again. This enables door movement monitoring also when ignition is off.

Attention: Decoupling diodes are necessary!

6.4.1.9 Release of entrance illumination (LICHT) pin 11/12

Normally the driving light (clamp 58) is connected to the signal input „release of entrance illumination“. The door-specific entrance illuminations are active when a 24 V-signal applies at the input (LIGHT) **and** the corresponding door opens.

6.4.1.10 Deactivation of haltbrake (HBAB) pin 12/12

It is possible to connect an external accelerator switch to the signal input „deactivation of haltbrake“. A 24 V-signal at this input deactivates the control of the haltbrake (HB - pin 9/12), after all doors have closed without fault. If the parameter 012 is set to „without external clearing signal“, this input is not evaluated. A 24 V-permanent signal is not necessary in that case.

Effective parameters:

- Parameter 012 (haltbrake deactivation mode)

This parameter defines whether the haltbrake (HB) is deactivated immediately after the condition „all doors CLOSED“ or whether an additional external clearing signal (HBAB, e. g. from the accelerator pedal) is necessary.

Preset: without external clearing signal

- Parameter 013 (selection of alternative function)

This parameter defines whether at door 1 the haltbrake logic for door 1 is active as an alternative to the automatic selection (AUTO).

Preset: haltbrake logic door 1

Depending on this parameter the pin 12/15 has the following **alternative function**:

Haltbrake logic door 1

general : manual operation (automatic mode is not possible)

Pin 12/15 open (0 Volt)

➔ deactivation of the haltbrake under the condition “all doors CLOSED” and - if applicable - by external clearing signal (see 012).

Pin 12/15 active (+Ub)

➔ deactivation of the haltbrake under the condition “all doors CLOSED except of door 1 and - if applicable - by external clearing signal (see 012).

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6.4.1.11 Door-release (FG) pin 4/6

The door-release function is possible only for doors in automatic mode.

A release switch is connected to the signal input „door-release“. A 24 V-signal releases the door for automatic opening when the vehicle is standing still. Via the CAN-vehiclebus two different buttons (setting, clearing) can be used alternatively depending on parameter 001. The active door-release is indicated at pin 13/15 FGA (door-release indicator) at each control device in automatic mode.

If a door was opened in driver-button mixed operation (par. 010) with active door-release via the driver-button, the door closes automatically after the keeping-open time expired. If the door-release is not active, the door must be closed automatically by means of the driver-button.

Effective parameters:

- Parameter 001 (release mode)
This parameter defines whether the door is released by two buttons (setting, clearing) or via one switch. Operation via buttons is possible only with CAN.
Preset: switch
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function is also cleared by deactivating the door-release.
Preset: no clearing
- Parameter 009 (opening by light barrier)
This parameter defines whether the corresponding automatic door opens after activating the door-specific light barrier.
Preset: no
- Parameter 010 (driver-button mixed operation)
This parameter defines whether the driver-buttons are additionally active with automatic doors.
Preset: no
- Parameter 011 (quick closing after clearing release)
This parameter defines whether the doors close immediately before the keeping-open time expired after the door-release is deactivated.
Preset: no

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6.4.1.12 Baby-buggy function driver (KWFA) pin 5/6

The baby-buggy function (= blocked for closing) works only with doors in automatic mode. With an active baby-buggy function the door remains open until the driver clears the „blocked for closing“ function.

The signal input „baby-buggy function driver“ can principally work in two different ways (see parameter 002):

Variation baby-buggy clearing button (standard)

In the variation with one button at the input KWFA, the passenger activates the baby-buggy function (= blocked for closing) directly at an automatic door by pushing the door-specific button „baby-buggy“ (pin 14/15 - KW). Blocked for closing is immediately active and indicated to the driver by the output „baby-buggy notification“ (pin 2/6 - KWA). The block for closing is active until the driver activates the clearing signal KWFA. The output „baby-buggy notification“ is also cleared then. With CAN-vehiclebus two buttons (setting, clearing) can be used alternatively depending on parameter 002.

Variation baby-buggy release switch

In the variation with one switch at the input KWFA the passenger only signalizes the request for a baby-buggy function (= blocked for closing) at an automatic door by pushing the door-specific button „baby-buggy“ (pin 14/15 - KW). This request is stored and indicated to the driver via the output „baby-buggy notification“. A 24 V-signal at the input KWFA activates the block for closing and the output „baby-buggy notification“ is cleared. The block for closing is active until the driver deactivates the KWFA-signal.

Effective parameters:

- Parameter 002 (baby-buggy mode)
This parameter defines whether the baby-buggy function is activated from the driver's seat (KWFA) with setting/clearing buttons or a release switch.
Preset: buttons
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function is additionally cleared by deactivating the door-release.
Preset: no clearing
- Parameter 011 (quick closing after release is cleared)
This parameter defines whether the doors close immediately before the keeping-open time expired after the door-release is activated.
Preset: no
- Parameter T05 (opening impulse/storing KW)
This parameter defines whether the corresponding automatic door opens (with storage of opening impulse) after having pushed the baby-buggy button (KW). This parameter refers only to the control device input KW (pin 14/15) but not to the CAN-signal.
Preset: yes
- Parameter T06 (opening impulse KW-driver)
This parameter defines whether the corresponding automatic door opens after having pushed the baby-buggy setting button by the driver. This parameter refers only to the CAN-signal but not to the input KWFA.
Preset: no

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6.4.2 Vehicle-specific outputs

6.4.2.1 Warning lamp door 1 (ST1) pin 4/12

6.4.2.2 Warning lamp door 2 (ST2) pin 5/12

6.4.2.3 Warning lamp door 3 (ST3) pin 3/6

Normally the warning lamp of the corresponding driver-button in the dashboard is connected to the signal output „warning lamp door 1 (2, 3)“. The output switches to supply voltage. The load is connected to vehicle ground.

The output is an **indicator of the door position** with the following three states:

- output permanently on (24 V): door open, opening, closing (without malfunction)
- output permanently off (0 V): door closed (without malfunction)
- output flashing: malfunction of a door

Malfunction is detected in the following cases:

- the door is pressureless
- the door is switched powerless
- plausibility fault of pressure switches
- emergency control has been activated
- CAN-systembus fault
- sensor fault incl. fault of reference voltage
- solenoid powerstage fault
- perhaps fault of lifting lock (EIN 1 / EIN 2), see door specification

The warning lamp signals for the fourth and fifth door (ST4 / ST5) are transmitted via CAN vehiclebus only. Corresponding outputs on the control device are not provided.

6.4.2.4 Red/green indicator (RTGN) pin 6/12

Normally the green indicator lamp (= all doors CLOSED) in the dashboard is connected to the signal output „red/green indicator“. The output switches to supply voltage. The load is connected to vehicle ground.

A 24 V-signal at the output (= green lamp in the dashboard) signalizes that **all doors** are **closed** with correct supply pressure (the pressure value is above the threshold value of the pressure switches, normally 4 bar).

A 0 V-signal at the output (= green lamp in the dashboard off or optionally red lamp in the dashboard on / via inverting relay) signalizes that at least one door is open or at least one door is out-of-order (pressureless, powerless, ...).

Conditions of **activating** the green lamp:

- the door-wing is in the end-position **CLOSED and**
- the pressure switch **CLOSED** is closed **and**
- there is no pressurelessness **and**
- there is no powerlessness **and**
- the **CLOSE**-solenoid is activated

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- Conditions of **deactivating** the green lamp:
- the locking switch is not closed (lifting lock) **or**
 - there is a system-CAN-bus fault **or**
 - the door-wing is not in its end-position „CLOSED“ **or**
 - the door is controlled into opening direction **or**
 - the system is pressureless **or**
 - the system is powerless **or**
 - there are non-plausible pressure switch values **or**
 - the emergency valve is electrically operated (NHB) **or**
 - there is a sensor fault (potentiometer) **or**
 - there is a reference voltage fault **or**
 - the CLOSE-solenoid is not activated.

The summation signal „green indicator lamp“ of door 1 is a logic AND-link of the local signals. If door 1 is excluded from the haltbrake demand, the red/green-signal of door 1 is not evaluated for the summation signal.

6.4.2.5 Pressureless buzzer (SUM) pin 8/12

Normally the pressureless-buzzer at the driver's place is connected directly to the signal output „pressureless-buzzer“. The output switches to supply voltage. The load is connected to vehicle ground.

The output is active (24 V) if at least one door is pressureless (threshold value lower than 4 bar) or the emergency valve was operated at one door at least.
The output becomes inactive (0 V) again, if the door is closed under pressure. A defective pressure switch activates this output as well.

6.4.2.6 Haltbrake (HB) pin 9/12

Normally the haltbrake valve or the starting lock of the vehicle are connected to the signal output „haltbrake“. The output switches to supply voltage. The load is connected to vehicle ground.

This output is activated with each correct opening of at least one door when the vehicle is standing still (24 V). Emergency control or improper opening of a closed door do not activate this output. The output is deactivated again (0 V), after all doors are closed under supply pressure. As an alternative, an external clearing signal (HBAB - pin 9/12, e. g. with accelerator pedal) can be activated by the parameter 012. Moreover the first door can be excluded from the haltbrake logic by the parameter 013 and a 24 V-signal at input 12/15 of door 1. Then the haltbrake is already deactivated although door 1 is still open!

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Conditions to **activate** the haltbrake by each door:

- the vehicle is standing still **and**
- the standstill signal is valid **and**
- there is no emergency control **and**
- the door is opening (logic control from the program) **and**
- the OPEN-solenoid was activated by the program

or

- the driving-signal is no yet valid (after ignition on) **and**
- one door-wing is not closed **or** is just opening.

The setting of the summation signal of the haltbrake at door 1 is a logic OR-link of the different doors.

Conditions to **deactivate** the haltbrake by each door:

- there is no emergency control **and**
- the green indicator lamp is active (see also pt. 2.3) **and**
- the door is not opening (logic control from the program) **and**
- the lifting lock switch is closed (if existing) **and**
- there is no sensor fault **and**
- there is a signal to release the haltbrake (if parameter is set).

The haltbrake signal is cleared after all local HB-demands are cleared and the summation signal of the red/green indicator is activated.

Effective parameters:

- Parameter 012 (haltbrake-deactivation mode)

This parameter defines whether the haltbrake (HB) is deactivated immediately after the condition „all doors CLOSED“ or whether an additional external clearing signal (HBAB, e. g. via accelerator pedal) is necessary.

Preset: without external clearing signal

- Parameter 013 (selection of alternative function)

This parameter defines whether at door 1 the haltbrake logic for door 1 is active alternatively instead of the automatic mode (AUTO).

Preset: haltbrake logic door 1

Dependent on this parameter the pin 12/15 has the following **alternative function**:

Haltbrake logic door 1

General: manual mode (automatic mode is not possible)

Pin 12/15 open (0 Volt)

➔ deactivation of the haltbrake under the condition “all doors CLOSED” and - if applicable - by external clearing signal (see 012).

Pin 12/15 active (+Ub)

➔ deactivation of the haltbrake under the condition “all doors CLOSED except of door 1” and - if applicable - by external clearing signal (see 012).

6.4.2.7 Halt demand indicator (HWA2) pin 1/6

A vehicle-specific halt demand indicator, e. g. for display at the driver's place, is connected to signal output „halt demand indicator 2“. The output switches to supply voltage. The load is connected to vehicle ground.

The sum of all halt demands from all doors (HWA1) is indicated via this output. The indicator is set by the halt demand for at least one door und cleared by opening the door (e. g. by driver-button or release). The output works in manual mode as well as in automatic mode.

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6.4.2.8 Baby-buggy notification (KWA) pin 2/6

The baby-buggy notification signalizes exclusively information from doors in automatic mode. A vehicle-specific baby-buggy notification, e. g. for indication at the driver's place, is connected to the signal output „baby-buggy notification“. The output switches to supply voltage. The load is connected to vehicle ground. The signal output „baby-buggy notification“ can principally work in two different versions (see parameter 002):

Variation baby-buggy clearing button (standard)

In the variation with one button at the input KWFA, the passenger activates the baby-buggy function (= blocked for closing) directly at an automatic door by pushing the door-specific button „baby-buggy“ pin 14/15 - KW). Blocked for closing is immediately active and indicated to the driver by the output „baby-buggy notification (pin 2/6 - KWA). The block for closing is active until the driver activates the clearing signal KWFA. The output „baby-buggy notification“ is also cleared then.

Variation baby-buggy release switch

In the variation with one switch at the input KWFA the passenger only signalizes the request for a baby-buggy function (= blocked for closing) at an automatic door by pushing the door-specific button „baby-buggy“ (pin 14/15 - KW). This request is stored and indicated to the driver via the output „baby-buggy notification“ is cleared. The block for closing is active until the driver deactivates the KWFA-signal.

Effective parameter:

- Parameter 002 (baby-buggy mode)
This parameter defines whether the baby-buggy function is activated from the driver's seat (KWFA) with setting/clearing buttons or a release switch.
Preset: buttons

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7 Description of MTS - parameters

7.1 General

The following list includes all parameters implemented in the MTS control devices. The column 'preset' describes the basic parameter setting of the WABCO control devices as delivered. Necessary changes of these presets can only be realized by the vehicle manufacturer at the end of line.

All parameters are stored in the basic module at door 1. Parameters needed in the extension modules are transmitted to the extension modules when the MTS is activated. This means that when a basic module at door 1 is exchanged, the parameters which were initially loaded by the vehicle manufacturer at the end of line must be re-loaded in the exchanged device. The vehicle manufacturer must define an appropriate method how to do and document this in the field. The control device of door 1 (basic module) must be marked in a suitable way after the parameters are loaded.

In the extension modules the WABCO basic parameters are stored as well, but in operation they are not evaluated. Therefore extension modules can be exchanged without additional parameter setting. The control devices of doors 2 to 5 must not be installed at door 1 as they are not loaded with the parameters of the vehicle manufacturer.

For an easier structure the list is divided into system-specific parameters which are valid for the whole MTS system and in door-specific parameters which are existing for each single door.

The parameters are identified with a three-digit figure. The system-specific parameters have a „0“ at the left digit. The door-specific parameters are marked with the number of the door in the left digit. T: number of the door, door 1 = 1, etc., e. g. door functionality T32 at door 3 → parameter 332.

Only the uncritical door-specific parameters T07 to T23 can be set via PC-diagnosis by field-sales people. All other parameters must be set by the vehicle manufacturer at the end of line with a special end-of-line diagnosis.

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7.2 System-specific parameters

no.	parameter	description	→ preset/ alternative
001	door-release (FG) at the driver's place by buttons or switch	This parameter defines whether the door is released by two buttons (setting, clearing) or one switch. Activation via buttons is only possible with CAN. Relevant only for automatic doors.	→ switch buttons
002	baby-buggy function at the driver's place (KWFA) by buttons or switch	This parameter defines whether the baby-buggy function at the driver's place is set with two setting/clearing functions or a release switch. Relevant only for automatic doors.	→ buttons switch
003	baby-buggy function cleared by deactivating the door-release (FG)	This parameter defines whether the baby-buggy function is additionally cleared by deactivating the door-release. Relevant only for automatic doors.	→ no clearing clearing
004	outside button at door 1 operates both door-wings or only the front door-wing	This parameter defines whether only the front door-wing or both wings of door 1 are operated by pushing the outside button.	→ both wings front wing
005	opening impulse at all automatic doors by driver-switch 2 (FAT2) → see also remark 2	This parameter defines whether all automatic doors open when the driver-button for door 2 is pushed. Relevant only for automatic doors.	→ no yes
006	opening impulse by corresponding driver-button (stadium circuit) → see also remark 2	This parameter defines whether the corresponding automatic door opens after pushing the door-specific driver-button. This parameter is only evaluated if driver-button mixed operation (par. 010) is active. Relevant only for automatic doors.	→ no yes
007	Separate operation of door wings for door 1 (FAT1V, FAT1H)	This parameter defines whether the front and the rear door wing of door 1 are operated separately by two different driver-buttons.	→ no yes
008	all automatic doors deactivated by CAN-bus signal	This parameter defines whether all other automatic doors must be deactivated in addition to door 1 and door 2 when automatic function via CAN bus is deactivated. Relevant only for automatic doors.	→ no yes
009	door opens by light barrier (LS) → see also remark 2	This parameter defines whether the corresponding automatic door opens when the door-specific light barrier is activated with door-release. Relevant only for automatic doors.	→ no yes
010	driver-button mixed operation	This parameter defines whether the driver-buttons are additionally in function for automatic doors. Relevant only for automatic doors.	→ no yes

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no.	parameter	description	→ preset/ alternative
011	quick closing by clearing the door-release (FG)	This parameter defines whether the doors close immediately after door-release is deactivated before the keeping-open time expired. Relevant only for automatic doors.	→ no yes
012	haltbrake deactivation mode	This parameter defines whether the haltbrake (HB) is deactivated immediately after the condition „all doors CLOSED“ or whether an additional external clearing signal (HBAB, e. g. via accelerator pedal) is necessary.	→ without ext. clearing signal with ext. clearing signal
013	alternative function of pin 12/15 (AUTO) at door 1 → see also remark 3	This parameter defines whether at door 1 the haltbrake logic is active at door 1 as an alternative instead of automatic selection (AUTO).	→ haltbrake logic door 1 automatic selection

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7.3 Door-specific parameters

A door-specific set of parameters is available for each of maximally five possible doors (T = 1...5).

no.	parameter	description	→ preset alternative
T01	light barrier (LS) with closing or opening contact	This parameter defines whether the light barrier LS at pin 6/15 works with a closing or an opening contact	→ closing opening
T02	feeling wing edge switch (DW) with closing or opening contact	This parameter defines whether the feeling wing edge switch DW at pin 3/16 works with a closing or an opening contact.	→ closing opening
T03	permanent operation of the driver-button (FAT) skips the light barrier	This parameter defines whether forced closing by pushing the driver-button permanently is possible after door-release is deactivated. Doing so the light barrier LS (pin 6/15) is skipped.	→ no yes
T04	opening impulse by halt demand button (HW) → see also remark 2	This parameter defines whether the corresponding automatic door opens on pushing the halt demand button (HW). This parameter refers only to the control device input HW, but not to the CAN-signal. Relevant only for automatic doors.	→ yes no
T05	opening impulse by baby-buggy button (KW) → see also remark 2	This parameter defines whether the corresponding automatic door opens on pushing the baby-buggy setting button at the driver's place. This parameter refers only to the CAN-signal, but not to the input KWFA. Relevant only for automatic doors.	→ yes no
T06	opening impulse by the setting button at the driver's place for baby-buggy function → see also remark 2	This parameter defines whether the corresponding automatic door opens on pushing the baby-buggy setting button at the driver's place. This parameter refers only to the CAN-signal, but not to the input KWFA. Relevant only for automatic doors.	→ no yes
T07	clearing time for stored halt demand and opening impulse (20-o'clock-circuit)	This parameter defines the automatic clearing time for the stored halt demand and the opening impulse when the doors are not released after manual opening of door 1 or door 2. This parameter is effective also for manually operated doors. Selection: no clearing 5 s, 10 s, 20 s.	→ 5 seconds - 10 seconds - 20 seconds - no clearing
T08	keeping-open time (standard) after opening impulse or light barrier (LS)	This parameter defines the standard keeping-open time of an automatic door. Relevant only for automatic doors.	→ 3 seconds range of 1,5 ... 25,5 sec.

no.	parameter	description	→ preset alternative
T09	keeping-open time after feeling wing edge reversing (DW) or after door-wing reversing	This parameter defines the keeping-open time of an automatic door after reversing. Relevant only for automatic doors.	→ 3 seconds range of 1,5 ... 25,5 sec.
T10	entrance illumination off delay time (ESB)	This parameter defines the period of time in which the entrance illumination shines after door-CLOSED-position is reached.	→ 2 seconds range of 0 ... 255 sec.
T11	acoustic warning signal (TSW) when door opens	This parameter defines whether the buzzer output TSW is active while the door is opening.	→ no yes
T12	acoustic warning signal (TSW) when door closes	This parameter defines whether the buzzer output TSW is active while the door is closing.	→ no yes
T13	acoustic warning signal (TSW) before door opens	This parameter defines whether the buzzer output TSW is active before the door opens.	→ no yes
T14	acoustic warning signal (TSW) before door closes	This parameter defines whether the buzzer output TSW is active before the door closes.	→ no yes
T15	acoustic warning signal (TSW) when door is bblocked (TBL)	This parameter defines whether the buzzer output TSW is active when the door is blocked.	→ yes no
T16	Acoustic warning signal (TSW) in case of emergency control (NHB)	This parameter defines whether the buzzer output TSW is active in case of emergency control.	→ yes no
T17	permanent sound or sound pattern when door opens (T11)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door opens.	→ Perm. sound Sound pattern
T18	permanent sound or sound pattern when door closes (T12)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door closes.	→ Perm. sound Sound pattern
T19	permanent sound or sound pattern before door opens (T13)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern before the door opens.	→ Sound pattern Perm. sound
T20	permanent sound or sound pattern before door closes (T14)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern before the door closes.	→ Sound pattern Perm. sound
T21	permanent sound or sound pattern when door is blocked (T15)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door is blocked.	→ Sound pattern Perm. sound
T22	permanent sound or sound pattern in case of emergency control (T16)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern in case of emergency control.	→ Sound pattern Perm. sound

no.	parameter	description	→ preset alternative
T23	sound pattern selection for T17 ... T22	This parameter defines the kind of sound pattern (1, 2 or 3).	→ sound pattern 1 (2x long) sound pattern 2 (4x medium) sound pattern 3 (6x short)
T24	ramp control (RMPST) timing selection	This parameter defines whether the ramp control signal is active already when the door starts closing or only if door is already CLOSED. Relevant only for doors with ramp.	→ when door starts closing when „door CLOSED“
T25	ramp control (RMPST) impulse type	This parameter defines whether the ramp control signal is a 5 s-deactivating impulse of a 0.5 s-activating impulse. Relevant only for doors with ramp.	→ deactivating impulse (5 sec.) activating impulse (0.5 sec.)
T26	door is blocked (TBL) and opening the door is prevented	This parameter defines whether an active door blocking input (TBL) prevents from opening the door. Also the CAN-signal is evaluated.	→ yes no
T27	door is blocked (TBL) and closing the door is prevented	This parameter defines whether an active door blocking input (TBL) prevents from closing the door. Also the CAN-signal is evaluated.	→ yes no
T28	end-position damping when door opens	This parameter defines at which position of the door the end-position damping is activated when the door is opening. 0 % = door closed 100 % = door open The value is defined in the door specification!	→ 50 % range of 0 ... 100 %
T29	end-position damping when door closes	This parameter defines at which position of the door the end-position damping is activated when the door is closing. 0 % = door closed 100 % = door open The value is defined in the door specification!	→ 25 % range of 0 ... 100 %
T30	deactivating point of feeling wing edge (DW)	This parameter defines at which position of the door the input feeling wing edge (DW) is no longer active when the door closes. 0 % = door closed 100 % = door open The value is defined in the door specification!	→ 0 % range of 0 ... 100 %
T31	deactivating point of light barrier (LS)	This parameter defines at which position of the door the input light barrier (LS) is no longer active when the door closes. 0 % = door closed 100 % = door open	→ 0 % range of 0 ... 100 %

no.	parameter	description	→ preset alternative
T32	door functionality → see also remark 1	This parameter defines the door functionality. The value is defined in the door specification! This parameter sets the complete function of the door.	→ 1 range of 1, 2, 3,
T33	feeling wing edge test	This parameter defines whether the feeling wing edge test at the feeling wing edge input (DW) is activated.	→ not active active

Remark 1: Parameter T32

By this parameter the MTS functions are adapted to the different door types of each door manufacturer. Therefore a door functionality is related to each door type. The following table lists the up-to-date door types. However, only the corresponding actual door specification is binding!

Remark 2: Parameter 005 , 006 , 009, T04, T05, T06

An automatic door opens only if an opening impulse is stored on activating the door-release resp. if during door-release an opening impulse is created. Opening impulses are only created when the corresponding parameters are set. The opening impulse of an external halt demand via CAN-signal is independent of parameters. If door-release is not activated while an impulse is created, the opening impulse is stored when the corresponding parameter is available. In automatic mode a stored opening impulse is cleared only after the corresponding door is opened or after a specified period of time (parameter T07). The only exceptions from this rule for opening automatic doors are pushing the workshop-button resp. the driver-button in driver-button mixed operation.

Remark 3: Parameter 013 (function of the AUTO-pin at door 1)

- automatic selection door 1:

general : deactivation of haltbrake under the condition "all doors CLOSED" and if necessary by external clearing signal (see par. 012).

Pin 12/15 open (0 Volt)

→ manual mode

Pin 12/15 active (+Ub)

→ automatic mode

- haltbrake logic door 1:

general : manual mode (automatic mode is not possible)

Pin 12/15 open (0 Volt)

→ deactivation of haltbrake under the condition "all doors CLOSED" and if necessary by external deactivation signal (see 012).

Pin 12/15 active (+Ub)

→ deactivation of haltbrake under the condition "all doors CLOSED except of door 1" and if necessary by external deactivation signal (see 012).

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7.4 Door-functionalities

no.	MTS-P pneumatic doors	MTS-E electric doors
1	– inward swinging door / two wings	– hinged sliding door / two wings / 1 motor / incremental position sensor
2	– outward swinging door / linear drive – outward swinging door / rotary drive on top	– hinged sliding door / one wing / incremental position sensor
3	– outward swinging door / rotary drive at the bottom / stroke locked by switch	– outward swinging door / two wings / 2 motors / incremental position sensor
4	– outward swinging door / rotary drive at the bottom / stroke locked without switch	– outward swinging door / one wing / incremental position sensor
5	– outward swinging door / rotary drive at the bottom / stroke locked with switch / with extension step	– inward swinging door / two wings / 2 motors / potentiometer sensor
6		– inward swinging door / one wing / potentiometer sensor
7		– outward swinging door with pneumatic sealing / two wings / 2 motors / incremental position sensor
8		– outward swinging door with pneumatic sealing / one wing / incremental position sensor
9		– inward swinging door / two wings / 2 motors / incremental position sensor
10		– inward swinging door / two wings / 1 motor / incremental position sensor

8 Specification of the CAN-vehiclebus

8.1 General

The general aim of using a CAN-bus between door control MTS and the vehicle is to clearly reduce the number of cables between door control and vehicle, especially the driver's place, and consequently to lower the total cost of a door system.

8.2 Bus design

Designed as high-speed CAN-bus in accordance with ISO 11898 for this application specified with:

- linear bus structure
 - data rate 125 kBd
 - terminal resistor in the vehicle wiring (2x120 Ohm or 1x60 Ohm)
 - CAN-protocol version 2.0 Part A with 11-bit-identifiers
 - internal capacity of CAN-interface of the MTS control device: less than 750 pF
 - max. admissible load capacity: 4 nF
 - max. length of the branch to the CAN-bus-devices: 30 cm
 - further CAN-bus-devices, as well as the necessary CAN-wiring are defined by the vehicle manufacturer. The max. number of CAN-bus-devices and the max. cable length result from the capacitive load of the corresponding devices and the capacity of the installed wires resp. from the load capacities of the corresponding control devices which must max. be driven.
- If other bus structures than described here are used, safe transmission must be assured by the vehicle manufacturer.

8.3 Bit Timing / Sampling

The Bit Time, resp. the sampling of the CAN-controller of the MTS is defined as follows:

- total number of Time Quanta : 16
- length of the segment SYNC_SEG: 1 TQ
- length of the segments PROP_SEG and PHASE_SEG1: 10 TQ
- length of the segments PHASE_SEG2: 5 TQ
- sampling-mode: 1 Sample/Bittime
- maximum Resynchronisation Jump Width = 2 TQ
- width of transition interval: less than 500 ns

8.4 EMC

The electro-magnetic compatibility of the CAN-interface is measured in accordance with the BCI-method according to ISO 11452 part 4.

EMC is satisfying, if the following limits are observed:

F1=2-30 MHz, Pvor=45 dBm
 F2=30-100 MHz, Pvor=45 dBm
 F3=100-200 MHz, Pvor=40 dBm
 F4=200-400 MHz, Pvor=35 dBm
 F5=400-1000 MHz, Pvor=35 dBm

Pvor means the forward power into current injection probe.

Radio interference suppression is assessed in accordance with VDE 0879 part 3 on the vehicle-electric-system simulator. Satisfying interference suppression is guaranteed if the degree of interference suppression 5 and extrapolated for the frequency ranges in between is not exceeded by CAN activities.

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8.5 Data format

Single-bit information:

Single-bit information are always represented by 2 bit.

The following codification is used:

- 00: OFF / OPEN / NOT ACTIVE / NOT OK
- 01: ON / CLOSED / ACTIVE / OK
- 10: not defined
- 11: signal not available

Multiple-bit information:

With multiple-bit information the code ,all bits equal to 1' is always used as ,signal not available'. The further definition of the real data contents is done in the description of the corresponding data.

Not defined data:

If certain data areas are not defined in the messages, the corresponding control devices must set them to ,signal not available', i. e. all bits are 1.

8.6 System start

After activation both CAN communication participants (MTS and vehicle) start sending cyclic messages immediately after their corresponding computer initialization times. Fault detections in the receiver of the MTS-messages must not be activated earlier than 2 sec after switching-on the MTS because of the initialization time of the MTS. After sending cyclic messages was started the bus-signal of the MTS might still be set to ,signal not available' during the software initialization time. This is signaled to the other bus-participants by corresponding CAN-information. CAN fault detections within the MTS are also activated not earlier than 2 sec after power-on.

8.7 Fault detections

The MTS can be used in two different ways, with or without CAN-bus. Consequently fault detections for the CAN-bus are only defined for the CAN-operation.

In this case MTS identifies the following data communication faults :

- **'BusOff'**:
This fault is identified, if repeated trials to reconnect to the data-communication on the vehiclebus is not successful.
The door control stops transmission.
- **'Timeout message vehiclebus'**:
This fault is identified if one or both messages of the vehicle are not received anymore.
At least 3 messages must fail before this fault is identified.
The fault is only detected in the range of 22.5 V to 29.5 V.

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8.8 Data specification

8.8.1 Data from the vehiclebus to the MTS system

8.8.1.1 Message FZG_MTS_1

Sender: vehicle
Receiver: MTS
Size: 8 Byte
Rate: 50ms
Identifier: 1195 decimal

Details see ‘ message specification of the data received by the MTS ’

byte	bit	signal	remarks
0	0/1	ignition identification (Cl.15)	ZUN
	2/3	deactivation of haltbrake	HBAB
	4/5	release of entrance illumination	LICHT
	6/7	clearing of door-release (clearing button)	FGL
1	0/1	blocking of rear-wing (door 1)	SPH
	2/3	blocking of front-wing (door 1)	SPV
	4/5	baby-buggy function (clearing button)	KWL
	6/7	door-release (alternative setting button)	FG
2	0/1	driver-button door 1(alternative front-wing)	FAT1 / FAT1V
	2/3	halt demand door 1 / external	HW1
	4/5	baby-buggy door 1 / external	KW1
	6/7	blocking of door 1 / external	TBL1
3	0/1	driver-button door 2	FAT2
	2/3	halt demand door 2 / external	HW2
	4/5	baby-buggy door 2 / external	KW2
	6/7	blocking of door 2 / external	TBL2
4	0/1	driver-button door 3	FAT3
	2/3	halt demand door 3 / external	HW3
	4/5	baby-buggy door 3 / external	KW3
	6/7	blocking of door 3 / external	TBL3
5	0/1	driver-button door 4	FAT4
	2/3	halt demand door 4 / external	HW4
	4/5	baby-buggy door 4 / external	KW4
	6/7	blocking of door 4 / extern	TBL4
6	0/1	driver-button door 5	FAT5
	2/3	halt demand door 5 / external	HW5
	4/5	baby-buggy door 5 / external	KW5
	6/7	blocking of door 5 / external	TBL5
7	0/1	deactivation of automatic mode	AUTOAB
	2/3	baby-buggy function (release switch)	KWFG
	4/5	driver-button door 1 rear-wing	FAT1H
	6/7	supply voltage	UB

8.8.2 Data from the MTS-system to the vehicle

8.8.2.1 Message MTS_FZG_1

Sender: MTS
Receiver: vehicle
Size: 8 Byte
Rate: 50ms
Identifier: 1164 decimal

Details see 'message specification of the data received by the MTS'

byte	bit	signal	remarks
0	0..3	initialization	INIT
	4/5	pressureless buzzer	SUM
	6/7	stop light	STOP
1	0..3	fault/-rating	FEHLER
	4/5	(not defined)	
	6/7	(not defined)	
2	0/1	red/green indicator lamp	RTGN
	2/3	halt demand	HWA2
	4/5	baby-buggy demand	KWA
	6/7	baby-buggy function active	KWAKT
3	0/1	reversing of a door	REV
	2/3	C3 status indication	C3STATUS
	4/5	(not defined)	
	6/7	(not defined)	
4	0/1	haltbrake	HB
	2/3	kneeling-demand	KNEEL
	4/5	(not defined)	
	6/7	(not defined)	
5	0/1	(not defined)	
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
6	0/1	warning lamp door 1	ST1
	2/3	door-release indicator door 1	FGA1
	4/5	emergency control door 1 active	NBA1
	6/7	blocking indicator door 1	SPA1
7	0/1	ramp control door 1	RMPST1
	2/3	(not defined)	
	4/5	warning lamp door 1 front-wing	ST1V
	6/7	warning lamp door 1 rear-wing	ST1H

8.8.2.2 Message MTS_FZG_2

Sender: MTS
 Receiver: Fahrzeug
 Size: 8 Byte
 Rate: 50ms
 Identifier: 1165 decimal

Details see 'message specification of the data received by the MTS'

byte	bit	signal	remarks
0	0/1	warning lamp door 2	ST2
	2/3	door-release indicator door 2	FGA2
	4/5	emergency controll door 2 active	NBA2
	6/7	blocking indicator door 2	SPA2
1	0/1	ramp control door 2	RMPST2
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
2	0/1	warning lamp door 3	ST3
	2/3	door-release indicator door 3	FGA3
	4/5	emergency control door 3 active	NBA
	6/7	blocking indicator door 3	SPA3
3	0/1	ramp control door 3	RMPST3
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
4	0/1	warning lamp door 4	ST4
	2/3	door-release indicator door 4	FGA4
	4/5	emergency control door 4 active	NBA4
	6/7	blocking indicator door 4	SPA4
5	0/1	ramp control door 4	RMPST4
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
6	0/1	warning lamp door 5	ST5
	2/3	door-release indicator door 5	FGA5
	4/5	emergency control door 5 active	NBA5
	6/7	blocking indicator door 5	SPA5
7	0/1	ramp control door 5	RMPST5
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	

8.9 Message specification of the data received by the MTS

8.9.1 General

If single data is set to ‚signal not available‘, the evaluation is differentiated dependent on the inputs and the variation of control device. Together with some CAN-signals equivalent input-signals are read-in directly by the MTS control devices and evaluated. This is mentioned with the corresponding signals in the following. To prevent the MTS from creating malfunctions because of unstable (bouncing) signals, all data received by the MTS must be de-bounced by the control devices which are connected to the corresponding sensors, switches, buttons, etc.

8.9.2 Ignition identification (ZUN)

This signal indicates that the driver turned the ignition on (clamp 15).

Codification:

- 00: ignition off
- 01: ignition on
- 10: not defined
- 11: signal not available

Application:

To identify whether the MTS was activated by the outside button.

If the ignition was not turned in, the MTS controls only door 1. If ignition is off, only door 1 can be operated by the outside button. Learning processes are not possible anymore.

8.9.3 Release of entrance illumination (LICHT)

This signal allows to switch-on the entrance illumination permanently or when the corresponding door opens. It is valid for all doors.

Codification:

- 00: no activation of entrance illumination
- 01: activation of entrance illumination when door opens
- 10: activation of entrance illumination permanently even if doors are closed
- 11: signal not available

Application:

Switching-on entrance illumination, e. g. when driving or parking light is switched-on.

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8.9.4 Deactivation of haltbrake (HBAB)

This signal deletes the signal haltbrake (HB).
It is evaluated only with certain parameters.

Codification:

- 00: no deactivation of haltbrake
- 01: deactivation of haltbrake
- 10: not defined
- 11: Signal not available

Application:

To deactivate haltbrake, e. g. by accelerator pedal.

The signal HBAB is only used if parameter 012 'haltbrake deactivation mode' is set to 'with ext. clearing signal'. In this case the haltbrake is not deactivated before the signal is set to '01'. This deactivation is not done before all doors are closed under pressure (see also signal 'haltbrake').

Effective parameters:

- Parameter 012 (haltbrake deactivation mode)
This parameter defines whether the haltbrake (HB) is deactivated immediately after the condition „all doors CLOSED“ is fulfilled or whether an additional external clearing signal HBAB is necessary.
Preset: without external clearing signal
- Parameter 013 (selection of alternative function)
This parameter defines whether at door 1 the haltbrake logic for door 1 is alternatively active instead of the automatic selection (AUTO).
Preset: haltbrake logic door 1

Dependent on this parameter the pin 12/15 has the following **alternative function**:

Haltbrake logic door 1

general: manual mode (automatic mode is not possible)

- Pin 12/15 offen (0 Volt) → deactivation of the haltbrake under the condition "all doors CLOSED" and - if applicable - by external clearing signal (see 012).
- Pin 12/15 aktiv (+Ub) → deactivation of the haltbrake under the condition "all doors CLOSED except of door 1" and - if applicable - by external clearing signal (see 012).

8.9.5 Driver-button door x (FAT x)

This signal is accordingly valid for each door (x = 1...5).

It shows the status of the corresponding driver-button. In case of separate operation of the door-wings at door 1 (2-valve-operation) the signal is used for the front-wing only (FAT1V). The corresponding input at the basic module (FAT1...3) is simultaneously evaluated by the MTS so that both signal paths can be used at the same time.

Codification:

- 00: button open
- 01: button closed
- 10: not defined
- 11: signal not available

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Application:
 Opening and closing of the corresponding doors.

If the door is in powerless condition, the next impulse from the driver-button induces always a closing impulse (exceptions see door specification). A permanent actuation of the driver-button has no influence on the monitoring of door-wing and feeling wing edge (light barrier see parameter T03). Closing is also possible when driving (e. g. after reset of emergency control). If undervoltage is detected ($U < 20\text{ V}$) the driver-button remains without function. After an (external) pneumatic control of the MTS valve the driver-button is under function. If pressureless door is detected (e. g. $p < 4\text{ bar}$) the driver-button remains without function. Exception: at door 1 the driver-button works also below 4 bar in order to enable opening the door by outside button.

At door 1 an alternative function can be set by parameters for the signal FAT 1: driver-button 1 front-wing (FAT1V) with 2 valves/motors. In case of separate door-wing control is selected by parameters this signal acts as an independent driver-button which controls only the front-wing.

Effective parameters:

- Parameter 004 (outside button door 1 front/both wings)
 This parameter defines whether only the front wing or both wings are operated when the driver pushes the outside button at door 1.
 Preset: both wings
- Parameter 005 (FAT 2 mode)
 This parameter defines whether all automatic doors open when the driver-button for door 2 is pushed.
 Preset: no
- Parameter 006 (stadium circuit)
 This parameter defines whether the corresponding automatic door opens when the door-specific driver-button is pushed. This parameter is evaluated only if driver-button mixed operation is not active (par. 010).
 Preset: no
- Parameter 007 (separate door-wing control for door 1)
 This parameter defines whether at door 1 the front and the rear door-wing are separately operated by two driver-buttons.
 Preset: no
- Parameter 010 (driver-button mixed operation)
 This parameter defines whether the driver-buttons are additionally in function for automatic doors.
 Preset: no
- Parameter T03 (skipping of light barrier)
 This parameter defines whether forced closing is possible after having deactivated the door-release by permanently pushing the driver-button. Doing so the light barrier LS (pin 6/15) is skipped.
 Preset: no

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8.9.6 Driver-button door 1 rear-wing (FAT1H)

In case of two separate driver-buttons for both door-wings of door 1 this signal indicates the condition of the driver-button for the rear door-wing. This signal is evaluated only with 2 valves/ motors. The corresponding input at the basic module (FAT1H) is simultaneously evaluated by the MTS so that both signal paths can be used at the same time.

- Codification:
- 00: button open
 - 01: button closed
 - 10: not defined
 - 11: signal not available

Application:

Opening and closing of the rear door-wing of door 1.

This signal acts like an independent driver-button signal acting only on the rear door-wing. When the vehicle is standing still, only the rear door-wing is opened or closed. If the door-wing is in powerless condition the next impulse from the driver-button induces always a closing impulse (exceptions see door specification).

- Effective parameter:
- Parameter 007 (separate operation of doors wing at door 1)
This parameter defines whether at door 1 the front and the rear door-wing are operated separately by two driver-buttons.
Preset: no

8.9.7 Halt demand door x (HW x) / external

This signal is accordingly valid for each door (x = 1...5).
It shows the status of one or more door-specific halt-demand buttons in the passenger compartment, which are not directly connected to the door control. The input at the corresponding door control (HW) as well as the CAN-bus-signal are both evaluated so that both signals can be used simultaneously.

- Codification:
- 00: button open
 - 01: button closed (with storage of the opening impulse)
 - 10: button closed (without storage of the opening impulse)
 - 11: signal not available

Application:

Consideration of halt-demand buttons which are not directly connected to the door control.

The signals of the buttons are transmitted to the MTS via the vehiclebus (e. g. stadium circuit). The signal is evaluated in manual mode as well as in automatic mode.

Remark:

In case of an automatic door with storage of the opening impulse and active door-release, the signal HW acts as follows: With an open door the keeping-open time is immediately re-triggered without starting a closing process. When closing the door will reverse.

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8.9.8 Baby-buggy door x (KW x) / external

This signal is accordingly valid for each door (x = 1...5).
It shows the status of one or more baby-buggy buttons in the passenger compartment in order to demand for the baby-buggy function. The buttons are not directly connected to the door control via cables but indirectly via the cabling of other control devices and the vehiclebus. The input at the corresponding door-control (KW) as well as the CAN-bus-signal are evaluated so that both signals can be used simultaneously. In certain configurations these signals can also be used to characterize the condition of the baby-buggy setting button at the driver's place. In this case the condition of the KW setting button must be delivered with this signal several times, i. e. for each door separately.

- Codification:
- 00: button open
 - 01: button closed
 - 10: not defined
 - 11: signal not available

Application:
Consideration of baby-buggy demands which are transmitted to the MTS via the vehiclebus. The signal is evaluated only in automatic mode.

8.9.9 Blocking door x (TBL x) / external

This signal is accordingly valid for each door (x = 1...5).
It prevents from unwanted opening and/or closing of the doors. Here the input at the corresponding door control (TBL) as well as the CAN bus signal is evaluated so that both signals can be used simultaneously.

- Codification:
- 00: door movement not prevented
 - 01: door movement prevented
 - 10: not defined
 - 11: signal not available

Application:
The signal „door blocking“ is a universal signal for different peripheral switches at a door (e. g. key-operated switch, switch for luggage compartment lid, ramp, etc.). Parameters define whether a signal prevents the movement of a door. A started door movement will not be interrupted. Door-blocking (TBL) is also active after a wing-specific blocking input SPV/SPH is deactivated.
Blocking (TBL) of a door with separate door-wing operation and two driver-buttons is possible according to the parameter setting, even if the wings are in different end-positions.

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Effective parameters:

- Parameter T26 (opening blocked)
This parameter defines whether an active door-blocking input (TBL) prevents from opening the door. Also the CAN-signal is evaluated.
Preset: yes
- Parameter T27 (closing blocked)
This parameter defines whether an active door-blocking input (TBL) prevents from closing the door. Also the CAN-signal is evaluated.
Preset: yes
- Parameter T15 (warning buzzer mode)
This parameter defines whether the buzzer-output TSW is active when the door is blocked.
Preset: yes
- Parameter T21 (sound pattern TBL)
This parameter defines whether an active buzzer-output TSW produces a permanent sound or a sound pattern when the door is blocked.
Preset: sound pattern
- Parameter T23 (sound pattern selection for T17 ... T22)
This parameter defines the kind of sound pattern (1, 2 or 3).
Preset: sound pattern 1 (2x long)

8.9.10 Blocking of door-wing (SPH) / door 1

This signal indicates the condition of the switch for blocking the rear door-wing of door 1. The MTS evaluates simultaneously the corresponding input at door 1 (SPH) so that both signal paths can be used at the same time. The signal is evaluated in 2-valve-operation only.

Codification:

- 00: switch open
- 01: switch closed
- 10: not defined
- 11: signal not available

Application:

Blocking the rear door-wing of door 1 by the driver.

A signal ensures that a closed door-wing is blocked and does not open. If the blocking signal SPH changes to „00“ while the rear door-wing is blocked and the front wing is open, the rear door-wing opens as well. A following closing impulse closes both door-wings at the same time.

8.9.11 Blocking of door-wing (SPV) / door 1

This signal indicates the condition of the switch for blocking the front door-wing of door 1. The MTS evaluates simultaneously the corresponding input at door 1 (SPV) so that both signal paths can be used at the same time. The signal is evaluated in 2-valve-operation only.

Codification:

- 00: switch open
- 01: switch closed
- 10: not defined
- 11: signal not available

Application:

Blocking the front door-wing of door 1 by the driver.

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A signal ensures that a closed door-wing is blocked and does not open. If the blocking signal SPV changes to „00“ while the front door-wing is blocked and the rear wing is open, the front door-wing opens as well. A following closing impulse closes both door-wings at the same time.

8.9.12 Door-release (FG) / alternative setting button

The function „door-release“ works only with doors in automatic mode. This signal indicates the condition of the door-release switch or the button for setting the door-release.

Codification:

- 00: button / switch open
- 01: button / switch closed
- 10: not defined
- 11: signal not available

Application:

Release of automatic doors by the driver, control of opening impulse.

Normally a release switch is connected to the signal input „door-release“. A signal releases the door for automatic opening when the vehicle is standing still. Via the CAN-vehiclebus two buttons (setting, clearing) can be used dependent on parameter 001. The active door-release is indicated at pin 13/15 FGA (door-release indicator) at each control device in automatic mode.

If a door in driver-button mixed operation (par. 010) was opened by the driver-button with active door-release, the door closes automatically after the keeping-open time expired. If door-release is not active, the door must be closed manually by the driver-button.

Effective parameters:

- Parameter 001 (release mode)
This parameter defines whether door is released by two buttons (setting, clearing) or one switch. Two buttons is only possible with CAN.
Preset: switch
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function can be additionally cleared by deactivating the door-release.
Preset: no clearing
- Parameter 009 (opening by light barrier)
This parameter defines whether the corresponding automatic door opens on activating the door-specific light barrier while the door is released.
Preset: no
- Parameter 010 (driver-button mixed operation)
This parameter defines whether the driver-buttons are additionally in function with automatic doors.
Preset: no
- Parameter 011 (quick closing after release is cleared)
This parameter defines whether the doors close immediately before the keeping-open time after the door-release is deactivated.
Preset: no

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8.9.13 Clearing door-release (FGL)

The function „clearing door-release“ works only at doors in automatic mode. This signal shows the condition of the button for clearing the door-release. If a door-release switch is installed at the driver's place, this signal cannot be used.

Codification:
 00: button open
 01: button closed
 10: not defined
 11: signal not available

Application:
 Clearing of door-release.

With the CAN-vehiclebus two alternative buttons (setting, clearing) can be used depending on the setting of parameter 001. Active door-release is indicated at pin 13/15 FGA (door-release indicator) at each control device in automatic mode. If a door was opened in driver-button mixed operation (par. 010) with active door-release by the driver-button, the door closes automatically after the keeping-open time expired. If door-release is not active, the door must be closed manually with the driver-button.

Effective parameters:

- Parameter 001 (release mode)
 This parameter defines whether the door can be released by two buttons (setting, clearing) or one switch. Two buttons is only possible with CAN.
 Preset: switch
- Parameter 003 (FG clears KW-function)
 This parameter defines whether the baby-buggy function is additionally cleared by clearing door-release.
 Preset: no clearing
- Parameter 009 (opening by light barrier)
 This parameter defines whether the corresponding automatic door opens when the door-specific light barrier is activated and door is released.
 Preset: no
- Parameter 010 (driver-button mixed operation)
 This parameter defines whether with automatic doors the driver-buttons are additionally in function.
 Preset: no
- Parameter 011 (quick closing after door-release is cleared)
 This parameter defines whether the doors close immediately before the keeping-open time expired when door-release is deactivated.
 Preset: no

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8.9.14 Baby-buggy function clearing button (KWL)

8.9.15 Baby-buggy function release switch (KWFG)

The baby-buggy function (= closing blocked) works only with doors in automatic mode. It is stored when door-release (FG) is not active. If the doors have not yet been released with FG, the opening impulse is stored if correspondingly selected by parameters so that the corresponding doors open then with active door-release.

Codification:

- 00: button / switch open
- 01: button / switch closed
- 10: not defined
- 11: signal not available

The parameter 002 'baby-buggy function at the driver by pushing button/switch' allows two alternative handlings of the baby-buggy function:

a) clearing button or b) release button of the baby-buggy function.

a) Clearing button KWL

This signal indicates the condition of the clearing button for the baby-buggy function. The closing block is activated by pushing the button „baby-buggy“ (KW). The signal KWL clears the active block for closing.

b) Release switch KWFG

This signal indicates the condition of the release switch for the baby-buggy function. The closing block is activated by the driver. The passenger only announces the demand for closing block by pushing the door-specific button „baby-buggy“. The signal KWFG activates the block for closing. The block for closing is active only at those doors where a passenger announced a corresponding demand.

Effective parameters:

- Parameter 002 (baby-buggy mode)
This parameter defines whether the baby-buggy function is activated at the driver's place with setting/clearing buttons or a release switch.
Preset: button
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function is additionally cleared by deactivating the door-release.
Preset: no clearing
- Parameter 011 (quick closing after clearing door-release)
This parameter defines whether the doors close immediately after deactivating the door-release, before the keeping-open time expired.
Preset: no
- Parameter T05 (opening impulse/-storage KW)
This parameter defines whether the corresponding automatic door opens (with storage of opening impulse) when pushing the baby-buggy button (KW). This parameter refers only to the control device input KW (pin 14/16) but not to the CAN-signal.
Preset: yes
- Parameter T06 (opening impulse KW-driver)
This parameter defines whether the corresponding automatic door opens when the baby-buggy setting button at the driver's place is pushed. This parameter refers only to the CAN-signal but not the the input KWFA.
Preset: no

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8.9.16 Deactivation of automatic mode (AUTOAB)

This signal changes doors in automatic mode into ‚manual mode‘, i. e. opening and closing is activated by the signal ‚driver-button door x (FAT x)‘ for each door. It is evaluated only with certain parameter settings.

Codification:

- 00: automatic doors stay in automatic mode
- 01: demand to change automatic doors into ‚manual mode‘
- 10: not defined
- 11: signal not available

Application:

Deactivation of automatic mode, e. g. after 8 o'clock pm.

The signal ‚manual mode‘ is only evaluated if manual mode is allowed by the parameter 008 ‚deactivation of all automatic doors via CAN-bus-signal. Because of this signal, changing into manual mode is realized only when doors are closed or immediately after switching MTS in.

Effective parameter:

- Parameter 008 (AUTO deactivation)
 - This parameter defines whether all other automatic doors are deactivated in addition to door 1 and 2 when automatic function is deactivated. Relevant only for doors in automatic mode.
 - Preset: no

8.9.17 Supply voltage (UB)

This signal indicates correct operating voltage resp. over- or undervoltage in the vehicle electric system. ‚voltage OK‘ indicates that the operating voltage (clamp 16) is between 22.5 V and 29.5 V. For these limits a tolerance of +/- 0.85 V is allowed..

Codification:

- 00: voltage OK
- 01: under-/overvoltage
- 10: not defined
- 11: signal not available

Application:

For identification of undervoltage, overvoltage or contacting faults.

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8.9.18 Vehicle driving (FAHRT)

This signal is optional! It may be omitted in the transmission.

This signal is effective for all doors at the same time. It prevents that doors are opened by driver-button or door-release while the vehicle is driving. Closing a door is always possible.

Codification:

00: vehicle standing

01: vehicle driving

10: not defined

11: signal not available

Application:

Prevents from opening doors while the vehicle is driving.

The CAN-message „FAHRT“ is logically connected to the pin-signal „C3“. The C3-signal at pin 12/18 must be identified as valid. Once a valid CAN-message „vehicle standing“ or „vehicle driving“ was transmitted after supply voltage was activated, this information is always linked with the C3-status. Then both signals always must have „vehicle standing“-status in order that doors can be opened. If once a valid message „vehicle standing“ or „vehicle driving“ was transmitted, the status is set to „vehicle driving“ for both of the messages „not defined“ and „signal not available“.

8.9.19 Block of door-opening (BLOCK)

This signal is optional! It may be omitted in the transmission.

This signal is effective for all doors at the same time. It prevents control of all closed doors in the vehicle. The signal acts independent of the door-specific selected door blocks (parameter T26). There is no ‚acoustic warning signal when door blocked‘ (T15) at the door-specific output (TSW). Closing the door is possible at any time.

Codification:

00: no block

01: doors blocked

10: not defined

11: signal not available

Application:

Blocking of all closed doors in the vehicle.

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8.10 Message specification of the data transmitted by the MTS

8.10.1 General

During the initialization phase of the door control all signals can be set to 'signal not available'. The code 's.n.v.' is used for the single data listed below, only if they are also used beyond the initialization. The transmitting signals are often demands of the MTS to indicate certain conditions at the driver's place. On principle it is left to the driver whether he realizes all or only some of these indications. The vehicle manufacturer must take care that at least the legal requirements for the indications are fulfilled. If indicator signals are used for other purposes than indication, it is also the vehicle manufacturer who is responsible.

If no additional information is given for single signals, these are permanent signals, i. e. they remain set as long as the corresponding control is realized resp. as long as the corresponding status is existing.

8.10.2 Initialization (INIT)

The initialization bit characterizes a condition where the communicated data are not yet available after a reset and consequently can be set to 'signal not available'.

Codification:

0000: initialization finished

1000: initialization active

Further codifications are not used.

Application:

For identification of the system condition of the MTS for other control devices.

8.10.3 Pressureless buzzer (SUM)

This signal controls the pressureless buzzer at the driver's place.

Codification:

00: pressureless buzzer not controlled

01: pressureless buzzer controlled

10: not defined

Application:

Acoustic signal about critical system conditions for the driver.

The signal is active if

- at least one door is pressureless (threshold lower than 4 bar) or
- emergency valve is actuated at one door at least.

The signal is active again after a door is closed under pressure. Also a defective pressure switch activates this signal.

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8.10.4 Stoplight (STOP)

This signal controls a stoplight at the driver's place.

Codification:
00: stoplight not controlled
01: stoplight controlled
10: not defined

Application:
Signal to the driver to interrupt driving immediately.

The stoplight is activated under the following conditions:
the vehicle is driving
- and at least one door-wing is not CLOSED (in case of haltbrake logic except of door 1)
- or faulty pressure
- or pressureless circuit
- or emergency valve actuated
- or one wing is opened
- or door CLOSED, but wrong pressure switch values
- or optional lifting lock switch not connected.

The STOP-message is stopped for 2.5 seconds when changing from „vehicle standing“ into „vehicle driving“.

8.10.5 Fault/ -rating (FEHLER)

If the MTS identifies faults, the fault rating of the fault with the highest rating is indicated.

Codification:
0000: no fault
0001: rating 0 (fault to be eliminated next time in the workshop)
0010: rating 1 (drive can be continued, fault should be eliminated at the first opportunity)
0011: rating 2 (for safety reasons driving must be interrupted immediately)
Other codifications are not used.

Application:
To inform the driver about a fault identified by the MTS.

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8.10.6 Red/green indicator lamp (RTGN)

This signal indicates that the door control system is ,ready to start‘.

Codification:

- 00: not ready to start (e. g. control red lamp)
- 01: ready to start (e. g. control green lamp)
- 10: not defined

Application: Red/green indicator lamp at the driver's place to signalize the driver readiness to start.

„Ready to start“ when all doors are correctly closed under pressure.

„Not ready to start“ when

- at least one door is open or
- at least one door is disturbed (pressureless, powerless, ...).

The green lamp switches **ON** under the following conditions:

- the door-wings are in their end-position **CLOSED and**
- the pressure switch **CLOSED** is closed **and**
- there is no pressurelessness **and**
- there is no powerlessness **and**
- the **CLOSE**-solenoid is activated.

The green lamp switches **OFF** under the following conditions:

- the locking switch ist not closed (lifting lock) **or**
- a system-CAN-bus fault occured **or**
- a door-wing ist not in its end-position **CLOSED or**
- a door is opening **or**
- there is pressurelessness **or**
- there is powerlessness **or**
- there are non-plausible pressure switch values **or**
- the emergency valve is electrically operated (NHB) **or**
- there is a sensor fault (potentiometer) **or**
- there is a reference voltage fault **or**
- the **CLOSE**-solenoid is not activated.

The summation signal green indicator lamp at door 1 is a logic AND-link of the local signals. If door 1 is excepted from the haltbrake demand, the red/green signal of door 1 is not evaluated for the summation signal.

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8.10.7 Baby-buggy notification (KWA)

8.10.8 Baby-buggy function active (KWAKT)

The baby-buggy function (= blocked for closing) works only with doors in automatic mode. These signals indicate that a passenger demands for the baby-buggy function (KWA) and activates the baby-buggy function (KWAKT) at the driver's place.

Codification KWA:

00: no baby-buggy demand
 01: baby-buggy demand
 10: not defined

Codification KWAKT:

00: baby-buggy function not active
 01: baby-buggy function active
 10: not defined

The parameter 002 'baby-buggy function at the driver by pushing button/switch' allows two alternative handlings of the baby-buggy function:

a) clearing button or b) release button of the baby-buggy function.

a) Clearing button KWL

The baby-buggy function is activated directly by pushing the button „baby-buggy“ (KW). The block for closing and the signals KWA and KWAKT are immediately active. The signal KWL clears active baby-buggy function and the signals KWA and KWAKT.

b) Release switch KWFG

Here block for closing is activated by the driver only. The passenger only announces his request for a block for closing by pushing the door-specific button „baby-buggy“ (KW). This demand is stored and signalized to the driver by the „baby-buggy notification“ (KWA).

The signal KWFG

- activates the block for closing and
- sets the signal KWAKT and
- clears the signal KWA.

The block for closing is active only at those doors, where the passenger announced a corresponding request. It remains active until the signal KWFG is switched-off again by the driver.

Effective parameters:

- Parameter 002 (baby-buggy mode)
 This parameter defines whether the baby-buggy function is activated at the driver's place by setting/clearing buttons or by a release switch.
 Preset: button
- Parameter 003 (FG clears KW function)
 This parameter defines whether the baby-buggy function is additionally cleared by deactivating the door-release (FG).
 Preset: no clearing
- Parameter 011 (quick closing after clearing of door-release)
 This parameter defines whether the doors close immediately after door-release (FG) before the keeping-open time expired.
 Preset: no
- Parameter T05 (opening impulse/-storage KW)
 This parameter defines whether the corresponding automatic door opens (with storage of opening impulse) when pushing the baby-buggy button (KW). This parameter refers only to the control device input KW (pin 14/16) but not to the CAN-signal.
 Preset: yes

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- Parameter T06 (opening impulse KW driver)
This parameter defines whether the corresponding automatic door opens when the baby-
buggy setting button at the driver's place is pushed. This parameter refers only to the CAN-
signal but not to the input KWFA.
Preset: no

8.10.9 Halt demand notification (HWA2)

This signal indicates the stored 'halt demand' of a passenger. The signal is transmitted in manual operation as well as in automatic operation.

Codification:

- 00: no halt demand
- 01: indicate halt demand
- 10: not defined

Application:

Indication of a halt demand at the driver's place and in the passengers' display.

As a source for the indication the following signals are possible: halt demand inputs of the MTS control devices (HW) and signal 'door x external halt demand' from the vehiclebus. The summation of the halt demands at all doors (HWA1) is indicated by this signal. It is set by the halt demand of at least one door and cleared by opening one door (e. g. by driver-button or door-release).

8.10.10 Reversing of a door (REV)

This signal indicates a reversing process at the driver's place when the door is closing. It is a summation signal of all doors.

Codification:

- 00: no reversing of a door
- 01: at least one door is reversing resp. reversed during the last closing
- 10: not defined

Application:

The following reversing devices are considered when this signal is generated: light barriers, feeling wing edge, door-wing reversing. The signal is cleared when the closing process of the last door identified as reversing begins.

8.10.11 C3 status indicator (C3STATUS)

This signal indicates the calculated status of the C3-input at the control device of door 1 (pin 12/18).

Codification:

- 00: vehicle standing (ground signal)
- 01: vehicle driving (impulses ; $v > 3\text{km/h}$)
- 10: line tears off (open input)
- 11: signal not available

Application:

External utilization of the C3-signal.

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8.10.12 Kneeling demand (KNEEL)

This signal indicates the door opening status of the vehicle.

Codification:

- 00: at least one door is just opening resp. is open
- 01: the last open door is closing
- 10: all doors CLOSED
- 11: signal not available

Application:

Kneeling by vehicle level regulation at halts in order to make getting in/off easier for the passenger resp. reduction of the blower capacity of the air conditioning system in order that the last door to be closed can easily be closed.

8.10.13 Haltbrake (HB)

This signal describes the demand of the MTS to control the haltbrake in order to avoid starting driving. The signal can be differently generated, i. e. dependent on the parameters and the wiring of the MTS.

Codification:

- 00: haltbrake not controlled (inactive)
- 01: haltbrake controlled (active)
- 10: not defined

Application:

Control of haltbrake.

This signal becomes active with each correct opening of at least one door when the vehicle is standing still. Emergency control or improper opening of a closed door does not activate this signal. The signal is **deactivated** again after **all doors** are **closed** under supply pressure.

As an alternative the parameter 012 can activate an external clearing signal (HBAB, e. g. with accelerator pedal). Moreover the first door can be excluded from the haltbrake logic by parameter 013 and a 24 V-signal at input 12/15 of door 1. In that case the haltbrake is already deactivated while door 1 is still open!

The haltbrake is **ACTIVATED** by each door under the following conditions:

- the vehicle is standing **and**
- the standstill signal is valid **and**
- emergency control is not active **and**
- the door opens (logic control from the program) **and**
- the OPEN-solenoid was activated from the program **or**
- the driving signal is not yet valid (after ignition on) **and**
- one door-wing is not closed **or** is just closing.

The setting of the summation signal of the haltbrake at door 1 is a logic OR-link of single doors.

The haltbrake is **DEACTIVATED** by each door under the following conditions:

- emergency control is not active **and**
- the green indicator is active **and**
- the door is not opening (logic control from the program) **and**
- the lifting lock switch is closed (if existing) **and**
- no sensor fault **and**

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signal to release haltbrake is available (if set by parameters)
 The haltbrake signal is cleared after all local HB demands are cleared and the summation signal of the red/green indicator lamp is activated.

Effective parameters:

- Parameter 012 (haltbrake deactivation mode)
 This parameter defines whether the haltbrake (HB) is immediately activated when the condition „all doors CLOSED“ is fulfilled, or whether an additional external clearing signal (HBAB, e. g. via accelerator pedal) is necessary.
 Preset: without external clearing signal
- Parameter 013 (selection of the alternative function)
 This parameter defines whether at door 1 instead of the automatic selection (AUTO) the haltbrake logic for door 1 is active as an alternative.
 Preset: haltbrake logic door 1

Dependent on this parameter the pin 12/15 has the following alternative function:
 Haltbrake logic door 1
 general: manual mode (automatic mode is not possible)

- Pin 12/15 open (0 Volt) → deactivation of the haltbrake under the condition “all doors CLOSED” and - if applicable - by external clearing signal (see 012).
- Pin 12/15 active (+Ub) → deactivation of the haltbrake under the condition “all doors CLOSED except of door 1” and - if applicable - by external clearing signal (see 012).

8.10.14 Warning lamp door x (ST x)

This signal is accordingly valid for each door (x = 1...5).
 It indicates the status of a door, i. e. an open, opening, closing or out-of-order door is indicated at the driver's place. It is sufficient for the indication if at least one wing is open, opening or closing or out-of-order.

Codification:

- 00: door closed (no fault)
- 01: door open, opening, closing (no fault)
- 10: door out-of-order

Application:

Indication of open doors and indication of faults of the corresponding door at the driver's place.
 Out-of-order is identified for the following causes:

- the door is pressureless
- the door is switched powerless
- plausibility fault of the pressure switch
- emergency control is activated
- CAN-systembus fault
- sensor fault incl. reference voltage fault
- fault of solenoid powerstage
- perhaps fault of lifting lock (EIN 1/EIN 2), see door specification.

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8.10.15 Warning lamp door 1 front wing (ST1V)

8.10.16 Warning lamp door 1 rear wing (ST1H)

These signals indicate the status of the front (rear) door-wing of door 1, i. e. an open, opening, closing or out-of-order door-wing is indicated at the driver's place. The signals are defined only if **two drives** are available at door 1. If only **one** drive for one or two door-wings is available, these signals **cannot** be evaluated.

Codification:

- 00: door-wing closed (no fault)
- 01: door-wing is open, opening, closing (no fault)
- 10: door out-of-order

Application:

Indication of an open front (rear) or out-of-order door-wing at door 1 at the driver's place.

Out-of-order is identified for the following causes:

- the door is pressureless
- the door is switched powerless
- plausibility fault of the pressure switch
- emergency control is activated
- CAN-systembus fault
- sensor fault incl. reference voltage fault
- fault of solenoid powerstage

8.10.17 Door-release indication door x (FGA x)

This signal is accordingly valid for each door (x = 1...5).

The door-release indication works only with doors in automatic mode. It indicates a valid door-release for the corresponding door at the driver's place.

Codification:

- 00: no door-release indicated
- 01: door-release indicated
- 10: not defined

Application:

Indication of door-release at the driver's place.

Dependent on the design of the driver's place the door-release can either be activated by button or switch. The indication is only an acknowledgement of the control device for the driver, i. e. an indication appears also if the door-release is not yet active because for example the vehicle is driving.

8.10.18 Emergency control active door x (NBA x)

This signal is accordingly valid for each door (x = 1...5).

It indicates emergency control of the corresponding door at the driver's place.

Codification:

- 00: emergency control not active
- 01: emergency control active
- 10: not defined

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Application:
 Indication of an active emergency control.

8.10.19 Blocking indication door x (SPA x)

This signal is accordingly valid for each door (x = 1...5).
 It indicates the blocked door-wing of the corresponding door at the driver's place. The blocking is done via the inputs/signals (SPV, SPH).

Codification:
 00: door-wing not blocked
 01: front or both door-wings blocked
 10: rear door-wing blocked

Application:
 Indication of blocked door-wings at the driver's place.

8.10.20 Ramp control door x (RMPST x)

This signal is accordingly valid for each door (x = 1...5).
 This signal represents the demand of the MTS e. g. to drive-in the driven-out ramp at the corresponding door.

Codification:
 No permanent signal, but impulse signal. The impulse signal depends on the parameters (T24, T25) of the door:

either
 00: driving-in the ramp, this signal is active for 5 sec
 01: not driving-in the ramp
 10: not defined
 or
 00: not driving-in the ramp
 01: driving-in the ramp, this signal is active for 5 sec
 10: not defined

Effective parameters:
 - Parameter T24 (timing selection)
 This parameter defines whether the ramp-control signal is active already when the door starts closing or when the door is CLOSED.
 Preset: when door starts closing
 - Parameter T25 (impulse type)
 This parameter defines whether the ramp-control signal is a 5 seconds-deactivating impulse or a 0.5 seconds-activating impulse.
 Preset: deactivating impulse (5 seconds)

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9 Hardware specification

9.1 Technical data

9.1.1 Mechanic data

Dimensions, tolerances and fastening in accordance with outline drawing, code 605.

9.1.2 Identification

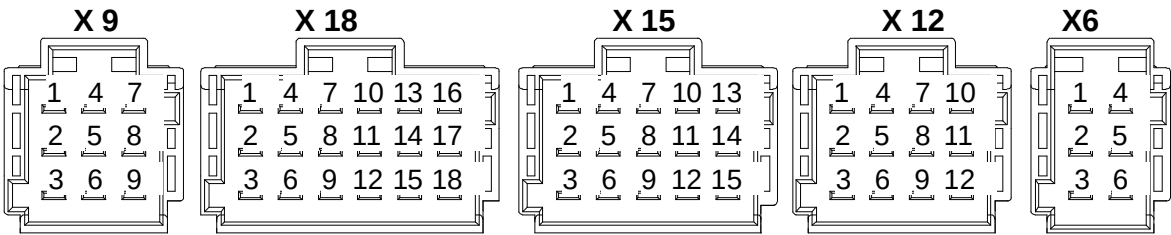
Identification in accordance with JED 341.

9.1.3 Weight

The weight of the ECU is about 0,6 kg.

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9.2 Pinning



pin	component
plug connection X18	
1	UB, supply voltage (Cl.15)
2	VBGND, valve block ground
3	GND, ground (Cl. 31)
4	HSS, solenoid valve OPEN front
5	HSS, solenoid valve CLOSE front
6	HSS, solenoid valve POWERL. front
7	HSS, solenoid valve OPEN rear
8	HSS, solenoid valve CLOSE rear
9	HSS, solenoid valve POWERL. rear
10	UREF, reference voltage for sensors
11	ANGND, ana. ground for sensors
12	C3-input
13	Ana.input, position sensor front
14	dig. input, press. switch OPEN front
15	dig. input, press. switch CLOSED front
16	ana.input, position sensor rear
17	dig. input, press. switch OPEN rear
18	dig. input, press. switch CLOSED rear
plug connection X15	
1	HSS, door closing warning
2	dig. input, workshop-button
3	dig. input, feeling wing edge
4	HSS, entrance illumination (ESB)
5	dig. input, emergency control
6	dig. input, light barrier
7	HSS, ramp control
8	dig. input, door blocking
9	dig. input, input 1
10	HSS, halt demand indicator
11	dig. input, halt demand
12	dig. input, automatic mode
13	HSS, door-release indicator
14	dig. input, baby-buggy
15	dig. input, input 2

pin	component
plug connection X9	
1	CAN-HIGH (vehiclebus)
2	CAN-GND (vehiclebus)
3	CAN-LOW (vehiclebus)
4	CAN-HIGH (systembus)
5	CAN-RS (systembus), termination
6	CAN-LOW (systembus)
7	diagnosis: K-line / address 3
8	dig. input, address 2
9	dig. input, address 1
plug connection X12	
1	dig. input, driver-button door 1
2	dig. input, driver-button door 2
3	dig. input ignition identification
4	HSS, warning lamp door 1
5	HSS, warning lamp door 2
6	HSS, red/green indicator lamp
7	dig. input, blocking rear wings
8	HSS, pressureless buzzer
9	HSS, haltbrake (HB)
10	dig. input, blocking front wings
11	dig. input, ESB-release
12	dig. input, deactivating HB
plug connection X6	
1	HSS, halt demand
2	HSS, baby-buggy demand
3	HSS, warning lamp door 3
4	dig. input, door-release
5	dig. input, baby-buggy fct. driver
6	dig. input, driver-button door 3

9.3 Electrical specification

The electrical data refer to an ambient temperature of $T_a = 25\text{ }^{\circ}\text{C}$ and a operating voltage of $U_B = 24\text{ V}$ unless differently indicated.

9.3.1 Voltage supply

pin	name	remark
X18,1	UB	supply voltage (Cl.15)
X18,3	GND	ground (Cl. 31)

symbol	definition	condition	min	typ.	max	unit
UB	voltage supply	normal mode	21	24	30	V
UB _{max}	overvoltage ECU without function	t < 1 min			36	V
U _{low thr}	undervoltage deactivation		19	20	21	V
U _{high thr}	overvoltage deactivation		30	31	32	V
I (UB)	current consumption	no output active no sensor connected		120		mA
I _{max} (UB)	maximum current consumption	incl. all loads			5	A
U _{rev}	reverse battery protection				-30	V

9.3.2 Data interfaces

9.3.2.1 ISO

pin	name	remark
X9,7	DIAK	diagnosis K-line

symbol	definition	condition	min	typ.	max	unit
R _{i+}	internal resistor against UB			220		kΩ
C _i	input capacitance against GND				1	nF

9.3.2.2 CAN

pin	name	remark
X9,1	CANHF	vehiclebus CAN HIGH
X9,2	CANGF	vehiclebus CAN GROUND
X9,3	CANLF	vehiclebus CAN LOW
X9,4	CANHS	systembus CAN HIGH
X9,5	CANRS	systembus 120 Ω terminal resistor to be connected to CANLS (directly at the plug)
X9,6	CANLS	systembus CAN LOW

The CAN-vehiclebus is not terminated in the ECU.

9.3.3 Inputs

9.3.3.1 Switch inputs

pin	name	remark
X12,1	FAT1	driver-button door 1
X12,2	FAT2	driver-button door 2
X12,3	ZUN	ignition identification
X12,11	LICHT	release of entrance illumination
X15,2	WFAT	workshop-button
X15,14	KW	baby-buggy
X15,15	EIN2	input 2

symbol	definition	condition	min	typ.	max	unit
U _{in high}	input voltage for high level		14			V
U _{in low}	input voltage for low level				4	V
C _i	input capacitance against GND			1		nF
R _i	input resistor against GND			4,7		kΩ

9.3.3.2 Address inputs

pin	name	remark
X9,7	ADR3	address 3
X9,8	ADR2	address 2
X9,9	ADR1	address 1

symbol	definition	condition	min	typ.	max	unit
R _{pull up}	internal pull-up-resistor	ADR1, ADR2		22		kΩ
U _{in high}	input voltage for high level		4			V
U _{in low}	input voltage for low level				1	V

The inputs are to be wired active to ground. In unconnected condition the levels are HIGH. Only connection with a short wire (length < 20 cm) directly at the plug is allowed for coding the control.

9.3.3.3 Speedometer signal

pin	name	remark
X18,12	C3	speedometer signal

symbol	definition	condition	min	typ.	max	unit
U _{in high}	input voltage for high level		6,7			V
U _{in low}	input voltage for low level				1,2	V
R _i	input resistor against GND			100		kΩ
C _i	input capacitance against GND			100		pF
R _{pull up}	internal pull-up-resistor			100		kΩ

In unconnected condition the control device identifies High level by an internal pull-up-resistor.

pin	name	remark
X18,13	POSV	position sensor front
X18,16	POSH	position sensor rear

symbol	definition	condition	min	typ.	max	unit
R _{Poti}	resistor value of the potentiometer		1		10	kΩ
U _{in}	input voltage range		0		15	V
R _i	input resistor against ANGND			143		kΩ

The inputs are provided for connecting potentiometers. The potentiometers are powered by Y18,10; ground is connected to X18,11.

9.3.4 Outputs

9.3.4.1 Reference voltage for sensors

pin	name	remark
X18,10	UREF	reference voltage for sensors
X18,11	ANGND	analogous ground for sensors

symbol	definition	condition	min	typ.	max	unit
UREF	reference voltage potentiometer	$R_{Load} \geq 500 \Omega$	14,4	15	15,6	V
I_{UREF}	max. load current	UREF = 15 V			30	mA

9.3.4.2 Solenoid valve

pin	name	remark
X18,4	AUFV	valve OPEN front
X18,5	ZUV	valve CLOSE front
X18,6	KLK	valve POWERLESS front
X18,7	AUFH	valve OPEN rear
X18,8	ZUH	valve CLOSE rear
X18,9	KLH	valve POWERLESS rear

symbol	definition	condition	min	typ.	max	unit
$I_{\text{Out high}}$	output current activated				0,5	A
U_{out}	output voltage	$I = I_{\text{out max}}$	UB-2			V
U_{clamp}	neg. clamping voltage when deactivating		UB-65			V
$I_{\text{Out low}}$	residual current with deactivated powerstage				4	mA
R_{Load}	minimum load for open-load identification	resistive load	400			Ω
W_{cutoff}	cut-off energy in the powerstage	inductive load			80	mJ

All outputs switch internally to UB, that means they are HIGH active.
Valve block ground: X18,2 (VBGND)

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9.4 Permissible conditions of use

9.4.1 Environmental conditions

9.4.1.1 Temperature

	min	max	unit	condition
operating temperature	-40	+70	°C	50 mm distance from parts which influence the air circulation. Minimum airspeed 0,2 m/s. If this requirement cannot be fulfilled, the alternative condition is that the surface temperature of the housing must not exceed max. +70 °C.
storage temperature	-40	+90	°C	

9.4.1.2 Environmental test

The environmental test is divided into the following single tests which are realized in the listed sequence. After the environmental test the device fulfils all functions as required.

no.	test	in accordance with	number of test devices	test temp.	conditions
1	function test	-	5	-40 °C +25 °C +70 °C	storage time before measuring: 1 h at least until temperature is balanced
2	dry heat test	DIN IEC 68-2-2 test Bb (status 8.94)	5	+70 °C	test time: 72h power supply cyclic 1 h ON/1 h OFF
3	cold test	DIN IEC 68-2-1 test Ab (status 8.85)	5	-40 °C	test time: 72h power supply cyclic 1 h ON/1 h OFF
4	thermal cycling test	DIN IEC 68-2-14 test Nb (status 9.86)	5	-40 °C +70 °C	30 cycles with 1 h at - 40 °C and 1 h at +70 °C. speed of temp. change: 3°C/min without power supply. Test concludes with function test at 25 °C
5	damp heat test	DIN IEC 68-2-30 test Db (status 9.86)	5	+55 °C	6 cycles with power supply cyclic 1 h ON/ 1 h OFF. Test concludes with function test at 25 °C

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Texts according to ISO 16016

6	vibration test	IEC-68-2-6, test Fc sinusoidal (status 6.94)	3 (2 used for reference)	+25 °C	10 cycles in frequency range 5 - 30 Hz deflection $\pm$ 11 mm constant (corresponds to 1.1 g with 5 Hz and 5 g with 11 Hz) $f \geq$ 11 Hz: acceleration 5 g const. Test concludes with function test at 25 °C and visual inspection.
7	shock test	IEC-68-2-27 test Ea (status 8.89)	3	+25 °C	30g /13ms, half sine wave, 3 shocks in each 3 axis and each 2 directions. Test concludes with function test at 25 °C and visual inspection.
8	EMC-test	JED 614	1	+25 °C	see 3.2.4 and 3.2.5

9.4.2 Protection grade
In accordance with IEC 529 (status 11.89): IP 30

9.5 Electromagnetic compatibility

9.5.1 Electrical disturbance by conduction
9.5.1.1 Disturbance by supply lines

This test is done in accordance with ISO 7637, part 2.

The ECU is protected against the pulses 1, 2, 3a and 3b with test level IV. The ECU remains at functional status class A. When charged with test pulse 4 (starting process), the ECU may behave like after switching-on.
In case of overvoltage as a consequence of load-dump (test pulse 5) the ECU remains at functional status class A with central load-dump limitation ($UB \leq 58$ V for 0.5 s).

Classification of functional status class A in accordance with ISO 7637-2:

The device fulfils all required functions during and after being stressed with the disturbance variable.

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9.5.1.2 Electrical disturbance by capacitive coupling

The test is done in accordance with ISO 7637, part 3.
 The ECU is protected against the pulses a and b with test level IV. It remains at functional status class A.

Classification of functional status class A in accordance with ISO 7637-3:
 The device fulfils all required functions during and after being stressed with the disturbance variable.

9.5.2 Interference suppression

The ECU fulfils the following degrees of interference suppression in accordance with DIN 57876/VDE 0879 part 3:

Frequency range	degree of interference suppression
LW (150...300 kHz)	5
MW (500 kHz...1,65 MHz)	5
KW (SW) (5,95...26,1 MHz)	5
UKW (FM) (88...108 MHz)	5

9.5.3 Electromagnetic interference

In accordance with BCI-method according to WABCO JED 614.

Modulation frequency: 1 kHz/15 Hz
 Modulation degree: changing between 95 % and 0 % with each amplitude step

P [dBm]	F1 2 - 30 MHz	F2 30 - 100 MHz	F3 100 - 200 MHz	F4 200 - 400 MHz	F5 400 - 1000 MHz	transient Immunity class S
50	A					7
45	A	A				6
40	A	A	A			5
35	A	A	A	A	A	4
30						3

Functional status in accordance with JED 614:
 A no functional interference

The ECU is certified in accordance with the EEC directive 72/245*95/54/EG with the e1-sign. It has been released under type approval no. e1*72/245*95*54*1231*00 and marked with EEC approval

e1 021231.