

Product Specification

446-190-011-0_435_-.doc

Modular Control System

for electrically controlled doors with
extended inputs and outputs

MTS-EX

from Rev.: MTSEX110

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1 General Description

This specification describes the **MTS-EX, WABCO-No. 446 190 011 0** from software status **MTSEX110** on.

1.1 MTS-EX in a system network

The WABCO modular door control system (MTS) is an electronic control system to operate vehicle doors in buses, mainly in vehicles of the public urban passenger transports (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-EX** : Variation for **electrically controlled doors**,
i. e. direct control of the electric motors for the door drives with eXtended inputs and outputs
- **MTS-PX** : Variation for pneumatically controlled doors, i. e. control of air-operated vehicle doors by means of solenoid valves and cylinders with extended inputs and outputs.

Attention:

The MTS-EX ECU (446 190 011 0) can be used in mixed application with the following ECUs:

MTS-E	WABCO-No. 446 190 010 0 (up to MTSPD106)
MTS-P-BM	WABCO No. 446 190 000 0 (up to MTSPD104)
MTS-P-EM	WABCO-No. 446 190 002 0 (up to MTSPD104 / under-equipped version)
MTS-PX	WABCO-No. 446 190 001 0 (from MTSPX 110)

The MTS-PX is the continued development of the MTS-E and uses inputs and outputs of the ECUs which had not been activated in the CAN operation before.

1.1.1 Free usable inputs and outputs

In the CAN operation the following additional functions are available via the vehiclebus:

- door 1 : 6 inputs and 3 outputs are free usable
- door 2...door 5: 8 inputs and 8 outputs at each door are free usable

These corresponding input and output signals are transmitted via the CAN vehiclebus and are independent of the MTS control software. They are not affected by the setting of parameters.

1.1.1.1 Design:

All previous MTS functions remain unchanged. The software is extended by free usable input and output functions. Resources which had not been used before are available now. The new functions are not logically bound to the MTS functions. They are absolutely independent of the MTS functions. The previous infrastructure can still be used (including the end-of-line parameter setting).

Two new messages for the MTS-operation are transmitted in addition to the previous (partly extended) CAN messages on the vehiclebus:

- one message from the vehicle to the MTS for the new output signals at the MTS-ECUs and

- one message from the MTS to the vehicle for the new input signals at the ECUs.

The pinning is described in ➔ **chapter 5**.

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2 System structure

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

The MTS-ECU at **door 1** is called **basic module**. The MTS-ECU at the **doors 2 to 5** are the **extension modules**. The MTS-E 446 190 001 0 can be installed 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. external button at the outside. The basic module can control one or two motors, this allows single-wing control or blocking of a door wing.
- Data link to the vehicle via a CAN vehiclebus.
- Data link to the extension modules at the doors 2...5 via a CAN-systembus.
- Connection to the vehicle electric system (driver's place, E-box, etc.) by direct wiring.
- Diagnosis of the MTS preferably via CAN-vehiclebus (or K-Line).
- Parameter setting of the MTS system via CAN-vehiclebus (or K-Line).
- In the CAN-operation 6 inputs and 3 outputs for free usable signals are available. These signals are transmitted via the CAN-vehiclebus.

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 a CAN-systembus.
- In the CAN-operation 8 inputs and 8 outputs for free usable signals are provided on each extension module. These signals are transmitted via the CAN-vehiclebus.

The installation place is identified by a plug code (address identification) on the 9-polar plug. The ECU allows a separate blocking of a door wing in operation with 2 motors also at the doors 2 ... 5.

The ECU 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, **one 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 must 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 ECU before. Only the vehicle manufacturer can load these parameters as he defines the parameters in accordance with the customer's order. Therefore new ECUs 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 Initialisation, learning processes and diagnosis of the MTS

3.1.1 General

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

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

3.1.2 Conditions for the initialisation:

1. The MTS ECU 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 ECU of door 1.
3. Ignition must be on, i. e. 24 volts on pin 3/12 at the ECU 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 done at each door in **opening direction** in the following way:

- close the door
- push the workshop button continuously
- the door moves into OPEN position
- after ca. 7 seconds the entrance illumination of the learning door starts flashing: once at door 1, twice at door 2, three times at door 3, etc.
- after flashing, release the workshop button
- the 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 learning door starts flashing: once at door 1, twice at door 2, three times at door 3, etc.
- after flashing, release the workshop button
- the 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 endposition of the position sensor.

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

3.1.4.1 Validity for the signal „vehicle running“ on the systembus

The doors 2 ... 5 evaluate the standstill signal with a 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) is subject to a plausibility check. The internal status of the ignition signal (ZUN) is set by an external signal but not reset. The consequence is that operation with the external button at door 1 (without considering the standstill signal) works only once before ignition is switched on. After ignition is on, the external button is handled like a driver's button with the corresponding monitoring.

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3.1.4.3 The logical connection of C3-status and CAN-message „driving“

The CAN-message „driving“ is logically connected with the pin-signal „C3“. The C3-signal at pin 12/18 must be identified as being valid. If the MTS receives once a valid CAN message „vehicle standing“ or „vehicle driving“ after switching the supply voltage on, this information is always logically connected 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 when the messages „not defined“ and „signal not available“ are transmitted.

3.1.5 Further information for the initialisation

All MTS-E serial ECUs are delivered with a standard set of parameters. It includes the functionality (1) for the two-wings hinged sliding door. However, the damping parameters differ from the perfect adjustment. Therefore local initialisations at single doors (also at door 1) can be done only with particularly parameterised ECUs. The ECUs must include the parameter set corresponding to the door design (SST, AST, IST) with the appropriate damping parameters. This applies also to the end-of-line tests in the factory!

3.1.6 Diagnostic connection

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

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

(only relevant until software status MTSEC104)

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

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

When the 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 the vehiclebus to the MTS-ECU
3. Ignition on
4. Learning process at door 1

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5. Ignition off
6. Ignition on

The re-initialisation of the vehiclebus must be checked by opening the door with the driver's button.

4 Functional groups of the ECU

The MTS-PX and the MTS-EX only differ by the drive-specific functions.
the other functional groups are principally the same.

All

4.1 Vehicle-specific functions

- Driver's-place signals and vehicle signals via CAN-vehiclebus or discrete wiring,
- Diagnosis via K-line or CAN-vehiclebus,
- Parameterisation of the MTS via diagnostic K-line or CAN-vehiclebus,
- Address inputs for the definition of the installation place (door 1 ... 5).

4.2 Drive-specific functions

- Direct control of the motors (OPEN, CLOSED, soft starting and deceleration),
- Detecting the position of the door-wings by
 - a) incremental transmitter of the motor and blocking detection by limit switch
 - or
 - b) 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 the automatic mode,
- baby-buggy function in the automatic mode,
- blocking of the door (e. g. by the ramp),
- door-specific functions (e. g. drive coupling detection...)

Outputs for ...

- direct control of the entrance illumination up to max. 40 Watt per door,
- door closing warning (buzzer),
- halt demand indicator at the door (also without automatic function),
- release indication in the automatic mode,
- ramp control,
- door-specific functions (e. g. inflatable sealing...)

4.4 Other functions

- CAN-systembus to interconnect the MTS-ECUs,
- voltage supply with 24 volts,
- reference voltage for position sensing (15 volts output, separate ground),
- C3 (B7) signal evaluation for standstill identification (approx. 3km/h threshold).
- free usable inputs and outputs which are transmitted as message signals via the CAN-vehiclebus.

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5 Description of connections

5.1 9-polar 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-polar plug

On this plug the voltage supply, the C3-speedometer signal and the drive outputs as well the position detection of the door-wings are installed. For the pneumatic operation of the MTS-PX the pinning changes only on this drive-specific plug. The 1- or 2-motors-operation of the MTS-EX is automatically set by the door functionality in the parameters.

5.3 15-polar plug

On this plug only door-specific functions are installed.

5.4 12-polar plug and 6-polar plug

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

Moreover, in the CAN-operation, free usable inputs and outputs at all MTS-ECUs can be activated via the messages of the CAN-vehiclebus.

5.5 General remarks about inputs and outputs

Inputs:

All digital logic-inputs are activated by 24 volts-level (1-signal). Exceptions: The three address inputs of the 9-polar 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.

Exception:

The motor bridge outputs of the electric drive are working as a full bridge with polarity conversion.

5.5.1 Free usable inputs and outputs at CAN-operation

For these functions only the 12-polar and the 6-polar plugs are used.

The functions of the 9-, 15- und 18-polar plugs are fully maintained. Two-motors-operation is possible at all doors. Then the locking-inputs (SPV/SPH) are active. The separate operation of the door-wings with two driver switches is possible at door 1 only.

The two-digits figure IN xy resp. OUT xy stands for the address of the door (x) and the number of the input/output (y).

Examples: IN 25 → door 2 - input 5; OUT 32 → door 3 - output 2.

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5.6 Overview on the pinning of the MTS-EX ECU 446 190 011 0

pin	MTS-code	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-termination	each bus-end to be bridged to 6/9
6/9	CANLS	CAN L systembus	bus	125 kBit/s
7/9	DIAK /ADR3	diagnostic K - line (door 1)/ addr. 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 volts supply
2/18	VBGND	valve block ground	separate ground	ground for the MTS-valves
3/18	GND	cl. 31 / ground	supply	chassis ground
4/18	MOT+V	motor plus front (open)	switching output	max.20 A / 5s
5/18	MOT-V	motor minus front (open)	switching output	max.20 A / 5s
6/18	AUS1	output 1 for door-spec. functions	switching output	depending on function and design
7/18	MOT+H	motor plus rear (open)	switching output	max.20 A / 5s
8/18	MOT-H	motor minus rear (open)	switching output	max.20 A / 5s
9/18	AUS2	output 2 for door-spec. functions	switching output	depending on function and design
10/18	UREF	voltage reference of sensors	15 V output	for sensors only
11/18	ANGND	analogous ground sensors	separate ground	for sensor only
12/18	C3	C3	dig. input	speedometer signal to be connected to door 1 only
13/18	CNTBV/POSV	incremental transm. B fr./poti fr.	ana.input	incremental transm. A or ana. poti
14/18	CNTAV	incremental transm. A front	dig. input	incremental transm. B
15/18	ESZV	limit switch closed front	dig. input	over dead-center blocking
16/18	CNTBH/POSH	incremental transm. B r. / Poti r.	ana.input	incremental transm. A or ana. poti
17/18	CNTAH	incremental transm. A rear	dig. input	incremental transm. B
18/18	ESZH	limit switch closed rear	dig. input	over dead-center blocking

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	ana.input	reversing equipment
4/15	ESB	entrance illumination	switching output	add. acknowl. signal for learning
5/15	NHB	emergency control	dig. input	identif. of active emergency control
6/15	LS	light barrier	dig. input	reversing and keeping open
7/15	RMPST	ramp control	switching output	adjustable by parameters
8/15	TBL	door blocking	dig. input	adjustable by parameters
9/15	EIN1	input 1 for door-spec. functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for interior display
11/15	HW	halt demand	dig. input	also possible via vehiclebus
12/15	AUTO	automatic mode	ana.input	switch in door-frame
13/15	FGA	door-release mode	switching output	also exterior-HW/KW-button
14/15	KW	baby-buggy	dig. input	also possible via vehiclebus
15/15	EIN2	input 2 for door-spec. functions	dig. input	depending on function and design

1/12	FAT1 / INx1	driver's button door 1 / FAT1 front	dig. input	FAT 1 front in case of sep. operation
2/12	FAT2 / INx2	driver's button door 2	dig. input	
3/12	ZUN / INx3	ignition identification	dig. input	to be connected to cl. 15
4/12	ST1 / OUTx1	fault warning lamp door 1	switching output	door not closed under pressure
5/12	ST2 / OUTx2	fault warning lamp door 2	switching output	door not closed under pressure
6/12	RTGN/OUTx3	red/green indicator	switching output	all doors closed under pressure
7/12	SPH/FAT1H	blocking of wing rear / FAT 1 front	dig.. input	FAT 1 rear in case of sep. operation
8/12	SUM / OUTx4	pressureless buzzer	switching output	buzzer at the driver's place
9/12	HB / OUTx5	haltbrake	switching output	direct control of haltbrake possible
10/12	SPV	blocking of wing front	dig. input	
11/12	LICHT / INx4	release of entrance illumination	dig. input	detection of entrance illumination
12/12	HBAB / INx5	deactivation of haltbrake	dig. input	

1/6	HWA2/OUTx6	announcement of halt demand	switching output	bell / display
2/6	KWA / OUTx7	baby-buggy announcement	switching output	announce KW function at the door
3/6	ST3 / OUTx8	fault warning lamp door 3	switching output	4 th & 5 th lamp only via vehiclebus
4/6	FG / INx6	door release	dig. input	
5/6	KWFA / INx7	baby-buggy function driver	dig. input	clearing button or release switch
6/6	FAT3 / INx8	driver's button door 3	dig. input	4 th & 5 th FAT via vehiclebus only

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Texts according to ISO 16016

6 Functional description of the plugs

6.1 9-polar plug

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

Short overview

pin	MTS code	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-end	each bus-end to be bridged to 6/9!
6/9	CANLS	CAN L systembus	bus	125 kBit/s
7/9	DIAK /ADR3	diagnostic 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 to connect external termination resistors to the vehiclebus (pins 1/9 and 3/9) when using the CAN-vehiclebus. 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 internal 120 Ohm termination resistors.

6.1.3 Address identification in the MTS-system

ground The three address inputs are ground-active, i. e. an address line to be activated must be connected to ground.
nc not connected (open port)

Pin 9/9 ADR1 = address input 1
Pin 8/9 ADR2 = address input 2
Pin 7/9 ADR3 = address input 3
(function of diagnostic 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-polar plug

On this plug are installed the voltage supply, the drive outputs, the identification of the door-wing positions including the limit switch of the door blocking. The **C3**-speedometer signal is connected only to the basic module at door 1.

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

The 1- or 2-motors operation of the MTS-E is automatically adjusted by the door functionality in the parameters.

Short overview

pin	MTS code	pin name	character	remarks
1/18	UB	cl.15	supply	24 V supply
2/18	VBGND	valve block ground	separate ground	MTS-valves ground
3/18	GND	cl. 31 / ground	supply	chassis ground
4/18	MOT+V	motor plus front (open)	switching output	max.20 A / 5s
5/18	MOT-V	motor minus front (open)	switching output	max.20 A / 5s
6/18	AUS1	output 1 for door-spec. functions	switching output	depending on function and design
7/18	MOT+H	motor plus rear (open)	switching output	max.20 A / 5s
8/18	MOT-H	motor minus rear (open)	switching output	max.20 A / 5s
9/18	AUS2	output 2 for door-spec. functions	switching output	depending on function and design
10/18	UREF	reference voltage sensors	15 V output	only for the sensors
11/18	ANGND	analogous ground sensors	separate ground	only for the sensors
12/18	C3	C3	dig. input	speed. signal to be conn. to door
13/18	CNTBV/POSV	incremental transm. B f. / poti f.	ana. input	incremental trans. A or ana. poti
14/18	CNTAV	incremental transm. A front	dig. input	incremental trans. B
15/18	ESZV	limit switch close front	dig. input	over dead-center locking
16/18	CNTBH/POSH	incremental transm. B r. / poti r.	ana. input	incremental transm. A or ana. poti
17/18	CNTAH	incremental transm. A rear	dig. input	incremental transm. B
18/18	ESZH	limit switch close rear	dig. input	over dead-center locking

6.2.1 Supply voltage

Operating voltage (22 volts - 30 volts) 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“ (clamp 15).
If several MTS-ECUs with internal CAN-link are used at the doors 1 ... 5, the supply voltage of the ECUs must be available at all ECUs 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 CAN-vehiclebus.
2. C3-signal at pin 12/18 of the MTS-ECU at door 1.
The MTS-ECU 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 volts) at pin 12/18 of the MTS-ECU at door 1.
Do **not** use a **continuous signal** for this, otherwise the doors could open while the vehicle is driving!

If after switching on the supply voltage for the MTS-ECU 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

- Direct control of the motors (OPEN, CLOSED, soft starting and deceleration),
 - Detecting the position of the door-wings by
 - a) incremental transmitter of the motor and blocking detection by limit switch
 - or
 - b) potentiometer

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

6.2.4 Motor connection and sensors

The MTS-ECU 446 190 011 0 is able to control 1 or 2 motors.

Two configurations are possible:

1. One motor with one position sensor.
2. Two motors with two position sensors.

In the **1-motor operation** the motor and the sensors are connected with the following pins:

Motor:

4/18	MOT+V	motor plus front (open)	switching output
5/18	MOT-V	motor minus front (open)	switching output

Sensors :

a) with incremental transmitter of the motor and locking detection by limit switch:

10/18	UREF	reference voltage sensors	15 V output
11/18	ANGND	analogous ground sensors	sep. ground
13/18	CNTBV	incremental transmitter B front	dig. input
14/18	CNTAV	incremental transmitter A front	dig. input
15/18	ESZV	limit switch CLOSE front	dig. input

or b) with potentiometer

10/18	UREF	reference voltage sensors	15 V output
11/18	ANGND	analogous ground sensors	sep. ground
13/18	POSV	potentiometer front	ana. input

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The motor and the sensors of the rear door-wing are connected to the following pins:

7/18	MOT+H	motor plus rear (open)	switching output
8/18	MOT-H	motor minus rear (open)	switching output

10/18	UREF	reference voltage sensors	15 V output
11/18	ANGND	analogous ground sensors	sep. ground
16/18	CNTBH/POS H	incremental transmitter B rear	dig. input
17/18	CNTAH	incremental transmitter A rear	dig. input
18/18	ESZH	limit switch CLOSE rear	dig. input

10/18	UREF	reference voltage sensors	15 V output
11/18	ANGND	analogous ground sensors	sep. ground
16/18	POSH	potentiometer rear	ana. input

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

In case of a faulty „reference voltage sensor“ at pin 15/18 the opening impulses from driver's button, halt demand button, baby-buggy button and the light barrier are automatically cleared.

6.2.5 Door-specific outputs

6.2.5.1 Output 1 for door-specific functions (AUS1) Pin 6/18

6.2.5.2 Output 2 for door-specific functions (AUS2) Pin 9/18

The 24 volts signal outputs „Ausgang 1“ and „Ausgang 2“ deliver additional door-specific signals at the respective door (e. g. for holding magnet, inflatable sealings, ...). These are optional outputs. Their application depends on the function and the design. The connection and the signals are specified in the descriptions of the door designs.

Effective parameter:

- T32 (door functionality)

This parameter determines the door functionality.

The value is defined in the specification of the door!

This parameter adjusts the whole function of the door.

Preset: 1

6.3 15-polar 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 adjustable by parameters: automatic operation at door 1 is not possible in this adjustable function. A 24 volts-signal at pin 12/15 at the door 1 means then, that the haltbrake is not controlled when the 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 door specification.

Short overview

pin	MTS code	pin name	character	remarks
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	ana. input	reversing equipment
4/15	ESB	entrance illumination	switching output	learning add. acknowl. signal
5/15	NHB	emergency control	dig. input	detection of active emergency opening
6/15	LS	light barrier	dig. input	reversing and keeping open equipm.
7/15	RMPST	ramp control	switching output	adjustable by parameters
8/15	TBL	door blocking	dig. input	adjustable by parameters
9/15	EIN1	input 1 for door-spec. functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for interior display
11/15	HW	halt demand	dig. input	also possible via vehiclebus
12/15	AUTO	automatic operation	ana. input	switch in doorframe
13/15	FGA	door-release indicator	switching output	also external HW/KW-button
14/15	KW	baby-buggy	dig. input	also possible via vehiclebus
15/15	EIN2	input 2 for door-spec. functions	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 initialisation and maintenance. It must not be used by passengers. The workshop button is a closing function, powered with 24 volts and connected to the input pin 2/15.

Opening the door is not possible while driving is identified ($C3 > 3 \text{ km/h}$). Closing the door is possible at any time. A malfunctioning door can be closed by continuously pushing the workshop button (so-called emergency closing, e. g. in case of sensor faults).

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“ (feeling wing edge, 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 resp. switching boards are powered with 24 volts and connected to the input pin 3/14. A continuous signal keeps the door open.

Simple test of the feeling wing edge:

- Close the open door by means of 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, 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, the ESB does not flash!

When there is a continuous signal at this input in **open** position of the door ($t > 30 \text{ s}$), a fault is identified (fault memory) and signaled in the „reversing status door x“ in the CAN-message during the malfunction.

Monitoring of the switching board:

Moreover an electrical switching board with a load resistor (8200 Ohm) can be connected directly. Since this input is analogously supervised, no external switching device is needed. The monitoring function (line break-away) is activated by the parameter T33. Also the parallel wiring of two electrical switching boards (with one load resistor each) at the main closing edges of a double-wing door is possible. However, only if both switching boards fail, a fault is identified. A line break (interruption) is identified when the switching threshold of 3 volts at this input is fallen below for more than 1.25 seconds.

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
- 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)

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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 (monitoring of the switching board with termination resistor)

This parameter defines whether the monitoring of the switching board with termination resistor at the input „feeling wing edge“ (DW) is active.

Preset: not active

6.3.1.3 Emergency control (NHB) Pin 5/15

The input „emergency control“ is a signal input which identifies active emergency control 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 is not controlled anymore then.

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

Effective parameters:

- Parameter T16 (warning buzzer mode)

This parameter defines whether the buzzer-output TSW at the door is active during emergency control.

Preset: yes

- Parameter T22 (tone pattern NHB)

This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern in case of emergency control.

Preset: tone pattern

- Parameter T23 (tone pattern selection for T17 ... T22)

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

Preset: tone 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, it 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 volts 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)

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This parameter defines whether forced closing at the continuous push of the driver's button is possible after the door-release was deactivated.

In this case the light barrier (LS) is skipped (pin 6/15).

Preset: no

- Parameter T08 (standard keeping-open time 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

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 the door is released.

Preset: no

Relevant only for doors in automatic mode.

6.3.1.5 Door blocking (TBL) Pin 8/15

The input „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 volts and connected to input pin 8/15. Parameters define whether a signal at this input prevents the door from moving. An already started movement of the door is not interrupted. The door blocking (TBL) is still active after deactivating the wing-specific blocking input SPV / SPH (so-called trailing).

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

Effective parameters:

- Parameter T26 (opening 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 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 (tone pattern TBL)

This parameter defines whether an active buzzer output (TSW) produces a continuous tone or a tone pattern when the door is blocked.

Preset: tone pattern

- Parameter T23 (tone pattern selection for T17 ... T22)

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

Preset: tone pattern 1 (2x long)

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WABCO	620	18.10.2005	446 190 011 0	435	21/85

6.3.1.6 Automatic mode (AUTO) Pin 12/15

A 24 volts-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 the baby-buggy function is active, the door remains open (= closing blocked) until the driver clears this function.

!!! Alternative function at door 1 is described in parameter 013 !!!

If a door was opened with the driver's button in driver's button mixed operation (par. 010), the door remains open and must be closed manually with the driver's button. If the door reverses during closing movement and the door-release is active, it automatically tries to close again after the keeping-open time expired.

Effective parameters:

- Parameter 001 (door-release mode)
This parameter defines whether the door can be released by two buttons (setting, clearing) or one switch. Release by buttons is only possible with CAN.
Preset: switch
- Parameter 002 (baby-buggy mode)
This parameter defines whether the baby-buggy function at the driver's place (KWFA) can be activated by setting/clearing buttons or by a 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 all automatic doors open at the push of the driver's button for door 2.
Preset: no
- Parameter 006 (stadium circuit)
This parameter defines whether the corresponding automatic door opens at the push of the door-specific driver's button. The parameter is evaluated only in case the driver's button mixed operation is not active (par. 010).
Preset: no
- Parameter 008 (automatic deactivation)
This parameter defines whether deactivating the automatic function via CAN-bus deactivates all other automatic doors in addition to 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's button mixed operation)
This parameter defines whether the driver's buttons are additionally active at 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 before the keeping-open time expired.
Preset: no
- Parameter 013 (selection of the alternative function)

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This parameter defines whether at door 1 the haltbrake logic for door 1 is alternatively 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 volts) → deactivation of haltbrake under the condition "all doors CLOSED" and - if need is - by external deactivation signal (described under 012).

Pin 12/15 active (+Ub) → deactivation of haltbrake under the condition "all doors except of door 1 CLOSED" and - if need is - by external deactivation signal (described under 012).

- Parameter T04 (opening impulse / -storage HW)

This parameter defines whether the respective automatic door opens (storing the opening impulse) at the push of the halt demand button (HW). This parameter refers only to the ECU 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) at the push of the baby-buggy button (KW). This parameter refers only to the ECU 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 at the push of 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 (standard keeping-open time 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 feeling wing edge reversing or door-leaf reversing

Preset: 3 seconds

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

Effective parameter:

- Parameter T04 (opening impulse / -storage HW)

This parameter defines whether the respective automatic door opens at the push of the halt demand button (HW) (including opening impulse storage).

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

Preset: yes

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Remark:

At an automatic door with opening impulse storage and active release the signal HW acts in the following way: When the door is open the keeping-open time is immediately re-started without starting a closing motion. During closing movement the door reverses.

6.3.1.8 Baby-buggy (KW) Pin 14/15

The „baby-buggy“ input is a signal input for peripheral buttons at a door (baby-buggy button inside/ outside) which works only in automatic mode (AUTO).
The internal buttons are directly powered with 24 volts and connected to the input pin 14/15, while the external buttons normally are supplied by the pin „release indicator“ (FGA 13/15). Consequently the external buttons are only active when the door-release is activated.

Effective parameter:

- Parameter T05 (opening impulse / -storage KW)
This parameter defines whether the respective automatic door (with opening impulse storage) opens at the push of the baby-buggy button (KW). The parameter refers only to the ECU 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 volts-signal inputs „Eingang 1“ and „Eingang 2“ evaluate additional door-specific signals at each door. These are optional inputs. Their application depends on function and design of the door. Connection and signals are described in the door specification.

Effective parameter:

- T32 (door functionality)
This parameter defines the door functionality.
The value is determined in the door specification!
This parameter adjusts the complete function of the door.
Preset: 1

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 tone patterns.

Effective parameters:

- Parameters T11 to T23 (warning-buzzer modi) (Preset = ➔)

T11	acoustic signal (TSW) when door opens	This parameter defines whether the buzzer output TSW is active when the door opens.	➔ no yes
T12	acoustic signal (TSW) when door closes	This parameter defines whether the buzzer output TSW is active when the door	➔ no yes

		closes.	
T13	acoustic signal (TSW) before door opens	This parameter defines whether the buzzer output is active before the door opens.	➔ no yes
T14	acoustic signal (TSW) before door closes	This parameter defines whether the buzzer output is active before the door closes.	➔ no yes
T15	acoustic signal (TSW) when door blocks (TBL)	This parameter defines whether the buzzer output is active when the door blocks.	➔ yes no
T16	acoustic signal (TSW) at emergency operation (NHB)	This parameter defines whether the buzzer output is active at emergency operation.	➔ yes no
T17	continuous tone or tone pattern when door opens (T11)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door opens.	➔ cont. tone tone pattern
T18	continuous tone or tone pattern when door closes (T12)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door closes.	➔ cont. tone tone pattern
T19	continuous tone or tone pattern before door opens (T13)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern before the door opens.	➔ tone pattern cont. tone
T20	continuous tone or tone pattern before the door closes (T14)	This parameter defines whether an active buzzer output produces a continuous tone or a tone pattern before the door closes.	➔ tone pattern cont. tone
T21	continuous tone or tone pattern when door blocks (T15)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door blocks.	➔ tone pattern cont. tone
T22	continuous tone or tone pattern at emergency operation (T16)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern at emergency operation.	➔ tone pattern cont. tone
T23	tone pattern selection for the parameters T17 ... T 22	This parameter defines the kind of tone pattern (1, 2 or 3).	➔ tone pattern 1 (2x long) tone pattern 2 (4x medium) tone pattern 3 (6x short)

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6.3.2.2 Entrance illumination (ESB) Pin 4/15

The door-specific illumination is connected to the signal output „entrance illumination“. This output switches to supply voltage. The load (maximal 40 Watt) is connected to vehicle ground. Since the entrance illumination does not only illuminate but provides also signals (e. g. acknowledgement flashing after learning-in), it should be controlled directly from the MTS. The entrance illumination is switched on immediately after the command for opening the door was given, if a 24 volts-signal is available at the input „entrance illumination“ (pin 11/12 LICHT).

Effective parameter:

- Parameter T10 (delay time)

This parameter defines the period of time in which the entrance illumination remains on after the door reached its CLOSED position.

Preset: 2 seconds

Special feature at door 1: External button can be actuated when ignition is off:

For this a (driver's) external button with clamp 30 is connected to input FAT 1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes the door 1 at the push of the button and activates (24 volts) the output entrance illumination ESB (pin 4/15 at door 1 immediately after ignition off is detected (0 volts 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 endposition or powerless condition, output ESB and consequently the relay are deactivated. The ECU is de-energised again. This allows door movement monitoring also when ignition is off.

Attention: Decoupling diodes are needed!

Ramp control (RMPST) Pin 7/15

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

Effective parameters:

- Parameter T24 (selection of the time)

This parameter defines whether the signal „ramp control“ is active already when the door starts closing or when the door is CLOSED.

Preset: when the door starts closing

- Parameter T25 (impulse type)

This parameter defines whether the signal „ramp control“ is a 5 seconds switch-off impulse or a 0.5 seconds switch-on impulse.

Preset: switch-off impulse (5 seconds)

6.3.2.3 Halt demand indicator (HWA1) Pin 10/15

Automatic mode:

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

The display is cleared at the push of the halt demand button (via input HW) or the baby-buggy demand button (by input KW) and by opening the door (e. g. by the driver's button or the door release). Only the halt demand stored locally at this door is displayed. A summarized indication of all doors is realised via HWA2 (pin 1/6).

Special feature: Manual operation at door 1

This output then has the same function at door 1 like the pin 1/6 (HWA2): summarised indication of all doors.

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WABCO	620	18.10.2005	446 190 011 0	435	26/85

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Texts according to ISO 16016

6.3.2.4 Door-release indicator (FGA) Pin 13/15

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

6.4 12-polar plug and 6-polar plug (MTS-EX in pin operation)

Only vehicle-specific functions are installed on these plugs in conventional pin-operation. They are used **for the basic module at door 1 only**. Free usable inputs and outputs are not active.

Exception: At pin 7/12 - blocking of front wing (SPV) and pin 10/12 - blocking of rear wing (SPH) it is optional to lock also the door-wings of the doors 2 ... 5 separately in 2-motors operation. The pins FAT1 (1/12) and SPH (7/12) at the door 1 have an alternative function which can be adjusted by parameters: Separate operation of door-wings at door 1 by parameter 007. In this case the two door wings are independingly controlled by two driver's buttons (FAT1V and FAT1H):

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

All functionalities except of the blocking functions at doors 2 ... 5 (SPV/SPH) are transmitted via the CAN-vehiclebus alternatively.

Short overview

pin	MTS code	pin name	character	remarks
1/12	FAT1 (V)	driver's button door 1 / FAT 1 front	dig. input	FAT 1 front at sep. wing operation
2/12	FAT2	driver's 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 / FAT 1 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 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 th and 5 th lamp only via vehiclebus
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's button door 3	dig. input	4 th and 5 th FAT only via vehiclebus

6.4.1 Vehicle-specific inputs

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6.4.1.1 Driver's button door 1 (FAT1)

6.4.1.2 Alternatively: driver's button 1 front wing (FAT1V) Pin 1/12

6.4.1.3 Driver's button door 2 (FAT2) Pin 2/12

6.4.1.4 Driver's button door 3 (FAT3) Pin 6/6

The driver's buttons in the dashboard are connected to these signal-inputs. When the vehicle is standing still, the respective vehicle door is opened and closed by a 24 volts-signal. If the door is in powerless condition, the next impulse from the driver's button always starts a closing impulse (exceptions are described in the door specification).

A continuous activation of the driver's button has no influence on the door-wing or feeling wing edge monitoring (light barrier is described under T03). Closing is possible while driving (e. g. after the emergency control was reset). If undervoltage is detected ($U < 20$ volts), the driver's button has no function.

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

Driver's button 1 front wing (FAT1V):

If separate door-wing operation is parameterised, this 24 volts-input acts like an independing driver's button input activating only the front door-wing.

Special features at door 1: Operation by external button when ignition is off.

For this a (driver's) external button supplied with clamp 30 is connected to input FAT1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes door 1 at the push of the external button and immediately activates the output "entrance illumination" ESB (pin 4/15) at door 1 (24 volts) when ignition off is detected (0 volts 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 endposition or powerless status, output ESB and consequently the relay are deactivated. The ECU is without supply voltage again. This allows door movement monitoring also when ignition is off.

Attention: Decoupling diodes are needed!

The driver's button signals for the fourth and fifth door (FAT4 / FAT5) are transmitted only via the CAN vehiclebus. Inputs at the ECU are not provided.

In case a door was opened with the driver's button in driver's button mixed operation (par. 010), it remains open and must be closed manually with the driver's button. If the door reverses while closing and the door-release is active, a new closing movement is started automatically after the keeping-open time expired.

Effective parameters:

- Parameter 004 (external button door 1 front/both wings)
This parameter defines whether the external button at door 1 operates only the front wing or both wings.
Preset: both wings
- Parameter 005 (FAT 2 mode)
This parameter defines whether all automatic doors open at the push of the driver's button for door 2.
Preset: no
- Parameter 006 (stadium circuit)
This parameter defines whether the respective automatic door opens at the push of the door-specific driver's button. This parameter is evaluated only if driver's button mixed operation is not active (par. 010).
Preset: no
- Parameter 007 (sep. operation of the door-wings at door 1)

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This parameter defines whether the front and rear wing of door 1 are operated separately by two driver's buttons.

Preset: no

- Parameter 010 (driver's button mixed operation)

This parameter defines whether at automatic doors the driver's buttons are additionally working.

Preset: no

- Parameter T03 (light barrier skipping)

This parameter defines whether forced closing by continuously pushing the driver's button is possible after the release is deactivated. In this case the light barrier LS (pin 6/15) is skipped.

Preset: no

6.4.1.5 Blocking of rear wings (SPH)

6.4.1.6 Alternative: driver's button 1 rear wing (FAT1H) Pin 7/12

This signal-input at pin 7/12 is active only in case of operation with two motors. At door 1 the alternative functions „blocking front wing“ and „blocking rear wing“ can be adjusted by parameters.

Blocking of rear wing (with stop switch):

A 24 volts-signal at this input makes that a closed door-wing is blocked and does not open. If the signal SPH changes to 0 volts 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-motors-operation, e. g. as blocking input for luggage compartment lids.

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

If separate door-wing operation is parameterised, this 24 volts-input acts like an independing driver's 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 volts-signal. If the drive is switched off after an obstacle was identified, the next impulse from the driver's button starts always a closing impulse (exceptions are described in the door specification).

Effective parameter:

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

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

Blocking of front-wing (with stop switch):

A 24 volts-signal at this input makes that a closed door-wing is blocked and does not open. If the signal SPV changes to 0 volts 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 close at the same time. This function can be used for all doors in 2-motors-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's buttons!), this input is not active.

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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 on (clamp 15). If ignition is off, only door 1 can be operated via the external button. No learning processes are realized anymore.

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

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

Special feature at door 1: Operation by external button when ignition is off.

For this a (driver's) external button supplied with clamp 30 is connected to input FAT1 (pin 1/12) and UB (pin 1/18). The basic module at door 1 opens/closes door 1 at the push of the external button and immediately activates the output „entrance illumination“ ESB (pin 4/15) at door 1 (24 volts) when ignition off is identified (0 volts 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 endposition or in powerless status, the output ESB and consequently the relay are deactivated. The ECU is without supply voltage again. This allows door movement monitoring also when ignition is off.

Attention: Decoupling diodes are needed!

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 volts-signal applies at the input (LICHT) and the respective 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 volts-signal at this input deactivates the control of the haltbrake (HB - pin 9/12), after all doors have closed faultlessly. If the parameter 012 is set to „without external clearing signal“, this input will not be evaluated. A 24 volts continuous 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 an additional external clearing signal (HBAB, e. g. from the accelerator pedal) is needed.

Preset: no 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**:

General: manual operation (automatic mode 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 volts-signal releases the door for automatic opening when the vehicle is standing still. Via the CAN-vehiclebus two different buttons (set/clear) can be used alternatively depending on the parameter 001. The active door-release is indicated at pin 13/15 FGA (door-release indicator) at each ECU in automatic mode.

If a door was opened in driver's button mixed operation (par. 010) by the driver's button, this door remains open and must be closed manually with the driver's button. If the door reverses during the closing movement and the door-release is activated, a new trial for closing is started automatically after the keeping-open time expired.

Effective parameters:

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

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 (described under parameter 002):

Variation with baby-buggy clear-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 announcement“ (pin 2/6 - KWA). The block for closing is active until the driver activates the clear-signal KWFA. The output „baby-buggy announcement“ is also cleared then. With the CAN-vehiclebus two buttons (set/clear) can be used alternatively depending on parameter 002.

Variation with baby-buggy release switch

In the variation with one switch at the input KWFA the passenger only signalizes his request for the baby-buggy function (= blocked for closing) at an automatic door by a push of the door-specific button „baby-buggy“ (pin 14/15 - KW). This request is stored and indicated to the driver via the output „baby-

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buggy announcement“. A 24 volts-signal at the input KWFA activates the block for closing and the output „baby-buggy announcement“. A 24 volts-signal at the input KWFA activates the block for closing and the output „baby-buggy announcement“ 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 place (KWFA) with set/clear buttons or a release switch.
Preset: buttons
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function is additionally cleared when the door-release is deactivated
Preset: no
- Parameter 011 (rapid closing after release is cleared)
This parameter defines whether the doors close immediately after the door-release is deactivated, before the keeping-open time expired.
Preset: no
- Parameter T05 (opening impulse /-storage KW)
This parameter defines whether the respective automatic door opens (with storage of the opening impulse) after having pushed the baby-buggy button (KW). This parameter refers only to the ECU 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 when the driver pushed the baby-buggy setting button. This parameter refers only to the CAN-signal but not to the input KWFA.
Preset: no

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 respective driver's 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 continuously on (24 volts): door open, opening, closing (without malfunctions)
- output continuously off (0 volts): door closed (without malfunctions)
- output flashes: malfunction of a door

Malfunction is detected in the following cases:

- the door is switched powerless
- emergency control is activated
- CAN-systembus fault
- sensor fault incl. reference voltage fault
- powerstage fault
- perhaps fault of the inputs EIN 1 / EIN 2, described in the door specification.

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The warning lamp signals for the fourth and fifth door (ST4 / ST 5) - if existing - are transmitted via CAN-vehiclebus only. Corresponding outputs on the ECU 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 volts-signal at the output (= green indicator in the dashboard is on) indicates that **all doors** are orderly **closed**.

A 0 volts-signal at the output (= green indicator in the dashboard is off or optionally the red indicator in the dashboard is on / via inverting relay) indicates that at least one door is open or at least one door is disturbed.

Conditions for **activating** the green indicator:

- the door-wings are in their endpositions CLOSED (limit switch or potentiometer) **and**
- the drive is coupled (corresponding to the door type)

Conditions for **deactivating** the green indicator:

- the drive is not coupled (depending to the door type) **or**
- a system-CAN-bus fault occurred **or**
- the door-wings are not in their endposition CLOSED **or**
- the door is controlled in opening direction **or**
- the emergency valve is electrically operated (NHB) **or**
- a sensor fault occurred (potentiometer) **or**
- a reference voltage fault occurred

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 becomes active (24 volts), if the emergency valve is operated at one door at least. The output becomes inactive (0 volts) when the door is orderly closed.

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 orderly opening of at least one door when the vehicle is standing (24 volts). Emergency control or improper opening of a closed door do not activate this output.

The output is deactivated (0 volts) after all doors are closed. 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 volts-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 for **activating** the haltbrake by each door:

- the vehicle is standing **and**
- the standstill signal is valid **and**
- no emergency control is active **and**
- the door opens (logical control from the software)

or

- the driving signal is not yet valid (after ignition on) **and**
- one door-wing is not closed **or** just opening

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

Conditions for **deactivating** the haltbrake by each door:

- no emergency control is active **and**
- the green indicator is active **and**
- the doors is not opening (logic control from the program) **and**
- no sensor fault occurred **and**
- no signal to release the haltbrake was given (if parameterised).

The haltbrake signal is cleared when all local HB demands are cleared and the summation signal of the red/green indicator is switched on.

Effective parameters:

- Parameter 012 (haltbrake deactivating mode)

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

Preset: no external clearing signal

- Parameter 013 (selection of alternative function)

This parameter defines whether at door 1 the haltbrake logic for door 1 is active instead of 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 volts) → deactivation of the haltbrake under the condition “all doors CLOSED” and - if applicable - by external clearing signal (described under 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 (described under 012).

6.4.2.7 Halt demand indicator (HWA2) Pin 1/6

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

The sum of all halt demands at all doors (HWA1) is indicated via this output. The indicator is set by the halt demand for at least one door and cleared by opening the door (e. g. by the driver's button or release). The output works in both modes, manual and automatic.

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6.4.2.8 Baby-buggy announcement (KWA) Pin 2/6

The baby-buggy announcement signals exclusively information from doors in automatic mode. A vehicle-specific baby-buggy announcement, e. g. displayed at the driver's place, connected to the signal-output „baby-buggy announcement“. The output switches to supply voltage. Load is connected to vehicle ground. The signal-output „baby-buggy announcement“ principally works in two different versions (described under parameter 002):

Variation with baby-buggy clear-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 at the push of 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 announcement“ (pin 2/6 - KWA). The block for closing is active until the driver activates the clear-signal KWFA. The output „baby-buggy announcement“ is cleared then as well.

Variation with baby-buggy release switch

In the variation with one switch at the input KWFA, the passenger only signalizes his wish for the baby-buggy function (= blocked for closing) at an automatic door at the push of the door-specific button „baby-buggy“ (pin 14/15 - KW). This demand is stored and displayed to the driver via the output „baby-buggy announcement“. A 24 volts-signal at the input KWFA activates the closing block and clears the output „baby-buggy announcement“. The closing block remains active until the driver clears the signal KWFA.

Effective parameter:

- Parameter 002 (baby-buggy mode)

This parameter defines whether the baby-buggy function is activated at the driver's place (KWFA) with set/clear-buttons or a release switch.

Preset: buttons

6.5 12-polar plug and 6-polar plug (MTS-EX in CAN-operation)

As an alternative to the pin-functions at conventional MTS operation via the CAN vehiclebus, free **usable inputs/outputs** can be used via the extended CAN message of the vehiclebus.

The transmission of these signals in the messages on the CAN bus are specified in ➔ chapter 8.

Operation with two motors is possible at all doors. The inhibiting inputs (SPV/SPH) are active then. The separate operation of the door-wings by two driver's buttons is possible only at door 1.

The two-digits figure behind the code IN **xy** or OUT **xy** stands for the address of the door (x) and the number of the input resp. output (y).

Examples: IN **25** ➔ door **2** - input **5**; OUT **32** ➔ door **3** - output **2**.

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6.5.1 Pinning of door 1

6 inputs and 3 outputs for free usable functions are available on the ECU for door 1.
 Only a limited number of new functions can be provided in CAN-operation. This assures compatibility with the previous series.
 Moreover some basic functions parallel to the CAN bus can be controlled and queried via pins inspite of CAN operation. The pin functions used at door 1 are described in ➔chapter 6.4.

The input-signals (IN 1y) and output-signals (OUT 1y) refer to the same pin-numbers analogous to the signals at doors 2 ... 5. Therefore they are not consecutively numbered.

<i>pin</i>	<i>character</i>	<i>pin name</i>	<i>door 1</i>
1/12	dig. input	driver's button door 1	FAT1 / FAT1V
2/12	dig. input	input 12	IN 12
3/12	dig. input	ignition identification	ZUN
4/12	switching output	warning lamp door 1	ST1
5/12	switching output	output 12	OUT 12
6/12	switching output	red/green indicator	RTGN
7/12	dig. input	blocking of rear wing	SPH / FAT1H
8/12	switching output	pressureless buzzer	SUM
9/12	switching output	haltbrake	HB
10/12	dig. input	blocking of front wing	SPV
11/12	dig. input	input 14	IN 14
12/12	dig. input	input 15	IN 15

1/6	switching output	halt demand announcem.	HWA2
2/6	switching output	output 17	OUT 17
3/6	switching output	output 18	OUT 18
4/6	dig. input	input 16	IN 16
5/6	dig. input	input 17	IN 17
6/6	dig. input	input 18	IN 18

6.5.2 Pinning of doors 2 ... 5

8 inputs and 8 outputs are available at the ECUs of each of the doors 2 ... 5 for free usable functions. The inhibiting signals SPV and SPH are activated via the 12-polar plug only. “ x ” is a placeholder for the door address.

<i>pin</i>	<i>character</i>	<i>pin name</i>	<i>door 2</i>	<i>door 3</i>	<i>door 4</i>	<i>door 5</i>
1/12	dig. input	input x1	IN 21	IN 31	IN 41	IN 51
2/12	dig. input	input x2	IN 22	IN 32	IN 42	IN 52
3/12	dig. input	input x3	IN 23	IN 33	IN 43	IN 53
4/12	switching output	output x1	OUT 21	OUT 31	OUT 41	OUT 51
5/12	switching output	output x2	OUT 22	OUT 32	OUT 42	OUT 52
6/12	switching output	output x3	OUT 23	OUT 33	OUT 43	OUT 53
7/12	dig. input	blocking of rear wing	SPH	SPH	SPH	SPH
8/12	switching output	output x4	OUT 24	OUT 34	OUT 44	OUT 54
9/12	switching output	output x5	OUT 25	OUT 35	OUT 45	OUT 55
10/12	dig. input	blocking of front wing	SPV	SPV	SPV	SPV
11/12	dig. input	input x4	IN 24	IN 34	IN 44	IN 54
12/12	dig. input	input x5	IN 25	IN 35	IN 45	IN 55

1/6	switching output	output x6	OUT 26	OUT 36	OUT 46	OUT 56
2/6	switching output	output x7	OUT 27	OUT 37	OUT 47	OUT 57
3/6	switching output	output x8	OUT 28	OUT 38	OUT 48	OUT 58
4/6	dig. input	input x6	IN 26	IN 36	IN 46	IN 56
5/6	dig. input	input x7	IN 27	IN 37	IN 47	IN 57
6/6	dig. input	input x8	IN 28	IN 38	IN 48	IN 58

6.5.3 Input xy (IN xy) / free usable

These digital signal-inputs are only active in CAN operation. A 24 volts-signal at an input cares that the respective signals are given in the corresponding messages on the CAN vehiclebus. The input-signals IN xy are independing of the MTS control software. They are not influenced by the parameters.

The two-digits figure behind the code IN **xy** stands for the address of the door (x) and the number of the input (y). For example IN **25** → door **2** - input **5**.

6.5.4 Output xy (OUT xy) / free usable

These digital signal-outputs are active in CAN-operation only. If corresponding signals are given in the respective message on the CAN vehiclebus, the appropriate output is controlled (24 volts). The output-signals OUT xy are independing of the MTS software. They are not influenced by the parameters.

The two-digits figure behind the code OUT **xy** stands for the address of the door (x) and the number of the output (y). For example: OUT **32** → door **3** - outlet **2**.

The permissible initial stress is specified in → chapter 9.

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7 Description of the MTS-parameters

7.1 General

The following list includes all parameters implemented in the MTS control devices. The column „preset“ describes the basic parameter settings of the WABCO ECUs as delivered. Only the vehicle manufacturer can change these presets at the end of line, if need is.

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, 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 realize and document this in the field. The ECU of door 1 (basic module) must be marked in an appropriate manner after the parameters were loaded.

In the extension modules the WABCO basic parameters are stored as well, but in operation they are not evaluated. Therefore the extension modules can be exchanged without additional parameter setting. The ECUs of the doors 2 ... 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“ as the left figure. 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 by PC-diagnosis in the field. All other parameters must be set by the vehicle manufacturer with a special diagnosis at the end of line.

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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 (set/clear) or by one switch. Activation by buttons is only possible with CAN. Relevant only for doors in automatic mode.	→ switch buttons
002	baby-buggy function at the driver's place (KWFA) by buttons or switch	This parameter defines whether the baby-buggy function is set with two set/clear buttons or with one release switch at the driver's place. Relevant only for doors in automatic mode.	→ buttons switch
003	baby-buggy function is cleared by deactivating the door-release	This parameter defines whether the baby-buggy function is additionally cleared by deactivating the door-release. Relevant only for doors in automatic mode.	→ not clear clear
004	external 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 door-wings are operated at the push of the driver's button for door 2. Relevant only for doors in automatic mode.	→ both wings front wing
005	opening impulse at all automatic doors by driver's button 2 (FAT2) → refer also to remark 2	This parameter defines whether all automatic doors open when the driver's button for door 2 is pushed. Relevant only for doors in automatic mode.	→ no yes
006	opening impulse by respective driver's button (stadium circuit) → refer also to remark 2	This parameter defines whether the corresponding automatic door opens at the push of the door-specific driver's button. It is only evaluated if driver's button mixed operation (par. 010) is active. Relevant only for doors in automatic mode.	→ no yes
007	separate operation of the door wings at 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's buttons.	→ no yes
008	deactivation of all automatic doors by CAN bus signal	This parameter defines whether all other doors must be deactivated additionally to doors 1 and 2 when automatic function via CAN bus is deactivated. Relevant only for automatic doors.	→ no yes
009	door opens by light barrier (LS) → refer also to remark2	This parameter defines whether the corresponding automatic door opens when the door-specific light barrier is activated with door-release.	→ no yes
010	driver's button mixed operation	This parameter defines whether the driver's 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	rapid closing by clearing the door-release (FG)	This parameter defines whether the doors close immediately after door-release is deactivated although the keeping-open time was not over. Relevant only for doors in automatic mode.	➔ no yes
012	haltbrake deactivation mode	This parameter defines whether the haltbrake (HB) is deactivated immediately after the condition „all doors CLOSED“ or an additional external clearing signal (HBAB, e. g. via accelerator pedal) is needed.	➔ without ext. clearing signal with ext. clearing signal
013	alternative function of Pin 12/15 (AUTO) at door 1 ➔ refer also to remark 3	This parameter defines whether at door 1 the haltbrake logic is active instead of the 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	continuous operation of the driver's button (FAT) skips the light barrier	This parameter defines whether forced closing by pushing the driver's button continuously 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 respective automatic door opens at the push of 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 respective automatic door opens at the push of 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 respective automatic door opens at the push of 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 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	continuous tone or tone pattern when door opens (T11)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door opens.	→ Cont. tone Tone pattern
T18	continuous tone or tone pattern when door closes (T12)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door closes.	→ Cont. tone Tone pattern
T19	continuous tone or tone pattern before door opens (T13)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern before the door opens.	→ Tone pattern Cont. tone
T20	continuous tone or tone pattern before door closes (T14)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern before the door closes.	→ Tone pattern Cont. tone
T21	continuous tone or tone pattern when door is blocked (T15)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern when the door is blocked.	→ Tone pattern Cont. tone
T22	continuous tone or tone pattern in case of emergency control (T16)	This parameter defines whether an active buzzer output TSW produces a continuous tone or a tone pattern in case of emergency control.	→ Tone pattern Cont. tone

no.	parameter	description	→ preset alternative
T23	tone pattern selection for T17 ... T22	This parameter defines the kind of tone pattern (1, 2 or 3).	→ tone pattern 1 (2x long) tone pattern 2 (4x medium) tone pattern 3 (6x short)
T24	ramp control (RMPST) time selection	This parameter defines whether the ramp control signal is active already when the door starts closing or only if the 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 prevented from opening	This parameter defines whether an active door blocking input (TBL) prevents the door from opening. Also the CAN-signal is evaluated.	→ yes no
T27	door is blocked (TBL) and prevented from closing	This parameter defines whether an active door blocking input (TBL) prevents the door from closing. Also the CAN-signal is evaluated.	→ yes no
T28	endposition damping when door opens	This parameter defines at which position of the door the endposition 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	endposition damping when door closes	This parameter defines at which position of the door the endposition 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 %

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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	monitoring of the electrical switching board(s) with termination resistors	This parameter defines whether the monitoring of the switching board with termination resistor 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 present door types. However, only the respective actual door specification is binding!

Remark 2: Parameters 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 the 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's button in driver's button mixed operation.

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

- Automatic selection door 1:

General : deactivation of haltbrake under the condition "all doors CLOSED" and if necessary by external clearing signal (described under 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 operation 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 (described under 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 (described under 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 (type A)
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		
8		
9		– hinged sliding door / two wings / 1 motor / incremental position sensor (type B)
10		– hinged sliding door / two wings / 1 motor / incremental position sensor (type C)
11		
12		

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8 Specification of the CAN-vehiclebus

7.5 General

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

7.6 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 ECU: less than 750 pF
- max. admissible load capacity: 4 nF
- max. length of the branches 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 ECUs which must maximally be driven.

If other bus structures than described here are used, the vehicle manufacturer must assure safe transmission.

7.7 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_SEG: 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

7.8 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 satisfactory, if the following limits are kept:

- 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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7.9 Data format

Single-bit information:

Single-bit information is always represented by 2 bits.

The following codes are 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 real data contents is defined in the description of the corresponding data.

Not defined data:

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

7.10 System start

After their activation both participants of the CAN communication (MTS and vehicle) start sending cyclic messages immediately after their corresponding computer initialisation times. Fault detections in the receiver of the MTS-messages must not be activated earlier than 2 seconds after switching on the MTS because of the initialisation 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 initialisation 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 seconds after power-on.

7.11 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 are 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 volts to 29.5 volts.

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7.12 Data specification

New functions from **MTSEX110** on are printed **bold**.

7.12.1 Data from the vehiclebus to the MTS-System:

7.12.1.1 Message FZG_MTS_1

Sender: vehicle
Receiver: MTS
Length: 8 Byte
Rate: 50ms
Identifier: 1195 dec

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	clear door-release (clear-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 (clear-button)	KWL
	6/7	door-release (alternative setting-button)	FG
2	0/1	driver's button door 1 (alt. front-wing)	FAT1 / FAT1V
	2/3	halt demand door 1 / external	HW1
	4/5	baby-buggy door 1 / external	KW1
	6/7	door blocking door 1 / external	TBL1
3	0/1	driver's button door 2	FAT2
	2/3	halt demand door 2 / external	HW2
	4/5	baby-buggy door 2 / external	KW2
	6/7	door blocking door 2 / external	TBL2
4	0/1	door 3 driver's button	FAT3
	2/3	halt demand door 3 / external	HW3
	4/5	baby-buggy door 3 / external	KW3
	6/7	door blocking door 3 / external	TBL3
5	0/1	driver's button door 4	FAT4
	2/3	halt demand door 4 / external	HW4
	4/5	baby-buggy door 4 / external	KW4
	6/7	door blocking door 4 / external	TBL4
6	0/1	driver's button door 5	FAT5
	2/3	halt demand door 5 / external	HW5
	4/5	baby-buggy door 5 / external	KW5
	6/7	door blocking door 5 / external	TBL5
7	0/1	deactivation of automatic mode	AUTOAB
	2/3	baby-buggy function (release switch)	KWFG
	4/5	driver's button door 1 rear-wing	FAT1H
	6/7	supply voltage	UB

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7.12.1.2 Message FZG_MTS_2

This message is optional. It must not necessarily be transmitted.

Sender: vehicle
Receiver: MTS
Length: 8 Byte
Rate: 50ms
Identifier: 1196 dec

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

byte	bit	signal	remarks
0	0/1	vehicle driving	FAHRT
	2/3	blocking of door opening	BLOCK
	4/5	(not defined)	
	6/7	(not defined)	
1	0/1	door 5 - output 2 (Pin 5/12)	OUT 52
	2/3	door 5 - output 7 (Pin 2/6)	OUT 57
	4/5	door 5 - output 8 (Pin 3/6)	OUT 58
	6/7	(not defined)	
2	0/1	(not defined)	
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
3	0/1	(not defined)	
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
4	0/1	(not defined)	
	2/3	(not defined)	
	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	(not defined)	
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	
7	0/1	(not defined)	
	2/3	(not defined)	
	4/5	(not defined)	
	6/7	(not defined)	

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7.12.1.3 Message FZG_MTS_3 (new message)

This message is optional. It must not necessarily be transmitted.

Sender: vehicle
Receiver: MTS
Length: 8 Byte
Rate: 50ms
Identifier: 1194dec

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

byte	bit	signal	remarks
0	0/1	door 5 - output 1 (pin 4/12)	OUT 51
	2/3	door 1 - output 2 (pin 5/12)	OUT 12
	4/5	door 5 - output 3 (pin 6/12)	OUT 53
	6/7	door 5 - output 4 (pin 8/12)	OUT 54
1	0/1	door 5 - output 5 (pin 9/12)	OUT 55
	2/3	door 5 - output 6 (pin 1/6)	OUT 56
	4/5	door 1 - output 7 (pin 2/6)	OUT 17
	6/7	door 1 - output 8 (pin 3/6)	OUT 18
2	0/1	door 2 - output 1 (pin 4/12)	OUT 21
	2/3	door 2 - output 2 (pin 5/12)	OUT 22
	4/5	door 2 - output 3 (pin 6/12)	OUT 23
	6/7	door 2 - output 4 (pin 8/12)	OUT 24
3	0/1	door 2 - output 5 (pin 9/12)	OUT 25
	2/3	door 2 - output 6 (pin 1/6)	OUT 26
	4/5	door 2 - output 7 (pin 2/6)	OUT 27
	6/7	door 2 - output 8 (pin 3/6)	OUT 28
4	0/1	door 3 - output 1 (pin 4/12)	OUT 31
	2/3	door 3 - output 2 (pin 5/12)	OUT 32
	4/5	door 3 - output 3 (pin 6/12)	OUT 33
	6/7	door 3 - output 4 (pin 8/12)	OUT 34
5	0/1	door 3 - output 5 (pin 9/12)	OUT 35
	2/3	door 3 - output 6 (pin 1/6)	OUT 36
	4/5	door 3 - output 7 (pin 2/6)	OUT 37
	6/7	door 3 - output 8 (pin 3/6)	OUT 38
6	0/1	door 4 - output 1 (pin 4/12)	OUT 41
	2/3	door 4 - output 2 (pin 5/12)	OUT 42
	4/5	door 4 - output 3 (pin 6/12)	OUT 43
	6/7	door 4 - output 4 (pin 8/12)	OUT 44
7	0/1	door 4 - output 5 (pin 9/12)	OUT 45
	2/3	door 4 - output 6 (pin 1/6)	OUT 46
	4/5	door 4 - output 7 (pin 2/6)	OUT 47
	6/7	door 4 - output 8 (pin 3/6)	OUT 48

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7.12.2 Data from the MTS system to the vehicle

7.12.2.1 Message MTS_FZG_1

Sender: MTS
 Receiver: vehicle
 Length: 8 Byte
 Rate: 50ms
 Identifier: 1164 dec

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

byte	bit	signal	remarks
0	0..3	initialisation	INIT
	4/5	pressureless buzzer	SUM
	6/7	stoplight	STOP
1	0..3	fault/-valence	FEHLER
	4/5	(not defined)	
	6/7	(not defined)	
2	0/1	red/green indicator	RTGN
	2/3	haltbrake announcement	HWA2
	4/5	baby-buggy announcement	KWA
	6/7	baby-buggy function active	KWAKT
3	0/1	reversing of one door	REV
	2/3	C3 status indicator	C3STATUS
	4/5	reversing status door 1	REV1
	6/7	reversing status door 2	REV2
4	0/1	haltbrake	HB
	2/3	kneeling requirements	KNEEL
	4/5	reversing status door 3	REV3
	6/7	reversing status door 4	REV4
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 active door 1	NBA1
	6/7	blocking indicator door 1	SPA1
7	0/1	ramp control door 1	RMPST1
	2/3	endposition OPEN door 1	ENDAUF1
	4/5	warning lamp door 1 rear-wing	ST1V
	6/7	warning lamp door 1 front-wing	ST1H

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7.12.2.2 Message MTS_FZG_2

Sender: MTS
Receiver: vehicle
Length: 8 Byte
Rate: 50ms
Identifier: 1165 dec

Details see ' message specification of the data sent 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 control active door 2	NBA2
	6/7	block indicator door 2	SPA2
1	0/1	ramp control door 2	RMPST2
	2/3	endposition OPEN door 2	ENDAU2
	4/5	reversing status door 5	REV5
	6/7	(not defined)	
2	0/1	warning lamp door 3	ST3
	2/3	door release indicator door 3	FGA3
	4/5	emergency control active door 3	NBA
	6/7	block indicator door 3	SPA3
3	0/1	ramp control door 3	RMPST3
	2/3	endposition OPEN door 3	ENDAU3
	4/5	door 5 - input 2 (pin 2/12)	IN 52
	6/7	door 5 - input 4 (pin 11/12)	IN 54
4	0/1	warning lamp door 4	ST4
	2/3	door release indicator door 4	FGA4
	4/5	emergency control active door 4	NBA4
	6/7	block indicator door 4	SPA4
5	0/1	ramp control door 4	RMPST4
	2/3	endposition OPEN door 4	ENDAU4
	4/5	door 5 - input 5 (pin 12/12)	IN 55
	6/7	door 5 - input 6 (pin 4/6)	IN 56
6	0/1	warning lamp door 5	ST5
	2/3	door release indicator door 5	FGA5
	4/5	emergency control active door 5	NBA5
	6/7	block indicator door 5	SPA5
7	0/1	ramp control door 5	RMPST5
	2/3	endposition OPEN door 5	ENDAU5
	4/5	door 5 - input 7 (pin 5/6)	IN 57
	6/7	door 5 - input 8 (pin 6/6)	IN 58

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7.12.2.3 Message MTS_FZG_3 (new message)

Sender: MTS
Receiver: vehicle
Length: 8 Byte
Rate: 50ms
Identifier: 1166 dec

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

byte	bit	signal	remarks
0	0/1	door 5 - input 1 (pin 1/12)	IN 51
	2/3	door 1 - input 2 (pin 2/12)	IN 12
	4/5	door 5 - input 3 (pin 3/12)	IN 53
	6/7	door 1 - input 4 (pin 11/12)	IN 14
1	0/1	door 1 - input 5 (pin 12/12)	IN 15
	2/3	door 1 - input 6 (pin 4/6)	IN 16
	4/5	door 1 - input 7 (pin 5/6)	IN 17
	6/7	door 1 - input 8 (pin 6/6)	IN 18
2	0/1	door 2 - input 1 (pin 1/12)	IN 21
	2/3	door 2 - input 2 (pin 2/12)	IN 22
	4/5	door 2 - input 3 (pin 3/12)	IN 23
	6/7	door 2 - input 4 (pin 11/12)	IN 24
3	0/1	door 2 - input 5 (pin 12/12)	IN 25
	2/3	door 2 - input 6 (pin 4/6)	IN 26
	4/5	door 2 - input 7 (pin 5/6)	IN 27
	6/7	door 2 - input 8 (pin 6/6)	IN 28
4	0/1	door 3 - input 1 (pin 1/12)	IN 31
	2/3	door 3 - input 2 (pin 2/12)	IN 32
	4/5	door 3 - input 3 (pin 3/12)	IN 33
	6/7	door 3 - input 4 (pin 11/12)	IN 34
5	0/1	door 3 - input 5 (pin 12/12)	IN 35
	2/3	door 3 - input 6 (pin 4/6)	IN 36
	4/5	door 3 - input 7 (pin 5/6)	IN 37
	6/7	door 3 - input 8 (pin 6/6)	IN 38
6	0/1	door 4 - input 1 (pin 1/12)	IN 41
	2/3	door 4 - input 2 (pin 2/12)	IN 42
	4/5	door 4 - input 3 (pin 3/12)	IN 43
	6/7	door 4 - input 4 (pin 11/12)	IN 44
7	0/1	door 4 - input 5 (pin 12/12)	IN 45
	2/3	door 4 - input 6 (pin 4/6)	IN 46
	4/5	door 4 - input 7 (pin 5/6)	IN 47
	6/7	door 4 - input 8 (pin 6/6)	IN 48

7.13 Message specification of the data received by the MTS

7.13.1 General

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

7.13.2 Ignition identification (ZUN)

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

Codes:

00: ignition off

01: ignition on

10: not defined

11: signal not available

Application:

To identify whether the MTS was activated by the external 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 external button. Learning processes are not possible anymore.

7.13.3 Release of entrance illumination (LICHT)

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

Codes

00: no activation of entrance illumination

01: activation of entrance illumination when door opens

10: continuous activation of entrance illumination even if doors are closed

11: signal not available

Application:

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

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WABCO	620	18.10.2005	446 190 011 0	435	54/85

7.13.4 Deactivation of haltbrake (HBAB)

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

Codes:

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

Application:

To deactivate the 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 an additional external clearing signal HBAB is needed.

Preset: no external clearing signal

- Parameter 013 (selection of the 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: halt brake 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).

7.13.5 Driver's button door x (FAT x)

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

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

Codes:

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

Application:

Opening and closing of the corresponding doors.

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If the door is in powerless condition, the next impulse from the driver's button induces always a closing impulse (exceptions are described in the door specification). A permanent actuation of the driver's button has no influence on the monitoring of door-wing and feeling wing edge (light barrier see parameter T03). Closing is also possible at driving (e. g. after reset of the emergency control). If undervoltage is detected, the driver's button remains without function.

At door 1 an alternative function can be set by parameters for the signal FAT1: driver's button 1 front-wing (FAT1V) with 2 motors. In case separate door-wing control is selected by parameters, this signal acts like an independent driver's button which controls only the front-wing.

Effective parameters:

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

7.13.6 Driver's button door 1 rear-wing (FAT1H)

In the case of two separate driver's buttons for both door-wings of door 1, this signal indicates the status of the driver's button for the rear door-wing. This signal is evaluated only if two motors are installed. 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.

Codes:

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

Application:

Opening and closing of the rear wing of door 1.

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This signal acts like an independing driver's button signal operating only on the rear door-wing. When the vehicle is standing, only the rear door-wing is opened or closed. If the door-wing is in powerless status the next impulse from the driver's button will always be a closing impulse (exceptions are described in the specification of the door).

Effective parameter:

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

7.13.7 Halt demand x (HW x) / external

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

Codes:

- 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:

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

The signals from 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: when the door is open the keeping-open time is immediately re-triggered without starting a closing movement. When the door is closing, it will reverse.

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

This signal is accordingly valid for each door (x = 1 ... 5).
It indicates 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 system by cables but indirectly via the wiring of other ECUs and the vehiclebus. The input at the corresponding door control system (KW) as well as the CAN-bus signal are evaluated so that both signals can be used parallelly. In certain configurations these signals can also be used to characterise the status of the baby-buggy setting switch at the driver's place. In this case the status of the KW setting switch must be indicated by this signal several times, i. e. for each door separately.

Codes:

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

Application:

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WABCO	620	18.10.2005	446 190 011 0	435	57/85

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

7.13.9 Blocking of door x (TBL x) / external

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

It prevents the doors from unwanted opening and/or closing. Here the input at the respective door control system (TBL) as well as the CAN-bus signal is evaluated so that both signals can be used parallelly.

Codes:

- 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 one door (e. g. key-operated switch, luggage compartment lid switch, ramp, etc.). Parameters define whether a signal prevents the door from moving. An already started movement of the door will not be interrupted. Door-blocking (TBL) is also active after a wing-specific blocking input SPV/SPH was deactivated. Blocking (TBL) of a door with separate door-wing operation and two driver's buttons is possible according to the parameters set, even if the wings are in different endpositions.

Effective parameters:

- Parameter T26 (opening 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 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 (tone pattern TBL)
This parameter defines whether an active buzzer-output (TSW) produces a continuous tone or a tone pattern when the door is blocked.
Preset: tone pattern
- Parameter T23 (tone pattern selection for T17 ... T22)
This parameter determines the kind of tone pattern (1, 2 or 3).
Preset: tone pattern 1 (2x long)

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

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

Codes:

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

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WABCO	620	18.10.2005	446 190 011 0	435	58/85

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.

7.13.11 Blocking of front door-wing (SPV) / door 1

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

Codes:

- 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.

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 will close both door-wings at the same time.

7.13.12 Door-release (FG) / alternative setting switch

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

Codes:

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

Application:

Release of automatic door 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. Via the CAN vehiclebus two buttons (set/clear) can be used depending on the parameter 001. The active door-release is indicated at pin 13/15 FGA (door-release indicator) of each ECU in automatic mode.

If a door was opened in driver's button mixed operation (par. 010) by the driver's button, this door remains open and must be closed manually with the driver's button. If the door reverses during the closing movement and the door-release is activated, a new trial for closing is started automatically after the keeping-open time expired.

Effective parameters:

- Parameter 001 (release mode)

This parameter defines whether the door is released by two buttons (set/clear) or one switch. Two buttons is only possible with CAN.

Preset: switch

- Parameter 003 (FG clears KW-function)

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This parameter defines whether the baby-buggy function can be additionally cleared by deactivating the door-release.

Preset: no deletion

- Parameter 009 (opening by light barrier)

This parameter defines whether the respective automatic door opens on activating the door-specific light barrier while the door is released.

Preset: no

- Parameter 010 (driver's button mixed operation)

This parameter defines whether the driver's buttons are additionally operating with automatic doors.

Preset: no

- Parameter 011 (rapid closing after release was cleared)

This parameter defines whether the doors close immediately before the keeping-open time expired when the door-release was deactivated.

Preset: no

7.13.13 Deletion of door-release (FGL)

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

Codes:

00: button open

01: button closed

10: not defined

11: signal not available

Application:

Deletion of door-release.

With the CAN vehiclebus two alternative buttons (set/clear) can be used depending on the parameter 001. Active door-release is indicated at pin 13/15 FGA (door-release indicator) at each ECU in automatic mode. If a door was opened in driver's button mixed operation (par. 010) by the driver's button, this door remains open and must be closed manually with the driver's button. If the door reverses during the closing movement and the door-release is activated, a new trial for closing is started automatically after the keeping-open time expired.

Effective parameters:

- Parameter 001 (release mode)

This parameter defines whether the door can be released by two buttons (set/clear) or by 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 deactivating the door-release.

Preset: no clearing

- Parameter 009 (opening by light barrier)

This parameter defines whether the respective automatic door opens when the door-specific light barrier is activated and the door is released.

Preset: no

- Parameter 010 (driver's button mixed operation)

This parameter defines whether the driver's buttons are additionally functioning at automatic doors.

Preset: no

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- Parameter 011 (rapid closing after door-release is cleared)
This parameter defines whether the doors close immediately after the door-release is deactivated although the keeping-open time was not over.
Preset: no

7.13.14 Button to clear baby-buggy function (KWL)

7.13.15 Baby-buggy function release switch (KWFG)

The baby-buggy function (= closing blocked) works only when the doors are in automatic mode. It is stored when the door-release (FG) is not active. If the doors have not yet been released with FG, the opening impulse will be stored if accordingly parameterised so that the respective doors open when the door release is active.

Codes:

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

The parameter 002 ,baby-buggy function activated at the push of a button/switch at the driver's place' allows two alternative actuations of the baby-buggy function:

a) clearing switch or b) release switch

a) Clearing switch KWL

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

b) Release switch KWFG

This signal indicates the status of the release button for the baby-buggy function. The closing block is activated by the driver. The passenger only announced the demand to block closing at the push of the door-specific „baby-buggy“ button. 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 with set/clear buttons or a release switch at the driver's place.
Preset: button
- Parameter 003 (FG clears KW-function)
This parameter defines whether the baby-buggy function will be additionally cleared by deactivating the door-release.
Preset: no deletion
- Parameter 011 (rapid closing after deletion of door-release)
This parameter defines whether the doors will close immediately after the door-release was deactivated although the keeping-open time was not over.
Preset: no
- Parameter T05 (opening impulse/storage KW)
This parameter defines whether the respective automatic door will open (with storage of the opening impulse) at the push of the baby-buggy button (KW). This parameter refers only to the ECU input (pin 14/16) but not to the CAN-signal.
Preset: yes
- Parameter T06 (opening impulse KW-driver)

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This parameter defines whether the respective automatic door will open at the push of 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

7.13.16 Deactivation of automatic mode (AUTOAB)

This signal changes doors from automatic mode into ,manual mode', i. e. opening and closing will be activated by the signal ,driver's button door x (FAT x)' for each door. It will be evaluated with certain parameter settings only.

Codes:
 00: automatic doors remain automatically operated
 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 permitted by the parameter 008 ,deactivation of all automatic doors via CAN-bus signal! Because of this signal, changing into manual mode is realised 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 doors 1 and 2 when the automatic function is deactivated. Relevant only for doors in automatic mode.
 Preset: no

7.13.17 Supply voltage (UB)

This signal indicates the 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 volts and 29.5 volts. A tolerance of +/- 0.85 volts is allowed.

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

Application:
 For the identification of undervoltage, overvoltage or contacting faults.

7.13.18 Vehicle driving (FAHRT)

This signal is optional. It must not necessarily be transmitted.

This signal is effective for all doors at the same time. It prevents the doors from being opened by the driver's button or by the door-relase while the vehicle is driving. Closing the doors is possible at any time.

Codes:
 00: vehicle standing

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01: vehicle driving
10: not defined
11: signal not available

Application:

Prevents the doors from opening while the vehicle is driving.

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

7.13.19 Blocking of door-opening (BLOCK)

This signal is optional. It must not necessarily be transmitted.

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

Codes:

00: no blocking
01: doors block
10: not defined
11: signal not available

Application:

Blocking of all closed doors in the vehicle.

7.13.20 Output xy (OUT xy) / free usable

This signal is optional. It must not necessarily be transmitted.

The signals OUT xy control the free usable outputs.

The two-digits figure behind the code OUT **xy** stands for the address of the door (x) and the number of the output (y). Example: OUT **32** → door **3** - output **2**.

The output signals OUT xy are independing of the MTS-software. They are not influenced by the parameters.

The permissible initial stress is described in → chapter 10.

Codes:

00: output not controlled
01: output controlled
10: signal not defined
11: signal not available

Application:

When the appropriate message signals are given, the respective output is controlled (24 volts active).

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7.14 Message specification of the data transmitted by the MTS

7.14.1 General

During the initialisation 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 initialisation. The transmission signals are often requirements of the MTS to indicate certain conditions at the driver's place. On principle it is up to the driver whether he realises all or only some of these indications. The vehicle manufacturer must make sure that at least the legal requirements regarding the indicating device are fulfilled. If the indicator signals are used for other purposes than indication, it is also the vehicle manufacturer who is responsible for it.

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

7.14.2 Initialisation (INIT)

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

Codes:

0000: initialisation finished

1000: initialisation active

Other codes are not used.

Application:

For the identification of the system status of the MTS for other ECUs.

7.14.3 Pressureless buzzer (SUM)

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

Codes:

00: pressureless buzzer not controlled

01: pressureless buzzer controlled

10: not defined

Application:

Acoustic signals inform the driver about critical conditions of the system.

The system is active when the emergency valve is operated at one door at least.

The signal becomes inactive after the door is orderly closed.

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7.14.4 Stoplight (STOP)

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

Codes:

00: stoplight not controlled

01: stoplight controlled

10: not defined

Application:

Signalizes 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 (not in case of haltbrake logic without door 1)
- or pressureless switching
- or emergency valve operated
- or one wing is opened manually.

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

7.14.5 Fault / fault valency (FEHLER)

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

Codes:

0000: no fault

0001: valency 0 (eliminate the fault next time in the workshop)

0010: valency 1 (drive can be continued, fault should be eliminated at the first opportunity)

0011: valency 2 (for safety reasons driving must be interrupted immediately)

Other codes are not used.

Application:

Informs the driver about faults identified by the MTS.

7.14.6 Red/green indicator (RTGN)

This signal indicates that the door control system is „ready to depart“.

Codes:

00: not ready to depart (e. g. control red lamp)

01: ready to depart (e. g. control green lamp)

10: not defined

Application:

Red/green indicator at the driver's place to signalise the driver readiness to depart.

„Readiness to depart“ means all doors are orderly closed under pressure.

„Not ready to depart“ means

- at least one door is open or
- at least one door is disturbed.

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

- the door-wings are in their endposition CLOSED (limit switch or potentiometer) **and**
- the drive is coupled (in case of the corresponding door design).

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

- the drive is not coupled (in case of the corresponding door design) **or**
- a system CAN-bus fault occurred **or**
- the door-wings are not in their endposition CLOSED **or**
- the door is being opened **or**
- the emergency valve is electrically operated (NHB) **or**
- a sensor fault occurred (potentiometer) **or**
- a reference voltage fault occurred.

The summation signal green indicator 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.

7.14.7 Baby-buggy announcement (KWA)

7.14.8 Baby-buggy function active (KWAKT)

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

Codes KWA:

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

Codes KWAKT:

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

The parameter 002 'baby-buggy function at the driver's place at the push of a button/switch' allows two alternative operations of the baby-buggy function:

a) clearing button or b) release switch.

a) Clearing button KWL

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

b) Release switch KWFG

Here only the driver can activate the 'block for closing'. 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 indicated to the driver by the signal „baby-buggy announcement“ (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 demand. It is active until the driver switches off the signal KWFG.

Effective parameters:

- Parameter 002 (baby-buggy mode)

This parameter defines whether the baby-buggy function is activated by set/clear buttons or by a release switch at the driver's place.

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).

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Preset: not cleared

- Parameter 011 (rapid closing after door-release was cleared)

This parameter defines whether the doors close immediately after the door-release was switched-off although the keeping-open time was not yet over.

Preset: no

- Parameter T05 (opening impulse/ -storage (KW)

This parameter defines whether the respective automatic door opens (with storage of opening impulse) at a push of the baby-buggy switch (KW). This parameter refers only to the ECU input KW (pin 14/16) but not to the CAN-signal.

Preset: yes

- Parameter T06 (opening impulse KW driver)

This parameter defines whether the respective 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

7.14.9 Halt demand announcement (HWA2)

This signal indicates that a passenger has pushed the 'halt demand' button. This signal is transmitted in both modes, manual and automatic.

Codes:

00: no halt demand

01: indicate halt demand

10: not defined

Application:

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

As the source for the indication the following signals are possible: halt demand/baby-buggy inputs of the MTS ECUs (HW or KW) and the signals 'door x external halt demand/baby-buggy' from the vehiclebus. The summed-up indication of the halt demands of all doors (HWA1) is realised by this signal. It is cleared by setting at least one halt demand at one door und by opening one door (e. g. by the driver's button or door-release).

7.14.10 Reversal of a door (REV)

This signal indicates a reversal of a door closing movement at the driver's place. It is a summation signal of all doors.

Codes:

00: no reversal of the door

01: at least one door reverses or reversed during the previous closing

10: not defined

Application:

The following reversing devices generate this signal: light barriers, feeling wing edge, door-leaf reversal. The signal is cleared when the closing of the door begins which was identified as the last one that reversed.

7.14.11 Reversal status door x (REV x)

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

It indicates at the driver's place a door-specific reversal status when the door is closing.

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Codes:
 00: no door reversal (normal operation)
 01: reversal of the door
 10: reversing device disturbed at input DW (e. g. brake-away of line, continuous signal)
 11: signal not available

Application:
 The following reversing devices generate this signal: light barrier, feeling wing edge, door-wing reversing.

7.14.12 C3 status indicator (C3STATUS)

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

Codes:
 00: vehicle standing (ground signal)
 01: vehicle driving (impulse ; v>3km/h)
 10: break-away of line (open input) / Ubatt short-circuit / continuous high level
 11: signal not available

Application:
 External utilisation of the C3 signal.

7.14.13 Demand for kneeling (KNEEL)

This signal indicates the door opening status of the vehicle.

Codes:
 00: at least one door just opens or is open
 01: the last open door is closed
 10: all doors CLOSED
 11: signal not available

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

7.14.14 Haltbrake (HB)

This signal marks the command from the MTS to control the haltbrake and thus avoid that the vehicle drives off. The signal can be generated in different ways, i. e. depending on the paramerisation and the pinning of the MTS.

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

Application:
 Control of haltbrake.

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

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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 volts-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 switched-**ON** by each door under the following conditions:

- the vehicle is standing **and**
 - the standstill signal is valid **and**
 - no emergency control **and**
 - the door opens (logical control from the software)
- or**
- the driving signal is not 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-connection of the single doors.

The haltbrake is switched-**OFF** by each door under the following conditions:

- no emergency control **and**
- the green indicator is active **and**
- the door does not open (logical control from the software) **and**
- no sensor fault occured **and**
- no signal to release the haltbrake was delivered (if parameterised)

The haltbrake signal is cleared after all local haltbrake demands have been cleared and the summation signal of the red/green indicator is switched-on.

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 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

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

Haltbrake logic door 1

General: manual mode (automatic 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 (described under 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 (described under 012).

7.14.15 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. it is indicated at the driver's place whether the door is open, opening, closing or out-of-order. It is sufficient for the indication if at least one wing is open, opening, closing or out-of-order.

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Codes:
00: door closed (no malfunction)
01: door open, opening, closing (no malfunction)
10: malfunction of the door

Application:
Open doors and malfunction of the respective doors is indicated at the driver's place:
- the door is switched powerless
- emergency control was actuated
- CAN-systembus fault
- sensor fault incl. reference voltage fault

7.14.16 Warning lamp door 1 front-wing (ST1V)

7.14.17 Warning lamp door 1 rear-wing (ST1H)

These signals indicate the status of the front (rear) door-wing of door 1, i. e. it is indicated at the driver's place whether one door-wing (front/rear) is open, opening, closing or out-of-order. 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.

Codes:
00: door-wing closed (no malfunction)
01: door-wing open, opening, closing (no malfunction)
10: malfunction of the door

Application:
Open front (rear)- or malfunctioning door-wing of door 1 is indicated at the driver's place.

Malfunction is identified for the following causes:
- the door-wing is switched powerless
- emergency control was actuated
- CAN-systembus fault
- sensor fault incl. reference voltage fault

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

Codes:
00: door-release not indicated
01: door-release indicated
10: not defined

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

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7.14.19 Emergency control active at door x (NBA x)

This signal is accordingly valid for each door (x = 1 ... 5).
It indicates emergency control of the respective door at the driver's place.

Codes:

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

Application:

Indication of active emergency control.

7.14.20 Indication that door x is blocked (SPA x)

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

Codes:

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

Application:

Indication at the driver's place that a door-wing is blocked.

7.14.21 Ramp control door x (RMPST x)

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

Codes:

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

Either

00: driving the ramp in, this signal is active for 5 seconds
01: not driving the ramp in
10: not defined

or

00: not driving the ramp in
01: driving the ramp in, this signal is active for 0.5 seconds
10: not defined

Effective parameters:

- Parameter T24 (selection of the point of time)

This parameter defines whether the ramp-control signal is active when the door starts closing or when the door is CLOSED.

Preset: when the door starts closing

- Parameter T25 (impulse type)

This parameter defines whether the ramp-control signal is a 2 seconds switch-off impulse or a 0.5 seconds switch-in impulse.

Preset: switch-off impulse (5 seconds)

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7.14.22 Endposition OPEN door x (ENDAUF x)

This signal is accordingly valid for the respective doors (x = 1 ... 5).
It indicates that one or both door-wings have reached the OPEN-position.

- Codes:
- 00: no wing in endposition OPEN
 - 01: both wings in endposition OPEN
 - 10: one wing in endpostion OPEN
 - 11: signal not available

Application:
Further application for other vehicle systems.

7.14.23 Input xy (IN xy) / free usable

The signals In xy describe the status of the free usable inputs.
The input signals IN xy are independing of the MTS-software. They are not influenced by the parameters.
The two-digits figure behind the code IN **xy** stands for the address of the door (x) and the number of the output (y). For example: IN **25**→ door **2** - input **5**.

- Codes:
- 00: input has ground potential
 - 01: input has plus potential (24 Volt)
 - 10: signal not defined
 - 11: signal not available

Application:
When a free usable input is controlled (active 24 volts), there is a signal in the appropriate message.

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Texts according to ISO 16016

8 Hardware specification

8.1 Technical data

8.1.1 Mechanical data

Dimensions, tolerances and fastening according to outline drawing, code 605

8.1.2 Identification

Identification according to JED 341.

8.1.3 Weight

The weight of the ECU is approx. 0.8 kg.

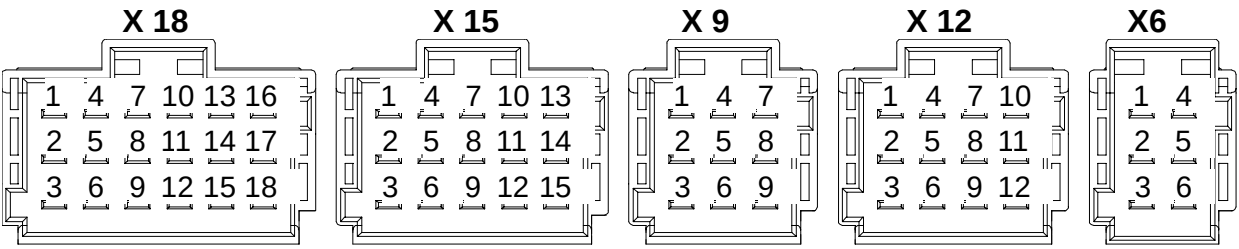
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8.2 Pinning



pin	components
plug connection X18	
1	UB, supply voltage (cl.15)
2	VBGND, valve block ground
3	GND, ground (cl. 31)
4	motor bridge 1, motor plus front
5	motor bridge 1, motor minus front
6	output 1
7	motor bridge 2, motor plus rear
8	motor bridge 2, motor minus rear
9	output 2
10	UREF, reference voltage sensors
11	ANGND, analagous ground sensors
12	C3-input
13	ana. input, position sensor front dig. input, incremental transm. B front
14	dig. input, incremental transm. A front
15	dig. input, limit switch CLOSED front
16	ana. input, position sensor rear dig. input, incremental transm. B rear
17	dig. input incremental transm. A rear
18	dig. input limit switch CLOSED rear
plug connection X15	
1	HSS, door closing warning
2	dig. input, workshop switch
3	ana. 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	ana. input, automatic operation
13	HSS, door-release indicator
14	dig. input, baby-buggy
15	dig. input, input 2

pin	component
plug connetion 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	diagnostic K-line / address 3
8	dig. input, address 2
9	dig. input, address 1
plug connection X12	
1	dig. input, driver's button door 1
2	dig. input, driver's 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
7	dig. input, blocking of rear wings
8	HSS, pressureless buzzer
9	HSS, haltbrake (HB)
10	dig. input, blocking of front wing
11	dig. input, ESB-release
12	dig. input, deactivating of HB
Steckverbindung X6	
1	HSS, halt demand announcement
2	HSS, baby-buggy announcement
3	HSS, warning lamp door 3
4	dig. input, door-release
5	dig. input, baby-buggy, driver
6	dig. input, driver's button door 3

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8.3 Electrical specification

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

8.3.1 Voltage supply

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

symbol	definition	condition	min	type	max	unit
UB	voltage supply	normal operation	21	24	30	V
UB _{max}	overvoltage ECU out of 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 t < 5 s			20	A
U _{rev}	reverse battery protection				-30	V

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8.3.2 Data interfaces

8.3.2.1 ISO

pin	description	remark
X9,7	DIAK	diagnostic K-line

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

8.3.2.2 CAN

pin	description	remarks
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 with CANLS (directly at the plug)
X9,6	CANLS	systembus CAN LOW

CAN interface according to ISO 11898 (CAN specification, separate document)

The CAN vehiclebus is not terminated in the ECU.

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8.3.3 Inputs

8.3.3.1 Switching inputs

pin	description		remark	
X12,1	FAT1	(INx1)	driver's button door 1	(input x1)
X12,2	FAT2	(INx2)	driver's button door 2	(input x2)
X12,3	ZUN	(INx3)	ignition identification	(input x3)
X12,11	LICHT	(INx4)	entrance illum. release	(input x4)
X15,2	WFAT		workshop button	
X15,14	KW		baby-buggy	
X15,15	EIN2		input 2	

symbol	definition	condition	min	type	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

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pin	description	remark
X12,7	SPH	blocking rear wing
X12,10	SPV	blocking front wing
X12,12	HBAB (INx5)	haltbrake deactivation (input x5)
X6,4	FG (INx6)	door release (input x6)
X6,5	KWFA (INx7)	baby-buggy function driver (input x7)
X6,6	FAT3 (INx8)	driver's button door 3 (input x8)
X15,3	DW	feeling wing edge; ana. input
X15,5	NHB	emergency control
X15,6	LS	light barrier
X15,8	TBL	door blocking
X15,9	EIN1	input 1
X15,11	HW	halt demand
X15,12	AUTO	automatic mode
X18,14	DSAV	pressure switch OPEN front
X18,15	DSZV	pressure switch CLOSED front
X18,17	DSAH	pressure switch OPEN rear
X18,18	DSZH	pressure switch CLOSED rear

symbol	definition	condition	min	type	max	unit
U _{in high}	input voltage for high level	all except of X15,3 and X15,12	0,7			UB
U _{in low}	input voltage for low level	all except of X15,3 and X15,12			0,3	UB
C _i	input capacitance against GND			1		nF
R _i	input capacitance against GND			4,7		kΩ

All inputs are to be wired HIGH active to UB. In unconnected condition the levels are LOW.

The inputs X15,3 (DW) and X15,12 (AUTO) are provided with an analogous evaluation. Electrical switching boards can be connected preferably. Because of the analogous evaluation, the precise values for U_{in high} and U_{in low} are not indicated in this hardware specification. Please find the respective values in the chapter 6.3.1.2.

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8.3.3.2 Address inputs

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

symbol	definition	condition	min	type	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 status the levels are HIGH. Only connection with a short wire (length < 20 cm) directly at the plug is allowed for coding the control.

8.3.3.3 Speedometer signal

pin	description	remark
X18,12	C3	speedometer signal

symbol	definition	condition	min	type	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 ECU identifies high level by an internal pull-up resistor.

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8.3.3.4 Position sensors (incremental transmitter or potentiometer)

The inputs are provided for the alternative circuiting with incremental transmitters or potentiometers. The incremental transmitters/potentiometers are powered from X18,10; ground is connected to X18,11.

8.3.3.4.1 Incremental transmitter:

The incremental transmitters have got an open-collector output and internal pull-up resistors!

pin	description	remark
X18,13	CNTBV	incremental transmitter B front
X18,14	CNTAV	incremental transmitter A front
X18,16	CNTBH	incremental transmitter B rear
X18,17	CNTAH	incremental transmitter A rear

symbol	definition	condition	min	type	max	unit
U_{in}	input voltage range		0		15	V
R_i	input resistor against ANGND			75		k Ω

8.3.3.4.2 Potentiometer:

pin	description	remark
X18,13	POSV	potentiometer front
X18,16	POSH	potentiometer rear

symbol	definition	condition	min	type	max	unit
R_{Poti}	resistor value of the potentiometer		1		10	k Ω

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8.3.4 Outputs

8.3.4.1 Reference voltage sensor

pin	description	remark
X18,10	UREF	reference voltage sensor
X18,11	ANGND	analogous ground sensors

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

8.3.4.2 Motor bridges

pin	description	remark
X18,4	MOT+V	motor plus front (opening)
X18,5	MOT-V	motor minus front (opening)
X18,7	MOT+H	motor plus rear (opening)
X18,8	MOT-H	motor minus rear (opening)

symbol	definition	condition	min	type	max	unit
I_{Out}	output current			7		A
$I_{Out} (5s)$	output current	$t < 5s$			20	A
U_{Out}	output voltage	$I = I_{out max}$	UB-2			V
U_{Klemm}	neg. clamp voltage when switching-off		UB-65			V
f_{max}	maximum switching frequency	PWM-control			1	kHz

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8.3.4.3 Switching output (Alternative function: free usable output / x = door address)

pin	description	remark
X12,4	ST1 (OUTx1)	warning lamp door 1 (output x1)
X12,5	ST2 (OUTx2)	warning lamp door 2 (output x2)
X12,6	RTGN (OUTx3)	red/green indicator (output x3)
X12,8	SUM (OUTx4)	pressureless buzzer (output x4)
X12,9	HB (OUTx5)	haltbrake (output x5)
X6,1	HWA2 (OUTx6)	halt demand announcem. (output x6)
X6,2	KWA (OUTx7)	baby-buggy announcem. (output x7)
X6,3	ST3 (OUTx8)	warning lamp door 3 (output x8)
X15,1	TSW	door closing warning
X15,4	ESB	entrance illumination
X15,7	RMPST	ramp control
X15,10	HWA1	halt demand indicator
X15,13	FGA	door-release indicator
X18,6	AUS1	output 1
X18,9	AUS2	output 2

All outputs switch internally to UB, that means they are HIGH active. The following table lists the allowed load capacity of the outputs:

symbol	definition	condition	min	type	max	unit
U _{out}	output voltage	I = I _{out max}	UB-2			V
I _{out high}	output current	t > 1 min			0,5	A
I _{out high}	output current X12,9	HB			1,5	A
I _{out high}	output current X15,4	ESB			2	A

8.3.5 Free pins

Not used, not connected pins of the ECU must remain open.
No cables must be connected.

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8.4 Permissible service conditions

8.4.1 Environmental conditions

8.4.1.1 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 condition cannot be fulfilled, the alternative requirement is that the surface temperature of the housing must not exceed max. + 70 °C.
storage temperature	-40	+90	°C	

8.4.1.2 Environmental test

The environmental test is divided into the following single tests which are realised 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 temperature	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: 72 h 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: 72 h 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 +75 °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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6	vibration test	IEC-68-2-6, test Fc sinusoidal (status 6.94)	3 (2 are used for reference)	+25 °C	10 cycles in frequency range 5 - 300 Hz deflection ± 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	30 g/13 ms, 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	

8.4.2 Protection grade

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

8.5 Electromagnetic compatibility

8.5.1 Electromagnetic disturbance by conduction

8.5.1.1 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 function 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.

8.5.1.2 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.

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8.5.2 Interference suppression

The ECU fulfils the following degrees of interference suppression in accordance with VDE 0879 part 4:

frequency range	degree of interference suppression
LW	5
MW	4
KW	5
UKW	5

To fulfil the degree of interference suppression the ECU must be operated only with the following certified drive motors of the company Dunkermotoren:

- GR 63X55, 24V, ref. no. 88442.03180
- G 42X40, 24V, ref no. 88632.02440

8.5.3 Electromagnetic interference

In accordance with the BCI method according to ISO11452-4.

Modulation frequency: 1 kHz/15 Hz
Modulation degree: 80 %

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

Functional status in accordance with ISO11452-4:

A no functional interference

The ECU is certified in accordance with the EEC directive 72/245*95/54/EG with the e1-sign. It was released under the type approval no. e1*72/245*95*54*1328*00 and marked with the EEC approval

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