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Product Specification

Modular Control System

for Pneumatically Controlled Vehicle Doors

MTS-P-EM

(Extension module)

from Rev.: MTSPD104

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1 General description

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

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

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

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

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

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

This specification describes the MTS-P-EM control device with the WABCO-No. **446 190 002 0** **starting with software status MTSPD104** for exclusive application as extension module for the doors 2 to 5. One extension module can control only one door valve.

These control devices require at door 1
either MTS-P control device **446 190 000 0** (full version)
or MTS-E control device **446 190 010 0**.

2 System structure

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

The MTS control device at **door 1** is called **basic module**. The control devices at the **doors 2 to 5** are **extension modules**. The MTS-P 446 190 002 0 can only be used for the doors 2 to 5.

2.1 Functions of the extension modules

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

The installation place is identified by a plug code (address identification) on the 9-pin plug. The control device allows only one-valve-operation at the doors 2 to 5.

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

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3 System parameter setting

In order to adapt the MTS system perfectly to the vehicle, a set of parameters for the whole door system in the vehicle is permanently stored in the basic module of door 1. These parameters include the adjustments of the door system regarding handling, door designs, operating types, etc. After each ignition-on, the basic module transmits the parameters to the other doors. Consequently the parameters for doors 2 to 5 need not be stored again after extension modules were replaced.

Since no parameters are administrated or set in the extension modules of doors 2 to 5, please refer to the product specification of MTS-P 446 190 000 0 (full version) or the MTS-E control device 446 190 010 0.

(Ref. : Description of MTS-parameters)

3.1 Initialization, learning processes and diagnosis of MTS

3.1.1 General

For initializing the MTS system in a vehicle, the MTS control devices at all doors must be completely connected. Local initialization of the doors 2 to 5 (i. e. without CAN systembus / 9-pin plug) is not possible. MTS-initialization includes an individual learning process at each door. Doing so the values of the door wings' end positions (CLOSED, OPEN) are learned-in and permanently stored locally in the corresponding control devices.

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

3.1.2 Conditions for initialization

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

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

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

then

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

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

3.1.3 Initialization of the whole MTS-system:

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

Local initialization is not possible with this control device. This concerns also the end-of-line test in the factory!

3.1.4 Standstill identification

The CAN systembus of door 1 (basic module) signalizes standstill to the doors 2 to 5.

3.1.4.1 Validity for the signal „vehicle running“ on systembus

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

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4 Functional groups of the control device

4.1 Drive-specific functions

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

4.2 Door-specific functions

Inputs for ...

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

Outputs for ...

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

4.3 Other functions

- Address inputs to define the installation place (doors 2 to 5)
- CAN systembus for interconnecting the MTS control devices,
- Voltage supply with 24 V,
- Reference voltage for position sensing (15 V output, separate ground).

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5 Description of plugs

5.1 9-pin plug

On this plug are installed the databus interface of the systembus and the address inputs.

5.2 18-pin plug

On this plug are installed the voltage supply, the valve outputs and the position identification of the door-wings.

5.3 15-pin plug

Only door-specific functions are installed on this plug.

5.4 General Remarks about inputs and outputs

Inputs:

All digital logic inputs are activated by 24 V-levels (1-signal).

Exceptions:

The three address inputs of the 9-pin plug have internal pull-up resistors and are activated by ground signal!

Outputs:

All switching outputs are positive switching outputs.

The 12-pin plug and the 6-pin plug are not used for extension modules.

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5.5 Pinning of the MTS-P control device 446 190 002 0

The 12-pin plug and the 6-pin plug are not connected (nc = not connected).

The pins marked with „nc“ must not be connected!

Pin	MTS-abbr.	Pin-Name	Character	Remark
1/9			nc	
2/9			nc	
3/9			nc	
4/9	CANHS	CAN H systembus	bus	125 kBit/s
5/9	CANRS	CAN systembus	bus connection	each bus end to be bridge to 6/9!
6/9	CANLS	CAN L systembus	bus	125 kBit/s
7/9	ADR3	address 3	dig. input	switching to ground
8/9	ADR2	address 2	dig. input	switching to ground
9/9	ADR1	address 1	dig. input	switching to ground
1/18	UB	Cl.15	supply	24 V supply
2/18	VBGND	valve block ground	sep. ground	ground for MTS valves
3/18	GND	Cl. 31 / ground	supply	chassis ground
4/18	AUF	valve OPEN	switching output	
5/18	ZU	valve CLOSE	switching output	
6/18	KL	valve POWERLESS	switching output	
7/18			nc	
8/18			nc	
9/18			nc	
10/18	UREF	reference voltage for sensors	15 V output	to be used for sensors only
11/18	ANGND	analogous ground for sensors	sep. ground	to be used for sensors only
12/18			nc	
13/18	POSV	position sensor front	ana. input	analogous potentiometer
14/18	DAS	pressure switch open front	dig. input	
15/18	DSZ	pressure switch closed front	dig. input	
16/18	POSH	position sensor rear	ana. output	analogous potentiometer
17/18			nc	
18/18			nc	
1/15	TSW	door closing warning	switching output	buzzer at the door
2/15	WFAT	workshop button	dig. input	learning, FAT, forced closing
3/15	DW	feeling wing edge	dig. input	reversing equipment
4/15	ESB	entrance illumination	switching output	add. acknowl. signal learning
5/15	NHB	emergency control	dig. input	identif. of actuated emergency control
6/15	LS	light barrier	dig. input	reversing and keeping-open
7/15	RMPST	ramp control	switching output	parameter setting possible
8/15	TBL	door blocking	dig. input	parameter setting possible
9/15	EIN1	input 1 for door-specific functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for inside display
11/15	HW	halt demand	dig. input	also possible via vehiclebus
12/15	AUTO	automatic mode	dig. input	switch in the door frame
13/15	FGA	door release indicator	switching output	also outside-HW/KW-button
14/15	KW	baby-buggy	dig. input	also possible via vehiclebus
15/15	EIN2	input 2 for door-specific function	dig. input	depending on function and design

6 Functional description of the plugs

6.1 9-pin plug

On this plug are installed the databus interface of the systembus and the address inputs. The pins marked with „nc“ must not be connected!

Short survey

Pin	MTS-abbr.	Pin-Name	Charakter	Remark
1/9			nc	
2/9			nc	
3/9			nc	
4/9	CANHS	CAN H systembus	bus	125 kBit/s
5/9	CANRS	CAN systembus	bus connection	each bus end to be bridge to 6/9!
6/9	CANLS	CAN L systembus	bus	125 kBit/s
7/9	/ADR3	address 3	dig. input	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 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.

6.1.2 Address identification in the MTS-System

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

nc not connected

Pin 9/9 ADR1 = address input 1

Pin 8/9 ADR2 = address input 2

Pin 7/9 ADR3 = address input 3

addressed door	ADR3	ADR2	ADR1
door 2	nc	nc	ground
door 3	nc	ground	nc
door 4	nc	ground	ground
door 5	ground	nc	ground

6.2 18-pin plug

On this plug are installed the voltage supply, the valve outputs, the position identification of the door-wings and the pressure monitoring of the drive-cylinders.
The pins marked with „nc“ must not be connected!

Short Survey

Pin	MTS-abbr.	Pin-Name	Charakter	Remark
1/18	UB	Cl.15	supply	24 V supply
2/18	VBGND	valve block ground	sep. ground	ground for the MTS-valves
3/18	GND	Cl. 31 / ground	supply	chassis ground
4/18	AUF	valve OPEN	switching output	
5/18	ZU	valve CLOSED	switching output	
6/18	KL	valve POWERLESS	switching output	
7/18			nc	
8/18			nc	
9/18			nc	
10/18	UREF	reference voltage for sensors	15 V output	to be used only for the sensors
11/18	ANGND	analogous ground for sensors	sep. ground	to be used only for the sensors
12/18			nc	
13/18	POSV	position sensor front	ana. input	analogous potentiometer
14/18	DSA	pressure switch OPEN	dig. input	
15/18	DSZ	pressure switch CLOSED	dig. input	
16/18	POSH	position sensor rear	ana. input	analogous potentiometer
17/18			nc	
18/18			nc	

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 switched off after „ignition OFF“ (Cl. 15).
Using several MTS control devices at the doors 1 to 5 with internal CAN link the supply voltages of the control devices must be available at all control devices at the **same time**.

6.2.2 Drive-specific functions

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

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6.2.3 Connection of valves

The MTS-P control device 446 190 002 controls the MTS control valve (WABCO no. 422 812 000 0).

Two principle configurations are possible:

1. One valve with one cylinder and one position sensor (potentiometer).
2. One valve with two cylinders and two position sensors (potentiometers).

The valve solenoids are connected to the following pins:

4/18	AUF	valve OPEN	switching output
5/18	ZU	valve CLOSE	switching output
6/18	KL	valve POWERLESS	switching output
2/18	VBGND	valve block ground	sep. ground

The two pressure switches in the valve (e. g. WABCO No. 441 014 017 0 - 4 bar contact) are powered with 24 V and connected to the following inputs:

14/18	DSA	pressure switch OPEN	dig. input
15/18	DSZ	pressure switch CLOSED	dig. input

6.2.4 Solenoid valve control

6.2.4.1 Active „keeping-closed“

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

6.2.4.2 Automatic switching-on

The CLOSE powerstage is automatically controlled under the following conditions:

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

6.2.4.3 Automatic deactivation

The CLOSE-solenoid valves are deactivated under the following conditions:

1. no regular opening of the door **or**
2. powerstage fault identified **or**
3. the last movement was closing **and** the door-wings are not in their CLOSED end position **and** pressurelessness or powerlessness is identified **and** the emergency valve was not activated **or**
4. the last movement was closing **and** the door was closed **and** a potentiometer fault was identified.

6.2.4.4 CLOSED-pulsing with emergency control

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

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6.2.4.5 Extension of OPEN-valve-control

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

6.2.4.6 Extension of end-position damping

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

6.2.5 Connection of position sensors

The potentiometers are connected to the following pins:

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

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

6.2.5.1 Acceptance limits of sensor voltages

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

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

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

6.2.5.2 Door function after sensor faults

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

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

6.3 15-pin plug

Only **door-specific functions** are installed on this plug.
 The automatic functions can be activated at all doors.
 The functions of inputs EIN1 and EIN2 differ depending on the door drives.
 The pinning of these optional inputs is described in the corresponding door specification.

Short survey

Pin	MTS-abbr.	Pin-Name	Character	Remark
1/15	TSW	door closing warning	switching output	buzzer at the door
2/15	WFAT	workshop button	dig. input	learning-in, FAT, forced closing
3/15	DW	feeling wing edge	dig. input	reversing equipment
4/15	ESB	entrance illumination	switching output	add. acknowl. signal learning-in
5/15	NHB	emergency control	dig. input	identif. of actuated emergency control
6/15	LS	light barrier	dig. input	reversing- and keeping-open equipment
7/15	RMPST	ramp control	switching output	parameter setting possible
8/15	TBL	door blocking	dig. input	parameter setting possible
9/15	EIN1	input 1 for door-specific functions	dig. input	depending on function and design
10/15	HWA1	halt demand indicator	switching output	for inside display
11/15	HW	halt demand	dig. input	also possible via vehiclebus
12/15	AUTO	automatic mode	dig. input	switch in the doorfram
13/15	FGA	door release indicator	switching output	also outside-HW/KW-button
14/15	KW	baby buggy	dig. input	also possible via vehiclebus
15/15	EIN2	input 2 for door-specific 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 „workshop button“-input is normally used for initialization and maintenance. It must not be used by passengers. The workshop button has a closing function, is powered with 24 V and connected to input pin 2/15.

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

6.3.1.2 Feeling wing edge (DW) pin 3/15

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

Simple test of the feeling wing edge:

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

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

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Effective parameters:

- Parameter T02 (feeling wing edge type)
This parameter defines whether the feeling wing edge switch DW at pin 3/15 is works as closing or opening contact.
Preset: closing contact
- Parameter T30 (feeling wing edge deactivation)
This parameter defines in which door position the input „feeling wing edge“ (DW) stops being active when the door is closing.
0 % = door closed
100 % = door open
The value is fixed in the door specification.
Preset: 0%
- Parameter T09 (keeping-open time after feeling wing edge reversing)
This parameter defines the keeping-open time of an automatic door after feeling wing edge reversing or door-wing reversing.
Relevant for automatic doors only.
Preset: 3 seconds
- Parameter T33 (feeling wing edge test)
This parameter defines whether the feeling wing edge test at the input „feeling wing edge“ (DW) is active.
Preset: not active

6.3.1.3 Emergency control (NHB) Pin 5/15

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

A switch which is installed on the emergency valve must be connected to this input.

Effective parameters:

- Parameter T16 (warning buzzer mode)
This parameter defines whether the buzzer-output TSW is active at a door in emergency control.
Preset: yes
- Parameter T22 (sound pattern NHB)
This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern in case of emergency control.
Preset: sound pattern
- Parameter T23 (sound pattern selection for T17 ... T22)
This parameter defines the sound pattern (1, 2 or 3).
Preset: sound pattern 1 (2x long)

6.3.1.4 Light barrier (LS) Pin 6/15

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

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

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Effective parameters:

- Parameter T01 (light barrier type)
This parameter defines whether the light barrier (LS) at pin 6/15 works with a closing or an opening contact.
Preset: closing contact
- Parameter T31 (deactivation of the light barrier)
This parameter defines at which position of the door the input „light barrier“ (LS) is no longer active when the door is closing.
0 % = door closed
100 % = door open
Preset: 0%.
- Parameter T03 (skipping the light barrier)
This parameter defines whether forced closing by permanently pressing the driver button is possible after deactivating the door-release.
Doing so the light barrier LS (pin 6/15) is skipped.
Preset: no
- Parameter T08 (keeping-open time standard or after light barrier)
This parameter defines the (standard-) keeping-open time after a light barrier signal or after a regular opening impulse at an automatic door.
Preset: 3 seconds
Further impulses while the door is open restart 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 while 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 one door (e. g. key switch, luggage compartment lid switch, ramp, etc). A switch is powered with 24 V and connected to pin 8/15. Parameters define whether a signal at this input prevents a movement of the door. An already started door movement will not be interrupted.

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

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6.3.1.6 Automatic Mode (AUTO) Pin 12/15

A 24 V signal at this signal input activates „automatic mode“ of the door. In this case the passenger can open the door directly via a stop button or a baby-buggy button when the driver has 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 see parameter 013 !!!

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

Effective parameters:

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

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- Parameter T04 (opening impulse / -storage HW)
This parameter defines whether the corresponding automatic door opens (storing the opening impulse) on activating the halt demand button (HW). The parameter refers only to the control-device input HW (pin 11/15) but not to the CAN-signal.
Preset: yes
- Parameter T05 (opening impulse / -storage KW)
This parameter defines whether the corresponding automatic door opens (storing the opening impulse) after activating the baby-buggy button (KW).
The parameter refers only to the control device input KW (pin 14/15) but not to the CAN-signal.
Preset: yes
- Parameter T06 (opening impulse KW-driver)
This parameter defines whether the corresponding automatic door opens on activating the baby-buggy setting button at the driver's place. This parameter refers only to the CAN-signal but not to the input KWFA.
Preset: no
- Parameter T08 (keeping-open time standard or after light barrier)
This parameter defines the (standard) keeping-open time after a signal from the light barrier 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-wing 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). This input works in manual mode as well as in automatic mode.

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

Effective parameter:

- Parameter T04 (opening impulse / -storage HW)
This parameter defines whether the corresponding automatic door opens (including storage of opening impulse) when the halt demand button /HW) is activated. This parameter refers only to the control device input HW but not to the CAN-signal. This is only relevant for doors in automatic mode.
Preset: yes

Remark:

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

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6.3.1.8 Baby-buggy (KW) pin 14/15

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

Effective parameter:

- Parameter T05 (opening impulse/-storage KW)

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

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

Preset: yes

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

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

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

Effective parameters:

- T32 (door functionality)

This parameter defines the functionality of the door.

The value is fixed in the door specification!

This parameter adjusts the complete door function.

Preset: 1

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. Load is connected to vehicle ground. Depending on the parameters, the warning buzzer has different functions and sound patterns.

Effective parameters:

- Parameters T11 to T23 (warning buzzer modi)

(Preset = ➔)

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

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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 blocks (TBL)	This parameter defines whether the buzzer output TSW is active when the door blocks.	➔ yes no
T16	Acoustic warning signal (TSW) in case of emergency control (NHB)	This parameter defines whether the buzzer output TSW is active during emergency control	➔ yes no
T17	Permanent sound or sound pattern when door is opening (T11)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door opens.	➔ permanent sound sound pattern
T18	Permanent sound or sound pattern when door closes (T12)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door closes.	➔ permanent sound sound pattern
T19	Permanent sound or sound pattern before door opens (T13)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern before the door opens.	➔ sound pattern permanent sound
T20	Permanent sound or sound pattern before door closes (T14)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern before the door closes.	➔ sound pattern permanent sound
T21	Permanent sound or sound pattern when door blocks (T15)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern when the door blocks.	➔ sound pattern permanent sound
T22	Permanent sound or sound pattern in case of emergency control (T16)	This parameter defines whether an active buzzer output TSW produces a permanent sound or a sound pattern during emergency control	➔ sound pattern permanent sound
T23	Sound pattern selection for the parameters T17 ... T 22	This parameter defines the kind of sound pattern (1, 2 or 3)	➔ sound pattern 1 (2x long) sound pattern 2 (4x medium) sound pattern 3 (6x short)

6.3.2.2 Entrance illumination (ESB) pin 4/15

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

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

Effective parameter:

- Parameter T10 (illumination off delay time)

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

Preset: 2 seconds

6.3.2.3 Ramp control (RMPST) pin 7/15

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

Effective parameters:

- Parameter T24 (timing selection)

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

Preset: when door starts closing.

- Parameter T25 (type of impulse)

This parameter defines whether the signal „ramp-control“ is a 5-seconds deactivating impulse or a 0.5-seconds activating impulse.

Preset: deactivating impulse (5 seconds)

6.3.2.4 Halt demand indicator (HWA1) pin 10/15

A door-specific halt demand indicator, e. g. for an onboard display inside the passenger compartment, can be connected to the signal output „halt demand indicator 1“. The output is switched to supply voltage. The load is connected to vehicle ground.

The display is activated by pushing the halt demand button (via input HW) and cleared by opening of the door (e. g. via driver button or release). Only the halt demand which is locally stored at this door is displayed. The summarized display of all doors is activated via HWA2 (pin 1/6). This output works in automatic mode and manual mode.

6.3.2.5 Door release indicator (FGA) pin 13/15

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

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

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7 Hardware specification

7.1 Technical data

7.1.1 Mechanic data

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

7.1.2 Identification

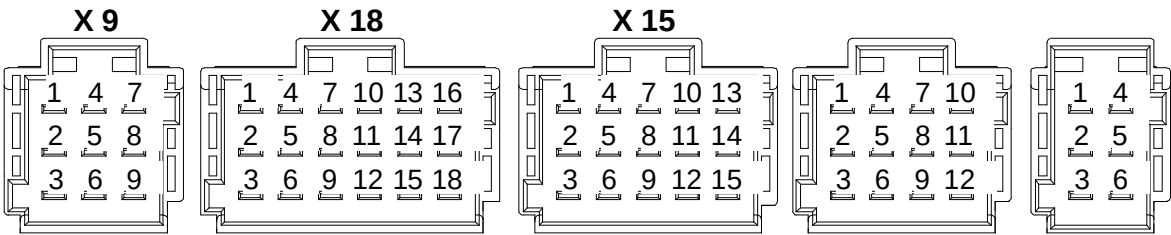
In accordance with JED 341.

7.1.3 Weight

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

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7.2 Pinning



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

Pin	Component
plug connection X9	
1	
2	
3	
4	CAN-HIGH (systembus)
5	CAN-RS (systembus), end
6	CAN-LOW (systembus)
7	Dig. input, address 3
8	Dig. input, address 2
9	Dig. input, address 1

7.3 Electrical specification

The electrical data refer to ambient temperature of T_U = 25 °C and operating voltage of UB = 24 V unless differently indicated.

7.3.1 Voltage supply

pin	name	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 mode	21	24	30	V
UB _{max}	overvoltage ECU without function	t < 1 min			36	V
U _{low thr}	undervoltage- deactivation		19	20	21	V
U _{high thr}	overvoltage- deactivation		30	31	32	V
I (UB)	current consumption	no output active no sensor connected		60		mA
I _{max} (UB)	maximum current consumption	incl. all loads			3	A
U _{rev}	reverse battery protection				-30	V

7.3.2 Data interface

CAN systembus

pin	name	remark
X9,4	CANHS	systembus CAN HIGH
X9,5	CANRS	systembus 120 Ω end resistor to be connected to CANLS (directly at the plug)
X9,6	CANLS	systembus CAN LOW

7.3.3 Inputs

7.3.3.1 Switching inputs

pin	name	remark
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

pin	name	remark
X15,3	DW	feeling wing edge
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	DSA	pressure switch OPEN
X18,15	DSZ	pressure switch CLOSED

symbol	definition	condition	min	type	max	unit
U _{in high}	input voltage for HIGH level		0,7			UB
U _{in low}	input voltage for LOW level				0,3	UB
C _i	input capacitance against GND			1		nF
R _i	input resistor against GND			4,7		kΩ

All inputs are to be wired for HIGH active to UB. In non-wired condition the levels are LOW.

7.3.3.2 Address Inputs

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

symbol	definition	condition	min	type	max	unit
R _{pull up}	internal pull-up-resistor			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 non-wired condition the levels are HIGH. Only connection with a short wire (length < 20 cm) directly at the plug is allowed for coding the control.

7.3.3.3 Position sensors

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

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

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

7.3.4 Outputs

7.3.4.1 Reference voltage sensors

pin	name	remark
X18,10	UREF	reference voltage sensors
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}	admissible current	UREF = 15 V			30	mA

7.3.4.2 Solenoid valves

pin	name	remark
X18,4	AUF	valve OPEN
X18,5	ZU	valve CLOSED
X18,6	KL	valve POWERLESS

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

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

7.4 Permissible conditions of use

7.4.1 Environmental conditions

7.4.1.1 Temperature

	min	max	unit	conditions
operating temperature	-40	+70	°C	50 mm distance from parts which influence the air circulation. Min. air speed 0.2 m/s. If this condition cannot be fulfilled, the alternative condition is that the surface temperature of the body must not exceed max. + 70 °C.
storage temperature	-40	+90	°C	

7.4.1.2 Environmental test

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

no.	test	in acc. with	number of test devices	test temp.	conditions
1	function test	-	5	-40 °C +25 °C +70 °C	storage time before measuring: 1 h at least until temperature is balanced
2	dry heat test	DIN IEC 68-2-2 test Bb (status 8.94)	5	+70 °C	test time: 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 +70 °C	30 cycles with 1h at -40 °C and 1h 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/1h OFF. Test concludes with function test at 25 °C

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6	vibration test	IEC-68-2-6, test Fc si- nusoidal (status 6.94)	3 (2 used for reference)	+25 °C	10 cycles in frequency range 5 - 300 Hz deflection ± 11 mm constant (corresponds to 1.1g with 5 Hz and 5g with 11 Hz) f ≥11 Hz: acceleration 5g constant. Test concludes with function test at 25 °C and visual inspection.
7	Shock test	IEC-68-2-27 test Ea (status 8.89)	3	+25 °C	30g /13ms, half sinus, 3 shocks in each 3 axis and each 2 directions. Test concludes with function test at 25 °C and visual inspection.
8	EMC-test	JED 614	1	+25 °C	see 3.2.4 and 3.2.5

7.4.2 Protection grade

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

7.5 Electromagnetic compatibility

7.5.1 Electrical disturbance by conduction

7.5.1.1 Disturbance by the supply lines

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

The ECU is protected against the pulses 1, 2, 3a and 3b with test level IV. The ECU remains at functional status class A. When charged with test pulse 4 (starting process), the ECU may behave like after switching-on.

In case of overvoltage as a consequence of load-dump (test pulse 5) the ECU remains at functional status class A with central load-dump limitation ($UB \leq 58 \text{ V}$ for 0.5 s).

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

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

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7.5.1.2 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.

7.5.2 Interference suppression

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

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

7.5.3 Electromagnetic interference

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

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

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

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

The ECU is certified in accordance with the EEC directive 72/245*95/54/EG with the e1-sign. It has been released under type approval no. e1*72/245*95*54*1231*00 and marked with EEC approval 021231.

e1