



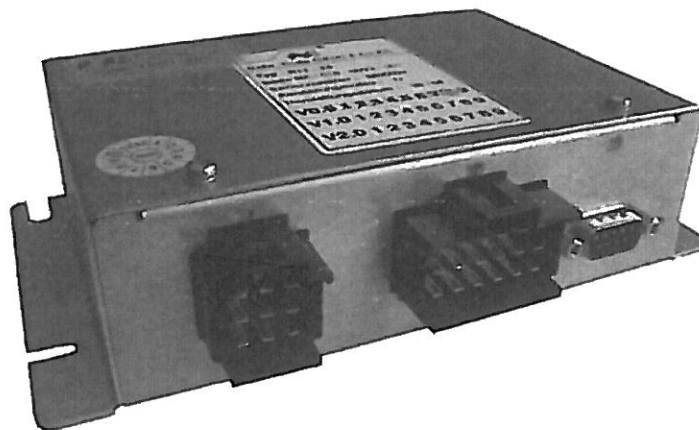
# Door Control Unit

## Technical Documentation

### Door Control Unit B12-24

for

doors with electrical  
drive and potentiometer



**Document: 006-1202-651**

**Issue: 10.06.2009**

**Version: 1.3**

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## Summary of changes

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# 1 System description / operation

**Note:**

The terms "+Ub", "open" and "GND" are used to assign switching states:

- "+Ub" stands for the input or output voltage at the door control unit of +12 V
- "open" stands for a non-connected input
- "GND" stands for an input connected to ground

## 1.1 Complete system

A complete system is made up of one electrically driven door and one or two door controls. In the case of a single-panel door, one door control is required to trigger the drive motor. Two door controls are required for a double-panel door, since each door panel has its own drive motor.

Since the individual door systems have different features (lift locking, sensitive edges, pressure waves), each door control has to be set to the door system it is being used for. This is carried out by respective circuitry of the digital inputs provided.

(see Signals – Inputs)

## 1.2 Door control

The door control has the task of controlling the door system, monitoring and securing it and detecting any faulty functions that may occur. Each door or door panel is fitted with a separate door control.



## 1.2.1 Types of operation

### 1.2.1.1 Normal operation

During normal operation, the door system is operated by the driver's switch-key. When the door closes or is closed, it is opened when the driver's switch-key is pressed. When it opens or is already opened, it is then closed.

When the driver's switch-key is pressed twice within one second, the door is closed. This way, if in the case of a double-panel door the panels should be triggered differently by mistake, one closing process can be initiated for both panels.

When the driver's switch-key is actuated to close the door and is kept pressed for longer than one second, the closing process takes place with increased closing force. This means that the obstacle detection through the motor current becomes less sensitive. This has no influence on the obstacle detection by means of time / path monitoring, sensitive edges, pressure waves or lift reversing switches.

When the driver's switch-key is kept pressed for more than 10 seconds, the door control is reset and automatically readapted to the voltage values of the potentiometer.

If the door control is not configured to the moving distance of the door, the digital output for the entry lighting is used to indicate potentiometer voltage.

(see Signals – Outputs)

### 1.2.1.2 Emergency release

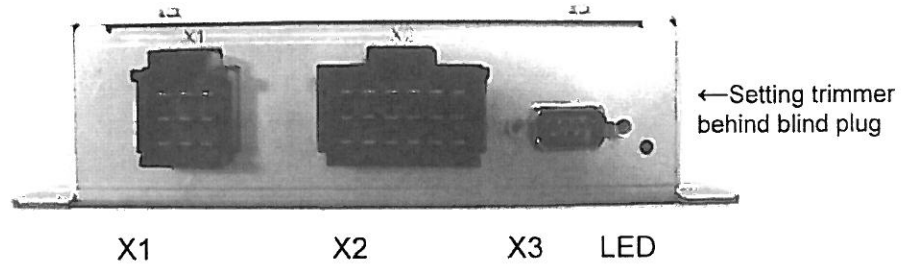
In the case of a door that has been released manually in an emergency, it is no longer possible to trigger the drive motor. The motor is stopped and the door mechanically decoupled, so that the door or the door panel can be moved by hand.

The driver's switch-key is without function and the entry lights and function display signalize the emergency release by flashing at 0.5 Hz.

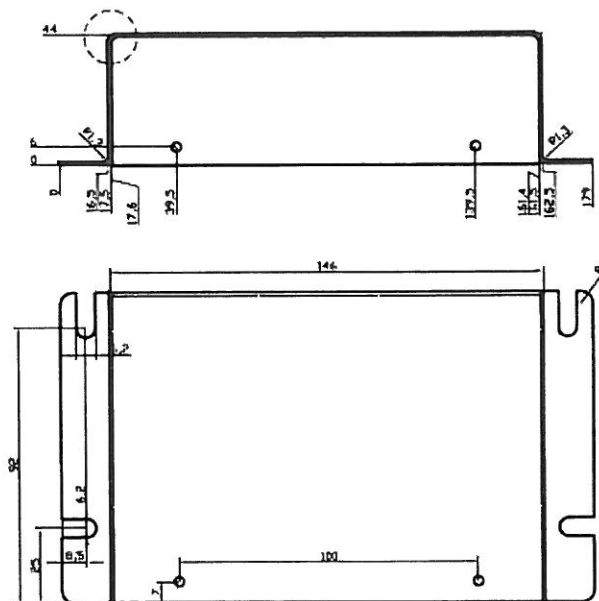
## 1.2.2 Program memory

The program memory (Flash) is continually checked during program execution. If a fault is found in this memory, the door is no longer triggered and the door control indicates a fault. The system must be put out of operation.

### 1.2.3 Housing



A pin assignment plan can be found at the end of the document.



#### 1.2.3.1 LED

A yellow LED in the housing, located next to the 9-pin Sub-D plug for diagnosis, flashes at 1 Hz when the door control is switched on and working correctly.







## 2.1 Obstacle detection

The door system is fitted with three independent safety devices for limiting jamming forces. These are described below.

### 2.1.1 Monitoring of motor current

The door control measures the motor current during every controlled door motion. The current is stored depending on the position and direction of motion. After every door motion, a reversing threshold is calculated from the previous door motions. If the reversing threshold is exceeded for a certain time, the door control unit detects an obstacle.

The behaviour of the door system when an obstacle is detected is described later.

The first closing and opening processes after the door control has been switched on are carried out with a high reversing threshold, since the door control has to recalculate the reversing thresholds and adapt them to the existing door system.

### 2.1.2 Time / path monitoring

When a door is activated, the motion is monitored by means of the potentiometer. If door motion is not detected for a certain time, the door control registers an obstacle.

The behaviour of the door system when an obstacle is detected is described later.

### 2.1.3 Sensitive edges, pressure waves or lift reversing switches

If the door system is fitted with electrical sensitive edge or pressure waves, the door control detects an obstacle when a sensitive edge / pressure wave has been actuated (finger protection rubber intended).

If a door has a lift locking feature and is already lifted before locking while closing, the door control also detects an obstacle.

The behaviour of the door system when an obstacle is detected is described later.



## 2.2 Reversing behaviour with obstacle detection

### 2.2.1 Obstacle in the direction of opening

When an obstacle is detected in the direction of opening, the door stops for two seconds and is then activated again in the direction of opening. If an obstacle is detected five times in succession during an opening process, the door stops completely and a fault is indicated by the functional display flashing at 5 Hz. The fault can be reset by pressing the driver's switch-key.

### 2.2.2 Obstacle in closing direction

If an obstacle is detected in the closing direction, the door opens or both door panels open completely. The driver's switch-key has to be pressed to close them again. If the door control unit has detected an obstacle in five successive closing attempts, a fault is indicated by the functional display flashing at 5 Hz. The fault can be reset by pressing the driver's switch-key.



## 3 Input signals

### 3.1 Standstill

The door control uses this input to inquire the vehicle status (motion, standstill). When this input is activated, the door control can trigger the motor bridge in the opening direction. In addition, the input has to be activated for the door to be able to be opened using the driver's switch-key. If there is no standstill (in connection with C3 signal) the door is closed. (see safety concept)

Standstill given  $\Rightarrow$  Input X2:1 = +Ub

### 3.2 Driver's switch-key

The door control uses this input to inquire the actuation of the driver's switch-key.

The driver's switch-key works as a toggle switch. When the door closes or is closed, it is opened when the driver's switch-key is pressed. When it opens or is already opened, it is then closed.

When the driver's switch-key is pressed twice within one second, the door is closed. This way, if in the case of a double-panel door the panels should be triggered differently by mistake, one closing process can be initiated for both panels.

When the driver's switch-key is actuated to close the door and is kept pressed for longer than one second, the closing process takes place with increased closing force. This means that the obstacle detection through the motor current becomes less sensitive. This has no influence on the obstacle detection by means of time / path monitoring, sensitive edges, pressure waves or lift reversing switches.

When the driver's switch-key is kept pressed for more than 10 seconds, the door control is reset and automatically adapted to the voltage values of the potentiometer.

Driver's switch-key actuated  $\Rightarrow$  Input X2:3 = +Ub



### 3.3 Opening suppression

When this input is activated, the opening suppression function is active. In this case the door cannot be opened even if the vehicle is at a standstill and the driver's switch-key has been pressed.

Opening suppression active  $\Rightarrow$  Input X2:4 = +Ub

### 3.4 Door lifted (lift reversing switch)

This input is only relevant for doors with lift locking.

The door control is informed that the door is lifted via this input. The signal is necessary for the correct detection of a closed door. In addition, this signal is used to detect an obstacle in the closing direction if the door should be lifted prematurely during locking in the event of it meeting an obstacle.

Door lifted  $\Rightarrow$  Input X2:5 = +Ub

### 3.5 Emergency released

The door control evaluates emergency release via this input. If the door is released manually, a switch is actuated at the same time, via which this input is inquired.

Emergency released  $\Rightarrow$  Input X2:6 = +Ub

### 3.6 Entry lighting

The door control inquires via this input whether the entry lighting is to be activated. The corresponding output X2:2 is activated when the input described here is activated and the door is not closed.

Entry lighting on  $\Rightarrow$  Input X2:7 = +Ub

### 3.7 Pressure waves(s) actuated

This input is only relevant for doors with pressure waves.

The door control evaluates the signals of the pressure waves via this input.

Pressure wave(s) actuated  $\Rightarrow$  Input X2:8 = +Ub



### 3.8 Reversing requirement

This input is only relevant for two-panel doors.

The door control detects the reversing requirement of a further door control via this input. With a two-panel door system, each door panel is controlled by a separate door control. If an obstacle is detected at only one of the door panels during the closing process, the door control of the other door panel detects an obstacle as well via this input. This has the effect of initiating reversal for both door panels and the motion remains synchronous.

Reversing requirement set  $\Rightarrow$  Input X2:9 = +Ub

### 3.9 Pressure waves available

This input serves to adapt the door control to different door types. If the door has pressure waves available, this input must be activated.

Pressure waves available  $\Rightarrow$  Input X2:11 = +Ub

### 3.10 Sensitive edges available

This input serves to adapt the door control to different door types. If the door has sensitive edges available, this input must be activated.

The input is activated as standard through the internal door control circuitry. The input has to be set to ground to be deactivated.

Sensitive edges available  $\Rightarrow$  Input X2:12 = GND

Sensitive edges not available  $\Rightarrow$  Input X2:12 = +Ub (*default*)

### 3.11 Lift locking available

This input serves to adapt the door control to different door types. If the door has lift locking available, this input must be activated.

The input is activated as standard through the internal door control circuitry. The input has to be set to ground to be deactivated.

Lift locking available  $\Rightarrow$  Input X2:13 = GND

Lift locking not available  $\Rightarrow$  Input X2:13 = +Ub (*default*)



### 3.12 Speedometer signal (C3 signal)

The current status (speed) of the vehicle is determined via input X2:17.

The signal is evaluated in connection with the standstill signal X2:1. Standstill is detected via the C3 signal if the signal is low for longer than 0.5s.

Standstill via C3  $\Rightarrow$  Input X2:17 = 0V

### 3.13 Path sensor (potentiometer)

The door system is fitted with a potentiometer for evaluation of the current door position.

The potentiometer works with a quiescent current which diagnoses a break in the wire. Supply voltage is directly through door control (X2:18 = 12V).

Voltage	Evaluation
0V - 0.5V	Fault
0.5V - 12V	OK

The current door position is determined via an analogue input. The potentiometer provides a voltage value according to the current door position.

Potentiometer signal  $\Rightarrow$  Input X2:14 = 0V – 12V

Note:

If the potentiometer is not adjusted during door travel, it must be set so that the door control unit determines a voltage value of 1V – 2V when the door is closed. The entry lighting (see chapter 4.2) provides help in setting the potentiometer.



### 3.14 Electrical sensitive edges

These inputs are only relevant for doors with sensitive edges.

The sensitive edges work with a quiescent current which diagnoses a break in the wire. Supply voltage is directly through door control (X2:18 = 12V).

Voltage	Evaluation
0V - 0.5V	Fault
0.5V - 9V	OK, not activated
9V - 12V	OK, activated

#### 3.14.1 Sensitive edge 1

This input evaluates the analogue signal of sensitive edge 1.

Sensitive edge 1 signal  $\Rightarrow$  Input X2:15 = 0V – 12V

#### 3.14.2 Sensitive edge 2

This input evaluates the analogue signal of sensitive edge 2.

Sensitive edge 2 signal  $\Rightarrow$  Input X2:16 = 0V – 12V





## 4 Outputs

The door control has four power outputs and one motor connection.

### 4.1 Motor connection

A door drive motor can be connected to the door control. The current voltage being used to trigger the motor is determined on the basis of the current door position. The direction of the triggering is a result of the output polarity.

Motor  $\Rightarrow$  Output X1:1

Motor  $\Rightarrow$  Output X1:4

### 4.2 Entry lighting

The output is used to trigger the entry lighting. It is activated in normal operation if input X2:7 (requirement entry lighting) is activated and the door is not closed.

In the case of emergency release, the output is triggered flashing at 0.5 Hz.

If the door control is not configured to the moving distance of the door, this output is used to indicate potentiometer voltage. When the door is completely opened, the output is triggered flashing at 5 Hz, if the door is in an intermediate position, the output is triggered at 2 Hz. If the potentiometer voltage is within the final position range of a closed door, the output is switched on statically. If the potentiometer voltage falls below the minimum value, the output is switched off.

Entry lighting switched on  $\Rightarrow$  Output X1:2 = +Ub

### 4.3 Kneeling function

This output is activated when the door is triggered in the opening direction or is completely opened. It is used to activate the kneeling function.

Switch on kneeling function  $\Rightarrow$  Output X1:3 = +Ub



#### 4.4 Function display

This output is used to trigger a function display (e.g. switch-key lighting).

In the case of emergency release, the output is triggered flashing at 0.5 Hz.

If a fault occurs, the output is triggered flashing at 5 Hz.

Function display switched on  $\Rightarrow$  Output X1:5 = +Ub

#### 4.5 Reversing requirement

This output is activated for one second if the door control has detected an obstacle during closing and the door was reversed to the opening direction. With a double-panel door, this output serves to synchronise both door panels.

Set reversing requirement  $\Rightarrow$  Output X1:6 = +Ub



## 5 Service interface

The door control unit has a service interface (plug X3) which is a serial RS232 interface. Almost any standard PC can be connected to this. This interface can be used to transmit programming data and for communication with the Bode diagnosis program.

### 5.1 Programming

The door control door software is stored in a programmable memory (Flash). New software can be loaded into the door control via the service interface using the Bode diagnosis program. A special connection cable is necessary for this.

### 5.2 Diagnosis

The door system can be diagnosed using the Bode diagnosis program *HARDI*. For this, data are exchanged with the door control via the service interface.

The functional description of the Bode diagnosis program is in a separate document.

## 6 Pin assignment

Plug X1 (outputs and voltage supply)

Pin	Function / Remarks
X1:1	Output door drive motor
X1:2	Output entry lighting
X1:3	Output kneeling function
X1:4	Output door drive motor
X1:5	Output function display
X1:6	Output reversing requirement
X1:7	+12V voltage supply
X1:8	GND voltage supply
X1:9	GND voltage supply

Plug X2 (inputs and path sensor supply)

Pin	Function / Remarks
X2:1	Input standstill
X2:2	GND supply sensor
X2:3	Input driver's switch-key
X2:4	Input opening suppression
X2:5	Input door lifted
X2:6	Input door emergency released
X2:7	Input entry lighting
X2:8	Input signal pressure wave(s)
X2:9	Input reversing requirement
X2:10	-
X2:11	Input pressure waves available
X2:12	Input sensitive edges available
X2:13	Input lifting lock available
X2:14	Input signal path sensor / 0V – 12V
X2:15	Input signal sensitive edge 1 / 0V – 12V
X2:16	Input signal sensitive edge 2 / 0V – 12V
X2:17	Speedometer signal / C3 signal
X2:18	+12V supply sensor

## 7 Technical data

### Operating voltage

#### Door control

006-1203-301 (12 Volt) 8.4V – 15 V

006-2403-301 (24 Volt) 16.8V – 30V

Max. permanent current 13A

Polarity safeguard, excess voltage protection

Output load capacity

Max. output current: 1A

Path sensor/sensitive edge supply

#### Door control

006-1203-301 (12 Volt) dep. on operating voltage

006-2403-301 (24 Volt) 15V +/- 5% max. 0.06A

Input current digital inputs

(valid from HW index A)

Door control Input / current	006-1203-301 (12 Volt)		006-2403-301 (24 Volt)	
	typical	for a short time	typical	for a short time
X2:1	5mA	19mA	5.5mA	39mA
X2:3	14mA	19mA	26mA	53mA
X2:4	5mA	19mA	5.5mA	39mA
X2:5	14mA	19mA	26mA	53mA
X2:6	5mA	19mA	5.5mA	39mA
X2:7	5mA	19mA	5.5mA	39mA
X2:8	14mA	19mA	26mA	53mA
X2:9	14mA	19mA	26mA	53mA
X2:10	5mA	19mA	5.5mA	39mA
X2:11	5mA	19mA	5.5mA	39mA

Climatic environmental conditions

Operating temperature range -40...+70°C

Upper operating temperature 8h at +70 °C  
acc. to IEC 68-2-2

Lower operating temperature 4h at -40 °C  
acc. to IEC 68-2-1

## 8 Fault messages

No.	Fault text (always in English!)	Reason for fault
1	<i>Memory error</i>	When the door control was switched on, a fault was established in the RAM or there is a fault in the ROM (Flash). (Replace control)
2	<i>No motion detected</i>	After the door drive motor was triggered no door motion was detected.
3	<i>Value of potentiometer too low</i>	The read-in voltage value of the potentiometer (path sensor) has fallen short of the minimum value.
4	<i>Supply voltage too high</i>	The supply voltage has exceeded the maximum value of 15 Volt.
5	<i>Supply voltage too low</i>	The supply voltage has fallen short of the minimum value of 8.9 Volt.
6	<i>Short circuit / overload at a digital output</i>	A short circuit has been detected at a digital output.
7	<i>Resistance at a digital output too high (broken)</i>	An interruption has been detected at a digital output. (Load resistance > approx. 10k $\Omega$ )
8	<i>Closing trials exceeded</i>	The prescribed number of closing trials has been exceeded.
9	<i>Opening trials exceeded</i>	The prescribed number of opening trials has been exceeded.
10	<i>Error sensitive edge 1</i>	The voltage value for sensitive edge 1 is lower than 0.5 Volt (interruption) or the sensitive edge is activated continually (15s).
11	<i>Error sensitive edge 2</i>	The voltage value for sensitive edge 2 is lower than 0.5 Volt (interruption) or the sensitive edge is activated continually (15s).

