



Test Instructions

for VARIO-C Wiring System with "7-way [24N] - ISO 7638" Supply

with

ABS-Test Unit 446 007 001 0

VARIO-C Adaptor 446 007 320 0

and ABS-Trailer Test Unit

446 007 005 0



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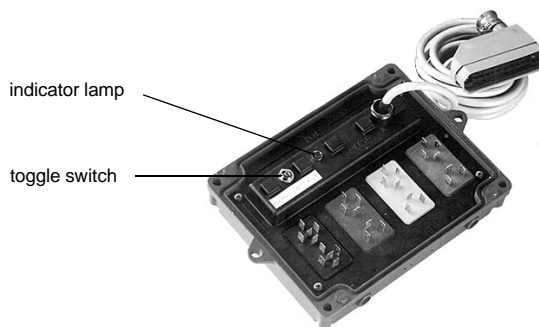
ABS-Test Units

Parts required:

ABS - Test Unit	446 007 001 0
ABS - Trailer Test Unit (1)	446 007 005 0
ABS - VARIO-C-Adaptor	446 007 320 0
ABS - Coiled Cable	446 008 230 0
ABS - Adaptor (2)	446 007 313 0
ABS - Test Cable (4)	446 007 236 0
Battery Cable (3)	884 900 130 0



ABS - Test Unit



ABS - VARIO C - Adaptor

Preparatory Measures:

1. Connect ABS Test Unit to ABS VARIO-C Adaptor.
2. Connect ABS Adaptor to the trailer to be tested, using the vehicle, 7-way [24N] Cable or ABS Test Cable and the Trailer Test Unit.
3. Connect the ABS Adaptor to a motor vehicle or to a charged 24-volt battery using the Battery Cable.

Caution: Ensure correct polarity !

4. Connect the modulator and sensor plugs (red, yellow and blue) to their respective plates on the VARIO-C Adaptor.
5. Connect the power supply plug (white) to the base-plate on the VARIO-C Adaptor.
6. The red lamp on the VARIO-C Adaptor should be **OFF** prior to commencement of test procedure. This lamp is controlled by the toggle switch adjacent to it.

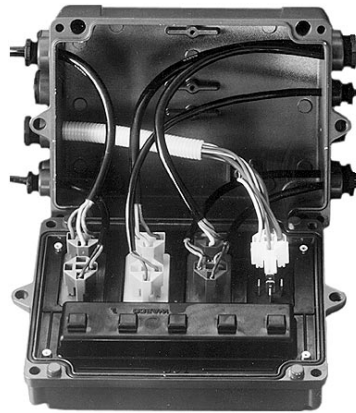
Note:

Some of the test steps in this procedure feature a permitted range of values to allow for the following variables:

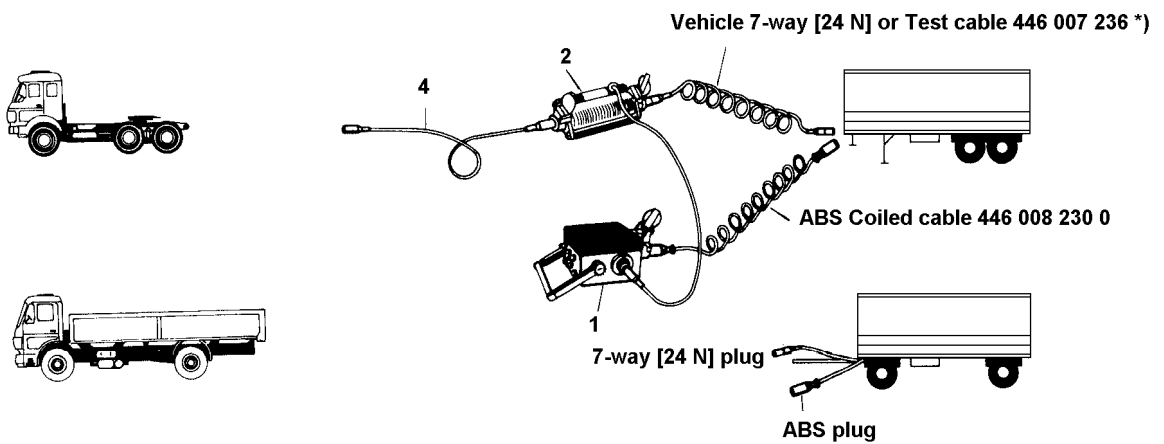
1. Supply voltage (level of battery charge)
2. Imperfect battery connections
3. Effect of other components on the vehicle
4. Temperature

Power Supply Options for Trailer Test Unit

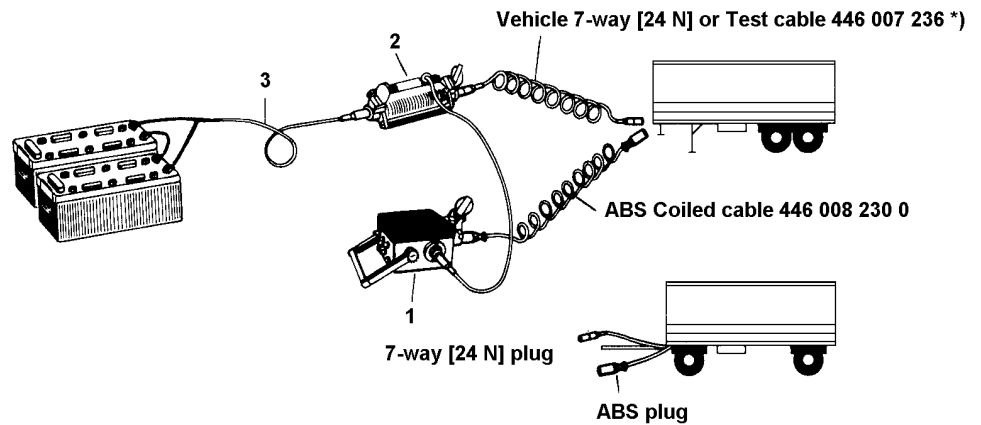
ABS-VARIO-C Electronic Control Unit (ECU)



Option A: Power supply from vehicle



Option B: Power supply from battery



*) Only necessary if stop light or mixed power supply in used.

Test Step "Test"

Test Unit check when using Vehicle power supply:

Display check.

Actions required prior to test:

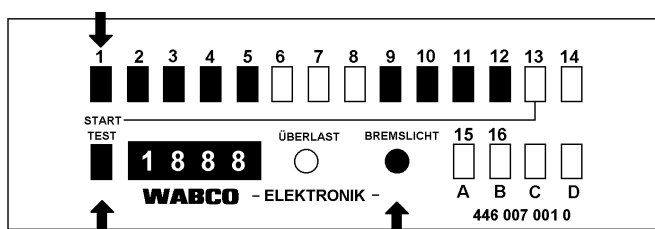
- Vehicle ignition on, engine OFF.
- Connect compressed air braking system of motor vehicle to that of trailer.
- Switch on tail lamp to power Test Unit.

How to test:

Press Push-Buttons "1" and "TEST" on Test Unit.

Display reading:

When Push-Buttons "TEST" is pressed, the Test Unit must display 1 8 8 8 .
The "**BREMSLICHT**" lamp on the Test Unit is on permanently. Supply via Contact 1 on ABS plug (ISO-7638) or Contact 54 (7-way [24 N] plug).



Test Unit check when using Battery power supply:

Display check.

How to test:

Press Push-Buttons "1" and "TEST" on Test Unit.

Display reading:

When Push-Buttons "TEST" is pressed, the Test Unit must display 1 8 8 8 .
The "**BREMSLICHT**" lamp on the Test Unit is on permanently. Supply via Contact 1 on ABS plug (ISO-7638) or Contact 54 (7-way [24 N] plug).

Fault:

no display

Possible causes:

- break in supply voltage
- insufficient battery charge
- Contact 1 and/or Contact 4 of white supply plug not wired or cross-wired

Notes:

- The "**BREMSLICHT**" lamp will be on permanently during testing.
- "Trailer-warning light" referred to in this test procedure is the lamp mounted on the front of the trailer (usually green).

Test Step No."1"

(STOPLIGHT Power via 7-way [24 N] plug or mixed supply)

Actions required prior to test: Connect white supply plug to the white base plate on VARIO-C Adaptor. Plug remains connected during the entire check. If power is supplied from the motor vehicle ACTUATE BRAKES.

What is being tested: Power supply via 7-way [24 N] plug. (STOPLIGHT)

How to test: Press Push-Button "1" on Test Unit.

What is being measured: The WARNING Light EXTERNAL CONNECTION is fed to the STOP-LIGHT Circuit earth (Contact 31) via a precision resistor. The current passing through this precision resistor is measured.

Current supply: The Test Unit power is supplied via the 7-way [24 N] plug.

Display reading: Trailer warning light ON! and current in mA:

Good: **0 6 0** to **1 5 0** (if rating of trailer warning light 2 W)

or

1 5 0 to **3 1 5** (if rating of trailer warning light 5 W)

or

3 1 5 to **6 3 0** (if rating of trailer warning light 10 W)

Note: The different readings are the result of the nominal value of the Trailer warning light used.

Fault:

Possible cause:

1. **0 0 0** to **0 0 3**

Trailer warning light connected directly to Contact 4 of supply plug (**base plate BK**) or stoplight earth (Contact 31).

2. **1 5 1** to **2 5 0** [2 W]

Contact 3 is not connected.

or

3 1 6 to **4 1 5** [5 W]

or

6 3 1 to **7 3 0** [10 W]

3. **7 3 1** to **1 9 9 9**

Contact 5 is connected to Contact 1 or Contact 2 (**base plate BK**).

or display dark.

4. Trailer warning light **OFF!**

Trailer warning light defective or wiring defective.

Test Step No. "1 / 1.1"

(Plug Connection to ISO-7638) or mixed supply

- Actions required prior to test:** **Remove 7-way [24 N] cable, if used.**
Connect **ABS Trailer Test Unit** to the trailer using the ABS coiled cable.
All plugs remain connected during this test step.
- What is being tested:** Correct polarity of Contact 5 on ISO plug.
- How to test:** Push-Button "1" on Test Unit remains depressed.
- What is being measured:** Contact 5 (ISO plug) is earthed at Contact 4 (ISO plug) via a precision resistor. The current passing through this precision resistor is measured.
- Current supply:** The Test Units are powered via Contact 1 of ISO plug.

Display reading: **Trailer warning light and warning light on trailer Test Unit ON !**
Current in mA:

- Good** **0 2 0** to **0 6 0** without external trailer warning light
or
0 8 0 to **1 8 0** (if rating of trailer warning light 2 W)
or
1 7 0 to **3 6 0** (if rating of trailer warning light 5 W)
or
3 2 0 to **6 6 0** (if rating of trailer warning light 10 W)

Fault:

Possible cause:

1. WARNING Light on trailer Test Unit **off**. Contact 5 of ISO plug not led or line disconnected.
2. **0 6 1** to **1 5 0** [—] Contact 3 not connected.
or
1 8 1 to **2 7 0** [2 W]
or
3 6 1 to **4 4 0** [5 W]
or
6 6 1 to **7 4 0** [10 W]

Test Step No. "1.1"

(Plug Connection to ISO-7638) or mixed supply

Display: After Push-Button "1.1" on the trailer Test Unit has been pressed, the "SILA" lamp must go OFF !

The display should now read:

0 0 0 to **0 0 3** without external trailer warning light

or

0 6 0 to **1 2 0** (if rating of trailer warning light 2 W)

or

1 5 0 to **3 0 0** (if rating of trailer warning light 5 W)

or

3 0 0 to **6 0 0** (if rating of trailer warning light 10 W)

Test Step No. "2"

(Plug Connection to ISO-7638)

Actions required prior to test: All plugs remain connected during this test step.

What is being tested: Voltage at Contact 1 of **BK**.

How to test: Press Push-Button "2" on Test Unit.

What is being measured: Voltage at Contact 1 of ISO plug.

Current supply: The Test Units are powered via Contact 1 of ISO plug.

Display reading: Voltage in V:

Good: **2 0.2** to **2 7.4** also: trailer warning light and warning light on trailer Test Unit must both be **OFF** !

Fault:

Possible cause:

1. **0 0.0** to **2 0.1**

Insufficient battery charge.

2. Both warning lights ON

Contact 5 of ISO is connected to Contact 4 of ISO.

Test Step No. "3" : is not required

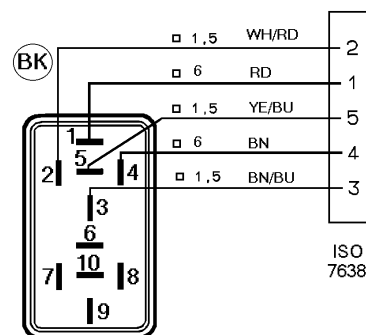
Test Step No. "4"

(Wiring of BK 3)

- Actions required prior to test:** All plugs remain connected during this test step.
- What is being tested:** Wiring of Contact 3 of the white supply plug.
- How to test:** Press Push-Button "4" on Test Unit.
- Current supply:** The Test Units are powered via Contact 1 of ISO plug.

Display reading: Voltage in V:

Good: **0 4.5** to **0 7.0** also: trailer warning light and light on trailer Test Unit must both be **ON!**



Fault:

1. **1 0.0** to **1 5.0**

2. **1 5.1** to **2 3.0**

Possible cause:

Contact 3 is not connected to earth (Contact 4).

Contact 3 is connected to Contact 1 or Contact 2.

Test Steps No. "5", "6.1" and "6.2" : are not required

Test Step No. "6.3"

(for vehicles used for the transportation of dangerous goods)

What is being tested: Use a test lamp to check if the vehicle's chassis is connected to the battery's positive or negative pole.

Result: **Test lamp must not light up.**

Fault:

Test lamp lights up

Possible cause:

Vehicle chassis is connected to battery's positive or negative pole.

Test Step No. "6"

(Modulator Coil Resistance)

Actions required prior to test: All plugs remain connected during this test step.

What is being tested: The parallel resistance of the inlet and outlet valve-coils. Each ABS relay valve is tested individually.

How to test: Press Push-Button "6" on Test Unit. Separately press one of the Single Wheel Buttons "A", "B" or "C" .

Current supply: The Test Units are powered via Contact 1 of ISO plug.

Display reading: Resistance in Ω :

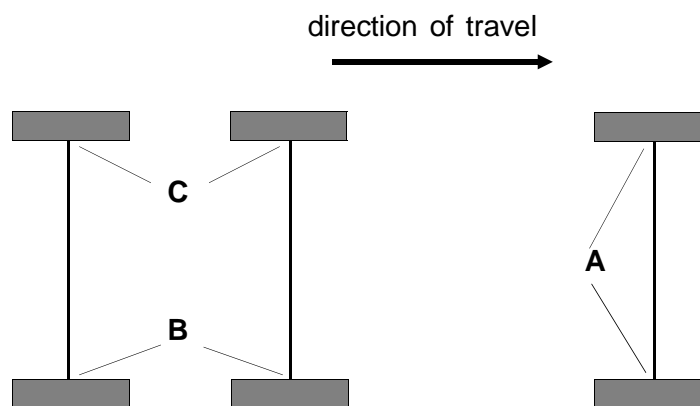
Good: **5.0** to **1 1.0** measured values (MV)

1 . indicates connections not wired (open circuit)

Variants / Buttons	A	B	C
6S / 3M	MV	MV	MV
4S / 3M	MV	MV	MV
4S / 2M	1 .	MV	MV
2S / 2M	1 .	MV	MV
2S / 1M	MV	1 .	1 .

Push-Button allocation to wheels: **Modulators A, B and C**

For example: 3 axle drawbar - trailer



Note: For 3 axle semi - trailers the steerable axle will be controlled by modulator A. If liftable axles are fitted, different configurations may occur.

Test Step No. "7"

(Sensor Coil Resistance)

Actions required prior to test: All plugs remain connected during this test step.
Actuate switch on the ABS VARIO-C Adaptor so that the red indicator diode (LED) is OFF!

What is being tested: The coil resistance of the sensors and their respective wiring.

How to test: With push-button "7" depressed, individual sensors are tested buttons "A", "B", "C" and "D".

Current supply: The Test Units are powered via Contact 1 of ISO plug.

Display reading: Resistance in k Ω (MV)

1.37 to **1.99** (MV means measurement value)

1. indicates connections not wired (open circuit)

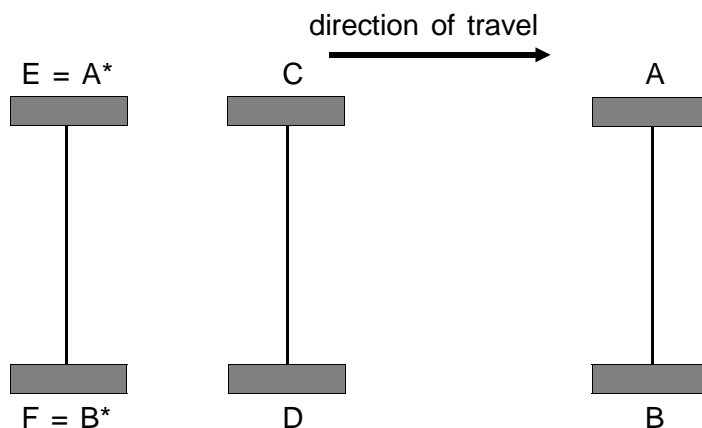
Variants / Buttons	A	B	C	D	E = A*	F = B*
6S / 3M	MV	MV	MV	MV	MV	MV
4S / 3M	MV	MV	MV	MV	1.	1.
4S / 2M	1.	1.	MV	MV	MV	MV
2S / 2M	1.	1.	MV	MV	1.	1.
2S / 1M	MV	MV	1.	1.	1.	1.

A* → Push-Button "A" on Test Unit and Adaptor indicator lamp ON: Sensor E is measured.

B* → Push-Button "B" on Test Unit and Adaptor indicator lamp ON: Sensor F is measured.

Push-Button allocation to wheels: Sensors A, B, C, D, E and F

For example: 3 axle drawbar - trailer



Note: see note on page 9

Test Step No."8"

(Sensor -Earth Resistance)

Actions required prior to test: All plugs remain connected during this test step.
 Actuate switch on the ABS VARIO-C Adaptor so that the red indicator diode (LED) is OFF!

Establish connection between chassis and battery's negative pole.

What is being tested: The contact resistance of the sensors coil and the wiring to vehicle earth.

How to test: With push-button "8" depressed, individual sensors are tested buttons "A", "B", "C" and "D".

Current supply: The Test Units are powered via Contact 1 of ISO plug.

Display reading: Resistance in k Ω (MV):

3 0. to **1 .** (MV means measurement value)

1 . indicates connections not wired

Variants / Buttons	A	B	C	D	E = A*	F = B*
6S / 3M	MV	MV	MV	MV	MV	MV
4S / 3M	MV	MV	MV	MV	1 .	1 .
4S / 2M	1 .	1 .	MV	MV	MV	MV
2S / 2M	1 .	1 .	MV	MV	1 .	1 .
2S / 1M	MV	MV	1 .	1 .	1 .	1 .

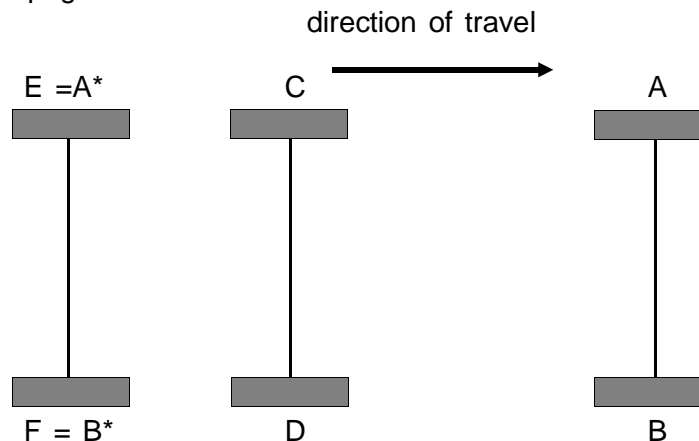
A* → Push-Button "A" on Test Unit and Adaptor indicator lamp ON: Sensor E is measured.

B* → Push-Button "B" on Test Unit and Adaptor indicator lamp ON: Sensor F is measured.

Push-Button allocation to wheels: Sensors A, B, C, D, E and F

For example: 3-axle drawbar - trailer

Semi-trailer: see note on page 9



Disconnect the wiring between chassis and battery negative pole after this Test Step !

Test Step No. "11 / 11.1" (Plug Connection to ISO 7638 only)

Test Step No. "9" and "10" : are not required

- Actions required prior to test:** All plugs remain connected during this test step.
- What is being tested:** Correct wiring of Contacts 1 and 2 of ISO plug connection. A precision resistor is fitted upstream of Contact 2 (ISO plug) for the purpose of this test.
- How to test:** Press Push-Button "11" on Test Unit and Push-Button "11.1" on trailer Test Unit.
- Current supply:** The Test Units are powered via Contact 1 of ISO plug.

Display reading: Voltage in V:

Good:

ISO

1 0.0

to

1 7.0

mixed &
7-way plug

2 0.2

to

2 7.4

Fault:

1. "BREMSLICHT" lamp goes off or display is blank

Possible cause:

Contacts 1 and 2 of ISO plug (7638) are reversed.

2. **0 0.0** to **0 0.3**

Contact 2 not connected to white power supply plug on **base plate BK**.

Test Step No. "12" : is not required

Test Step No. "13"

(Valve cycling test)

Actions required prior to test: No faults indicated in Test Steps No. "1" to "11 / 11.1".
All plugs remain connected during this test step.
Reservoir pressure must be at cut-off value of the braking system.
When using a motor vehicle, apply the brakes !

What is being tested: Correct functioning of the modulator inlet and outlet valves (cycling test) and correct axle allocation.

How to test: a) on the trailer: — with a pressure gauge on each brake chamber
— or with rolling-road having individual wheel drive

b) on the Test Unit: Press Push-Button "13" plus
— Button "A" for Modulator **[A]**
— Button "B" for Modulator **[B]**
— Button "C" for Modulator **[C]**

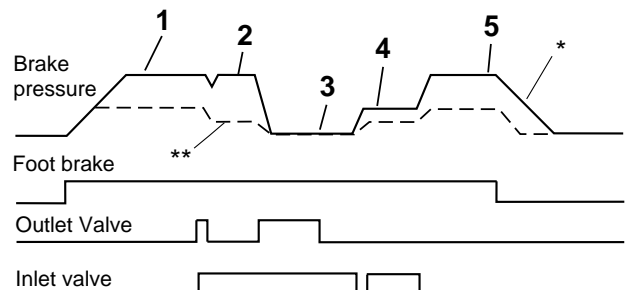
Start pulse programme by pressing Push-Button "START". During pulse programme observe correct axle allocation !
During the entire Test Step No. "13" there must not be venting noises > 1 second.

Current supply: The Test Unit is powered via Contact 1 of ISO plug.

Pulse-program operating sequence: * Pressure distribution for VARIO-C equipment without Load Sensing Valve and equipment with Load Sensing Valve - position "Full Load"
** Pressure distribution with Load Sensing Valve - position "Empty"

Pressure gauge:

1. Max. brake pressure, holding phase
2. Pressure decrease, holding phase
3. Pressure decrease to 0 bar, holding phase
4. Pressure increase, holding phase
5. Pressure increase to brake pressure



Display reading:

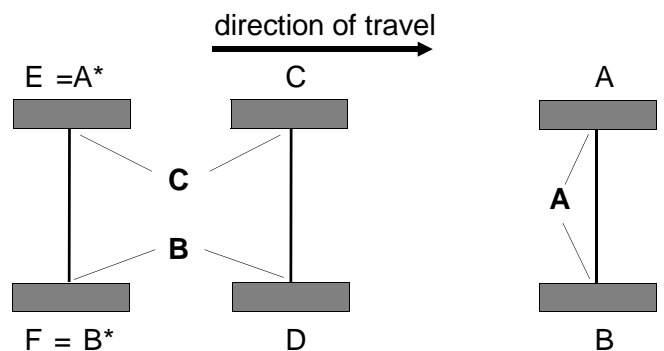
before starting **0 0 0** to **0 0 3**

after pressing Push-Button "START" **1**

at the end of valve cycle: **0 0 0** to **0 0 3**

Push-Button allocation to wheels:

Modulatoren A, B and C Sensoren A, B, C, D, E and F



For example: 3 axle drawbar - trailer

Note: see note on page 9

Test Step No. "14"

Actions required prior to test: No faults indicated in Test Steps No. "1" to "13".
Rolling-road with individual wheel drive or wheel-jack
All plugs remain connected during this test step.

What is being tested: Sensor output voltage and correct location of sensor / wheel.

How to test: With push-button "14" on Test Unit depressed, sensors are individually checked using buttons "A", "B", "C" and "D".
Rotate only the wheel selected (at no more than 5 km/h or 0.5 rev/s).

Current supply: The Test Units are powered via Contact 1 of ISO plug.

Display reading: Sensor voltage in mV:

1 0 0 to **1 9 9 9** (MV means measurement value)

Higher voltages change the display to **1**

0 0 0 indicates connections not wired.

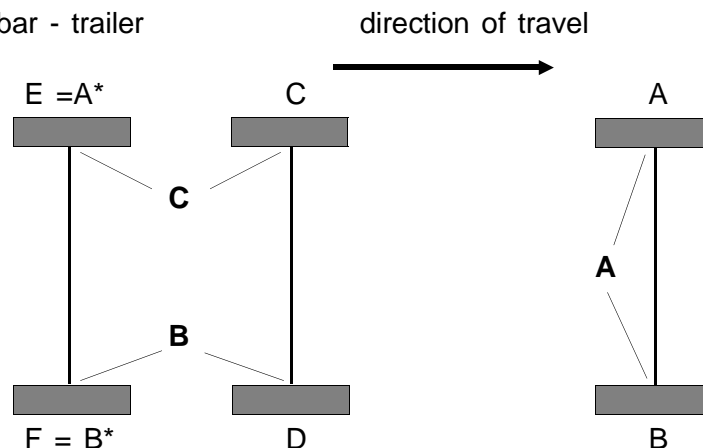
Variants / Buttons	A	B	C	D	E = A*	F = B*
6S / 3M	MV	MV	MV	MV	MV	MV
4S / 3M	MV	MV	MV	MV	000	000
4S / 2M	000	000	MV	MV	MV	MV
2S / 2M	000	000	MV	MV	000	000
2S / 1M	MV	MV	000	000	000	000

A* → Push-Button "A" on Test Unit and Adaptor indicator lamp ON: Sensor E is measured.

B* → Push-Button "B" on Test Unit and Adaptor indicator lamp ON: Sensor F is measured.

Push-Button allocation to wheels: **Modulatoren A, B and C**
Sensoren A, B, C, D, E and F

For example: 3 axle drawbar - trailer



Semi-trailer: see note on page 9

Operation of Blinkcode

Use of the Blinkcodes requires some system knowledge. The major points are as follows:

The Blinkcode cannot be used to verify the correct location of sensors and modulators following the initial installation !

Reason:

The electronic control unit (ECU) can check sensors and modulators for their electrical function but not for their correct corresponding location.

Example:

The left rear sensor has been wired accidentally so its signal reaches one of the ECU inputs that controls the right rear modulator.

The test procedure therefore must be done with the test unit 446 007 001 0 and adaptor 446 007 320 0 or the Diagnostic Controller 446 300 320 0.

Error storage:

The error messages for the VARIO-C ECU will remain stored in memory, even if there is no power supplied to the ECU.

What's a general application ?

The ECU will, as soon as it is turned on, check the sensors and modulators circuits.

The test is performed approximately 250 times per second (also for ABS controlled braking). If the test checks out o.k., the Warning Light goes OFF when the vehicle speed reaches about 5 miles/h.

If the ECU recognizes the existence of a non valid condition: i. e. "red" sensors connected but "red" modulator is missing, the light stays ON.

The ECU recognizes only accepted variations of the electrical layout and it will consider all other variations as errors.

When the ECU finds a permissible configuration it "remembers" the condition (until the unit is turned off) and registers each particular peripheral error – as it occurs.

A non acceptable configuration is caused if sensor **or** modulator lines are disconnected or interrupted while the ECU unit is turned off. The ECU will, due to safety reasons, assume the default setting of a 6 sensors / 3 modulators (6S/3M) system as soon as it turned on.

Operation of Blinkcode

Error storage

The ECU has two error buffers

- a) temporary buffer (comparable to a note pad)
- b) non-volatile buffer (comparable to a drawer panel)

Each error is first written to the buffer. If the vehicle is driven during a failure occurrence (and the Warning Light is OFF), the entry in the temporary buffer will cause the following:

- the Warning Light goes ON
- the defective part will be switched off
- the error will be stored in the non-volatile buffer (one of 250 "drawers")

If another failure occurs, that error will be written to the temporary buffer.

When compared with a) and b): The first note went into the waste box, the second note is being stored. Since the Warning Light is already ON, it need not be activated.

An additional entry is made in the "drawer".

Each type of failure will occupy an address ("drawer") in the electronic buffer. The same error (e. g.: failure in the right front sensor) can be stored only once at a certain address up to 253 times. Counting this error will be discontinued after 253 times. A modulator failure is stored under a **different** address, and theoretically could be recorded up to maximum 253 times.

The number of counts per address cannot be determined by the Blinkcode.

Therefore a diagnostic unit like 446 300 320 0 is necessary. To stay with the Blinkcode, an address needs to be erased only once !

The temporary buffer will lose all information as soon as the ECU is turned off, where as the non-volatile buffer can store information for many years.

If no error had been stored, the Blinkcode will, after activation, display the frame and its system identification. Refer to page 22.

Entries in the non-volatile buffer must be erased by using a special procedure, which be described later. First, some recommendations.

Operation of Blinkcode

ECU handling procedures

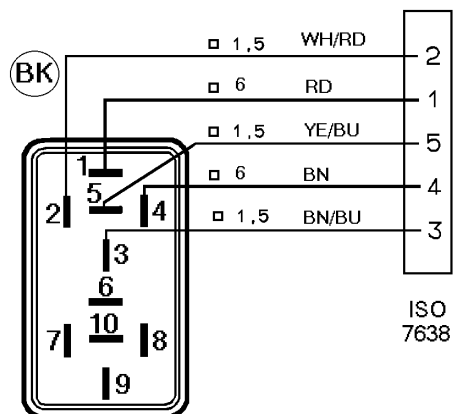
Connections in use:

Upper part – white –

- 1 Valves voltage supply
- 2 ECU voltage supply
- 3 Ground (ECU)
- 4 Ground (Valves)
- 5 Warning Light

Lower part – black –

- 6 L-line (diagnostic)
- 7 C1 = Not used; C plus = Retarder cut off
- 8 C1 = Ground; C2 = PWM (v - Signal)
- 9 K-line, (diagnostic)
- 10 Ground



Since the ECU starts checking immediately after it is powered, the following steps should be done in order:

- 1) Connect the white supply plug only after all sensors and modulators have been properly connected.
- 2) Disconnect the white plug first, (or disconnect main power)....., before any type of work is done on the sensors or modulators, which would interrupt the lines (failure will be stored !).

The ECU recognizes sensors and modulators starting from the color-coded plug in board.

Even a "highly intelligent" ECU cannot differentiate if a disconnection (or a short circuit) is caused by the sensor or modulator or by the connecting line.

As mentioned previously, the ECU starts checking procedures of the connected components immediately after it is turned on regardless whether the vehicle is stationary or moving.

When sensor or modulator connections are to be changed in the housing for individual preference, shut off the ECU, and after the plugs have been reconnected (sensor or modulator) switch the ECU on again !

No damage will occur if the previous recommendations are not followed, but unnecessary failure entries will be written to the buffer, which must be erased.

Each — even the shortest — disconnection of a sensor or modulator line will cause an error entry in the buffer !

Operation of Blinkcode

Voltage supply

Activation of the Blinkcode, requires a nominal voltage at the ECU (Pin 1).

Nominal voltage	24 V	Board supply	24 V (minimum 23.1 V)
	12 V	Board supply	12 V (minimum 11.6 V)

There are various possible ways to supply the ECU during repair with the necessary voltage:

- a) By the trailer test unit
- | | |
|--|----------------------|
| | 446 007 005 0 (24 V) |
| | 446 007 006 0 (12 V) |

Test unit supplied by the battery
Test unit supplied by the tractor

- b) Direct supply
- | |
|----------------------------|
| from the auxiliary battery |
| from the tractor battery |

- c) Stabilized power supply unit (contact WABCO)

to a)

The trailer test unit has an electronic overload protection which needs approximately 1.4 V - which means a continuous supply of 24 (12) V at the ECU outlet, requires the availability of 25.4 (13.4) V at the input side. Also, line voltage reductions having at least 26 (14) V available must be taken into consideration. This problem can be solved by not using the trailer test unit.

to b)

Connect an auxiliary battery, in good condition and fully charged from its positive post directly to the ABS plugs Pin 1 and 2 and the ABS Pin 3 and 4 plug receptacle to the negative post. The battery post, obviously must be completely polished, and is to be coated with Vaseline.

If the power supply is taken from the tractor, the generator can supply additional voltage in case the tractor battery is not fully charged.

to c)

A so called "stabilized power supply" is in any case the best recommendation. Such a power supply unit can be used universally eliminating problems of poorly charged batteries, and can be used for all electrical trailer units, even to charge any battery.

Requirements: controllable output voltage

single stage	0 V to 30 V
or switchable from	0 V to 15 V
and	12 V to 30 V

Current maximum 10 A - current limit control.

Operation of Blinkcode

The ECU must NOT be operated using a charging unit without battery:
35 V are deadly for the ECU !

Voltage overload:

The ECU tolerates a voltage of up to approximately 32 V, or 15 V for 12 V systems. Voltage overload starts above 32 V, or above 15 V for 12 V systems.

The ECU ceases to operate and the Warning light comes ON.

Even if the voltage drops, the ECU will not reset and the Warning light will not turn off.

If the Warning Light comes ON due to a voltage overload, the system can only be reset to its default condition by disconnecting the supply voltage.

Low voltage:

The ECU differs between 2 conditions:

1. the moment the unit is turned on
2. while operating

all following values in brackets for 24 V systems.

The unit must have at least $U_{Nominal} \text{ minus } (-) 4 \% = 23.04 \text{ V}$ for 24 V system, or 10.85 V for 12 V system, available at Pin 1, when it is turned on – otherwise, the ECU will not operate.

Operation:

If this voltage was set up one time, it may drop quickly to 8.5 V (18 V), and as soon as 8.5 V (18V) have been reached, the internal timer is activated. If the voltage remains longer than 1 second on 8.5 V (18 V), the Warning Light will be activated.

A voltage drop to 7.5 V (16 V) eliminates this delay and the Warning Light turns ON immediately.

Note: These voltage drops may occur in the power supply of the vehicle when powerful auxiliary units are activated.

The Warning Light goes OFF during voltage increase and an entry may be made in the buffer (no error entry will be made if the voltage drops rapidly and the ECU shuts off).

The unique failure condition "low voltage", causes the Warning Light to turn OFF by itself, when returning to standard power.

Recommendation:

The white plug can be removed to turn the ECU off.

If the trailer is powered by the tractor (I.S.O.) while a failure search is made, remember: the red 6 mm² line carries voltage independently, whether the ignition is on or off.

Avoid short circuits in line 2 during individual separation. Otherwise, you may damage the Information Module in the tractor.

Operation of Blinkcode

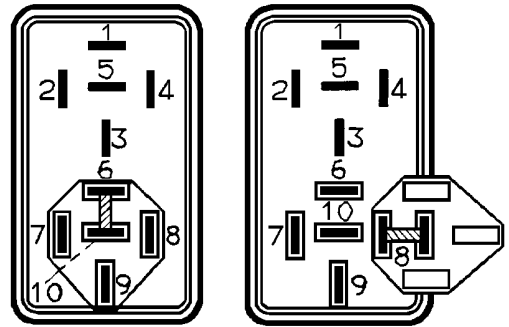
Blinkcode activation

The installation package 446 105 530 2 to . . . 534 2 includes a black test plug with a violet jumper wire.

The drawing on the right shows the two possible plug locations.

Right: Storage location
(The plug should always remain at the ECU)

Left: Blinkcode activated location.



The ECU will activate the Blinkcode as soon as the black test plug (contacts 6 and 10) has been connected more than 5 seconds.

The error message is coming from either the temporary or non-volatile buffer. The code will be displayed as long as the connection of Pin 6 and 10 exists.

As soon as the black test plug is disconnected, the present code will be displayed to its end. Then the address location will be erased.

If the message should not be erased (at workday end - to continue in the morning), disconnect the voltage supply first and then pull the test plug.

If the test plug is not removed after the error message has been erased, and the connection of Pin 6 and 10 remains, the following occurs:

Trailer coupled to the tractor

Ignition on

Warning Light ON

after 5 seconds

Warning Light goes OFF
Blinkcode starts

Vehicle moves

Blinkcode remains ON

Vehicle reaches a speed of 2 miles/h

Blinkcode stops, Warning Light ON

Vehicle reaches a speed of 5 miles/h

Warning Light goes OFF

Vehicle stops

Blinkcode will start again

These procedure would repeat for each driving and stopping operation.

The position of the test plug has no influence on the ABS control.

Operation of Blinkcode

Blinkcode structure

The Blinkcode structure is made up of 4 groups

Frame	2.5 seconds continuous	flashes 1 time
Identification	0.5 seconds continuous	flashes 1 to 5 times
1. Failure location	0.5 seconds continuous	flashes 1 to 4 times
2. Failure location	0.5 seconds continuous	flashes 0 to 15 times

All time delays have a 2.5 second duration. All 4 groups are made up by time delays.

The input delay of 5 seconds prevents accidental activation of the Blinkcode caused by short circuit of contact Pins 6 and 10 on the connection board.

The codes are listed in the code table starting on page 26.

The Frame (R)

The frame starts with 2.5 seconds Warning Light OFF, followed by 2.5 sec. ON and again 2.5 sec. OFF indicating "ready to provide data".

The frame "combines" all other information beginning with the 2.5 seconds Warning Light ON to its reactivation.

Identification (K)

The identification provides for the system's configuration given by the ECU

1 blink	0.5 seconds ON	"6 Sensor / 3 Modulator"
2 blinks	0.5 seconds ON	"4 Sensor / 3 Modulator"
3 blinks	0.5 seconds ON	"4 Sensor / 2 Modulator"
4 blinks	0.5 seconds ON	"2 Sensor / 2 Modulator"
5 blinks	0.5 seconds ON	"2 Sensor / 1 Modulator"

The identification must coincide with the installed system, otherwise, a failure must have occurred while the ECU was not powered.

VARIO-C1

The identification must correspond to the system fitted since otherwise the error might have occurred only when it was switched off.

VARIO-C2

Here the system selected has been stored in the memory since it was first "commissioned". For this reason it is not possible for a wrong identification to be returned in the event of a line disconnection.

1. Failure location (1. F)

The first failure location will be between the 1 and 4 Blinkcode impulses. The explanations are listed in the code table.

2. Failure location (2. F)

The second failure location may be between 0 and 15. The explanations are listed in the code table as well. The sketch on page 23 shows an example.

Explanation from left to right: (upper illustration)

Triggering the Warning Light to ON will indicate the ECU's condition, as soon as the test plug PIN 6 and 10 contact is made. Subsequently 5 seconds go by ($\text{Time}_{\text{Zero}} + 5 \text{ seconds}$) in which the present condition of $\text{Time}_{\text{Zero}}$ is not changed.

Reason: The Warning Light can be ON or OFF depending on conditions.

1. Example:

The supply voltage is connected in the morning at work start. The Warning Light must go ON since the vehicle has not been driven – regardless of whether a failure occurred or not.

Operation of Blinkcode

2. Example:

The vehicle comes directly into the repair shop (Warning Light OFF) and the tractor remains coupled while the ignition is on. If the ECU is now opened and the Blinkcode requested, the Warning Light must be OFF. (The dotted lines under the word SILA indicates this).

This may occur, if the Warning Light goes ON at times during driving, but indicating at the same time a properly operating system. (Failure e. g.: intermittant contact is caused by a broken cable).

If the Warning Light was ON, it will go OFF after 2.5 seconds and ON again after 2.5 seconds. This signal can be distinguished clearly from all other and indicates the triggering of the Blinkcode. Another break delay of 2.5 seconds will follow.

The following impulse of 0.5 seconds indicates recognition of a system with 6 sensors and 3 modulators (6S/3M). A 4S/3M system would show three impulses.

The following delay of 2.5 seconds separates the system identification from the first failure location. An additional delay of 2.5 seconds will be followed by 15 impulses.

Thus, the Blinkcode identification may be read as 1 / 2 / 15.

Interpretation from Code table from page 26:

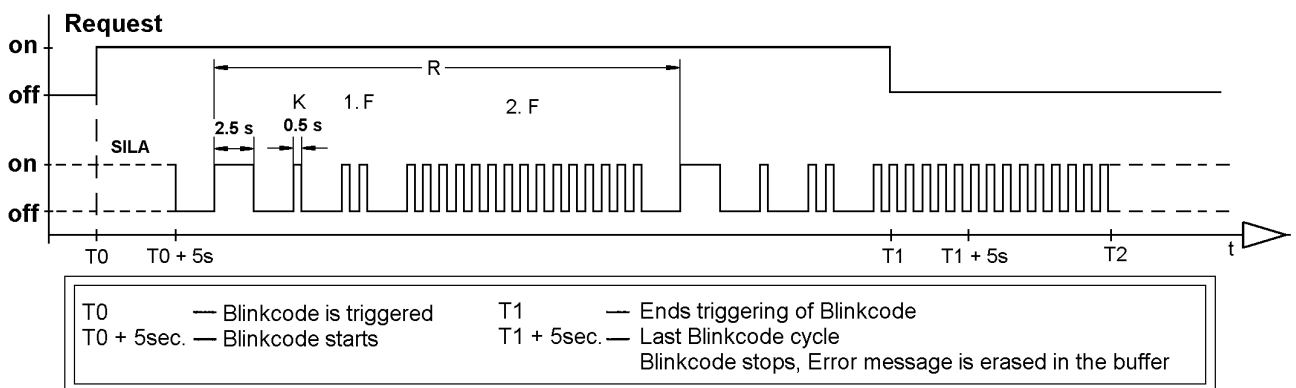
6 sensors / 3 modulators (system 6S/3M) – modulator C (H2) – outlet solenoid short circuit.

As already described on page 18, the short circuit may also occur in the modulator cable (or in extreme cases: in the color coded modulator plug inside the ECU).

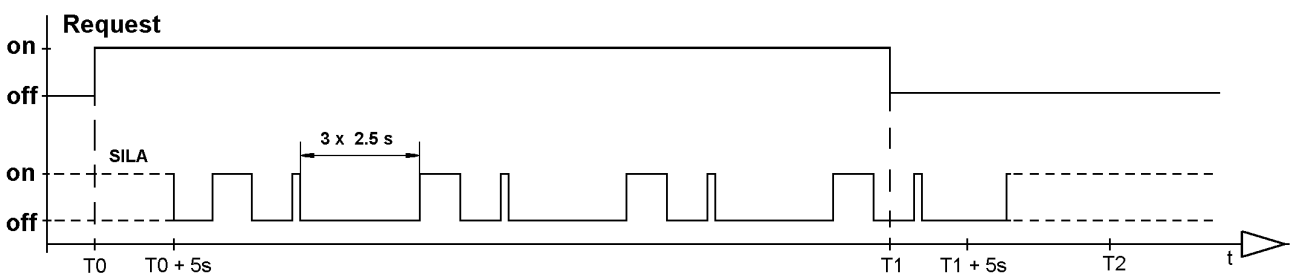
Back to the illustration: the triggering time of the Blinkcode (connection of contacts 6 and 10) remains longer than needed. Therefore the next **blinkcode frame** will start. At the time period T1 contact 6 and 10 become disconnected. The triggered Blinkcode remains activated until the frame is once more fully displayed.

Subsequently, the Warning Light will remain either ON or OFF, depending on the condition prior to the triggering of the Blinkcode.

Example: a System 1 (6S / 3M), Errorcode 2 - 15 (H2-OV short to earth / ground)



Example: b System 1 (6S / 3M), Errorcode 0 - 0 (no error)



Operation of Blinkcode

If the failure was already erased before the Blinkcode started, the address location in the buffer is automatically erased after display of the frame. Start the unit again for verification. If the same error message is displayed, erase it again by removing the black test plug. In this case, only the latest error could have been recorded in both the temporary and non-volatile buffers.

After repair of a failure, turn off the ECU, thus causing the temporary buffer entry to be erased.

Major points

1. Check for sufficient voltage supply.
2. Do not work on any peripheral device while the supply voltage is connected.
3. Does the installed system coincide with the Blinkcode?
4. If the Warning Light goes on at times, it goes off during (without entry will be made in the error buffer), it can only be caused due to a power supply interrupt.
5. Make sure the ground wiring (Pin 3) and (Pin 4) is good and secure. If the contact resistance is too high for the ground wiring, errors which are difficult to locate may result. The resulting voltage drop, depending on the current of the modulators, may cause shut down of the ECU (undervoltage). After the voltage comes back to standard value, the ECU repeats its tests again. Now the voltage drops again. This procedure will repeat in a fraction of a second as long as power is available. Possible result: Buzzing noise in the ECU (valve relay) and modulators.
6. Make sure to erase the error buffer after each repair or installation test.
7. Do not return any ECU back to stock, which memory has not been fully cleared.
8. Various displays: The trailer Warning Light is ON continuously in the tractor or on the test unit while the ECU supplies Blinkcode. This indicates a failure within the ECU and the ECU must be replaced.
9. Instead of Warning Light: Connect a test lamp (10 watts max.) to the white supply plug to contacts 2 and 5.

Operation of Blinkcode

The Flash Code

The moment it is switched on, the VARIO-C1 ECU ascertains which system is connected (e. g. 6S/3M), and whether the right number of sensors and valves required for that system are available (e. g. a disconnected sensor is not considered "available" because the ECU is unable to recognize it). The moment it is switched off, the ECU loses that "knowledge".

The VARIO-C2 (plus) "knows" (also whilst still in the store and packaged!) which system it belongs to. However, whether this internal "knowledge" and the external assignment on the trailer coincide is a completely different matter.

All C2 ECUs with 3 possible modulators are "commissioned" at the factory as 4S/3M, those with two possible modulators as 4S/2M. There is, however, one exception: the ECU ... 042 0 is "commissioned" as 2S/2M. If a different assignment is used, a VARIO-C2 ECU can easily be "re-commissioned" from 4S/3M, for example, to 2S/2M or to 6S/3M.

"Re-commissioning" is a simple process and can be repeated any number of times. The same procedure which is used to delete an error recorded in the memory is repeated while the memory is empty. (**Do not switch off voltage supply in the meantime !**)

If a new ECU (whose internal identification is 4S/3M, for instance,) is installed in a faulty 6S/3M system - assuming sensor Z2 (E) is defective - the VARIO C2 will first report an error, and then, after repairs or after deletion of the error from the memory, it will report "1 1 1". In this case the first "1" stands for "system found is 6S/3M", the following "1 1" stands for "internal identification not identical with system found". This eliminates the displays (which were sometimes a little difficult to interpret) sometimes found on the C1.

Another novelty is the output of a (PWM - pulse-width modulated) speed signal at Pin 8 (which is parked on the black plug for stimulating the flash code). In connection with a special relay (speed limit value switch) this can be used to activate facilities such as steering locks, for instance. Please also refer to the circuit diagram on Page 15.

VARIO-C2 ECU	System Commissioned by WABCO	System-Code 1st Digit
	6S / 3M	1 identical with C1
446 105 031 0 / 041 0	4S / 3M	2 "
446 105 032 0 / 052 0	4S / 2M	3 "
446 105 042 0	2S / 2M	4 "
	2S / 1M on red/yellow/blue	5 "
446 105 051 0	6S / 3M with 3rd brake (retarder)	6 additional with C plus
	4S / 3M with 3rd brake (retarder)	7 "
	4S / 2M with 3rd brake (retarder)	8 "
	2S / 2M with 3rd brake (retarder)	9 "

Operation of Blinkcode

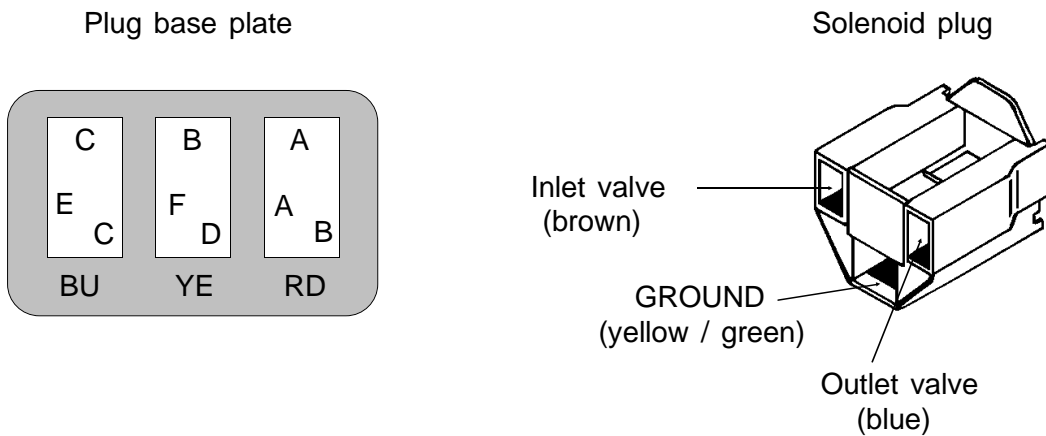
System Code 1.	Failure Code		POSSIBLE CAUSE OF FAILURE
	2.	3.	
	0	0	System okay
	1	1	Parameterize system (re-initialise Blinkcode)
	1	2	Sensor B (L1): Sensor speed jump () = development designation
	1	3	Sensor B (L1): Air gap
	1	4	Sensor B (L1): Interruption of wire, short circuit
	1	5	Sensor D (H1): Sensor speed jump
	1	6	Sensor D (H1): Air gap
	1	7	Sensor D (H1): Interruption of wire, short circuit
	1	8	Sensor A (L2): Sensor speed jump
	1	9	Sensor A (L2): Air gap
	1	10	Sensor A (L2): Interruption of wire, short circuit
	1	11	Sensor C (H2): Sensor speed jump
	1	12	Sensor C (H2): Air gap
	1	13	Sensor C (H2): Interruption of wire, short circuit
	1	14	Sensor F (Z1): Sensor speed jump
	1	15	Sensor F (Z1): Air gap
	2	0	Sensor F (Z1): Interruption of wire, short circuit
	2	1	Sensor E (Z2): Sensor speed jump
	2	2	Sensor E (Z2): Air gap
	2	3	Sensor E (Z2): Interruption of wire, short circuit
	2	4	Modulator A (L) IV: Break in wiring
	2	5	Modulator A (L) OV: Break in wiring
	2	6	Modulator B (H1) IV: Break in wiring
	2	7	Modulator B (H1) OV: Break in wiring
	2	8	Modulator C (H2) IV: Break in wiring
	2	9	Modulator C (H2) OV: Break in wiring
	2	10	Modulator A (L) IV: Short to earth / ground
	2	11	Modulator A (L) OV: Short to earth / ground
	2	12	Modulator B (H1) IV: Short to earth / ground
	2	13	Modulator B (H1) OV: Short to earth / ground
	2	14	Modulator C (H2) IV: Short to earth / ground
	2	15	Modulator C (H2) OV: Short to earth / ground
	3	2	Contact 3 (Supply plug) earth missing
	3	3	Undervoltage
	3	4	Break in wiring contact 7: retarder (ECU 446 105 051 0 only)
	3	5	Short circuit contact 7: retarder (ECU 446 105 051 0 only)
	3	6	} Earth break modulator A (L) [red] *) or ECU *)
	3	7	
	3	8	} Earth break modulator B (H1) [yellow] *) or ECU *)
	3	9	
	3	10	} Earth break modulator C (H2) [blue] *) or ECU *)
	3	11	
	3	12	Overvoltage
	3	13	Permanent positive at contact 7: retarder (ECU 446 105 051 0 only)
	4	6	Modulator A (L) IV: Short circuit to positive
	4	7	Modulator A (L) OV: Short circuit to positive

SYSTEM CODE SEE TABLE PAGE 25

Operation of Blinkcode

System Code	Failure Code		POSSIBLE CAUSE OF FAILURE
	1.	2. 3.	
see page 25	4	8	Modulator B (H1) IV: Short circuit to positive
	4	9	Modulator B (H1) OV: Short circuit to positive
	4	10	Modulator C (H2) IV: Short circuit to positive
	4	11	Modulator C (H2) OV: Short circuit to positive
	4	12	No operative modulator connected
	4	13	No operative sensor connected
	4	14	Short circuit to positive contact 7: retarder (ECU 446 105 051 0 only)
	5	16	Safety controller (changing ECU)

*) With this fault, the system configuration flashed out is meaningless. Before changing the ECU, check the earth lead (yellow / green) of each valve against outlet (OV) and inlet valves (IV) again



Display reading for 12 V VARIO-C System

Test Step No. "1" (STOPLIGHT Power via 7-way [12 N] plug or mixed supply), refer to page 5

Good:

1 2 0 to **3 0 0** (2 W)
3 0 0 to **7 0 0** (5 W)
6 0 0 to **1 4 0 0** (10 W)

Fault:

1. **0 0 0** to **0 0 3**
2. **3 0 1** to **3 6 0**
7 0 1 to **7 6 0**
1 4 0 1 to **1 4 6 0**
3. **1 4 6 1** to **1 9 9 9**

Test Step No. "1" (Plug Connection to ISO 7638), refer to page 6

Good:

0 5 0 to **1 3 0** (—)
1 5 0 to **4 0 0** (2 W)
3 0 0 to **8 0 0** (5 W)
6 0 0 to **1 4 0 0** (10 W)

Fault:

2. **1 3 1** to **1 7 0**
4 0 1 to **4 5 0**
8 0 1 to **8 5 0**
1 4 0 1 to **1 4 5 0**

Test Step No. "1.1" (Plug Connection to ISO 7638), refer to page 7

Good:

0 0 0 to **0 0 3** (—)
1 0 0 to **2 7 0** (2 W)
2 5 0 to **6 7 0** (5 W)
5 5 0 to **1 2 7 0** (10 W)

Fault:

Display reading for 12 V VARIO-C System

Test Step No. "2"(Plug Connection to ISO 7638), refer to page 7

Good:

0 9.4 to **1 4.4**

Fault

0 0 0 to **0 9.3**

Test Step No. "4"(Wiring of BK 3), refer to page 8

Good:

0 1.5 to **0 2.7**

Fault:

1. **0 2.8** to **0 5.0**

2. **0 5.5** to **0 9.0**

Test Step No. "6"(Modulator Coil Resistance), refer to page 9

Good:

2.0 to **5.0**

Fault

Test Step No. "11 / 11.1"(Plug Connection to ISO 7638 only), refer to page 12

Good:

ISO **0 7.5** to **1 2.0**

Mixed &
7-way plug **0 9.4** to **1 4.4**

Fault:

2. **0 0.0** to **0 0.3**