

■ Vario Compact ABS

EMC - Certification
e1 021058

■ System Proposals
Components
Brake Diagram

■ 2. Edition

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WABCO

Vehicle Control Systems
An American Standard Company

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Instructions for the Installation of a Vario Compact ABS "VCS"

- The vehicle design is determined by the trailer manufacturer:

e. g.: 3-axle semitrailer
with air suspension
with a lifting axle
with a steering axle

- System selection and components using this brochure:

seeking:

3-axle semitrailer

see "1" **System Suggestions** 3-axle semitrailers (Page 14), taking into account the information for lifting and steering axles.

selected, for example

4S/3M (4 sensors / 3 modulators), allocation of control channels INSR / IR / MAR as shown in the illustration.

The components required for a VCS 4S/3M system are listed under "2" **Components** or can be ordered using the list of components for the respective diagram.

Please note:

All VCS systems can be optimized with a view to two aspects:

- a) technically
- b) costs

WABCO's proposals represent the best possible solution from the technical point of view.

The alternatives show ways of reducing costs. Subsequent operating costs should be taken into account at all events.

By no means should possible alternatives lead to systems which are not feasible from a technical point of view, such as 2S/1M systems in a 3-axle semi-trailer.

- The purpose of the trailer with corresponding axle sensors and pneumatic design

The diagrams shown for this purpose (see under "3" **Braking Diagrams**) are suggestions only. The type actually selected is up to the trailer manufacturer.

- Electrical Wiring:

See "2" **WABCO Wiring Diagram** 841 801 188 0 (Page 22).

For instructions on wiring and on components, please refer to the brochure

"Vario Compact ABS (VCS)" (Wabco Publication 815 000 242 3).

Reason:

- wheels with no sensors can lock
- even a single error in the system can cause the ABS to fail.

WABCO generally recommends to install a power supply in keeping with ISO 7638 since among the disadvantages of a power supply from the brake light are:

- Due to the absence of a power supply, the constant self-monitoring process is effective only during the braking process.

- In the event of a fault, the driver can only perceive this via the warning lamp in his rearview mirror (which may not be possible when negotiating bends or steering) and only whilst braking.
- The brake-light switches in many motor vehicles are not equipped for the additional (inductive) load and may fail prematurely.
- A failure of the brake-light fuse would cause a failure of the ABS system.

Information on Installation:

When installing the pneumatic system, care must be taken that the supply pressure is greater than the actuating pressure.

Official Test Report for Trailer and Product Specification 472 195 031 0 or 472 195 041 0

Note:

supply pressure > actuating pressure
otherwise see WABCO VCS

Carry out time check, when response and pressure build-up time ≤ 0.35 s on one axle, use ABS relay valve as add-on circuit (see product specification).

Circuitry of ABS Relay Valve 472 195 031 0

Recommended mounting location: On the vehicle frame or on the axle, ensuring that the specifications – such as acceleration values – are not exceeded (see product specification).

operating ports (2) should be used, with similar lengths of pipe to the brake cylinders (see Fig. 1). Their nominal width should be between 9 and 11 mm.

For **proper functioning of the ABS** in connection with the WABCO control equipment specified it is generally important that the braking pressure in the connected braking cylinders can follow the pressure in the control chamber of the ABS relay valve sufficiently rapidly.

The nominal width of the supply lines to the ABS relay valves (Port 1) should be as large as possible ($NW \geq 9$ mm).

If two ABS relay valves have to be served by one supply line, the pipe lengths, nominal widths and flow conditions (identical exits on the T-piece) should be the same.

For this reason, the brake cylinder volume controlled by an ABS relay valve should, as a rule, not be more than 2 dm^3 (e. g. $2 \times 30''$).

The nominal width of the pilot lines to the ABS relay valves (Port 4) should be $NW \geq 6$ mm, and the conditions in the supply should be similar if possible.

Note:

Brake cylinder volume not to exceed 2 dm^3 since otherwise Value ε may be impossible to achieve when testing the vehicle according to ECE.

Should excessive braking occur, due to small brake cylinders or a small filling volume (possibly short locking phases at the beginning of the braking process), throttling may be effected **upstream from Pilot Port 4** by, for instance, reducing the nominal width of the brake pressure pipe/hose down to $NW 6$ (e. g. pipe 8×1).

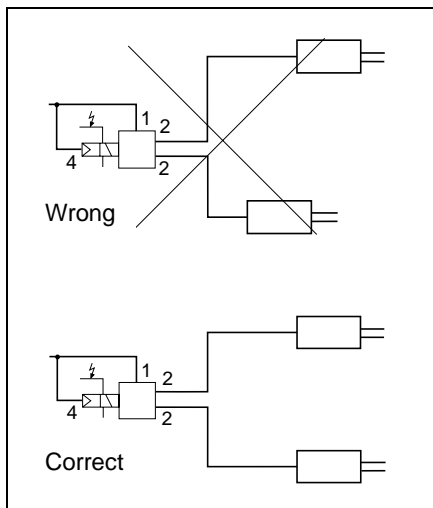


Fig. 1

With braking systems which are "quick-acting" anyway, it is possible to operate the ABS relay valve without a relay effect.

Here the control or pilot line from the relay emergency valve is directly connected to Port 1, and the bypass with as short a pipe as possible (e. g. T-piece directly in Port 1) linked with Pilot Connection 4 if no other braking equipment is fitted upstream. If there is a load-sensing valve, adapter valve etc. present, these should be fitted in the bypass (between Ports 1 and 4 of the ABS relay valve).

This is only possible if time response is adequate, e. g. on the front axles of drawbar trailers where steep pressure gradients prevail due to short pipes (see Brake Diagram VCS 841 600 452 0, page 45).

For retro-fitting, please remember: If a relay valve is fitted in the normal braking system (e. g. on the rear axles), this can be removed when ABS relay valves are fitted, i. e. the pilot and supply lines can be led directly to the ABS relay valves.

When fitting a 4S/2M system in 3-axle semi-trailers (three brake cylinders on one side of the semi-trailer are controlled by one ABS relay valve), the locking sequence of the axles should be determined before fitting the ABS relay valves. The two brake cylinders of the axles tending to lock first should be jointly connected to one Operating Port 2 of the ABS relay valve. Mounting should be effected symmetrically, making sure that both the cross sections and the lengths of pipe from the T-piece are identical.

Adhering the above description it should be possible to properly install the ABS relay valve, thus achieving a proper ABS function.

Should problems persist (e. g. in special-purpose vehicles), please do not hesitate to contact WABCO Hannover, Dept. PM 4/5, Tel. (0049) 511 9 22 - 1941 or 1181.

System Proposals

1-Axle Central Axle Trailers
(< 3.5 tons permissible total weight)

**WABCO's Proposal:
2S / 1M**

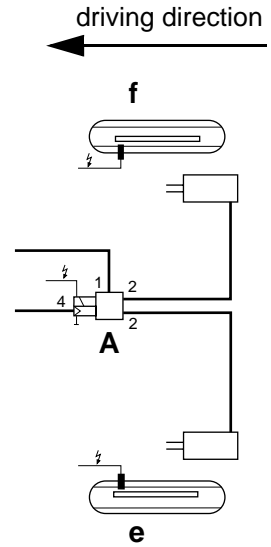


System: **2 Sensors / 1 Modulator**

MAR control principle

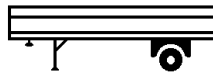
Note:

- The MAR principle should be used only if the axle load is small compared with the total weight of the tractor-trailer combination. (trailer < 3.5 tons).
- Not recommended for 1-axle semi-trailers.



1-Axle Semi-Trailers

**WABCO's Proposal:
2S / 2M**

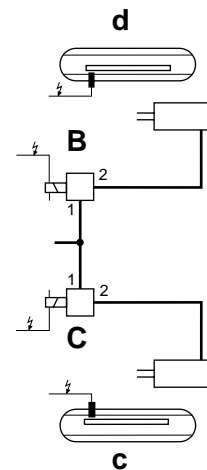


System: **2 Sensors / 2 Modulators**

IR control principle

Alternative:

None since 2S/1M would result in an increased braking distance on road surface with μ -split conditions.



- IR** = individually controlled
- INSR** = indirect side control
- MAR** = modified axle control
- MSR** = modified side control
- DAR** = diagonal axle control

A, B, C = Modulators
c, d, e, f = Sensors

2-Axle Trailers



**WABCO's Proposal:
4S / 3M**

System: **4 Sensors / 3 Modulators**

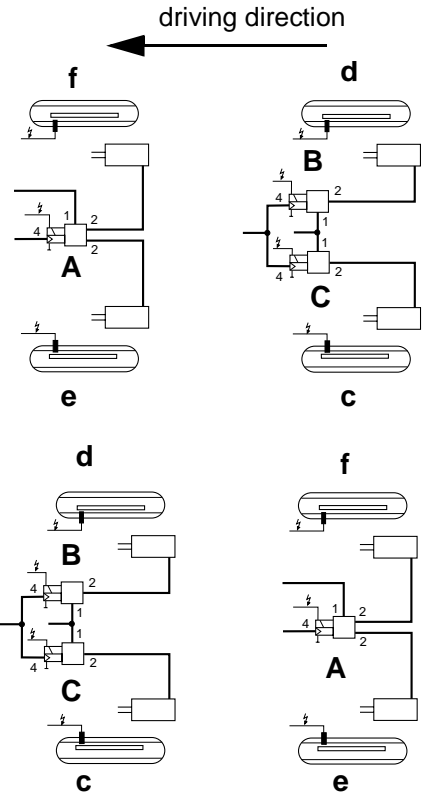
MAR / IR control principle

or

IR / MAR control principle

Comments:

- Alternative if efficiency rating is insufficient.



2-Axle Central-Axle Trailers



**WABCO's Proposal:
4S / 2M**

System: **4 Sensors / 2 Modulators**

MSR control principle

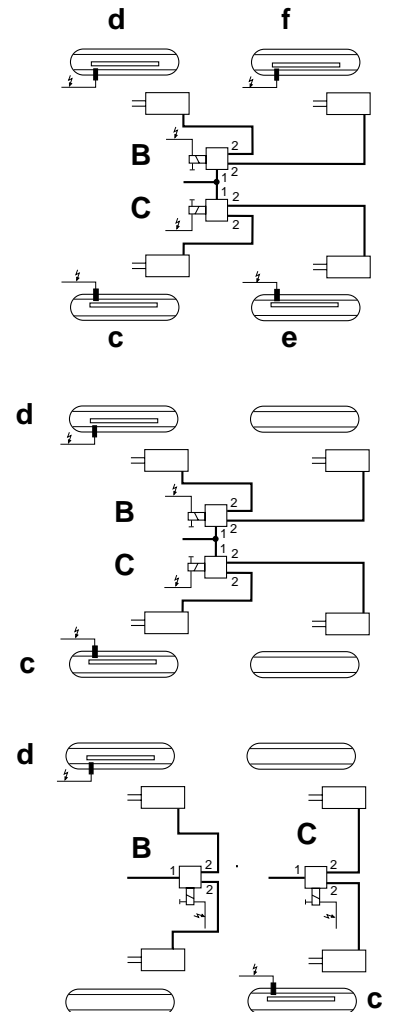
**ALTERNATIVE:
2S / 2M**

System: **2 Sensors / 2 Modulators**

IR / INSR control principle

or

DAR control principle



2-Axle Semi-Trailers
normal axes



WABCO's Proposal:
4S / 2M

System: **4 Sensors / 2 Modulators**

MSR control principle

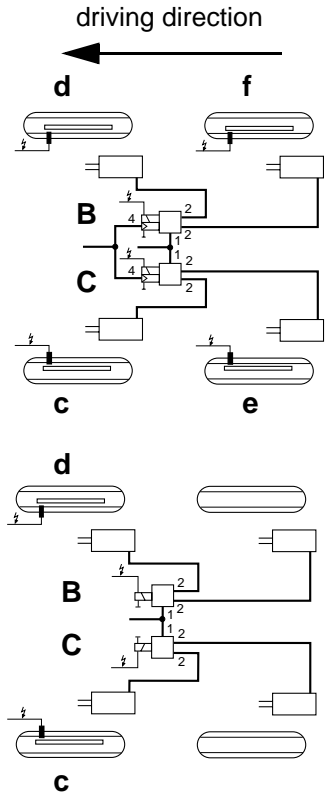
ALTERNATIVE:
2S / 2M

System: **2 Sensors / 2 Modulators**

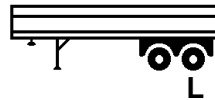
IR / INSR control principle

Note:

- For selecting the axle to be fitted with a sensor, take locking sequence into account !
- Wheels with no sensor can lock !
- In the event of a sensor or the ABS relay valve failing, only the side with no failure will continue to be ABS controlled.



2-Axle Semi-Trailers with
normal axle and lifting axle



WABCO's Proposal:
4S / 2M

System: **4 Sensors / 2 Modulators**

MSR control principle

Sensors e and f **always** on the lifting axle

ALTERNATIVE:
2S / 2M

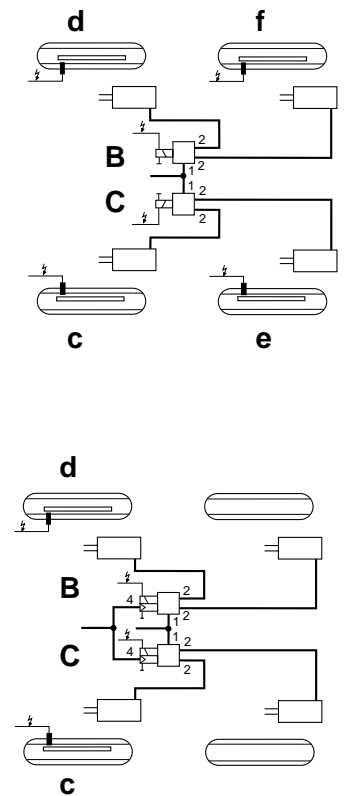
System: **2 Sensors / 2 Modulators**

IR / INSR control principle

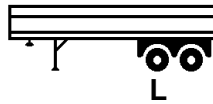
Lifting axle without sensor

Note:

- Wheels with no sensor can lock !
- In the event of a sensor or the ABS relay valve failing, only the side with no failure will continue to be ABS controlled.



2-Axle Semi-Trailers with normal axle and lifting axle



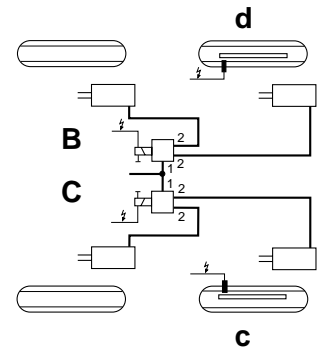
**ALTERNATIVE:
2S / 2M**

System: **2 Sensors / 2 Modulators**

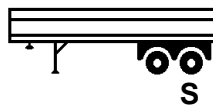
INSR / IR control principle

Lifting axle without sensor

driving direction
←



2-Axle Semi-Trailers with normal axle and self-steering axle



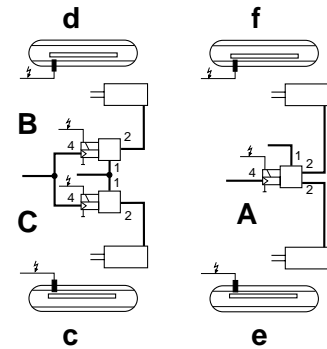
**WABCO's Proposal:
4S / 3M**

System: **4 Sensors / 3 Modulators**

IR / MAR control principle

Note:

- For self-steering axles, MAR is fitted in order to avoid a roll-steer effect (inclination) on road surfaces with laterally different friction coefficients (μ -split).
- Forced steering axles and assemblies can be treated as rigid axles.



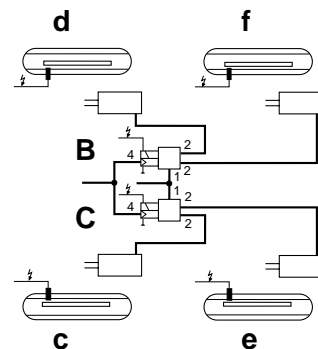
2-Axle Semi-Trailers with normal axle and forced-steering axle



**WABCO's Proposal:
4S / 2M**

System: **4 Sensors / 2 Modulators**

MSR control principle



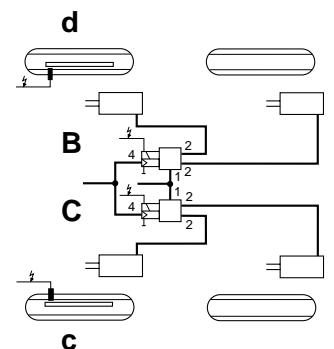
**ALTERNATIVE:
2S / 2M**

System: **2 Sensors / 2 Modulators**

INSR / IR control principle

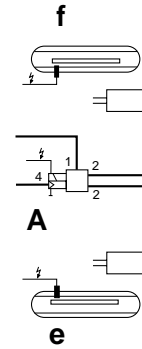
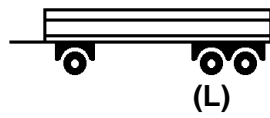
Note:

- Wheels with no sensor can lock !

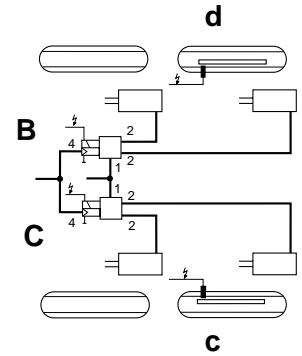


3-Axle Trailers with normal axles or with one lifting axle

WABCO's Proposal: 4S / 3M



← driving direction

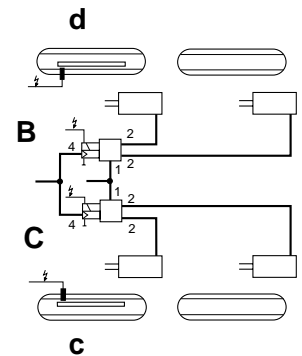
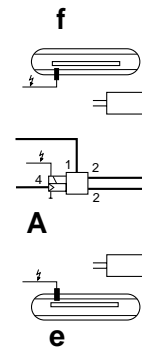
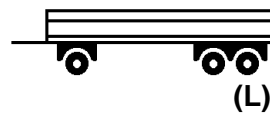


System: 4 Sensors / 3 Modulators

MAR / INSR / IR control principle

or

MAR / IR / INSR control principle



depending on the locking sequence of the two rear axles.

Note:

- Wheels with no sensor can lock !
- In the case of lifting axles, sensors are to be fitted to **non-lifting** axle.

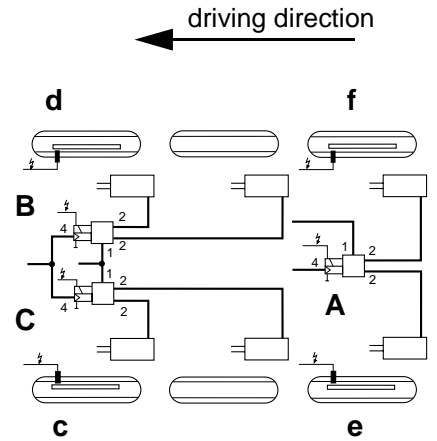
3-Axle Semi-Trailers with normal axles



**WABCO's Proposal:
4S / 3M**

System: **4 Sensors / 3 Modulators**

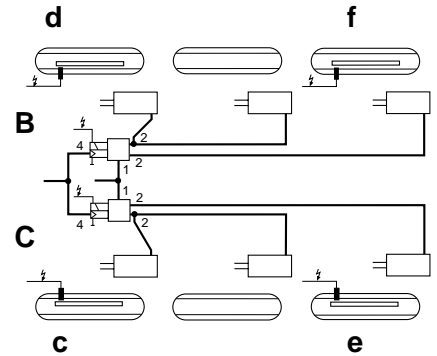
IR / INSR / MAR control principle



**ALTERNATIVE:
4S / 2M**

System: **4 Sensors / 2 Modulators**

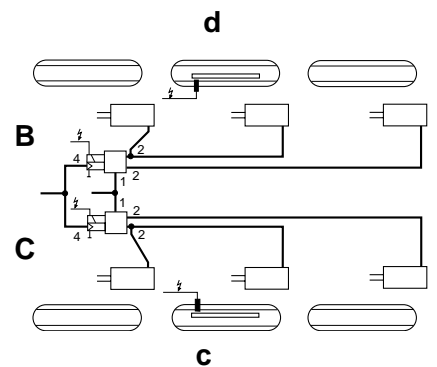
MSR / INSR / MSR control principle



**ALTERNATIVE:
2S / 2M**

System: **2 Sensors / 2 Modulators**

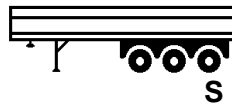
INSR / IR / INSR control principle



Note:

- Wheels with no sensor can lock !
- For further suggestions on the placement of sensors, please refer to the VCS Expertise, WABCO Publication 815 000 314 3.

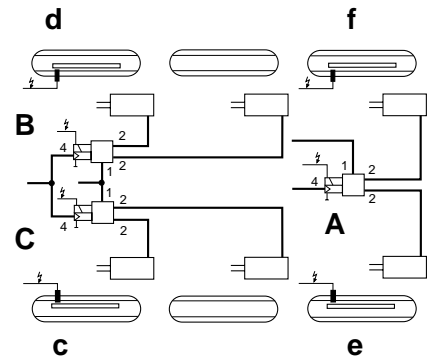
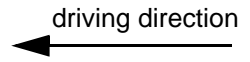
3-Axle Semi-Trailers with normal axes and self-steering axle(s)



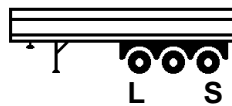
System: **4 Sensors / 3 Modulators**

IR / INSR / MAR control principle

**WABCO's Proposal:
4S / 3M**



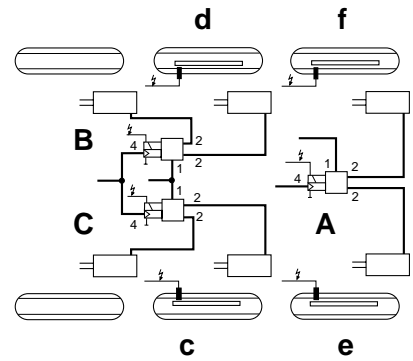
with lifting axle (L) and self-steering axle (S)



INSR / IR / MAR control principle

Note:

- Sensors e / f always on the self-steering axle (adhesion-controlled).
- Forced steering axles and assemblies can be treated as rigid axles.



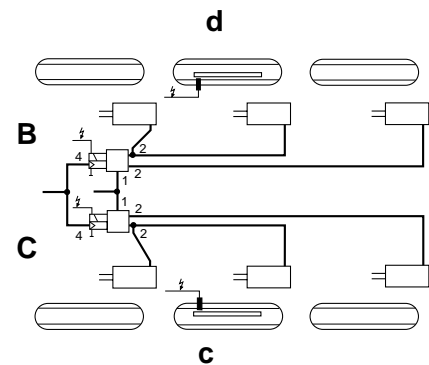
System: **2 Sensors / 2 Modulators**

INSR / IR / INSR control principle

Note:

- Non -MAR- controlled self-steering axles can cause jackknifing on road surfaces with a μ -split friction coefficient.
- Wheels with no sensor can lock!
- For further suggestions on the placement of sensors, please refer to the VCS Expertise, WABCO Publication 815 000 314 3.

**ALTERNATIVE:
2S / 2M**



3-Axle Semi-Trailers with lifting axles and normal axle



← driving direction

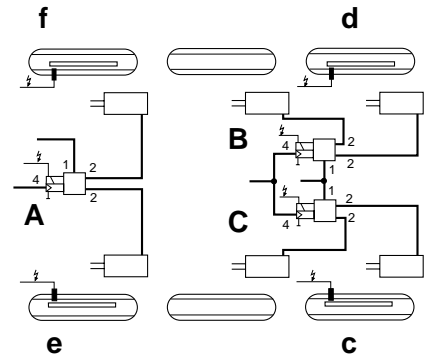
**WABCO's Proposal:
4S / 3M**

System: **4 Sensors / 3 Modulators**

MAR / INSR / IR control principle

Note:

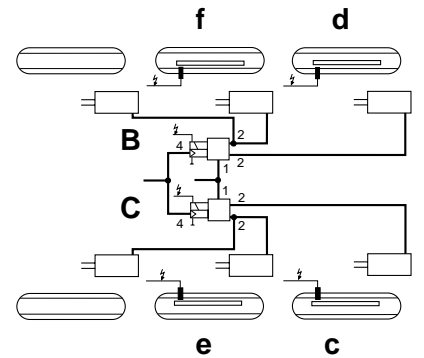
- Sensors lifting axle on e / f and second lifting axle pneumatically attached. Non-lifting axle **always** on c / d.



**ALTERNATIVE:
4S / 2M**

System: **4 Sensors / 2 Modulators**

INSR / MSR / MSR control principle



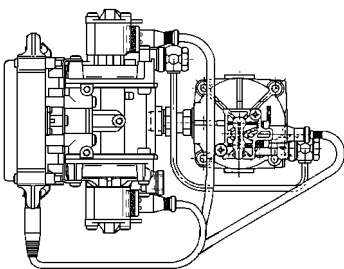
Components

1. ECU 446 108 . . . 0

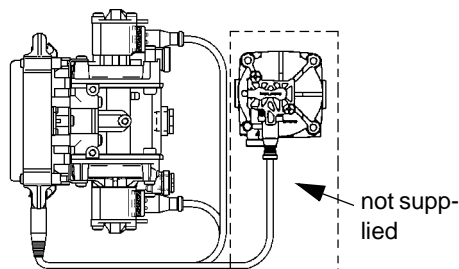
WABCO - Part Number			Possible Systems			Features							Comments
Type A													
Compact-Design Standard	Compact-Design with coating	separate ECU	4S/3M	4S/2M	2S/2M	ISO	24N	RV	MRV	ISS	RET	C3	
400 500 030 0	–	446 108 030 0	X	X	X	X	–	X	–	X	–	X	3 MOD
–	–	446 108 031 0	X	X	X	X	–	X	X	X	–	X	VCS-Plus
400 500 037 0	–	–	X	X	X	X	X	X	–	X	–	X	3 MOD
400 500 038 0	–	–	X	X	X	X	X	X	–	X	–	X	3 MOD
Type B													
400 500 032 0	–	446 108 032 0	+RET	X	X	X	–	X	X	–	X	X	2 MOD, 4S/3M+RET
400 500 034 0	–	–	X	X	X	X	X	X	–	X	–	X	w. stud bolts, 2 MOD
400 500 035 0	400 500 063 0	446 108 035 0	X	X	X	X	X	X	–	X	–	X	2 MOD
400 500 036 0	400 500 064 0	–	X	X	X	X	–	X	–	X	–	X	2 MOD
400 500 050 0	–	446 108 050 0	X	X	X	X	–	X	X	X	–	X	12 V-ECU
Type C													
400 500 040 0	400 500 066 0	446 108 040 0	–	X	X	X	–	X	–	–	–	X	
–	–	446 108 041 0	–	X	X	X	–	X	X	–	–	X	VCS-Plus
400 500 042 0	–	–	–	X	X	X	–	X	–	–	–	X	
400 500 045 0	400 500 067 0	446 108 045 0	–	X	X	X	X	X	–	–	–	X	
400 500 046 0	–	–	–	X	X	X	X	X	–	–	–	X	

Explanations:

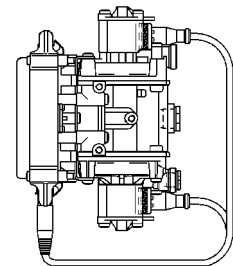
- 4S/3M, 4S/2M, 2S/2M: system suitable for the respective ECU; grey background means as supplied, 2S/1M always being possible.
- ISO: Supply according to ISO 7638; with supply exclusively according to ISO, voltage output for Diagnostic Controller on the diagnostic plug.
- 24N: additional supply with 24N (mixed supply)
- RV: actuation for ABS relay valve only
- MRV: actuation for solenoid control valve (ABS relay valve possible)
- Ret: actuation of a retarder possible
- ISS: Integrated Speed Switch
- C3: Output for speed signal at the diagnostic plug (e. g. for ECAS)
- 2 MOD: 3rd modulator and solenoid cable are **not** supplied with the compact unit
- 3 MOD: 3rd modulator and solenoid cable are supplied with the compact unit.
- w. stud bolts: with 3 stud bolts M8 for mounting on the ABS relay valve.



Type A



Type B



Type C

2. ABS Relay Valve

2.1 Relay Valve
472 195 03 . 0



2.2 Double ABS Relay Valve
472 195 041 0



2.3 Solenoid Control Valve
472 195 ... 0



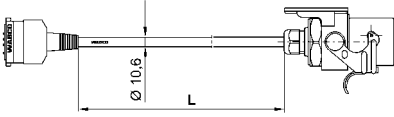
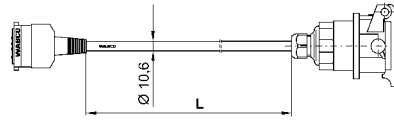
Relay Valve:

Part Number	Pilot Connection	Inlet/Outlet	Volts	used as/in	Bemerkungen
472 195 031 0	1 x M 16x1,5	3 x M 22x1,5	24	Standard	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 033 0	1 x 3/8"-18 NPTF	2 x 3/4"-14 NPTF 4 x 3/8"-18 NPTF	12	USA / Austr.	with bayonet to DIN 72585-A1-3.1-Sn/K1 pilot pressure higher by 4 psi
472 195 034 0	1 x M 16x1,5	3 x M 22x1,5	12	12 V Europa	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 041 0	1 x M 16x1,5	7 x M 22x1,5	24	Horizontally opposed valve	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 044 0	1 x M 16x1,5	7 x M 22x1,5	12		with bayonet to DIN 72585-A1-3.1-Sn/K1

Solenoid Control Valve:

Part Number	Inlet / Outlet Port	Volts	Comments
472 195 016 0	M 22 x 1,5 Voss	24	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 018 0	M 22 x 1,5	24	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 019 0	M 22 x 1,5 Parker	24	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 052 0	1/2"-14 NPTF	12	with bayonet to DIN 72585-A1-3.1-Sn/K1
472 195 066 0	M 22 x 1,5	12	with bayonet to DIN 72585-A1-3.1-Sn/K1

3. Supply cables (ISO 7638)

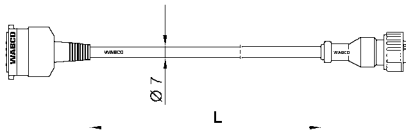


with socket for semi-trailer

with plug for drawbar trailer

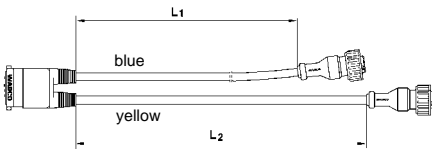
Part Number	Length [mm]	Part Number	Length [mm]
449 112 035 0	3500	449 212 060 0	6000
449 112 047 0	4700	449 212 080 0	8000
449 112 060 0	6000	449 212 090 0	9000
449 112 080 0	8000	449 212 100 0	10000
449 112 090 0	9000	449 212 120 0	12000
449 112 100 0	10000	449 212 140 0	14000
449 112 120 0	12000		
449 112 130 0	13000		
449 112 140 0	14000		

4. Solenoid valve cable



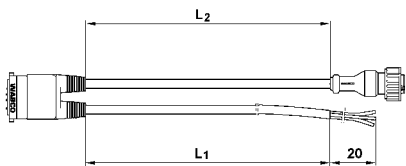
Part Number	Length [mm]	Part Number	Length [mm]
449 411 005 0	500	449 411 060 0	6000
449 411 020 0	2000	449 411 080 0	8000
449 411 030 0	3000	449 411 100 0	10000
449 411 040 0	4000	449 411 140 0	14000
449 411 050 0	5000		

4.1 Solenoid cable for relay valve



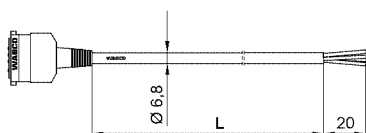
Part Number	Length [mm]	Part Number	Length [mm]
449 444 022 0	400 / 400	449 444 190 0	4000 / 4000
449 444 064 0	1350 / 1350	449 444 251 0	4500 / 6000
449 444 106 0	2000 / 2000	449 444 253 0	6000 / 6000
449 444 169 0	3500 / 3500	449 444 274 0	7000 / 7000
449 444 187 0	2500 / 4000	449 444 316 0	10000 / 10000
449 444 188 0	3000 / 4000		

4.2 Solenoid cable for 3rd modulator/retarder



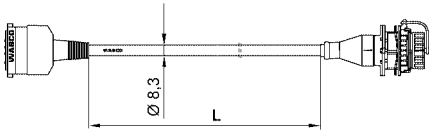
Part Number	Length [mm]	Part Number	Length [mm]
449 454 295 0	8000 / 8000		

ISS cable



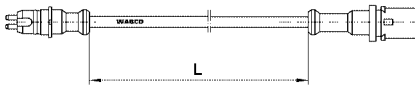
Part Number	Length [mm]	Part Number	Length [mm]
449 402 030 0	3000	449 402 100 0	10000
449 402 060 0	6000	449 402 120 0	12000
449 402 070 0	7000		

4.3 Diagnostic cable



Part Number	Length [mm]	Part Number	Length [mm]
449 612 010 0	1000	449 612 060 0	6000
449 612 030 0	3000	449 612 120 0	12000
449 612 050 0	5000		

5. Sensor extension cable



Part Number	Length [mm]	Part Number	Length [mm]
449 712 008 0	760	449 712 064 0	6350
449 712 018 0	1780	449 712 070 0	7000
449 712 023 0	2300	449 712 080 0	8000
449 712 030 0	3000	449 712 090 0	9000
449 712 035 0	3500	449 712 100 0	10000
449 712 038 0	3810	449 712 120 0	12000
449 712 040 0	4000	449 712 130 0	13000
449 712 051 0	5080	449 712 150 0	15000
449 712 060 0	6000	449 712 200 0	20000

ALLGEMEIN:
GENERAL:

UEBERSICHT:
SURVEY OF DESIGNATIONS:

MODULATOR A = L
MODULATOR B = H1
MODULATOR C = H2

SENSOR c = H2
SENSOR d = H1
* SENSOR e = Z2/L2
* SENSOR f = Z1/L1

WL = WARNLAMPE
WARNING LIGHT

GROUND = MASSE
VALVES = VENTILE

* DURCH STECKEN DES KABELS AM MODUL. A(L) -4S/3M- WERDEN DIE SENSORSIGNALE VON e+f ZUR MAR-REGELG. DIESER ACHSE HERANZUGEN.

* CONNECTING THE CABLE TO MODULATOR A(L) -4S/3M- THE SENSOR SIGNALS OF e+f ARE USED FOR MAR-CONTROL.

ZUORDNUNG:

1. REGELKANAELE

SIEHE UEBERSICHT SYSTEMBEISPIELE GUTACHTEN "VARIO C" ODER "VARIO COMPACT"

2. FARBEN

WICHTIG IST: FUER JEDE FAHRZEUGSEITE DIESELBE FARBE ZU WAELHEN. DAMIT IST IMMER DIE RICHTIGE PNEUMATISCHE UND ELEKTRONISCHE ZUORDNUNG GEWAHRLEISTET. (BEISPIELE SIEHE UNTEN)

YE IN FAHRRICHTUNG RECHTS GILT AUCH FUER VCS.

ALLOCATION:

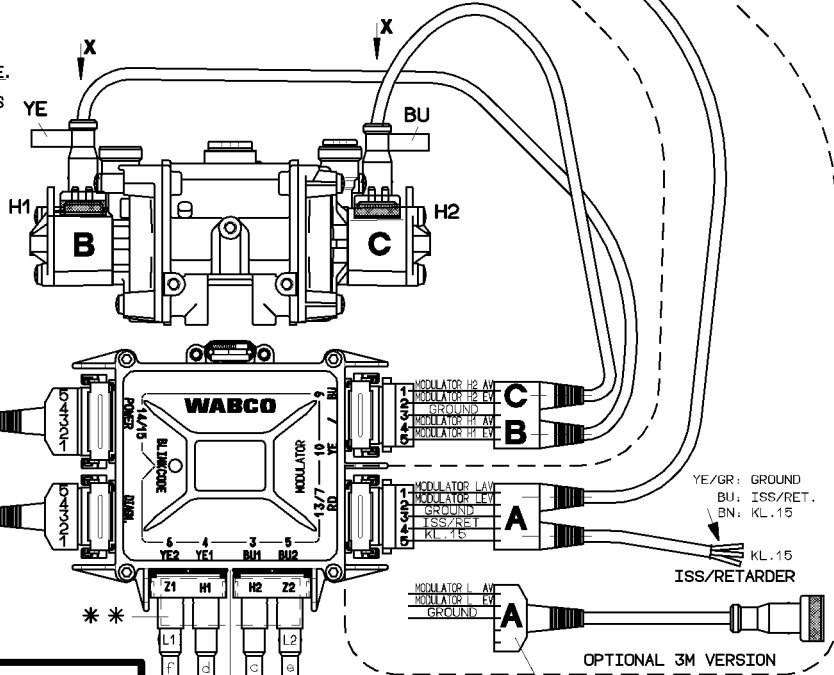
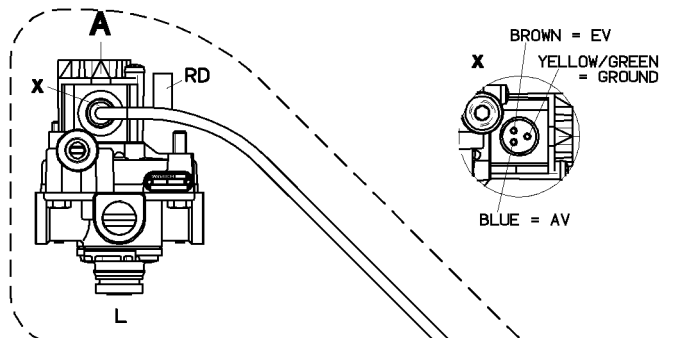
1. CONTROL CHANNELS

PLEASE SEE SYSTEM EXAMPLES CERTIFICATION "VARIO COMPACT"

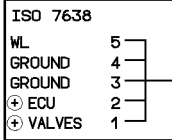
2. COLOURS

IT IS IMPORTANT TO CHOOSE THE SAME COLOUR FOR EACH SIDE OF THE VEHICLE. THUS THE CORRECT PNEUMATIC AND ELECTRONIC ALLOCATION IS ALWAYS GUARANTEED. (EXAMPLES SEE BELOW)

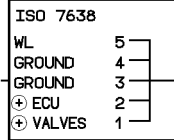
YE IN DRIVING DIRECTION TO THE RIGHT ALSO APPLIES TO VCS.



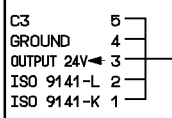
ISO 7638-
POWER SUPPLY



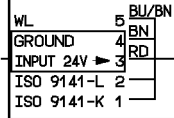
MIXED POWER SUPPLY



DIAGNOSTIC:



DIAGNOSTIC & 24N



BEISPIEL:
EXAMPLE:
4S/3M F. SATTELANH./ZENTRALACHS-ANH.
4S/3M F. SEMITRAIL./CENTRE-AXLE TRAILER

NUR 3M- AUSFUEHRUNG OHNE RETARDER
ONLY 3M- VERSION WITHOUT RETARDER

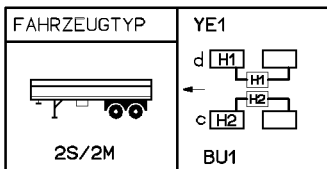
SENSORKABELMARKIERUNG UND AUFKLEBER FUER BLINKCODE:
SENSOR AND BLINKCODE STICKER:

WL	SENSORSTICKER
f = YE2 = f	
d = YE1 = d	
c = BU1 = c	
e = BU2 = e	

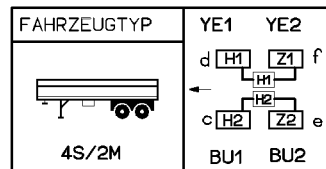
051066	A	95-01-16	DATE	0101	CODE FOR SHEET	REPLACEMENT FOR
051083	B	95-05-19	DATE	841	CODE FOR FUNCTION	0101
051085	C	95-06-27	DATE	801	CODE FOR FUNCTION	1880
051100	D	95-12-11	DATE	171	CODE FOR FUNCTION	51101
059924	E	95-06-17	DATE			
059825	F	98-06-18	DATE			
059897	G	99-03-16	DATE			

BEISPIELE:
EXAMPLES:

MODULATOREN:
YE = H1 = B
BU = H2 = C



MODULATOREN:
YE = H1 = B
BU = H2 = C



MODULATOREN:
RD = L = A
YE = H1 = B
BU = H2 = C

