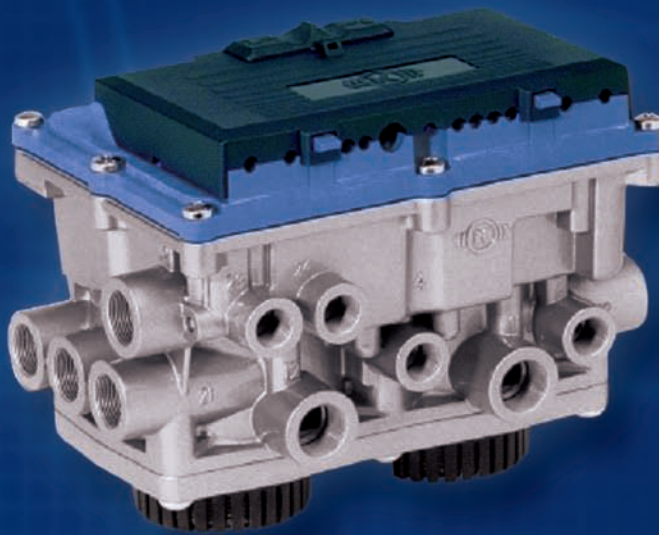


Product Manual

System and Installation Instructions for KB4TA



- 24 Volt Multi-channel Trailer ABS
- With integrated anti-compounding

KNORR-BREMSE



Disclaimer

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This disclaimer is an English translation of a German text, which should be referred to for all legal purposes.

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Safety Advice

Note: The safety advice below is applicable to general service and diagnostic work on air braking systems and may not all be directly relevant to the activities and products described in this document.

Before and whilst working on or around air braking systems and devices, the following precautions should be observed in addition to any specific advice given in this document:

- Always wear safety glasses when working with air pressure.
- Never exceed manufacturer's recommended air pressures.
- Never look into air jets or direct them at anyone.
- Never connect or disconnect a hose or line containing pressure; it may whip as air escapes.
- Never remove a device or pipe plug unless you are certain all system pressure has been depleted.
- Park the vehicle on a level surface, apply the parking brakes, and always chock the wheels as depleting vehicle air system pressure may cause the vehicle to roll.
- If work is being performed on the vehicle's air braking system, or any auxiliary pressurised air systems, and if it is necessary to drain the air pressure from reservoirs, etc., keep clear of brake actuator push rods and levers since they may move as system pressure drops. Be aware that if the vehicle is equipped with an air dryer system, it can also contain air pressure along with its purge reservoir, if fitted, even after pressure has been drained from the other reservoirs.
- When working under or around the vehicle, and particularly when working in the engine compartment, the engine should be shut off and the ignition key removed. Where circumstances require that the engine be running, EXTREME CAUTION should be taken to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components. Additionally, it is advisable to place a clear sign on or near the steering wheel advising that there is work in progress on the vehicle.
- Examine all pipework for signs of kinks, dents, abrasion, drying out or overheating. Be aware that kinks in pipework may result in air pressure being trapped in the pipework and associated equipment. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems. Check the attachment of all pipework; it should be supported so that it cannot abrade or be subjected to excessive heat.
- Components with stripped threads or damaged/corroded parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle or component manufacturer.
- Never attempt to install, remove, disassemble or assemble a device until you have read and thoroughly understood the recommended procedures. Some units contain powerful springs and injury can result if not properly dismantled. Use only the correct tools and observe all precautions pertaining to use of those tools. Before removing any device note its position and the connections of all pipework so that the replacement/serviced device can be properly installed. Ensure that adequate support or assistance is provided for the removal/installation of heavy items.
- Use only genuine Knorr-Bremse replacement parts, components and kits.
- Prior to returning the vehicle to service, make certain all components and systems are leak free and restored to their proper operating condition.

Welding

To avoid damage to electronic components when carrying out electrical welding, the following precautions should be observed:

- In all cases, before starting any electrical welding, remove all connections from any electronic control units or modules, noting their position and the order in which they are removed.
- When re-inserting the electrical connectors (in reverse order) it is essential that they are fitted to their correct assigned position - if necessary this must be checked by PC Diagnostics.

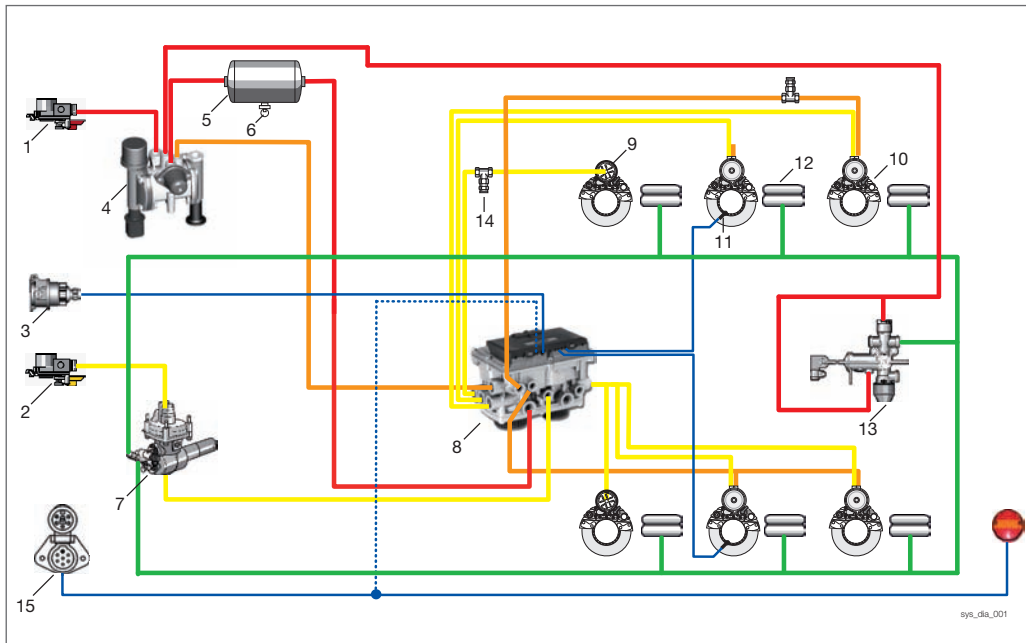
The Knorr-Bremse KB4TA module is an integrated ABS electronic control unit and dual modulator valve for air braked trailers: semi-trailers, centre-axle trailers and full trailers.

For 4S/3M applications an additional external (third) ABS Modulator is necessary.

2 System Diagrams

This section contains a number of 'typical' trailer installations. Further installation options may be found in the ABS Information Document Y023866 or contact your Knorr-Bremse representative.

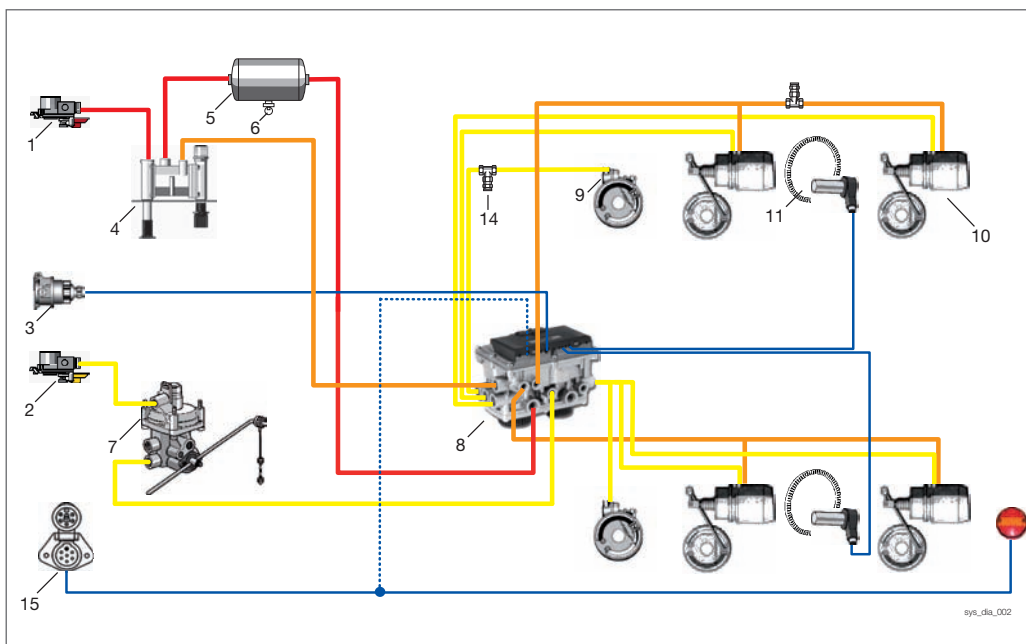
2.1 System diagram (2S/2M) for semi-trailer with air suspension



Legend:

- (1) Coupling Head with Filter - "Supply"
- (2) Coupling Head with Filter - "Control"
- (3) ABS Connector ISO 7638
- (4) Park / Shunt Valve AE4311
– K015380 with Emergency
Function and integral Charging
Valve
- (5) Air Reservoir
- (6) Drain Valve
- (7) Load Sensing Valve (e.g. BR5522)
- (8) ABS Module with 6 delivery ports
- (9) Brake Chamber
- (10) Spring Brake
- (11) Sensing Ring and Wheel Speed
Sensor
- (12) Air Spring Bellow
- (13) Levelling Valve
- (14) Test Connector
- (15) Electrical Connector "Lighting" acc.
to ISO 1185

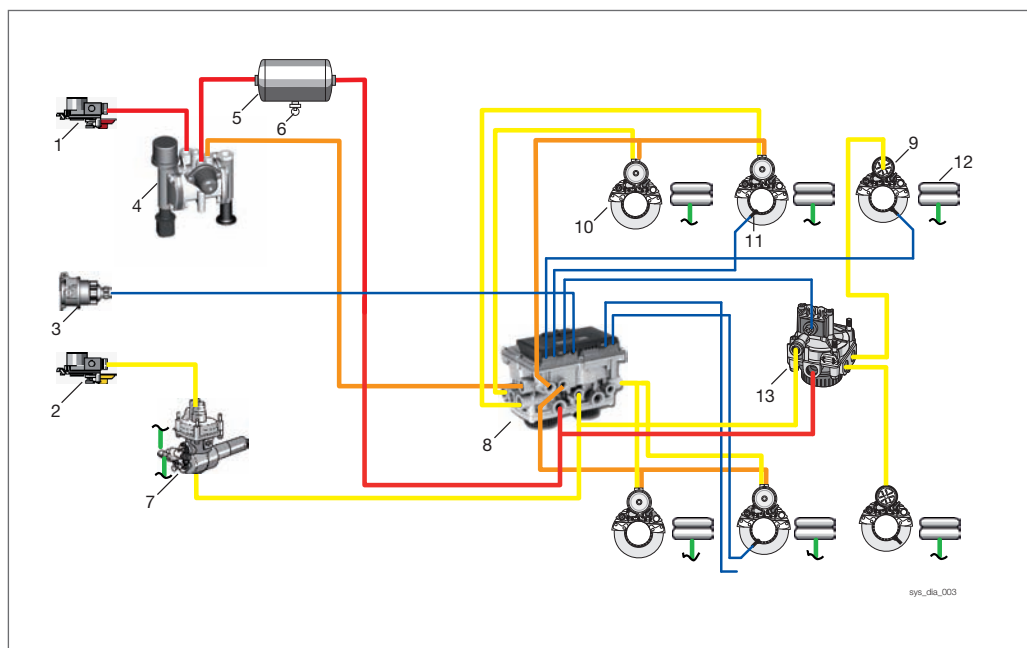
2.2 System diagram (2S/2M) for semi-trailer with mechanical suspension



Legend:

- (1) Coupling Head with Filter - "Supply"
- (2) Coupling Head with Filter - "Control"
- (3) ABS-Connector ISO 7638
- (4) Park-/Shunt Valve AE4311
– K000896 with Emergency
Function
- (5) Air Reservoir
- (6) Drain Valve
- (7) Load Sensing Valve (e.g. BR4370)
- (8) ABS Module with 6 delivery ports
- (9) Brake Chamber
- (10) Spring Brake
- (11) Sensing Ring and Wheel Speed
Sensor
- (14) Test Connector
- (15) Electrical Connector "Lighting"
acc. to ISO 1185

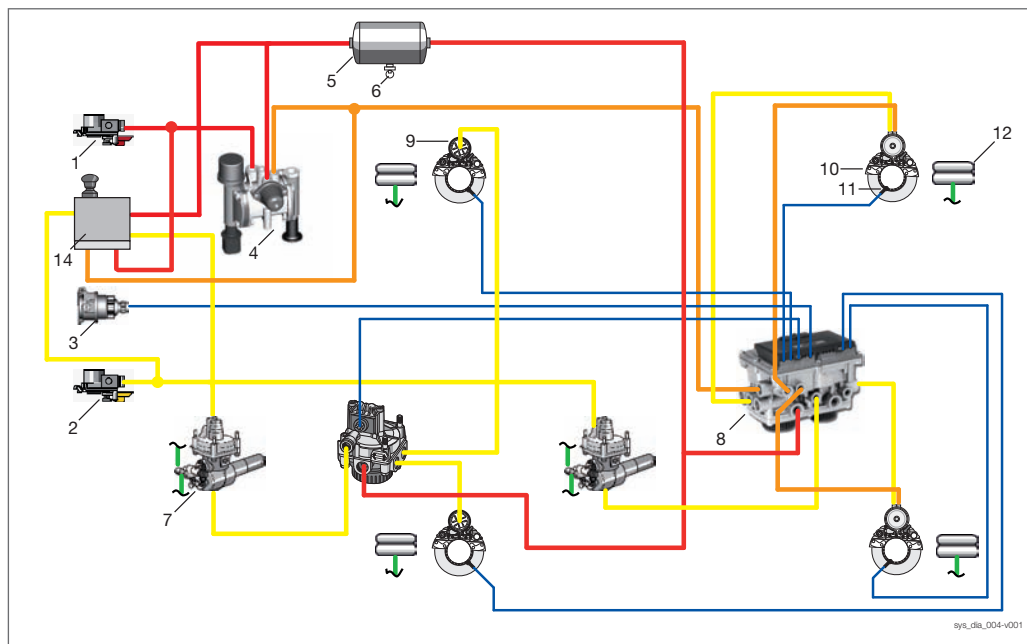
2.3 System diagram (4S/3M) for semi-trailer with air suspension



Legend:

- (1) Coupling Head with Filter - "Supply"
- (2) Coupling Head with Filter - "Control"
- (3) ABS Connector ISO 7638
- (4) Park / Shunt Valve AE4311
– K015380 with Emergency Function and integral Charging Valve
- (5) Air Reservoir
- (6) Drain Valve
- (7) Load Sensing Valve (e.g. BR5522)
- (8) ABS Module with 6 delivery ports
- (9) Brake Chamber
- (10) Spring Brake
- (11) Sensing Ring and Wheel Speed Sensor
- (12) Air Spring Bellow
- (13) Additional (third) Modulator Valve

2.4 System diagram (4S/3M) for full trailer with air suspension



Legend:

- (1) Coupling Head with Filter - "Supply"
- (2) Coupling Head with Filter - "Brake"
- (3) ABS Connector ISO 7638
- (4) Park / Shunt-Valve AE4311
– K015380 with Emergency Function and integral Charging Valve
- (5) Air Reservoir
- (6) Drain Valve
- (7) Load Sensing Valve (e.g. BR5522)
- (8) ABS Module with 6 delivery ports
- (9) Brake Chamber
- (10) Spring Brake
- (11) Sensing Ring and Wheel Speed Sensor
- (12) Air Spring Bellow
- (13) Additional (third) Modulator Valve
- (14) Operating Valve AE4211

3 Components

This section provides basic information about components used within a typical braking system. More comprehensive information can be obtained from the Trailer Product Catalogue or contact your Knorr-Bremse representative.

3.1 Coupling Heads

Features:

Coupling heads are used to connect the braking system of the towing vehicle and trailer. An integral filter protects the air braking system and the auxiliary system of the trailer from non liquid contamination.

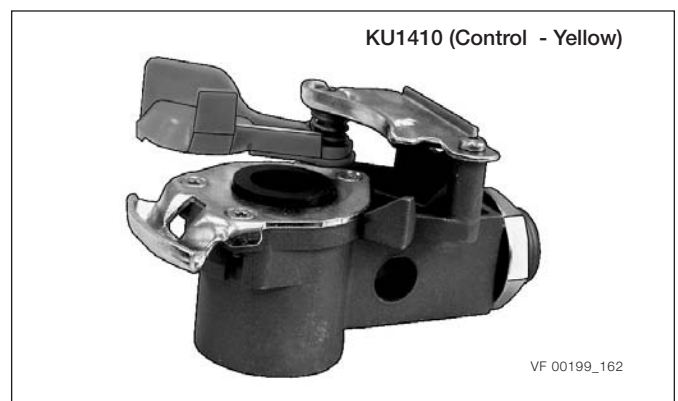
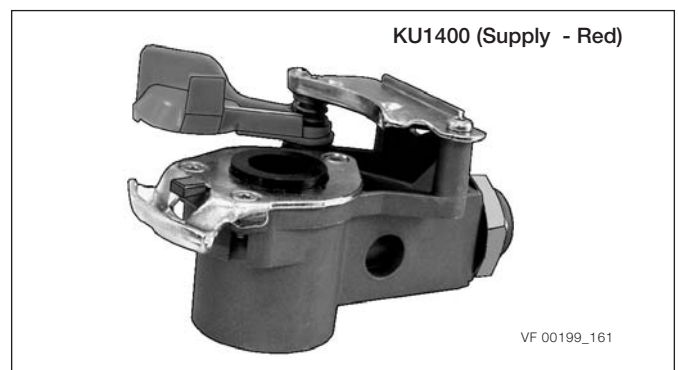
Each coupling has an integrated filter which in the case of the filter becoming blocked provides a by-pass to enable the trailer brakes to be applied and released.

Coupling heads are colour coded to indicate the control (yellow) and supply (red) air line connections and are designed, as defined in DIN ISO 1728, to prevent wrong connection.

The versions for semi-trailers are designed to prevent the rotation of the coupling head when connecting or disconnecting the air line.

Technical Data:

- Maximum operation pressure: 8,5 bar
- Operating temperature range: . . . -40 °C to +80 °C
- Filter: Integrated



3 Components

3.2 Park / Shunt Valve

3.2.1 Valve for trailers with air suspension

Features:

- Priority to service braking system during charging
- Spring brakes held off during energy consumption test
- Spring brakes are fully applied when either the supply line or reservoir pressure < 2.5 bar
- Charging Valve closing pressure 5.4 bar

Technical Data:

- Maximum operation pressure: 10.0 bar
- Operating temperature range: . . . -40 °C to +80 °C



3.2.2 Valve for trailers with mechanical suspension

Features:

- Priority to service braking system during charging
- Spring brakes held off during energy consumption test
- Spring brakes are fully applied when either the supply line or reservoir pressure < 2.5 bar

Technical Data:

- Maximum operation pressure: 10.0 bar
- Operating temperature range: . . . -40 °C to +80 °C

3.3 Load Sensing Valve

3.3.1 Valve for trailers with air suspension

Features:

The load sensing valve is used to modify the applied service brake pressure in relation to the load imposed on the vehicle's axles. The air suspension load sensing valve uses the pressure in the suspension air springs to "sense" the load imposed on the axles and determine the valve's braking ratio.

Versions of the valve are available with or without relay and emergency features, and with static or dynamic operation. A static valve uses the load sensing ratio at the point of brake application which remains constant throughout the brake application while a dynamic valve continually adjusts the load sensing ratio throughout the brake application and therefore takes account of any load transfer.

A trailer mounted data plate, showing the settings of the load sensing valve is required by ECE Regulation 13 and Directive 71/320/EEC.

Technical Data:

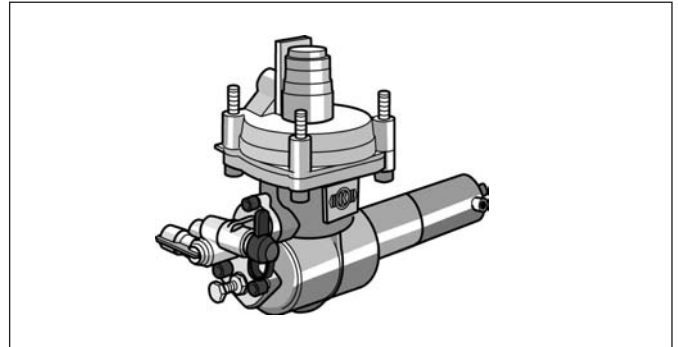
- Maximum operation pressure: 8,5 bar
- Operating temperature range: . . . -40 °C to +80 °C

3.3.2 Valve for trailers with mechanical suspension


Function:

The load sensing valve is used to adjust the applied service brake pressure in relation to the load imposed on the vehicle's axles. The mechanical suspension load sensing valve uses the movement between the vehicle's chassis and axles to „sense“ the load imposed on the axles.

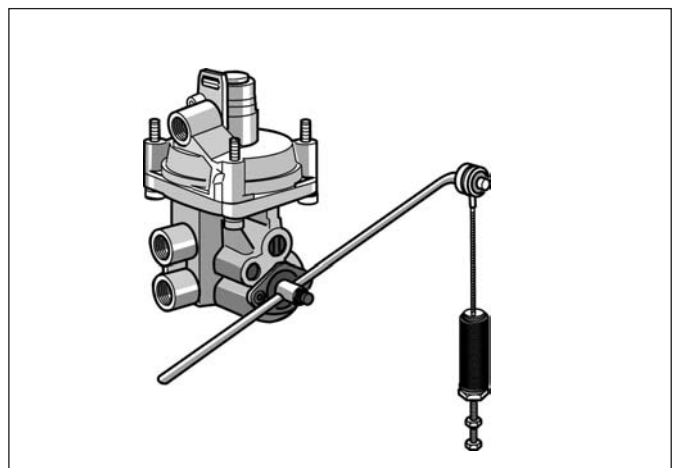
The valve is installed on the chassis and a linkage is required to connect the control arm of the valve to the axle(s). Any movement of the chassis changes the position of the valve's control arm which, in turn, alters the ratio of input pressure to output pressure.



Trailer Data Plate

 KNORR-BREMSE AG		Automatisch-Lastabhängige Bremskraftregelung (ALB) for Type: Load Sensing Device for Type: Dispositif de correction automatique de freinage pour type:	
Eingangsdruck, Input Pressure Pression d'entrée		bar	
Vorderachse, Front Axle, Essieu avant		Hinterachse, Rear Axle, Essieu arrière	
Ventile Nr. Valves No. Valves No.		Ventile Nr. Valves No. Valves No.	
Achslast Axle Load Charge essieu kg	Federungsdruck Suspension Pressure Pression de suspension bar	Ausgangsdruck Output Pressure Pression de sortie bar	Achslast Axle Load Charge essieu kg

VF 00075/9



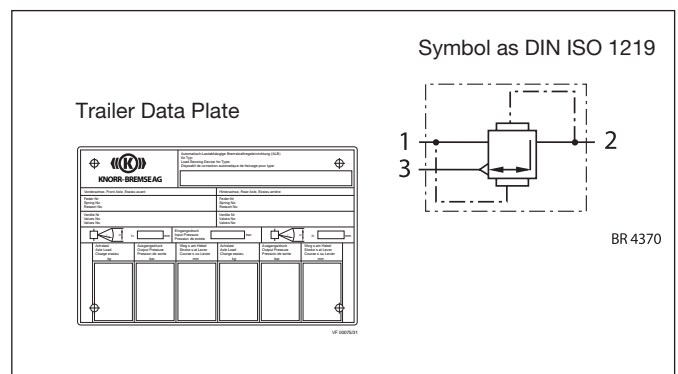
3 Components

Versions of the valve are available with or without relay and emergency features, and with static or dynamic operation. A static valve uses the load sensing ratio at the point of brake application which remains constant throughout the brake application while a dynamic valve continually adjusts the load sensing ratio throughout the brake application and therefore takes account of any load transfer.

A trailer mounted data plate, showing the settings of the load sensing valve is required by ECE Regulation 13 and Directive 71/320/EEC.

Technical Data:

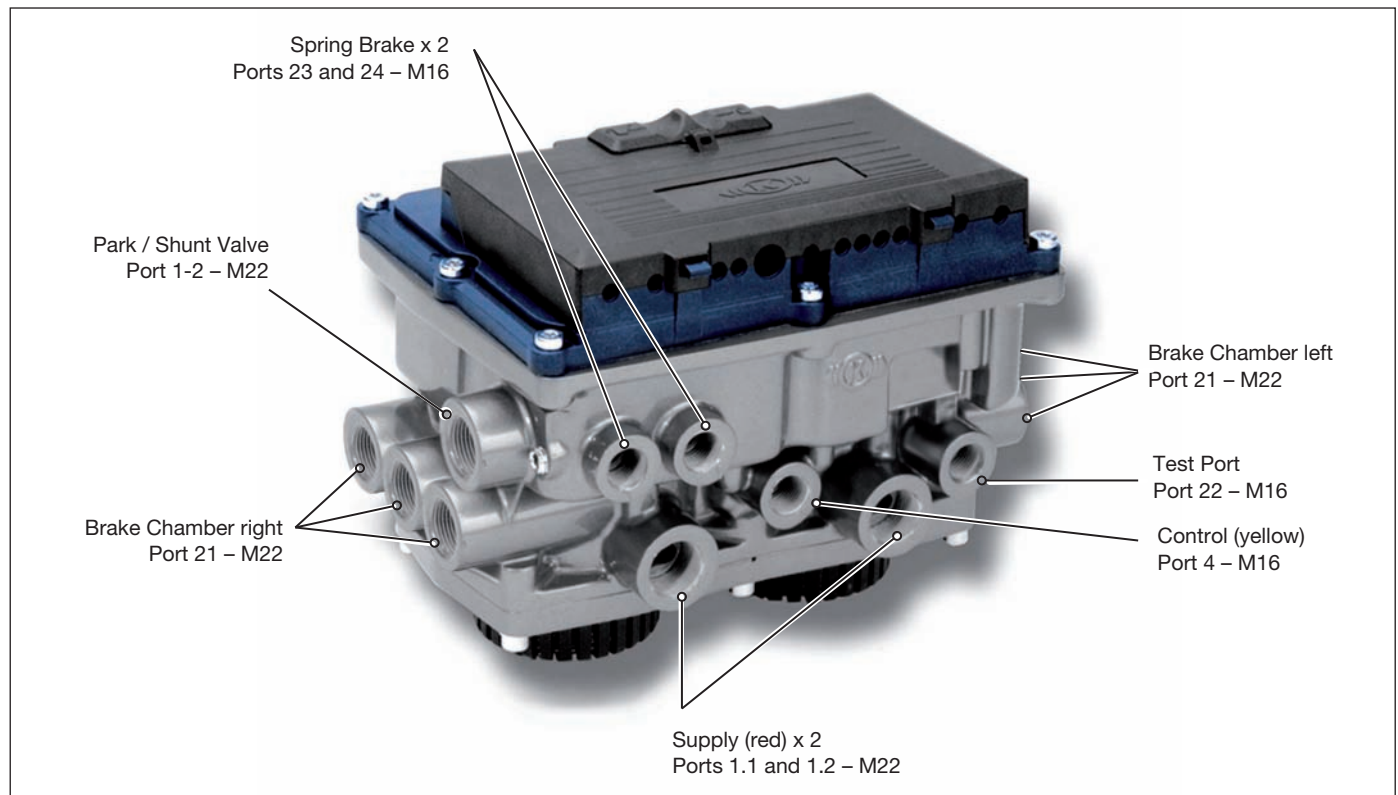
- Maximum operation pressure: 8,5 bar
- Operating temperature range: . . . -40 °C to +80 °C



3.4 Trailer ABS Module

3.4.1 Pneumatic Connections

KB4TA: 24 Volt Trailer Anti-lock System: Pneumatic connections



3.4.2 System Features:

- Mechatronic Module for multi-channel ABS applications
 - System configurations – 2S/2M, 4S/2M (axle and side control) and 4S/3M
- Applications:
 - Semi-trailer
 - Centre-axle trailer
 - Full trailer
- Auxiliary functions:
 - Reset to Ride (RtR) *
 - Independent Speed Switch (ISS) *
 - ABS Active *
 - Brake wear monitoring
 - Stop lamp powering
 - Headboard warning lamp
 - 24V Supply
- Automatic System Configuration ** (2S/2M & 4S/2M only)
- 4S/3M System Configuration only via PC diagnostics **
- Blink code activation via stop lamp

Technical Data:

- Maximum operation pressure: 12.5 bar
- Operating temperature range: . . . -40 °C to +65 °C

* Only available with certain Part Numbers

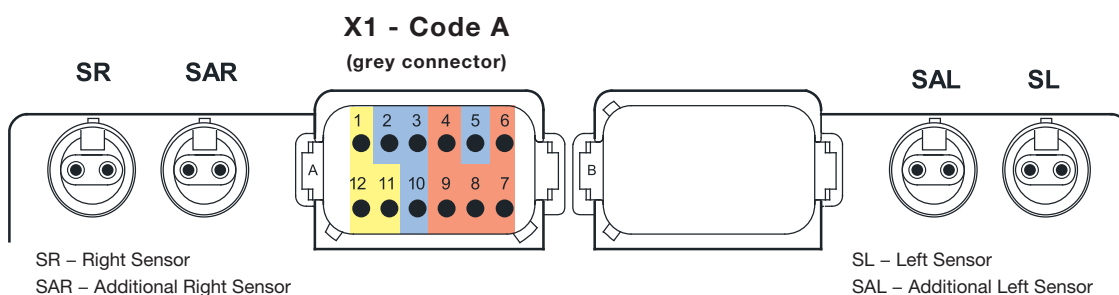
** EOL-test is recommended

3.4.3 ECU Connectors

The Knorr-Bremse KB4TA module ECU connectors use a 12-pin Deutsch DT series connector for ISO 7638 power supply, diagnostics and auxiliary I/Os like ISO 1185 stop lamp power supply, additional third modulator and one additional Input/Output.

The module also utilizes either two or four wheel speed sensor inputs.

- SL & SR are used for 2S/2M applications.
- SAL and SAR are additional connections for 4S/2M and 4S/3M applications, note: these sensors may be installed on lift axles in certain system applications.



Pin	Signal	Connection
X1-1	AUXI01	Auxiliary Input/Output (4S/3M: Valve 3rd Modulator)
X1-2	AUXRET23	Return Line for AUXI02 and AUXI03 (Diagnostics Ground)
X1-3	TI_CANL	5V-CAN Low for Diagnostics
X1-4	GND_M	System Ground (ISO 7638 - ABS connector - Pin 4)
X1-5	TI_CANH	5V-CAN High for Diagnostics
X1-6	BAT	Valve Supply Voltage (ISO 7638 - ABS connector - Pin 1)

Pin	Signal	Connection
X1-7	GND_H	Warning Lamp Ground (ISO 7638 - ABS connector - Pin 3)
X1-8	WL	Warning Lamp (ISO 7638 - ABS connector - Pin 5)
X1-9	IGN	ECU Supply Voltage
X1-10	AUXI03 (DIA)	Auxiliary Input/Output (Diagnostics Supply Voltage)
X1-11	AUXI02/ GND_BL	Auxiliary Input/Output (Stop lamp ground)
X1-12	AUXRET1/BL	Return Line for AUXI01 (Stop lamp Supply) (4S/3M: Return Line 3rd Modulator)

ISO 7638 Connection (5 Pins)

- X1-4 = ISO 7638 Pin 4 valve ground
- X1-6 = ISO 7638 Pin 1 valve supply
- X1-7 = ISO 7638 Pin 3 ignition / warning lamp ground
- X1-8 = ISO 7638 Pin 5 warning lamp
- X1-9 = ISO 7638 Pin 2 ignition

Diagnostic Connector

KB4TA harnesses provide a 4-pin 5 Volt J1939 CAN diagnostic connection for a diagnostic tool. Remote diagnostic cables are available from Knorr-Bremse to provide a J1939 diagnostic port at the side of the trailer.

- X1-2 = Diagnostics ground
- X1-3 = 5 Volt CAN low
- X1-5 = 5 Volt CAN high
- X1-10 = 24 Volt diagnostics supply

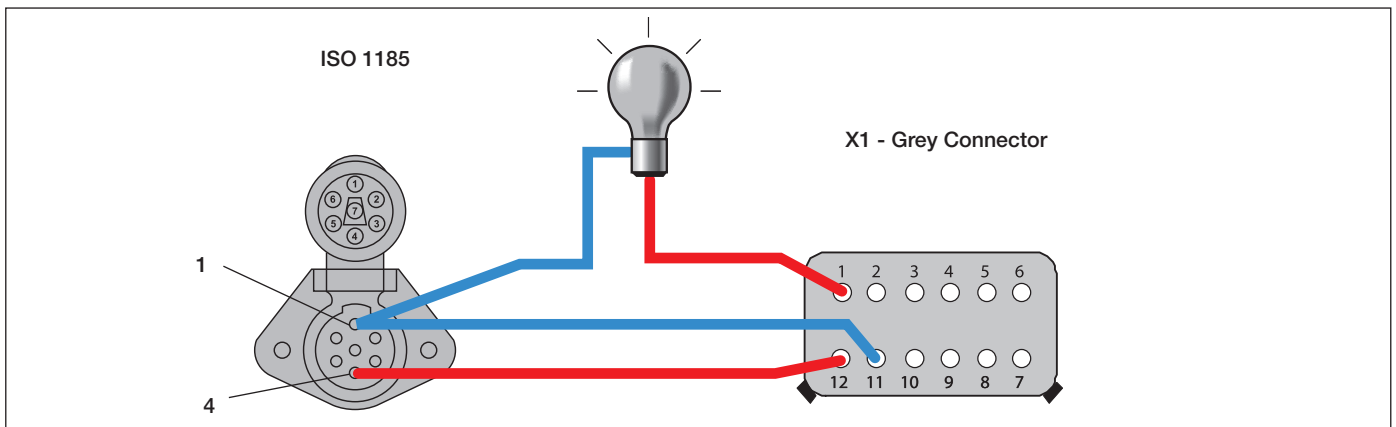
3.4.4 Stop Lamp Power

The KB4TA module provides a connection for stop lamp power, with an optional connection for a headboard mounted warning light.

Note:

A system configured for stop lamp power cannot support 4S/3M system configurations.

Installation: Stop Lamp Power with External Warning Lamp.



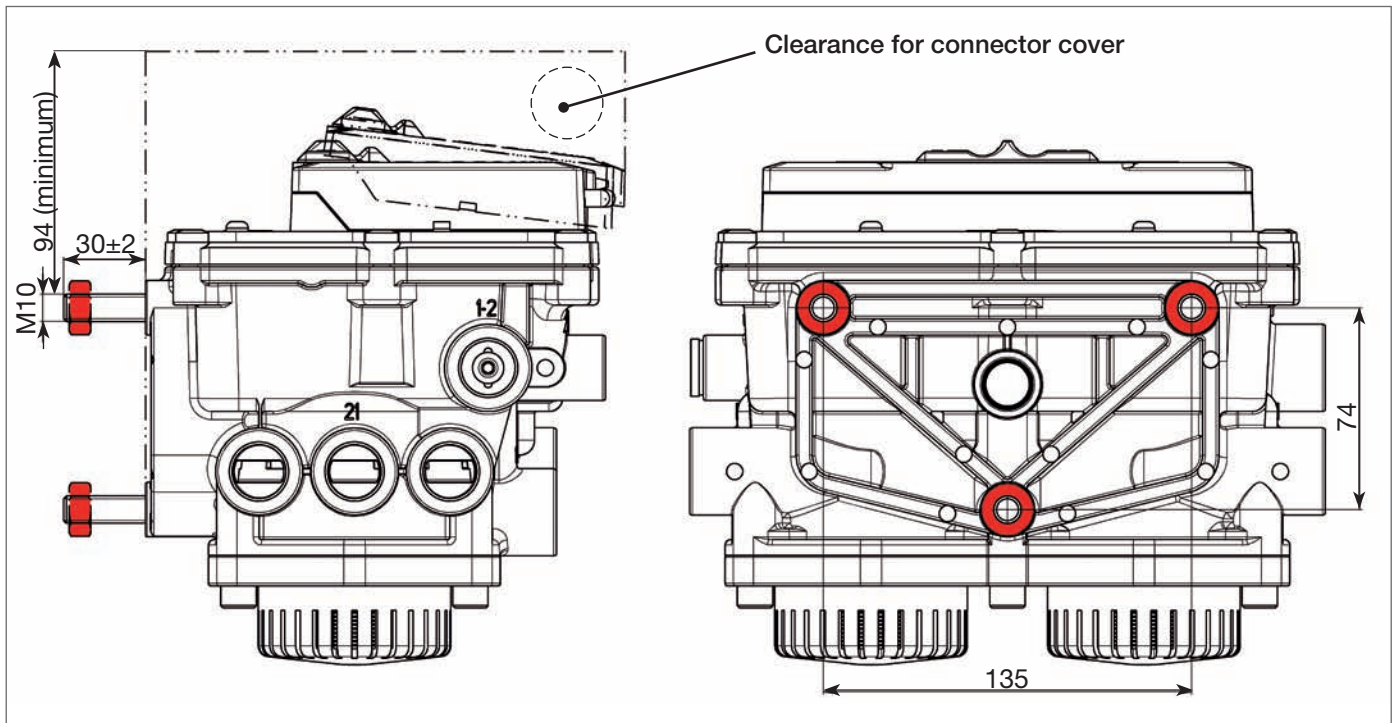
ISO 1185 Pin	Connection
1	Common return
2	Left-hand rear position and end outline marker light and rear registration plate illuminating device
3	Left-hand direction-indicator light
4	Stop lamp
5	Right-hand direction-indicator light
6	Right-hand rear position and end outline marker light and rear registration plate illuminating device
7	Connection "54g" – free

Note:

The use of a headboard mounted warning lamp is prohibited on vehicles approved to ECE Regulation 13 unless national requirements specifically allow the installation.

3.4.6 Module Mounting

Diagram showing fixings for the KB4TA Module



Note:

Tightening torque of the retaining nuts = 40 +5 Nm.

3.5 ABS Modulator Relay Valve (BR9234)

Function:

An additional axle modulator valve (BR9234) is required for 4S/3M ABS applications. This is an electro-pneumatic control valve and is the last valve that air passes through on the way to the brake chambers. In case of an ABS intervention, the ECU will energise only the exhaust solenoid to modify or hold the brake actuator pressure. During normal braking, the BR9234 operates as a standard relay valve. As the brake control is applied or released by the driver, the pneumatic control signal from the tractor causes the BR9234 to apply proportional pressure to the trailer brake actuators.

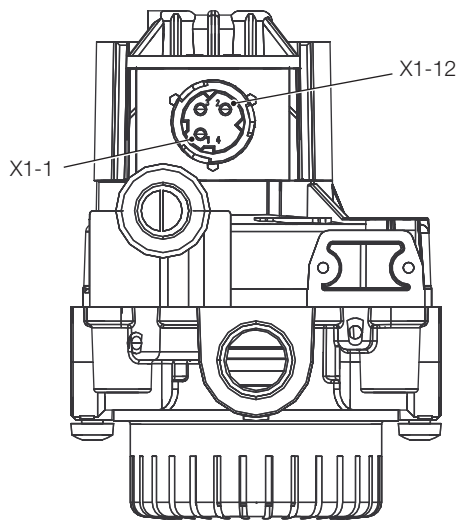
Connections to ECU:

- X1-1 Connection to exhaust solenoid of BR9234
- X1-12 Connection to Common (GND)

Technical Data:

- Maximum Pressure: 10 bar
- Operating Temperature Range: . . -40 °C to +75 °C

Modulator Relay Valve



Front view showing pin connection

3.6 Wheel Speed Sensor

3.6.1 Function and technical details

Function:

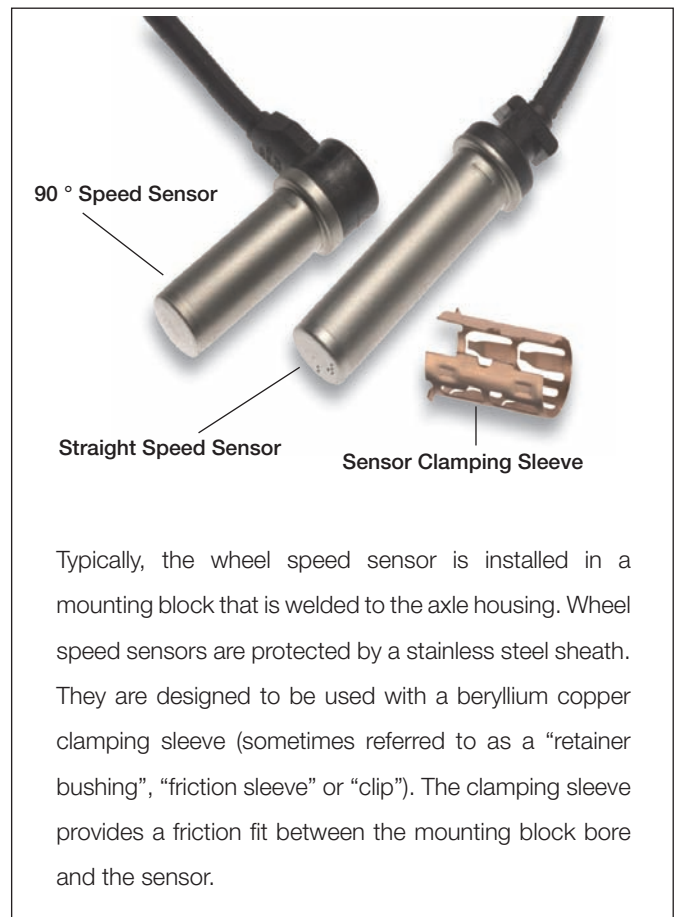
The wheel speed sensor is mounted, using a spring-loaded bush, in a housing on the axle in such a position that the end of the sensor is as close as possible to the teeth of the sensing ring. The wheel speed sensor contains an internal permanent magnet whose magnetic field extends a short distance beyond the end of the sensor case. A coil is wrapped around a soft iron core, which is attached to the magnet. This coil is connected to the output cable.

When a wheel rotates, the teeth of the sensing ring pass in turn through the magnetic field of the sensor magnet and disturb the field thereby creating an induced voltage in the sensor coil. This voltage is monitored by the KB4TA module via the output cable. The voltage generated takes the form of a sine wave with both the voltage and frequency increasing as the rotational speed of the wheel increases. The module requires a minimum voltage before it recognises the signal from the wheel speed sensor and thereafter it uses the frequency of the signal to monitor the rotational speed of the wheel. The voltage generated by the coil is dependent not only on the rotational speed of the wheel but also on the gap between the end of the wheel speed sensor and the teeth of the sensing ring: the larger the gap the lower the generated voltage. It is important, therefore, that the gap is kept as small as possible to ensure that sufficient voltage is generated to maintain low speed ABS performance.

Technical data:

Operating temperature range:

- Speed sensor: -40 °C to +160 °C
- Cable: -40 °C to +180 °C
- Plug: -40 °C to +80 °C



3.6.2 Installation instruction

A proper sensor installation is critical for correct ABS operation.

- 1) For increased corrosion protection it is recommended that a high temperature rated silicon or lithium based grease be applied to the interior of the mounting block, the wheel speed sensor, and to the new clamping sleeve. Recommended grease - Part No. I90693.
- 2) Push the new clamping sleeve fully into the block, with the retaining tabs toward the inside of the vehicle. Please note that wheel speed sensors must use the correct clamping sleeve. Failure to do so may result in reduced retention force, allowing sensor movement resulting in ABS failure.
- 3) Gently push (DO NOT STRIKE) the wheel speed sensor into the clamping sleeve until it contacts the face of the sensing ring. Secure the sensor cable to the knuckle/ axle housing or the brake hose 10-15 cm from the sensor.
- 4) During cable installation it is important that maximum distance from the heat radiating components (foundation brake) is achieved.
- 5) Apply a moderate amount of dielectric non-conductive grease to both the sensor connector and harness connector.
- 6) Engage the connectors, and push together until the lock tab snaps into place.

7) The sensor cable and extension cable should be fixed on either side of the connection.

8) Fasten cables using cable clips (not supplied by KB), individual suspension travel should be taken into account to avoid possible damage. If necessary the cable should be secured in the back plate of the foundation brake with a cable grommet!

NOTE: It is important for the wheel bearings to be adjusted in accordance with the manufacturer's recommendations

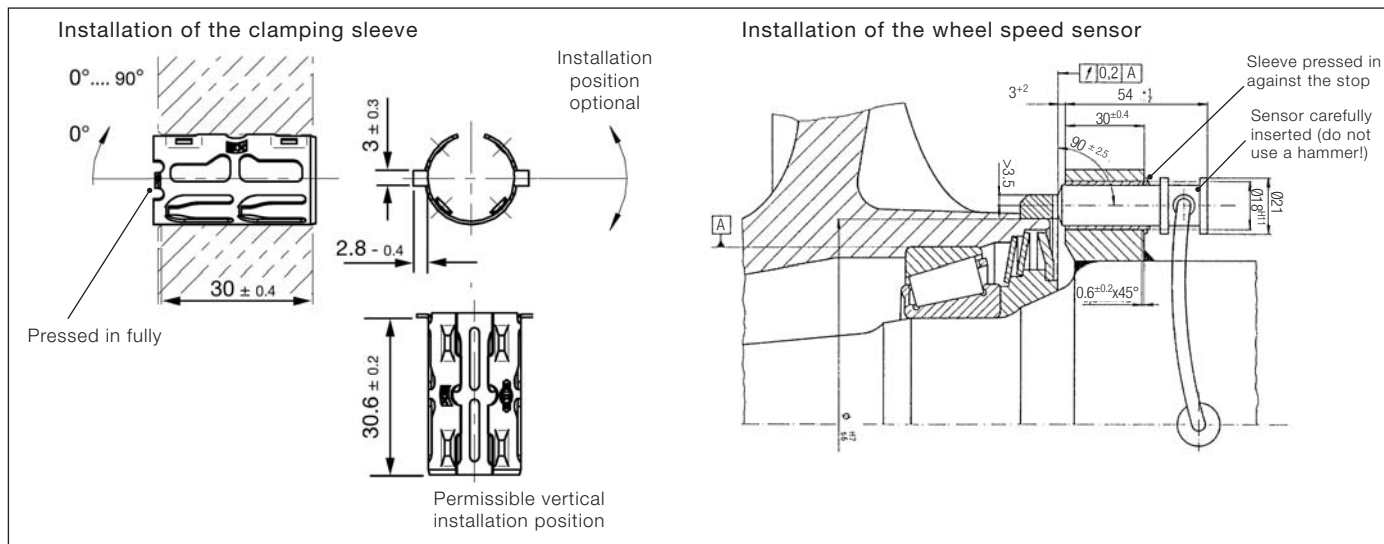
The friction fit allows the wheel speed sensor to slide back and forth under force but to retain its position when the force is removed. When the sensor is inserted all the way into the mounting block and the drum or hub is installed on the axle, the sensing ring contacts the sensor and normal bearing clearance will push the sensor away from the sensing ring, which will establish a running clearance (air gap) between the sensor and sensing ring.

Excessive bearing clearance will result in the sensor being pushed further away from the sensing ring and can result in ABS failure.

If the air gap is >1 mm, resulting in a low output signal, the speed sensor has to be adjusted.

If the wheel speed sensor becomes damaged during installation it must be replaced. It is recommended that the clamping sleeve is also replaced (Part No. II16774) whenever the sensor is replaced.

Diagram showing mounting of clamping sleeve and wheel speed sensor



3.7 Wiring Harness

Several wiring harnesses are available to connect the KB4TA module and other trailer system components. All cables are environmentally sealed at the connector interface and are clearly labelled for correct installation.

Because of the moulded design of the KB4TA module wiring harnesses and individual cables, Knorr-Bremse recommends that a complete harness or cable be replaced if damage or corrosion occurs.

The following connector options may be present:

- additional (third) modulator
- auxiliary
- diagnostic
- additional axle wheel speed sensors.

3.7.1 Power supply cables available from Knorr-Bremse

Part No.	Description	Cable Length (m)	Wiring Diagram	Picture
2264462396 2264462397 2264462398	Power supply cable with socket (for semi-trailers)	8.0 12.0 14.0		
2264462399 2264462400	Power supply cable with plug (for drawbar trailers and centre axle trailers)	8.0 10.0		
K010838	Power supply + Diagnostics	6.0 (DIA) 0.5 (ISO 7638)		

continued on following page.....

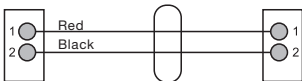

Table of power supply cables continued...

Part No.	Description	Cable Length (m)	Wiring Diagram	Picture
K016660	Power supply + External warning lamp + Stop Lamp Power	15.0 (Ext. WL) 15.0 (ISO 1185) 0.5 (ISO 7638)	<p>Yellow 1 AUXI01 2 AUXRET23 3 TI_CANL 5 TI_CANH 10 AUXI03 11 GND_BL 12 BL 6 BAT 9 IGN 7 GND_H 4 GND_M 8 WL</p> <p>Red 1 Black 2 Yellow 3 Brown 4 White 5</p>	
K016991	Power supply + Diagnostics + 3rd ABS Modulator	6.0 (DIA) 10.0 (3rd Mod.) 0.5 (ISO 7638)	<p>Yellow 10 AUXI03 (DIA) 2 AUXRET23 3 TI_CANL 5 TI_CANH 11 GND_BL 12 BL 6 BAT 9 IGN 7 GND_H 4 GND_M 8 WL</p> <p>Black 1 Yellow 12 Red 6 Black 9 Yellow 7 Brown 4 White 8</p>	
K015313	Power supply cable with socket - Direct to X1 Connector + Stop Lamp Power	12.0 (ISO 1185) 12.0 (ISO 7638)	<p>Black 11 GND_BL Yellow 12 BL 6 BAT 9 IGN 7 GND_H 4 GND_M 8 WL</p>	
K015468	Power supply cable without socket or plug - Direct to X1 Connector. + Stop Lamp Power	12.0 (ISO 1185) 12.0 (ISO 7638)	<p>Red 6 BAT Black 9 IGN Yellow 7 GND_H Brown 4 GND_M White 8 WL</p>	<p>possible connection for: - Socket K002290 - Plug K002291</p>

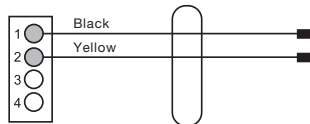

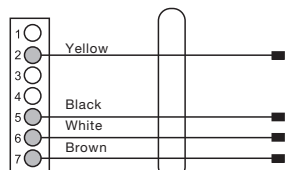



Note:

The power supply cables defined above allow diagnostics to be supported either via blink code or ECUTalk®.

3.7.2 Extension cables for wheel speed sensors

Part No.	Description	Cable Length (m)	Wiring Diagram	Picture
II36756...	Extension cable for wheel speed sensor	2.0 3.0 4.0 5.0 6.0 8.0 10.0 12.0 15.0		 KBM7A-G2-004

3.7.3 Modular system cables

Part No.	Description	Cable Length (m)	Wiring Diagram	Picture
K002274* K002275* K002276* K017003*	Connecting cable for 3rd ABS Modulator	2.0 6.5 10.0 15.0		
K013194	Diagnostic cable	4.0		
K016629 K016630	External Warning Lamp	7.0 15.0		

* Starting from production date (ww/yy): 27/06 (Cable imprint)

3.7.4 Installation of wheel speed sensor extension cables and modulator connection cables

The rotation angle of the fifth wheel and the suspension travel must be taken into account when determining cable length and also during installation.

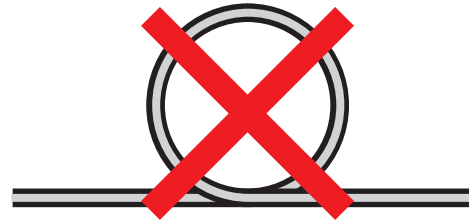
To reduce the risk of damage and subsequent faults in the system, Knorr-Bremse recommends the following:

- 1) Lay the modulator cable and the wheel speed sensor cables separately on the vehicle frame. The sensor cable should have a minimum distance to other cables of approximately 5 –10 cm.
- 2) Cables installed in conduit must be protected at entry and exit with cable grommets.
- 3) It is **not permitted** to 'lose' any excessive length of the extension and connection cables in circular loops or ring form. Excess cable should be detoured or folded (see diagram).

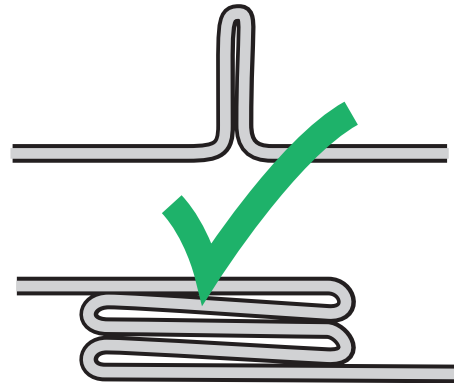
Wire cross section

- Modulator cable: 1.0 mm²
- Wheel speed sensor cable: 0.75 mm²

Installation of excess cable length



Circular looping is **not** permissible



Permissible methods

4 System Description

4.1 Power up Sequence

At power up, the KB4TA module performs a series of self-checks that can assist a technician to determine the ABS system status and configuration.

4.2 Trailer ABS Warning Lamp

At power up (when no faults are detected) the trailer ABS warning lamp in the towing vehicle will turn on for approximately 2 seconds as a bulb check and then turn off. If a fault has been detected the bulb will remain on. The same warning lamp sequence is produced by the trailer mounted headboard warning lamp (when installed)

4.3 Modulator 'Chuff Test' at Power up

At power up, the KB4TA module activates a modulator 'chuff test'. This electrical and pneumatic ABS modulator test can help the technician identify problems with modulator installations and/or wiring.

With brake pressure applied, a properly installed modulator will generate five rapid audible 'chuffs' of air pressure on the left internal modulator followed by five 'chuffs' on the right modulator. There will then be five further 'chuffs' on the additional axle modulator if fitted.

If the modulator is wired incorrectly, the modulator will only produce one 'chuff', or no 'chuffs' at all. If a fault is detected during the modulator 'chuff test', compare the modulator wiring and piping to the KB4TA module's electrical system schematic and make any necessary alterations.

4.4 Operation

KB4TA provides basic service braking in addition to the ABS function.

4.4.1 ABS Operation

The KB4TA module is used to prevent the wheels of a trailer locking whilst braking. The friction between the tyre and the road is created by relative movement between their two surfaces, i.e. difference in surface speeds of road and tyre and is referred to as 'slip'. It is well known that a wheel operating on a wet surface has reduced friction

(adhesion) and hence can transmit reduced braking effort to the road.

The KB4TA module constantly monitors the rotational speed of all sensed wheels on the trailer by using the wheel speed sensor outputs. It then calculates an average of these wheel speeds (Reference Speed) and constantly compares it with the speed of each wheel.

During braking, if one or more wheels is on a slippery surface and is unable to support the level of braking that it is being asked to contribute, the wheel speed will drop relative to the Reference Speed, i.e. there will be 'slip', and deceleration of that wheel will increase. The KB4TA module will normally detect this during the application of the brake and, before the wheel becomes locked, send an electrical signal to the appropriate modulator to reduce the pressure in the service brake actuator(s) on that wheel or group of wheels. Once the wheel starts to accelerate and the slip is reduced, the KB4TA module will send an electrical signal to the modulator to gradually increase the pressure until either the wheel again starts decelerating or the requested level of braking is reached. It is therefore possible to maximise the utilisation of the available adhesion to improve stopping distance whilst maintaining stability.

4.4.2 Normal Braking

During normal braking, the KB4TA module operates as two standard relay valves in parallel. If the ECU does not detect excessive wheel slip, ABS control will remain inactive while the vehicle is braked according to driver demand.

4.5 Odometer Function

4.5.1 Odometer

The KB4TA module has an odometer function to provide a means of storing the accumulated mileage of the trailer. The mileage is computed by utilizing information calculated from the wheel speed sensors. This feature will accurately store mileage information up to 1,000,000 km. The accuracy of readings higher than this cannot be guaranteed. The mileage can be displayed using PC diagnostics ECUtalk® or through blink codes.

4.5.2 Trip Counter

The KB4TA module provides a counter to record the trip mileage. The feature is accessed through PC diagnostics ECUTalk®.

4.5.3 Service Interval

The KB4TA module provides a feature that can be used to indicate a service interval for the trailer. The service interval can be accessed via PC diagnostics ECUTalk®. If configured, the KB4TA module can flash the warning lamp when the vehicle is at standstill and the ABS is first powered to indicate when the service interval has been exceeded.

4.6 Configuration of the KB4TA Module

4.6.1 Production Configuration

The KB4TA module is manufactured with the following default configurations:

Part Number	Type Number	Default ABS Configuration	Stop Lamp Power Enabled	AUXIO1
K004246	ES1305	2S/2M	Yes	Headboard Warning Light
K004236	ES1305	2S/2M	Yes	RtR

4.6.2 Valid Configurations

ABS Configuration	Stop Lamp Power Allowed	Stop Lamp Power Enabled	AUXIO1 Allowed / Return Location	AUXIO2 Allowed / Return Location
2S/2M	Yes	Yes	Yes / X1-11 ²⁾	No
4S/2M Side 4S/2M Axle		No	Yes / X1-12	Yes / X1-2
4S/3M ¹⁾	No	Not applicable	No ³⁾	Yes / X1-2

¹⁾ Auto configuration not supported.

²⁾ Split in wiring harness using a junction box (not supplied) or if a diagnostic connector is not fitted then X1-2 may be used.

³⁾ AUXIO1 (X1-11) and AUXRET1 (X1-12) are used for external modulator.

4.6.3 ABS Auto Configuration

When manufactured the KB4TA module has a default ABS configuration of 2S/2M. If the ABS configuration has not been manually set using the diagnostic tool ECUTalk® then, at power up, if the KB4TA detects additional sensors it will perform an auto-configuration. An auto-configuration only adjusts upward (e.g. from 2S/2M to 4S/2M). **A**

configuration will not be accepted if a wheel speed signal is generated at the time of configuration.

A 4S/3M configuration cannot be realised automatically, this requires manual configuration with the diagnostic tool ECUTalk®.

4.6.4 ABS manual Configuration

Depending upon the required ABS configuration it may be necessary to use the diagnostic tool *ECUtalk®* to manually configure the KB4TA module, i.e. 4S/3M ABS configuration.

Once manually configured, the KB4TA module will no longer auto-configure, unless the "Reset ABS Configuration" option is used in the diagnostic tool *ECUtalk®*.

4.6.5 Auxiliary Configuration

The KB4TA module supports the configuration of auxiliary functions on AUXIO1 and AUXIO2 using the diagnostic tool *ECUtalk®*. However, the associated pins can only be configured as AUXIO if they are not already configured as 4S/3M and stop lamp power respectively.

Part number K004246 (ES1305) will only allow the AUXIO to be configured as headboard warning light, 24V (Power Supply) or OFF.

Part number K004236 (ES1305) will allow the AUXIO to be configured as headboard warning light, 24V (Power Supply), RtR, ISS, ABS Active or OFF.

Both part numbers additionally support configuration of the AUXIO as Pad Wear inputs.

4.6.6 Non Standard Tire Sizes

The KB4TA module allows for tyre rolling radius and sensing ring tooth count parameters to be set for each axle using a diagnostic tool *ECUtalk®*. This setting is necessary for the module to accurately calculate the vehicle speed and determine the odometer mileage. Wheels of the same axle must be set to the same rolling radius and sensing ring tooth count. In most cases, these parameters are set by the trailer OEM and do not need to be adjusted. In the case of a service replacement unit, always check that these parameters are set to match the vehicle. Refer to the manufacturer's tyre specification for correct values. Sensing ring tooth count is defaulted to 100 teeth, but can be adjusted between 60 and 120 teeth.

4.7 Error Detection

The KB4TA module contains self-testing diagnostic circuitry that monitors the ABS components and wiring. When the module senses an erroneous system condition, it activates

the trailer ABS warning lamp in the towing vehicle (and headboard if installed), disables all or part of the ABS functions and stores the error in memory as a Diagnostic Trouble Code (DTC).

For some trouble codes, the KB4TA module will automatically reset and clear the "active" DTC once the error has been corrected. When an "active" DTC is cleared automatically, the error remains stored in memory as an „inactive“ DTC and can be viewed using blink code diagnostics or *ECUtalk®*. However repeated occurrences of certain errors will result in the DTC being "latched" which means the error remains "active" even if the condition is only intermittent.

Once the code is latched, a manual reset will be necessary. After the problem is resolved, trouble codes can be deleted using the diagnostic tool *ECUtalk®*.

4.7.1 ABS Shutdown

Depending on the detected error and the ABS configuration the ECU will either partially or totally disable the ABS function as follows:

- 2S/2M configurations: total shut down.
- 4S/2M configurations: Reduce to 2S/2M
- 4S/3M configurations: Reduce to 2S/2M.

The above shutdown modes are dependent on the type and location of the detected error. For more information see ABS Electronics Information Document Y023867. In all cases a warning signal will be transmitted to illuminate the trailer ABS warning lamp which will remain "ON" as long as the ignition is in the "RUN" position. In cases where the ABS is completely disabled, the vehicle reverts to normal braking (without ABS intervention).

ABS faults should be rectified at the earliest opportunity.

4.7.2 ECU Errors

If an ECU related problem is detected the ABS function is disabled while normal brake control remains available.

4.7.3 Low and High Voltage Operation

Should the supply voltage to the ECU be outside the defined voltage range (18 to 32V) the ABS function is disabled while normal brake control remains available.

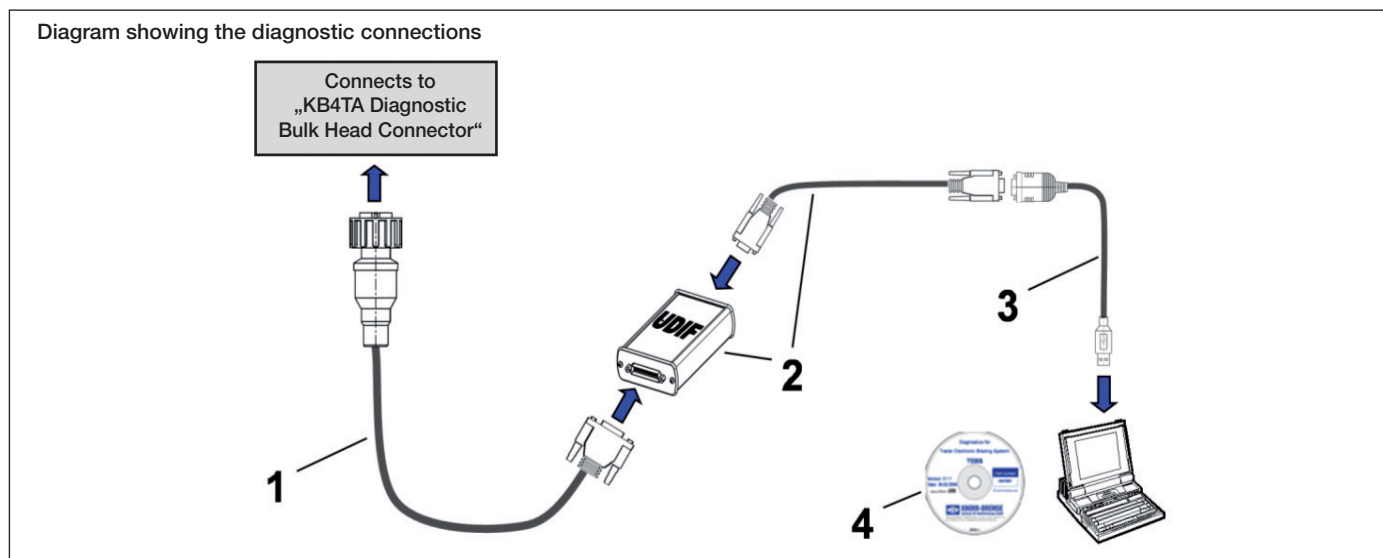
5 Diagnostics

5.1 Diagnostic Components/Tools

In order to configure the KB4TA, carry out 'End Of Line' testing and system checks – additional hardware and software is required as listed below:

Pos.	Name	Part No.	Type No.	Description
1	Diagnostic cable	K010837	EZ1037	length = 3m
2	Diagnostic Set UDIF ¹⁾	II39809F	EZ1031	includes connecting cable Z005474 (9-pin sub-D-plug and 9-pin sub D-socket)
3	Connecting cable	Z007887		optional for USB-connection to PC
4	Diagnostic software	K015844		CD-ROM "ECUtalk®"

1) UDIF = Universal Diagnostic Interface



Adapter cable available from Knorr-Bremse

Part No.	Type No. + Description	Cable Length (m)	Wiring Diagram	Picture
K010837	EZ1037 Adapter cable for UDIF (for 5V CAN Diagnostics)	3		

5.2 Blink Code Diagnostics

The KB4TA module provides diagnostic and configuration functions through blink code diagnostics. This means that the technician, even without diagnostic tools, can read a series of blinks of the ABS warning lamp(s) (in the cab of the towing vehicle and/or on the trailer headboard) to diagnose the trouble codes being generated. However to enter this diagnostic mode the KB4TA module must be wired to accept both a permanent and stop lamp power supply.

The blink code diagnostics mode is entered by providing constant power to the ignition circuit and by switching the stop lamp power input supply "ON" and "OFF" a number of times (see section 5.2.1). With a parked towing vehicle attached to the trailer, this is achieved by switching on the ignition and, after the power up sequence is complete, applying and releasing the brake pedal a number of times (see section 5.2.1). Depending on the blink code mode activated, the KB4TA module will blink the trailer ABS warning lamp(s) to display:

- active faults
- inactive faults (fault history)
- ABS configuration
- odometer mileage.

Wait until after the modulator 'chuff test' before activating the stop lamp power. Following a single display of all available messages, the trailer ABS warning lamp(s) will remain on for five seconds and then return to normal operating mode.

Blink code diagnostics can only be activated following a power up, where wheel speeds have not been detected. If a wheel speed signal is generated during the blink code diagnostics mode, the module will cancel the blink code diagnostics and return to normal operating mode. Blink code diagnostics must be activated within the first 15 seconds of ignition power being applied.

If stop lamp power is continuously applied for longer than five seconds, blink code diagnostics will be disabled until the next time the ignition power is cycled.

5.2.1 Diagnostic Trouble Codes (DTCs)

Display "Active" DTCs

To display "active" codes, switch on the ignition and apply/release the brake pedal three times within 15 seconds. Following activation, there will be a five second delay followed by a blink code display of all "active" trouble codes.

Display "Inactive" DTCs

To display "inactive" trouble code history, switch on the ignition and apply/release the brake pedal four times within 15 seconds. Following activation, there will be a five second delay followed by a blink code display of all "inactive" trouble codes held in the ECU memory.

5.2.2. ABS Configuration

To display the ABS configuration, switch on the ignition and apply/release the brake pedal six times within 15 seconds. The first blink code defines the number of sensors (2 or 4), the second defines the number of modulators (2 or 3) and the third defines the control mode which can be ignored.

5.2.3 Display Odometer Mileage

To display the trailer odometer mileage, switch on the ignition and apply/release the brake pedal seven times within 15 seconds. Following activation, there will be a five second delay followed by a blink code display of the odometer information (x1000). Example: 152.431 km will be displayed as 152 (x1000); i.e. one blink (pause), five blinks (pause), two blinks. Zeros will be displayed by the ABS warning lamp blinking twice. Odometer mileage cannot be altered with blink code diagnostics. Complete odometer information can be retrieved using the PC diagnostic tool ECUtalk®.

5.2.4 Blink Code Label

ABS sign attached to the vehicle showing the DTCs

1st Blink Code		2nd Blink Code	
Code	Location	Code	Description
1	All	1	No faults present
2	Sensor SL	1	Wheel speed sensor air gap too big
3	Sensor SR	2	Loss of wheel speed sensor signal
4	Sensor SAL	3	Noisy wheel speed sensor signal
5	Sensor SAR	4	Short or open circuit wheel speed sensor
		5	Tyre size differential out of range
		6	Wheel speed sensor configuration error
6	Power	1	Voltage too high
		2	Voltage too low
		3	Excessive resistance on ISO 7638 Pin1
7	Modulator 22	2	Exhaust solenoid short or open circuit
8	Modulator 21	3	ABS valve installation error
9	AUXIO1 / Modulator 2	4	Valve configuration error
10	Common	1	Internal short to ground
		2	AUXIO1 or Modulator 2 short to ground
		3	ABS valve dynamic error – all valves
		4	Excessive ABS activity
		5	AUXIO1 or Modulator 2 short to battery
11	ECU	1	Internal error
		2	Configuration error
12	AUXIO1	1	Short or open circuit
13	AUXIO2		
14	System	2	Service interval exceeded

KNORR-BREMSE



Trailer-ABS KB4TA

To read current and stored faults:

1. Ensure that the ABS is powered via the ISO 7638 connection.
2. Apply and release the brake pedal at 1 second intervals:
 - a) 3 times to read current faults
 - b) 4 times to read stored faults.
3. After a period of 5 seconds the blink codes will be displayed.
4. Observe the trailer ABS lamp in the towing vehicle and record the blink code sequence.
5. A description of each blink code is shown in the table.
6. After rectifying any faults, check that the trailer ABS warning lamp in the towing vehicle is not illuminated after turning the ignition off and on. This may necessitate driving the vehicle at a speed >10km/h.

Note: Blink code information is only available when the Stop Lamp power option and either 2S/2M or 4S/2M ABS are configured.



6 Installation Instructions

6.1 Installation

- 1) Fit the KB4TA module to the trailer, normally on a cross member in the centre of the rear axle bogie.
- 2) If required fit the additional axle modulator, normally on a cross member in the centre of the front axle bogie.
- 3) Make the necessary pneumatic connections. For information on the recommended tube sizes see ABS Information Document Y023866.
- 4) Make the necessary electrical connections. Take care to follow the guidelines given in section 3.7.4 when dealing with excess cable lengths. It is recommended that all wiring harness and sensor extension cables are secured at least every 45cm.

6.2 Required checks after installation

- 1) Before performing the checks, chock the wheels.
- 2) Fully charge air brake system and verify proper brake adjustment.
- 3) Make several trailer brake applications and check for prompt application and release at each wheel brake.
- 4) Check the module, modulator valve(s) and all air hose fittings for leakage using a soap solution.
- 5) Apply power and monitor the power-up sequence to verify proper system operation.
- 6) Determine the current ABS configuration by activating blink code diagnostics or using the PC diagnostic tool ECUtalk®.
- 7) Where necessary configure the required ABS configuration and Auxiliary configuration using the diagnostic tool ECUtalk®.
- 8) It is recommended that a full EOL check is carried out using the diagnostic tool ECUtalk®.

7 Diagnostic Troubleshooting Flow Charts

Diagnostic trouble code information can be retrieved from the KB4TA module by using blink code diagnostics or the PC diagnostic tool ECUtalk®. The following troubleshooting flow charts will help the technician isolate the cause of the problem and confirm whether the problem lies in the component, wiring or connectors.

Troubleshooting should always begin by observing the dashboard or trailer-mounted ABS warning lamp during the KB4TA module's power-up sequence.

If it is necessary to make electrical measurements, always begin by taking voltage and resistance measurements at the 12-pin ECU harness connector.

Once the circuit problem is found, isolate the area needing attention by repeating the measurements at all connections in the affected circuit working towards the modulator, wheel speed sensor, etc.

No voltage or resistance measurements must to be made on the X1 connector pins of the KB4TA module.

The following pages contain detailed information on:

- 7.1 Diagnostic Trouble Codes – Blink Code Quick Reference
- 7.2. Power-Up Sequence – Dashboard mounted ABS Warning Lamp
- 7.3 Power-Up Sequence –Trailer-mounted ABS Warning Lamp
- 7.4 Troubleshooting the Trailer-mounted ABS Warning Lamp Circuitry
- 7.5 Troubleshooting the ISO 7638 (and ISO 1185, if connected) Power Supply
- 7.6 Troubleshooting the Wheel Speed Sensors
- 7.7 Troubleshooting the Modulator Relay Valve (BR9234)

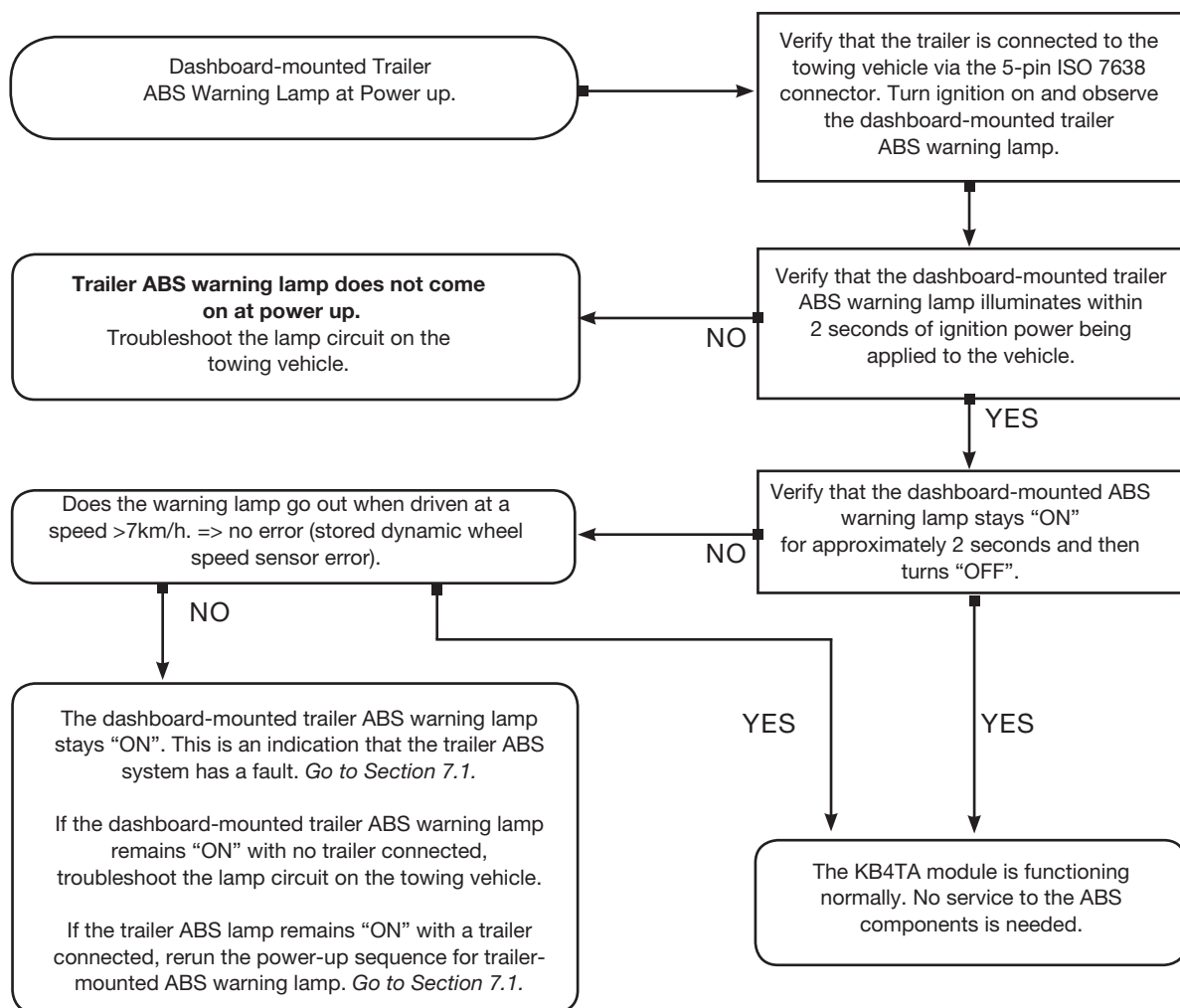
7.1 Diagnostic Trouble Codes — Blink Code Quick Reference

1st Blink Code		2nd Blink Code		Information on action required
Code	Location	Code	Description	
1	All	1	No Faults	System fully operational - no faults detected
2	Sensor SL	1	Wheel speed sensor air gap is too big	Go to Section 7.6
3	Sensor SR	2	Loss of wheel speed sensor signal	Go to Section 7.6
4	Sensor SAL	3	Noisy wheel speed sensor signal	Go to Section 7.6
5	Sensor SAR	4	Short or open circuit wheel speed sensor	Go to Section 7.6
		5	Tyre size differential out of range	Verify correct tyre size, proper tyre inflation & correct number of sensing ring teeth. Verify that the ECU has the correct tyre size settings.
		6	Wheel speed sensor configuration error	Verify correct ABS configuration.
6	Power Supply	1	Voltage too high	Go to Section 7.5
		2	Voltage too low	Go to Section 7.5
		3	Excessive resistance ISO 7638 pin 1	Go to Section 7.5
7	Modulator M22	2	Exhaust solenoid shorted or open circuit	Go to Section 7.7
8	Modulator M21	3	ABS valve installation error	Go to Section 7.7
9	AUXIO1 / Modulator	4	Valve configuration error	Verify correct ABS configuration.
10	Common	1	Internal short to ground	Check for damaged or corroded connectors. Check for damaged wiring. After corrections or if no issues found, then clear trouble codes. If problems return, replace the module.
		2	AUXIO1 or modulator 2 short to ground	Go to Section 7.7
		3	ABS modulator dynamic error - all valves	Go to Section 7.7
		4	Excessive ABS activity	Go to Section 7.5 or 7.7
		5	AUXIO1 or modulator 2 short to battery	Go to Section 7.7
11	ECU	1	Internal error	Check for damaged or corroded connectors. Check for damaged wiring. After corrections or if no issues found, then clear trouble codes. If problems return, replace the module.
		2	Configuration error	Verify correct ABS configuration.
12	AUXIO2	1	Shorted or open circuit	Check for corroded/damaged wiring or connectors
13	AUXIO3	1	Shorted or open circuit	Check for corroded/damaged wiring or connectors
14	System	2	Service Interval Exceeded	...

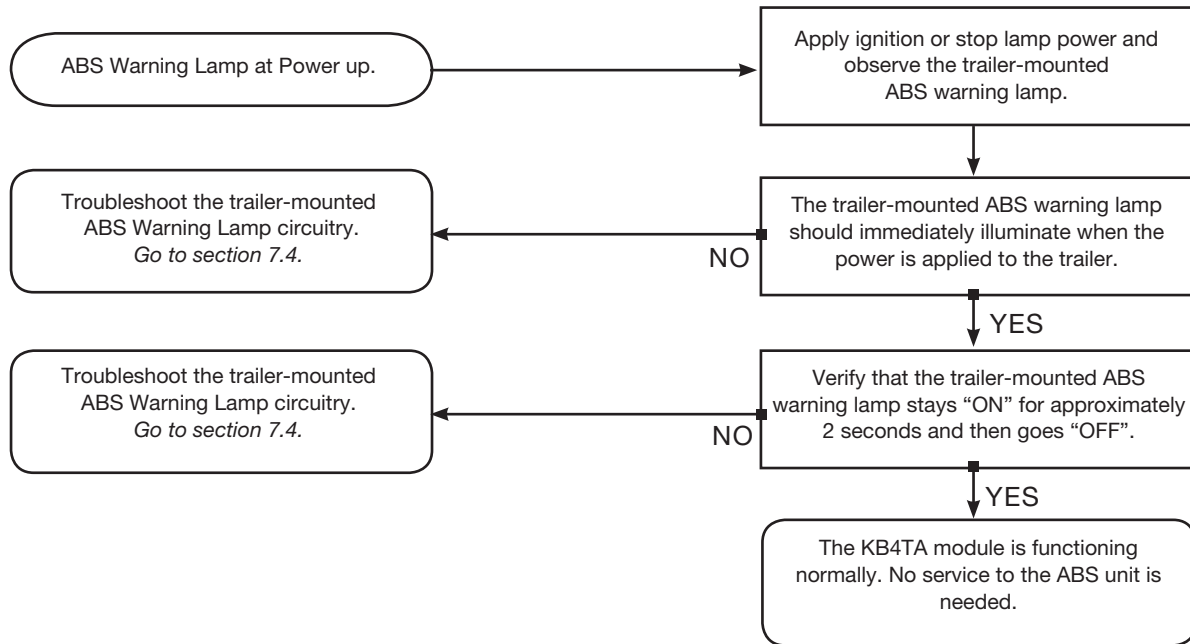
To Read Diagnostic Trouble Codes (DTCs):

- 1) Apply constant power to the trailer (towing vehicle ignition switch).
- 2) Within 15 seconds, apply/release the brake pedal at 1 second intervals:
 - (a) 3 times for displaying "Active" DTCs.
 - (b) 4 times for displaying "Inactive" DTCs.
- 3) Observe the dashboard mounted ABS warning lamp and record blink code(s).
- 4) Refer to blink code chart for description.
- 5) After resolving problems, verify that the warning lamp is no longer illuminated.

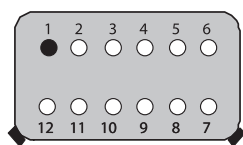
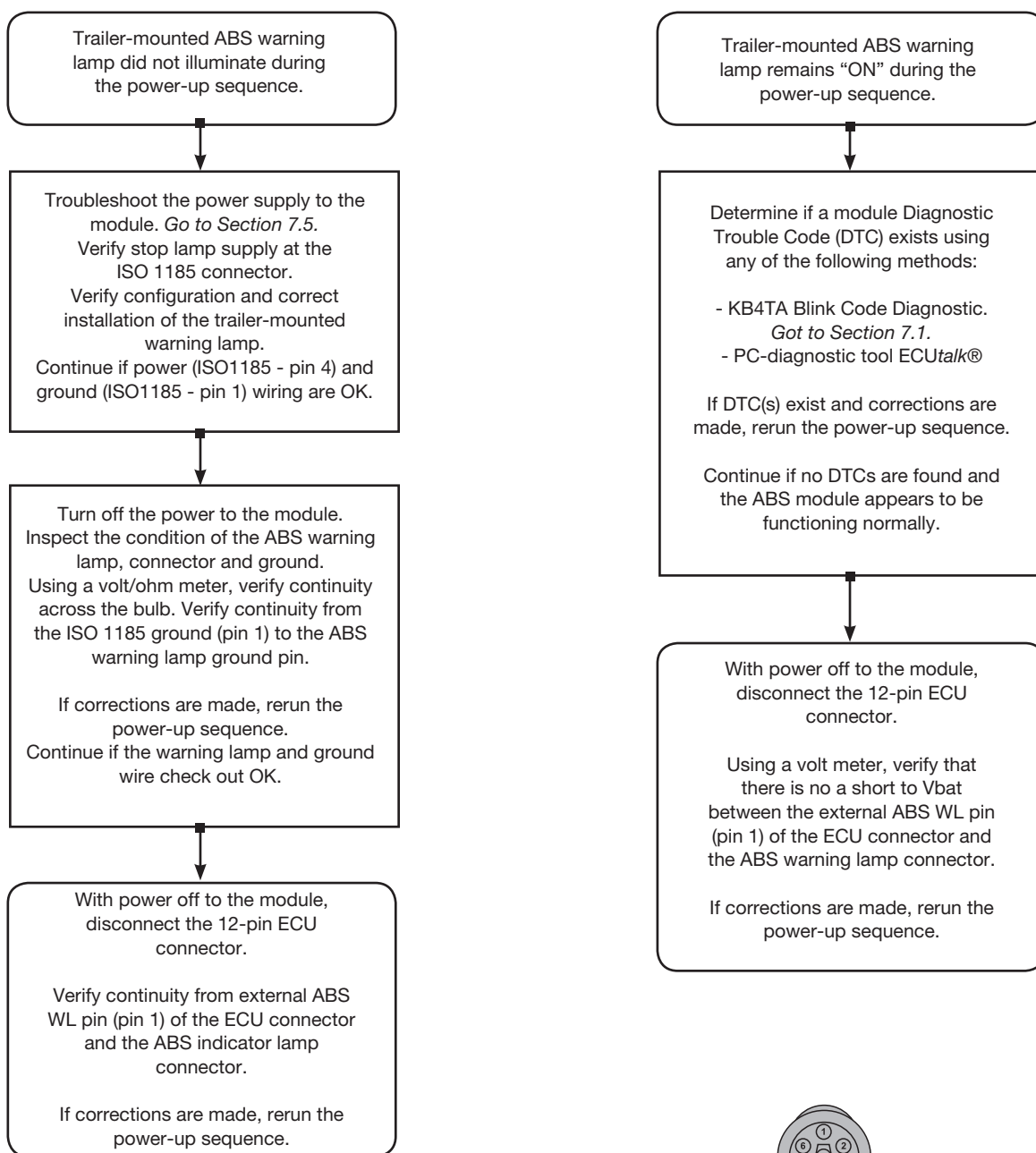
7.2 Power-up Sequence – Dashboard mounted ABS Warning Lamp



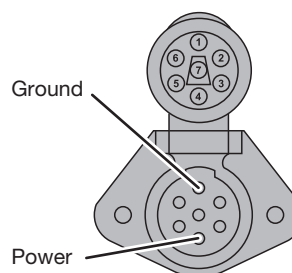
7.3 Power-up Sequence – Trailer-mounted ABS Warning Lamp



7.4 Troubleshooting the Trailer-mounted ABS Warning Lamp Circuitry

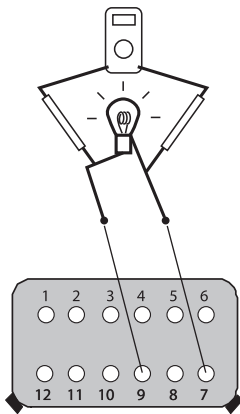
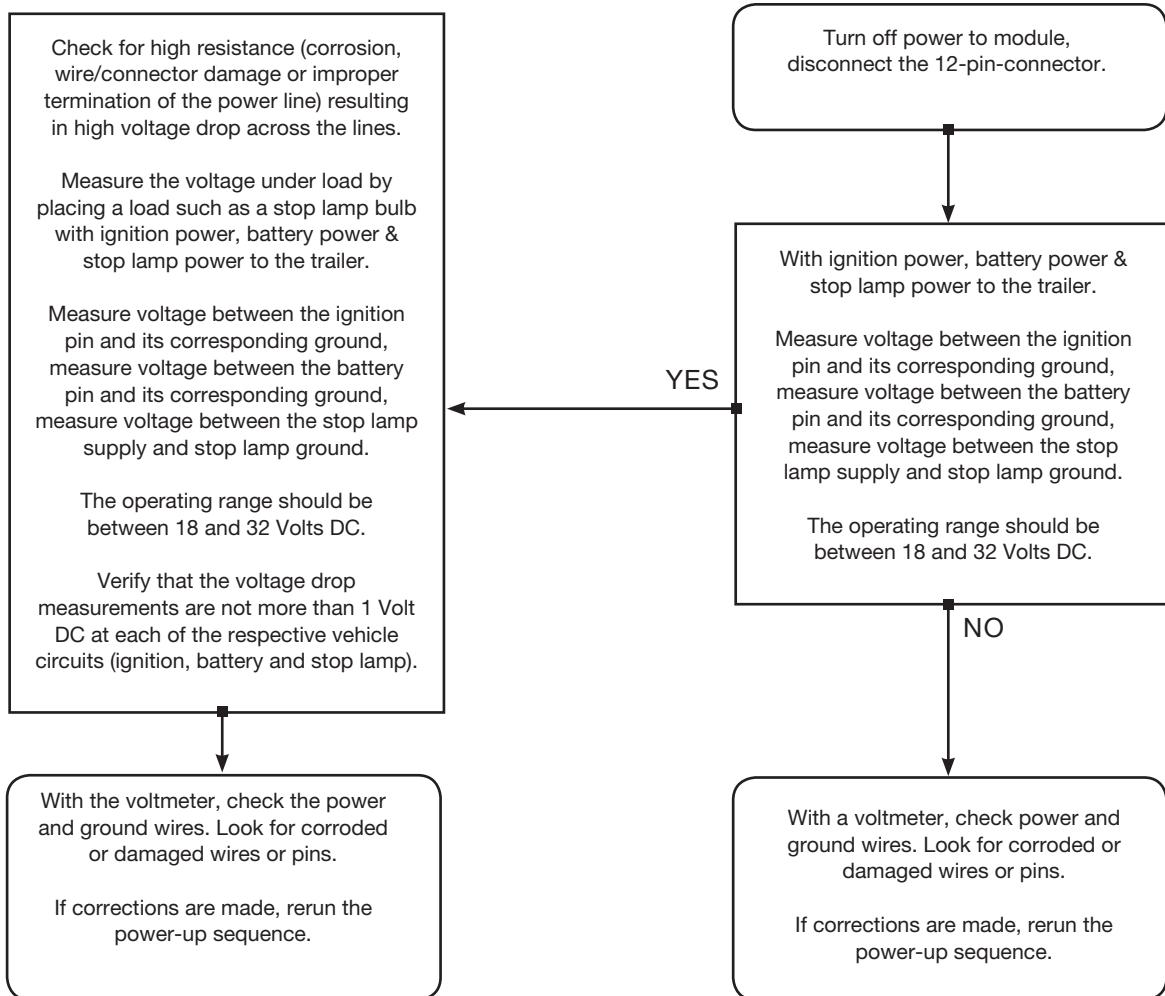


KB4TA Module
Wire Harness (Pin 1 - ABS Warning Lamp)

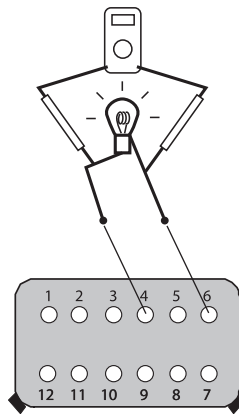


ISO1185-connector
(Pin 1 - ground / Pin 4 - stop lamp power)

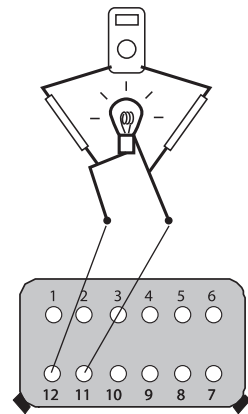
7.5 Troubleshooting the ISO 7638 (and ISO 1185 if connected) Power Supply



KB4TA Module Wiring Harness,
ECU Connector - measure:
Pin 9 (Ignition Power) to Pin 7 (ground)

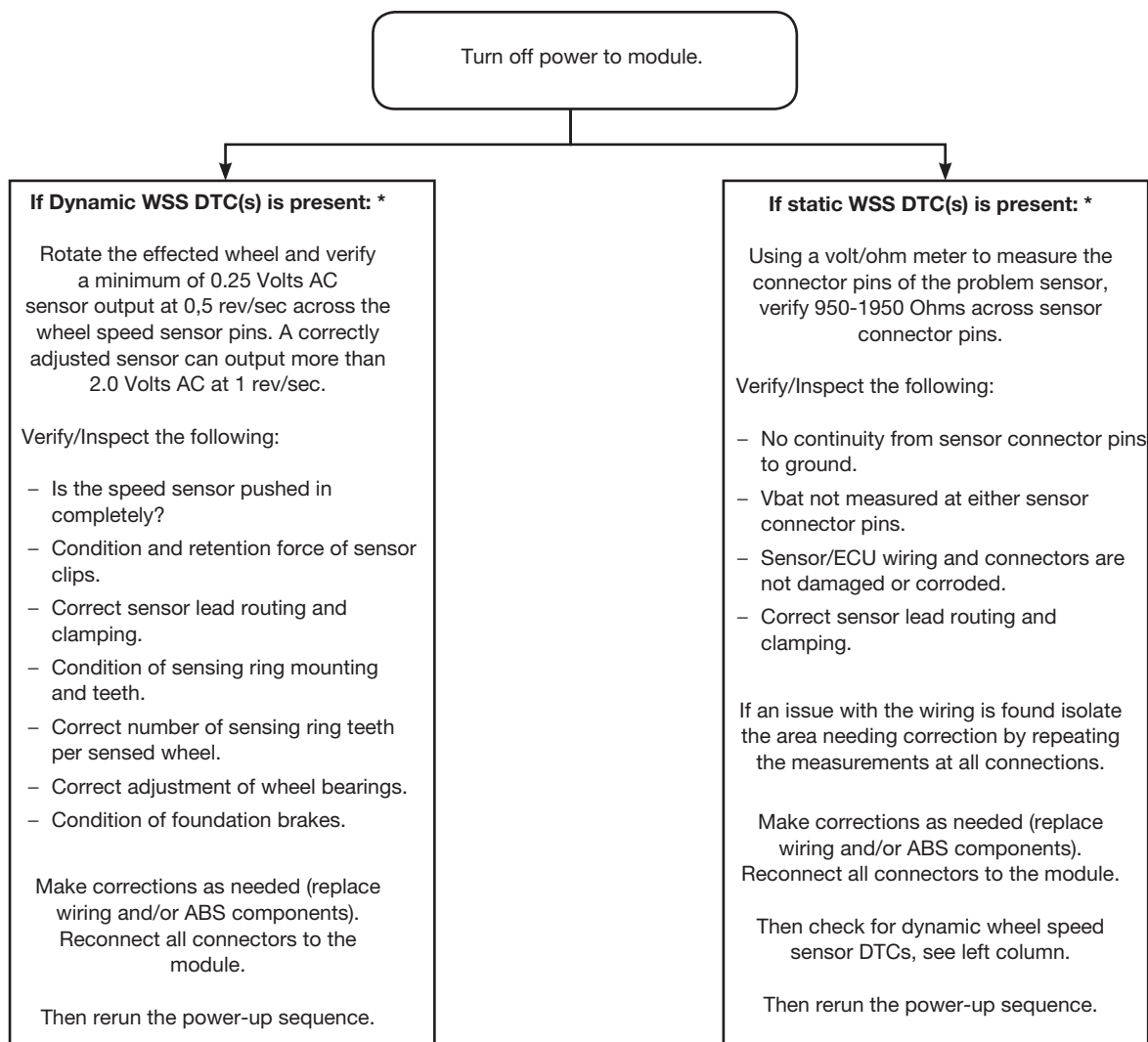


KB4TA Module Wiring Harness,
ECU Connector - measure:
Pin 6 (Battery Power) to Pin 4 (ground)



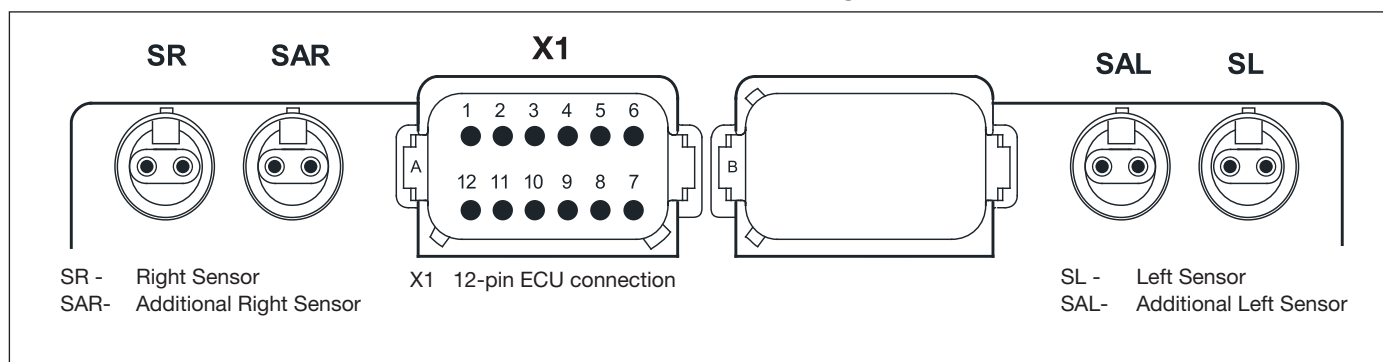
KB4TA Module Wiring Harness,
ECU Connector - measure:
Pin 12 (Stop lamp Power) to Pin 11 (ground)

7.6 Troubleshooting the Wheel Speed Sensors

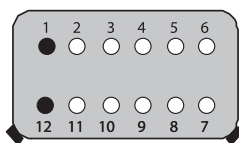
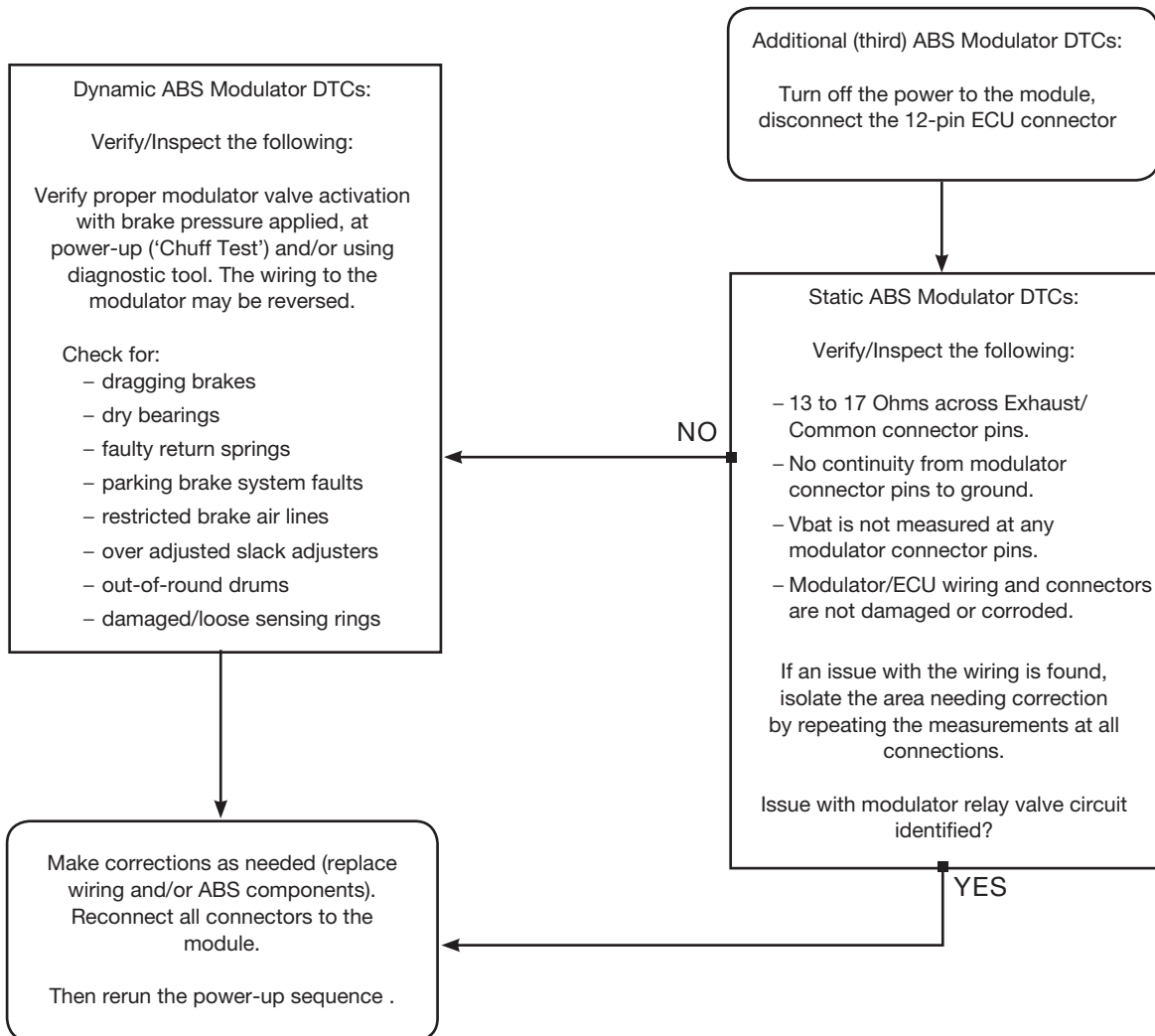


*** Note:** Both static and dynamic wheel speed sensor DTCs may be present.

KB4TA Module Pinning

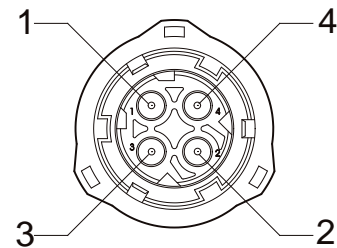


7.7 Troubleshooting the Modulator Relay Valve (BR9234)



KB4TA Module

Pin 1 AUXI01 (Valve 3rd Modulator)
Pin 12 AUXRET1 (Return Line 3rd Modulator)



Modulator Connector Pins

Pin 1 AUXI01 (Release)
Pin 2 AUXRET1 (Common)

7.8 Wiring

All cables are environmentally sealed at the connector interface and are clearly labelled for correct installation.

Because of the moulded design of the KB4TA module wiring harnesses and individual cables, Knorr-Bremse recommends that a complete harness or cable be replaced if damage or corrosion occurs.

When troubleshooting ABS wiring, some general rules should be followed where applicable:

- 1) Check all wiring and connectors to ensure they are secure and free from visible damage (e.g. cuts, abrasions, etc.).
- 2) Check for evidence of wire chafing due to poor routing, or poor securing of wires.
- 3) Check connectors for proper insertion and locking.
- 4) Connector terminals must not show signs of corrosion or exposure to the environment.
- 5) Never pierce wire insulation when checking for continuity.
- 6) Do not deform individual pins or sockets during probing with a volt/ohm meter.
- 7) It is strongly recommended to properly secure all wiring harness and sensor leads at least every 45 cm.

8 Service Replacement of the KB4TA

The KB4TA module is designed to be used as the service replacement part for the Knorr-Bremse KB3TA, A9 & A18 trailer ABS controllers.

For more information, contact Knorr-Bremse. See section 6 for the installation instructions.

9 Additional Documentation

Link to other KB4TA-Documents:

- KB4TA Trailer anti-lock braking system test report (RDW-20160001)
- KB4TA ABS Information document (Y023866)
- KB4TA Electronics Information document (Y023867)
- Installation Instructions "Wiring/Harness, Modular System" (Y011788)

Document Revision Level

Please visit www.Knorr-BremseCVS.com to ensure you have the latest version of this document.

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