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(54) Device for ABS-integrated brake pad wear indication in a motor vehicle

(57) A device for ABS-integrated brake pad wear indication in a motor vehicle in which all the line paths are constructed with avoidance of current loops and induction surfaces, in that all the wheel speed and pad wear signal lines 3.1 - 3.4, 4.1 - 4.4 respectively lead to the ABS or ABS/ASR control unit 8 in a single strand 9a - 9c, or combined at least via common fixings, grommets 19, intermediate connecting plugs 14, 15, 18 and a single terminal connecting plug 7, and owing to coding of different warning signals for, for example, ABS, ASR and brake pad wear the signal connection between the ABS or ABS/ASR control unit 8 and the instrument cluster 6 in the dashboard is reduced to a single line 10.

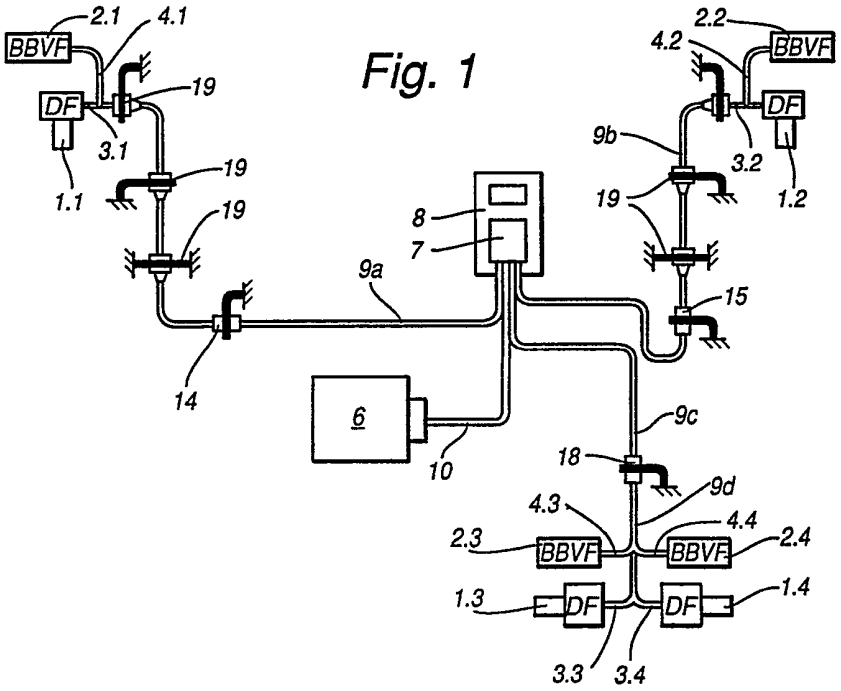

Fig. 1

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Fig. 1

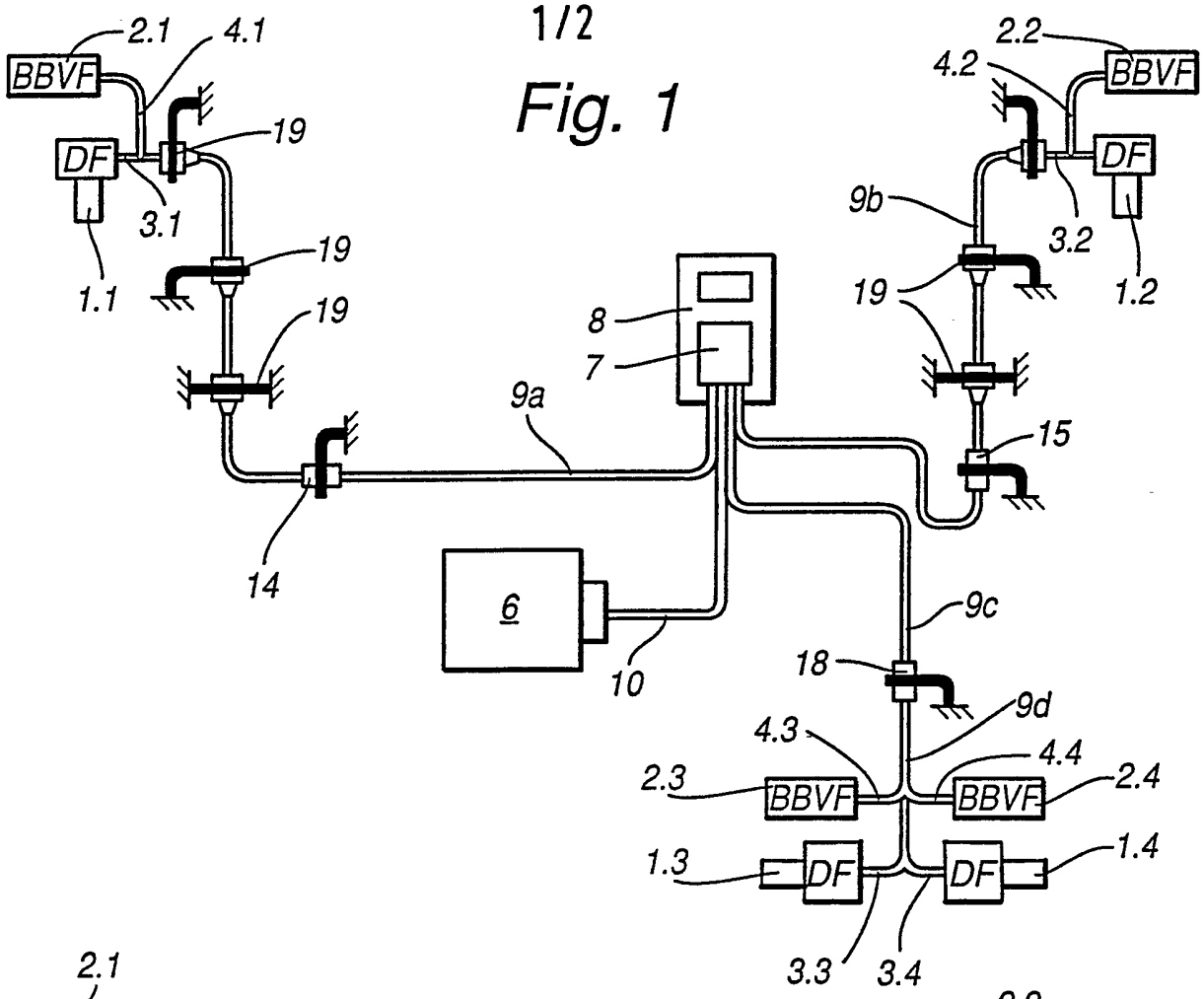

2.1
4.1
BBVF
19
DF
3.1
1.1
19
19
14
9a
8
7
6
10
2.2
4.2
BBVF
DF
9b
3.2
19
1.2
15
9c
18
9d
4.3
4.4
2.3
BBVF
BBVF
2.4
1.3
DF
DF
1.4
3.3
3.4

Fig. 3

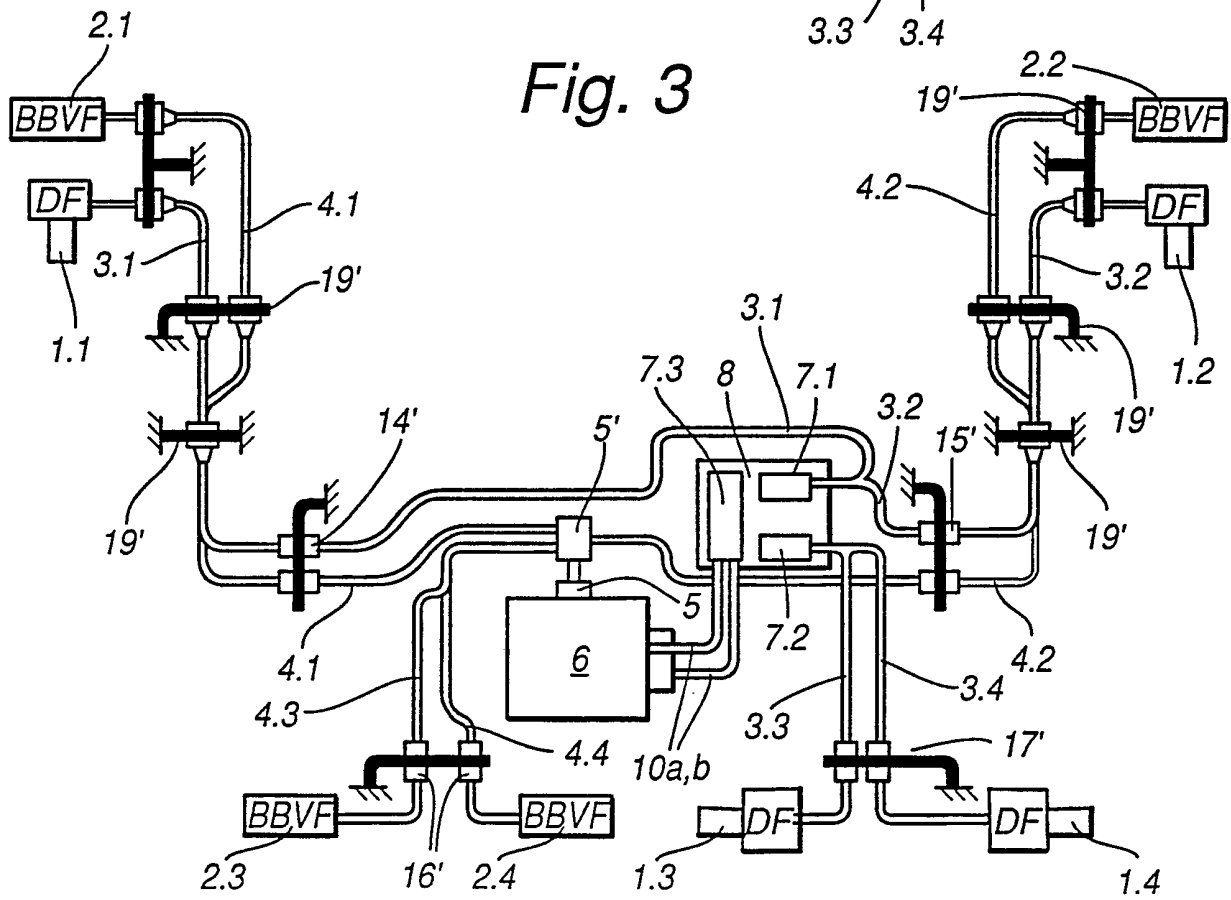
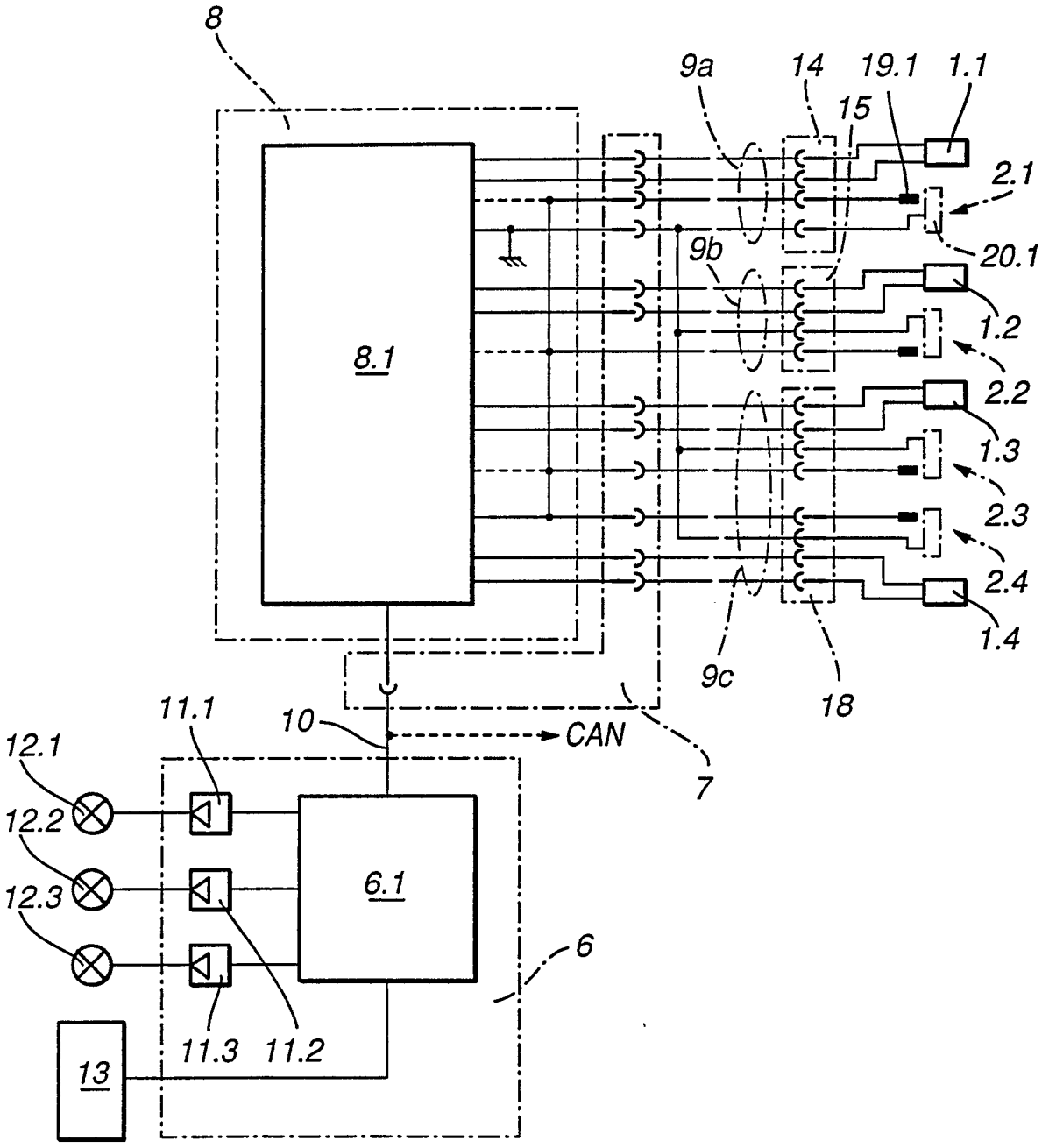

2.1
BBVF
DF
4.1
3.1
19'
1.1
19'
14'
4.1
4.3
4.4
BBVF
BBVF
2.3
16'
2.4
5'
5
6
10a,b
7.3
8
3.1
7.1
7.2
3.2
15'
19'
19'
4.2
3.4
3.3
17'
DF
DF
1.3
1.4
2.2
19'
BBVF
4.2
DF
3.2
1.2
19'
19'

Fig. 2


8
9a
14
19.1
1.1
15
2.1
20.1
9b
1.2
2.2
1.3
2.3
2.4
1.4
8.1
9c
18
11.1
10
CAN
7
12.1
12.2
12.3
6.1
6
11.3
11.2
13

Device for ABS-integrated brake pad wear indication in a motor vehicle

The invention relates to a device for ABS-integrated brake pad wear indication in a motor vehicle in which a central ABS or ABS/ASR microcomputer is adapted to receive both wheel speed signals and brake pad wear signals derived from sensors near the wheels, and which device comprises means for indicating fault states and/or brake pad wear.

With only slight modifications, it is known to provide brake pad wear indicators in passenger vehicles for example in accordance with Figure 3. As shown in this figure, speed sensor lines 3.1 to 3.4 of wheel speed sensors 1.1 to 1.4 are laid to an ABS or ABS/ASR control unit 8 and come together there in a plurality of plug-in connectors 7.1, 7.2 and 7.3 which produce the connection with this control unit. Brake wear sensor lines 4.1 to 4.4 of wheel brake pad wear sensors 2.1 to 2.4 are laid to the instrument cluster 6 in the dashboard of the vehicle and come together there in a connector 5′ or directly on the plug-in connector 5, which produces the connection with the instrument cluster for the purpose of driving a warning display integrated there before or upon pad wear-out. In the course of their extent, the individual lines are led via individual, respectively doubled plug-in connectors 14′, 15′, 16′ and 17′. Other electrical connections 10a and 10b, for the purpose, inter alia, of permitting a plurality of warning displays in the instrument cluster in the event of an error in ABS, ASR and otherwise, exist between the ABS or ABS/ASR control unit 8 and the instrument cluster 6. The lines 3.1 to 3.4, 4.1 to 4.4 and 10a, 10b are led individually via or through holders and, provided in duplicate in each case, grommets 19′, and fixed.

This solution is expensive and turns out to be susceptible to EMC interference during operation of radio telephones in or in the vicinity of vehicles equipped in this way.

DE 26 06 012 A1 describes a sensor arrangement for an

antiblock device for vehicle brakes, in which the pulse generator sampling the wheel speed is electrically connected to the sampling circuit of a brake pad wear indicator. Using this arrangement, it is possible to transmit a wheel speed signal and a brake pad wear signal from a wheel to the corresponding control unit via the same two wires of a single line.

DE 34 33 254 A1 describes a device for testing the serviceability of a slip-controlled brake system. In this system, all the lines which come from the wheels and transmit wheel speed signals and/or control signals are led to a plug-in connector which is normally connected to the control unit for the purpose of slip-controlled vehicle braking.

DE 38 29 949 A1 discloses, inter alia, a control device for operating an electric hydraulic service brake device in a motor vehicle. It comprises, inter alia, an electronic ABS control unit which processes individual wheel speed signals and, in addition, still further inputs for the purpose, inter alia, also of receiving and of processing signals from brake pad wear transmitters on braked wheels. Signal lines from sensors near the wheels lead to the central control unit.

The present invention seeks to provide a device for ABS-integrated brake pad wear indication in a motor vehicle, which has a high electromagnetic compatibility (EMC), but is nevertheless cost effective.

According to the present invention there is provided a device for ABS-integrated brake pad wear indication in a motor vehicle, in which a central ABS or ABS/ASR microcomputer is adapted to receive both wheel speed signals and brake pad wear signals derived from sensors near the wheels, and which device comprises means for indicating fault states and/or brake pad wear, and wherein at least wheel by wheel, lines which transmit wheel speed signals and brake pad wear signals to the central ABS or ABS/ASR microcomputer are combined or laid in a single strand, the lines being led to a single terminal plug-in connector to the brake control unit containing the ABS or ABS/ASR microcomputer, wherein the means for indicating

fault states and/or wear are assigned, with reference to their drive, to an instrument cluster in the dashboard of the vehicle, the instrument cluster is connected to the ABS or ABS/ASR control unit only via a single signal path which leads via a single terminal plug-in connector, and
the state and/or warning signals are adapted to be transmitted from the ABS or ABS/ASR control unit either by pulse width modulation or per protocol to the instrument cluster, and the instrument cluster comprises at least one dedicated microcomputer which performs the pulse width demodulation or protocol demodulation and the driving of appropriate display.

The device according to the invention has the advantage that, in conjunction with a simultaneous cost reduction, it permits a substantial suppression of EMC interference without the need for appreciable design modifications to known ABS or ABS/ASR control units. In this case, a high EMC interference suppression is achieved essentially by the fact that the line paths are constructed with simultaneous avoidance of current loops and induction surfaces, and in addition the wheel speed and pad wear signal lines are respectively fed to the ABS or ABS/ASR control unit in a single strand or combined at least via common fixings, grommets, intermediate connecting plugs and a single terminal connecting plug, and that owing to coding of different warning signals for, for example, ABS, ASR and brake pad wear the connection between the ABS or ABS/ASR control unit and the instrument cluster is reduced to a single line.

A device according to the invention is now described by way of example with reference to the drawings in which:-

Figure 1 shows a circuit of the device according to the invention;

Figure 2 shows a block diagram of the device according to the invention;

Figure 3 shows a circuit of a conventional device according to the prior art.

In accordance with Figure 1, speed sensor lines and brake wear sensor lines are laid in strands. The speed sensor line

3.1 of the speed sensor 1.1 and the brake wear sensor line 4.1 of the pad wear sensor 2.1 are thus combined to form a line strand 9a, the speed sensor line 3.2 of the speed sensor 1.2 and the brake wear sensor line 4.2 of the pad wear sensor 2.2 are combined to form a line strand 9b, and the speed sensor lines 3.3 and 3.4 of the speed sensors 1.3 and 1.4 and the brake wear sensor lines 4.3 and 4.4 of the pad wear sensors 2.3 and 2.4 are combined to form a bus line strand 9c and 9d respectively, by or via in each case common grommets, fixings and holders 19 and, if necessary, are also led via common intermediate plug-in connectors 14, 15 and 18 of the respective strand.

In addition, only one further single signal path 10 exists between the instrument cluster 6 and the ABS or ABS/ASR control unit 8, which signal path to this extent likewise ends in the plug-in connector 7. In this way, it is only more cable strands - four here, for example - which proceed in the shape of a star from said plug-in connector, and to that extent from the ABS or ABS/ASR control unit 8, and neither inherently nor mutually do they define EMC-critical induction surfaces or magnetic blocking surfaces. The resistance to irradiation by EMC interference is thereby drastically increased.

Figure 2 shows the symbolic electric circuit diagram of the device. It is based, for example, on a known brake pad wear transmitter of the contact type. It is illustrated at the brake pad wear transmitter 2.1 that the latter consists in principle of a contact recessed into the insulating brake pad 19.1, and of the brake disc or brake drum 20.1, which is conducting and at frame potential. As soon as the insulating brake pad has worn so far that the contact is exposed, the latter comes into contact with the brake disc, which is at frame potential, and thus produces a short-circuit frame which can be evaluated (low signal).

As already illustrated in Figure 1, the lines 9a, 9b and 9c are, for example, led via intermediate plug-in connectors 14, 15 and 18 - preferably via a port input protection and filter circuit (not shown here in the Figure) for the purpose

of further EMC interference suppression - to input ports of the microcomputer 8.1 in the ABS or ABS/ASR control unit 8.

The instrument cluster 6 has its own microcomputer 6.1 which can fulfil manifold functions there and is connected to the control unit 8 only via a single communication line 10. This can also, for example, be a serial bus, for example a CAN bus, to which it is also possible to this extent further to connect many other appliances in the vehicle.

Via driver amplifiers or driver switches 11.1, 11.2 and 11.3, the microcomputer 6.1 drives warning signal transmitters 12.1, 12.2 and 12.3 for indicating fault states in the ABS and/or ASR system, or for indicating service information. It is also possible in parallel therewith to provide driving of a more informative display 13. In the present example, the brake pad wear transmitters 2.1 and 2.4 are connected in parallel with reference to the microcomputer 8.1. Nevertheless, it is possible without restricting generality for these transmitters likewise to be led - in a fashion analogous to the wheel speed sensors 1.1 to 1.4 and as represented by dashes - to individual input ports of the computer 8.1 for the purpose of individual evaluation.

This is particularly sensible when the instrument cluster 6 comprises a display 13 on which it is then also possible to represent symbolically the wheel on which pad wear has been detected.

The brake pad wear signal is preferably transmitted from the computer 8.1 to the instrument cluster 6 using pulse width modulation or by means of a simple unidirectional protocol. It is then also possible in this case for the instantaneous braking path, the mean delay and/or also the output rate to be co-transmitted and indicated on the display 13. Such a data transfer is likewise also possible between the ABS or ABS/ASR control unit 8 and the instrument cluster 6 if the connection of the same is implemented via a bus having an omnidirectional communication possibility and which provides special priority planes by a protocol for time-critical indications.

Claims

1. A device for ABS-integrated brake pad wear indication in a motor vehicle, in which a central ABS or ABS/ASR microcomputer is adapted to receive both wheel speed signals and brake pad wear signals derived from sensors near the wheels, and which device comprises means for indicating fault states and/or brake pad wear, and wherein at least wheel by wheel, lines which transmit wheel speed signals and brake pad wear signals to the central ABS or ABS/ASR microcomputer are combined or laid in a single strand, the lines being led to a single terminal plug-in connector to the brake control unit containing the ABS or ABS/ASR microcomputer, wherein the means for indicating fault states and/or wear are assigned, with reference to their drive, to an instrument cluster in the dashboard of the vehicle, the instrument cluster is connected to the ABS or ABS/ASR control unit only via a single signal path which leads via a single terminal plug-in connector, and the state and/or warning signals are adapted to be transmitted from the ABS or ABS/ASR control unit either by pulse width modulation or per protocol to the instrument cluster, and the instrument cluster comprises at least one dedicated microcomputer which performs the pulse width demodulation or protocol demodulation and the driving of appropriate display.

2. A device according to Claim 1, wherein, for the purpose of connection between the ABS or ABS/ASR control unit and instrument cluster · a serial bus is provided to which other control units in the vehicle are also connected.

3. A device according to claim 3, wherein the serial bus comprises a CAN bus.

4. A device for ABS-integrated brake pad wear indication in a motor vehicle, substantially as described herein with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 -7-
(The Search report)

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(ii) Int Cl (Ed.5) F16D 66/02, B60T 8/88, 17/22

Search Examiner
PETER SQUIRE

Date of completion of Search
2 AUGUST 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ON-LINE DATABASES: WPI

Documents considered relevant following a search in respect of Claims :-
1-4

Categories of documents

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2202016 A (TEVES)	
A	GB 1572133 (BOSCH)	
A	EP 0357922 A2 (DAIMLER-BENZ)	

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