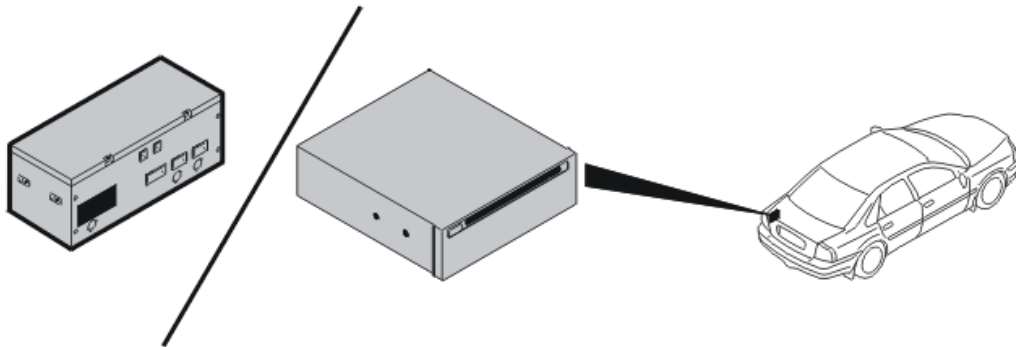


System overview

RTI (road traffic information)



The main role of the RTI system (Road and Traffic Information) is to manage the functions for:

- the GPS aerial
- The traffic message channel (TMC) receiver (EU only)
- The FM-MPX receiver (Japan only)
- 5" LCD display screen (only used in systems with a CD changer system)
- 6.5" wide screen LCD display screen (only used in systems with a DVD system)
- Steering wheel buttons
- TV receiver (accessory)
- The remote control (accessory)
- The CD changer (not used for DVD systems)
- DVD player (not use for the CD system).

There are two models of the RTI system, one old and one new version.

The older system has two units, the RTI control unit and the CD changer. In the new system the CD changer has been replaced by a DVD player which is integrated with the RTI control module.

The control module is located in the left section of the cargo compartment.

CDs cannot be played in the RTI system. This is because the system is not compatible with these types of disc.

The RTI system communicates partly with components which are directly connected and

partly with other control modules and components via serial communication and Control area network (CAN).

The control module checks activations and input and output signals using an integrated diagnostic system. A diagnostic trouble code (DTC) is stored if the control module detects a fault.

Diagnostic trouble codes (DTC) are stored in the control module memory. The data can be read off using the diagnostic tool.

A simple way to check that the RTI components are both powered and grounded is to try to insert or remove a CD or DVD. The RTI system is powered and grounded if the disc can be inserted and removed. If this is not functioning, check the power supply and ground for the RTI system.

The RTI system has an internal communication system, Melbus. Communication is between the RTI unit, the TV receiver, the CD changer and the audio module.

Melbus communication consists of three different signals:

- MSCK, clock signal
- MDATA, data signal which transmits information
- MBUSY, indicates whether the data signal is engaged or not.

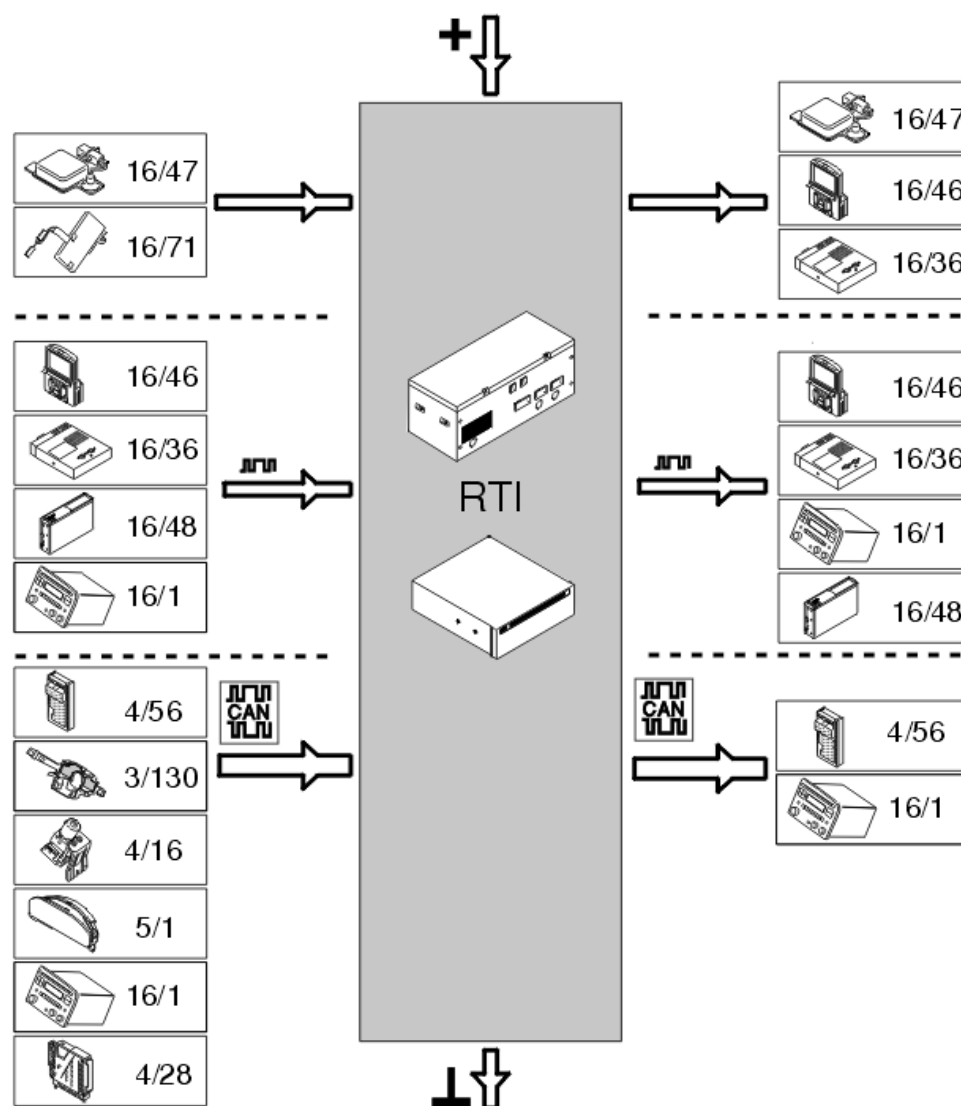
For information, also see Signal specifications.

Signals

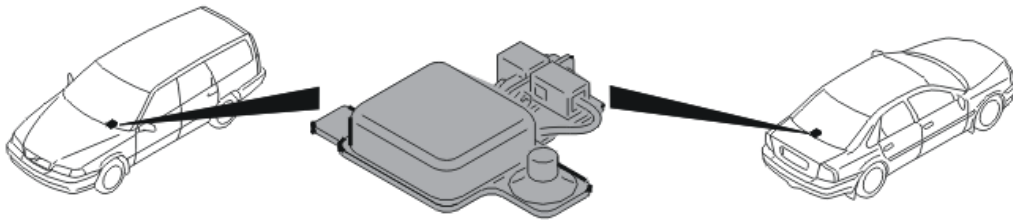
The table below summarizes input and output signals to and from the RTI control module. The signal types are divided into directly connected signals, serial communication and Control area network (CAN) communication. The illustration below displays the same information with the Volvo part numbers.

Input signals	Output signals
Directly connected: GPS aerial, 16/47 TMC aerial, 16/71 (EU only)	Directly connected: (power supply unless otherwise stated) GPS aerial, 16/47 Screen, 16/46, (colour and synchronization

	signals) TV receiver, 16/36
Via serial communication: Display screen, 16/46 TV receiver, 16/36 (Melbus communication) CD changer, 16/48 (Melbus communication) Audio module, 16/1 (Melbus communication)	Via serial communication: Display screen, 16/46 TV receiver, 16/36 (Melbus communication) Audio module, 16/1, sound unit (Melbus communication) CD changer, 16/48 (Melbus communication)
Via Control Area Network (CAN): Central electronic module, 4/56 Steering wheel module, 3/130 Brake control module (ABS), 4/16 Driver Information Module, 5/1 Audio module, 16/1 TCM (4/28)	Via Control Area Network (CAN): Central electronic module, 4/56 Audio module, 16/1



Design the GPS aerial



The data transmitted from the GPS aerial to the RTI control module consists of signals received from GPS satellites.

There is a signal booster (aerial amplifier) integrated in the GPS aerial. The signal is strengthened before it is transmitted to the GPS receiver which is integrated in the RTI unit. The GPS also adapts the impedance of the signal.

The RTI system and the GPS aerial require contact with at least three satellites to be able to calculate the position of the car. The RTI system can communicate with up to eight satellites at the same time.

The position calculated from the GPS satellites is accurate to within +/- 30 meters.

View the GPS information under system settings to check how many satellites are available.

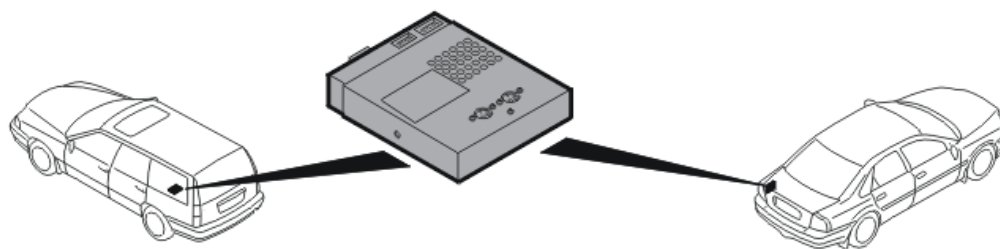
The power supply is from the RTI control module. The power supply uses the same high frequency wiring as the GPS information that is sent to the RTI unit.

The GPS aerial is located in the parcel shelf in S80 and S60 models. In V70 and V70XC models it is located in the dashboard.

Note! If there is no GPS signal, the signal should be checked outside. The signal may be blocked if the car is indoors. Large objects on the parcel shelf or tinted rear windshields may also be the

cause.

TV receiver



The role of the TV receiver is to manage the incoming TV signals from local TV transmitters. There are three models of the TV receiver:

- One for Europe (PAL)
- One for U.S.A. (NTSC), only applies to the S80 Executive
- One for Japan (NTSC).

The European TV receiver can handle three different PAL systems. The menu system on the TV receiver is used to change the PAL system settings. See the RTI manual for further information.

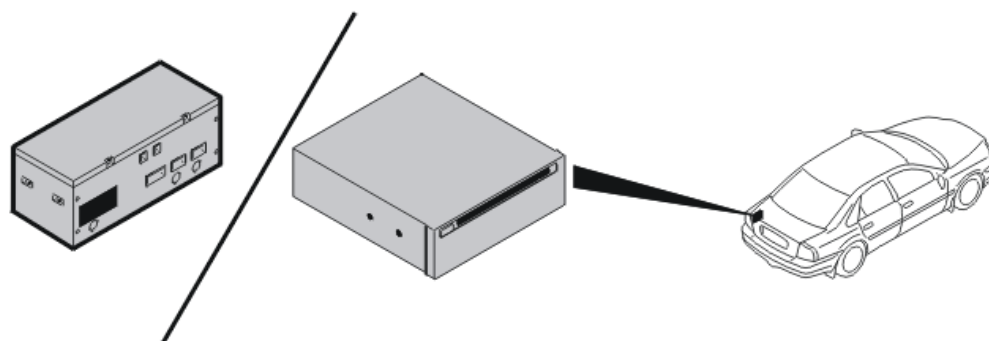
The TV receiver sends the received TV signals on a serial bus (Melbus) to the RTI system. The RTI system handles the incoming signals and sends them to the display screen.

The TV receiver transmits the TV sound on a serial bus (Melbus) to the audio module via the RTI unit.

Station settings, colour, TV picture size and the screen contrast are set using the audio module or the remote control.

The TV receiver is located in the left section of the cargo compartment in the S80 and S60. In V70 and V70XC models it is located behind the rear seat.

RTI control module



The role of the RTI control module is to calculate the position of the car based on the signals it receives from the GPS aerial, the speed signal from the central electronic module, the gear position and the gyro. The RTI system then works out a route for the selected destination.

There are two models of the RTI system, one old and one new version.

The older system has two units, the RTI control unit and the CD changer. In the new system the CD changer has been replaced by a DVD player which is integrated with the RTI control module.

There is an integrated three dimensional piezo electrical gyro in the RTI control module. This manages data about the movements of the car, such as whether any turnings are made.

Data transmitted on the CAN to the RTI unit from different nodes is:

- vehicle speed
- wheel rotation counter
- reverse (reverse) gear position
- signals from the steering wheel controls
- radio mute
- background lighting.

Gyro and wheel rotation counters are used to calculate the position of the car for shorter periods, if communication with the GPS satellites is lost in a tunnel for example or to assist when there is no GPS signal.

Used in conjunction with map matching, GPS navigation, the gyro and the speed signal, the position can be calculated to an accuracy of +/-

10 meters from the position indicated on the screen.

The traffic message channel (TMC) receiver is integrated in the RTI unit. TMC is a standardised code system for traffic messages such as road works. The Japanese equivalent is called FM multiplex.

There is no traffic information system in the USA.

The TMC aerial is located in the right-hand section of the rear bumper.

The control module is located on the left-hand side of the cargo compartment.

The RTI (road traffic information) control module can be diagnosed.

Display

There are two sizes of display screen. There is a 6.5" wide screen LCD screen and a 5" LCD screen.

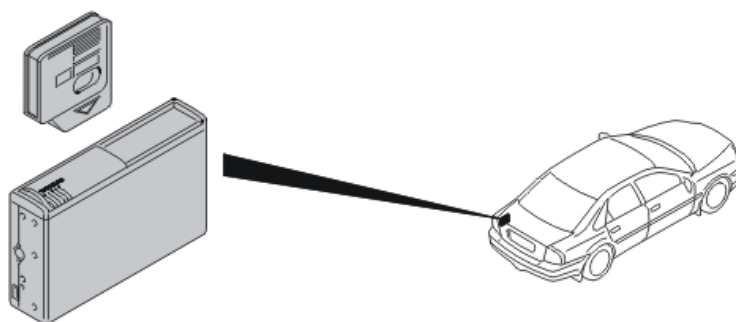
All signal information to the screen is from the RTI control module.

The screen has an infra red eye above it which is used for communication with the remote control.

The menu system for the screen can be controlled using the RTI buttons on the reverse of the steering wheel or using the remote control.

The screen is positioned in the middle of the dashboard.

CD changer



A six disc CD changer is used together with the RTI control module on the older RTI system. This unit only handles CD discs with map information, not music CDs.

The discs contain information about road networks, streets, voice guiding and the software required for the system to function. The CD changer communicates with the RTI unit on serial buses (Melbus).

Remote control

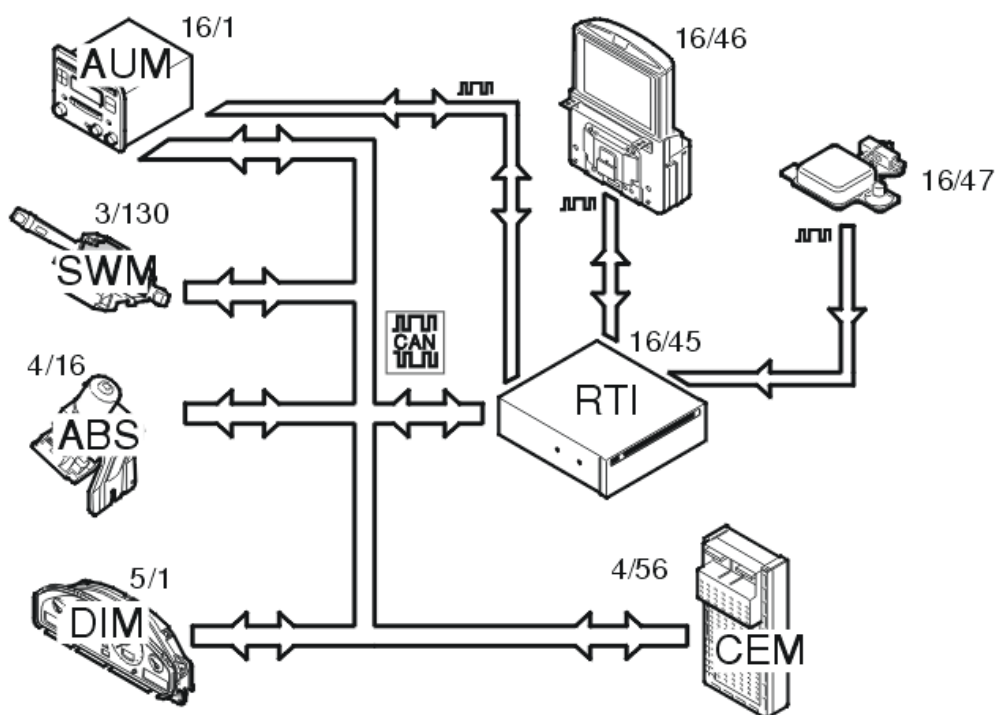
There is a dedicated remote control for the RTI unit. The function of the remote control is the same as the steering wheel buttons.

There is also a separate remote control for the TV receiver which can be used to store and change TV stations, the colour, the size of the picture and the contrast on the screen.

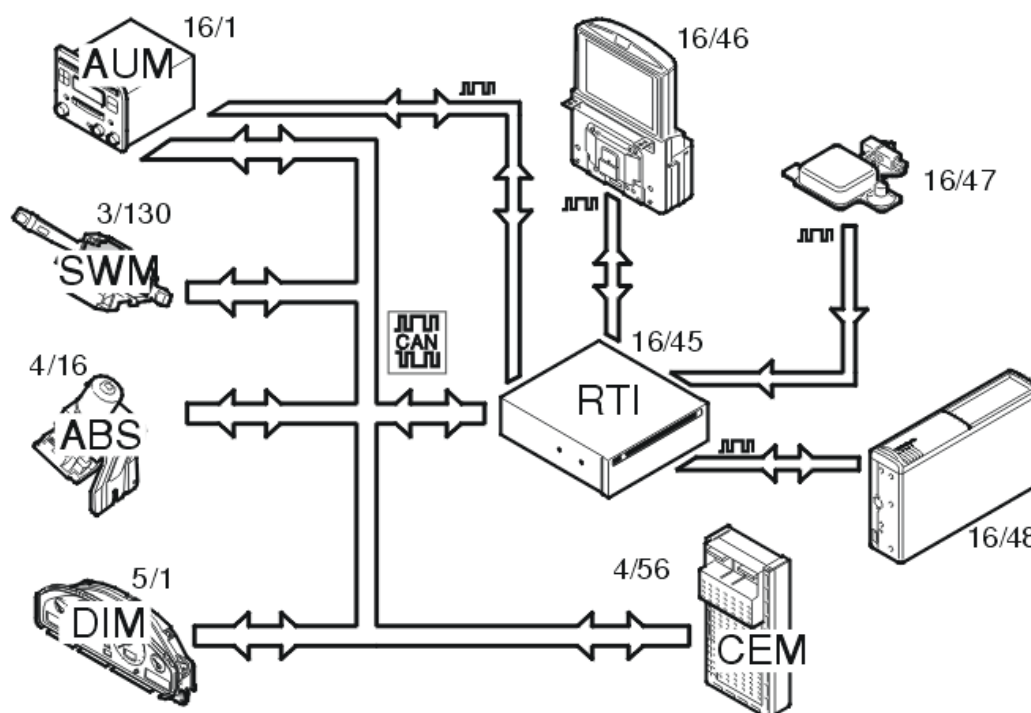
Function

GPS navigation

RTI with integrated DVD



RTI with CD changer



The GPS aerial (16/47) receives signals from a minimum of three and a maximum of eight GPS satellites. These signals are then sent on to the GPS receiver in the RTI control module (16/45). The position of the car is calculated and a route is displayed for the selected destination.

Data for voice guiding for the selected route is transmitted on the serial bus (Melbus) between the RTI control module and the audio module (16/1).

In order for the RTI system to select a route, a DVD (16/45) or CD (16/48) must be available with the road network. For CD changer systems the data is transmitted on a serial bus (Melbus) to the RTI.

Data about speed, the wheel rotation counter and handbrake is sent using CAN communication from the central electronic module (4/56), ABS (4/16) and driver information module DIM(5/1).

Data is sent to the display screen (16/46) from the RTI control module on serial buses.

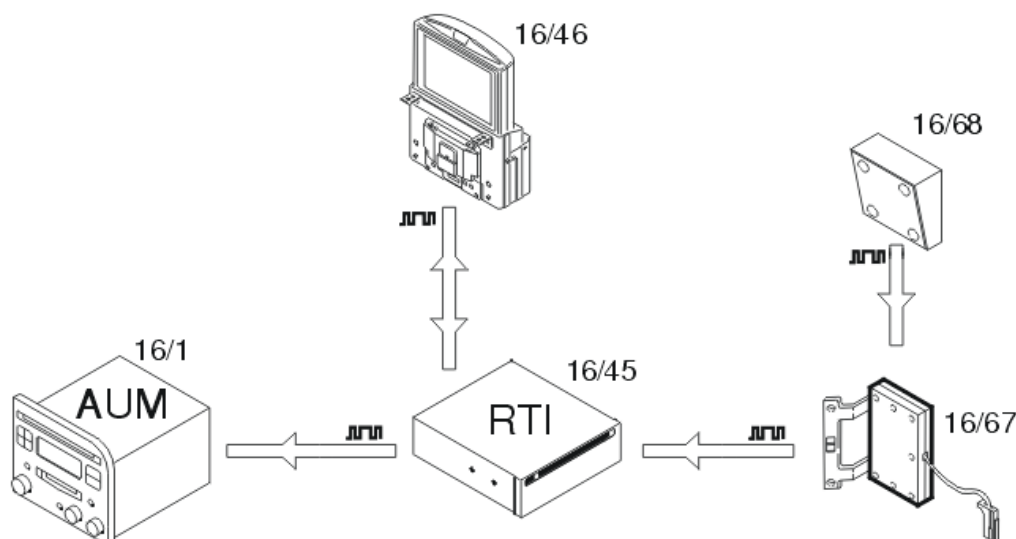
Commands from the remote control are sent from the display screen (16/46) to the RTI unit

(16/45) on a serial bus (remocon signal).

The menu is accessed and used via the buttons on the reverse of the steering wheel. Data is sent from the steering wheel module (3/130) to the RTI unit (16/45) via the Control area network (CAN). There are three steering wheel buttons which are used to control the menu on the screen. There is a four-way switch on which each part of the switch moves the cursor upwards, downwards, to the left or to the right. There is an ENTER button and a BACK button.

When a new GPS aerial is installed for the RTI system, it may take up to 15 minutes before the GPS receiver has the correct information.

Traffic message channel (TMC) reception

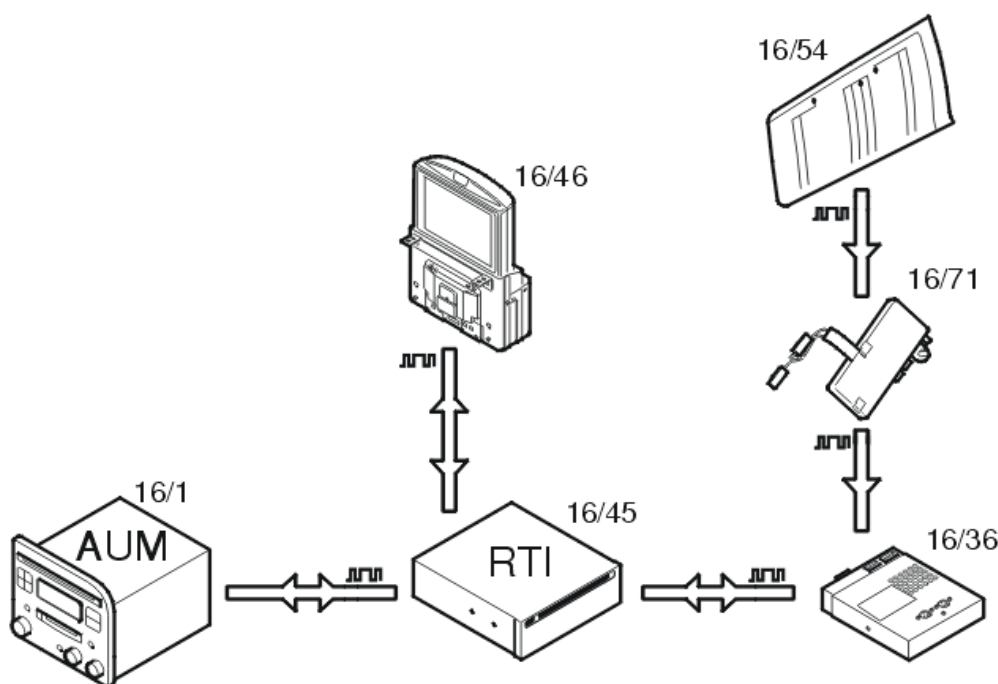


The role of the TMC receiver is to receive traffic information on the FM wavelength. The Japanese system is called FM multiplex. The TMC receiver is integrated in the RTI system and is connected to the aerial system for the FM radio.

There is no traffic information system in the USA.

The TMC data signal is received by the TMC/FM multiplex aerial (16/68) which is located in the rear bumper. The signal is boosted by the aerial amplifier (16/67) before it is sent to the RTI unit (16/45). This data is displayed on the screen (16/46).

TV reception



The TV aerial pattern on the rear windscreen (16/54 for the V70/V70XC, 16/9 and S60/S80) receives signals from the TV network. These signals are boosted in the TV aerial amplifier (16/71) which sends the signals to the TV receiver (16/36). The signals are sent on to the RTI unit (16/45) on a serial bus (Melbus). The RTI unit send the signals containing sound information to the audio module (16/1) on a series bus (Melbus) and signals containing picture information to the display screen (16/46). When the vehicle speed exceeds 7 km/h the RTI changes to navigation automatically.

The SOURCE button on the audio module (16/1) or on the remote control is used to set the TV stations.

RTI diagnostic functions

General

The RTI control module has a built-in diagnostic system, the Volvo on-board diagnostic (OBD) system, which continuously monitors itself and the input and output signals.

Diagnostic trouble codes (DTCs)

A diagnostic trouble code (DTC) is stored if the RTI detects a fault. A fault which is detected in the latest driving cycle is defined as permanent. Other detected faults are defined as intermittent.

Reading and erasing diagnostic trouble codes (DTCs)

Stored diagnostic trouble codes (DTCs) can be read off and erased using this function.

Diagnostic trouble codes (DTCs) can only be erased when all diagnostic trouble codes (DTCs) have been read at least once.

Reading off the control module identification

VADIS identifies the control modules by reading off a number of codes of RTI memory. The codes contains information about the RTI control module's:

- hardware P/N (control modules without software)
- hardware serial number (control modules without software)
- software P/N
- P/N diagnostic software.

Downloading software and replacing the control module

New software can be downloaded into the RTI control module. When ordering software, the hardware and the software in the car is compared to the Volvo central database. If the comparison is OK the software is downloaded to the control module.

If the comparison between the car and Volvo central database does not correspond, the database is updated with the configuration of the car. New software is downloaded after the update is complete.

All other software required for the RTI system to work is on the CDs or DVDs.

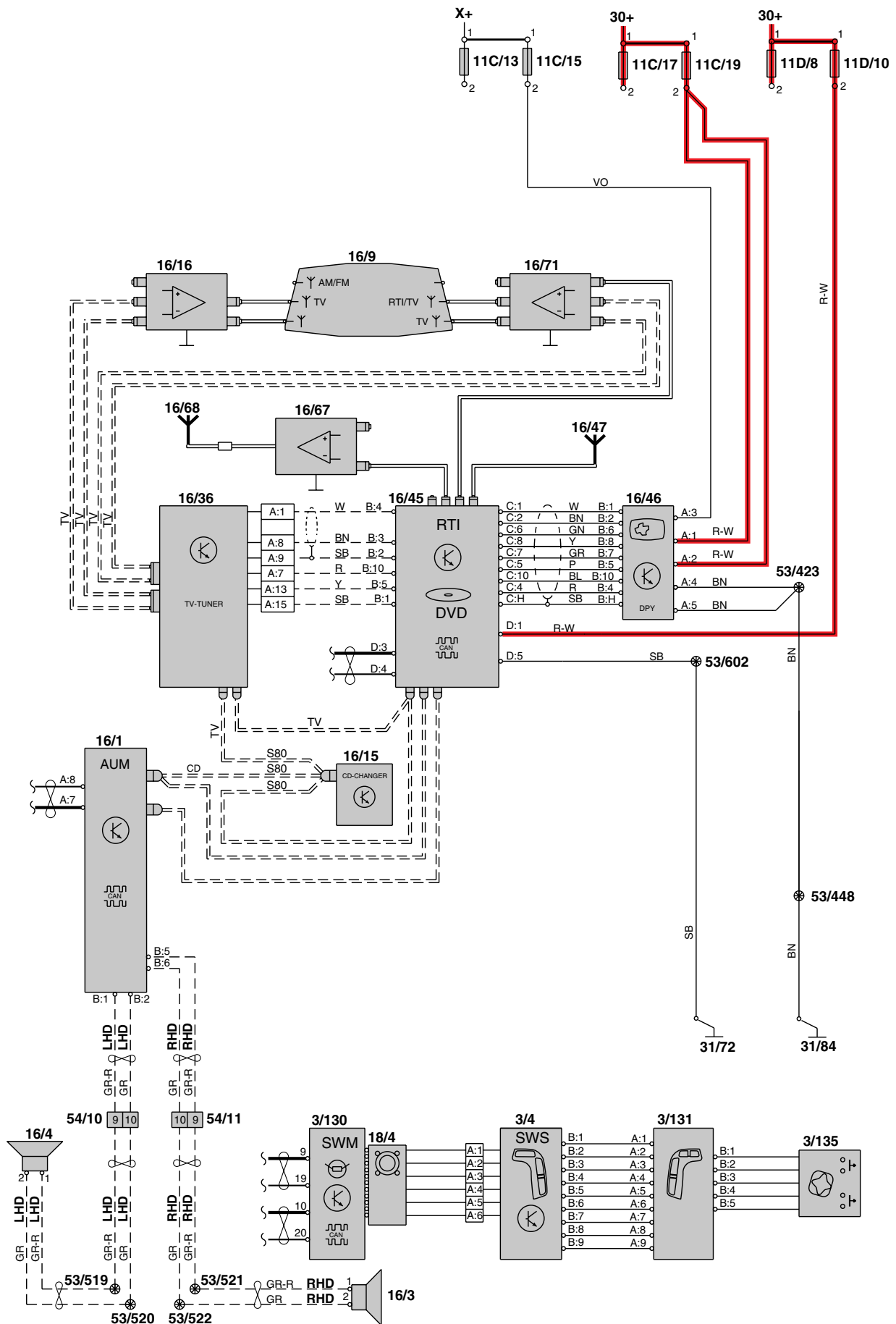
The following applies when downloading new software versions:

- The early version CD for structure weeks

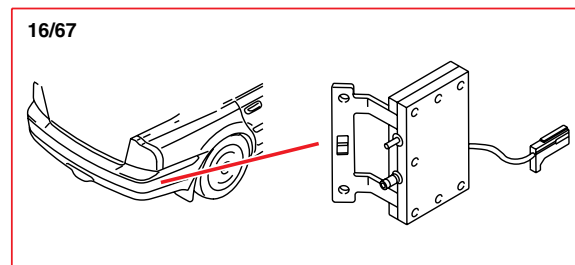
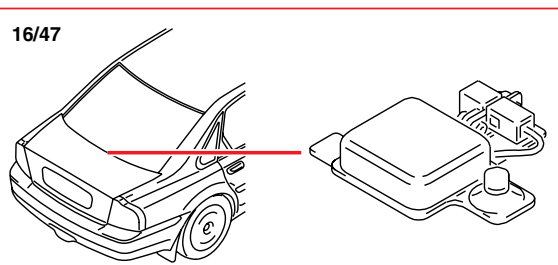
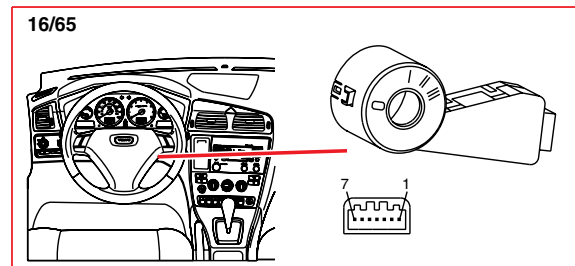
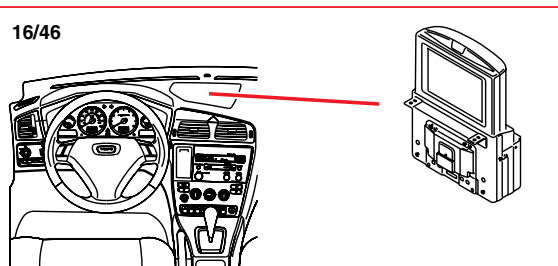
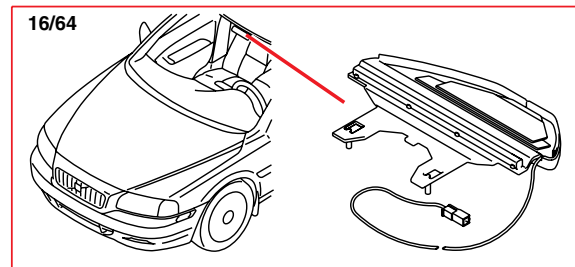
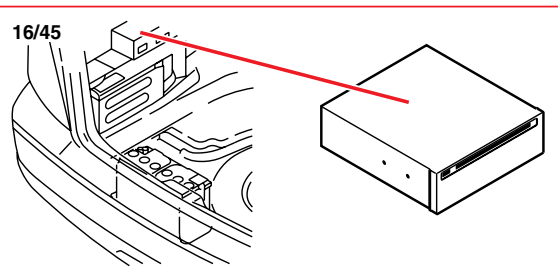
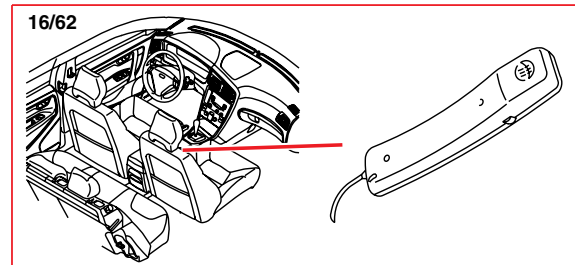
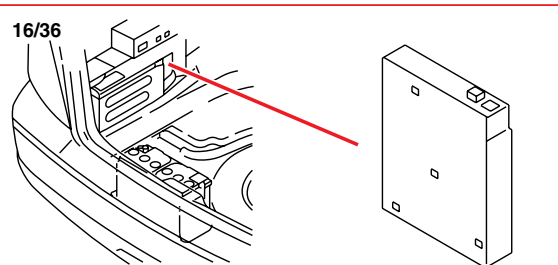
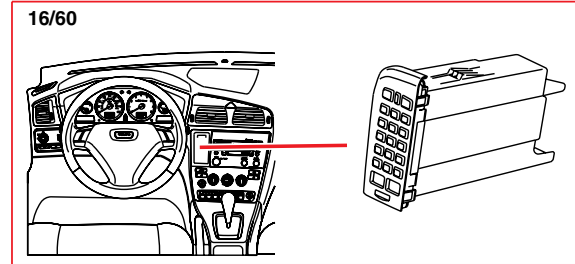
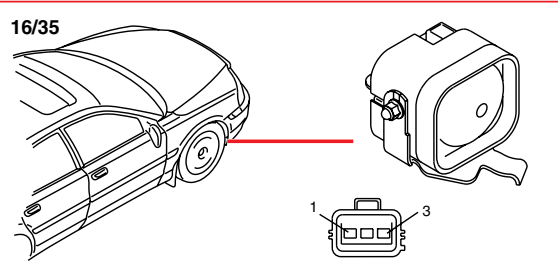
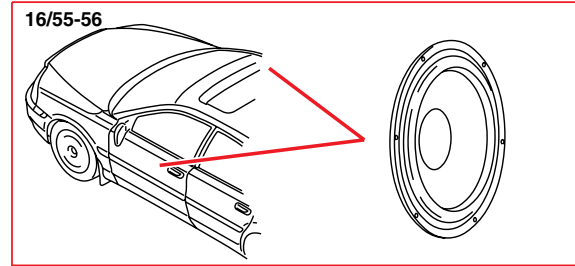
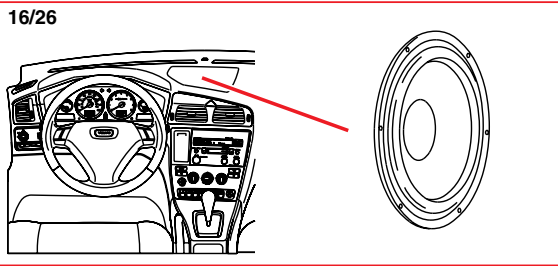
199815 to 200019 only work in the control
modules from the same structure weeks

- New version CDs from structure week 200020
onwards work in all RTI (road traffic
information) systems with CD changers
- DVDs, irrespective of version, work in all RTI
(road traffic information) systems with DVD
players.

Group 39 Road Traffic Information RTI



Component illustrations 16/26 - 16/67



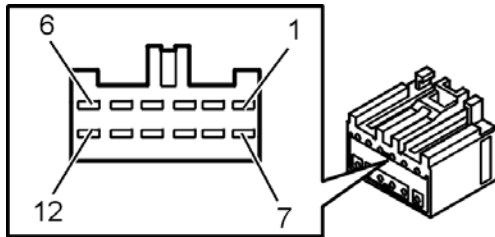
Signal specification, audio control module

Connecting the breakout box and checking the ground terminal

Caution! Before taking readings, the breakout box must be connected and the ground terminal must be checked. See [Checking the ground terminals](#) .

Definitions

DC voltage in volts (V)	Ulow = Voltage near 0 V
	Ubat = Battery voltage



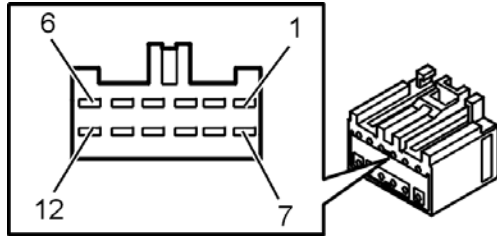
The audio control module, green connector

Note! The connectors on the adapter cable must be correctly colored to correspond to the signal table.

Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#) .

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
A1	#15	30 supply	Ubat	-
A2	#16	15 supply	Ubat	-
A3	#17	-	-	-
A4	#18	-	-	-
A5	#19	-	-	-
A6	#20	-	-	-
A7	#21	CANH	Digital signal 2-3 V	-
A8	#22	CANL	Digital signal 2-3 V	-
A9	#23	Power supply, aerial amplifier	11 V	-
A10	#24	Audio channel (+), centre loudspeaker	Alternating current at sound in centre loudspeaker	-
A11	#25	Audio channel (-), centre loudspeaker	Alternating current at sound in centre loudspeaker	-
A12	#26	Ground	Ulow	-

Audio control module (AUM)/External amplifier



to loudspeakers, gray connector

Note! The connectors on the adapter cable must be correctly colored to correspond to the signal table.

Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

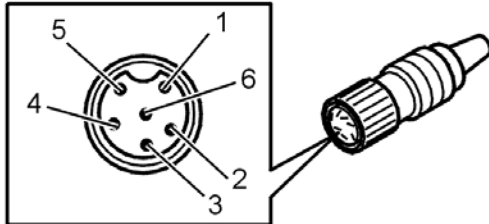
Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
B1	#1	Audio channel (+), loudspeaker left front	AC voltage (to pin 2) when sound in the left front loudspeakers	-
B2	#2	Audio channel (-), loudspeaker left front	AC voltage (to pin 1) when sound in the left front loudspeakers	-
B3	#3	-	-	-
B4	#4	-	-	-
B5	#5	Audio channel (+), loudspeaker right front	Alternating current (to pin 6) when sound in the right front loudspeakers	-
B6	#6	Audio channel (-), loudspeaker right front	Alternating current (to pin 5) when sound in the right front loudspeakers	-
B7	#7	Audio channel (+), loudspeaker left rear	Alternating current (to pin 8) when sound in the left rear loudspeakers	-
B8	#8	Audio channel (-), loudspeaker left rear	Alternating current (to pin 7) when sound in the left rear loudspeakers	-
B9	#9	-	-	-
B10	#10	-	-	-
B11	#11	Audio channel (+), loudspeaker right rear	Alternating current (to pin 12) when sound in the right rear loudspeakers	-
B12	#12	Audio channel (-), loudspeaker right rear	Alternating current (to pin 11) when sound in the right rear loudspeakers	-

Audio control module (to aerial)

Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
C1	#45	Aerial signal, head aerial	Analogue signal	-
C2	#46	Power supply and aerial signal, sub aerial	Analogue signal	The aerial signal is retained over DC

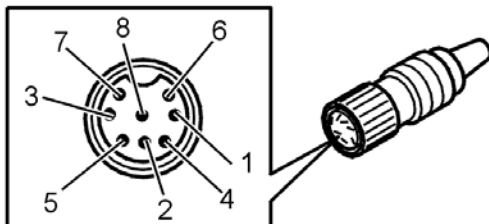
Audio control module (cable between the audio module and the amplifier)



Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
D1	#42	Audio channel, loudspeaker left front	Alternating current when sound at front left loudspeaker	-
D2	#43	Audio channel, loudspeaker right front	Alternating current when sound at front right loudspeaker	-
D3	#44	Audio channel, loudspeaker right rear	Alternating current when sound at right rear loudspeaker	-
D4	#45	Signal ground, audio channel	Ulow	-
D5	#46	Audio channel, loudspeaker left rear	Alternating current when sound at left rear loudspeaker	-
D6	#47	Control signal (off / on) amplifier	?	-

Audio control module (cable between the audio module and the CD changer/navigation unit)



Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

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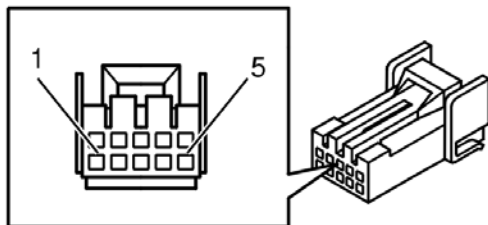
Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
E1	#16	Clock signal to audio unit	Digital signal	-
E2	#17	Signal ground, sound	Ulow	-
E3	#18	15 supply	Ubat	-
E4	#19	Data signal to audio unit	Digital signal	-
E5	#20	Busy signal to audio unit	Digital signal	-
E6	#21	Left audio channel	Alternating current when there is sound to the loudspeaker	-
E7	#22	Right audio channel	Alternating current when there is sound to the loudspeaker	-
E8	#23	Voice guide channel	Alternating current when there is sound to the loudspeaker	-
H		Screen ground, cable to audio unit	Ulow	-

External amplifier

Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

Control module terminal	Signal type	Ignition on	Other
F1	30 supply	Ubat	-
F2	Ground	Ulow	-

10CD changer



Before taking any readings, see [Connecting the breakout box and checking the ground terminal](#).

Control module terminal	Signal type	Ignition on	Other
G1	30 supply	Ubat	-
G2	Ground	Ulow	-
G3			

G4			
G5			

Signal specification, RTI

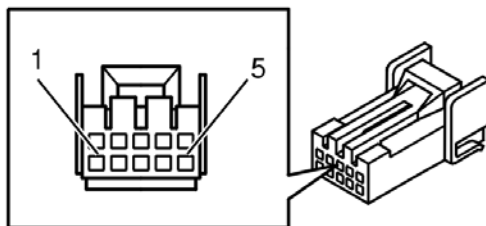
Connecting the breakout box and checking the ground terminal

Note! Before taking readings, the breakout box must be connected and the ground terminal must be checked. See [Checking the ground terminals](#).

Definitions

DC voltage in volts (V)	U _{low} = Ground, shield ground
	U _{bat} = Battery voltage

RTI control module

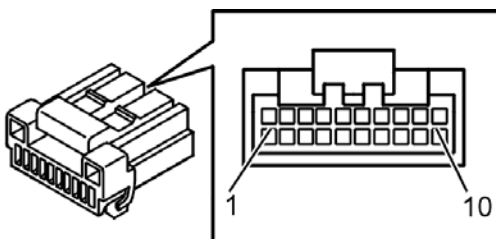


Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

The road and traffic information (RTI) control module terminals D1-D5 correspond to terminals #22-#26 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
D1	#22	30-supply (power supply from battery)	U _{bat}	-
D2	#23	-	-	-
D3	#24	CANH signal	U = 2.5-4.0 V	-
D4	#25	CANL signal	U = 1.0-2.5 V	-
D5	#26	Ground (Measured to battery negative terminal)	U _{low}	-

RTI control module (to TV receiver)



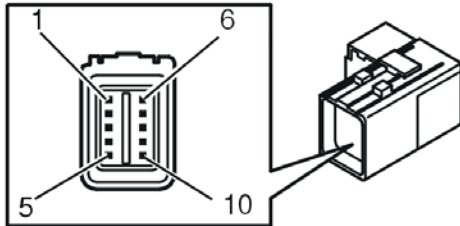
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

The RTI control module terminals B1-B10 correspond to terminals #1-#10 on the breakout box.

Control	Breakout	Signal type	Ignition on	Other
---------	----------	-------------	-------------	-------

module terminal	box terminal			
B1	#1	Ground (Measured to battery negative terminal)	Ulow	-
B2	#2	Screen ground, TV signals	Ulow	
B3	#3	Signal ground, TV signals	Ulow	-
B4	#4	Video signal, TV	Analog signal	1 V p-p +/- 0.2 V
B5	#5	Signal, remote control TV	Digital signal	33.3 kHz carrier wave when the remote control is pressed
B6	#6	-	-	-
B7	#7	-	-	-
B8	#8	-	-	-
B9	#9	-	-	-
B10	#10	30-supply (power supply from battery)	Ubat	Output signal to the TV tuner

RTI control module (to display)



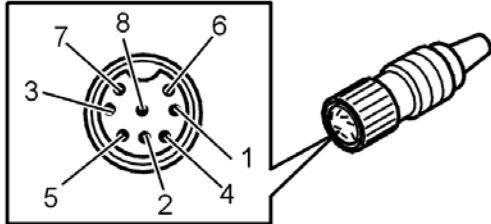
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

The RTI control module terminals C1-C10 correspond to terminals #1-#10 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
C1	#1	Color signal (red), screen	Analog signal when red color is displayed	0.714 V p-p
C2	#2	Color signal (green), display	Analog signal when green color is displayed	0.714 V p-p
C3	#3	-	-	-
C4	#4	Serial bus to the display	Digital signal	Half duplex, start-stop synchronizer, 2400 bps
C5	#5	Signal, remote control for the display screen	Digital signal	38 kHz carrier wave when the remote control is pressed
C6	#6	Color signal (blue), screen	Analog signal when blue color is displayed	0.714 V p-p
C7	#7	Screen ground, video	Ulow	-

		signals		
C8	#8	Composite sync, display screen	Analog signal	0-5 V
C9	#9	-	-	-
C10	#10	Video signal to display	Analog signal	1 V p-p +/- 0.2 V
H	-	Screen ground, cable to the screen	Ulow	-

RTI control module (to audio unit)

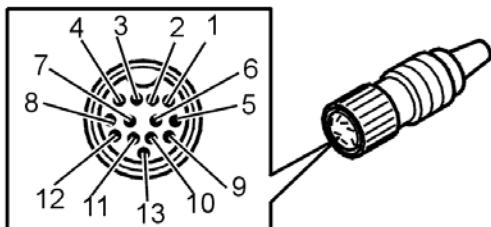


Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

The RTI control module terminals E1-E8 correspond to terminal #16-#23 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
E1	#16	Clock signal to audio unit	Digital signal	Melbus protocol
E2	#17	Signal ground, sound	Ulow	-
E3	#18	15 supply	Ubat	-
E4	#19	Data signal to audio unit	Digital signal	Melbus protocol
E5	#20	Busy signal to audio unit	Digital signal	Melbus protocol
E6	#21	Left audio channel	Alternating current on sound to loudspeakers	150 mV rms +/- 38 mV (1 kHz 30% mod)
E7	#22	Right audio channel	Alternating current on sound to loudspeakers	150 mV rms +/- 38 mV (1 kHz 30% mod)
E8	#23	Voice guide channel	Alternating current on sound to loudspeakers (for voice guidance)	150 mV rms +/- 38 mV (1 kHz 30% mod)
H		Screen ground, cable to audio unit	Ulow	-

RTI control module (to TV receiver)



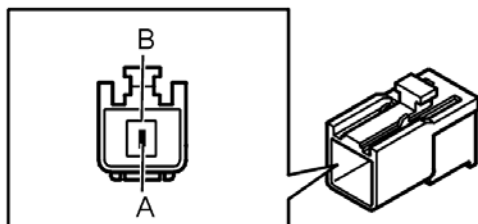
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

The RTI control module terminals F1-F13 correspond to terminals #1-#13 on the breakout box.

Control	Breakout	Signal type	Ignition on	Other
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module terminal	box terminal			
F1	#1	Signal ground	Ulow	-
F2	#2	Left audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
F3	#3	-	-	-
F4	#4	Right audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
F5	#5	-	-	-
F6	#6	Voice guide channel	Alternating current when there is sound to the loudspeaker (during voice guidance)	150 mV rms +/- 38 mV (1 kHz 30% mod)
F7	#7	-	-	-
F8	#8	-	-	-
F9	#9	-	-	-
F10	#10	15 supply	Ubat	-
F11	#11	Busy signal to TV receiver	Digital signal	Melbus protocol
F12	#12	Clock signal to TV receiver	Digital signal	Melbus protocol
F13	#13	Data signal to TV receiver	Digital signal	Melbus protocol
H		Screen ground, cable to TV receiver	Ulow	-

RTI control module (to GPS antenna, gray connector)

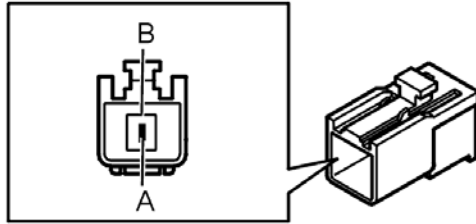


Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#) .

Control module terminal	Signal type	Ignition on	Other
G1	Power supply and GPS signal	Analog signal	Supply 5 V (DC), signal 1.575 GHz
G2	Screen ground	Ulow	-

RTI control module (to TMC (FM-MPX) antenna,

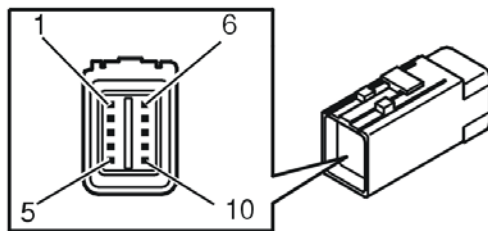
brown connector)



Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

Control module terminal	Signal type	Ignition on	Other
H1	Antenna signal	Analog signal	-
H2	Screen ground	Ulow	-

Display (to the road traffic information (RTI) control module)



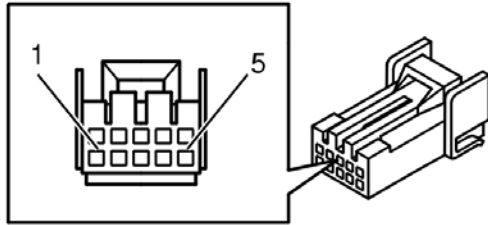
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

Display terminals J1-J10 correspond to terminals #1-#10 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
J1	#1	Color signal (red), screen	Analog signal when red color is displayed	0.714 V p-p
J2	#2	Color signal (green), display	Analog signal when green color is displayed	0.714 V p-p
J3	#3	-	-	-
J4	#4	Serial bus to the display	Digital signal	Half duplex, start-stop synchronizer, 2400 bps
J5	#5	Signal, display remote control	Digital signal	38 kHz carrier wave when the remote control is pressed
J6	#6	Color signal (blue), screen	Analog signal when blue color is displayed	0.714 V p-p
J7	#7	Screen ground, video signals	Ulow	-
J8	#8	Composite sync, display screen	Analog signal	0-5 V
J9	#9	-	-	-
J10	#10	Video signal to display	Analog signal	1 V p-p +/- 0.2 V

H	-	Screen ground, cable to the screen	Ulow	-
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Display

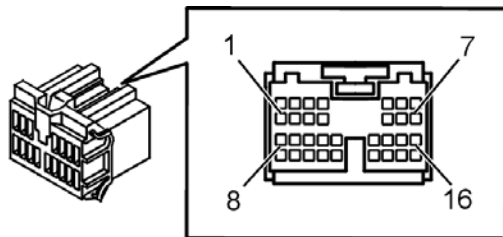


Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

Display terminals K1-K5 correspond to terminals #1-#5 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
K1	#1	30-supply (power supply from battery)	Ubat	-
K2	#2	30-supply (power supply from battery)	Ubat	-
K3	#3	15 supply	Ubat	-
K4	#4	Ground (Measured to battery negative terminal)	Ulow	-
K5	#5	Ground (Measured to battery negative terminal)	Ulow	-

TV receiver (to RTI control module)

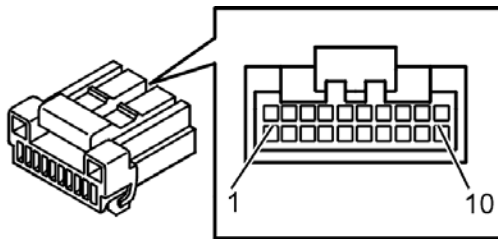


Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

TV receiver terminals M1-M16 correspond to terminals #25-#40 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
M1	#25	Video signal, TV	Analog signal	1 V p-p +/- 0.2 V
M2	#26	-	-	-
M3	#27	-	-	-
M4	#28	-	-	-
M5	#29	-	-	-
M6	#30	-	-	-
M7	#31	30 supply	Ubat	From road traffic information (RTI)
M8	#32	Signal ground, TV signals	Ulow	-

M9	#33	Screen ground, TV signals	Ulow	-
M10	#34	-	-	-
M11	#35	-	-	-
M12	#36	-	-	-
M13	#37	Signal, remote control TV	Digital signal	33.3 kHz carrier wave when the remote control is pressed
M14	#38	-	-	-
M15	#39	Ground (Measured to battery negative terminal)	Ulow	-
M16	#40	-	-	-



TV receiver (to the video)

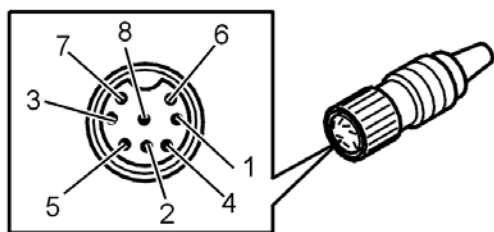
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).

TV receiver terminals N1-N10 correspond to #1-#10 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
N1	#1	-	-	-
N2	#2	-	-	-
N3	#3	-	-	-
N4	#4	-	-	-
N5	#5	Video signal	-	-
N6	#6	Signal ground, video signals	Ulow	-
N7	#7	Left audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
N8	#8	Right audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
N9	#9	signal ground, audio	Ulow	-
N10	#10	-	-	-

TV receiver (to RTI control module)

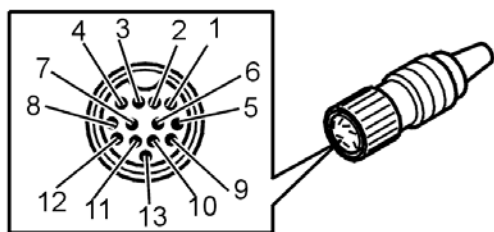
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#).



TV receiver terminals O1-O8 correspond to terminals #16-#23 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
O1	#16	Clock signal to TV receiver	Digital signal	Melbus protocol
O2	#17	Signal ground, sound	Ulow	-
O3	#18	15 supply	Ubat	-
O4	#19	Data signal to TV receiver	Digital signal	Melbus protocol
O5	#20	Busy signal to TV receiver	Digital signal	Melbus protocol
O6	#21	Left audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
O7	#22	Right audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
O8	#23	Voice guide channel	Alternating current when there is sound to the loudspeaker (during voice guidance)	-
H		Screen ground, cable to audio unit	Ulow	-

TV receiver (to CD player)



Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#) .

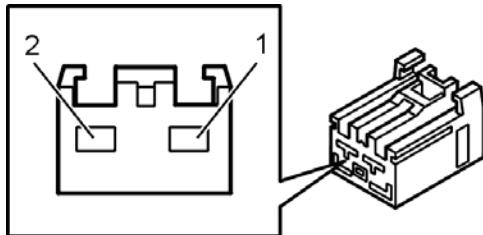
TV receiver terminals P1-P13 correspond to terminals #1-#13 on the breakout box.

Control module terminal	Breakout box terminal	Signal type	Ignition on	Other
P1	#1	signal ground	Ulow	-
P2	#2	Left audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)

P3	#3	-	-	-
P4	#4	Right audio channel	Alternating current when there is sound to the loudspeaker	150 mV rms +/- 38 mV (1 kHz 30% mod)
P5	#5	-	-	-
P6	#6	Voice guide channel	Alternating current when there is sound to the loudspeaker (during voice guidance)	-
P7	#7	-	-	-
P8	#8	-	-	-
P9	#9	-	-	-
P10	#10	15 supply	Ubat	-
P11	#11	Busy signal to TV receiver	Digital signal	Melbus protocol
P12	#12	Clock signal to TV receiver	Digital signal	Melbus protocol
P13	#13	Data signal to TV receiver	Digital signal	Melbus protocol
H		Screen ground, cable to TV receiver	Ulow	-

TV receiver (to TV tuner A)

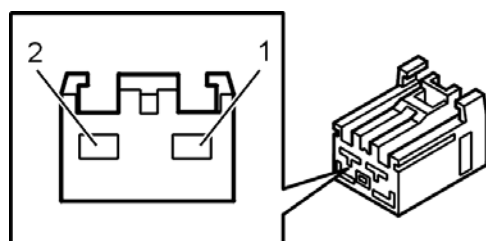
Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#) .



Control module terminal	Signal type	Ignition on	Other
Q1	Power supply and signal	Analog signal	The antenna signal is retained over DC EU: 48.5 -87.75 MHz 175.25 -229.75 MHz 471.25 -855.25 MHz JPN: 91.25 -103.75 MHz 175.25 -217.25 MHz 471.25 - 765.25 MHz
Q2	Power supply and signal	Analog signal	The antenna signal is retained over DC EU: 48.5 -87.75 MHz

			175.25 -229.75 MHz 471.25 -855.25 MHz JPN: 91.25 -103.75 MHz 175.25 -217.25 MHz 471.25 - 765.25 MHz
H	Screen ground	Ulow	-

TV receiver (to TV tuner B)



Before taking any readings, read [Connecting the breakout box and checking the ground terminal](#) .

Control module terminal	Signal type	Ignition on	Other
R1	Power supply and signal	Analog signal	The antenna signal is retained over DC EU: 48.5 -87.75 MHz 175.25 -229.75 MHz 471.25 -855.25 MHz JPN: 91.25 -103.75 MHz 175.25 -217.25 MHz 471.25 - 765.25 MHz
R2	Power supply and signal	Analog signal	The antenna signal is retained over DC EU: 48.5 -87.75 MHz 175.25 -229.75 MHz 471.25 -855.25 MHz JPN: 91.25 -103.75 MHz 175.25 -217.25 MHz 471.25 - 765.25 MHz
H	Screen ground	Ulow	-