TMR880i TETRA Mobile Radio Vehicle Installation Instructions

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AIRBUS

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DOCUMENT AMENDMENTS			
Version	**Date**	**Comments**	**Chapter Updated**
6-1	12/2020	Revised version.	Throughout
6-2	04/2021	Push-to-Talk switch's code updated. Two Cautions related to the connectors in the back-front have been added. Figure 34 modified and the related Caution updated.	4 5.1 6.2.1
6-3	09/2021	Ref to NMEA removed	2 and 6.5
6-4	01/2022	HFS-10 loudspeaker update BCH-14 plastic stud for MPR-4 CUR-3 new cable markings	4 and 4.9 4.8 6 and 8

1. General information

The Airbus TMR880i TETRA mobile radio conforms to the ETSI standards for compatible digital TETRA networks. It has been targeted to meet the demanding communications requirements of professional mobile radio (PMR) users, from voice communication to messaging and data transmission.

This document instructs how to install the TMR880i to a vehicle. There is a separate document available for instructions on installing the Desktop kit in the office environment.

Figure 1. TMR880i TETRA mobile radio

1.1. Contact

For support regarding this installation guide, please contact TETRA Terminal Customer Support via the Airbus SLC Customer Portal: https://hub.securelandcommunications.com/s/.

2. Technical specifications

The Airbus TMR880i TETRA mobile radio fulfils the following specifications for TETRA radio equipment in the temperature range –20 to +55°C:

- ETS 300 392-2 Voice and Data Air Interface,
- ETS 300 394 Voice and Data Conformance testing
- ETS 300 395 V + D Air Interface.

Table 1. Technical specifications

Functionality	Description
Operation mode	Trunked mode (TMO, duplex and semi-duplex) and Direct mode (DMO, simplex)
Frequency Band	RC9: TMO TX 380-390 and 410-420 MHz TMO RX 390-400 and 420-430 MHz DMO TX & RX 380-400 and 410-430 MHz
	RC16: TMO TX 806-825 MHz TMO RX 851-870 MHz DMO TX & RX 806-825 and RX 851-870 MHz
Output power	ETS 300 392-3 compliant power class 3
Receiver class	Class A
Durability	Control unit CUR-3 is water and dust resistant (IP55 classification).
Operating voltage	from 10.8 V to 15.6 V DC (min. voltage 6.0V in non-operation mode)
Dimensions & weight	**Control unit:** Length x Height: 190 x 72 mm Thickness: 26 mm (36 mm with rotary switch) Weight: 240 g
	Radio unit: L x H x W: 182 x 60 x 125 mm Weight: 1004 g
Interfaces	External control unit 16 configurable I/O pins (e.g. External alarm) Multiple audio devices Programming through Hirose connector in system - cable CA-105 Serial data, via external data cable DLR-3T External power on/off External PTT External emergency PTT Ignition sense
Display	2,6inch Illuminated high-contrast full graphics colour display 65,536 colours, 130 x 130 pixels
Keypad	Alphanumeric keypad, Power On key, selection keys, 4-way navigation keys, volume keys, Red Function key, Duty key, Fast Menu key, Group selector, Back key, Display brightness key
Current consumption	RX idle average 600 mA (CUR-3 lights on, GPS on, audio on) TX average 1.4 A (CUR-3 lights on, GPS on) Power supply requirement 8 A

3. Sales packages for TMR880i

The TMR880i has two separate sales packages available:

- Customer-specific radio sales package
- CUR-3 Control Unit sales package, which is generic for all customers.
  The CUR-3 Control Unit is available in 5 different keymat variants: Latin, Arabic, Chinese, Korean and Greek.

3.1. Radio sales package

A typical customer radio sales package contains a transceiver unit, system cable CA-105 or CA-156, installation plate and screws, as well as 1-3 Quick Guides.

3.2. Control Unit CUR-3 sales package

The CUR-3 Control Unit sales package contains a CUR-3 control unit with installation cable, with optional selection of speaker microphone cable, speaker microphone, loudspeaker, installation swivel HHR-1, hands-free PTT and a hands-free microphone.

3.3. Two configurations with system cables

Read all the installation guidelines through and follow them carefully (see Chapter 7). Airbus DS SLC cannot guarantee the targeted functionality if Airbus´s installation instructions are not properly followed.

3.3.1. Enhanced configuration with CA-105 cable

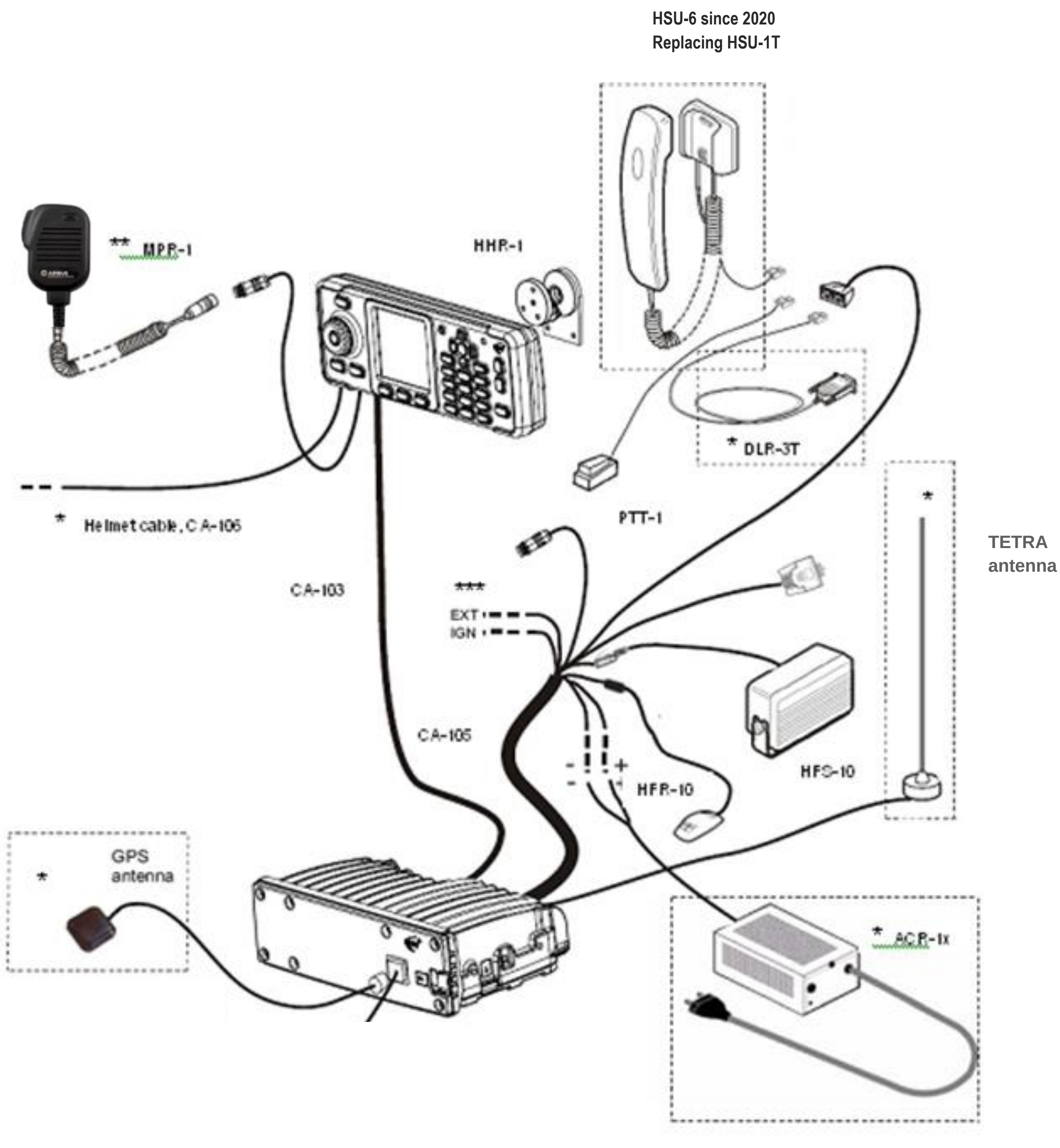

Figure 2. Enhanced configuration with CA-105 cable

* Not included in the sales package.
** May be included in the sales package. Please check from your sales contacts.
*** EXT line can be used to connect an external emergency button into the radio unit via system cable. The functionality of this button is similar to the CUR-3 red function key. Only in CA-105 cable.
*** IGN line can be used for controlling on/off the radio like vehicle Ignition key.

3.3.2. Basic configuration with CA-156 cable

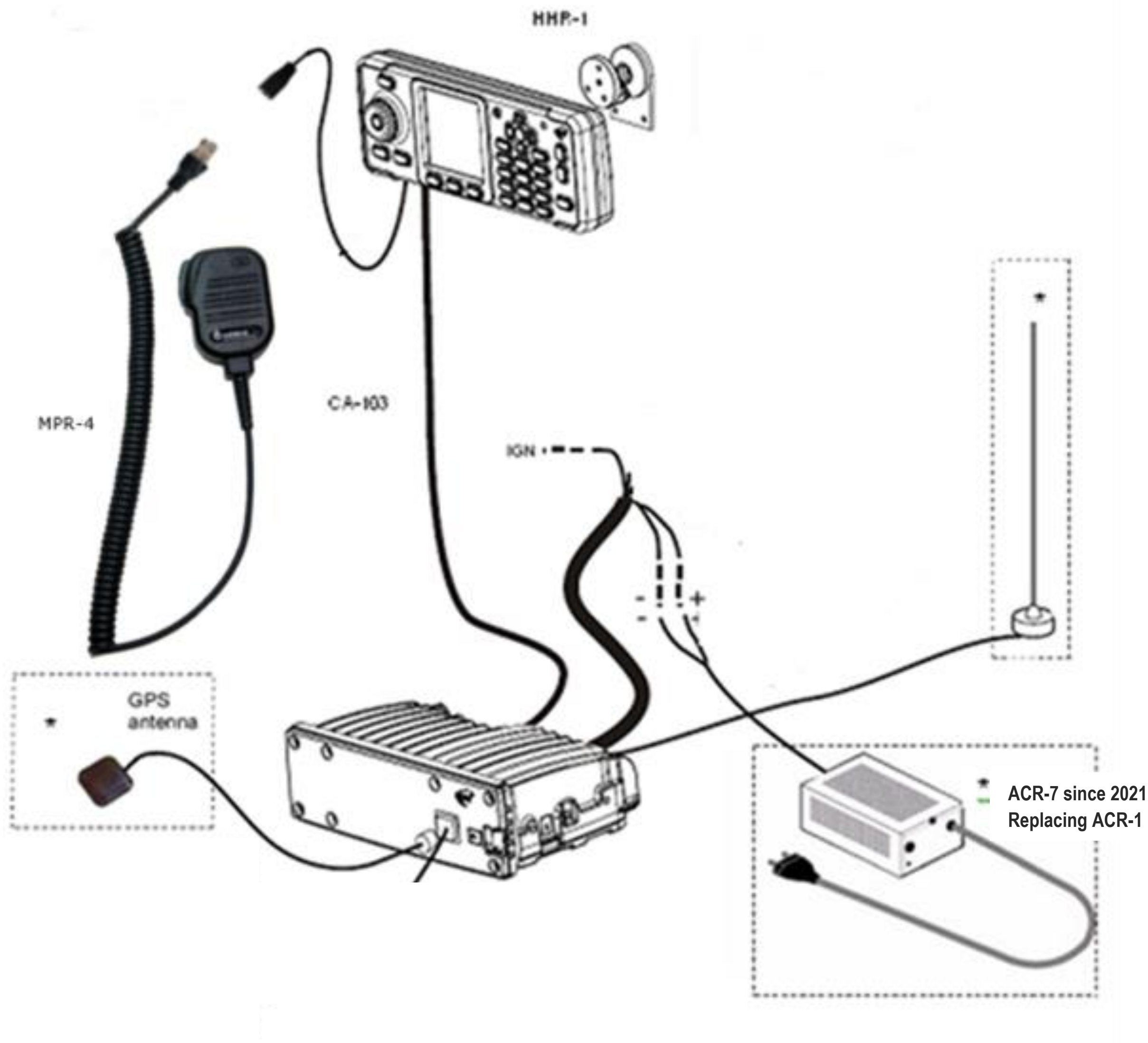

Figure 3. Basic configuration with CA-156 cable

Note

MPR-4’s cable must be connected only to CUR-3.

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* Not included in the sales package.
** May be included in the sales package. Please check from your sales contacts.
***IGN line can be used for controlling on/off the radio like vehicle Ignition key.

3.4. Use without CUR-3

The TMR880i RC-9 can be used without the external control unit CUR-3, for example as a modem. In this case, the radio unit can be powered on/off by the IGS line (see pin 20 of system cable). If there is a power outage when the IGS line is active, the radio unit starts up again automatically.

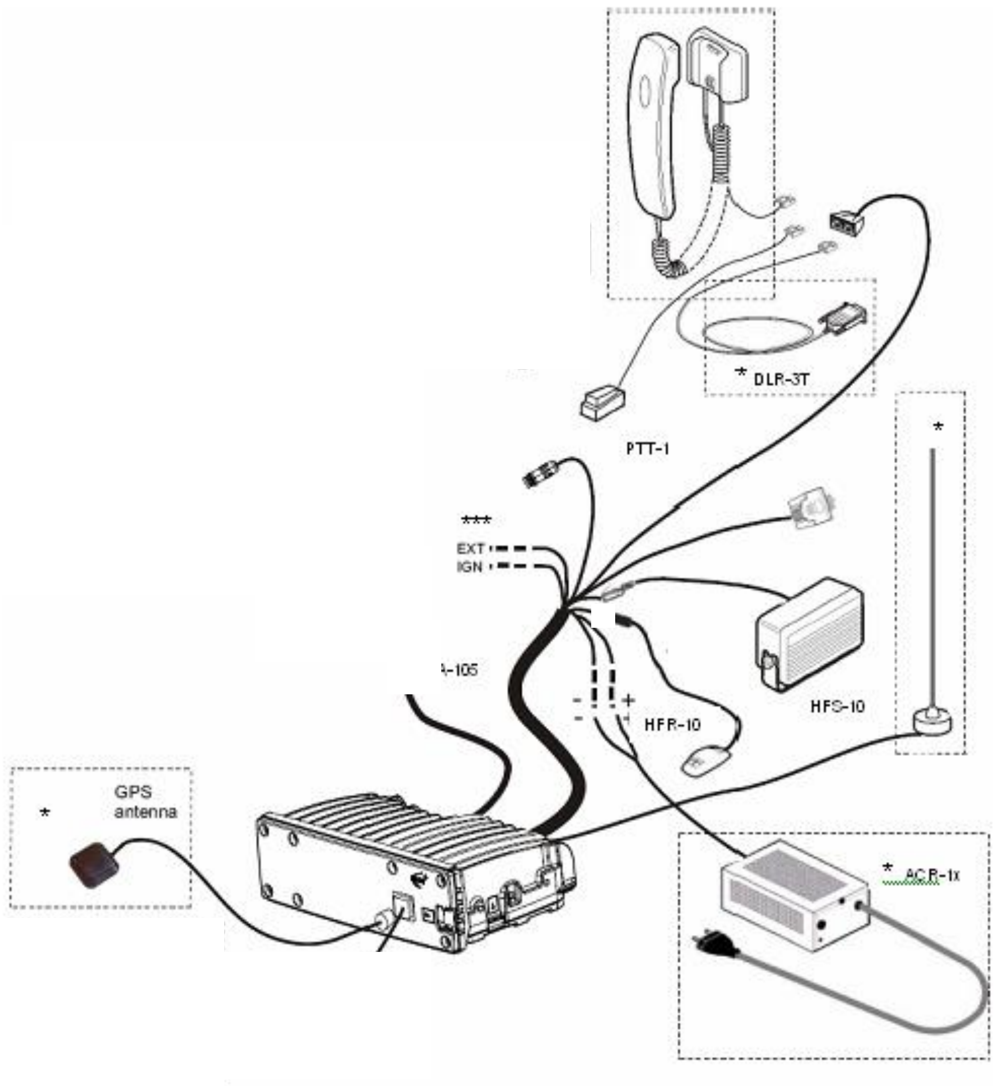


Figure 4. Use with CUR-3

4. Accessories for vehicle installation

TMR880i has the following accessories available. Note that some of the accessories may not be available in all countries. Check the availability from your local distributor.

Check your warranty terms before connecting other than those Airbus own accessories.

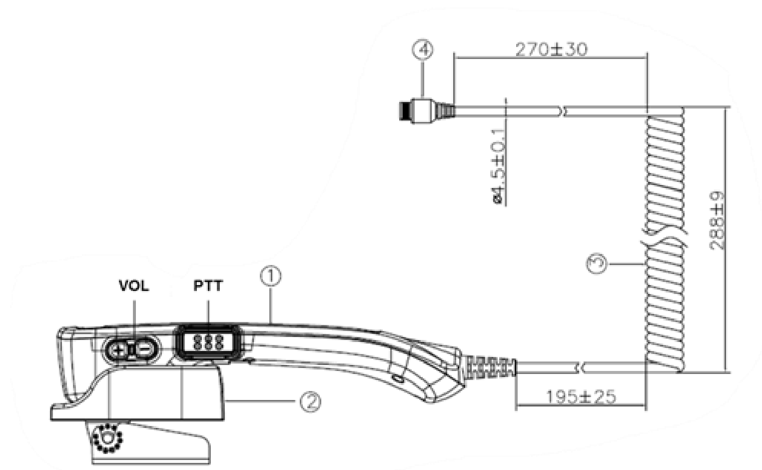
TMR880i can be assembled in a desktop kit. The installation manual of the desktop kit and its related accessories are available as a separate document.

Accessory	Type	Code
Speaker microphone	MPR-4	HR9205AA
Speaker microphone cable used with MPR-4	CA-157	HG5469A
HF microphone	HFR-1	HR10162AA
Loudspeaker 3W with Molex connector, old -> 2022	HFS-10	T0692006
Loudspeaker 5W with Molex connector, new 2022->	HFS-10	HR10415BA
Optional Loudspeaker 15W with Molex connector	HFS-11	HR10900AA
Push-to-Talk switch (old code 9780282)	PTT-1	HR10911AA
Handset	HSU-6	HR10749AA
Data cable	DLR-3T	T0730227
AC Power Supply	ACR-7EU, Eu Plug	HR10811AA
AC Power Supply	ACR-7UK, UK Plug	HR10812AA
AC Power Supply	ACR-7US, US Plug	HR10813AA
Swivel mount	HHR-1	T0620064
System cable	CA-105	HG5397A
System cable	CA-156	HG5467A
Installation cable, 0,75m	CA-116	HG5178B
Installation cable, 1.5m	CA-108	HG5178A
Installation cable, 5.5m	CA-103	T0730625
Installation cable, 10m	CA-104	T0730627
Helmet cable	CA-106	T0730632
Vehicle Antenna Installat. kit TETRA + GNSS	AN-58	HR10268AA
Vehicle Ant. Ins. Kit TETRA high Gain + GNSS	AN-59	HR10269AA
Magnet base antenna kit TETRA + GNSS	AN-60	HR10270AA
Smart card reader	DD-5	T0632189
Start –Stop Plug 10pcs	SS-4	HT11726AA
Fuse 5A 125°C rated	N/A	PK1705A
Installation plate	N/A	9500318
CUR-3 DIN installation kit	N/A	T0087632
PLASTIC STUD 100PCS KIT FOR MPR-4	BCH-18	HR10912AA

4.1. Handset (HSU-6)

Figure 5. Handset HSU-6 (left) and phased-out model HSU-1T (right)

In the following figure, the handset is connected to the system cable CA-105, and can be used. Check the Taqto parameter settings to support the more flat audio profile made for HSU-6.



HSU-6

Figure 6. Connected handset HSU-6

4.2. Handsfree microphone (HFR-1)

The handsfree HFR-1 microphone is connected to the system cable CA-105 with a 3.5mm jack. The direction and distance to the user should not exceed 40 cm. Avoid wind noise positions in the vehicle.

When installing the Audio HF-Mic Jack connector, add 1.5 round of electronics tape to cover the connectors to avoid the connection becoming loose when the vehicle vibrates.

Figure 7. Handsfree microphone HFR-1

4.3. Handsfree push-to-talk button (PTT-1)

The handsfree push-to-talk button HF PTT-1 with 1 m cable is connected to the system cable CA-105. The cable distance to the user should be optimised for ergonomics, so that it is not disturbing or preventing the use of the vehicle’s own controls.

Figure 8. Handsfree push to talk button PTT-1

4.4. Data cable (DLR-3T)

Figure 9. Data cable DLR-3T

4.5. Antennas (AN-58, AN-59 and AN-60)

Vehicle combination antennas of 380-400MHz, TETRA and GNSS.

The antenna datasheets for new vehicle antenna models are available separately from the Accessory Catalogue (https://www.securelandcommunications.com/tetra-radio-accessories).

4.6. CUR-3 installation cables

Table 2. CUR-3 installation cables

Desciption	Cable	Sales code
Installation cable, 0.75m	CA-116	HG5178B
Installation cable, 1.5m	CA-108	HG5178A
Installation cable, 5.5m	CA-103	T0730625
Installation cable, 10m	CA-104	T0730627

Figure 10. CUR-3 installation cables

4.7. Power supply (ACR-7E, ACR-7U, ACR-7X) for office use

The ACR-7 power supply is on the left. The previous model ACR-1E, ACR-1U, ACR-1X, which will be phased out in 2021, on the right. For more details on ACR-7, see the datasheet of ACR-7.

Figure 11. Power supply for office use ACR-7 (left) and ACR-1 (right)

4.8. Speaker microphone (MPR-4)

MPR-4 is optionally included in the CUR-3 sales package. Check the status from your sales contact.

Figure 12. Speaker microphone MPR-4 (left) and phased-out MPR-1 (right)

There is an optional item HR10912AA BCH-18 PLASTIC STUD for wet and high moisture use cases, such as at the sea or in boat environments as a replacement for the metallic stud. It can be ordered separately and installed by technical persons during the vehicle installation (compliant with MPR-4).

4.9. Loudspeaker (HFS-10)

The HFS-10 loudspeaker is included in some CUR-3 sales packages. It has a 2-pin Molex type connector, which is connected to system cable CA-105's external audio interface. Its maximum audio power is 3W.

A new loudspeaker design with same name is introduced as a replacement in 2022. It is smaller in size (103x45x81,7mm) and its maximum audio power is higher (5W). The cable length is 1.5m.

Figure 13. Loudspeaker HFS-10 (old model on the left and new model (since 2H/2022) on the right)

4.10. Loudspeaker 15W (HFS-11)

The optional HFS-11 loudspeaker has a 2-pin Molex type connector, which is connected to the system cable CA-105's external audio interface. Its rated audio power is 15W and the maximum is 20W.

Figure 14. Loudspeaker HFS-11

4.11. Swivel mount (HHR-1) for Control unit CUR-3

Figure 15. Swivel mount for CUR-3

4.12. Other parts

4.12.1. Installation plate

Figure 16. Installation plate

4.12.2. Fuse 5A 125°C rated

The power cable CA-156 and CA-105 + cable (red) includes a fuse holder. Use a 5A fuse.

The power cable has another wire with a fuse, which is for IGN control. The IGN input line fuse is 1A. For more information, see chapter 6.5.2.

CAUTION

Always use only the right size fuse. Never remove the fuse by bypassing it or replace it with a higher Ampere value fuse!

Figure 17. Fuse

4.12.3. Start-stop plug (SS-4)

The TMR880i RC-9 radios manufactured before 2021 and used with end-to-end encryption (E2EE) smart cards must have a SS-4 plug connected to the programming connector in the system cable. This plug is needed only if the E2EE feature is used (Smart Card).

For radios produced later, there is no need for the plug. However, if the plug is accidentally connected to a new radio, it does not cause harm to it.

Figure 18. Start-stop plug for TMR880i

5.Connectors and PIN layouts

5.1. Connectors in the back-front

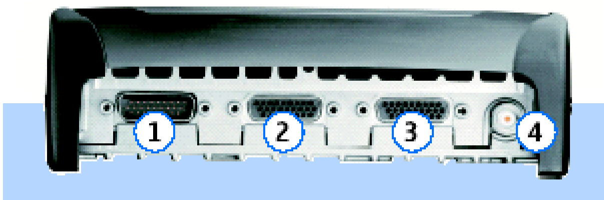


Figure 19. Back-front connectors

1. System Connector
2. Control Unit Interface Connector

Installation cables	from 0.75m to 10m
Overall diameter:	8.3±0.2 mm
Minimum bending radius:	5 x D

3. Auxiliary Accessory Connector (I/O Pins)
4. TETRA Antenna Connector

CAUTION

Both the control unit and auxiliary connectors are DB-26 female. Make sure that you connect the CUR-3 cable to the connector 2 and the I/O cable to the connector 3. Otherwise the devices can be damaged and the radio / CUR-3 or I/O device must be sent to the repair service.

CAUTION

Never short circuit the CA-105 cable and Control unit cable! It will damage the CUR-3.

5.2. Connectors in the front panel

Figure 20. Front panel connectors

5. GPS Antenna Connector
6. External Smart Card Connector
7. Integrated Smart Card Connector

5.3. Connectors in CUR-3

In addition to the connectors listed in the previous chapters, CUR-3 also has the following connectors:

- Speaker microphone connector
- Helmet cable connector
  Overall diameter: 5.9±0.2 mm
  Minimum bending radius: 5 x D

See chapters 6.2.1 and 6.2.2 for placements of the speaker microphone and helmet cable connectors.

All optional accessories that are connected to the CUR-3 control unit must be electromagnetic compatibility (EMC) tested before use.

Note

Do not connect or disconnect the cables or Smart Cards while the radio is powered on. Always power off the device before making any maintenance or installation work.

Ensure also that the accessories are powered off, including data accessories connected to the data cable, before you power on the TMR880i

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5.4. Audio accessory use

Different audio accessories can be connected to TMR880i:

- Speaker microphone (MPR-1/4)
- Handset (HSU-6)
- Handsfree (PTT-1, HFS-10, HFR-1)
- Additional audio through the auxiliary interface
- Helmet interface in CUR-3.

Recognition:

- Speaker microphone and handsfree accessories are automatically detected.
- Handset and auxiliary accessory connector need the HS_HOOK signal to activate the audio path.

Simultaneous use:

- Speaker microphone and handsfree can be used simultaneously.
- When you take off the handset, the MPR-1/4 and handsfree are muted.

5.5. Speaker microphone cable and connector options

5.5.1. Speaker microphone (MPR-4)

The MPR-4 acts as microphone and speaker.

The speaker microphone cable is used to provide a connection from the MPR-4 speaker microphone to the adapter cable CA-157. The adapter cable is connected to the PWB connector in CUR-3 via an opening in the back cover. The opening is sealed and protected by a cable clamp. If the cable is not installed, the opening in CUR-3 must be protected by a gum plug.

The speaker microphone adapter cable CA-157 is replaceable, too, but in field use you normally need to swap just the MPR-4 part.

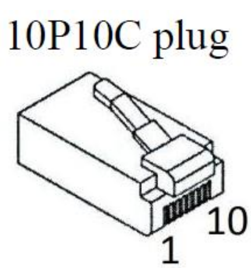


Figure 21. MPR-4 connector

Table 3. Technical data of the MPR-4 connector

10P10C pins	Signal	Parameter	IN/OUT	Min.	Typ.	Max.	Unit	Notes
10	SPM_PTT	Speaker -micPTT	IN	0	0 1.8	0.1	VDC VDC	PTT Pushed PTT released
9	GND			0	0	0.1	VDC	
7	SPM_SPK-	Speaker -micLSP-	OUT			4	Vpp	
8	SPM_SPK+	Speaker - micLSP+	OUT			4	Vpp	
1	SPM_MIC-	Speaker-mic microphone	IN		2.1		VDC	DC level
3	SPM_MIC+	Speaker-mic microphone						

Note that the speaker microphone MPR-4's connector must be locked with a clamp (included in MPR-4 delivery) or similar to protect the RJ-45 cable's connector when you need to operate the speaker microphone from a longer distance.

Figure 22. Speakermic MPR-4 connector

5.5.2. Old model speaker microphone (MPR-1)

The MPR-1 speaker microphone was replaced with MPR-4 in deliveries in 2016. These devices need different cables because the connector is different. The speaker microphone cable is used to provide the connection from CUR-3 to the MPR-1 speaker microphone. The cable is connected permanently to a PWB connector in CUR-3 via an opening in the back cover. The opening is sealed and protected by a cable clamp. If the speaker microphone cable is not installed, the opening in CUR-3 must be protected by a gum plug.

The other end of the cable provides a connection to the speaker microphone. A 12-pin Hirose plug is used for the connection with MPR-1 speaker microphone. The Hirose connector is used for the speaker microphone.

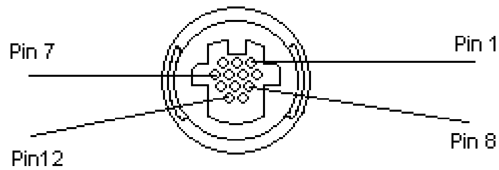


Figure 23. Face view of 12-pin Hirose Connector

Technical data:

Pin	Signal	Parameter	IN/OUT	Min.	Typ.	Max.	Unit	Notes
1	SPM_PTT	Speaker-mic PTT	IN	0	0 1.8	0.1	VDC VDC	PTT pushed PTT released
2	V_CTRL	VBAT regulator control	IN	0	0	0.1 2.7	VDC low VDC high	
3	Data	N/A			N/A			
4	Data	N/A			N/A			
5	SPM_SPK-	Speaker-mic LSP+	OUT			4	VPP	
6	Data	N/A			N/A			
7	GND			0	0	0.1	VDC	
8	SPM_MIC+	Speaker-mic microphone	IN		2.1		VDC level	DC level
9	SPM_SPK+	Speaker-mic LSP+	OUT			4	VPP	
10	SPM-MIC-	Speaker-mic microphone	IN					
11	Data	N/A			N/A			
12	Data	N/A			N/A			

5.6. System cable connector

The system cable connector is a male 26-pin high density D connector which makes all the main connections. These include the power feed, HF equipment; PTT, microphone, loudspeaker, and handset / data interface’s external data cable DLR-3T connection.

The system connector’s data interface is used for the data applications with DLR-3T data cable, which is an external accessory. The programming interface (DAU-9H) in the system cable connector cannot be used simultaneously with the peripheral equipment interface (PEI) (DLR-3T).

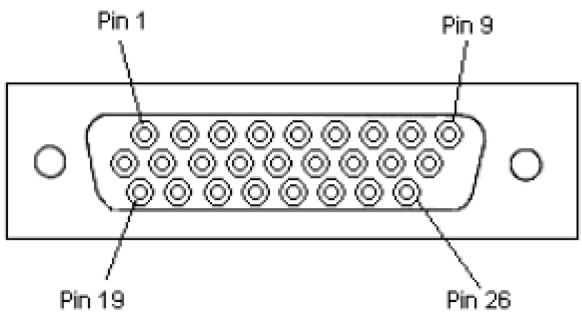


Figure 24. Face view of 26-pin high density D connector (radio part) X1

Table 4. System cable connector

Pin	Signal	Parameter	IN/ OUT	Min.	Typ.	Max.	Unit	Notes
1, 2, 3	CARBAT+	The external supply voltage	IN	10.8	13.2	15.6 6	V A	
4	EXT_EMERGENCY	External Emergency PTT button	IN	0	0 5	0.1	VDC VDC	Signal active Stand by. State change by driving low only (open collector).
5	+10V	Supply voltage for the data cable DLR-3T and handset HSU-1T	OUT	9.5	10 11	10.55 200	VDC mADC	
6	Data	N/A						
7	Data	N/A						
8	HS_MIC	Handset microphone input	IN		 60 5	500 2	Ω mVrms Vpp VDC	Source impedance for driver. Signal level Maximum signal level DC level if DLR-3T connected
9	AGND	HS_MIC ground			0	0.1	VDC	Connected to cable shields of HS_EAR and HS_MIC.
10	CARBAT-	External supply voltage ground	IN					Combined with line 19
11	Data	N/A	IN					
12	Data	N/A						
13	Data	N/A	IN					
14	HS_PTT	PTT button for Handset and HF	IN	 9.5	0 10	1 10.55	VDC VDC	PTT-standby / low state PTT pushed / high state
15	Data	N/A						

Pin	Signal	Parameter	IN/ OUT	Min.	Typ.	Max.	Unit	Notes
16	HS_HOOK	Handset Hook recognition	IN	0 5.1	 10	0.8 5.24	VDC VDC kΩ	Hook on/audio off/ Low state Hook off/audio on/ High state/ pull-down in TMR
17	GND			0	0	0.1	VDC	
18	HS_EAR	Handset earphone output	OUT	 10	35 10	 2.1	mVrms Vpp µF kΩ	signal level signal level series output capacitance HS load impedance to gnd
19	CARBAT-	External supply voltage ground	IN					Combined with line 10
20	IGS	Ignition sense line, Recognises the car start	IN		12		VDC	Fuse included on the cable line.
21	Data							
22	Data							
23	HF_MIC+	Hands Free device microphone input	IN		2.1 60		V mVrms	DC voltage level, Bias supplied by TMR880i Nom. 2k ohm
24	HF_MIC-	Hands Free device microphone input	IN		0			
25	SPK+	Hands Free device loudspeaker output	OUT			10	Vpp	Min 4 ohm
26	SPK-	Hands Free device loudspeaker output	OUT			10	Vpp	Min 4 ohm

Technical data of the CA-105/156 system connector interface (X1)

Notes to table 4:

1) The `IGS` command is associated with a timer. This line can be used from the 12V voltage controlled by vehicles ignition key. Once vehicle is switched off, there is user request to continue radio operation; otherwise radio will also be switched off as IGS line gets down.

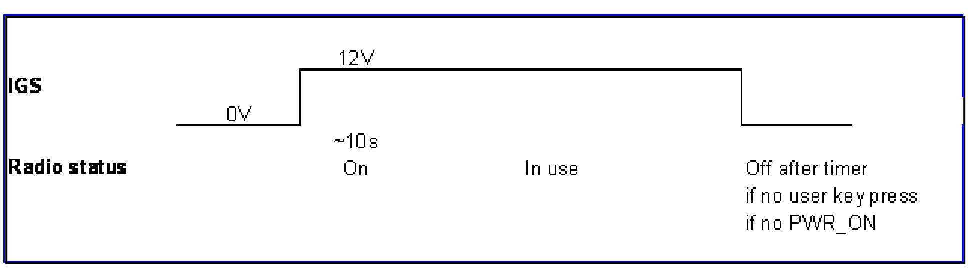


Figure 25. CA-105/156 system connector interface

2) Interfacing to the handset interface (HS_PTT, HS_HOOK, HS_MIC+, HS_EAR, AGND) can be used for line in/out in certain call types specific to the handset. This requires a low impedance buffer to drive the HS_MIC+ line to utilize the full available audio bandwidth. A DC block (series capacitor) is required on HS_MIC+ to prevent the driver from deviating the associated DC bias level while the data cable DLR-3T is connected, and to protect the driver from injection of DC.

   The HS_EAR signal also needs to be buffered to drive a speaker. Also filter the 20kHz side tone from the earphone output line

   HS_HOOK is used to enable this interface. See chapters 4.1 and 0 for the behavioral descriptions. The HS_HOOK signal may be left floating or driven to low state if the HS_PTT signal is used for controlling the HF interface instead of the HS interface. Note the HS_PTT polarity in both cases is “active high”.

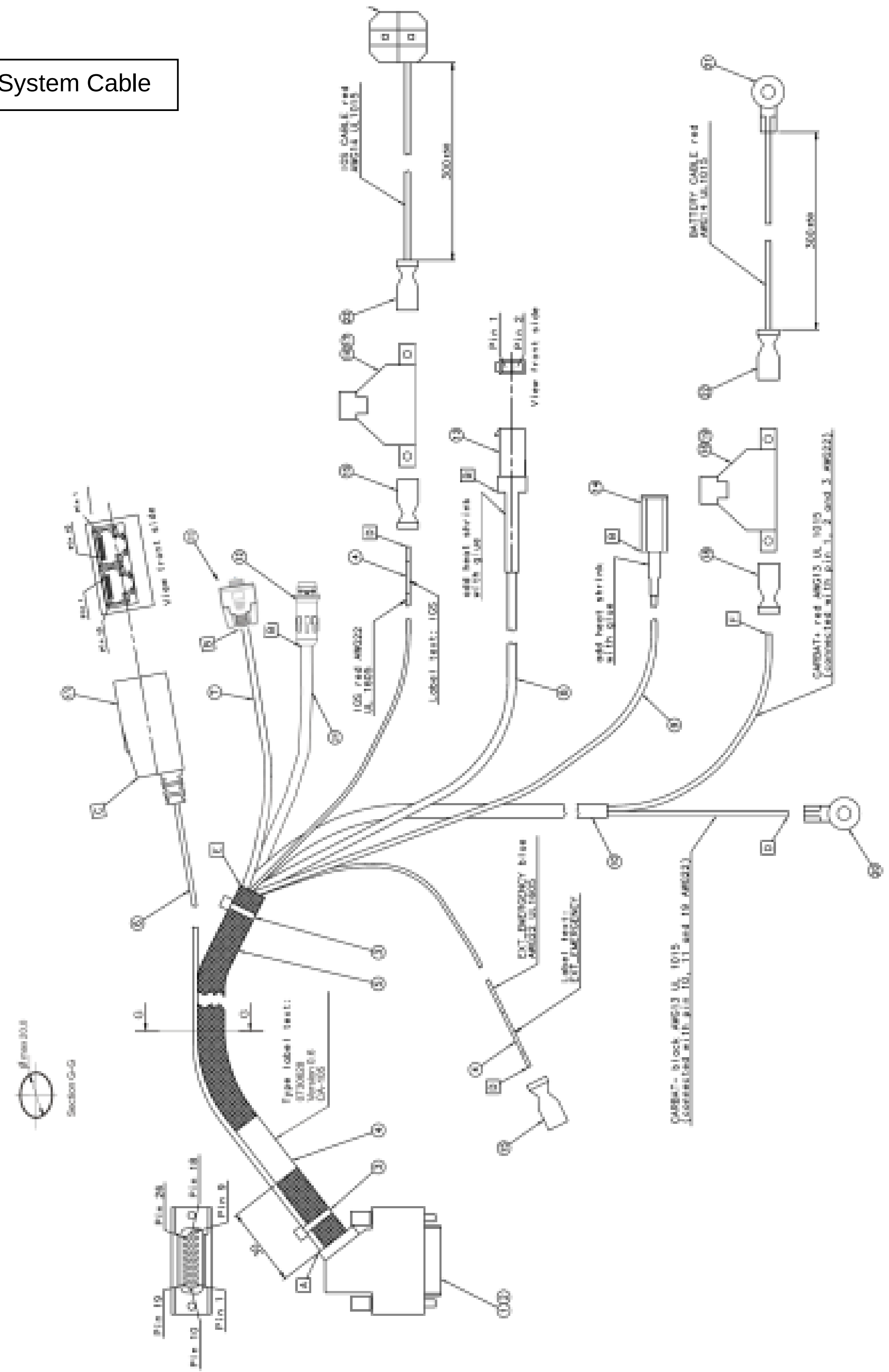
Technical data of the CA-105 power cable interface

The CA-156 cable has a similar connection. The difference is pin 4 external emergency, which is not supported / connected.

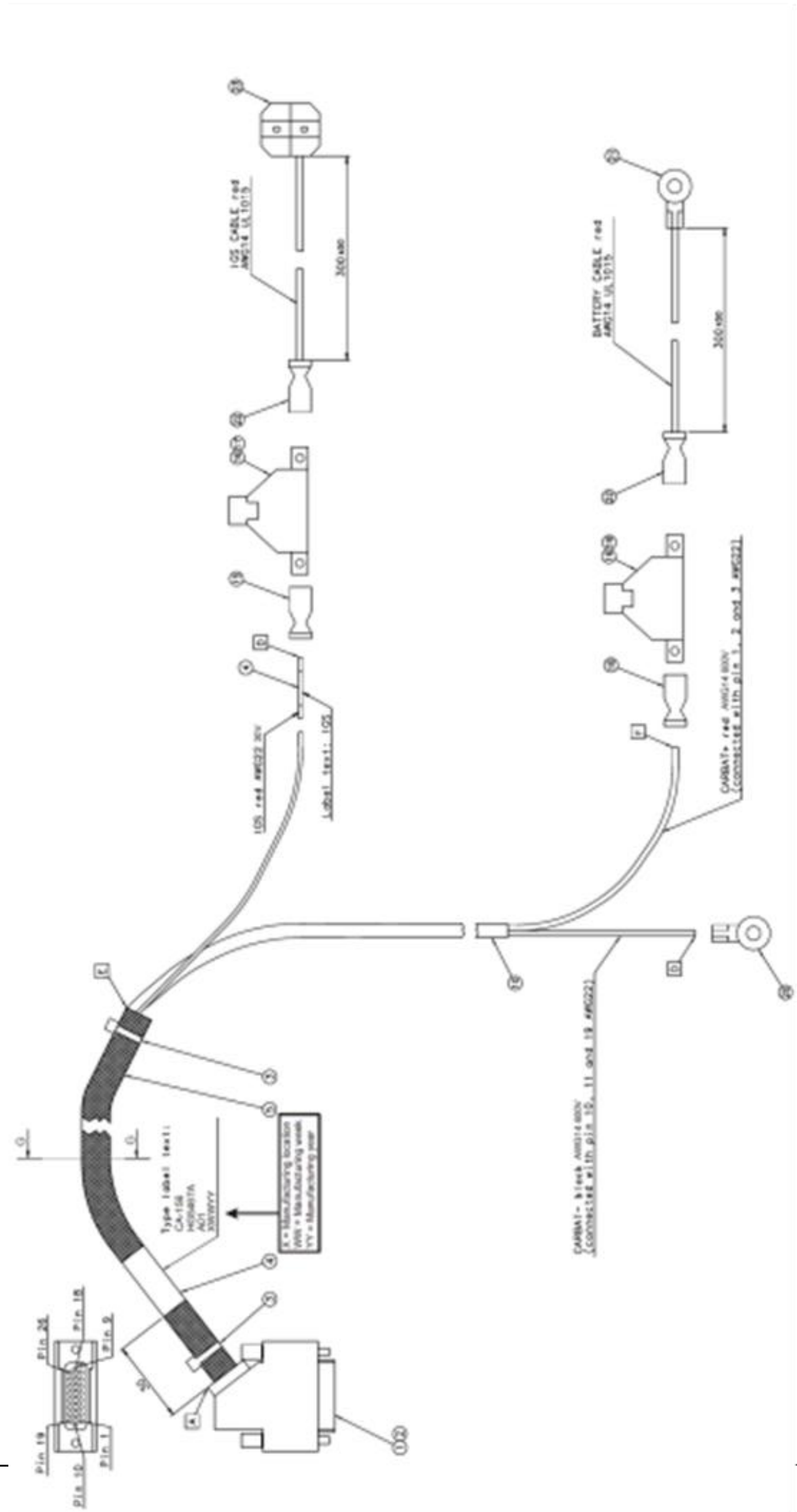
Table 5. CA-105 power cable interface

Pin at X1	Line Symbol	Cable colour	Cable thickness
1, 2, 3	CARBAT+	Red	3 x AWG22 combined to AWG13
10, 19	CARBAT-	Black	3 x AWG22 combined to AWG13
4	EXT_EMERGENCY	Blue	AWG22
20	IGS	Red	AWG22

CA-105 System Cable



CA-156 System Cable



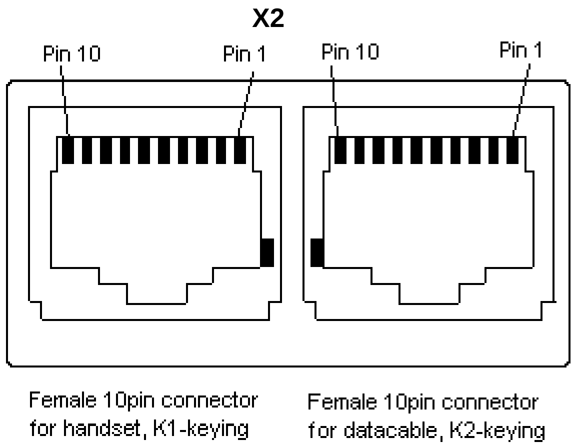


Figure 26. Face-view of integrated DTC-1 (X2)

When there is a need to connect 3rd party audio devices to the TMR880i or to integrate the TMR880i to the vehicle intercom solution, use the Handset interface connector X2 for the audio integration.

Table 6. Connections in X100 (handset connector in X2)

Pin	Line Symbol	Parameter	Min	Typical/ nominal	Max	Unit / Notes
1	PTT	PTT activation to TMR	 9.5	0 10	1 10.55	VDC (PTT-standby / low state) VDC (PTT pushed / high state)
2	+10V	DC voltage	9.5	10	10.55	VDC
3	NC					
4	NC					
5	HS_HOOK	Handset hook	0 8.5	 4.3 1	0.8 8.7	VDC Low state VDC High state kΩ / pulldown in acc. kΩ / EMI res. in acc.
6	NC					
7	NC					
8	HS_MIC	Audio from handset to TMR	1.0	 100 60 5	1.2 500 2	kΩ / input AC impedance Ω / handset source imp. Ω / maximum source imp MVrms / signal level Vpp / maximum signal level VDC / when DLR-3T connected.
9	HS_EAR	Audio output from TMR		35 47 10 10 1.0	 2.1	mVrms Ω / output AC impedance μF / series output capacitance kΩ / load to acc. Ground Vpp / maximum output level

10	AGND	Analog ground		0	0.1	VDC

For a detailed description of the handset (HS) interface signals, refer to chapter 5.6, note 2).

Table 7. Connections in X200 (data cable connection in X2)

Pin	Line Symbol	Parameter	Mini-mum	Typical/ nominal	Maxi-mum	Unit / Notes
1	PTT	PTT activation to TMR	 9.5	0 10	1 10.55	VDC (PTT-standby / low state) VDC (PTT pushed / high state)
2	+10V	DC voltage DC current	9.5	10	10.55	VDC mADC
3	FBUS_RX	Serial data to phone	0 1.7		0.8 2.9	VDC Low state VDC High state
4	MBUS	MBUS bi-directional serial bus	0 1.7		0.8 2.9	VDC Low state VDC High state
5	NC					
6	FBUS_TX	Serial data from phone	0 1.7		0.8 2.9	VDC Low state VDC High state
7	GND	Logic ground	0	0	0.1	VDC
8	HS_MIC	Audio from handset to TMR	2.0	 100 60 5	2.2 2	kΩ / input AC impedance Ω / handset source imp. mVrms / signal level Vpp / maximum signal level VDC level
9	NC					
10	AGND	Analog ground		0	0.1	VDC

5.7. Control unit interface connector

The CUR-3 connector provides an interface for the external control unit. The connector is a female 26-pin high density D connector. The display data bus parallel to the TMR880i's display controls and serial data interface are converted to RS-485 level. The connector includes also an audio interface and a voltages supply for the control unit.

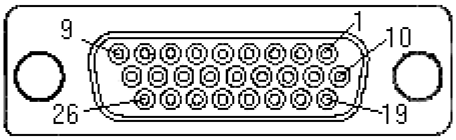


Figure 27. Face view of 26-pin high density D connector (radio part)

Table 8. Control unit interface connector

Pin	Signal	Parameter	IN/OUT	Min.	Typ.	Max.	Unit	Notes
1	/LCD_RES	Display Reset	OUT	 2.3		0.7	V V	Logic low Logic high
2	/SCE+	Display Chip Select, RS-485	OUT		2.5	3	V	Driver common mode output voltage
3	/SCE-	Display Chip Select, RS-485	OUT		2.5	3	V	Driver common mode output voltage
4	SDATA+	Display Serial data, RS-485	OUT		2.5	3	V	Driver common mode output voltage
5	SDATA-	Display Serial data, RS-485	OUT		2.5	3	V	Driver common mode output voltage
6	SCLK+	Display Serial clock, RS-485	OUT		2.5	3	V	Driver common mode output voltage
7	SCLK-	Display Serial clock, RS-485	OUT		2.5	3	V	Driver common mode output voltage
8	CU_TXD+	Ext. CU control data from TMR880i, RS-485	OUT		2.5	3	V	Driver common mode output voltage
9	CU_TXD-	Ext. CU control data fromTMR880i, RS-485 data	OUT		2.5	3	V	Driver common mode output voltage
10	GND							
11	CU_RXD+	Ext. CU control data to TMR880i, RS-485	IN	-7		+12	V	Common mode voltage limits
12	CU_RXD-	Ext. CU control data to TMR880i, RS-485	IN	-7		+12	V	Common mode voltage limits
13								
14	VB	+12V output from car battery voltage	OUT					
15	PWR_ON_CU	PWR button from ext. CU	IN		 2,1	0.7	V V	Logic low Logic high [1)]

16	CU_PTT	PTT button from Ext. CU	IN	-0.5 2.0		0.8 5.5	V V	Logic low Logic high
17	CU_REG_CTRL	Ext. CU voltage regulator control	OUT	 4.0	 5	0.8	V V	Logic low Logic high
18,19	GND							
20	EXT_MIC+	Ext. CU microphone, Connected to HS mic input using an analogue MUX	IN		0.5		Vrms	Signal level
21	EXT_MIC-	Ext. CU microphone ground	IN		0		V	
22	GND							
23	EAR+	Audio to Ext. CU	OUT			4	Vpp	Connected to audio PA
24	EAR-	Audio to Ext. CU	OUT			4	Vpp	Connected to audio PA
25	VB	Car battery voltage	OUT	10.8	13.2	15.6	V	Supply voltage to the Ext. CU
26	CARBAT-	Car battery ground	OUT		0			

[1] When CUR-3 is connected, the level is 2.1 V at VBAT 13.2 V. (There is 4k7 in this line in CUR-3, and 1k0 to GND inside radio.)

5.8. I/O Auxiliary Accessory Connector

This connector offers an interface for different auxiliary accessories such as status panel, different external function buttons, and parallel functions to the front panel buttons. The connector is a female 26-pin high density D connector. Inputs or outputs of GEN_IO pins in the interface can be programmed to match the needed connections by using parametering SW.

Airbus does not have a ready-made cable for this interface, because the connector is widely available commercially.

The I/0 Pin operation is configured using the Taqto tool.

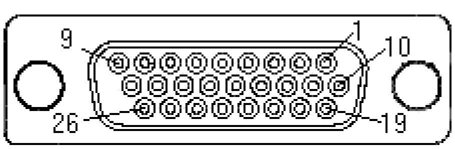


Figure 28. Face view of 26-pin high density D connector (radio part)

Table 9. I/O Auxiliary Accessory Connector

Pin	Signal	Parameter	IN/OUT	Min.	Typ.	Max.	Unit	Notes
1-9, 11-17	GEN_IO	Programmable I/O	IN/OUT	-0.5 2.0 4.0		0.8 5.5	V V V	Low level input High level input High level output **Maximum 8 mA** 1)
10	EXT_ALARM	External alarm control	OUT					Open collector/ drain output **Maximum 0.5 A** 2)
18, 19	GND							
20	HS_MIC+	Audio input, connected to HS microphone input	IN			0.2	Vrms	Activated by HS_HOOK 3)
21	HS_MIC-	Audio input, HS mic signal ground	IN		0		V	
22	LINE_OUT	Audio output, connected to HS ear output	OUT			0.2	Vrms	Activated by HS_HOOK 3)
23	PWR_ON	External power-on switch	IN	0	0	0.1	VDC	PWR_ON active PWR_ON inactive open (pull-up resistor in phone) 4)
24	GND							
25	EXT_VOUT2	+12V output	OUT	10.8	13.2	15.5	V	Filtered from car battery voltage **Maximum 0.5 A**
26	GND							

1) **PINS 1-9, and 11-17 Programmable (with TAQTO Software) I/O** Pins, are 5V logic outputs / inputs. **Maximum current is about 8mA**. External “amplifier” (transistor) needed to control relay.

2) **PIN 10 EXT Alarm** is named the “open collector” – output. **Maximum current is 0.5A** (Internal diode installed).

3) **HS_HOOK** is the handset hook recognition (see §4.1 PIN 16 of system connector).

4) **PWR_ON** should stay open during inactive phase and should be grounded during active phase:

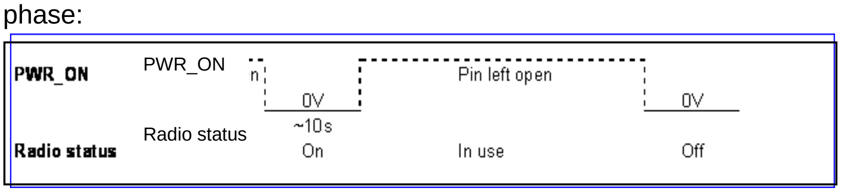


Figure 29. Face view of 26-pin high density D connector (radio part)

See also the IGN input use with I/O lines in chapter 6.4.2.

5.9. External Smart Card Connector

This connector offers the interface for an external smart card reader (DD-5) through an RJ45 connector. The length of the external smart card reader cable is approximately 1800 mm.

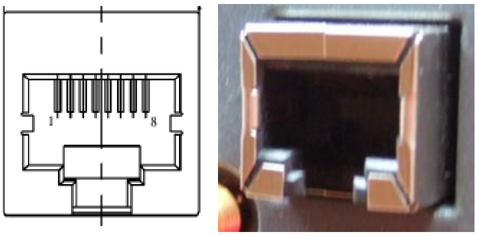


Figure 30. Face view of RJ45 smart card reader (radio part)

5.10. Active GPS antenna connector

This connector provides the interface for the active GPS antenna with output supply 5V, 30mA through an SMA (female) connector.

Figure 31. Face view of SMA GPS antenna (radio part)

5.11. TETRA antenna connector

This connector provides the interface for the TETRA RF antenna (50 ohm) through a TNC (female) connector.

Figure 32. Face view of TNC TETRA antenna (radio part)

5.12. Smart card connector

This connector provides the interface for a smart card or SIM card.

Figure 33. Face view of smart card connector (radio part)

6. Installing TMR880i

Note

Read these installation guidelines carefully through and follow them faithfully. Airbus DS SLC cannot guarantee the targeted functionality if the installation instructions are not properly followed.

6.1. Installing the antenna

6.1.1. Selecting the antenna site

Note

Select the antenna location so that it is safe for users, that is, the users can stay a minimum of 20 cm away.

Steps:

1. Install the vehicle antenna to the exterior of the vehicle and in accordance with:
   - The requirements of the antenna manufacturer/supplier
   - The requirements of the vehicle manufacturer.

   The best mounting location for the antenna is at the centre of a large, **flat conductive surface**. In almost all vehicles, mounting the antenna at the centre of the metal roof meets these requirements.

   A good alternative location is at the centre of the boot lid. If you use the boot lid, ensure that the lid is grounded by connecting the grounding straps between the lid and the vehicle chassis.

   A glass-mount antenna should be placed as high as possible on the vehicle. Ensure that a rear-window defogger element does not touch the inductive “button” on the mounting foot of the antenna.

2. Ensure that the antenna cable can be easily routed to the radio. Ensure that the antenna cable is routed separately and not in parallel with any other vehicle wiring or mobile radio cable wiring.

3. Check the antenna location for any electrical interference according to the vehicle manufacturer’s requirements.

4. Make sure that the mobile radio antenna is installed at least 30 cm away from any other antenna on the vehicle.

Note

Any two metal pieces rubbing against each other (such as seat springs, shift levers, boot lids and bonnets, exhaust pipes, and so on) in proximity to the antenna can cause severe receiver interference.

5. The TMR880i mobile radio has an integrated GPS board. If a GPS or combined TETRA/GPS antenna is used, make sure that the antenna has a clear view to the sky and that the antenna base which carries the GPS receiver is not covered with any metallic or radio frequency absorbing material.

6.1.2. Installing the antenna

Steps:

1. Mount the antenna according to the instructions provided with the antenna kit. Remember to check the grounding of the antenna's base.

2. Run the coaxial cable to the radio mounting location. If necessary, cut off the excess cable and install a new TNC cable connector.

3. Connect the antenna cable connector to the radio antenna connector at the rear of the radio.

4. In case of an installed GPS board, connect the GPS antenna to the GPS antenna connector at the front of the radio.

6.2. Assembling CUR-3

6.2.1. Assembling the installation cable

The installation cable CA-103 (or alternatively CA-104, CA-108, CA-116) is assembled to the connectors at the left side of CUR-3 as can be seen in Figure 35.

Note

If you need to remove cables from CUR-3 during the cable installation, be careful that you connect the cables back to their original position.

The CA installation cable's CUR-3 end is divided into two board connectors. The connector with 1 cm longer wires (C) belongs to the upper PWB connector and the shorter (D) in the lower PWB connector. See Figure 34.

CAUTION

A wrong connection will harm the device, as a result of which it must be sent to the repair service.

Follow the Assembly instructions sticker at the CUR-3 back cover, Figure 34 illustrates to install the cables to the right connectors. The letters A-D markings in the cables help identifying each cable.

Figure 34. CUR-3 back cover assembly instructions for cabling

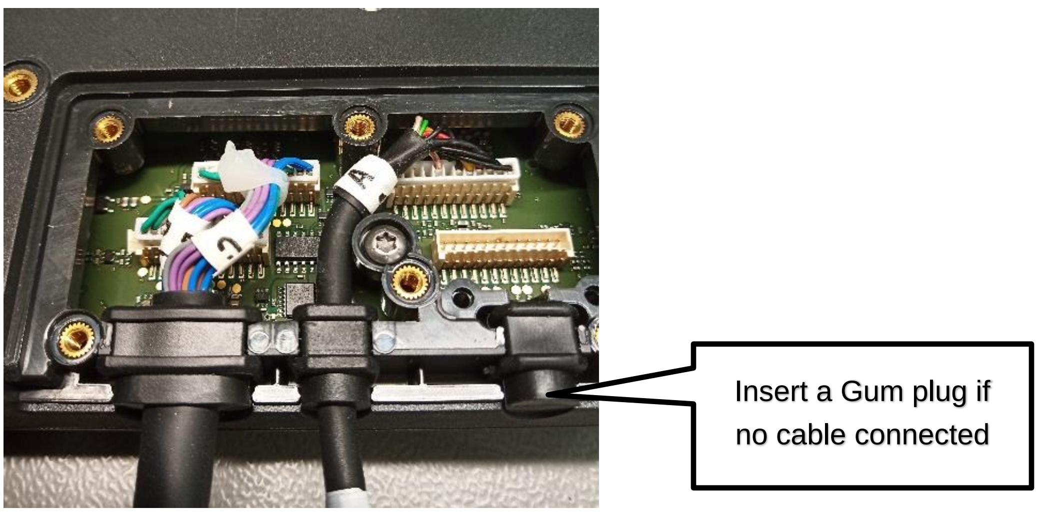


Figure 35. Connecting the CUR-3 installation cable

Installation cable (C) CA-103 (or alternatively CA-104, CA-108, CA-116) has a separate white cable tie to separate it from the (D) cable, which enables you to identify it by using your fingers even if you do not have direct eye contact to it. Notice also the 1cm difference of length in the cables: the cable (C) is longer.

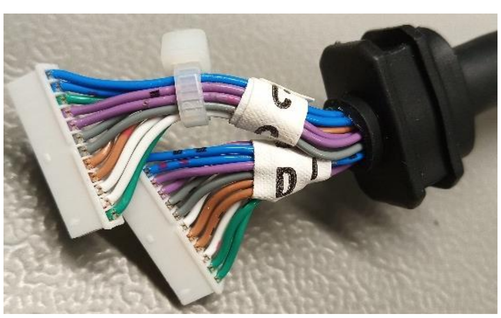


Figure 36. CUR-3 installation cable markings

6.2.2. Connecting the speaker microphone cable (used with MPR-4)

MPR-1
The connector for the MPR-1 speaker microphone is Hirose HR30-7J-12PC.
The connection to the circuit board is implemented using wires to the SMK CGP4512-0101 connector. The Hirose connector is used for the speaker microphone. The speaker microphone can be connected straight to this connector.

MPR-4
A speaker microphone cable is used to provide the connection from the speaker microphone MPR-4 to the adapter cable CA-157.The adapter cable is an accessory which can be connected permanently to CUR-3’s PWB connector via an opening in the back cover. The opening is sealed and protected by a cable clamp. If the cable is not installed, the opening in CUR-3 must be protected by a gum plug (see Figure 35).

The speaker microphone cable’s 10-pole connector provides a connection to the CUR-3 unit via a CA-157 adapter cable.

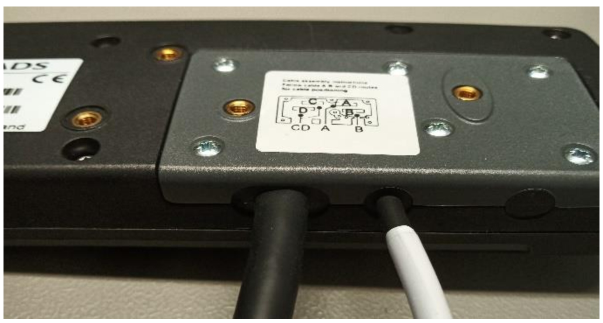


Figure 37. Fastened cable cover, with system cable and CA-157 speaker microphone cable

Figure 38. CA-157 speaker microphone adapter cable with RJ-45 connector / A-cable marking

6.2.3. Attaching the CUR-3 assembly swivel (HHR-1)

Figure 39. Complete swivel (HHR-1)

Figure 40. Swivel fastening (Fixed Mounting kit, MKE-1BK)

Figure 41. Fastening the swivel

Figure 42. Fastened swivel

6.3. Installing CUR-3 into DIN slot by using the DIN slot installation set

6.3.1. Preparing the DIN slot installation bracket

The assembly DIN slot installation bracket includes an electrical unlocking solenoid, which enables the assembly DIN slot installation bracket to be released.

Figure 43. DIN slot installation bracket

Note

An electrical or manual unlocking system must be in use before you insert the DIN slot installation adapter into the DIN slot installation bracket.

Electrical unlocking

The assembly DIN slot installation bracket includes electrical unlocking by means of a solenoid. To release the radio from the DIN slot, connect the 12 V DC directly to the solenoid wires. Also an external switch can be used (not included in the sales package).

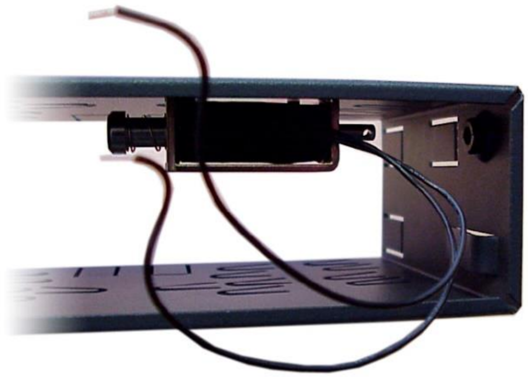


Figure 44. Electrical unlocking

Manual unlocking

The solenoid's shaft has an option for a pull cord for a manual release. Slip the pull cord through the hole in the side of the Assembly DIN slot installation bracket and position it as desired. (The pull cord is not included in the sales package).

A manual pull cord is useful if the vehicle has been in an accident and the power supply is not available to release the DIN slot

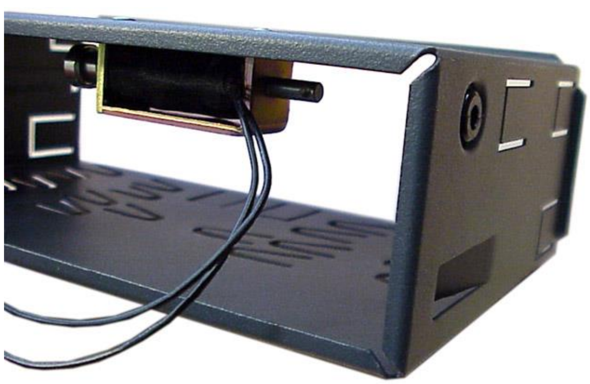


Figure 45. Manual unlocking

The fixing tabs of the assembly DIN slot installation bracket can be bent to lock it into the vehicle's DIN hole.

Figure 46. Bent fixing tabs

6.3.2. Preparing the DIN slot installation adapter

Fasten the swivel (HHR-1) into the DIN slot installation adapter with screws.

Figure 47. Fastening the swivel

Mount the DIN slot installation adapter mounted inside the DIN slot installation bracket. Lock it with solenoid.

Figure 48. Mounting and locking the DIN slot installation

6.3.3. Attaching CUR-3 into the DIN slot installation set

Attach the swivel (HHR-4) into the CUR-3 and fasten the CUR-3 into the swivel as described in Chapter 6.2.3.

Figure 49. Attaching the swivel into the CUR-3

Figure 50. Attaching CUR-3 into the DIN slot installation set

6.4. Installing TMR880i by using an installation plate

Mount the four pads included in the installation kit onto the bottom of the installation plate.

Figure 51. Installation kit

There are 12 holes at the bottom of the installation plate for fixing the bracket onto a base, panel and so on.

Figure 52. Installation plate

Fix the TMR880i radio unit onto the installation plate by using two of the stainless steel screws provided in the screw bag. The maximum inclination for the radio unit is approximately 10 degrees.

Figure 53. Maximum inclination

6.5. Power distribution

Before you install the power leads, make sure that all the relevant parts of your vehicle (battery, car battery terminal and so on) are in proper condition.

The car kit's main supply is obtained from the vehicle battery. **The supply voltage may vary between 10.8 and 15.6 Volts.** The positive voltage is taken directly from the battery, unless the vehicle has a mains voltage of other than 12 volts. This minimises the risk of disturbances from or to the radio unit, as well as guarantees a loss-free power distribution.

Note

Connect the grounding cable to the car chassis with as short a lead as possible. Do not connect the cable directly from the negative pole of the battery.

The battery connections should be carried out with care. The positive lead has a 5A fuse, which must always be used. If a fuse blows, replace it only with the same fuse type and size. Note that there is a 5A fuse 125°C rated available as accessory.

Route the power cables so that possible sources of disturbance are avoided.

If the vehicle has +24V electrical system (trucks, all-terrain vehicles, and so on), an external voltage converter must be used. That converter must be well protected against transients produced by the vehicle’s electrical system, and it must also be capable of maintaining a stable output during rapid changes in the load current.

Some vehicles – such as gas trucks – have a main switch, which separates the vehicle’s chassis from the negative lead of the battery. Under no circumstances do not pass this switch: the grounding of the reducer must be taken from the body of the vehicle, NOT directly from the battery.

The system cable CA-105 includes supply wires.

- Connect the red cable directly to the positive (+) pole of the vehicle's battery via a 5A fuse.
- Connect the positive power cable directly to the car battery terminal; no other appliances can be connected to this cable.
- Install a fuse in the positive battery lead as close to the battery as possible.
- Cut the power cables to a suitable length.
- Connect the black negative cable to the car chassis, close to the radio unit. The negative cable should be as short as possible.

6.5.1. Grounding

Grounding should be done separately and not to the car's existing screw connections.

The grounding place must be firm (for example, a lap joint of metal plates) so that the screw connection is reliable in the long term.

The grounding place must be cleaned carefully of paint, and it should be given rust prevention with Vaseline or a suitable chemical.

The grounding cable must be as short as possible to reduce noise coupling, and it must be placed as close to the radio unit as possible.

6.5.2. IGN power on/off control

The IGN control line can be used to switch on/off the supply voltage into the radio, from the 12V voltage controlled by vehicle’s ignition key. The IGN line must be connected to the corresponding IGN line in vehicle’s power switch. If the IGN line is connected and the vehicle is switched on, power is also supplied to the radio via the IGN line. Once the vehicle is switched off, there is a request to the user to confirm to continue the radio operation; otherwise the radio is also switched off when the IGN line gets down.

Simultaneous use of IGN and I/O interface lines
The IGS line detection does not work correctly if there is external voltage in other I/O pins during the radio’s IGN start-up phase.

If your application requires to have I/O lines powered on while starting, change a parameter (User interface settings / Power on parameters) to enable the radio start-up when power is connected, regardless of the IGS line state. With this setting, the IGS line is not used to start the radio.

6.5.3. System cable CA-105 interfaces

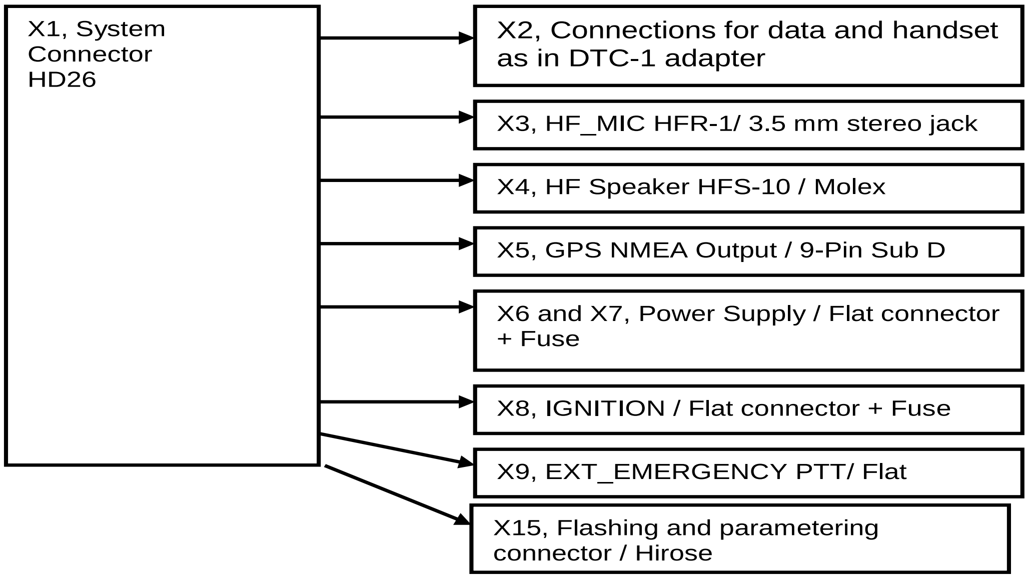


Figure 54. System cable CA-105 interfaces

Table 10. System cable CA-105 connectors

Connector(s)	Name	Note
X1	High Density 26 AMP plug	AMP 1658682-1
X100 (X2)	10-pin modular connector in X2 (DTC-1)	SS-641010-NF-K1 (Stewart)
X200 (X2)	10-pin modular connector in X2 (DTC-1)	SS-641010-NF-K2 (Stewart)
X3	3.5 mm stereo jack (HF_MIC connector)	Extension jack socket ∅ 3.5 mm, 3 pole, colour black / FUAN GEE Ja32101
X4	Molex 5559 (HF Speaker connector)	No. 39-01-3026 crimped with 5558
X5	9-POS D SUB connector (NMEA Output)	Female
X6	Cable shoe	AMP 735410-0
X7	Butt splice	AMP 34071 (Blue)
X8	Butt splice	AMP 34070 (Red)
X9	Flat connector	AMP 34070
X10	Blade- ‘Plasti Grip’(for connection with power supply unit)	AMP 140971-2
X11	Fuse 5A Fuse Holder with protective cap	257005/Littelfuse Bussmann HHF with cover HHD-C
X12	Fuse 1A Fuse Holder with protective cap	257001/Littelfuse Bussmann HDD with cover HHD-C

X13	Cable shoe connected to battery	JST: 342145-1
X14	Tap splice (current robber)	AMP 735410-0
X15	Hirose Plug	HR30-7J-12PC

Table 11. System cable CA-105's length

From system connector X1 to	Cable length	
X2	1500 ± 50 mm	
X3	500 ± 50 mm	
X4	500 ± 50 mm	
X5	500 ± 50 mm	
X6-X9	2000 ± 50 mm	
X15	500 ± 50 mm	
Battery connection cable	300 ± 50 mm	
IGS connection cable	300 ± 50 mm	

Table 12. System cable CA-105's diameter

	Cable diameter
G-G	20 mm max

6.6. Shortening the installation cable (CA-103, CA-104, CA-108)

In the basic installation, it is recommended to use the original cable length as it is manufactured. However, it is possible to shorten the installation cables CA-103 and CA-104 and CA-108 by using an extra connector, if the available space is limited and there is no room to pack the cable to a safe place. The modifications must be done by a professional engineer using the right tools to guarantee the functionality and performances of the product with the modified cable.

EMC testing has been performed with a 0.75 m long cable in the shortest, but Airbus DS SLC does not take any responsibility for the shortening operation.

The modification consists of cutting the cable and rewiring the connector on the radio side (① High density 26 AMP plug (X1)) using a new high density 26 AMP plug.

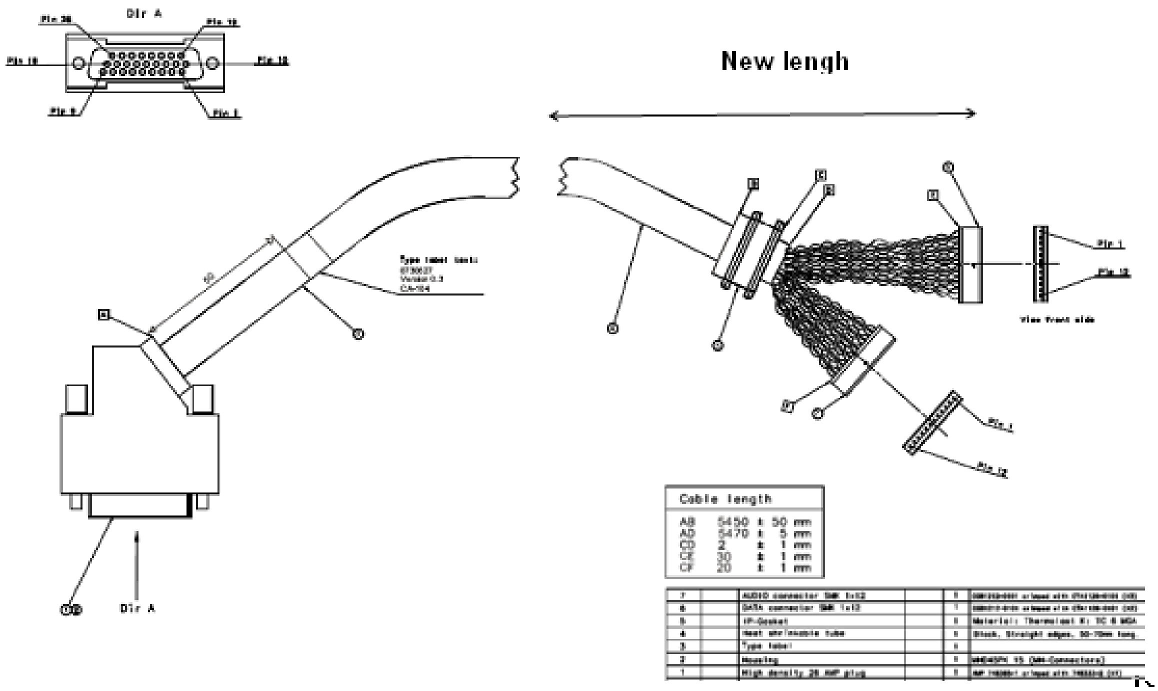


Figure 55. Appearance of the installation cable

During the modification, pay attention to the connection from the ground wire to the shield of the connector.

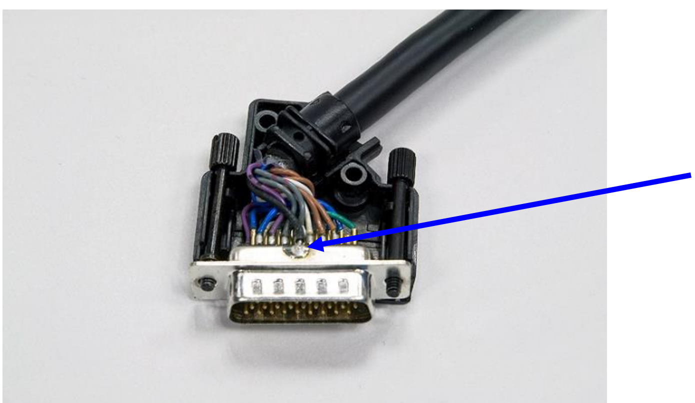


Figure 56. Appearance of Installation Cable X1

The X1 connector cover which must be assembled according to Dir. A in Figure 56.

The connection on X1 is described in the following circuit diagram and table.

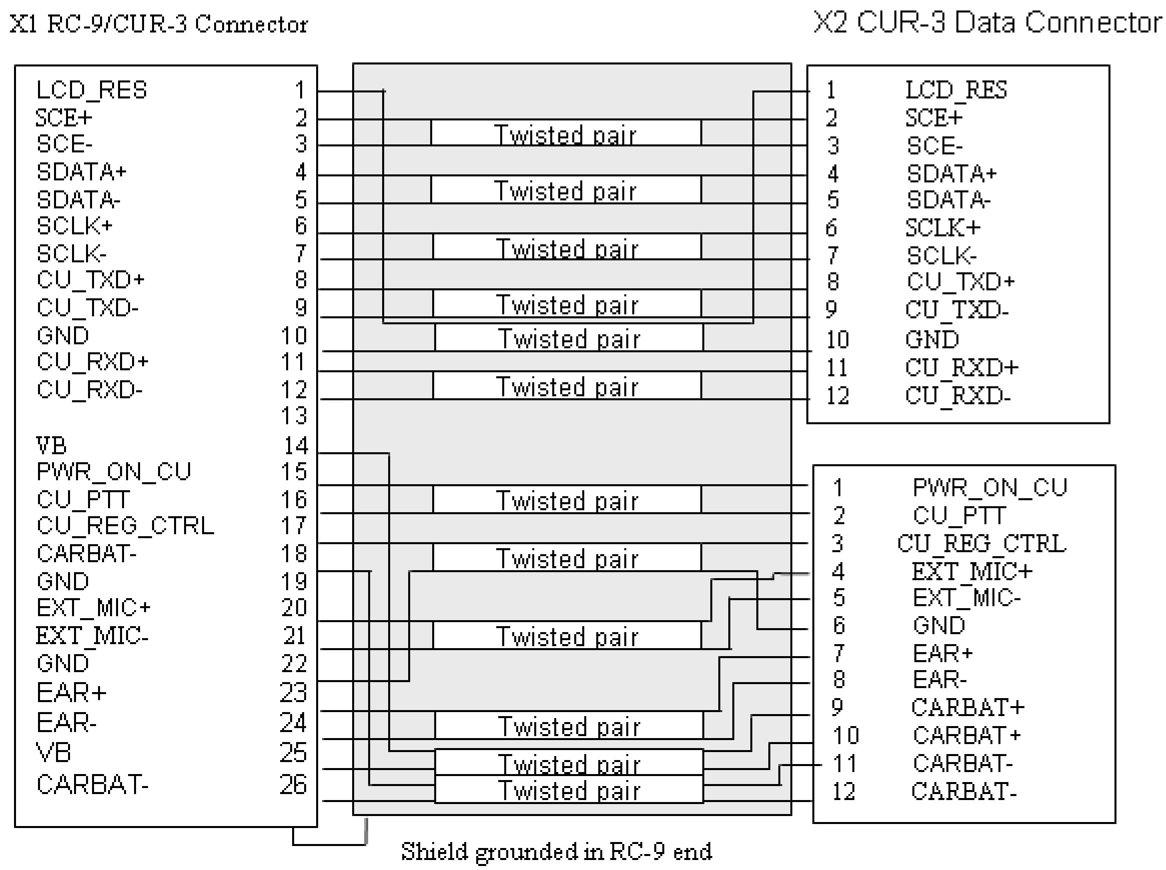


Figure 57. X1 connector's circuit diagram

Table 13. X1 connector's pins and connections

Pin	Signal	IN/OUT	Cable Color [1)]	Cable thickness	Twisted with line (pin)	Unit	Notes
1	/LCD_RES	OUT	Green/Black	AWG26	GND (10)	V	Logic low/high
2	/SCE+	OUT	White/Red	AWG26	SCE- (3)	V	Driver common mode output voltage
3	/SCE-	OUT	White/Black	AWG26	SCE+ (2)	V	Driver common mode output voltage
4	SDATA+	OUT	Brown/Red	AWG26	SDATA- (5)	V	Driver common mode output voltage
5	SDATA-	OUT	Brown/black	AWG26	SDATA- (4)	V	Driver common mode output voltage
6	SCLK+	OUT	Grey/red	AWG26	SCLK- (7)	V	Driver common mode output voltage
7	SCLK-	OUT	Grey/Black	AWG26	SCLK+ (6)	V	Driver common mode output voltage
8	CU_TXD+	OUT	Purple/Red	AWG26	CU_TXD- (9)	V	Driver common mode output voltage
9	CU_TXD-	OUT	Purple/Black	AWG26	CU_TXD+ (8)	V	Driver common mode output voltage
10	GND		Green/Red	AWG26	/LCD_RES (1)		
11	CU_RXD+	IN	Blue/Red	AWG26	CU_RXD- (12)	V	Driver Common mode voltage limits
12	CU_RXD-	IN	Blue/Black	AWG26	CU_RXD+ (11)	V	Driver Common mode voltage limits
13	-	-		-	-	-	-
14	VB	OUT	Purple/Red2	AWG26	VB	V	Supply voltage
15	PWR_ON_CU	IN	Green/Red2	AWG26	CU_PTT (16)	V	Logic low/high

16	CU_PTT	IN	Green/Black2	AWG26	PWR_ON_CU (15)	V	Logic low/high
17	CU_REG_CTRL	OUT	White/Pink2	AWG26	GND (22)	V	Logic low/high
18	CARBAT-	OUT	Blue/Red2	AWG26	CARBAT-		Car battery ground
19	GND						
20	EXT_MIC+	IN	Brown/Black2	AWG26	EXT_MIC- (21)	Vrms	External microphone signal level
21	EXT_MIC-	IN	Brown/Red2	AWG26	EXT_MIC+ (20)	V	External microphone ground
22	GND		White/Black2	AWG26	CU_REG_CTRL (17)		Ground
23	EAR+	OUT	Grey/Red2	AWG26	EAR- (24)	Vpp	Connected to audio PA
24	EAR-	OUT	Grey/Black2	AWG26	EAR+ (23)	Vpp	Connected to audio PA
25	VB	OUT	Purple/Black2	AWG26	VB	V	Supply voltage
26	CARBAT-	OUT	Blue/Black2	AWG26	CARBAT-		Car battery ground

[1)] The first color is the color of the wire.
The second color is the color of the dot added to the wire. “2” means there are 2 dots added to the wire.

7. Programming in the TAQTO tool

In Airbus TMR880i, the programming cable must be inserted into the connector in the system cable as shown in the following figure.

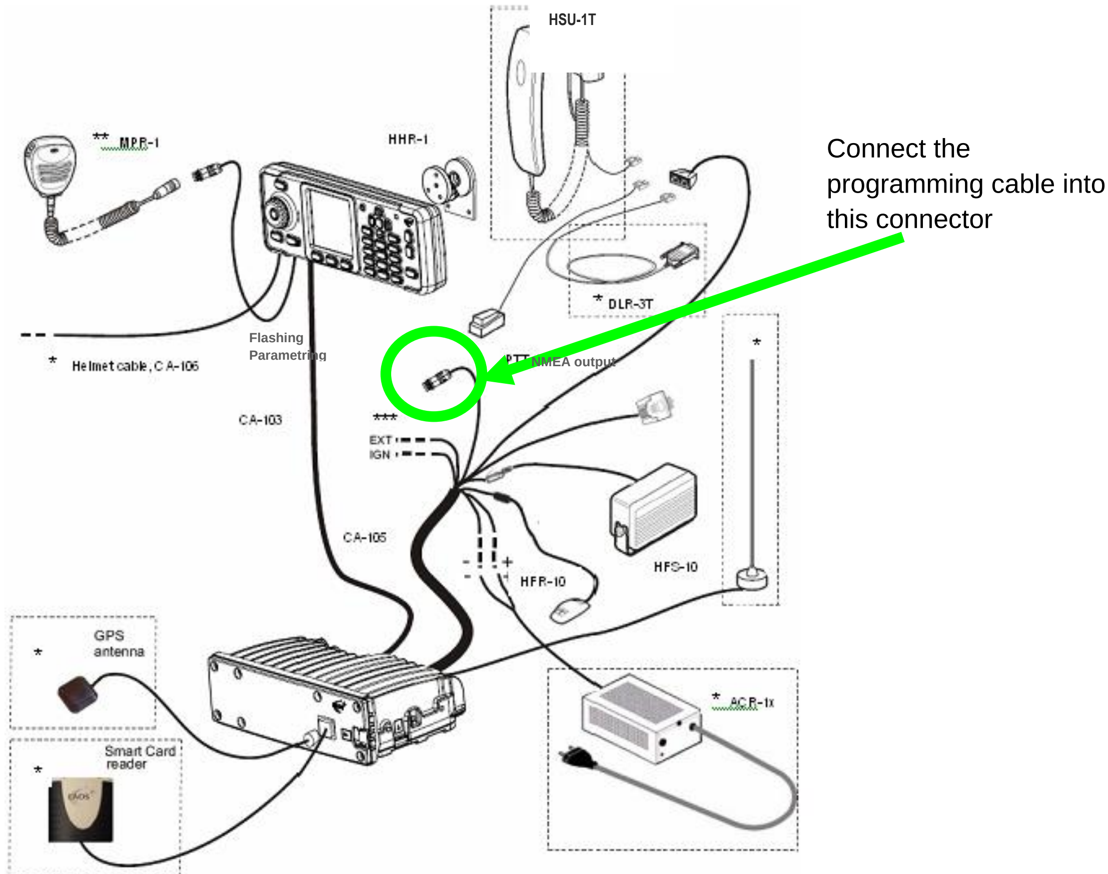


Figure 58. Connecting the programming cable

CAUTION

Make sure that you connect the system cable (CA-105) correctly to the TMR880i radio during flashing. If the system cable is connected incorrectly, it can cause a voltage peak which may cause some component of the TMR880i radio to break. As a result of this broken component, the E2EE smart card reader does not work properly.

The system cable should be connected to the TMR880i radio by complying with the following rules:

Option 1:

Main power (DC 13.2 V/5A) must be switched off, if the flash cable is connected to the system cable when the system cable is connected or disconnected to/from the radio.

Option 2:

Main power (DC 13.2 V/5A) may be switched on, if the flash cable is disconnected from the system cable when the system cable is connected or disconnected to/from the radio.

8. Installing the helmet cable

A helmet installation cable is used to provide a connection from CUR-3 to the motorbike installation set. The cable is an accessory which can be connected permanently to a PWB connector of the CUR-3 via an opening in the back cover. The opening is sealed and provided by a cable clamp. If the helmet cable is not installed, the opening in CUR-3 must be protected by a gum plug. The other end of the cable is left open to allow motorbike specific installations.

The cable provides a connection to the helmet microphone and speaker and three control buttons/handles. It is possible to install the speaker microphone cable CA-157 simultaneously to the top/right and route it through the cable clamp in the middle. For more details, from chapter 6.2.1.

In Figure 59 below, the optional helmet cable CA-106 (B) is assembled to the connector on the right side of CUR-3. Fit the rubber plug (around the helmet cable) to its place in the back cover.

Figure 59. CA-103/CA-104/CA-108/CA-116 Installation Cable (C and D), speaker microphone cable CA-157 (A) and CA-106 Helmet Cable (B) assembly

8.1. Circuit diagram

The helmet cable’s connections are presented in Figure 60. The microphone interface is specified for an electret microphone and it does not need any extra components. Some external components are needed if a dynamic microphone is used. Modifications for a dynamic microphone are presented in the next chapter.

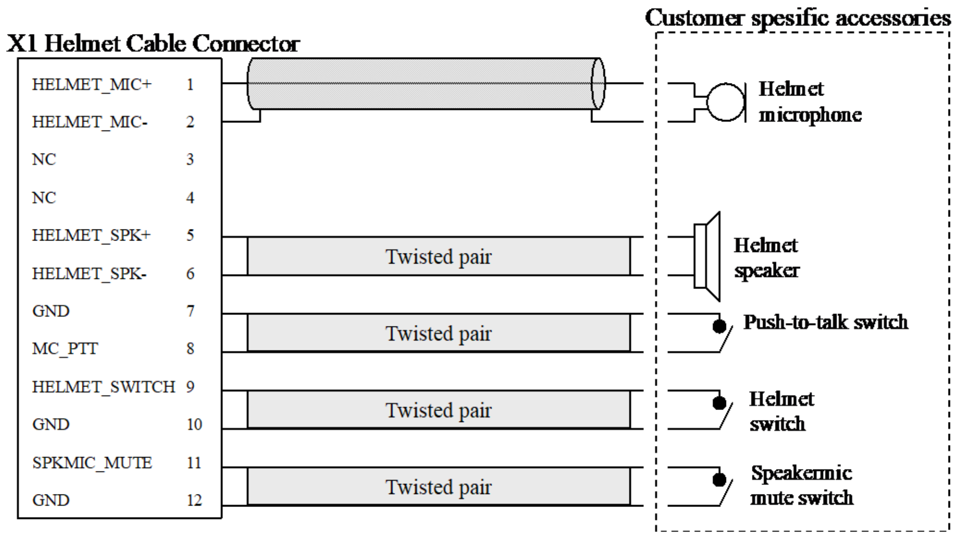


Figure 60. Circuit diagram of helmet cable

8.2. Detailed description of the helmet interface

8.2.1. Microphone input interface

The helmet cable's microphone input is presented in

Figure **61**. The microphone input is a balanced type interface, which includes electrostatic discharge (ESD) suppression and EMC filtering circuitry. The interface also includes a biasing circuit for the electret microphone.

A connection with unbalanced accessories *(microphone and speaker use same ground)* is not allowed. If common ground is used, the microphone interface must be equipped with the applicable audio balun. Using common ground, the electret microphone must be equipped with external bias circuitry.

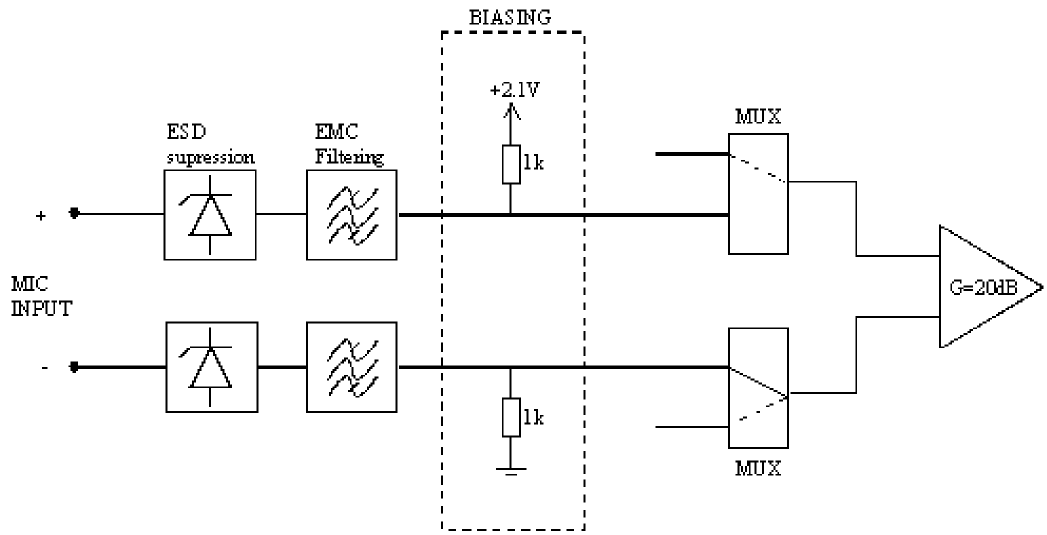


Figure 61. Helmet cable microphone's input flowchart

8.2.2. Electrical specifications

Table 14. Microphone Input Electrical Specifications

Parameter	Min.	Typ.	Max.	Unit	Notes
Input impedance		2		kΩ	
Biasing voltage		1.7		V	Biasing voltage level to 2kΩ microphone impedance.
Input level			200	mV_{pp}	Maximum differential peak to peak input voltage level to the microphone input.

8.2.3. Modifications for a dynamic microphone

The microphone input has been specified for an electret microphone. If a dynamic microphone is used, an external amplifier must be used. The external amplifier gain must be up to +20dB. The amplifier circuit must be matched with the electret microphone's 2kΩ input impedance.

8.2.4. Selecting the electret microphone capsule

Be sure that the selected electret microphone capsule is the RF noise-resistant type and it fulfils the 89 / 336 / EEC EMC directive, because most of the electret microphones are very sensitive to the RF noise. HELMET_MIC+ and HELMET_MIC- inputs are filtered against the RF noise, but there is no possibility to filter the audio frequency noise, which has been indicated from the RF signal in the microphone capsule.

8.2.5. Speaker output interface

The Speaker output interface is presented in Figure 62. The speaker output is a balanced type interface. The quiescent voltage in the speaker outputs referred to system ground is about 2.4V. The speaker output lines have been protected against EMC and ESD.

A connection with unbalanced accessories *(microphone and speaker use same ground)* is not allowed. If common ground is used, the speaker interface must be equipped with the applicable audio balun.

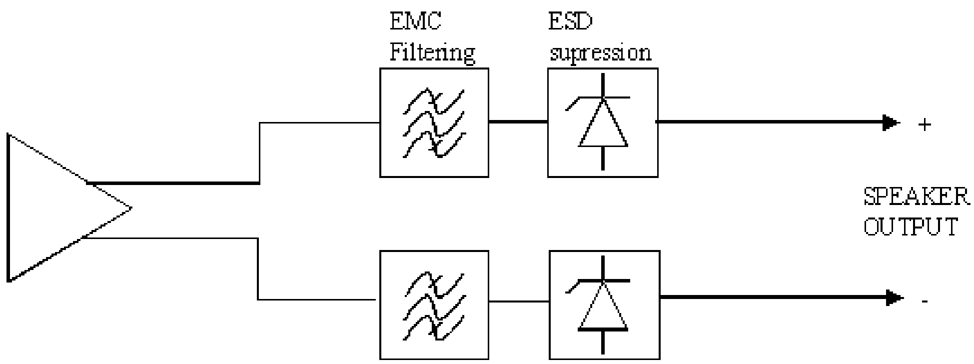


Figure 62. Speaker output flowchart

8.2.6. Electrical specifications

Table 15. Speaker output electrical specifications

Parameter	Min.	Typ.	Max.	Unit	Notes
Load Impedance	4			Ω	Min. load impedance, which can be connected between speaker outputs, without producing audible distortion. *
Output power			1.1	W	@ R_L = 8 Ω, THD = 0.5%, f = 1kHz
Output level			4.8	V_{pp}	Max. Differential peak to peak output voltage between speaker output lines.
Output bias		2.4		VDC	Quiescent voltage between speaker outputs and system ground. **

* Note that most helmets usually include two speakers, which have been connected in parallel.
** Bias voltage is available only when the audio path is open, for example when receiving transmission, keypad tones, and so on. The HELMET_SWITCH must be closed to enable the helmet interface, including the speaker output.

8.2.7. Control signals

The helmet cable interface includes three control signals. These signals are presented in Table 16. The detailed connection instructions are presented in Table 17.

The signal lines have internal pull-up resistors and all these three signals are low active. These control signals are controlled against system ground. Every signal wire is paired with its own ground wire (see Table 17).

Table 16 presents the functions of the control signals and the switches' contact types.

Table 16. Control signals

Control Signal	Contact type	Function
MC_PTT	OFF-ON	External push to talk button for semi-duplex calls. (ON) = momentary contacts. Switch is closed when it is pressed and open when released. Contacts return automatically to OFF position
HELMET_SWITCH	OFF-ON	Enables helmet microphone. When using the helmet interface, this switch should be closed.
SPM_MUTE	OFF-ON	Disables control unit (Keypad locked, all audio off, keypad and display lights switched-off only display active). Note that this does not affect external speaker if connected to RC-9.

8.3. Technical specification

Connections, pin numbers, cable colors, thickness of cable and acceptable limits for electrical requirements are shown in Table 17. Also lines included in certain cables and their thickness are listed in the table.

Table 17. Connections in X1 (helmet cable connector)

Pin	Line Symbol	In/ Out	Cable colour	Cable thickness	Pair with line (pin)	Min.	Typ.	Max.	Unit	Notes
1	HELMET_MIC+	IN	in Coaxial	AWG26	HELMET_MIC-		2.1		V	DC level (Impedance between MIC+ and MIC- lines 2kΩ)
2	HELMET_MIC-	IN	Coaxial shield	AWG26	Connected to the cable shield of HELMET_MIC+ line	0	0	0.1	VDC	
3	NC					0	0	0.1	VDC	
4	NC					0	0	0.1	VDC	
5	HELMET_SPK+	OUT	White	AWG26	HELMET_SPK- (6)			4.5	Vpp	
6	HELMET_SPK-	OUT	Brown	AWG26	HELMET_SPK- (5)			4.5	Vpp	
7	GND	OUT	Green	AWG26	MC_PTT (8)	0	0	0.1	VDC	

Pin	Line Symbol	In/ Out	Cable colour	Cable thickness	Pair with line (pin)	Min.	Typ.	Max.	Unit	Notes
8	MC_PTT	IN	Yellow	AWG26	GND (7)		 2.8	0.1	V V	Logic low Logic high
9	HELMET_SWITCH	IN	Grey	AWG26	GND (10)		 2.8	0.1	V V	Logic low Logic high
10	GND	OUT	Pink	AWG26	HELMET_SWITCH (9)	0	0	0.1	VDC	
11	SPKMIC_MUTE	IN	Blue	AWG26	GND (12)		 2.8	0.1	V V	Logic low Logic high
12	GND	OUT	Red	AWG26	SPKMIC_MUTE (11)	0	0	0.1	VDC	