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CCpilot V510 and V710

Technical Manual

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1. Introduction

This technical manual provides important information regarding the *CCpilot V510* and *V710* product's hardware and its basic usage, hereinafter referred to as *CCpilot V510/V710*.

The *CCpilot V510/V710* are 5" and 7" display computer products featuring an i.MX 8DualXPlus application processor.

For software and operating system specifics, please see additional documentation.

Revision history

Rev	Date	Author	Comments
PA1	2024-02-22	MLG	Draft
PA1	2024-02-23	FMG	Preliminary release
PA2	2024-04-03	CMM	Review of IO chapter
PA3	2024-04-22	JRN	Added some missing error codes

Contents

2. Product models

This documentation is applicable for all CCpilot V510/V710 models. These models are:

- CCpilot V510
- CCpilot V510 touch screen Wi-Fi and Bluetooth
- CCpilot V710
- CCpilot V710 touch screen Wi-Fi and Bluetooth

These devices share the same modular technology platform.

2.1.1. Customized models

The platform enables additional customization of hardware and software. Described herein are the features included in product models described above. Additional features in customized models will be documented separately.

Contact CrossControl for customization inquiries.

2.2. Document conventions

This document uses the following conventions:

Description	Appearance
Important information	 (Exclamation symbol)
Differences between product models	 (Observe' symbol)

Text formats used in this document are described in the table below:

Format	Use
Italics	*Names, designations, and references*
Bolded	**Important information**

2.3. Identification

Each device has an identification label with serial number, part number and revision which identifies that unique device. This information is required when communicating with CrossControl regarding Technical support and Service/Repair needs.

Figure 1: Identification labels

2.4. Environmental resistance

The CCpilot V510/V710 products has been designed to manage tough environmental demands. The focus, from design through components selection, has been to provide a reliable and robust device.

Thorough testing has been performed to ensure compliance to a broad range of applicable regulatory requirements and to meet user demands of a ruggedized product for machinery control.

A complete list of the standards to which the product has been tested for compliance can be found in chapters 8.2 and 8.3.

3. Product overview

This chapter contains illustrations of the CCpilot V510/V710 showing the location of external connectors, indicators etc. Connectors are described in more detail in chapter 7. Additional mechanical information can be found in chapter 8.4.

3.1. Front side view

On the front side of the device there is a 5” or 7” display with an optional projected capacitive (PCAP) touch-sensor, soft keys with configurable function and LED illumination. There is also a light sensor and an RGB status LED in the front. The light sensor enables automatic dimming of the display and the RGB status LED shows operation modes or fault indications.

All display variants are optical bonded and have an anti-glare treatment.

The number of soft buttons depends on product model. CCpilot V510 has 8 in 2*4 configuration and CCpilot V710 has 10 in a 2*5 configuration as shown below.

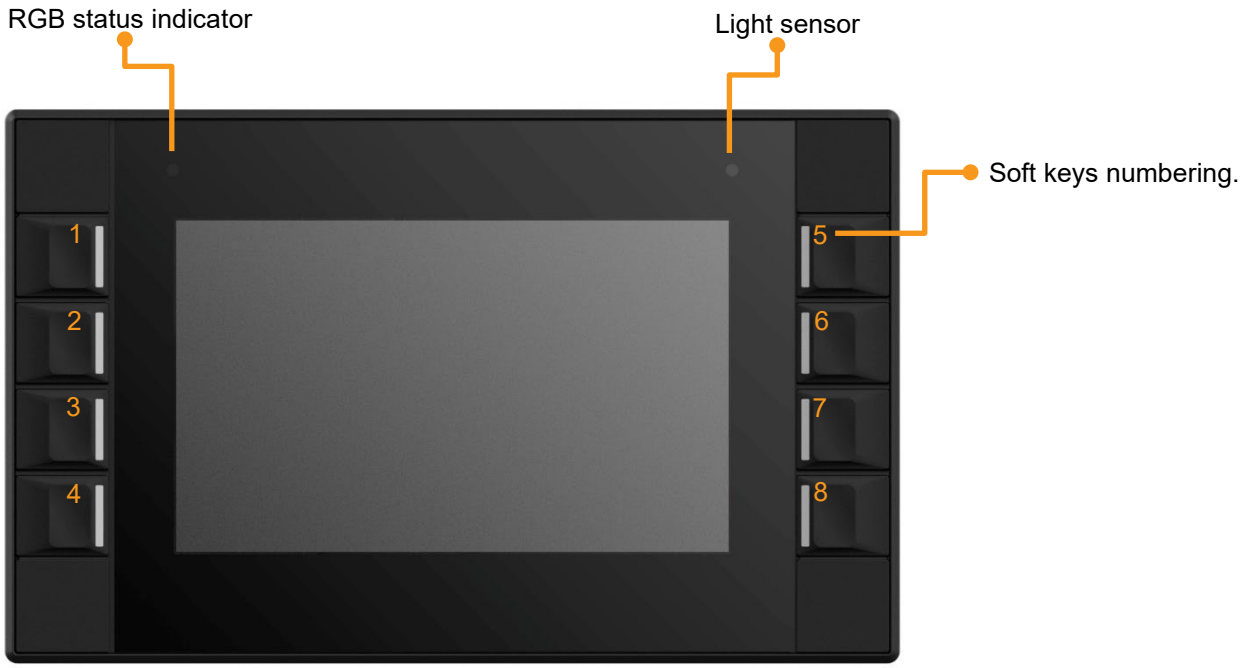

Figure 2: CCpilot V510 front side view

Figure 3 CCpilot V710 front side view

3.2. Rear side view

The rear side contains two external connectors (Deutsch DTM06-12SA + SB), mounting holes for RAM mount or custom bracket for panel mounting and a GORE-TEX® membrane for ventilation.

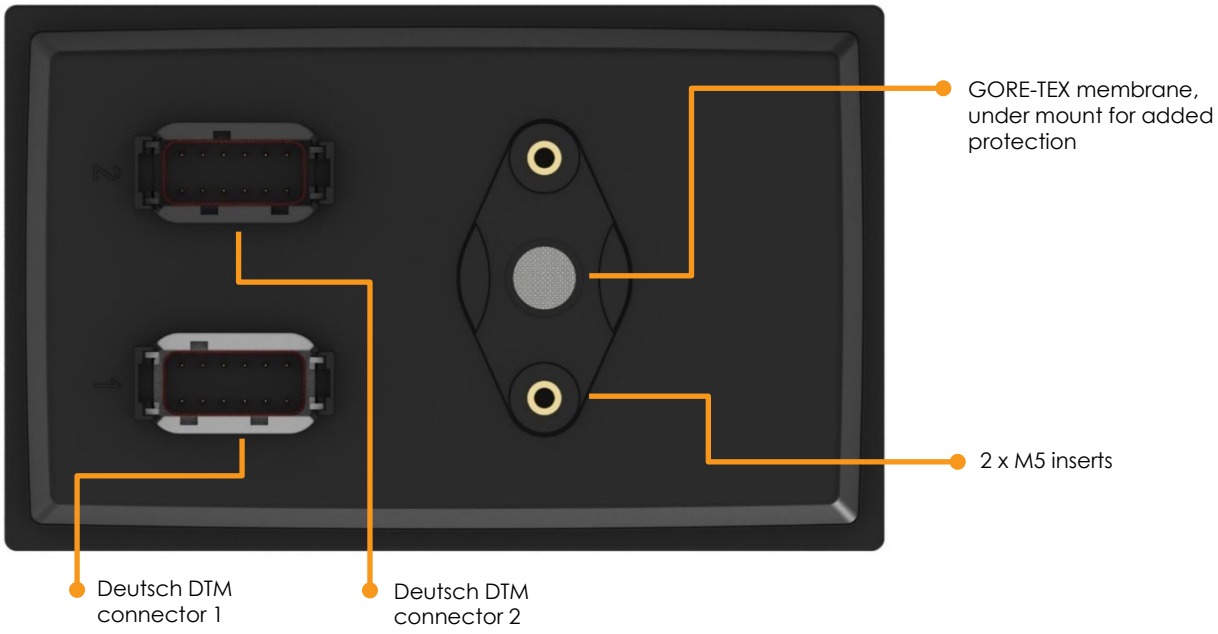

Figure 4 CCpilot V510 rear side view

CCpilot V510 contains mounting holes in accordance with AMPS hole pattern (RAM 2.43” x 1.31” Diamond Base) and CCpilot V710 in accordance with 1.5” RAM® ball mount (RAM-202U)

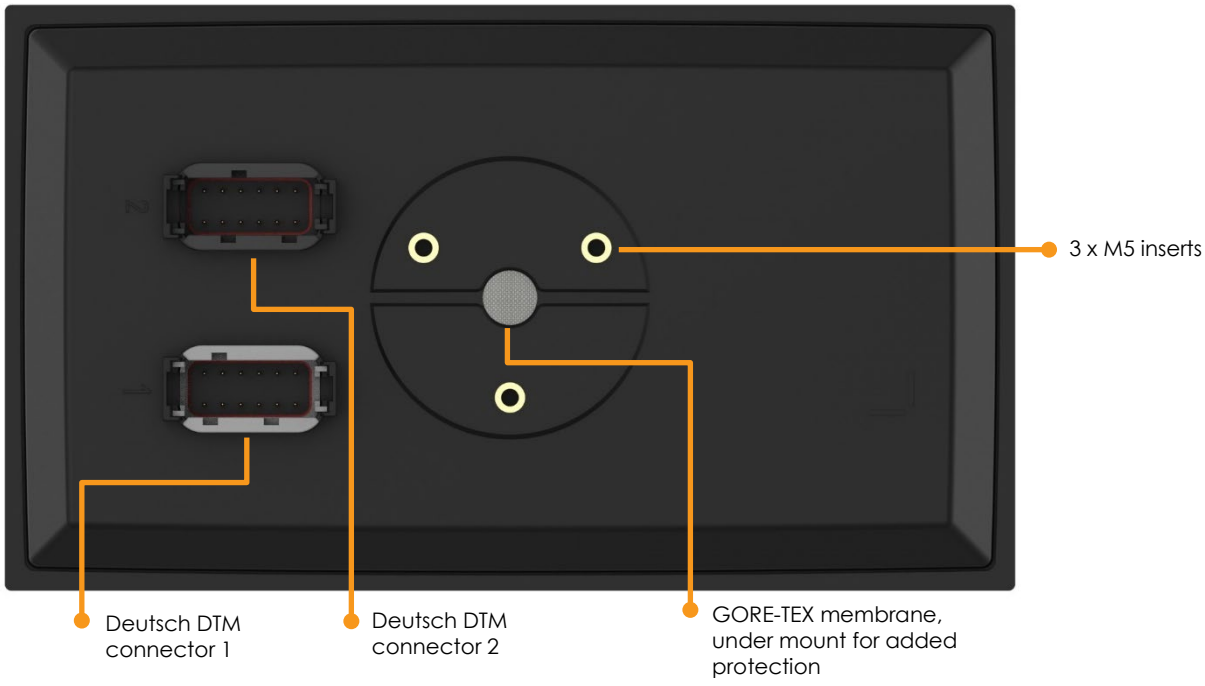

Figure 5: CCpilot V710 rear side view

4. Mounting and handling

This chapter contains recommendations for installation, handling and maintenance of the product.

4.1. Mounting

CCpilot V510/V710 supports two different mounting methods, a RAM mount, or a panel mount. These two mounting methods are described separately below.

For both fastening methods, use the appropriate M5 x 0.8 button head screw, for example type MRT (Torx) The recommended torque for the screws is 1.5-2.0 Nm. Using fluid locker or locking washers (split ring, toothed lock, etc.) is required for proper mounting. Ensure that the M5 mounting screws are clean and dry before mounting.

Note that the depth of the threaded holes is 8 mm. Be careful not to use longer screws which may damage the device when tightened. It is also very important to use a fastening plate with holes that are not larger in diameter than 6 mm to avoid pulling out the threaded inserts from the unit.

4.1.1. CCpilot V510 RAM mount

CCpilot V510 can be mounted using a RAM mount, i.e. RAM-B-238U, diamond plate 2.43" x 1.31" ball mount and accessories of choice which allows adjustment of the display's position and angle. Screw length should be 12mm.

Figure 6: CCpilot V510 RAM-B-238U diamond plate.

4.1.2. CCpilot V710 RAM mount

CCpilot V710 can be mounted using a RAM mount, i.e. RAM-202U, a round base 1.5” ball mount and accessories of choice which allows adjustment of the display’s position and angle. Screw length should be 12mm.

Figure 7: CCpilot V710 RAM-202U round base

4.1.3. CCpilot V510/710 panel mount

Alternatively, the device can be mounted in a panel cut-out using a panel mounting bracket (article number C000156-65 for CCpilot V510 and C000157-65 for CCpilot V710) with spacer and screw.

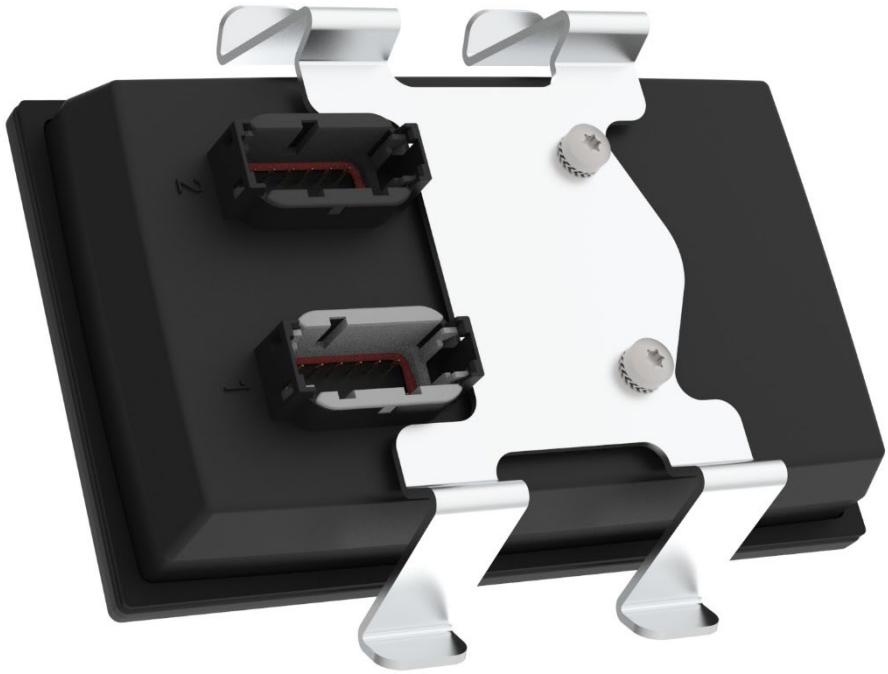

Figure 8: CCpilot V510 mounting bracket.

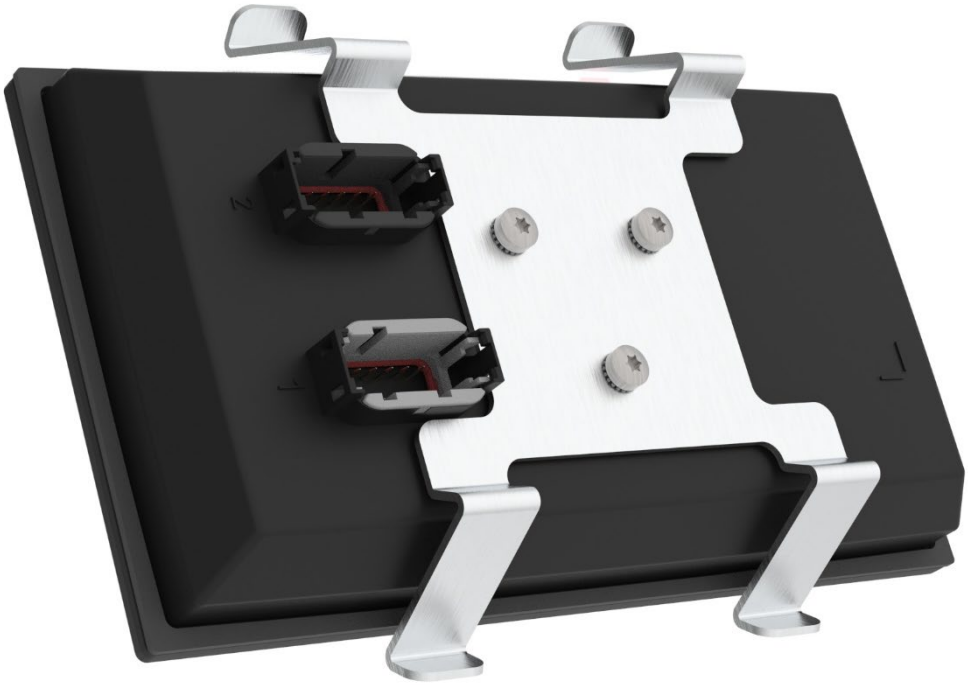

Figure 9: CCpilot V710 mounting bracket.

The mounting bracket is designed for a panel thickness of 1.5 - 3.0 mm. Panel cut out dimensions are shown in the figure below. A drawing in DXF-format for precision cutting of panels is available upon request. Screw length should be 10mm.

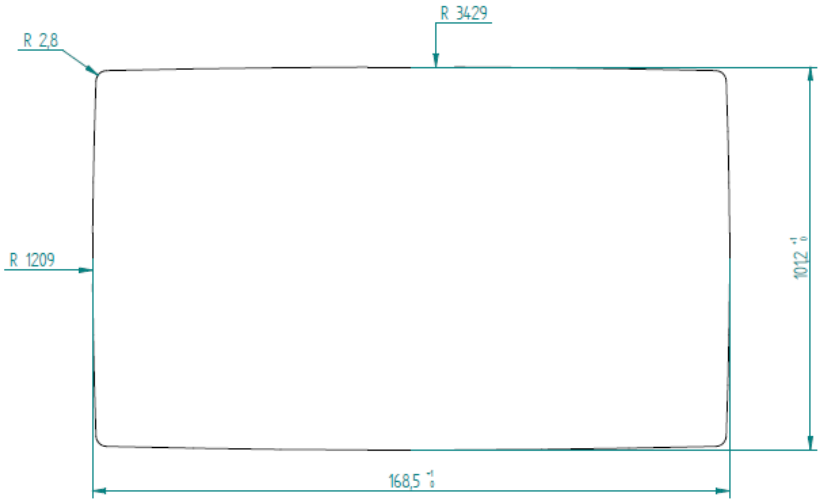

Figure 10: Panel cut-out CCpilot V510

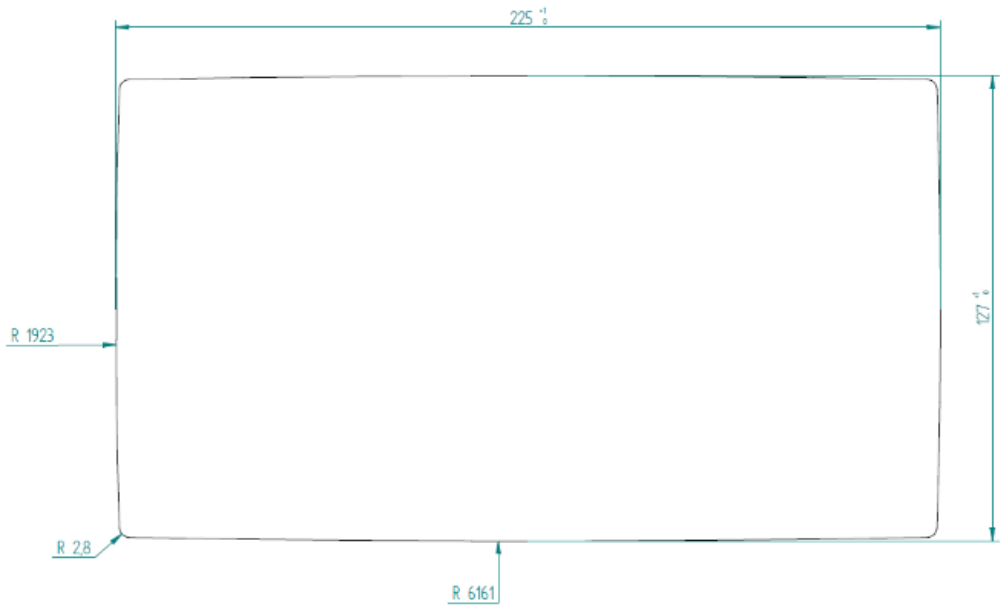

Figure 11: Panel cut-out CCpilot V710

Ensure that CCpilot V510/V710 is mounted to a smooth, flat surface. Fastening the unit to an uneven surface may stress the enclosure, damage the outer flange, or possibly even flex the circuit board inside, leading to a premature failure.

4.2. Connecting to power supply

This chapter describes how the CCpilot V510/V710 is preferably connected to the power supply of the equipment it is installed in. The principle is the same for vehicular and stationary installations.

Carefully read through the following sub-chapters. They are critical for designing and adapting the electrical system of the equipment in which the CCpilot V510/V710 is installed. Connector pinouts are found in chapter 7.

4.2.1. Wire gauge

Wire gauge for the power supply should be dimensioned with respect to the total load current, the cable length required, and the worst-case voltage drop allowed, considering the minimum operational voltage of the device.

- Current consumption of the CCpilot V510/V710 device is found in chapter 8.1.
- Power consumption of external loads driven by the CCpilot V510/V710 device should also be taken into account.
- The wire gauge for the power supply is recommended to be at least 0.75 mm^2 /AWG 18 for “normal” loads.
- The DTM connectors accept wire gauges between 0.75 and 3.3 mm2 /AWG 12 to 18.

4.2.2. External fuse

To prevent cable fire in case of short circuit, an external fuse must always be used when powering the device from a high current capable power source, for example a vehicle battery.

- The fuse shall be located as close to the battery/power source as practically possible. A recommendation is to place the fuse at a maximum distance of 15 cm (6 inches) from the (+) terminal of the source.
- Fuse rating shall be dimensioned with respect to wire gauge, maximum current consumption and the inrush current of the device. Refer to chapter 8.1 for fuse rating details.
- As a guideline, a slow acting fuse with 2-3 A current rating should be used.
- Remember to also apply fusing for the on/off control wiring, see chapter 4.2.4.

4.2.3. External key switch signal

The device’s key switch signal should be connected to the positive supply line via the vehicle’s ignition key switch.

- The wire gauge for the key switch signal shall be dimensioned to handle the total switch current and the fuse type and rating shall be selected to prevent cable fire in case of cabling short circuit.
- As a guideline, a slow acting fuse in the range of 100-500 mA for the key switch signal should be sufficient for most practically usable wire gauge.

4.2.4. Application example

Below is an application example schematic of the CCpilot V510/V710 power supply connection.

If the system has a main switch for completely disconnecting the battery (S1 in schematic below), the device's power supply and key switch signal shall be connected after the main switch.

It is **not** recommended to disconnect the battery without shutting down the device first - since doing so will immediately switch off all internal voltages, regardless of ongoing operations. Any information which was not saved to flash memory will be lost when disconnecting the battery. However, no physical damage will be caused to the device by disconnecting the battery.

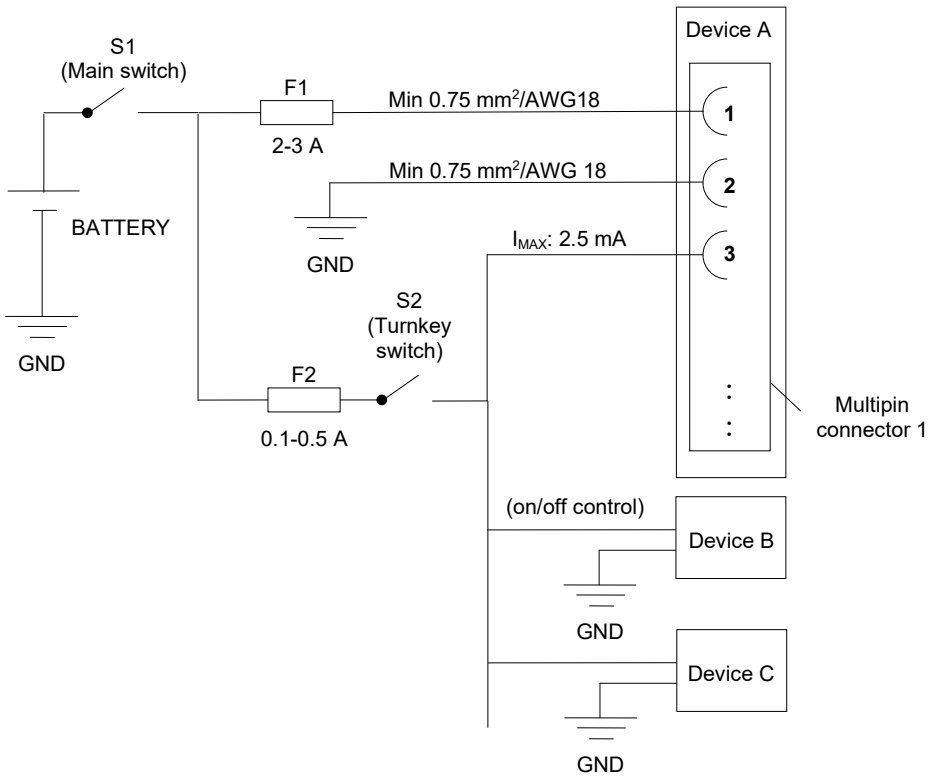

Figure 12: Schematic example for power supply installation of a CCpilot V510/V710 device in a vehicle. The ignition switch (S2) can be shared by several devices (Device X, Y, …)

By connecting the power supply according to the example above, the CCpilot V510/V710 device will automatically start up when the key switch (S2) is closed and shut down when the switch is opened.

Note that the on/off behaviour of the CCpilot V510/V710 described here is the default configuration. Its response to the on/off signal may be altered using the CCAux API, see chapter 5.1 for more details.

Be advised that the device consumes a small amount of power from the main supply even when shutdown. Therefore, if the device has been attached for a long period of time without the vehicle motor running, the battery may be drained, resulting in inability to start up the vehicle. A main switch for disconnecting the device's main supply is highly recommended in such situations.

4.3. Cable installation

Cables should be installed in such a way that they do not run any risk of being damaged, pinched or worn.

- Avoid excessive bending and twisting of cables.
- Use strain-relief on cables near the device to minimize stress on cables and connectors.
- Properly secure the connectors to give reliable contact and sealing and to avoid unnecessary strain.

4.3.1. Recommendations for cable shields

To achieve electromagnetic compliance and stable operation of the system, shielded cables are required for Ethernet and USB interfaces.

When using shielded cables for Ethernet, the shield is preferably connected/grounded at the other end of the cable (and remain unconnected close to the CCpilot V510/V710 device). Below are recommendations for inserting cable shields and coaxial cables into Deutsch DTM plugs to achieve robust connections and retaining IP classification of the device.

- Splice the cable shield (or coaxial inner and outer conductors) outside of the DTM plug and use regular, round cables for insertion into the plug.
- Minimize distance between cable joints and the DTM plugs for best shielding effect.

4.4. Special considerations

To ensure proper and reliable operation, and to retain the device's IP-classification, the below recommendations must be followed:

- The device should be placed in a way that prevents direct and continuous exposure to water or proximity to hot-air vents.
- To enable sufficient cooling, the device must be installed in a way that allows ambient air to circulate around it. A clearance of at least 50 mm around the device is recommended.
- To maintain IP classification, all connectors must have a mating external connector attached. Protective caps should be used on all non-mated connectors. Please note that the caps mounted on the connectors are for transportation protection only.
- The device has a ventilation membrane, refer to Figure 5 for the location. For proper ventilation of the device, dirt and water must be prevented from accumulating and covering the membrane. Be cautious not to insert objects which may puncture the membrane. Doing so will violate the IP-classification and void the warranty of the device.
- Install the device and any cables attached in a way that they are not subject to excess vibrations or other potentially harmful stress.
- Loose fasteners are a common cause for excessive vibration. Fasteners may come loose due to improper mounting techniques such as omitting thread lockers (fluid locker or locking washers) or by over/under-tightening. Proper tightening requires dry, clean fasteners and a torque wrench.
- If the device is exposed to chemicals, water, dirt or other pollutants, it is recommended to have it cleaned off as soon as possible. See chapter 4.5.1 for cleaning instructions.

4.5. Handling and maintenance

Handle the device with care and pay attention to the following handling instructions:

- Disconnect all cables to the device during welding or when performing other service to the machine imposing a risk of damaging electronic devices.
- Service and repair to the device shall only be made by authorized personnel. If the device is opened by unauthorized personnel, its warranty will be void.
- Scratches or other damages may occur to the display surface if it is exposed to sharp objects, abrasives or heavy impacts. This must be avoided to increase the longevity of the screen.
- The internal eMMC flash storage has a limited number of write cycles. Therefore, it is recommended that the amount of writing to flash is limited within software applications.[1]
- Always consider personal safety when installing and operating the product. For example, in vehicle installations, CrossControl does not recommend that the product is being actively operated by the driver when there is a risk of injury to people or property damage.

4.5.1. Cleaning

To ensure proper and reliable functionality over time, pay attention to the following cleaning instructions and precautions:

- Wipe the device clean from dirt using a soft damp cloth, preferably of microfiber type. Larger amount of dry dust may be swept off using a soft brush before wiping clean.
- Avoid using alkaline, alcoholic or other potentially adverse chemicals for cleaning as doing so may damage the device. However, small amount isopropyl alcohol may be used for removing harsh stains.
- Avoid spraying or by other means applying larger amount of water or alcohol directly to the device. Instead, lightly dampen a cloth before using it for cleaning the device.
- After cleaning, make sure that the device surface is left dry.
- Never use high-pressure air, vacuum, water or steam to clean the device.

4.5.2. Real time clock battery

Time and date information is stored in a memory sustained by an internal back-up battery. The battery is a 3V 1000mAh high operating temperature Poly-carbonmonofluoride Lithium battery. The expected lifetime of the battery is approximately 20 years. The battery is not replaceable.

4.6. Transportation

When transporting the device, it is recommended to use the original packaging. Make sure that protective caps are used on all non-mated connectors. The safe storage temperature range [-40°C to +80°C] must be adhered to.

[1] The eMMC is used in pseudo SLC mode and implements both static and dynamic wear levelling to achieve the best reliability. The number of program/erase cycles is between 20k to 60k depending on the manufacturer and temperature. Our recommendation for the application software is to temporary cache in RAM and to write larger chunks of data to the eMMC. This recommendation is not specific to eMMC but is applicable to all flash memories.

5. Basic operation

This section covers basic operation of the product such as start-up, shut down, suspend, resume, display operation and status notification.

Observe that the behaviour of on/off controls (external on/off control and front panel soft keys) is user configurable in terms of:

- Enabling/disabling functionality
- Which push button that shall hold the on/off functionality
- Configurable timing parameters
- External on/off control edge or level triggered

Notifications during start-up are indicated by the status LED or buzzer delivering different patterns. The buzzer is used for audible operation alerts as well as for various error notifications, see chapter 5.6 for error code details.

The status notification behaviour in the operational state of the device is configurable by user applications. Described herein are the factory default behaviours of the on/off controls and the status notification.

5.1. Turning ON

The CCpilot V510/V710 product can be started in different ways:

1. Connecting the external on/off control signal to a positive supply input (at or above approximately 4V).
    - When started this way, the on/off signal must remain asserted. De-assertion of this signal will shut down the device unless configured otherwise.
2. By a short-press on the front panel button configured as startup trigger.
    - Soft key number one is the factory default startup trigger.
3. It is possible to configure the device to automatically start up whenever external power is applied (i.e. without using any on/off control).
    - Note that this function is disabled as factory default.

For resuming the device from suspend mode, see chapter 5.2.

While starting up the device, it will give a short beep and the status LED will flash with 2 Hz. When the device enters operational state the status LED will stop flashing and be turned on.

5.2. Turning OFF and suspending

There are several ways to turn off the CCpilot V510/V710 device and alternatives to enter suspend mode instead of completely shutting down the device.

5.2.1. Shutting Down

There are three ways to shut down the device, provided that it is in normal operational state when the action occurs:

1. By disconnecting the external on/off control for more than a specified time, i.e. using the turn-key functionality.
    - The time-out is user configurable (default is set to 4 seconds).
    - If the on/off signal is brought back high again while the device is shutting down, it won't restart automatically. A low-to-high transition must occur after the device has fully shut down to make a restart.
2. By using the soft keys (action configurable for either short-press or long-press of the soft key)
    - The time used for detecting long-presses is user configurable and defaults to 4 seconds.
    - A prolonged long-press (min 8 seconds or double configured long-press time) gives a forced shutdown where the internal voltages are shut off immediately, see chapter 5.2.3 - Forced Shutdown for details. Note, this only applies to buttons configured as "action trigger". For details, see the software documentation.
    - By factory default, no action is configured for the pushbuttons.
3. By operating system shutdown requests.

To ensure that data is not lost nor the flash memory corrupted, it is recommended that all necessary data be saved, and all programs closed before the device is shut down.

Note that the device won't shut down from Suspend mode by these actions. See chapter 5.2.2 for details of Suspend mode and wakeup.

5.2.2. Suspending/resuming

Suspending and resuming are a faster alternative to shutting down and starting up the device. In suspend mode, the data remains in RAM memory and the device must be connected to external power supply to maintain its state.

Suspend mode can be entered in three ways:

1. By disconnecting the external on/off control, for example using the turn key functionality.
    - By factory default, disconnecting the external on/off control is configured to shut-down the device.
2. By using the front panel buttons (action configurable for either short-press or long-press of the button)
    - By factory default, no action is configured for the pushbuttons.
3. By selecting the operating systems suspend alternative.

Observe that the product current consumption in suspend mode is higher than in shut-down mode.

To prevent a vehicles or machines battery from draining when the device is suspended, a user configurable time-out can be set for how long the unit shall stay in suspend mode before it automatically shuts down. The default suspend time-out is set to 60 minutes.

Resuming from suspend mode can be done by one of the following events:

1. A low-to-high transition of the external on/off control, for example using the turn-key functionality.
2. By pressing a front panel pushbutton configured as wakeup trigger.
    - Note soft key number one is factory default enabled as wakeup trigger.

Configuration of suspend and resume is done through the CCSettingsConsole application or using the CCAux API. See the software guide for details.

5.2.3. Forced Shutdown

If the CCpilot V510/710 is not responding, a forced shutdown can be performed by pressing and holding a pushbutton (that is configured as action trigger) until the device is switched off.

- The default button-press time for performing a forced shutdown is min 8 seconds or double the configured long-press time.
- By factory default, no action is configured for the pushbuttons.

A forced shutdown immediately shuts down the device, regardless of its operational state. Any information which was not saved will be lost when performing a forced shutdown. Any ongoing writing to the flash memory will be disrupted which may lead to a corrupted file system.

- Therefore, it is **not** recommended to use the forced shutdown feature unless absolutely necessary.

5.3. Light sensor and screen brightness

The CCpilot V510/V710 contains a light sensor that can be used to automatically adjust the display brightness, depending on the ambient light conditions. As depicted in Figure 2, the light sensor is located in the upper right corner of the front surface. When automated dimming is enabled, the level of sensitivity can be adjusted.

The screen brightness can also be manually controlled directly from user applications through APIs.

For proper operation it is important to keep the light sensor opening clean and unobstructed visibility.

5.4. Using the touch screen

The touch screen's protective glass is covered with an anti-glare layer that reduces reflections when operating in very bright conditions,. Do not use any sharp or abrasive objects when interacting with the touch screen.

Basic usage of the capacitive touch screen should be intuitive for most users. Note that the touch screen is capable of handling multiple simultaneous touches.

5.5. Status notification

The CCpilot V510/V710 contains a status LED, in the front, used for notification while starting up, shutting down or in other operational states. The buzzer may also be used for user notifications. See Table 1 for a description of the status notification behaviour for different operational states.

Table 1: LED and buzzer indication for different operational states

Operational state	LED indication	Buzzer notification
Device off	OFF	-
Power applied, device off	OFF	-
Starting up	Yellow flashing, 2 Hz	Short beep
Operating (started up)	Static green	-
Suspended	Yellow flashing, 0.2 Hz	-
Shutting down	Static yellow	-
Rebooting	Static yellow	
Rescue mode, starting	Static orange	Short beep
Rescue mode, running	Green flashing, 2 Hz	-
OTG mode (OS update)	Yellow flashing, 0.5 Hz	-
Forced update mode (OS update)	Orange flashing, 0.5 Hz	-
SS firmware update mode	Static yellow	-

Observe that the status notification behaviour in both the start-up and operating states is configurable by user applications running on the device.

5.6. System related error codes

The status LED in the front is also used for indicating system related error codes by emitting a blue blinking pattern after shutdown of the device. The device may be started again when in this mode, by the key switch signal. Depending on the nature of the error, the device may start or go back into error indication.

When an error occurs, the device is immediately shut down and the error is reported by blinking a specific number of times corresponding to an error code (see table of error codes). The blinks will be in a continuous sequence of 1 Hz blinks, with a longer pause of two seconds after the specific number of blinks, allowing the end user to count the number of blinks. Refer to Figure 19 below for an example.

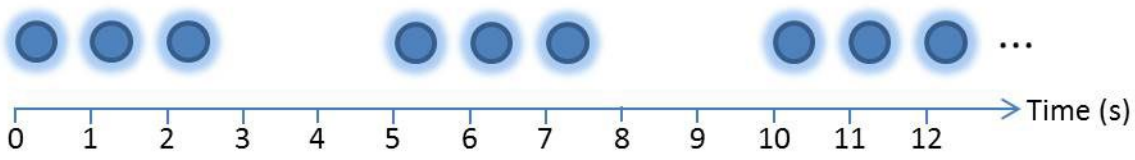

Figure 13: Example of the blinking pattern for error code 3

When an error occurs, an error code is also immediately saved to persistent storage (FRAM). If several errors occur before the device is shut down, only the code of the first error is saved and reported. The error code in persistent storage can be read and cleared from a user application.

Refer to Table 2: CCpilot V510/V710 system related error codes for a complete listing of the error codes.

The number of blinks is important information if the unit is sent in for service/repair.

Table 2: CCpilot V510/V710 system related error codes

Error code	Error code name	Likely problem cause
1	TEMP_ABOVE_MAX_ERROR	Temperature is above max limit
2	TEMP_BELOW_MIN_ERROR	Temperature is below min limit
3	TEMP_IMPOSSIBLE_VALUE_ERROR	PCBA temperature sensor malfunction
4	TEMP_MEAS_TIMEOUT_ERROR	PCBA temperature sensor malfunction
5	WD_RESET_ERROR	Watchdog timer reset
6	VMAIN_BELOW_LIMIT_ERROR	Main power supply voltage is below min limit
7	VMAIN_ABOVE_LIMIT_ERROR	Main power supply voltage is above max limit
8	MCU_HARD_EXCEPTION_ERROR	MCU hard fault exception
9	NVM_CORRUPTED_DATA_ERROR	Non-volatile memory data is corrupted

5.7. Display related error codes

Unlike system related errors, display related errors are not indicated by the LED. When a display related error occurs, an error code is immediately saved to persistent storage (EEPROM). The error log in persistent storage can store up to 32 error codes and is readable from the ccsystemreport application.

Refer to Table 3: CCpilot V510/V710 display related error codes for a complete listing of the error codes.

The error log is important information if the unit is sent in for service/repair.

Table 3: CCpilot V510/V710 display related error codes

Error code	Error code name	Likely problem cause
0	ERR_NO_ERROR	Default entry, log entry never written.
1	ERR_INVALID_LOG_ENTRY	Invalid log entry, i.e failed to read the log entry from EEPROM.
2	-	-
3	-	-
4	ERR_LS_INIT	Failed to initialize light sensor.
5	ERR_LS_I2C	Failed to access light sensor over I2C.
6	ERR_EEPROM_INIT	Failed to initialize eeprom.
7	ERR_DISP_ROT_AT_STARTUP	Failed to set display rotation at startup.

8	ERR_RCC	Failed to configure clocks.
9	ERR_TOUCH_I2C	Failed to access touch controller over I2C.
10	ERR_TOUCH_NUM_CONTACTS	Max number of contacts exceeded.
11	ERR_HID_START_TRANS_FAILED	Failed to start a touch data transfer.
12	ERR_HID_RX_BUFF_OVERRUN	I2C HID receive buffer overrun.
13	ERR_HID_REPORT_BUFF_OVERRUN	Touch report buffer overrun.
14	ERR_MP_RX_BUFF_OVERRUN	MP I2C receive buffer overrun.
15	ERR_MP_TX_BUFF_OVERRUN	MP I2C transmit buffer overrun.
16	ERR_MP_RX_WR_BUFF_OVERRUN	MP write buffer overrun.
17	ERR_MP_CMD_INVALID	Invalid/unknown command sent from MP.
18	ERR_LOG_INIT	Failed to read out error log from EEPROM.
19	ERR_EEPROM_DEFAULTS	Failed to write parameter default values to EERPOM.
20	ERR_EEPROM_PARAM_WRITE_FAILED	Failed to write EEPROM parameter.
21	ERR_EEPROM_PARAM_READ_FAILED	Failed to read EEPROM parameter.
22	ERR_BL_OFF_SEQ	Backlight OFF sequence failed.
23	ERR_BL_ON_SEQ	Backlight ON sequence failed.
24	ERR_TFT_EN_SEQ	TFT enable sequence failed.
25	ERR_TOUCH_EN_SEQ	Touch enable sequence failed.
26	ERR_DISP_OFF_SEQ	Display OFF sequence failed.
27	ERR_PARAM_BUFF_OVERRUN	EEPROM parameter buffer overrun.
28	ERR_I2C_CALLBACK	Failed to register callbacks for I2C transfer.
29	ERR_HID_IRQ_TIMEOUT	Touch interrupt not cleared by MP.
31	ERR_BL_FAULT	Unexpected state of backlight fault signal.
32	ERR_IO_EXP_INIT	Failed to initialize io expanders for buttons.
33	ERR_IO_EXP_UPDATE	Failed to update io expander register and/or port status.
34	ERR_IO_EXP_PORT_STATUS	Failed to read port status from io expanders.
36	ERR_BL_DRV_CONF	Failed to configure backlight driver circuit.
37	ERR_FLASH_WRITE	Failed to write display ID to flash.
38	ERR_CONFIG	Failed to set configuration.

6. Interface overview

This section describes the various interfaces of the product. Main part of these interfaces can be accessed via software APIs. These are described in more detail in the CCpilot V510/V710 Software Guide.

6.1. Soft keys

CCpilot V510 contains eight, and the V710 ten, software configurable soft keys depending on product model. The soft keys may be used for user application input, turning the unit on/off or for example controlling the backlight. All soft keys are backlit. The backlight can be turned on and off individually. The backlight intensity can also be adjusted but the intensity level is applied to all soft keys.

6.2. Touch screen

Some model variants feature and optional projective capacitive (PCAP) touch screen, which is capable of handling multiple simultaneous touches.

6.3. Light sensor

There is a light sensor in the front panel used by user applications or used with the built-in automated function for dimming of the display brightness. For light sensor location, see Figure 2. Refer to the CCpilot V510/V710 Software guide for details about accessing the light sensor data from within user applications.

6.4. RGB status LED

The CCpilot V510/V710 contains a status LED in the front used for notification while starting up, shutting down or in other operational states.

6.5. Buzzer

The CCpilot V510/V710 has a built-in buzzer that can be used for audible notifications. The buzzer is software controllable with configurable volume and frequency.

For buzzer location see Figure 5. See chapter 5.5 for buzzer notification events. Refer to the CCpilot V510/V710 Software guide for details about controlling the buzzer from user applications.

6.6. CAN

CCpilot V510/V710 has two CAN-FD ports that meets CAN ISO 11898 2.0B (29-bit extended identifier) and supports bit rates up to 5 Mbps.

Note that Internal EMI filters on CAN High/Low signals have a capacitance of 100 pF (typ) which deviates from the ISO 11898 standard and implies some limitations on the CAN bus topology (maximum bus length, number of CAN nodes etc.) when running at high bit-rates (above 250 kbps).

The ports feature highly protected CAN transceivers which are tolerant for bus short-circuits to main supply voltage and ground. There is no device-internal CAN bus termination, therefore bus termination must be applied externally.

There are two hardware mounting options for the CAN ports. The CAN ports can either be non-isolated or isolated with a galvanic isolation of 500V DC.

For the non-isolated CAN option the CAN shield pins are used as CAN shield and the connections are according to J1939-11 with capacitive coupling to ground, see Figure 14.

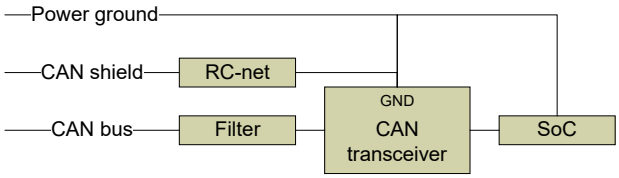

Figure 14: Non-isolated CAN port internal block diagram

For the isolated CAN option the CAN shield pins are connected to the ground reference of the isolated CAN transceivers, see Figure 15.

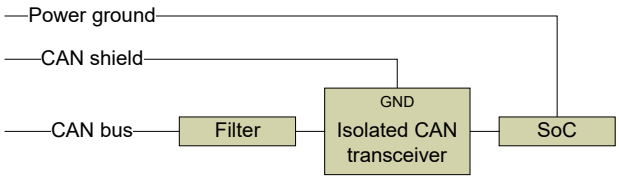

Figure 15: Isolated CAN port internal block diagram

For an isolated CAN bus or when using the shield pin for a non-isolated CAN bus the shield pin shall be grounded at only one of the nodes to avoid ground loops.

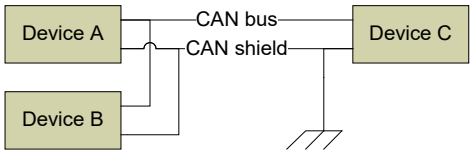

Figure 16: Grounding of CAN shield at only one of the nodes on the CAN bus.

6.7. Ethernet

CCpilot V510/V710 has one Ethernet interface in multipin connector 2 supporting 10BASE-T/100-BASE-TX and Auto-MDIX.

The Ethernet interface is galvanic isolated with 1.5 kV_{AC} insulation voltage.

Shielded cables should be used to ensure reliable communication and electromagnetic compliance. As with all Ethernet enabled devices, connecting the device to a public network environment may impose an IT security threat.

6.8. USB

The CCpilot V510/V710 has one USB port. This port supports an USB OTG interface, (can act as both host and device). Using the port in USB device mode is only for OS updates through a connected PC with appropriate tool installed.

In USB host mode, it can be used for application data transfer or the connection of a peripheral such as a mouse or keyboard.

Due to the multipin connector specification, USB data signal integrity cannot be guaranteed with higher speeds than full-speed USB (12 Mbps). However, hi-speed operation is supported by the USB host controller.

The USB port can supply up to 500 mA. The USB port is internally over current and short circuit to ground protected. Shielded cables shall be used to ensure reliable communication and electromagnetic compliance. Depending on installation the shield could be connected to USB ground or left unconnected on the Deutsch DTM-12 connector, i.e. CCpilot V510/710, side of the cable.

6.9. Bluetooth and Wi-Fi

The CCpilot V510/V710 offer an optional built in Bluetooth and Wi-Fi module to facilitate wireless communication to and from the device. The Linux based operating system in the CCpilot V510/V710 includes a software Bluetooth stack for easy application development including adding Bluetooth functionality.

Refer to the CCpilot V510/V710 Programmers manual guide for details about implementing Bluetooth and Wi-Fi functionality in user applications.

Table 4: Bluetooth and Wi-Fi module and communication specifications:

Items	Specification
Radio module certificates	FCC/IC/CE/RCM
Antenna Type	Internal
Wireless specification	802.11 a/b/g/n/ac
Bluetooth version	V5.0 Dual Mode – BR / EDR / LE
Frequency range	2.402 – 2.480 GHz, 5.15 – 5.825 GHz
Temperature range	The Bluetooth and Wi-Fi module is operational in the *CCpilot V510/V710*'s full temperature range
Max Transmit Power	Class 1 +8dBm from antenna

6.10. Configurable inputs

There are two configurable inputs on the CCpilot V510/710 available through Deutsch DTM connector 2. Each input can be configured for voltage measurement, frequency measurement, current measurement (sink to ground), resistance measurement or digital input. It is also possible to activate a pull-up or -down resistor for each input. Leaving the input as is will result in a weak low.

For electrical specification at different input modes, see chapter 8.1.

Note that the input grounds are internally joined with each other and with main supply ground. Precautions should be made to avoid ground-loops between input grounds and between input- and main supply ground. Ground-loop currents may affect readings.

A co-processor handles the configurable inputs and adds features such as filtering, frequency measurement and protection. Measurement results are accessible to user applications through CCAux API. Refer to the CCAux API documentation for programming details. Each input mode is further described in *chapters 6.9.1 - 6.9.4* below.

6.10.1. Digital input and frequency measurement

Digital and frequency inputs modes can be used for connecting simple logical signals (for example switch to battery/ground or various logic output sensors) or frequency-output sensors commonly used in industrial applications. Each input can be set as either floating, with internal pull-down or internal pull-up. This makes the inputs compatible with a wide range of sensors with different output types. The selectable internal pull-ups are sourced from internal 5v supply. External pull-ups may be used if other pull-up voltages or currents are required or for interfacing open-drain (sink-only) drivers.

In frequency mode a combination of measuring the number of pulses during a certain time (~30Hz update rate) and measuring the exact time for those pulses using a timer is used to get a good resolution in a wide range of frequencies. This gives good frequency measurement but gives no duty cycle measurement. In Frequency + duty cycle mode, a timer (2 MHz) is instead used to directly measure the pulse time and the relation between rising edge time and the full pulse time to get the duty cycle. This gives both frequency and duty-cycle but with a slightly lower accuracy and range compared to frequency measurement mode.

Refer to the CCAux API documentation for details about available configurations.

See *chapter 8.1* for electrical characteristics such as absolute maximum voltage, digital threshold levels, pull-up/pull-down strength, frequency range and accuracy.

6.10.2. Voltage measurement

Each input can be individually configured for measuring DC-voltages in the following ranges.

- “5V” range measures 0-5.2V
- “32V” range measure 0-38.2V

In general, smaller voltage range gives better accuracy and higher input impedance. See *chapter 8.1* for electrical characteristics such as impedances and accuracy for each range setting.

6.10.3. Current measurement (4-20 mA)

Each input can be configured for interfacing 4-20 mA current-loop sensors. To be able to detect signal errors, the actual measurable range is 0-25mA (typ). Values outside the nominal 4-20mA range are generally considered a fault but this is up to the user to decide. When enabled, a 100Ω input shunt resistor is connected to ground for closing the current loop. The inputs are protected by a current limitation of ~30-35mA.

See *chapter 8.1* for electrical characteristics such as effective range, accuracy, and over-load threshold voltage.

6.10.4. Resistance measurement

Input channels 1-2 can be configured for resistance measurement in the ~5Ω-~2.4kΩ range. The actual measurable range is wider but with limited accuracy.

See *chapter 8.1* for electrical characteristics such as effective ranges and accuracy.

6.11. Configurable outputs

There are two configurable outputs available through Deutsch DTM-connector 1. Two self-protected high-side PWM outputs for switching various external loads such as buzzers, relays, solenoids, lamps or other resistive or inductive loads. PWM frequencies between 1-5000Hz are supported and duty cycle can be controlled with 12-bit resolution (0-4095).

The high-side output drivers are powered from the main supply voltage through internal over-voltage protection that limits the output voltage to 36 V_{DC} (typ) in case of supply voltage transients. Each output handle load currents up to 1.0 A (typ).

Each output provides diagnostics/fault-detection for both ON- and OFF-state according to below:

Error code (hint)	Output off	Output on
0 = OK (no error present)	YES	YES
1 = Short to Ground (STG)	-	YES
2 = Short to Battery (STB)	X (pull up resistors off)	-
4 = Over Current	-	YES
16 = Open Load	X (pull up resistors on)	-
32 = Generic Error	YES	YES

The open load in off state detection requires the built-in pull-up resistor to be activated which drives a small current through the load in off-state. This small current can turn on loads like small LED lamps and the open load detection can therefore be turned off.

Note that the built-in pull-up resistor is by default off.

To ensure long-term reliability, the outputs are continuously monitored for faults, and each output is automatically switched off in case a fault is detected in on state. An output switched off by a fault condition must be reenabled by the user.

Observe that high continuous load through the outputs adds self-heating of the device. At high ambient temperatures, this may lead to outputs automatically switching off because of thermal protection. Outputs can be reenabled by the user once the driver IC temperature has decreased below its threshold. If output over-temperature shutdown occurs, it is recommended to improve air ventilation around the device and if possible, reduce the amount of output load.

Output on/off control as well as PWM frequency, duty-cycle and fault monitoring is handled by a co-processor and controlled though a software API. Fault codes shall be treated as a hint to what the problem is. The characteristics of the load, the PWM frequency and duty cycle can affect the possibilities to detect the exact reason for an error.

See chapter 8.1 for electrical characteristics such as channel resistance, timing, current limit and fault-detection details.

Additional notes

If pull up resistor is active when output is off, open load will be reported also for “Short to Battery” (STB). The user can switch off the pull up resistors to be able to detect STB in off state.

In case of over temperature, the output driver will shut off and will not allow switch on until temperature is within acceptable range. There is no specific error code for over temperature – Short to Ground or Generic Error will be reported. Over temperature is not monitored in off state.

Generic error is reported when the cause of error cannot be determined or when there is no specific error code available.

To clear an error code, the user must explicitly set a new duty cycle (To just clear the error code without activating output duty cycle 0 can be set). The exception is errors detected in off state that will automatically reset when the error is no longer present.

To protect the unit when driving inductive load, an internal freewheel diode is placed between ground and output pin carrying current when switching off the load.

External voltage applied to output pins will supply the unit backwards, via diode in high side switch, if the voltage at pin is higher than supply voltage. This might start the unit unintentionally if not powered on.

For PWM frequencies above 1000Hz, only 10-bit duty-cycle resolution is available.

7. Connectors

All connectors are accessible from the rear of the unit. The connectors, twelve pin molded-in Deutsch DTM series, are marked with a 1(J1) and a 2(J2).

Use caution and avoid plugging/unplugging of connectors when the computer is powered up. Always replace damaged cables. If a connector pin becomes bent the interface may not function correctly and the device should be returned to the manufacturer for repair.

7.1. Connector layout

Note that descriptions herein refer to the connectors located on the device and not the cable-side connectors which are attached to the device. However, the pinout numbering and signal descriptions are the same.

Pin	Function (DTM06-12SA)	Pin	Function (DTM06-12SB)
J1-1	Constant Power +12/24	**J2-1**	Configurable Input 1
J1-2	Power Ground	**J2-2**	Configurable Input 2
J1-3	Switched Power +12/24	**J2-3**	*Force pin for USB serial download.
J1-4	Switched Output 1	**J2-4**	-
J1-5	Switched Output 2	**J2-5**	Ground
J1-6	CAN 1 Shield	**J2-6**	CAN 2 Shield
J1-7	CAN 1+	**J2-7**	CAN 2+
J1-8	CAN 1 -	**J2-8**	CAN 2 -
J1-9	USB Ground	**J2-9**	Ethernet RD+
J1-10	USB Data -	**J2-10**	Ethernet RD-
J1-11	USB Data +	**J2-11**	Ethernet TD+
J1-12	USB Vbus	**J2-12**	Ethernet TD-

Figure 17: Multipin connector pin layout

*Pin for forcing the USB serial download mode of the i.MX 8X for flashing of boot and/or image. Active high. Leave floating or grounded for normal operation.

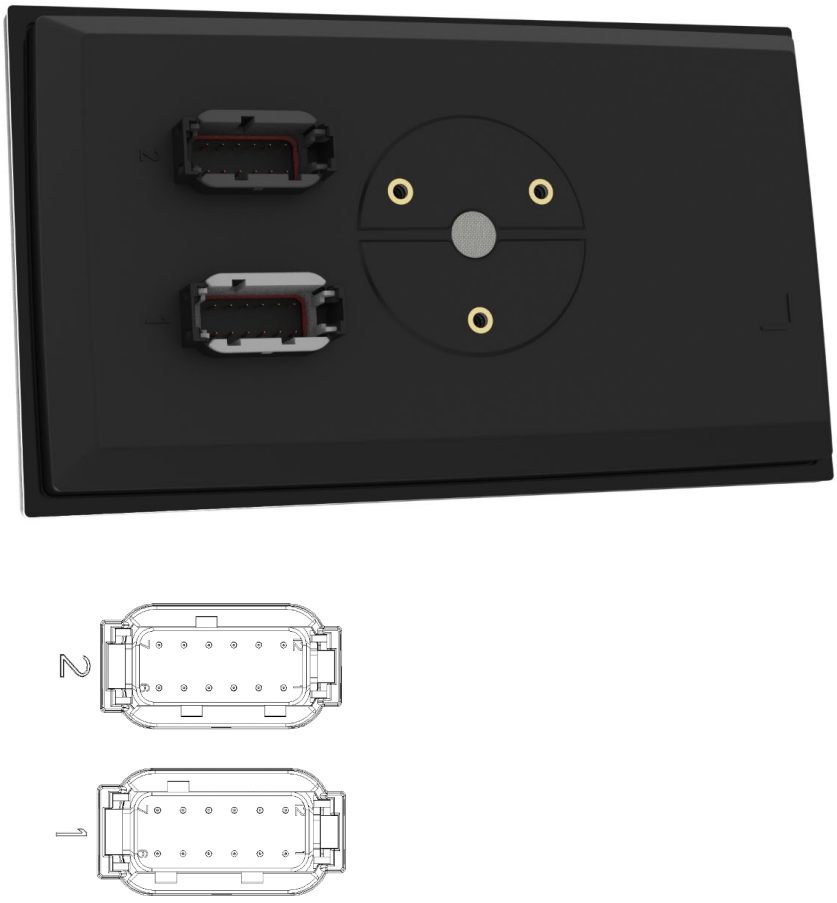

Figure 18: Connector numbering and placement CCpilot V510/710.

7.2. Deutsch DTM connectors, general

Use caution and avoid plugging/unplugging Deutsch DTM connectors while the device is powered up. If a connector pin becomes bent the interface may not function correctly and the device should be returned to the manufacturer for repair.

Pay close attention to the coding; violence or excessive force should not be used when mating the connectors.

The connector pins are rated for 7.5 A continuous current.

The DTM connector pins are made of tin-plated brass. It is recommended to use tin-plated receptacles in the mating connectors. Using different plating in the cable connectors might cause galvanic corrosion.

Note that all Deutsch DTM connectors must be mated with its corresponding cable connector or a proper blind plug to maintain the IP-classification.

8. Specifications

8.1. Technical data

Temperature specification	
Operating	-30 to +70 °C
Storage	-40 to +80 °C

Kernel	
Main Processor	NXP™ i.MX8 DualXPlus: ARM 64-bit, 1200MHz, Cortex®-A35
Co-processor	STMicroelectronics STM32G070RBT6, Cortex®-M0+
Data storage	8 Gbyte, Industrial grade eMMC(Note)
RAM memory	1 Gbyte, LPDDR4

Note: The eMMC is used in pseudo SLC mode and implements both static and dynamic wear levelling to reach the best reliability. The number of program/erase cycles is between 20k to 60k depending on the manufactures and temperature. Our recommendation for the application software is to temporary cache in RAM and to write larger chunks of data to the eMMC. This recommendation is not specific to eMMC but is applicable to all flash memories.

Power Supply		
Supply voltage		
Nominal	12 V_{DC} or 24 V_{DC}	
Voltage range	6 V_{DC}…36 V_{DC}	
Power consumption		
	Vin = 12 V_{DC}	**Vin = 24 V_{DC}**
CCpilot V510		
Typical, operating	0.5A	0.25A
Max, operating	0.75A*	0.40A*
Suspend to RAM	30 mA (typ)	18 mA (typ)
Shutdown	180 µA (typ)**	110 µA (typ)**
CCpilot V710		
	Vin = 12 V_{DC}	**Vin = 24 V_{DC}**
Typical, operating	0.5A	0.25A
Max, operating	0.85A	0.45A
Suspend to RAM	30 mA (typ)	18 mA (typ)
Shutdown	180 µA (typ)**	110 µA (typ)**
	* External load at OUT1/2 not included	
	** This assumes that the ignition signal is disconnected from supply voltage.	
Inrush current		
CCpilot V510	**Vin = 12 V_{DC}**	**Vin = 24 V_{DC}**
Duration <1 ms	< 1.2 A	< 1.2 A
CCpilot V710		
Duration <1 ms	< 1.2 A	< 1.2 A
External fuse recommendation		
Current rating	4A*	3A*
	* Including maximum external loads, This assumes that the fuse is in accordance with IEC 20127 i.e. can be continuously operated at 100% of rated current.	

CAN interfaces	
Type	Non-isolated, ISO 11898-1, CAN 2.0B
CAN transceiver	NXP TJA1051T/3
Baud Rate	Configurable 20 kbit/s – 1 Mbit/s.* CAN FD mode up to 5 Mbit/s. * Internal CAN bus filters have a capacitance of 100pF (typ) as stated in the J1939 specification. This puts restrictions on the CAN bus topology considering bus length, number of CAN nodes etc. when running at bit-rates higher than 250 kbps. The CAN4 interface has bus load bandwidth limitations for CAN baud rates above 75 kbps. The transmission capacity decreases with increasing baud rates.
Protection	Short circuit protected to -36V to +36V

USB 2.0 interfaces	
Type	1x USB 2.0 compatible host ports
Speed	Full-speed (12 Mbps) and Hi-speed USB (480 Mbps) is supported.
VBUS supply	5.0 V, 0.5 A per port, internally over-current (typically 0.7 A) and short-circuit to ground protected.

Ethernet	
Type	10/100 Mbps Ethernet compatible with 10BASE-T and 100BASE-TX Ethernet standards. Auto-MDIX support.
Insulation voltage	$1500V_{AC.}$

Configurable Inputs	
Number of inputs	2
Input voltage tolerance	+38.0 V (max), referred to main supply ground. -36 V (min), referred to main supply ground. (inputting voltages greater than specified may damage the device)
Digital input levels Voltage input high Voltage input low Hysteresis Impedance* Impedance pull-up Impedance pull-down	applies to both Digital and Frequency modes. >2.3 V (typ) <1.0 V (typ) 0.2 V (min) 130kΩ at 0-3V, ~36kΩ at >3V (typical) ~10 kΩ to internal 5V through diode. ~10 kΩ to ground *Typical input impedance without pull-up/down*
Frequency measurement Frequency range Time base Resolution Accuracy	Input amplitude ranges according to above. 1Hz* to 50 kHz **Measure possible from 0.1Hz, with slower update, with alternative settings* 20 MHz 0.1 Hz ± 100 ppm
Frequency + duty cycle Frequency range Duty-cycle range Time base	Input amplitude ranges according to above. 35Hz to 1000 kHz 1 – 99% outside duty-cycle limits may cause inaccurate readings. 20 MHz (± 100 ppm)

Resolution	0.1 Hz	
Accuracy frequency	0.1%	35Hz to 1000Hz
	0.2%	1000Hz to 2000Hz
	0.4%	2000Hz to 5000Hz
Accuracy duty cycle	1%	35Hz to 1000Hz
	2%	1000Hz to 5000Hz
Voltage measurement 5V		
Range	0 – 5.2 V_{DC}	
Accuracy	± (0.5% + 10 mV)	
Resolution	1 mV	
Input Impedance	130kΩ at 0-3V, 36kΩ at >3V (typical)	
Voltage measurement 32V		
Range	0 – 38.2 V_{DC}	
Accuracy	± (0.5% + 100 mV)	
Resolution	1 mV	
Input Impedance	82kΩ at 0-3V, 36kΩ at >3V (typical)	
Resistance measurement		
Range	0 Ω – 2.4 kΩ	
Accuracy (typ)	±0.25Ω	at 0Ω - 5Ω
	±1.35%	at 50Ω - 100Ω
	±3%	at 8.5Ω - 600Ω
	±5%	at 5Ω - 1.2kΩ
	±10%	at 2Ω - 2.4kΩ
Resolution (typ)	0.1Ω	
Current measurement		
Range	0 – 30mA, (limited to ~35 mA)	
Input impedance	100 Ω	
Accuracy	4 – 20mA ± (1% +50µA)	
Resolution	1µA	

Configurable Outputs	
Number of outputs	2
Output voltage	Supply Voltage
Nominal output current	1.0A
Protection	
Over current slow	>1.0A shut off by SW measuring current.
Over current fast	~9A (type) shut off by HW at fast rising, like shortcut.
Over temp	shut off at internal switch overtemp detection.
PWM output	
Frequency	1 to 5000Hz
Duty	0 to 4095 (corresponds to 0 to 100%)
Diagnostics	Short to GND, short to battery, overload, open load, over temperature
ON/OFF Pull-up resistor	10k to Supply Voltage
On-state resistance	200 mΩ (typ), 400 mΩ (max)
Turn-on time	70 µs (typ), 150 µs (max)
Turn-off time	70 µs (typ), 150 µs (max)
Leakage current	<1 µA (typ)

Buzzer	
Frequency range	700 – 10 kHz (SPL peak at 2830 Hz)
SPL range	75 dBA (max) at 0.1 meter (typ, 2500 ± 200Hz) The buzzer is located on the back (connector side) of the device and the typical SPL varies dependent on the acoustic properties of the installation environment and mounting hardware.

Software	
Operating system	CC Linux
Additional software	CCAux API, CCSettingsConsole. Refer to the *CCpilot V510/V710 Software Guide* and *Programmer's guide* for details.

Display CCpilot V510	
Size	
Diagonal size 5"	5 inch widescreen
Active area 5"	108.6 x 65.16 mm
Pixel pitch 5"	0.13575 x 0.13575 mm
Type	TFT a-Si (IPS type)
Aspect ratio	15:9
Resolution	WVGA, 800x480
Colour depth	24 bit (16.7M colors)
Contrast ratio	600:1 (min), 800:1 (typ)
Viewing angle	Horizontal: ± 85° Vertical: ± 85°
Backlight	

Type	LED
Brightness	900 cd/m^2 (typ)
LED Life time	50 000 h (typ) before brightness is reduced with 50 % (when operated with full brightness at 25 °C) (Note that sustained higher operating temperatures affects LED lifetime.)
Cover glass	
Protective glass	
thickness	1.8 mm
Surface treatment	Etched Anti-Glare, haze 10 ± 3%
Surface Hardness	6H

Display CCpilot V710	
Size	
Diagonal size7"	7 inch widescreen
Active area 7"	152.4 x 91.44 mm
Pixel pitch 7"	0.1905 x 0.1905 mm
Type	TFT a-Si (IPS)
Aspect ratio	15:9
Resolution	WVGA, 800x480
Colour depth	24 bit (16.7M colors)
Contrast ratio	800:1 (min), 1000:1 (typ)
Viewing angle	Horizontal: ± 88° Vertical: ± 88°
Backlight	
Type	LED
Brightness	800 cd/m^2 (typ)
LED Life time	50 000 h (typ) before brightness is reduced with 50 % (when operated with full brightness at 25 °C) (Note that sustained higher operating temperatures affects LED lifetime.)
Cover glass	
Protective glass	
thickness	1.8 mm
Surface treatment	Anti-Glare, haze 10 ± 3%
Surface Hardness	6H

8.2. Environmental specifications

Environmental Test	Test standard	Notes
Dry Heat	IEC 60068-2-2:2007	Operating: +70°C, 24h Storage: +80°C, 24h
Damp Heat	IEC 60068-2-30:2005	Operation: +10°C / +65°C >95% RH 12*24h
Cold	IEC 60068-2-1:2007	Operating: -30°C, 24h Storage: -40°C, 24h
Change of temperature	IEC 60068-2-14:2009	-30°C to +70°C, 5°C/min 1hr hold time, 20 cycles
Vibration	IEC 60068-2-64:2008	0.02 g^2/Hz 5-2000 Hz 3x3h
Shock	IEC 60068-2-27:2008	±50g /11ms ±3x3 impulses ±25g /6ms ±3x2500 impulses
Enclosure Ingress Protection	IEC 60529:2014	IP65, IP66 and IP67

Any changes or modifications to the device not expressly approved by CrossControl could void the environmental classification, warranty, and user's authority to operate the equipment.

8.3. EMC specification

The CCpilot V510/V710 device has been tested for Electromagnetic Compatibility according to the following standards EN ISO 14982 and ISO 13766-1.

EMC Test	Test standard	Notes
Electrical Transients	ISO 7637-2:2011 ISO 16750-2:2012 12 V system	**Pulse** **Level** 1 -75V 2a +37V 2b +10V 3a -112V 3b +75V Starting profile +4.5V Load dump +65V, Ri = 2Ω
	24 V system	1 -600V 2a +112V 2b +20V 3a -300V 3b +300V Starting profile +12V Load dump +202V, Ri = 2Ω
ESD immunity	ISO 10605:2008	Air ± 15 kV Contact ± 8 kV
Radiated RF immunity (1)	ISO 11452-2:2019	**MHz** **Level** **Modulation** 200-1000 100 V/m 80%AM, 1kHz 800-2000 30V/m PM 2000-2400 10V/m PM 2400-2700 5V/m PM
	ISO 11452-4:2011 (BCI)	**MHz** **Level** **Modulation** 20-200 60 mA 80%AM, 1kHz
Radiated RF emission (1)	ISO 13766-1:2018	**MHz** **Narrow-b. dBµV/m** **Broad-b. dBµV/m** 30-75 54-44 64-54 75-400 44-55 54-65 400-1000 55 65

(1) Compliance to RF immunity and RF emission standards require use of shielded cables for Ethernet and USB interfaces.

EMC tests are performed at 24 V_{DC} supply voltage unless other levels are specified in test standards.

System level compliance to relevant EMC standards may be affected by external factors like mounting, omitting the use of shielded cables etc.

8.4. Weight and dimensions

Attribute	Description	Comments
CCpilot V510 Dimensions	176 x 109 x 49 mm	(W x H x D)

CCpilot V710 Dimensions	233 x 135 x 49 mm	(W x H x D)
CCpilot V510 Weight	0.45 kg	
CCpilot V710 Weight	0.72 kg	
Mounting holes V510 Spacing Thread dimension Thread depth	RAM-B-238U 48.6mm M5 8.0 mm	
Mounting holes V710 Spacing Thread dimension Thread depth	RAM-202U Dia 46 mm M5 8.0 mm	
Enclosure material	PBT + PC plastic, impact modified and flame retarded	

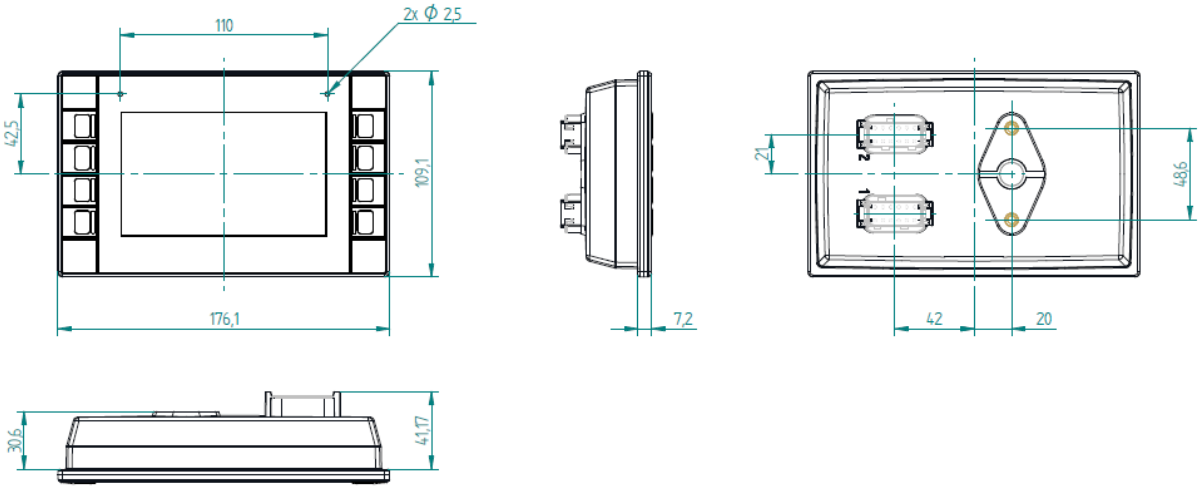

Figure 19: CCpilot V510 dimensions.

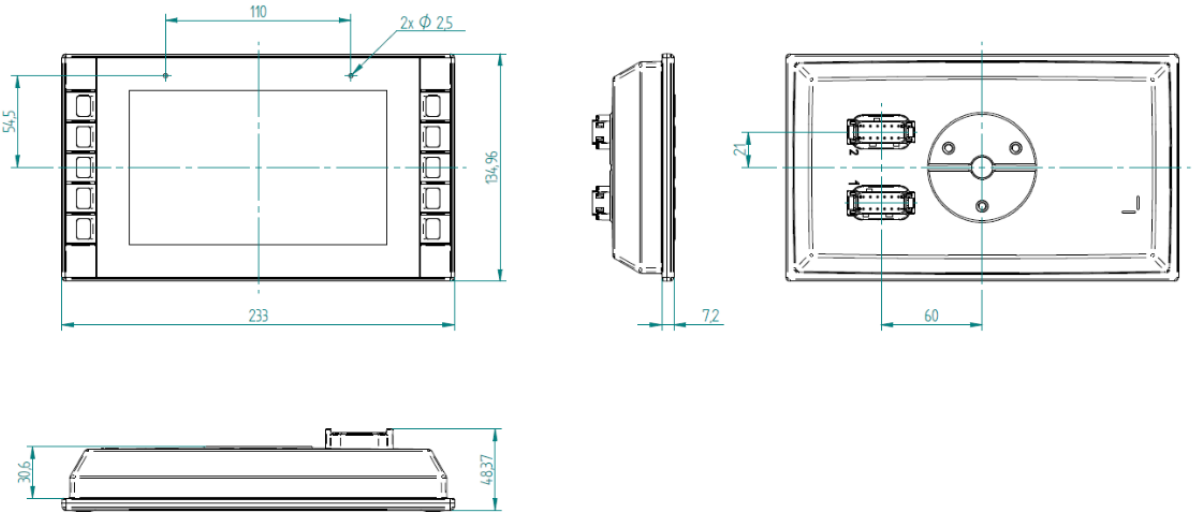

Figure 20: CCpilot V710 dimensions

Technical support

Additional sources of information are available on the CrossControl support site:
http://www.crosscontrol.com/support

Contact your reseller or supplier for help with possible problems with your device. In order to get the best help, you should have your device in front of you and be prepared with the following information before you contact support.

- Part number and serial number of the unit, which you find on the identification label, see Figure 1.
- Date of purchase, which is found on the invoice.
- The conditions and circumstances under which the problem arises.
- Error codes signaled by the internal buzzer.
- Possible error messages which are shown.
- Device log files (if possible).
- Information regarding possible external equipment which is connected to the device.

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