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CCpilot VA

Technical Manual

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ADAM KEY
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Contents

1. Introduction

CCpilot VA is a freely programmable display computer with 7" full-colour TFT and optional touch screen.

The powerful ARM® based CPU and Linux® operating system constitutes an open platform that enables implementation of premium user-machine interaction, reliable controls and integrated fleet management.

This technical manual provides important information regarding the device's hardware and its basic usage. For software and operating system specifics, please see additional documentation.

1.1. Product models

This documentation is applicable for all *CCpilot VA* standard models. These models are:

- *CCpilot VA* with pushbuttons and taped glass (no touch-screen).
- *CCpilot VA* with pushbuttons and optically bonded glass (no touch-screen).
- *CCpilot VA* with pushbuttons and taped capacitive touch-screen.
- *CCpilot VA* with pushbuttons and optically bonded capacitive touch-screen.

All models offer the same level of CPU performance and external connectors/interfaces.

The above product models are compatible with the CrossLink AI module to support wireless interfaces GSM/GPRS, WLAN and Bluetooth for communication and GPS for positioning.

1.1.1. 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 maximatecc for customization inquiries.

1.2. Document conventions

This document uses the following conventions:

Description	**Appearance**	
Important information		(exclamation symbol)
Model specific information		(observe symbol)

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

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

1.3. Identification

Each device has a label with article number, revision and serial numbers which identify your unique device. Take note of these numbers. During service and other contact with the supplier it is important to be able to provide this information.

1.4. Ruggedization

The *CCpilot VA* device has been designed to manage tough environmental demands. Much effort has been put into designing and selecting system components to provide a reliable and robust device.

Thorough testing has been performed in order to ensure compliance to a broad range of applicable regulatory requirements and to meet the user expectations of a ruggedized device for vehicle- and machinery control.

A complete list of standards to which the device has been tested for compliance can be found in *chapters 7.2 - 7.3*.

2. Device overview

This chapter contains illustrations of the *CCpilot VA* models showing the location of external connectors, indicators etc. Information about various *CCpilot VA* models can be found in *chapter 1.1 - Product models*.

Connectors are described in more detail in *chapter 6*.

Additional mechanical information can be found in *chapter 7.4*.

2.1. Front side view

At the front side of the device there is a 7" display with either a protective glass or a glass with projected capacitive touch-sensor (PCAP).

There are 10 x soft keys with user configurable functionality (backlight control, power on/off, suspend/resume or application specific functions). The buttons are backlit to be clearly visible also at dark conditions.

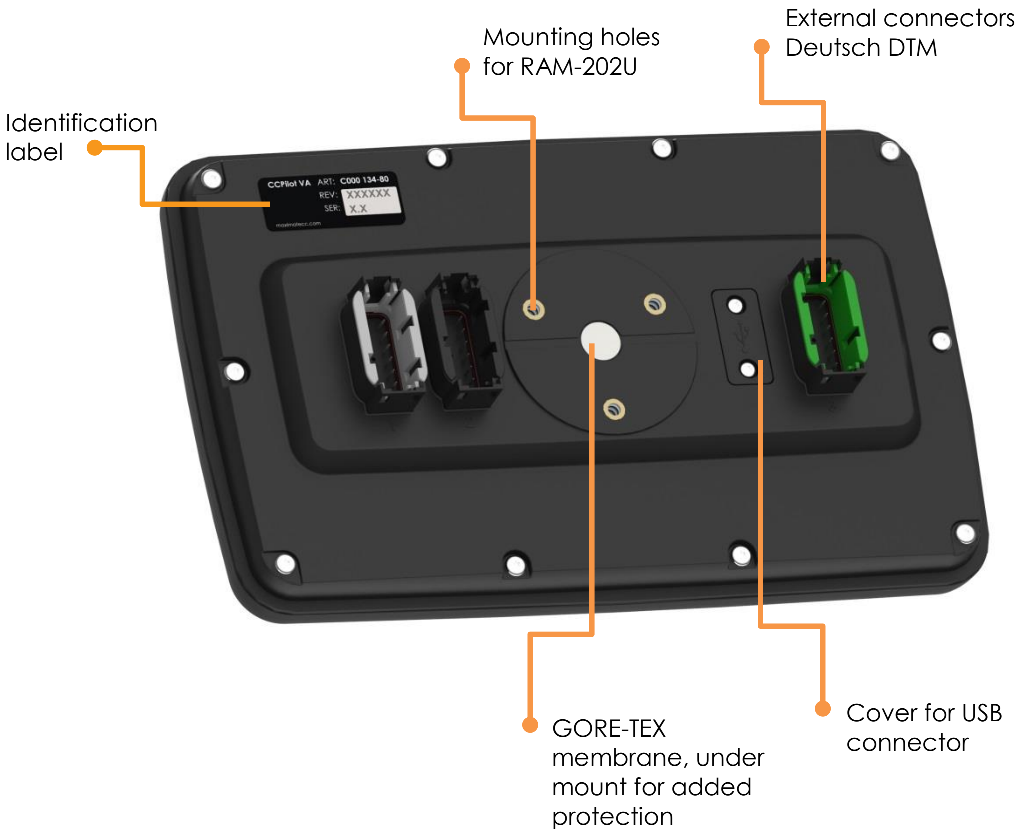
There is also a light sensor in the front panel which enables automatic dimming of display and buttons backlight.

***CCpilot VA* front side view**

2.2. Rear side view

At the rear side of the device there are external interface connectors, i.e. 3 x Deutsch DTM-12 connectors and an additional USB Mini-B receptacle located under a sealed cover.

There are also mounting holes for 1.5” RAM® ball mount (RAM-202U) or custom bracket for panel mounting and a GORE-TEX® membrane for ventilation.



***CCpilot VA* rear side view**

3. Mounting and handling

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

3.1. Mounting

CCpilot VA has the capability to support two different mounting methods, either using an industry standard RAM ball mount or mounting in a panel cutout. These two mounting methods are described further below.

For both fastening methods, it is recommended to use 3 pc. M5 x 0.8 button head screws of type MRT (Torx), length should be 12 mm. The recommended fastening torque is 1.5 - 2.0 Nm. Using a split ring or toothed lock washer is recommended. Ensure that the M5 mounting screws are clean and dry before mounting.

Note that the depth of the threaded holes is 9.5 mm. Be careful not to use too long screws which may damage the iwhen 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.

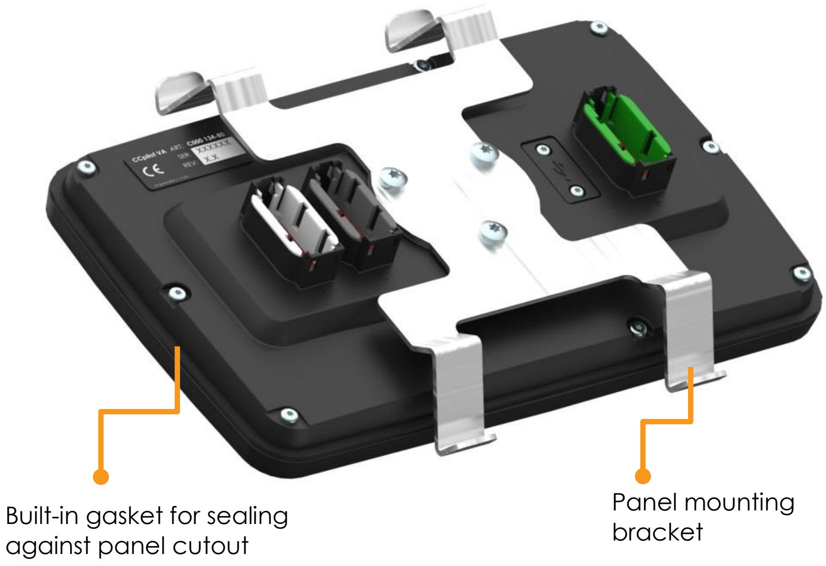
3.1.1. RAM mount

CCpilot VA is preferably mounted using a RAM mount, i.e. RAM-202U, a round base 1.5" ball mount which allows adjustment of the display's position and angle.

***CCpilot VA* with RAM mount**

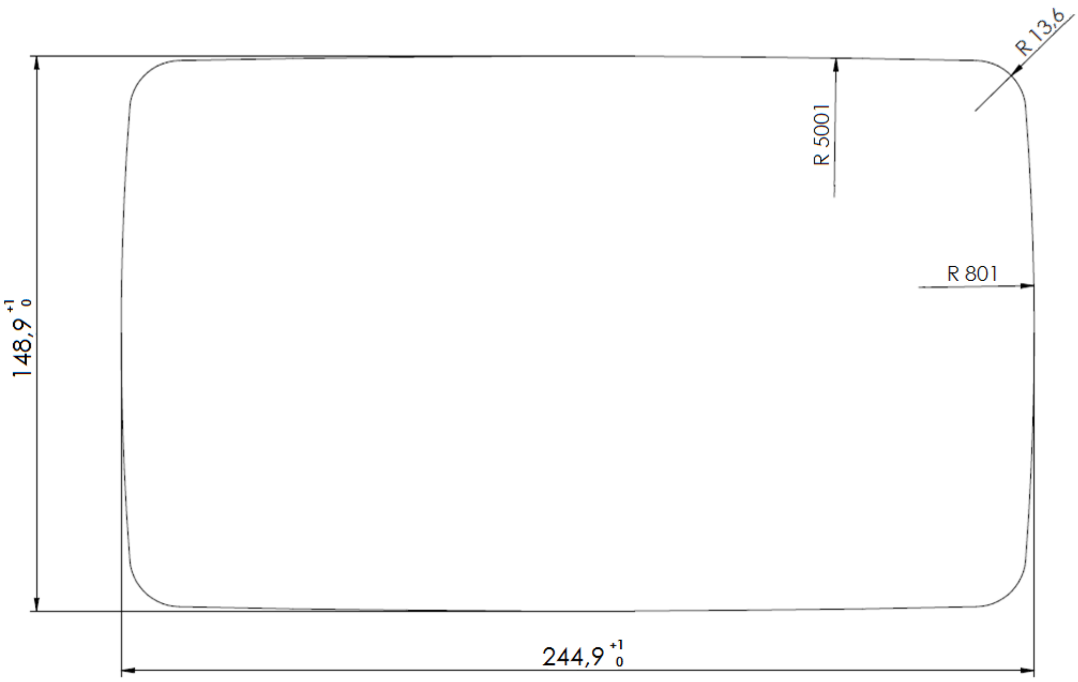
3.1.2. Panel mounting

Alternatively, the device can be mounted in a panel-cutout using a panel mounting bracket (article number C000134-07), see figure below.



***CCpilot VA* with panel mounting bracket**

The mounting bracket is designed for a panel thickness of 1.5 - 3.0 mm. Panel cutout dimensions are according to figure below. A drawing in DXF-format for precision cutting of panels is available upon request.



The device has a built-in gasket to provide some amount of sealing towards the panel. Ensure that the device is mounted to a smooth, flat surface. Fastening the device to an uneven surface will affect the sealing property and may stress the enclosure or damage the outer flange, leading to premature failure. Additional gasket or other means for sealing may be required to reach higher IP levels.

3.2. Connecting to power supply

This chapter describes how the *CCpilot VA* is preferably connected to the power supply of a vehicle, or other machinery. The principle is the same also for other types of installations.

Carefully read through the following sub-chapters before installing the device. Connector pinouts are found in *chapter 6*.

3.2.1. 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 VA* device is found in *chapter 7.1*.
- Power consumption of external loads driven by the *CCpilot VA* device should also be taken into account.
- Note that the *High side PWM outputs* are automatically switched OFF when the supply voltage drops below approximately 8 V_{DC}, for example while cranking the engine of a vehicle or machine. This is a measure for limiting the input current and voltage drop in the supply cables.
- As a guideline, the minimum wire gauge for the power supply should be: 0.75 mm^2 /AWG 18.

3.2.2. 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 7.1* for fuse rating details.
- As a guideline, a slow acting fuse with 5-8 A current rating should be used.
- Remember to also apply fusing for the on/off control wiring, see *chapter 3.2.3* below.

3.2.3. External On/off signal

The device's external on/off control signal should be connected to the positive supply line via the vehicles or machines turnkey switch or a separate on/off switch (see switch “S2” in application example, *chapter 3.2.4*).

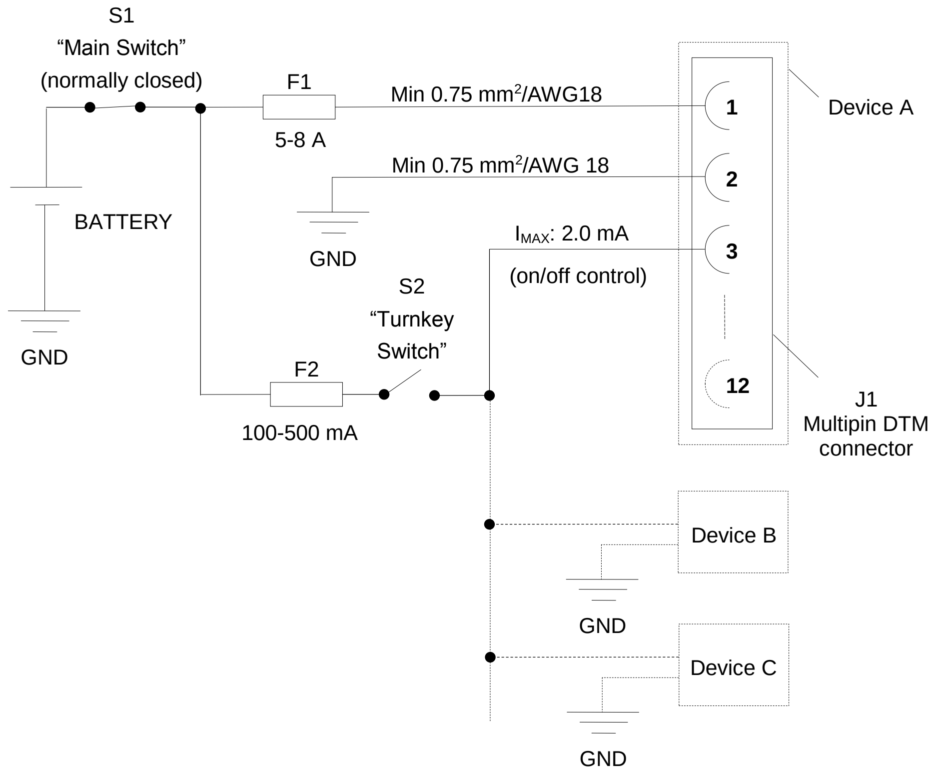
- Several *CCpilot VA*, or other devices, may be controlled by the same switch by joining their on/off control signals. The *CCpilot VA* device has an internal pull-down of 20 kΩ (typ), giving a worst case current of 2.0 mA per device at 32 V_{DC} input.
- The wire gauge for the on/off signal shall be 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 blows fuse in the range of 100-500 mA for the on/off signal should be sufficient for most practically usable wire gauge.

3.2.4. Application example

Below is an application example schematic of the *CCpilot VA* 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 on/off signal shall be connected after the main switch. Observe that this switch is only intended for disconnecting all system loads to prevent draining of the battery during prolonged dormant periods and shall **not** be used for starting/shutting down the *CCpilot VA* device on a regular basis.



Schematic example for power supply installation of one or more *CCpilot VA* devices in vehicles or other machines. The on/off control switch (S2) is shared by several devices (Device A, B, C…).

By connecting the power supply according to the example above, the *CCpilot VA* device(s) will automatically start up when the Turnkey switch (S2) is closed and shut down when the switch is opened.

Note that the on/off behaviour of the *CCpilot VA* described is the default configuration. Its response to the on/off signal may be disabled or changed by user applications. For example, the signal may be configured for suspending and resuming the device or the device may be configured to always start when the power supply is available. See *chapter 4* for more details and configurations available.

3.2.5. Precautions

Ensure that the device is shut down properly before switching off external power (main switch “S1” in example above). Ensure that any application data is saved prior to turning off the device.

- Sudden power disruptions may cause the device to shut down, potentially causing loss of user data (if not written to flash) or, at worst case, corrupted flash storage areas. If the power supply voltage sometimes fluctuates drastically, for example while running a starter engine, the *CCpilot VA* device should be started after the vehicle engine has been started.
- All cables to the *CCpilot VA* device shall be disconnected during welding to a machine.
- Be advised that the *CCpilot VA* device consumes a small amount of power from the main supply also when shut down or suspended (see chapter 7.1). 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 (see application example, *chapter 3.2.4*).

3.3. Grounding/touch-screen decoupling

This chapter applies primarily to touch-screen enabled product variants.

Capacitive touch-screens are, by design, sensitive to common-mode noise, i.e. electrical noise between its ground reference and the ground reference of its surrounding and person operating the touch-screen.

Therefore, the *CCpilot VA* device has a dedicated touch-screen grounding connection (connector J2, pin 5) for decoupling common-mode noise from the main supply.

The dedicated touch-screen grounding is highly recommended to be used for reducing noise susceptibility and avoiding false (unintentional) or imprecise touch detections. Connect a wire of minimum length, less than 2 m (or 80 inches), from connector J2, pin 5 directly to the nearest ground structure (vehicle chassis).

- The touch-screen ground connection is capacitively connected within the *CCpilot VA* device and will not cause ground-loops.
- For best noise cancelation effect, the grounding structure used for touch-screen decoupling should be proximate to both the *CCpilot VA* device and to the *operator* of the device.

3.4. Cable installation

Cables shall be installed in such a way that they don’t 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 snap the connectors to give reliable contact and sealing and to avoid unnecessary strain.
- Shielded cables are recommended and in some cases necessary to ensure reliable communication and appliance with industrial EMC standards.

3.4.1. Recommendations for cable shields and coaxials

To achieve electromagnetic compliance and stable operation of the end system, shielded cables may be required for CAN, Ethernet and USB interfaces. In addition, it is recommended to use 75 Ω coaxial cables for connecting analog video sources to the device.

Note that the Ethernet and USB interfaces don't have dedicated pins in the DTM connector for connecting cable shields.

- If shielded cable is used for Ethernet, the shield is preferably connected/grounded at the other end of the cable (and remain unconnected close to the *CCpilot VA* device).
- If shielded cable is used for the main USB port, the shield is preferably spliced and joined with the USB ground wire externally. Avoid creating ground-loops in the USB cable by insulating any attached USB-devices from ground structures connected with the *CCpilot VA* 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.

1. 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.
2. Minimize distance between cable joints and the DTM plugs for best shielding effect.

3.5. Special considerations

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

- The device should be placed in a way that prevents direct exposure to water or sunlight or near 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 three Deutsch DTM connectors must be attached to the device. Blind plugs must be used for unconnected pins. The sealed USB-port hatch at the backside of the device must also be properly attached.
- The device has a GORE-TEX® membrane for ventilation, see location in *chapter 2*. 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 or detach the membrane. Doing so will violate the IP-classification and void the warranty of the device.
- Install the device and any cables attached such 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's recommended to have it cleaned off as soon as possible. See *chapter 3.6.1* for cleaning instructions.

3.6. 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 authorised personnel. If the device is opened by unauthorised personnel, its warranty will be voided.
- Scratches or other damages may occur to the display surface if it is exposed to sharp objects or heavy impacts. This must be avoided to increase the longevity of the screen.
- The internal NAND 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.
- Always consider personal safety when installing and operating the device. For example, in vehicle installations, maximatecc does not recommend that the device is being actively operated by the driver when a risk of injury to people or damage to property is present.

3.6.1. 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.

3.6.2. RTC clock back-up battery

Time and date information is stored in a memory sustained by an internal back-up battery.

The expected life time of the battery is approximately 10 years. Contact supplier for instructions on replacing the battery.

4. Basic operation

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

Observe that the behaviour of various 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

Button backlight is used for status notification while starting up, shutting down or when de device is in suspend mode. Both button backlight and the buzzer is software controllable for notifications from user applications.

See *chapter 4.5* for details of button backlight status notification.

The buzzer is also used for various error notifications, see *chapter 4.6* for error code details.

4.1. Turning ON/OFF

The device can be configured to turn ON or OFF from one or more of the actions described in the following chapters. Not all on/off triggers are enabled by default but all software configurable.

To ensure that data does not get lost or the flash memory becomes corrupt, it is recommended that necessary data is saved and user application properly closed before the device is shut down.

Note that the shutdown triggers described herein don't have affect if the device has entered Suspend mode. The device must either first be *resumed* or reach its *suspend time-out* to be able to shut down. See *chapter 4.2* for suspend/resume details.

4.1.1. External ON/OFF signal

Turn ON the device by pulling the signal high (above 5.0 V), preferably by connecting to the positive supply voltage through a turnkey switch according to the application example (see *chapter 3.2.4*).

- This start-up action is enabled by default but may be disabled by user application.

Turn OFF the device by disconnecting or pulling the signal low (below 1.0 V) for at least 4 seconds (default response time) , i.e. using the turnkey switch. See *chapter 3.2.4* for application example.

- The external on/off signal is configured as *shut-down trigger* by default but may be *disabled* (or changed to *suspend trigger*) by software. The response time defaults to 4 seconds but is user configurable.
- Note that the device won't restart automatically if the external on/off signal is brought high while the device is in the progress of shutting down (shutdown may take several seconds). A low-to-high transition must occur after the shutdown is fully completed to trigger a restart. Increase the shutdown trigger response time in case you don't want the *CCpilot VA* device to shut down during short stops.

4.1.2. Front panel button(s)

Turn ON the device by short-pressing any of the front panel buttons configured as *start-up triggers*.

- Note that none of the buttons are configured as start-up triggers by default.

Turn OFF the device by either short- or long-pressing any of the buttons configured as *action triggers* with shutdown action assigned to either short- or long-presses.

- Note that none of the buttons are configured as start-up triggers by default.
- The time-out for detecting long presses is user configurable but defaults to 4 seconds.

4.1.3. "Always switched on" mode

It is possible to configure the device to always start up when external power is connected, i.e. without using any particular on/off controls.

- Note that this function is not enabled by default but may be enabled by the user.
- The device can still use suspend/resume functionality. See *chapter 4.2*.
- Shutting down the device is still possible. If shut down, the device can be started up by cycling the main power or by any of the enabled start-up triggers, i.e. external on/off signal or buttons.

4.1.4. Linux shutdown command

The device can be turned OFF by executing Linux shell shutdown commands, for example:

```
# shutdown
```

4.1.5. Forced shutdown

If the device stops responding, a forced shutdown can be performed by pressing and holding any button configured as *action trigger* until the device is switched off.

- The button press response time for the forced shutdown is double the user configurable *long press* detect time – or a minimum of 8 seconds. Default press time for forced shutdown is 8 seconds.
- Note that none of the buttons are configured as action trigger per default. This must be changed by software to enable forced shutdown.

It is **not** recommended to use the forced shut down unless absolutely necessary - 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 performing a forced shutdown. Any ongoing writing to the flash memory will be disrupted which may lead to a corrupted file system.

4.2. Suspending/resuming

Suspending and resuming are faster alternative to shutting down and starting up the device normally.

In suspend mode, the data remains in RAM to allow very fast wake-up without need for restarting the operating system or software applications. Note that the device must be connected to external power supply to maintain its state during suspend mode.

To prevent the device from draining a machines battery when suspended for a longer period of time, it is possible to set a time-out after which the device is automatically shut down. The time-out is user configurable and defaults to 60 minutes. It is also possible to disable this function (by setting the time-out to zero).

Current consumption in *suspend* mode is somewhat higher than in *shutdown* but is still low enough to allow relatively long suspend times without draining a machines battery. See *chapter 7.1* for details about current consumption at different modes and supply voltages.

Different ways of suspending and resuming the device are listed below:

Suspend triggers:

- External on/off signal brought low (enabled as shut-down trigger by default)
- Action trigger buttons (short- or long-press, not enabled by default)
- Linux suspend command

Resume triggers:

- External on/off signal brought high (enabled by default)
- Action trigger buttons (not enabled by default)
- CAN bus activity detection (not enabled by default)
- Configurable Input state change (digital inputs)

Make sure to enable one or more *start-up triggers* prior to entering suspend mode, otherwise the device won't be able to resume.

4.3. Adjusting the screen (and button) brightness

With the *CCpilot VA* device it is possible to configure any of the front-panel buttons for adjusting display brightness up or down.

- Note that all button actions are disabled by default.

The screen brightness can also be controlled directly from user applications through APIs or configured for automatic brightness adjustment through the ambient light sensor. When automated dimming is enabled, the level of sensitivity can be adjusted.

Button backlight can be configured to automatically follow the display brightness setting. The button backlight may otherwise be controlled directly from user applications through APIs.

4.4. Using the touch-screen

Note that not all *CCpilot VA* products variant contains a touch-screen.

Basic usage of the capacitive touch screen should be intuitive for most users. Refer to the *CCpilot VA Software guide* for details about touch calibration.

4.5. Status notification

Button backlight is used for status notification while starting up, shutting down or when de device is in suspend mode. Button backlight is software controllable for notifications from user applications.

The table below describes the *default* behaviour of the status notification for different operational states.

Operational state	Soft key backlight behavior
Device off	OFF
Starting up	Flashing, 2 Hz
Operating (started up)	OFF
Suspend mode	Short blink every ~20 second.
Shutting down	Stays ON or OFF depending on previous setting.

The internal buzzer may also be used for user notifications.

Observe that the status notification behaviour in the *operating* state is user configurable via software APIs. Default notifications may also disabled for other operational states.

4.6. Error codes (button backlight and buzzer notifications)

The internal buzzer and the button backlight is used for signalling error codes when the device shuts down or cannot start up due to severe hardware or software failure.

When this happens, the device will either try restarting or remain shut off, and indicates the failure reason by beeping the buzzer in different pattern. The pattern is a certain number of beeps and blinks followed by a longer pause after which the sequence is repeated. The number of beeps and blinks is important information if the unit is sent in for service/repair.

The table below lists the different error codes.

Number of beeps or blinks	Error code	Likely problem cause
1	Error reading from "SS FRAM" holding device specific configuration data and diagnostics.	Corrupted configuration settings in SS FRAM.
2	Error writing to "SS FRAM" holding device-specific configuration data and diagnostics.	Corrupted configuration settings in SS FRAM.
3	Error initializing SS hardware drivers.	SS FRAM or temp/light sensor malfunction.
4	Error reading internal voltages, voltage out of limit.	Internal voltages is outside allowed limits.
5	Time-out error waiting for Main processor to boot.	Faulty or un-programmed NAND Flash (OS image) or hardware error.
6	Time-out error wating for internal voltages to start-up.	Unstable internal voltages.
7	Error reading temperature sensor (over- or under-temprerature)	Temperature sensor malfunction or extreme operating conditions.
10	Clock error.	SS clock crystal malfunction or SS processor failure.
11	Error in SS program execution path	SS processor failure or programming bug.
12	Error managing device diagnostics	Corrupted configuration settings in SS FRAM.
13	Error managing activation/de-activation	SS processor failure or programming bug.
14	Error in tick-timer	SS processor failure or programming bug.
15	Error in operating mode	SS processor failure or programming bug.
16	Error in reading SS I/O channels	SS processor failure or programming bug.
17	Error in writing SS I/O channels	SS processor failure or programming bug.

5. Interface overview

This section describes the various interfaces of the device. Main part of these interfaces can be accessed via software APIs. These are described in the *CCpilot VA Software Guide* and *CCpilot VA Programmers Guide*.

5.1. Storage memory

An industrial grade SLC (singe level cell) NAND flash is used for data storage. This makes the device resilient to shock and vibrations which would be a problem when using mechanically rotating hard disks. The SLC flash device has the advantage of superior endurance and long term reliability compared to cheaper commercial graded MLC flash devices.

The Flash module is industrial grade classified and the file system used (UBIFS) has both static and dynamic wear levelling to prevent wear-out for extended lifetime. Still it has a limited number of write cycles. It is recommended that the amounts of writing to storage are limited within the software applications.

5.2. Front panel

5.2.1. 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 *chapter 2.1*. Refer to the *CCpilot VA Software guide* for details about accessing the light sensor data from user applications.

5.2.2. Pushbuttons

There are 10 pushbuttons in the front panel. Each button is software configurable and may be used as user application actions triggers, controlling backlight intensity, turning the device on/off or suspending/resuming.

Refer to the *CCpilot VA Software guide* for details about configuring button actions and reading the buttons from user applications.

5.3. Buzzer

There is a built-in buzzer that can be used for audible notifications. The buzzer is software controllable with configurable volume and frequency.

See *chapter 4.6* for buzzer error codes. Refer to the *CCpilot VA Software guide* for details about controlling the buzzer from user applications.

5.4. Analog video inputs

There are two video inputs for connecting analog video sources such as rear-view or surveillance cameras. Note that both inputs cannot be enabled/displayed simultaneously. Displaying of analog video is handled in hardware with minimum impact on CPU load.

The analog video inputs support a wide range of commonly used composite video formats (both PAL and NTSC).

- See *chapter 7.1* for details.

For proper video performance and to ensure electromagnetic compatibility, 75 Ω coaxial cable should be used for connecting video sources. Preferably use coaxial cables of type M17/94-RG179.

- Refer to *chapter 3.4.1* for recommendations about connecting video coaxial cables.

It is important to supply analog video sources with a stable well-filtered supply voltage. Note that video input grounds are internally connected with main supply ground. Precautions should be made to avoid ground-loops between the video sources and main supply ground which could affect video quality. One way of avoiding ground-loop is to add video isolators or use video sources with galvanic isolation between supply- and signal ground.

5.5. CAN

CCpilot VA has two CAN ports, supporting ISO 11898 CAN 2.0B protocol (29-bit extended identifier) and bit rates up to 1 Mbit/s.

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, i.e. above 250 kbit/s.

The ports feature highly protected CAN-transceivers which are tolerant for bus short-circuits to main supply voltage and ground.

CAN shield connections are according to J1939-11 with capacitive coupling to ground. There is no device-internal CAN bus termination, therefore bus termination must be applied externally.

- Refer to *chapter 3.4.1* for recommendations about connecting CAN cable shields.

5.6. Ethernet

CCpilot VA has an Ethernet interface supporting 10BASE-T/100-BASE-TX and Auto-MDIX.

The Ethernet interface is galvanically isolated with 1.0 kV_{AC} insulation voltage.

Shielded cables shall be used to ensure reliable communication and electromagnetic compliance. Note that there's no dedicated Ethernet shield connection on the *CCpilot VA* device, meaning that the cable shield must be terminated externally to provide full protection in electromagnetically noisy environments.

As with all Ethernet enabled devices, connecting the device to a public network environment may impose an IT security threat.

5.7. USB

CCpilot VA has two USB ports. One port is located in the multipin connector J1 and function as a USB host-port only. It can be used for connecting USB storage devices or other peripherals such as mouse, keyboard or various wireless interfaces.

The second USB port support USB OTG, i.e. acting as either host or device port, and is primarily intended for development use. It has a USB Mini-B port connector located under a sealed cover on the back of the device, see figure below.

- In USB *host-mode* (default mode), this port supports the same functionality as the first USB host port.
- USB *device-mode* is normally only used for loading the operating system image during production or recovery in case the internal flash storage is corrupted to a point where self-recovery is no longer possible. It is also possible to implement other USB device functionality, such as *USB mass-storage* or emulating a *USB Ethernet interface*. However, there is no build-in software support for such USB device implementations.

Note that the sealing property (IP classification) of the device is not retained when removing the hatch for accessing the second USB port.

Each USB ports can supply up to 500 mA, according to the USB 2.0 specification. The USB ports are internally over-current and short-circuit protected. Shielded cables shall be used to ensure reliable communication and electromagnetic compliance.

- Refer to *chapter 3.4.1* for recommendations about connecting shield cables.

Due to limitation in the multipin connector specification, USB data signal integrity cannot be guaranteed at higher speeds than full-speed USB (12 Mbps). Nevertheless, hi-speed (480 Mbit/s) operation is supported by the USB host controller and has demonstrated good stability for most applications. Using high-quality, shielded USB cables with minimum cable length improves noise immunity and USB stability.

5.8. Configurable Inputs

CCpilot VA has eight configurable inputs for a wide range of digital and analog measurements.

Note that there are two types of inputs. Channels 1-4 support resistance measurement but lack internal pull-up resistors. Channels 5-8 lack support for resistance measurement but have internal pull-up resistors. A summary of digital and analog input modes for each input are listed in the table below:

Input modes		Configurable Input 1-4	Configurable Input 5-8
Digital input modes			
Digital input	Selectable ranges:	5V, 10V or 32V	5V, 10V or 32V
	Selectable input configurations:	Floating or pull-down	Floating, pull-up or pull-down
Frequency measurement	Selectable range:	0.1-15 000 Hz	0.1-15 000 Hz
	Selectable input configuration:	Floating or pull-down	Floating, pull-up or pull-down
Analog input modes			
Voltage measurement	Selectable ranges:	5V, 10V or 32V	5V, 10V or 32V
Current measurement	Range:	4-20 mA	4-20 mA
	Input resistance:	100 Ω (overload protected)	100 Ω (overload protected)
Resistance measurement	Selectable ranges:	500 Ω or 5 000 Ω	(N/A)

For electrical specification at different input modes, see *chapter 7.1*.

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.

The co-processor handles all configurable inputs and adds features such as averaging for frequency measurement and protection of current input shunt resistors. Measurement results are accessible to user applications through software APIs. Refer to the *CCAux API documentation* for programming details. Each input mode is described more in chapters 5.8.1 - 5.8.4 below.

5.8.1. 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 individually configured for accepting a variety of logic signal levels and can be set as either floating, with internal pull-down (available on all channels) or internal pull-up (available on channels 5-8 only). This makes the inputs compatible with a wide range of sensors with different output types and signal levels.

The selectable internal pull-ups (input 5-8 only) are sourced from the main supply input through internal over-voltage protection. Therefore, pull-ups will follow the main supply voltage but never exceeds 32 V_{DC} in case of main voltage transients. External pull-ups may be used if other pull-up voltages or currents are required or for interfacing open-drain (sink-only) drivers with inputs 1-4 which lack internal pull-ups.

Frequency measurement is implemented in a co-processor though timer captures at a time-base of 72 MHz (100 ppm). This time-base gives a theoretical frequency resolution of approximately 0.014 Hz at 1 kHz and 3.12 Hz at 15 kHz (better resolution at lower frequencies). A configurable *weighed moving averaging* algorithm can be enabled for increased resolution at high frequencies at the expense of slower detection rate of frequency changes. Refer to the *CCAux API documentation* for details about available configurations.

Note that input channels 1-4 can measure frequencies up to 100 kHz compared to 20 kHz for channels 5-8. They also give better accuracy (less deviation) than channels 5-8, especially at higher frequencies. Consequently it is recommended to use input channels 1-4 for high accuracy frequency reading.

See *chapter 7.1* for electrical characteristics such as absolute maximum voltage, digital threshold levels, pull-up/pull-down strength, frequency range and accuracy.

5.8.2. Voltage measurement

Each input can be individually configured for measuring DC-voltages at ranges of:

- 0-5 V
- 0-10 V
- 0-32 V

In general, smaller voltage range gives better accuracy and higher input impedance. See *chapter 7.1* for electrical characteristics such as impedances and accuracy for each range setting.

5.8.3. Current measurement (4-20 mA)

Each input can be individually configured for interfacing 4-20 mA current-loop sensors commonly used in industrial applications.

When enabled, a 100 Ω input shunt resistors is connected to ground for closing the current loop and enabling current measurement. The 100 Ω shunt resistor is protected against over-load by continuously monitoring the voltage drop and disabling (breaking the current-loop) in case of over-voltage for more than 30-50 ms (typ). After being disabled by an overload condition, the current-loop will automatically be reenabled after a time-out of approximately 1 second and the overload monitoring is restarted. This protects the shunt resistor from destruction in case of short-circuit and allows a current-loop sensor to stabilize after enabling/closing the loop.

See *chapter 7.1* for electrical characteristics such as effective range, accuracy and over-load threshold voltage.

5.8.4. Resistance measurement

Input channels 1-4 can be individually configured for resistance measurement in the 0-500 Ω or 0-5 kΩ range.

An internal high-precision current source is shared by all input channels configured for resistance measurement. The current source is connected to one channel at the time in a sequence while sampling the resultant voltage though A/D-conversion for calculating the external resistance.

See *chapter 7.1* for electrical characteristics such as effective ranges and accuracy.

5.9. High-side PWM outputs

CCpilot VA has two self-protected high-side PWM outputs for switching various external loads such as buzzers, relays, solenoids, lamps or other resistive or inductive loads.

The high-side output drivers are powered from the main supply voltage through internal over-voltage protection that limits the output voltage to 32 V_{DC} (typ) in case of supply voltage transients. Each output handle load currents up to 1.0 A (typ) and are current-limited at 1.2 A (typ) per channel.

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

OFF-state	ON-state
Open load	-
Short to battery	-
-	Overload or short to ground
-	Over-temperature

To ensure long-term reliability, the fault-detections flags are continuously monitored and each output is automatically switched OFF in case its fault flag is triggered in ON state. An output switched OFF by a fault condition must be reenabled by the user or user application.

Observe that high continuous load at 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 (or user application) 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 software API.

See *chapter 7.1* for electrical characteristics such as channel resistance, timing, current limit and fault-detection details.

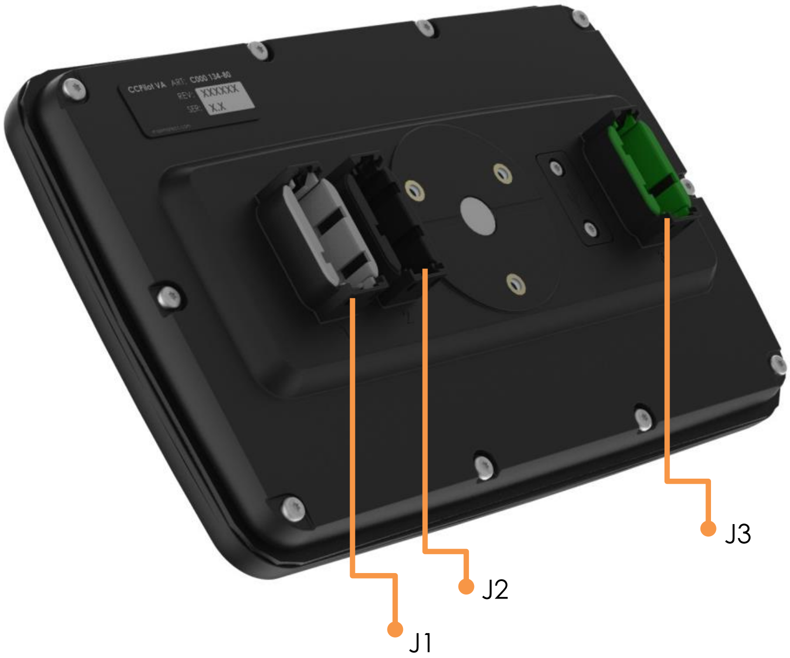
6. Connectors

All external connectors are accessible from the rear of the unit.

The main connectors which are three molded-in, 12-pin Deutsch DTM series connectors, are marked with numbers: 1, 2 or 3 and features keying (A-, B- and C-key respectively). Descriptions in this manual uses connector nomenclature J1, J2 and J3.

Connector pinouts are found in the following chapter.

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.



There is also a USB Mini-B connector placed under a sealed hatch according to *chapter 5.7*. Pinout for the USB connector is according to the USB specification and can be found in *chapter 6.2*.

6.1. Deutsch DTM connector pinout

Below are pinout maps for the external connectors.

Note that the pin-order 1-12 in tables below are oriented as when looking at the receptacles from the rear of the *CCpilot VA* device, i.e. pin 1 at *top-right* position and pin 12 at *top-left* position.

Connector J1 - GRAY			
Matching plug: DTM06-12SA (A-key)			
Pin	**Function**	**Pin**	**Function**
J1-12	USB VBUS	**J1-1**	VIN+ (main supply)
J1-11	USB D+	**J1-2**	VIN- (main supply)
J1-10	USB D-	**J1-3**	Ignition key input (ON/OFF)
J1-9	USB GND	**J1-4**	High side PWM out 1
J1-8	CAN 1 Low	**J1-5**	High side PWM out 2
J1-7	CAN 1 High	**J1-6**	CAN 1 Shield

Connector J2 - BLACK			
Matching plug: DTM06-12SB (B-key)			
Pin	**Function**	**Pin**	**Function**
J2-12	Ethernet RX-	**J2-1**	Video 1 Input
J2-11	Ethernet RX+	**J2-2**	Video 1 Ground
J2-10	Ethernet TX-	**J2-3**	Video 2 Input
J2-9	Ethernet TX+	**J2-4**	Video 2 Ground
J2-8	CAN 2 Low	**J2-5**	Touch-screen Ground
J2-7	CAN 2 High	**J2-6**	CAN 2 Shield

Connector J3 - GREEN			
Matching plug: DTM06-12SB (C-key)			
Pin	**Function**	**Pin**	**Function**
J3-12	Configurable Input 8	**J3-1**	Configurable Input 1
J3-11	Input Ground 7/8	**J3-2**	Input Ground 1/2
J3-10	Configurable Input 7	**J3-3**	Configurable Input 2
J3-9	Configurable Input 6	**J3-4**	Configurable Input 3
J3-8	Input Ground 5/6	**J3-5**	Input Ground 3/4
J3-7	Configurable Input 5	**J3-6**	Configurable Input 4

6.2. USB Mini-B connector pinout

Below is the pinout for the USB Mini-B connector:

Pin	Function
1	VBUS (5V, 500 mA)
2	Data (–)
3	Data (+)
4	ID-pin [Note]
5	GND
Metal housing	Cable shield (internally connected with GND)

Note: The ID-pin is used for selecting USB host-mode (pin low) or USB device-mode (pin high/floating). By default, the ID-pin is held low internally from CPU I/O-pin to force USB host-mode operation.

7. Specifications

7.1. Technical data

Temperature specification	
Operating	-30 to +70 °C
Storage	-40 to +85 °C

Kernel	
Main Processor	Freescale™ i.MX537: ARM 32-bit, 800 MHz, Cortex-A8
Co-processor	STMicroelectronics STM32F373, Cortex-M4
Data storage	512 MB, Industrial grade SLC NAND flash (Note)
RAM memory	512 MB*, DDR3 * Up to 1 GB is available upon request.

Note: The on-board NAND flash storage is industrial grade classified. The flash file system (UBIFS) implements both static and dynamic wear levelling to prevent wear-out, i.e. extends the lifetime of the flash memory. Still it has a limited number of write cycles. It is recommended that the amount of writing to flash storage is limited within the software applications.

Power Supply			
Supply Voltage			
Nominal		12 V_{DC} or 24 V_{DC}	
Extreme		6* V_{DC}…32 V_{DC} * Operates down to 6 Vdc with reduced functionality. High-side PWM outputs are automatically disabled below 8 Vdc (typ) to reduce total current consumption and prevent under-voltage leading to internal voltage failure and abrupt shutdown.	
Power Consumption			
Typical, operating		5-7 W typ	(not including external loads)
Max, operating		15 W max	(not including external loads)
Shutdown	Vin = 24 V_{DC}	90 mW (typ)	
	Vin = 12 V_{DC}	60 mW (typ)	
Suspend	Vin = 24 V_{DC}	310 mW (typ)	
	Vin = 12 V_{DC}	270 mW (typ)	
Inrush current			
Vin = 12 or 24 V_{DC}		< 1.5 A (for < 10 ms when applying external power)	
External fuse recommendation			
Current rating		5 A (min)* * 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 11898-2, CAN 2.0B with cable shield decoupling according to J1939-11. Supports a variety of CAN protocols including J1939 and CANopen®
CAN transceiver	Texas Instrument SN65HVD234
Baud Rate	20 – 250 kbit/s (up to 1 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 kbit/s.

USB interfaces	
Type	2 x USB 2.0 compatible host ports One USB port is available in Deutsch DTM connectors. The second port is covered by a removable sealed hatch and is only intended for development use in a protected environment. Device IP-classification is not retained when the USB hatch is removed.
Speed	Hi-speed USB (480 Mbit/s) is supported but only full-speed (12 Mbit/s) operation can be guaranteed though the Deutsch DTM connector.
VBUS supply	According to USB specification. 5.0 V, 500 mA per port, internally over-current and short-circuit protected.

Ethernet	
Type	Compatible with 10BASE-T and 100BASE-TX Ethernet standards. Auto-MDIX support.
Insulation voltage	1000 V_{AC}, 50/60Hz for 1 minute.

Analog video	
Number of inputs	2
Supported input signals	Composite video, PAL (B, D, G, H, I, M, N, Nc) and NTSC (J, M, 4.43)
Protection	Video inputs are over-voltage protected up to +40 V_{DC}.

Configurable Inputs	
Number of inputs	8
Input voltage tolerance	+40.0 V (max), referred to main supply ground - 5.0 V (min), referred to main supply ground (inputting voltages greater than specified may damage the device)

Digital input levels (5V)	"5V" modes (applies to both Digital and Frequency modes)	
Typical input amplitude	3.0 – 7.0 V	
Rising threshold	2.48 V (typ)	(± 5 %)
Falling threshold	2.41 V (typ)	(± 5 %)
Hysteresis	77 mV (typ)	(± 2 %)
Digital input levels (10V)	"10V" modes (applies to both Digital and Frequency modes)	
Typical input amplitude	7.0 – 14 V	
Rising threshold	4.95 V (typ)	(± 5 %)
Falling threshold	4.79 V (typ)	(± 5 %)
Hysteresis	155 mV (typ)	(± 2 %)
Digital input levels (32V)	"32V" modes (applies to both Digital and Frequency modes)	
Typical input amplitude	14 – 36 V	
Rising threshold	9.99 V (typ)	(± 5 %)
Falling threshold	9.68 V (typ)	(± 5 %)
Hysteresis	316 mV (typ)	(± 2 %)
Frequency measurement	Input amplitude ranges according to above.	
Frequency range		
Channel 1-4	0.1 Hz – 100 kHz	
Channel 5-8	0.1 Hz – 20 kHz	
Duty-cycle range	40-60% Exceeding above duty-cycle limits may cause inaccurate readings.	
Time base	72 MHz	(± 100 ppm)
Accuracy		
Channel 1-4	± 0.02 % (typ) up to 15 kHz ± 0.50 % (typ) up to 100 kHz	
Channel 5-8	± 0.50 % (typ) up to 15 kHz Input jitter (pulse time variations) will affect accuracy, especially at high frequencies. Averaging may be used to increase accuracy.	
Selectable pull-down	9.1 kΩ (± 3 %) to main supply ground. Pull-downs available for all eight Inputs.	
Selectable pull-up	9.1 kΩ (± 3 %) to main supply voltage. Pull-ups available for Inputs 4-8 only.	
Voltage (5V)		
Range (min)	0 – 5.5 V_{DC}	
Accuracy	± (0.5% + 1 mV)	
Resolution	1 mV	
Input Impedance	54.0 kΩ	(± 1 %)
Voltage (10V)		
Range (min)	0 – 11.0 V_{DC}	
Accuracy	± (0.5% + 2 mV)	
Resolution	1 mV	
Input Impedance	40.7 kΩ	(± 1 %)

Voltage (32V)	
Range (min)	0 – 34.0 V_{DC}
Accuracy	± (0.5% + 3 mV)
Resolution	1 mV
Input Impedance	29.7 kΩ (± 1 %)
Resistance (0-500 Ω)	
Effective range (min)	0 – 580 Ω
Accuracy	± (0.5% + 0.1 Ω)
Resistance (0-5 000 Ω)	
Effective range (min)	0 – 5 800 Ω
Accuracy	± (0.5% + 1.0 Ω)

High-side PWM outputs	
Number of channels	2
Current limit	
Initial peak current	1.2 A (typ) (min 0.7 A, max 2.0 A) per channel
Repetitive short-circuit	1.0 A (typ) Reverse current is not limited. Applying negative voltages to the output may damage the device.
Diagnostics	Built-on diagnostics and fault flag monitoring. To ensure long-term reliability, the fault flags are continuously monitored and each output is automatically switched OFF in case the fault flag is triggered in ON state.
OFF state diagnostics	Open load, short to battery
ON state diagnostics	Over-load (or short to GND), over-temperature
Open-load detection	
Internal pull-up current	5 µA (typ)
Threshold voltage	2.0 V (typ) (min 1.5V, max 3.5V) Open load is detected when output voltage rises above the threshold voltage in OFF state.
Short-circuit detection	
Voltage threshold	2.8 V (typ) Over-current is detected when output voltage falls below the threshold voltage in ON state.
Over-temp. detection	
Turn-off Threshold	+175 °C typ (min 150 °C, max 200 °C)
Hysteresis	10 °C
ON-state resistance	500 mΩ (typ), 1.2 Ω (max) Including PCB trace impedance.
Slew rate	
Turn ON:	80 µs (typ), 180 µs (max)
Turn OFF:	80 µs (typ), 200 µs (max)
OFF-state leakage	5 µA (typ) 12 µA (max)

Buzzer	
Frequency range	0 – 10 kHz (SPL peak at 2480 Hz)
SPL	55 dBA at 1 meter (typ, 2480 Hz) The buzzer is located on the back (connector side) of the device and the effective SPL varies dependent on the acoustic properties of the installation environment.

Buttons and Status notification	
Push buttons	10 x Configurable buttons with backlight and tactile feedback. Each button is configurable for controlling on/off, suspend/resume, backlight up/down or application specific actions.
Status notification	Button backlight is used for status notification, such as blinking at 2 Hz during start-up, etc. While in operating mode, button backlight is user configurable though *CCsettings* or *CCaux API*.

Software	
Operating system	Linux, Kernel version 2.6.35.3
Additional software	CCsettings, CCvideo, CCAux API. Refer to the *CCpilot VC Software Guide* and *programmers guide* for details.

Display	
Size	
Diagonal size	7 inch
Active area	152.4 x 91.44 mm
Pixel pitch	190.5 x 190.5 µm
Type	TFT, 16:9
Resolution	WVGA, 800x480
Colour depth	24 bit (16.2 million colors)
Viewing angle	Horizontal: ± 70° Vertical: ± 60°
Backlight	
Type	LED
Brightness	400 cd/m² (min), 500 cd/m² (typ)* * Above figures are according to display specification, i.e. without touch-screen or protective glass. The touch-screen or protective glass will lower the brightness by up to 15 %.
LED Life time	50 000 h (min) before brightness is reduced with 50 % (when operated with full brightness at 25 °C) (Note that higher operating temperatures affects LED life time.)
Touch-screen (optional)	Available as either “Taped” or “Optically bonded” variants.
Type	Projective capacitive touch panel (PCAP)
Coating	
“Taped”	AG (anti-gloss) and CS (chemically strengthened)
“Optically bonded”	AR (anti-reflective) and CS (chemically strengthened)
Surface Hardness	7H (typ), according to JIS K5400

Scan rate	122 points per second (max)
Protective glass (optional)	Available as either “Taped” or “Optically bonded” variants.
Coating	
“Taped”	AG (anti-gloss) and CS (chemically strengthened)
“Optically bonded”	AR (anti-reflective) and CS (chemically strengthened)
Surface Hardness	7H (typ), according to JIS K5400

7.2. Environmental specifications

Environmental Test	Test standard	Notes
Dry Heat	IEC 60068-2-2:2007	Operating: +70°C, 24h Storage: +85°C, 24h
Damp Heat	IEC 60068-2-30:2005	Operation: +25°C / +55°C >93% RH 6*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, 5C/min 3hr hold time, 20 cycles
Vibration	IEC 60068-2-64:2008	0.012 g^2/Hz 20 Hz 0.130 g^2/Hz 60 Hz 0.130 g^2/Hz 250 Hz 0.012 g^2/Hz 800 Hz 0.012 g^2/Hz 2000 Hz 3x3h
Shock	IEC 60068-2-27:2009	± 50 g / 11ms bumps
Enclosure Ingress Protection	IEC 60529:2014	IP66, IP67

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

7.3. EMC specification

The *CCpilot VA* device has been tested for Electromagnetic Compatibility according to the following standards.

EMC Test	Test standard	Notes		
Electrical Transients	ISO 7637-2:2011	**Pulse**	**Level**	
		1	-450V	
		2	+37V	
		3a/b	-/+150V	
		4	-12V	
		5	+123V	
	EN 61000-6-1	**Burst (EN 61000-4-4)**		
		DC	± 2 kV	
		Signal	± 1 kV	
		Surge (EN 61000-4-5)		
		DC	± 0.5 kV	
		Signal	± 1.0 kV	
ESD immunity	ISO 10605:2008, EN 61000-4-2	Air	± 8 kV	
		Contact	± 6 kV	
Radiated RF immunity (1)	ISO 11452-2:2004	**MHz**	**Level**	**Modulation**
		200-1000	30 V/m	80%AM, 1kHz
	EN 61000-4-3	**MHz**	**Field level**	
		80-1000	10 V/m	
		1400-2000	3 V/m	
		2000-2700	1 V/m	
Induces RF immunity(1)	ISO 11452-4:2005/Cor.1:2009 (BCI)	**MHz**	**Level**	**Modulation**
		20-200	60 mA	80%AM, 1kHz
	EN 61000-4-6	**MHz**	**Level**	
		0.15-80	10 V	
Radiated RF emission (1)	ISO 13309:2010		**Narrow-b.**	**Broad-b.**
		MHz	**dBµV/m**	**dBµV/m**
		30-75	54-44	64-54
		75-400	44-55	54-65
		400-1000	55	65
	EN 61000-6-4:2007	**MHz**	**dBµV/m**	**Distance**
		30-230	40	10 meters
		230-1000	47	10 meters
		1000-3000	76	3 meters
		3000-6000	80	3 meters

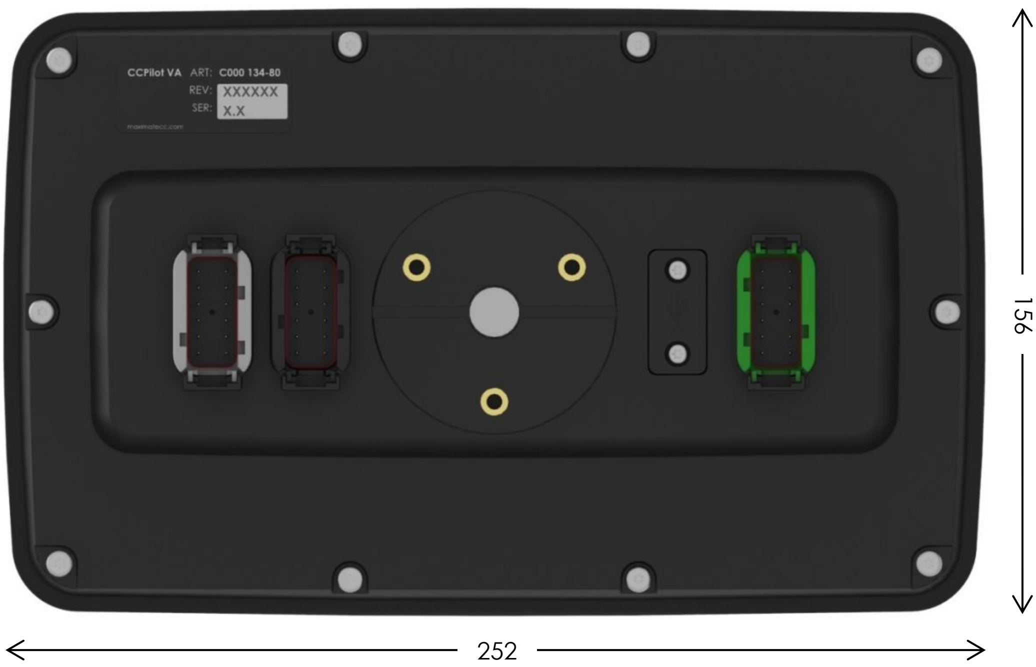
(1) Compliance to RF immunity and RF emission standards require use of shielded cables for Ethernet, USB and Video interfaces.

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

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

7.4. Weight and dimensions

Attribute	Description	Comments
Dimensions	252 x 156 x 51 mm	(W x H x D)
Weight	0,8 kg	
Mounting holes Spacing Thread dimension Thread depth	RAM-202U Dia 46 mm M5 9.5 mm	-



8. Technical 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 brand label.
- 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.
- Operating system type and its version number.
- Device log files (if possible).
- Prepare a system report on the device, from within *CCsettings* (if possible).
- Information regarding possible external equipment which is connected to the device.
- Additional sources of information are available on the maximatecc support site: http://support.maximatecc.com

9. Trademarks and Terms of use etc.

10. Index