

# CCpilot X900

Technical Manual



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## Revision history

Rev	Date	Author	Comments
1.0	2019-10-14	Finn Mc Guirk	
1.1	2020-02-03	Finn Mc Guirk	Minor formatting changes

## 1. Introduction

CCpilot X900, is a display computer that belongs to a family of CrossControl computers including CCpilot XM2 and CrossCore XM2. The CCpilot X900 and CCpilot XM are in most cases very similar in functionality and usage. It is an x86 based on board display computer and controller with a rich set of integrated functions. With its powerful Intel Atom quad core CPU with Linux or Android it is an open platform that facilitates easy implementation of premium user interaction, reliable controls and integrated fleet management.

This technical manual and reference handbook provides important information regarding the hardware and basic usage. For software and operating system specifics please refer to additional XM2 documentation.

[1] CC Linux – Programmers Guide

[2] CC Linux – Software Guide

### 1.1. Conventions and Definitions



The observe symbol is used to highlight information in this document.



The exclamation symbol is used to highlight important information.

Text formats used in this document.

Format	Use
<i>Italics</i>	<i>Paths, filenames, definitions</i>
<b>Bold</b>	<b>Command names and important information</b>

### 1.2. Identification

On the side of the CCpilot X900 device there is a label containing version and serial numbers which identify your unique computer. Take note of them. During service and other contact with the supplier it is important to be able to provide these numbers.

### 1.3. Care

- During service on the machine, all cables to the CCpilot X900 device shall be disconnected.
- Serviced shall only be made by authorised personnel. If the unit is opened by unauthorised personnel, the guarantee will cease to be valid.

- Scratches, or in the worst case irreparable damage, to the display may occur if it comes in contact with a sharp edge or hard material. In order to increase the longevity of the screen, this is naturally something which should be avoided.
- The Flash memory used for storage is durable; however as with all flash memory types the write cycles are limited. Avoid unnecessary writing to the flash memory. Plan any SW application to bear this in mind.
- If the unit becomes too hot it will operate at a limited speed and can also be damaged. Therefore, do not cover the unit by covering it, for example hanging a jacket or other clothes on it.
- Consider traffic safety when the unit is installed and whenever it is used. CrossControl does not recommend that the unit or its accessories be used actively by the driver when a risk of injury to people, or damage to property, is present.
- Be advised that the device draws power from the vehicle battery. This can result in the inability of the vehicle to start if the on-board computer has been on for a period of time without the vehicle engine running.

## 1.4. Environment and Environmental Tolerances

The device has been designed to cope with tough environmental demands. Strict tests have been conducted on the unit in order to ensure that it fulfils the expectations of a rugged unit. Much work has been performed to choose and design internal components so that they, under all circumstances and in the best possible way, provide you with a dependable and user-friendly working instrument. Within the chapter Specifications, a list of standards can be found according to which the device has been tested and approved.

The CCpilot X900 device is preferably placed in a way that prevents exposure to water contact. It is also important that it is mounted securely on a stand or the like to inhibit the unit from moving and thereby becoming damaged, damaging the vehicle and/or people during, for example, a traffic accident.

## 1.5. Cleaning

To ensure proper and reliable functionality over time, the unit should be wiped clean of dirt and dust. Use a suitable light cloth to clean the unit.

Never use alkaline, alcoholic or other chemicals for cleaning as these could damage the unit.

## 2. Overview

The CCpilot X900 device is a compact, robust and versatile on-board computer. It is equipped with, a number of connection alternatives such as Ethernet, USB, CAN-FD, and RS-232. It is also equipped with a PCAP touch screen.

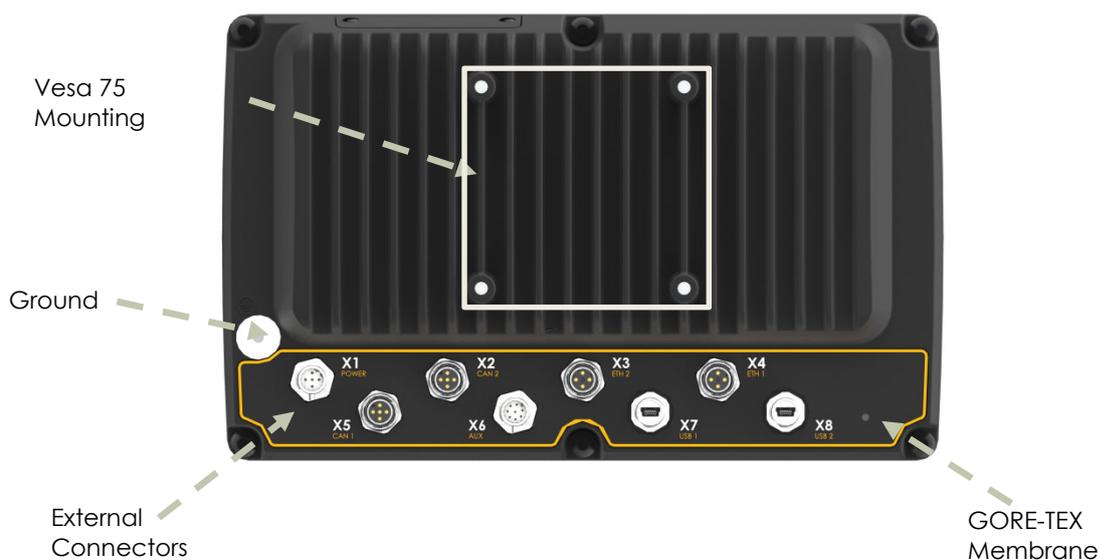
## 2.1. Front Panel

On the front face of the CCpilot X900 there is a touch screen, buttons for switching the unit on/off as well adjusting the screens brightness level, a speaker, status indicator and a light sensor. The on/off button can be programmed to perform other tasks than the default.



## 2.2. Rear Side

On the rear side of the device there are the external connectors, which are described in more detail in the chapter Connectors. There are also mounting holes for fasteners in accordance with VESA 75 on the rear side.



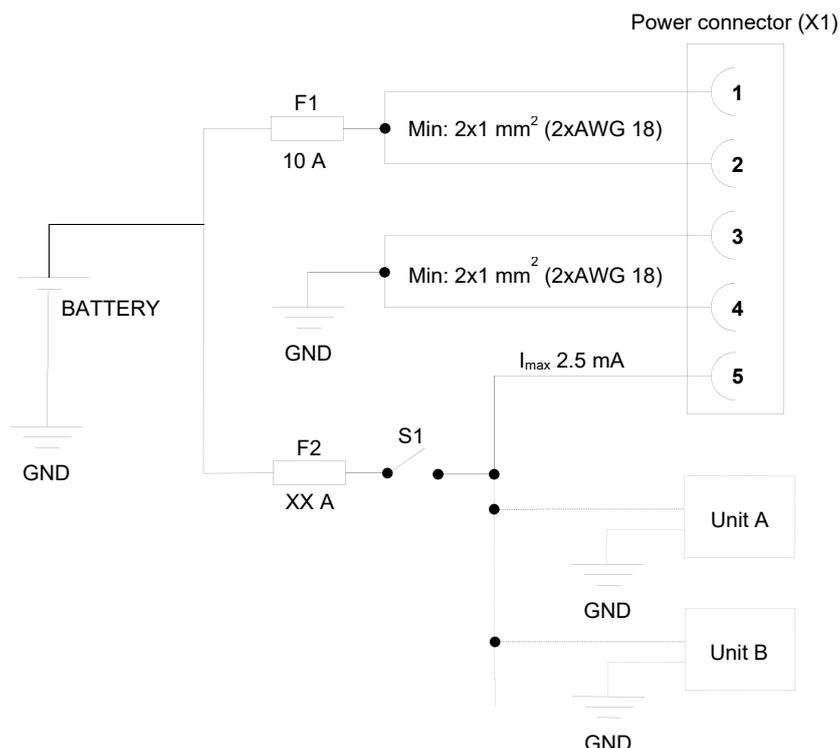
### 3. Installation

The device should be installed in such a way that is considered safe and does not expose any unnecessary stress to the unit. In this section, some recommendations are made regarding installation.

#### 3.1. Connecting Power to the Unit

This instruction address vehicle installations but the principle is the same also for other types of installations. See also the description of the pin outs for the Power Supply Connector under the section External interface description.

- Carefully follow the connection instructions below. Make sure that all contacts are angled correctly and that they do not have to be forced, but lock gently and pliant.
- GND (pin 3 and 4) is connected to the vehicle's ground.
- Battery (pin 1 and 2), i.e. the computer's power supply, should be connected directly to the vehicle's battery through 10 A fuses (F1). Wire gauges shall be dimensioned with respect to cable length, supply voltage etc. Minimum cable area is 2x1 mm<sup>2</sup> (2xAWG 18).
- The ON/OFF (pin 5), i.e. the computer's on/off signal is connected via the vehicles turnkey signal or an external on/off switch (S1). If the vehicle has a main power switch (S1) the computer shall be connected after it, as in the illustration below. The maximum allowed input current for the on/off signal is 2.5 mA. The fuse F2 fuse rating and wire gauge shall be dimensioned for the total switch current.



By connecting the power supply according to the illustration above, the device will automatically start when the main switch or turnkey is turned on, and shut down when the switch or turnkey is turned off. While the main switch is in the ON position, the computer can also be turned off and on with the On/Off-button.

### 3.1.1. Precautions

If applicable connect the power supply to the device before any main switch, as per the illustration above. If this is not possible, ensure that the device is turned off using for example the on/off button or turnkey functionality before turning off the main switch or in any other way making the computer powerless.

Sudden power disruptions may cause the device to shut down, potentially causing lost or corrupt data. If for example the power fluctuates when starting the vehicle engine, the device should be started after the vehicle engine is running.

Ensure that any application data is saved before turning off the device.

During welding or other service on the machine, all cables to the device shall be disconnected.

## 3.2. Mounting

The device is preferably mounted on a VESA 75 bracket which allows adjustment of the display's position and angle.

To fasten, use the appropriate M6 cap screw of type MC6S (Allen) or MRT (Torx). The enclosure has blind holes, which give a maximum thread depth in the enclosure of 12.5 mm. The maximum torque for 8.8 graded screws is 9.8 Nm. Apply a thread locker in all bolt holes, e.g. Loctite 222.

## 3.3. Environmental Consideration

- The device shall be placed in a way that prevents the unit from direct exposure to water.
- Use caps on any connectors that do not have attached cables.
- On the back side of the unit is a GORE-TEX® membrane located, seen as a small hole. This membrane must never be faced upwards when the unit is mounted. Be cautious not to insert any object into this hole since it can puncture the GORE-TEX® membrane, leaving the unit unprotected from moisture and dust intrusion. If the membrane is punctured the guarantee is void.
- To enable sufficient cooling, the device must be installed so that air is able to circulate around the device, avoid installing the device near hot air vents or the like. There must be at least 50 mm free distance around the unit.
- Loose mounting bolts are the most common reason for excessive vibration. Mounting bolts may become loose due to improper techniques such as missing lock washers, over tightening or under tightening. Proper tightening requires clean dry bolts, and a torque wrench.
- When The CCpilot X900 or any device is installed in a vehicle environment it is important that the installation is traffic-safe. CrossControl does not recommend that the device or its

accessories are used actively by the driver or operator when a risk of injury to people, or damage to property, is present.

### 3.4. Cables

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

- Avoid bending and twisting cables
- Strain-relief on cables near the connection to the respective unit
- Properly screw the connectors to give good contact and avoid unnecessary strain.
- Shielded cables is recommended and in some cases necessary to ensure reliable communication and appliance with industrial EMC standards.

Through adapter cables, as supplied by CrossControl, standard connectors can be connected to the unit. The installation of these adapter cables should be placed in a protected, moisture-free space and should be secured as well as strain-relieved.

## 4. Basic Operations

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 on/off button) is user configurable in terms of:

- Enabling/disabling functionality
- Configurable timing parameters
- External on/off control edge or level triggered

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.

### 4.1. Powering on the Unit

The CCpilot X900 product can be started up in different ways:

1. By connecting the external on/off control signal to positive supply input (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 on/off button.
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.

While starting up the device, it will give a short beep and the status LED will flash yellow with 2 Hz. When the device enters operational state the status LED will be static green.

## 4.2. Powering the Unit down

There are several ways to turn off the device and also alternatives to enter suspend mode instead of completely shutting down the unit.

Suspend is as a faster alternative to shutting down and starting up the unit. In suspend mode the data remains in RAM memory and the device must be connected to power to maintain its state.

The behaviour of the on/off button and the on/off signal through the Power connector can be adjusted in the device's settings application.

### 4.2.1. Shutting Down



To ensure that data does not get lost or the flash memory becomes corrupt, it is recommended that all necessary data shall be saved and all programs closed before the unit is shut down.

There are three ways to turn off the device:

- By releasing the power connectors On/Off signal, i.e. using the turn-key functionality. If power has been released for more than 4 seconds, the device starts shutting down.
- By selecting any of the operating systems shut-down alternatives.
- By pressing the On/Off button on the display for four seconds and then releasing it.

The times for the on/off button and on/off signal can be adjusted in settings and they can also be disabled so that the unit cannot be shut down using the button or turn-key, to prevent turning the computer off accidentally.

When performing any of the above, the device will shut down. The status LED will flash in yellow to indicate that. Releasing the on/off button will result in the unit starting shut down.

### 4.2.2. Suspend to RAM

Suspend to RAM is initiated by:

- By releasing the power connectors On/Off signal, i.e. using the turn key functionality.
- By selecting any of the operating systems suspend alternatives
- The device can also be suspended by a short press on the On/Off button

A user configurable time can be set for how long the unit shall be in suspend mode before the unit is completely shut down.

### 4.2.3. Forced Shut Down



If the device is not responding, a forced shut down can be performed by pressing and hold the On/Off button until the computer is turned off. The time for the forced shut down is double the normal shut down time, by default eight seconds.

Any information which was not saved will be lost when performing a forced shut down. It is not recommended to use the forced shut down since it immediately shuts down the computer regardless of the operating system state.

### 4.3. Adjusting the Screen Brightness

Press the respective brightness button to gradually increase or decrease the display brightness.

The brightness can also be controlled from software, which also allows for the automatic adjustment of the brightness using the light sensor.

### 4.4. Using the Touch Screen

The CCpilot X900 display is equipped with PCAP touch functionality which provides an intuitive HMI (Human-Machine Interface) for the user.

#### 4.4.1. Double Click and Right Click through the Touch Screen

A double click is performed by simply tapping the display twice in the appropriate space.

Tap and hold on the touch screen to perform the equivalent of a right click.

### 4.5. Status LED Indicators

The status LED indicator on the device indicates different device states using colours and flashing patterns. The LED behaviour can be controlled both by the operating system and by the applications executing on the device. For more details see CC Linux – Software Guide

### 4.6. Back-up Battery – Clock

Time and date information is stored in a memory sustained by a back-up battery. This battery has a limited life time and must therefore be replaced as required. The life time of the battery is approximately 10 years.

## 5. Interface Overview

This section describes the configuration of the CCpilot X900.

### 5.1. Storage

A CFast memory card is used for data storage. This makes the device robust to vibrations which would be a problem when using rotating hard discs.



The CFast card is industrial grade classified has both static and dynamic wear levelling to prevent a premature aging and to ensure the longest lifetime of the memory card, still it has a limited number of write cycles. It is recommended that the amount of writing to storage is limited within the application. Rather keep information in RAM memory and write larger blocks at one time instead of frequently writing smaller pieces.

### 5.2. Light sensor

A light sensor is placed in the front of the device. Using this, ambient light levels can be measured and used for example by software to automatically adjust the screen brightness.

### 5.3. Speaker

A speaker that can be used for user notifications exists in the front of the CCpilot X900 device. The speaker is application controllable with adjustable volume.

### 5.4. Audio output

The audio output can play everything from warning sound to music when the device is connected to a sound system. The output offers a line-out stereo signal. Volume is controlled through the operating system.

### 5.5. USB

USB ports enable connection of a multitude of devices to the device. The USB ports follow the USB 2.0 standard. Shielded cables shall be used to ensure reliable communication and EMC immunity.

The USB ports can supply up to 500 mA each. The USB ports are internal over current and short circuit protected.

### 5.6. Ethernet

The device has two Ethernet connections, fully compatible with the 10BASE-T and 100BASE-TX standards and is galvanically isolated (500 VAC or 707 VDC). Shielded cables shall be used to ensure reliable communication and EMC immunity.



**Be aware that connecting the device to a network environment can impose a security threat.**

### 5.7. Serial port

The serial port follows the RS232 standard but with a limited set of signals, listed in the connector's description. The supported communication speed for these ports is 2.4 to 115.2 kbps. Shielded cables shall be used to ensure reliable communication and EMC immunity.

### 5.8. CAN-FD

The device has two CAN-FD interfaces according to CAN ISO 11898 2.0B. The maximum speed is limited to 5 Mbit/s. The CAN channels are over current and short circuit protected..

## 6. Connectors

All connectors are accessible from the rear of the unit. The connectors are marked with an X and a number as well as a short descriptive text, e.g. X1 USB1.

In order to give the device its high environmental classification, the unit is equipped with DIN M12 connectors. CrossControl provides adapter cables which convert from DIN M12 to standard connectors.



Use caution and avoid plugging/unplugging of connectors when the computer is on.

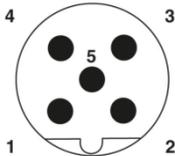
Always replace a damaged cable. If the pins become bent or damaged they may not function correctly, or in the worst case, the on-board computer or other equipment may be damaged.

## 6.1. Connectors layout

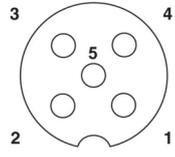


Notice that the connector descriptions are those which are located on the unit, not those that the attached cables shall have in order to mate with them. All directional reference is from a unit point of view.

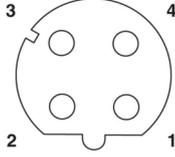
### X1 – Power supply connector

Pin #	Default signal	Comments	
1	+10...+30 VDC, 10A max.	Main Power Input	DIN M12 x 1 male, 5-pole, B-coded Rotation 180° 
2	+10...+30 VDC, 10A max.	Main Power Input	
3	GND	Main Ground Input	
4	GND	Main Ground Input	
5	ON/OFF	ON/OFF input signal	

### X2, X5 - CAN Connector

Pin #	Default signal	Comments	
1	CAN Shield		DIN M12 x 1 female, 5-pole, A-coded Rotation 180° 
2	NC		
3	CAN_GND		
4	CANH		
5	CANL		
Housing	CAN shield		

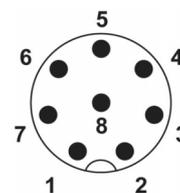
### X3, X4 – Ethernet Connectors

Pin #	Default signal	Comments	
1	Tx+		DIN M12 x 1 male, 4-pole, D-coded Rotation 180° 
2	Rx+		
3	Tx-		
4	Rx-		
Housing	Shielded		

### X6 - AUX Port Connector

Pin #	Default signal	Comments	
1	LINE OUT Right		DIN M12 x 1 male, 8-pole, A-coded Rotation 180°
2	RxD		
3	TxD		
4	GND		
5	GND		
6	LINE OUT Left		

7	RTS
8	CTS
Housing	Shield



### X7, X8 – USB Connector

Pin #	Default signal	Comments
1	Vbus out	5 Volt
2	D-	
3	D+	
4	NC	
5	GND	
Housing	Shielded	

M12 Speedcon x 1 female, 5-pole, Mini-B USB

## 7. Specifications

### 7.1. Technical data

Specifications	
Main Processor	Intel Atom® x5-E3940 quad core CPU.
Coprocessor	Runs functions controlling integrity of product, for increased reliability and safety.
Storage	8 GB. CFast
RAM	4 GB. DDR3L
GPU	Intel® HD Graphics 500
Display	TFT-LCD with LED Backlight.
Cover Lens	Optically bonded glass.
Display Size	9" with 15:9 WXGA resolution, 1280 x 768 pixels.
Brightness	720 cd/m2, dimmable in steps 1-100
Contrast	1000:1, Colour depth 24 bit.
USB	2 x USB 2.0 480 Mbit/s, 5V, max 500mA, protected for over current and short circuits
Ethernet	2 x 10/100 Base-T
Sound	1 x Line Out, Speaker: 0-93 dBA, 200-3000 Hz
LED	Status RGB LED
Serial	1 x RS 232 with RTS/CTS, protected for short circuit to ground , 'inter port' and 'to Main power'
CAN	2 x CAN-FD, physical layer ISO 11898-2:2016, SAE J2284-1 to SAE J2284-5.

Bit-rate configurable up to 5 Mbps.

Supported bit-rates include (but are not limited to):

10 kbps, 20 kbps, 50 kbps, 100 kbps, 125 kbps, 250 kbps,  
500 kbps, 800 kbps, 1 Mbps, FD 250/500 kbps, FD  
250/1000 kbps, FD 250/2000 kbps, FD 250/4000 kbps, FD  
500/1000 kbps, FD 500/2000 kbps, FD 500/4000 kbps

Power	12 or 24 VDC nominal voltage. Voltage range 10-34 VDC. CPU and communication operational down to 6,0 VDC. Power consumption : Shutdown : <100mW (typical 70mW @ 24 volt) Suspend : < 1.5W ( typical 700mW @ 24 Volt)
OS	CC Linux
Software	CCAux API, CCSettingsConsole. Refer to the <i>CC Linux - Software Guide</i> and <i>Programmer's guide</i> for details

## 7.2. Environmental Tolerance

Environmental Test	Standard	
Dry Heat	IEC 60068-2-2	Operating: +70°C, 24h Storage: +85°C, 24h
Damp Heat	IEC 60068-2-30	Operation: +25°C / +55°C >95% RH 6*24h
Cold	IEC 60068-2-1	Operating: -25°C, 24h Storage: -40°C, 24h
Temperature tolerances	IEC 60068-2-14	-25°C to +70°C, 5C/min 3hr hold time, 20 cycles
Vibration	IEC 60068-2-64	0.03g <sup>2</sup> /Hz 5-199Hz 0.02g <sup>2</sup> /Hz 20-399Hz 0.01g <sup>2</sup> /Hz 400-599Hz 0.005g <sup>2</sup> /Hz 600-1000Hz 3x 1h
	IEC 60068-2-6	+/- 7.5mm 5-11.5Hz 4g 11.5-1000Hz 1 oct/min 3 directions, 10 double sweeps/dir.
Shock	IEC 60068-2-27	30 g / 6ms 3x ±3 s 18 shocks
EMC Electrical Transient	ISO 7637-2	Pulse 1: -450V 2a: +37V 2b: +20V 3a: -150V 3b: +150V 4: -12V 5: +123V
EMC Immunity, ESD	EN 61000-4-2	8 kV air, 6 kV contact
EMC Immunity, RF	ISO 11452-2 ISO 11452-4	RF electromagnetic field 200-1000MHz 30V/m 1000-2000MHz 30V/m Bulk Current Injection 20-200MHz 60mA
EMC Emission	ISO 14982	Radiated MHz Nar.b dBµV/m Bro.b. dBµV/m

		30-75	54-44	64-54
		75-400	44-55	54-65
		400-1000	55	65
Enclosure	EN 60529	IP65		

Tests are performed with 24 V power level. The environmental tolerance may be affected by external factors like mounting and shielded cables etc.

### 7.3. Weight and Dimensions

Enclosure	Size (mm)	Weight (Kg)
	267 x 166 x 57	2



## 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 can find on the identification label.
- Date of purchase, which is found on the invoice.
- The conditions and circumstances under which the problem arises.
- Error codes signalled by the status LED
- Possible error messages which are shown.
- Device log files (if possible).
- Information regarding possible external equipment which is connected to the device.

- Prepare a system report on the device, from within CCsettings (if possible).
- Additional sources of information are available on the CrossControl support site:  
<http://support.CrossControl.com>

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