

CCpilot X1200

Technical manual



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1. Introduction

Based on an efficient Intel® Atom® quad-core architecture the CCpilot X1200 is a truly multipurpose on-board computer for business logic and advanced HMIs with Intel® UHD Graphics that provide laptop performance for the cabin. The device enables 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 device settings. For additional help please visit our website or reach out to your established Field Application Engineer.

It is very important to read and understand this manual before installation and operation of the device.

Not following the instructions around installation, and operation of the unit may lead to reduced safety of operators and machinery.

1.1. Product Models

This documentation is applicable for all standard product models of CCpilot X1200.

Additional features in customized models will be documented separately. Contact CrossControl for customization inquiries.

1.2. Conventions and Definitions

The 'exclamation' symbol -  - is used to highlight information that is especially important for the end-user.

1.3. Identification

On the top side of the CCpilot X1200 device there is a label containing part number and serial number to uniquely identify your computer. Please take note of them as during service and other contact with the supplier it is important to be able to provide this information.



1.4. Maintenance and Care



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

- Disconnect all cables to the device during welding or when performing other service to the machine that pose a risk of damage to 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 is void.
- Scratches, or even damages, to the display occur easily if it comes in contact with a sharp object or hard material. In order to increase the longevity of the screen, this 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.
- 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, for example, hanging a jacket or other clothes on it.
- Be advised that the device consumes 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 extended periods of time without the vehicle engine running.

1.5. Cleaning

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



Never use alkaline, alcoholic, or other chemicals for cleaning which can damage the unit. Never use high-pressure air, water or steam to clean the device.

1.6. Environment and Environmental Tolerance

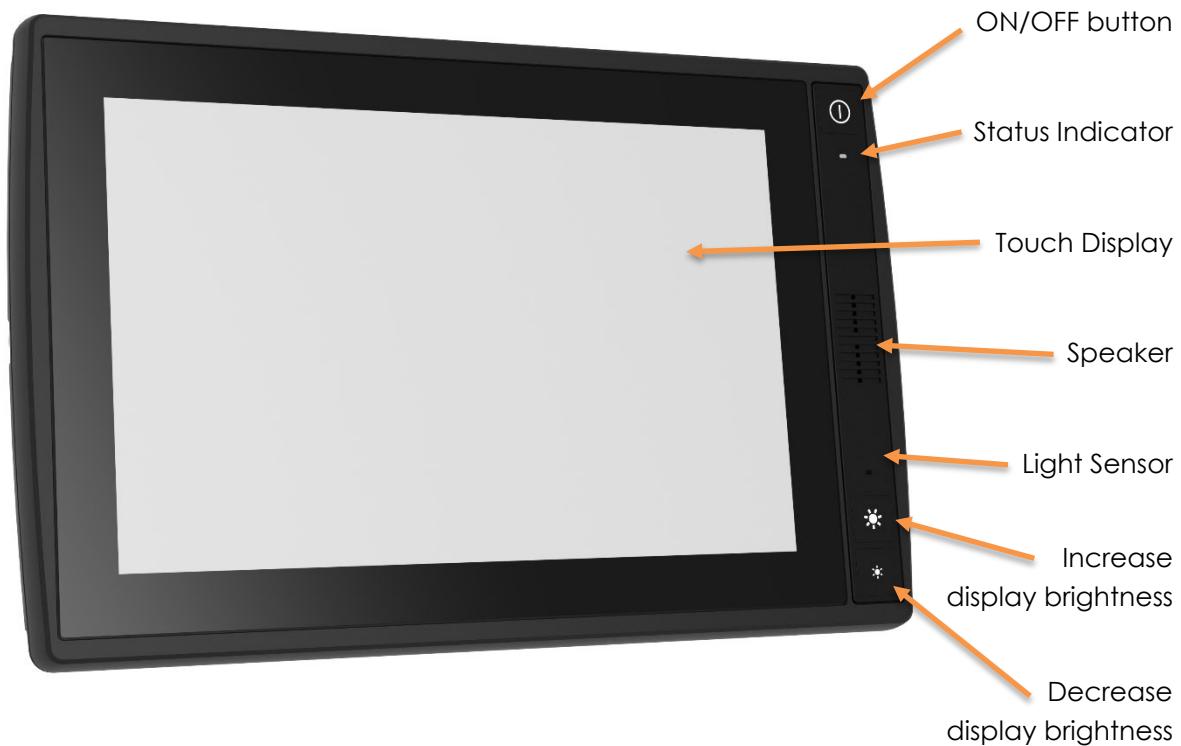
The CCpilot X1200 device has been designed to cope with tough environmental demands. Strict tests have been conducted on the unit in order to ensure that it fulfils the expectations of a rugged unit. Significant work has been performed to choose and design internal components so that they, in the best possible way, provide you with a dependable product. A full list of standards to which the device has been tested for compliance can be found in [Chapter 7 - Specifications](#).

It is preferable to place the device in a way that avoids exposure to water contact. It is also important that the device is securely mounted, e.g. on a bracket, to prevent the unit from moving which may cause damage to the device itself and/or the vehicle or injure people in the vicinity.

2. Device Overview

2.1. Front Side

On the front face of CCpilot X1200 there are buttons for switching the unit ON/OFF and adjusting the screens brightness level, a speaker, a status indicator and a light sensor.



2.2. Rear Side

The external connectors are located on the rear side of the CCpilot X1200, they are described in more detail in [chapter 6 - Connectors](#). There are also mounting holes (M6) for fasteners in accordance with VESA 75.



External Connectors

X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
PWR	CAN	CAN	ETH	ETH	USB	USB	CAN*	CAN*	AUX	USB	USB	USB

*Only available in 4xCAN / BT and W-iFi versions

** CFast memory only available in certain configurations/versions

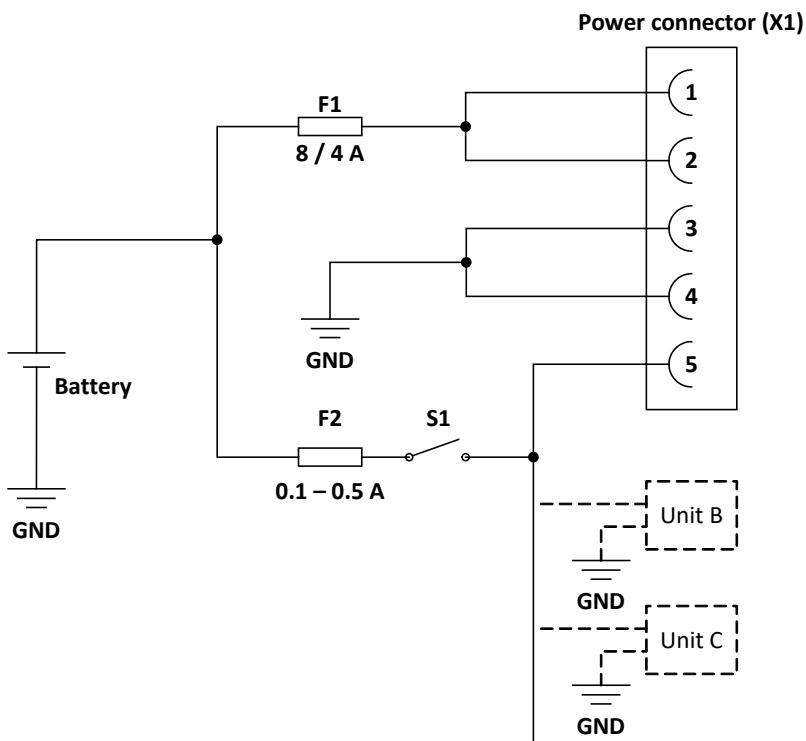
3. Installation

Install the device 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 to Power Supply

This instruction is focused on vehicle installations, but the principle is the same for other types of installations. The description of the pinout for the power connector can also be found in [chapter 6 – Connectors](#). Carefully follow the connection instructions below. Make sure that all connectors are aligned correctly and to not use excessive force when mounting.

- GND (pin 2 and 5) should be connected to the vehicle's ground.
- VIN (pin 1 and 4), i.e. the positive power supply terminals (12 V / 24 V DC), should **both** be connected directly to the vehicle's battery through a fuse (F1). For 12 V systems F1 shall be at least 7.5 A. For 24 V systems F1 shall be at least 4 A. Wire gauge shall be dimensioned with respect to cable length, supply voltage etc.
- ON/OFF signal (pin 3). The on/off signal should be connected via the vehicles turnkey signal or an external on/off switch (S1). If the vehicle has a main power switch the computer shall be connected after it. 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. The functionality of the ON/OFF signal and ON/OFF button can be changed in software (CCAux API).

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 CCpilot X1200 shall be disconnected.

3.2. Grounding



Proper grounding minimizes electrical emissions which is why CrossControl recommend grounding CCpilot X1200 properly using as short and wide ground strap as possible. Attach the ground strap with a screw next to the ground symbol on the backside of the unit. Use a M5 screw with a maximum length of 10mm using the same procedure as described in section [3.3. Mounting](#).

For product configurations with BT/Wi-Fi, the antenna connector shorts signal ground and chassis.

For products with BT/WiFi we do not recommend connecting the chassis ground of the device as this creates a ground loop. When using an external antenna this also has to be considered to avoid unintended currents in the antenna shield especially when mounting the antenna to the vehicle chassis.

3.3. Mounting

CCpilot X1200 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 e.g. MC6S (Allen) or MRT (Torx). The enclosure has blind holes, which give a maximum thread depth in the enclosure of 10 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.



3.4. Environmental Considerations

- 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 there is a GORE-TEX® membrane, visible as a small hole, see section [2.2 Rear Side](#). This membrane must never be faced upwards nor covered, when the unit is mounted. Be careful 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 similar. 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, missing thread locker, over tightening or under tightening. Proper tightening requires clean dry bolts, and a torque wrench.

- When CCpilot X1200 or any other device is installed in a vehicle environment it is important that the installation is traffic safe. CrossControl does not recommend that CCpilot X1200 or its accessories are used actively by the driver or operator when a risk of injury to people, or damage to property, is present.

3.5. Cable Installation

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

- Avoid bending and twisting cables
- Strain-relief cables near connections
- Properly screw the connectors to give good contact and avoid unnecessary strain
- Shielded cables are recommended and for USB and Ethernet cables it is required to ensure reliable communication and compliance with industrial EMC standards.

Through adapter cables, as offered 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 device such as start-up and shut-down.

4.1. Starting Up

Start CCpilot X1200 by pressing and releasing the ON/OFF button or using the turnkey functionality of the ON/OFF signal in the power connector. The status indication LED will start flashing indicating that the unit is starting up. For more information see [chapter 3.1 - Connecting to Power Supply](#).

4.1.1. Temperature control before start-up

An internal temperature control prevents the device from starting in too cold temperatures, by default -34 °C or below. The unit will then wait until the temperature inside the unit is above -34 °C before continuing the start-up sequence.

4.2. Turning Off

There are several ways to turn the device off. The behavior of the ON/OFF button and the ON/OFF signal through the Power connector can be adjusted in the CCsettings console and using the CCAux API.

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 is saved and all programs closed before the unit is shut down.

There are three ways to turn off the device:

- By disconnecting the ON/OFF signal, i.e. using the turn key functionality.
- By using any of the operating systems shut-down procedures.
- CCpilot X1200 can also be turned off by pressing the ON/OFF button on the display for four seconds and then releasing it. The time can be adjusted in the settings and it can also be disabled so that the unit cannot be shut down using the button to prevent turning the computer off accidentally. The status LED will flash in yellow to indicate that releasing the ON/OFF button will result in the unit shutting down.

4.2.2. 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 or a minimum of eight seconds, 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.



4.2.3. Suspend/Resume

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 signal, for example using the turn key functionality.
 - o By factory default, disconnecting the external ON/OFF signal is configured to shut-down the device.
2. By selecting the operating systems suspend alternative.
3. By pressing the power button
 - o By factory default, a short press

 Observe that the device's current consumption in suspend mode is higher than in shut-down mode. The power consumption in suspend is ~120 mA using 24 V power supply.

To prevent a v machine's 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 the following event:

1. A low-to-high transition of the external ON/OFF signal, for example using the turn-key functionality.

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

4.3. Adjusting the Screen Brightness

Press the respective brightness button to gradually increase or decrease the CCpilot X1200 display brightness. The brightness can also be controlled from software (via CCSettingsConsole and/or CCAux API) which also allows for automatic adjustment of the brightness using the light sensor, see separate software guide for details.

4.4. Using the Touch Screen

The CCpilot X1200 display is equipped with touch functionality which gives the opportunity to provide an intuitive HMI for the user.

4.4.1. Double click and right click equivalents on the touch screen

Double click is performed similar to how it is performed with an external pointing device – by tapping the screen twice in the same place. Tap and hold on the touch screen to perform the equivalent to a right click.

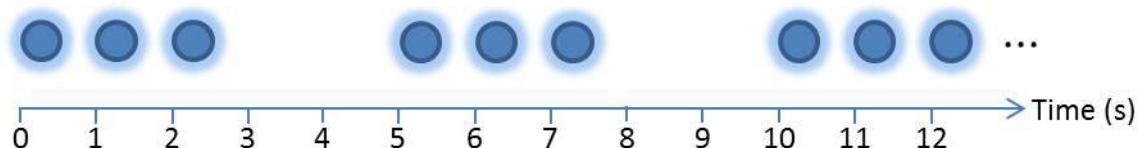
4.5. Status LED Indicators

The status LED indicator on the device indicates different device states using colors and flashing patterns. The LED behavior can be controlled both by the operating system and by the applications executing on the device.

4.6. Status LED 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 9 below for an example.



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 the table below for a complete listing of the error codes. The number of blinks is important information if the unit is sent in for service/repair.

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

4.7. 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 15 years (calculated at normal room temperature). The battery is not replaceable.

5. Interface overview

This section describes the interfaces on the device.

5.1. Storage Memory

5.1.1. eMMC flash memory

An eMMC flash memory is used for Operating System and data storage.

! The eMMC is set to pseudo SLC mode and implements wear levelling to increase the durability and program/erase cycles. The maximum number of program/erase cycles is 60k per memory cell (depending on 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.

5.1.2. CFast memory (Optional)

A CFast (faster variant of CompactFlash) may be chosen as an option for data storage.

! The industrial grade CFast module has both static and dynamic wear levelling to prevent premature aging and to ensure the longest lifetime. The CFast however has a limited number of write cycles and it is recommended that the amount of writing to storage is limited within the used applications. 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 located in the front of the CCpilot X1200. Using this sensor, ambient light levels can be measured and used by software to, for example, automatically adjust the screen brightness. The device software has a built-in option for this.

5.3. Audio

CCpilot X1200 has an onboard mono speaker and a stereo capable line output. The volume can be independently controlled from the operating system.

The onboard speaker is located in the front panel of the device and is capable of 1 W output with rich quality over a wide range of frequencies.

The line output is located in the Aux connector (X10). It operates at a line level of 1 Vrms and is intended to drive a nominal 10 kΩ external load.

5.4. CAN

The device has two CAN-FD interfaces, with two more available as an option, conforming to ISO 11898.

The CAN channels are short circuit protected. The CAN connectors follow the CANopen standard.

5.5. USB

USB ports enable connection of a multitude of devices to the CCpilot X1200 device.

There are five USB 2.0 interfaces integrated as M12 USB Mini connectors.

Each USB port can supply up to 500 mA, has built-in common mode filter, ESD protection diodes and over-current and thermal protection with auto-restart after error detection.

5.6. Ethernet

The CCpilot X1200 has two Ethernet interfaces, fully compatible with the 10BASE-T and 100BASE-TX standards and 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

There is a serial port in the Aux connector (X10) that follows the RS-232 standard but without control signals (only TX and RX). The supported communication speed for the serial port is 2.4 to 115.2 kbps. Shielded cables shall be used to ensure reliable communication and EMC immunity.

6. Connectors

All connectors are accessible from the rear side of the unit. The connectors are marked with an X and a number as well as a short descriptive text, e.g. X6 USB1.

As a part of the high environmental classification of CCpilot X1200, the unit is equipped with robust DIN M12 connectors. CrossControl can offer adapter cables which convert from DIN M12 to standard connectors.

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

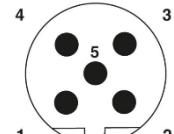
 Always replace a damaged cable. If the pins become bent or damaged they may not function correctly, and the on-board computer or other equipment may be damaged.

6.1. Connector layout

 Note: The connectors described below are located on the unit. Connecting cables need opposite gender in order to mate with them.

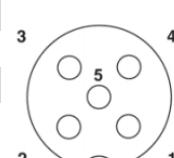
X1 - Power Supply Connector

Pin #	Default signal	Comments	DIN M12 x 1 Male, 5-pole B-coded Rotation 225°
1	VIN		
2	VIN		
3	GND		
4	GND		
5	IGNITION	ON/OFF Input signal	



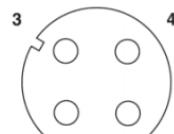
X2, X3, X8, X9 - CAN Connector

Pin #	Default signal	Comments	DIN M12 x 1 Female, 5-pole A-coded Rotation 135°
1	CAN Shield		
2	NC		
3	GND		
4	CAN_H		
5	CAN_L		



X4, X5 - Ethernet Connector

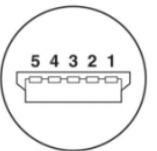
Pin #	Default signal	Comments	DIN M12 x 1 Female, 4-pole D-coded Rotation 135°
1	Tx+		
2	Rx+		
3	Tx-		
4	Rx-		



X6, X7, X11, X12, X13 – USB 2.0 Connector

Pin #	Default signal	Comments	
1	VBUS Out	5 V	
2	D-		
3	D+		
4	NC		
5	GND		

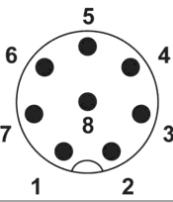
M12 x 1
Female, 5-pole
Mini-B USB



X10 - AUX Connector

Pin #	Default signal	Comments	
1	Audio R		
2	RS-232 RX		
3	RS-232 TX		
4	Audio GND	Only used with pin 1 and/or pin 6	
5	RS-232 GND		
6	Audio L		
7	Force	Only used by authorized personnel	
8	GND		

DIN M12 x 1
Male, 8-pole
A-coded
Rotation 225°



7. Specifications

The specifications may vary depending on your computer configuration.

7.1. Connections

Interface / Feature	Number of Connections
CAN	2 (4)
USB 2.0	5
Ethernet	2
AUX (Audio/RS232)	1
(Bluetooth / Wi-Fi™ Antenna)	(1)

7.2. Technical Data

Kernel	
Processor	Intel® Atom™ x6413E, 4 Cores, 1.5 GHz (3.0 GHz Burst)
Data storage	42 GB (pseudo SLC) eMMC flash memory
RAM Memory	8 GB, LPDDR4, 3200MT/s
Graphics	Intel® UHD Graphics for 10th Gen Intel® Processors
Interfaces	
CAN (X2, X3, (X8, X9))	
Type	CAN FD, ISO 11898, (High Speed CAN)
Baud Rate	Standard mode 20 kbit/s – 1 Mbit/s. CAN FD mode – 500 kbit/s / 4 Mbit/s.
USB 2.0 (X6, X7, X11, X12, X13)	
Type	USB 2.0 Host
Speed	480 Mbit/s
Power Output	5 V, max 500 mA, over current and short circuit protected
Ethernet (X4, X5)	
Type	10BASE-T, 100BASE-TX
Isolation Voltage	500 VAC / 707 VDC
Aux (X10)	
Audio	Stereo line-out (L+R) 1 Vrms with 10 kΩ nominal load
RS-232	2.4 kbit/s – 115.2 kbit/s.
External Force	Only to be used by authorized service personnel. Leave not connected for normal use.
HMI	
Status LED	Tricolor LED status indicator with configurable behavior
Software	
Operating system	Windows 10, Linux

Additional software CCAux API and ccsettingsconsole are available to access diagnostics and settings from software.

Display

14.1"

Type	TFT-LCD, 16:10, anti-glare coated
Resolution	1280 x 800
Colour Depth	16.2M
Backlight	LED, 1000 cd/m ²
Bad pixels allowed	Bright dots – 0 Dark dots – 2 (min 15 mm apart)

Power Supply

Supply Voltage	12 or 24 V nominal, Continuous operation 10 V to 34 V
Power Consumption	24 V – Max 2.5 A at peak load. Typical 1.4 A at idle. 12 V – Max 5 A at peak load. Typical 2.5 A at idle.

7.3. Environmental tolerance

Environmental Test	Standard			
Dry Heat	IEC 60068-2-2	Operating: +70°C*, 24h		
		Storage: +80°C, 24h		
Damp Heat	IEC 60068-2-30	Operation: +25°C / +55°C >93% RH 6*24h		
Cold	IEC 60068-2-1	Operating: -30°C*, 24h		
		Storage: -30°C, 24h		
Change of temperature	IEC 60068-2-14	-30°C to +70°C, 5C/min 3hr hold time, 20 cycles		
Vibration	IEC 60068-2-64	0,01 g ² /Hz 5-200 Hz 3x1h		
Shock	IEC 60068-2-29	30 g / 6ms 3x ± 3 bumps		
EMC Electrical Transient	ISO 13766-1 ISO 7637-2 ISO13766-2**	Pulse: 1. -600 V 2a. +112 V 2b. +20 V 3a. -300 V 3b. +300 V 4. -6 V (12 V system) 5.+151 V		
EMC Immunity, ESD	ISO 10605	±15 kV air, ±8 kV contact		
EMC Immunity, RF	ISO 11452-2 ISO 11452-4	RF electromagnetic field 200-1000 MHz, 100 V/m 1.0-2.0 GHz, 30 V/m 2.0-2.4 GHz, 10 V/m 2.4-2.7 GHz, 5 V/m Bulk Current Injection 1-200 MHz, 100 mA		
EMC Emission	ISO 14982	Radiated	Nar.b.	Bro.b.
		MHz	dB μ V/m	dB μ V/m
		30-75	54-44	64-54
		75-400	44-55	54-65
		400-1000	55	65
Enclosure	EN 60529	IP65		
UV	ISO 4892-3 method A, cycle no. 1 UVA-340	1500h		



The tests were performed with 24 V power level. Environmental tolerance may be affected by external factors like mounting and shielded cables etc.

To comply with the Radio Equipment Directory (RED) BT/Wi-Fi antennas with maximum gain of 3dBi (2.4 GHz) and 5dBi (5GHz) shall be used.

*The Intel Atom X6413E has a Dynamic Temperature Range (DTR) of $\pm 90^{\circ}\text{C}$ which, besides the specified operating range of the X1200, also needs to be considered. DTR is the range of the junction temperature of the Intel Atom chip starting from boot and transitioning cold-to-hot and/or hot-to-cold. Thus, if the ambient temperature changes significantly during the use of the device it is strongly recommended to power cycle the device to ensure reliable performance. Once the device has been power cycled the new temperature will be set as base temperature. For example if the device is started in -30°C it will need a power cycle, once warm, to be able to use it in high ambient temperatures.

**The device is affected by 10 W radio transmitter in the frequency range of 380-420 MHz (ISO 13766-2 section 5.3.2) and might cause the display to not function properly. Other external interfaces are not affected. The device shows immunity to a 6 W radio transmitter.

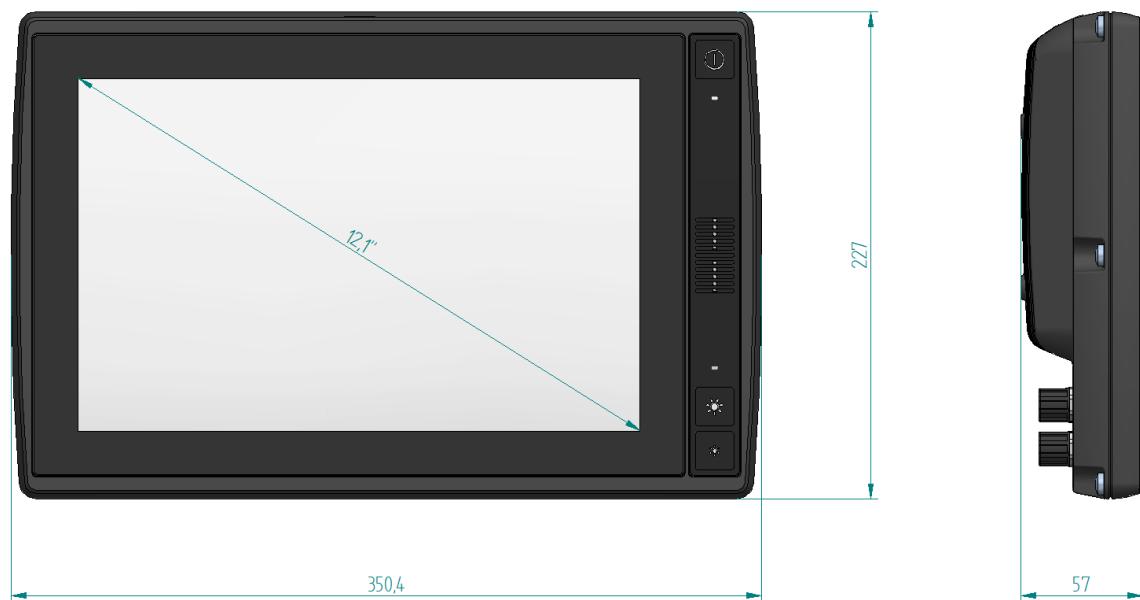
7.3.1. FCC Notice to Users



Users are not permitted to make changes or modify the device in any way. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

7.4. Weight and dimensions

	Description	Comments
Dimensions	350.4 x 277 x 57 mm	(W x H x D)
Weight	3.3 kg	



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 identification label, see section 1.3.
- Date of purchase, which is found on the invoice.
- The conditions and circumstances under which the problem arises.
- Error codes signaled by the status LED
- Possible error messages shown on the screen.
- Device log files (if possible).
- Information regarding possible external equipment which is connected to the device.
- Additional sources of information are available on the CrossControl support site:
<http://support.crosscontrol.com>

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