CCpilot X1400

Technical manual

Contents

1. Introduction

CCpilot X1400 is the fifth generation of the CCpilot XL family. A high-performance PC-based onboard display computer and controller with a rich set of integrated functions. With its powerful 8th generation Intel® Core i-5 CPU 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 see additional documentation.

1.1. Product Models

This documentation is applicable for all standard product models of CCpilot X1400.

The platform also enables customization of hardware and software.

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 side of the CCpilot X1400 device there is a label containing version and serial number to identify your unique computer. Take note of them. 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 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 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.

- Consider traffic safety when CCpilot X1400 is installed and whenever it is used. CrossControl does not recommend that CCpilot X1400 or its accessories is used actively by the driver when a risk of injury to people, or damage to property, is present.

- 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 a period of time without the vehicle engine running.

1.5. Cleaning

To ensure proper and reliable functionality over time, the unit shall 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 X1400 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, in the best possible way, provides you with a dependable and user-friendly working instrument. A full list of standards to which the device has been tested for compliance can be found in chapter 7 - Specifications.

The 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.

1.7. Supporting Documentation

This technical manual provides important information regarding the device's hardware, properties and basic usage. It is very important to read this manual before installation and usage of the unit.

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

2. Device Overview

The CCpilot X1400 is a robust and versatile on-board computer. It is equipped with several connection options including CAN, Ethernet and USB.

2.1. Front Side

On the front face of CCpilot X1400 there are buttons by default these are for switching the unit on/off and adjusting the screens brightness level, a speaker, status indicator and a light sensor.

ON/OFF button

Status Indicator

Touch Display

Speaker

Light Sensor

Increase display brightness

Decrease display brightness
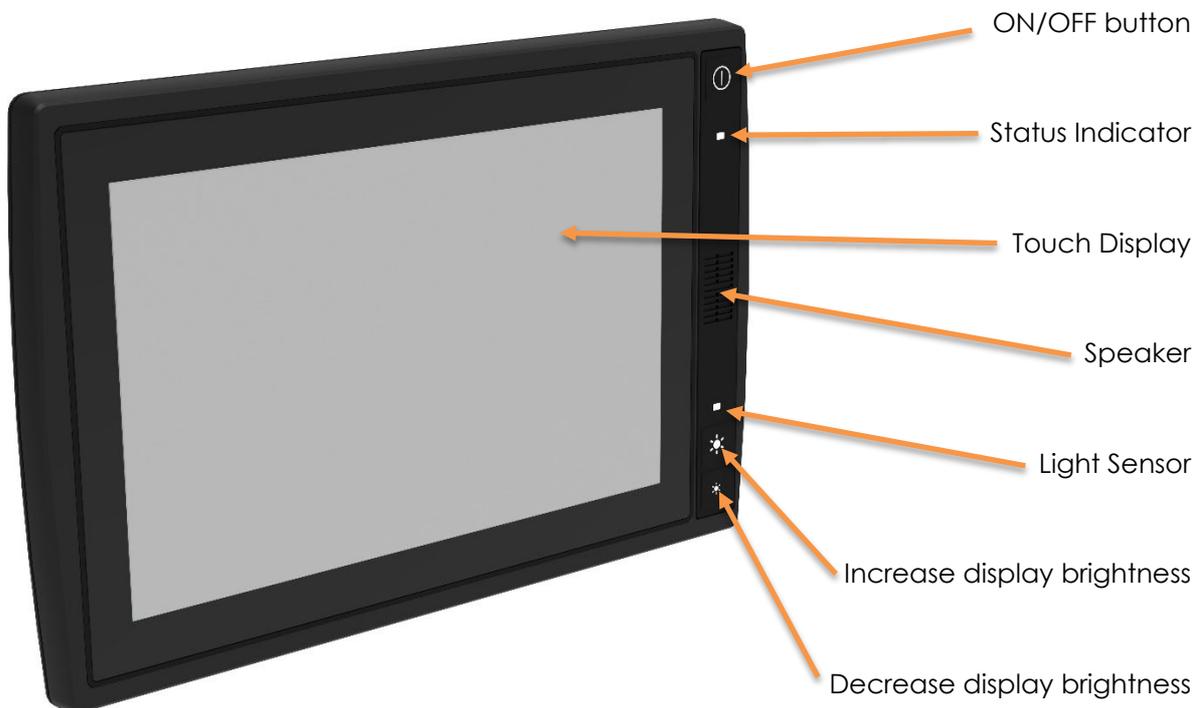
2.2. Rear Side

The external connectors are located on the rear side of the CCpilot X1400, they are described in more detail in chapter 6 - Connectors. There are also mounting holes (M6) for fasteners in accordance with VESA 75.

Cover for dual CFast memory

Cooling Fan

Mounting holes,
Vesa 75,
4 x M6

3x USB

Ground
M5

GORE-TEX™
Vent membrane
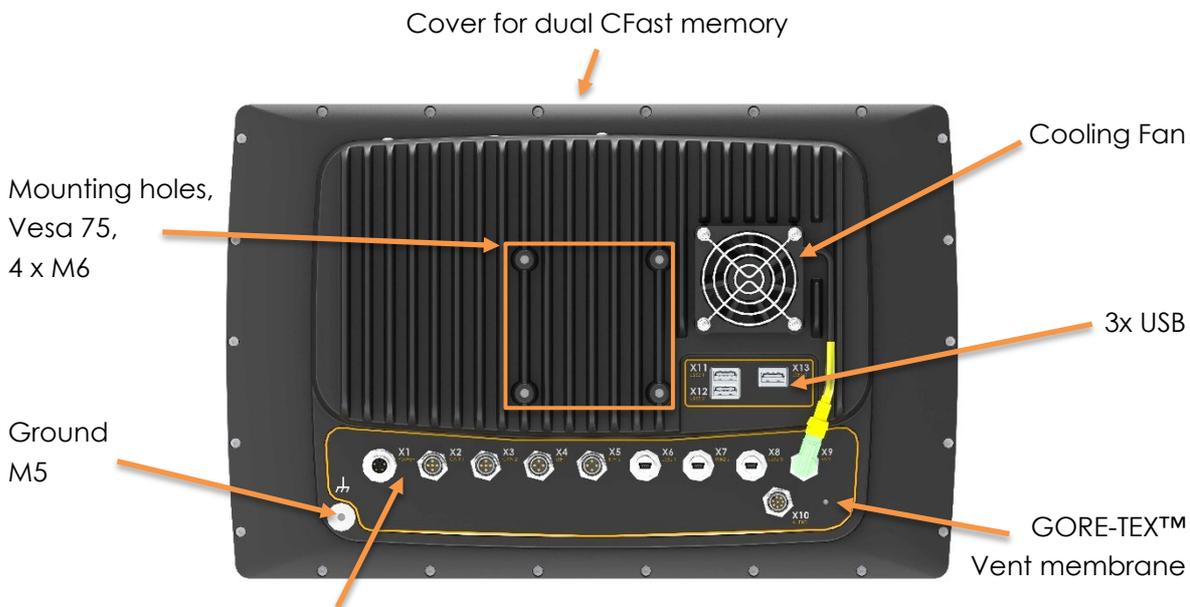
External Connectors

X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
PWR	CAN	CAN	ETH	ETH	USB	USB	USB	FAN	AUDIO

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 addresses vehicle installations, but the principle is the same for other types of installations. See also the description of the pin outs for the Power Supply Connector under chapter 6 – Connectors.

- 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 2 and 5) is connected to the vehicle's ground.

- Battery (pin 1 and 4), i.e. the computer's power supply (+24 VDC), should be connected directly to the vehicle's battery through 10 A fuses (F1). For 12V systems F1 shall be at least 15A. Wire gauge shall be dimensioned with respect to cable length, supply voltage etc.

- The ON/OFF (pin 3), 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 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.
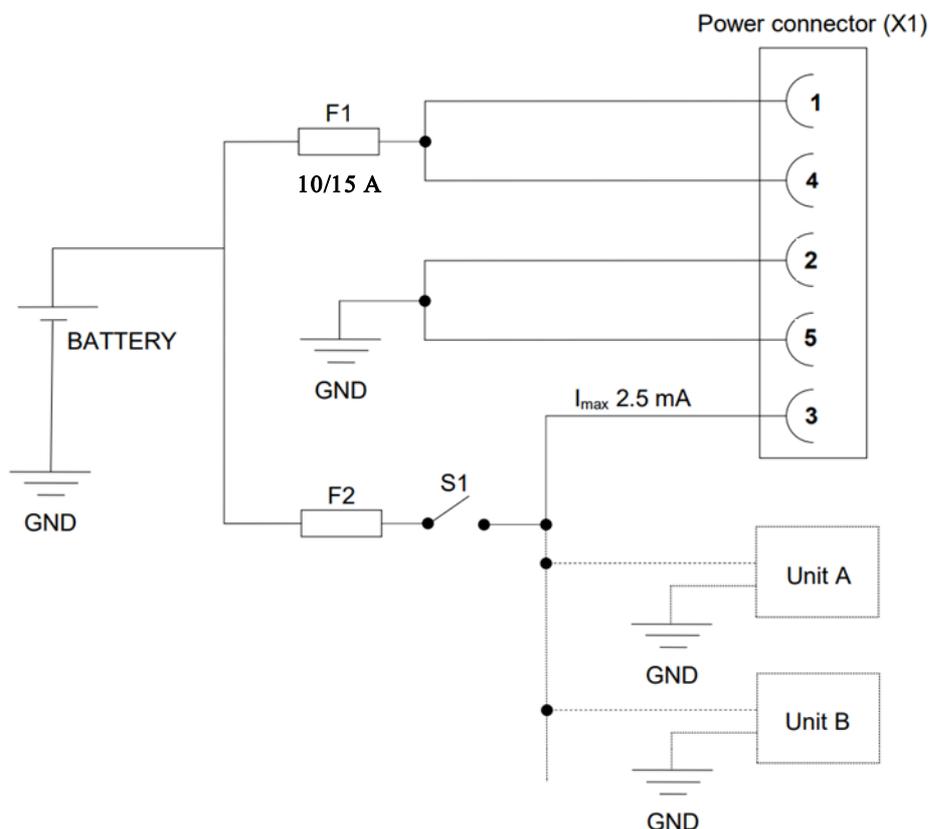
By connecting the power supply according to the illustration above, the device will automatically start when the main switch, or turnkey, is turned on, and shut down when the switch, or turnkey, is turned off. While the main switch is in the ON position, the computer can also be turned off and on with 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 X1400 shall be disconnected.

3.2. Grounding

Proper grounding minimizes electrical emissions which is why CrossControl recommend grounding CCpilot X1400 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 mounting.

3.3. Mounting

CCpilot X1400 can be mounted with 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 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 should 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, visible 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 CCpilot X1400 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 X1400 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 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, such as those 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 device such as start-up and shut-down.

4.1. Starting Up

Start the unit 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. Preheating

An internal temperature control prevents the device from starting in too cold or hot temperatures. When starting the unit in extremely low temperatures, by default -25 °C or below, preheating is activated to warm the unit before continuing the start-up sequence. When the internal temperature reaches -25 °C the preheating is deactivated, and the unit continues to start up.

Note that preheating consumes energy from the vehicle's battery. This can result in the vehicle not starting after prolonged preheating due to a discharged battery.

4.2. Turning Off

There are several ways to turn the device off. The behaviour of the On/Off button and the On/Off signal through the Power connector can be adjusted in the CCsettings application 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 shall is 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.

- By selecting any of the operating systems shut-down alternatives.

- CCpilot X1400 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 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.

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 shutting down.

4.2.2. Forced Shut Down

If the device is not responding, a forced shut down can be performed by pressing and holding 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 it is set to 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 CCpilot X1400 display brightness. The brightness can also be controlled from software, which also allows for automatic adjustment of the brightness using the light sensor.

4.4. Using the Touch Screen

The CCpilot X1400 display is equipped with touch functionality which gives the opportunity to provide a very easy-to-use HMI (Human Machine Interface) for the user.

4.4.1. Double and right click on the touch screen

Double click is performed similar to using an external pointing device - by tapping the screen twice in the same place. Tap and hold the 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 colours and flashing patterns. The LED behaviour can be controlled both by the operating system and by the applications executing on the device.

4.6. Clock Back-up Battery

Time and date information is stored in a memory sustained by a back-up battery. This battery has a limited lifetime and must therefore be exchanged at regular intervals. The lifetime of the battery is approximately 10 years.

5. Interface overview

This section describes the interfaces on the device.

5.1. Storage Memory

A CFast (faster variant of CompactFlash) memory is used for data storage. This makes the device robust to vibrations which would be a problem if using a rotating hard disc drive.

The CFast module is classified as industrial grade and has both static and dynamic wear levelling to prevent a premature aging and to ensure the longest lifetime of the CFast, even though it still 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 CCpilot X1400. Using this sensor, ambient light levels can be measured and used for example by software to automatically adjust the screen brightness. The device software as a built-in option for this.

5.3. Speaker

CCpilot X1400 has one speaker placed on the front side of the unit. The speaker volume is controllable through the settings application.

5.4. CAN

The device has two CAN FD interfaces according to CAN ISO 11898.

Each of the two CAN connectors may be prepared with a power supply output as an option for future use. The maximum total load current is specified at 1A.

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

Note:
Internal CAN bus filters have a capacitance of 200 pF (typ) which deviates from the ISO 11898 standard. This puts limitations on the CAN bus topology considering bus length, number of CAN nodes etc. when running at high bit-rates (i.e. above 100-250 kbit/s).

5.5. USB

USB ports enable connection of a multitude of devices to the CCpilot X1400 device.

There are three USB 3.0, one double connector and one single connector. The connectors type are female type-A-SuperSpeed. The USB ports have common mode filters and ESD protection diodes. There is a power controller protecting the unit from short-circuit and over current conditions on the USB ports externally. The USB3.0 ports can supply up to 900mA each.

There are also three USB 2.0 connectors, the same connector type as in XL4; USB Mini connectors integrated to the M12. The USB data signals, from all three ports are connected to a hub, to share connection to one USB channel. The three USB ports have common mode filter and ESD protection diodes. It does have thermal protection (shuts off output) and auto-restart after

error detection (both for short-circuit and thermal shut down), no end user mechanical intervention needed. The USB2.0 ports can supply up to 500mA each.

5.6. Ethernet

The CCpilot X1400 has two Ethernet connections, fully compatible with the 10BASE-T and 100BASETX standards and galvanic 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. Fan Control

The fan speed on CCpilot X1400 is controlled by the processor module and ON/OFF is controlled by the system supervisor.

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 USB 2.0.

In order to give the CCpilot X1400 its high environmental classification, the unit is equipped with DIN M12 connectors. CrossControl can provide adapter cables which convert from DIN M12 to other connector standards.

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, and the on-board computer or other equipment can be damaged.

6.1. Connector 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.

X1 - Power Supply Connector

Pin #	Default signal	Comments	
1	VIN	Main Power Input	DIN M12 x 1 Male, 5-pole L-coded
2	GND	GND Supply	
3	ON/OFF	ON/OFF Input Signal	
4	VIN	Main Power Input	
FE (5)	GND	GND Supply	
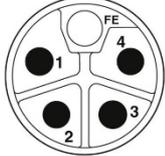
X2, X3 - CAN Connector

Pin #	Default signal	Comments	
1	CAN Shield	Connected to chassis ground	DIN M12 x 1 Female, 5-pole A-coded Rotation 180°
2	*V+*	*Can be implemented on request*	
3	CAN_GND		
4	CANH		
5	CANL		
Housing	CAN Shield		
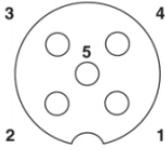
X4, X5 - Ethernet Connector

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

X6, X7, X8 – USB 2.0 Connector

Pin #	Default signal	Comments	M12 Speedcon x 1 Female, 5-pole Mini-B USB
1	Vbus Out	5 V	
2	D-		
3	D+		
4	NC		
5	GND		
Housing	Shield		

X9 - Fan Connector

Pin #	Default signal	Comments	DIN M12 x 1 Female, 4-pole A-coded
1	V+	12 V, max 200 mA	
2	GND		
3	FAN RPM PWM Ctrl	(Output)	
4	Tachometer	(Input)	
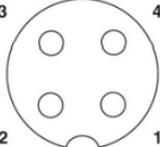
X10 - Audio Connector

Pin #	Default signal	Comments	DIN M12 x 1 Female, 8-pole A-coded
1	Line out R		
2	Line out L		
3	GND		
4	GND		
5	NC	*Line In R – Implementation on request*	
6	NC	*Line In L – Implementation on request*	
7	NC	*Mic In – Implementation on request*	
8	NC		
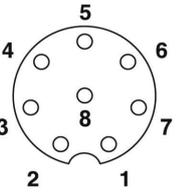
X11, X12, X13 – USB 3.0 Connector

Pin #	Default signal	Comments	USB 3.0, Rugged, Female, Type-A, R/A
1	Vbus		
2	D-		
3	D+		
4	GND		
5	SSRX-		
6	SSRX+		
7	GND		
8	SSTX-		
9	SSTX+		

7. Specifications

The specifications may vary depending on your computer configuration.

7.1. Connections

Interface / Feature	Number of Connections
CAN bus	2
USB 3.0	3
USB 2.0	3
Ethernet	2
Audio	1
Fan	1

7.2. Technical Data

Kernel	
Processor	Intel® Core™ i5-8400H, 4x 2.5 GHz
Data storage	64 GB, Industrial grade Cfast
RAM Memory	8 GB, DDR4-2400
Graphics	Intel® HD Graphics 630

Interfaces	
CAN (X2, X3)	
Type	CAN FD, ISO 11898, (High Speed CAN)
Baud Rate	Configurable 20 kbit/s – 1 Mbit/s. CAN FD mode – 500 kbit/s / 10 Mbit/s.
Power Output	*Optional feature*
USB 2.0 (X6, X7, X8)	
Type	Host, V 2.0
Speed	480 Mbit/s
Power Output	5 V, max 500 mA, over current and short circuit protected
USB 3.0 (X11, X12, X13)	
Type	Host, V 3.0
Speed	5 Gbit/s
Power Output	5 V, max 900 mA, over current and short circuit protected
Ethernet (X4, X5)	
Type	According to 10BASE-T and 100BASE-TX standards
Isolation Voltage	500 VAC / 707 VDC
Audio (X10)	
Line Out	Stereo (L+R)
Line In	*Optional feature*

Mic In	*Optional feature*

HMI	
Status LED	Tricolour LED status indicator with configurable behaviour

Software	
Operating system	Windows 10
Additional software	CCsettings, CCvideo. API's are available to access settings, video and other equipment from software

Display	
14.1"	
Type	TFT, 16:10, anti-glare coated and optically bonded
Resolution	1280 x 800, WXGA
Colour Depth	16.7M
Backlight	LED, 720 cd/m^2

Power Supply	
Supply Voltage	12 or 24 V nominal, Continuous operation 10V to 34V
Power Consumption	24 V - Max 6 A at peak load. Typical 1,4 A at idle. 12 V - Max 12 A at peak load. Typical 2,5 A at idle.

7.3. Environmental tolerance

Environmental Test	Standard	
Dry Heat	IEC 60068-2-2	Operating: +55°C, 24h Storage: +60°C, 24h
Damp Heat	IEC 60068-2-30	Operation: +25°C / +55°C >93% RH 6*24h
Cold	IEC 60068-2-1	Operating: -25°C, 24h Storage: -40°C, 24h
Change of temperature	IEC 60068-2-14	-25°C to +30°C, 5C/min 3hr hold time, 20 cycles
Vibration	IEC 60068-2-64	0,01 g2/Hz 5-200 Hz 3x1h
Shock	IEC 60068-2-29	5 g / 11ms 3x ±1000 bumps 30 g / 6ms 3x ± 3 bumps
EMC Electrical Transient	ISO 13766-1 ISO 7637-2	Pulse: 1. -450 V 2a. +55 V 2b. +20 V 3a. -220 V 3b. +220 V 4. -4 V (12V system) 5.+70 V
EMC Immunity, ESD	ISO 10605	±15 kV air, ±8 kV contact
EMC Immunity, RF	ISO 11452-2 ISO 11452-4	RF electromagnetic field 200-2000 MHz, 100 V/m Bulk Current Injection 20-250 MHz, 100 mA

EMC Emission	ISO 14982	Radiated	Nar.b.	Bro.b.
		MHz	dBµV/m	dBµV/m
		30-75	54-44	64-54
		75-400	44-55	54-65
		400-1000	55	65
Enclosure	EN 60529	IP54		

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

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	408 x 266 x 85 mm	(W x H x D)
Weight	5,5 kg	
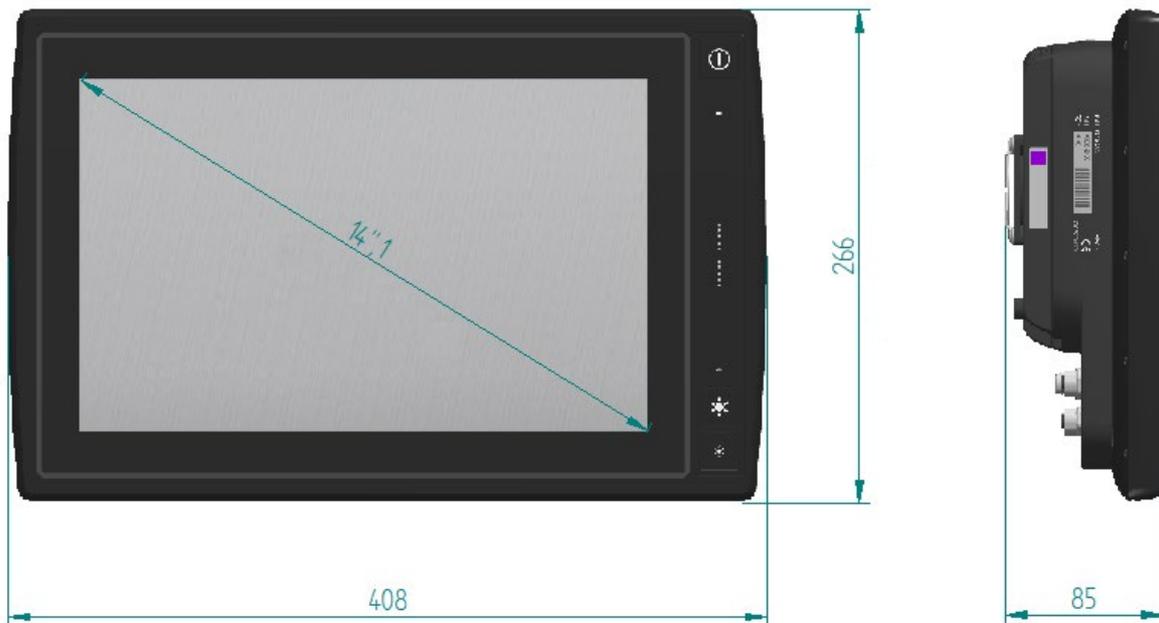
8. Technical Support

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

- 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.

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

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