ENGINEERING
TOMORROW

Technical Information

PLUS+1®
CS10 Wireless Gateway

Revision history

Table of revisions

Date	Changed	Rev
November 2020	Removed some redundancy	0102
October 2020	First edition	0101

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Literature references

Literature title	Document type	Literature ID
PLUS+1® CS10 Family Technical Information	User Guide	**BC314255793849**
PLUS+1® CS10 Data Sheet	Data Sheet	**AI314170881786**
PLUS+1® GUIDE Software User Manual	Operation Guide	**AQ152886483724**

Comprehensive technical literature is online at *www.danfoss.com*

Technical Information (TI)

A TI is comprehensive information for engineering and service personnel to reference.

Module product Data Sheet (DS)

A module product DS contains summarized information and parameters that are unique to an individual PLUS+1® module, including:

- Numbers and types of inputs and outputs
- Module connector pin assignments
- Module maximum current capacity
- Module sensor power supply (if present) current capacity
- Module installation drawing
- Module weights
- Product ordering information

API specifications (API)

Module API specifications contain detailed information about the module BIOS. PLUS+1® BIOS functionality is pin dependent. Pins are defined in module data sheets as C (connector number) p (pin number).

API specifications include:

- Variable name
- Variable data type
- Variable direction (read/write)
- Variable function and scaling

Module API specifications are the definitive source of information regarding PLUS+1® module pin characteristics.

PLUS+1® GUIDE User Manual

The Operation Manual (OM) details information regarding the PLUS+1® GUIDE tool used in building PLUS +1® applications. This OM covers the following broad topics:

- How to use the PLUS+1® GUIDE graphical application development tool to create machine applications
- How to configure module input and output parameters
- How to download PLUS+1® GUIDE applications to target PLUS+1® hardware modules
- How to upload and download tuning parameters
- How to use the PLUS+1® Service Tool

User liability and safety statements

OEM responsibility

The OEM of a machine or vehicle in which Danfoss products are installed has the full responsibility for all consequences that might occur. Danfoss has no responsibility for any consequences, direct or indirect, caused by failures or malfunctions.

- Danfoss has no responsibility for any accidents caused by incorrectly mounted or maintained equipment.
- Danfoss does not assume any responsibility for Danfoss products being incorrectly applied or the system being programmed in a manner that jeopardizes safety.
- All safety critical systems shall include an emergency stop to switch off the main supply voltage for the outputs of the electronic control system. All safety critical components shall be installed in such a way that the main supply voltage can be switched off at any time. The emergency stop must be easily accessible to the operator.

Overview

CS10 Wireless gateway

Warning

This device is not intended for safety-related applications and shall not be used for remote control or critical data communication.

The Danfoss PLUS+1® CS10 Wireless Gateway is engineered by security experts and designed for the harsh environments common with Off-Highway equipment. The CS10 is a rugged and secure wireless device for machine monitoring – locally or remotely.

CS10 Gateway enables a CAN system with Bluetooth® connectivity to a smart mobile application for diagnosis and updates. Connect any two CAN systems by adding a second CS10 to support the CAN Bridging functionality. In addition, the CS10 is a wireless replacement for wired connection interfaces like the CG150.

Secure data encryption and a flexible device API further enhance reliability and integration with existing applications.

Default settings

The device is shipped with standard settings for WiFi. To gain access to the CAN bus, the SSID and password must be changed from default.

WiFi works by default as an access point with the SSID being 'DanfossCS10_MAC address' and the password 'being the device's seriel number.

Specification WiFi

The WiFi functionality offers the possibility to configure and operate wireless networks. There are two operation modes: “Access point” and “Station mode”. In Access point mode other devices connect to the CS10 device; In Station mode the CS10 device is able to connect to a wireless network providing gateway.

Document purpose

The main purpose of this document is to provide electrical, mechanical, and configuration details of the CS10 Wireless Gateway.

Abbreviations

SSID	the identifier (name) of a network
IP address	a numerical label assigned to each device connected to a network
DHCP	a network management protocol used on Internet Protocol (IP) networks, whereby a DHCP server dynamically assigns an IP address and other network configuration parameters to each device on the network, so they can communicate with other IP networks
Baudrate	the rate at which information is transferred in a communication channel
M2M	Machine to machine

Configuration

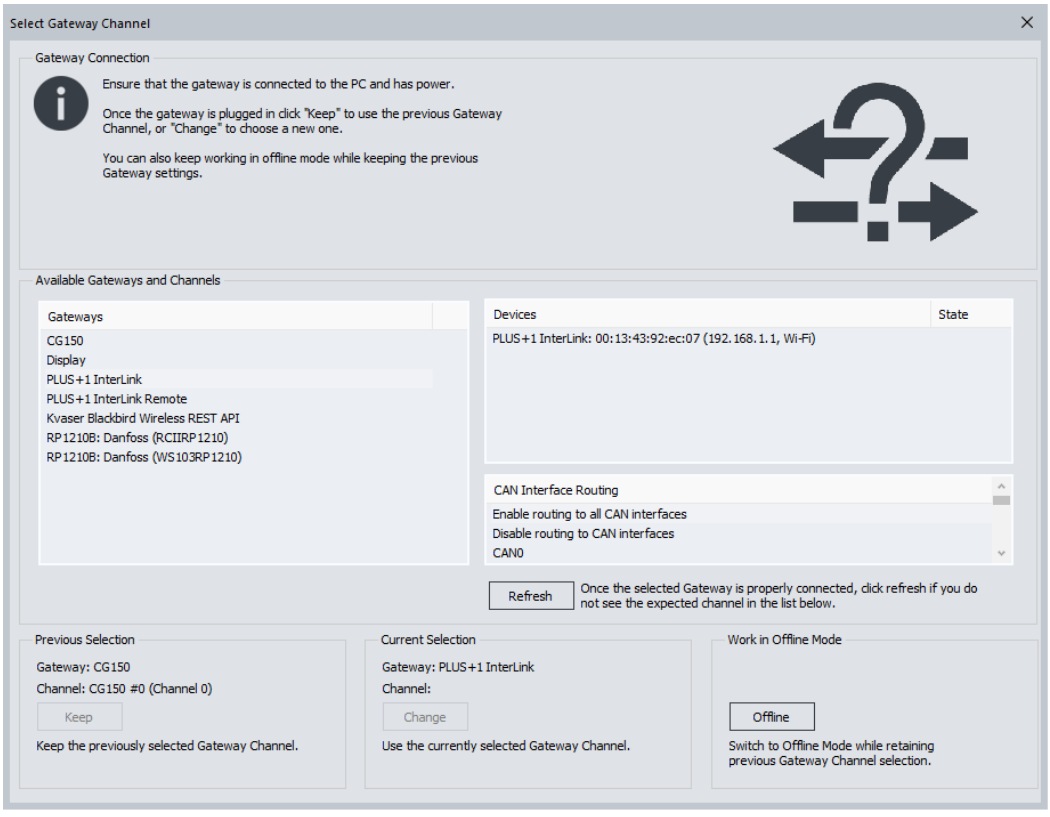
Connecting wirelessly to CS10

A connection between the Service Tool hosting device and the CS10 device via WiFi is a precondition. As with the M2M functionality there are two connection options:

1. In the peer to peer mode the CS10 must be configured as an access point. A connection to the CS10 needs to be established using the WiFi menu in the operating system of the Service Tool hosting device.
2. Alternatively, both devices can be connected to the same router.

The Service Tool gateway needs to be changed to "PLUS+1®Interlink" using the menu **Communications** > **Gateway** > **PLUS+1** > **Interlink** > **Enable**.

In the list **Devices** double-click the device with the matching device EID. The device EID can be found on the page **M2M**. The CS10 might have another node address if it was connected to another gateway previously. If so, in the menu select **Replace Missing ECU** and former address will be replaced by the current address of the device.



While in an **M2M** bridge, making an Interlink connection will break the **M2M** bridge functionality.

Overview

The keyswitch shutdown mode reduces the current consumption to a minimum and no functionality is provided. Setting the **Enable** checkbox to true makes the device monitor the C1p05 pin and enter the low power mode as soon as the pin voltage goes to GND. The **Shutdown delay time** parameter provides the time by which entering the low power mode is delayed in seconds.

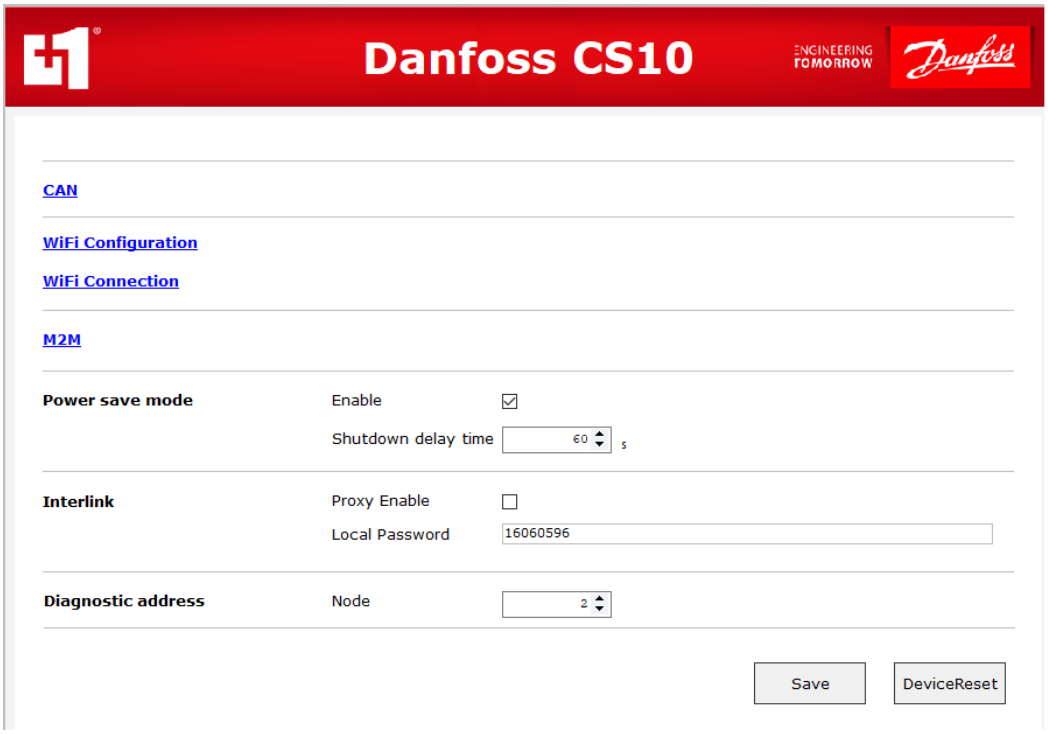
To have a remote connection to the CS10 via the internet, **Proxy Enable** flag must be set to true. Disabling the option requires a power cycle or **Device Restart**.

The diagnostic address can be configured byapplying the appropriate value to the field **Nodeaddress** and pressing the **Save** button. Changing this requires a power cycle or **Device Restart.**

Configuration

All device settings can be reset to their default values by using the **Reset device** button or by connecting the C1p06 input to supply voltage for at least 10 seconds. Leave this pin open If resetting the device by C1p06 is not intended.

Pressing the **Device Restart** button reboots the application and can be used as an alternative for a power cycle.



Station mode

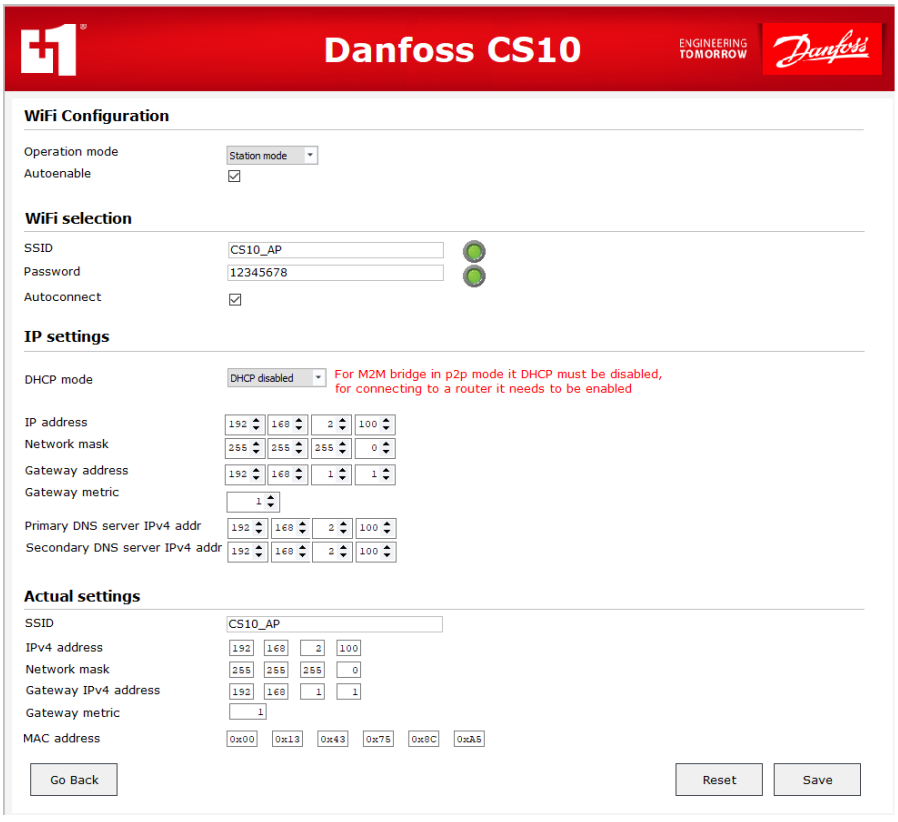
1. Go to the **WiFi Configuration** page and set “Station mode” as **Operation mode**.
2. If **Autoenable** is selected, the selected mode will be enabled once the device is powered.
3. Enter the **SSID** and **Password** of the network to be connected to.
4. If **Autoconnect** is selected, once the device is powered it will automatically try to connect to the configured network.
5. Select the appropriate **Country code**.
6. If DHCP mode is set to "DHCP diabled" adjust the following settings:
   - **IP address** and **Network mask** for the identification of the CS10 device,
   - **Gateway address** and **Gateway metric** for identifying the AP to connect to,
   - **Primary DNS-server IPv4 addr** and **Secondary DNS-server IPv4 addr** must be set to gather the IP address of an URI.

When **DHCP mode** is set to “DHCP enabled” no further settings need to be done.

Using the **Save** button downloads the data to the device. The actual settings are shown in the section **Actual settings**.

Using the **Reset** button applies a default set of standard parameters.

Configuration



On the **WiFi Connection** page, client status shows the connection status of the CS10 device.

Enable/Disable activates/deactivates the WiFi unit of the device, the actual status is indicated by the LED **WiFi enabled**. When using the **Connect** button the device tries to connect to the access point defined in the **WiFi Connection**.

The name of the network client is shown in the field **SSID**. The **Mode** field indicates if the connection has been established. **Link quality** shows the quality of the connection when it's established.

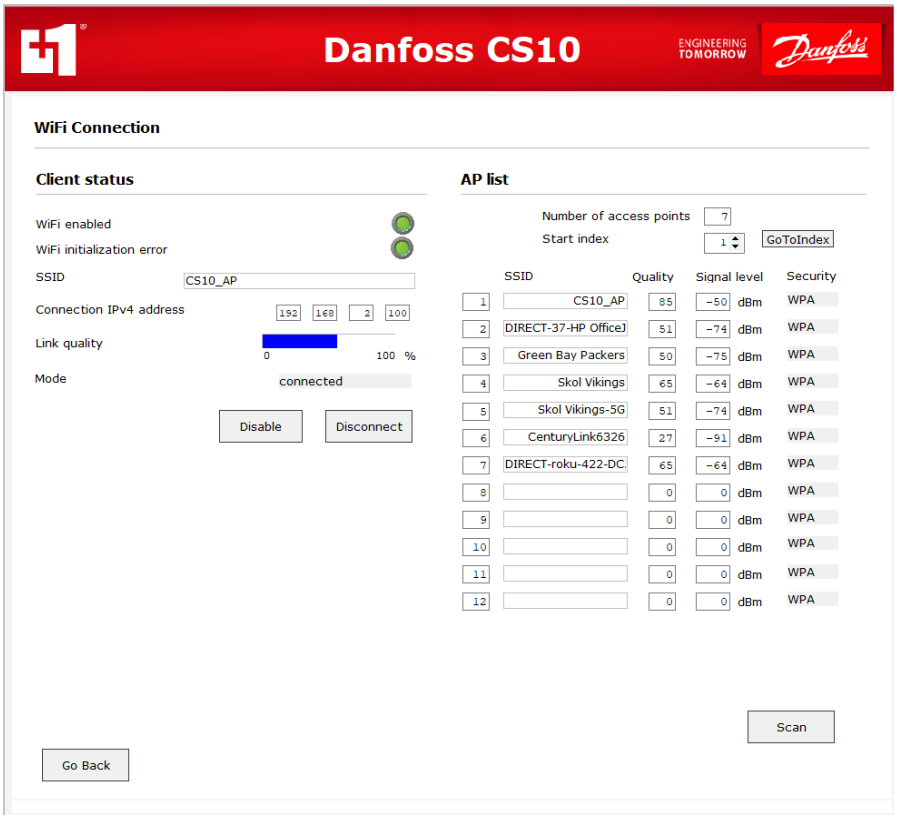
Connection IPv4 address shows the assigned network address.

The section **AP list** shows the networks available. Using the **Scan** button starts a scan for available networks.

The number of available networks is shown in the field **Number of access points**, the first element to be shown in the list can be selected with the **Start index** field.

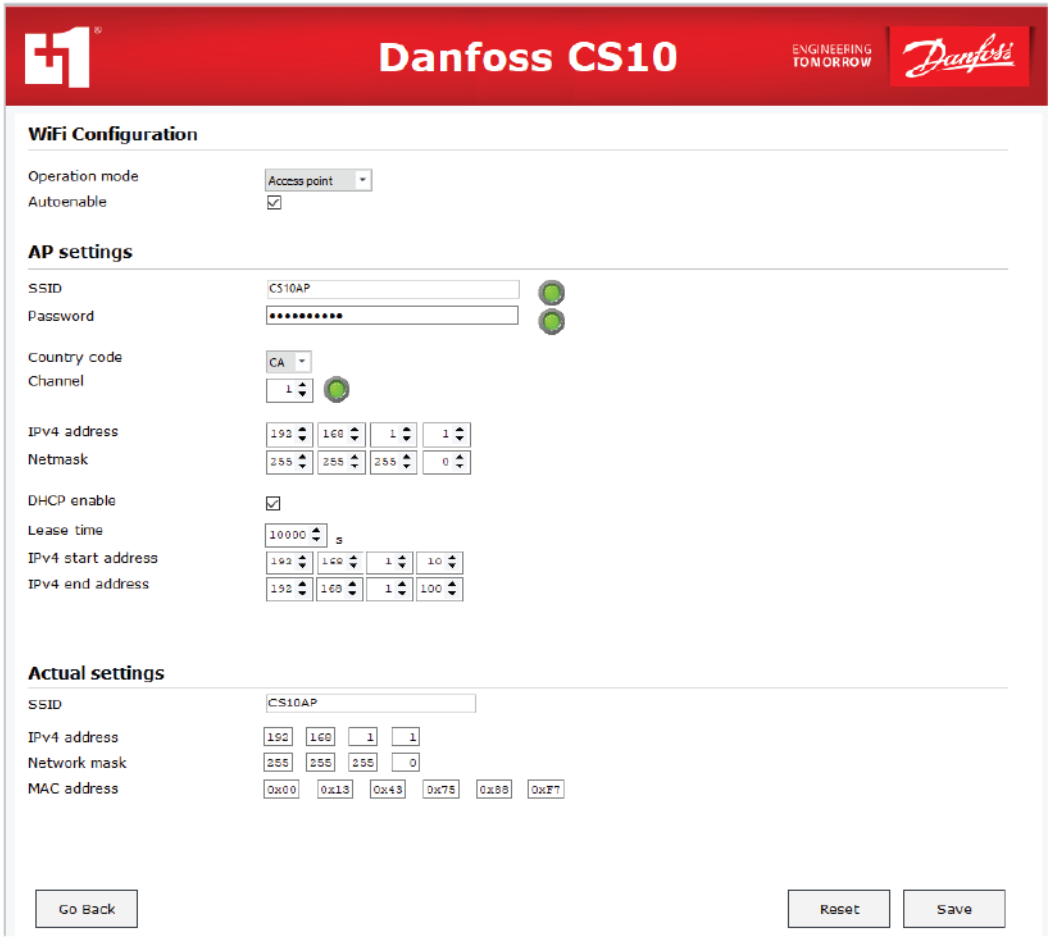
For each available network the **SSID**, **signal quality**, **signal level** and the **security** type are provided.

Configuration



Configuration

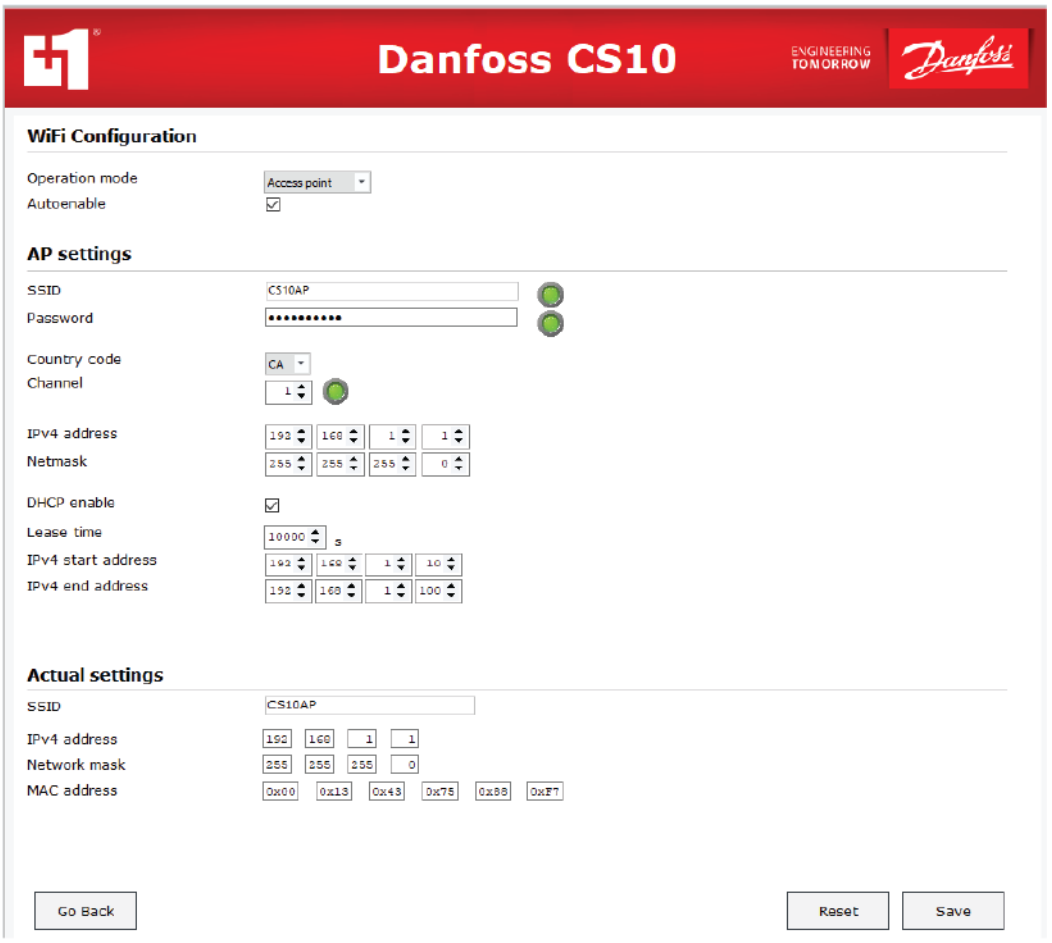
Access point



1. Go to the **WiFi Configuration** page and set “Access point” as **Operation mode**
2. If **Autoenable** is set the automatically enable itself when the device is powered
3. Select SSID and Password for identifying the network
4. Select the appropriate **Channel**
5. Set the address of the access point to be created in in **IPv4 address** and **Netmask**
6. If **DHCP enable** is set all clients that connect as DHCP client automatically retrieve an address from the range defined in the fields **IPv4 start address** and **IPv4 end address** for the time defined in the field **Lease time**
7. Using the **Save** button downloads the data to the device. The actual settings are then shown in the section **Actual settings**

Using the **Reset** button applies a set of default parameter.

Configuration



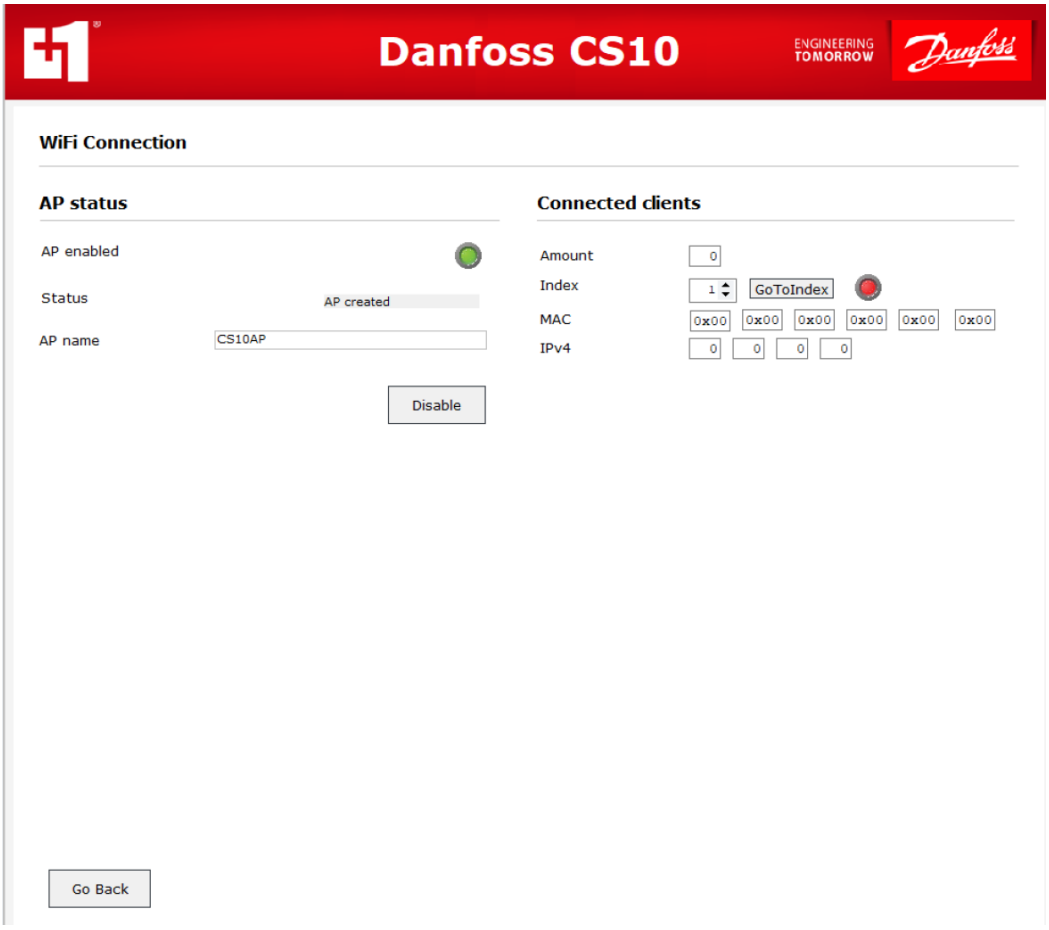
On the **WiFi Connection** page, the status of the configured access point is shown in the section **AP status**.

Enable/**Disable** activates/deactivates the Access point unit of the device manually, the actual status is indicated by the LED **AP enabled**.

A list of the devices connected to the access point is provided in the section **Connected clients**.

The number of clients is shown in the field **Amount**. In the field **Index** the device at this index in the list is shown when applying the **GoToIndex** button. The MAC address and IPv4 address are then shown in the corresponding fields.

Configuration



CAN

The CAN section provides the possibility to setup a set of messages to be received.

The desired baudrate for the CAN unit needs to be set in the field **Baudrate**.

When the baudrate has changed this setting activates after the next power cycle or by using the **DeviceRestart** button on the **Overview** page.

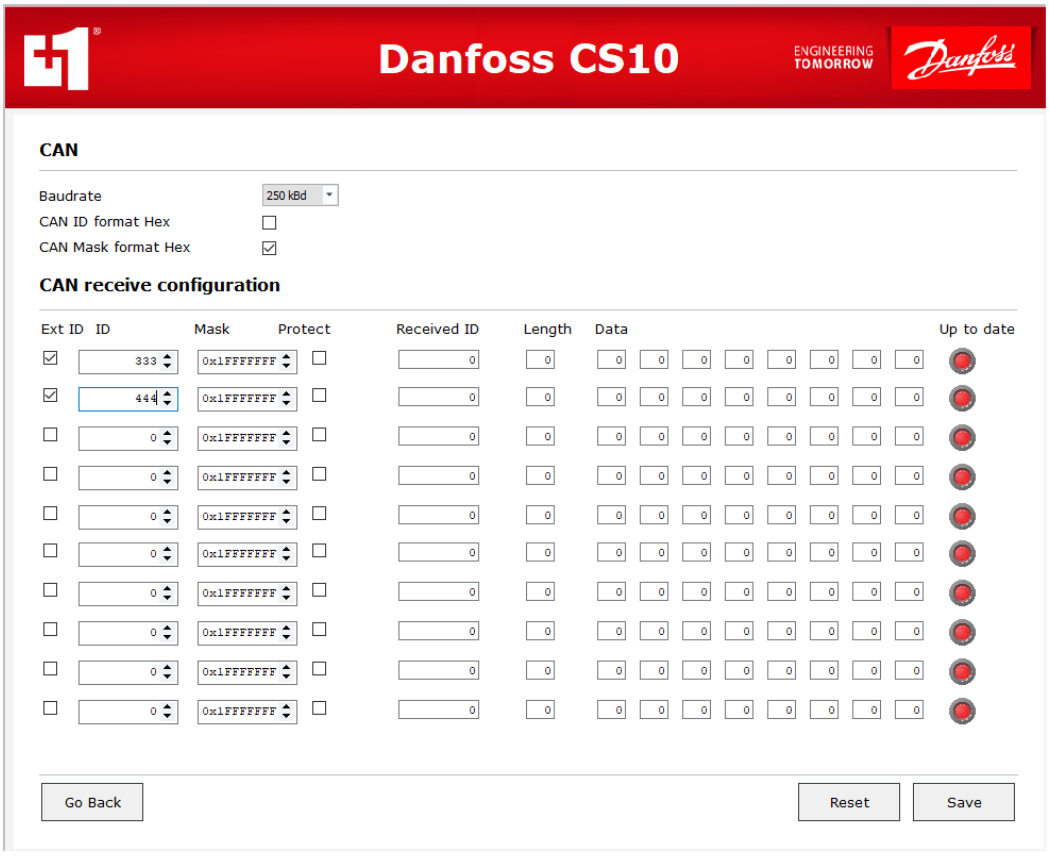
For each signal to be received the **ID**, Indicator for extended ID (**Ext ID**) and **Mask** must be applied. The option **Protect** leaves the latest received message at the output of the corresponding CAN receiver.

Pressing the **Save** button sends the applied configuration to the device.

Using the **Reset** button applies a set of default parameters.

When a corresponding message has been received its parameter appears in the fields **Received ID**, **Length** and **Data**. The LED indicates if the message has been received during the previous second.

Configuration



M2M

The M2M Bridge establishes a connection that transmits CAN messages between CS10 devices using an existing WiFi-connection between them. The two devices can be connected peer to peer where one device is configured as an Access point, and the other one is configured to station mode (DHCP must be disabled). Alternatively, both can be configured to station mode to connect to a router, in this case DHCP needs to be enabled.

For a successful M2M configuration one device needs to be configured as a master, the other one as a slave using the field **Role**.

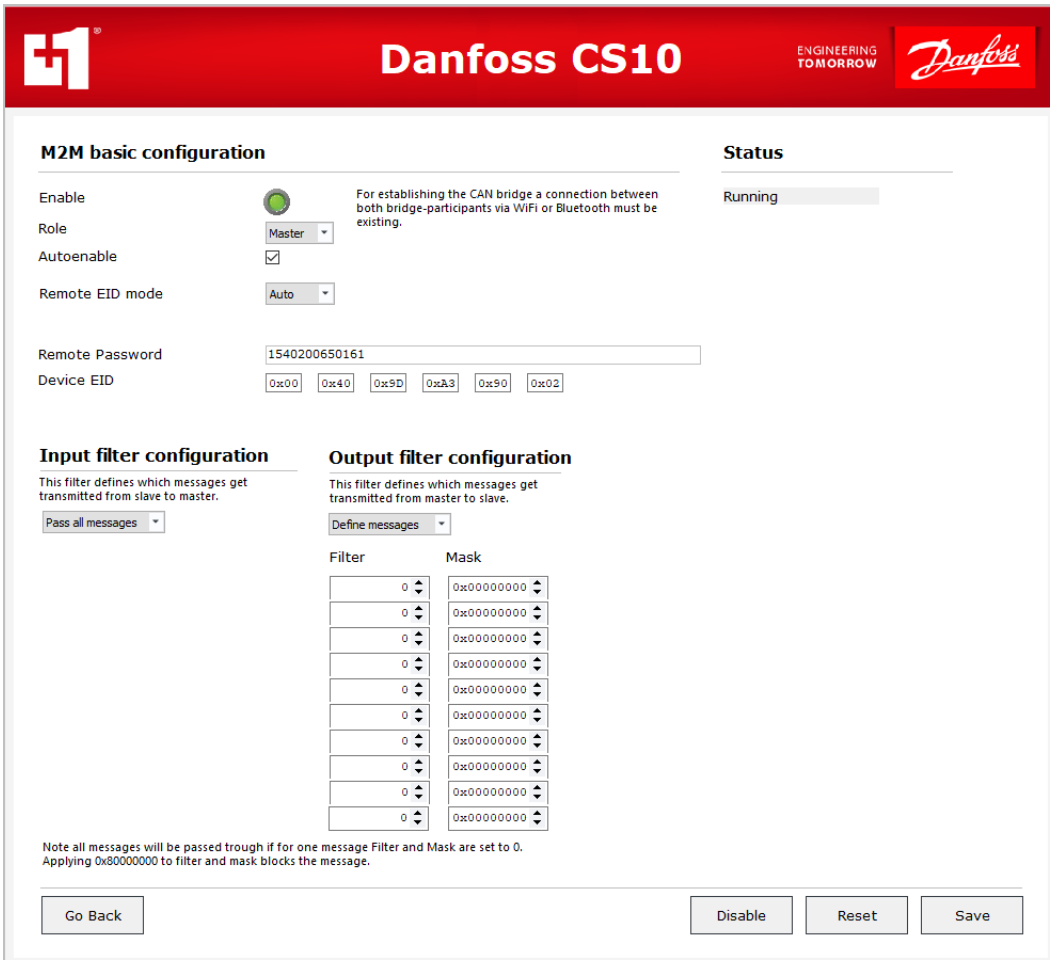
For the slave only the **Local Password** must be applied which needs to match the **Remote Password** of the master device. Due to its multipurpose meaning the local password can be found on the **Overview** page.

For the master device the following settings must be applied. The operation mode can be set in the field **Remote EID mode**. In auto-mode a connection to the first accessible Interlink-device to be found is established while in manual mode a connection to the device with the Interlink EID to be set in the field **Remote EID** is established. To connect to a device the remote password must be applied in the field **Remote Password** where it must match the local password of the slave device. If the option **Autoenable** is set, the M2M unit is automatically enabled when the device is powered. The set of messages to be transferred to and from the connected device is defined in the sections **Remote/Local filter configuration** . In the dropdown list above there are three options available where “Pass all messages” let’s all messages pass through while “Block all messages” let’s no message pass through. The option “Define messages” offers the opportunity to explicitly select up to 10 messages to be transmitted. If the set of Filter/Mask is set to 0 for both all messages will pass the bridge. If the set of Filter/Mask is set to 0x80000000 for both the message is blocked. In the **Output filter configuration** section all outgoing messages are defined, while in the **Input filter configuration** section all incoming messages are defined. All these settings get applied to the device when pressing the button **Save**.

Configuration

The master device automatically starts to establish a connection as soon as it's enabled. The current status of the connection is shown under **Status**.

Using the **Reset** button applies a set of default parameters.



LEDs

There are four LEDs on every CS10 module: one blue, one white, one green, and one red. These are under application software control of the primary processor.

Programming

Nonfunctional specifications

PLUS+1® compliance development

Applicable company software development standards must be adhered to. At time of initial development Danfoss Power Solutions SW PDP v5.00 (70036901v5.00) is the adopted standard.

Product ratings

Environmental testing criteria

Specifications

Operating temperature (ambient)	– 30°C to 70°C
Storage temperature	– 40°C to 85°C
IP rating (with mating connector attached)	IP 67 **Caution** With DEUTSCH DTM06-6S or equivalent mating connector attached
Operating input voltage	6 to 36 VDC
Operating input current	100 mA at 24 VDC
Power consumption	2.4 W
Shutdown current	1 mA max at 24 VDC
Vibration	IEC 60068-2-64
EMI/RFI rating	100 V/M
Weight	110 g

Chemical environment

Description	Applicable standard	Comment
Chemical resistance	ISO 16750-5	

Mechanical environment

Description	Applicable standard	Comment
Vibration	IEC 60068-2-64 test Fh	
Bump	IEC 60068-2-29 test Eb	
Shock	IEC 60068-2-27 Ea	
Free fall	IEC 60068-2-32 Ed	

Electrical/electromagnetic

Description	Applicable standard	Comment
EMC emission	ISO 13766	
EMC immunity	ISO 13766	
Electrostatic discharge	EN 61000-4-2, SAE J1113-13	
Auto electrical transients	ISO 7637-2 & -3	
Short circuit protection	504H0027	
Reversed polarity protection Reversed polarity logic power Reversed polarity battery power	504H0027	

Product ratings

Power

Module supply voltage/maximum current ratings

CS10 modules are designed to operate with a nominal 6 to 36 Vdc power supply.

The modules will survive with full functionality if the supply voltage remains below 36 Vdc.

Specifications

Description	Units	Minimum	Maximum	Comment
Allowed voltage at pin	V		36	
Allowed module current	A		0.3	

Caution

PCB damage may occur.
To prevent damage to the module all module power supply + pins must be connected to the vehicle power supply to support advertised module maximum output current capacity. DO NOT use module power supply + pins to supply power to other modules on a machine.

Modules housing

CS10 module housing features are ultrasonically welded together with an assembly that is tamper-proof. Once assembled at the factory, the housing cannot be opened for service.

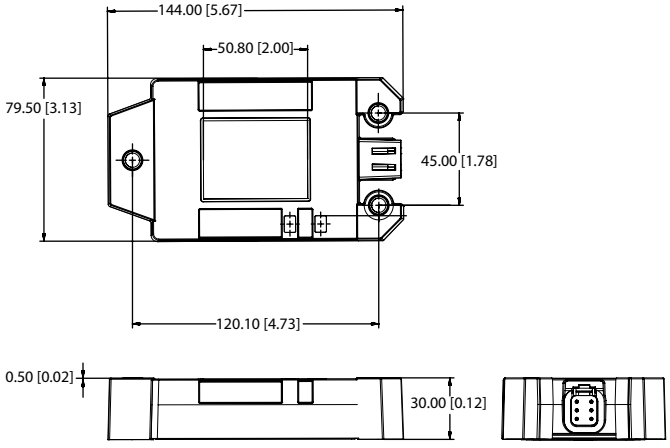
Caution

Warranty will be voided if device is opened.
Device is not field serviceable. Do not open the device.

Product installation and start-up

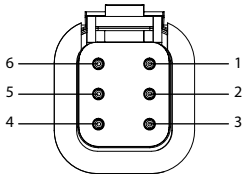
Dimensions

Mounting dimensions (mm [in] and pin assignments



Connector

CS10modules use DEUTSCH connectors. The approved mating connector is the DEUTSCH DTM06-6S Plug. Danfoss assembles mating connector kits, referred to as a bag assembly.



Pin connector

Pin	Function	Pin	Function
1	GND	4	CAN Low
2	Power	5	Key Switch
3	CAN High	6	CAN Shield / Pairing

Hot plugging

Machine power should be off when connecting CS10 modules to mating connectors.

Mounting

Care must be taken to insure that the module connector is positioned so that moisture drains away from the connector.

Provide strain relief for mating connector wires.

Fasteners

Recommended outer diameter (OD)
M6

Product installation and start-up

Grounding

Proper operation of any electronic control system requires that all control modules including displays, microcontrollers and expansion modules be connected to a common ground. A dedicated ground wire of appropriate size connected to the machine battery is recommended.

Product installation and start-up

Machine wiring guidelines

Warning

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. Improperly protected power input lines against over current conditions may cause damage to the hardware. Properly protect all power input lines against over-current conditions. To protect against unintended movement, secure the machine.

Caution

Unused pins on mating connectors may cause intermittent product performance or premature failure. Plug all pins on mating connectors.

- Protect wires from mechanical abuse, run wires in flexible metal or plastic conduits.
- Use 85˚ C (185˚ F) wire with abrasion resistant insulation and 105˚ C (221˚ F) wire should be considered near hot surfaces.
- Use a wire size that is appropriate for the module connector.
- Separate high current wires such as solenoids, lights, alternators or fuel pumps from sensor and other noise-sensitive input wires.
- Run wires along the inside of, or close to, metal machine surfaces where possible, this simulates a shield which will minimize the effects of EMI/RFI radiation.
- Do not run wires near sharp metal corners, consider running wires through a grommet when rounding a corner.
- Do not run wires near hot machine members.
- Provide strain relief for all wires.
- Avoid running wires near moving or vibrating components.
- Avoid long, unsupported wire spans.
- Ground electronic modules to a dedicated conductor of sufficient size that is connected to the battery (-).
- Power the sensors and valve drive circuits by their dedicated wired power sources and ground returns.
- Twist sensor lines about one turn every 10 cm (4 in).
- Use wire harness anchors that will allow wires to float with respect to the machine rather than rigid anchors.

Machine welding guidelines

The following is recommended when welding on a machine equipped with electronic components:

- Turn the engine off.
- Remove electronic components from the machine before any arc welding.
- Disconnect the negative battery cable from the battery.
- Do not use electrical components to ground the welder.
- Clamp the ground cable for the welder to the component that will be welded as close as possible to the weld.

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