MAKING MODERN LIVING POSSIBLE

Technical Information

CWH1000

CAN Wireless Hub

Revision History

Table of Revisions

Date	Changed	Rev
Mar 2014	First edition, Danfoss layout-DITA CMS	AA

Contents

Product overview

CWH1000 CAN Wireless Hub

The Danfoss CWH1000 CAN Wireless Hub provides a gateway between the WMSS1000 Wireless Multi-Sonic Sensors and the machine controller by transmitting and receiving data to and from the WMSS1000(s).

Dual radio modules allow redundancy for improved communication robustness. The CWH1000 is easily integrated into CAN bus systems.

CWH1000 features and options

- PLUS+1® Compliant
- CAN 2.0 B compliant
- Supports 11 bit and 29 bit message ID
- IP 67
- 802.15.4 communication
- Dual radio modules
- Channel hopping (7 groups)
- Support up to 10 sensors per hub
- Long range
- Fast data rate
- Low latency
- Encrypted data traffic

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.

Conformance and compliance

CWH1000 compliance statement

IC: 5969A-PROFLEX1; FCC ID: TFB-PROFLEX1

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

"Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced technician for help."

"Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment"

"This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Theory of operation

CWH1000 theory of operation

The CWH1000 CAN Wireless Hub is paired with up to (10) WMSS1000 Wireless Multi-Sonic Sensors at a time. The hub collects data from all of the sensors and transmits this data on the CAN bus acting as a wireless gateway between the sensors and the machine CAN bus. The hub sends out a wireless beacon on two channels containing sensor operational information. The hub receives the information and calculates when to respond back in a predetermined time. If the sensor does not receive the wireless beacon, it will change to the alternate channel and wait for a beacon from the hub.

Ordering information

CWH1000 ordering information

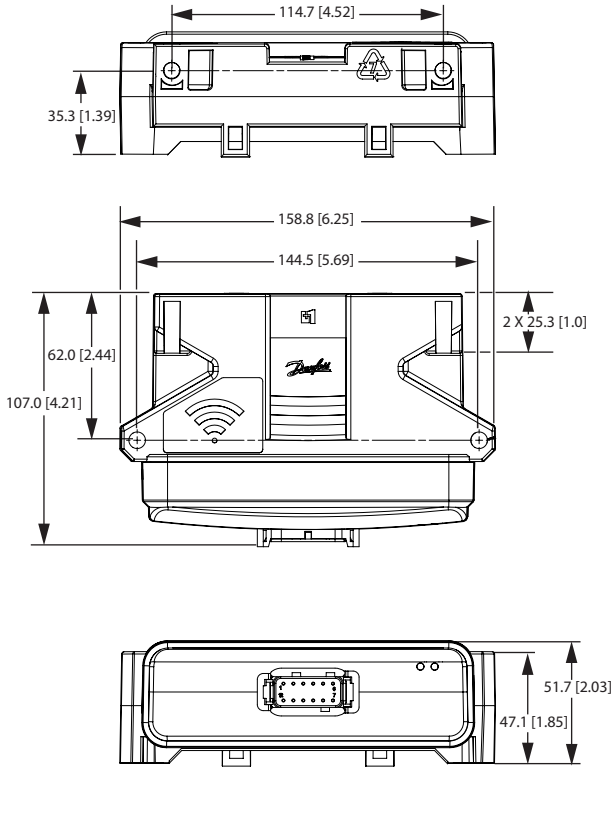
CWH1000 and related products

Product	Danfoss Part Number
CWH1000 CAN Wireless Hub	11138885
CG150 CAN/USB Gateway	10104136
WMSS1000 Wireless Multi-Sonic Sensor	11135819

Product installation

CWH1000 dimensions

mm [in]



P200 121

CWH1000 mechanical installation

The CWH1000 contains radio antennas. For best performance follow the guidelines listed below.

The CWH1000 should be mounted:

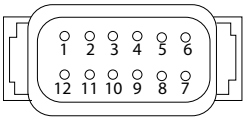
- In a central location on the machine with respect to the wireless sensors.
- As high on the machine as possible.
- In a vertical position.
- Away from metal.
- Using only the mounting holes provided.

Failure to follow these guidelines could result in a decrease in performance.

Connector

CWH1000 connector pin assignments

12 Pin Connector



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Connector pin assignments

Pin	Controller Function	Description	Notes
1	Power Ground	PWR_GND	
2	Power Input	PWR_1	
3	CAN HI	CAN_1_HI	
4	CAN LO	CAN_1_LO	
5	CAN SHIELD_1	CANSHIELD_1	There is a 0.68 uF capacitor and a 1 Ohm resistor in series to ground on this input for CAN shield termination.
6	Configuration Input	RCONFIG_1	Configuration resistor sets source address, see *Setting the CWH1000 source address* for further information.

Recommended machine wiring guidelines

1. All wires must be protected from mechanical abuse. Wires should be run in flexible metal or plastic conduits.
2. Use 85˚ C [185˚ F] wire with abrasion resistant insulation. 105˚ C [221˚ F] wire should be considered near hot surfaces.
3. Use a wire size that is appropriate for the module connector.
4. Separate high current wires such as solenoids, lights, alternators or fuel pumps from sensor and other noise-sensitive input wires.
5. 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.
6. Do not run wires near sharp metal corners. Consider running wires through a grommet when rounding a corner.
7. Do not run wires near hot machine members.
8. Provide strain relief for all wires.
9. Avoid running wires near moving or vibrating components.
10. Avoid long, unsupported wire spans.
11. All analog sensors should be powered by the sensor power source from the PLUS+1 controller and ground returned to the sensor ground pin on the PLUS+1 controller.
12. Sensor lines should be twisted about one turn every 10 cm [4 in].
13. It is better to use wire harness anchors that will allow wires to float with respect to the machine rather than rigid anchors.
14. Electronic modules should be grounded to a dedicated conductor of sufficient size that is connected to the battery (-).

Properly protect power input lines

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.

CWH1000 wireless communications

CWH1000 wireless communications overview

All wireless communication is handled by two 802.15.4 2.4GHz Radio Transceiver Modules controlled by a STM32F205RBT7 microcontroller. There are a total of 15 Radio Channels split into 7 channel groups with each channel group containing two channels. In addition, there is a configuration channel for when the CWH1000 is put into network configuration mode. In network configuration mode, the first Radio Module scans for free sensors to add to the group, while the second sensor looks at the energy in every channel group to determine which groups are busy or noisy.

In run mode, the first radio module emits radio beacons on the first channel in the channel group while the second radio module emits the same radio beacon but on the second channel in the channel group.

In the event that one of the channels becomes inoperable and the sensor loses communication with the CWH1000, the sensor will seamlessly switch to the other channel in the channel group to re-establish communication. This process repeats until the sensor re-establishes communication with the CWH1000.

CWH1000 RF communications initialization

During power up, the CWH1000 checks a switchable internal parameter to see if it should operate in configuration mode or run mode.

If the CWH1000 is set to configuration mode, it will initialize to the configuration channel and listen for any free sensors not already in a channel group.

If the CWH1000 is set to run mode, it will begin broadcasting immediately.

CWH1000 setting for the SA

The CWH1000 has one configuration input to set the Source Address (SA) which is capable of detecting up to 3 distinct source addresses. The input can be connected directly to ground SA=235, left floating (SA=last programmed value) or connected to ground through 2 different resistor values (see table below). The default factory SA is 235. SA can also be configured via CAN using the PLUS+1® Service Tool.

The SA input is only checked during start-up. To change the SA values, the device must be powered up with the SA input in the desired state. Any changes made to the SA input while the device is powered are ignored.

If, on power up, the SA selected by the input state differs from the SA currently stored in non-volatile (NV) memory, the new SA is written to NV memory, overwriting the current value.

Source Address and resistor values:

Source Address	Resistor (Ohms)
235 (0xEB)	0
236 (0xEC)	76.8
237 (0xED)	162

CWH1000 network parameters

The CWH1000 has several parameters stored in non-volatile memory that are used for configuration of the wireless hub. These parameters can be modified using the PLUS+1® Service Tool or, in some cases, by a CAN message. They include the following:

CAN communications:

PLUS+1 Service Tool signal (sensor parameter)	Allowable values	Comments
CANBaudRate:	100,000; 125,000; 250,000; 500,000; 1,000,000	Default=250,000
CANUpdateRate:	5-250mS	Default=10mS
UseExtendedID:	0 = 11 bit, 1 = 29 bit	Default=1(29 bit)
ID:	0- 536870911(0x00-0x1FFFFFFF)	Default=0x18FFB2

CWH1000 wireless communications

CAN communications: (continued)

PLUS+1 Service Tool signal (sensor parameter)	Allowable values	Comments
SA:	235(0xEB), 236(0xEC), 237(0xED)	Default=235
Sensor_ID:	0- 536870911(0x00-0x1FFFFFFF)	Default=218084096(0xCFFB300)

RF communications:

PLUS+1 Service Tool signal (sensor parameter)	Allowable values	Comments
Ch_Group(Channel Group Number):	1-7	Default=1
ClientNumber(Max Sensors):	1-10	Default=9
RFPowerLevel:	12,19	Default=12
ScanRate:	0-255	Default=3

The Ch_Group and ClientNumber parameters must be set on the CWH1000 before operation.

CWH1000 channel group number

The channel group number (Ch_Group) should be different from machine to machine. Each group has two channels; this allows the wireless sensors to change channels in case one of the channels is getting jammed.

It is important to choose channel group numbers that do not overlap with each other. If two running machines are assigned the same channel group number, and are near enough to hear each other, they will automatically sort out which machine gets which channel at the expense of losing their sensor's channel hopping ability. If three or more wireless hubs are in the same area and using the same channel group, the systems will interfere with each other and cause dropped packets and increased data latency.

To select the best channel, turn the CWH1000 on for 30 seconds in configuration mode. After 30 seconds, the CWH1000 will notify you of the best channel to use. The CWH1000 automatically scans all the channels for existing wireless sensor networks and returns the best channel with the least amount of traffic. Since there are a total of 14 channels, it takes time to collect and calculate the best channel. The byte structure is detailed in the programmer's manual. The operating channel group can be changed to the best detected channel with either the PLUS+1® Serivce Tool or by sending CAN command messages to the CWH1000. Further details are in the programmer's manual.

CWH1000 power level

For EU compliance, all devices are set to a lower power level by default. In North America, a higher power level is allowed to get better range and noise rejection. The power level can be changed by either using the PLUS+1® Service Tool or by sending a CAN command message. Further details are in the programmers manual.

CWH1000 Max Sensor parameter

The maximum sensor (ClientNumber) parameter defines how many wireless sensors can be paired to a single CWH1000. The minimum number is 0 and the maximum number is 10. If the number of paired sensors is less than the Max Sensor number or if one of the wireless sensors is turned off, the CWH1000 will still transmit out the missing sensor's respective CAN packets in run mode but will fill the data fields with 0xFF to signify a missing sensor.

CWH1000 wireless communications

Setting the Max Sensor value lets the system detect several error conditions, such as a loss of a sensor during operation or accidentally assigning two sensors the same machine position (PLID).

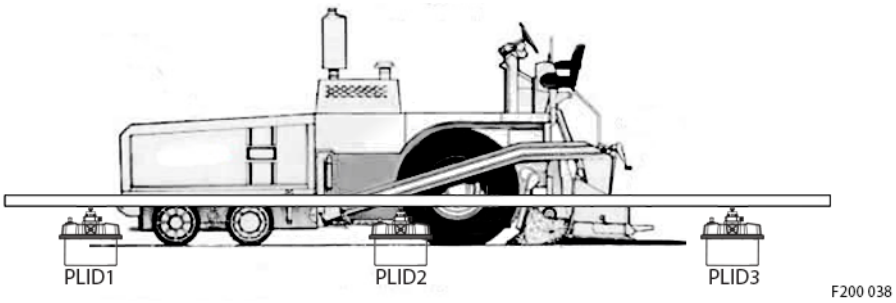
Pairing CWH1000 to WMS1000 and a machine position

WMSS1000 position on the machine

To assign a WMSS1000 Multi-Sonic Sensor to a given position on a machine, the sensor must be assigned a PLID (Programmable Location ID) number.

For example, on the paver machine in the figure below, the front left will be PLID 1, the middle left will be PLID 2, and back left will be PLID 3. To continue on the other side, the front right will be PLID 4, the middle right will be PLID 5, and the back right will be PLID 6.

Paver PLID (WMSS1000 position)



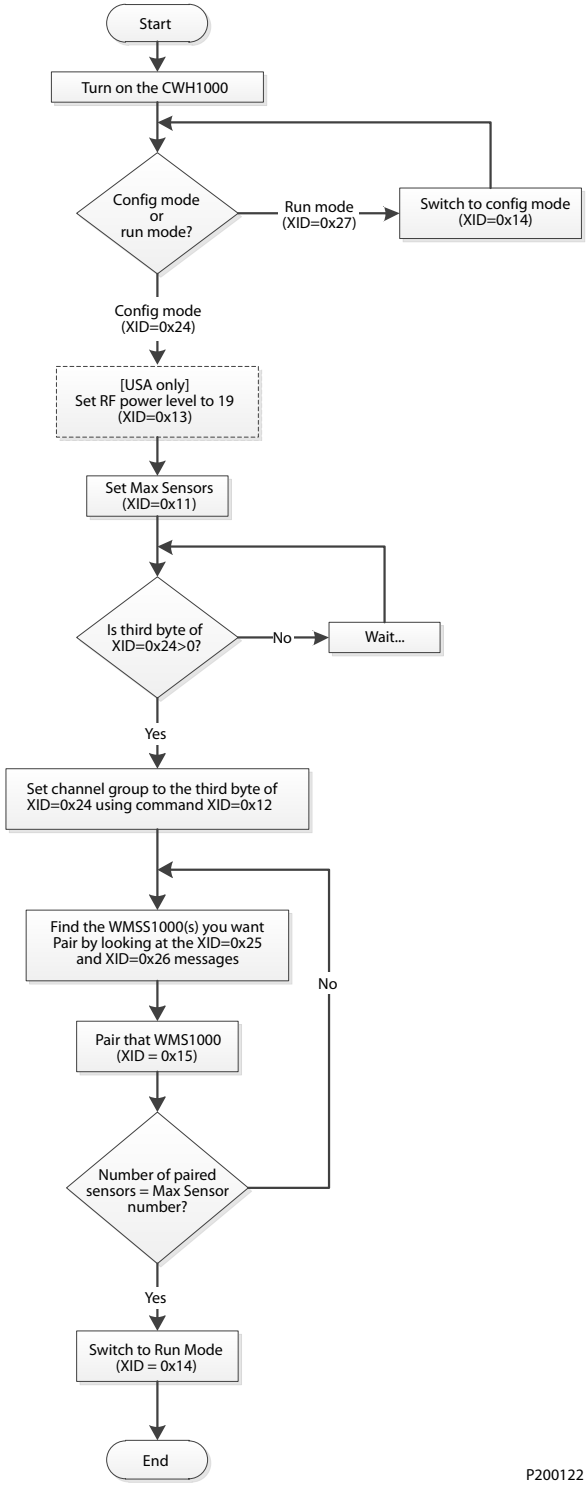
Once the machine positions are numbered, you can permanently pair the WMS1000 to a machine position with the Pair Sensor Command that is detailed in the programmers manual.

Once the sensor is paired, the PLID information is then programmed onto the machine mount such that any future sensors mounted in that position can run without setting up the system again.

CWH1000 wireless communications

CWH1000 to WMSS1000 pairing process

Diagram of the pairing process



Specifications

CWH1000 electrical

Wireless Hub Power Input

Symbol	Description	Values			Notes
		Min.	Typ.	Max.	
Vin	Operating voltage	9 V	-	36 V	
Iq	Typical idle current	-	100mA	-	

CWH1000 environmental

Environmental

Operating temperature range	-40° C to 70° C (-40° F to 158°)
Storage temperature range	-40° C to 70° C (-40° F to 158°
EMI/RFI rating	100 V/m
Ingress Protection (IP) rating (with mating connector attached)	IP 67

CWH1000 mechanical

Mechanical

Weight	0.344 kg (0.758) lbs
Vibration	IEC 60068-2-64
Shock	IEC 60068-2-27

CWH1000 update rates

Expected Network Latency

Number of Paired Sensors	Expected Update Rate (ms)
1	13
2	16
3	19
4	22
5	25
6	28
7	31
8	34
9	37
10	40

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