Fact Sheet

ZigBee Cluster Specification

Danfoss Icon™ Zigbee Radio Module and Icon2™ Main Controller

This ZigBee cluster specification is based of the ZigBee cluster library specification.
If nothing explicit is mentioned below, the commands, clusters and attributes are implemented as per ZigBee Specification

This document describes the interface of the Zigbee Router on SiLabs EFR32MG21, found in the Icon™ Zigbee Radio Module and the Icon2™ Main Controller.

The Danfoss Icon™ system supports a maximum of 3 Danfoss Icon™ Master/Slave Controllers and 45 Danfoss Icon™ Room Thermostats.
The Danfoss Icon2™ system supports a maximum of 4 Danfoss Icon2™ Main Controllers and 60 Danfoss Icon™ Room Thermostats.
Use the attribute ModelIdentifier in endpoint 232 to identify if system is Icon™ or Icon2™

The Zigbee Router will have:
15 Zigbee endpoints for Room Thermostats (due to this limit, an Icon™ Zigbee Radio Module is required for each Icon™ Master/Slave Controller) 1 Zigbee endpoint for the Zigbee Router itself.

If an Endpoint is enabled or disabled (room added/removed on Icon™ system), the following will happen:
1. Rejoin request is send.
2. Device announce is send.
Then it is up to the coordinator to re-discover active endpoints.

Revision History:

Zigbee Cluster + Attributes

Endpoint 1-15	Danfoss Icon™ Room Thermostat										
Profile	(0x0104) Home Automation										
DeviceID	(0x0301) Thermostat										
Cluster:	**(0x0000) Basic**										
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**	**Rep. int. min**	**Rep. int. max**	**Rep. int. change**	**Default**	**Descriptions**
0x0000	ZCLVersion		uint8	R	M					0x03	
0x0001	ApplicationVersion		uint8	R	O	(Yes)				1	Note: OTA not possible for thermostat
0x0002	StackVersion		uint8	R	O					1	Note: OTA not possible for thermostat
0x0003	HWVersion		uint8	R	O					1	Note: OTA not possible for thermostat
0x0004	ManufacturerName		string	R	O					"Danfoss"	
0x0005	ModelIdentifier		string	R	O					""	Danfoss Internal Product ID as string. Can be used to identify whether thermostat is regular or dial version, and if thermostat has floor sensor. "0x8020" - RT24V Display "0x8021" - RT24V Display Floor Sensor The following models are only available on Icon 1: "0x8030" - RTbattery Display "0x8031" - RTbattery Display Infrared "0x8034" - RTbattery Dial "0x8035" - RTbattery Dial Infrared The following models are only available on Icon 2: "0x8040" - RT Zigbee - Display "0x8041" - RT Zigbee - Featured (Infrared) "0x8042" - RT Zigbee - Sensor Lowest bit (bit 0) indicates floor sensor as can be seen by above values (infrared/floor sensor)
0x0006	DateCode		string	R	O					0	Not used.
0x0007	PowerSource		enum8	R	M					4 or 3	"DC Source" or "Battery"
0x4000	SWBuildID		string (16)	R	O					"" (Blank)	Note: OTA not possible for thermostat
Cluster:	**(0x0001) Power Configuration**										
Attribute ID	**Attribute name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0021	Battery Percentage Remaining		int8u	R	O	Yes	1	65534	1	0xFF	In this endpoint, please read both attribute DanfossRoomStatusCode in Thermostat Cluster and attribute DanfossSWStatusCode in Diagnostics Cluster, to determine if low battery or critical battery threshold has been triggered.
Cluster:	**(0x0003) Identify**										
Attribute ID	**Attribute name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	IdentifyTime		uint16	RW	M					0x0000	Added for certification purposes as the actual Room Thermostats are in a separate network and these endpoints are virtual representations.

Cluster:	(0x0201) Thermostat										
Attribute ID	Name	NVM	Data Type	R/W	M/O	Reporting				Default	Descriptions
0x0000	LocalTemperature		int16	R	M	Yes	1	65534	10	0x8000 / -32768	Measured Room Temperature
0x0002	Occupancy		map8	R	O	Yes	1	65534	1	1 (occupied)	Room occupancy state
0x0003	absMinHeatSetpointLimit		int16	R	O	(Yes)				500	Manufacturer specific: absolute minimum temperature in centigrades
0x0004	absMaxHeatSetpointLimit		int16	R	O	(Yes)				3500	Manufacturer specific: absolute maximum temperature centigrades
0x0012	OccupiedHeatingSetpoint	Yes	int16	R/W	M	Yes	1	65534	1	2100 (Suggested default Home setpoint, Danfoss terminology)	"- Setpoint can be written to temporarily override Monday-Sunday schedule until next transition in schedule. - Setpoint is overwritten by a transition in a schedule. - Setpoint can be updated by user on the room thermostat, and it can be written by a Zigbee device".
0x0014	UnoccupiedHeatingSetpoint	Yes	int16	R/W	M	Yes	1	65534	1	1900 (Suggested default Away setpoint, Danfoss terminology)	"- Setpoint can be written to temporarily override Vacation day schedule until next transition in Vacation day schedule. - Setpoint is overwritten by a transition in the Vacation day schedule. - Setpoint can be updated by user on the room thermostat (when vacation day schedule is active) or it can be written by a Zigbee device"
0x0015	MinHeatSetpointLimit	Host	int16	R/W	O	Yes	1	65534	1	absMinHeatSetpointLimit	
0x0016	MaxHeatSetpointLimit	Host	int16	R/W	O	Yes	1	65534	1	absMaxHeatSetpointLimit	
	Control Sequence of Operation		enum8	R/W	M	(Yes)				0x02	Supported: 0x02: Heating Only
0x001C	SystemMode		enum8	R/W	M	(Yes)				0x04	Supported: 0x04: Heating Control Active
0x0020	StartOfWeek		enum8	R	O	(Yes)				0x01	Monday
0x0021	NumberOfWeeklyTransitions		uint8	R	O	(Yes)				42	"= NumberOfDailyTransitions * 7 days"
0x0022	NumberOfDailyTransitions		uint8	R	O	(Yes)				6	Commonly 2 or 4 transitions is enough for hydronic floor heating
0x0025	ThermostatProgrammingOperationMode	Host	map8	RW	O	(Yes)				0b00000000	Supported: Bit 0 = Simple setpoint (0) or schedule (1)
0x0030	SetpointChangeSource		enum8	R	O	Yes	1	65534	1	0x00	
0x4100	DanfossRoomStatusCode		map16	R	n/a	Yes	1	65534	1	0b0000000000000000	See sheet "DanfossRoomStatusCode"
0x4110	DanfossOutputStatus		enum8	R	n/a	Yes	1	65534	1	0	0 = Inactive 1 = Active
0x4120	DanfossRoomFloorSensorMode	Host	enum8	R	n/a	Yes	1	65534	1	0	0 = Room control based on room sensor and room measurement. "DanfossFloorMinSetpoint" will be used to also maintain floor comfort, if floor temperature sensor connected (Temperature Measurement Cluster) to thermostat. 1 = Room control based on floor sensor measurement only (Temperature Measurement Cluster). 2 = Dual Emitter (rarely used)
0x4121	DanfossFloorMinSetpoint	Host	int16	R/W	n/a	(Yes)				1800	If floor sensor connected (Temperature Measurement Cluster), a minimum setpoint for the floor temperature can be specified.
0x4122	DanfossFloorMaxSetpoint	Host	int16	R/W	n/a	(Yes)				3500	If floor sensor connected (Temperature Measurement Cluster), a maximum setpoint for the floor temperature can be specified.
0x4130	DanfossScheduleTypeUsed	Host	enum8	RW	n/a	(Yes)				0	Danfoss Vacation CCB proposal is not finalized by Zigbee Alliance therefore we have this manufacturer specific attribute. 0 = Regular schedule selected 1 = Vacation schedule selected
0x4131	DanfossPreHeat	Host	enum8	RW	n/a	(Yes)				1	0 = Disable, 1 = Enable (Default)
0x414F	DanfossPreHeatStatus	Host	enum8	R	n/a	(Yes)				0	0 = Disable, 1 = Enable

Cluster:	(0x0204) Thermostat UI Configuration										
Attribute ID	Name	NVM	Data Type	R/W	M/O	Reporting				Default	Descriptions
0x0000	TemperatureDisplayMode	TBD	enum8	R/W	M					0x00	0x00 = °C 0x01 = °F Not supported!
0x0001	KeypadLockout	Host	enum8	R/W	M	Yes	1	65534	1	0x00	Range: 0 to 5 0x00 = no lockout 0x01 to 0x05 = lockout (child lock)
Cluster:	**(0x0402) Temperature Measurement**										
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	MeasuredValue		int16	R	M	Yes	1	65534	10	0x8000 / -32768	Third party may start showing that a floor sensor is connected when value changes from 0x8000 to a normal value. If value becomes invalid floor sensor was disconnected. Attribute ModelIdentifier in basic cluster can be used to determine if product has floor sensor
0x0001	MinMeasuredValue		int16	R	M	(Yes)				-2000	Minimum possible sensor value
0x0002	MaxMeasuredValue		int16	R	M	(Yes)				9990	Maximum possible sensor value
Cluster:	**(0x0405) Relative Humidity**	**Relative Humidity Cluster is only used for devices with the following ModelIdentifiers: "0x8040", "0x8041" or "0x8042". Cluster is not present in Icon™ Zigbee Radio Module.**									
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	MeasuredValue		uint16	R	M	Yes	1	65534	10	0xffff	RH % in centi-% (100%=10000) (HDC2010 sensor)
0x0001	MinMeasuredValue		uint16	R	M	(Yes)				0	Minimum possible sensor value
0x0002	MaxMeasuredValue		uint16	R	M	(Yes)				10000	Maximum possible sensor value
Cluster:	**(0x0B05) Diagnostic**										
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x4100	DanfossSWStatusCode		map16	R	n/a	(Yes)	1	65534	1	0x0000	See DanfossSWStatusCode

Endpoint 232	Danfoss Icon™ Zigbee Module
Profile	(0x0104) Home Automation
DeviceID	(0x0507) Physical Device

Cluster:	**(0x0000) Basic**										
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	ZCLVersion		uint8	R	M					0x03	
0x0001	ApplicationVersion		uint8	R	O	(Yes)				1	
0x0002	StackVersion		uint8	R	O					8	Ember ZNet released versions: 0 - unknown/invalid/previous 1 - 5.10.1.0 2 - 6.0.0.0 3 - 6.1.0.0 4 - 6.2.3.0 5 - 6.3.0.0 6 - 6.3.1.0 7 - 6.4.1.0 8 - 6.5.1.0 / 6.5.5.0
0x0003	HWVersion		uint8	R	O					1	
0x0004	ManufacturerName		string	R	O					"Danfoss"	
0x0005	ModelIdentifier		string	R	O					See description	"0x0200" = Icon 1 (Icon™ Zigbee Radio Module) | "0x0210" = Icon2™ Main Controller
0x0006	DateCode		string	R	O					YYYYMMDD	Set in production
0x0007	PowerSource		enum8	R	M					4	DC Source
0x4000	SWBuildID		string (16)	R	O					""	VV.SS.EEEE.vv.ss Example: "00.23.00005.00.29" Host: 00.23; Stack Version: 5; Radio Module: 00.29
Cluster:	**(0x0003) Identify**										
Attribute ID	**Attribute name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	IdentifyTime		uint16	RW	M					0x0000	
Cluster:	**(0x0019) OTA**										
Attribute ID	**Name**	**NVM**	**Data Type**	**R/W**	**M/O**	**Reporting**				**Default**	**Descriptions**
0x0000	UpgradeServerID		IEEE address	R	M					0xFFFFFFFFFFFFFFFF	
0x0001	FileOffset		uint32	R	O					0xFFFFFFFF	
0x0002	CurrentFileVersion		uint32	R	O					0xFFFFFFFF	Device Firmware where: AB.CD (build.release) - e.g. 01.13 (EFR sw version) = 0x010D example: 0x0000010D
0x0003	CurrentZigBeeStackVersion		uint16	R	O					0xFFFF	0x0002 = Zigbee Pro
0x0004	DownloadedFileVersion		uint32	R	O					0xFFFFFFFF	Is written at start of OTA upgrade
0x0005	DownloadedZigBeeStackVersion		uint16	R	O					0xFFFF	Is written at start of OTA upgrade
0x0006	ImageUpgradeStatus		enum8	R	M					0x00	
0x0007	Manufacturer ID		uint16	R	O					0x1246	Danfoss
0x0008	Image Type ID		uint16	R	O					0x0000	
0x0009	MinimumBlockPeriod		uint16	R	O					0x0000	
0x000A	Image Stamp		uint16	R	O					0x0000	

Cluster:	(0x0B05) Diagnostic										
Attribute ID	Name	NVM	Data Type	R/W	M/O	Reporting				Default	Descriptions
0x011C	LastMessageLQI		uint8	R	O					0x00	The Link Quality Indicator is a value between 0 and 255 where 0 indicates the worst possible link and 255 indicates the best possible link.
0x011D	LastMessageRSSI		int8	R	O					0	This is the receive signal strength indication (in dBm) for the last message received.
0x4000	DanfossSystemStatusCode		map16	R	n/a	Yes	1	65534	1	0b0000000000000000	See sheet "DanfossSystemStatusCode"
0x4031	DanfossHeatsupplyRequest		enum8	RW		(Yes)				0	0 = None, 1= Heat Supply Request
0x4200	DanfossSystemStatusWater		enum8	R	n/a	Yes	1	65534	1	0	0 = External indication of hot water flow in pipes 1 = External indication of cool water flow in pipes 2 = External indication of no water flow in pipes (System is IDLE)
0x4201	DanfossMultimasterRole	Yes	enum8	R	n/a					1	0 = Invalid/unused 1 = Master/Primary Controller (room 1 - 15) 2 = Slave1/Secondary Controller 1 (room 16 - 30) 3 = Slave2/Secondary Controller 2 (room 31 - 45) 4 = Secondary Controller 3 (room 46 - 60)
0x4210	DanfossIcon™Application		enum8	R	n/a	(Yes)				0	Current Icon™ MC application.
0x4220	DanfossIcon™ForcedHeatingCooling	Yes	enum8	RW	n/a	(Yes)				2	0 = Force Heating, 1 = Force Cooling, 2 = None (default)

Zigbee Commands

General command frames			
Command Id	**Command Name**	**M/O**	**Direction**
0x00	Read Attributes	M	client->server
0x02	Write Attribute	M	client->server
0x06	Configure Reporting	O	client->server
0x08	Read Reporting Configuration	O	client->server
0x0A	Report Attributes	O	server->client
0x0C	Discover Attributes	O	client->server
Thermostat Cluster (0x0201)			
Command Id	**Command Name**	**M/O**	**Direction**
0x00	Setpoint Raise/Lower	M	client->server
0x01	Set Weekly Schedule	O	client->server
0x02	Get Weekly Schedule	O	client->server
0x03	Clear Weekly Schedule	O	client->server
Identify Cluster (0x0003)			
Command Id	**Command Name**	**M/O**	**Direction**
0x00	Identify	M	client->server
0x01	Identify Query	M	client->server
OTA Update Cluster (0x0019)			
Command Id	**Command Name**	**M/O**	**Direction**
0x00	Image Notify	M	server->client
0x01	Query Next Image Request	M	client->server
0x02	Query Next Image Response	M	server->client
0x03	Image Block Request	M	client->server
0x05	Image Block Response	M	server->client
0x06	Upgrade End Request	M	client->server
0x07	Upgrade End Response	M	server->client

Danfoss Icon™ Zigbee Setpoint/Schedule Scenarios

Please also read sheets "Clusters+Attributes" and "Commands" for attributes and commands related to below descriptions.

User changes Setpoint on Icon™ Room Thermostat Icon™ Controller receives new setpoint, and updates control algorithm immediately. New setpoint is written to "Zigbee OccupiedHeatingSetpoint", if no schedule is running, or if Monday-Sunday schedule is running, If vacation (away) day schedule is running, then new Setpoint is written to "Zigbee UnoccupiedHeatingSetpoint" instead.
Zigbee OccupiedHeatingSetpoint is changed via Zigbee If no schedule is running, or if Monday-Sunday schedule is running, then Icon™ Master (Rail) updates control algorithm immediately with this setpoint. Schedule data is not changed by this action. Schedule (if active) will continue to run.
Zigbee UnoccupiedHeatingSetpoint is changed via Zigbee If vacation (away) day schedule is running, then Icon™ Master (Rail) updates control algorithm immediately with this setpoint. Schedule data is not changed by this action. Schedule (if active) will continue to run.
Zigbee Schedule Monday - Sunday are changed via Zigbee Schedule is stored. If schedule activated control algorithm setpoint will be updated by scheduled transitions. If schedule is activated "Zigbee OccupiedHeatingSetpoint" is updated by schedule transitions.
Zigbee Schedule Monday - Sunday is activated/deactivated using standard Zigbee attribute ThermostatProgrammingOperationMode
Zigbee Schedule Vacation (Away) day is changed using Zigbee. Vacation (away) day schedule is stored (seperate storage from existing day schedules). Vacation is not activated by this action.
Zigbee Schedule Vacation (Away) day is activated/deactivated using standard Zigbee (not possible!) Not possible. Zigbee Alliance stated vacation was assumed to be activated locally and not via Zigbee. A Zigbee CCB has been created and accepted by the Application workgroup
Zigbee Schedule Vacation (Away) day is activated using manufacturer specific Zigbee attribute Control algorithm setpoint will be updated by vacation day schedule transitions. "Zigbee UnoccupiedHeatingSetpoint" is updated by schedule transitions.
Zigbee Schedule Vacation (Away) day is deactivated using manufacturer specific Zigbee attribute Schedule Monday - Sunday are used, if present

DanfossSystemStatusCode

Use the attribute ModelIdentifier in endpoint 232 to identify if system is Icon™ or Icon2™		
For Icon:		
Value	**Status**	**Note**
0x0000	No error	
0x0101	Missing Expansion board	
0x0201	Missing Radio module	
0x0401	Missing Command module	Not applicable
0x0801	Missing Master Rail	
0x1001	Missing Slave Rail no 1	
0x2001	Missing Slave Rail no 2	
0x4001	Pt1000 input short circuit	Forward line temperature sensor error
0x8001	Pt1000 input open circuit	Forward line temperature sensor error
0x0102	Error on one or more output(s)	
For Icon 2:		
Value	**Status**	**Note**
0x0000	No error	
0x0101	Missing Primary	
0x0201	Missing Secondary No 1	
0x0401	Missing Secondary No 2	
0x0801	Missing Secondary No 3	
0x1001	Shunt output short circuit	
0x2001	Shunt output open circuit	
0x4001	Pt1000 input short circuit	Forward line temperature sensor error
0x8001	Pt1000 input open circuit	Forward line temperature sensor error
0x0102	Error on one or more output	
0x0202	Nothing mounted to connector J1	

DanfossSWStatusCode

Value	Status	Note
Bit 0 Bit 1	Cooling/heating mode	Value: 0: System is heating, but room is not active. Value: 1: System is heating, room is active. Value: 2: System is cooling, but room is not active. Value: 3: System is cooling, room is active.
Bit 2		
Bit 3		
Bit 4		
Bit 5		
Bit 6		
Bit 7		
Bit 8		
Bit 9		
Bit 10		
Bit 11		
Bit 12		
Bit 13	Low battery	The battery level on a RT is low. Value is only set if system is Icon™ 1. DanfossRoomStatusCode should also be read to support Icon2™
Bit 14	Critical battery	The battery level on a RT is critical. Value is only set if system is Icon™ 1. DanfossRoomStatusCode should also be read to support Icon2™

DanfossRoomStatusCode

Value	Status	Note
0x0000	No error	
0x0101	Missing RT	No communication between master and RT
0x0201	RT Touch error	Do not use (in an application).
0x0401	Floor sensor short circuit	Floor sensor error
0x0801	Floor sensor disconnected	Floor sensor error
0x1001	Battery Low	Value is only set if system is Icon2™. DanfossSWStatusCode should also be read to support Icon™
0x2001	Battery Critical	Value is only set if system is Icon2™. DanfossSWStatusCode should also be read to support Icon™