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TECHINCAL SPECIFICATION

FreshWell LIN bus description

Revision	Date	# of pages	Description
0.00	04/09/2013	7	First Release / Draft
0.10	23/01/2013	7	System Status Layout definition
0.20	17/11/2014	7	Protocol update after implementation
0.30	04/12/2014	7	Updated Master Request, Slave Response descirption

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1 General Description

This document describes the LIN bus slave protocol implemented into the FreshWell air conditioner.

The protocol implemented into the FreshWell is a LIN V2.2 compliant.

The communication baud rate is set at 19200baud.

The data frame is composed as follow:

Name	Type	Description
ID	1 byte	ID Frame
Data Frame [0]	1 byte	D1 Data
Data Frame [0]	1 byte	D2 Data
Data Frame [0]	1 byte	D3 Data
Data Frame [0]	1 byte	D4 Data
Data Frame [0]	1 byte	D5 Data
Data Frame [0]	1 byte	D6 Data
Data Frame [0]	1 byte	D7 Data
Data Frame [0]	1 byte	D8 Data
Checksum Frame	1 byte	Previous Data Checksum

2 Frame Description

2.1 Control Frame

ID = 0x08

This frame is sent from the master to the slave (the master sends the ID and data frame).

It contains all the data needed to modify the air conditioner status (look at the following tables for details).

Note: The FreshWell air conditioner can be controlled also via remote control, the control frame and the info frame includes some flags used to synchronize

2.2 Information Frame

ID = 0x17

This frame is a data request for the slave (the master sends the ID frame, the slave sends the data frame).

It contains all the information regarding the air conditioner status (look the following tables for details)

2.3 Read By Identifier (Master Request)


ID = 0x3C

The FreshWell air conditioner

2.4 Read By Identifier (Slave Response)

ID = 0x3D


Look at LIN specs for further information

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2.5 Tables

Frame description

FRAME	CTRL_FRAME	INFO_FRAME	LIN_PRODUCT_IDENT_REQ	LIN_PRODUCT_IDENT_RES
ID	0x08	0x17	0x3C	0x3D
DATA 0	Remote Data 1	Remote Data 1	NAD - 0x10	NAD 0x10
DATA 1	Remote Data 2	Remote Data 2	PCI - 0x06	PCI - 0x06
DATA 2	Remote Data 3	Remote Data 3	SID - 0xB2	RSID - 0xF2
DATA 3	Remote Data 4	Remote Data 4	Identifier - 0x00	Supplier ID - 0x1234
DATA 4	Remote Data 5	Remote Data 5	Supplier ID - 0x1234 known / 0x7FFF unknown	
DATA 5	Reserved	Remote Data 6		
DATA 6	Reserved	SYSTEM_STATUS	Function ID - 0x0004 known / 0xFFFF unknown	Function ID - 0x0005
DATA 7	CTRL_STATUS	INFO_STATUS		

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Remote Data1				
bit	Name	Description	Value	unit
0	Not Used			
1	Mode_A	Function mode A	See Table A	
2	FanMode	Ventilation Mode	1-manual 0- auto	
3	SleepMode	Sleep Function	1- Sleep mode enabled	
4	TimerOffMode	Turning off timer flag	1-Timer Off enabled	
5	TimerOnMode	Turning on timer flag	1- Timer On enabled	
6	Not Used		Not used	
7	Power	Air Conditioner status	1- A/C on	
Remote Data2				
bit	Name	Description	Value	unit
0-1	Mode_B	Function mode B	See Table B	
2-3	Speed	Fan Speed	0-Speed1 / 1-Speed2 / 2-Speed3	
4-7	Temp	Target temperature	Temperature = Temp + 16	°C
Remote Data3				
bit	Name	Description	Value	unit
0-7	OnTimerMSBits	Turning on minutes left	TimeON = OnTimerMSBits * 10	min
Remote Data4				
bit	Name	Description	Value	unit
0-7	OffTimerMSBits	Turning off minutes left	TimeOFF = OffTimerMSBits * 10	
Remote Data5				
bit	Name	Description	Value	unit
0-3	TimerMinLSBits	Residual timer time within the 10min set	TimeON(or TimeOFF) + TimerMinLSBits = minutes left to timeout	
4-7	Not Used			
Remote Data6				
bit	Name	Description	Value	unit
0	EconomyOn	Economy Function Status	1-Economy mode Enabled	
1	InverterOn	External inverter Function Status	1-External Inverter Enabled	
2-7	Not Used			
System Status				
bit	Name	Description	Value	unit
0	CompRun	Compressor Status	1-Compressor ON	
1	Not Used			
2-7	IntTemp	Internal temperature Level	Internal temperature value (0 – 45)	°C
Info Status				
bit	Name	Description	Value	unit
0	LocalChange	Status Modified from external control	1-Sync Request	
1	Not Used			
2	Error	Temp. Probe error	1 - error	
3	TimerOnReq	AC On due to a timer on timeout	1 - Timer On Completed	
4	TimerOffReq	AC Off due to a timer off timeout	1 - Timer Off Completed	
5	RemoteOn	AC On due to a Remote input request	1 - Remote On Enabled	
6	Not Used			
7	LinError	Error on LIN bus	1 -Error	
Ctrl Status				
bit	Name	Description	Value	unit
0	RemoteCtrlDis	Remote control disable	1-Disabled	
1	RemoteOnDisable	Remote Input disable	1-Disabled	
2	SyncFrame	Master LIN synchronized to AC	1-Master Synchro	
3	TimerUpdate	Update Timer	1-Update Timer	
4	SetInverterOff	Disable the Output for external inverter	1-Force OFF	
5	SetInverterOn	Enable the output for external inverter	1-Force ON	
6-7	Reserved	Reserved		

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Note:

- Remote Data1..5 has the same layout in both the frames (info and control), the Info Frame describes the actual status of the air conditioner, the Control Frame set the desired status of the air conditioner. The air conditioner modify its internal status only if it reads a change on the control frame, if the control frame is the same as the previous the air conditioner discard the settings contained. That is done to save time on the air conditioner control card.
Remote Data 6 is used only as info.
Note: It is not possible to modify the air conditioner modes, or the fan speed, or the UV Lamp status faster than 1s in order to preserve the life of the control card relay.
- Synchronization procedure:** The FreshJet air conditioner can be controlled in several ways (LIN, CAN or remote control). In order to align all the controllers it is necessary to introduce a synchronization procedure. In this paragraph it is described the procedure that a master LIN has to follow to work properly with the other controllers. The flag Local change (Info_Status.0) informs that an external controller has modified the air conditioner status. The LIN master has to read all the info contained on the remote data and update its memory, then send a control frame with the remote data updated and the SyncFrame flag set (Ctrl_Status.2).
NOTE: Only the synch frame has to set the SyncFrame bit. The slave recognize a sync frame only if there is a SyncFrame bit modification from 0 of the previous message to 1 of the actual one.
- Timer Description**
The FreshJet includes a double way timer (turning on and turning off). It is possible to set the time left to turning on and the time left to turning off expressed in minute.
It is possible to set the timer in three different modes:
 - Only turning on timer
 - Only turning off timer
 - Turning on then Turning off timer
 The procedure to set up a timer is as follow described:
 - Set the timer left time to event
 - Set the timer enable flag
 - Set the timer update flag
 - Send the control message and on the next Info_Frame it is possible to verify the settings done
 - Once the timer event has happened the timer count down flag will be set. The reset of this flag it will be done after the next timer settings.*NOTE: every message received with timer update flag set will set the timers with the new value received, to let the timer run it is necessary to reset the timer update flag!*
- External Functions description**
The FreshJet air conditioner has the capability to read external inputs and to set an external output:
 - Input to set the economy mode (disable the compressor)
 - Input to remotely turn on the air conditioner
 - Output to be connected to enable an external power source (inverter or generator) in case of mains supply failure
 Through the LIN bus communication the LIN master can monitor these functions status or control they setting the economy mode, turning on and off the air conditioner or also drive an external power source.
- Function Modes Table**

Mode_A	Mode_B.1	Mode_B.0	Function Mode
0	0	0	Dry
0	0	1	Reserved
0	1	0	Reserved
0	1	1	Reserved
1	0	0	Auto ^(*)
1	0	1	Cool
1	1	0	Heat ^(*)
1	1	1	Fan

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- *LIN timeout*

LIN master have to keep active the communication with the slave (air conditioner) in case of communication missing the slave disables the LIN driver in order to save energy. The communication timeout just described is set in 5s. In case of master reconnection (new message sent after more then 5s) the slave uses the first message as wakeup, and it doesn't answer to this message.

NOTE: Actually the LIN doesn't have any timeout.

2.6 Other Implemented Frames

In order to better fulfil the LIN protocol the Master Request, Slave Response frames have been enlarged to the following SID:

- 0xB0: Assign NAD
As described into the LIN 2.2 protocol it is used to change NAD for a slave device
- 0xB2: Read By Identifier
Previously described frame, it works as described into the LIN 2.2 protocol
- 0xB4: Data Dump, used for Debug
It is used as debug for the air conditioner, and it can directly drive the AC functions.
 DATA1: Defines which debug message id request
 DATA2-3: Contains the password for the Debug (0x0251)
 The answer contained into the slave response depend by the debug id request:
 DATA1: ID 0x01 = Temperature byte
 DATA2: Room Temperature ($T = (\text{value} / 2) - 30$)
 DATA3: Indoor coil Temperature ($T = (\text{value} / 2) - 30$)
 DATA4: Outdoor coil Temperature ($T = (\text{value} / 2) - 30$)
 DATA5: Save counter, it counts the number of times it has saved into eeprom

 DATA1: ID 0x02 = Compressor Timers
 DATA2-3: Safety Timer
 DATA4-5: Compressor Timer

 DATA1: ID 0x03 = System Status
 DATA2-3: Sleep Timer
 DATA4.0: Mains Failure
 DATA4.1: Room Temp. Probe Failure
 DATA4.2: Indoor Temp. Probe Failure
 DATA4.3: Outdoor Temp. Probe Failure
 DATA4.4: 4 ways valve status
 DATA4.5: Heating resistor status
 DATA5.0: Indoor Fan Speed LOW
 DATA5.1: Indoor Fan Speed MID
 DATA5.2: Indoor Fan Speed HIGH
 DATA5.0: Outdoor Fan Speed LOW
 DATA5.1: Outdoor Fan Speed MID
 DATA5.2: Outdoor Fan Speed HIGH
- 0xB6: Save Configuration
As described into the LIN protocol it is used to save the settings into eeprom.
- 0xB7: Assign Frame ID range
As described into the LIN protocol it is used to change the frame address. Frame 0 is the control frame, frame 1 is the INFO frame.