ClimateTalk 2.0
HAC Motor Application Profile

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Abstract

ClimateTalk is a universal language for innovative, cost-effective solutions that optimize performance, efficiency and home comfort. The ClimateTalk Open Standards define a set of messages and commands to enable interoperability, enhanced user interface, and machine to machine control independent of the physical layer connecting the devices.

This document defines the application requirements corresponding to OSI Layer 7 that are specific to a Heating and Air Conditioning (HAC) motor operation and interaction with other devices on a ClimateTalk network.

Updates

This specification may be updated at any time and may be superseded by a more recent version or amended to from time to time. Users should be certain they are using the current ClimateTalk version and the latest revision of the documents.

The released versions of all specifications are available at http://www.ClimateTalk.org

Version History

ClimateTalk Version	Document Revision	Release Date	Comments
V 1.0		2009-08-24	Initial Release
V 1.3		2011-11-02	Errata Updates, Revised Formatting
V 2.0	00	2013-01-18	Version 2.0 Release – Correct packet example messages (Reset, power level, manufacturer ID reply).
V 2.0	01	2013-06-12	Updated references to /4 to be *4. Actual data transmitted is the desired CFM or RPM multiplied by 4. Updated DMA Request - CFM Status to show the correct number of bytes requested for the response received.

Contributors

The following is a list of ClimateTalk Alliance member companies that were actively engaged in the development of this standard:

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1.0 Overview

1.1 ClimateTalk Model

ClimateTalk is an open standard that defines a set of messages and commands to enable interoperability, enhanced user interface, and machine to machine control independent of the physical layer connecting the devices.

The messages and commands defined by ClimateTalk Information Model (CIM) are the presentation and application layers as defined by the OSI Model[1]. ClimateTalk Applications are fully defined at Layer 7 of the OSI model by a combination of a Device Specific Application Profile, the Generic Application Specification and the Command Reference.

ClimateTalk messages can be carried over any physical medium following the OSI model. The ClimateTalk Presentation Layer defines how messages are executed over the various physical mediums in use.

CT-485 and CT-LWP are wired serial physical and network layers designed to support the formation of ClimateTalk networks and transport ClimateTalk messages, but other OSI based protocols – including wireless transports - can be used as well.

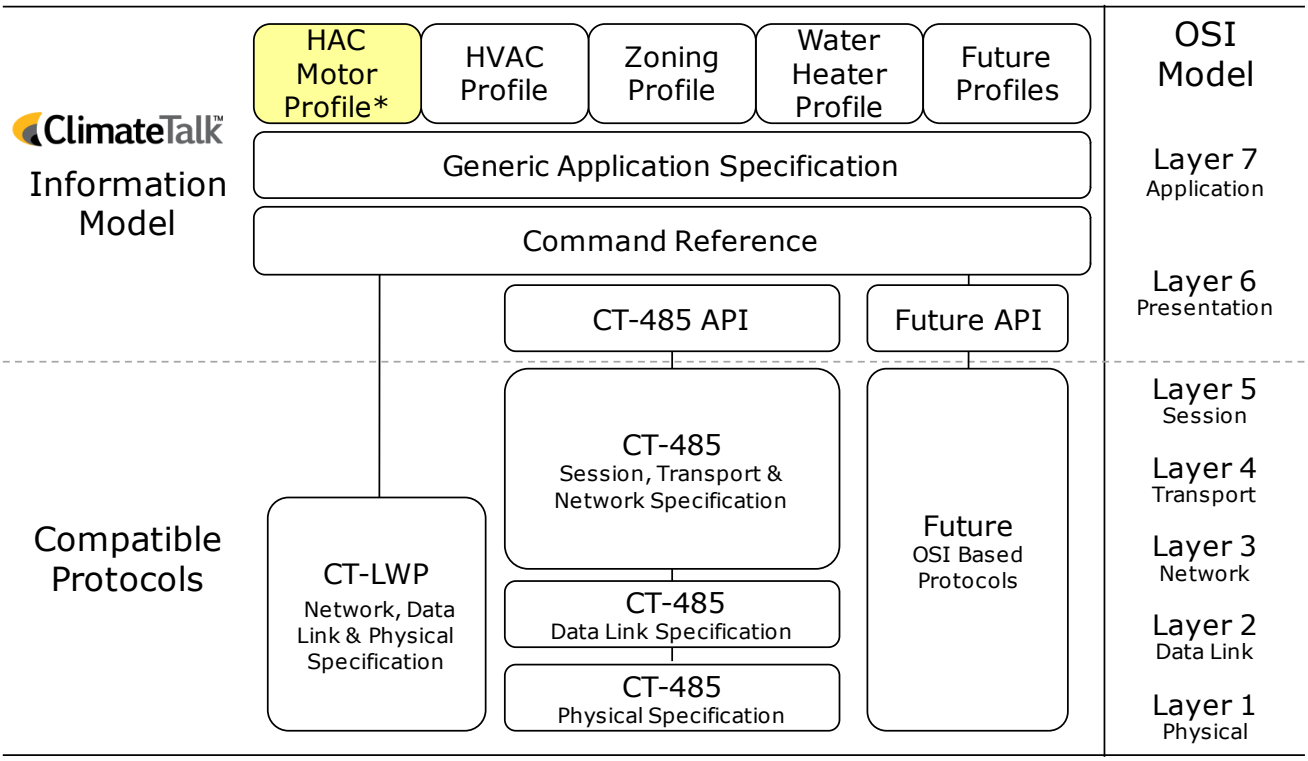
1.2 Scope

This document defines the specific application requirements for a variety of Heating and Air Conditioning (HAC) motors designed to ClimateTalk Open Standards. This profile defines how to operate & monitor the motors and how the motor interacts with other devices on a ClimateTalk network. This profile builds on the *Generic Application Specification* defining requirements common to all ClimateTalk enabled devices.

The ClimateTalk Open Standards package shown in Figure 1 - OSI Layers for ClimateTalk Implementation prescribes the mandatory requirements to ensure proper network formation of interoperable devices. Membership in the ClimateTalk Alliance as well as successful completion of mandatory conformance testing is required for listing a product as a ClimateTalk Certified Device.

[1] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=20269

Figure 1 - OSI Layers for ClimateTalk Implementation



**This Document*

This profile also defines the testable requirements used to validate that a motor is behaving properly within a ClimateTalk network. Each device must comply with the mandatory requirements defined in this document as well as all other ClimateTalk standards applicable to the device functionality.

2.0 Normative References

A good understanding of the most recent version of the following documents is required to apply the contents of this specification correctly.

ClimateTalk HVAC Application Profile

ClimateTalk Generic Application Specification

ClimateTalk Command Reference

ClimateTalk CT-LWP Specification

3.0 Terminology

3.1 Definitions

Attempt Delay The amount of time a subsystem waits for a response from another subsystem to a request.

Null Byte Hexadecimal zero, also shown as 0x00.

Profile Set of rules governing the implementation of certain aspects of the protocol, which will include timings and communication rules to function properly.

Shared Data Configuration information for each subsystem on the network that is stored by multiple subsystems on the network. This allows for automatic configuration of replacement subsystems and is optional for the Motor Profile.

Master Network node in charge of all communication functions. The master node shall be one of the subsystems defined in the ClimateTalk HVAC profile.

Slave Within this profile, a slave is a motor that only communicates upon initiation from a Master node. There can be up to 254 slave nodes per CT-LWP network.

Twos compliment A means by which binary numbers can be used to represent both positive and negative numbers. The twos compliment of a binary number is defined as the value obtained by subtracting the number from a large power of two, specifically, from 2^N for an N-bit two's complement. This mechanism enables negative numbers behave like the negative of the original number in most arithmetic, and it can coexist with positive numbers in a natural way. An N-bit two's-complement numeral system can represent every integer in the range −2N−1 to +2N−1−1.

3.2 Acronyms

A_{rms}	Root mean square of the amperage
CCW	Counter clockwise
CFM	Cubic Feet per Minute
CW	Clockwise
DBID	Database Identification
DMA	Data Memory Access
IBM	Indoor Blower Motor (Furnace/ Air Handler Blower Motor)
IEEE	Institute of Electrical and Electronics Engineers
IFM	Inducer Fan Motor
LE	Lead end of the motor
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MDI	Message Data Interface
Nm	Newton meters
OFM	Outdoor Fan Motor
PHOME	Position Home
PVAL	Position Value
RPM	Revolutions per Minute
SD	Shared Data
STP	Stepper Valve Position Motor
SW	Software
VAC_{rms}	Root mean square of the AC Voltage

3.3 Word Usage

The conventions used in this document are modelled after the definitions of the *2009 IEEE Standards Style Manual*. The *IEEE Standards Style Manual* can be downloaded from https://development.standards.ieee.org/myproject/Public/mytools/draft/styleman.pdf.

can Equivalent to *is able to* or *is capable of*.

may Equivalent to *is permitted to* or *is allowed to*. The use of *may* means that something is optional and does not imply a requirement.

must Used to describe situations where no other course of action is possible.

shall Equivalent to *is required to*. Use of the word *shall* means that the specification shall be implemented exactly as described in order to ensure correct operation and interoperability with other devices.

should Equivalent to *is recommended that*. This is used in situations where there are several possible options, but one option is preferable to the others.

4.0 Normal Operation

4.1 Protocol Requirements

This version of the Motor Application Profile shall be used with CT-LWP protocol. In its current definition, the motors are intended to be connected as a slave in a master-slave configuration with the master device being one of the subsystems defined in the ClimateTalk HVAC profile.

4.2 ACK and NAK Usage

The ClimateTalk Motor, as a slave device, supports multiple message acknowledgements presented in the application layer and a NAK1 message used in the network layer. Reference ClimateTalk standard, CT-LWP for the proper response from the slave device under each circumstance.

4.3 General Rules

This section details the general rules that apply for normal operation of the motor types supported in this profile.

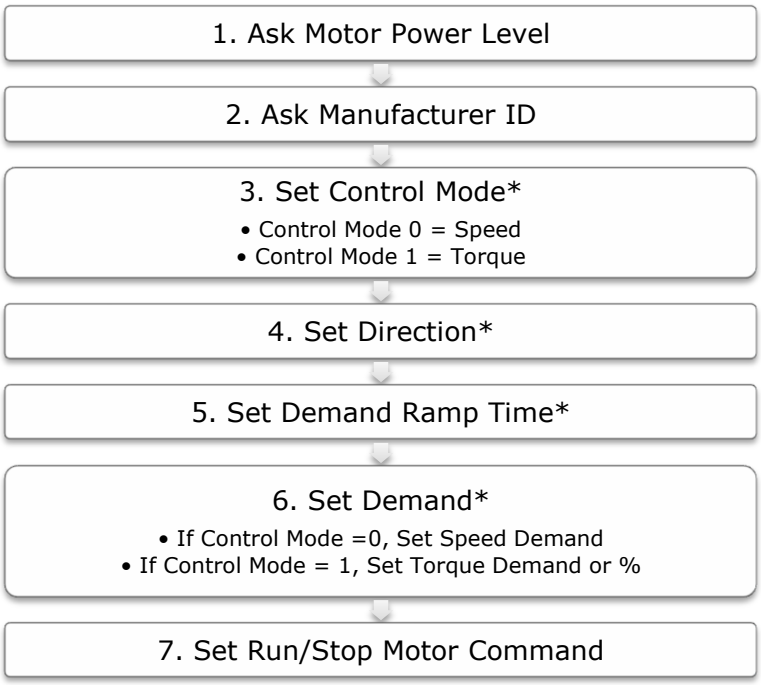
- Control Status1 indicates the status of the motor. The master is responsible for asking the Control Status1 of the motor using a DMA request as specified in Section 7.1. Packet examples of these commands can be found in Section 8.0. The control status 1 request can be made at any time.
- If required minimum parameters, as defined in the following sections for each motor type, are set, the motor will run.
    - If a run command is sent and the minimum parameters are not set, the motor will not run and respond with ACK3.
    - Bit 10 of Control Status1 is set if the minimum parameters required to run the motor have not been set. This flag will be cleared once all the required parameters are successfully sent to the motor.
- Direction, Control Mode and Blower Coefficients (if applicable) should not be changed while the motor is running.
    - Attempt to change these parameters while the motor is running will result with an ACK2 response and the motor will keep running using prior settings.
    - Bit 15 of Control Status 1 is set if 'Undesired Parameters' have been sent. This flag will be cleared once a stop command is issued to the motor. The motor will not retain the undesired parameter that was sent.
- When the motor is stopped, the master is responsible for issuing new direction, control mode and blower coefficients (if applicable) otherwise the motor will use the previous values that were sent.
- The master is responsible for ramping down to a lower desired demand (airflow, speed or torque) before issuing a command to stop the motor.
- If Run/Stop Motor Command is cleared, the master stops the motor immediately.

4.3.1 Running an Indoor Blower Motor

A motor must be able to understand and respond to the mandatory set of message types as defined in Section 6.0.

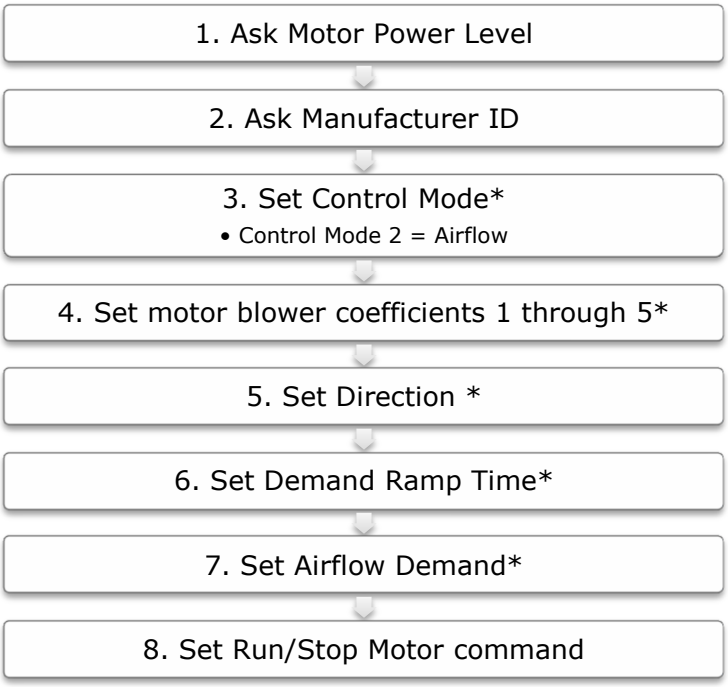
The steps to operate an Indoor Blower Motor are dependent on the operating mode selected and are defined as follows:

In Speed or Torque Mode - Control Modes 0 or 1



*NOTE 1: In speed or torque mode, Parameters 3 through 6 are required to run the motor

In Airflow Mode - Control Mode 2;



*NOTE 2: In airflow mode, Parameters 3 through 7 are required to run the motor

The following table shows appropriate responses from the motor for most commonly used commands on an Indoor Blower Motor.

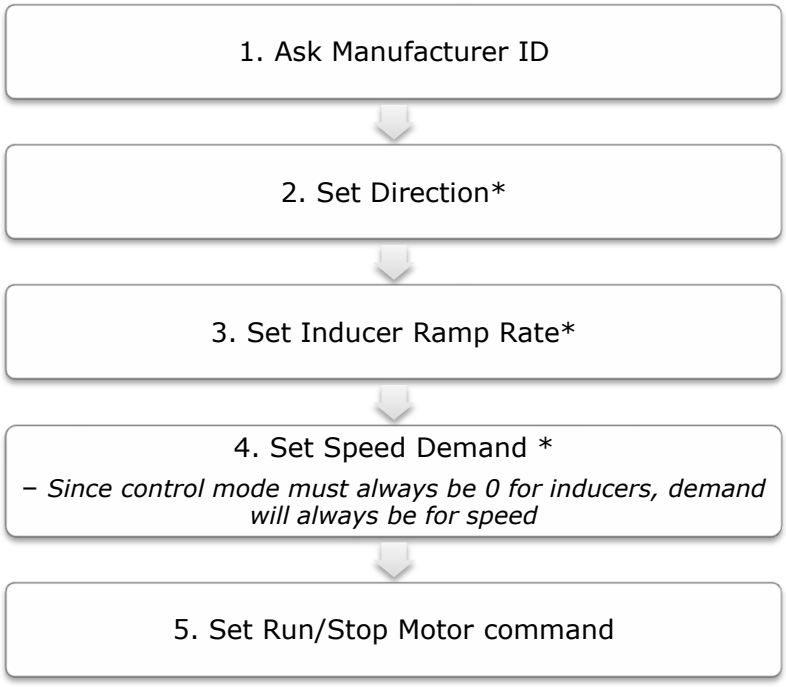
Command	Response if Stopped			Response if Running		
	Torque Mode	**Speed Mode**	**CFM Mode**	**Torque Mode**	**Speed Mode**	**CFM Mode**
Set Control Mode	ACK1	ACK1	ACK1	ACK2	ACK2	ACK2
Set Motor Speed	ACK2	ACK1	ACK2	ACK2	ACK1	ACK2
Set Motor Torque	ACK1	ACK2	ACK2	ACK1	ACK2	ACK2
Set Air Flow Demand	ACK2	ACK2	ACK1	ACK2	ACK2	ACK1
Set Demand Ramp Time	ACK1	ACK1	ACK1	ACK1	ACK1	ACK1
Set Motor Direction	ACK1	ACK1	ACK1	ACK2	ACK2	ACK2
Set Motor Torque Percent	ACK1	ACK2	ACK2	ACK1	ACK2	ACK2
Set Blower Coefficient 1	ACK2	ACK2	ACK1	ACK2	ACK2	ACK2
Set Blower Coefficient 2	ACK2	ACK2	ACK1	ACK2	ACK2	ACK2
Set Blower Coefficient 3	ACK2	ACK2	ACK1	ACK2	ACK2	ACK2
Set Blower Coefficient 4	ACK2	ACK2	ACK1	ACK2	ACK2	ACK2
Set Blower Coefficient 5	ACK2	ACK2	ACK1	ACK2	ACK2	ACK2
Set Air Flow Limit	ACK1	ACK1	ACK1	ACK1	ACK1	ACK1
RUN/STOP Motor	ACK1	ACK1	ACK1	ACK1	ACK1	ACK1

NOTE 3: *ACK1 represents a valid message receipt with valid and complete parameters*
ACK2 represents a valid message with undesired parameters

Table 1 - Acknowledgements to Commands

4.3.2 Running an Inducer Fan Motor

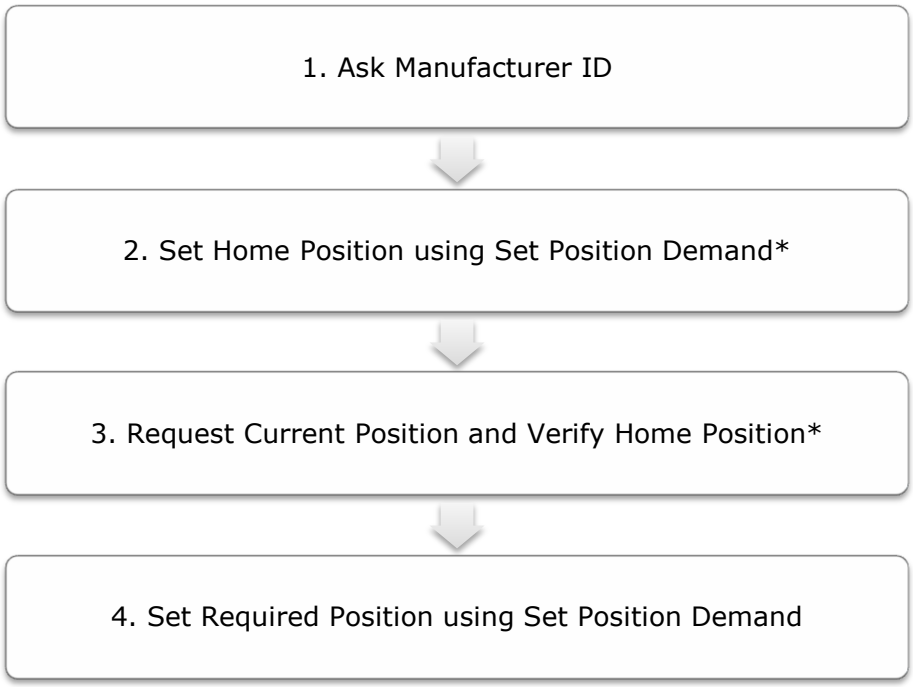
A motor must be able to understand and respond to the mandatory set of message types as defined in Section 6.0. The steps to operate an Inducer Fan Motor are as follows:



*NOTE 4: Parameters 2 through 4 are required to run an inducer fan motor

4.3.3 Running a Stepper Motor

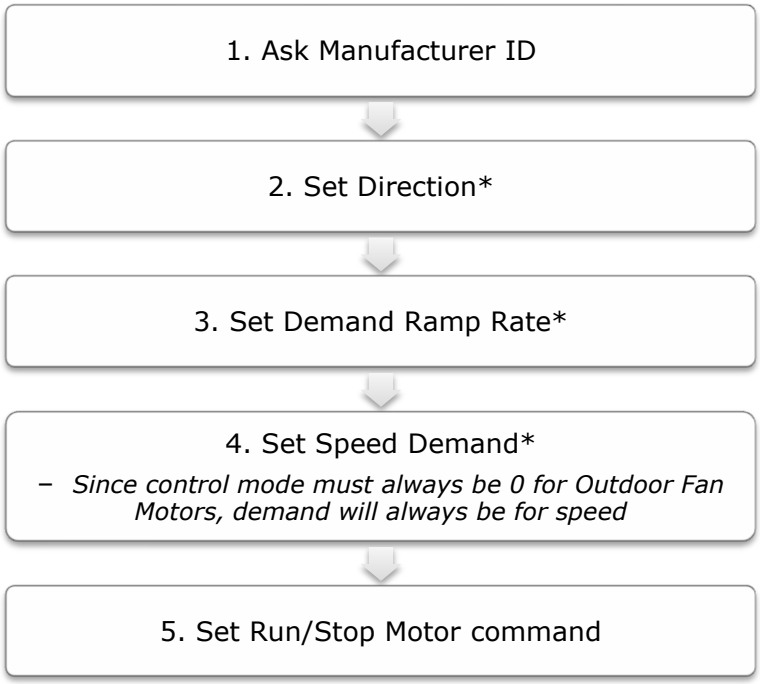
A motor must be able to understand and respond to the mandatory set of message types as defined in Section 6.0. The steps to operate a Stepper Motor (STP) as a Furnace Gas Valve controller are as follows;



*NOTE 5: Parameters 2 through 3 are required to run a stepper motor

4.3.4 Running an Outdoor Fan Motor

A motor must be able to understand and respond to the mandatory set of message types as defined in Section 6.0. The steps to operate an Outdoor Fan Motor (OFM) for an Air Conditioner or Heat Pump are as follows;



*NOTE 6: Parameters 2 through 4 are required to run an Outdoor Blower Motor

5.0 Diagnostics

5.1 Diagnostic Control

Diagnostic information is provided via the Status MDI using the DMA Request Message Type as defined in Section 7.1. Any device needing diagnostic information must request that specific information from the motor.

6.0 Application Supported Message Types

A motor must be able to understand and respond to the following mandatory set of message types as defined in the table below.

Message Name	Code	
	Hex	DEC
Control Command	0x03	3
DMA Request	0x1D	29
DMA Reply	0x1E	30
OEM Generic Set	0x1F	31
OEM Generic Request	0x20	32
OEM Generic Reply	0x21	33

Table 2: Application Message Types

In order to keep the data payload below 16 bytes, Status, Identification and Sensor Data are accessed thru DMA requests as specified in Section 7.0.

6.1 Control Commands

Control commands are used for remotely modifying a device function. The control commands used by the Motor Profile are shown in the table below. Control Command Definitions are located in the Command Reference.

The Mandatory column identifies the control command which must be implemented for the type of motor specified. All control commands not identified as Mandatory are optional and may be used per application specific requirements.

Control Command	Code (Hex)	Code (Decimal)	Mandatory Applications			
			Indoor Blower Motor	Inducer Fan Motor	Outdoor Fan Motor	Stepper Motor
Reset Micro	0x31	49				
Set Motor Speed	0x6A	106	X	X	X	
Set Motor Torque	0x6B	107	X			
Set Airflow Demand	0x6C	108	X			
Set Control Mode	0x6D	109	X	X	X	
Set Demand Ramp Rate	0x6E	110	X		X	
Set Motor Direction	0x6F	111	X	X	X	
Set Motor Torque Percent	0x70	112	X			
Set Motor Position Demand	0x71	113				X
Set Blower Coefficient 1	0x72	114	X			
Set Blower Coefficient 2	0x73	115	X			
Set Blower Coefficient 3	0x74	116	X			
Set Blower Coefficient 4	0x75	117	X			
Set Blower Coefficient 5	0x76	118	X			
Set Blower Identification 0	0x77	119				
Set Blower Identification 1	0x78	120				
Set Blower Identification 2	0x79	121				
Set Blower Identification 3	0x7A	122				
Set Blower Identification 4	0x7B	123				
Set Blower Identification 5	0x7C	124				

Control Command	Code (Hex)	Code (Decimal)	Mandatory Applications			
			Indoor Blower Motor	Inducer Fan Motor	Outdoor Fan Motor	Stepper Motor
Reserved	*0x7D*	*125*				
Reserved	*0x7E*	*126*				
Set Speed Limit	0x7F	127		X		
Set Torque Limit	0x80	128				
Set Airflow Limit	0x81	129	X			
Set Power Output Limit	0x82	130				
Set Device Temperature Limit	0x83	131				
Reserved	*0x84*	*132*				
STOP Motor by Braking	0x85	133				
RUN/STOP Motor	0x86	134	X	X	X	
Reserved	*0x87*	*135*				
Set Demand Ramp Time	0x88	136				
Set Inducer Ramp Rate	0x89	137		X		
Set Blower Coefficient 6	0x8A	138				
Set Blower Coefficient 7	0x8B	139				
Set Blower Coefficient 8	0x8C	140				
Set Blower Coefficient 9	0x8D	141				
Set Blower Coefficient 10	0x8E	142				

NOTE 7: *Green Shaded cells are required in order for the system to function properly*

Table 3: Motor Control Commands

7.0 Message Data Interfaces (MDIs)

Motors shall support the message data interfaces defined below by motor type.

Fields shaded in Green are mandatory and must have accurate values reflecting the state of the device. Space must be reserved for the optional fields. If not being used, it is recommended that the optional fields be set to 0.

In the packet examples at the end of this document, the following codes shall be used in the Data 1 byte position to represent the various MDI requests: Status = 0x02, Sensor = 0x07, Identification = 0x0E.

7.1 Status Message Data Interface

7.1.1 Indoor Blower Motor Status Data

Packet	DBID	Bit	Description	Size	Notes
0	0	7-0	Speed Low Byte	1 Byte	RPM * 4
	1	7-0	Speed High Byte	1 Byte	
	2	7-0	Torque Low Byte	1 Byte	Nm * 2048
	3	7-0	Torque High Byte	1 Byte	
	4	7-0	Airflow Low Byte	1 Byte	CFM * 4
	5	7-0	Airflow High Byte	1 Byte	
	6	7-0	Reserved	1 Byte	
	7	7-0	Reserved	1 Byte	
	8	7-0	Control Mode	1 Byte	0 = speed 1 = torque 2 = airflow 3 to 255 : not defined
	9	7-0	Demand Low Byte	1 Byte	Demand = Speed demand(RPM*4), if speed mode = Torque demand (Nm *2048), if torque mode = Airflow demand(CFM*4), if Airflow mode
	10	7-0	Demand High Byte	1 Byte	
	11	7-0	Direction	1 Byte	0 = CCW LE; 1 = CW LE
	12	7-0	Demand Ramp Rate	1 Byte	Time in seconds to ramp from 0% to 100%
	13	7-0	Inducer Ramp Rate	1 Byte	0,128 = Ramp as fast as possible 1-127 = ramp rate in RPM / sec 129-255 = ramp rate in 10 * RPM / sec
	14	7-0	Speed Limit set Low Byte	1 Byte	RPM * 4
	15	7-0	Speed Limit set High Byte	1 Byte	
	16	7-0	Torque Limit set Low Byte	1 Byte	Nm * 2048
	17	7-0	Torque Limit set High Byte	1 Byte	

Packet	DBID	Bit	Description	Size	Notes	
	18	7-0	Airflow Limit set Low Byte	1 Byte	CFM * 4	
	19	7-0	Airflow Limit set High Byte	1 Byte		
	20	7-0	Shaft Power Out Limit Low Byte	1 Byte	Watts * 2	
	21	7-0	Shaft Power Out Limit High Byte	1 Byte		
	22	7-0	Power In Limit Low Byte	1 Byte	Watts * 2	
	23	7-0	Power In Limit High Byte	1 Byte		
	24	7-0	Motor Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
	25	7-0	Motor Temp Limit High Byte	1 Byte		
	26	7-0	Device Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
	27	7-0	Device Temp Limit High Byte	1 Byte		
	28	7-0	Reserved	1 Byte		
	29	7-0	Reserved	1 Byte		
	30	7-0	Control Status1 Low Byte	1 Byte	Bit 0	Starting Routine
					Bit 1	Demand Slew
					Bit 2	Run : Normal
					Bit 3	Run : Power Limit
					Bit 4	Run : Temp Limit
					Bit 5	Lost Rotor Trip
					Bit 6	Current Trip
					Bit 7	Over Voltage
	31	7-0	Control Status1 High Byte	1 Byte	Bit 8	Under Voltage
					Bit 9	Over Temp.
					Bit 10	Incomplete Parameters.
					Bit 11	Reserved
					Bit 12	Reserved
					Bit 13	Reserved
					Bit 14	Reserved
					Bit 15	Undesired Parameter

Packet	DBID	Bit	Description	Size	Notes
					Change
	32	7-0	Control Status2 Low Byte	1 Byte	User defined
	33	7-0	Control Status2 High Byte	1 Byte	User defined
	34	7-0	Control Status3 Low Byte	1 Byte	User defined
	35	7-0	Control Status3 Low Byte	1 Byte	User defined
	36	7-0	Reserved	1 Byte	
	37	7-0	Reserved	1 Byte	
	38	7-0	Reserved	1 Byte	
	39	7-0	Reserved	1 Byte	
	40	7-0	Reserved	1 Byte	
	41	7-0	Reserved	1 Byte	
	42	7-0	Reserved	1 Byte	
	43	7-0	Reserved	1 Byte	
	44	7-0	Reserved	1 Byte	
	45	7-0	Reserved	1 Byte	
	46	7-0	Reserved	1 Byte	
	47	7-0	Reserved	1 Byte	
	48	7-0	Reserved	1 Byte	
	49	7-0	Reserved	1 Byte	

NOTE 8: *Green Shaded rows are required in order for the system to function properly*

Table 4: Indoor Blower Motor Status Data

7.1.2 Inducer Fan Motor Status Data

Packet	DBID	Bit	Description	Size	Notes
0	0	7-0	Speed Low Byte	1 Byte	RPM * 4
	1	7-0	Speed High Byte	1 Byte	
	2	7-0	Torque Low Byte	1 Byte	Nm * 2048
	3	7-0	Torque High Byte	1 Byte	
	4	7-0	Airflow Low Byte	1 Byte	CFM * 4
	5	7-0	Airflow High Byte	1 Byte	
	6	7-0	Reserved	1 Byte	
	7	7-0	Reserved	1 Byte	
	8	7-0	Control Mode	1 Byte	0 = speed 1 = torque 2 = airflow 3 to 255 : not defined
	9	7-0	Demand Low Byte	1 Byte	Demand = Speed demand(RPM*4), if speed mode = Torque demand (Nm *2048), if torque mode = Airflow demand (CFM*4), if Airflow mode
	10	7-0	Demand High Byte	1 Byte	
	11	7-0	Direction	1 Byte	0 = CCW LE; 1 = CW LE
	12	7-0	Demand Ramp Rate	1 Byte	Time in seconds to ramp from 0% to 100%
	13	7-0	Inducer Ramp Rate	1 Byte	0,128 = Ramp as fast as possible 1-127 = ramp rate in RPM / sec 129-255 = ramp rate in 10 * RPM / sec
	14	7-0	Speed Limit set Low Byte	1 Byte	RPM * 4
	15	7-0	Speed Limit set High Byte	1 Byte	
	16	7-0	Torque Limit set Low Byte	1 Byte	Nm * 2048

Packet	DBID	Bit	Description	Size	Notes	
	17	7-0	Torque Limit set High Byte	1 Byte		
	18	7-0	Airflow Limit set Low Byte	1 Byte	CFM * 4	
	19	7-0	Airflow Limit set High Byte	1 Byte		
	20	7-0	Shaft Power Out Limit Low Byte	1 Byte	Watts * 2	
	21	7-0	Shaft Power Out Limit High Byte	1 Byte		
	22	7-0	Power In Limit Low Byte	1 Byte	Watts * 2	
	23	7-0	Power In Limit High Byte	1 Byte		
	24	7-0	Motor Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
	25	7-0	Motor Temp Limit High Byte	1 Byte		
	26	7-0	Device Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
	27	7-0	Device Temp Limit High Byte	1 Byte		
	28	7-0	Reserved	1 Byte		
	29	7-0	Reserved	1 Byte		
	30	7-0	Control Status1 Low Byte	1 Byte	Bit 0	Starting Routine
					Bit 1	Demand Slew
					Bit 2	Run : Normal
					Bit 3	Run : Power Limit
					Bit 4	Run : Temp Limit
					Bit 5	Lost Rotor Trip
					Bit 6	Current Trip
					Bit 7	Over Voltage
	31	7-0	Control Status1 High Byte	1 Byte	Bit 8	Under Voltage
					Bit 9	Over Temp.
					Bit 10	Incomplete Parameters.
					Bit 11	Reserved
					Bit 12	Reserved
					Bit 13	Reserved
					Bit 14	Reserved

Packet	DBID	Bit	Description	Size	Notes	
					Bit 15	Undesired Parameter Change
	32	7-0	Control Status2 Low Byte	1 Byte	User defined	
	33	7-0	Control Status2 High Byte	1 Byte	User defined	
	34	7-0	Control Status3 Low Byte	1 Byte	User defined	
	35	7-0	Control Status3 Low Byte	1 Byte	User defined	
	36	7-0	Reserved	1 Byte		
	37	7-0	Reserved	1 Byte		
	38	7-0	Reserved	1 Byte		
	39	7-0	Reserved	1 Byte		
	40	7-0	Reserved	1 Byte		
	41	7-0	Reserved	1 Byte		
	42	7-0	Reserved	1 Byte		
	43	7-0	Reserved	1 Byte		
	44	7-0	Reserved	1 Byte		
	45	7-0	Reserved	1 Byte		
	46	7-0	Reserved	1 Byte		
	47	7-0	Reserved	1 Byte		
	48	7-0	Reserved	1 Byte		
	49	7-0	Reserved	1 Byte		

NOTE 9: *Green Shaded rows are required in order for the system to function properly*

Table 5: Inducer Fan Motor Status Data

7.1.3 Outdoor Fan Motor Status Data

DBID	Bit	Description	Size	Notes
0	7-0	Speed Low Byte	1 Byte	RPM * 4
1	7-0	Speed High Byte	1 Byte	
2	7-0	Torque Low Byte	1 Byte	Nm * 2048
3	7-0	Torque High Byte	1 Byte	
4	7-0	Airflow Low Byte	1 Byte	CFM * 4
5	7-0	Airflow High Byte	1 Byte	
6	7-0	Reserved	1 Byte	
7	7-0	Reserved	1 Byte	
8	7-0	Control Mode	1 Byte	0 = speed 1 = torque 2 = airflow 3 to 255 : not defined
9	7-0	Demand Low Byte	1 Byte	Demand = Speed demand(RPM*4), if speed mode = Torque demand (Nm *2048), if torque mode = Airflow demand (CFM*4), if Airflow mode
10	7-0	Demand High Byte	1 Byte	
11	7-0	Direction	1 Byte	0 = CCW LE; 1 = CW LE
12	7-0	Demand Ramp Rate	1 Byte	Time in seconds to ramp from 0% to 100%
13	7-0	Inducer Ramp Rate	1 Byte	0,128 = Ramp as fast as possible 1-127 = ramp rate in RPM / sec 129-255 = ramp rate in 10 * RPM / sec
14	7-0	Speed Limit set Low Byte	1 Byte	RPM * 4
15	7-0	Speed Limit set High Byte	1 Byte	
16	7-0	Torque Limit set Low Byte	1 Byte	Nm * 2048
17	7-0	Torque Limit set High Byte	1 Byte	
18	7-0	Airflow Limit set Low Byte	1 Byte	CFM * 4
19	7-0	Airflow Limit set High Byte	1 Byte	
20	7-0	Shaft Power Out Limit Low	1 Byte	Watts * 2

DBID	Bit	Description	Size	Notes	
		Byte			
21	7-0	Shaft Power Out Limit High Byte	1 Byte		
22	7-0	Power In Limit Low Byte	1 Byte	Watts * 2	
23	7-0	Power In Limit High Byte	1 Byte		
24	7-0	Motor Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
25	7-0	Motor Temp Limit High Byte	1 Byte		
26	7-0	Device Temp Limit Low Byte	1 Byte	Degrees C * 128, twos complement	
27	7-0	Device Temp Limit High Byte	1 Byte		
28	7-0	Reserved	1 Byte		
29	7-0	Reserved	1 Byte		
30	7-0	Control Status1 Low Byte	1 Byte	Bit 0	Starting Routine
				Bit 1	Demand Slew
				Bit 2	Run : Normal
				Bit 3	Run : Power Limit
				Bit 4	Run : Temp Limit
				Bit 5	Lost Rotor Trip
				Bit 6	Current Trip
				Bit 7	Over Voltage
31	7-0	Control Status1 High Byte	1 Byte	Bit 8	Under Voltage
				Bit 9	Over Temp.
				Bit 10	Incomplete Parameters
				Bit 11	Reserved
				Bit 12	Reserved
				Bit 13	Reserved
				Bit 14	Reserved
				Bit 15	Undesired Parameter Change
32	7-0	Control Status2 Low Byte	1 Byte	User defined	
33	7-0	Control Status2 High Byte	1 Byte	User defined	
34	7-0	Control Status3 Low Byte	1 Byte	User defined	

DBID	Bit	Description	Size	Notes
35	7-0	Control Status3 Low Byte	1 Byte	User defined
36	7-0	Reserved	1 Byte	
37	7-0	Reserved	1 Byte	
38	7-0	Reserved	1 Byte	
39	7-0	Reserved	1 Byte	
40	7-0	Reserved	1 Byte	
41	7-0	Reserved	1 Byte	
42	7-0	Reserved	1 Byte	
43	7-0	Reserved	1 Byte	
44	7-0	Reserved	1 Byte	
45	7-0	Reserved	1 Byte	
46	7-0	Reserved	1 Byte	
47	7-0	Reserved	1 Byte	
48	7-0	Reserved	1 Byte	
49	7-0	Reserved	1 Byte	

NOTE 10: *Green Shaded rows are required in order for the system to function properly*

Table 6: Outdoor Fan Motor Status Data

7.1.4 Stepper Motor Status Data

DBID	Bit	Description	Size	Notes	
0	7-0	Position Home (PHOME)	1 Byte	If PHOME ≠ 0, position % = PVAL / 2	
1	7-0	Position Value (PVAL)	1 Byte	If PHOME = 0, position = HOME	
2	7-0	Control Status1 Low Byte	1 Byte	Bit 0	Home Position Flag
				Bit 1	Positioning in Progress
				Bit 2	Positioning complete
				Bit 3	Reserved
				Bit 4	Reserved
				Bit 5	Reserved
				Bit 6	Been Reset Flag
				Bit 7	Motor Fault
3	7-0	Control Status1 High Byte	1 Byte	Bit 8	Dip Encoding bit 0
				Bit 9	Dip Encoding bit 1
				Bit 10	Dip Encoding bit 2
				Bit 11	Dip Encoding bit 3
				Bit 12	Reserved
				Bit 13	Reserved
				Bit 14	Reserved
				Bit 15	LPG / LNG Flag

NOTE 11: *Green Shaded rows are required in order for the system to function properly*

Table 7: Stepper Motor Status Data

7.2 Sensor Message Data Interfaces

7.2.1 Indoor Blower Motor Sensor Data

DBID	Bits	Description	Size	Notes
0	7-0	DC Bus Low Byte	1 Byte	Volts * 64
1	7-0	DC Bus High Byte	1 Byte	
2	7-0	AC Input Low Byte	1 Byte	VAC_{rms} * 64
3	7-0	AC input High Byte	1 Byte	
4	7-0	PHASE A Current Low Byte	1 Byte	A_{rms} * 2048
5	7-0	PHASE A Current High Byte	1 Byte	
6	7-0	PHASE B Current Low Byte	1 Byte	A_{rms} * 2048
7	7-0	PHASE B Current High Byte	1 Byte	
8	7-0	PHASE C Current Low Byte	1 Byte	A_{rms} * 2048
9	7-0	PHASE C Current High Byte	1 Byte	
10	7-0	Reserved	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Reserved	1 Byte	
13	7-0	Reserved	1 Byte	
14	7-0	Motor Temp Low byte	1 Byte	Degrees C * 128, twos complement
15	7-0	Motor Temp High Byte	1 Byte	
16	7-0	Ambient Temp Low Byte	1 Byte	Degrees C * 128, twos complement
17	7-0	Ambient Temp High Byte	1 Byte	
18	7-0	Reserved	1 Byte	
19	7-0	Reserved	1 Byte	
20	7-0	Reserved	1 Byte	

NOTE 12: *Green Shaded rows are required in order for the system to function properly*

Table 8: Indoor Blower Motor Sensor Data

7.2.2 Inducer Fan Motor Sensor Data

DBID	Bits	Description	Size	Notes
0	7-0	DC Bus Low Byte	1 Byte	Volts * 64
1	7-0	DC Bus High Byte	1 Byte	
2	7-0	AC Input Low Byte	1 Byte	VAC_{rms} * 64
3	7-0	AC input High Byte	1 Byte	
4	7-0	PHASE A Current Low Byte	1 Byte	A_{rms} * 2048
5	7-0	PHASE A Current High Byte	1 Byte	
6	7-0	PHASE B Current Low Byte	1 Byte	A_{rms} * 2048
7	7-0	PHASE B Current High Byte	1 Byte	
8	7-0	PHASE C Current Low Byte	1 Byte	A_{rms} * 2048
9	7-0	PHASE C Current High Byte	1 Byte	
10	7-0	Reserved	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Reserved	1 Byte	
13	7-0	Reserved	1 Byte	
14	7-0	Motor Temp Low byte	1 Byte	Degrees C * 128, twos complement
15	7-0	Motor Temp High Byte	1 Byte	
16	7-0	Ambient Temp Low Byte	1 Byte	Degrees C * 128, twos complement
17	7-0	Ambient Temp High Byte	1 Byte	
18	7-0	Reserved	1 Byte	
19	7-0	Reserved	1 Byte	
20	7-0	Reserved	1 Byte	

NOTE 13: *Green Shaded rows are required in order for the system to function properly*

Table 9: Inducer Fan Motor Sensor Data

7.2.3 Outdoor Fan Motor Sensor Data

DBID	Bits	Description	Size	Notes
0	7-0	DC Bus Low Byte	1 Byte	Volts * 64
1	7-0	DC Bus High Byte	1 Byte	
2	7-0	AC Input Low Byte	1 Byte	VAC_{rms} * 64
3	7-0	AC input High Byte	1 Byte	
4	7-0	Phase A Current Low Byte	1 Byte	A_{rms} * 2048
5	7-0	Phase A Current High Byte	1 Byte	
6	7-0	Phase B Current Low Byte	1 Byte	A_{rms} * 2048
7	7-0	Phase B Current High Byte	1 Byte	
8	7-0	Phase C Current Low Byte	1 Byte	A_{rms} * 2048
9	7-0	Phase C Current High Byte	1 Byte	
10	7-0	Reserved	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Reserved	1 Byte	
13	7-0	Reserved	1 Byte	
14	7-0	Motor Temp Low byte	1 Byte	Degrees C * 128, twos complement
15	7-0	Motor Temp High Byte	1 Byte	
16	7-0	Ambient Temp Low Byte	1 Byte	Degrees C * 128, twos complement
17	7-0	Ambient Temp High Byte	1 Byte	
18	7-0	Reserved	1 Byte	
19	7-0	Reserved	1 Byte	
20	7-0	Reserved	1 Byte	

NOTE 14: *Green Shaded rows are required in order for the system to function properly*

Table 10: Outdoor Fan Motor Sensor Data

7.3 Identification Message Data Interfaces

7.3.1 Indoor Blower Motor Identification Data

DBID	Bits	Description	Size	Notes
0	7-0	Software Version 0	1 Byte	
1	7-0	Software Version 1	1 Byte	
2	7-0	Software Version 2	1 Byte	
3	7-0	Software Version 3	1 Byte	
4	7-0	Control Version	1 Byte	
5	7-0	Drive Serial Number 0	1 Byte	
6	7-0	Drive Serial Number 1	1 Byte	
7	7-0	Drive Serial Number 2	1 Byte	
8	7-0	Drive Serial Number 3	1 Byte	
9	7-0	Drive Serial Number 4	1 Byte	
10	7-0	Drive Serial Number 5	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Protocol Version	1 Byte	
13	7-0	Manufacturer ID (OEM1 ID)	1 Byte	
14	7-0	EEPROM Version Low Byte	1 Byte	
15	7-0	EEPROM Version High Byte	1 Byte	
16	7-0	OEM ID (OEM0 ID)	1 Byte	
17	7-0	Power Level	1 Byte	
18	7-0	Blower Coefficient 1 Low Byte	1 Byte	
19	7-0	Blower Coefficient 1 High Byte	1 Byte	
20	7-0	Blower Coefficient 2 Low Byte	1 Byte	
21	7-0	Blower Coefficient 2 High Byte	1 Byte	
22	7-0	Blower Coefficient 3 Low Byte	1 Byte	
23	7-0	Blower Coefficient 3 High Byte	1 Byte	
24	7-0	Blower Coefficient 4 Low Byte	1 Byte	
25	7-0	Blower Coefficient 4 High Byte	1 Byte	
26	7-0	Blower Coefficient 5 Low Byte	1 Byte	
27	7-0	Blower Coefficient 5 High Byte	1 Byte	
28	7-0	Blower Identification 0 Low Byte	1 Byte	

DBID	Bits	Description	Size	Notes
29	7-0	Blower Identification 0 High Byte	1 Byte	
30	7-0	Blower Identification 1 Low Byte	1 Byte	
31	7-0	Blower Identification1 High Byte	1 Byte	
32	7-0	Blower Identification2 Low Byte	1 Byte	
33	7-0	Blower Identification2 High Byte	1 Byte	
34	7-0	Blower Identification3 Low Byte	1 Byte	
35	7-0	Blower Identification3 High Byte	1 Byte	
36	7-0	Blower Identification4 Low Byte	1 Byte	
37	7-0	Blower Identification4 High Byte	1 Byte	
38	7-0	Blower Identification 5 Low Byte	1 Byte	
39	7-0	Blower Identification5 High Byte	1 Byte	
40	7-0	Blower Identification6 Low Byte	1 Byte	
41	7-0	Blower Coefficient 6 High Byte	1 Byte	
42	7-0	Blower Coefficient 7 Low Byte	1 Byte	
43	7-0	Blower Coefficient 7 High Byte	1 Byte	
44	7-0	Blower Coefficient 8 Low Byte	1 Byte	
45	7-0	Blower Coefficient 8 High Byte	1 Byte	
46	7-0	Blower Coefficient 9 Low Byte	1 Byte	
47	7-0	Blower Coefficient 9 High Byte	1 Byte	
48	7-0	Blower Coefficient 10 Low Byte	1 Byte	
49	7-0	Blower Coefficient 10HighByte	1 Byte	

NOTE 15: *Green Shaded rows are required in order for the system to function properly*

Table 11: Indoor Blower Motor Identification Data

7.3.2 Inducer Fan and Outdoor Fan Motor Identification Data

DBID	Bits	Description	Size	Notes
0	7-0	Software Version 0	1 Byte	
1	7-0	Software Version 1	1 Byte	
2	7-0	Software Version 2	1 Byte	
3	7-0	Software Version 3	1 Byte	
4	7-0	Control Version	1 Byte	
5	7-0	Drive Serial Number 0	1 Byte	
6	7-0	Drive Serial Number 1	1 Byte	
7	7-0	Drive Serial Number 2	1 Byte	
8	7-0	Drive Serial Number 3	1 Byte	
9	7-0	Drive Serial Number 4	1 Byte	
10	7-0	Drive Serial Number 5	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Protocol Version	1 Byte	
13	7-0	Manufacturer ID (OEM1 ID)	1 Byte	
14	7-0	EEPROM Version Low Byte	1 Byte	
15	7-0	EEPROM Version High Byte	1 Byte	
16	7-0	OEM ID (OEM0 ID)	1 Byte	
17	7-0	Power Level	1 Byte	
18	7-0	Blower Coefficient 1 Low Byte	1 Byte	
19	7-0	Blower Coefficient 1 High Byte	1 Byte	
20	7-0	Blower Coefficient 2 Low Byte	1 Byte	
21	7-0	Blower Coefficient 2 High Byte	1 Byte	
22	7-0	Blower Coefficient 3 Low Byte	1 Byte	
23	7-0	Blower Coefficient 3 High Byte	1 Byte	
24	7-0	Blower Coefficient 4 Low Byte	1 Byte	
25	7-0	Blower Coefficient 4 High Byte	1 Byte	
26	7-0	Blower Coefficient 5 Low Byte	1 Byte	
27	7-0	Blower Coefficient 5 High Byte	1 Byte	
28	7-0	Blower Identification 0 Low Byte	1 Byte	
29	7-0	Blower Identification 0 High Byte	1 Byte	

DBID	Bits	Description	Size	Notes
30	7-0	Blower Identification 1 Low Byte	1 Byte	
31	7-0	Blower Identification1 High Byte	1 Byte	
32	7-0	Blower Identification2 Low Byte	1 Byte	
33	7-0	Blower Identification2 High Byte	1 Byte	
34	7-0	Blower Identification3 Low Byte	1 Byte	
35	7-0	Blower Identification3 High Byte	1 Byte	
36	7-0	Blower Identification4 Low Byte	1 Byte	
37	7-0	Blower Identification4 High Byte	1 Byte	
38	7-0	Blower Identification 5 Low Byte	1 Byte	
39	7-0	Blower Identification5 High Byte	1 Byte	
40	7-0	Blower Identification6 Low Byte	1 Byte	
41	7-0	Blower Coefficient 6 High Byte	1 Byte	
42	7-0	Blower Coefficient 7 Low Byte	1 Byte	
43	7-0	Blower Coefficient 7 High Byte	1 Byte	
44	7-0	Blower Coefficient 8 Low Byte	1 Byte	
45	7-0	Blower Coefficient 8 High Byte	1 Byte	
46	7-0	Blower Coefficient 9 Low Byte	1 Byte	
47	7-0	Blower Coefficient 9 High Byte	1 Byte	
48	7-0	Blower Coefficient 10 Low Byte	1 Byte	
49	7-0	Blower Coefficient 10HighByte	1 Byte	

NOTE 16: *Green Shaded rows are required in order for the system to function properly*

Table 12: Inducer Fan and Outdoor Fan Motor Identification Data

7.3.3 Stepper Motor Identification Data

DBID	Bits	Description	Size	Notes
0	7-0	Software Version 0	1 Byte	
1	7-0	Software Version 1	1 Byte	
2	7-0	Software Version 2	1 Byte	
3	7-0	Software Version 3	1 Byte	
4	7-0	Control Version	1 Byte	
5	7-0	Drive Serial Number 0	1 Byte	
6	7-0	Drive Serial Number 1	1 Byte	
7	7-0	Drive Serial Number 2	1 Byte	
8	7-0	Drive Serial Number 3	1 Byte	
9	7-0	Drive Serial Number 4	1 Byte	
10	7-0	Drive Serial Number 5	1 Byte	
11	7-0	Reserved	1 Byte	
12	7-0	Protocol Version	1 Byte	
13	7-0	Manufacturer ID (OEM1 ID)	1 Byte	
14	7-0	EEPROM Version Low Byte	1 Byte	
15	7-0	EEPROM Version High Byte	1 Byte	
16	7-0	OEM ID (OEM0 ID)	1 Byte	

NOTE 17: *Green Shaded rows are required in order for the system to function properly*

Table 13: Stepper Motor Identification Data

8.0 Packet Examples

The packet examples are provided as an aid to device development and debugging by showing what the contents of both request and response packets should be for each command. The examples are divided up by device type and show commands that the device should either be capable of transmitting or responding to. The tables are not inclusive and the presence or absence of a command does not imply that a device should or should not support the command.

In the packet examples, a length field of "n" indicates that the value in the field depends on the amount of data to be returned. A value of "-" for the data field means that there is no data for that packet.

The following section identifies the normal expected traffic for motors designed to ClimateTalk standards.

8.1 Indoor Blower Motor

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Control Commands												
Mode Set Command - CFM	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6D*	*0x02*	*-*	*-*	*-*	*x*	*x*
Mode Set Response	**0x0A**	**0x03**	**0x00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**	**-**	**-**	**x**	**x**
Mode Set Command - Torque	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6D*	*0x01*	*-*	*-*	*-*	*x*	*x*
Mode Set Response	**0x0A**	**0x03**	**0x00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**	**-**	**-**	**x**	**x**
Mode Set Command - RPM	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6D*	*0x00*	*-*	*-*	*-*	*x*	*x*

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Mode Set Response	**0x0A**	**0x03**	**0x00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**	**-**	**-**	**x**	**x**
Set CFM	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x6C*	*CFM*4 low*	*CFM*4 high*			*x*	*x*
Set CFM Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set RPM	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x6A*	*RPM*4 low*	*RPM*4 high*	-	-	*x*	*x*
Set RPM Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Torque	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x70*	*(Torque% * 65535/100) lo byte*	*(Torque% * 65535/100) hi byte*	-	-	*x*	*x*
Set Torque Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Demand Ramp Rate (circulator)	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6E*	*rate*				*x*	*x*
Set Demand Ramp Rate(circulator) - Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
Set Direction	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6F*	*direction*				*x*	*x*
Set Direction Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Set Blower Coefficient 1	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x72*	*low byte*	*high byte*	-	-	*x*	*x*
Set Blower Coefficient 1 Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Blower Coefficient 2	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x73*	*low byte*	*high byte*	-	-	*x*	*x*
Set Blower Coefficient 2 Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Blower Coefficient 3	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x74*	*low byte*	*high byte*	-	-	*x*	*x*
Set Blower Coefficient 3 Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Blower Coefficient 4	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x75*	*low byte*	*high byte*	-	-	*x*	*x*
Set Blower Coefficient 4 Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Blower Coefficient 5	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x76*	*low byte*	*high byte*	-	-	*x*	*x*
Set Blower Coefficient 5 Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Speed Limit - Max RPM	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x7F*	*RPM * 4 low byte*	*RPM * 4 high byte*	-	-	*x*	*x*
Set Speed Limit - Max RPM Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Set Airflow Limit - Max CFM	*0x0A*	*0x03*	*0x00*	*0x04*	*0x00*	*0x81*	*CFM * 4 low byte*	*CFM * 4 high byte*	-	-	*x*	*x*
Set Airflow Limit - Max CFM Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Run / Stop	*0x0A*	*0x03*	*0x00*	*0x03*	*0x00*	*0x86*	*0 = stop;1=run*				*x*	*x*
Run / Stop Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
Reset Micro	*0x0A*	*0x03*	*0x00*	*0x02*	*0x00*	*0x31*					*x*	*x*
Reset Micro - Response	**0x0A**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
API Requirements												
Unknown Application Transactions	*0x0A*	*UNKNOWN TYPE*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Unknown App Trans Response	**0x0A**	**SAME TYPE**	**0X00**	**1**	**0x1B**						**x**	**x**
Commands with Incomplete parameters	*0x0A*	*0x03*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Incomplete Parameters Response	**0x0A**	**0x03**	**0X00**	**1**	**0x0D**						**x**	**x**
Command with undesired parameter change	*0x0A*	*0x03*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Undesired Parameter Change Response	**0x0A**	**0x03**	**0X00**	**1**	**0x0A**						**x**	**x**
Status Requests												
DMA Request - Speed RPM	*0x0A*	*0x1D*	*0x00*	*4*	*2*	*0*	*0*	*1*			*x*	*x*
DMA Reply - Speed RPM	**0x0A**	**0x1E**	**0x00**	**5**	**2**	**0**	**0**	**RPM * 4 low**	**RPM * 4 high**		**x**	**x**
DMA Request - Control Status 1	*0x0A*	*0x1D*	*0x00*	*4*	*2*	*0*	*0x1E*	*1*			*x*	*x*
DMA Reply - Control Status 1 Reply	**0x0A**	**0x1E**	**0x00**	**5**	**2**	**0**	**0x1E**	**CS1L**	**CS1H**		**x**	**x**
DMA Request - CFM Status	*0x0A*	*0x1D*	*0x00*	*4*	*2*	*0*	*0x08*	*2*			*x*	*x*
DMA Reply - CFM Status	**0x0A**	**0x1E**	**0x00**	**6**	**2**	**0**	**0x08**	**MODE**	**CFM*4 low**	**CFM*4 high**	**x**	**x**
Identification Requests												
DMA Request - Manufacturer ID	*0x0A*	*0x1D*	*0x00*	*4*	*0x0E*	*0*	*0x0D*	*0*			*x*	*x*
DMA Reply - Manufacturer ID Reply	**0x0A**	**0x1E**	**0x00**	**4**	**0x0E**	**0**	**0x0D**	**OEM**			**x**	**x**

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
DMA - Request Motor Power Level	*0x0A*	*0x1D*	*0x00*	*4*	*0x0E*	*0*	*0x11*	*0*			*x*	*x*
DMA - Motor Power Level Reply	**0x0A**	**0x1E**	**0x00**	**4**	**0x0E**	**0**	**0x11**	**Power**			**x**	**x**

8.2 Inducer Fan Motor

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Control Commands												
Mode Set Command - RPM	*0x14*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6D*	*0x00*	*-*	*-*	*-*	*x*	*x*
Mode Set Response	**0x14**	**0x03**	**0x00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**	**-**	**-**	**x**	**x**
Set RPM	*0x14*	*0x03*	*0x00*	*0x04*	*0x00*	*0x6A*	*RP*/4 low*	*RPM*4 high*	*-*	*-*	*x*	*x*
Set RPM Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Set Inducer Ramp Rate	*0x14*	*0x03*	*0x00*	*0x03*	*0x00*	*0x89*	*rate*				*x*	*x*
Set Inducer Ramp Rate - Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
Set Direction	*0x14*	*0x03*	*0x00*	*0x03*	*0x00*	*0x6F*	*direction*				*x*	*x*
Set Direction Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Set Speed Limit - Max RPM	*0x14*	*0x03*	*0x00*	*0x04*	*0x00*	*0x7F*	*RPM * 4 low byte*	*RPM * 4 high byte*	-	-	*x*	*x*
Set Speed Limit - Max RPM Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**	**-**	**-**			**x**	**x**
Run / Stop	*0x14*	*0x03*	*0x00*	*0x03*	*0x00*	*0x86*	*0 = stop;1=run*				*x*	*x*
Run / Stop Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
Reset Micro	*0x14*	*0x03*	*0x00*	*0x02*	*0x00*	*0x31*					*x*	*x*
Reset Micro - Response	**0x14**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
API Requirements												
Unknown Application Transactions	*0x14*	*UNKNOWN TYPE*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Unknown App Trans Response	**0x14**	**SAME TYPE**	**0X00**	**1**	**0x1B**						**x**	**x**
Commands with Incomplete parameters	*0x14*	*0x03*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Incomplete Parameters Response	**0x14**	**0x03**	**0X00**	**1**	**0x0D**						**x**	**x**
Command with undesired parameter change	*0x14*	*0x03*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Undesired Parameter Change Response	**0x14**	**0x03**	**0X00**	**1**	**0x0A**						**x**	**x**
Status Requests												
DMA Request - Speed RPM	*0x14*	*0x1D*	*0x00*	*4*	*2*	*0*	*0*	*1*			*x*	*x*
DMA Reply - Speed RPM	**0x14**	**0x1E**	**0x00**	**5**	**2**	**0**	**0**	**RPM * 4 low**	**RPM * 4 high**		**x**	**x**
DMA Request - Control Status 1	*0x14*	*0x1D*	*0x00*	*4*	*2*	*0*	*0x1E*	*1*			*x*	*x*
DMA Reply - Control Status 1 Reply	**0x14**	**0x1E**	**0x00**	**5**	**2**	**0**	**0x1E**	**CS1L**	**CS1H**		**x**	**x**
Identification Requests												
DMA Request - Manufacturer ID	*0x14*	*0x1D*	*0x00*	*4*	*0x0E*	*0*	*0x0D*	*0*			*x*	*x*
DMA Reply - Manufacturer ID Reply	**0x14**	**0x1E**	**0x00**	**4**	**0x0E**	**0**	**0x0D**	**OEM**			**x**	**x**
DMA - Request Motor Power Level	*0x14*	*0x1D*	*0x00*	*4*	*0x0E*	*0*	*0x11*	*0*			*x*	*x*
DMA - Motor Power Level Reply	**0x14**	**0x1E**	**0x00**	**4**	**0x0E**	**0**	**0x11**	**Power**			**x**	**x**

8.3 Stepper Motor

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Control Commands												
Set Position Demand	*0x3C*	*0x03*	*0x00*	*0x04*	*0x00*	*0x71*	*PHOME*	*PVAL*			*x*	*x*
Set Position Response	**0x3C**	**0x03**	**0X00**	**0x01**	**ACK/NAK**	**-**					**x**	**x**
Reset Micro	*0x3C*	*0x03*	*0x00*	*0x02*	*0x00*	*0x31*					*x*	*x*
Reset Micro - Response	**0x3C**	**0x03**	**0X00**	**0x01**	**ACK/NAK**						**x**	**x**
API Requirements												
Unknown Application Transactions	*0x3C*	*UNKNOWN TYPE*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Unknown App Trans Response	**0x3C**	**SAME TYPE**	**0X00**	**1**	**0x1B**						**x**	**x**

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
Commands with Incomplete parameters	*0x3C*	*0x03*	*0x00*	*X*	*<X NUMBER OF DATA BYTES>*						*x*	*x*
Incomplete Parameters Response	**0x3C**	**0x03**	**0X00**	**1**	**0x0D**						**x**	**x**
Status Requests												
DMA Request – Position	*0x3C*	*0x1D*	*0x00*	*4*	*2*	*0*	*0*	*1*			*x*	*x*
DMA Reply – Position	**0x3C**	**0x1E**	**0x00**	**5**	**2**	**0**	**0**	**PHOME**	**PVAL**		**x**	**x**
DMA Request - Control Status 1	*0x3C*	*0x1D*	*0x00*	*4*	*2*	*0*	*2*	*1*			*x*	*x*
DMA Reply - Control Status 1 Reply	**0x3C**	**0x1E**	**0x00**	**5**	**2**	**0**	**2**	**CS1L**	**CS1H**		**x**	**x**
Identification Requests												
DMA Request - Manufacturer ID	*0x3C*	*0x1D*	*0x00*	*4*	*0x0E*	*0*	*0x0D*	*0*			*x*	*x*

Description	CT-LWP Address	Message Type	Packet #	Length	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	CRC1	CRC2
DMA Reply - Manufacturer ID Reply	0x3C	0x1E	0x00	4	0x0E	0	0x0D	OEM			x	x