

Application Note

ECE 480

Design Team 4

Rapid Prototyping Environment for Climate Control Development

Rain Light Humidity Module (RLHM) SENSOR

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Executive Summary

The purpose of this document is to describe the functionality and proper user guide constraints on how to apply the RLHM (Rain Light Humidity Module) with the use of a micro-autobox and Matlab.

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Introduction/Background

The Rain Light Humidity Module (RLHM) is a control unit that recognizes the moisture level on the windshield and the ambient lighting conditions. According to its acquired information and the sensitivity set by the user, it shall request the required wiper operation to maintain the associated windshield moisture level. The RLHS can provide raw ambient light and Lights On/Off information to the lighting subsystem. Moreover, RLHS can also measures the temperature of windscreen surface on the compartment side. Both values are used as control inputs for the climate control application to calculate the fog risk on the windscreen compartment side and ability to reduce fuel consumption by utilizing the air conditioner. The appearance of RLHM sensor is like the figure below.



Figure 1 The Rain Light Humidity Module

ILSS Components

- Overhead and Forward Looking Ambient Light sensors
- Rain sensor
- Humidity sensor
- Control electronics
- LIN interface management
- Lens/bracket for mounting on the glass

Implementation of RLHM

Connecting RLHM to MicroAutoBox

The RLHM shall have an integral connector. The system is powered by Fused Battery. One other pin is connected to ground. There are limitations to insert or remove the connectors, for example, the RLHM connector insertion force of the wiring harness connector shall not exceed 45 N. The connector removal force for each wiring harness connector to the RLHM shall not exceed 75 N. The connector retention force for each wiring harness connector to the RLHM shall be equal to or greater than 20 N. The terminal retention force for each .63 mm terminal and pin on the RLHM shall exceed 50 N (terminal) and 15 N (pin) respectively. The pin assignment is like the following figures.

Table Pin Assignment

Pin Number	Pin Name	Description	Current Load [mA]
1	BAT	Power (+)	30mA (Nominal) 600mA (Peak)
2	DATA	Bi-directional interface (to	10mA
23	GND	Ground (-)	30mA (Nominal) 600mA (Peak)
3	DATA	Bi-directional interface (to	10mA

Table 1 RLHM pin assignment

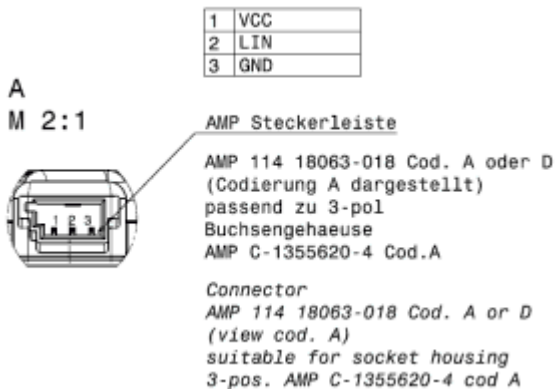


Figure 2 RLHM pin assignment

Programming the Rain Light Humidity Module

Once the RLHM is connected to the MicroAutobox, develop a design that has a set of parameters that will give the best accuracy results from the RHLM component and the raw data got from the RLHM is able to transmit to the MicroAutobox. With the help of Simulink, a virtual base model that represents Rain Light Humidity Module can be implemented in real climate control systems.

Tutorial on How to setup MicroAutoBox

(Refer to Omar Ali's Application Note)

Tutorial on How to Use Matlab/Simulink

(Refer to Guiseppe Farro's Application Note pg. 2-8)

Examples of sensor blocks <http://www.mathworks.com/help/physmod/elec/sensors.html>

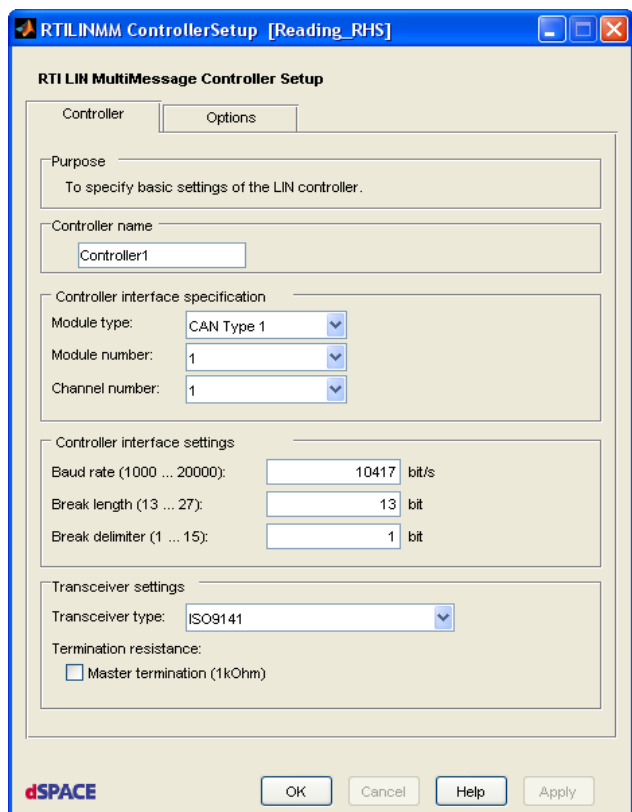


Figure2 Controller setup

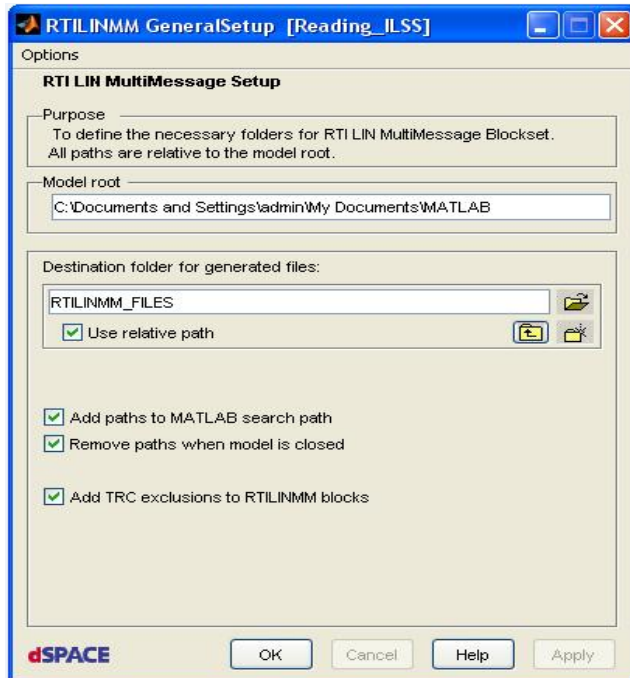


Figure 3 General setup

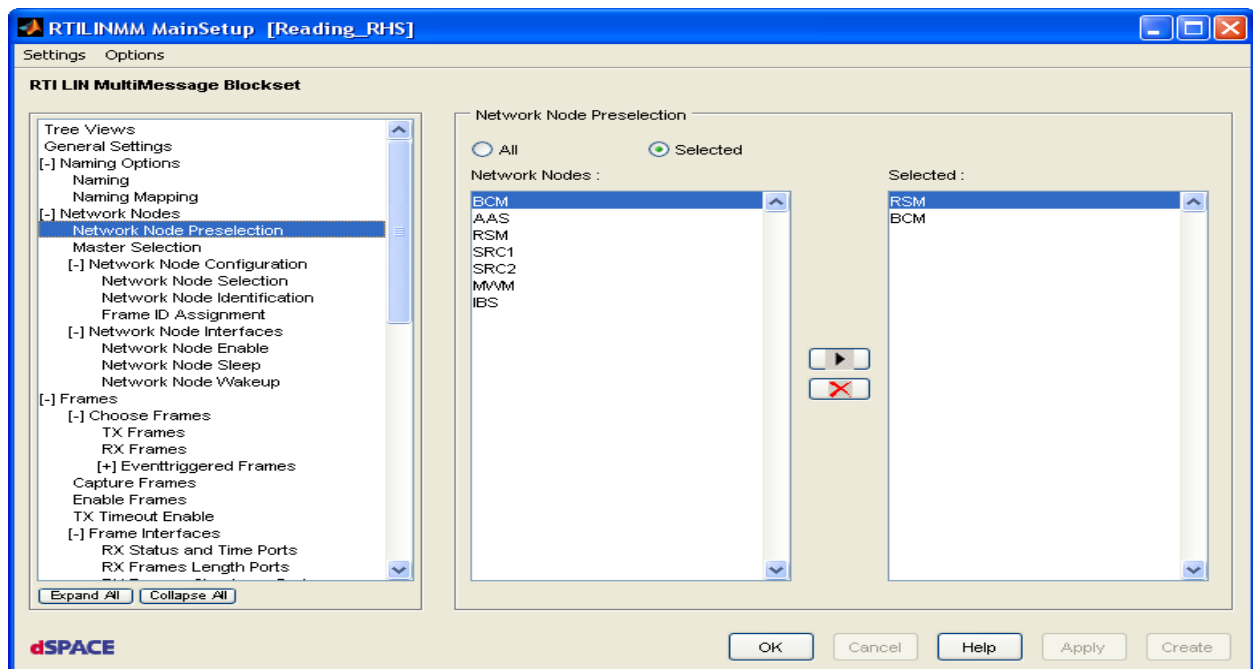


Figure 4 Network node

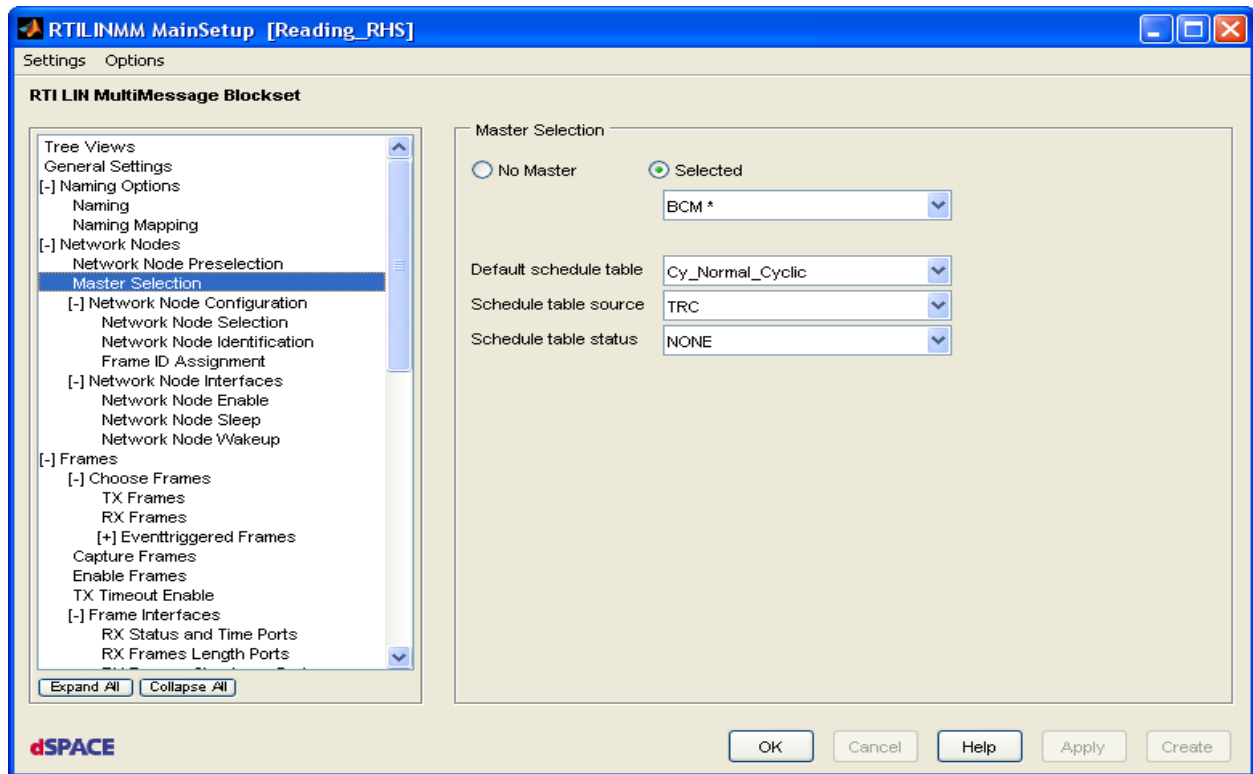


Figure 5 Master node

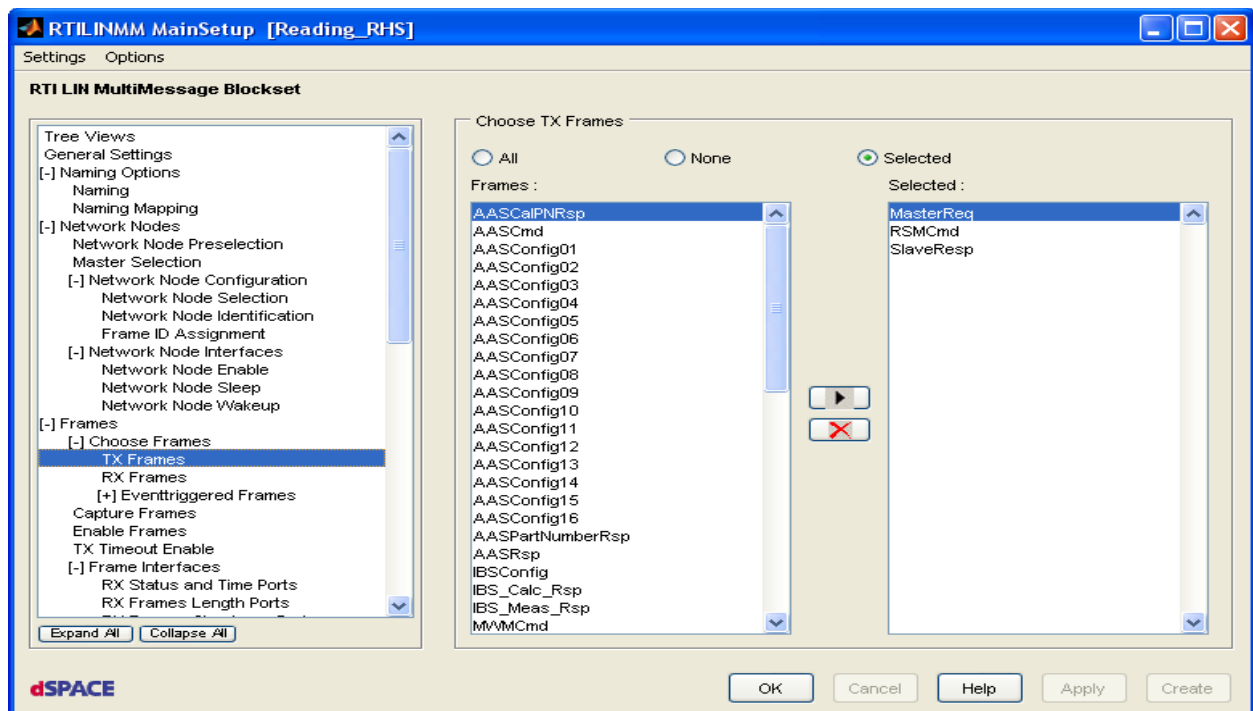


Figure 6 Tx frame

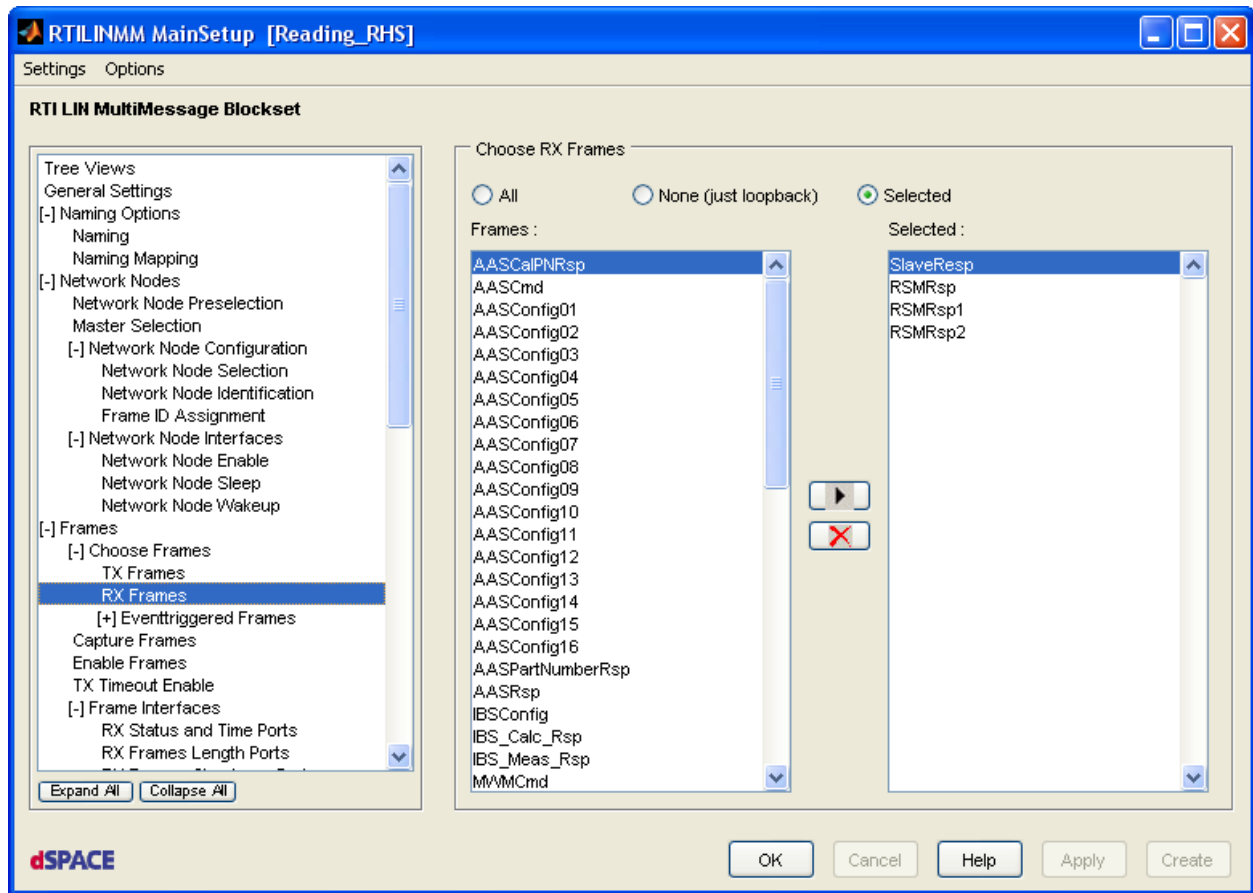


Figure 7 Rx frame

Data: Rain Light Humidity Module Parameters

The RLHM shall be mechanically attached to the windshield through a windshield mounted attachment device, which shall be adhered to the glass windshield with an adhesive film. For the Humidity Sensor Part, adequate air flow should flow over the sensor. The sensor must be able to provide correct and reliable RH level within 250 ms. The measurement range shall be within 3% RH and 100% RH. The RLHM shall broadcast this information to the vehicle via LIN. The output RH range is between 0 to 100%. The accuracy of the signal is like the table below

Range (%)	Accuracy (+/-%) @ 25°C	Accuracy (+/-%) -40°C to +40°C
20 to 80	+/- 3.0%	< +/- 5.0%
3 to 20 / 80 to 100	< +/- 5.0%	< +/- 7.0%

The RLHM consists of a temperature measurement device, and its measurement range - 40 to 85 Celsius degrees. The minimum temperature accuracy is as follows. The RLHM shall broadcast this information to the vehicle via LIN. The output range is between -50 to 100 Celsius degrees.

Range (°C)	Accuracy (+/-°C)
-5 to +40	+/- 0.40
-40 to -5; +40 to +55	+/-0.50
> +55	< +/-1.0

The Rain Sense feature allows the driver to adjust the moisture level at which the Rain Sensor automatically wipes the windshield. The Rain Sense feature shall be turned ON or OFF via the software Latching (across Ignition Cycles) AUTOMATIC Front Wiper (Rain Sense) Switch. To setup RLHM, it should be powered at LIN-Bus wake up. It uses unconditional frames to communication.

References

- 1 .General Motors Users Guide RHLM applications
2. General Motors Users Guide MicroAutoBox
3. www.dSPACE.com (Hardware Installation and Configuration)

