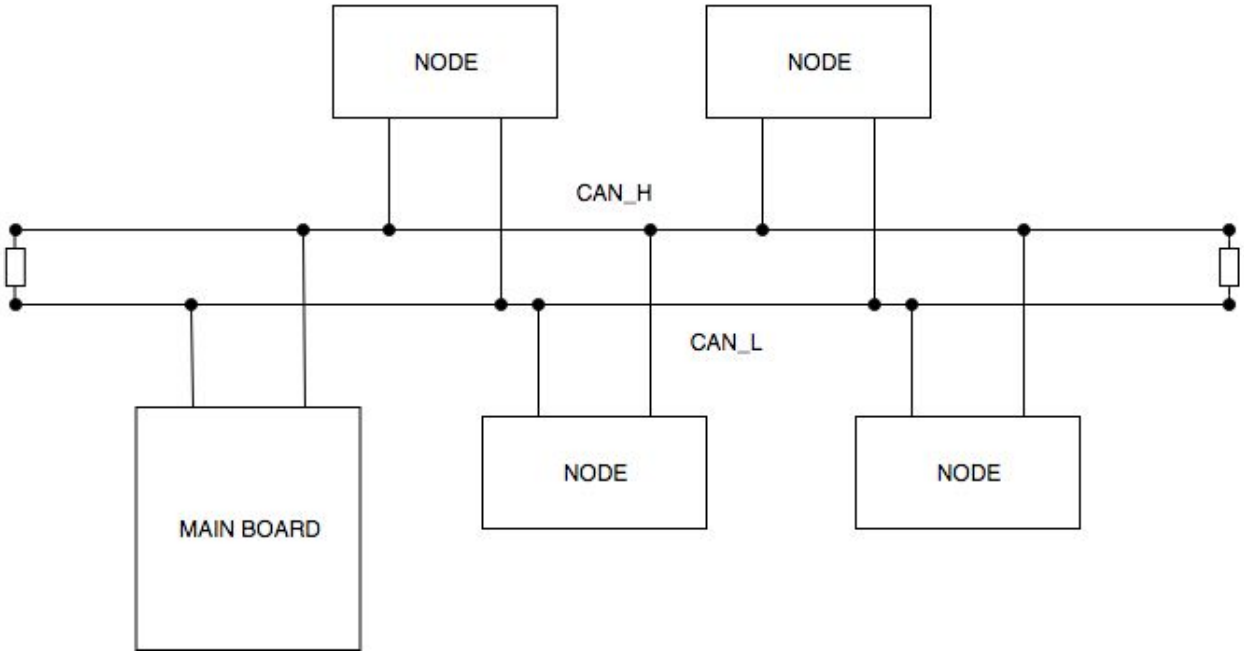
AeroCAN Application Layer Specification - 11bit version

Background:

Rather than using the 11 bit CAN identifier to address each node individually, a protocol is necessary to spread this functionality across the address space to facilitate the ease of use and minimization of messages across the bus.



Address Space:

For this protocol, we're going to use the 11 bit standard frame CAN identifier to support the functionality we desire. Implementation of the protocol can be easily achieved using bit masks for desired tasks. Most important will be the message type address and all other fields will be read as needed. The bits correspond as follows:

Bits 6-10	Message Type Address
Bits 0-5	Target Addresses

Target Addresses:

Bits 0-5 are designated as the address space for target operator addresses. This means that on a system, one could have up to 63 nodes plus one master. Setting the address of a node is achieved by flipping the dip switches to the binary representation of the address. It is located on the circuit board. **The master always gets address 0.**

For example, if you wanted all 63 nodes to open or close, you could send a single message to the group address and all nodes that subscribe to that group would react accordingly. Additionally, if you would like to split the aero control into zones, say for instance a right and left side, you could assign all the nodes on one side of a vehicle to the group corresponding to that zone.

Message Type Addresses:

Bits 10-6 are designated as the address space that defines what type of message is occurring. The definitions are as follows:

Bit Pattern	Decimal	Message Type - Destination	Description
"00000"	0	Set Target - Node	A message from the main board to a node and sets the open/closed target of a node
"00001"	1	Set Target - Group	A message from the main board to a node and sets the open/closed target of a group ID
"00010"	2	Current State - Main	A message from the node to the main board that tells the main board the current status of the node
"00011"	3	Set Open Time - Node	A message from the main board to a node that will set the time to open in milliseconds
"00100"	4	Set Close Time - Node	A message from the main board to a node that will set the time to close in milliseconds
"00101"	5	Set Open Angle - Node	A message from the main board to a node that will set the open angle in degrees
"00110"	6	Set Close Angle - Node	A message from the main board to a node that will set the closed angle in degrees
"00111"	7	Set Retries - Node	A message from the main board to a node that will set the number of times a node will attempt to reach a target state
"01000"	8	Set Timeout - Node	A message from the main board to a node that will set the timeout time in milliseconds
"01001"	9	Set MinPulse - Node	A message from the main board to a node that will set the minimum pulse width in microseconds for the servo
"01010"	10	Set MaxPulse - Node	A message from the main board to a node that will set the maximum pulse width in microseconds for the servo
"01011"	11	Set Group ID - Node	A message from the main board to a node that will set the group id for a node
"01100"	12	Clear Group ID - Node	A message from the main board to a node that will clear the group id for a node
"01101"	13	Configuration Request - Node	A message from the main board to a node that will request that a node return the configuration for a specified parameter
"01110"	14	Configuration Response - Main	A message from a node to the main board that will contain the previously requested information.

Command Set

Set Target - Node:

Message Type Bit Pattern : "00000"

When this message type is sent, the target state is set at the node defined in the "Target Address" portion of the identifier.

The data for this message is sent in the lowest byte of a CAN frame.

A 0 will tell the node to close the control surface.

A1 will tell the node to open the control surface.

Set Target - Group:

Message Type Bit Pattern : "00001"

When this message type is sent, the target state is set for the group defined in the "Target Address" portion of the identifier.

The data for this message is sent in the lowest byte of a CAN frame.

A 0 will tell the logical group to close the control surface.

A 1 will tell the logical group to open the control surface.

Current State:

When this message type is sent, the current status of the node defined in the “Target Address” is relayed to the main board.

The data for this message is sent in the lowest byte of a CAN frame.

A 0 will tell the main board that this node’s control surface is closed.

A 1 will tell the main board that this node’s control surface is open.

A 4 will tell the main board that this node’s control surface is in an unknown state.

Set Open Time:

When this message type is sent, the transition time from closed state to open state is set at the node defined in the "Target Address" portion of the identifier. This time is empirically defined by timing the movement of the control surface from one state to another. This helps the node to understand how long a movement should take, in order to more tightly control operation.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of time in milliseconds and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set Close Time:

When this message type is sent, the transition time from open state to closed state is set at the node defined in the "Target Address" portion of the identifier. This time is empirically defined by timing the movement of the control surface from one state to another. This helps the node to understand how long a movement should take, in order to more tightly control operation.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of time in milliseconds and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set Open Angle:

When this message type is sent, the angle which defines the open state is set at the node defined in the "Target Address" portion of the identifier. This angle is empirically defined by measuring the angle that the servo must rotate to in order to move the control surface to the open state.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of angular measurement in degrees and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set Closed Angle:

When this message type is sent, the angle which defines the closed state is set at the node defined in the "Target Address" portion of the identifier. This angle is empirically defined by measuring the angle that the servo must rotate to in order to move the control surface to the closed state.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of angular measurement in degrees and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set Retries:

When this message is sent, the number of attempts that a node will take to reach a target state is set at the node defined in the "Target Address" portion of the identifier.

The data for this node is sent in the lower byte of a CAN frame.

This parameter is an 8 bit unsigned integer with a minimum of 1.

Set Timeout:

When this message is sent, the timeout before which a node will give up on reaching a target state is set at the node defined in the "Target Address" portion of the identifier.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of time in milliseconds and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set MinPulse:

When this message is sent, the minimum pulse that can be interpreted by the servo is set at the node defined in the “Target Address” portion of the identifier.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of time in microseconds and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set MaxPulse:

When this message is sent, the maximum pulse that can be interpreted by the servo is set at the node defined in the “Target Address” portion of the identifier.

The data for this node is sent in the lower two bytes of a CAN frame.

This parameter is a unit of time in microseconds and is sent as a 16 bit unsigned integer with the most significant 8 bits sent in byte 1 and the least significant 8 bits sent in byte 0.

Set Group ID:

When this message is sent, the Group ID is set at the node defined in the “Target Address” portion of the identifier.

The data for this node is sent in the lower two bytes of a CAN frame.

The slot for which the group id is to be assigned is sent in byte 0.

The group id to be assigned is sent in byte 1.

Clear Group ID:

When this message is sent, the Group ID is cleared at the node defined in the “Target Address” portion of the identifier.

The data for this node is sent in the lower two bytes of a CAN frame.

The slot for which the group id is to be cleared is sent in byte 0.

The group id to be assigned is sent in byte 1.

Configuration Request:

When this message is sent, the configuration is requested of the node defined in the “Target Address” portion of the identifier.

The data for this message is sent in the lower byte of the CAN frame.

The code for the parameter requested is sent as an unsigned integer in byte 0.

Configuration Response:

When this message is sent, the configuration of the node defined in the “Target Address” portion of the identifier is seen by the main board.

The data for this message is sent in the lower two bytes of the CAN frame.

The parameter value is sent as an unsigned 16 bit integer with the least significant 8 bits sent in byte 0 and the most significant bits sent in byte 1.