APPLICATION NOTE

DOOR CANBUS STRUCTURE

1 Glossary

Node: It is a physical module connected on the network.
The node has a position on the door and this position is defined by the node location.

Activ8 indoor right 1
Eagle outdoor left 1

Service: It is functionality inside the node.
For example an activ8 has three services.

Safety, motion and counting

All the messages sent on the CAN bus can be divided into two main categories:

A remote frame (only 29 bits ID) is sent by the control box to ask a peripheral to send corresponding information.

A data frame (29 bits ID + 0 to 8 bytes data) is sent by the requested peripheral to answer the remote frame request or because the peripheral needs to transmit data to the control box.

A data frame (29 bits ID + 0 to 8 bytes data) can also be sent by the control box to set a given parameter value inside a peripheral.

2 Main principles of CAN network

Here under will be used the Extended Identifier structure of the CAN BUS. This identifier field has 29 bits. It mainly describes the meaning of the data/remote frame and also the localization of the destination node.

Using this strategy, we take benefit of the built-in hardware message filtering. This way of addressing minimizes the amount of disturbance to nodes for which the message is not dedicated. This is because, the address decoding will be taken care or ignored by the CAN chip only.

Another advantage is that the identifier field of a specific message (for example : setting of a new radar sensitivity parameter value) sent to a specific node (for example radar on the exterior side) is exactly the same as the message sent by this node to communicate the same information (its own current parameter value)

The lowest layers of the can bus (inbuilt in controller IC) manage messages acknowledgement.
Those only insure that a message is properly sent but does not insure that this last one has been properly received by the destination node.
For that, the application layer and mainly the application layer of the main node (door controller) has to make sure that all the nodes are alive and that all the messages sent are well received by destination node.

The sending of sensor status (service status) is immediate in case of detection status change (no detection -> detection or monitoring OK -> bad monitoring).
Before taking any decision by playing with mechanical parts which could be dangerous for users, the door controller has to control the monitoring status of the safety devices insuring that the area is safe.
For that, prior opening or closing the door, the door controller has to send a status request to the relevant sensors.

3 Identifier field structure

3.1 Protocol identifier : Bits : 28 - 27- 26 (8 items max, 3 bits)

The 3 most significant bits allow to select the type of protocol if different incompatible protocols are used on the same physical network.

Protocol identifier value	Protocol type
0 0 0 (0) :	Protocol #1
0 0 1 (1) :	Protocol #2
0 1 0 (2) :	Protocol #3
0 1 1 (3) :	Door control protocol
1 0 0 (4) :	Reserve
...	
1 1 1 (7) :	Broadcast (hardly usable)

All the messages used by the protocol 3 have absolutely to follow the same message hierarchy.

Hierarchy structure of the Door control protocol :

Domain (control box, sensor, ……)
Service (I.E. for sensor : presence , motion .....)
Function (I.E. for Sensor / motion ; sensitivity
Location (I.E. for Sensor / Exterior ….)

3. 2 Domain identifier : Bits : 25- 24 - 23 - 22 - 21 (32 items max, 5 bits)

This part of the identifier defines the domain concerned by the message. These bits identify the contain of the message. Their never identify the origin or the destination node.

Examples :
The sensors always send messages with domain identifier=8 and when the control box sends a message for one sensor it uses also the same domain identifier 8 because the contain of the message concerns sensor.

Domain identifier value	Domain
0	Highest priority messages (Safety devices)
1 to 3 :	reserves
4	Control box messages
5 to 7 :	reserve
8:	Sensor messages
9 to 11 :	reserve
12:	Keyboard and display messages
13 to 15 :	reserve
16	Monitoring messages
17 to 30 :	reserve
31:	broadcast

The following pages describes only the structure of the sensor services.
All the domain are structured by the same way using Services and Functions

3.3 Service identifier : Bits : 12 – 20

All the messages of a domain are grouped in service
The bits 12 to 20 identify the type of service
The control box domain could have for instance the following services

Motor driver
Door Encoder -> used by sensor f needed (accurate door position)
Door Position -> used by sensors if needed (basic door position : open / closed / opening ….)
Monitoring system
Beam manager
……

Notes : The door position messages used by some kind of sensors have to be included in the control box domain..

3.3.1 Sensor service Identifier

In the following paragraphs, we will describes the structure of the sensor domain.
The sensor messages are grouped in services.
As in the other domains, the bit 12 to 20 identify the type of service

Service number (bit 12 to 20)	Service name
0	IR presence detection service (reflectivity)
1	IR presence detection service (distance)
2	U.sonic Presence detection service
3	Light beam service
4	Multi-beam service
5	Microwave Motion detection service
6	Infrared motion detection service
7	Ultrasonic motion detection service
8	Counting service
511	Broadcast service

The full description of the each service is given at the paragraphs 4.

3.4 Function identifier : Bits : 6 – 11

All the services contains one or more functions
The bit 6 to 11 identify the function in the specified service.
For instance, the Motor driver service in the control box domain could have the following functions :
Speed setting
Torque setting
Current limitation setting
Motor type and manufacturer reading
…….
All the functions included in the services of the sensor domain are described in the paragraph 4

3.5 Service (nodes) locations identifier : Bits: 0 – 5 : (64 items max, 6 bits)

This identifier allows to specify the location of a service in case of there is several same services in the same network.
This part of the identifier field is mainly used for the sensor domain where we have for instance several motion or presence detection service on the CAN network but not located at the same place.

Default individual location

Value 63: Default location (set at factory)
A node installed on the network may never have the location 63.
The location "63" means " that the sensor is not yet configured and therefore not accessible.

Broadcast messages locations (Value 62 – 59)

Value 62: All Nodes
Value 61: Interior nodes
Value 60: Exterior nodes
Value 59: Node mounted on leafs

Individual nodes locations (Value 0 – 58)

Unmoving sensor locations (Swinging / Sliding / Revolving / industrial doors)

Value 0: Interior right 1	Value 8: Exterior right 1
Value 1: Interior right 2	Value 9: Exterior right 2
Value 2: Interior center 1	Value 10: Exterior center 1
Value 3: Interior center 2	Value 11: Exterior center 2
Value 4: Interior left 1	Value 12: Exterior left 1
Value 5: Interior left 2	Value 13: Exterior left 2
Value 6-7: Interior reserves	Value 14-15: Exterior reserves

Moving sensor locations(Swinging / Revolving doors)

Value 16: leaf 1 top edge	Value 24: leaf 2 top edge
Value 17: leaf 1 middle edge	Value 25: leaf 2 middle edge
Value 18: leaf 1 bottom edge	Value 26: leaf 2 bottom edge
Value 19: leaf 1 interior edge	Value 27: leaf 2 interior edge
Value 20: leaf 1 left edge	Value 28: leaf 2 left edge
Value 21: leaf 1 right edge	Value 29: leaf 2 right edge
Value 22-23:leaf 1 reserves	Value 30-31:leaf 2 reserves
Value 32: leaf 3 top edge	Value 40: leaf 4 top edge
Value 33: leaf 3 middle edge	Value 41: leaf 4 middle edge
Value 34: leaf 3 bottom edge	Value 42: leaf 4 bottom edge
Value 35: leaf 3 interior edge	Value 43: leaf 4 interior edge
Value 36: leaf 3 left edge	Value 44: leaf 4 left edge
Value 37: leaf 3 right edge	Value 45: leaf 4 right edge
Value 38-39:leaf 3 reserves	Value 46-47:leaf 4 reserves

4 Sensor Service & Functions

4.1 Broadcast service (511)

This service is not dedicated to one type of detection.
its use allows to read or set several or all the nodes installed on the CAN network.

There are 5 different functions in the broadcast service.

Function #0 : service status request
Data field of transmitted frame : no data field

Data field of requested frame : contains the detection and monitoring status of the relevant service. (presence motion .....) see service status in following services

Function #1 : node type+ software version
Data field of transmitted frame : no data field

Data field of requested frame :
Byte 1 : node type (Eagle, Eyetech, Activ8)
Byte 2 : Software version (P1,P2, V1,V2)

Function #2 : Set specified location to a node having a specific serial number
Data field of transmitted frame :
Byte 1 : LSB sensor serial number
Byte 2 : MSB sensor serial number
Byte 3 : new location

Function #3 : Force random serial number calculation
Data field : no data field

Data field of requested frame :
Byte 1 : LSB sensor serial number
Byte 2 : MSB sensor serial number

Function #4 : Force red led flash of the node having the specified location.(== IR remote login)

Data field of transmitted frame : node location

Function #5 : Force red led flash of the node having the specified serial number.

Data field of transmitted frame :
Byte 1 : LSB sensor serial number
Byte 2 : MSB sensor serial number

4.2 IR presence sensor service (reflectivity) (0)

This service is dedicated to active IR presence sensor using reflectivity principle.
Its use allows to read or set one or several sensor installed on the CAN network.

Following the selected function, the data field will contain different type of information

Function #0 : Service Status (detection + monitoring)
Byte 1 0 non detection
1 detection

Byte 2 0 monitoring OK
1 supply fail
2 memory fail
3 detection monitoring fail
4-255 reserve

Function #1: Time interval between status automatic sending (sec)
Byte 1 : Time interval in seconds

Function #2: Sensor Sensitivity
Byte 1 : Sensor sensitivity

Function #3: IR Frequency
Byte 1 : Emitting frequency

Function #4: Learning time
Byte 1 : Learning time

Function #5: Setup launch (request only -> remote frame)

Data field of requested frame :
Byte 1 : Status of setup
0 Setup in progress
1 Setup OK
2 Warning
3 Error during setup

4.3 Microwave Motion sensor service (5)

This service is dedicated to microwave motion sensor using Doppler effect.
Its use allows to read or set one or several sensor installed on the CAN network.

Following the selected function, the data field will contain different type of information

Function #0 : Service Status (detection + monitoring)
Byte 1 0 non detection
1 detection
Byte 2 0 monitoring OK
1 supply fail
2 memory fail
3 detection monitoring fail
4-255 reserve
Byte 3 Speed of target
Byte 4 Direction of target

Function #1: Time interval between status automatic sending (sec)
Byte 1 : Time interval in seconds

Function #2: Sensor Sensitivity
Byte 1 : Sensor sensitivity

Function #3: Detection hold time
Byte 1 : hold time

Function #4: Detection mode
Byte 1 : Detection mode : unidirect,. Bidirect, MTF

Function #5: Sensor immunity
Byte 1 : immunity

Function #6: Sensor height
Byte 1 : installation height

4.4 Counting sensor service (8)

This service is dedicated to counting devices.
Its use allows to read or set one or several sensor installed on the CAN network.

Following the selected function, the data field will contain different type of information

Function #0 : Service Status (detection + monitoring)
Byte 1 0 no detection
1 Ingoing target detected
2 Outgoing target detected

Byte 2 0 monitoring OK
1 supply fail
2 memory fail
3 detection monitoring fail
4-255 reserve

Byte 3 LSB total counter in

Byte 4 MSB total counter in

Byte 3 LSB total counter out

Byte 4 MSB total counter out

Function #1: Time interval between status automatic sending (sec)
Byte 1 : Time interval in seconds

Function #2: Counting sensor Sensitivity
Byte 1 : Sensor sensitivity

Function #3: Reset counter

5 Examples

1. Identifier filters structure of the MCP 2510

The MCP 2510 can manage at the same time 6 different hardware filters.
Here are the filters of a double technology sensor (Wizard) located at the interior side center of the door.

Filter 1

28 27 26	25 21	20 12	11 6	5 0
011	01000	111111111	XXXXXX	111110
Prot.(3)	Sens(8)	Broadcast	(511)	All nodes(62)

Accepts the broadcast requests group (64 messages) of the protocol 3 and dedicated only to sensors

Filter 2

28 27 26	25 21	20 12	11 6	5 0
011	01000	000000101	XXXXXX	000010
Prot.(3)	Sens(8)	Microwave Motion(5)		Interior center1 (2)

Accepts the microwave motion sensor group messages (64 messages) dedicated to interior center sensor .

Filter 3

28 27 26	25 21	20 12	11 6	5 0
011	01000	000000000	XXXXXX	000010

Accepts the I-R presence sensor group messages (64 messages) dedicated to interior center sensor

Filter 4

28	27	26	25	21	20	12	11	6	5	0
011			01000		000001000		XXXXXX		000010	

Accepts the counter group messages (64 messages) dedicated to interior center sensor
If the sensor needs status door:

Filter 5

28	27	26	25	21	20	12	11	6	5	0
011			00100		000000000		XXXXXX		111110	

Accepts All the broadcast door status group messages (64 messages) for the door controller domain

Filter 6

28	27	26	25	21	20	12	11	6	5	0
111			11111		111111111		XXXXXX		111110	

Accepts all broadcast messages (64 messages)

				Can frame contain								
				Identifier field					Data field			
	Event n°	Type of frame	Origin	Protocol	Domain	Service	Function	Location	Data1	Data2	Data3	Data4
Installation procedure	1	Remote	Door ctrl	3	8	511	3	62				
	2	Data	Sensor1	3	8	511	3	63	34	0		
	3	Data	Sensor2	3	8	511	3	63	75	0		
	4	Data	Sensor3	3	8	511	3	63	234	0		
	5	Data	Door ctrl	3	8	511	5	62	34	0		
	6	Data	Door ctrl	3	8	511	2	62	34	0	0	
	7	Data	Door ctrl	3	8	511	5	62	75	0		
	8	Data	Door ctrl	3	8	511	2	62	75	0	0	
	9	Data	Door ctrl	3	8	511	5	62	234	0		
	10	Data	Door ctrl	3	8	511	2	62	234	0	8	
Adjustment procedure	11	Data	Door ctrl	3	8	5	2	0	5			
	12	Remote	Door ctrl	3	8	5	2	0				
	13	Data	Sensor1	3	8	5	2	0	5			
	14	Data	Door ctrl	3	8	5	4	0	2			
	15	Remote	Door ctrl	3	8	5	4	0				
	16	Data	Sensor1	3	8	5	2	0	2			
Normal function	17	Data	Sensor1	3	8	5	0	0	1	0		
	18	Data	Sensor2	3	8	0	0	0	1	0		
	19	Data	Sensor1	3	8	5	0	0	0	0		
	20	Data	Sensor3	3	8	0	0	8	1	0		
	21	Data	Sensor2	3	8	0	0	0	0	0		
	22	Data	Sensor3	3	8	0	0	8	0	0		

Event n° :

1 Start random serial number calculation (must be a remote frame).

2-4 The nodes send their serial number (data frame).

5 Door controller ask to the node with the serial number 34 to blink its led.

6 Door controller assign the location to the node which has the serial number 34.

7 Door controller ask to the node with the serial number 75 to blink its led.

8 Door controller assign the location to the node which has the serial number 75.

9 Door controller ask to the node with the serial number 234 to blink its led.

10 Door controller assign the location to the node which has the serial number 234.

11-16 The door control box adjusts the sensitivity and the mode of the interior motion sensor service.

17-22 Detection messages sent by sensors services.

Origin :

Door ctrl : Door control box
Sensor 1 : Interior right 1 motion sensor service
Sensor 2 : Interior right 1 safety sensor service
Sensor 3 : Exterior right 1 safety sensor service

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