CAN Bus Interface

Interface Overview

Data Availability

This document details the latest fully optioned Modal communication interface. Some data at both the message and signal levels may not be available in all units. The Modal may also transmit CAN messages not referenced in this document that are used only for internal communications.

Baud Rate

The default baud rate is 500kbps. Other rates may be used upon customer request.

Reserved Message Identifiers

The Modal has several distinct blocks of CAN message identifiers that must not be used to avoid undefined behavior. Additional blocks may be added at any time.

Modal Messages

A consecutive block of 255 (0xFF) message identifiers must be reserved for Modal control and data messages. Using identifiers within this block may cause undefined behavior.

The Modal block is reserved by specifying a base identifier that is added to each Modal message's identifier. The default base identifier is 0x200. Other identifiers may be used upon customer request. If the identifier is set to 0x700 or less, the Modal will transmit 11-bit identifiers (CAN 2.0A). Otherwise, it will transmit 29-bit identifiers (CAN 2.0B).

All identifiers in this document are specified relative to this base identifier.

Internal Messages

29-bit identifiers of the pattern 0x189*n nnnn* (where *n* is a hexadecimal number) must be reserved for internal communications. These identifiers are outside the scope of this document and will not be defined.

Command Periods

Command periods are the those expected by the Modal. Errors and containment actions may occur if commands are transmitted at a significantly different rate.

Data Field

The data field is expected to be in little endian byte order (least significant byte transmitted and received first). All messages have a DLC of 8 to minimize rework needed as available data is increased.

Signal Formatting

The formatting of signal values utilizes a scaler and an offset to convert between physical and transmission values.

Transmission value = (physical_value - offset) / scaler

Physical value = transmission_value * scaler + offset

Limits

Limits are listed as physical values i.e., after the scalar and offset have been applied to received data. Limit ranges are listed as *lower bound, upper bound* and are inclusive of the listed values. Physical capability of the Modal hardware may result in limits different than those listed in this document.

Faults

No filtering of fault conditions is necessary as the Modal performs those computations internally. The Modal will attempt to notify its controller of faults before executing containment actions that disrupt operation, but this cannot be guaranteed for all issues.

Commands

Driving Commands

ID: Base identifier + 0x20
Period: 10 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	APED<7:0>							
1	15:8	APED<15:8>							
2	23:16	BPED<7:0>							
3	31:24	BPED<15:8>							
4	39:32	STEERANG<7:0>							
5	47:40	STEERANG<15:8>							
6	55:48	-	-	-	-	PRND			
7	63:56	-	-	-	-	STRMODE			

bit 0-15 **APED**: Accelerator Pedal Command (%)
Type: unsigned Scalar: 0.0625 Offset: 0.0 Limits: 0.0, 100.0

bit 16-31 **BPED**: Brake Pedal Command (%)
Type: unsigned Scalar: 0.0625 Offset: 0.0 Limits: 0.0, 100.0

bit 32-47 **STEERANG**: Steering Angle (°)
Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: 90.0, -90.0
Positive is left
Negative is right

bit 48-51 **PRND**: Gear Select (enumerated)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 4
0 = Park
1 = Reverse
2 = Neutral
3 = Drive
4 = Emergency Stop

bit 52-55 Reserved

bit 56-59 **STRMODE**: Steer Mode (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 3

0 = Front-Wheel Steering

1 = Rear-Wheel Steering

2 = 4-Wheel Steering

3 = Crab Steering

bit 60-63 Reserved

Lighting Commands

ID: Base identifier + 0x60
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	HEAD	HAZARD	TURN_L	TURN_R
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **TURN_R**: Right Turn Signal (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Right turn signal off
1 = Right turn signal on

bit 1 **TURN_L**: Left Turn Signal (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Left turn signal off
1 = Left turn signal on

bit 2 **HAZARD**: Hazard Lights (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Hazard lights off
1 = Hazard lights on

bit 3 **HEAD**: Head Lights (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Head lights off
1 = Head lights on

bit 4-63 Reserved

Front Locker Commands

ID: Base identifier + 0x70
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	-	-	-	DOORCMD
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **DOORCMD**: Door command (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Close door
1 = Open door

bit 1-63 Reserved

Rear Locker Commands

ID: Base identifier + 0x80
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	-	-	-	DOORCMD
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **DOORCMD**: Door command (bool)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1

0 = Close door

1 = Open door

bit 1-63 Reserved

Data

Driving Data

ID: Base identifier + 0x40
Period: 10 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	APED<7:0>							
1	15:8	APED<15:8>							
2	23:16	BPED<7:0>							
3	31:24	BPED<15:8>							
4	39:32	STEERANG<7:0>							
5	47:40	STEERANG<15:8>							
6	55:48	-	-	-	-	PRND			
7	63:56	-	-	-	-	STRMODE			

bit 0-15 **APED**: Accelerator Pedal Command (%)
Type: unsigned Scalar: 0.0625 Offset: 0.0 Limits: 0.0, 100.0

bit 16-31 **BPED**: Brake Pedal Command (%)
Type: unsigned Scalar: 0.0625 Offset: 0.0 Limits: 0.0, 100.0

bit 32-47 **STEERANG**: Steering Angle (°)
Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: 90.0, -90.0
Positive is left
Negative is right

bit 48-51 **PRND**: Gear Select (enumerated)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 4
0 = Park
1 = Reverse
2 = Neutral
3 = Drive
4 = Emergency Stop

bit 52-55 Reserved

bit 56-59 **STRMODE**: Steer Mode (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 3

0 = Front-Wheel Steering

1 = Rear-Wheel Steering

2 = 4-Wheel Steering

3 = Crab Steering

bit 60-63 Reserved

Wheel Speeds

ID: Base identifier + 0x41

Period: 100 ms

DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	WHLSPD_RR<7:0>							
1	15:8	WHLSPD_RR<15:8>							
2	23:16	WHLSPD_RL<7:0>							
3	31:24	WHLSPD_RL<15:8>							
4	39:32	WHLSPD_FR<7:0>							
5	47:40	WHLSPD_FR<15:8>							
6	55:48	WHLSPD_FL<7:0>							
7	63:56	WHLSPD_FL<15:8>							

bit 0-15 **WHLSPD_RR**: Rear right wheel speed (KPH)

Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: -100.0, 100.0

bit 16-31 **WHLSPD_RR**: Rear left wheel speed (KPH)

Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: -100.0, 100.0

bit 32-47 **WHLSPD_FR**: Front right wheel speed (KPH)

Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: -100.0, 100.0

bit 48-63 **WHLSPD_FR**: Front left wheel speed (KPH)

Type: signed Scalar: 0.0078125 Offset: 0.0 Limits: -100.0, 100.0

Battery Power Data

ID: Base identifier + 0x50
Period: 10 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	BATCURR<7:0>							
1	15:8	BATCURR<15:8>							
2	23:16	BATVOLT<7:0>							
3	31:24	BATVOLT<15:8>							
4	39:32	MAXVOLT<7:0>							
5	47:40	MAXVOLT<15:8>							
6	55:48	MINVOLT<7:0>							
7	63:56	MINVOLT<15:8>							

bit 0-15 **BATCURR**: Battery Current (A)
Type: signed Scalar: 0.1 Offset: 0.0 Limits: -100.0, 100.0
Positive is discharging
Negative is charging

bit 16-31 **BATVOLT**: Battery Voltage (V)
Type: unsigned Scalar: 0.1 Offset: 0.0 Limits: 0.0, 100.0

bit 32-47 **MAXVOLT**: Maximum Cell Voltage (V)
Type: unsigned Scalar: 0.01 Offset: 0.0 Limits: 0.00, 10.00

bit 48-63 **MINVOLT**: Minimum Cell Voltage (V)
Type: unsigned Scalar: 0.01 Offset: 0.0 Limits: 0.00, 10.00

Battery State Data

ID: Base identifier + 0x51
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	BATSOC<7:0>							
1	15:8	BATSOC<15:8>							
2	23:16	BATTEMP<7:0>							
3	31:24	BATTEMP<15:8>							
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-15 **BATSOC**: Battery State of Charge (%)

Type: unsigned Scalar: 0.1 Offset: 0.0 Limits: 0.0, 100.0

Note: SOC presently fluctuates as current draw changes. Therefore, SOC may rise slightly while the Modal is coasting or idling and may drop significantly during heavy acceleration or steep grades. There is a small charge reserve below zero, but it should not be relied upon

bit 16-31 **BATTEMP**: Battery Temperature (°C)

Type: signed Scalar: 0.1 Offset: 0.0 Limits: -100.0, 100.0

bit 32-63 Reserved

Lighting Data

ID: Base identifier + 0x90
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	BRAKE	HEAD	HAZARD	TURN_L	TURN_R
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **TURN_R**: Right Turn Signal (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Right turn signal off
1 = Right turn signal on

bit 1 **TURN_L**: Left Turn Signal (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Left turn signal off
1 = Left turn signal on

bit 2 **HAZARD**: Hazard Lights (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Hazard lights off
1 = Hazard lights on

bit 3 **HEAD**: Head Lights (bool)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = Head lights off
1 = Head lights on

bit 4 **BRAKE**: Brake Lights (bool)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 1

0 = Brake lights off

1 = Brake lights on

bit 5-63 Reserved

Front Locker Data

ID: Base identifier + 0xA0

Period: 100 ms

DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	-	-	-	DOORST
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **DOORST**: Door command (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 3

0 = Door open

1 = Door close

bit 1-63 Reserved

Rear Locker Data

ID: Base identifier + 0xB0
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	-	-	-	DOORST
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **DOORST**: Door command (enumerated)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 3
0 = Door open
1 = Door close

bit 1-63 Reserved

Main Controller Heartbeat

ID: Base identifier + 0xF0
Period: 1 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	TXERR							
1	15:8	RXERR							
2	23:16	-	LEC			-	BOFF	EPVF	EWGF
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-7 **TXERR**: Transmit error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 8-15 **RXERR**: Receive error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 16 **EWGF**: Error warning flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below warning limit (96)
1 = TX or RX counter at or above warning limit

bit 17 **EPVF**: Error passive flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below passive limit (127)
1 = TX or RX counter at or above passive limit

bit 18 **BOFF**: Bus-off flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = CAN bus is normal
1 = CAN bus is off (TX counter above 255)

bit 19 Reserved

bit 20-22 **LEC**: Last error code (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 6

0 = No error
1 = Stuff error
2 = Form error
3 = Acknowledgement error
4 = Bit error – recessive
5 = bit error – dominant
6 = CRC error

bit 23-63 Reserved

Main Controller Semantic Software Version

ID: Base identifier + 0xF1
Period: 10 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	MAJOR_VER <7:0>							
1	15:8	MAJOR_VER <15:8>							
2	23:16	MINOR_VER <7:0>							
3	31:24	MINOR_VER <15:8>							
4	39:32	PATCH_VER <7:0>							
5	47:40	PATCH_VER <15:8>							
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-15 **MAJOR_VER**: Major software version
bit 16-31 **MINOR_VER**: Minor software version
bit 32-47 **PATCH_VER**: Patch software version
bit 48-63 Reserved

Front Axle Heartbeat

ID: Base identifier + 0xF2
Period: 1 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	TXERR							
1	15:8	RXERR							
2	23:16	-	LEC			-	BOFF	EPVF	EWGF
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-7 **TXERR**: Transmit error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 8-15 **RXERR**: Receive error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 16 **EWGF**: Error warning flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below warning limit (96)
1 = TX or RX counter at or above warning limit

bit 17 **EPVF**: Error passive flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below passive limit (127)
1 = TX or RX counter at or above passive limit

bit 18 **BOFF**: Bus-off flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = CAN bus is normal
1 = CAN bus is off (TX counter above 255)

bit 19 Reserved

bit 20-22 **LEC**: Last error code (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 6

0 = No error
1 = Stuff error
2 = Form error
3 = Acknowledgement error
4 = Bit error – recessive
5 = bit error – dominant
6 = CRC error

bit 23-63 Reserved

Front Axle Semantic Software Version

ID: Base identifier + 0xF3
Period: 10 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	MAJOR_VER <7:0>							
1	15:8	MAJOR_VER <15:8>							
2	23:16	MINOR_VER <7:0>							
3	31:24	MINOR_VER <15:8>							
4	39:32	PATCH_VER <7:0>							
5	47:40	PATCH_VER <15:8>							
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-15 **MAJOR_VER**: Major software version
bit 16-31 **MINOR_VER**: Minor software version
bit 32-47 **PATCH_VER**: Patch software version
bit 48-63 Reserved

Rear Axle Heartbeat

ID: Base identifier + 0xF4
Period: 1 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	TXERR							
1	15:8	RXERR							
2	23:16	-	LEC			-	BOFF	EPVF	EWGF
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-7 **TXERR**: Transmit error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 8-15 **RXERR**: Receive error counter (counts)
Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 255

bit 16 **EWGF**: Error warning flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below warning limit (96)
1 = TX or RX counter at or above warning limit

bit 17 **EPVF**: Error passive flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = TX and RX counter below passive limit (127)
1 = TX or RX counter at or above passive limit

bit 18 **BOFF**: Bus-off flag (bool)
Type: bool Scalar: 1.0 Offset: 0.0 Limits: 0, 1
0 = CAN bus is normal
1 = CAN bus is off (TX counter above 255)

bit 19 Reserved

bit 20-22 **LEC**: Last error code (enumerated)

Type: unsigned Scalar: 1.0 Offset: 0.0 Limits: 0, 6

0 = No error
1 = Stuff error
2 = Form error
3 = Acknowledgement error
4 = Bit error – recessive
5 = bit error – dominant
6 = CRC error

bit 23-63 Reserved

Rear Axle Semantic Software Version

ID: Base identifier + 0xF5
Period: 10 s
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	MAJOR_VER <7:0>							
1	15:8	MAJOR_VER <15:8>							
2	23:16	MINOR_VER <7:0>							
3	31:24	MINOR_VER <15:8>							
4	39:32	PATCH_VER <7:0>							
5	47:40	PATCH_VER <15:8>							
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0-15 **MAJOR_VER**: Major software version
bit 16-31 **MINOR_VER**: Minor software version
bit 32-47 **PATCH_VER**: Patch software version
bit 48-63 Reserved

Faults

Fault Map 0

ID: Base identifier + 0x00
Period: 100 ms
DLC: 8

Byte	Bits	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7:0	-	-	-	-	-	ESTOP_TRIG	ESTOP_COMM	ESTOP_CMD
1	15:8	-	-	-	-	-	-	-	-
2	23:16	-	-	-	-	-	-	-	-
3	31:24	-	-	-	-	-	-	-	-
4	39:32	-	-	-	-	-	-	-	-
5	47:40	-	-	-	-	-	-	-	-
6	55:48	-	-	-	-	-	-	-	-
7	63:56	-	-	-	-	-	-	-	-

bit 0 **ESTOP_CMD**: Emergency stop requested by user controls
bit 1 **ESTOP_COMM**: Emergency stop engaged due to communication loss with user controls
bit 2 **ESTOP_TRIG**: Emergency stop engaged due to manual trigger
bit 3-63 Reserved

Changelog

2022 January 08	Ann Larson	Initial Revision
2022 January 12	Ann Larson	Updated formatting
2022 January 22	Ann Larson	Clarified steering positive/negative angles
2022 February 22	Ann Larson	Added speed feedback for all wheels Default baud rate 125kbps -> 500kbps
2022 March 07	Ann Larson	Added Battery, Lighting, and Locker messages Added DLC information
2022 March 12	Ann Larson	Fixed signal labels for Battery State Data
2022 March 14	Ann Larson	Added signal scaler/offset equations
2022 March 31	Ann Larson	Fixed Modal Heartbeat signal BOFF being mislabeled Flipped order of wheel speed signals to match reality
2022 April 09	Ann Larson	Added software version message
2022 April 14	Ann Larson	Added Emergency Stop fault flags
2022 April 21	Ann Larson	Added steering modes
2022 May 28	Ann Larson	Added extra information about what SOC presently represents
2022 August 19	Ann Larson	Added *Data Availability* section Added reserved identifier block for internal messages Added axle heartbeat and software version messages