IDEX CORPORATION

Class 1

ISO 9001 CERTIFIED

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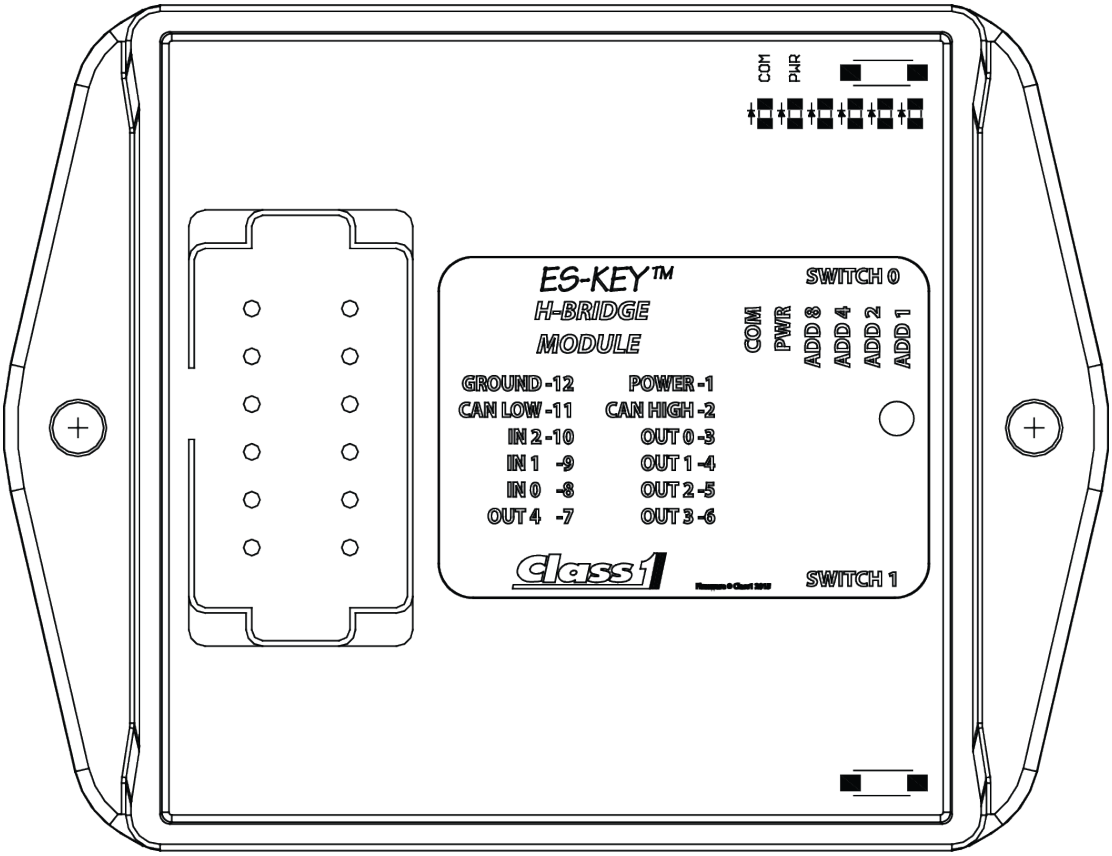
OPERATION MANUAL

H-Bridge Module
610-00041



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PRODUCT GROUP	Electronics	P/N	FSG-MNL-00160	REV	1.02
PRODUCT	H-Bridge Module			BY	GMC

1. Revision Log

Rev	Date	Approved	Changes
1.00	7-15-2016	GMC	Initial requirements
1.01	8-04-2016	GMC	Updated Module Type CAN RX ID Numbers
1.02	3-10-2017	GMC	Updated the physical dimensions.

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2. System Overview

2.1. Scope

The H-Bridge module is an ES-Key™ node designed to allow a designer the ability to utilize the product within the ES-Key™ electrical system network. The module responds to commands to activate its physical outputs and reports the state of its inputs back to the network. The module has 5 outputs of which 2 of the outputs can be polarity selectable the module also has 3 polarity selectable inputs of which one can be configured as an analog input or frequency. The module having the ability to also work as a network controlled H-bridge module.

2.2. Part numbers

H-bridge Module Hale – p/n 610-00041

3. Operation

3.1. Module Operation

For detailed operation of module type (see section 5).

3.2. LED indications

The module uses LEDs to show the power status, and configuration setup.

3.3. Magnetic switches

The module has two magnetic switches (SWITCH 0 and SWITCH 1). The switches are activated by touching a magnet to either side of the module (see section 4.2).

3.4. Show device address

The device address will be displayed for 5 seconds if the show device address password is entered (see section 4.1). The address is represented by the 4 ADD LED's in a binary number format. NOTE: Address 0 will flash all the LED's

ADD 8	ADD 4	ADD 2	ADD 1	ADDRESS #
FLASH	FLASH	FLASH	FLASH	0
OFF	OFF	OFF	ON	1
OFF	OFF	ON	OFF	2
OFF	OFF	ON	ON	3
OFF	ON	OFF	OFF	4
OFF	ON	OFF	ON	5
OFF	ON	ON	OFF	6
OFF	ON	ON	ON	7
ON	OFF	OFF	OFF	8
ON	OFF	OFF	ON	9
ON	OFF	ON	OFF	10
ON	OFF	ON	ON	11
ON	ON	OFF	OFF	12
ON	ON	OFF	ON	13
ON	ON	ON	OFF	14
ON	ON	ON	ON	15

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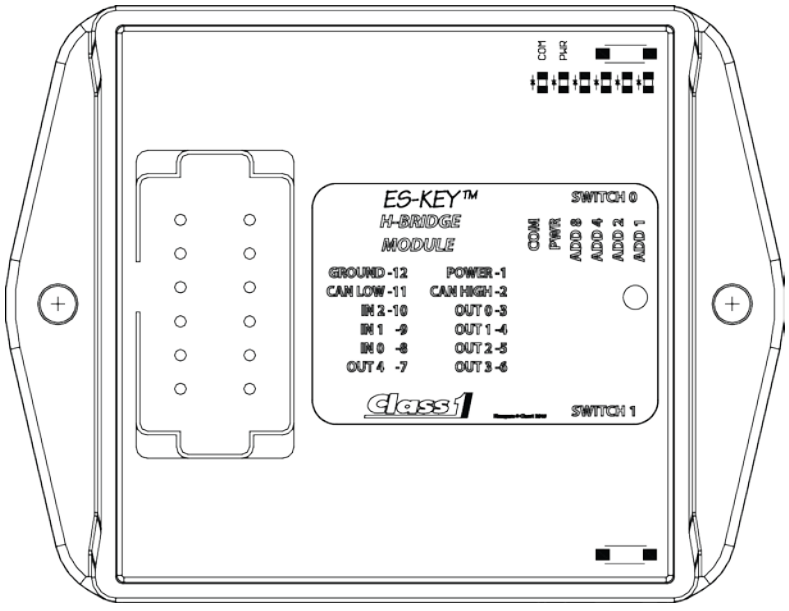
4. Passwords

4.1. Password List

1100 0000 (0xC0)	Set the module to ES-Key mode.	
1100 0001 (0xC1)	Set the module to H-Bridge mode.	
1100 0010 (0xC2)	Set the module to MIV Control mode.	
1100 0011 (0xC3)	Set the module to Door Lock mode.	
1000 0000 (0x80)	Set Input 0 polarity	
1000 0001 (0x81)	Set Input 1 polarity	
1000 0010 (0x82)	Set Input 2 polarity	
1000 0011 (0x83)	Set Input 0 switch mode	NO/NC
1000 0100 (0x84)	Set Input 1 switch mode	NO/NC
1000 0101 (0x85)	Set Input 2 switch mode	NO/NC
1000 0110 (0x86)	Set Input 2 analog mode	
1001 0000 (0x90)	Set the device address.	
1001 0001 (0x91)	Show the device address.	
1001 0101 (0x95)	Enter Boot load Mode	
1111 0000 (0xF0)	Load Defaults	

4.2. Password Entry

To enter a password, a magnetic switch must activate the two magnetic switches in a specific order. Switch 0 will indicate a 0 from the password list and Switch 1 will indicate a 1 from the password list. When the switch is activated by a magnet, the address LED's will turn on to indicate the switch was activated. Switch 0 will activate ADD 1 and Switch 1 will activate all the ADD LED's. If a password is entered incorrectly or a password is entered that is not in the password list, the ADD LED's will alternate On and OFF to indicate an invalid password was entered.



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4.3. Set Module to ES-Key mode

To set the module to ES-Key™ mode use a magnet and enter password 1100 0000 (see section 4.2). The module will indicate that the mode is saved by flashing ADD2 and ADD 4 indicators then flashing all the ADD indicators as it saves the new mode.

4.4. Set Module to H-Bridge mode

To set the module to H-Bridge mode use a magnet and enter password 1100 0001 (see section 4.2). The module will indicate that the mode is saved by flashing ADD2 and ADD 4 indicators then flashing all the ADD indicators as it saves the new mode.

4.5. Set Module to MIV Control mode

To set the module to MIV mode use a magnet and enter password 1100 0010 (see section 4.2). The module will indicate that the mode is saved by flashing ADD2 and ADD 4 indicators then flashing all the ADD indicators as it saves the new mode.

4.6. Set Module to Door Lock mode

To set the module to Door Lock mode use a magnet and enter password 1100 0011 (see section 4.2). The module will indicate that the mode is saved by flashing ADD2 and ADD 4 indicators then flashing all the ADD indicators as it saves the new mode.

4.7. Set Input 0 switch polarity

To set the switch polarity for Input 0, first use a magnet and enter password 1000 0000 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	NEGATIVE
ON	OFF	OFF	ON	POSITIVE

4.8. Set Input 1 switch polarity

To set the switch polarity for Input 1, first use a magnet and enter password 1000 0001 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	NEGATIVE
ON	OFF	OFF	ON	POSITIVE

4.9. Set Input 2 switch polarity

To set the switch polarity for Input 2, first use a magnet and enter password 1000 0010 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	NEGATIVE

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ON	OFF	OFF	ON	POSITIVE

4.10. Set Input 0 switch mode

To set the switch mode for Input 0, first use a magnet and enter password 1000 0011 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	Normally Open
ON	OFF	OFF	ON	Normally Closed

4.11. Set Input 1 switch mode

To set the switch mode for Input 1, first use a magnet and enter password 1000 0100 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	Normally Open
ON	OFF	OFF	ON	Normally Closed

4.12. Set Input 2 switch mode

To set the switch mode for Input 2, first use a magnet and enter password 1000 0101 (see section 4.2). The current polarity will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the polarity. Once the desired polarity is displayed, activating Switch 1 will save the polarity and all the ADD LED's will flash to indicate the polarity was saved.

ADD 8	ADD 4	ADD 2	ADD 1	MODE
OFF	ON	ON	OFF	Normally Open
ON	OFF	OFF	ON	Normally Closed

4.13. Set Input 2 Analog Mode

To set the analog mode for Input 2, first use a magnet and enter password 1001 0110 (see section 4.2). The current mode will be displayed by the 4 ADD LED's (see table). Activating Switch 0 will change the mode. Once the desired mode is displayed, activating Switch 1 will save the mode and all the ADD LED's will flash to indicate the mode was saved. (**Note: will only work if the module is set to ES-Key or H-Bridge mode**)

ADD 1	DIGITAL
ADD 2	0-5 VOLT
ADD 4	0-30 VOLT
ADD 8	Frequency

4.14. Set Address

To enter a device address, first use a magnet and enter password 1001 0000 (see section 4.2). The current address will be displayed (see section 3.4). Activating Switch 0 will increase the address by 1 every time the switch is activated. Once the desired address is displayed, activating Switch 1 will save the mode and all the ADD LED's will flash to indicate the mode was saved.

4.15. Show Address

To show the current device address, first use a magnet and enter password 1001 0001 (see section 4.2). The current address will begin to flash (see section 3.4).

4.16. Boot load

The device can have the software upgraded by entering the following password 1001 0101 (see section 4.2). The password must be entered within 30 seconds after the unit is powered up or the boot load password will be disabled.

4.17. Defaults

Enter the password 1111 00000 (see section 4.2). ADD LED's 2 and 4 will flash to acknowledge the password and then all the ADD led's will flash to indicate the mode was saved. When the default password is entered the module will reset to the following operation.

- Address = 0.
- Module Function = ES-key.
- Input 0 polarity = positive.
- Input 1 polarity = positive.
- Input 2 polarity = positive.
- Input 0 switch mode = Normally Open.
- Input 1 switch mode = Normally Open.
- Input 2 switch mode = Normally Open.
- Input 2 analog mode = Digital.

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5. Module Operation

5.1. ES-Key™ mode

5.1.1. Selectable Digital polarity inputs

The module has digital inputs that can be configured for either positive or ground input (see section 4.1). An input is flagged as ACTIVE in the ES-Key database when the voltage level of the input is within the required range (refer to the table below). (refer to the table below).

Input Polarity	Input requirement
Positive	Input is flagged as ACTIVE when its voltage is greater than 60% of supply power.
Ground	Input is flagged as ACTIVE when its voltage is less than 40% of supply power.

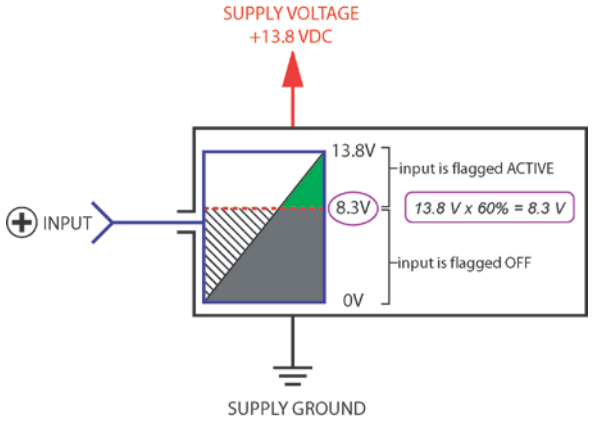

Figure 1. ***Positive input example.***

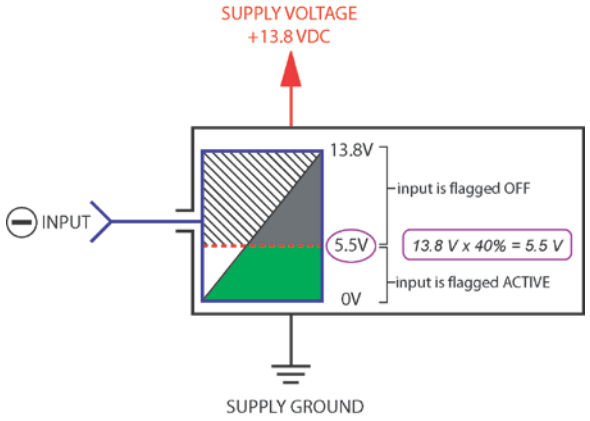

Figure 2. ***Ground input example.***

The examples above illustrate the voltage range required for an input to be flagged as ACTIVE to the ES-Key database. The voltage range is based on the polarity of the input (positive or ground) and the voltage level of the supply voltage. In figure 1 the input is a positive polarity type, the supply voltage is 13.8 VDC, and the valid voltage range for the input is 8.3 VDC and greater (less than 8.3 VDC flags the input as OFF).

5.1.2. Selectable Analog input

The module has one input (Input 2) that can be configured for analog operation . (**Note: will only work if the module is set to ES-Key or H-Bridge mode**) Input 2 can be configured for the following functions Digital, 0-5 Volt, 0-30, and Frequency (see section 4.13). The module will send out the CAN BUS what the input is configured to read. If voltage a bit value from 0-1023. If the input is set to frequency it will send out a value in Hertz.

5.1.3. Solid State Outputs

The module has 2 fully protected high-side drivers that feature overload protection, current limitation, open load detection and transient protection. These output drivers replace the requirement of a relay and circuit breaker. The module also has 3 low-side drivers that feature overload protection and transient protection.

High Current Rating. Each of the high current outputs is capable of supplying 6.0 Amps continuously on all outputs at 85º Celsius.

Low Current Rating. Each of the low current outputs is capable of supplying .25 Amps continuously on all outputs at 85º Celsius.

Circuit Protection/Breaker. If output current exceeds 6.5 Amps nominal the output will automatically turn off. The module will attempt to connect the output to the load two more times at 5 second intervals. If the output is still overloaded, then it will remain off.
The "circuit breaker" feature can be reset (or reinitialized) by de-activating the output through the ES-Key™ network - in the distributed network, any number of switches may be configured to deactivate the particular output. When the output is turned back on, the over current tests will be initiated.
The system com light will flash while any over current situation exists.

5.1.4. Input/output memory space

The module uses standard an ES-Key™ defined input and output memory space. The polarity selectable inputs are mapped into the input space, and the outputs are mapped into the output space.

INPUT MEMORY SPACE	
INPUT	DESCRIPTION
0	Physical input 0
1	Physical input 1
2	Physical input 2
3	*reserved*
4	*reserved*

OUTPUT MEMORY SPACE	
OUTPUT	LOCATION
0	Physical output 0
1	Physical output 1
2	Physical output 2
3	Physical output 3
4	Physical output 4

5.2. H-Bridge Mode

In H-Bridge mode the module works like ES-Key except that output 0 and 1 operate in an H-Bridge configuration. When output space 0 is activated output 0 will be a positive output and output 1 will be a ground output. When output space 1 is activated output 0 will be a negative output and output 1 will be a positive output.

Output space 5 and 6 can be used for limit switches that will control the operation of the H-Bridge outputs.

Output space 0 will allow Output 0 to turn on Positive and Output 1 to turn on Negative.
Output space 1 will allow Output 0 to turn on Negative and Output 1 to turn on Positive.

While Output space 0 is activated the H-Bridge will be activated until Output space 5 is active then the H-Bridge will stop. While Output space 1 is activated the H-Bridge will be active until the Output space 6 is active then the H-Bridge will stop.

The Rest of the modules function operate the same as in ES-Key mode

5.2.1. Input/output memory space

The module uses standard an ES-Key™ defined input and output memory space. The polarity selectable inputs are mapped into the input space, and the outputs are mapped into the output space.

INPUT MEMORY SPACE	
INPUT	DESCRIPTION
0	Physical input 0
1	Physical input 1
2	Physical input 2
3	*reserved*
4	*reserved*
5	*reserved*
6	*reserved*

OUTPUT MEMORY SPACE	
OUTPUT	LOCATION
0	DIR A
1	DIR B
2	Physical output 2
3	Physical output 3
4	Physical output 4
5	Limit A
6	Limit B

5.3. MIV Operation

The MIV Control Module was designed to operate the Master Intake Control Valve as a standalone module or has the ability to be controlled from CAN.

The MIV Control mode will open and close the Master Intake Valve using both local or network switch inputs. The module will only allow the valve to operate if the local or network limit switches are in range. The module will turn on valve status indicators based on the current state of the local or network limit switches.

Output space 0 will allow Output 0 to turn on Positive and Output 1 to turn on Negative.
Output space 1 will allow Output 0 to turn on Negative and Output 1 to turn on Positive.

While Output space 0 is activated the H-Bridge will be activated until Output space 5 is active then the H-Bridge will stop. While Output space 1 is activated the H-Bridge will be active until the Output space 6 is active then the H-Bridge will stop.

The Output 3 output will turn on when both Limit switches are not active.
The Output 2 output will turn on when Limit A switch is active.
The Output 4 output will turn on when Limit B switch is active.

The modules local inputs are polarity selectable and have the ability to have the switch activated in either the normally open or normally closed position by activating a password (see section 4.2).

5.3.1. Input/output memory space

The module uses standard an ES-Key™ defined input and output memory space. The polarity selectable inputs are mapped into the input space, and the outputs are mapped into the output space.

INPUT MEMORY SPACE	
INPUT	DESCRIPTION
0	INPUT 0
1	INPUT 1
2	INPUT 2
3	INPUT 3
4	*reserved*
5	*reserved*
6	*reserved*

OUTPUT MEMORY SPACE	
OUTPUT	LOCATION
0	DIR A
1	DIR B
2	*reserved*
3	*reserved*
4	*reserved*
5	Limit A
6	Limit B

Note: Input 2 and 3 share the same physical input but the input is configured to function as an open / close circuit. Applying power will open and applying ground will close.

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5.4. Door Lock Mode

In Door Lock mode the module works like ES-Key except that output 0 and 1 operate in an H-Bridge configuration. The H-Bridge output when activated will turn on for a 500mS pulse. When output space 0 is activated output 0 will be a positive output and output 1 will be a ground output. When output space 1 is activated output 0 will be a negative output and output 1 will be a positive output.

Output space 0 will allow Output 0 to turn on Positive and Output 1 to turn on Negative.
Output space 1 will allow Output 0 to turn on Negative and Output 1 to turn on Positive.

The Rest of the modules function operate the same as in ES-Key mode

5.4.1. Input/output memory space

The module uses standard an ES-Key™ defined input and output memory space. The polarity selectable inputs are mapped into the input space, and the outputs are mapped into the output space.

INPUT MEMORY SPACE	
INPUT	DESCRIPTION
0	Physical input 0
1	Physical input 1
2	Physical input 2
3	*reserved*
4	*reserved*
5	*reserved*
6	*reserved*

OUTPUT MEMORY SPACE	
OUTPUT	LOCATION
0	DIR A
1	DIR B
2	Physical output 2
3	Physical output 3
4	Physical output 4
5	*reserved*
6	*reserved*

6. Module Network TX RX CAN messages

6.1. TX message (ES-Key designation 0x4X to 0x1E)

Message/Frame Format	SAE J1939 CAN 2.0B (PDU1 Format)
Transmission Repetition Rate:	10 per second
Data Length:	8 Bytes
Data Page:	0
PDU Format:	239 (EF_{16}) Proprietary A
PDU Specific:	30 ($1E_{16}$)
Default Priority:	6
Parameter Group Number (PGN):	61184 ($EF00_{16}$)
Source address:	64-79(40_{16}-$4F_{16}$)

Byte 0 – Input States *See memory map for each mode*
Byte 1 – 0x00
Byte 2 – 0x00
Byte 3 – 0x00
Byte 4 – 0x00
Byte 5 – 0x00
Byte 6 – 0x00
Byte 7 – 0x00

6.2. TX message (ES-Key designation 0x4X to 0xFF)

Message/Frame Format	SAE J1939 CAN 2.0B (PDU1 Format)
Transmission Repetition Rate:	10 per second
Data Length:	8 Bytes
Data Page:	0
PDU Format:	239 (EF_{16}) Proprietary A
PDU Specific:	255 (FF_{16})
Default Priority:	6
Parameter Group Number (PGN):	61184 ($EF00_{16}$)
Source address:	64-79(40_{16}-$4F_{16}$)

Byte 0 – 0x00
Byte 1 – 0xFF
Byte 2 – 0x00
Byte 3 – 0x00
Byte 4 – Module address
Byte 5 – Software version *(high nibble = major rev, low nibble = minor rev)*
Byte 6 – 0x00
Byte 7 – 0x00

6.3. TX Software version message (ES-Key designation 0x4X to 0xAA)

Message/Frame Format	SAE J1939 CAN 2.0B (PDU1 Format)
Transmission Repetition Rate:	10 per second
Data Length:	8 Bytes
Data Page:	0
PDU Format:	239 (EF_{16}) Proprietary A
PDU Specific:	170 (AA_{16})
Default Priority:	6
Parameter Group Number (PGN):	61184 ($EF00_{16}$)
Source address:	64-79(40_{16}-$4F_{16}$)

Byte 0 – Data Low Byte
Byte 1 – Data High Byte *Analog or Flow data*
Byte 2 – Module Function *ES-Key = 0, H-Bridge = 1, MIV Valve = 2*
Byte 3 – Input States *See memory map for each mode*
Byte 4 – Output States *See memory map for each mode*
Byte 5 – Switch States
Byte 6 – Analog Function *Digital = 1, 0-5 = 2, 4-20mA = 3, Freq = 4*
Byte 7 – ShortFlag

Switch States

1. Bit 0 Input 0 Polarity 0 = NEG 1 = POS
2. Bit 1 Input 0 Mode 0 = N/C 1 = N/O)
3. Bit 2 Input 1 Polarity 0 = NEG 1 = POS
4. Bit 3 Input 1 Mode 0 = N/C 1 = N/O)
5. Bit 4 Input 2 Polarity 0 = NEG 1 = POS
6. Bit 5 Input 2 Mode 0 = N/C 1 = N/O)
7. Bit 6
8. Bit 7

6.4. RX message (ES-Key designation 0x1E to 0x4X)

Message/Frame Format	SAE J1939 CAN 2.0B (PDU1 Format)
Transmission Repetition Rate:	as received
Data Length:	8 Bytes
Data Page:	0
PDU Format:	239 (EF_{16}) Proprietary A
PDU Specific:	64-79 (40_{16}-$4F_{16}$)
Default Priority:	6
Parameter Group Number (PGN):	61184 ($EF00_{16}$)
Source address:	30($1E_{16}$)

Byte 0 – Output States *See memory map for each mode*
Byte 1 – 0x00
Byte 2 – 0x00
Byte 3 – 0x00
Byte 4 – 0x00
Byte 5 – 0x00
Byte 6 – 0x00
Byte 7 – 0x00

6.5. RX message (ES-Key designation 0xAA to 0x4X)

Message/Frame Format	SAE J1939 CAN 2.0B (PDU1 Format)
Transmission Repetition Rate:	as received
Data Length:	8 Bytes
Data Page:	0
PDU Format:	239 (EF_{16}) Proprietary A
PDU Specific:	64-79 (40_{16}-$4F_{16}$)
Default Priority:	6
Parameter Group Number (PGN):	61184 ($EF00_{16}$)
Source address:	170(AA_{16})

Byte 0 – Command
- 0x43 – Module Mode
- 0x44 – Input Polarity
- 0x49 – Input Mode
- 0x45 – Analog Mode
- 0x40 – Defaults

Byte 1 – Validation (0x23 = message approved)
Byte 2 – Channel
Byte 3 – Data Low byte
Byte 4 – Data High byte

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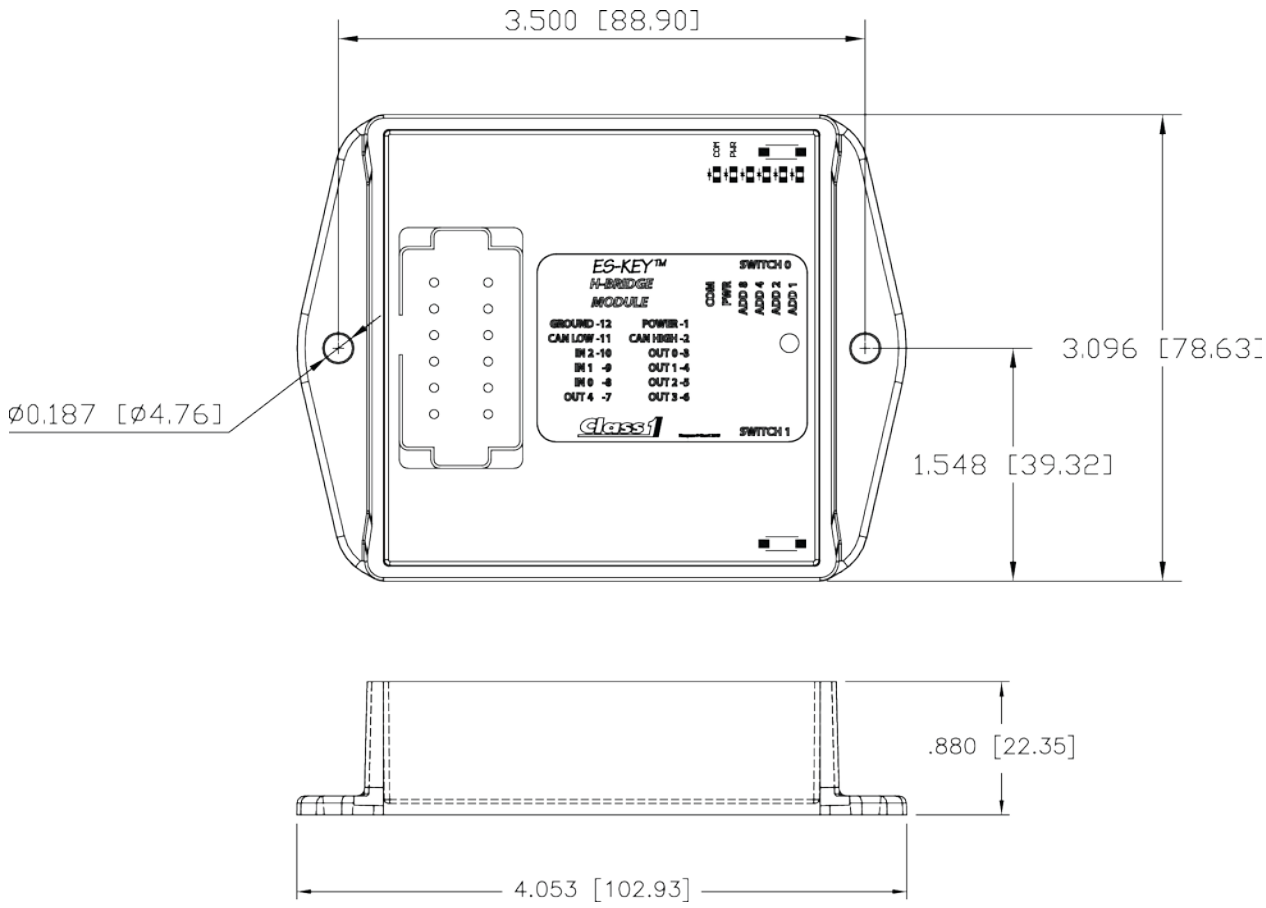
7. Installation

7.1. Mounting dimensions



Unit of scale: inches [millimeters]

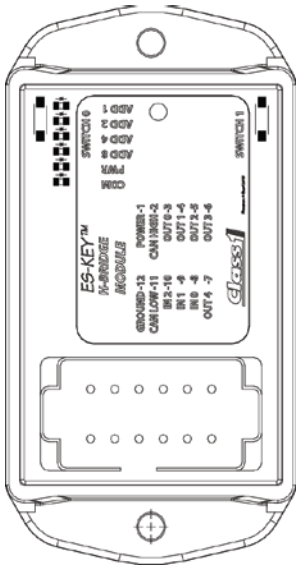
8. Wiring

8.1. H-Bridge Module connector

The Module has one connector and the following definitions apply:

Mating connector: Deutsch DT06-12SA
Mating sockets: Deutsch 0462-201-16141
Wedge lock: Deutsch W12S
Plug Seal: Deutsch 114017
Recommended wire gage: 16-18 AWG

PIN	CIRCUIT	DESCRIPTION
1	SUPPLY (+)	(INPUT) – battery voltage (+9VDC…+32VDC)
2	CAN HIGH	(DATA) – SAE J1939 CAN 2.0B, 250Kbits/s
3	Output 0	(OUTPUT) – POS / NEG 6 Amp
4	Output 1	(OUTPUT) – POS / NEG 6 Amp
5	Output 2	(OUTPUT) – Ground 500mA
6	Output 3	(OUTPUT) – Ground 500mA
7	Output 4	(OUTPUT) – Ground 500mA
8	Input 0	(INPUT) – Polarity Selectable
9	Input 1	(INPUT) – Polarity Selectable
10	Input 2	(INPUT) – Polarity Selectable
11	CAN LOW	(DATA) – SAE J1939 CAN 2.0B, 250Kbits /s
12	SUPPLY (-)	(INPUT) – battery ground

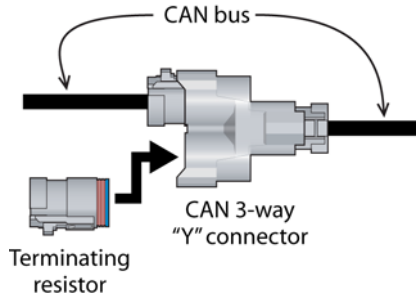


8.1.1. Terminating resistor requirement (CAN communication)

Two terminating resistors (120 Ohm) are required on the CAN bus for proper operation (one at each end of the CAN bus). Only two terminating resistors are allowed on a CAN bus.

Terminating resistor p/n DT06-3S-P006

CAN 3-way "Y" connector p/n DT04-3P-P007



8.2. System compatibility

The H-Bridge Module is compatible with other Class 1 CAN devices.

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9. Diagnostics

The **module** has 2 diagnostic LEDs which are viewable through the potting compound.

PWR - +9…+32VDC Module power
COM - Module status indicator

The COM LED indicates the module's CAN communication status.

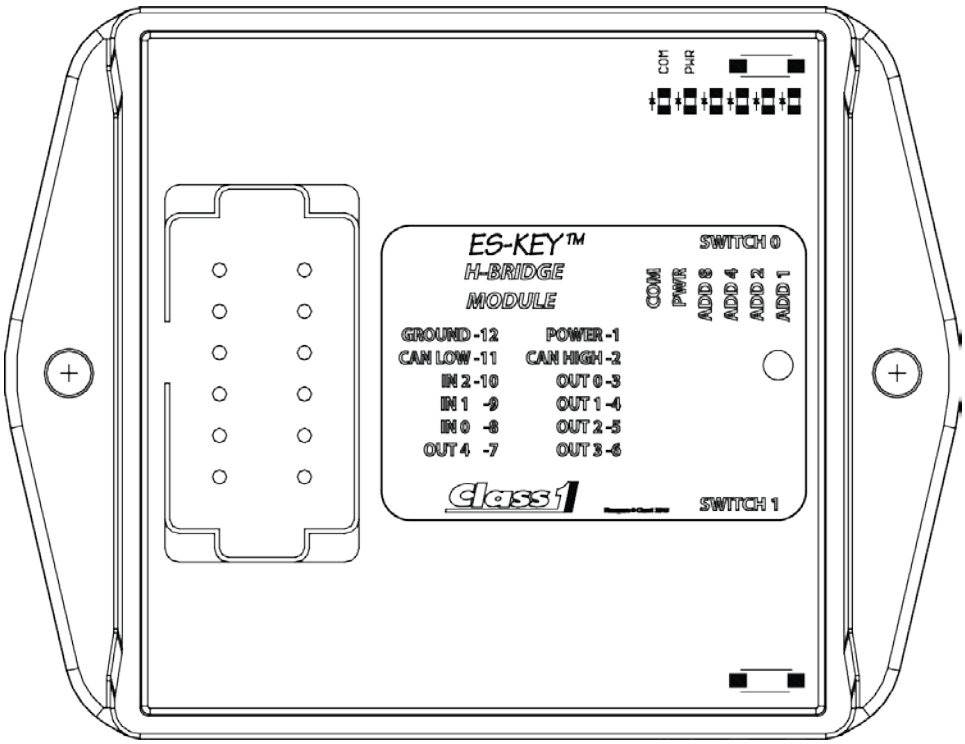
On Solid
Module on-line

Currently the module only will show a steady COM LED.

Flashing slow (2Hz)
CAN bus okay, but the module is not receiving messages from the Universal System Manager (USM).

Flashing fast (8Hz)
CAN bus error, no communications or not connected.

Double flash
CAN bus has an *ACTIVE* error, no communications.



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PRODUCT GROUP	Electronics	P/N	FSG-MNL-00160	REV	1.02
PRODUCT	H-Bridge Module			BY	GMC

10. Glossary

LED	Light Emitting Diode. The lights on the display used to show tank level and information.
CAN	Controller Area Network. SAE J1939 communication method.
EEPROM	Electrically Erasable Programmable Read-Only Memory. The memory of the tank level display, used to store the display information (tank level points, display type, dim value, etc).
OEM	Original Equipment Manufacturer.
SAE	Society of Automotive Engineers.
ESD	ElectroStatic Discharge.
IP	Ingress Protection (IP 67, etc).
p/n	part number

11. Technical details

11.1. Technical details

Product category	ES-Key
Voltage range	+9VDC…+32VDC
Power consumption	
@13.8VDC (25ºC)	30 mA
@27.6VDC (25ºC)	50 mA
Operational temperature range	-40ºC…+85ºC
Environmental range	IP 67
CAN specification	SAE J1939 proprietary, 250 Kbits/second
Protection	Internal thermal fuse Reverse voltage protection (pins 1 and 12 of connector) CAN buses protected to 24V ESD voltage protected to SAE J1113 specifications Transient voltage protected to SAE J1113 specifications
Dimensions (W x H x D) in inches [mm]	3.500 [88.90] x 2.096 [53.24] x .880 [22.35]

11.2. WEEE (Waste of Electrical and Electronic Equipment) directive

This symbol [crossed-out wheeled bin WEEE Annex IV] indicates separate collection of waste electrical and electronic equipment in the European Union countries.
Please do not throw the equipment into the domestic refuse.
Each individual European Union member state has implemented the WEEE regulations into national law in slightly different ways. Please follow your national law when you want to dispose of any electrical or electronic products.

More details can be obtained from your national WEEE recycling agency.