KS SYSTEM

TECHNICAL SPECIFICATION

July 08
Release 4.1

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Luminita MARTY

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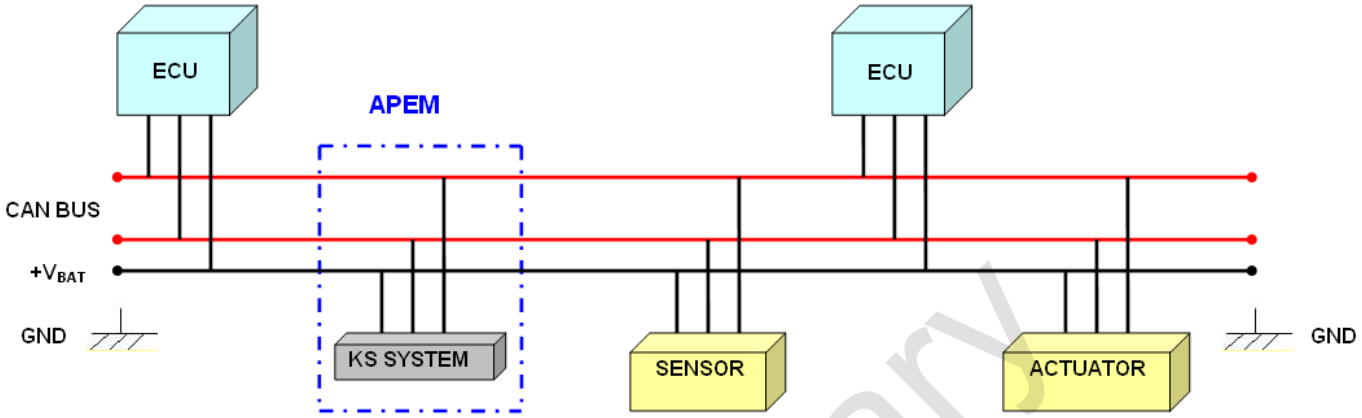
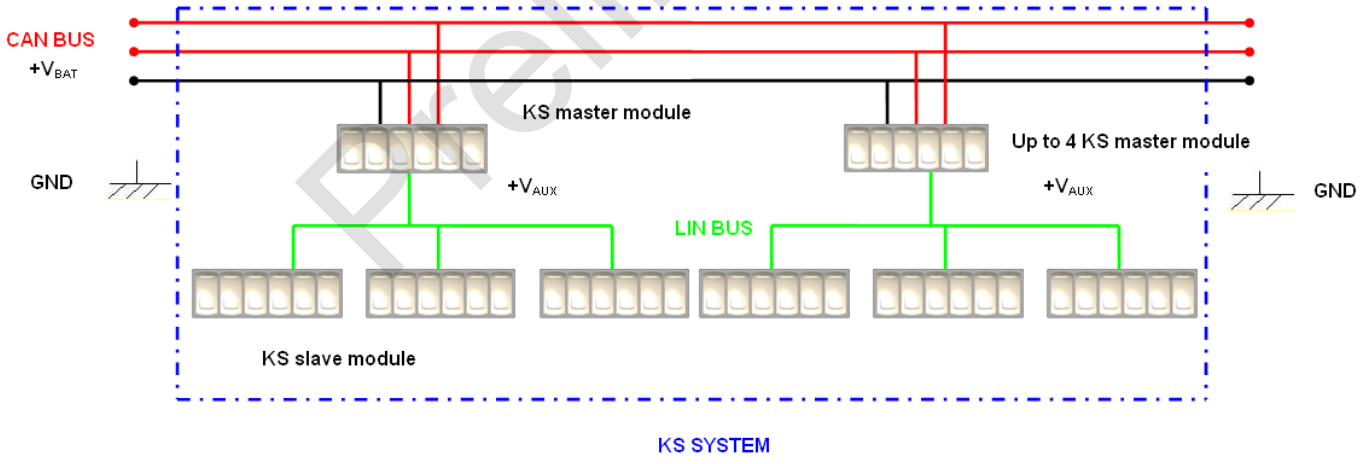
1. KS SYSTEM

1.1 Overview



The KS System communicates with ECU (Electronic Control Unit) through a multiplexed CAN network.

The KS system is described below:



The APEM KS Series is a mechatronics concept integrating rocker switches and electronics.

1.2 Main functions of the KS System

- The two main functions of the KS system are:
  - Take the information of the switches position (activated or not) and send this information on the CAN network.
  - Receive from the CAN network the information concerning the status of the LED (on, off, value of backlight).

Two module variants: master Module and Slave Module

- Up to 4 master module and up to 3 slave module per master module
- Up to 96 switches in a KS System

1.3 Advantages of the KS System

- **Increased reliability**
- **Flexible and expandable system**
- **Reduce wiring costs**

1.4 Environmental specifications

Characteristic	***Standard/Title***	***Test condition/result***
TEMPERATURES		Storage : -40° C to +85° C
		Operating : -40 to +70° C
FLAMMABILITY	ISO 3795 (Road vehicles, tractors and machinery for agriculture and forestry – Determination of burning behaviour of interior materials)	combustion speed < 100 mm/min
RESISTANCE TO SOLAR RAYS	NF T 51-056 (French standard of exposure of plastics to xenon lamp)	Test duration : 300h Spraying : no Light : xenon Relative humidity : 50% Blue wool index : 6 to 7
PROTECTION INDEX	EN 60529 (Specification for degrees of protection provided by enclosures - IP code)	Front side IP30 Back side IP20
SALT MIST	IEC 68-2-52 (Environmental testing - Test KS : Salt mist, cyclic (sodium chloride solution)	Test duration : 10h Solution 5% sodium chloride (NaCl)

1.5 EMC - Susceptibility

Characteristic	*Standard/Title*	*Test condition/result*
Electrical disturbance on power leads and power active inputs	ISO 7637-2 (Road vehicles - Electrical disturbances from conduction and coupling – Electrical transient conduction along supply lines only)	pulse 1a : -300V; Ri=10 Ω; td=2ms pulse 2 : +100V; Ri=10 Ω; td=0.2ms pulse 3a, 3b : ± 200V; Ri=50 Ω; 0.1µs pulse 4 : Vs= - 16V; Va = -12V; t6 = 100 ms; t8 = 10s (fluctuation in voltage caused by actuation of the starter) pulse 5 : +58V; Ri=1.5 Ω; td=480ms Class B for all
Electrical disturbance on signal lines	ISO 7637-3 (Road vehicles - Electrical disturbances from conduction and coupling – Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines)	pulse 2 : +100V Class A pulse 3a, 3b : ± 200V Class B
Electrostatic discharges	ISO 10605 (Road vehicles - Test methods for electrical disturbances from electrostatic discharge)	Direct discharges on the connector pins through 2 kΩ and 330 pF: ± 2 kV Class C Air discharges : ± 8 kV Class A Contact discharges : ± 4 kV Class A
Bulk current injection (BCI) on wiring harness	ISO 11452-4 (Road Vehicles - Component test methods for electrical disturbance from narrowband radiated electromagnetic energy Bulk current injection (BCI)	100 mA from 1MHz to 400 MHz Class A
Radiated susceptibility	ISO 11452-2 (Road vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy -- Part 2: Absorber-lined shielded enclosure)	100 V/m from 150 kHz to 2GHz class A

1.6 EMC - Emission

Characteristic	*Standard/Title*	*Test condition/result*
Radiated emission	CISPR 25/ EN 55025 (Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices - Limits and methods of measurement)	class 3

1.7 Mechanical characteristics

Characteristic	*Standard/Title*	*Test condition/result*
Vibrations		No resonance present into the frequency ranges : 1 to 17 Hz (haulage) 25 to 34 Hz (slow running engine)
Sinusoidal vibration	IEC 68-2-6 (Environmental testing - test Fc: Vibration (sinusoidal)	Band [5 Hz, 27.3Hz] with an amplitude of +/- 1mm Band [27.3 Hz, 100 Hz] with an acceleration level of 3g, 1 octave / minute Test duration 20 hours on each main axis. No mechanical damages.
Random vibrations	IEC 68-2-35 (Environmental testing for electrical engineering; test Fda : random vibration wide band, reproducibility high)	Acceleration spectral density: 0.01g²/Hz Frequency range: 5 to 100 Hz Test duration 20 hours on each main axis. No mechanical damages.
Shock	IEC 68-2-27 (environmental testing procedures - test Ea and guidance : Shock)	50g during 11ms (form : 1/2 sinus), 3 shocks by axis in both (18 shocks)

1.8 Homologation

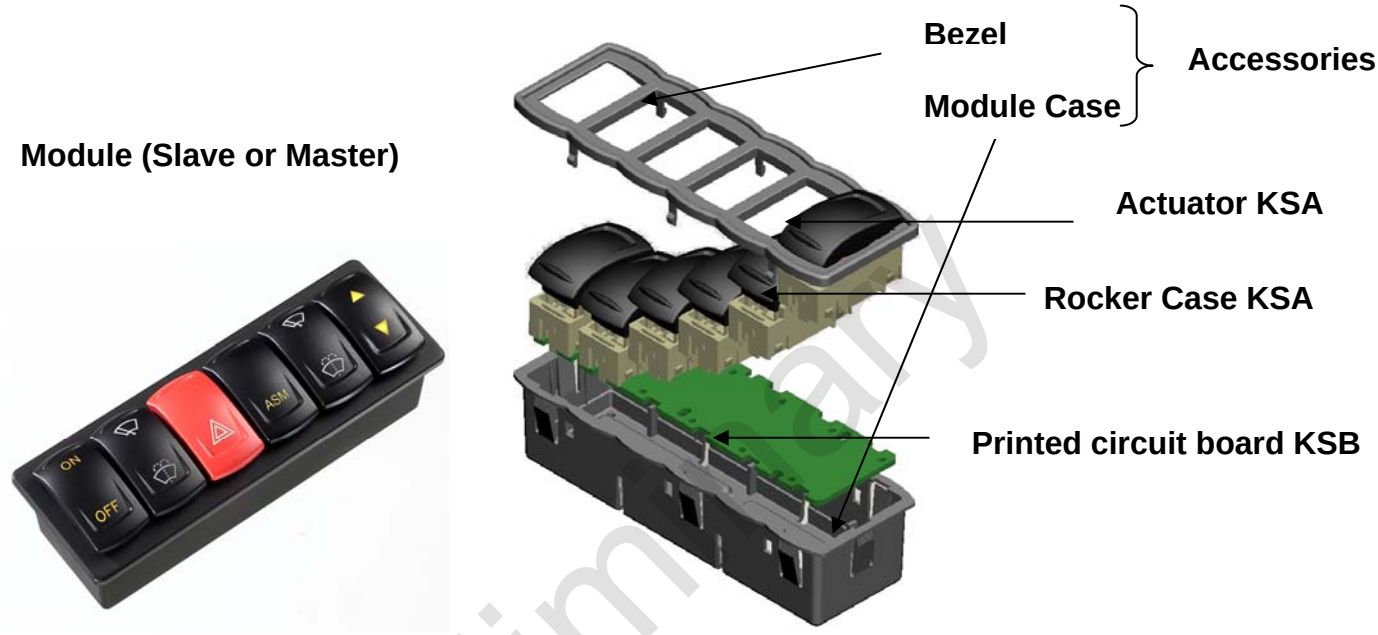
- e marking according European regulations 2006/28 CE

1.9 Electrical characteristics

MASTER Module :	***SLAVE Module :***
• Communicates with the CAN Bus • Gateway for all Slave Modules • 12V or 24V (direct from battery) (the normal operating range to function properly is between 8V and 32V) • Current consumption in normal mode < 1,5A. (This maximum value is for a full equipped KS system: one master and three slaves modules) • Current consumption in sleep mode < 2 mA (on fully equipped master and 3 slaves) • Complies with SAE J1939 communication protocol	• Communicates with the Master Module through a LIN Bus • power supplied by the Master Module

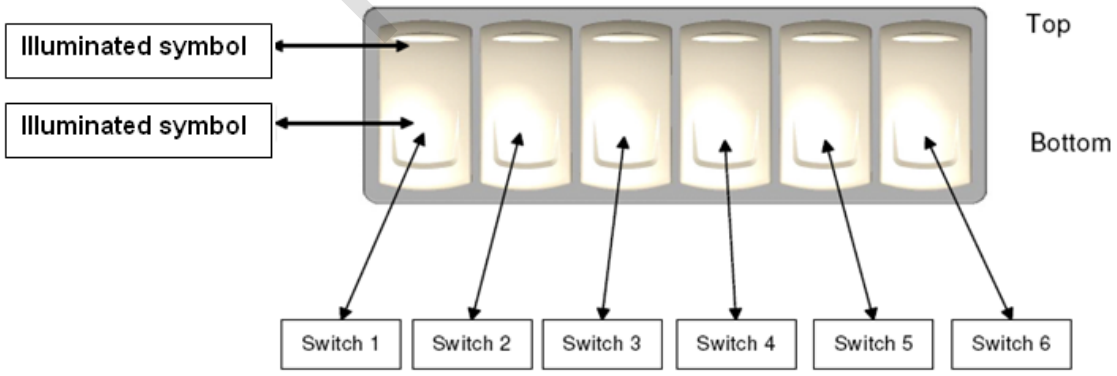
2. KS MODULE

2.1 Description



2.2 Slave and Master Module common specifications

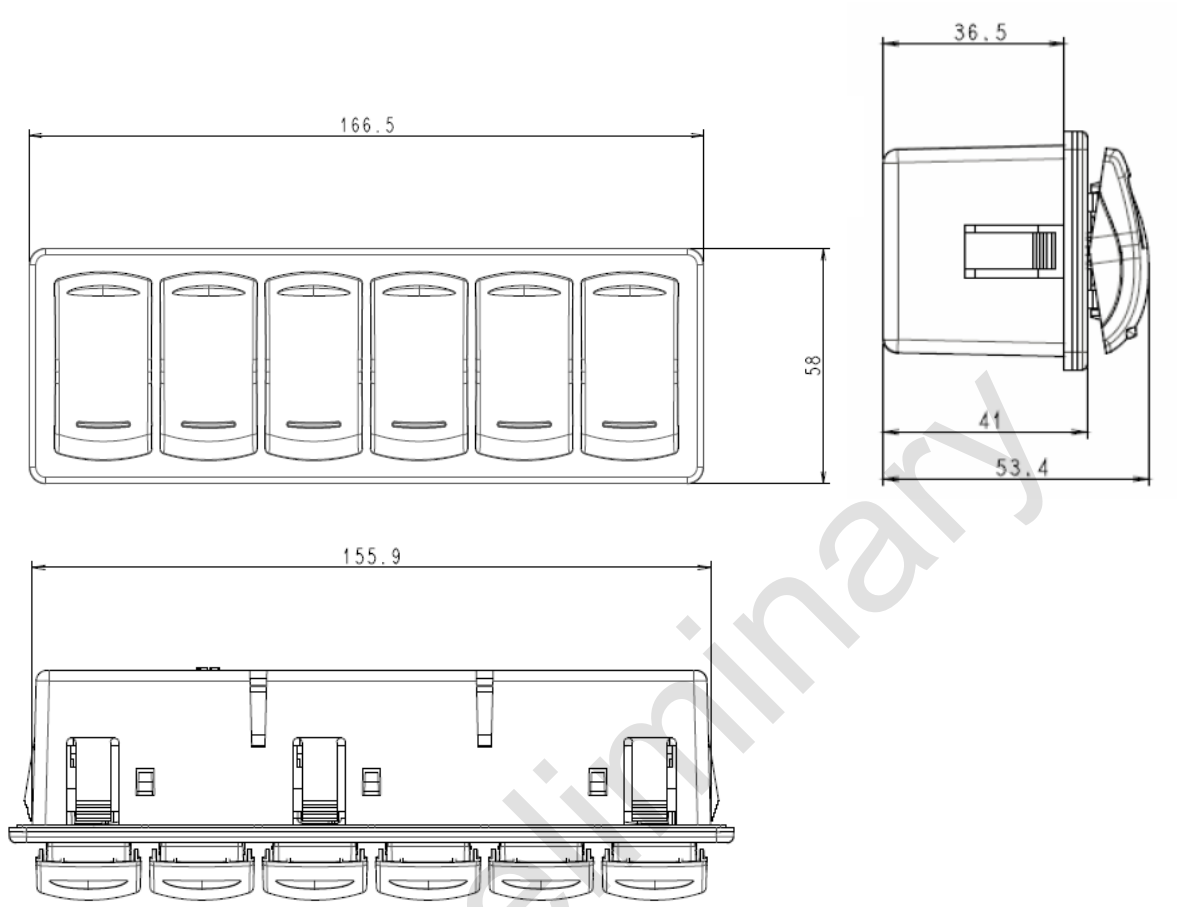
- up to 6 switches x 3 positions



The rocker switch

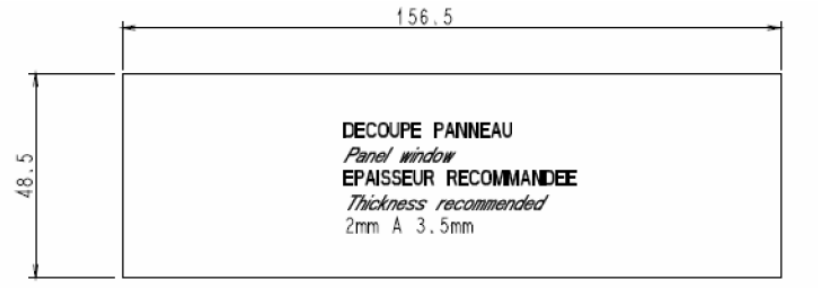
- Wide choice of actuator colours (up to 9)
- Laser etched symbols
- Illuminated or non-illuminated
- Full separation of the electrical and mechanical parts

- ***Slave and Master Module outline dimensions***



- ***Module fixations***

Switch panel cut-out

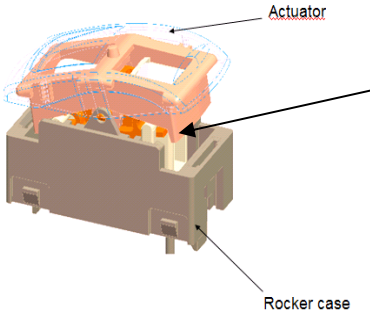


- Front panel can be easily removed for switch changing

3. ROCKER SWITCH KSA

3.1 Overview

The KSA rocker switch is made up of 2 differents parts: an actuator and a rocker case.
It is possible to order the complete rocker (actuator + rocker case) or separately the actuator and the rocker case.



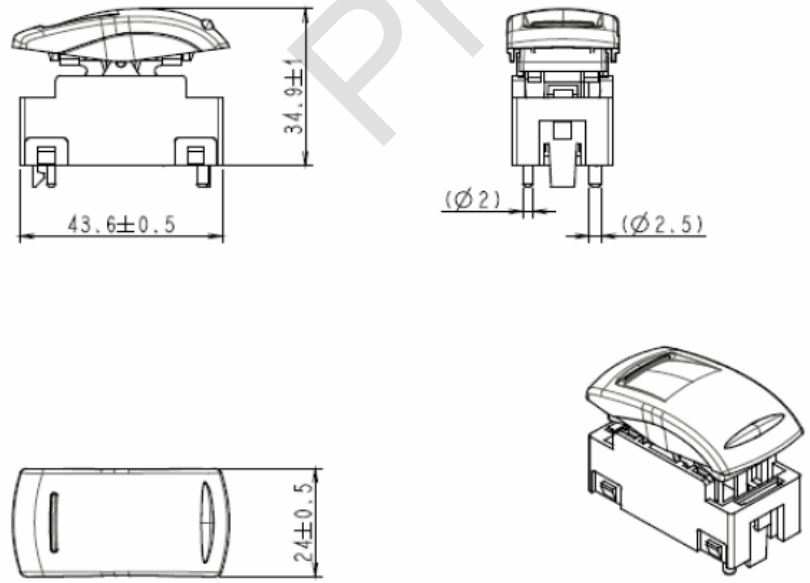
3.2 Mechanical specifications

- 1.000.000 cycles min

3.3 Materials

- Case : PA 6-6
- Actuator : ABS

3.4 Dimensions

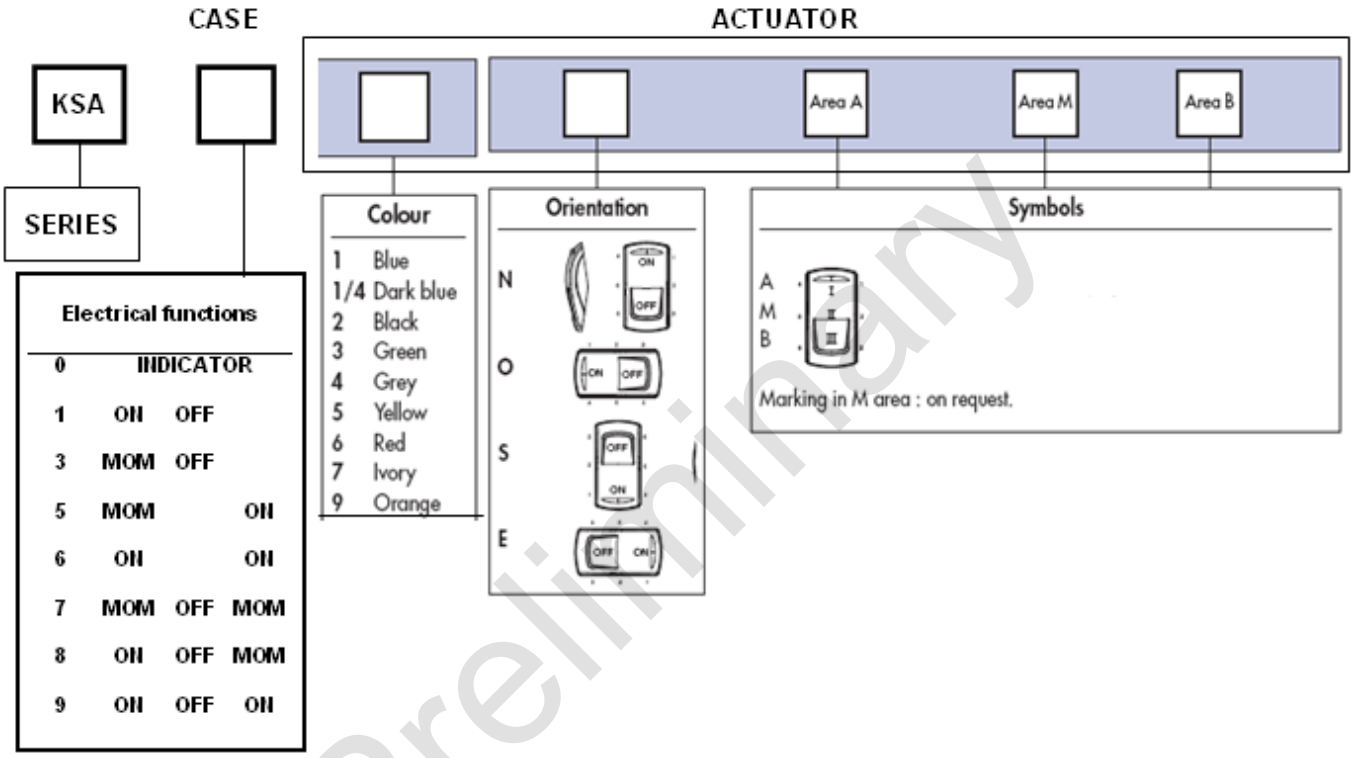


3.6 Selection Guide

HOW TO ORDER

• To order a complete product, fill in all the boxes of the following order guide.

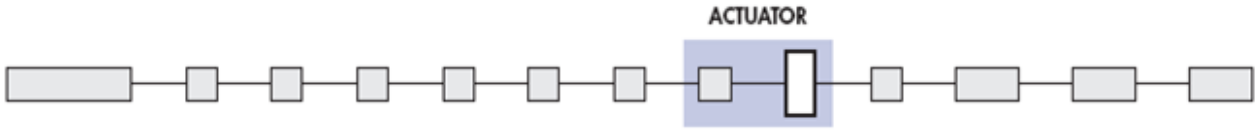
• To order actuator only (without case), begin the order number with code KSR, then follow the order format from "actuator colour" until the end of the options.



ELECTRICAL FUNCTIONS

	Position I	Position II	Position III
			
0	INDICATOR		
1	ON	OFF	
3	MOM	OFF	
5	MOM		ON
6	ON		ON
7	MOM	OFF	MOM
8	ON	OFF	MOM
9	ON	OFF	ON

ACTUATOR COLOUR



Code	Colour
1	Blue
1/4	Dark blue
2	Black
3	Green

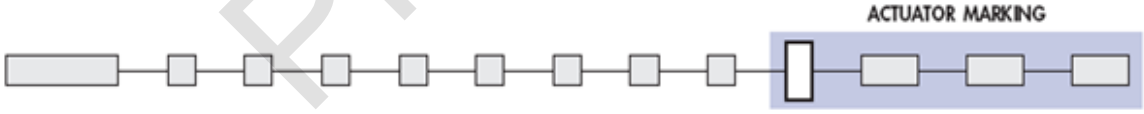
Code	Colour
4	Grey
5	Yellow
6	Red
7	Ivory

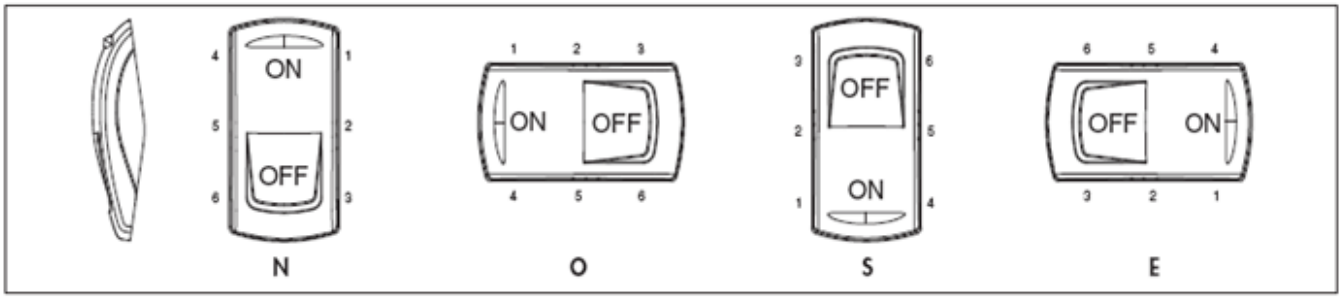
Code	Colour
9	Orange

Note : colours A, B and 7 not available on illuminated versions.
A **soft-touch varnish** can be added. Consult us.

MARKING ORIENTATION

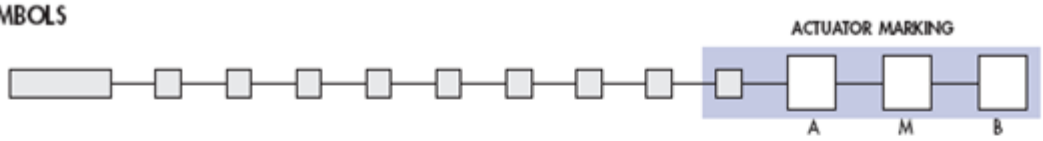
If no marking required, leave box blank.





Other orientations : on request

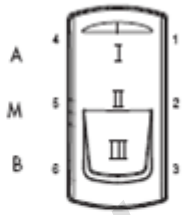
SYMBOLS



Marking in M area : on request.

Most symbols meet the ISO 7000 standard "graphical symbols for use on equipments" (code given in bracket in the description).

Contact us for symbols not featured in the following tables.

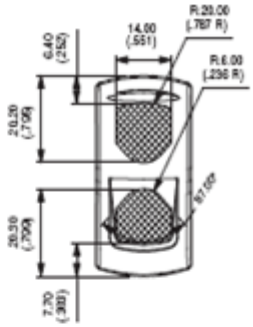


CODE	SYMBOL	DESCRIPTION
XX	None	-
01	ON	-
02	OFF	-
03	O	-
04	I	-
05	II	-
06	STOP	-
07	A	Stop
08	M	Motion
09		Up motion
10		Down motion
11		Hot
12		Cold
13		Hazard warning (0085)

CODE	SYMBOL	DESCRIPTION
14		Traveller lighting
15		Driver lighting (1421)
16		Revolving light
17		Rear ventilator
18		Heating (0637)
19		Door opening
20		Windshield demister/defroster (0635)
21		Windshield wiper (0086)
22		Windshield washer (0088)
23		Ventilator fan (0089)
24		Side mirror defroster
25		Restarting pump
26		Front fog lights (0633)
27		Rear fog lights (0634)

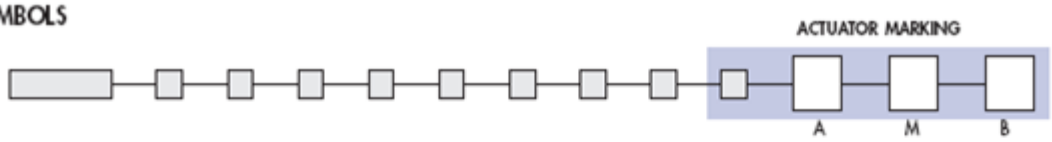
Marking area

For illuminated versions.
The symbol will be included in the hatched area.



Symbol scale : 1:1 (standard).
Other : on request.

SYMBOLS



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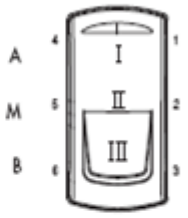


CODE	SYMBOL	DESCRIPTION
28		-
29		Beacon (1141)
30		-
31		Electric motor (0011)
32		Emergency first aid vehicle (2565)
33		Load tipping (1557)
34		Loading light (2457)
35		Tractor, rear-ward (0089)
36		Combine, direction of movement (1678)
37		Use no forks (2406)
38		Transmission (1166)
39		Working spot light (1145)
40		Engine (0634)
41		Horn (0244)

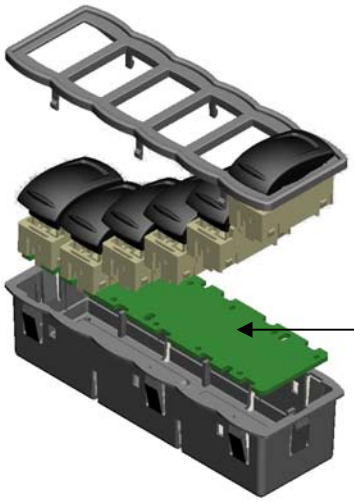
CODE	SYMBOL	DESCRIPTION
42		Lock (1656)
43	TAXI	Taxi sign light (2551)
44		Flood light (1024)
45		-
46		-
47	ASM	-
48		-
49		Differential lock (1662)
50	TOP	-
51	1000	-
52	540E	-
53	N	-
54		Rear window wiper (0097)
55		Rear window washer (0099)

Symbol scale : 1:1 (standard).
Other : on request.

CODE	SYMBOL	DESCRIPTION
56		Lower load (2223)
57		Cab lock (1560)
58		Extraction
59		Pumping in
60		Rear PTO (1572)
61		Front PTO
62		Rockshaft down
63		Rockshaft up
64		Indicator

4. PRINTED CIRCUIT BOARD KSB

4.1 Overview



Printed circuit board KSB

MASTER KSB :

- 4 master modules can be connected on the same CAN bus. To differentiate them, 2 addressing lines define the master module number depending on their connection to ground

CAN1_ADR	CAN0_ADR	Master Module number
nc	nc	1
nc	GND	2
GND	nc	3
GND	GND	4

Where CAN0_ADR, CAN1_ADR: CAN addressing lines
nc: not connected
GND: connected to ground

- Complies with SAE J1939 communication protocol
- The CAN data transfer is specified at 250 kbaud.
- Contain 120 Ohm termination resistor to be connected

SLAVE KSB :

- 3 slave modules can be connected on the same LIN bus. To differentiate them, 2 addressing lines defines the slave module number depending on their connection to ground

LIN1_ADR	LIN0_ADR	Slave Module number
nc	nc	1
nc	GND	2
GND	nc	3
GND	GND	Non authorised

Where LIN1_ADR, LIN_ADR: LIN addressing lines
nc: not connected
GND: connected to ground

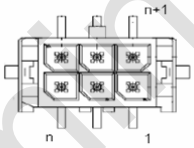
4.2 Connectors

Slave and Master module connector

- The connector used is a Molex connector referenced: 43045-1218.
- Reference of female connector is: Molex 43025-1200.
- Reference of contact pins is: 43030-0007
- The correspondence between signals and pins connectors is given on the right :

Pin	Description_Master Module Connector	Description_Slave Module Connector
1	GND	GND
2	$+V_{BAT}$	V_{AUX}_IN
3	CAN0_ADR	LIN0_ADR
4	CAN1_ADR	LIN1_ADR
5	CAN_H	nc
6	CAN_L	nc
7	GND	GND
8	V_{AUX}_OUT	V_{AUX}_OUT
9	LIN	LIN
10	WAKE_UP_OUTPUT	nc
11	LIN	LIN
12	TERM_CAN_L	nc

Where
nc: not connected
GND: connected to ground



4.3 Cables

The maximum length of the cable (0.5 mm² multi-wire) between the master module and the farest slave module is 5 meters.

RESPONSE TIME DELAY

- The time delay between a switch status change and the associated CAN frame emission is less than 100 ms.

- The time delay between a CAN frame reception with a LED status change and the associated LED command is less than 100 ms.

WAKE UP FUNCTION

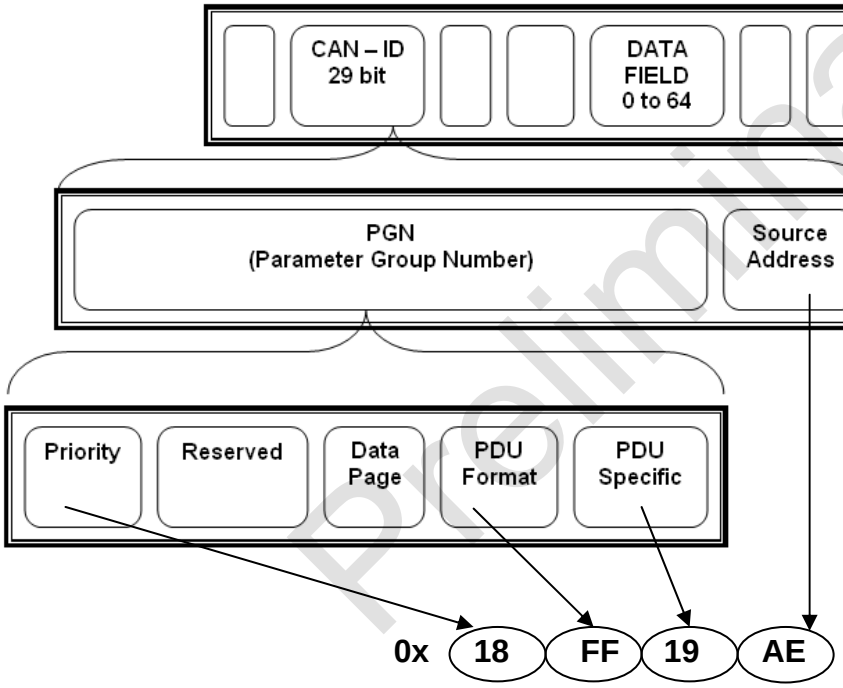
- There are two different ways to wake up the KS system: an activity on the CAN line or a switch associated to a wake up function in 'ON' position.
- The bottom position of switch 1, 2, 3 and 4 of the master module can be associated to a wake-up function (optional).

INPUT STATUS FRAME

- The input status frame is transmitted by the KS system with the appropriate frame identifier :

Master Module Number	Input Status Frame Identifier
1	0x18FF19AE
2	0x18FF1AAE
3	0x18FF1BAE
4	0x18FF1CAE

J1939 message format



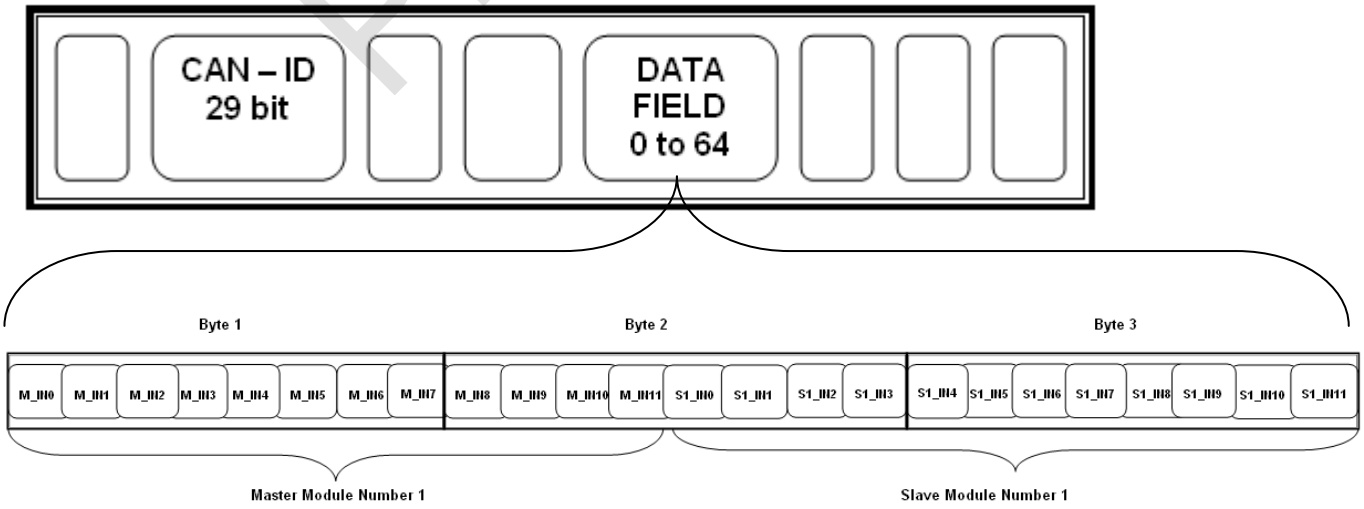
Input status frame for the Master Module Number 1

- The frame contains the following information spreads on 8 data bytes :

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	M_IN7	M_IN6	M_IN5	M_IN4	M_IN3	M_IN2	M_IN1	M_IN0
2	S1_IN3	S1_IN2	S1_IN1	S1_IN0	M_IN11	M_IN10	M_IN9	M_IN8
3	S1_IN11	S1_IN10	S1_IN9	S1_IN8	S1_IN7	S1_IN6	S1_IN5	S1_IN4
4	S2_IN7	S2_IN6	S2_IN5	S2_IN4	S2_IN3	S2_IN2	S2_IN1	S2_IN0
5	S3_IN3	S3_IN2	S3_IN1	S3_IN0	S2_IN11	S2_IN10	S2_IN9	S2_IN8
6	S3_IN11	S3_IN10	S3_IN9	S3_IN8	S3_IN7	S3_IN6	S3_IN5	S3_IN4
7	*not used*	*not used*	*not used*	*not used*	M_WK3	*not used*	M_WK1	M_WKCAN
8	*not used*	S3_LINErr	S2_LINErr	S1_LINErr	*not used*	*not used*	*not used*	*not used*

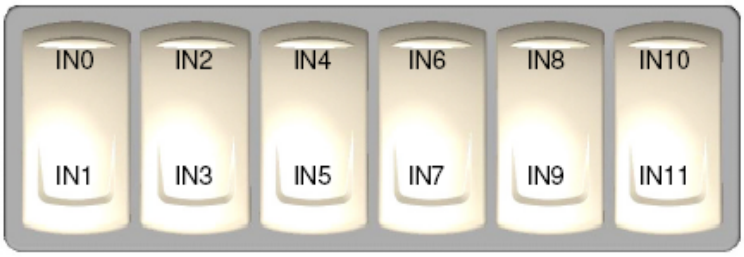
‘1’ = Active
‘0’ = Inactive

Where:
M_IN0 to 11: Master Module input status
S1_IN0 to 11: Slave Module#1 input status
S2_IN0 to 11: Slave Module#2 input status
S3_IN0 to 11: Slave Module#3 input status
M_WKCAN: CAN wake-up origin
M_WK1 & M_WK3: Master Module wake-up input status at wake-up
S1_LINErr: Slave Module#1 LIN error
S2_LINErr: Slave Module#2 LIN error
S3_LINErr: Slave Module#3 LIN error



Input physical location (on slave and master SWP):

Top



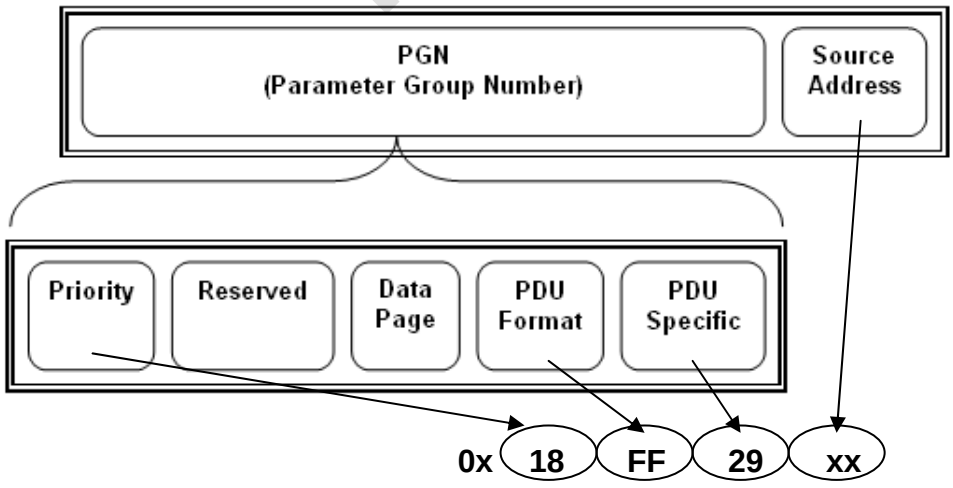
Bottom

OUTPUT COMMANDS FRAME

- The output commands frame is received by the KS System with the appropriate proprietary frame identifier :

Master Module Number	Output Command Frame Identifier
1	0x18FF29xx
2	0x18FF2Axx
3	0x18FF2Bxx
4	0x18FF2Cxx

Where “xx” is the Source Address of the transmitting unit
The Source Address field contains the unique address of the device (rocker switch) sending the message. Since each device has a unique address this also assures that every CAN identifier becomes unique, which is required by CAN.



- The frame contains the master and the slave module output commands spread on 8 data byte as defined below :

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	M_OUT7	M_OUT6	M_OUT5	M_OUT4	M_OUT3	M_OUT2	M_OUT1	M_OUT0
2	S1_OUT3	S1_OUT2	S1_OUT1	S1_OUT0	M_OUT11	M_OUT10	M_OUT9	M_OUT8
3	S1_OUT11	S1_OUT10	S1_OUT9	S1_OUT8	S1_OUT7	S1_OUT6	S1_OUT5	S1_OUT4
4	S2_OUT7	S2_OUT6	S2_OUT5	S2_OUT4	S2_OUT3	S2_OUT2	S2_OUT1	S2_OUT0
5	S3_OUT3	S3_OUT2	S3_OUT1	S3_OUT0	S2_OUT11	S2_OUT10	S2_OUT9	S2_OUT8
6	S3_OUT11	S3_OUT10	S3_OUT9	S3_OUT8	S3_OUT7	S3_OUT6	S3_OUT5	S3_OUT4
7	Cab Illumination (1 % / bit, 0 offset)							
8	*not used*	*not used*	*not used*	*not used*	BKL	*not used*	*not used*	*not used*

Output symbol description:
M_OUT0 to 11: Master Module output commands
S1_OUT0 to 11: Slave Module#1 output commands
S2_OUT0 to 11: Slave Module#2 output commands
S3_OUT0 to 11: Slave Module#3 output commands

Cab Illumination: output PWM ratio for backlight
Resolution: 1% / bit, 0 offset

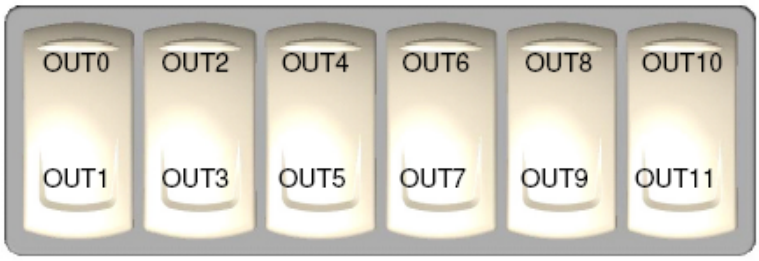
Binary								Decimal	Resolution
0	0	0	0	0	0	0	0	0	0%
0	0	0	0	0	0	0	1	1	1%
0	0	0	0	0	0	1	0	2	2%
…									

Range: 0 - 100%

BKL: Backlight command
0: Backlight not activated
1: Backlight activated

- Output physical location (on slave and master module)

Top

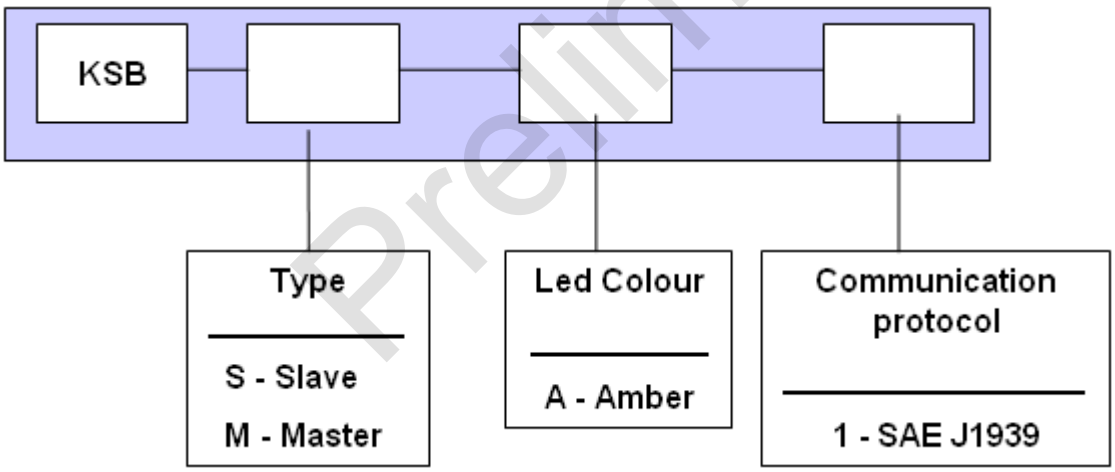


Bottom

INPUT STATUS FRAME AND OUTPUT COMMANDS FRAME

- The frame cycle is specified at 50 ms.

4.2 Selection Guide



5. ACCESSORIES

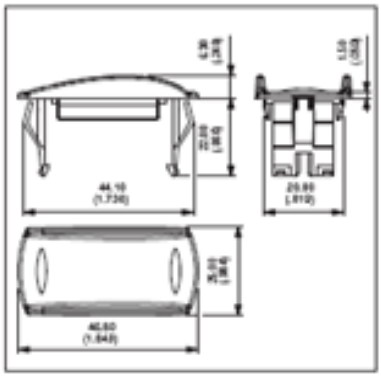
5.1 Hole Plug

Usefull for future extensions.

Code	Colour
U2271	Blue
U2271/4	Dark blue
U2272	Black
U2273	Green

Code	Colour
U2274	Grey
U2275	Yellow
U2276	Red
U2277	Ivory

Code	Colour
U2279	Orange



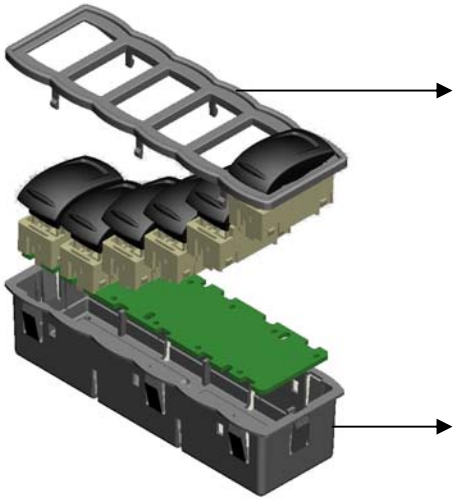
Recommended panel thickness :
1,50 mm to 6 mm

5.2 Actuator Removing Tool

U3052

2 tools are supplied

EXTRACT ACTUATOR
Allows the extraction of the rocker / rocker support assembly.
Place the 2 claws under the support and push as indicated by the arrow.



5.3 Bezel

Code	Colour
U6802	black
U680x	…

5.4 Module Case

Code	Colour
U6742	black
U674x	…