BOSCH

CAN Keypad CK-M12

Manual

Version 1.0 03/11/2022

Content

1 Introduction

The CAN Keypad CK-M12 allows for simplification of the dashboard by offering 12 buttons and 9 additional wired inputs to be evaluated and transmitted via CAN bus to other devices on the bus. Each button has an individually addressable LED indicating ring that can be used to acknowledge a button press event, indicate status of a device, or alert the driver to a fault condition.

No special configuration software is needed, all feedback logic is done by PBX, DDU or ECU.

2 Getting started

The following supplies are required to use the CK-M12:

- CK-M12
- Engine controller, data logger or related CAN enabled device
- Appropriate harnessing to connect all devices, **note that the CK-M12 does not contain a termination resistor.**

These steps are recommended to get started with the CK-M12:

- Verify the resistance across CANH and CANL is equal to 60 ohms with a multimeter when the system is powered off. If 60 ohms is not found, check the CAN termination and refer to the wiring diagram in section three.
- Configure the CAN enabled device of choice to read the CAN messages from the CK-M12.
- Provide power to the CK-M12 and verify CAN communications between the CK-M12 and CAN enabled device.
- Transmit indicator CAN messages for color and brightness to the CK-M12 and verify response.

3 Wiring

The following table lists descriptions for each wire of the CK-M12.

CK-M12 Wire Identification

Wire	Function
Red	12/24 V Power
Black	Ground
Yellow	CAN high (CANH)
Green	CAN low (CANL)
White, Black Trace	Digital Input 1 active Low
White, Brown Trace	Digital Input 2 active Low
White, Red Trace	Digital Input 3 active Low
White, Orange Trace	Digital Input 4 active Low
White, Yellow Trace	Digital Input 5 active Low
White, Green Trace	Digital Input 6 active Low
White, Blue Trace	Digital Input 7 active Low
White, Purple Trace	Digital Input 8 active Low
White, Grey Trace	Digital Input 9 active Low

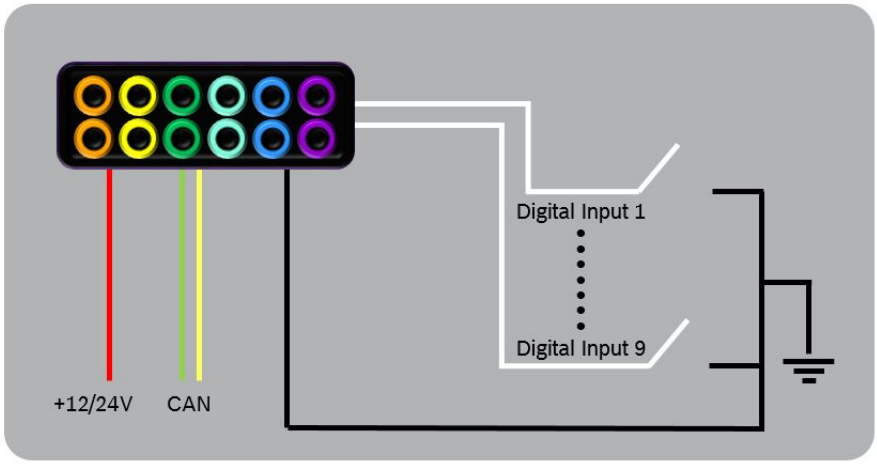

Illustration 1: CK-M12 Wiring Concept

NOTICE

Digital Inputs 1 to 9 are not intended to accept voltage! Additionally a maximum resistance to ground of 100 Ohm must be respected for proper function of digital inputs.

The CK-M12 does not include CAN termination on board. Proper CAN termination must be included in the wiring harness at each end of the bus. A daisy chain style bus must be constructed with stub lengths for added devices kept to under 1 foot (0.3 meters). Figure 3 shows a correctly constructed CAN bus with termination. Shielding is not required and the CK-M12 does not offer a shield wire. However, if another module on the CAN bus offers a shield pin, it is recommended to use it.

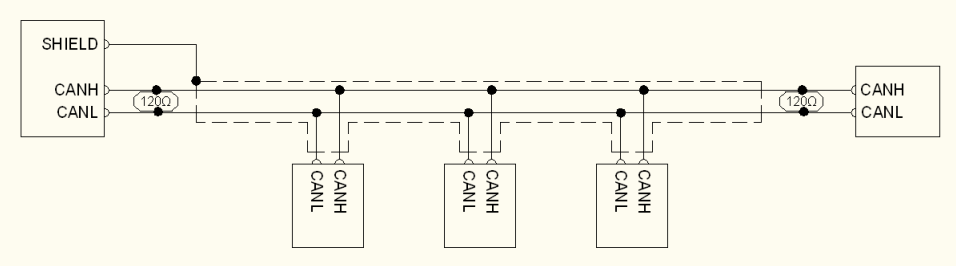

Illustration 2: Example CAN bus with proper termination and shield concept

4 CK-M12 Mounting and Environmental Considerations

The following specifications should be considered for CK-M12 vehicle mounting.

Max. Fastener Torque	0.7 Nm ± 0.1 Nm
Min. Temperature	-40°C
Max. Temperature	+85°C
Max. Vibration	Bosch Motorsport Vibration Profile 1
Sealing Tightness	IP68

5 Voltage Supply and Current Consumption

The following specifications should be considered for wire and circuit selection.

Supply Voltage	9 V to 32 V
Nominal Voltage	12 V/24 V
Max Current draw	250 mA
Average Current draw	100 mA

6 CAN Communications

The CK-M12 transmits 1 CAN message that provides the status of each button and digital input, and receives 1 message to configure the indicating ring color for each button and the overall keypad brightness. The default baud rate is 1,000 kbps, however, other baud rates and IDs can be achieved through custom configuration by Bosch Motorsport.

NOTICE

The brightness value MUST be sent to see any indicator feedback. Colors 9 to 15 will not be visible when using brightness value 1.

Illustration 3: DBC Data flow

6.1 Primary Data Message (CK-M12_TX.dbc)

ID	0x800 (default setting however IDs can be reconfigured)
ID type	Extended (29 bit identifier)
Direction	Transmit from CK-M12
Length	4 bytes
Rate	10 ms
Endianness	Little (Intel)

Button Status (0 not pressed, 1 pressed)

Bit 0	Button_01
Bit 1	Button_02
Bit 2	Button_03
Bit 3	Button_04
Bit 4	Button_05
Bit 5	Button_06
Bit 6	Button_07
Bit 7	Button_08
Bit 8	Button_09
Bit 9	Button_10

Bit 10	Button_11
Bit 11	Button_12

Digital Input Status (0 not grounded, 1 grounded)

Bit 16	DigIn_01
Bit 17	DigIn_02
Bit 18	DigIn_03
Bit 19	DigIn_04
Bit 20	DigIn_05
Bit 21	DigIn_06
Bit 24	DigIn_07
Bit 25	DigIn_08
Bit 26	DigIn_09

6.2 Feedback Message (CK-M12_RX.dbc)

ID:	0x801 (default setting however IDs can be reconfigured)
ID type	Extended (29 bit identifier)
Direction	Receive to CK-M12
Length	7 bytes
Rate	N/A
Endianness	Little (Intel)

Feedback Message Data

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Indicator 1/2	Indicator 3/4	Indicator 5/6	Indicator 7/8	Indicator 9/10	Indicator 11/12	Keypad Brightness

Indicator Data

Each button on the keypad can be addressed to display a different color depending on the 4 bit integer (0-15) sent to the corresponding address. The integer to color chart is shown below. The keypad also has a global brightness setting again set by a 4 bit integer (0-15) value.

NOTICE

The brightness value MUST be sent to see any indicator feedback. Colors 9 to 15 will not be visible when using brightness value 1.

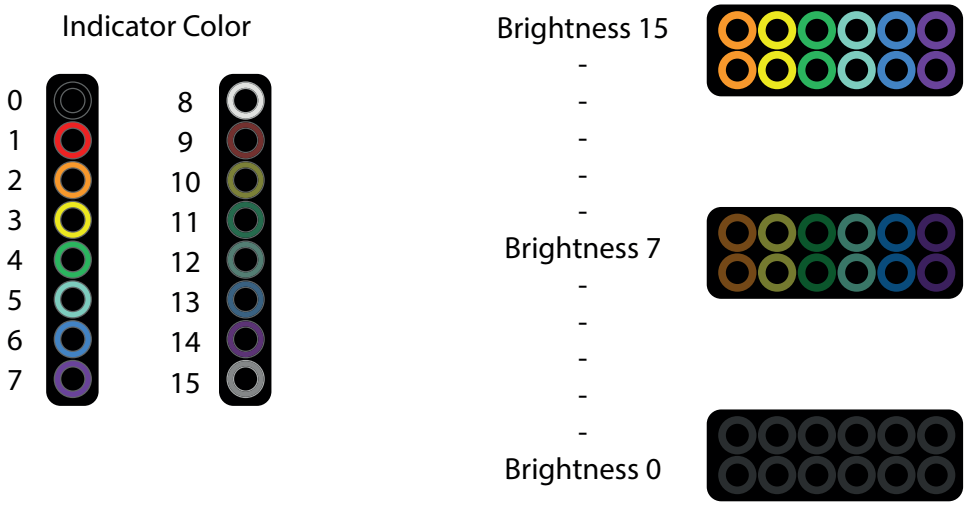

Illustration 4: Indicator Color and Brightness Chart

Button 1 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	0
Length	4 bit
Endianness	Little (Intel)

Button 2 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	4
Length	4 bit
Endianness	Little (Intel)

Button 3 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	8
Length	4 bit
Endianness	Little (Intel)

Button 4 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	12
Length	4 bit
Endianness	Little (Intel)

Button 5 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	16
Length	4 bit
Endianness	Little (Intel)

Button 6 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	20
Length	4 bit
Endianness	Little (Intel)

Button 7 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	24
Length	4 bit
Endianness	Little (Intel)

Button 8 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	28
Length	4 bit
Endianness	Little (Intel)

Button 9 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	32
Length	4 bit
Endianness	Little (Intel)

Button 10 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	36
Length	4 bit
Endianness	Little (Intel)

Button 11 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	40
Length	4 bit
Endianness	Little (Intel)

Button 12 Indicator (0-15 Color)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	44
Length	4 bit
Endianness	Little (Intel)

Keypad Brightness (0-15 Brightness)	
Type	Unsigned
Factor	1
Offset	0
Start Bit	48
Length	4 bit
Endianness	Little (Intel)

7 Example Usage - PBX

The CK-M12 is designed to be used in conjunction with the PBX190/90 power controllers, below is a simple example showing how to configure the keypad to switch on a high side output when a button is pushed. In this example the indicating ring will toggle between 0 (black/off) and 6 (blue) when the button is pushed. The values shown in the blue boxes are representing the default value for each of the blocks.

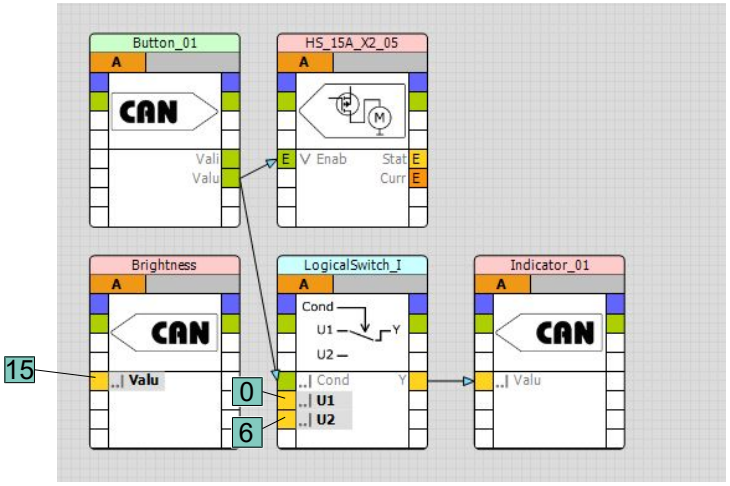

Illustration 5: Momentary Switch Implementation

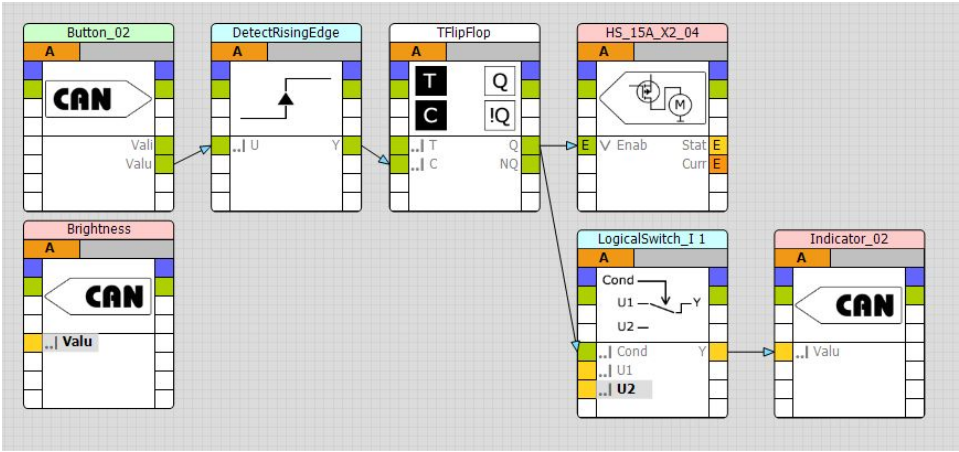

Illustration 6: Toggle Switch Implementation

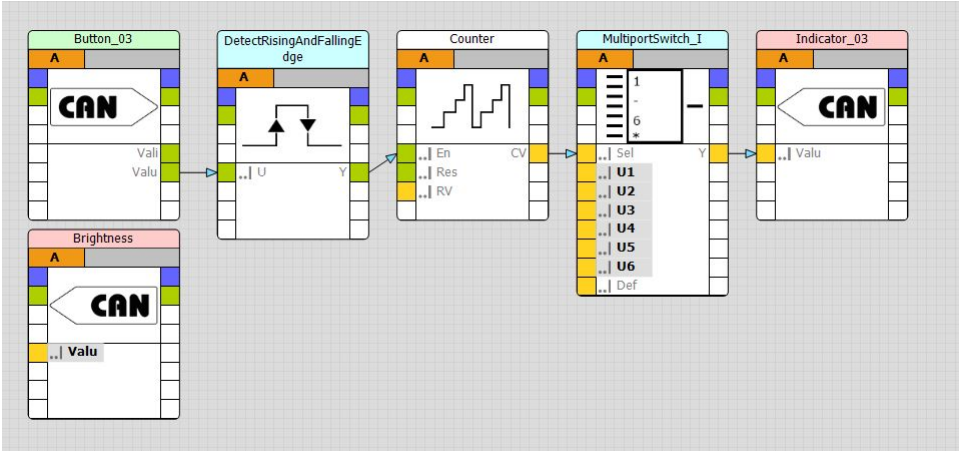

Illustration 7: 6 Position Toggle Switch Implementation

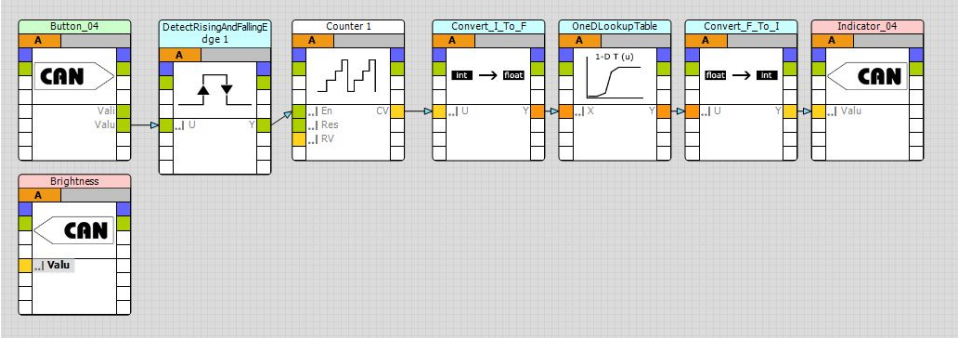

Illustration 8: X Position Switch with Non-linear Output

8 Example Usage - DDU

The CK-M12 can be used with a DDU for various functions using simple math channels. In this example the DDU 7 will be controlling indicator 1 on the keypad based on the state of button 1. In the case that the button is pushed the math channel will return 4 (green). If the button is released it will return 13(dimmed blue). The corresponding 4 bits of 0x801 are filled with the math channel CKM_Ind1 to be transmitted to the keypad.

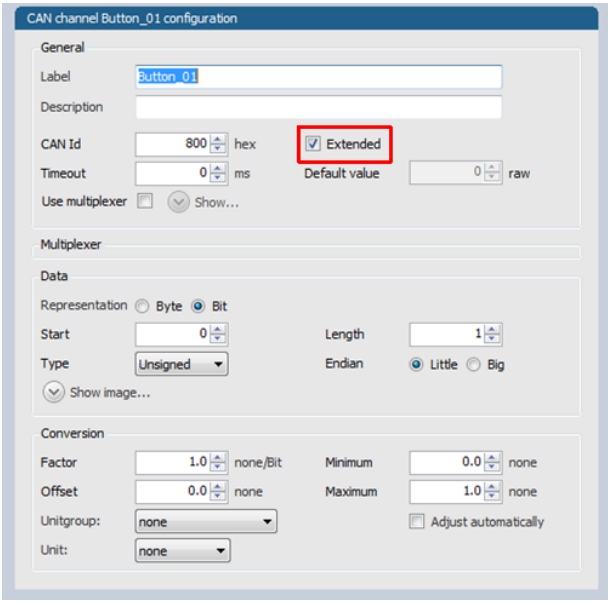

Illustration 9: CAN configuration to read button 1 of the CK-M12

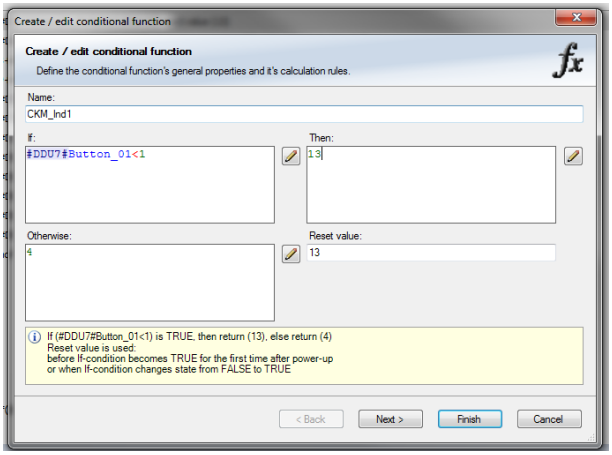

Illustration 10: Math channel to create indicator color integer based on button 1 state, light blue when button is not pressed, green when pressed

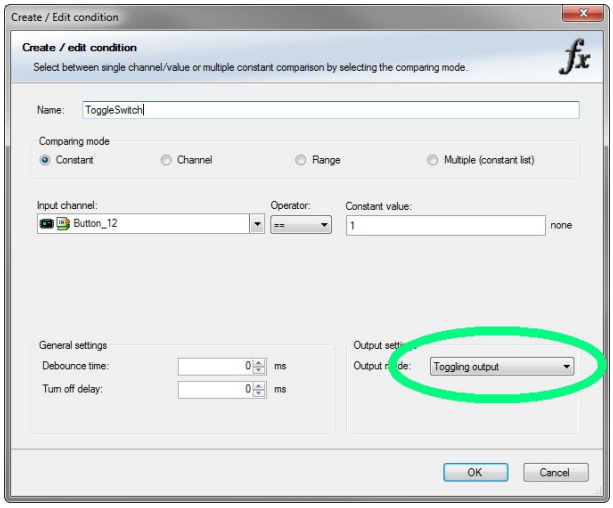

Illustration 11: Simple Toggle Switch Logic

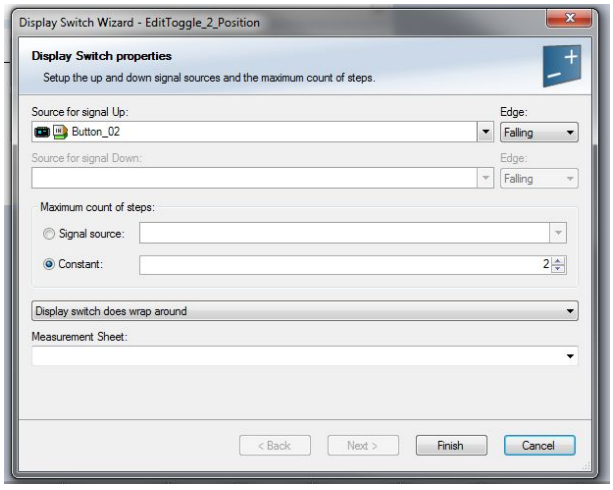

Illustration 12: Computed channel configuration for 2 or more position toggle switch functionality

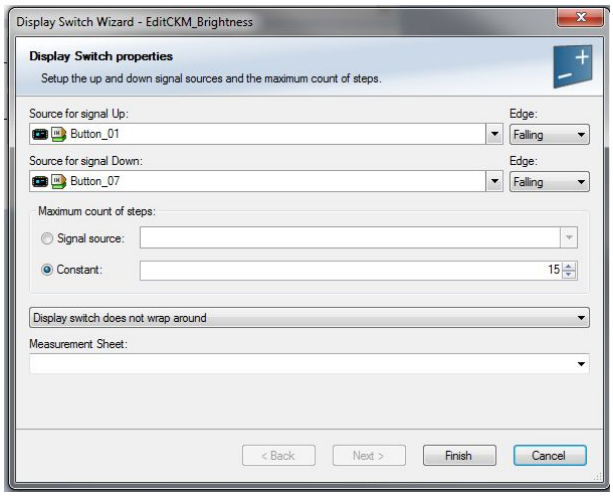

Illustration 13: Computed channel configuration for Up-Down switches for brightness control

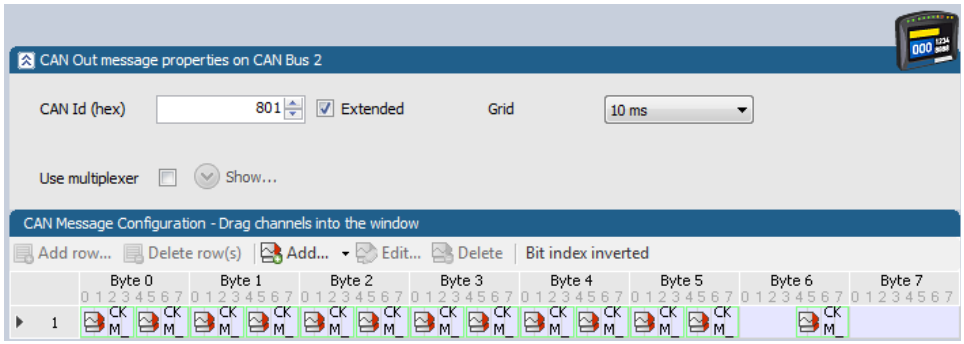

Illustration 14: CAN configuration for indicator output to CK-M12 including 12 math channels, one for each indicator and the brightness value

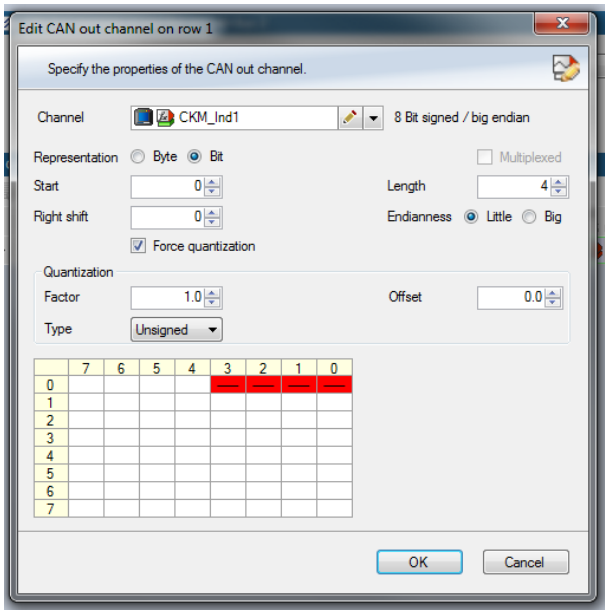

Illustration 15: CAN channel configuration for transmitting Indicator 1 value

9 Legal

9.1 Legal Restrictions of Sale

The sale of this product in Mexico is prohibited.

Due to embargo restrictions, sale of this product in Russia, Belarus, Iran, Syria, and North Korea is prohibited.

9.2 Open Source Software (OSS) Declaration

Modified BSD License (avr-libc)

The AVR-libc library is used with GCC on Atmel AVR microcontrollers.

The contents of avr-libc are licensed with a Modified BSD License.

All of this is supposed to be Free Software, Open Source, DFSG-free,GPL-compatible, and OK to use in both free and proprietary applications.

See the license information in the individual source files for details.

Additions and corrections to this file are welcome.

****

Portions of avr-libc are Copyright (c) 1999-2010

Keith Gudger,

Bjoern Haase,

Steinar Haugen,

Peter Jansen,

Reinhard Jessich,

Magnus Johansson,

Artur Lipowski,

Marek Michalkiewicz,

Colin O'Flynn,

Bob Paddock,

Reiner Patommel,

Michael Rickman,

Theodore A. Roth,

Juergen Schilling,

Philip Soeberg,

Anatoly Sokolov,

Nils Kristian Strom,

10 Contacts

Bosch Europe

Bosch Engineering GmbH

Motorsport

Robert-Bosch-Allee 1

74232 Abstatt

Germany

Phone: +49 7062 911 02

Fax: +49 7062 911 6001

Bosch North and South America

Bosch Engineering

Motorsports

38000 Hills Tech Drive

Farmington Hills, MI 48331-3417

United States of America

Phone: +1 248 876 2977

Fax: +1 248 876 7373

Bosch Asia Pacific

Bosch Engineering Japan K.K.

Motorsport

18F Queens's Tower C, 2-3-5 Minato Mirai

Nishi-ku, Yokohama-shi

Kanagawa 220-6218

Japan

Tel: +81 45 650 5610

Fax: +81 45 650 5611

E-Mail: motorsport@bosch.com

www.bosch-motorsport.com

Bosch Engineering GmbH
Motorsport
Robert-Bosch-Allee 1
74232 Abstatt

www.bosch-motorsport.com