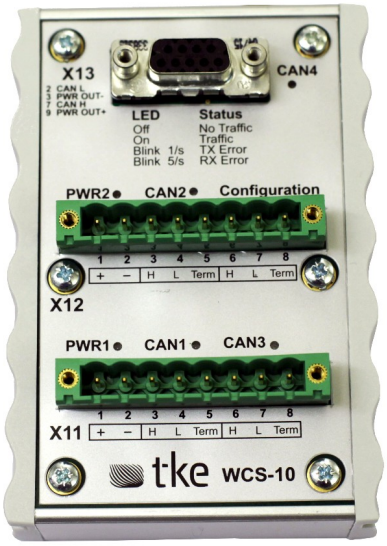
CAN Switch WCS-10 User Guide



The CAN Switch WCS-10 forwards messages between up to four CAN Bus networks, with optional filters and routing tables.

WCS-10 manual version 1.48

Hardware versions 04 and 05

Marine Type Approvals

Table of Contents

Definitions, acronyms and abbreviations

ASCII	American standard for information interchange
CAN	Controller Area Network
CAN-ID	Identifier of the CAN-telegram
CANopen	Higher level CAN-protocol by CiA
CiA	CAN in Automation organization
DLC	Data Length Code
EMCY	CANopen emergency protocol or –telegram
HW	Hardware
LSB	Least significant byte
Mbps	Megabits per second
MSB	Most significant byte
NMT	CANopen network management
OD	Object Dictionary
RX	Receive/reception
SDO	CANopen Service Data Object
SW	Software
TX	Transmit/Transmission

Exclusion of Liability

Important note! Please read before using WCS-10

All machines, vehicles or other technical installations, which are controlled by electronic systems can be through disturbing the network communication or other intervention, lead to disorder or failure, which can injure persons or cause material-damage.

Before you connect WCS-10 to such an electronic system, please ensure that connecting the WCS-10 to your system/network will not injure persons or cause material-damage.

You must not use WCS-10 in applications/environments where the use of WCS-10 can directly lead to disorder or failure, of such machines, vehicles or other technical installations or where such failures or damages can lead to injuring of persons.

Do not use WCS-10 if you are not absolutely certain that you know how to use the WCS-10. If you are uncertain about compatibility between WCS-10 and your system, do not use WCS-10 in your system.

TK Engineering Oy does not take over any liability for damages, injuries etc. caused by the use of WCS-10.

Introduction

WCS-10 is a product name for a product originally targeted to connect up to 4 CAN buses running different protocols with each other. The WCS-10 takes care of forwarding CAN-messages, CAN-ID, DLC and data contents according to the configuration. The WCS-10 support bit rate configurations on each CAN-port.

Forwarding software enhanced to the network switch function. The WCS-10 has a powerful processor called X-gate used for software forwarding of telegrams to give high performance.

Technical Data

Technical details

- Operating voltage 10…40V DC.
- Power consumption max 3.5W typical 3W
- CAN routing ports, CAN1 – CAN4, galvanically isolated 1kV, ISO11898, Max 1Mbps
- CAN configuration port, CANA, ISO11898, Max 1Mbps
- Operating temperature range -40°C…+85°C
- Storage temperature range -50°C…+105°C
- Protection class IP30
- Weight ~210g
- Flammability UL94 V0
- DNV type approval: Ships, offshore units, and high speed and light craft. Temperature: B, Humidity: B, Vibration: B, EMC: B. Certificate No: TAA00002DV
- GL type approval: Environmental Category D, EMC1, software class 3
  GL type approval certificate number: 7518909 HH

Mechanical Dimensions

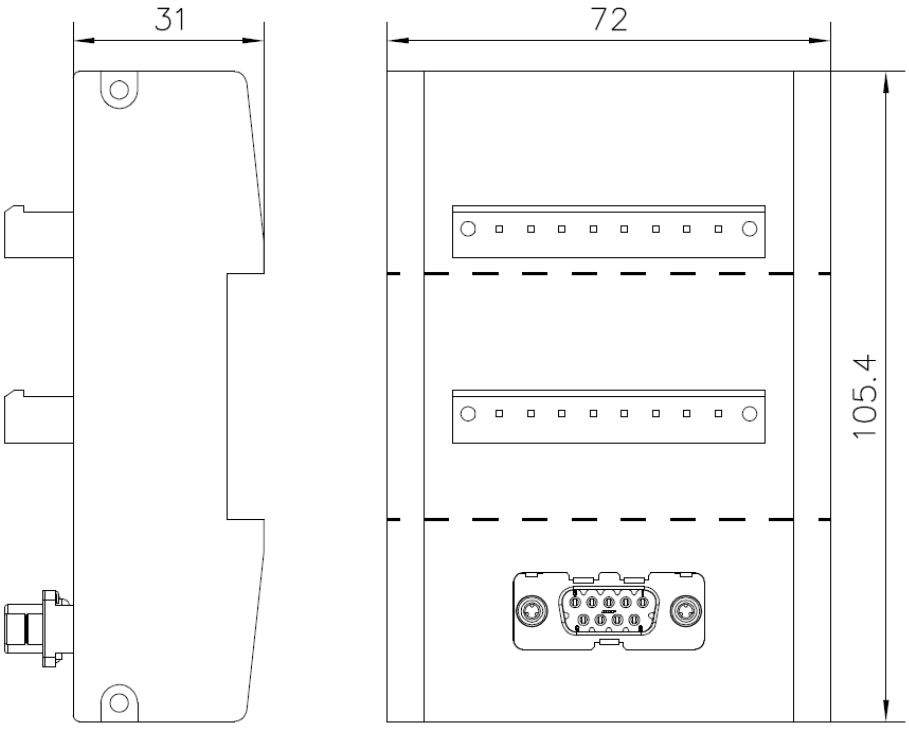


Figure 1: Mechanical dimensions

Connectors

The WCS-10 has 2 Phoenix MSTBV 2,5/8-GF-5,08-AU connectors and one DSUB 9 pin Female connector Tyco AMP 3-388313-2.

Phoenix MSTBV 2,5/8-GF-5,08-AU	
X11	
X11.1	PWR 1+
X11.2	PWR 1-
X11.3	CAN1 H
X11.4	CAN1 L
X11.5	CAN1 Term
X11.6	CAN3 H
X11.7	CAN3 L
X11.8	CAN3 Term

Phoenix MSTBV 2,5/8-GF-5,08-AU	
X12	
X12.1	PWR 2+
X12.2	PWR 2-
X12.3	CAN2 H
X12.4	CAN2 L
X12.5	CAN2 Term
X12.6	CANA H
X12.7	CANA L
X12.8	CANA Term

Tyco AMP 3-388313-2	
X13	
X13.1	NC
X13.2	CAN4 L
X13.3	PWR OUT-
X13.4	NC
X13.5	NC
X13.6	CAN4 CAN_GND
X13.7	CAN4 H
X13.8	NC
X13.9	PWR OUT+
X13.Screen	PE

Crimp Terminal, Ring, 3mm	
X14	
X14.1	PE

Figure 2: WCS-10 connectors

Block schema

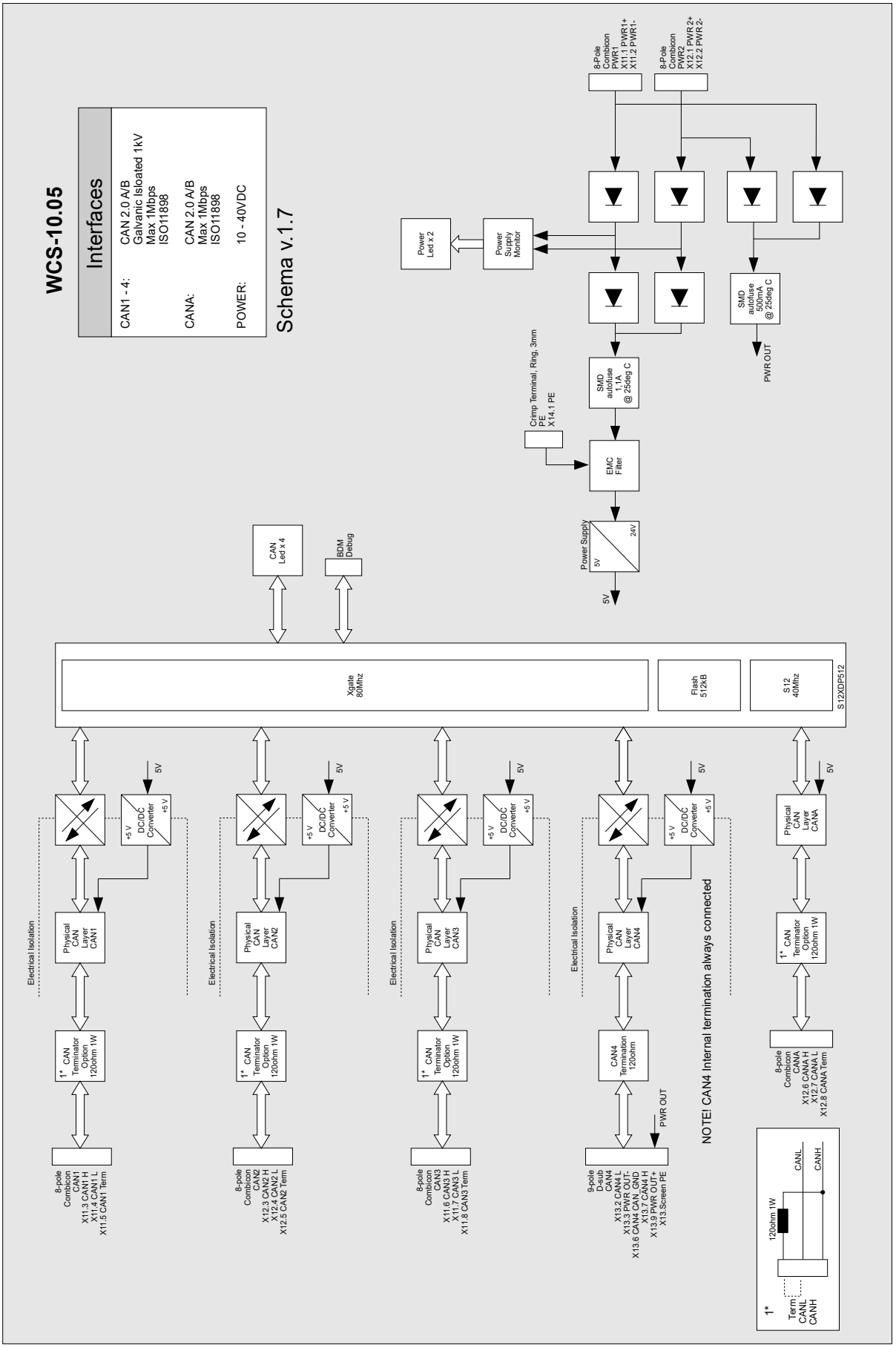


Figure 3: WCS-10.04 and WCS-10.05 Block schema

Termination

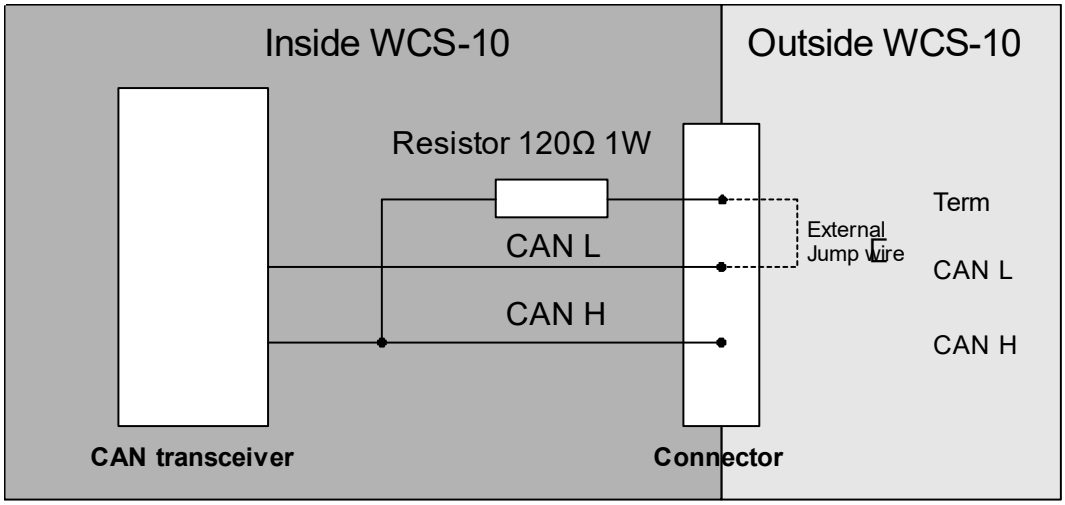


Figure 4: Internal termination

The WCS-10 has internal termination resistors. By installing a “jump” wire from CAN term to CAN L the CAN bus can be terminated. CAN 4 is always terminated at the WCS-10.

Power Supply

The WCS-10 must be powered by DC voltage from 10 to 40 Volt. The WCS-10 has dual power inputs and can be powered on both simultaneous or on only one of the two. The max power consumption when stress tested was 3,5W. In normal operation the power consumption is about 3W.

Note: When operating below the recommended 12V, the green power indicator LEDs turn off around 11V and below, though the switch remains operational.

Table 1: Power supply characteristics

Info	Max	Min	Recommended/Normal
Voltage supply	40VDC	10VDC	12VDC or 24VDC
Power usage	3,5W	2W	3W

Transceivers

The WCS-10 uses Philips TJA1050 CAN transceivers

Isolation

Four of the five CAN ports on the WCS-10 are galvanic isolated. The ports that are isolated are CAN 1, CAN 2, CAN 3 and CAN 4. The CAN A port is not isolated. The data lines are isolated with ADuM 1201. DC/DC isolations are done with C&D NTE0505.

PE Grounding

The WCS-10 X14 ground strip needs to be connected to a high quality ground point for WCS-10 to fulfil EMC requirements.

There are currently two variants of the WCS-10:

- with the X14 ground strip attached to a screw on the back, pointing upwards
- with the X14 ground strip attached to a screw on the front, pointing downwards

Figure 5: WCS-10 variants A (left) and B (right) with different ground strip attachment positions

Light Emitting Diodes (LEDs)

The WCS-10 have 6 LEDs, two green and four yellow. The green ones are for input voltage monitoring. **Note:** When the input voltage drops below 11VDC the power LEDs switch off, though the switch remains operational.

The yellow CAN LEDs indicate different CAN controller states.

Table 2: Power LED status

LED	**Status**
Off	Input voltage, Low
On	Input voltage, OK

Table 3: CAN controller led status

LED	**Status**
Off	No traffic
On	Traffic
Blink 1/s	TX Error
Blink 5/s	RX Error

Table 4: Priority of led indication states

Prio	Status
Prio 1	No traffic
Prio 2	TX Buffer overrun
Prio 3	RX Buffer overrun
Prio 4	Traffic

Table 5: Led blink times

State Change	Time
Traffic - Tx Overrun – No Traffic	10sec - 10sec
Tx Overrun Corrected	2min
Traffic - Rx Overrun	10sec
Rx Overrun Corrected	2min
No traffic - Traffic	1sec
Traffic – No traffic	10sec

The configuration port does not have any LED indications.

CAN-Port usage

The WCS-10 consists of 5 CAN ports. Port 1-4 are used for CAN telegram forwarding. Port A is used for WCS-10 configuration. Port CAN A has implemented Micro CANopen for making the configuration via CANopen SDO telegrams.

Frequently Asked Questions (FAQ)

Does the CAN Switch need to be configured before use?

The default configuration of the CAN Switch is to forward all CAN messages on CAN ports 1-4 using the bitrate 500kbit/s. If this is compatible with your network then no configuration is needed. See the chapter *Factory Settings* for the complete default configuration.

The CAN Switch can be ordered pre-configured for your network. In that case no further configuration is needed.

Legal Information

RoHS directive

This product is in compliance with the Restriction of Hazardous Substances in Electrical and Electronic Equipment directive (RoHS Directive 2011/65/EU).

EMC directive

This product is in compliance with the Electromagnetic Compatibility directive (EMC Directive 2014/30/EU).

WEEE directive

This product is in compliance with the Waste from Electrical and Electronic Equipment directive (WEEE Directive 2012/19/EU).

About This Manual

We believe that the information in this user guide was accurate at the time of printing. TK Engineering Oy cannot, however, assume responsibility for any errors or omissions in this document. The information in this document is subject to change without notice and should not be taken as a commitment by TK Engineering Oy.

Trademarks

All product names mentioned in this manual are registered or unregistered trademarks of their respective owners.

Revision History

The following revision history table summarizes changes contained in this document.

Date	Revision	Author	Description
31.10.07	1.0	PSAN	New Book
14.11.07	1.1	PSAN	Added object dictionary for BTR0 and BTR1 for all CAN channels
15.11.07	1.2	PSAN	Added examples of bit rates and Sampling point
24.01.08	1.3	BCAB	Renamed CAN-Switch to WCS-10
24.01.08	1.4	BCAB	Changed hardware chapter
25.03.08	1.5	PSAN	Removed objects 0x1001 and 0x1014 from documentation. Changed the logo to TKE logo.
25.03.08	1.6	BCAB	Changed address on front page, added picture on front page
01.04.08	1.7	BCAB	Added more info to HW
25.06.08	1.8	BCAB	Changed first page picture
20.08.08	1.9	BCAB	Changed min max voltage levels
22.08.08	1.10	BCAB	Changed Firmware nr and version on front page
25.09.08	1.11	BCAB	Changed switch in text to WCS-10
07.10.08	1.12	BCAB	Changed text in 4.3 Power supply
13.10.08	1.13	BCAB	LED chapter added
21.10.08	1.14	BCAB	Grounding chapter added, prio added to led chapter
13.11.08	1.15	MCJW	Legal Disclaimer
14.11.08	1.16	BCAB	Changed order of Legal, HW and SW
26.11.08	1.17	PSAN	Changed Firmware version
22.12.08	1.18	BCAB	Changed Firmware version
29.12.08	1.19	PSAN	Changed EMCY-codes to match firmware
29.12.08	1.20	BCAB	Changed help text in EMCY-codes table
30.12.08	1.21	BCAB	Changed EMCY bus state messages and firmware version
05.01.09	1.22	BCAB	Changed EMCY, firmware updated, WCD-10 changed to WCS-10, Changed front page picture.
07.01.09	1.23	BCAB	WCS-10 front page picture changed
19.01.09	1.24	BCAB	WCS-10 front page picture changed
29.01.09	1.25	BCAB	WCS-10 block schema added and mechanical drawing
04.02.09	1.26	BCAB	HW filter example added updated to match firmware 0x1002b. Changed block schema v.1.4, updated connector picture, Technical information added.

04.02.09	1.27	BCAB	GL type approval changed to pending GL type approval
04.02.09	1.28	BCAB	Factory default routing table changed, spelling corrections, baud rate changed to bit rate.
06.02.09	1.29	BCAB	PE ground text changed, HW filter sample text changed
11.02.09	1.30	BCAB	New block schema v.1.5
12.02.09	1.31	BCAB	Halt removed, GL removed from PE grounding
12.02.09	1.32	BCAB	Blink times table added
13.02.09	1.33	BCAB	New block schema v.1.6
05.03.09	1.34	BCAB	New internal terminator picture, and spelling fixes
10.03.09	1.35	BCAB	EMCY error text changed
26.03.09	1.36	BCAB	BRT1 changed to BTR1
31.03.09	1.37	BCAB	X13 pin out changed. Pin 8 added as NC
12.06.09	1.38	BCAB	WCS-10 front page picture changed
12.06.09	1.39	BCAB	GL type approval status changed
19.01.17	1.41	RCS	Front page picture changed to one with TKE logo, spelling fixes
25.04.19	1.42	TO	Split up the hardware and the firmware guide into different documents. Updated to new document template.
30.08.22	1.42	SB	Added the supported hardware versions (04 and 05)
16.03.23	1.43	CS	Updated caption for block schema to also cover hw v05, updated copyright year and document version.
11.04.23	1.44	SB	Added the DNV type approval mark and description
18.12.24	1.45	CS	Updated block schema and copyright year. Spelling corrections.
24.10.25	1.46	TR	Updated “Legal” chapter to mention EMC and WEEE directives.
29.10.25	1.47	TR	Added note about power LEDs turning off when supplied with voltage below the recommended value in the “Power Supply” chapter.
17.04.26	1.48	TR	Changed classification in header to “PUBLIC”.

References

/2/ MC9S12XDP512 Data Sheet, Rev. 2.11, Freescale Semiconductor

/3/ CiA301, CiA Draft Standard Proposal 301, V4.1

/4/ Embedded Networking with CAN and CANopen, Pfeiffer, Ayre and Keydel

/5/ CiA302-1, CiA Addition application layer functions, V3.4.1

/6/ CiA Draft Recommendation 303-3 Indicator specification V1.2