USB-I<sup>2</sup>C-bus interface OM13518 with a GUI for the RTCs PCF85263 and PCF85363

Rev. 1 — 19 May 2014

<b>Document information</b>	1
Info	Content
Keywords	I <sup>2</sup> C-bus, computer control, GUI, RTC, PCF85263, PCF85363, USB
Abstract	User manual for the universal USB-I <sup>2</sup> C-bus interface dongle OM13518



#### USB-I<sup>2</sup>C-bus dongle OM13518 with a GUI

**Revision history** 

Rev	Date	Description
v.1	20140519	first revision

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### 1. Introduction

The OM13518 dongle is an easy to use interface handler between the USB of a PC and the I<sup>2</sup>C-bus. The software control via a Graphical User Interface (GUI) allows a fast start to communicate with different circuits.

- USB-2 is used for data and the 5 V power supply.
- Three I<sup>2</sup>C-bus ports are wired in parallel.
- Cables to connect up the I<sup>2</sup>C-bus are enclosed.

### 2. Key features

### 2.1 USB-I<sup>2</sup>C interface module

The OM13518 dongle is a ready to run module. It creates a virtual COM-port via an USB connection. It provides three  $I^2$ C-bus connections with 5 V option to power the application (max 450 mA).

**Power consumption:** module/total: <50 mA/max 500 mA

**I<sup>2</sup>C-bus clock frequency:** 245 Hz – 400 kHz

USB driver for Windows: Windows XP, Windows 7, Windows 8

Size: 50 mm × 40 mm × 15 mm

#### 2.2 Software

The software control via a GUI allows a fast start to communicate to the different circuits.

Aside from the detailed GUI pages for the Real-Time Clocks, a UNIVERSAL INTERFACE allows to communicate with any I<sup>2</sup>C-bus device by entering directly the hex codes. Example: s A2 28 p

Where s stands for the  $I^2C$  START and p for the  $I^2C$  STOP condition.

## 3. Dongle

#### 3.1 Circuit diagram

The dongle establishes the connection between the PC (USB port) and the  $I^2$ C-bus interface.



## 3.2 Interfacing I<sup>2</sup>C-bus peripherals

The  $l^2$ C-bus peripherals are connected directly with the  $l^2$ C-bus. The 3 connectors Con1, Con2, and Con3 are connected in parallel and carry the four signals as also imprinted on the package:

**+5 V:** Optional 5 V supply can be used. Total consumption of all 3 outputs must be kept below 450 mA.

SCL: Serial CLock line

SDA: Serial DAta line

GND: Ground

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There is no need for external pull-up resistors, since 10 k $\Omega$  pull-ups are already built in the OM13518 dongle.

#### Installation 4.

#### 4.1 Hardware and driver installation

#### 4.1.1 The box contains:

- One dongle
- One USB cable
- Three I<sup>2</sup>C-bus cables:
  - One with female connector dedicated for NXP-RTC evaluation boards
  - Two cables for custom use via solder connection
  - The signal assignment is imprinted on the interface module \_



#### 4.1.2 Driver

First install the USB software driver before connecting the interface module.

- Unpack the file : cp210x\_vcp\_win\_xp\_s2k3\_vista\_7\_8\_v6\_6\_1.zip
- Install the driver in administrator mode

#### 4.1.3 Hardware

- Connect the USB cable with the dongle and with the PC and let the device to install. Connect the I<sup>2</sup>C-bus cable to your application; turn on the power in case an external one is needed.
- 2. The red LED will light up to indicate that the OM13518 successfully started up.
- 3. Now the system is ready for starting the GUI software

#### 4.2 GUI Installation

- 1. Unpack the file NXP\_USB-I2C-RTC\_GUI\_V02.zip. The latest version can be downloaded from the OM13518 home page.
- 2. Run the exe file: NXP\_USB-I2C-RTC\_GUI\_V02.exe
- 3. A start window will pop op
- 4. Choose the right com port in the drop down list
- 5. Press Connect: Status changes to Connected and turns green

Connection COM7	Conviedt	IPC Address:	OxA2	•
- 0	0М7 👻	Disconnect		
USB-I2C Command	Connected to	COM7	e, Alarms, Timestamps	Register Readba
Status, Firmwar	re, Y-Parameter	Direct Command		

## 5. Features of the Graphical User Interface (GUI)

The GUI can be used as a universal I<sup>2</sup>C-bus interface for controlling any peripheral circuit. Alternatively some specific windows are available e.g. for the Real-Time Clocks PCF85263 and PCF85363.

### 5.1 Universal I<sup>2</sup>C-bus interface

The Universal  $I^2C$  interface allows controlling any circuit by entering directly the  $I^2C$ -bus instructions. It is part of the Tab *USB-I2C Commands*.

Connection	10		MO
COMB   Disconnect	IC Address: DxA2	•	
Total and the second second			RIC GUI VO2
USB-I2C Commands Standard Registers Sp	ecial Registers   Time 6   Timestamps   F	legister Readback RAM 85363 on	y Demoboard
			_
1 sa2 28 sa3 0A p		> Send Command	
		45	
Save Configuration			
Read Configuration 5			
Reset the dongle			
Reset dongle (Y-Parameters)			
Reset USB-I7C			
Status, Firmware, Y-Parameter			
Received Data	Clear received Transmitted D	ata	Clear transmitted
80 00 00 00 00 00 00 00 00 00 00	s a2 28 s a3 0	Ap	
		2	

Procedure and details:

- 1. Universal I<sup>2</sup>C-bus interface control, type in the following format:
- Writing data, e.g.: s A2 28 04 p press Send Command (s = START, A2 = slave address, 28 04 = data, p = STOP)
- Reading data, e.g.: s A2 28 s A3 0A p: press Send Command setting address pointer, then reading 10 bytes (0Ah)
- 2. The sent data will be reflected in the field *Transmitted Data*.
- 3. The read data bytes are listed in the field *Received Data*.
- 4. Configuration can be saved on the PC (see section 5.2.1).
- Configuration can be reloaded to continue with the used presetting for further tasks (see section 5.2.1.2).

- 6. Tabs on the GUI of the RTCs: PCF85263, PCF85363, to follow
- 7. Hovering the mouse-pointer over a function button, tool tips will pop up for explanations.
- 8. Pressing ▼ will open the list of possible options to select from.

	s Timestamps			
Time and Ala	m Register Sett	ings		-
	24 Hour -	Display Mode	1 second	<ul> <li>Resolution</li> </ul>
TIME :	AM/P Select	t 24 Hour Mode o	or 12 Hour Mode	WDAY DA
Set	AM Note	: The default is 24	Hour Mode	
Current				
ALARMI				1
Enable		HR MN	] SC	
Set				
			_ /	-
			1	
			Issand	- 0
			1 Server of Maria	NR
			1 second	

#### 5.2 GUI pages for the RTC PCF85263 and PCF85363

The objective is to have a fast and straight forward control of all the functions of the RTC.

The principle for controlling is explained on the window *Time, Alarms, Timestamps* in Fig 7.

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Connection				13	C						
COM3		Dise	connect	1	C Address: Dx	A2		-			
	Connected I	to COM3									
										2	
SB-I2C Comma	nds Stan	dard Regi	sters Spe	ecial Reg	isters Time, A	ams, Time	stamps Re	gister Read	iback R	AM 85363 only	Demoboard
Time and Alarm	is Timesta	amps									
Time and Ala	Im Register	rSettings			1/100				-		
	24 Hour	♥ Dis	play Mode		1/100 secon		esolution	_	RIC	Mode	Watch Mode
	AM/PM	HOUR	MIN	SEC	1/100s	In	put fiel	ds	YEAR		
Set	AM 👻	14	09	03	00	00	15	05	14	EXECUTE	SET TIME
Current	-	14	09	17	95	SAT	13	MAR	2014	READ	START
						0	utput fi	elds	1		
Enable		HR	MN MN	SC SC			DY 📃	MH	·		CLEAR A1F
Set					1					EXECUTE	STATUS A1F
Current		-	-	-	1				In	teractive	knobs
										itoraouro i	
ALARM2 : Enable		HR	MN			W	DY				CLEAR A2F
Set			-							EXECUTE	STATUS A2F
Current		-	-							READ	
Alexan Fred	In Devide	DEAD	-	-							
Alarms Ena	DIE Register	READ									
aceived Data	Ĩ	Mani	tor Di	-	omionior	Ta	nemitted Dat		1		
0		WOTI		is trai	ISTRISSIO		ionitted par		_		Clear transmitted
0						2			3.11		
0						s Az s Az	00 000309 00 s A3 08	141306031 P	4p		
04 09 14 13 0	6 03 14					s A2 s A2	28 s A3 01 28 80 p	p			
15 09 14 13 0	6.03.14					s A2	00 s A3 08	p			
15 09 14 13 0	6 03 14					= s A2	00 s A3 08	p			
17 09 14 13 0	6 03 14					s A2	00 s A3 08	p			0.11
		_				-					Subior

#### 5.2.1 Save and read back the configuration

#### 5.2.1.1 All the setting can be saved

- 1. Work with the GUI until you have the IC configured as desired.
- 2. Save the desired configuration to a file as follows: *USB-I2C-Commands* tab, *Save Configuration*, select a directory and name (see Fig 8).

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Connection COM8	Disconnect	PC PC Address:	(bxA2 🔹	RI		
SB-12C Commands	Standard Registers Spec	Sal Registers   Time	, Alarms, Timestamps   Register Rea	dback RAM 85363 only Dem Send Command	oboard	
	Ger Se	ive a Xml File				- march
Save	Configuration	🔘 🛛 📕 🕨 Com	puter + AWS_System (C:) + LocalD	ata + 12C_BUS_Platform + Proj	ect_Time_control	• 4+ Search Project
L Sure	Or	ganize 🔻 New f	older			
Read	Configuration	2006		* Name	Туре	Size
		2007		TCTRL V 202	XML Decu	ment 161
		2008		TCTRL_V_201	XML Docu	ment 16 l
		2009				
		2010		0		
		2012				
		2013				
		2014				
		LZC_BUS_Plat	form			
		L Outlook		1.20		
		MININT		• "		
		File name:	CTRL V, 203			
		Save as type: XI	ML Files			
			R			-
	. 6	Hide Folders				Save
		_				

3. If the GUI succeeds in writing the file, it will produce a pop-up window and then just press OK (see Fig 9).

	Save Configuration	File written successfully
	Reset the dongle	
Fig 9.	Confirmation window	

#### File Format:

The file is written in standard XML format, which almost all Operating Systems can read (see Fig 10).



#### 5.2.1.2 Reload the settings

1. Read back a saved configuration file with *Read Configuration* (see Fig 11):

Connection COM8	PC PC Address: DxA2		10	
USB-I2C Commands Standard Registers	Special Registers   Time, Alarms, Timestamps   Re	RTI gister Readback.   RAM 85363 only   Demo	boerd	
	Organize + New folder			
	2005	* Name	Туре	Size
	<u>4</u> 2006	TCTRL V 202	XML Document	161
Save Comguration	2007	TCTRL V_201	XML Document	16 K
Read Configuration	2008			
These consignments	2010	1		
	2011	E		
	L 2012			
	2013			
	2014			
	L2C_BUS_Platform			
	Project_Time_control			
	J Outlook			
	MUNUN I	-		
	File name: TCTRL_V_202	a state of the sta	•	XML Files
				Open 🔫
				-

2. If the GUI manages to read in the files successfully, it will produce a pop-up window and then just press OK (see Fig 12).

Connection	Disconne     disconne     disconne	IPC IPC Addr	ress: OxA2	*		NM RTC GUI	V02
USB-12C Commands	Standard Registers	Special Registers	Time, Alarms, Timestamps	Register Readback	RAM 85363 only	Demoboard	
					Send Command		
Save	Configuration		File read successfully				
Read	Configuration		OK				
ig 12. Conf	irmation win	dow					

### 5.3 Examples

#### 5.3.1 Setting the clock and reading it

1. Perform a Software reset: Reset tab, function SWR (see Fig 13).

USB-I2C Comma Resets Flags	nds Standard Registers Special R Watch Dog Offset	agisters Time, Alarms, Timestamps	Register Readba
R	eset Settings : Register P.2EH	TS I I Send Cl Send Sc Send Cl Send Cl	ear Timescaler Coi vftware Reset Corr ear Prescaler Com
13. Reset of the s	oftware		

- 2. Select menu Special Registers and press SWR.
- 3. Set the time and read back to verify that the clock is running (see Fig 7).
- A valid time and date can be entered in the Set row, then press EXECUTE
- The SET TIME programs the actual time based on your PC (see Fig 7 and Fig 14).
- *READ* reads the current time and date of the RTC (see Fig 7 and Fig 14).

• *START* will continuously read the time at about once every second (see Fig 7 and Fig 14).

There are options to change from 24 hour to 12 hour mode, activate the 1/100s resolution and change the RTC from *RTC mode* (clock mode) to *stop watch mode* (see Fig 7 and Fig 14).

	24 Hour	Dis	splay Mod	e	1/100 secon	nd 🔻 Reso	lution		RTC	Mode •	Watch Mode
TIME :	AM/PM	HOUR	MIN	SEC	1/100s	- WDAY	DAY	MONTH	YEAR	>	
Set	AM 🔻	15	48	00	00	02	15	04	14	EXECUTE	SET TIME
Current	-	15	57	06	11	TUE	15	APR	2014	READ	START

#### 5.3.2 Blinking the LED at the interrupt output with the help of the watchdog

Procedure and details:

1. Perform a Software reset: Reset tab, function SWR (see Fig 15).

USB-I2C Commands Standard Registers Special Registers Time, Alarms, Timestamps F Resets Flags Watch Dog Offset Reset Settings : Register 0x2EH CPR SWR CTS	legister Readback	RAM 85363 on
Resets Flags Watch Dog Offset Reset Settings : Register 0x2EH CPR SWR CTS		10.00 0000 000
Reset Settings : Repister 0x2EH		
Send Clear	Timescaler Comma vare Reset Commar Prescaler Commar	and 0x25 nd 0x2C nd 0xA4

2. Enable INTA for interrupt mode (see Fig 16).

				1					
USB-I2C Co	mmands Stand	ard Registers	Special Registers	Time, Al	arms, Timesta	amps   Regis	ster Readback	RAM 8	5363 onl
Timestamp	OSC Settings	Battery Switc	h PIN Settings	Function	Interrupt A	Interrupt B	RAM Setting	STOP	
	-PIN Settings :	Register 0x27H	1						
	0 0	0 0	disabled	TNI 🔻	A	•	> SET	BYTE	
			. I. I.						
					I		B0:INTA	PM[0]	(PIN 9)
							- DI.INTA	E MIL I	
	i i	i i	i -				- B2 : TSPN	4[0]	(PIN 4)
							<ul> <li>B3 : TSPN</li> </ul>	4[1]	
Fig 16. E	nable the IN	ITA for inte	errupt mode						

3. Enable INTA for Watchdog (pulse at each time countdown occurs) (see Fig 17).

ſ	USB-I2C Corr	nmands Stand	ard Registers	Special Registers	Time, A	arms, Timesta	imps Regi	ster Readback	RAM 85363 onl
	Timestamp	OSC Settings	Battery Switch	PIN Settings	Function	Interrupt A	Interrupt B	RAM Setting	STOP
	l l	-INTA Settings	: Register 0x29H	1	_				
		0 0	0 0	0 0 0	) 1	>	SET BYT	E	
						ВО	: WDIEA	(WatchDog)	
						B1	: BSIEA	(Battery Switch)	)
			1.1.1	1 1					
F	ig 17. Er	able the IN	TA for Wat	chdog					

4. Enable the watchdog for a repeat every 2 seconds for example (see Fig 18).

USB-I2C Commands Standard Registers Special Registers Time, Alarms	, Timestamps Register Readback RAM 85363 only Demoboard
Resets Flags Watch Dog Offset	
Watch Dog Settings : Register 0x2DH	
repeat         0         0         1         0         1 second         ▼	Watchdog Duration           2 seconds         SET BYTE           B0 : WDS[0] (WatchDog Step Size)           R1 : WDS[1]
	B2 : WDR[0] (WatchDog Register Bits) READ WD-COUNTER B3 : WDR[1] B4 : WDR[2] B5 : WDR[3] B6 : WDR[4]
	B7 : WDM (WatchDog Mode, single shot or continuous)
Fig 18. Enable the watchdog for a repeat eve	ry 2 seconds

5. Observe the LED flashing every 2 seconds!!!

#### 5.3.3 Interactive quartz frequency offset correction:

The quartz crystals come with a tolerance of typical  $\pm$  20 ppm. To correct the actual offset of the quartz in use, take the following steps:

- 1. Measure the frequency at CLKout pin, e.g. 32 768.51 Hz
- 2. Write the measured frequency in the entry field, it automatically calculates the offset and the needed correction value. 15.19 ppm or 7 correction pulses.
- 3. By activating *SET BYTE* the offset value is programmed in to the RTCs offset register.

**Note**: The offset calibration operates at the time counter level and will not result in any observable change in frequency.

Resets Flags	Watch Dog	Offset		_				
Offset Setting : I	Register 0x24	SH .		Qu	artz Load Cap 7 pF	ectance		Correction Mode
msb 0	0 0	OFFSET[7			Offset in deci 7	mal Offset in pp 15.19	m> (	SET BYTE
Enter measured	crystal freque	ncy in (Hz)	32768.51		> 30.51710	3 us	Period	in us :
						$\stackrel{1}{\vee}$		
		Diffe	arence to the ideal p	eriod in us :	0.000475	us		
						V.		
		Diffe	erence to the ideal p	eriod in ppm :	145.56396	5 ppm		
					~	1 V		
		Offs	et Register value in	decimal :	7 correction	on pulses in normal m	ode	
		Offs	et Register value in	binary :	00000111	1		

#### 5.3.4 Dedicated drop down menus are integrated for e.g.:

- Register overview: reading all the values at once
- Back-up battery control
- Timestamp
- Watch dog
- RAM

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## 7. List of figures

Fig 1.	Simplified Block diagram of the OM13518	4
Fig 2.	Interfacing to the I <sup>2</sup> c-bus	5
Fig 3.	A) Dongle OM13518, B) connected to an evaluation board	5
Fig 4.	Start window of the GUI	6
Fig 5.	First Tab: USB-I2C commands	7
Fig 6.	Hovering the mouse-pointer and drop-dowr menus	า 8
Fig 7.	Window structure; Time, Alarms, Timestam	ps9
Fig 8.	Selecting the directory	10
Fig 9.	Confirmation window	10
Fig 10.	XML format example	11
Fig 11.	Selecting the directory and file	11
Fig 12.	Confirmation window	12
Fig 13.	Reset of the software	12
Fig 14.	Time control	13
Fig 15.	Software reset	13
Fig 16.	Enable the INTA for interrupt mode	14
Fig 17.	Enable the INTA for Watchdog	14
Fig 18.	Enable the watchdog for a repeat every 2 seconds	15
Fig 19.	Offset correction	15

### USB-I<sup>2</sup>C-bus dongle OM13518 with a GUI

## 8. Contents

1.	Introduction3
2.	Key features3
2.1	USB-I <sup>2</sup> C interface module
2.2	Software
3.	Dongle4
3.1	Circuit diagram4
3.2	Interfacing I <sup>2</sup> C-bus peripherals4
4.	Installation5
4.1	Hardware and driver installation5
4.1.1	The box contains:5
4.1.2	Driver6
4.1.3	Hardware6
4.2	GUI Installation6
5.	Features of the Graphical User Interface (GUI).7
5.1	Universal I <sup>2</sup> C-bus interface7
5.2	GUI pages for the RTC PCF85263 and
	PCF853638
5.2.1	Save and read back the configuration9
5.2.1.1	All the setting can be saved
5.2.1.2	Reload the settings11
5.3	Examples
5.3.1	Setting the LCD at the interrupt output with the
5.3.2	blinking the LED at the interrupt output with the
533	Interactive quartz frequency offset correction: 15
534	Dedicated drop down menus are integrated for
0.0.4	e.g.:
6.	l egal information
61	Definitions 17
6.2	Disclaimers
6.3	Trademarks
7.	List of figures 18
Q.	Contents 10
0.	Jourgenta

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