# **ZSSC3240 CURRENT LOOP / OWI**

#### Ext. Temp. Config 1/2 fig 1/2 **ZSSC3240** Configuration 28 Gain 1.32 Gain Ŧ Recommended AFE configuration Polarity Positive Positive Polarity Ŧ for test application using the 16 Bit 16 Bit ADC Resolution ADC Resolution 0% Sensor Replacement Board ADC Offset 44% ADC Offset -ADC Reference Ratiometric ADC Reference Bandgap **IOffsC** OmV (no shift) -IOffsC OmV (no shift) -5uA Thias out 5uA Thias out Default mode is the Cyclic Mode. ADC Gain/Offset On Off ADC Gain/Offset After IC-reset the ZSSC3240 starts On Off CM Adjustment CM Adjustment autonomously the measurements. **Desired DAC resolution** Smart Sensor Feature Reg. 1 Smart Sensor Feature Reg. 2 Sensor choice for analog output DAC resolution 13Bit Default Mode Cyclic Mode Dithering Off Dithering OWI Listen Time 50ms DAC functionality has to be enabled Sensor -> DAC DAC Input OWI interface is activated for 50ms OWI SU Case Startup Window DAC Output enabled Analog Out after IC-reset. internal PTAT Temp, Source Aout Setup Current loop / OWI1 / OWI2 If in this period the command 0xD9 Necessary configuration for Sensor Supply Ratiometric Supply VDDB Diagnotstic Analog Diagnostic Off (START\_UP\_OWI) is received, the Internal Rt 1.3kOhm Current Loop application in LDOctrl On External Rt No ZSSC240 stays in OWI communication combination with OWI. LDOctrl Voltage VDD = 4.8V OWI off OWI enabled mode. Otherwise it provides the AZM Sensor Off AZ Sensor NVM lock NVM write OK measurement results after 50ms at Desired regulated VDD voltage AZ Temp. AZM Temp. Off On • Charge Pump AOUT. Oversampling No Overs. -

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#### **ZSSC3240 CURRENT LOOP / OWI HW SETUP**



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#### **CB FW UPDATE FOR OWI IN CURRENT LOOP**

For the ability of the CB to decode OWI communication, in combination with Current Loop, the firmware (FW) of the CB has to be updated to revision V4.20.

The recent FW revision, Bootloader and the documentation for the updating process are available at the Renesas site: https://www.renesas.com/us/en/products/sensor-products/sensor-signal-conditioners-ssc-afe/ssc-cb-ssc-communication-board

Follow the instructions in the *Communication Board Firmware Update* Application Note for flashing the FW version 4.20 to the CB controller.

After a successful flashing process, the HW information in the ZSSC3240 GUI displays the FW version:



#### **ZSSC3240 CURRENT LOOP - POWER UP**

After ZSSC3240 configuration, HW connection, and FW flashing:

- 1. Connect the Communication Board via USB to a host PC and turn on HV supply (26V)
- $\Rightarrow$  No current should be flowing in the Loop
- 2. Start the ZSSC3240 Evaluation SW
- $\Rightarrow$  KS5V is set to 5V when the GUI is loaded, it enables the HV supply to EB. The Current Loop is supplied.
- $\Rightarrow$  ZSSC3240 is in Cyclic Mode, providing the measurement result at AOUT pin. The AOUT voltage is driving the CL current.





#### Scoping the signals after GUI start

# **SW CONFIGURATION FOR OWI COMMUNICATION**

1. Switch to OWI interface: Menu -> Interface -> OWI

2. CB configuration to decode the ZSSC3240 OWI output (modulated on the Loop-Current): *Diagnostic / Cyclic... / Command Section tab -> OWI Master -> OWI Master Application* 

R 7.5SC3240 Evaluation SW v3	1.42	- 🗆 X	R ZSSC3240 Evaluation SW	v3.42		– 🗆 ×
ile Interface			File Interface			
Cur I2C Int SPI Hz]=	Kessurement Control ✓ Raw Measurement Sensor and Temp, Meas ▼ Meas. Timer[ms] ☐ Corr. Measurement ▼ 0	Display Control     Log       ADC Resolution     Ext. Sensor       16 Bit     Temp. Sensor       *C     Log Measurement Data	Current IF Setup Interface OWI [1kHz] OWI-Address 0x0 Scan 12C-Bus	Measurement Control           Raw Measurement         Sensor and Temp. Meas         Meas. Timer[ms]           Corr. Measurement         Full Measurement         0	Display Control     Log       ADC Resolution     ✓ Ext. Sensor       16 Bit     ✓       Temp. Sensor     °C       Log Measurement Data	RENESAS
	Measurement NVM Calibration Diagnostic / Cyclic Configurati	ion / Command Section AFE Configuration		Measurement NVM Calibratio Diagnostic / Cyclic Configuratio	on / Command Section AFE Configuration	
IC Status	DAC-Diagnostic On-Chip Diagnostics	Cyclic Operation Sequence 1 / 2	IC Status	DAC-Diagnostic On-Chip Diagnostic	Syche operation Sequence 1/2	
Mem Error Saturation	V_DAC10_AOUT [V] = n.a. INP	Sensor Bridge Meas. Enable  V SM / AZSM 1st Slot Enable  V SM / AZSM-Pause [0,.15] 0	Nem Error Saturation	V_DAC10_AOUT [V] = n.a. INP	Sensor Bridge Meas. Enable   SM / AZSM 1st Slot Enable   SM / AZSM 1st Slot	AZSM-Pause [015] 0
Sleep Mode Test Mode Cyclic Mode CMD Mode	V_DAC90_AOUT [V] = n.a. INP Range	Temperature Meas.         Enable         TM / AZTM Pause [063]         0           Sensor Conn. Check         Enable         SC Check 1st Slot         Enable         SC CPause [01023]         0	Sleep Mode Test Mode Cyclic Mode CMD Mode	V_DAC90_AOUT [V] = n.a. INP Range	Temperature Meas.         Enable         TM / AZTM 1st Slot         Enable         TM /           Sensor Conn. Check         Enable         SC Check 1st Slot         Enable         SC	AZTM-Pause [063] 0 C-Pause [01023] 0
Sensor Check Status Request	Set DAC-Input [065535] 0 INN Range Apply DAC-Diagnostic Sensor Short	Update Rate Oms	Sensor Check Status Request	Set DAC-Input [065535] 0 INN Range  Apply DAC-Diagnostic Sensor Short	Update Rate Oms	
HW Connection	T_EXT Open	Single Command Section OWI Master	HW Connection	T_EXT Range	Single Command Section OWI Master	
CB V4.1 FW V4.19.13	ADC-Diagnostic SSC Saturation	Start Command Mode OWI Master Application OWI Master Application	CB V4.1 FW V4.19.13	ADC-Diagnostic SSC Saturation	Start Command Mode OWI Master Application	
Close Port	Set ADC-Input [031] 0 Die Crack  T EXT-INP Short	Start Cyclic Mode Reset (POR)	Close Port	Set ADC-Input [031] 0 Die Grack  T EXT-INP Short	Start Cyclic Mode Reset (POR)	
	Apply ADC-Diagnostic Reset Diagnostic	Single Messurement POR + START UP OWI + CM Mode Write CRC		Apply ADC-Diagnostic Reset Diagnostic	Single Measurement POR + START UP OWI + CM Mode Write CRC	
External Sensor	Output [hex]: 0 Output [hex]: 0 Output [hex]: 0	Reset (RESQ) + START UP OWI + CM Mode	External Sensor	Output [hex]: 0 Output [hex]: 0 Output [hex]: 0	Reset (RESQ) + START UP OWI + CM Mode Apply HV-Supply(12V)	
	Terminal			Terminal		
Temperature Sensor	Write Commands:		Temperature Sensor	Write Commands:		
Ü	Send Write Command		Ü	Send Write Command		
Power Off	Read Commands:		Power Off	Read Commands:		
Reset	Send Read Command		Reset	Send Read Command		
START Measurement	Output [hex]:		START Measurement	Output [hex]:		
Get Measurement Value for Calibration			Get Measurement Value for Calibration			
		å				.a

# SWITCH FROM CYCLIC MODE TO COMMAND MODE

POR (Power-On Reset) Diagnostic / Cyclic... / Command Section tab -> OWI Master -> POR START\_UP\_OWI\_CM\_Mode

ile Interface								
Current IF Setup	IF Setup Measurement Control		Dientay Control	Dienay Control				
Interface OWI [1kHz]	Raw Measurement Sensor and T	Raw Measurement Sensor and Temp. Meas  Meas. Times  Meas.		ADC Resolution 🗹 Ext. Sensor 🗌 % FS		tion Open Com Log	ZENIESAS	
OWI-Address 0x0	Corr. Measurement Full Measure	ment 🔻 0	16 Bit 🔻 🗹 1	'emp. Sensor 🔲 ℃	Log Measureme	ent Data		_3/15
Scan I2C-Bus								
	Measurement NVM Calibration	Diagnostic / Cyclic Config	juration / Command Section	AFE Configuration				
IC Status	DAC-Diagenestic	On-Chip Diagnostics	Cyclic Operation Seque	nce 1 / 2				
Mem Error Saturation	V_DAC10_AOUT [V] = n.a.	INP 🗌	Sensor Bridge Meas.	Enable 🔻	SM / AZSM 1st Slot	Enable 👻	SM / AZSM-Pause [015]	0
Sleep Mode Test Mode	V DAC90 AOUT M = n a	INN 🗌	Temperature Meas.	Enable 🔹	TM / AZTM 1st Slot	Enable 🔹	TM / AZTM-Pause [063]	0
Cyclic Mode CMD Mode		INP Range	Sensor Conn. Check	Enable 🔻	SC Check 1st Slot	Enable 👻	SCC-Pause [01023]	0
Status Request	Set DAC-Input [065535] 0	INN Range	Update Rate	0ms 👻				
Status Request	Apply DAC-Diagnostic	T EXT Open			Write to N	VM		
HW Connection		T_EXT Range						
CD 1/4.1		T_EXT-INN Short	Single Command Sectio	OWI	Master			
FW V4.20 ©	ADC-Diagnostic	SSC Saturation	Start Comman	i Mode	OWI Master Applic	OWI Master Application		
MCB No	Set ADC Insut [0, 21]	Memory Error	Start Sleep I	1ode				
Close Port	Set ADC-input [051] 0	Die Crack	Start Cyclic M	1ode	Reset (POR)			
	Apply ADC-Diagnostic	T_EXT-INP Short	Single Measur	ement	POR + START UP OWI	+ CM Mode		
		Reset Diagnostic	Write CR		For Former of One	r driftidae		
	Output [hex]: 0	Apply Sensor Check	techning Court	Res	et (RESQ) + START UP C	WI + CM Mode		
External Sensor		Output [hex]: 0	Apply HV-Supp	y(12v)				
0	Terminal							
Temperature Sensor	Write Commands:							
U	Send Write C	Command						
Power Off	Read Commands:	Read Commands:						
Deest								
Kesët	Send Read C							
START Measurement	Output [hex]:							
0.111								

Communication Log:

send\_cmd: 'OWT00001D2' response: 'ACK', (STARTUP OWI) send\_cmd: 'OW\_00001A9' response: 'ACK', (ENTER COMMAND MODE) receive\_owi: 'OR\_00001' response: 'ACK', '44', (READ 1 byte -> IC-status)



⇒ In Command Mode any digital interaction via OWI is applicable: NVM Reading / NVM Writing / Measuring

# **MEASUREMENT VIA OWI**



Consistency check, digital vs. analog output:

Measured Loop-Current at given SRB positistion: 15.8mA

17213 LSBs + 32768 LSBS = 49981 LSBs 49959 LSBs  $\div$  65536 LSBs = 0.763 % FSO 0.763 %FSO × 20mA = **15.3mA**  $\Rightarrow$  OK, small offset due to DAC deviation

#### Commnication Log:

send\_owi: 'OW\_00001A2' response: 'ACK', " receive\_owi: 'OR\_00004' response: 'ACK', '44433D00' send\_owi: 'OW\_00001A4' response: 'ACK', " receive\_owi: 'OR\_00004' response: 'ACK', '44EE5000'



# ENTERING CYCLIC MODE FROM COMMAND MODE

HV power supply is controlled by the KS5V signal on the CB. Toggling it causes a POR (power-on reset).

- $\Rightarrow$  After the POR, the ZSSC3240 is restarting in the programmed default mode (here: Cycling Mode).
- $\Rightarrow$  Sensor measurement results are provided at AOUT pin such that the Current Loop is driven by the sensor output

File Interface							
Current IF Setup	Measurement Control		Display Control		Log		
Interface OWI [1kHz]	Raw Measurement Sensor and Temp. Meas  Meas. Timer[ms]		ADC Resolution 🗹 Ext. Sensor 🗌 % FS		Log Communicat	tion Open Com Log	2CNICS/
OWI-Address 0x0 Scan I2C-Bus	Corr. Measurement Full Measurem	ent 👻 🛛	16 Bit 🔻 🗹 1	iemp. Sensor 🔲 °C	Log Measuremen	nt Data	
	Measurement NVM Calibration	Diagnostic / Cyclic Configurat	ion / Command Section	AFE Configuration			
IC Status	DAC-Diagnostic	On-Chip Diagnostics	Cyclic Operation Seque	nce 1 / 2			
Powered Busy Mem Error Saturation	V DAC10 AOUT [V] = n.a.	INP 🗌	Sensor Bridge Meas.	Enable -	SM / AZSM 1st Slot	Enable 👻	SM / AZSM-Pause [015] 0
Sleep Mode Test Mode		INN 🗌	Temperature Meas.	Enable -	TM / AZTM 1st Slot	Enable 👻	TM / AZTM-Pause [063] 0
Cyclic Mode CMD Mode	v_DAC90_AODT [v] = n.a.	INP Range	Sensor Conn. Check	Enable -	SC Check 1st Slot	Enable 👻	SCC-Pause [0 1023] 0
nnection	Set DAC-Input [065535] 0	INN Range	Update Rate	0ms 👻	ĺ		
3 V4.1	Apply DAC-Diagnostic	Sensor Short			Write to NV	м	
V V4.20 ©		T_EXT Bange					
B No		T_EXT-INN Short	Single Command Section	n OWI	Master		
Close Port	ADC-Diagnostic	SSC Saturation	Start Comman	d Mode	OWI Master Applica	ation	
		Memory Error	Start Sleep 1	1ode			
	Set ADC-Input [051]	Die Crack	Start Cyclic I	1ode	Reset (POR)		
	Apply ADC-Diagnostic	T_EXT-INP Short	Single Measur	ement	POR + START UR OWT +	CM Mode	
	Approvide Disglobate	Reset Diagnostic	Write CR	c	POR + START OF OWL +	CHIMODE	
	Output [hex]: 0	Apply Sensor Check	white CR	Res	et (RESQ) + START UP O		
External Sensor		Output [hex]: 0	Apply HV-Supp	ly(12V)			
17026	Terminal						
Terreration Course	Write Commands:						
C C L O							
-5648	Send Write Co	mmand					
Power Off	Read Commands:						
Reset							
Reset	Send Read Command						
START Measurement	Output [hex]:						
Get Measurement Value							

Communication Log (POR):

. . .

send\_cmd: 'PS\_A50' response: 'ACK', " send\_cmd: 'TWAIT100' response: 'ACK', " send\_cmd: 'PS\_A51' response: 'ACK', "



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#### **ZSSC3240 CURRENT LOOP CHARACTERISTIC**

#### DAC Current-Loop Output

#### Corresponding Voltage at AOUT-pin

