

Ultrasonic-Flow-Converter Data Sheet

GP30-DEV-KIT

Development System for TDC-GP30 Ultrasonic Flow Converter

March 18, 2015 Document-No: DB_GP30-DEV_en Version 0.1

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GP30-DEV-KIT

1 Introduction

1.1 General

The GP30-DEV-KIT is designed as a platform for a quick and easy start-up and evaluation of the TDC-GP30 Ultrasonic Flow Converter. The development kit offers user-friendly configuration and extensive testing of the TDC-GP30, but also the complete assembler environment for programming the device. For a proper use of the evaluation system, we strongly recommend to refer to the latest TDC-GP30 datasheets. Please request them from acam.



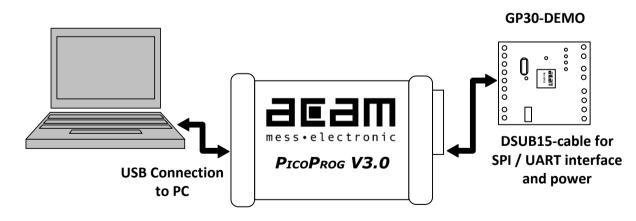
1.2 System Components

The GP30-DEV-KIT includes the following components:

- GP30-DEMO--PCB: Small demo board with TDC-GP30, assembled with DSUB15 cable
- PICOPROG V3.0: USB-to-SPI/UART communication interface
- USB cable: For connecting the PICOPROG communication Interface to the local PC
- CD-ROM: Contains software, drivers, examples and technical documentation

The GP30-DEMO-PCB is connected to the PC via the PICOPROG SPI-to-USB converter.

Figure 1

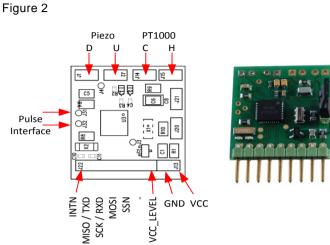




2 Hardware Description

2.1 Introduction

The GP30-DEMO-PCB, shown in figure Fig 2.1, represents the complete front-end for a water or heat meter. The transducers and temperature sensors can be connected directly to this board. It comes with a 32,768 kHz quartz (X2) and a 4 MHz ceramic oscillator (X1).

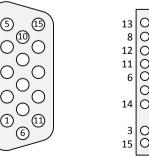


2.2 Communication Interface

The PICOPROG device is acam's standard USB-to-SPI converter box that interfaces all acam evaluation systems. With version 3.0, the PICOPROG also supports the USB-to-UART conversion of GP30. The PICOPROG is registered by operating system initially as "picoprog v3.0 unprogrammed". As soon as the GP30 evaluation software is started, a special firmware is written into the PICOPROG to make the SPI or UART communication with the GP30. For SPI communication only, PICOPROG version 2.0 is sufficient.

Figure 2.2 shows the connection between the PICOPROG and the GP30 board. The flat connector includes the power lines and the SPI or UART communication lines. On demo board the communication interface is initially selected to SPI (by solder bridge LJ2). VCC LEVEL is the voltage feedback for the PICOPROG level shifters.

Figure 2.2



13	O INTN	
8	O MISO / TXD	
12	🔿 SCK / RXD	
11	O MOSI	CD20
6	O SSN	GP30
	0 -	DEMO
14	○ VCC_LEVEL	22.00
3	O gnd O vcc	
15	O vcc	

GP30-DEV-KIT

3 Software Installation

The GP30 evaluation software described here is an early version for use with the TDC-GP30. It is continuously under evaluation and subject to on-going improvement. Please hold contact with acam to be informed about latest revisions.

The description herein is based on software version 1.2.7

To install the software, go to folder GP30y_Software\acam GP30 Installer v1_2_7\ Volume and run setup.exe. Follow the instructions. After starting the software the PICOPROG is listed under devices and printers as "UNIPROG".

If not, go to the drivers folder , e.g. GP30_Confidential\drivers\Win7_8 and install the driver for your operating system manually. In case of an upgrade of the software to a newer version please make sure that the software uses the latest driver. The driver is located in C:\Program Files (x86)\acammesselectronic\GP30\data.



Therefore open the USB communications window and check the firmware version of the PICOPROG. It should be version PicoProg_GP30_v21.hex or higher:

Figure 4

File Tools Firm	ware	Help	
Measurements	Ultra	Help Contents	F1
		USB Communications	Ctrl+U
24		About	F12

PicoProg Settings		
	Disa	ble USB Handle
PicoProg FW Path		
B C:\Users\GP3\GP30Y	Software\PicoProgFW_GP30_v20.hex	Change
GP30 Communication		
Last_Com_Action		Read Res
stop_meas	Comm w/ GP30 OK	USB Error



4 Software Tabs in Main Window

4.1 Measurement

When started, the software comes up with the main window, showing the "Measurement" tab.

Figure 5 Main window

ultrasonic Meas	urement Control	Temperature Measu	rement Control General C	ontrol Interfaces Interrupt & Er	rror Hand	dling acar	n				
162	Time of Flight	Measurement			-		2-Wire Ter	npera	ture Meas	surement	
# Name	Results / ns	Average / ns	Std. Dev. / ps 100	Write Config	\$	Current Tem			accuracy p	pm/K	
1 TOF SUM AVG UP	64020,2	64020,2	275,0	White Coning		20,0			4000		
2 TOF SUM AVG DOWN		64020,2	269,2			RC/Rref cu		RH/I	Rref current	t T	Open Graph
3 TOF1 UP	60530,3	60530,3	305,4	Stop Measurement		() 1,000	00	1	1,0000	l]
4 TOF2_UP	61527,1	61527,1	281,3	Read Config from RAM first		Calc	ulated Tempe	rature	Results		
5 TOF3_UP	62524,7	62524,7	280,5		#	Name	Results	Unit	StD (mK)	SNR (Bit)	
6 TOF4_UP	63521,9	63521,9	274,7		and the second second	cold		°C	7,57	15.0	
7 TOF5_UP	64518,8	64518,8	285,4	System Reset		hot		°C	4.87	15.6	
8 TOF6_UP	65516,4	65516,4	281,1	Disable Watchdog	1-11	Measurement Values				15,0	
9 TOF7_UP	66512,6	66512,6	276,0	Watchdog is Disabled	#					12	
10 TOF8_UP	67509,8	67509,8	277,9			Name	Result	101		Apply RDSC	N compensation
11 TOF1 DOWN	60530,2	60530,2	281,0	Disable Watchdog		Ref	-25,662		μs	Apply Gain	compensation
12 TOF2 DOWN	61527,1	61527,1	277,4	Enable Watchdog		cold	-25,285		μs		and a state of the
13 TOF3 DOWN	62524,7	62524,7	266,2		3 t	Hot	-25,289		μs	Mult. Gain Co	omp. 1,25
14 TOF4 DOWN	63521,9	63521,9	279,6		4	Rcold/Rref	0,9852			Offect	: 0,0001
15 TOF5 DOWN	64518,8	64518,8	278,2	Verify Interface	100000	Rhot/Rref	0,9854				
16 TOF6 DOWN	65516,5	65516,5	276,9	Pico Prog FW Version	12	MOUNTEI	0,9034			Gain Factor	0,9998
17 TOF7 DOWN	66512,9	66512,9	272,8	20				HS	Clock		
18 TOF8 DOWN	67509,7	67509,7	281,7				HS clk perio	od/ns	Cal Facto	or HS clock	
19 diff. TOF 1	0,1297	0,1297	114,5	Comm. with GP30 OK?			249,71		0,99882	27	
20 diff. TOF 2	0,0000	0,0000	97,0	Comm. w/ GP30 OK			Apply calibrat	ed clo	ck period t	to display valu	ues
21 diff. TOF 3	0,0191	0,0191	95,6				Ampl	itude	Measuren	nent	
22 diff. TOF 4	0,0229	0,0229	103,8		<u> </u>						
23 diff. TOF 5	-0,0267	-0,0267	84,7	Remote Interface					ment Valu		
24 diff. TOF 6	-0,0725	-0,0725	109,4	(@) SPI - Interface			Name			Std Dev. / I	mV
25 diff. TOF 7	-0,3052	-0,3052	107,2	O UART - Interface		1	AM UP		11,57	0,74	
26 diff. TOF 8	0,0839	0,0839	107,6	A CONTRACTOR OF A CONTRACTOR O		2	AM Down		10,35	0,65	
27 diff. TOF SUM AVG	-0,0186	-0,0186	49,6	Baudrate 4800		3	AM diff		1,22	0,69	
	_			Baudrate 115200					tion Values		
	P	ulse Width Ratio UP	Pulse Width Ratio DOWN				# Name	2	Resul	lts	
Open TOF Graph		0,59	0,59	Selected Baudrate			1 AM C			,45	
				4800			2 AM C	AL Lo	w 1240	,86	

4.1.1 First step with measurement control elements

A good first step is to load a working configuration and make measurements in frontend mode (without using the internal 32-Bit μ P). acam provides some sample configuration files the software which are working well. Please use those for a first measurement

- Load configuration file: File menu → Open Config → choose appropriate config file
- Next step: Press "System Reset" button. Now the PicoProg FW version field should get green and the appropriate version should be displayed (20 or higher). Also "Comm GP30 OK?" should get green to show that communication with GP30 works.
- Next step: If watchdog is not disabled by "System Reset" button → press "Disable Watchdog" button.
- **Next step:** Press "Write Config" button. Now the configuration settings are downloaded to GP30 and written to register area of GP30.
- **Next step:** Press "Start measurement" button. Now the chip starts to measure and the results are displayed in the tables of different measurements.

Now, this configuration can be modified to fit the user's needs. In the end the user can store his own configuration files.

4.1.2 Time of Flight Measurement Results

GP30 stores the first 8 hits of every TOF direction separately and also the sum of all measured hits. For both directions these 9 results are displayed. The evaluation software additionally calculates the difference between up and downstream, DIFF-TOF. In total, all 27 results are displayed in the "Results" column.

In the "Average" column the user can set the sample size for the averaging (<1000) and the software calculates the rolling average of the results accordingly. In "Std. Dev." column the standard deviation, calculated over a variable sample size, is displayed. The number of samples can be chosen (e.g. 100).

The same is done with the amplitude values of the receiving signals and the pulse width ratio between first hit and start hit. The values for both directions are displayed.

A graph to display TOF measurement results can be opened in a separate window by "TOF Graph" button

Up to 4 plots can be activated. Every plot have various possible values which can be shown (e.g. TOF1UP, TOF2UP ...). The averaged values are displayed.

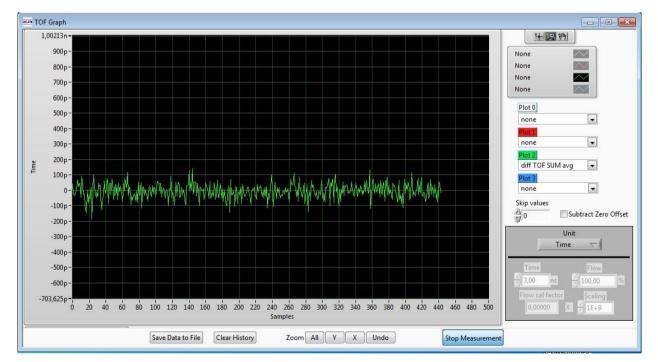


Figure 6 TOF Graph



4.1.3 **2-Wire Temperature Measurement Results**

A graph to display temperature measurement results can be opened in a separate window by "Temperature Graph" button, similar to TOF graph.

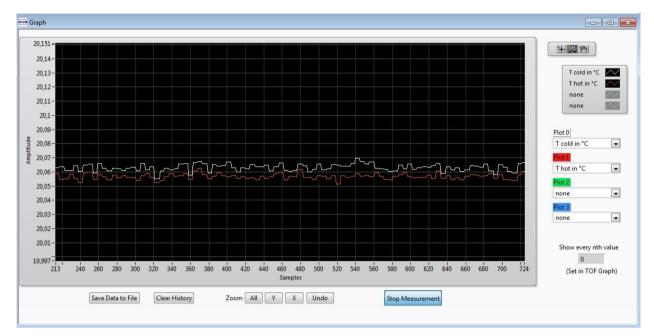


Figure 7

4.2 Ultrasonic Measurement Control

All settings for an appropriate ultrasonic measurement are done in this tab, which are grouped as follwos:

- Time of Flight Sequence Control
- Time of Flight Hit Control
- Amplitude Measurement Control
- Transducer Interface Options

Figure 8

easurements	Ultrasonic Measurement Control	Temperature Measurement Control	General Control	Interfaces	Interrupt & Error Handlin	acam	
			Series control	Interfoces	anterrape ex error rionann	9 0.000	
in the second second	ht: Sequence Control	(%)					
TOF Ra	te	Ultrasonic Pause Handling					on Mode e Direction with every Measurement 💌 2
-				Pause betwee	n TOF Up and TOF Down		
	s Calibration Rate	Pause 1,0 * T(BF_SEL) in ms	▼ 4		20,00 ms		Of Flight Edge Mode
Every 20t	h Sequence Cycle Trigger 💽 5					Positiv	ve Edge of TOF Hit 🔹 0
	e Pulse Clock Divider Setting HS Clock Divisor	Number of Fire Pulses	Ni 40	oise Mask Win)			ut TOF 5 m 0
Time Of Flig	ht: Hit Control						
	TOF Hits Stored i	n Front End data Buffer and first 8 TOF values 💌 1	Start Hit Mode Start Hit by First Selected Start Hit 5. Hit Start Hit Delay Wi 0 2 0	after First Hit	O 40 Detection Fit 4 4 4	st Hit Level [35,2 mV
	Neasurement Control						
Every TC Amplitud	le Measurement Rate]	Amplitude Measu After 8 Hits	urement Peak	Detection End		
	Amplitude Measurement	3					
	Interface Options						
	er Interface Select			s Meter Mode			
Fire Buff	er 1 & Receive Path 1 Selected	1		oth Fire Buffer oth Receive Pa	h Transistors		Pull-Down Transistors in both US Buffer Analog Switches in both US buffer





4.3 Temperature Measurement Control

All settings for an appropriate temperature measurement are done in this tab, which are grouped as follows:

- Sequence Control
- Measurement Control
- Temperature Measurement Cycle Time

Figure 9

main.vi					x
File Tools Firmware Help					
Measurements Ultrasonic Measurement Control Sequence Control	Temperature Measurement Control	General Control Interfac	es Interrupt & Error Handling	acam	•
Measurement R	Measurement every: 4	ience Cycle Triggers	Temperature Measurement S Only One Measuremen Pause between Tempe		
	der -> 2. Reversed		N/A	ms	
Vire Mode * 2-Wire Measurement N External Resis * Current Softw	Tode	Control Number of Ports 3 Ports 1 Inactive Ports during Mee Set to High 1 erature Mode	surement	umber of Fake Measurements 2 Fake	E
Temperature Mea Discharge Sel 512 μs	surement Cycle Time ect v 0		m		-

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4.4 General Control

The "General Control" tab covers configuration settings for

- Task sequencer
- High speed clock control
- Voltage measurement
- CPU handling
- Timer Settings

Figure 10

Tools Firmware	0				(1			
easurements Ult	rasonic Measurement C	Control	Temperature Measurement	Control	General Control	Interfaces	Interrupt & Error Hand	ling acam	
ask Sequencing									
Set Cycle Time of	Task Sequencer Se	lect Base	requency for Pause Times			Enable Tas	k Sequencer Restart		Bandgap Pulse Mode
Cycle Time Task	Sequencer	Bas	e Frequency Select			Task Sequenc	er Start Mode		Synchronized with task sequencer
256	250 ms	BF_S	EL = 50 Hz 💌 0	Tas	k Sequencing Starts	Only if Rem	ote Interface is Idle	• 0	Synchronized with task sequencer
High Speed Clock C	ontrol								
Settling	Time				High Speed Clock S	elect			HS_CLK Calibration Rate
135 µs	▼ 2				4MHz 💌	0			Every 20th Sequence Cycle 5
Voltage Measureme	ent								
Vcc Measuremen				Low Bat	tery Detection Thre	shold			Vcc Measured
Disabled	▼ 0			40	÷ 3,13 V	/olt			0,00 Read Measured Vcc
CPU Handling									
Enable Post Pro	cessing	32-bit CP	U Enable						
Post Processing N	lode					[] Faabla (General Purpose Timer Re		Checksum Execution after Bootloader
Post Processing a	fter every Measuremen	t Cycle	• 0				seneral Purpose Timer Ke	quest	
Timer									
					General Purpose T	imer			
Update Mod	de for Time Stamp Valu	e			1 hour	0			Checksum Timer
Updated Auton	natically every second	• 1							Checksum Timer Disabled 💌 🛛
					🔲 General Purp	ose Handling	with HS Clock		



4.5 Interfaces

The "Interfaces" tab covers configuration settings for

- Pulse interface including test option
- EEPROM interface
- GPIO Control
- UART remote interface.

Figure 11

asurements	Ultrasonic Measurement Control	Temperature Measurement Contro	General Control	Interfaces	Interrupt & Error	Handling	acam		
	Pulse Interface		GPIO	5			UART Int	terface Control *	
	Pulse Interface Control	Co	nfiguration SCK (SPI)	or RxD (UART) P	ort		CRC Control		
Enable Pulse General Update		In	put High Z 💌 0				UART CRC Polynomial		
Update by PI_U		GPIO 0			GPIO 1		UART CRC Reversed Or	der	
Output Mode		Configuration GPIO 0		Configuration	GPIO 1		UART CRC in Unreverse	ed Order 💌 👩	
Forward and Bi	ackward Pulses on 1 Line 🔹	0 Output	• 0	Output		• 0	UART Initial CRC Value		
Pulse Width		Select GPIO 0		Select GPIO 1			Initial CRC Value 0x000	and the second se	
10 🚔	9,766 ms	Pulse Interface->Pulse	• 1	Pulse Interface	e->Direction	• 1	UART CRC Mode	· <u>· · ·</u>	
	Pulse Interface Test	GPIO 2	GPIO 2 Configuration GPIO 2			GPIO 3			
	Update Pulse Interface	Configuration GPIO 2					Configured Settings		
	No. of Pulses	Output	• 0	Output(UART)	/Input High Z (S	PI) 💌 0	UART Wake Up Comma	and Enable	
	0,00000	Select GPIO 2		Select GPIO 3			Wake Up Command Er	nabled 💌 1	
-		General Purpose Out [2]	- 0	General Purpo	se Out [3]	• 0		Baud rate	
ļ	Minimum Distance 2 Pulses	GPIO 4 (QFN 4	GPIO 4 (QFN 40 only)			GPIO 5 (QFN 40 only)		Jaud Tate	
	10,742 ms	Configuration GPIO 4		Configuration GPIO 5		UART High Baud Rate			
Ti	me Between Internal Updates	Output	• 0	Output		• 0		-	
	3 🚖 2,93 ms	Select GPIO 4		Select GPIO 5			High Baud Rate Timeou 120 ms	rt 7	
No. of I	nternal Upd. between General Upd.	General Purpose Out [4]	• 0	General Purpo	ose Out [5]	• 0	UART High Baud Mode		
	0	GPIO 6 (OFN 4	D only)			Local Column		led by remote controller 💌 👩	
Exter	mal EEPROM Interface Control	Configuration GPIO 6					Class Made 6 UADT ID	0	
EEPROM	Interface Mode	Output	• 0				Clear Mode for UART IR UART INT cleared by re		
EEPROM	1 Disabled 📃 💿	Select GPIO 6					UART INT cleared by re		
EEPROM	Pull Up Enable	General Purpose Out [6]					UART	Data Message	
Interface	e Pull Ups Enabled 📃 🔳 🔳	Concrat Purpose Out [0]	0				Address	Length	
EEPROM	Slave Address						0 🚖	0	
80	A V						* Current Software Relea	se supports only SPI Interface	

4.6 Interrupt & Error Handling

On this tab error indicators and interrupt sources for remote interface can be selected.

Figure 12

Ieasurements Ultrasonic Measurement Control Temperature Measurement Control General Control Interfaces Interrupt & Error Handling acam	
tessurements Ultrasonic Messurement Control Temperature Messurement Control General Control Interfaces Interrupt & Error Handling acm Selected Error Indicators Interface Interrupt & Error Handling Interrupt Sources for Remote Interface Image: DDC Timeout Image: DDC T	



5 Software Menu

Beside main window, the software menu allows the opening of other windows. There are some menu items which are redundant to available buttons of main window.

5.1 File

5.1.1 Open Config

This dialog box allows the path selection of a configuration file, covering the register settings, necessary for a proper configuration of the GP30. After opening this file, the control settings are updated in the GUI.

5.1.2 Save Config

This menu item allows the saving of the current GUI control settings into a configuration file

5.1.3 **Close**

Close all open windows of the GP30 Evaluation software.

5.2 Tools

5.2.1 Run Measurement

Same function as "Start/Stop Measurement" button in "Measurement" tab of main window.

5.2.2 TOF Graph

Same function as "Open TOF Graph" button in "Measurement" tab of main window.

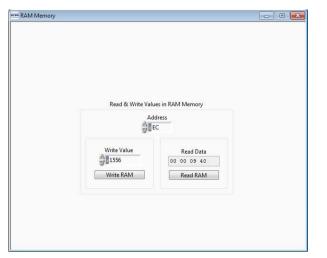
5.2.3 **Temperature Graph**

Same function as "Open Graph" button for temperature measurement in "Measurement" tab of main window.

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5.2.4 RAM Memory

Figure 13



5.2.5 Registers

Figure 14

ister	Settings	User Interfac	e	Register	Settings	GP30 RAM
	Configuratio	n Register UI		Config	uration Regi	ster GP30
0xC0	× 00230808	CR_WD_DIS		0xC0	× 00000000	CR_WD_DIS
0xC1	× 00230808	CR_PI_E2P		0xC1	× 0034010A	CR_PI_E2P
0xC2	× 00230808	CR_GP_CTRL		0xC2	× 00000044	CR_GP_CTRL
0xC3	× 00230808	CR_UART	Read Settings from GP30	0xC3	× 00003000	CR_UART
0xC4	× 00230808	CR_IEH	RAM and Transfer to GUI	0xC4	× 001F03FF	CR_IEH
0xC5	× 00230808	CR_CPM	Read and Transfer	0xC5	× 00680AE8	CR_CPM
0xC6	× 00230808	CR_MRG_TS	<	0xC6	× 00012100	CR_MRG_TS
0xC7	× 00230808	CR_TM	<	0xC7	× 00380004	CR_TM
0xC8	× 00230808	CR_USM_PRC		0xC8	× 00002824	CR_USM_PRC
0xC9	× 00230808	CR_USM_FRC		0xC9	× 03E68C83	CR_USM_FRC
0xCA	× 00230808	CR_USM_TOF		0xCA	× 00002808	CR_USM_TOF
0xCB	× 00230808	CR_USM_AM		0xCB	× 0000B481	CR_USM_AM
0xCC	× 00230808	CR_TRIM1		0xCC	x 04A0C07C	CR_TRIM1
0xCD	× 00230808	CR_TRIM2		0xCD	x C03765CF	CR_TRIM2
0xCE	× 00230808	CR_TRIM3		0xCE	× 00230808	CR_TRIM3
	SHR Regis	ter UI		S	HR Register	GP30
	TOF Rate			1	OF Rate	
	1				1	
	Start Hit Dela	v Window			tart Hit Delay \	Nindow
	0	, initiaetti			0	window .
	100					
	First Wave Le	vei Up			irst Wave Leve	l Up
	40				40	
	First Wave Le	vel Down		F	irst Wave Leve	I Down
	40				40	
				Read	GP30 Register	Settings

Opens a window which allows single write and read accesses to random access area for addresses 0x000 – 0x0FF.

The random access area from 0x100 – 0x17F, containing the firmware data, can be accessed separately by "Firmware Download" window.

Opens a window which shows the registers important for a proper configuration setting of the GP30. In the left column, the register contents correspond to the settings done in tabs of GUI main window. If the button "Read GP30 Register Settings" is pressed, the configuration settings located in GP30 registers are displayed in the right column,. By pressing "Read and Transfer" button, the register settings in the tabs of main window and in the left column of this window are updated with the register settings from right column.



5.2.6 Remote Commands

This window summarizes some additional commands which can be executed via remote interface.

- System Reset: Executes a complete system reset of GP30. Same function as "System Reset" button in "Measurement" tab of main window.
- System Init: Same function as "System Reset" without clearing the configuration (CR_...) and the system handling (SHR_...) register.

Figure 15

Remote Commands	
Remote communus	
System Reset	
System Init	
CPU Init	
SV Init	
Request Bus Master Release Bus Master	
Measure Cycle Timer Off Measure Cycle Timer On	
Clear Interrupt Flags	
Communication Request	
General Purpose Request	
Tag Measure Cycle Timer Off	

- CPU Init: Clears the CPU block in GP30
- SV Init: Clears the supervisor block in GP30
- FEP Init: Clears the frontend processing block in GP30
- Request/Release Bus Master: Allows the request of the bus master in GP30, e.g. if the random access bus is blocked by a deadlock, caused by an improper firmware download.
- Measure Cycle Timer Off/On: Stop & start of the measure cycle timer.
- Clear Interrupt Flags: Clears all bits in SRR_IRQ_FLAG register
- Communication Request: Allows an asynchronous demand by remote controller to get an interrupt by GP30, signalizing the time for remote communication
- General Purpose Request: Allows an asynchronous request by remote controller to initiate a general purpose handling in in firmware of integrated GP30 CPU.

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5.3 Firmware

5.3.1 Assembler

The TDC-GP30 assembler is integrated into the GP30 evaluation software. It is opened in the Firmware menu of the main program:

Figure 16

acar	ma	ain.	vi						
F	File Tools			Firmware	Calibration	on Help		_	
	Measureme		Assembler			rl+A	trol	Temp	
			Debugging		Ctrl+D			. emp	
				Firmware Download			ic Measur esults Tab		
	#		CPU Val	lues	Ctrl+V		esuits	Table	
			INdiffe			resuit	s / ns	Avera	
				SUM AVG UP SUM AVG DOWN			64558	3,4 6455	
							64558	,4	64558

The following window comes up:

Figure 17

acan aca	am Assemble	r						
File	Edit Find	Assembler Help)					
GP3	0Y_FW_v2.1.2	Compile	F5					
190 191	; ; Opera	Download Assembler Info	F6	ME_INT (32-bit Integer) and RAM_FLOW_VOLUME_FRACTION (32-bit Fraction)				
192	; Call	Settings	Ctrl+F5					
193	;							
194 195 196	;SM_SAV	E_FLOW_VOLUM	Æ:					
196 197 198	mul	t y,	x	; Flow (fd 16) * Volume multiplication factor (fd 44) ; Result with 4 int + 60 fd				
199								
200								
201		-		-> X Accu : 32 Fd				
202		ftR x,						
203		ftR x,		; Shifting out 28 fds from X moving 31:28 in the lowest 4				
204	and		0x000000					
205		e z,	-	; Moving Y content to Z for manipulation				
206	sn1 or	ftL z, x,		; Removing the 4 integer bits : X Accu : 32 bit Fractional bits				
207	Or	х,	4	; A ACCU : 52 DIL FRACTIONAL DITS				
208	• Cumul	ative Flow a	colume in	cubic meter per measurement cycle in RAM FLOW VOLUME INT & RAM FLOW VOLU				
209	, сошал	active fille v	orane in	CADIC MEDET DET MENSBIEMENE CYCLE IN KAM_FLOW_VOLDME_INT & KAM_FLOW_VOLD				
210	clr	c						
212		-	I FLOW VO	LUME FRACTION				
213	abs			; Taking absolute value of fractional part				
214	get	flag y		; Checking if original 64 bit was a negative number				
215				; If yes, then subtract abs(fractional part) and on carry				
21.6				: If no. then add fractional part and on carry increment				

This is a comfortable editor with syntax highlighting, search and replace, copy and paste functions.

Under menu item "Assembler" the user finds the compile and download options. The download option effects, that "Firmware Download" window is opened (see also below).



Whether the call of these functions was successful or not is indicated by the messages at the bottom of the assembler window.

5.3.2 **Debugging**

Not supported in this software revision.

5.3.3 Firmware Download

This window allows the download of the firmware which is typically handeld by 2 files, one for the "Firmware User Code" and one for the "Firmware Data".

Figure 18

		Firmware User (Code			Firmware D	ata		
Download Firmware	File: GP30Y_A1.F1.12.02	hex		File: GP30Y_A1.F1.12.02.dat		FW Data 1		FW Data 2	
Code and Data		00 F2 FB 62 4B 61 43 65 6	CA 20 E2 E2 E2 E2 EC 20 .		_	# Value	# Value	# Value	# Valu
1	Open File	A5 CB SF FF FF FC OC CB J		Open File		0 000A0000	32 00000000	64 00000000	96 00000000
			SE F2 DC 61 23 CA 00 35			1 00000000	33 00000000	65 00000000	97 00000000
	Reload File	CD F2 DC 0B CD 00 00 00 00 00 00 00 00 00 00 00 00 00	00 F2 DC F1 13 CF A5 62 01 F2 DC F1 0B C9 F0 00	Reload File		2 00000000	34 00000000	66 00000000	98 00000000
Check Status Flags	Neluad File		CB 74 F2 A5 7D 76 9B 73		_	3 00000000	35 00000000	67 00000000	99 00000000
		CB 74 F2 A6 7D CA FA EE 1	F2 5E 77 CB 54 CA FF 9B	Save File		4 00000000	36 00000000	68 00000000	100 00000000
Watchdog Disabled			FF 9B F3 00 77 CB 54 CA	C		5 00000000	37 00000000	69 00000000	101 00000000
	Download FW Code	FF 9B 82 7C CA F9 FF CF 1 CF CA F6 AA F3 6B 73 F2 1	F2 A6 73 F2 A5 33 87 7C DA 7C F2 DB 7C F2 5F 7F	Transfer Configuration Se		6 0000000	38 0000000	70 00000000	102 00000000
FW Unlocked	bonnoutri couc		00 04 31 F2 C5 62 43 F2	Transfer Configuration 3	ungs	7 00000000	39 00000000	71 00000000	103 00000000
			C3 F2 CA 73 CB 80 00 00	From GUI to FWD2 1st Hi	Level to FWD2	8 00000000	40 00000000	72 00000000	104 00000000
			73 CB 80 00 00 1F FF 09 78 CB 86 CB 54 CE 58 F2			9 00000000	41 00000000	73 00000000	105 00000000
			78 CB 86 CB 54 CE 58 F2 CB 54 CA FF 98 F2 95 7C		_	10 00000000	42 00000000	74 00000000	105 00000000
		F3 5B 73 F3 5C 77 F2 9E 1	78 CA F2 DC 8A 7C F2 9E	Set Bootloader Release (ode	11 00000000	43 00000000	75 00000000	107 00000055
		77 CE 51 70 01 2A 42 F9 0	CB 54 CE B0 CB 80 00 0F		_	12 00000000	44 00000000	76 00000000	108 AF0A7435
Download FW Code & Data		FF FF CE B9 CE 79 CB 85 0 F2 DC F1 17 C9 F0 00 00 0	01 F0 00 00 CB A1 89 7C			13 00000000	45 00000000	77 00000000	109 0034310A
Jownload PW Code & Data				Download FW Data		14 00000000	46 00000000	78 0000000	110 00000044
				Recall FW Data		15 0000000	47 00000000	79 00000000	111 00001000
Lock FW after Download	Checksums			Recall FW Data		16 00000000	48 00000000	80 00000000	112 011F03FF
LOCK PW after Download				Read FW Data		17 00000000	49 00000000	81 00000000	113 00280AE8
J	Calc	ulated by Software A727				18 00000000	50 00000000	82 00000000	114 00016080
		Calculated by GP30	PASS	Checksums FWD		19 00000000	51 00000000	83 00000000	115 00F99400
				circustino i irro.		20 0000000	52 00000000	84 00000000	115 00099400
		Read from FWD2 A727	PASS	Calculated by Software		21 00000000	53 00000000	85 00000000	118 00002824 117 03E48C83
					PASS	22 00000000	54 00000000	86 00000000	118 00000C10
Verify FW	AIF	1202 User FW Revision	40 User FW Range	Calculated by GP30		23 00000000	55 00000000	87 00000000	119 0000B481
	<u></u>		Read from FWD2	PASS	24 00000000	56 00000000	88 00000000	120 04A0C07C	
		Firmware Acam C			25 00000000	57 00000000	89 00000000	120 04A0C0/C	
	Checksums			Checksums FWD	2	26 0000000	58 00000000	90 00000000	122 00230808
	checksums					27 00000000	59 00000000	91 0000000A	123 ABCD765
		alculated by GP30 3BCFC		Calculated by Software 11D9		28 0000000	60 00000000	92 00000BB8	123 ABCD/65
Erase FW		Read from FWD2	PASS	Calculated by GP30 11D9	PASS	29 00000000	61 00000000	93 0000055	125 000011D9
1.135		Read from PV/D2 23BCFC	PASS		PASS	30 0000000	62 00000000	94 00000000	125 00001109 126 0000A727
	B3BCFC Ch	ecksum FWA manual entry	A1A11201 acam FW Revisio	Read from FWD2 11D9	PASS	31 00000000	63 0000000	95 00000000	128 0000A727
	a socie		Entrated account of the the			31 0000000	65 0000000	93 00000000	12/ 0003BCFC

- With "Check Status Flag", the watchdog and the lock state of the GP30 can be checked. Please make sure that the watchdog is disabled before starting a download or other transactions in this window.
- In the "Firmware User Code" section, a firmware user code file (*.hex), which is typically generated by the assembler tool and intended for the user part of 4kx8 Program NVRAM, can be loaded by pressing "Open File".
- In the "Firmware Data" section, a firmware data file (*.dat), which is intended for the 128x32 Data NVRAM, can be loaded by pressing "Open File". This section also contains some additional transfer options from GUI to FW Data 2 fields and from GP30 back to FW Data 2 fields.
- By pressing "Download FW Code & Data" both files are stored in the corresponding NVRAMs. This action takes a few seconds. After the download, both files are located in the volatile as well in the non-volatile part of the appropriate NVRAMs. The download can be combined with a lock option of the firmware.

- When pressing "Download FW Code & Data" a possible auto running firmware program is stopped. If a new proper auto running firmware program is downloaded, this firmware can be started again by performing a system reset.
- The last 4 addresses of FW Data 2 section contains the fields for the checksums which are stored to GP30 when downloading firmware to GP30. These fields are directly updated, when firmware files are loaded or contents of firmware data fields are changed.
- If pressing the "Verify FW" button after downloading, the content of the NVRAMs can be compared with the given files by their checksums. The software calculates the checksum of the given files and reads the calculated checksums of GP30 as well as the stored checksums at the end of FWD2 section. Then the checksums of every section are compared to each other. In case of a successful programming all indicators have to be green.
- In the "Firmware Acam Code" section, the checksums for the firmware acam code are also checked and displayed after a "Verify FW". The firmware acam code cannot be modified by user. Therefore a checksum calculated by software filed is missing in this section.
- A lock state of GP30 or a hang-up, caused by a faulty firmware user code can be dissolved by pressing "Erase FW" button. After that, a new firmware (user code & data) need to be downloaded again.

5.3.4 CPU Values

This tab is only for customer who uses the acam firmware for flow calculation. It reads out some important CPU values like water temperature, flow, velocity, etc. To enable the readout the "Read calculated values" checkbox has to be set.



Figure 19

con CPU values										
File Edit Operate	Tools	Window Help								
Set fo	or u	using on-chip	o firmw	are						
			Aeasurement alculated value	:5		Open CPL	J Graph CPU Resul			
	#	Name	Results	Unit	#	Name	Resul		Init	
	1	Temperature	30,28	°C	1	Flow	0,000		iter / Hour	
	2	Sound Velocity	1510,36	μs	2	Flow averaged	-0,062		iter / Hour	
					3	Volume Flow	0,00000		n^3	
		CPU Results with ext. Ten	CALCULATION CONTRACTOR	CONTRACTOR OF THE OWNER	4	Volume Flow	0,000	L	iter	
	#	Name	Results	Unit	5	Flow Speed	-0,00	n	n/s	
	1 Temperature Cold 2 Temperature Hot		0,00	°C	CPU TOF Values					
			0,00	°C						
	3	Resistance Cold Sensor	0,00	Ohm	#			Results		
	4	Resistance Hot Sensor	0,00	Ohm	1	TOF sum		141777,25		
	5	Temperature Internal	0,00	°C	2	TOF diff		-0,0648	ns	
		Address 1	* \$	Mult. Factor : 0 Mult. Factor 0 Mult. Factor	1	Calculated = 0 Calculated = 0 Calculated	Result 2			
4		0	* 7	0		= 0				,

5.4 Calibration

Not supported in this software revision

5.5 Help

When moving the cursor over the values in tabs of main window, the parameter name (used in the GP30 manual) is displayed. By right-click and selection of "Description and Tip", a window is opened showing additional description of the value.

ause 1,0 * T(BF_SEL) in ms		4
se 1,0 " 1 (BF_SEL) in ms	USM_PAUSE	4

Ultrasonic Pause Handling" Description	
USM_PAUSE> CR_USM_PRC (0x0C8)	
Selects pause time between 2 ultrasonic measu	irements
	-
Jltrasonic Pause Handling" Tip	

5.5.1 Help Contents

Not supported in this software revision

5.5.2 **USB Communication**

As described in chapter "Software Installation".

5.5.3 About

Displays software version number together with general information about software and acam.

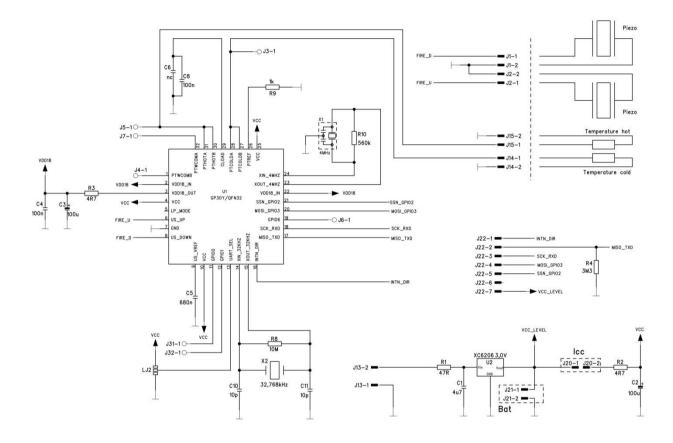
20



6 Development Board Hardware Details

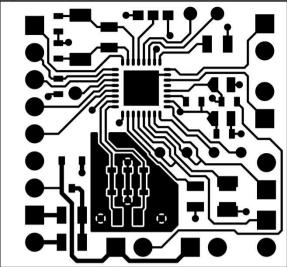
6.1 Schematics / Layout

Figure 20 Schematics



GP30-DEV-KIT

Figure 21 Top layer



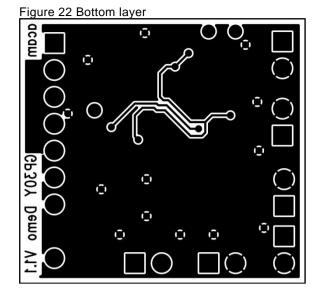
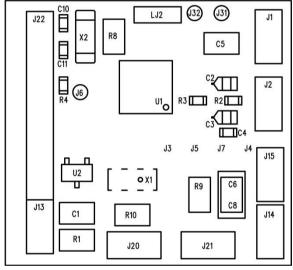


Figure 23 Assembly





6.2 Bill of Materials

Table 6.1 GP30-DEMO-US-PCB BOM

Qty	Reference	Value	Part	Description
1	U1	GP30	QFN32	TDC GP30
	U2	3,0 V	XC6206	Voltage Regulator
1	X1	4 MHz	CSTR_G	Ceramic Resonator
1	X2	32,768 kHz	KX-327XS	Quartz Crystal
1	C1	4u7	C805	Chip Capacitor
2	C2, C3	100u	F95_P	Solid Tantalum
1	C4	100n	CC603	Chip Capacitor
1	C5	680n	C805	Chip Capacitor
1	C6	nc	C805	Chip Capacitor
1	C8	100n	C1206	Chip Capacitor
2	C10, C11	10p	CC603	Chip Capacitor
1	R1	47R	R805	Chip Resistor
2	R2, R3	4R7	R603	Chip Resistor
1	R4	3M3	R603	Chip Resistor
1	R8	10M	R805	Chip Resistor
1	R9	1k	R805	Chip Resistor
1	R10	560k	R805	Chip Resistor
1	J13	2 pol.	ST/254_2	Connector for power supply (combined with J22)
1	J22	7 pol.	ST/254_7_1 R	Connector for SPI interface (combined with J13)
1	J20	2 pol.	ST/254_2	Jumper for current measurement of Vcc
1	LJ2	3 pol.		Solder bridge to select between SPI & UART

7 Miscellaneous

7.1 Literature Guide

Datasheets

Title	Document-No.
TDC-GP30 Datasheets	DB_GP30_Vol1.en
	DB_GP30_Vol2.en
Development kits	DB_GP30-DEV_en

Application Notes

Title	Document-No.

The latest versions of the available documents can be downloaded from the acam website at:

http://www.acam.de/download-center/ultrasonicflowconverter/

7.2 Last Changes

18.03.2015 First release







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