

GP30

Reference Board

GP30-DEV-KIT

ams Demo Kit Manual [v1-00] 2016-Aug-08 Page 1 Document Feedback

Content Guide

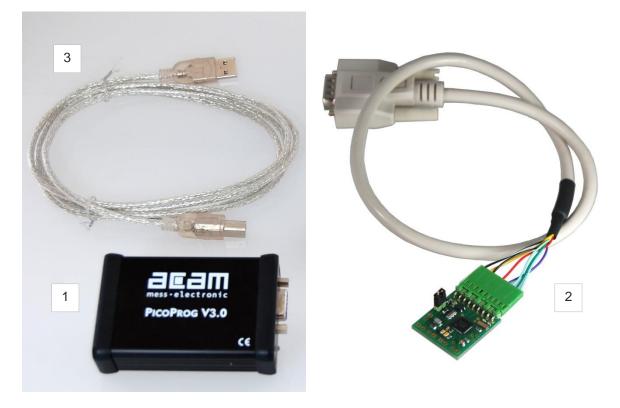
1	Introduction
2	Quick Start Guide
2.1	Install the Software
2.2	Install the Hardware:
2.3	Quick Start for Initial Measurements
3	Hardware Description
3.1	Introduction
3.2	Communication Interface
4	Software Description
4.1	Measurement7
4.1.1	First step with measurement control elements7
4.1.2	Time of Flight Measurement Results
4.1.3	2-Wire Temperature Measurement Results
4.2	Ultrasonic Measurement Control
4.3	Temperature Measurement Control11
4.4	General Control
4.5	Interfaces
4.6	Interrupt & Error Handling 14
5	Software Menu
5.1	File
5.2	Tools
5.3	Firmware
5.4	Help
6	Schematics, Layers and BOM
7	Ordering & Contact Information
8	Copyrights & Disclaimer
9	Revision Information



1 Introduction

The GP30-DEV-KIT is a platform for a quick and easy start-up and evaluation of the TDC-GP30 ultrasonic flow converter (UFC). It supports the QFN32 package, which offers the functionality need for standard water and heat meters. 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.





Pos.	Item	Comment
1	PICOPROG V3.0	Programmer and interface
2	GP30-DEMO MODULE	Based on TDC-GP30 in QFN32 package
3	USB cable	Connects PicoProg V3.0 to PC

Please download the latest software for the kit from http://www.acam.de/download-center/ultrasonicflowconverter/

2 Quick Start Guide

This section describes how to quickly set up the GP30-DEV-KIT, establish basic operation and make measurements.

2.1 Install the Software

It is crucial to install the software before connecting the evaluation kit to your computer. A default driver loading of your OS may interfere with correct installation.

- Download the latest zipped software installation package to the desired directory.
- Unzip the package to the desired directory.
- Open "setup.exe" from the unzipped directory.
- Follow the instructions on the screen.

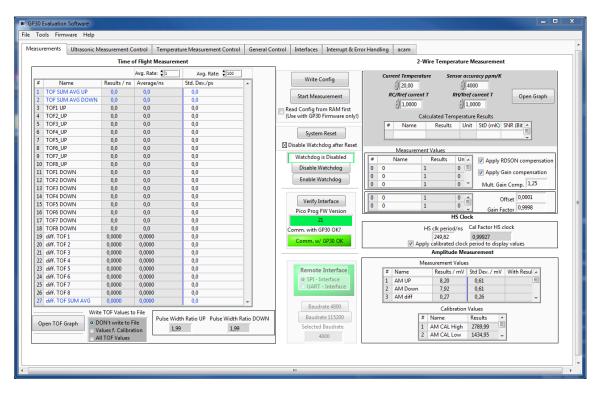
2.2 Install the Hardware:

- Make sure software is installed correctly before proceeding with this step!
- Connect your computer with the PicoProg V3.0 using USB cable.
- Connect PicoProg V3.0 and the evaluation kit motherboard using the DB15 interfaces
- The green LED on the evaluation kit should be on.
- Connect your spool piece to US_UP and US_DOWN

2.3 Quick Start for Initial Measurements

From the "Start" menu, go to "All Programs" and then to the "acam" directory. Double click the "GP30_v1_5_3" icon (or newer versions, if available) to begin execution of the evaluation software. The following screen should appear:

Figure 2: Measurement Page





- Click the "Verify Interface" button to confirm communication between PicoProg V3.0 and TDC-GP30 is working. Both fields, "Pico Prog FW version " and "Comm. With GP30 OK?" should become green.
- 2. Next, open our configuration GP30Y_config_default_A1.A2.11.03 and download it into the chip, pressing "Write Config".
- 3. Connect your spool piece to pins US_UP and US_DOWN.
- 4. Press "Start Measurement" to begin measuring.

At this point, after successful completion of the above steps, a basic operation of the EVA kit should be possible. The following sections provide a detailed description of the hardware and software for advanced operation.

Figure 3: PICOPROG registry



If PICOPROG is not displayed correctly then go to the drivers folder , e.g. C:\Program Files (x86)\acam-messelectronic\GP30\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. For manual installation open the USB communications window and check the firmware version of the PICOPROG. It should be version PicoProg_GP30_v21.hex or higher:

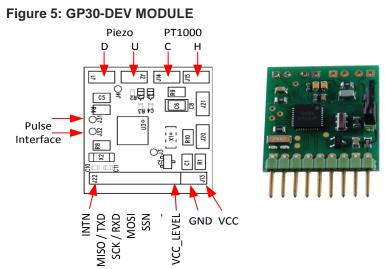


an main.vi				attain USB Communications	
File Tools Firm	nware	Help		PicoProg Settings	
Measurements	Ultra	Help Contents	F1		
	(Materia)	USB Communication	: Ctrl+U	Disable USB Handle	
		About	F12	PicoProg FW Path	
P		r i		C:\Users\GP3\GP30Y Software\PicoProgFW_GP30_v20.hex Change	
				GP30 Communication	
				Last_Com_Action Read_Res	
				stop_meas Comm w/ GP30 OK USB Error	

3 Hardware Description

3.1 Introduction

The GP30-EVA MODULE board, shown in figure 3, s the 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). All ports of TDC-GP30 are available. Additional patch fields allow an easy extension with additional circuits. Those can be amplifiers or analog switches for operation in gas meter mode.



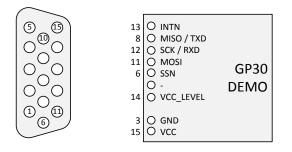
3.2 Communication Interface

The PICOPROG device is a USB-to-SPI converter box that interfaces all UFC evaluation systems. With version 3.0, the PICOPROG also supports the USB-to-UART conversion of TDC-GP30. The PICOPROG is registered by the operating system initially as "picoprog v3.0 unprogrammed". As soon as the GP30 evaluation software starts, a special firmware is written into the PICOPROG to handle the SPI or UART communication with the TDC-GP30. The PICOPROG is now listed as "UNIPRO" in the device manager. For SPI communication only, PICOPROG version 2.0 is sufficient.

Figure 4 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 the 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 6: SUBD15 Connector



ams Demo Kit Manual [v1-00] 2016-Aug-08

4 Software Description

4.1 Measurement

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

Figure 7 Main window

 GP30 Evaluation Software 							x
File Tools Firmware Help							
Measurements Ultrasonic M	1easurement C	ontrol Temper	ature Measurement Control	General Con	trol Interfaces Interrupt & Erro	or Handling acam	^
	Time o	of Flight Measure	ment			2-Wire Temperature Measurement	
		Avg. Rate: 🗐 1	Avg. Rate: \$100			Current Temperature Sensor accuracy ppm/K	
# Name	Results / ns	Average/ns	Std. Dev./ps	<u> </u>	Write Config	() 20,00 () 4000	
1 TOF SUM AVG UP	0,0	0,0	0,0				
2 TOF SUM AVG DOWN	0,0	0,0	0,0		Start Measurement	openoloph	
3 TOF1 UP	0,0	0,0	0,0	1 I.	Read Config from RAM first	() 1,0000	
4 TOF2_UP	0,0	0,0	0,0	1.1	(Use with GP30 Firmware only!)	Calculated Temperature Results	
5 TOF3_UP	0,0	0,0	0,0		-	# Name Results Unit StD (mK) SNR (Bit ^	
6 TOF4_UP	0,0	0,0	0,0		System Reset		
7 TOF5_UP	0,0	0,0	0,0				
8 TOF6_UP	0,0	0,0	0,0		Disable Watchdog after Reset	Measurement Values	
9 TOF7_UP	0,0	0,0	0,0		Watchdog is Disabled		
10 TOF8_UP	0,0	0,0	0,0		Disable Watchdog	# Name Results Un ▲ ✓ Apply RDSON compensation 0 0 1 0 ■	
11 TOF1 DOWN	0,0	0,0	0,0		Disable watchdog		
12 TOF2 DOWN	0,0	0,0	0,0		Enable Watchdog		
13 TOF3 DOWN	0,0	0,0	0,0			0 0 1 0 • Mult. Gain Comp. 1,25	
14 TOF4 DOWN	0,0	0,0	0,0			0 0 1 0 Cffset 0,0001	
15 TOF5 DOWN	0,0	0,0	0,0		Verify Interface	0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	E
16 TOF6 DOWN	0,0	0,0	0,0		Pico Prog FW Version	Gain Factor 0,5550	
17 TOF7 DOWN	0,0	0,0	0,0		21	HS Clock	
18 TOF8 DOWN	0,0	0,0	0,0		Comm. with GP30 OK?	HS clk period/ns Cal Factor HS clock	
19 diff. TOF 1	0,0000	0,0000	0,0			249,82 0,99927	
20 diff. TOF 2	0,0000	0,0000	0,0		Comm. w/ GP30 OK	Apply calibrated clock period to display values	
21 diff. TOF 3	0,0000	0,0000	0,0			Amplitude Measurement	
22 diff. TOF 4	0,0000	0,0000	0,0			Measurement Values	
23 diff. TOF 5	0,0000	0,0000	0,0		Remote Interface	# Name Results / mV Std Dev. / mV With Result	
24 diff. TOF 6	0,0000	0,0000	0,0		SPI - Interface	1 AM UP 8.20 0.61	
25 diff. TOF 7	0,0000	0,0000	0,0		O UART - Interface	2 AM Down 7.92 0.61	
26 diff. TOF 8	0,0000	0,0000	0,0			3 AM diff 0,27 0,26	
27 diff. TOF SUM AVG	0,0000	0,0000	0,0 -	-		3 Alvi diff 0,27 0,20 +	
Write	e TOF Values t	o File		_	Baudrate 4800	Calibration Values	
		Dulse W	idth Ratio UP Pulse Width Rati	io DOWN	Baudrate 115200	# Name Results A	
	ON't write to F alues f. Calibra		99 1,99	r I	Selected Baudrate	1 AM CAL High 2789,99	
	alues F. Calibra II TOF Values	tion	4,55		4800	2 AM CAL Low 1434,95 +	
()A	in tot values						
							-
•							

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). ams provides a sample configuration file named GP30Y_config_default_A1.A2.11.03 which typically works well with DN20 spool pieces.

Load configuration file: File menu \rightarrow Open Config \rightarrow choose appropriate configuration 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). Further, "Comm GP30 OK?" should get green to show that communication with TDC-GP30 works.
- Next step: If watchdog is not disabled by "System Reset" button → press "Disable Watchdog" button.
- Next step: Press "Write Config" button to download the configuration settings into TDCX-GP30.
- **Next step:** Press "Start measurement" button. Now the chip starts to measure and the software displays the results in the table "Time of Flight Measurements".

The user can now modify the configuration to fit it to his needs. Having done this, 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. These 9 results are displayed for both directions, as we call them up and down. The evaluation software additionally calculates the difference between up and down stream, 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). 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.

Note: The high speed calibration is by default off. This is more convenient when comparing measurement data. But when collecting data for calibration it is strongly recommended to have this active.

Figure 8 HS Clock calibration

HS Clock	
HS clk period/ns Cal Factor HS clock	
249,81 0,999257	
Apply calibrated clock period to display values	

A graph to display TOF measurement results opens in a separate window by pressing "TOF Graph" button

It is possible to activate up to four plots. Each plot has various selections, e.g. TOF1UP, TOF2UP etc.. Always averaged values are displayed.

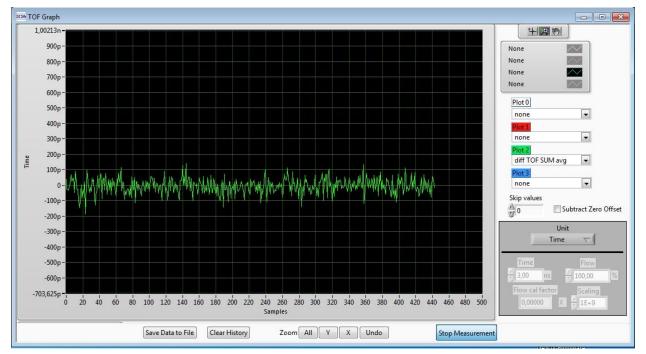


Figure 9 TOF Graph

The measurement data can be exported into text files, either the main values for calibration only, or the full data.

ams Demo Kit Manual [v1-00] 2016-Aug-08

Figure 10 Data export for calibration

	А	В	С	D	E	F	G	Н	Ι	J	К	L
1	08.08.2016 16:18	s Elapsed	diffTOFSu	sumTOFS	diffTOF1	sumTOF1	PW UP	PW DOW	AM UP	AM DOW	Status Re	gister
2	16:18:50	0	0,000000	0,000000	0,000000	0,000000	1,992,187	1,992,187	7,168,211	6,991,830		FFFFFFF
3	16:19:03	13,69	0,000000	0,000000	0,000000	0,000000	1,992,187	1,992,187	7,152,268	7,215,327		FFFFFFF
4	16:19:04	14,03	0,000000	0,000000	0,000000	0,000000	1,992,187	1,992,187	7,152,268	7,215,327		FFFFFFF
5	16:19:04	14,49	0,000000	0,000000	0,000000	0,000000	1,992,187	1,992,187	8,988,957	9,103,998		FFFFFFF
6	16:19:05	15,02	0,000000	0,000000	0,000000	0,000000	1,992,187	1,992,187	9,177,363	9,125,247		FFFFFFF

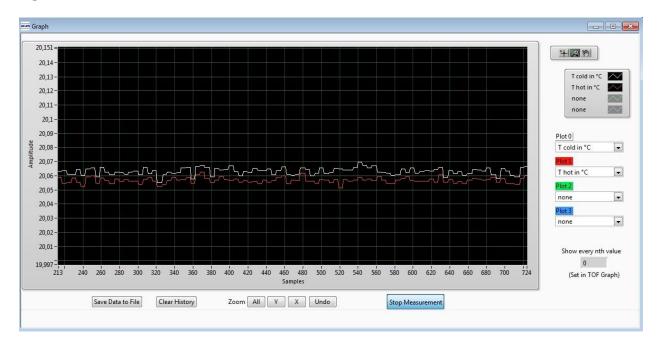
Figure 11 Dat export complete

	A .	B	C	D	E	F	G	н	1	J	K	L	M	N	0	P	Q	B	s	Т	U	v	V	×	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AL
1	****	## s Elaps	e TOFSur	n TOFSum	TOF1up	TOF2 up	TOF3 up	TOF4 up	TOF5 up	o TOF6 up	TOF7 up	p TOF8 up	TOF1dov	TOF2 do	TOF3 do	TOF4 dor	TOF5 do	TOF6 do	TOF7 do	TOF8 do	diff. TOF	diff. TOF	diff. TOF	diff. TOF4	diff. TOF	PW UP	PW DOW	AMUP	AMBOW	Status R	egister				
2	16:15	E10	0 0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00					0,00000												1,99	8,89	9,10		FFFFFFFF
3	16:19	22 12,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00					0,00000												1,99	9,26	8,81		FFFFFFFF
4	16:19	22 12,30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	1,99	1,99	9,26	8,81		FFFFFFFF
5	16:19	23 12,75	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00					0,00000												1,99	8,81	8,46		FFFFFFFF
6	16:19	23 13,30	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00					0,00000												1,99	8,18	8,41		FFFFFFFF
7	16:19	24 13,79	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	1,99	1,99	6,81	6,91		FFFFFFFF

4.1.3 2-Wire Temperature Measurement Results

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

Figure 12



4.2 Ultrasonic Measurement Control

In this tab the user makes all settings for an appropriate ultrasonic measurement. They group as follows:

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

Figure 13

GP30 Evaluation Software								- • ×
File Tools Firmware Help								
Measurements Ultrasonic Measurement Control	Temperature Measurement Control	General Control	Interfaces	Interrupt & Error Hand	ling acam			<u>^</u>
Time of Flight: Sequence Control					Direc	tion Mode		
TOF Rate	Ultrasonic Pause Handling		Davias hatva	en TOF Up and TOF Dow	Tee	gle Direction with every Mea	isurement 💌 2	
Zero Cross Calibration Rate	Pause 1,0 * T(BF_SEL) in ms	▼ 4	Pause betwe	20.00 ms		e Of Flight Edge Mode	2	
Every 50th Sequence Cycle Trigger 🔹 🕫		4				sitive Edge of TOF Hit	▼ 0	
Fire Pulse Clock Divider Register Setting HS Clock Divisor	Number of Fire Pulses	1	Noise Mask Wi	ndow		neout TOF		
3 🜩 4	25		40 🗘	39,6 µs	128	3 μs 💌 0		
Time Of Flight: Hit Control								
Time Of Flight: Hit Control		Start Hit Mode						
No. of TOF Hits		Start Hit by First	Hit Detection	• 0	First Hit Lev	vel Up ≑ 74,8 mV		
12 Hits TOF Hits Stored in F	Front End data Buffer	Selected Start Hir	t after First Hit		Eirst Hit Lev		First Hit Polarity	_
No. of ignored Hits Sum of All TOF and	d first 8 TOF values 🔹 1	9. Hit		- 8		⇒ 74,8 mV	Positive 💌 0	-
0 Hits 💌 0		Start Hit Delay V						
		0 🖨 0	ns		🗹 Enable Pu	ulse Width Detection		
Amplitude Measurement Control								
Amplitude Measurement Rate Every TOF Measurement	_							
Every TOF Measurement		Amplitude Meas After 8 Hits	urement Peak	▼ 8				
Every 20th Amplitude Measurement 👻	5			8				
Transducer Interface Options								
Transducer Interface Select								
Fire Buffer 1 & Receive Path 1 Selected	• 1				nable Analog S nable Precharo	Switches in both US buffer ge Transistors in both US Buf	fer	
Enable External Receive Amplifier (QFN 40			Enable	Gas Meter Mode 🛛 🗷 E	nable Pull-Dov	wn Transistors in both US Bu		
Enable External Receive Amplifier (QHV 40	oniy)				nable Both Rec nable Both Fire	ceive Path Transistors e Buffer		
<pre></pre>								

The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

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 14

main.vi					
File Tools Firmware Help					
Measurements Ultrasonic Measurement Control	Temperature Measurement Control	General Control Interfaces	Interrupt & Error Handling	acam	*
Measurements Ultrasonic Measurement Control Sequence Control Measurement Ri Temperature N Port Measureme I. Default Ord Wire Mode * 2-Wire Measurement M External Resist * Current Softwa	epetion Rate leasurement every: 4	Lence Cycle Triggers	Temperature Measurement Su Only One Measurement Pause between Tempera N/A	ubtask Handling (Pause Time) per Cycle 💌 👔	E
٤		111			

The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

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 15

iin.vi							
Tools Firmware Help							
easurements Ultrasonic Measurem	ent Control Temp	erature Measurement Control	General Control	Interfaces	Interrupt & Error Handlin	g acam	
Task Sequencing				AT			
Set Cycle Time of Task Sequencer	Select Base Freque	ncy for Pause Times		Enable Ta	sk Sequencer Restart		Bandgap Pulse Mode
Cycle Time Task Sequencer	Base Frequ	uency Select		Task Sequence	er Start Mode		Synchronized with task sequencer
256 A	BF_SEL =	50 Hz 💌 0 Ta	sk Sequencing Starts	Only if Rem	ote Interface is Idle	▼ 0	Synchronized with task sequencer
ligh Speed Clock Control							
Settling Time			High Speed Clock S	elect			HS_CLK Calibration Rate
135 µs 💌 2	1		4MHz 💌	0			Every 20th Sequence Cycle 🗾 5
Disabled	0	40	÷ 3,13 V	/olt			0,00 Read Measured Vcc
CPU Handling							
Enable Post Processing	📰 32-bit CPU Ena	ble					
Post Processing Mode				Enable (General Purpose Timer Requ	(est	Checksum Execution after Bootloader
Post Processing after every Measure	ement Cycle	▼ 0		Endbie	seneral rapose nine neq	(CSC	
Timer							
			General Purpose T	imer			
Update Mode for Time Stamp	Value		1 hour 💌)			Checksum Timer
Updated Automatically every seco	ond 💌 1						Checksum Timer Disabled 💌 0
			🔲 General Purp	ose Handling	with HS Clock		
				III			

The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

Firmware

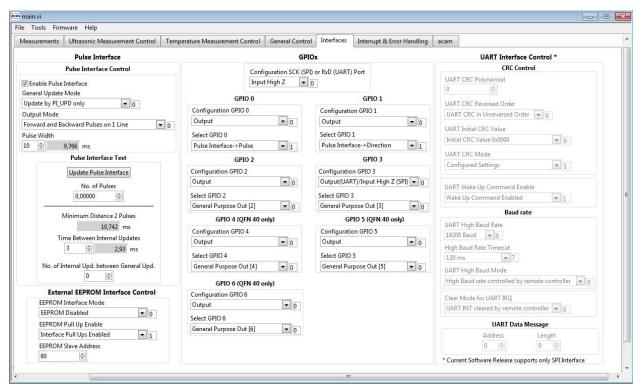
In case the TDC-GP30 has firmware, setting flag "Enable post processing" turns on the CPU (flow meter mode). Having this not set, the GP30 runs as front-end in time conversion mode.

4.5 Interfaces

The "Interfaces" tab covers configuration settings for

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

Figure 16



The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

Pulse Interface

The pulse interface needs an appropriate firmware in the chip. This settings in the evaluation software only generate an artificial pulse to test the general functionality. But it is not related to any measurement.

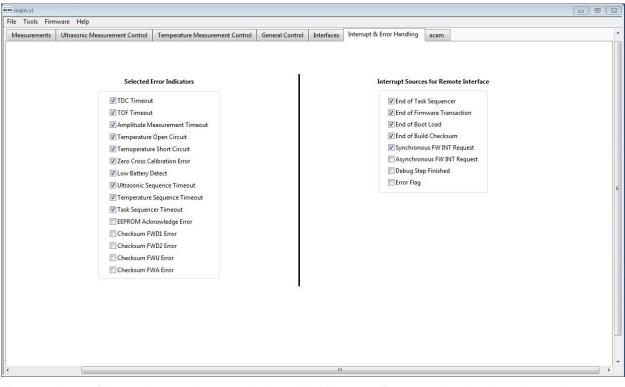
UART

The UART is not supported in this software version.

4.6 Interrupt & Error Handling

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

Figure 17



The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

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

• 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.

• Save Config

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

Close

Close all open windows of the GP30 Evaluation software.

5.2 Tools

Run Measurement

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

• TOF Graph

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

• Temperature Graph

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

RAM Memory

Figure 18

RAM Memory			
		ues in RAM Memory	
	Ac	ldress EC	
	Write Value		
	1556	Read Data	
	Write RAM	Read RAM	

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.

• Registers

ers						
		User Interface n Register UI			Settings uration Regi	GP30 RAM
-	configuratio	in Register of		coning	uration keyi	ster GP30
0xC0 0xC1 0xC2 0xC3 0xC4 0xC5 0xC6 0xC7 0xC8 0xC9 0xCA 0xCB 0xCC 0xCD	x 00230806 x 00230808 x 00230808	CR_UART CR_IEH CR_CPM CR_MRG_TS CR_TM CR_USM_PRC CR_USM_PRC CR_USM_FRC CR_USM_TOF CR_USM_AM CR_TRIMI	Read Settings from GP30 RAM and Transfer to GUI Read and Transfer <	0xC5 0xC6 0xC7 0xC8 0xC9 0xCA 0xCB 0xCC	× 0000000 × 0034010A × 00000044 × 00003000 × 001F03FF × 00680AE8 × 00012100 × 00380004 × 00380004 × 00802808 × 00002808 × 00008481 × 04A0C07C	CR_WD_DIS CR_PI_E2P CR_GP_CTRL CR_UART CR_IEH CR_CPM CR_MRG_TS CR_TM CR_USM_PRC CR_USM_PRC CR_USM_FRC CR_USM_TOF CR_USM_AM CR_TRIMI CR_TRIMI
0xCE	× 00230808	CR_TRIM3		0xCE	× 00230808	CR_TRIM3
	SHR Regis	ter UI		s	HR Register	GP30
	TOF Rate 1 Start Hit Dela 0 First Wave Le 40 First Wave Le 40	vel Up		5	FOF Rate 1 Start Hit Delay 1 0 First Wave Leve 40 First Wave Leve 40	IUp
				Read	GP30 Register	Settings

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.

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 20

Remote Commands	
System Reset Recall FW Code System Init CPU Init SV Init FEP 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.



5.3 Firmware

Assembler

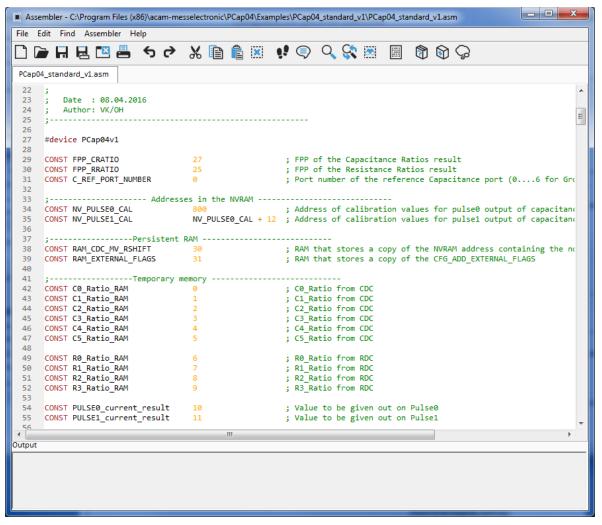
The TDC-GP30 assembler is integrated into the GP30 evaluation software. It is opened in the Firmware menu of the main program:

Figure 21

a	acan main.vi									
ſ	File Tools		Firmware	Calibration	Н	elp	_			
	Measureme		Assembler		Ctrl+A trol		Temp			
					Debugging		Ctr	rl+D		
			Firmwa	re Download			ic Mea esults	Table		
			CPU Va	lues	Ctr	rl+V	esuits			
		#			INdiffie		_	resuit	s / ns	Avera
			SUM AVG	UP		64558	,4	64558		
			SUM AVG	DOWN		64558	,4	64558		

The following window comes up:

Figure 22



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.

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".



Download_GP30_FW.vi					
	Firmware User Code	Firmware Data			
Download Firmware	File: GP30Y_A1.D2.11.03.hex	File: GP30Y_A1.A2.11.03.dat	FW Data 1 FW Dat	a 2	
Code and Data	Open File 00 C9 0F D3 CA 0F D0 F2 DC 61 13 CA 0F CD F2 DC 61 23 CA 00 1F F2 DC 62 07 61 0F CD C9 F0 00 00	Open File	# Value # Value # Value		
Start Measurement	F2 DC F1 3 CF 00 </td <td>Reload File</td> <td>0 00000000 32'1A312D53 64'FFFA3B9B 1 00000000 33 2F414C49 65 00000000 2 00000000 34 26484C8B 66 0000000</td> <td>97 03E80000 98 00000000</td>	Reload File	0 00000000 32'1A312D53 64'FFFA3B9B 1 00000000 33 2F414C49 65 00000000 2 00000000 34 26484C8B 66 0000000	97 03E80000 98 00000000	
System Reset		Save File	3 FFFFFFF 35 2E2C6372 67 00000000 4 FFFFFFF 36 1C5B6082 68 00000000 5 00000000 37 494B55B4 69 00000000	99 0000000 100 0029F000 101 0000000	
Check Status Flags	Download FW Code 00 00 00 00 00 00 00 00 00 00 00 00 00	Transfer Configuration Settings From GUI to FWD2 1st Hit Level to FWD2	6 0000000 38 50585884 70 0000000 7 0000000 39 68715C7C 71 0225000 8 0000000 40 71675873 72 0225000	102 0000000 103 03C20000 104 00010000	
Watchdog Disabled	00 00 00 00 00 00 00 00 00 00 00 00 00	Set Bootloader Release Code	0 00000000 41 0000000 71 02250000 9 00000000 41 0000000 73 02250000 10 00000000 42 FEE90711 74 00061400 11 00000000 43 FFFFF713 75 002CA2E2	105 00010000 106 38000110	
FW Unlocked		Download FW Data	12 00000000 44 0004C4C 76 000F6C3A 13 00000000 45 FF2B3F9 77 004A002B 14 00000000 46 FFFE6A3 78 0000020	108 95659C6A	
Download FW Code & Data	Checksums	Recall FW Data	15 0000000 47 00006161 79 00000755 16 6004010C 48 FF86F4CD 80 0007FFFF	111 10215000 112 0111F3FF	
System Reset and Start Measurement	Calculated by Software 5599 Calculated by GP30 5599	Checksums FWD1	17 D4A75A32 49 FFFFEF04 81 0001FFFF 18 0000000 50 00001BFB 82 0009C400 19 0000067 51 FF997E5B 83 0000001	113 004ECAE8 114 0091E080 115 00793400	
Lock FW after Download	Read from FWD2 1599	Calculated by Software 11CC	20 000004F9 52 FFFEB73 84 00200000 21 000007AB 53 000057F4 85 003C0000 22 00000B07 54 000CB86D 86 00000000	116 01002824 117 03E70C83 118 00002C10	
	A1D21103 User FW Revision 440 User FW Range	Calculated by GP30 11CC OPASS Read from FWD2 11CC OPASS	23 0000007 24 000012DF 56 001C8A44 58 0000000 58 000000 58 0000000 58 0000000 50 000000 50 000000 50 000000 50 000000 50 000000 50 0000000 50 0000000 50 000000 50 000000 50 000000 50 000000 50 000000 50 0000000 50 0000000 50 000000 50 0000000 50 00000000 50 000000000 50 00000000 50 0000000000	118 00002C10 119 0000D081 120 84A0C47C	
Verify FW	Checksums	Checksums FWD 2	25 00001B53 57 00357176 89 00000004 26 00002C4A 58 0097C276 90 00000010	121 401725CF 122 00270808	
	Calculated by GP30 6638A Read from FWD2 6638A	Calculated by Software 5828 Calculated by GP30 5828	27 000040AD 59 0000724A 91 0000000A 28 000054A4 60 00000F5C 92 00000B88 29 00012170 61 000004BD 93 FFFA0000	123 ABCD7654 124 000011CC 125 00005828	
Erase FW	O Checksum FWA manual entry A1A21103 acam FW Revision	Read from FWD2 5828	25 0000000 35 FFFA3B9B 94 0000000B 31 18193E25 63 FFFA3B9B 95 00008000	125 00005020 126 00001599 127 00000000	
				, ,	

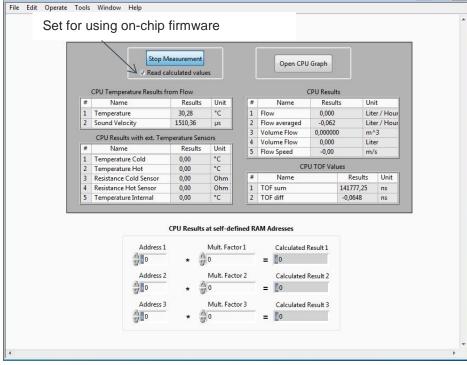
- With "Check Status Flag", the watchdog and the lock state of the GP30 can be checked.
 Please make sure that the watchdog is disabled before starting a download or other transactions in this window.
- In the "Firmware User Code" section, a firmware user code file (*.hex), which is typically generated 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.
- **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.

- -







5.4 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.

Pause 1,0 * T(BF_SEL) in ms	- 4

USM_PAUSE> CR_USM_PRC (0x0C8)	
Selects pause time between 2 ultrasonic mea	surements
Ultrasonic Pause Handling" Tip	
USM_PAUSE	

Help Contents

Not supported in this software revision

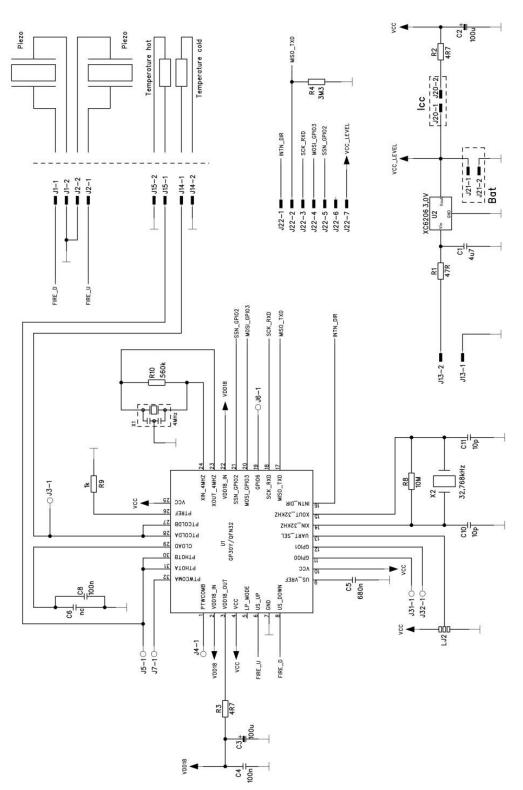
USB Communication

USB Comn	nunications
	PicoProg Settings
	Disable USB Handle
	PicoProg FW Path B C:\Program Files (x86)\aca\data\PicoProgFW GP30_v21.hex Change
	GP30 Communication
	Last_Com_Action Read_Res stop_meas USB Error USB Error

As described in chapter "Software Installation".

About

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



6 Schematics, Layers and BOM

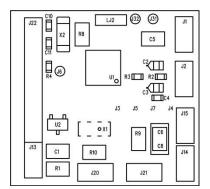
Figure 25: GP30-DEMO MODULE Schematics

ams Demo Kit Manual [v1-00] 2016-Aug-08

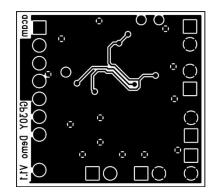
Figure 26: GP30-DEMO MODULE Layout (200% size)

Top layer

Assembly



Bottom layer



ltem	Qty	Reference	Part Name	PART DESC	ТҮРЕ
1	1	U1	GP30	QFN32	TDC GP30
2		U2	3.0 V	XC6206	Voltage Regulator
3	1	X1	4 MHz	CSTR_G	Ceramic Resonator
4	1	X2	32.768 kHz	KX-327XS	Quartz Crystal
5	1	C1	4u7	C805	Chip Capacitor
6	2	C2, C3	100u	F95_P	Solid Tantalum
7	1	C4	100n	CC603	Chip Capacitor
8	1	C5	680n	C805	Chip Capacitor
9	1	C6	nc	C805	Chip Capacitor
10	1	C8	100n	C1206	Chip Capacitor
11	2	C10, C11	10p	CC603	Chip Capacitor
12	1	R1	47R	R805	Chip Resistor
13	2	R2, R3	4R7	R603	Chip Resistor
14	1	R4	3M3	R603	Chip Resistor
15	1	R8	10M	R805	Chip Resistor
16	1	R9	1k	R805	Chip Resistor
17	1	R10	560k	R805	Chip Resistor
18	1	J13	2 pol.	ST/254_2	Connector for power supply (combined with J22)
19	1	J22	7 pol.	ST/254_7_1R	Connector for SPI interface (combined with J13)
20	1	J20	2 pol.	ST/254_2	Jumper for current measurement of Vcc
21	1	LJ2	3 pol.		Solder bridge to select between SPI & UART

Figure 27: Bill of Materials for GP30-DEMO MODULE

7 Ordering & Contact Information

Ordering Code	Part Number	Description
GP30-DEV-KIT	220260003	GP30 Demo Kit for QFN32 version including PICOPROG and cables
GP30-DEMO-KIT-F01	220260006	GP30 Demo Kit with firmware for QFN32 version including PICOPROG and cables
GP30-DEMO MODULE	220260002	GP30 demo board for QFN32 version
GP30-DEV-F01 MODULE	220260005	GP30 demo board with firmware for QFN32 version

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Page

9 Revision Information

Changes from previous version to current revision 1-00 (2016-Aug-08) New Layout

Note: Page numbers for the previous version may differ from page numbers in the current revision. Correction of typographical errors is not explicitly mentioned.