User Guide

UG000292

TDC-GP30

Reference Board

GP30-DEV-KIT

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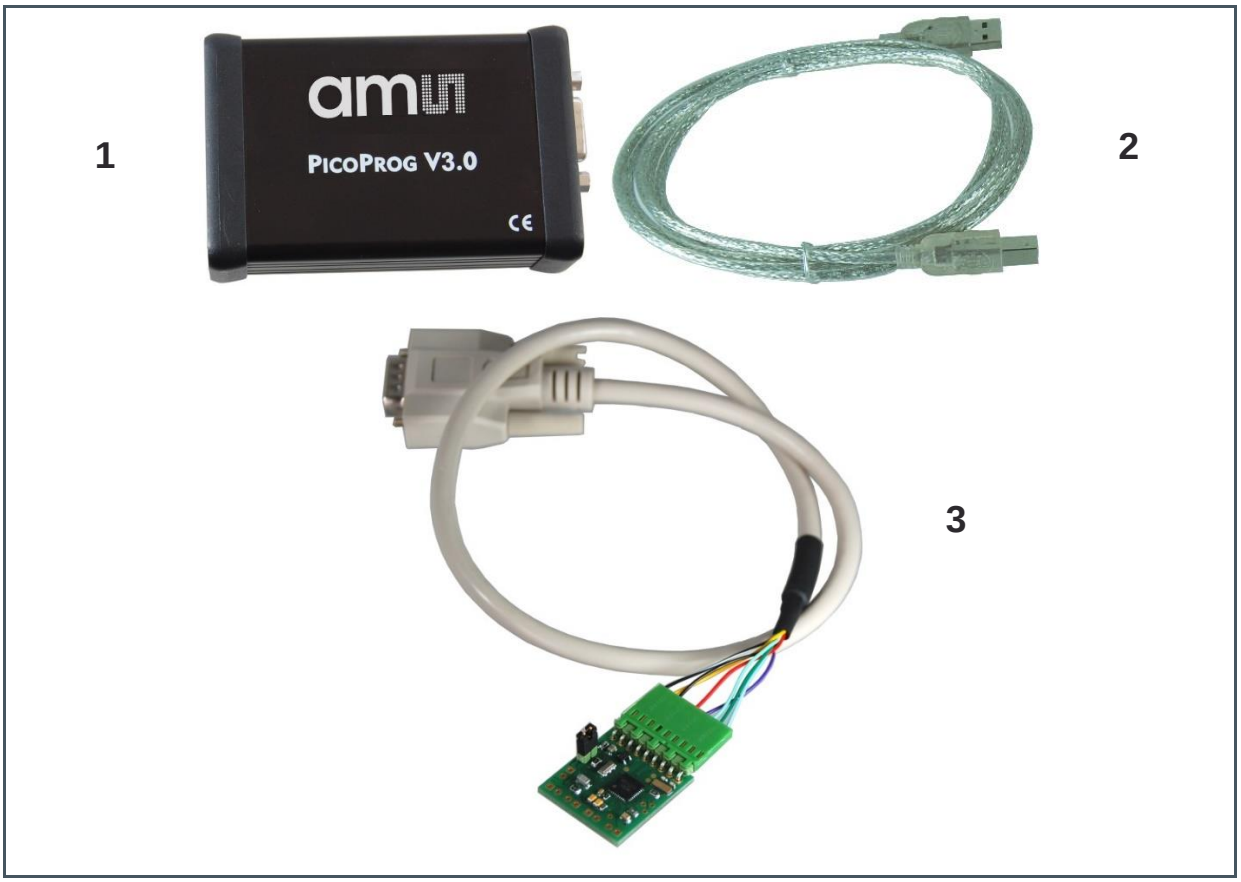
Content Guide

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.

1.1 Kit Content

Figure 1:
Kit Content



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

Please download the latest software for the kit from
https://download.ams.com/SPECIALTY-SENSORS/TDC-GP30

1.2 Ordering Information

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

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.

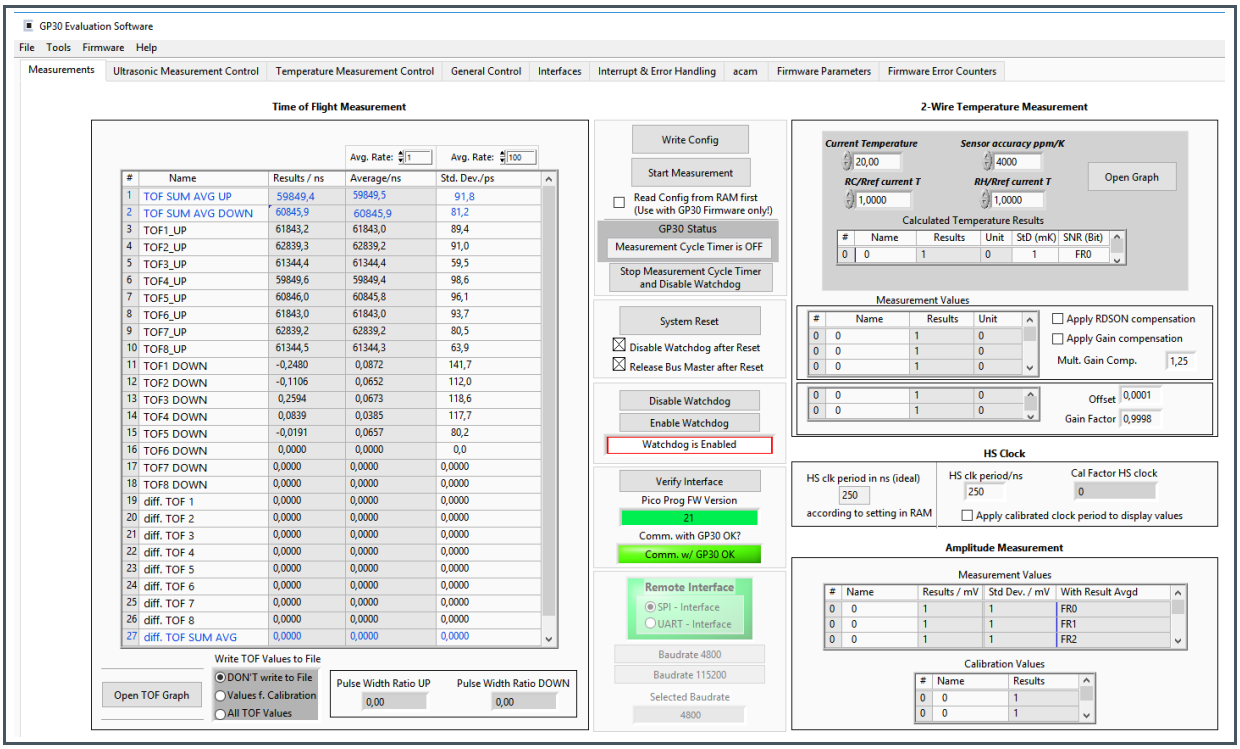
2.2 Install the Hardware

- 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 “ams” directory. Double click the “GP30_v1_7_0” icon (or newer versions, if available) to begin execution of the evaluation software. The following screen should appear:

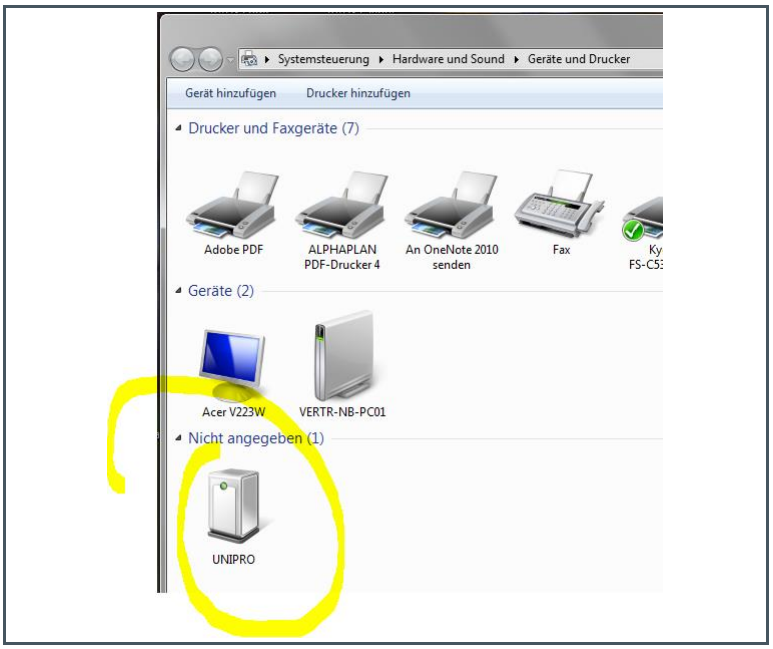
Figure 2:
Measurement Page



- 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.
- Next, open our configuration GP30Y_config_default_A1.A2.11.03 and download it into the chip, pressing “Write Config”.
- Connect your spool piece to pins US_UP and US_DOWN.
- Press “Start Measurement” to begin measuring.

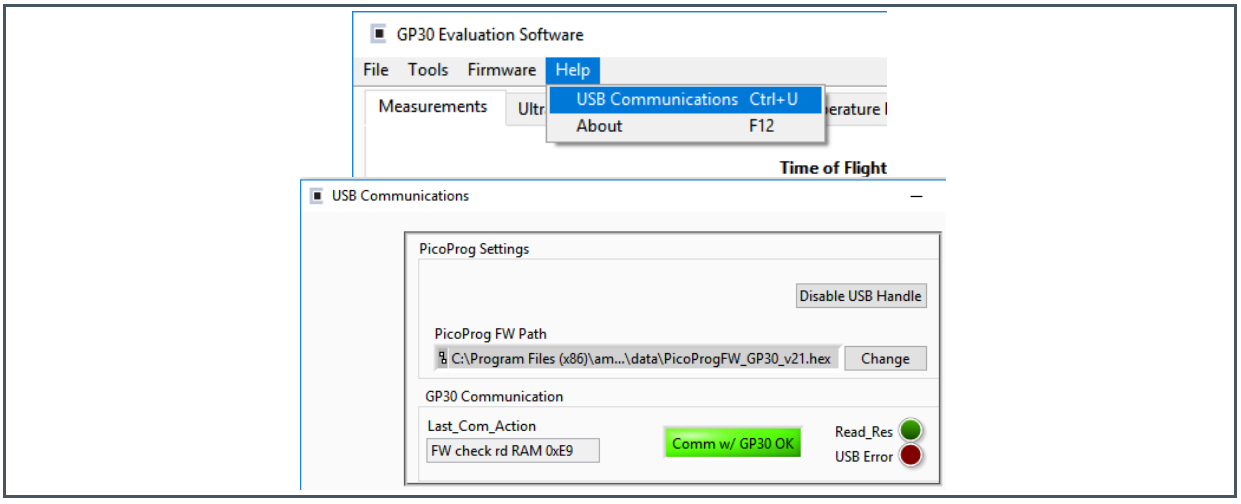
At this point, after successful completion of the above steps, a basic operation of the EVA kit should be possible. The following sections provide a detailed description of the hardware and software for advanced operation.

Figure 3:
PICOPROG Registry



If PICOPROG is not displayed correctly then go to the drivers folder, e.g. C:\Program Files (x86)\ams\GP30\data\ 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:

Figure 4:
PICOPROG Manual Installation

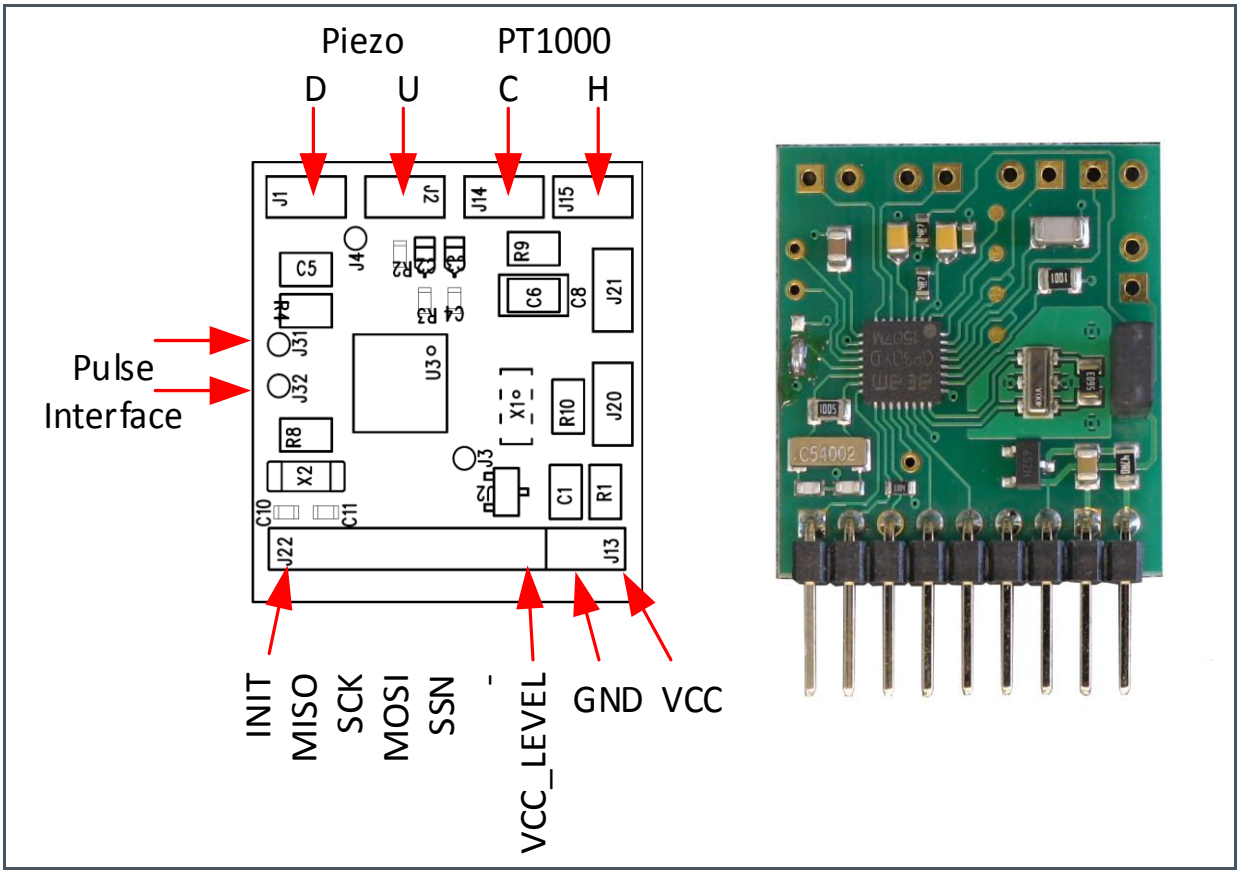


3 Hardware Description

3.1 Introduction

The GP30-DEMO MODULE board, shown in Figure 5, is a front-end for a water or heat meters. The transducers and temperature sensors are directly connected 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.

Figure 5:
GP30-DEMO MODULE



3.2 Communication Interface

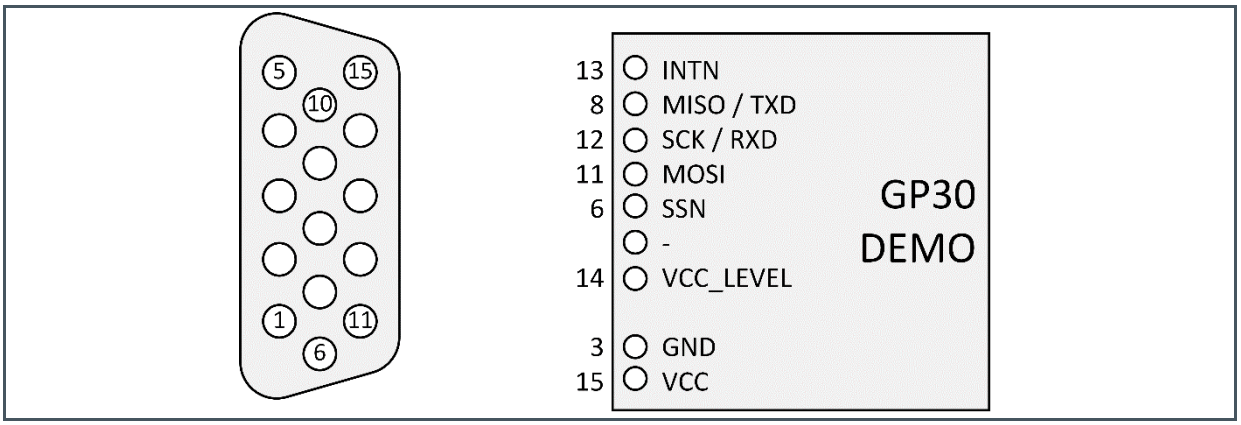
The PICOPROG device is a USB-to-SPI converter box that interfaces all UFC evaluation systems. With version 3.0, the PICOPROG also supports the USB-to-UART conversion of TDC-GP30. The PICOPROG is registered by the operating system initially as “PICOPROG v3.0 unprogrammed”. As

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 6 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

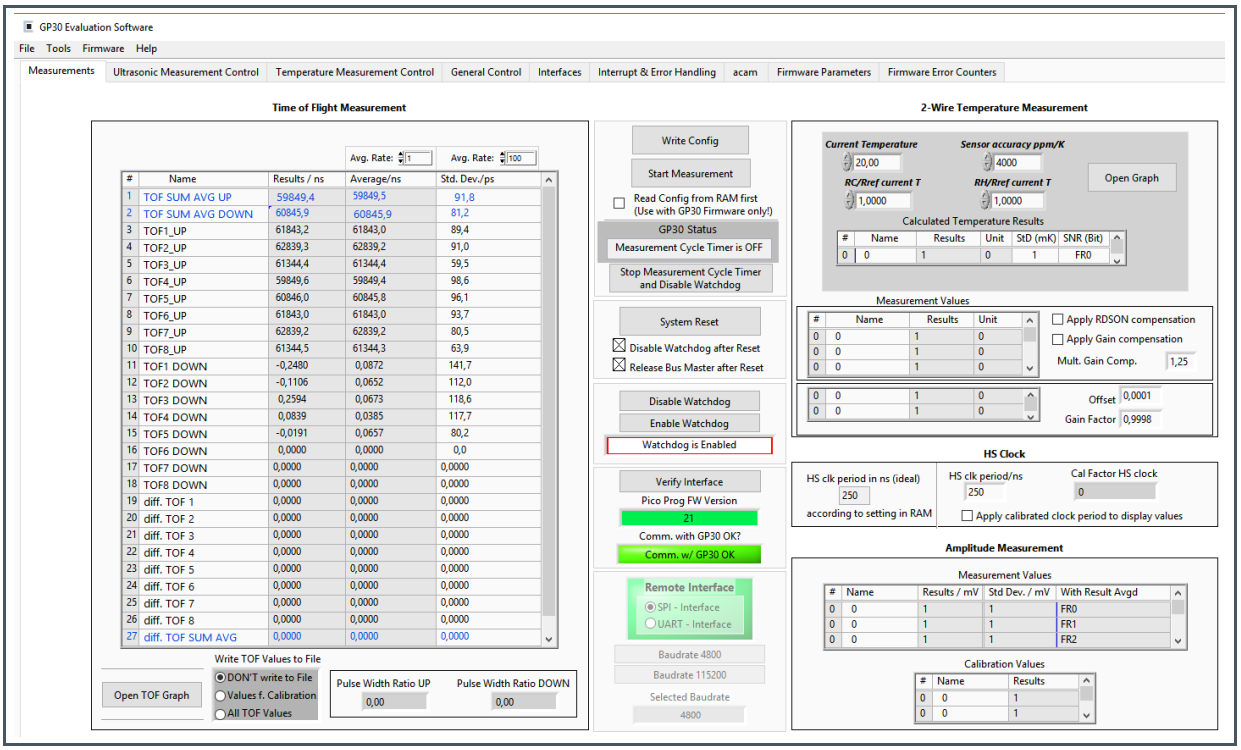


4 Software Description

4.1 Measurement

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

Figure 7:
Main Window



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 µP). **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 → Open Config → choose appropriate configuration file

1. 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.
2. If watchdog is not disabled by “System Reset”. Button → press “Disable Watchdog” button.
3. Press “Write Config” button to download the configuration settings into TDCX-GP30.
4. 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.

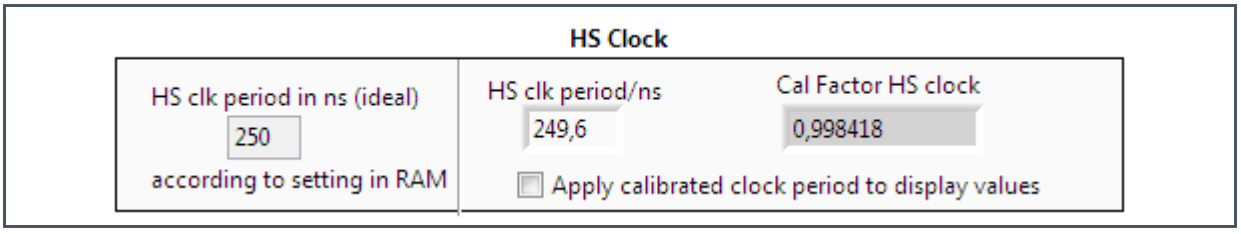
In the “Average” column the user can set the sample size for the averaging (<1000). The software calculates the rolling average of the results accordingly. In “Std. Dev.” column the standard deviation, calculated over a variable sample size, is displayed. The number of samples can be chosen (e.g. 100).

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.

Information

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

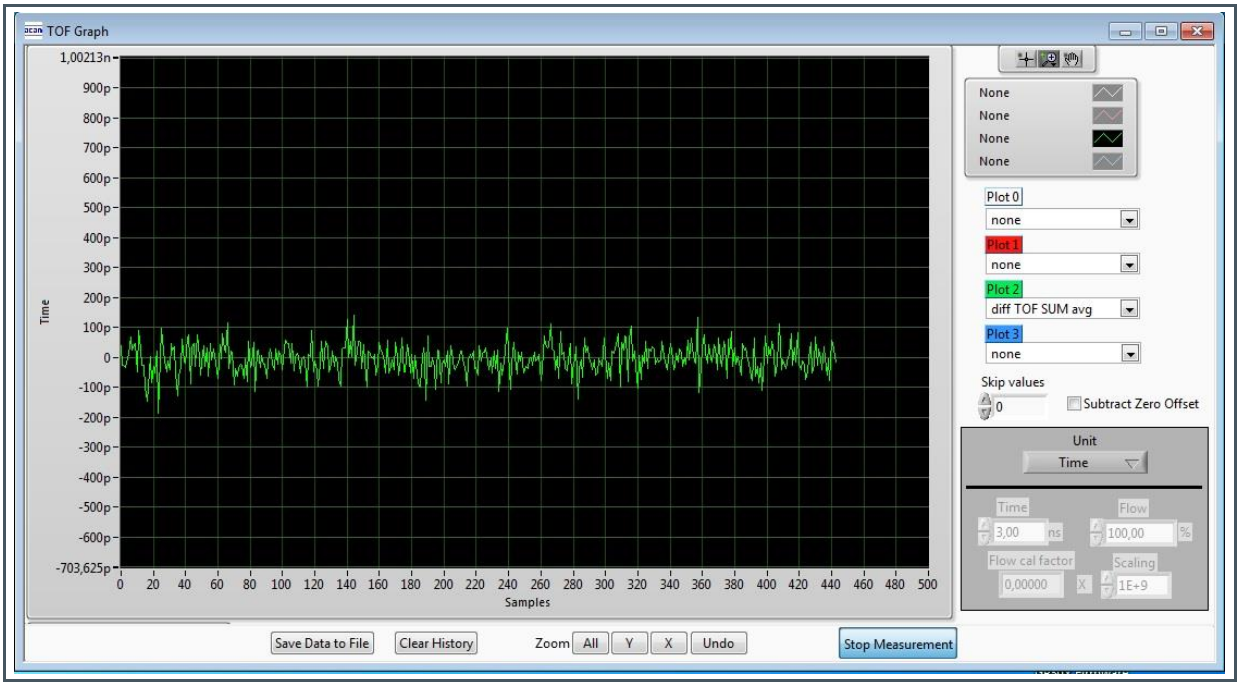
Figure 8:
HS Clock Calibration



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

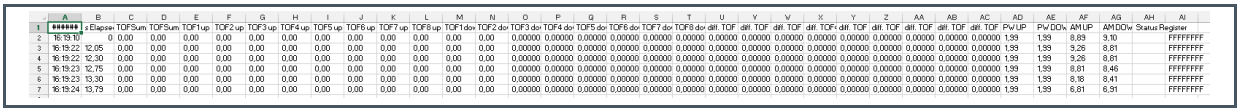


The measurement data can be exported into text files, either the main values for calibration only, or the full data.

Figure 10:
Data Export for Calibration

	A	B	C	D	E	F	G	H	I	J	K	L
1	08.08.2016 16:18	s Elapsed	diffTOFSu	sumTOFSu	diffTOF1	sumTOF1	PW UP	PW DOW	AM UP	AM DOW	Status Register	
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		FFFFFFFF
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		FFFFFFFF
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		FFFFFFFF
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		FFFFFFFF
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		FFFFFFFF

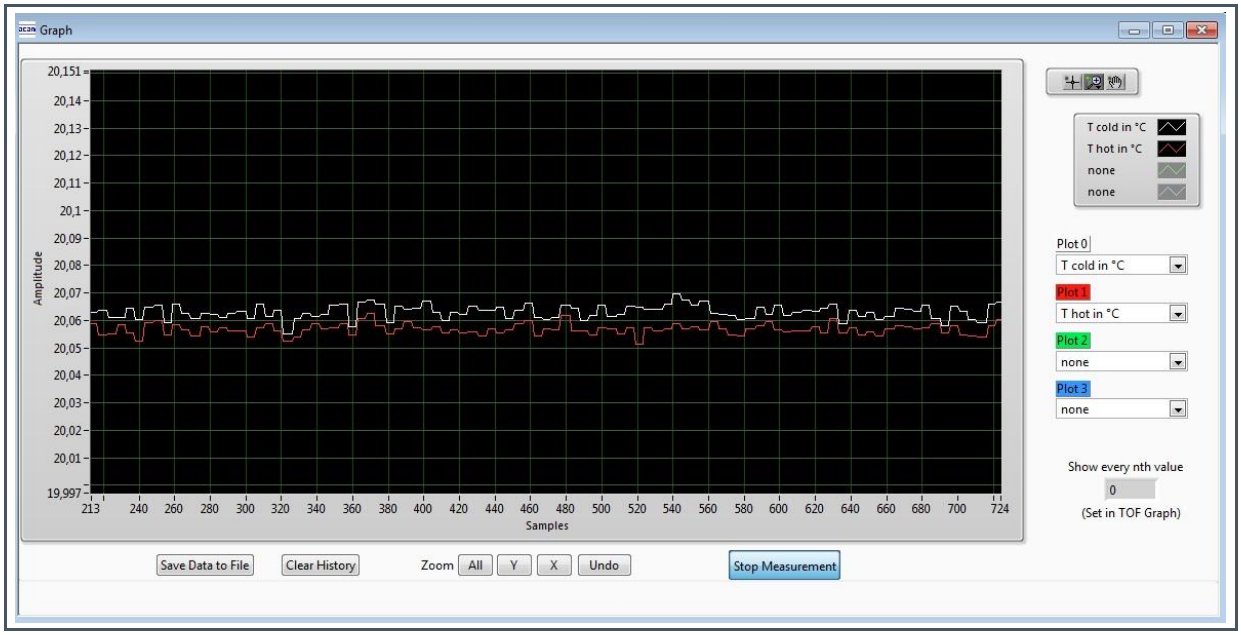
Figure 11:
Data Export Complete



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:
Temperature Measurement Results Graph

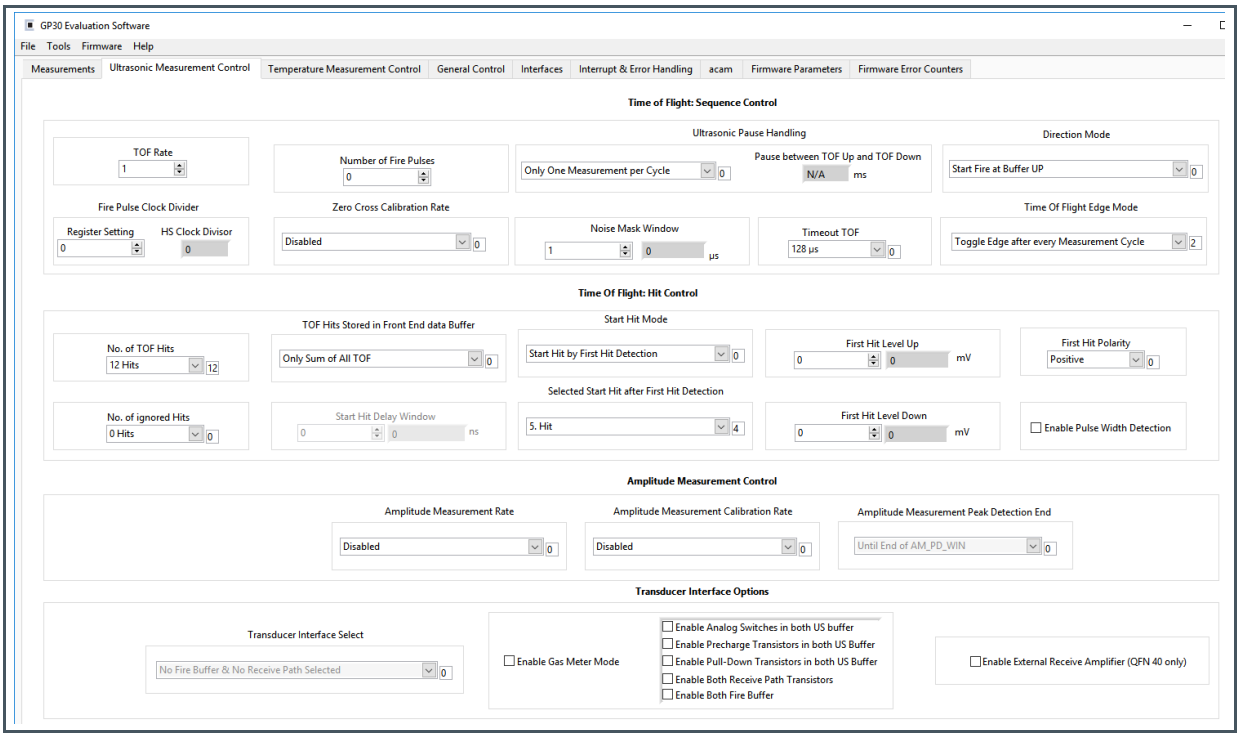


4.2 Ultrasonic Measurement Control

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:
Ultrasonic Measurement Control Tab



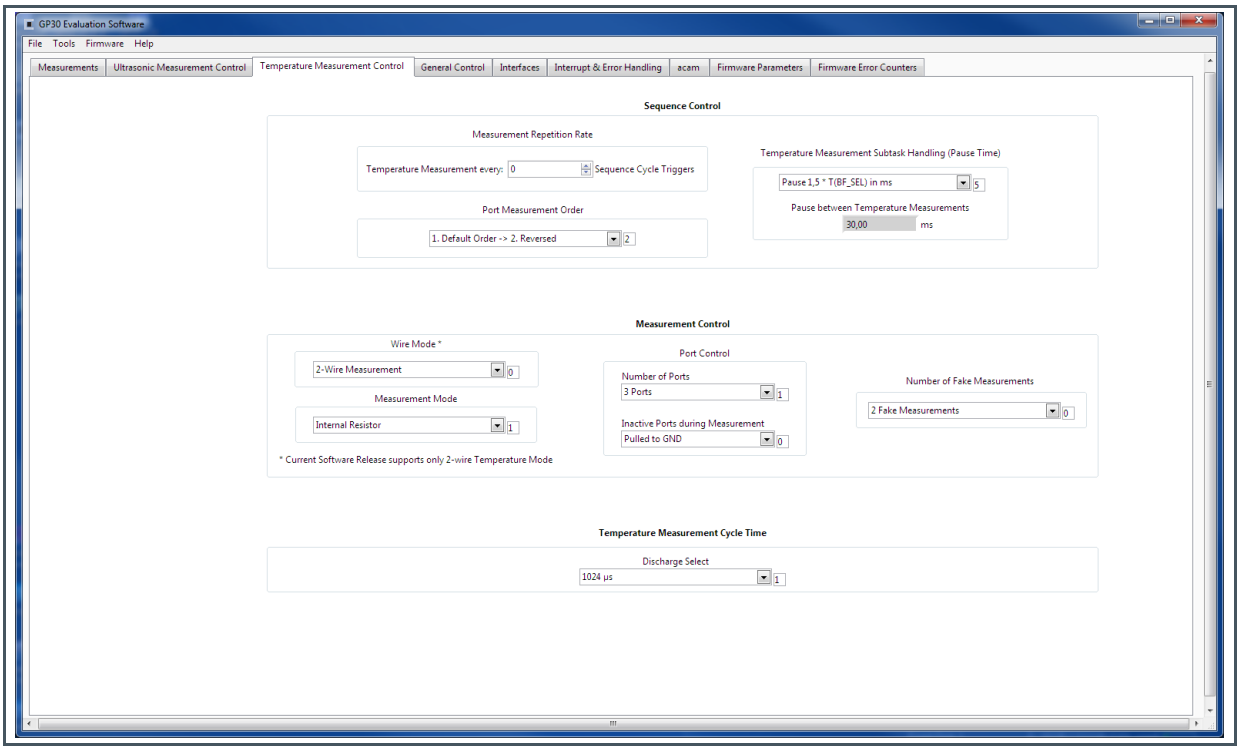
The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

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:
Temperature Measurement Control Tab



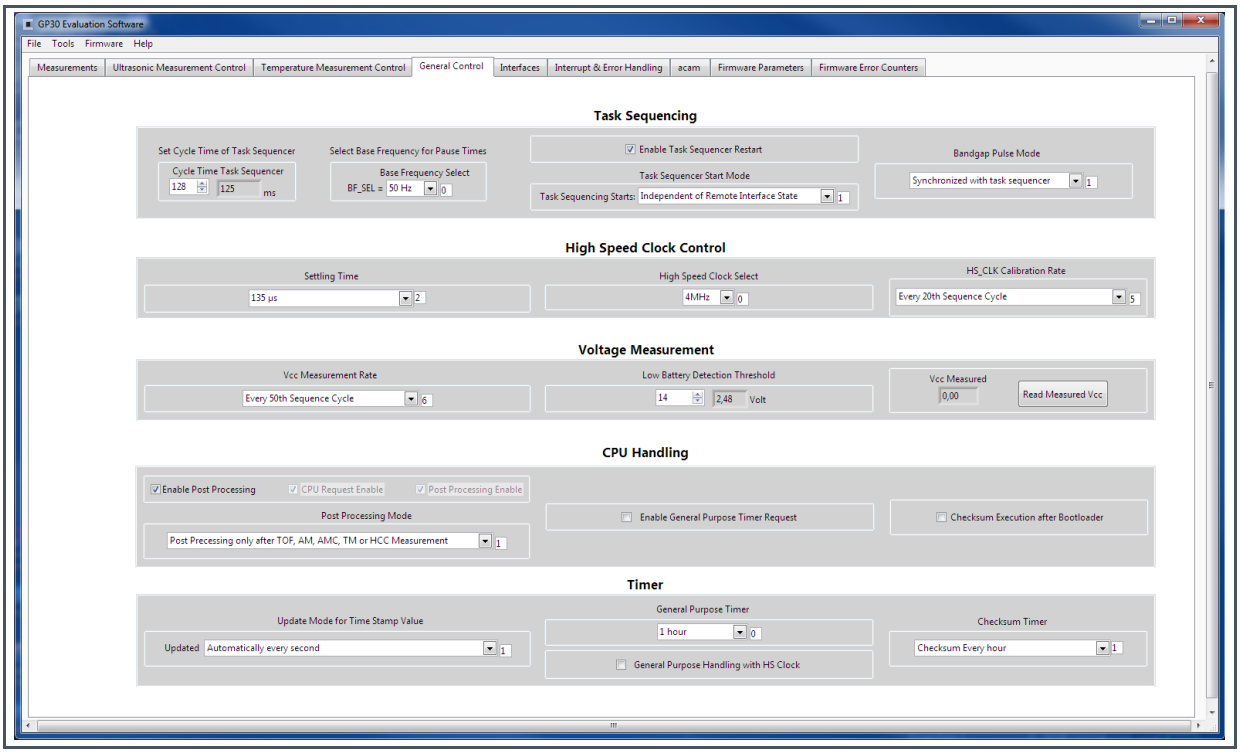
The meanings of the various settings are displayed in clear text. For more details about the register settings please refer to the GP30 manual.

4.4 General Control

The “General Control” tab covers configuration settings for

- Task sequencing
- High speed clock control
- Voltage measurement
- CPU handling
- Timer settings

Figure 15:
General Control Tab



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

4.4.1 Firmware

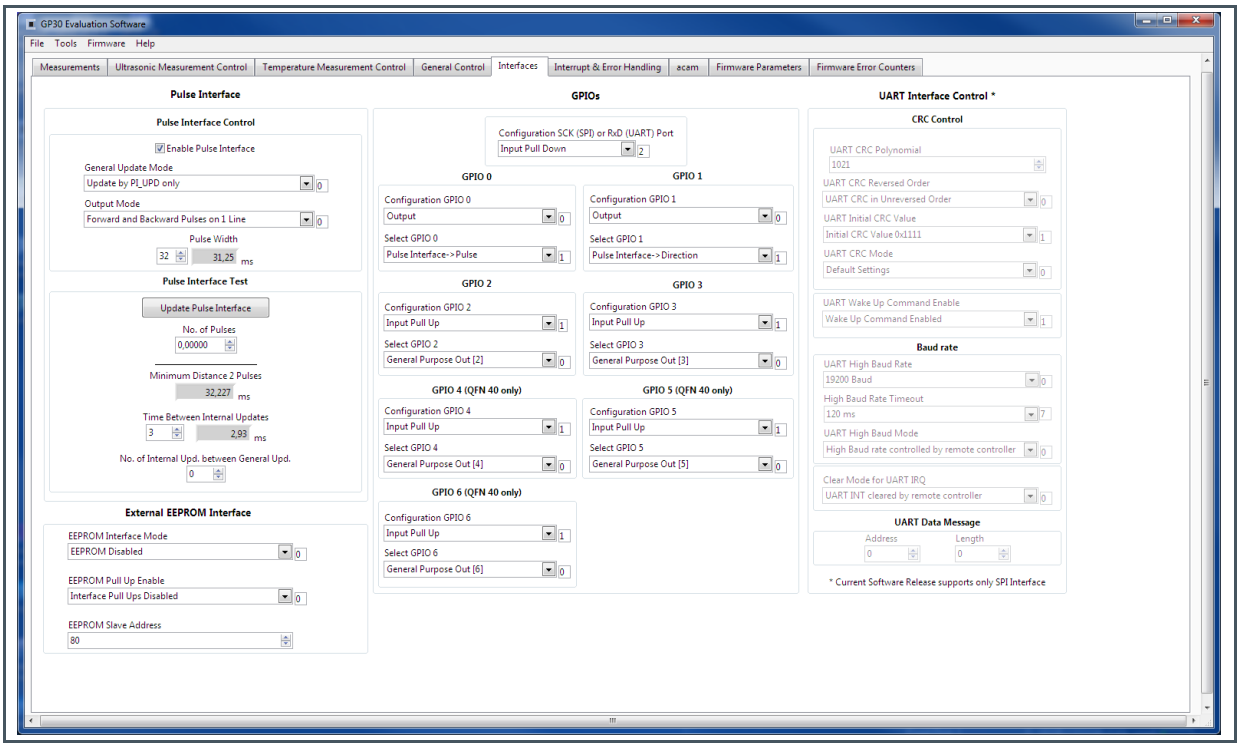
In case the TDC-GP30 has firmware, setting flag “Enable post processing” turns on the CPU (flow meter mode). Having this not set, the GP30 runs as front-end in time conversion mode.

4.5 Interfaces

The “Interfaces” tab covers configuration settings for

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

Figure 16:
Interfaces Tab



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

4.5.1 Pulse Interface

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

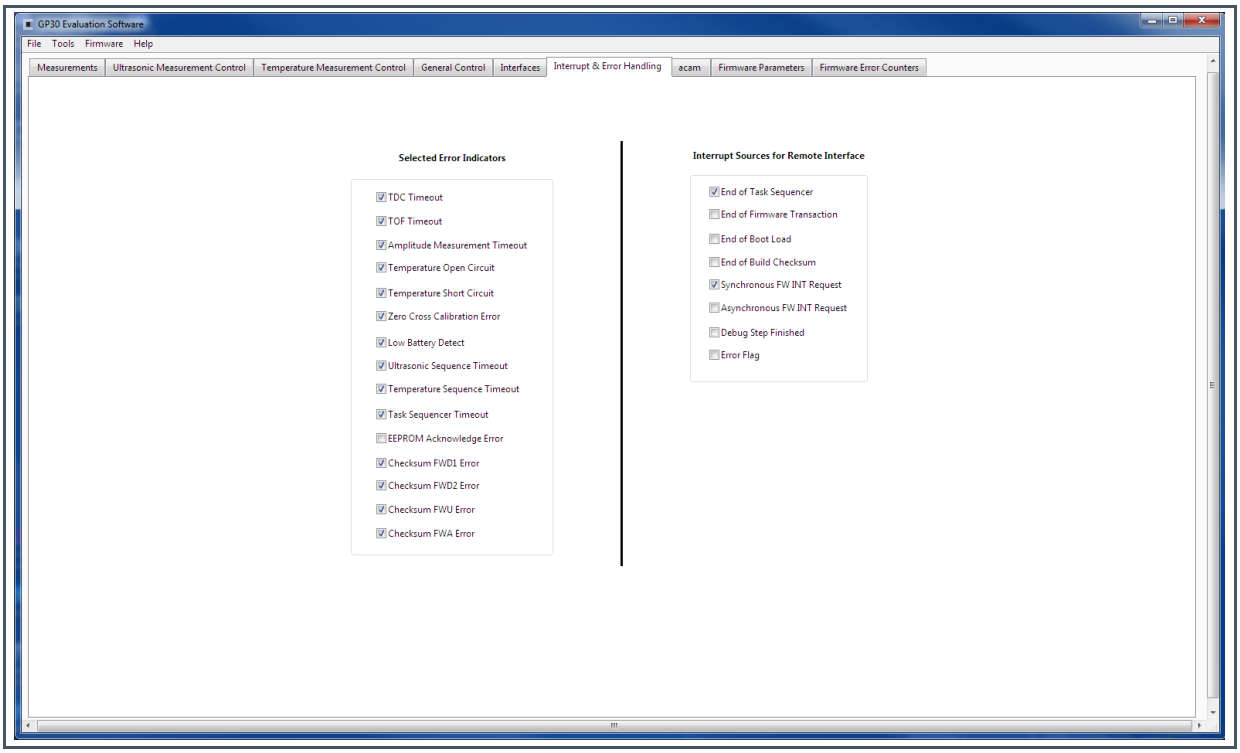
4.5.2 UART

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:
Interrupt and Error Handling



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

4.7 ams

On this tab, named acam, specific parameters are displayed, but for **ams** internal use and analysis only.

4.8 Firmware Parameters and Firmware Error Counters

Those two tabs display and allow editing of parameters related to the **ams** flow firmware. They are of use only for TDC-GP30-F01. For details please refer to the datasheet TDC-GP30 Vol.4 Firmware Overview.

Figure 18:
Firmware Parameters Tab

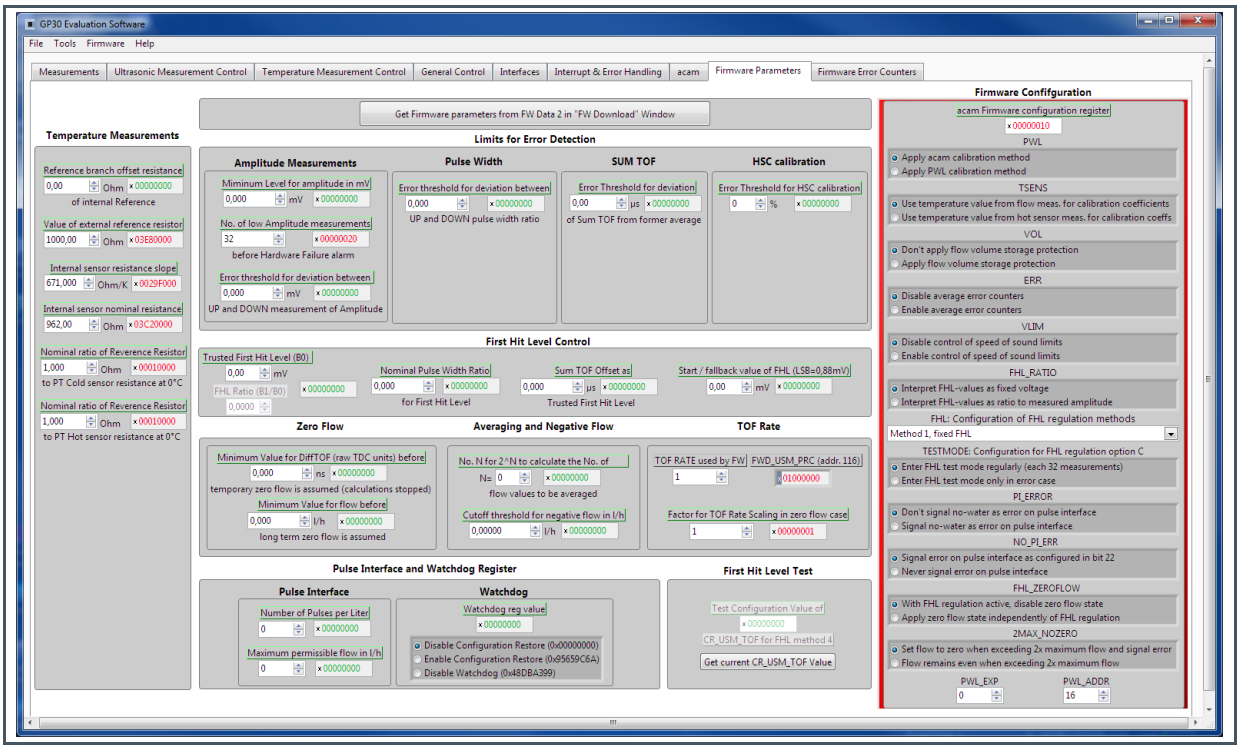
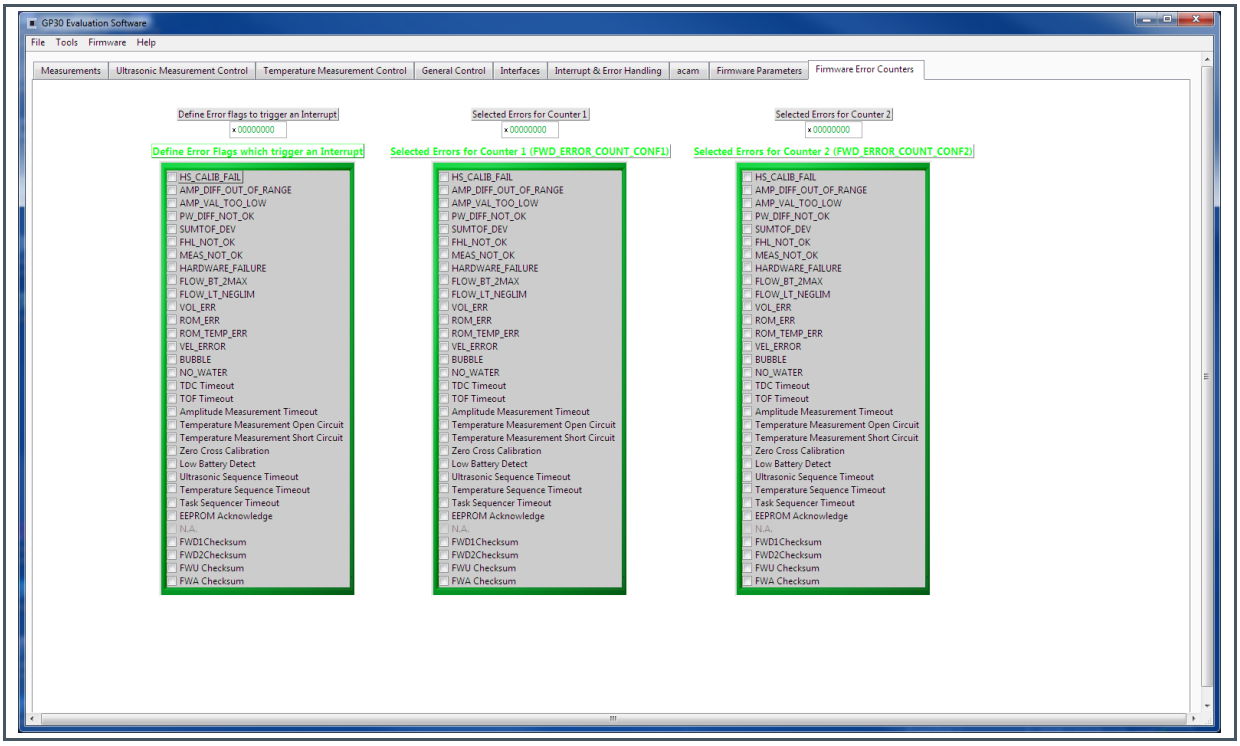


Figure 19:
Firmware Error Counters



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

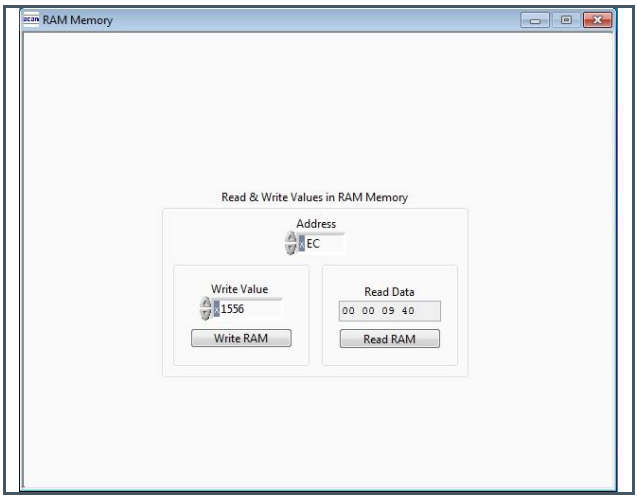
Same function as “Open TOF Graph” button in “Measurement” tab of main window.

- Temperature Graph

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

- RAM Memory

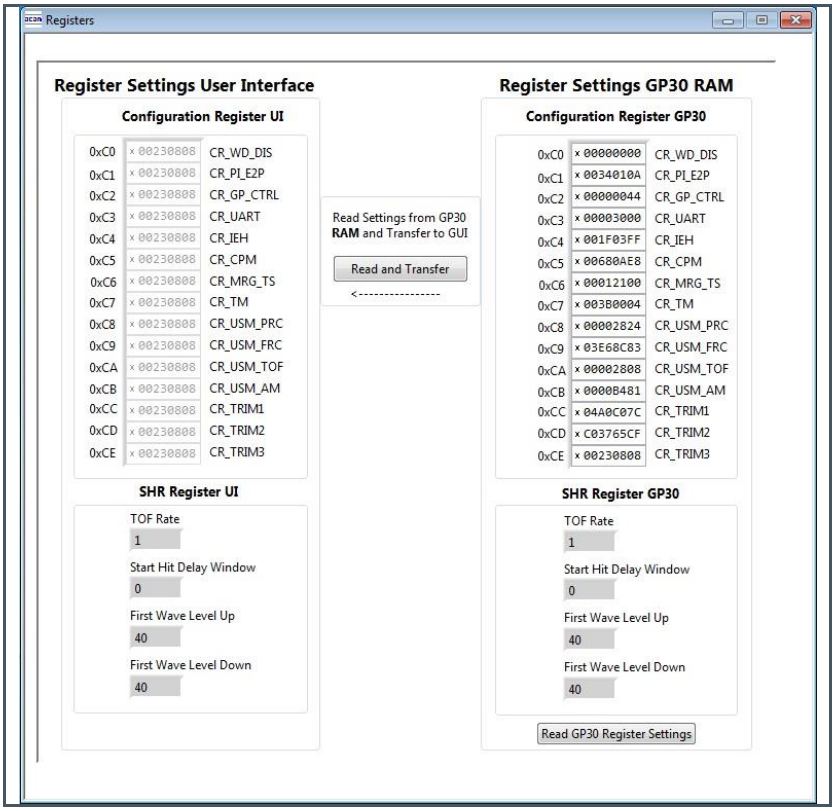
Figure 20:
RAM Memory Access



- 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

Figure 21:
Registers

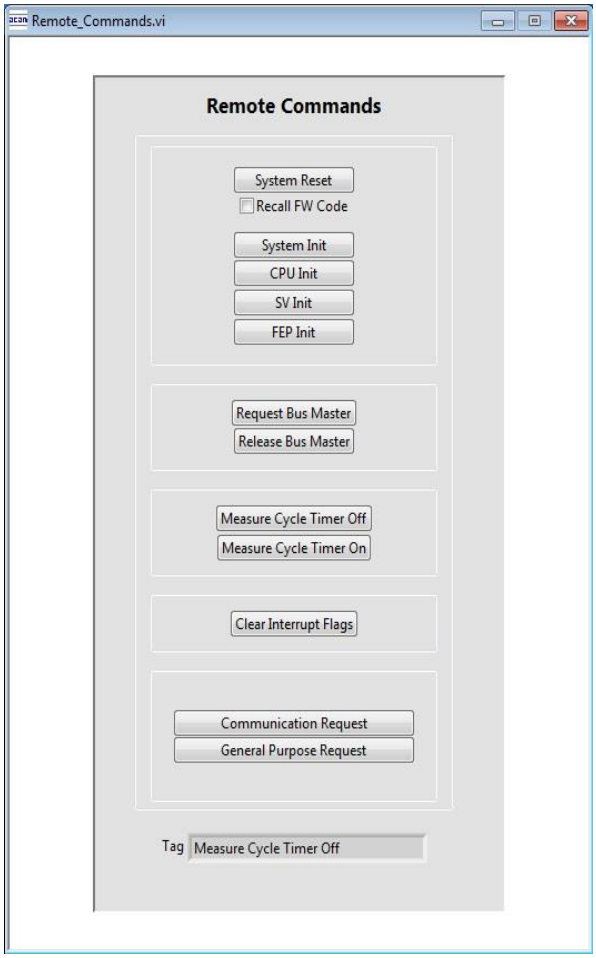


- Opens a window, which shows the registers important for a proper configuration setting of the GP30. In the left column, the register contents correspond to the settings done in tabs of GUI main window. If the button “Read GP30 Register Settings” is pressed, the configuration settings located in GP30 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. Description of Position 2

- Remote Commands

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

Figure 22:
Remote Commands



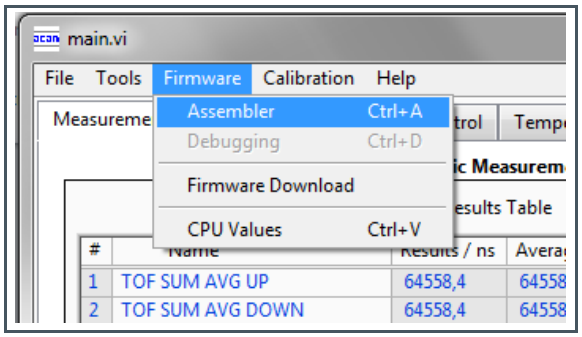
- System Reset: Executes a complete system reset of GP30. Same function as “System Reset” button in “Measurement” tab of main window
- System Init: Same function as “System Reset” without clearing the configuration (CR_...) and the system handling (SHR_...) register.
- CPU Init: Clears the CPU block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

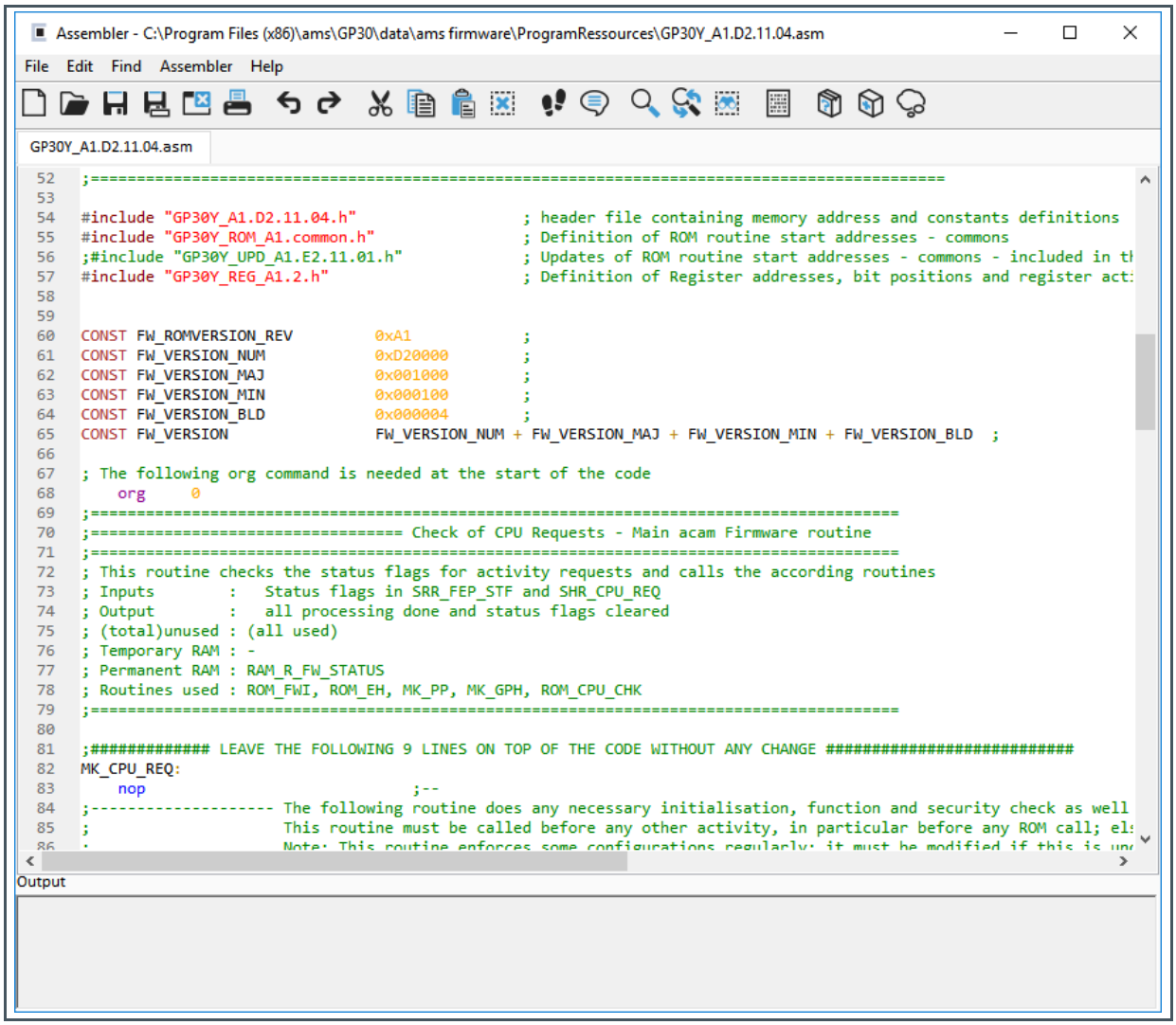
The TDC-GP30 assembler is integrated into the GP30 evaluation software. It is opened in the Firmware menu of the main program:

Figure 23:
Firmware Menu



The following window comes up:

Figure 24:
Assembler Window



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).

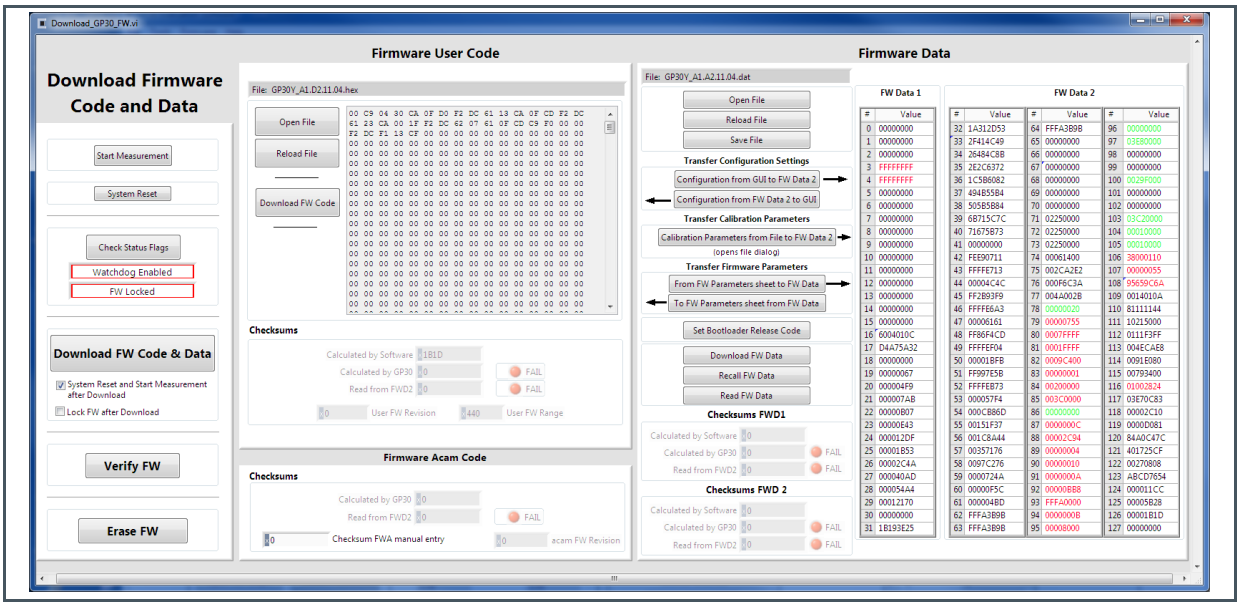
Whether the call of these functions was successful or not is indicated by the messages at the bottom of the assembler window.

- Firmware Download

This window allows the download of the user code and firmware data, including the configuration, to the non-volatile memory. In case the bootlaoder release code is set, the configuration from the FW Data 2 section is copied into the configuration registers.

“Firmware User Code” is either one of **ams** firmware examples, either the customers code or in case of chips with **ams** firmware (TDC-GP30-F01) the open source part. The FW Data 1 and 2 include firmware relevant coefficients and the configuration. The figure below shows an example for anTDC-GP30-F01 application. As free part of the user code firmware GP30Y_A1.D2.11.04.hex is loaded. For the configuration and flow calculation data file GP30Y_A1.A2.11.04.dat is loaded.

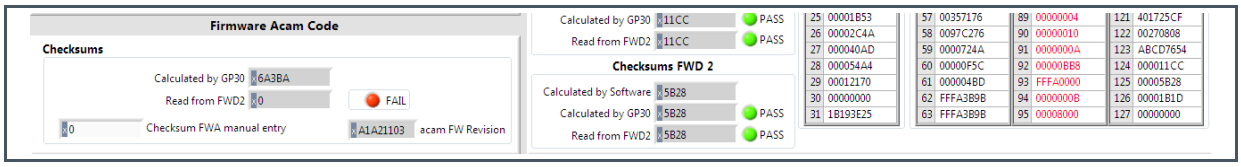
Figure 25:
Firmware Download



- 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. The configuration can exchanged between the GUI of the evaluation file and the data file. Calibration can also be exchanged between GUI and data file.
- 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” any 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. A select box allows to reset and restart measurement automatically after download.

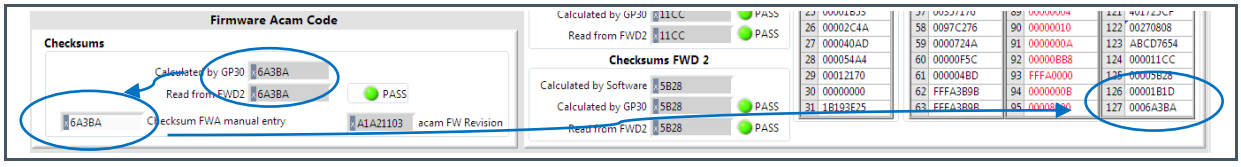
- The last four addresses of the FW Data 2 section contain the checksums which are stored to GP30 when downloading firmware to GP30. These fields are directly updated, when firmware files are loaded or content of firmware data fields are changed.
- Pressing the “Verify FW” button after downloading compares the content of the NVRAMs 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. Note: The firmware data file word 127 is by default empty, not knowing the checksum of the on-chip **ams** firmware.

Figure 26:
Firmware ams Code



So copy manually the calculated checksum for the **ams** code into the field “Checksum FWY manual entry”. Word 127 in the data will be updated and after downloading again the verification will pass for all.

Figure 27:
Verification by Calculated Checksum

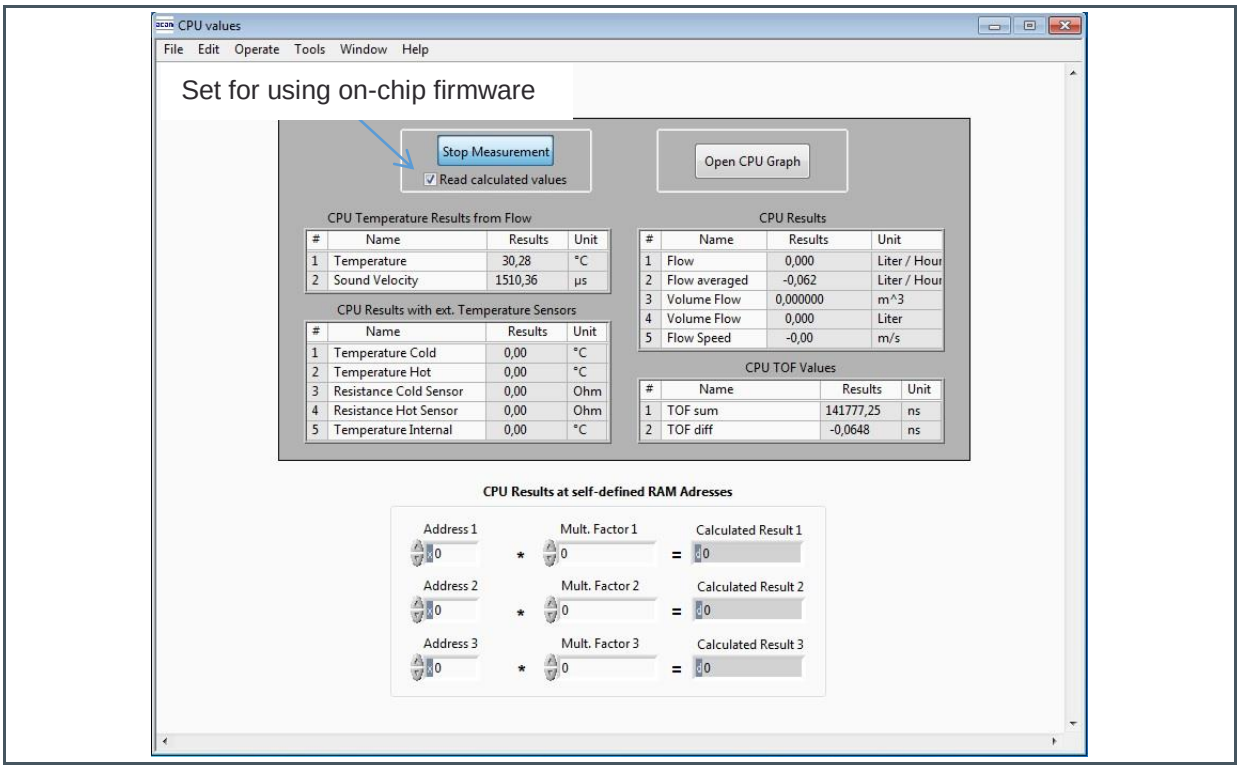


- In the “Firmware ams Code” section, the checksums for the **ams** firmware code are also checked and displayed after a “Verify FW”. The **ams** firmware code cannot be modified by user. Therefore a checksum calculated by software field is missing in this section.
- A lock state of GP30 or a hang-up, 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 ams 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.

The lower sections allows to read from any RAM addresses.

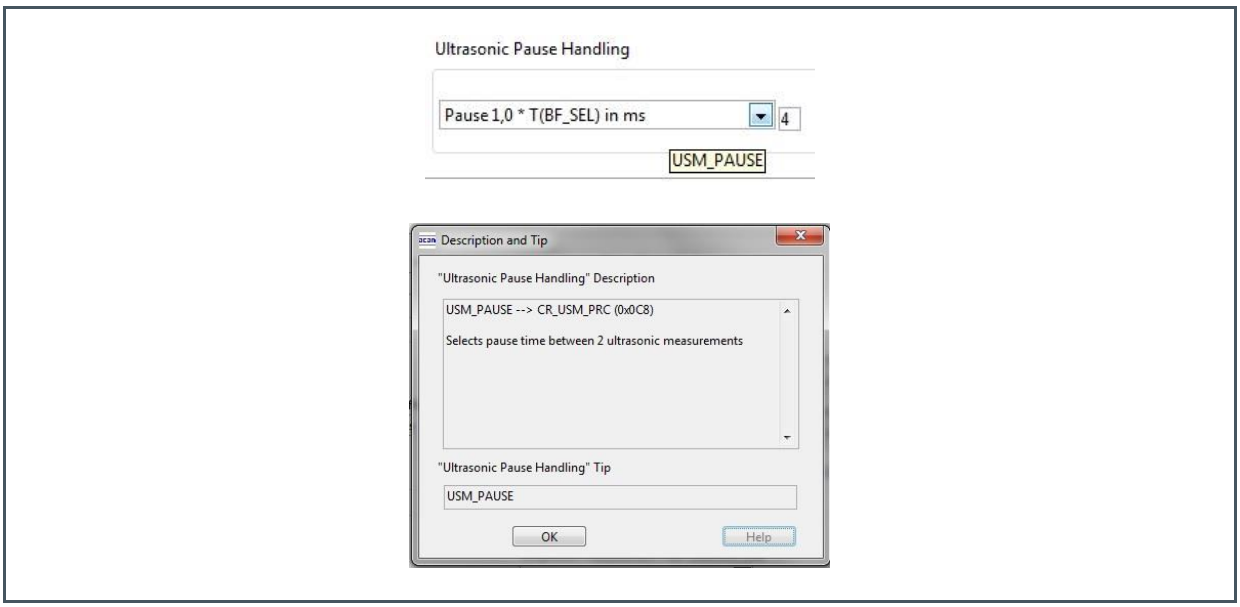
Figure 28:
Flow Calculation Tab



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.

Figure 29:
Description and Tip Window

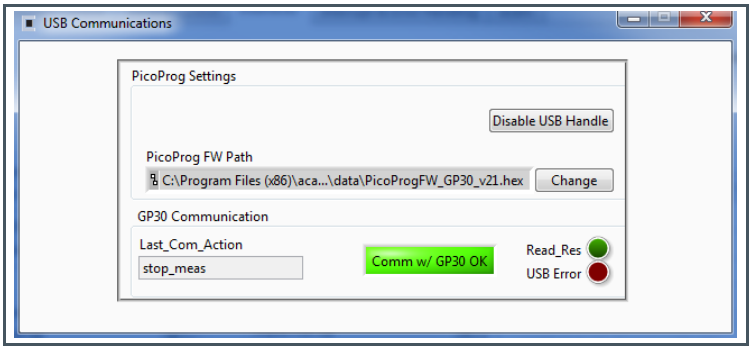


- Help Contents

Not supported in this software revision.

- USB Communication

Figure 30:
USB Communications



As described in chapter “Software Installation”.

- About

Displays software version number together with general information about software and **ams**.

6 Schematics, Layers and BOM

Figure 31:
GP30-DEMO MODULE Schematics

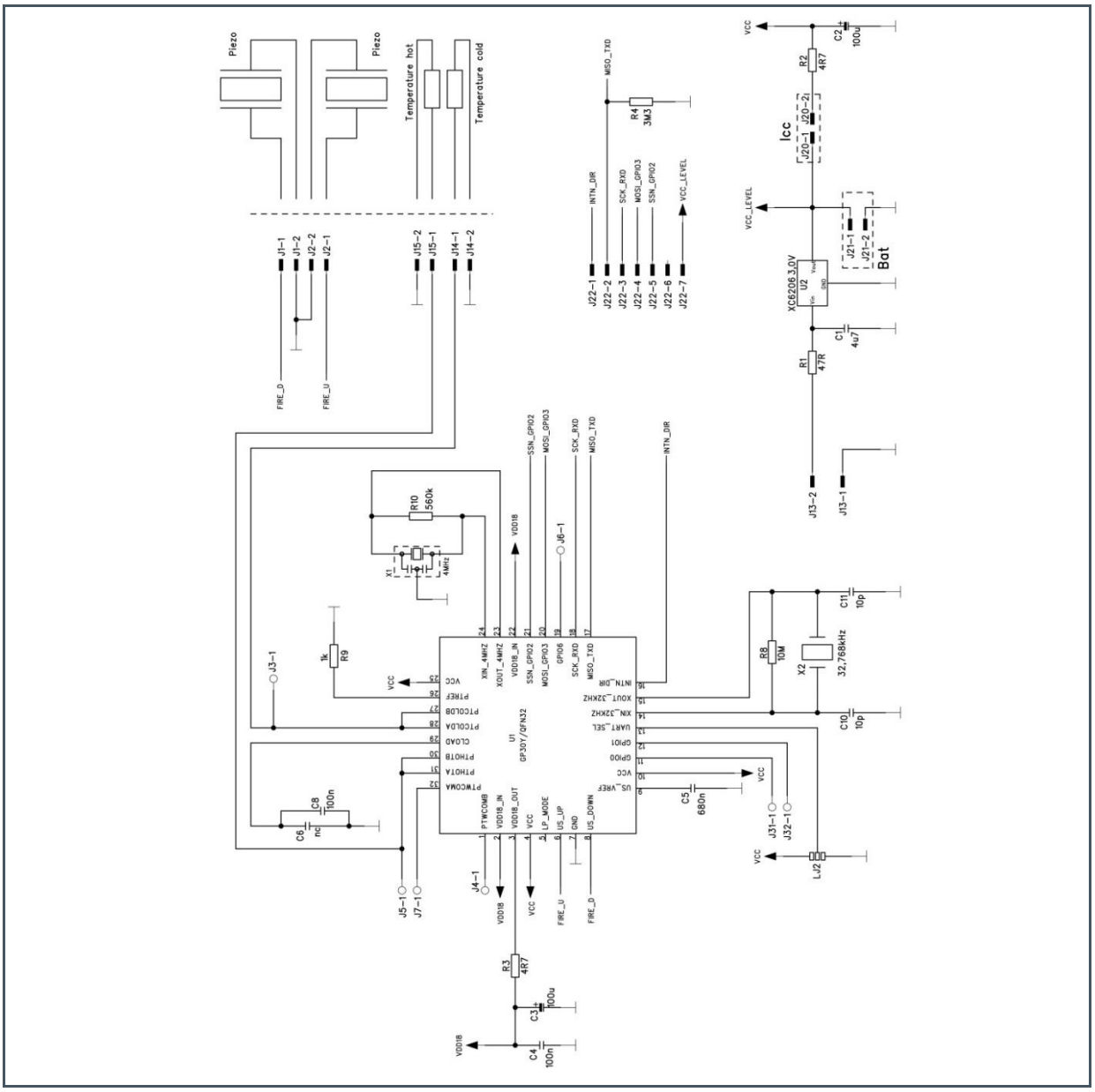


Figure 32:
GP30-DEMO MODULE Layout (200% size)

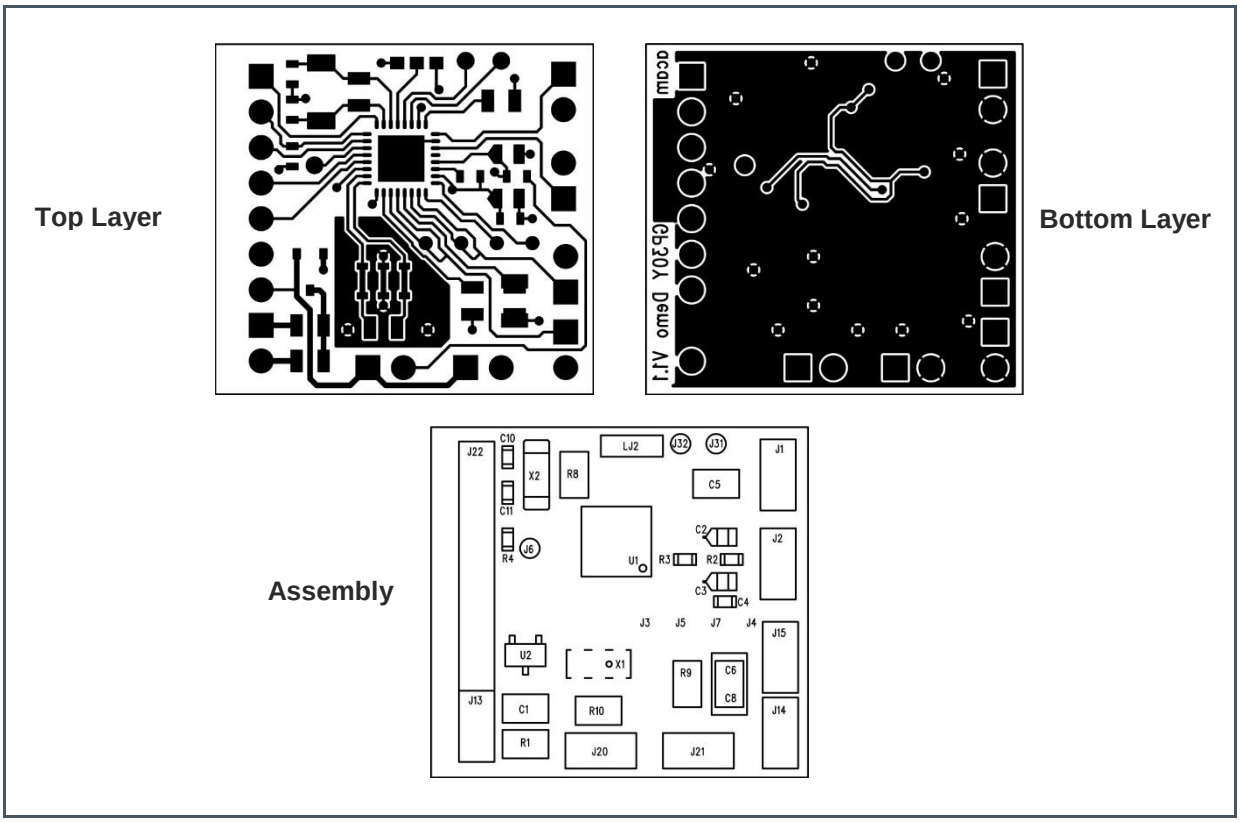


Figure 33:
Bill of Materials for GP30 Demo Module

Item	Qty	Reference	Value	Part Desc	Type
1	1	U1	TDC-GP30	QFN32	TDC-GP30 UFC ams
2		U2	3.0 V	XC6206	Voltage regulator
3	1	X1	4 MHz	CSTR_G	Ceramic resonator Murata
4	1	X2	32.768 kHz	KX-327XS	Quartz crystal Geyer
5	1	C1	4.7 µF	C805	Chip capacitor
6	2	C2,C3	100 µF	F95_P	Solid tantalum
7	1	C4	100 nF	CC603	Chip capacitor
8	1	C5	680 nF	C805	Chip capacitor
9	1	C6	Nc	C805	Chip capacitor
10	1	C8	100 nF	C1206	Chip capacitor
11	2	C10, C11	10 pF	CC603	Chip capacitor
12	1	R1	47 Ω	R805	Chip resistor
13	2	R2, R3	4.7 Ω	R603	Chip resistor
14	1	R4	3.3 MΩ	R603	Chip resistor

Item	Qty	Reference	Value	Part Desc	Type
15	1	R8	10 MΩ	R805	Chip resistor
16	1	R9	1 k Ω	R805	Chip resistor
17	1	R10	560 k Ω	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

7 Reference Modules and Transducers

7.1 Modules

ams has a close cooperation with Qingdao iESLab to support customers with complete ultrasonic flow modules for water and gas. For water, iESLab offers pipes made of brass and made of plastic and modules can be ordered un-calibrated or calibrated. The gas meter modules are made of plastic and come un-calibrated, as the final housing will have a major impact on the calibration.

7.1.1 Water Meter Modules Made of Brass

DN15 and DN20 modules come with tubes made of brass and the sensor frontend are based on TDC-GP22.

Figure 34:
Water Meter Module, Brass

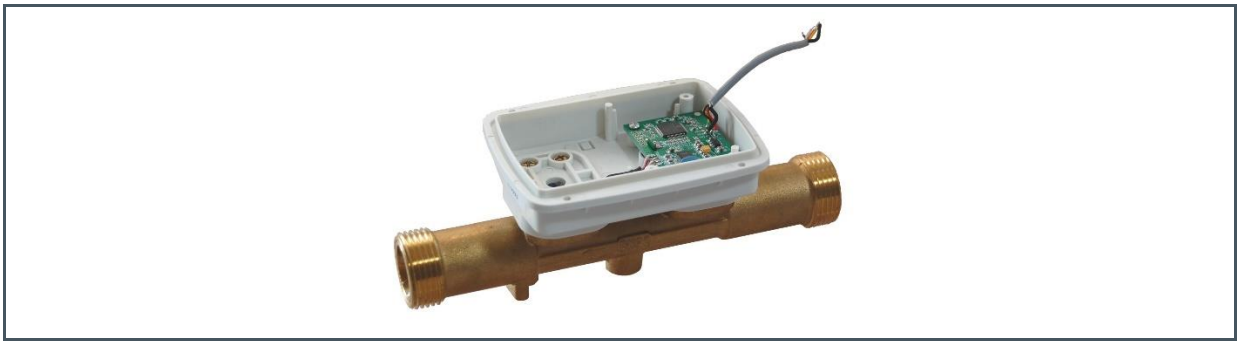


Figure 35:
Ordering Information

Ordering Code	Description	Part Number	Markup Information(1)
t.b.d.	Water meter module with brass pipeline No calibration	IA-UWM-1-GP22-DN20	IA-UWM-1-GP22-DN20-YYYYMMDD-SSSSSS
t.b.d.	Water meter module with brass pipeline With calibration	IA-UWM-2-GP22-DN20	IA-UWM-2-GP22-DN20-YYYYMMDD-SSSSSS

(1) YYYY = year, MM = month, DD = day, SSSSSS = product serial number that day

Figure 36:
Measurement Characteristics

Nominal Diameter [mm]	15	20	25	32	40
Starting Flow [m³/h]	0.002	0.003	0.003	0.005	0.005
Minimum Flow Rate Q_1 [m³/h]	0.010	0.016	0.025	0.040	0.064
Transitional Flow Rate Q_2 [m³/h]	0.016	0.025	0.040	0.064	0.100
Permanent Flow Rate Q_3 [m³/h]	2.500	4.000	6.300	10.000	16.000
Overload Flow Rate Q_4 [m³/h]	3.125	5.000	7.875	12.500	20.000
Flow Range Ratio R (Q_3/Q_1)	R250(1), R400				
Accuracy Class	Class 2				
Temperature Class	T30(1), T50				
Sample Rate	0.5 Hz to 4 Hz, fixed or self-adopting(1)				
Maximum Admissible Pressure	1.0 MPa				
Pressure Loss Range	< 63 kPa			< 40 kPa	
Flow Data Storage	Accumulated volume 90 days				

(1) Default

7.1.2 Water Meter Modules Made of Plastic

DN15 and DN20 modules come with tubes made of plastic and the sensor frontend are based on TDC-GP30.

Figure 37:
Water Meter Module, Plastic

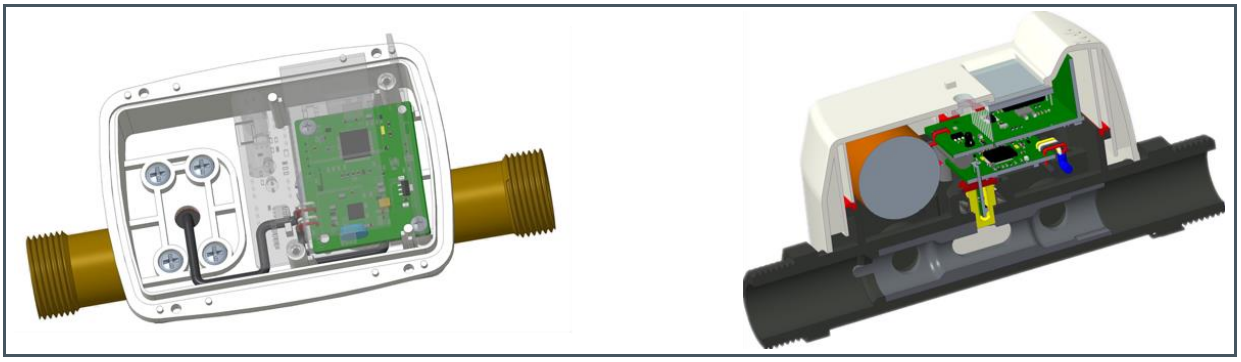


Figure 38:
Ordering Information

Ordering Code	Description	Part Number	Markup Information[1]
t.b.d.	Water meter module with plastic pipeline No calibration	IA-UWM-3-GP30-DN20	IA-UWM-3-GP30-DN20-YYYYMMDD-SSSSSS
t.b.d.	Water meter module with plastic pipeline With calibration	IA-UWM-4-GP30-DN20	IA-UWM-4-GP30-DN20-YYYYMMDD-SSSSSS

(1) YYYY = year, MM = month, DD = day, SSSSSS = product serial number that day

Figure 39:
Measurement Characteristics

Nominal Diameter [mm]	15	20	25	32	40
Starting Flow [m³/h]	0.002	0.003	0.003	0.005	0.005
Minimum Flow Rate Q_1 [m³/h]	0.010	0.016	0.025	0.040	0.064
Transitional Flow Rate Q_2 [m³/h]	0.016	0.025	0.040	0.064	0.100
Permanent Flow Rate Q_3 [m³/h]	2.500	4.000	6.300	10.000	16.000
Overload Flow Rate Q_4 [m³/h]	3.125	5.000	7.875	12.500	20.000
Flow Range Ratio R (Q_3/Q_1)	R250[1], R400				
Accuracy Class	Class 2				
Temperature Class	T30[1], T50				
Sample Rate	8 Hz to 32 Hz (8 Hz default)				
Maximum Admissible Pressure	up to 1.6 MPa (1.0 MPa @ default)				
Pressure Loss Range	< 40 kPa				
Flow Data Storage	Accumulated volume 90 days				

(1) Default

7.1.3 Gas Meter Modules

The residential and industrial modules come with tubes made of plastic and the sensor frontend are based on TDC-GP22.

Figure 40:
Gas Meter Module, Brass

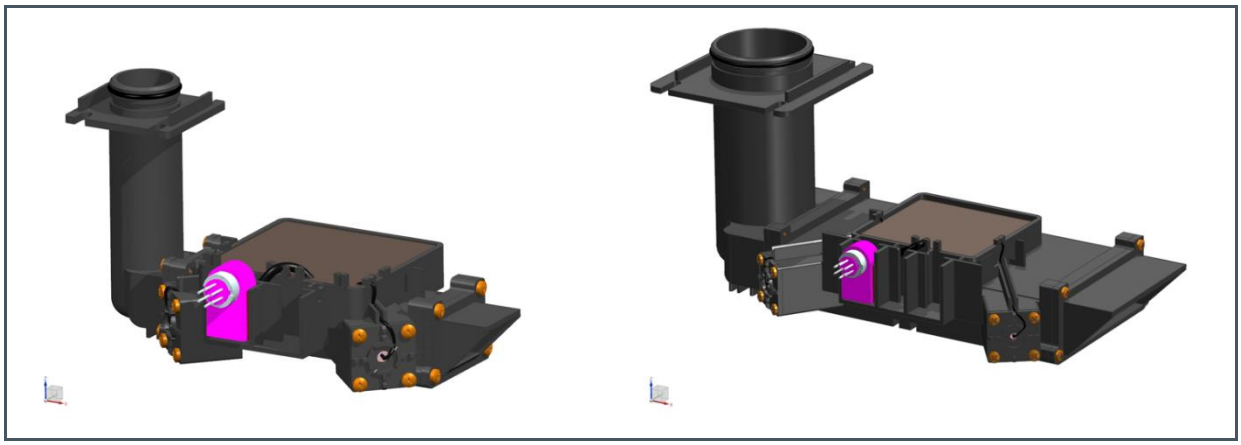


Figure 41:
Ordering Information

Ordering Code	Description	Part Number	Markup Information(1)
t.b.d.	Gas meter module residential	IA-UGM-1	IA-UGM-1-YYYYMMDD-SSSSSS
t.b.d.	Gas meter module industrial and commercial	IA-UGM-2	IA-UGM-2-YYYYMMDD-SSSSSS

(1) YYYY = year, MM = month, DD = day, SSSSSS = product serial number that day

Figure 42:
Measurement Characteristics

Application	Residential	Commercial & Industrial
Flow Range	G1.6 to G4	G6 to G25
Flow Range Ratio	R250	R350
Accuracy Class	Class 1.5	Class 1.5
Temperature Range	-15°C to 45°C	
Pressure Range	60 to 150 kPa	
Sampling Frequency	0.5 to 4 Hz @ working mode	
Outputs	Temperature, pressure (optional), flow under working condition and standard condition	
Auto-calibration for Gas	Yes	
Compensation	Temperature and pressure	
Power Consumption	< 50µA @ 4 Hz sampling rate	

Contact information:

Qingdao iESLab Electronic Co., Ltd.
High-tech Zone, Han Yu Valley Building A2-3 17 layers, Ningxia Road 288, Qingdao Software Park Building 3, Room 601, Qingdao, 266070, China

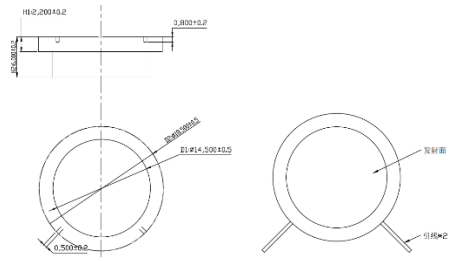
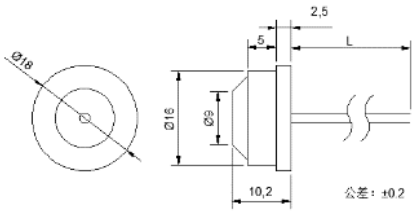
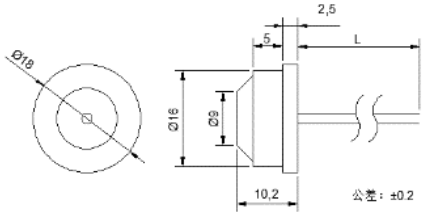
http://en.qdies.com

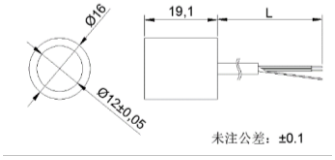
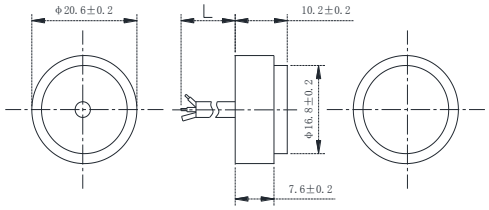
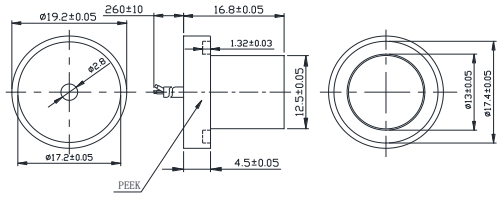
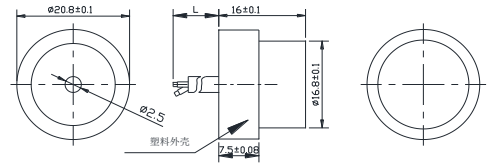
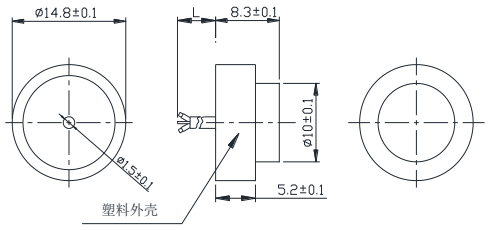
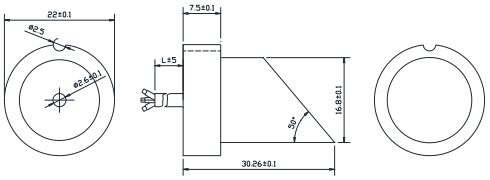
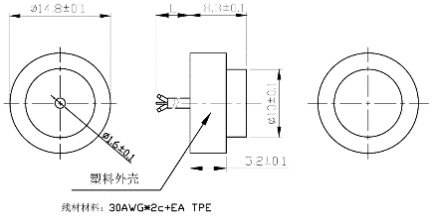
Mr. WANG Chuan
Mobile: +86 177-5310-5044
Email: wangchuan@ieslab.cn
Address: No. 1677, Kehang Rd., Licheng Dist., Jinan City, Shandong, PR. China
WeChat: wangchuan9418

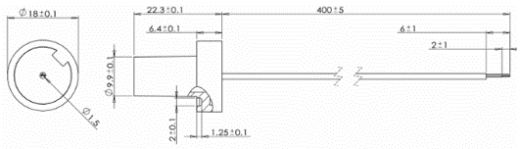
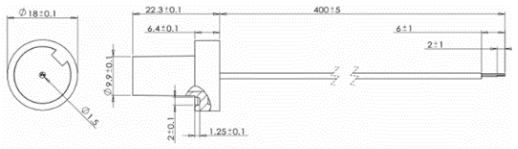
7.2 Transducers

For transducers we recommend products from Zhejiang Jiakang Electronics Co., Ltd.:

Figure 43:
Zhejiang Jiakang Ultrasonic Transducers

Part Number	Frequency	Drawing
Gas Meters		
PSC500K018060H2AD2-B1	f: 500 ± 10 kHz Cp 470 pF ± 10% Top -35 to 70 °C	
PSC200K018102H3AD0-B1	f: 200 ± 10 kHz Cp 2000 pF ± 20% Top -35 to 70 °C	
PSC200K018102H3AD1-B1	f: 200 ± 10 kHz Cp 430 pF ± 20% Top -35 to 70 °C Angle 12° (average) Q 2.9 ± 0.3 g	

Part Number	Frequency	Drawing
PSC200K016191H2AD1-B1	f: 200 ± 10 kHz Cp 600 pF ± 20% Top -35 to 70 °C Angle > 6° (half angle)	
Water Meters		
PSC1.0M020100H2AD0-B0/PSC1.0M020107H2AD0-B0	f: 1.0 ± 0.1 MHz R1MHz 100 to 350 Ω Cp 1300 pF ± 20% Top -40 to 85 °C S >800mV (@ 2Vpp, 110mm)	
PSC1.0M019168H2AD2-B0	f: 1.0 ± 0.1 MHz R1MHz 150 to 400 Ω Cp 1000 pF ± 20% Top -40 to 85 °C S >700mV (@ 2Vpp, 110mm)	
PSC1.0M020160H2AD1-B0	f: 1.0 ± 0.1 MHz R1MHz 150 to 350 Ω Cp 1200 pF ± 20% Top -40 to 85 °C S >800mV (@ 2Vpp, 110mm)	
PSC1.0M014083H2AD2-B0	f: 1.0 ± 0.1 MHz R1MHz 500 to 1500 Ω Cp 600 pF ± 20% Top -40 to 85 °C S >450mV (@ 2Vpp, 110mm)	
PSC1.0M022300H2AD4-B0	f: 1.0 ± 0.1 MHz R1MHz 150 to 500 Ω Cp 1300 pF ± 20% Top -40 to 85 °C S >700mV (@ 2Vpp, 110mm)	
PSC2.0M014083H2AD2-B0	f: 2.0 ± 0.1 MHz R1MHz 100 to 400 Ω Cp 1200 pF ± 20% Top -40 to 85 °C S >450mV (@ 2Vpp, 110mm)	

Part Number	Frequency	Drawing
PSC2.0M018223H2AD2-B0	f: 2.0 ± 0.1 MHz R1MHz 150 to 500 Ω Cp 1100 pF ± 20% Top -40 to 85 °C S >200mV (@ 3Vpp, 140mm)	
PSC4.0M018223H2AD2-B0	f: 4.0 ± 0.2 MHz R1MHz 30 to 150 Ω Cp 2050 pF ± 20% Top -40 to 85 °C S >200mV (@ 3Vpp, 140mm)	

(1) Tstrg = -40 to 85°C for all parts

Contact information:

Zhejiang Jiakang Electronics Co., Ltd.
No.1188 Jiahang Road, Jiaxing City, Zhejiang Province, China
http://www.jkelec.com/
dym@jkelec.com Tel. 13967380228
ayq@jkelec.com Tel. 13857347855

8 Revision Information

Changes from previous version to current revision v1-00	Page
Section 7, Reference Modules and Transducers, added	31ff

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

9 Legal Information

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