

PGA 450

EVM Demonstration using PGA 450 Firmware Rev 2.1

Objective:

This demonstration is to illustrate the method of using 8051 firmware to determine the time of flight (TOF) using LIN communication to trigger a distance computation and to retrieve the time information back.

Changes from Rev 2.0:

The settings for short distance measurements are updated in Rev 2.1 of the firmware. Differences include an optimized threshold algorithm (optimized for the TI setup) and less blanking time for short distance measurements.

Introduction:

TOF is the estimation of the time from the ultrasonic wave burst from the transducer to the object and then from the object back to the transducer. This time is an indicator of the distance of the object from the transducer.

Distance = TOF / 2 * Speed of sound in air (Typically 340 meters / sec at room temperature)

The firmware sets up the device with the appropriate settings for long and short distance estimation. These operations are initiated by a LIN transmission via the GUI and LIN master on the EVM to PGA450 which is the slave device.

The idea is to:

- 1. Hold the micro in reset and load the firmware into the DEVRAM (OTP programmed to JUMP to DEVRAM so that micro executes instructions from the DEVRAM)
- 2. Then release the micro and send specific LIN transmissions to trigger operations listed below:

LIN PID	Data	Purpose
11	0x(01)	Long distance from 1m to 5m
11	0x(00)	Short distance from 15cm to 1m
31	7 bytes <d0:d6></d0:d6>	Program 7 bytes of EEPROM data from 0x0400 to 0x0406. These 7 bytes are used to determine the threshold levels during echo detection. The upper nibble of each byte is used for long distance measurement, while the lower nibble is used for short distance measurement.

3. Data can also be retrieved back from the device using specific LIN transmissions, stated below:



LIN PID	Bytes to be received	Purpose
21	2	LIN communication check – Data 0x1234 will be received
22	2	Time of flight data – Data 0xYYYY will be received Data = FFFF implies no object, Data = 0000 implies no burst Time of flight can be determined by converting data into decimal and then multiplying by 1e-6 (Timer resolution) TOF = hex2dec(YYYY) * 1e-6 sec. Distance = TOF/2 * 340 meters

4. Echo data is stored in an external RAM of 768 bytes (FIFO_DATA from 0 to 767). A valid echo is determined by comparing the FIFO_DATA with the threshold level corresponding to the FIFO_DATA location. The threshold levels typically reduce as the FIFO_DATA location increases as nearer objects produce a stronger echo than the ones further away. An illustration is shown below:



5. For this demonstration to work, it is imperative to ensure that the first 7 bytes of the EEPROM data is programmed with appropriate values to ensure that the echo determination is correct. Thresholds levels for long distance range can be set up independent to the threshold levels for the short distance range. The upper nibble of EE_DATA<0:6> controls the threshold levels for the long distance instruction, while the lower nibble of EE_DATA<0:6> controls the threshold levels for the short distance instruction.

For long distance instruction, FIFO_CTRL (= 0x06) is set up for LSB mode with NO ROLLOVER in the firmware. The relation between FIFO DATA location and threshold value is as stated below:



FIFO loca	DATA tion	Threshold level for long distance
Start	End	
0	31	Ignore echo
32	63	EE_DATA_0<7:4> X 8 + 12
64	95	EE_DATA_1<7:4> X 8 + 12
96	127	EE_DATA_2<7:4> X 8 + 12
128	159	EE_DATA_3<7:4> X 8 + 12
160	191	EE_DATA_4<7:4> X 8 + 12
192	223	EE_DATA_5<7:4> X 8 + 12
224	255	EE_DATA_6<7:4> X 8 + 12
256	767	10

For short distance instruction, FIFO_CTRL (= 0x07) is set up for MSB-1 mode with NO ROLLOVER in the firmware. The relation between FIFO DATA location and threshold value is as stated below:

FIFO loca	DATA tion	Threshold level for short distance
Start	End	
0	3	EE_DATA_0<3:0> X 16 + 4
4	7	EE_DATA_1<3:0> X 16 + 4
8	11	EE_DATA_2<3:0> X 16 + 4
12	15	EE_DATA_3<3:0> X 16 + 4
16	19	EE_DATA_4<3:0> X 16 + 4
20	23	EE_DATA_5<3:0> X 16 + 4
24	63	EE_DATA_6<3:0> X 16 + 4
64	767	4

6. The preferred method of determining the threshold levels is to look at the FIFO DATA for a set up with no object ("empty set up") and then determine the appropriate levels. The raw FIFO DATA can be viewed by putting the micro in reset and clicking on the "Read and save FIFO data to file" button (Note: This feature will require MICROSOFT OFFICE 2007 or a later version installed). This procedure will need to done for both long and short distance. Plots for the empty set up on the TI bench is shown below for reference:







As a reference, the EE_DATA<0:6> was programmed with 0x(DC), 0x(6B), 0x(59), 0x(44), 0x(33), 0x(22) and 0x(11) for measurements on the TI set up.



Procedure with GUI screenshots:

1. Power up the device and open GUI.

			ED	000		DI USB	SCON	INEC DWA	RE	MA	: 11:07 AM JAL /5/ IMR	🏼 🚺	BASE CONVER 255
			-	non		R AF	PLIC	THIS	N N		/M1 /M2	Ĵ 🕜 📱	FF 1111111111111
EEPROM RAM OT	DEVRAM	4 1	FIFO	/ECł	10	EVA	NL MC	DNIT	OR		Evaluation LIN	Test MUX	
ADDRESS	HEX	b7	7 Ы	6 65	5 Б4	4 b3	3 62	b1	ь0				
92 (BPF_B1_MSB)	00	0	0	0	0	0	0	0	0	П	TRANSM	IT TO LIN SLAV	E (PGA450)
93 (BPF_B1_LSB)	00	0	0	0	0	0	0	0	0		Tr Frame RID		
94 (BPF_A2_MSB)	00	0	0	0	0	0	0	0	0		Soldered Device: (Enter 6 hits 0	Ox 0	Tx Checksur
95 (BPF_A2_LSB)	00	0	0	0	0	0	0	0	0	Ε	Microcontroller State		ENHANCED
96 (BPF_A3_MSB)	00	0	0	0	0	0	0	0	0		Data to be 1x	ed Ox	
97 (BPF_A3_LSB)	00	0	0	0	0	0	0	0	0		(Micro Active)		
A1 (LPF_B1_MSB)	00	0	0	0	0	0	0	0	0	U	Note: 1 byte p	CF FOW	
A2 (LPF_B1_LSB)	00	0	0	0	0	0	0	0	0		OFF (Micro Beset)		
A3 (LPF_A2_MSB)	00	0	0	0	0	0	0	0	0		(menor rester)		TRANSMIT
A4 (LPF_A2_LSB)	00	0	0	0	0	0	0	0	0		MICRO ACTIVE		
A5 (DOWNSAMPLE)	00	0	0	0	0	0	0	0	0				
A6 (BURST_ONA_MSB)	00	0	0	0	0	0	0	0	0				
A7 (BURST_ONA_LSB)	00	0	0	0	0	0	0	0	0		PECEIVE		
A9 (BURST_OFFA_MSB)	00	0	0	0	0	0	0	0	0		RECEIVE	THOM LIN SLAV	
AA (BURST_OFFA_LSB)	00	0	0	0	0	0	0	0	0		Number of dat	ra bytes 0	Rx Checksu
AB (BURST_ONB_MSB)	00	0	0	0	0	0	0	0	0		to be received		ENHANCED
AC (BURST_ONB_LSB)	00	0	0	0	0	0	0	0	0		Rx Frame PID	0x 0	
AD (BURST_OFFB_MSB)	00	0	0	0	0	0	0	0	0		(Enter 6 bits C)nly)	
AE (BURST_OFFB_LSB)	00	0	0	0	0	0	0	0	0	1	Data received	Ox A	
AF (PULSE_CNTA)	00	0	0	0	0	0	0	0	0				
B1 (PULSE_CNTB)	00	0	0	0	0	0	0	0	0	1			
B2 (DEADTIME)	00	0	0	0	0	0	0	0	0		Note: 1 byte p	Der row	
B3 (BURST_MODE)	00	0	0	0	0	0	0	0	0				RECEIVE
	20	0	0	4	0	0	0	0	0			-	
		-	CC1	FOT	ED.		MDI			тге			
		мD	SEL	EU II	20		WRI	10.2	CLEU	ICL		T	
/E GRID RECALL GRI		RE	AD /	ALL			V	VRIT	E AL	L		INCTDI	MENTS

2. Put the micro in reset.

			EDI	POP		DI: USB	SCON HARE	NECT		TIME: 11:07 AM MANUAL		- I I I I I I I I I I I I I I I I I I I	BASE CONVERT
			ERI	RUH	5	R AP	ESET 1 PLICA	TION		DVM1 DVM2		Î 🕜 🛅	FF 111111111111
SFR EEPROM RAM OTP	DEVRA	N I	FIFO.	/ECI	10	EVA	L MO	NITO	R		Evaluation LIN Test MUX	(
ADDRESS	HEX	b7	ь	6 b!	5 b4	ЬЗ	b2	b 1	b0	*			
92 (BPF_B1_MSB)	00	0	0	0	0	0	0	0			TRANSMIT TO	LIN SLAVE	(PGA450)
93 (BPF_B1_LSB)	00	0	0	0	0	0	0	0)		Te France PID		(
94 (BPF_A2_MSB)	00	0	0	0	0	0	0	0)	Soldered Device:	(Enter 6 bits Only)	U	Tx Checksun
95 (BPF_A2_LSB)	00	0	0	0	0	0	0	0)	Microcontroller State			ENHANCED
96 (BPF_A3_MSB)	00	0	0	0	0	0	0	0)		Data to be fixed 0x	^	
97 (BPF_A3_LSB)	00	0	0	0	0	0	0	0)	(MicroActive)			
A1 (LPF_B1_MSB)	00	0	0	0	0	0	0	0)		Note: 1 byte per row		
A2 (LPF_B1_LSB)	00	0	0	0	0	0	0	0	וו	(Micro Reset)			
A3 (LPF_A2_MSB)	00	0	0	0	0	0	0	0)	(meror nearcy)		-	TRANSMIT
A4 (LPF_A2_LSB)	00	0	0	0	0	0	0	0)	MICRO IS IN RESET			
A5 (DOWNSAMPLE)	00	0	0	0	0	0	0	0	וו				
A6 (BURST_ONA_MSB)	00	0	0	0	0	0	0	0)				
A7 (BURST_ONA_LSB)	00	0	0	0	0	0	0	0)		DECEIVE EDON		
A9 (BURST_OFFA_MSB)	00	0	0	0	0	0	0	0)		RECEIVE FROM		- (1 0/430
AA (BURST_OFFA_LSB)	00	0	0	0	0	0	0	0)		Number of data bytes	0	Rx Checksur
AB (BURST_ONB_MSB)	00	0	0	0	0	0	0	0)		to be received		ENHANCED
AC (BURST_ONB_LSB)	00	0	0	0	0	0	0	0)		Rx Frame PID 0x	0	
AD (BURST_OFFB_MSB)	00	0	0	0	0	0	0	0)		(Enter 6 bits Only)		
AE (BURST_OFFB_LSB)	00	0	0	0	0	0	0	0	וו		Data received 0x	~	
AF (PULSE_CNTA)	00	0	0	0	0	0	0	0)				
B1 (PULSE_CNTB)	00	0	0	0	0	0	0	0)				
B2 (DEADTIME)	00	0	0	0	0	0	0	0)		Note: 1 byte per row		
B3 (BURST_MODE)	00	0	0	0	0	0	0	0)	-		+	RECEIVE
		-	0.511	COT	50		NOIT		503				
INO GRID		://	əcli	eu li	20		artill	E JEI			T		
VE GRID RECALL GRID		RE	AD A	ALL			W	RITE	ALL		IEXAS IN	STRUN	IENTS
		ST	ATU	IS: L	oade	d.							



3. Check status of OTP (Make sure it says "PROGRAMMED to jump to DEVRAM" or "EMPTY"). If it says just "PROGRAMMED", replace the PGA450 unit on the EVM with a new one.

PGA450 Customer EVM GUI 1.38.20 SE VT	
ERRORS DISCONNECT UB HARDWARE THE SVSV JMP USAN DISCONNECT UB HARDWARE TVUS VVSV JMP UVM1 UVM1 UVM2 UVM2 UVM2 UVM2 UVM2 UVM2 UVM2 UVM2	BASE CONVERTER 255 25 25 25 2
ESFR EEPROM RAM OTP DEVRAM FIFO/ECHO EVAL MONITOR	Evaluation LIN Test MUX
Control Contr	TRANSMIT TO LIN SLAVE (PGA450) Tr Frame PID to for the bis Orby) Data to be Txed to a to be Txed to a to be trad to be received Note: 1 byte per row Re Frame PID Data received Note: 1 byte per row Re Frame PID Data received Re Frame PID Data received Re Frame PID Re PROMULIN SLAVE (PGA450) Re Checksum Re Frame PID Re PROMULIN SLAVE (PGA450) Re Checksum Re Frame PID Re PROMULIN SLAVE (PGA450) Re Checksum Re Frame PID Re PROMULIN SLAVE (PGA450) Re Frame PID RE
ZERO GRID DESELECT GRID READ SELECTED WRITE SELECTED SAVE GRID RECALLGRID READ ALL WRITE ALL	Texas Instruments
STATUS, LOADEd.	

4. Load program into the DEVRAM. If the OTP status was PROGRAMMED to JUMP to DEVRAM in the previous step, you don't need to have the "PROGRAM OTP Memory Also" box checked (As shown below). If the OTP status was EMPTY, then you need to have this box checked and supply 8V on VPROG OTP pin (There is a provision on the EVM to provide 8V to the VPROG_OTP pin through jumper settings).

PGA450 Customer EVM GUI 1.38.20 SE VT	CONTRACTOR OF A DECISION OF A DECISIONO OF A DECISI
ESFR EEPROM RAM OTP DEVRAM FIRO/ECH EVAL MONITOR	BASE CONVERTER 255 FF F F Evaluation LIN Tex MUX
ADDRESS DATA 0x 0x	TRANSMIT TO LIN SLAVE (PGA450) Tx Frame PID (fatier 6 bits Only) Data to be Txed Qx
Load. HEX File into GUI	Note: I byte per now
DEVRAM Verification Successful	Number of data bytes 0 Rx Checksum to be received ENAMORE -
	Rx Frame PID (Enter 6 bits Only) 0x Data received 0x
	Note: 1 byte per row
ZERO GRID DESELECT GRID READ SELECTED WRITE SELECTED SAVE GRID RECALLGRID READ ALL WRITE ALL STATUS: Loaded.	Texas Instruments



5. Release the micro out of reset.

				000		USE	SCO	NNE(IT RE	M	ME: 11:09 AM NUAL		BASE CONVERT 255
					IS	RESET T APPLICA		THE	THIS ATION		3V/5V JMP DVM1 DVM2	Ĵ 🕐	FF 11111111111
FR EEPROM RAM OTP	DEVRA	MF	FIFO	/ECI	HO	EVA	L MO	пис	OR			Evaluation LIN Test MUX	
ADDRESS	HEX	ь7	ь	6 b	5 b-	4 Ы	3 Ы2	2 Б	ьо	1	1		
92 (BPF_B1_MSB)	00	0	0	0	0	0	0	0	0	П		TRANSMIT TO LIN SLA	VE (PGA450)
93 (BPF_B1_LSB)	00	0	0	0	0	0	0	0	0			Tx Eramo RID	
94 (BPF_A2_MSB)	00	0	0	0	0	0	0	0	0		Soldered Device:	(Enter 6 bits Only)	Tx Checksum
95 (BPF_A2_LSB)	00	0	0	0	0	0	0	0	0	1	Microcontroller State		ENHANCED
96 (BPF_A3_MSB)	00	0	0	0	0	0	0	0	0			Data to be ixed Ox	*
97 (BPF_A3_LSB)	00	0	0	0	0	0	0	0	0	Ш	(MicroActive)		
A1 (LPF_B1_MSB)	00	0	0	0	0	0	0	0	0			Note: 1 byte per row	
A2 (LPF_B1_LSB)	00	0	0	0	0	0	0	0	0	Г	OFF (Marco Report)		
A3 (LPF_A2_MSB)	00	0	0	0	0	0	0	0	0	L	(MICIONBOC)		TRANSMIT
A4 (LPF_A2_LSB)	00	0	0	0	0	0	0	0	0	L	MICRO ACTIVE		
A5 (DOWNSAMPLE)	00	0	0	0	0	0	0	0	0	L			
A6 (BURST_ONA_MSB)	00	0	0	0	0	0	0	0	0				
A7 (BURST_ONA_LSB)	00	0	0	0	0	0	0	0	0	L		RECEIVE EROM LIN SL	
A9 (BURST_OFFA_MSB)	00	0	0	0	0	0	0	0	0	L		RECEIVE FROM LIN 3D	
AA (BURST_OFFA_LSB)	00	0	0	0	0	0	0	0	0	L		Number of data bytes 0	Rx Checksun
AB (BURST_ONB_MSB)	00	0	0	0	0	0	0	0	0	L		to be received	ENHANCED
AC (BURST_ONB_LSB)	00	0	0	0	0	0	0	0	0	L		Rx Frame PID Or 0	
AD (BURST_OFFB_MSB)	00	0	0	0	0	0	0	0	0	1		(Enter 6 bits Only)	
AE (BURST_OFFB_LSB)	00	0	0	0	0	0	0	0	0	L		Data received 0x	*
AF (PULSE_CNTA)	00	0	0	0	0	0	0	0	0	L			
B1 (PULSE_CNTB)	00	0	0	0	0	0	0	0	0				
B2 (DEADTIME)	00	0	0	0	0	0	0	0	0			Note: 1 byte per row	
B3 (BURST_MODE)	00	0	0	0	0	0	0	0	0				
	p	AD	SEL	FCT	FD		WRI	TES	FLFC	TE			
		DC		411				MDI	E AI		- Jin -	TEVAC INCTRI	

Send a LIN transmission by clicking the RECEIVE button with a PID = 21, bytes to be received
 = 2. You should receive 0x(1234) as shown below that verifies the LIN communication.





7. Send a LIN transmission by clicking the TRANSMIT button with a PID = 11 with data = 0x(01) as shown below. This will trigger a "long distance" measurement. Next, send a LIN transmission by clicking the RECEIVE button with PID = 22 and bytes to be received = 2. You will receive the time of flight in u sec as 0xYYYY as shown below.

						DI: USB	SCON HAR	INEC DWA	T RE	TI M/	ME: 11:11 AM INUAL				BASE CONVERTER 255
			EP	HOP	s	R AP	ESET PLIC	THIS	۷		3V/5V JMP DVM1 DVM2		Î 💽 (FF 1111111111111111
SFR EEPROM RAM OTP	DEVRA	M	FIFC)/EC	HO	EVA	L MC	NIT	OR			Evaluation LIN Test MU	<		
ADDRESS	HEX	Ь	7 Ь	6 Ь	5 Ь4	ЬЗ	b2	b1	ь0	1					
 92 (BPF_B1_MSB) 	00	0	0	0	0	0	0	0	0	U		TRANSMIT TO	LIN SLA	VE I	(PGA450)
93 (BPF_B1_LSB)	00	0	0	0	0	0	0	0	0			Tx Frame PID 0-	11		Tr. Chardenum
94 (BPF_A2_MSB)	00	0	0	0	0	0	0	0	0		Soldered Device:	(Enter 6 bits Only)			ENHANCED
95 (BPF_A2_LSB)	00	0	0	0	0	0	0	0	0	E	Microcontroller State	Data to be Tred o	•		LITTINGED
96 (BPF_A3_MSB)	00	0	0	0	0	0	0	0	0		ON	Data to be fixed to	1	^	
97 (BPF_A3_LSB)	00	0	0	0	0	0	0	0	0		(MicroActive)	Note: 1 bute per mw			
A1 (LPF_B1_MSB)	00	0	0	0	0	0	0	0	0	Į.	055	Note. Toyte per tow			
A2 (LPF_B1_LSB)	00	0	0	0	0	0	0	0	0		(MicroReset)				
A3 (LPF_A2_MSB)	00	0	0	0	0	0	0	0	0					-	TRANSMIT
A4 (LPF_A2_LSB)	00	0	0	0	0	0	0	0	0		MICRO ACTIVE				
A5 (DOWNSAMPLE)	00	0	0	0	0	0	0	0	0	L					
A6 (BURST_ONA_MSB)	00	0	0	0	0	0	0	0	0						
A7 (BURST_ONA_LSB)	00	0	0	0	0	0	0	0	0			RECEIVE FROM	LIN SLA	VE	(PGA450)
A9 (BURST_OFFA_MSB)	00	0	0	0	0	0	0	0	0	L					(
AA (BURST_OFFA_LSB)	00	0	0	0	0	0	0	0	0			to be received	2		Rx Checksum
AB (BURST_ONB_MSB)	00	0	0	0	0	0	0	0	0	L					ENHANCED
AC (BURST_ONB_LSB)	00	0	0	0	0	0	0	0	0			Rx Frame PID 0x	22		
AD (BURST_OFFB_MSB)	00	0	0	0	0	0	0	0	0			(Enter 6 bits Only)			
AE (BURST_OFFB_LSB)	00	0	0	0	0	0	0	0	0	L		Data received Ox	15	^	
AF (PULSE_CNTA)	00	0	0	0	0	0	0	0	0				CA		
B1 (PULSE_CNTB)	00	0	0	0	0	0	0	0	0						
B2 (DEADTIME)	00	0	0	0	0	0	0	0	0			Note: 1 byte per row			
B3 (BURST_MODE)	00	0	0	0	0	0	0	0	0					-	RECEIVE
ZERO GRID	R	EAD	SEL	ECT	ED		NRIT	TE SI	ELEC	TEI		L			
AVE GRID RECALL GRID		RE	AD	ALL			٧	/RIT	E AL	L	i 🚽 🐴 '	Texas In	STRU	M	ENTS
		ST	TAT	US: L	oade	d.					· · · · · · · · · · · · · · · · · · ·				

 If you want to program the EEPROM used for echo threshold comparison, send a LIN transmission by clicking the TRANSMIT button with a PID = 31 with 7 data bytes as shown below. This will program the EEPROM locations 0x0400 to 0x0406 with the transmitted data.

							CONN HA	IECT RDW	TO U:	58	TI	E: 10:32 AM (NOWN		III 🧾	BASE CONVERTE
				ER	ROR		RE APP	SET	THIS		17	V/SV JMP IV/M1 IV/M2		Î 🕜 🗄	FF 11111111111
SFR EEPR	DM RAM OTP	DEVR/	M	FIFO	/ECH	0	EVAL	. MO	NITC	R			Evaluation LIN Test MUX	x	
ADDRE	SS	HE	(b	7 Ы	b5	b4	b 3	b2	Ь1	ьо	1				
 92 (BPF_ 	B1_MSB)	00	0	0	0	0	0	0	0	0			TRANSMIT TO	LIN SLAVE	(PGA450)
93 (BPF_	B1_LSB)	00	0	0	0	0	0	0	0	0			Tx Frame PID or	21	Te Chookeum
94 (BPF_	A2_MSB)	00	0	0	0	0	0	0	0	0		Soldered Device:	(Enter 6 bits Only)	51	ENLIANCED
95 (BPF_	A2_LSB)	00	0	0	0	0	0	0	0	0	1	Microcontroller State	Data to be Typed o		CHINNEED
96 (BPF_	A3_MSB)	00	0	0	0	0	0	0	0	0		ON	Data to be fixed ()x	60 ^	
97 (BPF_	A3_LSB)	00	0	0	0	0	0	0	0	0		(MicroActive)	Note: 1 hade and and	59	
A1 (LPF_	B1_MSB)	00	0	0	0	0	0	0	0	0			Note: I byte per row	33	
A2 (LPF_	B1_LSB)	00	0	0	0	0	0	0	0	0		(MicroBeset)		22	
A3 (LPF	A2_MSB)	00	0	0	0	0	0	0	0	0	Ŀ			··· ·	TRANSMIT
A4 (LPF_	A2_LSB)	00	0	0	0	0	0	0	0	0		MICRO ACTIVE			
A5 (DOW	(NSAMPLE)	00	0	0	0	0	0	0	0	0	Ŀ				
A6 (BUR	ST_ONA_MSB)	00	0	0	0	0	0	0	0	0					
A7 (BUR	ST_ONA_LSB)	00	0	0	0	0	0	0	0	0	Ŀ		RECEIVE FROM	I IN SLAV	F (PGA450)
A9 (BUR	ST_OFFA_MSB)	00	0	0	0	0	0	0	0	0					_ ()
AA (BUR	ST_OFFA_LSB)	00	0	0	0	0	0	0	0	0	Ŀ		Number of data bytes to be received	2	Rx Checksum
AB (BUR	ST_ONB_MSB)	00	0	0	0	0	0	0	0	0			10 00 1000 100		ENHANCED
AC (BUR	ST_ONB_LSB)	00	0	0	0	0	0	0	0	0			Rx Frame PID 0x	22	
AD (BUR	ST_OFFB_MSB)	00	0	0	0	0	0	0	0	0			(Enter 6 bits Only)		
AE (BUR	ST_OFFB_LSB)	00	0	0	0	0	0	0	0	0			Data received 0x	15 ^	
AF (PULS	SE_CNTA)	00	0	0	0	0	0	0	0	0				LA	
B1 (PULS	SE_CNTB)	00	0	0	0	0	0	0	0	0					
B2 (DEAL	DTIME)	00	0	0	0	0	0	0	0	0			Note: 1 byte per row		
B3 (BUR	ST_MODE)	00	0	0	0	0	0	0	0	0	•			-	RECEIVE
ZERO GRID	DESELECT GRID	F	EAD	SEL	СТЕ	D	V	RIT	E SE	LEC	TE				
SAVE GRID	RECALL GRID		RE	AD /	NLL.			W	RITE	AL	L		FEXAS IN	STRUM	IENTS
		_	S	TATI	IS-1	ader						· · · · ·			



9. To retrieve the echo data, put the micro in reset and click on the "Read and Save FIFO data to File" button as shown below. This will open an EXCEL file with the data. Note: MICROSOFT OFFICE 2007 or newer version needed.

PGA450 C	Customer EVM GUI 1.38.20 SE V	т			
		ERRORS	Image: Signal and Sig		BASE CONVERTER 255 FF 111111111111111111111111111111111111
ESFR EEF	ROM RAM OTP DEVRAM	FIFO/ECHO EVAL MONIT	OR	Evaluation LIN Test MUX	
FIFO	MEMORY (EXTER	NAL RAM)		TRANSMIT TO LINEOU	
ADDRESS	REG b7 b6 b5 b4 b3 b2	b1 b0		TRANSMIT TO LIN SLA	AVE (PGA450)
• 0			Read and Save	Tx Frame PID 0x 31 (Feder 6 bits Only)	Tx Checksum
2	9C 1 0 0 1 1 1 0	0 0	FIFO Data to File		ENHANCED -
3	8F 1 0 0 0 1 1	1 1		Data to be ixed 0x dc	A
4	79 0 1 1 1 1 0 0	0 1		Signature 1 byte per par	
5	69 0 1 1 0 1 0 0	0 1		33	
6	5F 0 1 0 1 1 1	1 1		222	
7	58 0 1 0 1 1 0 0	0 0			
8	48 0 1 0 0 1 0	1 1			
9	42 0 1 0 0 0 0	1 0			
A	56 0 1 0 1 0 1	1 0			
c	61 0 1 1 0 0 0 0	0 1		RECEIVE FROM LIN SL	AVE (FGA450)
D	65 0 1 1 0 0 1 0	0 1		Number of data bytes 2	Rx Checksum
E	66 0 1 1 0 0 1 1	1 0		to be received	ENHANCED -
F	6B 0 1 1 0 1 0 1	1 1		Rx Frame PID 0x 22	
10	70 0 1 1 1 0 0 0	0 0			
11	71 0 1 1 1 0 0 0	0 1		Data received 0x 15 CA	*
12	6A 0 1 1 0 1 0 1	1 0			
13		1 0		Note: 1 byte per row	
14	51 0 1 0 1 0 0	0 1 -			DEDENE
15					+ RECEIVE
ZERO GRID	DESELECT GRID READ	SELECTED WRITE S	ELECTED		
SAVE GRID	RECALL GRID	EAD ALL WRIT	EALL	TEXAS INSTRU	JMENTS
	S	TATUS: Loaded.	· · · · · · · · · · · · · · · · · · ·		