

EventMessage	3
PPSmessage	11
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Event Message

1. Event Data Format

No.	32-bit words			
	32 25	24 16	15 8	7 0
0	Total length		Header length	
1	Data format version	Firmware version	Adaq version	Dudaq version
2	DU station number			
3	Hardware ID			
4	Event ID			
5	CTP			
6	CTD			
7	ADC sampling frequency		ADC sampling resolution	
8	Dudaq seconds			
9	Dudaq nanoseconds			
10	Trigger position			
11	Trigger T3 flag		Trigger status	
12	Statistics - Trigger rate		Statistics - DDR storage rate	
13	PPS ID			
14	FPGA temperature		ADC temperature	
15				
16				
17	Atmospheric temperature		Atmospheric pressure	
18	Atmospheric humidity		Accelerometer X	
19	Accelerometer Y		Accelerometer Z	
20	Input voltage			
21	Time of the week			
22	Week number		UTC offset	
23	Time flag	Seconds	Minutes	Hours
24	Day of month	Month		
25	Year			
26	Receiver mode	Disciplining mode	Self-survey progress	
27	Minor alarms		GNSS decoding status	Disciplining activity
28	PPS offset			
29	Temperature			
30	Latitude (upper 32 bits)			
31	Latitude (lower 32 bits)			
32	Longitude (upper 32 bits)			
33	Longitude (lower 32 bits)			
34	Altitude (upper 32 bits)			
35	Altitude (lower 32 bits)			
36	Event trace length			
37	Channel readout selection			
38	Trigger selection			
39	Channel 1 Signal / Noise Threshold			
40	Channel 2 Signal / Noise Threshold			
41	Channel 3 Signal / Noise Threshold			
42				
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69	Channel 1 Notch Filter 2 Parameters 2	
70	Channel 1 Notch Filter 2 Parameters 3	
71	Channel 1 Notch Filter 2 Parameters 4	
72	Channel 1 Notch Filter 2 Parameters 5	
73	Channel 1 Notch Filter 3 Parameters 1	
74	Channel 1 Notch Filter 3 Parameters 2	
75	Channel 1 Notch Filter 3 Parameters 3	
76	Channel 1 Notch Filter 3 Parameters 4	
77	Channel 1 Notch Filter 3 Parameters 5	
78	Channel 1 Notch Filter 4 Parameters 1	
79	Channel 1 Notch Filter 4 Parameters 2	
80	Channel 1 Notch Filter 4 Parameters 3	
81	Channel 1 Notch Filter 4 Parameters 4	
82	Channel 1 Notch Filter 4 Parameters 5	
83	Channel 2 Notch Filter 1 Parameters 1	
...	...	
102	Channel 2 Notch Filter 4 Parameters 5	
103	Channel 3 Notch Filter 1 Parameters 1	
...	...	
122	Channel 3 Notch Filter 4 Parameters 5	
123		
...	...	
142		
143	Total no. of ADC sample pairs	
144	No. of ADC sample pairs in Channel 3	No. of ADC sample pairs in Channel 2
145	No. of ADC sample pairs in Channel 1	
146	Channel 1 ADC sample 2	Channel 1 ADC sample 1
	... max. 16384 samples (max. 8192 sample pairs)	
	Channel 2 ADC sample 2	Channel 2 ADC sample 1
	... max. 16384 samples (max. 8192 sample pairs)	
	Channel 3 ADC sample 2	Channel 3 ADC sample 1
	... max. 16384 samples (max. 8192 sample pairs)	

2. Event Fields Description

2.1 DU IDs and Status

Data Field	Data type	Description		
Total length	uint16	(total # of ADC samples + header length) in 32-bit units.		
Header length	uint16	146 32-bit fields.		
Data format version	uint8	Event Message format version.		
Firmware version	uint8	FPGA firmware version.		
Adaq version	uint8	Adaq version.		
Dudaq version	uint8	Dudaq version.		
DU station number	uint16	DU station host ID.		
Hardware ID	uint32	DU FPGA unique identifier.		
Event ID	uint32	Event ID.		
CTP	uint32	Number of 2ns time units between the most recent PPS and the previous PPS.		
CTD	uint32	Number of 2ns time units between the current trigger time moment and the most recent PPS time moment.		
ADC sampling frequency	uint16	500 MHz		
ADC sampling resolution	uint16	14 bits		
Dudaq seconds	int32	UTC time in unix format.		
Dudaq nanoseconds	int32	Trigger time moment corrected for GPS offsets.		
Trigger position	uint32	Trigger sample number relative to the first readout sample in the trace.		
Trigger T3 flag	uint16	T.B.D.		
Trigger status	Bit field	Bit	Value	Description
		0	1 / 0	Ch. 1 trigger detected / not detected
		1	1 / 0	Ch. 2 trigger detected / not detected
		2	1 / 0	Ch. 3 trigger detected / not detected
		4	1 / 0	(Ch. 1 & Ch. 2) trigger detected / not detected
		5	1 / 0	(Ch. 1 & Ch. 2 & Ch. 3) trigger detected / not detected
		6	1 / 0	(Ch. 1 & Ch. 2 & ~Ch. 3) trigger detected / not detected
		7	1 / 0	20Hz trigger detected / not detected
		8	1 / 0	10sec trigger detected / not detected
		9	1 / 0	Custom frequency trigger detected / not detected
Statistics - Trigger rate	uint16	Number of triggered events per second.		
Statistics - DDR storage rate	uint6	Number of triggered events that are committed to DDR per second.		
PPS ID	uint16	PPS message ID associated with the most recent PPS.		
FPGA temperature	uint16	To derive the FPGA temperature T_{FPGA} [C] , based on the RegisterValue: T_{FPGA} [C] = (RegisterValue * 509.3140064)/2^16 - 280.23087870.		
ADC temperature	uint16	To derive the ADC temperature T_{ADC} [C] , based on the RegisterValue: T_{FPGA} [C] = (RegisterValue - 819)/2.654 + 25.		

Spare 3		
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2.2 Sensors data

Sensors Data Field	Data type	Description
Atmospheric temperature	int16	To derive temperature, T [C] , based on RegisterValue: $\text{RegisterValue} = 4096 * \text{Vadc [V]} / 2.5;$ $\text{Vadc [mV]} = (\text{T} - \text{Tinfl}) * \text{Tc} + \text{Voffs}$ <ul style="list-style-type: none"> For T in [-40, 100] degrees Celsius, (Tinfl = 0C; Tc = 19.5mV/C; Voffs = 400mV) For T in [100, 125] degrees Celsius, (Tinfl = 100C; Tc = 19.7mV/C; Voffs = 2350mV)
Atmospheric pressure	int16	????
Atmospheric humidity	int16	To derive Relative Humidity, sensor RH [%] , based on RegisterValue: $\text{RegisterValue} = 4096 * \text{Vadc [V]} / 2.5;$ $\text{Vadc [V]} = 3.3 * (0.00636 * \text{sensor RH} + 0.1515)$
Accelerometer X	int16	????
Accelerometer Y	int16	????
Accelerometer Z	int16	????
Input voltage	int16	To derive the Input voltage Vin [V] , based on the RegisterValue: $\text{RegisterValue} = 4096 * \text{Vadc [V]} / 2.5;$ $\text{Vadc [V]} = 18\text{k} / (18\text{k} + 91\text{k}) * \text{Vin}$

2.3 GPS data

GPS Data Field	Data type	Description																												
PPS Offset	float	Nanoseconds. Positive values indicate that the PPS is coming out late relative to GPS.																												
Time of week	uint32	Number of seconds since Sunday 00:00:00 GPS.																												
Week number	uint16	GPS week number.																												
UTC Offset	int16	UTC Offset (seconds) from chosen constellation time ref. Can be positive or negative.																												
Time flag	Bit field	<table> <tr> <th>Bit</th><th>Value</th><th>Description</th></tr> <tr> <td rowspan="2">0</td><td>0</td><td>GPS time (default)</td></tr> <tr> <td>1</td><td>UTC or GNSS time</td></tr> <tr> <td rowspan="2">1</td><td>0</td><td>GPS PPS (default)</td></tr> <tr> <td>1</td><td>UTC or GNSS PPS</td></tr> <tr> <td rowspan="2">2</td><td>0</td><td>Time is set</td></tr> <tr> <td>1</td><td>Time is not set</td></tr> <tr> <td rowspan="2">3</td><td>0</td><td>Have UTC info</td></tr> <tr> <td>1</td><td>No UTC info</td></tr> <tr> <td rowspan="2">4-5</td><td>0</td><td>UTC time</td></tr> <tr> <td>1</td><td>GLONASS time</td></tr> </table>	Bit	Value	Description	0	0	GPS time (default)	1	UTC or GNSS time	1	0	GPS PPS (default)	1	UTC or GNSS PPS	2	0	Time is set	1	Time is not set	3	0	Have UTC info	1	No UTC info	4-5	0	UTC time	1	GLONASS time
Bit	Value	Description																												
0	0	GPS time (default)																												
	1	UTC or GNSS time																												
1	0	GPS PPS (default)																												
	1	UTC or GNSS PPS																												
2	0	Time is set																												
	1	Time is not set																												
3	0	Have UTC info																												
	1	No UTC info																												
4-5	0	UTC time																												
	1	GLONASS time																												

		2	BeiDou time
		3	Galileo time
		6-7	0 UTC PPS
			1 GLONASS PPS
			2 BeiDou PPS
			3 Galileo PPS
Seconds	uint8	0-59 seconds	
Minutes	uint8	0-59 minutes	
Hours	uint8	0-23 hours	
Day of the month	uint8	1-31 day of the month	
Month	uint8	1-12 month of the year	
Year	uint32	four digits of year	
Temperature	float	Celsius. Reported by the on-board temperature sensor.	
Latitude	double	Radians from $-\pi/2$ to $+\pi/2$. Negative values represent southern latitudes. Positive values represent northern latitudes.	
Longitude	double	Radians from $-\pi$ to $+\pi$. Negative values represent western longitudes. Positive values represent eastern longitudes.	
Altitude	double	meters	
Disciplining Activity	uint8	0x00 - Phase Locking 0x01 - Oscillator warm-up 0x02 - Frequency locking 0x03 - Placing PPS 0x04 - Initializing loop filter 0x05 - Compensating OCXO (Holdover) 0x06 - Inactive 0x07 - Not used 0x08 - Recovery mode 0x09 - Calibration/control voltage	
GNSS Decoding Status	uint8	0x00 - Doing fixes 0x01 - Don't have GNSS time 0x08 - No usable satellites 0x09 - Only 1 usable sat 0x0A - Only 2 usable sats 0x0B - Only 3 usable sats 0x0C - The chosen sat is unusable	
Disciplining Mode	uint8	0 - Normal (Locked to GPS) 1 - Power Up 2 - Auto Holdover 3 - Manual Holdover 4 - Recovery 5 - Not used	
Receiver Mode	uint8	0 - Automatic (2D/3D) 1 - Single Satellite (Time) 3 - Horizontal (2D) 4 - Full Position (3D) 7 - Over-determined Clock	
Self-Survey Progress	uint8	0-100%	
Minor Alarms	Bit field	Bit 1 : Antenna Open Bit 2 : Antenna shorted Bit 3 : Not tracking satellites Bit 4 : Not disciplining oscillator (ICM only) Bit 5 : Survey-in progress Bit 6 : No stored position Bit 7 : Leap second pending Bit 8 : In test mode Bit 9 : Position is questionable Bit 10 : Not used Bit 11 : Almanac not complete Bit 12 : PPS not generated	

2.3 DU configuration

DU Data Field	Data type	Description		
Event trace length	uint16	(total # of ADC samples) in 32-bit units		
Channel readout selection	Bit field	Bit	Value	Description
		14 to 11	0001	CH3 readout source: ADC channel A
			0010	CH3 readout source: ADC channel B
			0100	CH3 readout source: ADC channel C
			1000	CH3 readout source: ADC channel D
			0000	CH3 readout source: OFF (channel is disabled)
		10	0	CH3 readout data: unfiltered
			1	CH3 readout data: IIR filtered
		9 to 6	0001	CH2 readout source: ADC channel A
			0010	CH2 readout source: ADC channel B
			0100	CH2 readout source: ADC channel C
			1000	CH2 readout source: ADC channel D
			0000	CH2 readout source: OFF (channel is disabled)
		5	0	CH2 readout data: unfiltered
			1	CH2 readout data: IIR filtered
		4 to 1	0001	CH1 readout source: ADC channel A
			0010	CH1 readout source: ADC channel B
			0100	CH1 readout source: ADC channel C
			1000	CH1 readout source: ADC channel D
			0000	CH1 readout source: OFF (channel is disabled)
		0	0	CH1 readout data: unfiltered
			1	CH1 readout data: IIR filtered
Trigger selection	Bit field	Bit	Value	Description
		25 to 23	000 - no filter 001 - 1 filter 010 - 2 filters 011 - 3 filters 100 - 4 filters	Number of IIR filters to be used for channel 3 prior to L1-triggering
		22 to 20	000 - no filter 001 - 1 filter 010 - 2 filters 011 - 3 filters 100 - 4 filters	Number of IIR filters to be used for channel 2 prior to L1-triggering
		19 to 17	000 - no filter 001 - 1 filter 010 - 2 filters 011 - 3 filters 100 - 4 filters	Number of IIR filters to be used for channel 1 prior to L1-triggering
		16 to 14 (B)		Custom frequency trigger with period given by

		13 to 9 (E)		$(B \ll E) \cdot 256 \cdot 4 \text{ ns}$, for all channels selected for readout (B = bits 16 to 14; E = bits 13 to 9).
		8	1 / 0	Enable / disable periodic 10 sec trigger, on all channels selected for readout.
		7	1 / 0	Enable / disable 20 Hz trigger, on all channels selected for readout.
		6	1 / 0	Enable /disable trigger when coincidence on channels 1 and 2, and no trigger on channel 3
		5	1 / 0	Enable / disable trigger when coincidence on channels 1, 2 and 3
		4	1 / 0	Enable / disable trigger when coincidence on channels 1 and 2
		2	1 / 0	Enable / disable trigger on channel 3.
		1	1 / 0	Enable / disable trigger on channel 2.
		0	1 / 0	Enable / disable trigger on channel 1.
Channel 1 Signal / Noise Threshold	Bit field	23 to 12	Signal threshold in ADC units for channel 1.	
		11 to 0	Noise threshold in ADC units for channel 1.	
Channel 2 Signal / Noise Threshold	Bit field	23 to 12	Signal threshold in ADC units for channel 2.	
		11 to 0	Noise threshold in ADC units for channel 2.	
Channel 3 Signal / Noise Threshold	Bit field	23 to 12	Signal threshold in ADC units for channel 3.	
		11 to 0	Noise threshold in ADC units for channel 3.	
Channel 1 Trigger Parameters	Bit field	29 to 21	Pre-T1 - No. of sample pairs before T1 crossing.	
		20 to 12	Post-T1 - No. of sample pairs after T1 crossing	
		11 to 9	No. of sample pairs between T2 crossings during Post-T1.	
		8 to 5	Minimum no. of T2 crossings during Post-T1.	
		4 to 0	Maximum no. of T2 crossings during Post-T1.	
Channel 2 Trigger Parameters	Bit field	29 to 21	Pre-T1 - No. of sample pairs before T1 crossing.	
		20 to 12	Post-T1 - No. of sample pairs after T1 crossing	
		11 to 9	No. of sample pairs between T2 crossings during Post-T1.	
		8 to 5	Minimum no. of T2 crossings during Post-T1.	
		4 to 0	Maximum no. of T2 crossings during Post-T1.	
Channel 3 Trigger Parameters	Bit field	29 to 21	Pre-T1 - No. of sample pairs before T1 crossing.	
		20 to 12	Post-T1 - No. of sample pairs after T1 crossing	
		11 to 9	No. of sample pairs between T2 crossings during Post-T1.	
		8 to 5	Minimum no. of T2 crossings during Post-T1.	
		4 to 0	Maximum no. of T2 crossings during Post-T1.	
Additional gain channel A and B (physical channels)	Bit field	31 to 16	Gain channel 1.	$\text{Gain bits} = (4096 * (\text{Gain[dB]}+14)/37.5)/2.5$
		15 to 0	Gain channel 2.	$\text{Gain bits} = (4096 * (\text{Gain[dB]}+14)/37.5)/2.5$
Additional gain channel C and D (physical channels)	Bit field	31 to 16	Gain channel 3.	$\text{Gain bits} = (4096 * (\text{Gain[dB]}+14)/37.5)/2.5$
		15 to 0	Gain channel 4.	$\text{Gain bits} = (4096 * (\text{Gain[dB]}+14)/37.5)/2.5$
Baseline Subtraction Channel 1 and 2	Bit field	25 to 23	W = bits 25 to 23. No. of samples for averaging channel 2 = 2^W .	
		22 to 13	Baseline averaging limit for channel 2.	
		12 to 10	W = bits 12 to 10. No. of samples for averaging channel 1 = 2^W .	
		9 to 0	Baseline averaging limit for channel 1.	
Baseline	Bit field	12 to	W = bits 25 to 23. No. of samples for averaging channel 3 = 2^W .	

Subtraction Channel 3		10	Baseline averaging limit for channel 3.
		9 to 0	
Channel 1 Notch Filter 1 Parameters 1			
...			

2.4 ADC data

ADC Data Field	Data type	Description
Channel 1 ADC sample 1	int16	ADC data sample at time moment t_1 . Range [-8192, 8191]. ADC data samples are taken every 2ns.
Channel 1 ADC sample 2	int16	ADC data sample at time moment $t_2=t_1+2ns$.
...		

PPS Message

1. PPS Message Data Format

	32-bit words			
No.	32 25	24 16	15 8	7 0
0	Total length			
1	PPS message ID			
2	CTP			
3	Time of the week			
4	Week number		UTC offset	
5	Time flag	Seconds	Minutes	Hours
6	Day of month	Month		
7	Year			
8	Receiver mode	Disciplining mode	Self-survey progress	
9	Minor alarms		GNSS decoding status	Disciplining activity
10	PPS Offset			
11	Temperature			
12	Latitude (upper 32 bits)			
13	Latitude (lower 32 bits)			
14	Longitude (upper 32 bits)			
15	Longitude (lower 32 bits)			
16	Altitude (upper 32 bits)			
17	Altitude (lower 32 bits)			
18	Atmospheric temperature		Atmospheric pressure	
19	Atmospheric humidity		Accelerometer X	
20	Accelerometer Y		Accelerometer Z	
21	Battery voltage			

IDs & status

Sensors'

GPS data

2. PPS Message Fields Description

2.1 IDs and Status

Data Field	Data type	Description
Total length	uint16	22 32-bit fields.
PPS message ID	uint32	PPS message ID.
CTP	uint32	Number of 4ns time units between the most recent PPS and the previous PPS.

2.2 GPS data

GPS Data Field	Data type	Description																																									
PPS Offset	float	Nanoseconds. Positive values indicate that the PPS is coming out late relative to GPS.																																									
Time of week	uint32	Number of seconds since Sunday 00:00:00 GPS.																																									
Week number	uint16	GPS week number.																																									
UTC Offset	int16	UTC Offset (seconds) from chosen constellation time ref. Can be positive or negative.																																									
Time flag	Bit field	<table><tr><th>Bit</th><th>Value</th><th>Description</th></tr><tr><td rowspan="2">0</td><td>0</td><td>GPS time (default)</td></tr><tr><td>1</td><td>UTC or GNSS time</td></tr><tr><td rowspan="2">1</td><td>0</td><td>GPS PPS (default)</td></tr><tr><td>1</td><td>UTC or GNSS PPS</td></tr><tr><td rowspan="2">2</td><td>0</td><td>Time is set</td></tr><tr><td>1</td><td>Time is not set</td></tr><tr><td rowspan="2">3</td><td>0</td><td>Have UTC info</td></tr><tr><td>1</td><td>No UTC info</td></tr><tr><td rowspan="4">4-5</td><td>0</td><td>UTC time</td></tr><tr><td>1</td><td>GLONASS time</td></tr><tr><td>2</td><td>BeiDou time</td></tr><tr><td>3</td><td>Galileo time</td></tr><tr><td rowspan="4">6-7</td><td>0</td><td>UTC PPS</td></tr><tr><td>1</td><td>GLONASS PPS</td></tr><tr><td>2</td><td>BeiDou PPS</td></tr><tr><td>3</td><td>Galileo PPS</td></tr></table>	Bit	Value	Description	0	0	GPS time (default)	1	UTC or GNSS time	1	0	GPS PPS (default)	1	UTC or GNSS PPS	2	0	Time is set	1	Time is not set	3	0	Have UTC info	1	No UTC info	4-5	0	UTC time	1	GLONASS time	2	BeiDou time	3	Galileo time	6-7	0	UTC PPS	1	GLONASS PPS	2	BeiDou PPS	3	Galileo PPS
Bit	Value	Description																																									
0	0	GPS time (default)																																									
	1	UTC or GNSS time																																									
1	0	GPS PPS (default)																																									
	1	UTC or GNSS PPS																																									
2	0	Time is set																																									
	1	Time is not set																																									
3	0	Have UTC info																																									
	1	No UTC info																																									
4-5	0	UTC time																																									
	1	GLONASS time																																									
	2	BeiDou time																																									
	3	Galileo time																																									
6-7	0	UTC PPS																																									
	1	GLONASS PPS																																									
	2	BeiDou PPS																																									
	3	Galileo PPS																																									
Seconds	uint8	0-59 seconds																																									
Minutes	uint8	0-59 minutes																																									
Hours	uint8	0-23 hours																																									
Day of the month	uint8	1-31 day of the month																																									
Month	uint8	1-12 month of the year																																									
Year	uint32	four digits of year																																									
Temperature	float	Celsius. Reported by the on-board temperature sensor.																																									
Latitude	double	Radians from $-\pi/2$ to $+\pi/2$. Negative values represent southern latitudes.																																									

		Positive values represent northern latitudes.
Longitude	double	Radians from -pi to +pi. Negative values represent western longitudes.
Altitude	double	Positive values represent eastern longitudes.
Disciplining Activity	uint8	0x00 - Phase Locking 0x01 - Oscillator warm-up 0x02 - Frequency locking 0x03 - Placing PPS 0x04 - Initializing loop filter 0x05 - Compensating OCXO (Holdover) 0x06 - Inactive 0x07 - Not used 0x08 - Recovery mode 0x09 - Calibration/control voltage
GNSS Decoding Status	uint8	0x00 - Doing fixes 0x01 - Don't have GNSS time 0x08 - No usable satellites 0x09 - Only 1 usable sat 0x0A - Only 2 usable sats 0x0B - Only 3 usable sats 0x0C - The chosen sat is unusable
Disciplining Mode	uint8	0 - Normal (Locked to GPS) 1 - Power Up 2 - Auto Holdover 3 - Manual Holdover 4 - Recovery 5 - Not used
Receiver Mode	uint8	0 - Automatic (2D/3D) 1 - Single Satellite (Time) 3 - Horizontal (2D) 4 - Full Position (3D) 7 - Over-determined Clock
Self-Survey Progress	uint8	0-100%
Minor Alarms	Bit field	Bit 1 : Antenna Open Bit 2 : Antenna shorted Bit 3 : Not tracking satellites Bit 4 : Not disciplining oscillator (ICM only) Bit 5 : Survey-in progress Bit 6 : No stored position Bit 7 : Leap second pending Bit 8 : In test mode Bit 9 : Position is questionable Bit 10 : Not used Bit 11 : Almanac not complete Bit 12 : PPS not generated

2.3 Sensors data

Sensors Data Field	Data type	Description
Atmospheric temperature	int16	To derive temperature, T [C] , based on RegisterValue: $\text{RegisterValue} = 4096 * \text{Vadc [V]} / 2.5;$ $\text{Vadc [mV]} = (\text{T} - \text{Tinfl}) * \text{Tc} + \text{Voffs}$ <ul style="list-style-type: none"> For T in [-40, 100] degrees Celsius, (Tinfl = 0C; Tc = 19.5mV/C; Voffs = 400mV) For T in [100, 125] degrees Celsius, (Tinfl = 100C; Tc = 19.7mV/C; Voffs = 2350mV)
Atmospheric pressure	int16	????
Atmospheric humidity	int16	To derive Relative Humidity, sensor RH [%] , based on RegisterValue: $\text{RegisterValue} = 4096 * \text{Vadc [V]} / 2.5;$

		$V_{adc} [V] = 3.3 * (0.00636 * \text{sensor RH} + 0.1515)$
Accelerometer X	int16	???
Accelerometer Y	int16	???
Accelerometer Z	int16	???
Input voltage	int16	<p>To derive the Input voltage Vin [V], based on the RegisterValue:</p> $\text{RegisterValue} = 4096 * V_{adc} [V] / 2.5;$ $V_{adc} [V] = 18k / (18k + 91k) * V_{in}$

DU Registers Map

Ind ex	Address	Register (32 bits)
Board Management		
0	0 x 8000_0000	Hibernation Voltage Limits (HVL)
1	0 x 8000_0004	Hibernation Temperature Limits - nut sensor/ADC source (HTL)
2	0 x 8000_0008	Hibernation Temperature Limit High - GPS source (HTLH_GPS)
3	0 x 8000_000C	Hibernation Temperature Limit Low - GPS source (HTLL_GPS)
19	0 x 8000_004C	Board Management (MNG)
20	0 x 8000_0050	DMA handshaking (DMA)
Additional Gain (physical channels)		
21	0 x 8000_0054	Additional Gain Channel A and B (AGC12)
22	0 x 8000_0058	Additional Gain Channel C and D (AGC34)
Event Readout Trace Length		
4	0 x 8000_0010	Readout Windows (RW)
Channel Readout Selection		
5	0 x 8000_0014	Channel Readout Source (CRS)
Trigger Configuration (mapped channels)		
6	0 x 8000_0018	Trigger Selection (TS)
7	0 x 8000_001C	Channel 1 Signal / Noise Threshold (CH1SNTH)
8	0 x 8000_0020	Channel 1 Trigger Parameters (CH1TP)
9	0 x 8000_0024	Spare
10	0 x 8000_0028	Channel 2 Signal / Noise Threshold (CH2SNTH)
11	0 x 8000_002C	Channel 2 Trigger Parameters (CH2TP)
12	0 x 8000_0030	Spare
13	0 x 8000_0034	Channel 3 Signal / Noise Threshold (CH3SNTH)
14	0 x 8000_0038	Channel 3 Trigger Parameters (CH3TP)
15	0 x 8000_003C	Spare
16	0 x 8000_0040	Channel 4 Spare
17	0 x 8000_0044	Channel 4 Spare
18	0 x 8000_0048	Spare
Baseline Subtraction (mapped channels)		

23	0 x 8000_005C	Baseline Subtraction Parameters Channel 1 and 2 (BSC12)
24	0 x 8000_0060	Baseline Subtraction Parameters Channel 3 (BSC34)
		Notch Filtering Channel 1 (mapped channel)
25	0 x 8000_0064	Channel 1 Notch Filter 1 Parameters 1 (CH1NF1P1)
26	0 x 8000_0068	Channel 1 Notch Filter 1 Parameters 2 (CH1NF1P2)
27	0 x 8000_006C	Channel 1 Notch Filter 1 Parameters 3 (CH1NF1P3)
28	0 x 8000_0070	Channel 1 Notch Filter 1 Parameters 4 (CH1NF1P4)
29	0 x 8000_0074	Channel 1 Notch Filter 1 Parameters 5 (CH1NF1P5)
30	0 x 8000_0078	Spare
31	0 x 8000_007C	Channel 1 Notch Filter 2 Parameters 1 (CH1NF2P1)
32	0 x 8000_0080	Channel 1 Notch Filter 2 Parameters 2 (CH1NF2P2)
33	0 x 8000_0084	Channel 1 Notch Filter 2 Parameters 3 (CH1NF2P3)
34	0 x 8000_0088	Channel 1 Notch Filter 2 Parameters 4 (CH1NF2P4)
35	0 x 8000_008C	Channel 1 Notch Filter 2 Parameters 5 (CH1NF2P5)
36	0 x 8000_0090	Spare
37	0 x 8000_0094	Channel 1 Notch Filter 3 Parameters 1 (CH1NF3P1)
38	0 x 8000_0098	Channel 1 Notch Filter 3 Parameters 2 (CH1NF3P2)
39	0 x 8000_009C	Channel 1 Notch Filter 3 Parameters 3 (CH1NF3P3)
40	0 x 8000_00A0	Channel 1 Notch Filter 3 Parameters 4 (CH1NF3P4)
41	0 x 8000_00A4	Channel 1 Notch Filter 3 Parameters 5 (CH1NF3P5)
42	0 x 8000_00A8	Spare
43	0 x 8000_00AC	Channel 1 Notch Filter 4 Parameters 1 (CH1NF4P1)
44	0 x 8000_00B0	Channel 1 Notch Filter 4 Parameters 2 (CH1NF4P2)
45	0 x 8000_00B4	Channel 1 Notch Filter 4 Parameters 3 (CH1NF4P3)
46	0 x 8000_00B8	Channel 1 Notch Filter 4 Parameters 4 (CH1NF4P4)
47	0 x 8000_00BC	Channel 1 Notch Filter 4 Parameters 5 (CH1NF4P5)
48	0 x 8000_00C0	Spare
		Notch Filtering Channel 2 (mapped channel)
49	0 x 8000_00C4	Channel 2 Notch Filter 1 Parameters 1 (CH2NF1P1)
50	0 x 8000_00C8	Channel 2 Notch Filter 1 Parameters 2 (CH2NF1P2)
51	0 x 8000_00CC	Channel 2 Notch Filter 1 Parameters 3 (CH2NF1P3)
52	0 x	Channel 2 Notch Filter 1 Parameters 4 (CH2NF1P4)

	8000_00D0	
53	0 x 8000_00D4	Channel 2 Notch Filter 1 Parameters 5 (CH2NF1P5)
54	0 x 8000_00D8	Spare
55	0 x 8000_00DC	Channel 2 Notch Filter 2 Parameters 1 (CH2NF2P1)
56	0 x 8000_00E0	Channel 2 Notch Filter 2 Parameters 2 (CH2NF2P2)
57	0 x 8000_00E4	Channel 2 Notch Filter 2 Parameters 3 (CH2NF2P3)
58	0 x 8000_00E8	Channel 2 Notch Filter 2 Parameters 4 (CH2NF2P4)
59	0 x 8000_00EC	Channel 2 Notch Filter 2 Parameters 5 (CH2NF2P5)
60	0 x 8000_00F0	Spare
61	0 x 8000_00F4	Channel 2 Notch Filter 3 Parameters 1 (CH2NF3P1)
62	0 x 8000_00F8	Channel 2 Notch Filter 3 Parameters 2 (CH2NF3P2)
63	0 x 8000_00FC	Channel 2 Notch Filter 3 Parameters 3 (CH2NF3P3)
64	0 x 8000_0100	Channel 2 Notch Filter 3 Parameters 4 (CH2NF3P4)
65	0 x 8000_0104	Channel 2 Notch Filter 3 Parameters 5 (CH2NF3P5)
66	0 x 8000_0108	Spare
67	0 x 8000_010C	Channel 2 Notch Filter 4 Parameters 1 (CH2NF4P1)
68	0 x 8000_0110	Channel 2 Notch Filter 4 Parameters 2 (CH2NF4P2)
69	0 x 8000_0114	Channel 2 Notch Filter 4 Parameters 3 (CH2NF4P3)
70	0 x 8000_0118	Channel 2 Notch Filter 4 Parameters 4 (CH2NF4P4)
71	0 x 8000_011C	Channel 2 Notch Filter 4 Parameters 5 (CH2NF4P5)
72	0 x 8000_0120	Spare
		Notch Filtering Channel 3 (mapped channel)
73	0 x 8000_0124	Channel 3 Notch Filter 1 Parameters 1 (CH3NF1P1)
74	0 x 8000_0128	Channel 3 Notch Filter 1 Parameters 2 (CH3NF1P2)
75	0 x 8000_012C	Channel 3 Notch Filter 1 Parameters 3 (CH3NF1P3)
76	0 x 8000_0130	Channel 3 Notch Filter 1 Parameters 4 (CH3NF1P4)
77	0 x 8000_0134	Channel 3 Notch Filter 1 Parameters 5 (CH3NF1P5)
78	0 x 8000_0138	Spare
79	0 x 8000_013C	Channel 3 Notch Filter 2 Parameters 1 (CH3NF2P1)
80	0 x 8000_0140	Channel 3 Notch Filter 2 Parameters 2 (CH3NF2P2)
81	0 x 8000_0144	Channel 3 Notch Filter 2 Parameters 3 (CH3NF2P3)
82	0 x	Channel 3 Notch Filter 2 Parameters 4 (CH3NF2P4)

	8000_0148	
83	0 x 8000_014C	Channel 3 Notch Filter 2 Parameters 5 (CH3NF2P5)
84	0 x 8000_0150	Spare
85	0 x 8000_0154	Channel 3 Notch Filter 3 Parameters 1 (CH3NF3P1)
86	0 x 8000_0158	Channel 3 Notch Filter 3 Parameters 2 (CH3NF3P2)
87	0 x 8000_015C	Channel 3 Notch Filter 3 Parameters 3 (CH3NF3P3)
88	0 x 8000_0160	Channel 3 Notch Filter 3 Parameters 4 (CH3NF3P4)
89	0 x 8000_0164	Channel 3 Notch Filter 3 Parameters 5 (CH3NF3P5)
90	0 x 8000_0168	Spare
91	0 x 8000_016C	Channel 3 Notch Filter 4 Parameters 1 (CH3NF4P1)
92	0 x 8000_0170	Channel 3 Notch Filter 4 Parameters 2 (CH3NF4P2)
93	0 x 8000_0174	Channel 3 Notch Filter 4 Parameters 3 (CH3NF4P3)
94	0 x 8000_0178	Channel 3 Notch Filter 4 Parameters 4 (CH3NF4P4)
95	0 x 8000_017C	Channel 3 Notch Filter 4 Parameters 5 (CH3NF4P5)
96	0 x 8000_0180	Spare
		Channel 4
97	0 x 8000_0184	Spare
98	0 x 8000_0188	Spare
99	0 x 8000_018C	Spare
100	0 x 8000_0190	Spare
101	0 x 8000_0194	Spare
102	0 x 8000_0198	Spare
103	0 x 8000_019C	Spare
104	0 x 8000_01A0	Spare
105	0 x 8000_01A4	Spare
106	0 x 8000_01A8	Spare
107	0 x 8000_01AC	Spare
108	0 x 8000_01B0	Spare
109	0 x 8000_01B4	Spare
110	0 x 8000_01B8	Spare
111	0 x 8000_01BC	Spare
112	0 x	Spare

	8000_01C0	
113	0 x 8000_01C4	Spare
114	0 x 8000_01C8	Spare
115	0 x 8000_01CC	Spare
116	0 x 8000_01D0	Spare
117	0 x 8000_01D4	Spare
118	0 x 8000_01D8	Spare
119	0 x 8000_01DC	Spare
120	0 x 8000_01E0	Spare
		Debugging registers / Spares
121	0 x 8000_01E4	Debugging register 1
122	0 x 8000_01E8	Debugging register 2
123	0 x 8000_01EC	Debugging register 3
124	0 x 8000_01F0	Debugging register 4
125	0 x 8000_01F4	Debugging register 5
126	0 x 8000_01F8	Debugging register 6
127	0 x 8000_01FC	Debugging register 7

DU Registers Description

1. Board Management

Registers:

Hibernation Voltage Limits (HVL)

Address: 0 x 8000_0000

31	0	16	15
V_{high}		V_{low}	

Bits	Field Name	Default	Description
31 to 16	Battery Voltage High (V_{high})	0x0BA0, RW	Battery voltage should be $> V_{high}$ for getting out of hibernation mode.
15 to 0	Battery Voltage Low (V_{low})	0x0765, RW	Battery voltage should be $< V_{low}$ for entering hibernation mode.

Hibernation Temperature Limits - nut sensor/ADC source (HTL)

Address: 0 x 8000_0004

31	0	16	15
T_{high}		T_{ow}	

Bits	Field Name	Default	Description
31 to 16	Temperature High (T_{high})	0x0AAC, RW	Temperature should be $> T_{high}$ for entering hibernation mode.
15 to 0	Temperature Low (T_{low})	0x08CD, RW	Temperature should be $< T_{low}$ for getting out of hibernation mode.

Hibernation Temperature Limit High - GPS source (HTLH_GPS)

Address: 0 x 8000_0008

31	0
T_{high}	

Bits	Field Name	Default	Description
31 to 0	Temperature High (T_{high})	0x42820000, RW	Temperature should be $> T_{high}$ for entering hibernation mode. Format: single precision floating point.

Hibernation Temperature Limit Low - GPS source (HTLL_GPS)

Address: 0 x 8000_000C

31	0
T_{low}	

Bits	Field Name	Default	Description
31 to 0	Temperature Low (T_{low})	0x42480000, RW	Temperature should be $< T_{low}$ for getting out of hibernation mode. Format: single precision floating point.

Description:

$\text{if } (V_{\text{battery}} < V_{\text{low}}) \vee (T > T_{\text{high}})$ then hibernation
 $\text{if } (V_{\text{battery}} > V_{\text{high}}) \wedge (T < T_{\text{low}})$ then out of hibernation
 otherwise, nominal operation

The temperature limits used by the DU are either from register HTL, or from registers HTLL_GPS and HTLH_GPS, depending on the temperature sensing chip selected as source.

Board Management (MNG)

Address: 0 x 8000_004C

31	2	0	Reserved			
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Bits	Field Name	Default	Description
31 to 3	Reserved	0, RO	Writes ignored, read as 0.
2 to 0	Temperature source for hibernation	010, RW	001 - ADC temperature 010 - GPS temperature 100 - nut sensor temperature

DMA Handshaking (DMA)

Address: 0 x 8000_0050

31	1	0	Reserved			
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Bits	Field Name	Default	Description
31 to 2	Reserved	0, RO	Writes ignored, read as 0.
1	PPS ready for DMA	0, RO	1 - PPS message ready for DMA transfer 0 - PPS message not ready for DMA transfer
0	Event ready for DMA	0, RO	1 - Event message ready for DMA transfer 0 - Event message not ready for DMA transfer

2. Additional Gain

Additional Gain Channel A and B (AGC12)

Address: 0 x 8000_0054

31	0	16	15
Gain channel 1		Gain channel 2	

Bits	Field Name	Default	Description
31 to 16	Additional gain channel 1	0x05CD, RW	Gain channel 1.
15 to 0	Additional gain channel 2	0x05CD, RW	Gain channel 2.

Additional Gain Channel C and D (AGC34)

Address: 0 x

8000_0058

31	0	16	15
Gain channel 3		Gain channel 4	

Bits	Field Name	Default	Description
31 to 16	Additional gain channel 1	0x05CD, RW	Gain channel 3.
15 to 0	Additional gain channel 2	0x05CD, RW	Gain channel 4.

3. Event Readout Trace Length**Registers:****Readout Windows (RW)****Address: 0 x 8000_0010**

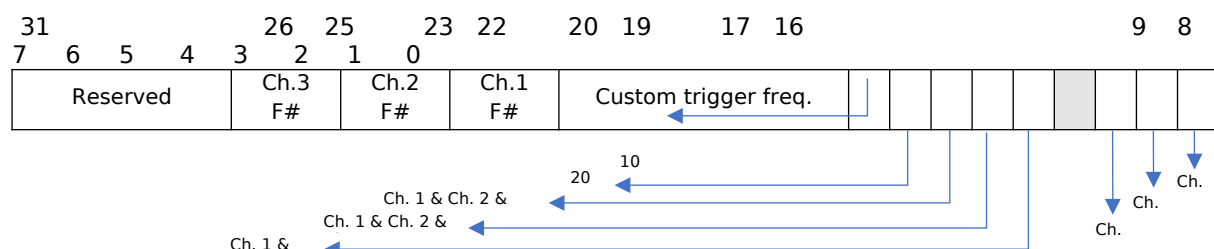
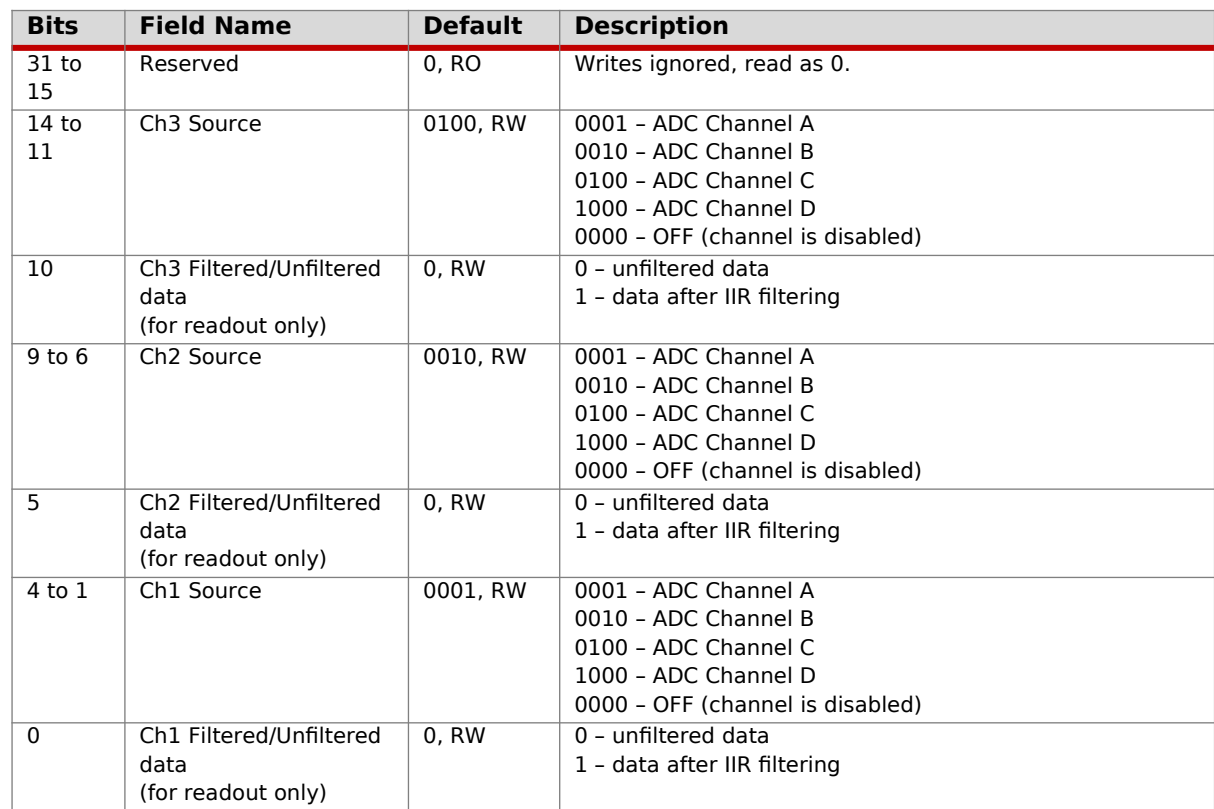
31	29	28	17	16
5	4	0		
Reserved	Post-Trigger Overlap		Pre-Trigger Overlap	
				Trigger overlap

Bits	Field Name	Default	Description
31 to 29	Reserved	0, RO	Writes ignored, read as 0.
28 to 17	Post-Trigger overlap	001000000000, RW	No. of sample pairs after the trigger overlap window.
16 to 5	Pre-Trigger overlap	000111100000, RW	No. of sample pairs before the trigger overlap window.
4 to 0	Trigger overlap window	11111, RW	No. of sample pairs within the trigger coincidence window (coincidence detection among the enabled DU channels).

Description:

The total trace length in no. of samples = The total trace length in no. of sample pairs * 2
 =
 = (pre-trigger overlap + trigger overlap + post-trigger overlap) * 2.

4. Channel readout selection**Channel Readout Source (CRS)****Address: 0 x 8000_0014**



20			triggering
19 to 17	Ch. 1 no. of IIR filters	000, RW	Number of IIR filters to be used for channel 1 prior to L1-triggering
16 to 9	Custom trigger freq.	00000000, RW	> 0 - enable custom frequency trigger with period given by $(B \ll E) \cdot 256 \cdot 4 \text{ ns}$, for all channels selected for readout in CRS register (B = bits 16 to 13; E = bits 12 to 9) 0 - disable custom frequency trigger, on all channels selected for readout in CRS register
8	10 sec	1, RW	1 - enable periodic 10 sec trigger, on all channels selected for readout in CRS register 0 - disable 10 sec trigger, on all enabled channels selected for readout in CRS register
7	20 Hz	0, RW	1 - enable 20 Hz trigger, on all channels selected for readout in CRS register 0 - disable 20 Hz trigger, on all enabled channels selected for readout in CRS register
6	Ch. 1 & Ch. 2 & (~Ch. 3)	0, RW	1 - enable trigger when coincidence on channels 1 and 2, and no trigger on channel 3 0 - disable trigger when coincidence on channels 1 and 2, and no trigger on channel 3 The triggering follows algorithm of choice.
5	Ch. 1 & Ch. 2 & Ch. 3	0, RW	1 - enable trigger when coincidence on channels 1, 2 and 3 0 - disable trigger when coincidence on channels 1, 2 and 3 The triggering follows algorithm of choice.
4	Ch. 1 & Ch. 2	0, RW	1 - enable trigger when coincidence on channels 1 and 2 0 - disable trigger when coincidence on channels 1 and 2 The triggering follows algorithm of choice.
3	Reserved	0, RO	Writes ignored, read as 0.
2	Ch. 3	0, RW	1 - enable trigger on channel 3 0 - disable trigger on channel 3 The triggering follows algorithm of choice.
1	Ch. 2	0, RW	1 - enable trigger on channel 2 0 - disable trigger on channel 2 The triggering follows algorithm of choice.
0	Ch. 1	1, RW	1 - enable trigger on channel 1 0 - disable trigger on channel 1 The triggering follows algorithm of choice.

Channel 1 Signal / Noise Threshold (CH1SNTH)

Address: 0 x 8000_001C

31	24	23	12	11
0				
Reserved	Signal threshold T1	Noise Threshold T2		

Bits	Field Name	Default	Description
31 to 24	Reserved	0, RO	Writes ignored, read as 0.
23 to 12	Signal Threshold T1	000001100100, RW	Signal threshold in ADC units
11 to 0	Noise Threshold T2	000000110010, RW	Noise threshold in ADC units

Channel 1 Trigger Parameters Channel 1 (CH1TP)

Address: 0 x

8000 0020

$$\begin{array}{ccccccc} & 31 & 30 & 29 & & 21 & 20 & & 12 & 11 & & 9 & 8 \\ \textcircled{} & 5 & 4 & & 0 & & & & & & & & \end{array}$$

	Pre-T1	Post-T1	Betw.T 2	T2-cross min	T2-cross max
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Bits	Field Name	Default	Description
31 to 30	Reserved	0, RO	Writes ignored, read as 0.
29 to 21	Pre-T1	100000000, RW	No. of sample pairs before T1 crossing (no T1 crossing allowed).
20 to 12	Post-T1	100000000, RW	No. of sample pairs after T1 crossing (T1 crossings allowed without restrictions, T2 crossings allowed with restrictions).
11 to 9	Between T2	101, RW	Maximum no. of sample pairs between T2 crossings during Post-T1.
8 to 5	T2-cross min	0000, RW	Minimum no. of T2 crossings during Post-T1.
4 to 0	T2-cross max	01010, RW	Maximum no. of T2 crossings during Post-T1.

Channel 2 Signal / Noise Threshold (CH2SNTH)

**Address: 0 x
8000 0028**

$$31 \quad \qquad\qquad 24 \quad 23 \quad \qquad\qquad 12 \quad 11$$

\downarrow

Reserved	Signal threshold T1	Noise Threshold T2
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Bits	Field Name	Default	Description
31 to 24	Reserved	0, RO	Writes ignored, read as 0.
23 to 12	Signal Threshold T1	000001100100, RW	Signal threshold in ADC units
11 to 0	Noise Threshold T2	000000110010, RW	Noise threshold in ADC units

Channel 2 Trigger Parameters (CH2TP)

**Address: 0 x
8000 002C**

[illegible]

Pre-T1	Post-T1	Betw.T 2	T2-cross min	T2-cross max
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Bits	Field Name	Default	Description
31 to 30	Reserved	0, RO	Writes ignored, read as 0.
29 to 21	Pre-T1	100000000, RW	No. of sample pairs before T1 crossing (no T1 crossing allowed).
20 to 12	Post-T1	100000000, RW	No. of sample pairs after T1 crossing (T1 crossings allowed without restrictions, T2 crossings allowed with restrictions).
11 to 9	Between T2	101, RW	Maximum no. of sample pairs between T2 crossings during Post-T1.
8 to 5	T2-cross min	0000, RW	Minimum no. of T2 crossings during Post-T1.
4 to 0	T2-cross max	01010, RW	Maximum no. of T2 crossings during Post-T1.

Channel 3 Signal / Noise Threshold (CH3SNTH)

Address: 0 x

8000 0034

31 24 23 12 11
0

Reserved	Signal threshold T1	Noise Threshold T2
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Bits	Field Name	Default	Description
31 to 24	Reserved	0, RO	Writes ignored, read as 0.
23 to 12	Signal Threshold T1	000001100100, RW	Signal threshold in ADC units
11 to 0	Noise Threshold T2	000000110010, RW	Noise threshold in ADC units

Channel 3 Trigger Parameters (CH3TP)

**Address: 0 x
8000 0038**

[illegible]

Pre-T1	Post-T1	Betw.T 2	T2-cross min	T2-cross max
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Bits	Field Name	Default	Description
31 to 30	Reserved	0, RO	Writes ignored, read as 0.
29 to 21	Pre-T1	100000000, RW	No. of sample pairs before T1 crossing (no T1 crossing allowed).
20 to 12	Post-T1	100000000, RW	No. of sample pairs after T1 crossing (T1 crossings allowed without restrictions, T2 crossings allowed with restrictions).
11 to 9	Between T2	101, RW	Maximum no. of sample pairs between T2 crossings during Post-T1.
8 to 5	T2-cross min	RW	Minimum no. of T2 crossings during Post-T1.
4 to 0	T2-cross max	RW	Maximum no. of T2 crossings during Post-T1.

6. Baseline subtraction (mapped channels)

Baseline Subtraction Channel 1 and 2 (BSC12)

**Address: 0 x
8000 005C**

31 26 25 23 22 13 12 10 9
 0

Reserved	W Ch. 2	Baseline limit Ch. 2	W Ch. 1	Baseline limit Ch. 1
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Bits	Field Name	Default	Description
31 to 26	Reserved	0, RO	Writes ignored, read as 0.
25 to 23	Averaging width W channel 2	101, RW	No. of samples for averaging channel 2 = 2^W
22 to 13	Baseline limit channel 2	1000000000, RW	Baseline limit for channel 2. Only samples $\in [-BASELIM, BASELIM]$ contribute to the baseline computation.
12 to 10	Averaging width W channel 1	101, RW	No. of samples for averaging channel 1 = 2^W
9 to 0	Baseline limit channel 1	1000000000.	Baseline limit for channel 2. Only samples

		RW	$\in [-BASELIM, BASELIM]$ contribute to the baseline computation.
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Baseline Subtraction Channel 3 (BSC34)

Address: 0 x 8000_0060

31	0	13	12	10	9
Reserved			W Ch. 3		Baseline limit Ch. 3

Bits	Field Name	Default	Description
31 to 13	Reserved	0, RO	Writes ignored, read as 0.
12 to 10	Averaging width W channel 3	101, RW	No. of samples for averaging channel 3.
9 to 0	Baseline limit channel 3	1000000000, RW	Baseline limit for channel 3. Only samples $\in [-BASELIM, BASELIM]$ contribute to the baseline computation.

7. Notch filtering (mapped channels)

7.1. Notch filtering channel 1

Channel 1 Notch Filter 1 Parameters 1 (CH1NF1P1)

Address: 0 x 8000_0064

31	0	16	15
C2		C1	

Bits	Field Name	Default	Description
31 to 16	C2	0xA877, RW	Notch filter coefficient C2.
15 to 0	C1	0x3FF0, RW	Notch filter coefficient C1.

Channel 1 Notch Filter 1 Parameters 2 (CH1NF1P2)

Address: 0 x 8000_0068

31	0	16	15
C4		C3	

Bits	Field Name	Default	Description
31 to 16	C4	0xC021, RW	Notch filter coefficient C4.
15 to 0	C3	0x5789, RW	Notch filter coefficient C3.

Channel 1 Notch Filter 1 Parameters 3 (CH1NF1P3)

Address: 0 x 8000_006C

31	0	16	15
C6		C5	

Bits	Field Name	Default	Description
31 to 16	C6	0x5772, RW	Notch filter coefficient C6.
15 to 0	C5	0xFFEA, RW	Notch filter coefficient C5.

Channel 1 Notch Filter 1 Parameters 4
(CH1NF1P4)

Address: 0 x 8000_0070

31	0	16	15
C8		C7	

Bits	Field Name	Default	Description
31 to 16	C8	0x37DA, RW	Notch filter coefficient C8.
15 to 0	C7	0xC837, RW	Notch filter coefficient C7.

Channel 1 Notch Filter 1 Parameters 5
(CH1NF1P5)

Address: 0 x 8000_0074

31	30	29							16	15
0										
			Reserved						C9	

Bits	Field Name	Default	Description
31	MSB C8	0, RW	MSB notch filter coefficient C8.
30	MSB C7	1, RW	MSB notch filter coefficient C7.
29 to 16	Reserved	0, RO	Writes ignored, read as 0.
15 to 0	C9	0xA8A4, RW	Notch filter coefficient C9.

...