

trigger_manager

Version: 2.0

Monday 14th December, 2020 20:10

The Trigger Manager is responsible for synchronization and trigger commands. It can be configured in standalone mode, or in a master/slave configuration with other pRUs. The module is either master or slave based on the physical settings of the pRU board. The Trigger Manager has direct access to the ALPIDE Control module, and can transmit the most common broadcast messages.

1 Register List

#	Name	Mode	Address	Type	Length	Reset
0	status	RO	0x00000000	FIELDS	5	0x3
1	config	RW	0x00000001	FIELDS	3	0x3
2	cmd	RW	0x00000002	FIELDS	15	0x0
3	msg	RW	0x00000003	SLV	8	0x0
4	arm_and_execute	PULSE	0x00000004	SL	1	0x0
5	btbi_master_status	RO	0x00000005	FIELDS	7	0x0
6	btbi_slave_status	RO	0x00000006	FIELDS	12	0x0
7	btbi_slave_cmd	RO	0x00000007	FIELDS	15	0x0
8	num_triggers	RW	0x00000008	DEFAULT	32	0x1
9	trigger_to_execution_delay	RW	0x00000009	DEFAULT	32	0x7
10	slave_trigger_to_execution_delay	RW	0x0000000A	DEFAULT	32	0x2
11	sequence_delay	RW	0x0000000B	DEFAULT	32	0x28
12	pulse_trigger_delay	RW	0x0000000C	DEFAULT	32	0x28
13	num_trains	RW	0x0000000D	DEFAULT	32	0x1
14	trains_delay	RW	0x0000000E	DEFAULT	32	0x28
15	trigger_source	RW	0x0000000F	SLV	2	0x3
16	alpide_mode	RW	0x00000010	SLV	1	0x1
17	absolute_time	RO	0x00000011	DEFAULT	32	0x0
18	spill_id	RO	0x00000012	SLV	16	0x0
19	frame_id	RO	0x00000013	DEFAULT	32	0x0

2 Registers

Register 2.1: STATUS - RO (0x00000000)
Status of the module.

31	unused	5	4	3	2	1	0						
-								0	0	0	1	1	Reset

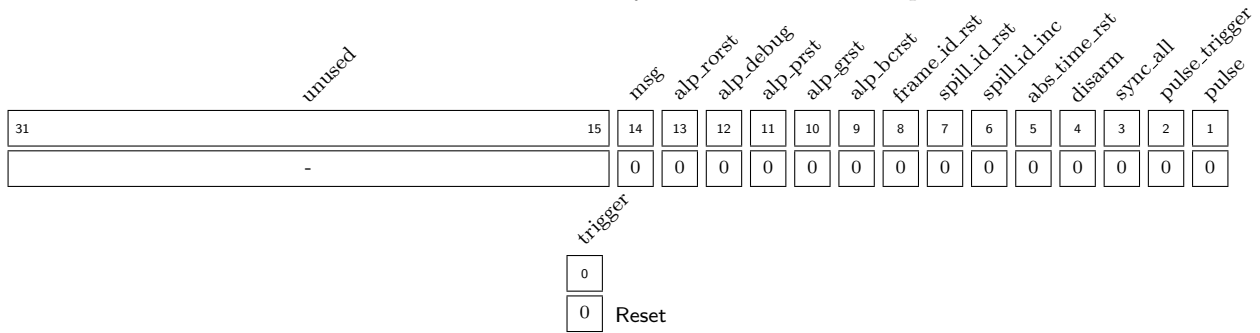
- idle** Indicates that the manager is in idle state to receive new commands.
- master** This field is high when pRU is master or the module is configured to be standalone.
- error** Indicates that something prevents any commands to be transmitted.
- alp_ctrl_busy** Indicates that the ALPIDE Control is busy with either MM-interface commands or Trigger Manager commands.
- alp_ctrl_locked** Indicates that the ALPIDE Control is locked and ready to receive commands. OBS! In standalone mode, lock must be done manually via the configuration register.

Register 2.2: CONFIG - RW (0x00000001)
Configuration of the module.

31	unused	3	2	1	0				
-						0	1	1	Reset

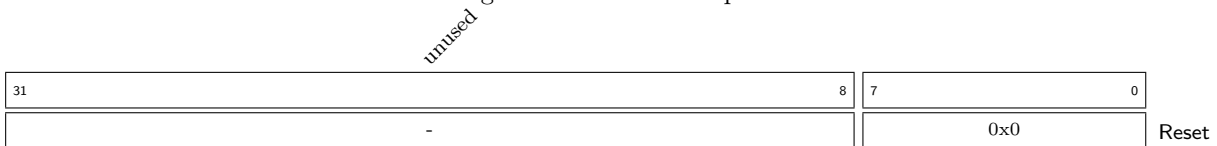
- standalone** When standalone, the Trigger Manager does not bother with BTBI communication.
- lock_alp_ctrl** When standalone, the ALPIDE Control module must be locked manually with this register. Disregarding this might cause conflicts with the MM-interface access to the ALPIDE Control module.
- increment_spill_id** Increment Spill ID at the end of each trigger train. NOT IMPLEMENTED.

Register 2.3: CMD - RW (0x00000002)
The command to be executed by master or standalone pRU.

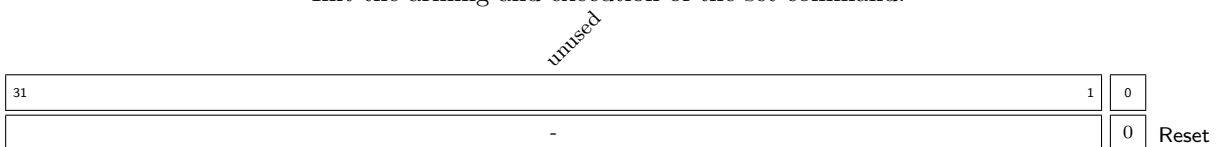


- trigger** Sequence of triggers.
- pulse** Sequence of pulse commands.
- pulse_trigger** Sequence of pulse-triggers.
- sync_all** Sequence of for synchronization all sync-parameters: Abs time, Frame ID, Bunch counter and Spill ID.
- disarm** Disarming the slaves.
- abs_time_rst** Reset Absolute time. Non-sequence.
- spill_id_inc** Increment Spill ID. Non-sequence.
- spill_id_rst** Reset Spill ID. Non-sequence.
- frame_id_rst** Reset Frame ID. Non-sequence.
- alp_bcrst** ALPIDE BCRST. Non-sequence.
- alp_grst** ALPIDE GRST. Non-sequence.
- alp_prst** ALPIDE PRST. Non-sequence.
- alp_debug** ALPIDE Debug. Non-sequence.
- alp_rorst** ALPIDE RORST. Non-sequence.
- msg** Transfer message to slaves. Non-sequence.

Register 2.4: MSG - RW (0x00000003)
The message to transfer to the pRU slaves.



Register 2.5: ARM_AND_EXECUTE - PULSE FOR 1 CYCLES (0x00000004)
Init the arming and execution of the set command.



Register 2.6: BTBLMASTER_STATUS - RO (0x00000005)
Status of the BTBI communication module when configured as master.

<i>unused</i>							<i>err</i>	<i>ready_for_trig</i>	<i>wait_for_lock</i>	<i>timeout</i>	<i>all_ack</i>	<i>waiting</i>	<i>busy</i>	
31							7	6	5	4	3	2	1	0
-							0	0	0	0	0	0	0	

Reset

- busy** Busy with slave communication.
- waiting** Waiting for ack or unack.
- all_ack** All slaves are acknowledging, i.e. no slaves are driving the ack signal down. Note that this signal is weakly driven by a weak pull-up resistor.
- timeout** High when timeout occurred when waiting for ack.
- wait_for_lock** Waiting for the ALPIDE Control module to lock.
- ready_for_trig** We are ready to start triggering.
- err** Something went wrong, e.g., ALPIDE Control didnt lock in time.

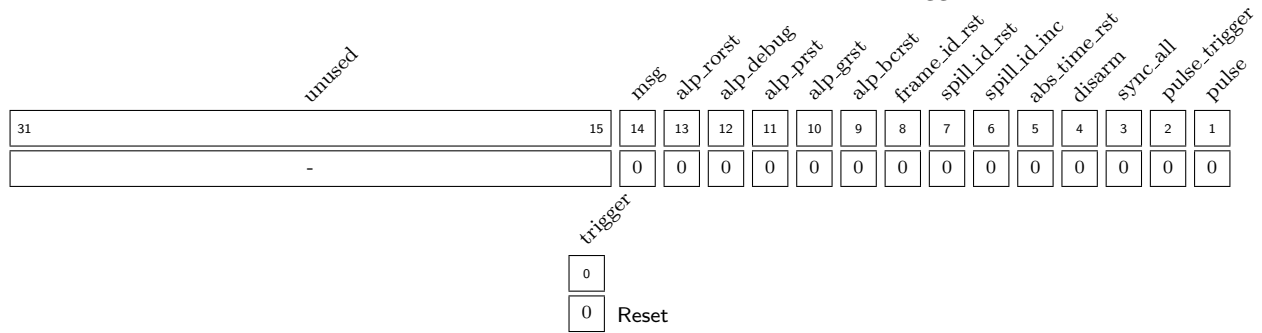
Register 2.7: BTBLSLAVE_STATUS - RO (0x00000006)
Status of the BTBI communication module when configured as slave.

<i>unused</i>											<i>msg</i>	<i>armed</i>	<i>err</i>	<i>wait_for_lock</i>	<i>busy</i>		
31											12	11	4	3	2	1	0
-											0x0	0	0	0	0	0	

Reset

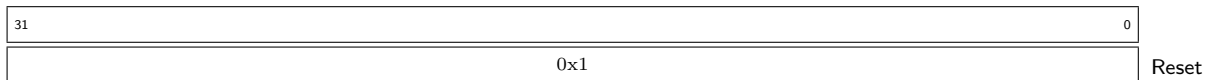
- busy** Busy receiving command.
- wait_for_lock** Waiting for the ALPIDE Control module to lock.
- err** ALPIDE Control didnt lock, or something wrong with RX.
- armed** Slave is ready to receive trigger to execute command.
- msg** The message received.

Register 2.8: BTBL_SLAVE_CMD - RO (0x00000007)
The last received command to be executed if armed and triggered.

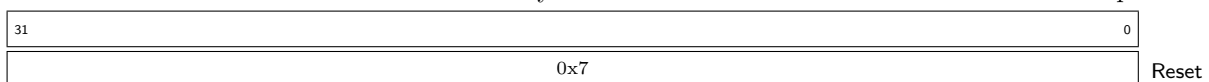


- trigger** Sequence of triggers.
- pulse** Sequence of pulse commands.
- pulse_trigger** Sequence of pulse-triggers.
- sync_all** Sequence of for synchronization all sync-parameters: Abs time, Frame ID, Bunch counter and Spill ID.
- disarm** Disarming the slaves.
- abs_time_rst** Reset Absolute time. Non-sequence.
- spill_id_inc** Increment Spill ID. Non-sequence.
- spill_id_rst** Reset Spill ID. Non-sequence.
- frame_id_rst** Reset Frame ID. Non-sequence.
- alp_bcrst** ALPIDE BCRST. Non-sequence.
- alp_grst** ALPIDE GRST. Non-sequence.
- alp_prst** ALPIDE PRST. Non-sequence.
- alp_debug** ALPIDE Debug. Non-sequence.
- alp_rorst** ALPIDE RORST. Non-sequence.
- msg** Transfer message to slaves. Non-sequence.

Register 2.9: NUM_TRIGGERS - RW (0x00000008)
The number of triggers to be transmitted of sequence commands. Valid for trigger, pulse and pulse/trigger commands.



Register 2.10: TRIGGER_TO_EXECUTION_DELAY - RW (0x00000009)
Delay added between the transmission of trigger signal from master to slave, to the execution of commands on the master side. Minimum 7. Added to synchronize when the command is executed on all pRUs.



Register 2.11: SLAVE_TRIGGER_TO_EXECUTION_DELAY - RW (0x0000000A)

Delay added between the receiving trigger signal and the execution of the command on the slave pRUs. Minimum 2. Added to synchronize when the command is executed on all pRUs. Only change if one needs to synchronize between slaves.

31	0
0x2	
Reset	

Register 2.12: SEQUENCE_DELAY - RW (0x0000000B)

For sequences: The number of clock cycles (40 MHz) between the execution of each command. Minimum 40 (time required to complete operation).

31	0
0x28	
Reset	

Register 2.13: PULSE_TRIGGER_DELAY - RW (0x0000000C)

Special delay for pulse/trigger sequence: delay between the pulse and the trigger command. Minimum 40 (time required to complete operation).

31	0
0x28	
Reset	

Register 2.14: NUM_TRAINS - RW (0x0000000D)

Specific for the trigger sequence: the number of trains to be transmitted. Trains are grouping of a number of triggers to be executed.

31	0
0x1	
Reset	

Register 2.15: TRAINS_DELAY - RW (0x0000000E)

The delay between each train - from train stop to it begins again - in 40 MHz clock cycles. Minimum 40 (time required to complete operation).

31	0
0x28	
Reset	

Register 2.16: TRIGGER_SOURCE - RW (0x0000000F)

Optional, used for data tagging. The source of the ALPIDE trigger signal. 0x0 = ALPIDE Internal Strobe Sequencer, 0x1 = External pRU Hardware Signal, 0x2 = Software trigger. Used in data tagging, 0x3 = FPGA Trigger Manager.

31	2	1	0
-		0x3	
Reset			

unused

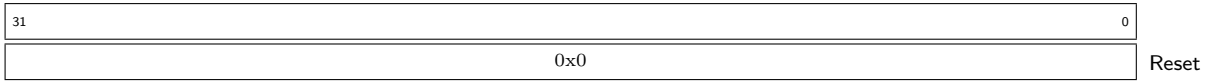
Register 2.17: ALPIDE_MODE - RW (0x00000010)

Optional, used for data tagging. The readout mode the ALPIDEs are configured in. 0x0 = TRIGGERED mode, 0x1 = CONTINUOUS mode. Used in data tagging.

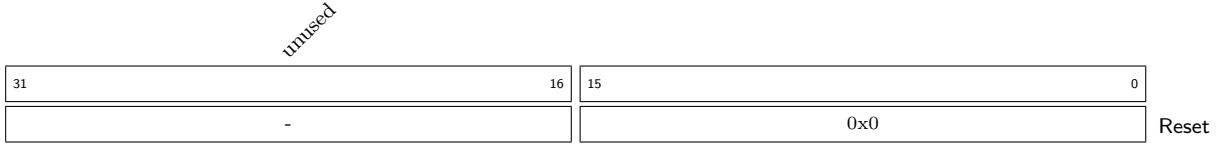
31	1	0
-		1
Reset		

unused

Register 2.18: ABSOLUTE_TIME - RO (0x00000011)
 32-bit counter value of 40MHz system clock. Used to tag data.



Register 2.19: SPILL_ID - RO (0x00000012)
 Spill ID. Used to tag data.



Register 2.20: FRAME_ID - RO (0x00000013)
 Frame ID. Used to tag data.

