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## Re: [etherlab-users] Slave DC start time calculation

[Philippe Leuba Thu, 17 May 2018 21:35:07 -0700](#)

Hi Gavin,

Thanks for the detailed explanation, this explain why the code is like it is. This works for slaves that are doing oversampling but not for mine that just want to shift the SYNC1 a bit.

Now if we want a solution working for all kind of possibles slave configurations we will need to use the sync1\_shift\_time parameter of the ecrt\_slave\_config\_dc into the loop...

What do you think ?

Philippe

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> On May 18, 2018, at 5:15 AM, Gavin Lambert <gavin.lamb...@tomra.com> wrote:
>
> The SYNC1 Cycle register (0x09A4) is a little weird; it acts as both a cycle
> and shift in one register, depending on the value of the SYNC0 Cycle (0x09A0).
>
> Where SYNC0 Cycle is X and SYNC1 Cycle is 0, SYNC0 and SYNC1 occur at the
> same time – thus same cycle, no shift.
> Where SYNC0 Cycle is X and SYNC1 Cycle is less than X, SYNC1 occurs at (SYNC1
> Cycle) ns after the SYNC0, but otherwise at the same cycle rate – thus it
> acts as a shift.
> Where SYNC0 Cycle is X and SYNC1 Cycle is equal to X, SYNC1 occurs at every
> second SYNC0 – thus it acts as a 2X cycle with no shift.
> Where SYNC0 Cycle is X and SYNC1 Cycle is equal to 2X, SYNC1 occurs at every
> third SYNC0 – thus it acts as a 3X cycle with no shift.
> Where SYNC0 Cycle is X and SYNC1 Cycle is greater than X but not an exact
> multiple, it acts as a combination of cycle and shift as above.
>
> (Under the hood, it always does behave as a shift that fires exactly once
> non-overlapping offset from the SYNC0 pulse. Or to put it another way, SYNC0
> starts the timer but doesn't reset it if already running, and it fires SYNC1
> once when the timer finishes.)
>
> The ecrt_slave_config_dc method essentially just sets the cycle values into
> the registers directly, while using the sync0_shift to calculate the overall
> DC start time relative to the master cycle. The sync1_shift parameter is
> ignored and should always be 0 because there's nothing it can actually do
> with it.
>
> Exactly what these mean is slave-specific; some slaves want a simple shift at
> the same cycle rate because they use one to control output timing and the
> other to control input timing. Other slaves might want a subordinated cycle
> (SYNC1 occurring at the master cycle rate, SYNC0 occurring more frequently)
> because they want to oversample inputs. Or there can be a number of other
> scenarios. The slave documentation should tell you what settings you need
> relative to your master cycle.
>
> For what it's worth, I do have a subordinated slave – it uses
> ecrt_slave_config_dc(sc, 250000, 100000, 750000, 0) to make SYNC0 pulse every
> 0.25ms, SYNC1 pulse every 1ms (yes, 1ms, not 0.75ms), and both to be offset
> from the 1ms master cycle by about 100us – although that's a little arbitrary.
>
> I assume the change was probably motivated by this sort of slave
> configuration (since it does extend the "true" cycle time of the slave, from
> a certain point of view), but simple addition is probably wrong when a
> non-multiple sync1 cycle time is used to introduce any kind of shift into the
> mix.
>
> From: etherlab-users [mailto:etherlab-users-boun...@etherlab.org] On Behalf
> Of Graeme Foot
> Sent: Friday, 18 May 2018 13:03
> To: Philippe Leuba <ple...@swissonline.ch>; etherlab-users@etherlab.org
> Subject: Re: [etherlab-users] Slave DC start time calculation
>
> Hi,
>
> This piece of code is getting a start time that is in sync with the initial
> app time from a multiple of the sync0/sync1 cycle times, adjusted by the
> sync0 shift time.
>
> https://download.beckhoff.com/download/Document/io/ethercat-development-products/ethercat\_esc\_datasheet\_sec2\_registers\_2i7.pdf
> says the sync1 cycle time is the "Time between SYNC1 pulses and SYNC0 pulse
> in ns".
>
> However
> https://infosys.beckhoff.com/english.php?content=../content/1033/tcsystemmanager/reference/ethercat/html/EtherCAT\_DistributedClocks.htm&id=
> (Twincat DC settings) and the information for my yaskawa drives are saying
> that the sync1 cycle time should be a multiple of the sync0 cycle time, and
> the sync1 offset is the offset between the sync0 and sync1 interrupts.
>
> The master code doesn't even look like it uses the sync1 shift time, and
> information from my Yaskawa slave says it's sync1 cycle time is readonly and
> matches the sync0 cycle time.
>
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>
> So:
> - It looks like the first documents registers 0x09A4:0x09A7 should actually
> be called sync1 shift time.
> - It does not look like there is currently any slave support for a different
> (from sync0) sync1 cycle time.
>   (anyone got a slave out there that does?)
> - The EtherLab master should not be using sync1 cycle time in the calculation
> you mention below.
> - The EtherLab master should be sending sync1 shift time to 0x09A4:0x09A7
> instead of the sync1 cycle time.
> - TwinCAT is probably using its cycle time "multiple" parameters to figure
> out how often to send the PDO requests for each slave (just a guess).
>
>
> In your case, set the second to last parameter to zero, i.e.:
> ecrt_slave_config_dc(sc, 0x0700, 500000, 250000, 0, 0);
>
> You have already adjusted the sync0 shift time (third to last parameter)
> anyway.
>
>
> Regards,
> Graeme.
>
>
> From: etherlab-users [mailto:etherlab-users-boun...@etherlab.org] On Behalf
> Of Philippe Leuba
> Sent: Friday, 18 May 2018 7:11 AM
> To: etherlab-users@etherlab.org
> Subject: Re: [etherlab-users] Slave DC start time calculation
>
> Hi,
>
> I have changed how to calculate the slave start time by taking only the
> sync0->cycle_time as cycle time.
> The results is good and I can see in the log that the 'remainder' is almost
> the same for all slaves.
>
> @Florian: Why did you did this change on 2016-09-16 ?
>
> Best regards
>
> Philippe
>
> On May 16, 2018, at 6:22 PM, Philippe Leuba <ple...@swissonline.ch> wrote:
>
> Hi All,
>
> I can not understand how to configure correctly my slaves with the
> ecrt_slave_config_dc() function.
>
> I use nine EL7211-9014 servo controllers and the XML declarations is:
>
> <Dc>
> <OpMode>
> <Name>DC</Name>
> <Desc>DC-Synchron</Desc>
> <AssignActivate>#x700</AssignActivate>
> <CycleTimeSync0 Factor="1">0</CycleTimeSync0>
> <ShiftTimeSync0 Input="0">30000</ShiftTimeSync0>
> <CycleTimeSync1 Factor="-1">0</CycleTimeSync1>
> <ShiftTimeSync1>1000</ShiftTimeSync1>
> </OpMode>
> </Dc>
>
> SYNC0 and SYNC1 should be fired at each cycle.
>
> My realtime cycle is at 500us, so initially I used:
>
>   ecrt_slave_config_dc(sc, 0x0700, 500000, 30000, 1000, 0);
>
> but I sometimes faced some hiccup on some motor movements (almost always on
> the same motor, but sometimes not), most probably due to frames late
> regarding SYNC events, so I increased the sync1_shift to half of the cycle
> time:
>
>   ecrt_slave_config_dc(sc, 0x0700, 500000, 250000, 1000, 0);
>
> This help, but I'm still not convinced that it is correct.
>
> How can I debug this, I did not see any error on slaves C0Es 1c32 or 1c33 ?
>
> Startup debug messages are the followings:
>
> EtherCAT DEBUG 0-12: Checking for synchrony.
> EtherCAT DEBUG 0-12: 19 ns difference after 1 ms.
> EtherCAT DEBUG 0-12: app_start_time=64456682505935
> EtherCAT DEBUG 0-12:   app_time=64460192975876
> EtherCAT DEBUG 0-12:   start_time=64460292975876
> EtherCAT DEBUG 0-12:     cycle=501000
> EtherCAT DEBUG 0-12:   shift_time=250000
> EtherCAT DEBUG 0-12:   remainder=263941
> EtherCAT DEBUG 0-12:   start=64460293462935
> EtherCAT DEBUG 0-12: Setting DC cyclic operation start time to 64460293462935.
> EtherCAT DEBUG 0-12: Setting DC AssignActivate to 0x0700.

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> -
> -
> -
> EtherCAT DEBUG 0-13: Checking for synchrony.
> EtherCAT DEBUG 0-13: 9 ns difference after 1 ms.
> EtherCAT DEBUG 0-13: app_start_time=64456682505935
> EtherCAT DEBUG 0-13:      app_time=64460854977928
> EtherCAT DEBUG 0-13:      start_time=64460954977928
> EtherCAT DEBUG 0-13:      cycle=501000
> EtherCAT DEBUG 0-13:      shift_time=250000
> EtherCAT DEBUG 0-13:      remainder=444993
> EtherCAT DEBUG 0-13:      start=64460955283935
> EtherCAT DEBUG 0-13: Setting DC cyclic operation start time to 64460955283935.
> EtherCAT DEBUG 0-13: Setting DC AssignActivate to 0x0700.
>
> I'm really surprised that the remainder can be so different, so I looked in
> the source code and can not understand the logic:
>
> // set DC start time
> start_time = master->app_time + EC_DC_START_OFFSET; // now + X ns (X
> being 100000000 = 100 ms)
>
> if (sync0->cycle_time) {
>     // find correct phase
>     if (master->has_app_time) {
>         u64 diff, start;
>         u32 remainder, cycle;
>
>         diff = start_time - master->app_start_time;
>         cycle = sync0->cycle_time + sync1->cycle_time;
>         remainder = do_div(diff, cycle);
>
>         start = start_time + cycle - remainder + sync0->shift_time;
>
> Why the cycle is the sum of the two sync->cycle_time, in my case 501000,
> should not it be: sync0->cycle_time (500000) ?
>
> This was changed on 2016-09-16, but It seems it was right before.
>
> I can see that sync0->cycle_time is written to register 9A0 (500000)
> and sync1->cycle_time is written to register 9A4 (1000), this is correct.
>
> It seems to me that the sync1_cycle parameter of the ecrt_slave_config_dc()
> is handled as as sync1_shift, this is really confusing.
>
> Is it normal, can someone explain this ?
>
> Philippe

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<http://lists.etherlab.org/mailman/listinfo/etherlab-users>

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