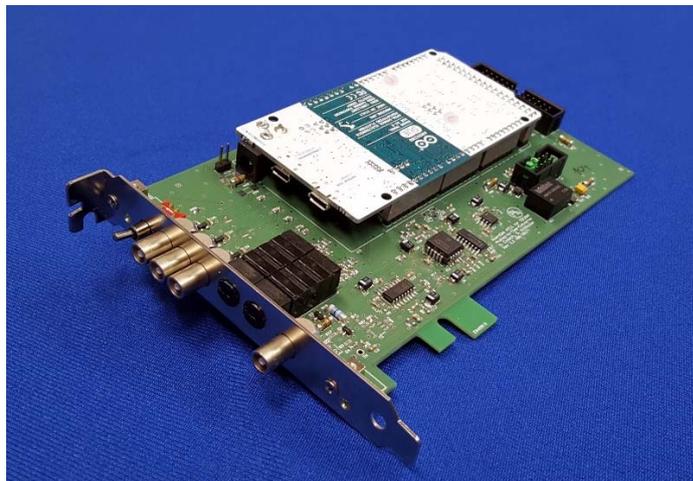


Manual for the ATC1 (add-on card for the TDC8HP)

manual version 2.1



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1 General description

The **ATC1** has 3 ADC-channels (10 bit 0V - +3.3V, minimum width 3.3 μ s or 2.3 μ s). Digitized values are transferred to the **TDC8HP** card's (low resolution channel inputs) via flat ribbon cable.

While at least one channel (up to two) is sampled every second the sampling moment for at least one other (up to two) is determined by a trigger signal and selectable delay: ADC channel 1 is always trigger-controlled, ADC channel 3 operates trigger-independent. ADC channel 2 can be switched between these two modes by jumper setting.* For the trigger-controlled channel(s) the sampling moment can be shifted backwards in time or into the future with respect to the trigger signal. The digital data output can be delayed separately.



green LED (an analog signal was detected on a triggered channel at the sampling moment)

switch (up: delayed measurement after trigger, down: get sampled value from the past)

ADC channel 1 (always trigger-controlled)

ADC channel 2

ADC channel 3 (never trigger-controlled)

output delay (rotary switch with 10 steps: 1-10)

sampling delay pre or post trigger (rotary switch with 10 steps: 1-10)

trigger signal input (NIM-signal)

red LED (no signal detected in presence of trigger for given sampling setting)

Figure 1: front panel with controls

2 Connecting the ATC1 to the TDC8HP card

The ATC1 must be connected with the **TDC8HP** card's low resolution channel inputs using the grey flat ribbon cable (supplied together with the **ATC1**). Afterwards reboot the computer.

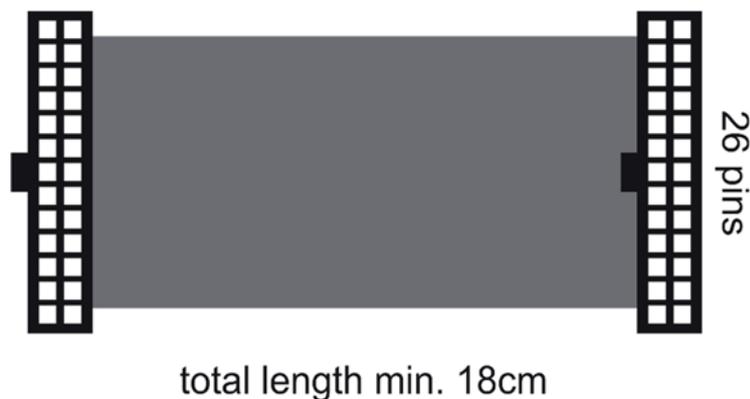


Figure 2: connection cable to the TDC8HP

* For a certain setting combination of the delay switches (9&9, see below) all 3 channels operate trigger-independent.

3 Operation

Range: Allowed ADC input levels: 0V - +3.3V (digitized with 10 bit nominal resolution)
 Trigger: NIM-signal (low=0V, HIGH = -0.8 V @ 50 Ohm). Minimum lengths 7ns.

Important: If a triggered ADC input is not connected to an external device it should be terminated (e.g. with 50 Ω terminating plug). Otherwise, it will charge up to a level that may appear as a received a signal erroneously affecting the status LED function (see below).

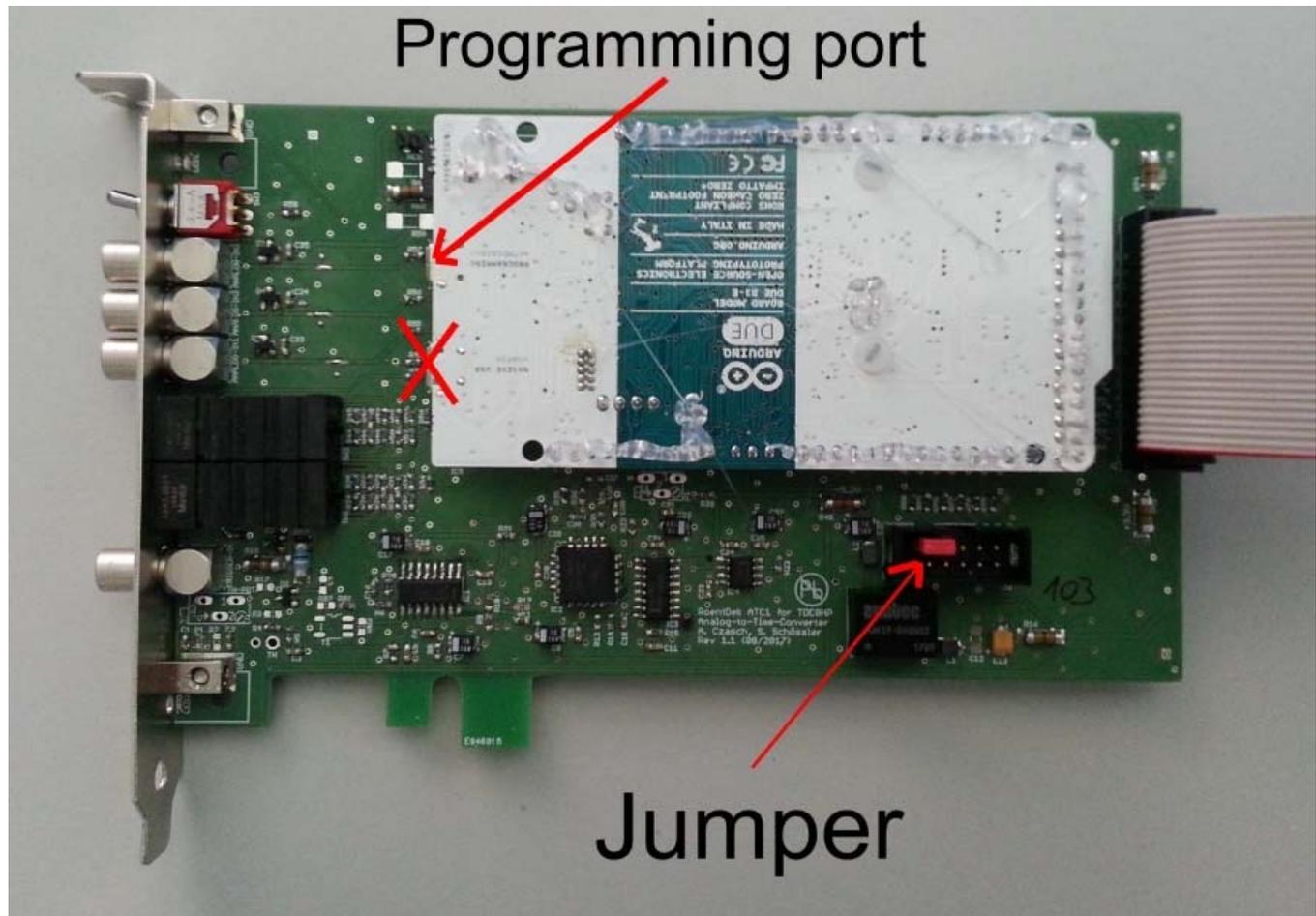


Figure 3: Side view of the ATC1 with jumper position for selecting channel 2 trigger mode. The other red arrow points to the position of the programming port (see below). Do not connect the port at the position marked with X.

Jumper setting:

Jumper not set: ADC channel 1 is sampled at each trigger, ADC channels 2 and 3 every second.
 Jumper set: ADC channels 1 and 2 are sampled at each trigger, ADC channel 3 every second.

4 Sampling moment and data output

There are 3 modes of operation:

Mode 1:

Jumper is not set:

Only ADC1 is trigger-controlled. The minimum width of the analog signal must be 2300 ns.
 ADC channels 2 and 3 will be sampled and transfer each second (no exact timing relative to the trigger).

Switch down: The analog signal is sampled before the trigger between
 $780\text{ns} + (\text{sampling_delay_step\#}) * 3450\text{ns}$ and $780\text{ns} + (\text{sampling_delay_step\#}) * 3450\text{ns} + 2300\text{ns}$

Switch up: The analog signal is sampled after the trigger between
 $840\text{ns} + (\text{sampling_delay_step\#}) * 3400\text{ns}$ and $840\text{ns} + (\text{sampling_delay_step\#}) * 3400\text{ns} + 2300\text{ns}$

The digital output signals will be generated during the time region 6450 ns to 9200 ns after the trigger. The transfer to the TDC can be further delayed by the output delay switch: Delay per step = 1520 ns (0-9 steps) measured from trigger (cannot be before generation of digital output signals).

Mode 2:

Jumper is set:

ADC channels 1 and 2 are trigger-controlled. The minimum width of the analog signals must be 3300 ns. ADC3 will be sampled and transfer each second (no exact timing relative to the trigger)

Switch down: The analog signal is sampled before the trigger between $1770\text{ns} + (\text{sampling_delay_step\#}) * 1730\text{ns}$ and $1770\text{ns} + (\text{sampling_delay_step\#}) * 1730\text{ns} + 3300\text{ns}$

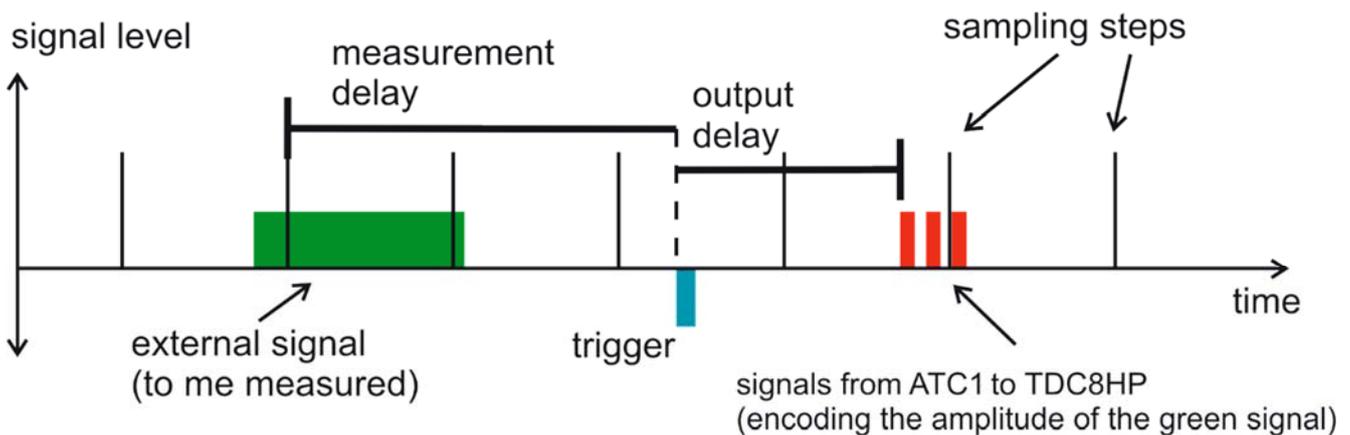
Switch up: The analog signal is sampled after the trigger between $-270\text{ns} + (\text{sampling_delay_step\#}) * 1750\text{ns}$ and $-270\text{ns} + (\text{sampling_delay_step\#}) * 1750\text{ns} + 3300\text{ns}$

The digital output signals will be generated during the time region 4700 ns to 7400 ns after the trigger. The transfer to the TDC can be further delayed by the output delay switch: Delay per step = 930 ns (0-9 steps) measured from trigger (cannot be before generation of digital output signals).

Mode 3:

Setting both the sampling delay switch and the output delay switch to position 9 will disable the trigger controlled sampling: All 3 ADC channels will be measured once per second.

switch down:



switch up:

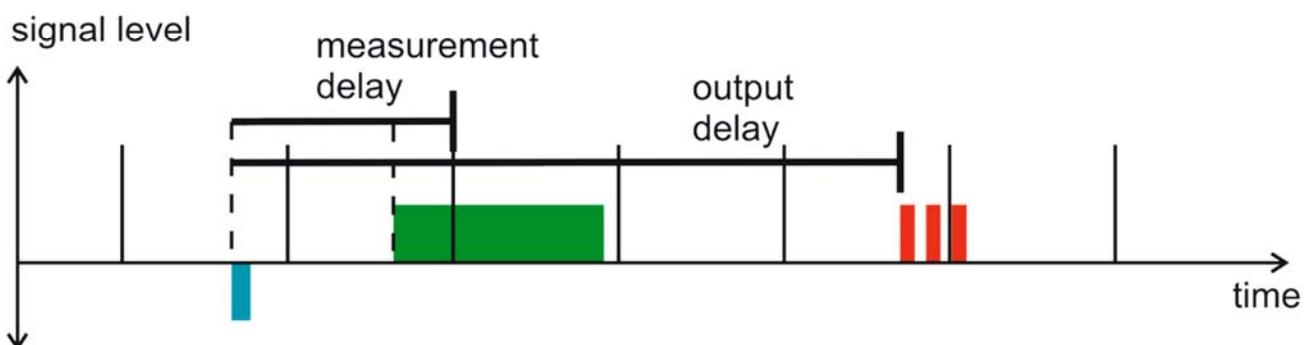


Figure 4: Sampling and output delay as function of switch setting

5 The status LEDs

The **red** LED will flash if the **ATC1** has received a trigger signal but no analog signal above +40mV was measured.

The **green** LED will flash if the **ATC1** has received a trigger signal and an analog signal above +40mV was measured.

If the jumper is set then the **ATC1** will flash the **green** LED if there was a signal in ADC channel 1 or 2 or both.

Therefore the ADC channel 2 must be terminated externally if it is not used. Otherwise it will float up to a value above 40mV and the **green** LED will flash constantly for each trigger signal independently of a signal being present on channel 1 or not.

6 Troubleshooting

Connect a trigger signal to the trigger input. The rate should be between 5 Hz and 10 kHz. Disconnect all cables and all terminators from the 3 ADC inputs. Due to leak currents the ADC input channels will float to voltages which are non-zero.

E.g. ADC1 may float to 0.65 V and ADC2 may float to 1.9 V. These values should become visible in **CoboldPC** if you start the data acquisition. For further testing you may connect a DC-power supply to the ADC-channels. Please make sure that the applied voltage stays within 0 V and +3.3 V to avoid damage of the **ATC1**.

7 Updating the firmware of the ATC1

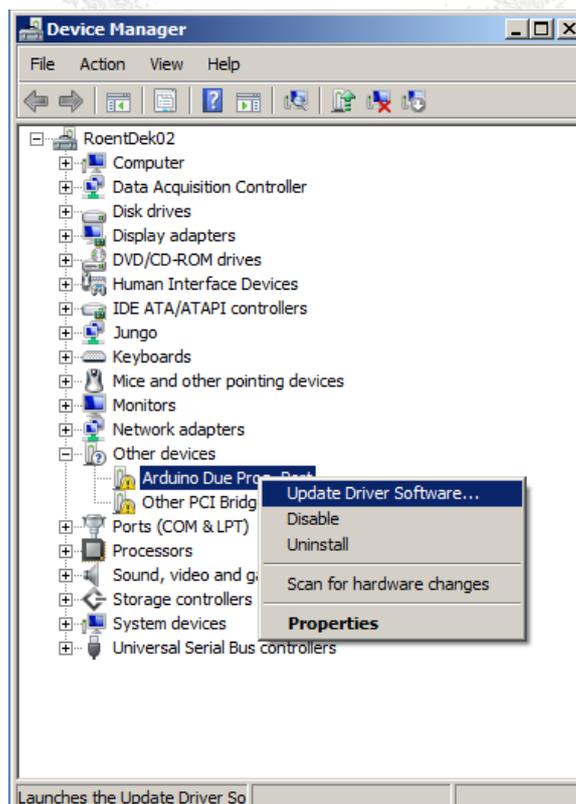
1) Connect the **ATC1** with the PC using an USB-cable. It is important to use the USB-port on the **ATC1** which is labelled with “Programming” (it is the port closer to the front switch, see figure 3). Do not use the “NATIVE” USB-port. The **ATC1** can stay connected with the TDC during the entire firmware upgrade.

2) Go into the “Device Manager” of Windows. The **ATC1** will appear as “Arduino Due Programming Port”. You will find it either in the section “Ports (COM & LPT)” or in “other devices”.

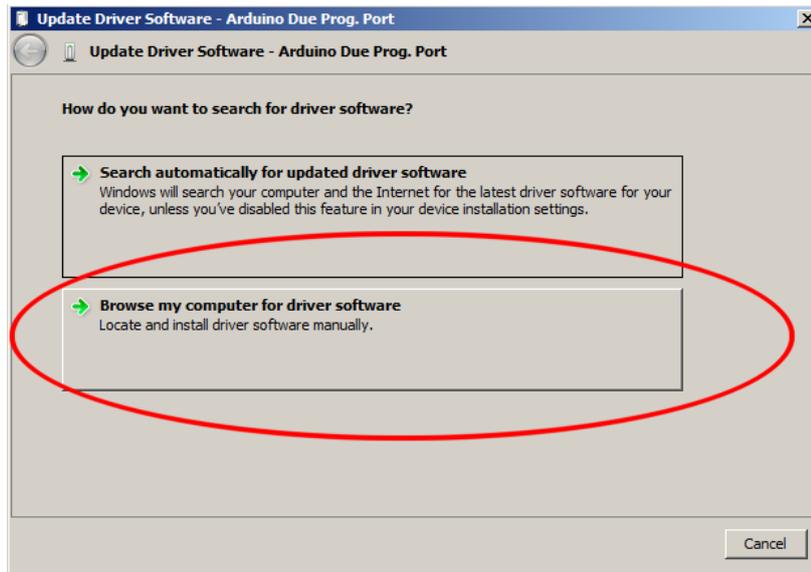
Please make sure that no other Arduino-Device is connected to the PC as it might be damaged during the flash procedure !

If it is visible in “Ports (COM & LPT)” then the necessary driver is already installed and you can continue with step 6.

3) Right click on “Arduino Due Programming Port” and select “Update Driver Software”

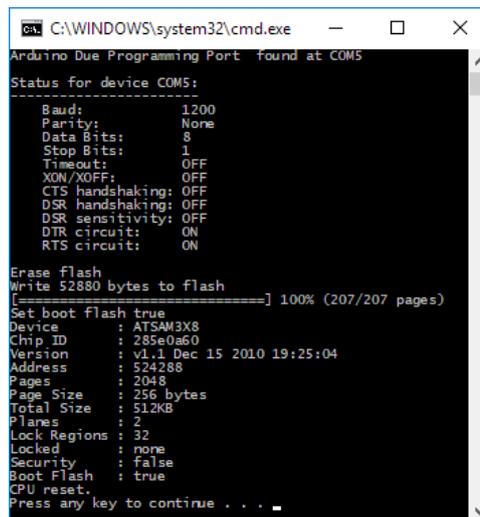


4) In the next window select “Browse my computer for driver software”.



5) point it to the “driver”-folder which is in the same folder as this document.
Now the driver will be installed. Please confirm all messages during the installation

6) Double click on the file “update_firmware_ATC1.bat”. Now a black window will open.
At the end of the flash procedure (it will take some seconds) the output should look as in the following image:



7) Disconnect the USB-cable from the ATC1. (But keeping it connected will not interfere with the operation of the ATC1.)