

catoolRT

CANbus Start of Combustion (SOC)

NOTE: Measuring the start of combustion using the ECM requested spark angle has two obvious drawbacks. Firstly, this is the angle that the ECM would like to initiate spark, not that actual angle that the coil fires. Secondly, delays between the ECM transmitting the spark angle and catoolRT receiving it can lead to cyclic delays. It is therefore recommended that a current clamp is used to measure spark angle if possible, especially if the engine is measured in transient operation or for the purposed of knock control development.

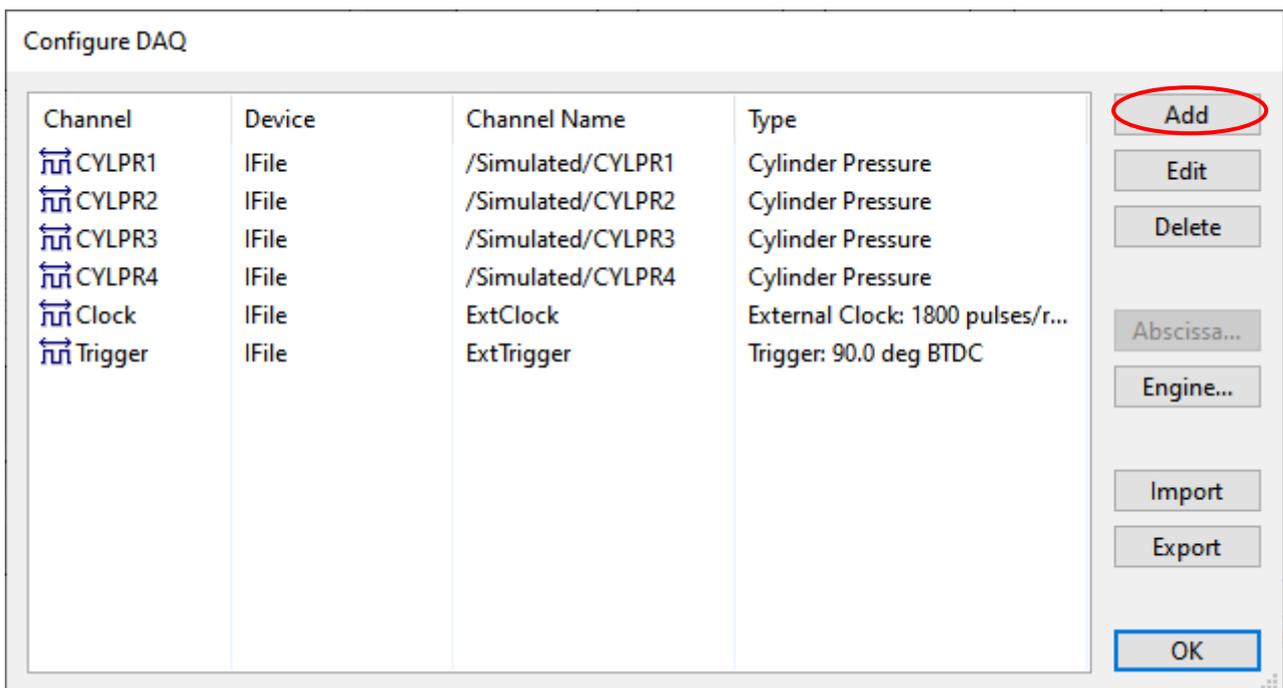
NOTE: catoolRT uses an angular convention in degrees after compression top dead centre. Most ECM software indicates spark timing in degrees before compression top dead centre. Start of combustion will therefore need to be inverted between the value transmitted by ECM and value used by catoolRT. This will be handled in the channel configuration.

1. Configure CANbus Input Signal

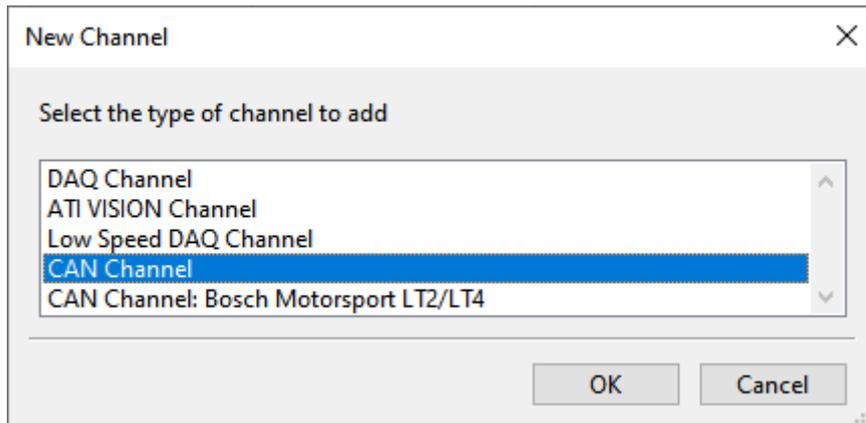
This document describes adding an SOC channel acquired from CANbus. Much the same process also applies if using the ATI VISION interface.

NOTE: The following will describe adding a single CANbus channel for all cylinders. If possible use a CANbus channel for each individual cylinder spark timing. This is particularly critical when the ECM adjusts individual cylinder spark timing for either idle balance or knock control.

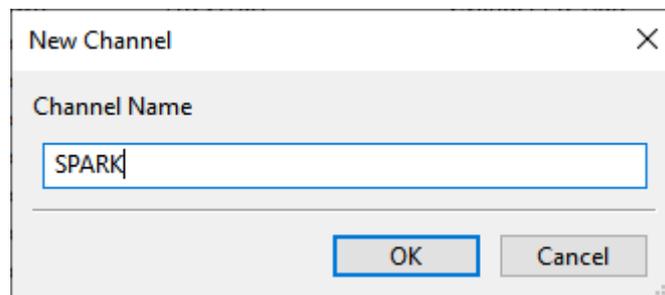
Select "Acquisition" -> "Configure DAQ". Click on "Add"



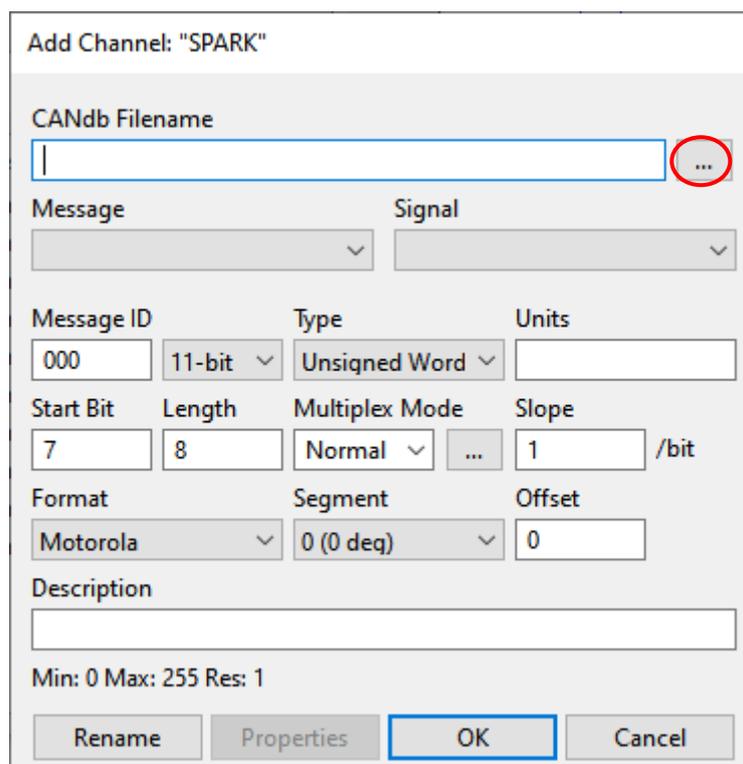
Select "CAN Channel" and click "OK":



Give the channel a name and click "OK":



The easiest way to use CANbus channels is with a CANdb (DBC) database file. Browse for a file by clicking on the "..." icon.



Once the database file is loaded you can select the "Message" and then "Signal" for the start of combustion indication:

Add Channel: "SPARK"

CANdb Filename
SCS_Delta.dbc

Message: Msg300 [0x300] Signal: MainA

Message ID: 300 Type: 11-bit Unsigned Word Units: deg

Start Bit: 55 Length: 16 Multiplex Mode: Normal Slope: 0.25 deg/bit

Format: Motorola Segment: 0 (0 deg) Offset: -10.0 deg

Description: Main Fuel Injection Timing

Min: -10 Max: 16373.8 Res: 0.25

Rename Properties OK Cancel

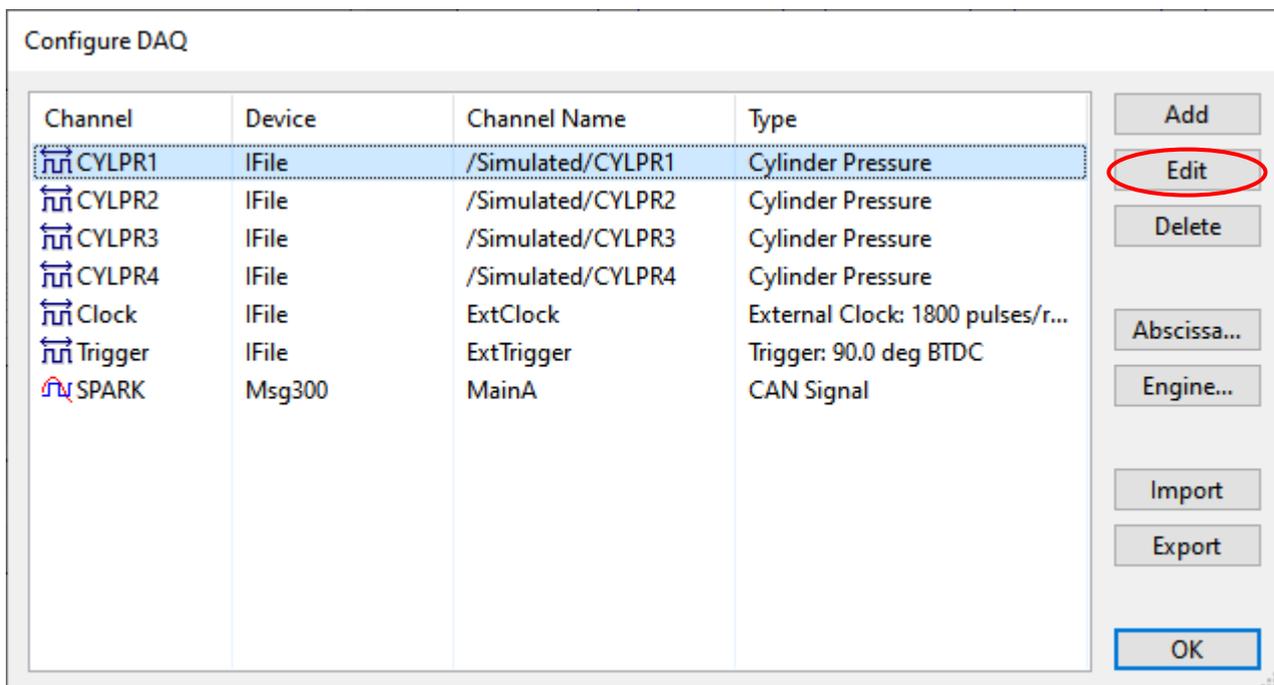
You can generate a DBC using the free Kvaser Database Editor 3 which you can download from <https://www.kvaser.com/download/>. The editor helps to visualise CAN bit positioning.

NOTE: the start bit numbering used by catoolRT is the same as the raw CANdb DBC file format. This differs from both the Vector and Kvaser bit numbering conventions depending on the endian format. If generating your own DBC file or entering CAN format direct to catoolRT, be sure to understand how these formats differ.

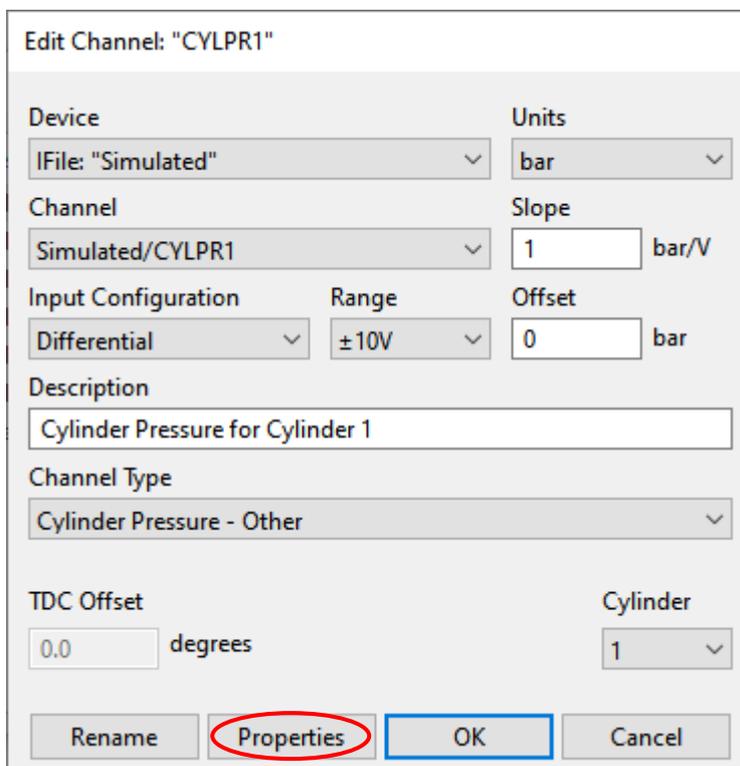
Once the CANbus signal is adequately described click "OK".

2. Configure Start of Combustion

Select each cylinder pressure channel in turn to configure the SOC by clicking “Edit”:



Click “Properties”:



In the "Start of Combustion" section change "Type" to "Channel Value", "Channel" to the CANbus channel you have configured and "Invert Value" to "True". This will convert the signal value from ECM to catoolRT angle reference.

CYLPR1 Properties

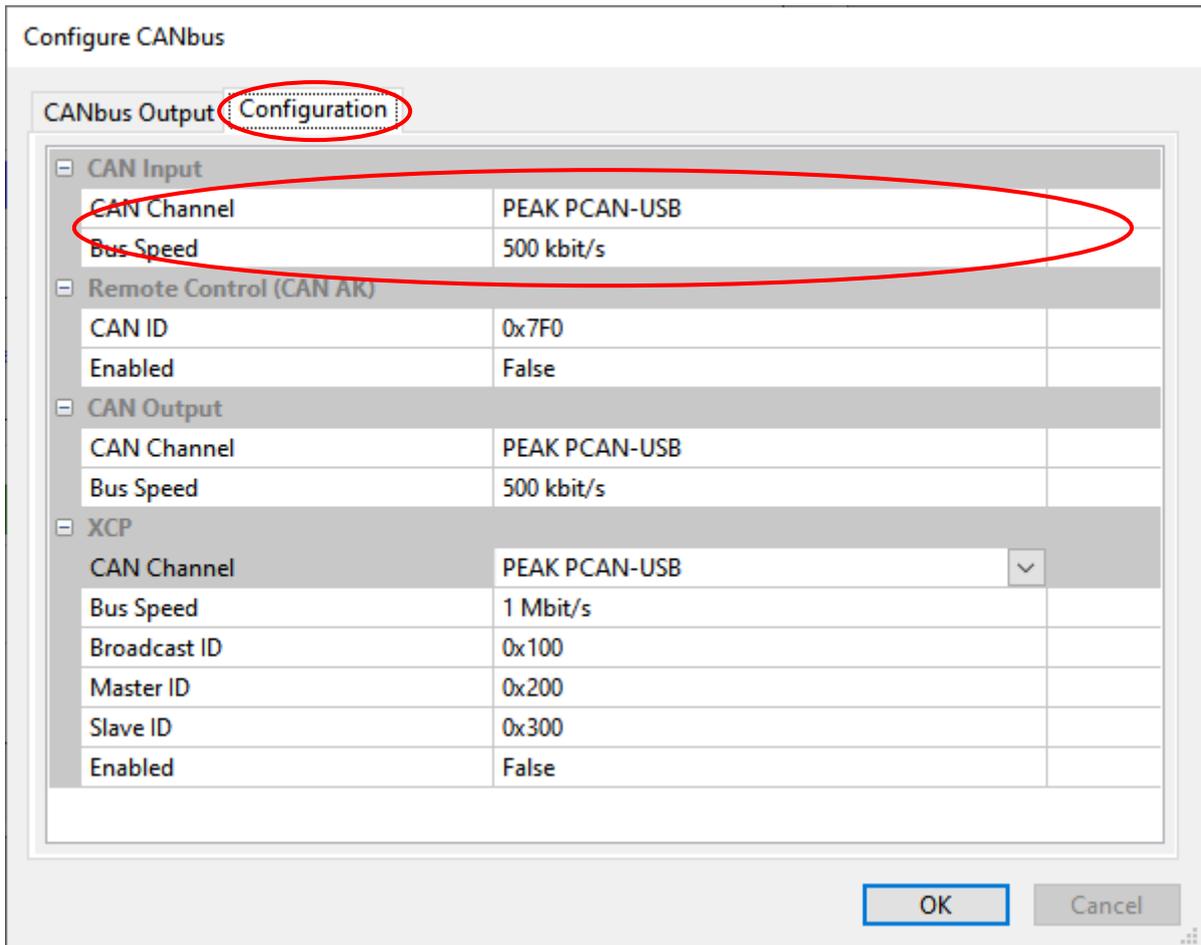
Offset Correction		
Type	Polytropic	
Window Start	-100	deg
Window Finish	-65	deg
Polytropic Index	1.32	
Interval	11	samples
Truncate	False	
Start of Combustion		
Type	Channel Value	
Channel	SPARK	
Invert Value	True	
Filtering		
Type	FIR Low Pass	
Lower Frequency	25000	Hz
Digital Conversion		
Type	None	

OK Cancel

Repeat this process for the remaining cylinder pressure channels.

3. Configure CANbus Hardware

“Acquisition” -> “Configure CANbus”. Click on the “Configuration” tab.

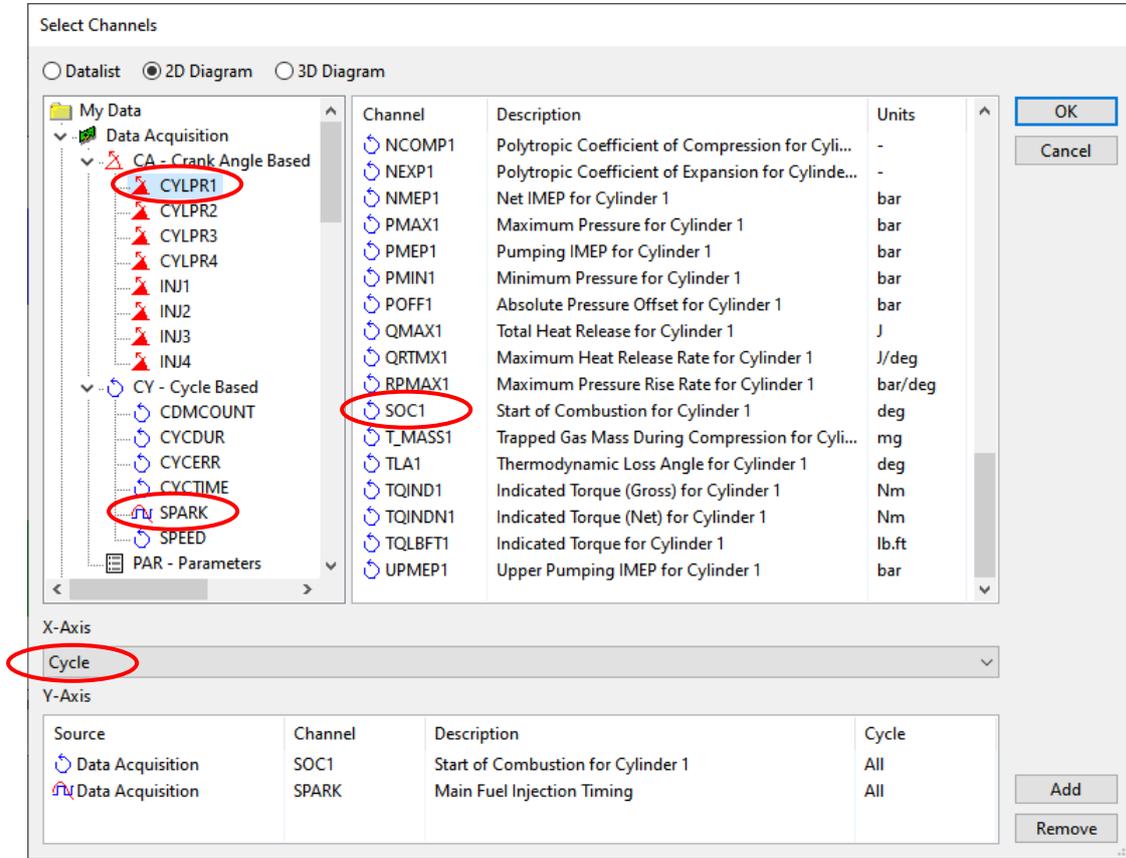


In the “CAN Input” section change the “CAN Channel” and “Bus Speed” to match your setup. Then click “OK”.

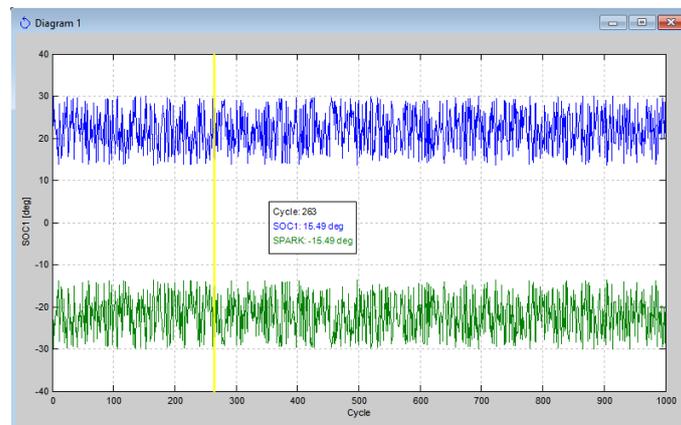
4. Validation

You should now be ready to test the configuration.

Go online and add a plot of the CAN channel and cylinder pressure start of combustion to ensure that the signal value matches the ECM output.



Note that the CAN channel value is not inverted. Only the cylinder pressure SOC value will reflect this inversion.



If possible, fix the spark value with the ECM software and check that the CAN and SOC channel values match.

NOTE: Fix spark with the engine in a safe speed-load condition, i.e. idle, where engine damage is unlikely. Do not allow the exhaust temperature to damage the catalyst.