Syvecs LTD

V1.1

Lam2CAN

This document is intended for use by a technical audience and describes a number of procedures that are potentially hazardous. Installations should be carried out by competent persons only.

Syvecs and the author accept no liability for any damage caused by the incorrect installation or configuration of the equipment.

Note: Due to regular firmware development, images shown might not be the same as more recent firmware versions, please check our forums for updated manuals and changes. Support can be obtained by contacting your Syvecs dealer.

Support@Syvecs.com

Table of Contents

Introduction

The Syvecs Lam2CAN is an 8 Channel NTK Lambda sensor CAN interface with comprehensive onboard fault logic. It also includes dual dedicated exhaust pressure sensor inputs enabling compensation for the effects of exhaust pressure on the lambda measurement. Data from the Lam2CAN is then transmitted via CAN to provide fast and accurate data.

Specifications

Outputs

8 x Lambda Heater Outputs - 10Amp Peak (100ms) / 6Amp Continuous
1 x 5V Sensor Supply (400ma Max)

Inputs

2 x Analogue Exhaust Pressure Sensor inputs (0-5V)

Interfaces

USB C For Updates and Configuration
1 x CAN 2.0B, fully user programmable

Power Supply

6 to 26V ignition switched supply

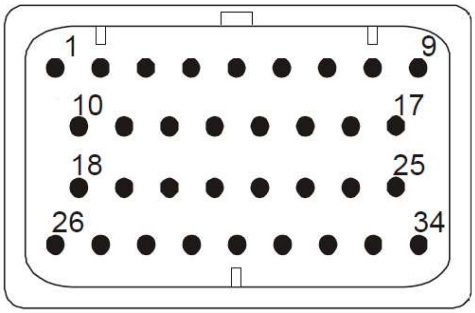
Physical

34 Way AMP Superseal connector

Environmental

High-quality anodised CNC aluminium body and military spec wiring (Tyco Spec44) ensures a rigorous and long-term use.

Pin Connections



DESCRIPTION	Connector		
PART NUMBER	2-1437285-3		
NOTES:	34 Way - Key1		
Pinout	**Function**	**NTK Wire Colour**	**Suggested Wire Size**
A1	Ground		AWG 16
A2	Lambda Heater 1	Blue	AWG 18
A3	Lambda Heater 2	Blue	AWG 18
A4	Lambda Heater 3	Blue	AWG 18
A5	Lambda Heater 4	Blue	AWG 18
A6	Lambda Heater 5	Blue	AWG 18
A7	Lambda Heater 6	Blue	AWG 18
A8	Lambda Heater 7	Blue	AWG 18
A9	Lambda Heater 8	Blue	AWG 18
A10	5v Regulated Output		AWG 22
A11	Exhaust Pressure 1		AWG 22
A12	Exhaust Pressure 2		AWG 22
A13	Lambda Ground 1	Black	AWG 16
A14	Lambda Ground 2	Black	AWG 16
A15	CAN 1 Low		AWG 22
A16	CAN 1 High		AWG 22
A17	12V Supply		AWG 18
A18	Ion Pump 1	White	AWG 22
A19	Ion Pump 2	White	AWG 22
A20	Ion Pump 3	White	AWG 22
A21	Ion Pump 4	White	AWG 22
A22	Ion Pump 5	White	AWG 22
A23	Ion Pump 6	White	AWG 22
A24	Ion Pump 7	White	AWG 22
A25	Ion Pump 8	White	AWG 22
A26	Ground		AWG 16
A27	Nernst 1	Grey	AWG 22
A28	Nernst 2	Grey	AWG 22
A29	Nernst 3	Grey	AWG 22
A30	Nernst 4	Grey	AWG 22
A31	Nernst 5	Grey	AWG 22
A32	Nernst 6	Grey	AWG 22
A33	Nernst 7	Grey	AWG 22
A34	Nernst 8	Grey	AWG 22

General Connections

Connecting Power/Ground

The Lam2CAN unit needs a single ignition 12v supply and dual ground connection, large size wire gauge (min AWG16) is important on the grounds as the lambda heaters consume a lot of current.

Note: Suggest to Fuse the 12v supply to the Lam2CAN with 5 Amp fuse.

Example Schematic

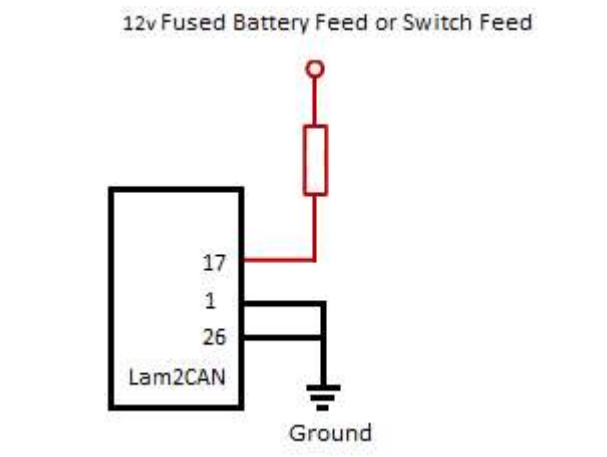


Figure 0-1 – Power and Ground Feeds

Pin Schedule

Pin Number	Function	Notes	Suggested wire size
17	VBAT	Use a fused Switched feed (5A)	AWG18
1	Power Ground	Ground for Power and Sensor Signal	AWG16
26	Power Ground	Ground for Power and Sensor Signal	AWG16

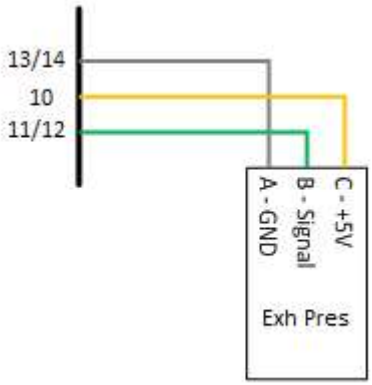
Input Connections

Exhaust Pressure AN Inputs

Two Analogue Inputs are available on the Lam2CAN. These are just 0-5v analogue inputs and cannot support frequency waveforms. They are designed just for pressure transducers.

Wiring Guidance

Example Schematic



Exhaust Pressure Sensor

Pin Schedule

Pin Number	Function	Notes
10	5v	5V Sensor Output
13 or 14	Ground	May be shared with multiple sensors and Lambdas sensors
11	Analogue input	AN01 0-5v
12	Analogue input	AN02 0-5v

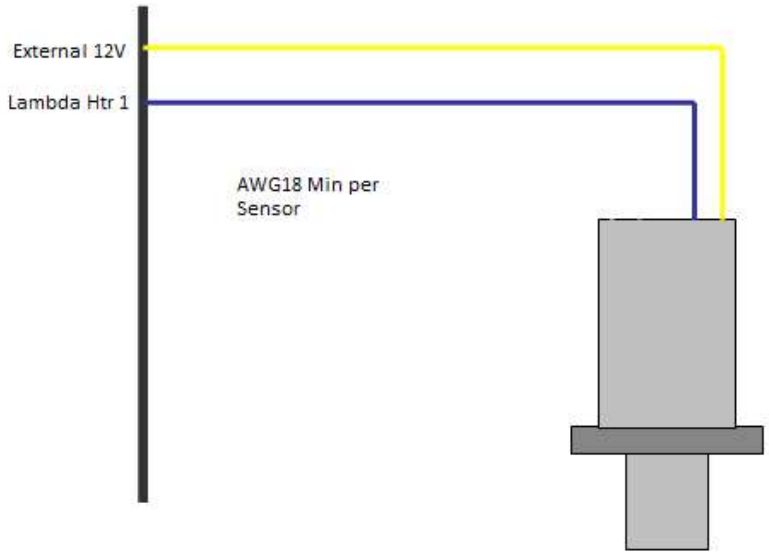
Lambda Heater Outputs

There are eight low side outputs available on the Lam2CAN to drive 8 NTK Lambda heater circuits. The outputs support 10 amp peak/ 6amp continuous loads, but please be aware that . Fault logic is also present on these outputs to check if a sensor is unplugged or damaged.

Wiring Guidance

The NTK Lambda heaters consumer around 3-4amps of current at 13v each, ensure you use the correct size wire gauge AWG18 or less for the heater wiring and make sure the lam2CAN Ground connections are both populated and AWG16.

Example Schematic



Lambda Heater

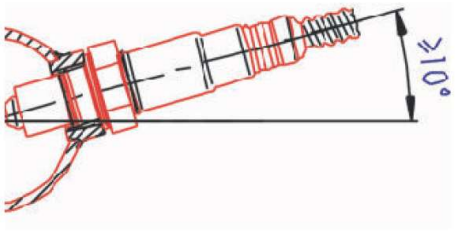
Pin Schedule

Pin Number	Function	Notes
2	Heater Drive	Lambda 1
3	Heater Drive	Lambda 2
4	Heater Drive	Lambda 3
5	Heater Drive	Lambda 4
6	Heater Drive	Lambda 5
7	Heater Drive	Lambda 6
8	Heater Drive	Lambda 7
9	Heater Drive	Lambda 8

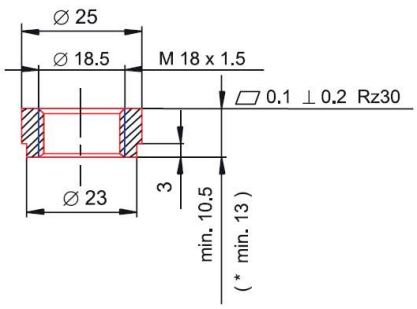
Lambda Wiring

Mounting Recommendation

Mounting recommendation

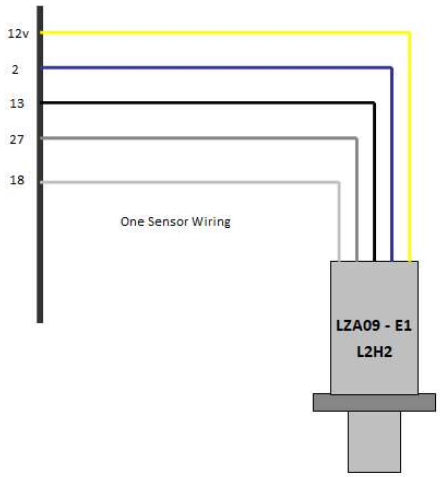


Recommended materials for the mating thread in the exhaust pipe
*: THexagon > 600°C or
TGas > 930°C



If fitting a Sensor in the Exhaust manifold its good to use a bung which has a heat-sink present. Like below
https://vibrantperformance.com/heat-sink-o2-sensor-weld-bung/

Example Wiring



Lambda Connections

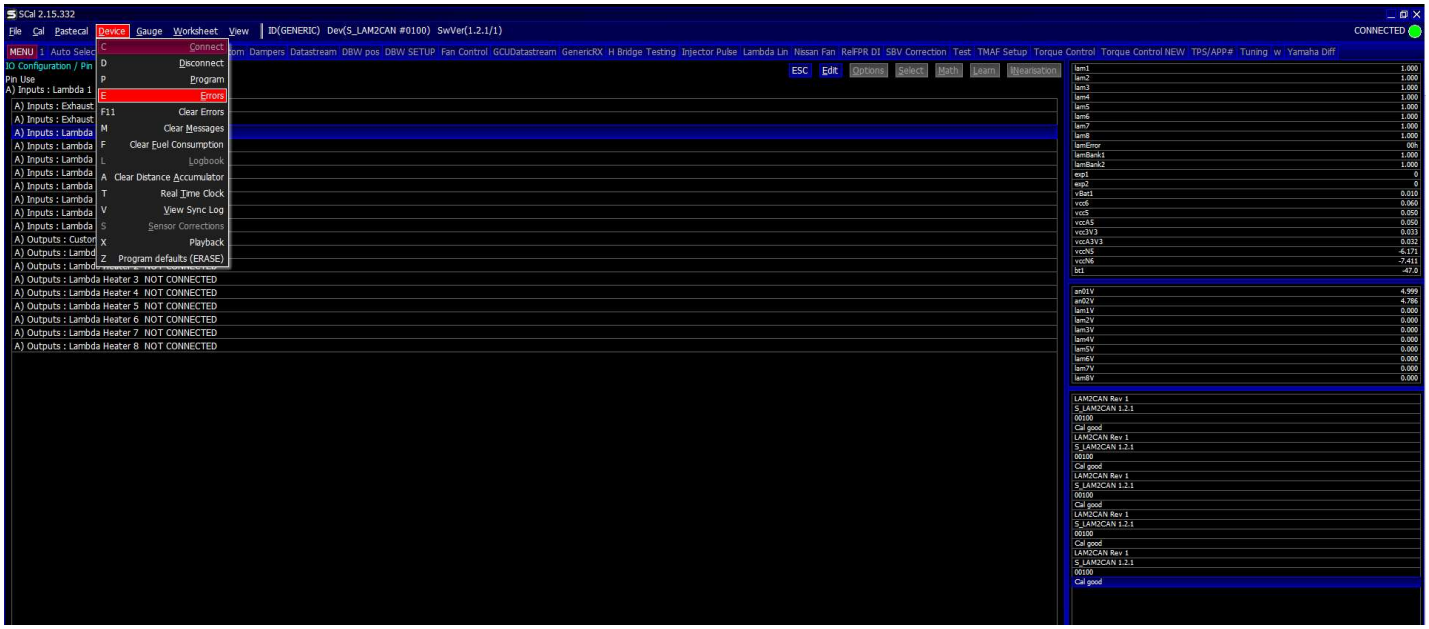
The following table lists all the connections for all 8 lambda sensors. It's important to note that the heater supply must be fused. 15Amp fuse for 4 Lambda heaters or 7.5Amp per pair of sensors.

Lambda Pin Number	Colour	Name	Lam2CAN Pin							
			Lam1	Lam2	Lam3	Lam4	Lam5	Lam6	Lam7	Lam8
1	Blue	Heater Drive	2	3	4	5	6	7	8	9
2	Yellow	Heater	12v Fused Supply				12v Fused Supply			
6	Grey	Nernst Cell Voltage	27	28	29	30	31	32	33	34
7	White	Ion Pump Current	18	19	20	21	22	23	24	25
8	Black	Signal Ground	13				14			

Lambda Fault Logic

The Lam2CAN has onboard fault detection to ensure that in the event of a sensor or heater circuit failure it is spotted and a diagnostic flag is set. Calibrators will be made aware of the issue by 2 systems.

First the Error System in Scal will prompt the user of an issue by causing Device to flash red at the top of the screen. Inside the Error area it will display the sensor in fault and a reason.



The Items in Scal LamDiag1 to LamDiag8 will set a decimal value to flag which error is present and can be decoded below:

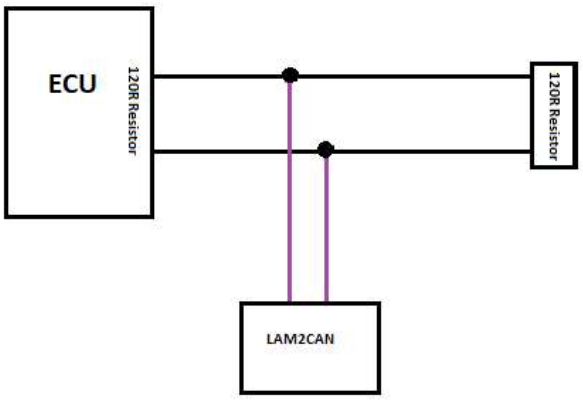
Diagnostic Message	Error Flag	Function
LAMDIAG_HTROPEN	1	Heater Circuit Open Circuit
LAMDIAG_HTRVBAT	2	Heater Control faulty
LAMDIAG_HTRGND	4	Heater Output fault
LAMDIAG_NSTOPEN	8	Nernst Cell open Circuit
LAMDIAG_NSTGND	16	Nernst short to Ground
LAMDIAG_IONOPEN	32	Ion Pump Circuit open
LAMDIAG_IONGND	64	Excessive Ion Current
LAMDIAG_NOGND	128	Lambda Ground missing

In the event of a Lambda fault the heater circuit will be shutdown for the sensor in fault.

CanBus Communications

Common **A**rea **N**etwork Bus (CAN Bus) is a widely used data interface, common used in many cars and after-market accessories, such as Data loggers and Dashes. The Lam2CAN has 1 x CAN bus interface and it **does not** have 120ohm termination resistors present, so a 120ohm external termination resistor will be required if the Lam2CAN is the single node on the bus.

Lam2CAN supports direct CAN connection to the vehicle or ECU data bus. This is a very powerful way of getting very fast real time data out to other modules. It also supports Generic Receive CAN to allow the Exhaust pressure sensors to be sent into the Lam2CAN via CAN data.



As Default the Lam2CAN sends out CAN data in the following format but it is fully configurable to can be setup to suit any ECU or CAN System.

CAN Speed : 1MB
CAN Format : MSB

Syvecs LAM2CAN Stream

Identifier	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte7
0x200	8	Lam1 - DIV1000		Lam1 - DIV1000		Lam1 - DIV1000		Lam1 - DIV1000	
0x201	8	Lam1 - DIV1000		Lam1 - DIV1000		Lam1 - DIV1000		Lam1 - DIV1000	
0x202	8	Lam Bank 1 DIV1000		Lam Bank 2 DIV1000		Ex Pressure 1 mbar/1		Ex Pressure 2 mbar/1	
0x203	8	Lambda Heater1 - %/81.92		Lambda Heater2 - %/81.92		Lambda Heater3 - %/81.92		Lambda Heater4 - %/81.92	
0x204	8	Lambda Heater5 - %/81.92		Lambda Heater6 - %/81.92		Lambda Heater7 - %/81.92		Lambda Heater8 - %/81.92	
0x205	8	LamDiag1 - BitWise		LamDiag2 - BitWise		LamDiag3 - BitWise		LamDiag4 - BitWise	

Lambda Diagnostics CAN bits:

Diagnostic Message	Address	Function
LAMDIAG_HTROPEN	0x1	Heater Circuit Open Circuit
LAMDIAG_HTRVBAT	0x2	Heater Control faulty
LAMDIAG_HTRGND	0x4	Heater Output fault
LAMDIAG_NSTOPEN	0x8	Nernst Cell open Circuit
LAMDIAG_NSTGND	0x10	Nernst short to Ground
LAMDIAG_IONOPEN	0x20	Ion Pump Circuit open
LAMDIAG_IONGND	0x30	Excessive Ion Current
LAMDIAG_NOGND	0x80	Lambda Ground missing

Motec LTC Stream

Identifier	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte7
0x460	8		Lam1 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x461	8		Lam2 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x462	8		Lam3 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x463	8		Lam4 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x464	8		Lam5 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x465	8		Lam6 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x466	8		Lam7 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x467	8		Lam8 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x468	8		Lam Bank 1 - DIV1000				Board Temp	Diagnostic	HeaterDuty
0x469	8		Lam Bank 2 - DIV1000				Board Temp	Diagnostic	HeaterDuty

Lambda Diagnostics CAN bits:

Diagnostic Message	Address	Function
LAMDIAG_HTROPEN	0x1	Heater Circuit Open Circuit
LAMDIAG_HTRVBAT	0x2	Heater Control faulty
LAMDIAG_HTRGND	0x4	Heater Output fault
LAMDIAG_NSTOPEN	0x8	Nernst Cell open Circuit
LAMDIAG_NSTGND	0x10	Nernst short to Ground
LAMDIAG_IONOPEN	0x20	Ion Pump Circuit open
LAMDIAG_IONGND	0x30	Excessive Ion Current
LAMDIAG_NOGND	0x80	Lambda Ground missing

Generic Can Receive

The generic CAN receive section allows for calibrators to setup the items they wish to receive on the Lam2CAN by setting the Identifier, Start Bit, Length, and scaling.

The easier way to setup the Generic CAN is to create a worksheet and add in all the maps like below to make each CANRX* maps line up.

Above you can see the Exhaust Pressure 1 is setup to be received from CAN ID 0x600, data is not Little Endian, value is signed, scaling is 1.00 and is being picked up from start bit 0 with a length of 16 bits.

More info can be found on www.youtube.com/SyvecsHelp. Search for Generic Can Receive and worksheets.

Please note: Any Item which is assigned in Pin Assignments will take its data from the Pin assignment and ignore the Generic CAN Rx data.

PC Connection - SCAL

In order for the Lam2CAN to work it must have a valid calibration present in the device and when shipping from the factory a default calibration is loaded to ensure calibrator's setup the configuration to suit the installation.

A USB C port is found on the back of the Lam2CAN which is used for calibration changes on the device.

The S-Suite software can be downloaded from below.
https://www.syvecs.com/software/

After running the SSuite installer, open SCal and click **D**evice > **C**onnect. You will be asked "How do you wish to access this device". Click OK.

Next you can load a calibration if you have one saved from a previous installation or program defaults if new installation.

The Lam2CAN will now connect. This status will be displayed in on the top right hand corner of SCal. A green indicator and Connected will be displayed.

TIP When navigating within SCal you will note that some configuration settings are in blue and others green. All green settings take effect immediately, and do not require programming. Settings highlighted in blue need to be programmed before the changes take effect.

Calibrators now have the ability to setup and monitor the Lam2CAN live.

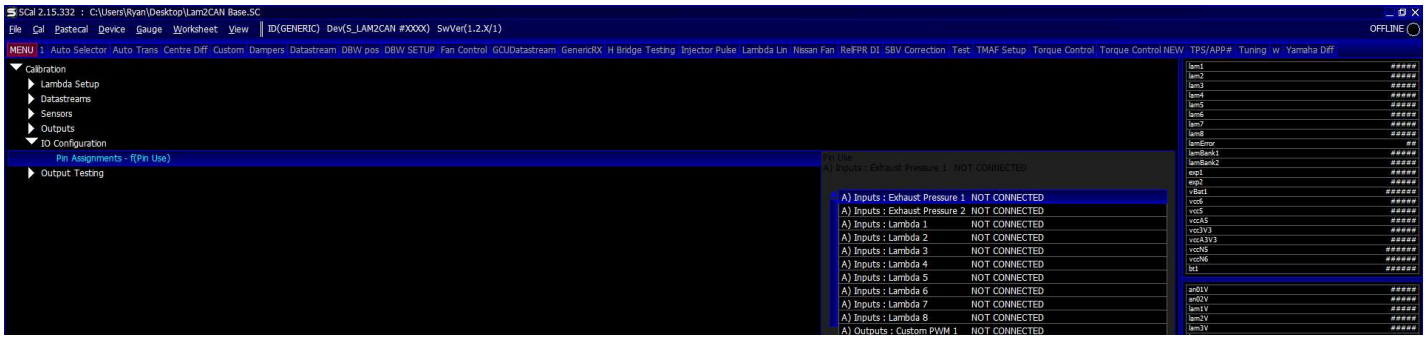
Press F1 for help on any map and remember that Calibration names highlights in Green are adjustable Live and changes are immediate. Blue Maps require programming (Device > Program) to take effect.

Lam2CAN Software Setup

Lambda Selection

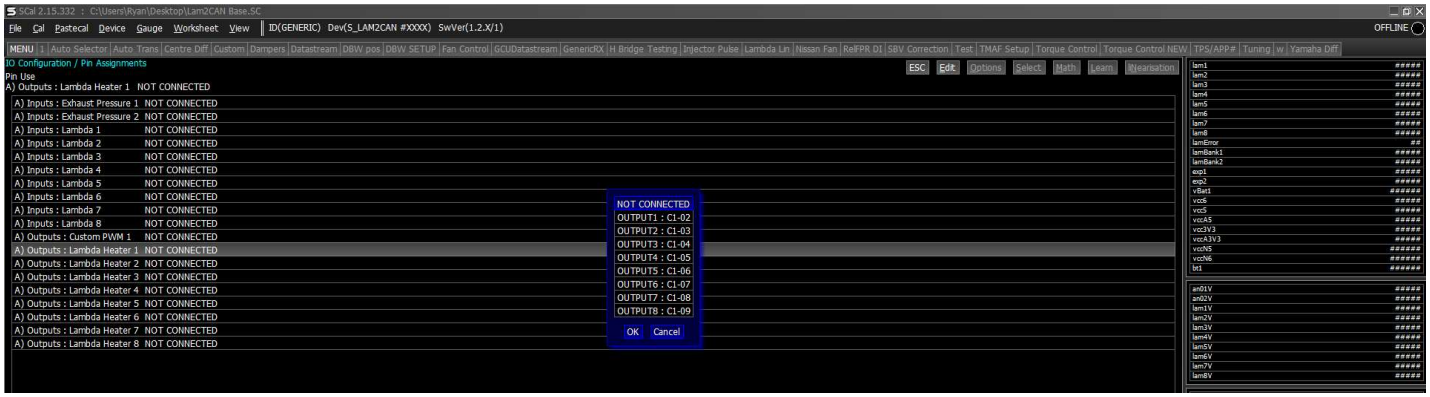
The Lam2CAN has eight NTK Lambda circuits present and depending on how many you have connected effects how you setup the software.

Pin Assignments – I/O Configuration is where you need to assign the lambda circuit used and the heater output used.

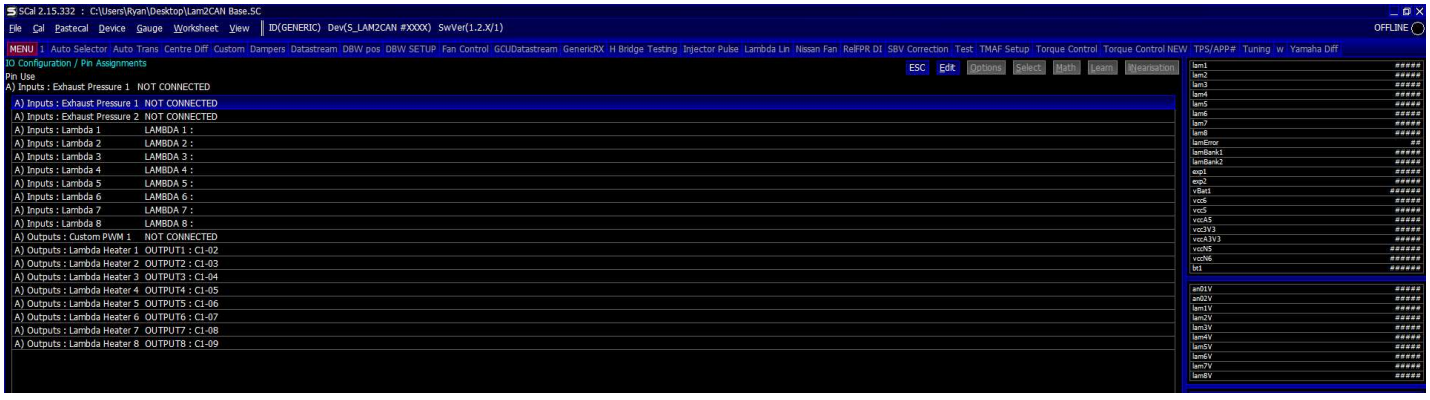


Assign the Lambda circuit used by double clicking on the corresponding lambda.

Next assign the Lambda heater output



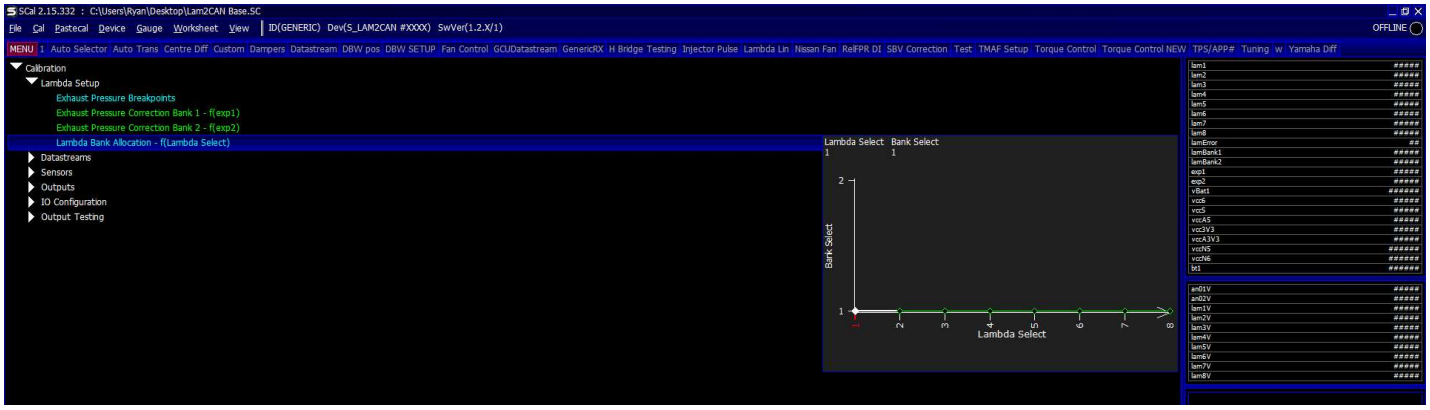
For 8 Channels your i/o configuration should look like below



Lambda Bank Assignment

Average banked Lambda values are available with the LAM2CAN. LamBank1 and LamBank2… These are useful for ECU systems which don't support individual cylinder lambda control.

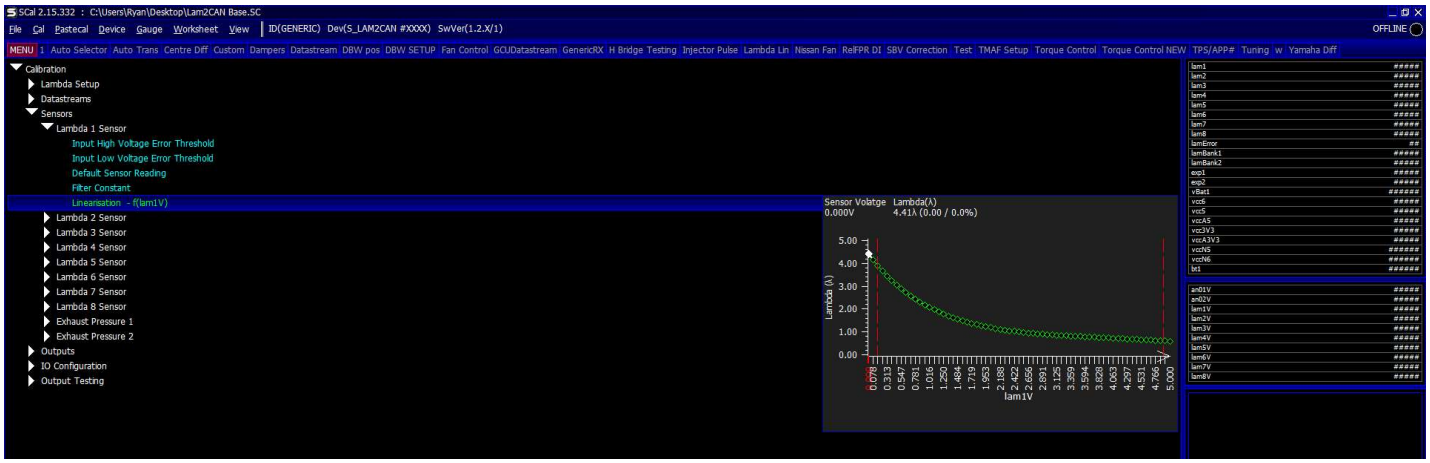
Users must assign which sensors are part of which bank in the Lambda Bank Allocation map.



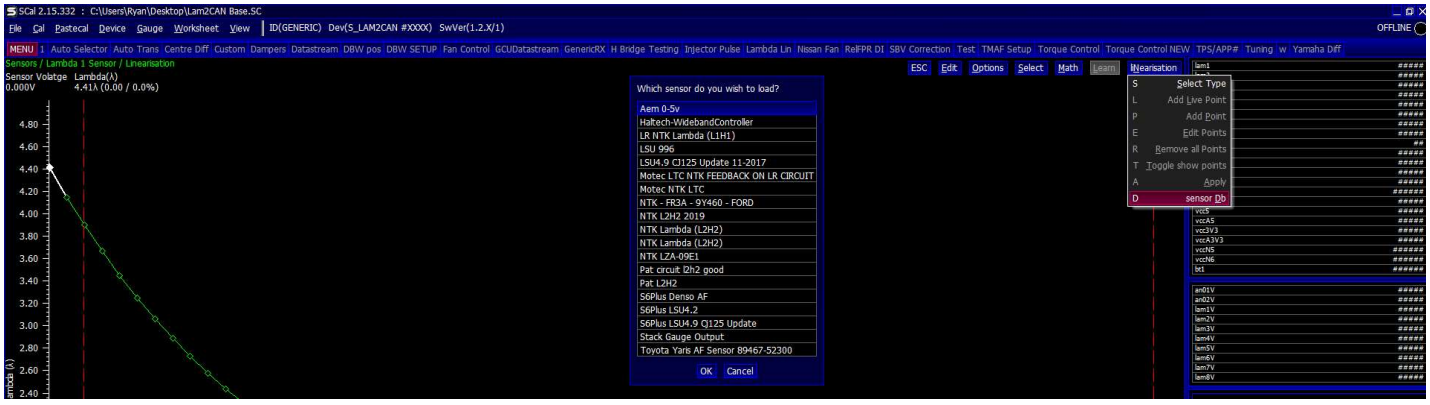
Set either bank1 or bank2 for each lambda sensor. This is important for the Exhaust pressure trims to ensure the correct pressure adjustment it applied to the correct signals.

Lambda Linearisation

The default values in the Lambda Linearisation maps are setup for an LZA09-E1 sensors, if you are using a different sensor like a motortsport L1H1. You can change the linearisation here to suit.



Scal has a Sensor database which contains a L1H1 Calibration if required

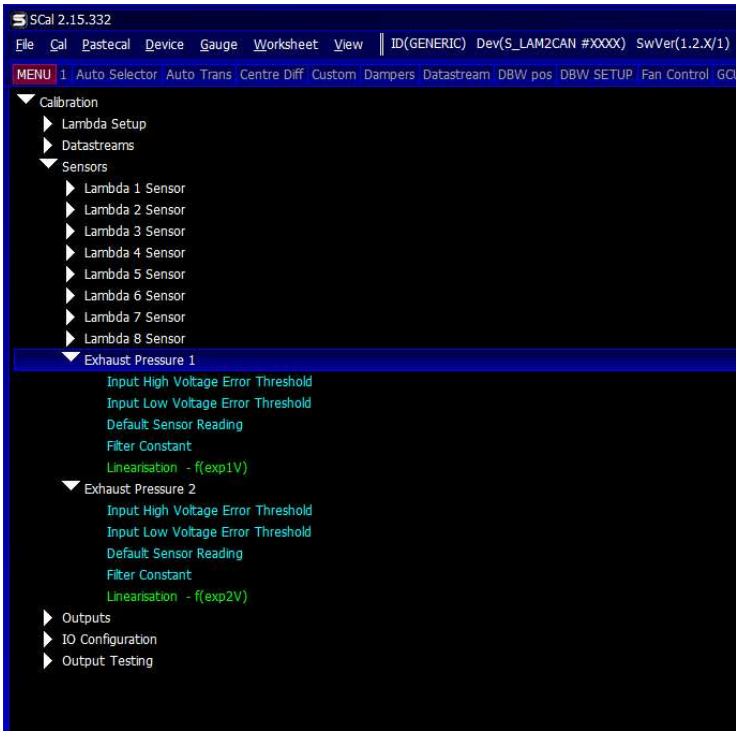


Exhaust Pressure Sensor Setup

The Lam2CAN supports two 0-5v Pressure signals which are used to adjust the Lambda signals based on pressure in the location lambda sensors are fitted. With sensors fitted in the exhaust manifold (pre turbo) this is important as the lambda value changes significantly with different pressures in the lambda cell.

The Exhaust pressures sensors can be either assigned in the I/O Configuration – Pin Assignments or picked up over CAN using our generic receive CAN code from another control unit.

Once assigned the calibrator can head to the sensors area to setup the input assigned.



Input High Voltage Error Threshold – Sets the high voltage level for which the TinyDash will class the input in Error

Input Low Voltage Error Threshold – Sets the low voltage level for which the TinyDash will class the input in Error

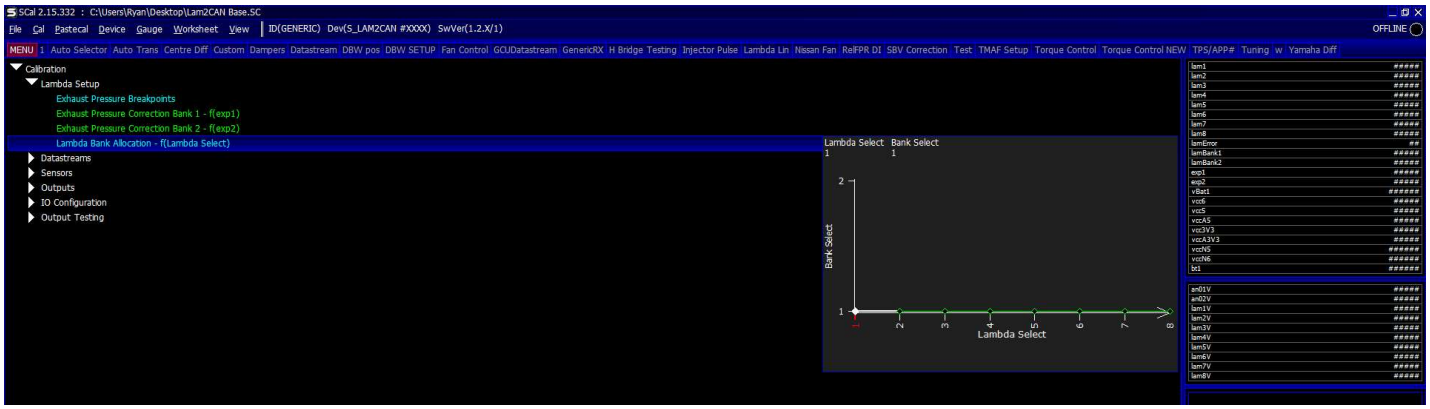
Default Sensor Reading – When the input is in Error the value in this map will applied on the Item

Filter Constant – Amount of recursive filtering to be applied to the Signal, higher the value = more filtering

Linearisation – Sets the input voltage to sensor units applied on the item

Exhaust Pressure 1 will be assigned to Bank1 lambda sensors and Exhaust Pressure 2 will be assigned to Bank2 lambda sensors.

Ensure the Lambda bank allocation is setup under Lambda Setup as shown below.



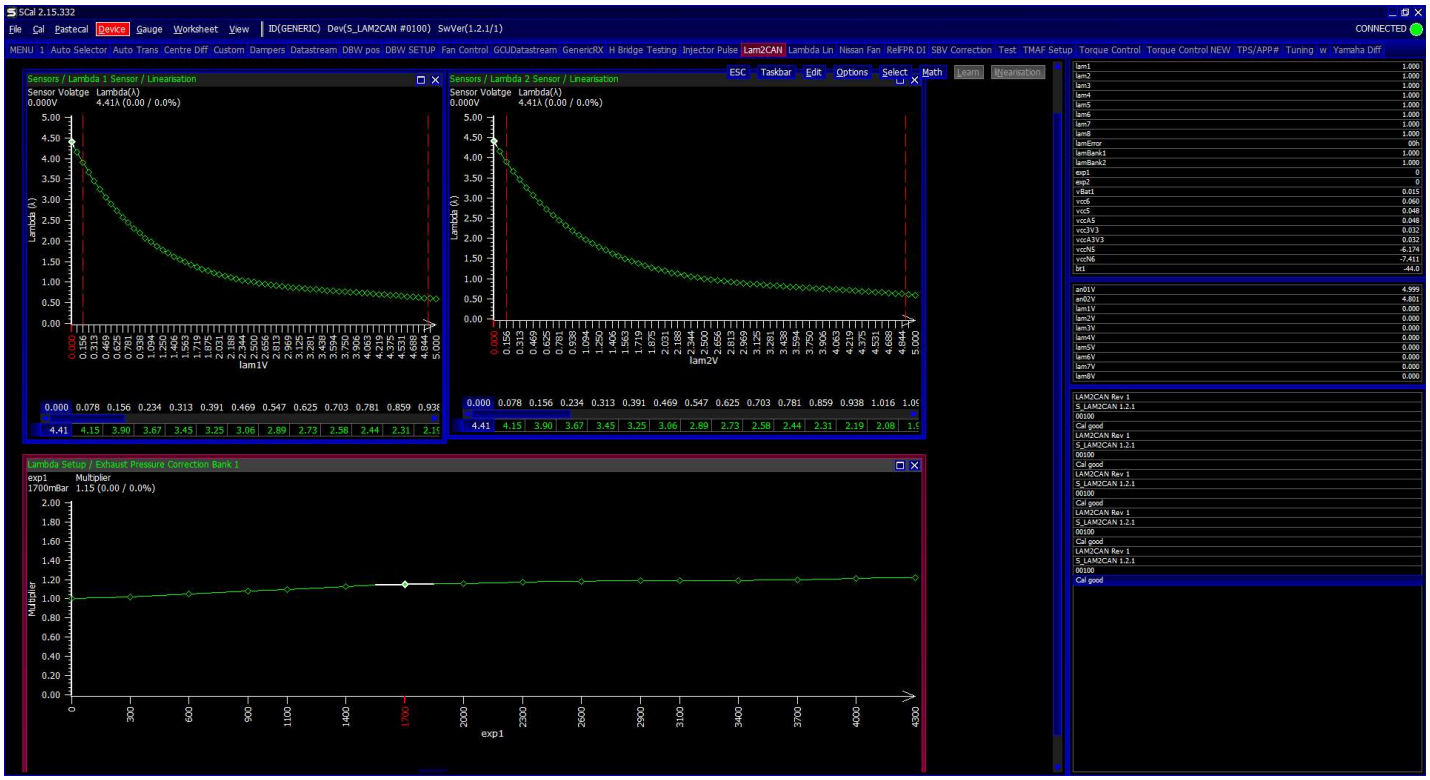
Gauges and Worksheets

Scal has the ability to have lots of custom gauges and trace layouts to monitor all the data from the Lam2CAN on screen

A good help video on this can be found here - https://www.youtube.com/watch?v=srlMwJwdhDw&t=339s

Custom worksheets can also be setup to have multiple maps open and laid out in a unique manner.

Here is a help video on how to do this - https://www.youtube.com/watch?v=X0W7BOigHFQ



Output Testing

The Lam2CAN outputs can be tested live with our Syvecs - Scal program and information on connecting to the unit can be found in the PC Connection section of the manual. After connecting to the unit via USB, users will see an area at the bottom of the calibration tree called output testing.

Here users are able to test the functions of each output outside the normal strategies on the Lam2CAN.

NOTE:* / *Low Side Output Frequency *maps must be set and programmed onto the device for the output testing logic of these outputs to apply. You cannot change these maps when* ***Output Test Mode Enable*** *is enabled.*

Remember that Calibration names highlights in Green are adjustable Live and changes are immediate. Blue Maps require programming (Device > Program) to take effect.

Set a frequency you wish the outputs to be driven at in **LowSide Output Frequency.** Device – Program for it to be saved. Then enable **Output Test Mode Enable** map.

Now you can then set a duty for each output to be driven in **Low Side Output Test Duty**, these maps can be adjusted live.

Strategy Help

All the strategies/maps on the Lam2CAN controller have help text available for them. This is shown by pressing F1 on the keyboard when in Scal when a calibration is open.