Spartan 3 OEM Manual

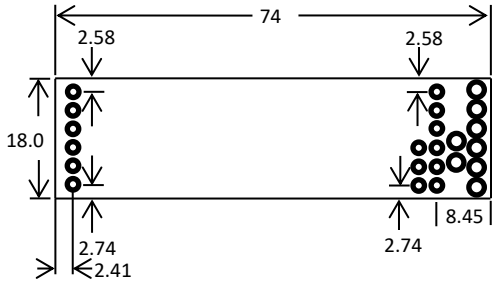
Read First

There is a calibration resistor inside the LSU 4.9 connector, do not cut the connector off. It is recommended to use 14Point7's Assembled LSU 4.9 connector for evaluation, it is compatible with both the LSU 4.9 and LSU Adv.

Specifications

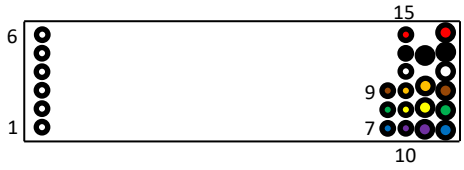
- Dimensions: 74mm x 18mm
- Compatible with Bosch LSU 4.9, Bosch LSU Adv, and clone LSU 4.9 sensors
- Does not require Free Air Calibration but FAC is available. Recommended for clone LSU sensors only
- Accuracy: 0.01[Lambda]
- Typical Response Time, Free Air to 0.8[Lambda]: 10[ms] in Performance Mode 1, 20[ms] in Performance Mode 0
- Integrated 5v Power Supply with Over-Voltage, Over-Current, and Reverse Polarity Protection
- Outputs: Programmable Linear, Programmable Simulated Narrowband, UART, CAN
- Default Linear Output: 0v @ 0.68 Lambda linear to 5v @ 1.36 Lambda
- Default Simulated Narrowband switch point @ 1.00 Lambda
- UART specifications: 5v, 9600 Baud, 8 Data Bits, 1 Stop Bit, No Parity, No Flow Control
- CAN Bus support for the following ECUs; Megasquirt 3, Adaptronic, Link, Haltech, HP Tuners, as well as YourDyno dyno controller are supported
- CAN Bus output of Lambda or %O2
- Operating Voltage 8[V] to 18[V]
- Typical 12[V] Operating Current: 1[A]
- Max 12[V] Operating Current: 3[A]
- Operating Temperature: -40[C] to +105[C]
- Lambda Range: 0.6[Lambda] to 3.4[Lambda]
- %O2 range: 0%O2 to 21%O2
- Lean Burn mode for lean burn applications
- Smart Heatup; RPM Triggered Heating of the oxygen sensor for MS3 ECU over CAN
- Smart Heatup; Temperature Triggered Heating, Spartan 3 Lite v2 will wait for the Oxygen sensor to be heated to 350C by engine exhaust gases before heating up the sensor
- Output Sequencer provides a dual-level precision voltage signal to the Linear Output during sensor heatup.
- 0.1% tolerance components for all components that affect accuracy

Dimensions



All dimensions in mm. All pinheader pitch is 2.54mm.

Pinout



Pin #	Name	Note
1	LSU IA	Connect to Bosch LSU 17025 Terminal #5, for Bosch LSU Adv you can leave connected or disconnected
2	LSU H+	Connect to Bosch LSU 17025/Adv Terminal #4, Grey wire on LSU
3	LSU IP	Connect to Bosch LSU 17025/Adv Terminal #1, Red wire on LSU
4	LSU UN	Connect to Bosch LSU 17025/Adv Terminal #6, Black wire on LSU
5	LSU H-	Connect to Bosch LSU 17025/Adv Terminal #3, White wire on LSU
6	LSU VM	Connect to Bosch LSU 17025/Adv Terminal #2, Yellow wire on LSU
7	CAN High	Heater Status LED output, Slow Blink = too cold, Fast Blink = too hot, LED solid = just right (780[C] +/- 25[C])
8	Linear Output	Default output 0[V] @ 10[AFR] linear to 5[V] @ 20 [AFR], 100 ohm output impedance
9	NB Output	Simulated Narrowband Output. Default switch point @ 1 Lambda
10	CAN Low	Electronics ground, 100[mA] max
11	UART Rx	Connect to Tx of interfacing device. 5v, 9600 Baud, 8 Data Bits, 1 Stop Bit, No Parity, No Flow Control
12	UART Tx	Connect to Rx of interfacing device. 5v, 9600 Baud, 8 Data Bits, 1 Stop Bit, No Parity, No Flow Control
13	Heater Ground	LSU Heater Ground, 3[A] max
14	E Ground	Electronics ground, 100[mA] max
15	12v	Connects to 8[V] to 18[V] power source capable of supplying 3[A], a 5[A] inline fuse should be used.

Bootloader

When Spartan 3 Lite OEM is powered up without the LSU Heater Ground (Pin 13) connected, it will enter bootloader mode. In Bootloader mode the Spartan 3 Lite OEM will be waiting for a firmware update, normal wideband functions and serial communications will not be available.

Serial Configuration Commands

Serial Command	Usage Note	Purpose	Example	Factory Default
GETHW		Gets Hardware Version		
GETFW		Gets Firmware version		
SETTYPEx	If x is 0 then Bosch LSU 4.9 If x is 1 then Bosch LSU ADV	Sets LSU sensor type	SETTYPE1	X=0, LSU 4.9
GETTYPE		Gets LSU sensor type		
SETCANFORMATx	x is an integer 1 to 3 character long. x=0; default x=1; Link ECU x=2; Adaptronic ECU x=3; Haltech ECU x=4; % Oxygen*100 x=5; Extended CAN format		SETCANFORMAT0	x=0
GETCANFORMAT		Gets CAN format		
SETCANIDx	x is an integer 1 to 4 characters long	Sets 11 bit CAN id	SETCANID1024 SETCANID128	x=1024
GETCANID		Gets 11 bit CAN id		
SETCANBAUDx	x is an integer 1 to 7 characters long	Sets CAN Baud Rate	SETCANBAUD1000000 will set CAN Baud rate to 1Mbit/s	X=500000, 500kbit/s
GETCANBAUD		Gets CAN Baud Rate		
SETCANRx	If x is 1 the resistor is enabled. If x is 0 the resistor is disabled	Enable/Disable CAN Termination Resistor	SETCANR1 SETCANR0	x=1, CAN term Res Enabled
GETCANR		Gets CAN Term Res State; 1=enabled, 0=disabled		
SETAFRMxx.x	xx.x is a decimal exactly 4 characters long including decimal point	Sets AFR Multiplier for Torque app	SETAFM14.7 SETAFM1.00	xx.x=14.7

GETAFRM		Gets AFR Multiplier for Torque app		
SETLAMFIVEVx.xx	x.xx is a decimal exactly 4 characters long including decimal point. Minimum value is 0.60, maximum value is 3.40. This value can be higher or lower than the SETLAMZEROV value.	Sets Lambda at 5[v] for the linear output	SETLAMFIVEV1.36	x.xx=1.36
GETLAMFIVEV		Gets the Lambda at 5[v]		
SETLAMZEROVx.xx	x.xx is a decimal exactly 4 characters long including decimal point. Minimum value is 0.60, maximum value is 3.40. This value can be higher or lower than the SETLAMFIVEV value.	Sets Lambda at 0[v] for the linear output	SETLAMZEROV0.68	x.xx=0.68
GETLAMZEROV		Gets Lambda at 0[v]		
SETPERFx	If x is 0 then standard performance of 20ms. If x is 1 then high performance of 10ms. If x is 2 then optimize for lean operation.		SETPERF1	x=0, standard performance
GETPERFx		Gets performance		
SETSLOWHEATx	If x is 0 then sensor is heated at normal rate during initial power up. If x is 1 then sensor is heated at 1/3 the normal rate during initial power up. If x is 2 then wait, a max of 10 min, for MS3 CAN RPM signal before heating. If x is 3 then wait, a max of 10 min, for exhaust gas to heat sensor to 350C before heating. Requires Firmware 1.05 and above		SETSLOWHEAT1	X=0, normal sensor heatup rate
GETSLOWHEAT		Gets slowheat setting		
MEMRESET		Reset to factory settings.		
SETLINOUTx.xxx	Where x.xxx is a decimal exactly 5 characters long including decimal point, greater than 0.000 and less than 5.000. Linear Output will resume normal operation on reboot.	Allows the user to set the High Perf Linear Output to a specific voltage	SETLINOUT2.500	
DOCAL	Pull sensor out of the exhaust. Power on wideband controller with sensor connected for about 5 minutes then issue the DOCAL command.	Do Free Air Calibration and display the value. A perfect sensor will have a value of 1.00. Recommended for clone sensors only.		
GETCAL	Requires Firmware 1.04 and above	Gets Free Air Calibration value		
RESETCAL	Requires Firmware 1.04 and above	Resets Free Air Calibration value to 1.00		
SETCANDRx	x is an integer 1 to 4 characters long Requires Firmware 1.04 and above	Sets CAN Data Rate in hz		X=50
GETCANDR	Requires Firmware 1.04 and above	Gets CAN Data Rate		
SETNBSWLAMx.xxx	x.xxx is a decimal exactly 5 characters long including decimal point. Requires Firmware 1.08 and above	Sets the Simulated Narrowband Switch Point in Lambda	SETNBSWLAM1.005	x.xxx=1.000
GETNBSWLAM		Gets the Simulated Narrowband switch point in Lambda		

*All commands are in ASCII, upper/lower case does not matter.

UART Real Time Datalogging

Send in ASCII “G” (without quotes, upper or lower case does not matter) via UART to Spartan 3 Lite OEM.

Spartan 3 Lite OEM will respond with something similar to the following in ASCII:
0:a:50.0 (50.0 is AFR, default AFR Multiplier is 14.7, you can change the multiplier by using the “SETAFRMxx.x” serial command)
1:a:780 (780 is LSU Temperature in Celsius)
2:a:3000 (To be disclosed)
3:a:129 (To be disclosed)

Each row is terminated with ASCII LF (Line Feed). If there are spaces in the response, ignore them.

CAN Bus Protocol Default Format (Lambda)

For %O2 CAN Format please see “Spartan 3 and Spartan 3 Lite for Lean Burn and Oxygen Metering Applications.pdf”
Spartan 3’s CAN Bus operates with 11 bit addressing.
Default CAN Baud rate is 500kbit/s
Default CAN Termination resistor is enabled, this can be changed by sending “SETCANRx” serial command.
Default CAN Id is 1024, this can be changed by sending “SETCANIDx” serial command.
Data Length (DLC) is 4.
Default Data Rate is 50 hz, data is sent every 20[ms], this can be changed by sending “SETCANDRx” serial command.
Little-endian for all data
Data[0] = Lambda x1000 High Byte
Data[1] = Lambda x1000 Low Byte
Data[2] = LSU_Temp/10
Data[3] = Status
Lambda = (Data[0]<<8 + Data[1])/1000
Sensor Temperature [C] = Data[2]*10
Status

Status Value (decimal)	Meaning
0	Reserved
1	Waiting for trigger before heating up
2	Sensor is heating up
3	Sensor in normal operation
4+	Reserved

Supported CAN Formats

CAN Format Name	CAN Format Serial Command	CAN Id Serial Command	CAN BAUD Rate Serial Command	Note
Link ECU CAN Format	SETCANFORMAT1	SETCANID950	SETCANBAUD1000000	Read “Spartan 3 to Link G4+ ECU.pdf” for additional information
Adaptronic ECU CAN Format	SETCANFORMAT2	SETCANID1024 (Default from factory)	SETCANBAUD1000000	
MegaSquirt 3 ECU CAN Format	SETCANFORMAT0 (Default from factory)	SETCANID1024 (Default from factory)	SETCANBAUD500000 (Default from factory)	Read “Spartan 3 to MegaSquirt 3.pdf”
Haltech ECU CAN Format	SETCANFORMAT3	Not required	SETCANBAUD1000000	Spartan 3 Emulates Haltech WBC1 wideband controller
YourDyno Dyno Controller CAN Format	SETCANFORMAT0 (Default from factory)	SETCANID1024 (Default from factory)	SETCANBAUD1000000	
Extended CAN Format	SETCANFORMAT5			Read “Spartan 3 Extend CAN Format.pdf” Requires Firmware 1.08 and above.