Syvecs LTD

V1.0

X20 - E8XX

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.

Please Note that due to frequent firmware changes certain windows might not be the same as the manual illustrates. If so please contact the Syvecs Tech Team for Assistance.

Support@Syvecs.com

Table of Contents

Introduction

The Syvecs X20 E8XX expander is a very powerful device for controlling additional I/O (Inputs and Outputs) in an automotive electrical installation. With the use of CAN controllers, the X20 communicates with MoTeC devices to behave as a slave for it, offering the I/O compliment to its master device.

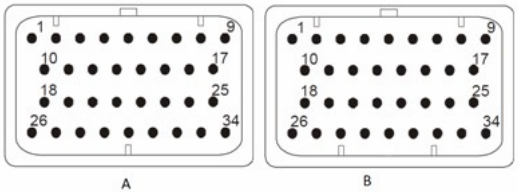
The X20 is able to communicate with MoTeC engine control units via the E8XX CAN protocol and the LTC CAN Protocol. *Note*: the X20 does not have K-Type thermocouple inputs so these are not supported in the protocol.

The following is supported with X20 MoTeC communication

- Digital inputs 1-4
- Analog Input Voltages 1-16
- Output 1-8 Control
- LTC Lambda 1 and Lambda 2
- Output driver faults
- Internal temperature
- Internal voltages (-5v, 8vAux, 5vAux, Vbat, 4.5v)

Specification

Outputs
8 PWM Outputs
Inputs
16 ADC Voltage Inputs
4 Digital Inputs
2 NTK Lambda Inputs
Interfaces
USB For Updates and Configuration
2 x CAN 2.0B interface for communication with other controllers or logging systems
Power Supply
6 to 26V input voltage range
Ignition Switch Logic with high current supply
Physical
Waterproof Sealed
Automotive Spec -40c to 125c
2 x 34 way Superseal 1.0 connectors
150mm x 150mm



A		DESCRIPTION	CONNECTOR A
		PART NUMBER	4-1437290-0
		NOTES:	34 Way - Key1
Pinout	**MoTeC Assignment**	**Description**	
N/C	N/C	N/C	
A2	PWR ON	Ignition 12V Signal - Used only for Board Wake up	
A3	DIG1	Digital Input - Frequency	
A4	DIG3	Digital Input - Frequency	
A5	AV1	0-5V Input Only – Pull Up Optional	
A6	AV3	0-5V Input Only	
A7	AV5	0-5V Input Only	
A8	Vbat	12V Supply - High Current (Required)	
A9	Vbat	12V Supply - High Current (Required)	
N/C	N/C	N/C	
N/C	N/C	N/C	
A12	DIG2	Digital Input - Frequency	
A13	DIG4	Digital Input - Frequency	
A14	AV2	0-5V Input Only – Pull Up Optional	
A15	AV4	0-5V Input Only	
A16	AV6	0-5V Input Only	
A17	5VOUT	5v Output for Sensors	
N/C	N/C	N/C	
A19	CAN0L	Can 0 Low	
A20	CAN0H	Can 0 High	
A21	NTK1 ION	NTK1 Ion Pump (White Wire)	
A22	NTK2 ION	NTK2 Ion Pump (White Wire)	
N/C	N/C	N/C	
N/C	N/C	N/C	
A25	0V/LamGnd	Sensor Ground Connection / NTK Ground (Black Wire)	
N/C	N/C	N/C	
A27	PWM1	Low Side Output	
A28	PWM2	Low Side Output	
A29	PWM3	Low Side Output	
A30	PWM4	Low Side Output	
A31	PWM5	Low Side Output	
A32	PWM6	Low Side Output	
A33	GROUND	Ground Connection - High Current (Required)	
A34	GROUND	Ground Connection - High Current (Required)	

B		DESCRIPTION	CONNECTOR B
		PART NUMBER	4-1437290-1
		NOTES:	34 Way - Key2
B1	Vbat	12V Supply - High Current (Required)	
B2	Vbat	12V Supply - High Current (Required)	
B3	AV13	0-5V Input Only	
B4	AV15	0-5V Input Only	
B5	AV7	0-5V Input Only – Pull Up Optional	
B6	AV9	0-5V Input Only – Pull Up Optional	
B7	AV11	0-5V Input Only – Pull Up Optional	
N/C	N/C	N/C	
N/C	N/C	N/C	
B10		5v Output for Sensors	
B11	AV14	0-5V Input Only	
B12	AV16	0-5V Input Only	
B13	AV8	0-5V Input Only – Pull Up Optional	
B14	AV10	0-5V Input Only – Pull Up Optional	
B15	AV12	0-5V Input Only – Pull Up Optional	
N/C	N/C	N/C	
N/C	N/C	N/C	
B18	0V/LamGnd	Sensor Ground Connection / NTK Ground (Black Wire)	
B19	NTK NRNST 1	NTK1 NRST Voltage (Grey Wire) / Can 3 Low	
B20	NTK NRNST 2	NTK2 NRST Voltage (Grey Wire) / Can 3 High	
B21	CAN1L	Can 1 Low	
B22	CAN1H	Can 1 High	
N/C	N/C	N/C	
N/C	N/C	N/C	
N/C	N/C	N/C	
B26	GROUND	Ground Connection - High Current (Required)	
B27	GROUND	Ground Connection - High Current (Required)	
B28	PWM7	Low Side Output	
B29	PWM8	Low Side Output	
B30	LAM1HTR	NTK Lambda Heater 1	
B31	LAM2HTR	NTK Lambda Heater 2	
N/C	N/C	N/C	
N/C	N/C	N/C	
N/C	N/C	N/C	

General Connections

Connecting Power/Ground

The X20 has **5** power connection points, **four** of these are high current and can be connected to a fused battery power or switched power source. **One** of them is Logic Switch / Ignition Switch power and used to switch the power gate so that current is able to flow from the 4x High current 12v pins into the Device.

If driving motors or solenoids which pull a lot of current then ensure the correct amount of pins are connected. Each pin on the X20 is able to sink around 14 amps of current, so if driving multiple solenoids that pulls 20+ amps total, ensure at **least** two high current 12v pins and two power ground pins are used.

Internally **A8/A9** are linked, as well as **B1/B2**. These can either be used to provide extra current on a supply, or as a way of providing switched power to additional loads through the loom.

Pin A2 (**Ignition Sw**) is for a 12v low current ignition switch supply to enable the power gate on the X20 internally, this is required on all installations.

Power Grounds are joined internally and the X20 must have at least A33 and B26 connected. If driving lots of Low Side outputs then connect A34 and B27 also to handle the current loading.

NOTE! Power Grounds are designed to conduct High Current loads – Do not mix Power Grounds with Analogue (AN) Grounds.

Example Schematic

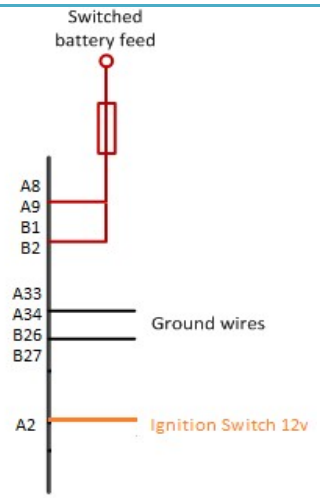


Figure 0-1 - Power Feeds and a Common grounding point.

Pin Schedule

Pin Number	Function	Notes
A8	VBAT1	Use a fused 12v Switched feed. **MUST CONNECT**
A9	VBAT1	Use a fused 12v Switched feed.
B1	VBAT2	Use a fused 12v Switched feed. **MUST CONNECT**
B2	VBAT2	Use a fused 12v Switched feed.
A33	Power Ground	Shared Power Ground
A34	Power Ground	Shared Power Ground
B26	Power Ground	Shared Power Ground
B27	Power Ground	Shared Power Ground
A2	Power On	12v Ignition Switch – Logic Power **MUST CONNECT**

Output Connections

Low Side Outputs

The low side outputs are only able to be driven to ground but offer full pulse width modulation control. The outputs can be used to drive up to 12A Peak / 6A Continuous and can only pull to ground.

Pin Schedule

Pin Number	Function	MoTeC Assignment
A27	PWM1	PWM1
A28	PWM2	PWM2
A29	PWM3	PWM3
A30	PWM4	PWM4
A31	PWM5	PWM5
A32	PWM6	PWM6
B28	PWM7	PWM7
B29	PWM8	PWM8

Sensor Supply and Grounds

Sensor/ Analogue Grounds (AN Grounds)

Sensors and miscellaneous analogue inputs have their own Ground pins; these grounds must be kept separate from the Power grounds shown in the first section. As there are 2 sensor ground pins you may have to connect multiple grounds to some of the pins if you have more than two sensors.

Pin Schedule

Pin Number	Function	Notes
A25	ANGND1	
B18	ANGND2	

5V Regulated Supply

Sensors and miscellaneous analogue inputs have their own power pins which need a stable power supply, the 5v Regulated outputs are protected and provide a stable/clean 5v which can handle 500ma Maximum.

Pin Schedule

Pin Number	Function	Notes
A17	5VOUT1	
B10	5VOUT2	

Input Connections

Digital Inputs

These Inputs are able to swing above and below the reference ground meaning they can see Positive Voltage as well as Negative. Fully adjustable trigger thresholds for the frequency decoding is supported on these pins as well as optional 3k pull-ups to 5v. These are configurable via a USB connection to X20 (see page 14).

Example of sensors normally used on these Inputs are:

- Reluctor Crank and Cam Sensors / ABS Sensors for wheel speed
- Hall Sensors

Pin Number	Input	
A3	DIG1	Optional 3k Pull-up
A12	DIG2	Optional 3k Pull-up
A4	DIG3	Optional 3k Pull-up
A13	DIG4	Optional 3k Pull-up

Voltage Inputs - AV Inputs

These Inputs are able to sense a Voltage level but not offer Frequency detection, some of these inputs support a 3k Pull-up option which is turned on via a USB connection, explained on page 14.

Example of sensors which normally use on these Inputs are:

- Manifold Pressure sensors
- Throttle Positions
- Oil Pressures
- Thermistor (requires 3k pull to be enabled)

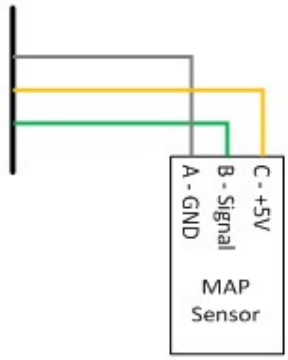
Voltage Inputs are not just limited to the above they can also be used for any sensor which outputs a 0-5volt signal.

Pin Number	Input	
A5	AV1	Optional 3k Pull-up
A14	AV2	Optional 3k Pull-up
A6	AV3	
A15	AV4	
A7	AV5	
A16	AV6	
B5	AV7	Optional 3k Pull-up
B13	AV8	Optional 3k Pull-up
B6	AV9	Optional 3k Pull-up
B14	AV10	Optional 3k Pull-up
B7	AV11	Optional 3k Pull-up
B15	AV12	Optional 3k Pull-up
B3	AV13	
B11	AV14	
B4	AV15	
B12	AV16	

Sensor Schematics - Examples

Manifold Pressure Sensor (MAP)

Example Schematic

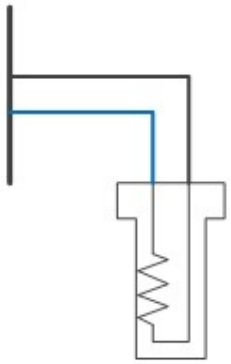


Pin Schedule

Pin Number	Function	Notes
A25	ANGND1	May be shared with multiple sensors
A17	5VOUT1	Regulated sensor power supply
B12	AV16 Input	Any Input can be used

Coolant Temperature Sensor (CTS)

Example Schematic

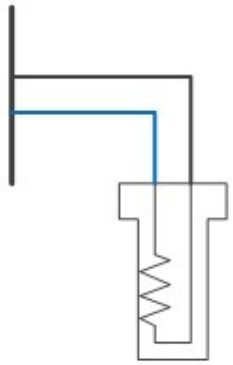


Pin Schedule

Pin Number	Function	Notes
A25	ANGND1	May be shared with multiple sensors
A5	AV1	Needs Pull up

Inlet Air Temperature Sensor (IAT)

Example Schematic

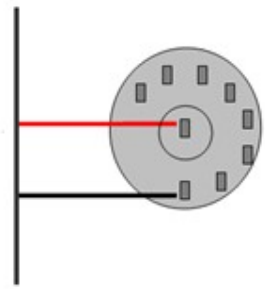


Pin Schedule

Pin Number	Function	Notes
A25	ANGND1	May be shared with multiple sensors
B5	AV7	Needs external pull up

Calibration Switches

Example Schematic



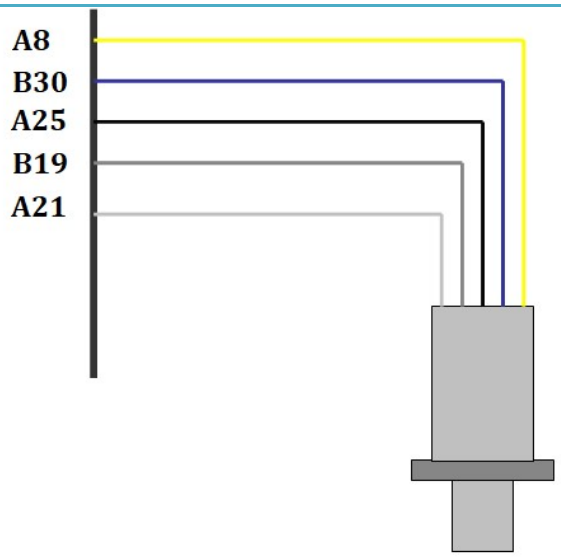
Pin Schedule

Pin Number	Function	Notes
A25	ANGND1	May be shared with multiple sensors
B14	AV10	Needs external pull up

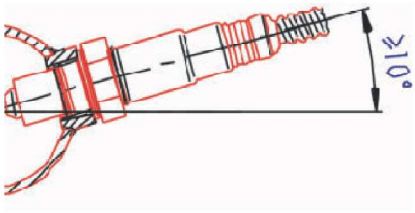
Wideband Lambda Sensors

The Syvecs X20 has the ability to drive two NTK L1H1/L2H2 Wideband Lambda sensors without the use of external hardware. Please see wiring and fitting information below

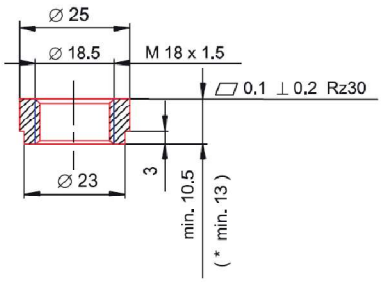
Example Schematic



Mounting recommendation



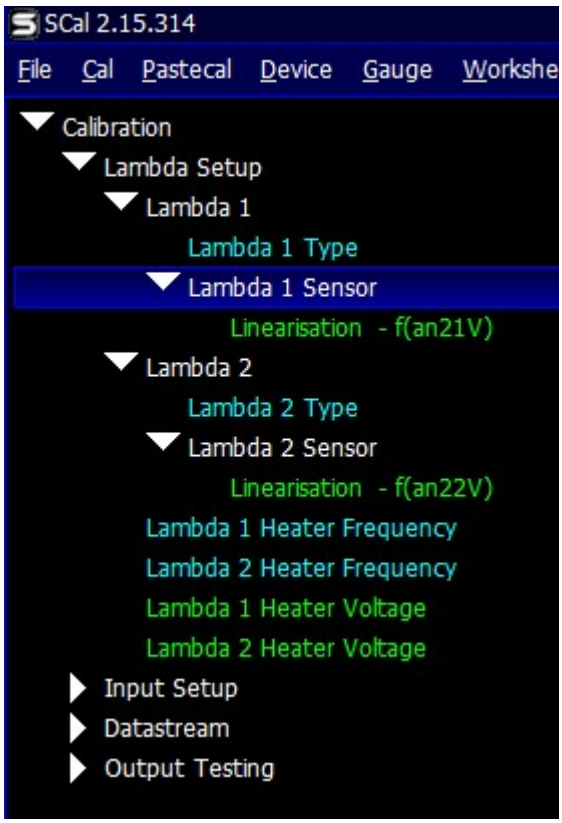
Recommended materials for the mating thread in the exhaust pipe
*: THexagon > 600°C or
TGas > 930°C



NTK L2H2

The Syvecs X20 supports 2 x NTK lambda sensors which output the LTC CAN data to the Motec M1 range.

Users are able to adjust the Linearisation, Heater frequency and Heater voltage via a USB connection to the X20 hardware using our Scal software (See page 14). The Default values are setup to suit a L2H2 NTK.



The NTK L2h2 lambda sensors like to have around 10.7v across the heater circuit and this is setup as default to be targeted. The LamHTR* outputs will then adjust the duty automatically through the heater based on the voltage supply level to the X20 on HVbat1 and HVbat2.

HVbat1 is used for calculating Lam1Htr voltage and HVbat2 is used for calculating Lam2Htr voltage. If using dual NTK, make sure that VBAT2 (Pin B1 or B2) is powered as this is needed for the Lam2Htr calculations.

NTK wiring

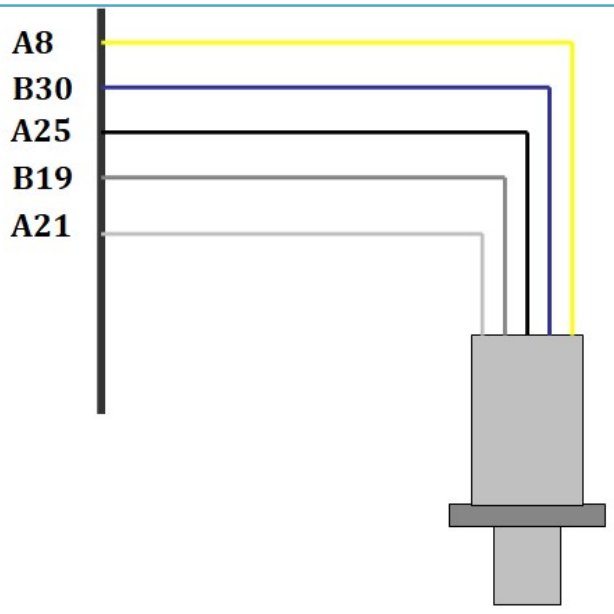
Lamda1

Lambda Pin Number	Colour	Name	X20 Pin
1	Yellow	Heater	VBAT1 or 12V Switched
2	Blue	Heater Drive	B30 - LamHTR1
6	Grey	Nernst Cell Voltage	B19
7	White	Ion Pump Current	A21
8	Black	Signal Ground	A25 or B18

Lambda2

Lambda Pin Number	Colour	Name	X20 Pin
1	Yellow	Heater	VBAT2 or 12V Switched
2	Blue	Heater Drive	B31 - LamHTR2
6	Grey	Nernst Cell Voltage	B20
7	White	Ion Pump Current	A22
8	Black	Signal Ground	A25 or B18

Example Schematic



CAN Bus

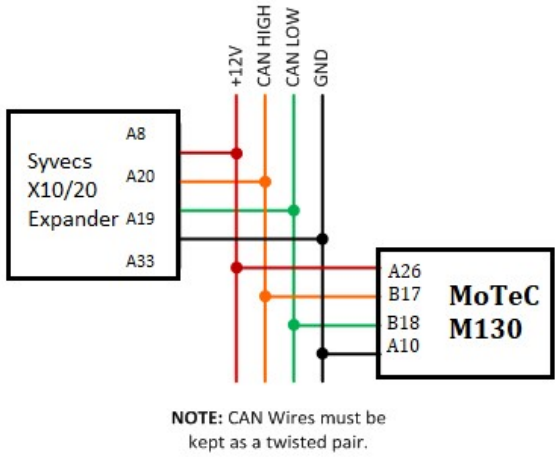
Common **A**rea **N**etwork Bus (CAN Bus) is a widely used data interface common used in many cars and aftermarket accessories (such as Data loggers and Dashes). Data is sent using the High and Low wires, which are maintained as a twisted pair.

The X20 as default has 2 x CAN bus interfaces:

CAN0 is used for expander communications with the MoTeC Ecu – 1MB

CAN1 is available for generic use but can be used also for bridging the custom can data from CAN0 to external dashboards.

Example Schematics



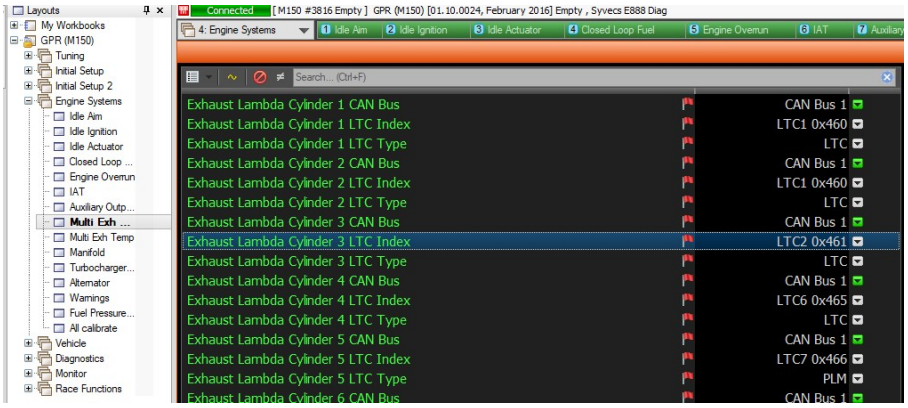
NOTE: CAN Wires must be kept as a twisted pair.

Pin Number	Function	Notes
A19	CAN0 LOW	Ensure wires are twisted pair.
A20	CAN0 HIGH	Ensure wires are twisted pair.
B21	CAN1 LOW	Ensure wires are twisted pair.
B22	CAN1 HIGH	Ensure wires are twisted pair.

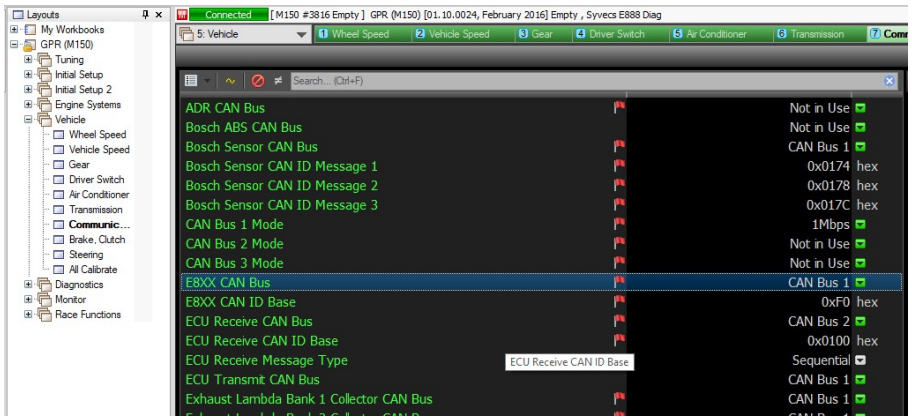
MoTeC Setup

The X20 can be set to communicate with MoTeC engine control units via the E8XX CAN protocol and the LTC CAN Protocol.

Calibrators need to set the Exhaust Lambda Cylinder 1&2 LTC Index to Frame 0x460



Calibrators need to set the E8XX Can ID Base to 0xF0



PC Connection - SCAL

The X20 has a calibration stored onboard to maintain settings of the X20 hardware. In order for the X20 to work it must have a valid calibration present in the device and when shipping from the factory a default cal is loaded to ensure it works out of the box. Calibrators who wish to enable an Input to work in SENT decoding or setup custom CAN transmit will need to connect live to the X20.

A USB-C port is found at the back of the X20 which is IP67 sealed. Use a USB-C to USB-A male/male cable to connect the X20 to the computer. The S-Suite software can be downloaded from below.

https://www.syvecs.com/software/

After running the SSuite installer, open the program called SCal and click **D**evice - **C**onnect

A X20 device will be found as shown below, press Ok to proceed

The connected green icon should now be present in the top right and all the voltages/temps from onboard the X20 are listed on the right hand side.

Calibrators now have the ability to change the Input setup for each AN Input, setup custom DataStream CAN options or use the output testing (see page 18).

Press F1 for help on a map and remember that:

Green Maps – Live Adjustable Blue Maps – Require programming to set

Output Testing

The X20 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 expander 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 by itself without the need for any master/slave CAN communication.

NOTE: ***H-Bridge Output Mode / H-Bridge Output Frequency / 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.*

Green Maps – Live Adjustable

Blue Maps – Require programming to set

Set a frequency you wish the outputs to be driven at in **H-Bridge Output Frequency** and **Low Side Output Frequency.** Next set the **H-Bridge Output Mode** and Device - program the X20.

Output Test Mode Enable can then be enabled.

Now you can then set a duty for each output to be driven in **H-Bridge Output Test Duty** and **Low Side Output Test Duty.** These maps can be adjusted live.

If ***H-Bridge Output Mode*** map is set on Full Bridge, the paired outputs used in the full bridge individually set the drive direction.

For example: Motor is wired to HBR1 and HBR2, Output Mode is set to Full Bridge on HBR1 and 2.

Increasing Duty on HBR1 output duty cell will cause the full bridge to drive the HBR1 output positive and the HBR2 output negative.

DAC Output Test Voltage is a live map which you can set the voltage that DAC1 -4 are driven at in Output test mode.