



## M150 Subaru 'Spec' STI 2015



**This Package, used with an activated M150, is a fully programmable replacement for the factory-fitted Subaru 'Spec' STI 2015 ECU.**

Included are numerous ancillary features common to race cars, such as anti-lag, driver switches (pit switch, launch enable, boost limit etc.), motorsport gearbox control, knock control, intercooler sprays, launch control, gearbox coolant pumps and traction control. It also caters for many systems found on modified road vehicles that may be useful in a racing context, such as air conditioning control and five definable control outputs.

This Package seamlessly integrates with other MoTeC products and provides pre-defined CAN messaging for all current Display Loggers, Enclosed Loggers, Power Distribution Modules and other devices including E888, VCS, GPS, ADR, BR2 and SLM.

### ► FEATURES

- Fully integrates with these original systems: ABS / Brakes, SI Drive, Air Conditioning, Start via Key or Button, VDC. **Lambda control is supported with optional LTC and Bosch LSU4.9 sensor.** See 'Operation' section for further details.
- Pre-configured sensor calibrations for Original Equipment (OE) sensors and engine triggers.
- Pre-configured control of primary (Port Injector) fuel system.
- Optionally configurable secondary (Port Injector) fuel control with a tuneable balance table.
- Pre-configured single fuel operation with selectable properties.
- Optional alternative fuel operation for Flex Fuel using ethanol composition sensor, or Secondary Fuel operation on secondary injectors.
- Pre-configured reference mode for engine synchronisation.
- Pre-configured physical settings for engine displacement, fuel density, stoichiometric ratio, fuel pressure, and primary injector linearisation, which allow for simplified engine start-up prior to tuning.
- Pre-configured CAN messaging for OE systems including dashboard, DCCD, SI Drive, ABS.
- Pre-configured control for MoTeC SDC3 (with M1-specific firmware upgrade). See 'Centre Differential Control' section for further information.
- Pre-configured control of OE coolant fan with temperature thresholds.
- Pre-configured transient fuelling compensation using physical modelling of fuel film for port injectors.
- Idle closed loop control system using ignition and drive by wire actuation.
- Pre-configured adjustable inlet manifold tumble valves with position feedback.
- Pre-configured on-board knock control for each cylinder using the OE knock sensor (optionally can be configured to use up to 2 sensors) and multiple centre frequencies.
- Pre-configured boost control with single wastegate actuator. Single and dual solenoids supported.
- Pre-configured Air conditioner request and clutch control.
- Configurable anti-lag for single turbo variants with ignition timing limit, fuel volume trim, ignition cut, fuel cut, engine speed limit, boost aim and throttle aim tables.
- GPS acquisition and logging via CAN or RS232.
- Intercooler temperature and spray control.
- Lap distance, time and number via GPS, BR2 or switched input, with split and sector options.
- Support of MoTeC devices: ADR, E8XX, PDM, SLM, VCS.
- Coolant pump output with PWM control.
- Coolant pump after-run functionality, optionally with additional pump output.

- Configurable launch control with tables.
- Configurable closed loop alternator system for PWM field winding control.
- Race time system with tables for ignition timing trim, fuel mixture aim, boost limit, and throttle limit.
- Engine Load Average channel with tables for engine speed limit, ignition timing trim, fuel mixture aim, boost limit, and throttle limit.
- Engine run time total for engine hour logging.
- Configurable security for multiple users with differing access options.
- ECU CAN Receive from a defined ID base address for data reception from MoTeC devices.
- Vehicle speed limiting (pit speed control).
- 8 configurable driver switches and 8 rotary switches each with 9 positions that can be simultaneously mapped to launch control, pit switch, anti-lag, traction, race time reset, engine speed limit maximum, throttle pedal translation, fuel volume trim, ignition timing, fuel mixture aim, boost limit, traction aim, and traction control range.
- Pre-configured pulsed tachometer output with configurable output pin and scaling.
- Transmission pump output with transmission temperature threshold and hysteresis control.
- Traction control with tables for aim main, aim compensation, control range.
- Optional channels for additional sensors via input pin and/or CAN message, including:
  - Airbox Mass Flow, Temperature and Pressure
  - Ambient Pressure and Temperature
  - Boost Pressure
  - Brake Pressure Front and Rear
  - Brake Switch
  - Clutch Switch, Pressure and Position
  - Coolant Pressure and Temperature
  - Engine Oil Pressure and Temperature
  - Engine Crankcase Pressure
  - Exhaust Pressure
  - Exhaust Temperature (EGT) via TCA Thermocouple Amplifier, Generic CAN, or E888 for Collector and Cylinders 1 to 4.
  - Exhaust Lambda via LTC, LTCN, or PLM for Collector and Cylinders 1 to 4.
  - Fuel Flow Supply and Return
  - Fuel Pressure and Temperature
  - Fuel Tank Level
  - Intercooler Temperature
  - Steering Angle and Pressure
  - Transmission Temperature and Pressure
  - Turbocharger Speed, Inlet and Outlet Temperature
  - G-Force (acceleration) - Longitudinal, Lateral, Vertical
  - Wastegate Pressure and Position
  - Wheel Speed

## ► LICENCING

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To load the **Subaru STI 2015 EJ207** Package onto the ECU, the **M1 Licence – Subaru WRX STI 2007 EJ2xx** (part number 23202) is required.

## ► VEHICLE COMPATIBILITY

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Numerous model year and wiring harness variants of the Subaru WRX and STI models exist. MoTeC produces three loom variants and numerous M1 Package variants to suit.

### Loom Variant 1: MoTeC part number 61289

- WRX and STI models 2008-2010 with EJ207, EJ255, and EJ257 engines
- C-spec STI model 2015 with EJ207 engine

### Loom Variant 2: MoTeC part number 61290

- WRX models 2011-2014 with EJ207 and EJ257 engines
- STI models 2011-2015 with EJ207 and EJ257 engines

### Loom Variant 3: MoTeC part number to be confirmed

- WRX Models 2015 + with FA20DIT engine

**This Data Sheet relates ONLY to Loom Variant 1 using the Subaru STI 2015 EJ207 Package.**

## ► ECU WIRING

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If the optional 61289 – Subaru STI 2015 EJ207 M150 ADAPTOR LOOM is used, no rewiring is necessary, the optional loom plugs into the stock wiring harness using the original sensors and fuel system. All original functions are maintained.

If the Subaru STI 2015 kit is purchased, the following additional components are supplied for a complete solution:

- 13150 – M150 ECU
- 61289 – Adaptor Loom

## ▶ OPERATION

When the M150 ECU is installed according to the included wiring pinout, this Package mimics most aspects of OE operation as follows:

### Starting

Starter motor operation is controlled by the M1 ECU.

#### STI Start Type

Set to **Key** if the vehicle has a key operated starter.

In this mode the **Start Relay** will be turned on with ignition power until **Engine Speed** is above **Start Engine Speed Threshold**. The start relay is only to prevent cranking while the engine is running. The clutch must be pressed and key turned to the start position to crank the engine.

Note: If this mode is incorrectly set on a push button start vehicle, the engine will crank as soon as the clutch is pressed.

Set to **Button** if the vehicle has push button start.

In this mode the **Start Relay** will activate when the clutch and start buttons are pressed at the same time. The keyless access module in the vehicle turns on ignition power to the ECU as well as signalling the ECU to crank the engine by the pin connected to **Start Request**. When this happens the ECU turns on the **Start Relay** until the engine starts or the **Start Timeout** elapses.

Note: If this mode is incorrectly set on a key start vehicle the starter will not operate.

### Alternator

The original equipment alternator on this vehicle has no interaction with the engine ECU. If a replacement alternator is used, the M1 can control the field winding to achieve the desired battery voltage.

### Air Conditioning

Air conditioning requests are received from the vehicle via CAN. The M1 ECU controls the **Air Conditioner Clutch Output** based on the request and additional settings within the **Air Conditioner** group.

### DCCD

See following section: *Centre Differential Control*

### SI Drive

The SI Drive switch on the centre console is configured as Driver Rotary Switch 2, which then allows control over many features simultaneously.

Each SI Drive mode is mapped numerically:

Position	-1	0	1	2	3
Mode	Unknown	None	Sharp	Intelligent	Sport
Mapping	nil	nil	Two	Zero	One

Mapping for the **Unknown** or **None** positions would have no effect on operation, while mapping for **Sharp**, **Intelligent**, and **Sport** modes may target such features as Anti-Lag, Traction, Boost Limit, or Fuel Mixture Trim.

### VDC Disable Switch

The VDC Disable Switch on the centre console is configured as Driver Switch 1, when then allows control over many features simultaneously.

Note: This option should be used with caution as the switch still directly controls the OE VDC Disable feature.

### VDC Sport Mode Switch

The VDC Sport Mode Switch on the centre console is configured as Driver Switch 2, also allowing control over many features simultaneously.

Note: This option should be used with caution as the switch still directly controls the OE VDC Sport Mode feature.

### Vehicle Yaw Rate and Acceleration

These channels are received from the OE Body CAN messaging and may be logged for analysis. **Vehicle Acceleration Lateral** may be used as a control input for **Traction Aim Compensation**.

### Wheel Speeds

These channels are received from the OE CAN messaging and are used in many subsystems, including Vehicle Speed, Traction Control, Gear detection, Pit Speed Limit.

If required, OE wheel speed information may be replaced by using hard-wired wheel speed sensors and re-configuring the Wheel Speed resources.

### Gear Shift

Operation is configured similarly to that of MoTeC's M1 GPR Packages.

**► CENTRE DIFFERENTIAL CONTROL**

Two options are available for Differential Control:

- Original Equipment DCCD ECU is installed on the car.
- MoTeC SDC3-M1 ECU is installed on the car.

**Configuring Original Equipment DCCD Control.**

When using the OE DCCD controller the only requirement for the M1 is to transmit normal CAN messaging. No user adjustment of centre differential behaviour is available.

To configure M1 operation for the OE DCCD ECU, simply set SDC3 CAN BUS to 'Not in Use'.

**Configuring SDC3-M1 Control.**

A new unique firmware version for the MoTeC SDC3 allows operation with M1 ECUs which have the **Subaru STI 2015 EJ207.February 2016** Package installed. The physical hardware of the SDC3 is unchanged, however the new firmware is not compatible with the existing MoTeC SDC Manager application. Refer to the end of this section for SDC3 firmware upgrade information.

Operation with the M1 Package is configured solely through settings in the M1 ECU via Tune.

To configure M1 operation for the MoTeC SDC3-M1 ECU, simply set SDC3 CAN BUS to 'CAN Bus 2' if using the MoTeC adaptor loom.

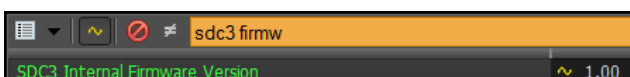
The centre differential control strategy is setup and tuned in the ECU, but follows the same strategy as the stand alone SDC3 module using SDC3 Manager for Subaru STI MY08 to MY12 vehicles. The SDC3 User manual can also be used as a reference to tune the M1 control strategy.

With this method, the SDC3 Module acts as a slave or dumb device. The M1 ECU calculates the required amount of lock based on the tuning and control strategy and sends a 'Lock' amount via CAN to the SDC3. The SDC3 sends back diagnostic information only. The ECU also sends the OE DCCD CAN data to the vehicle, rather than the SDC3 module.

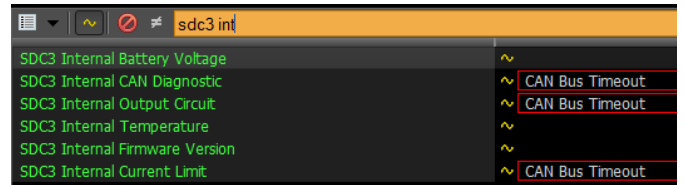
**SDC3-M1 Firmware Upgrade**

To check which firmware is loaded in the SDC3

- Connect to the M1 ECU.
- Navigate to **SDC3 Internal Firmware Version**.
- If the SDC3-M1 firmware is installed, **SDC3 Internal Firmware Version** is 1.00.



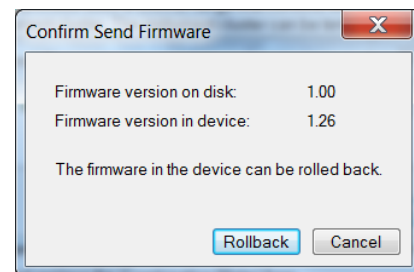
- If the legacy V1.26 software is installed, **CAN Bus Timeout** will be indicated next to SDC3 Internal channels: the SDC3 firmware must be upgraded using the **MoTeC SDC3 M1 Upgrade** utility.



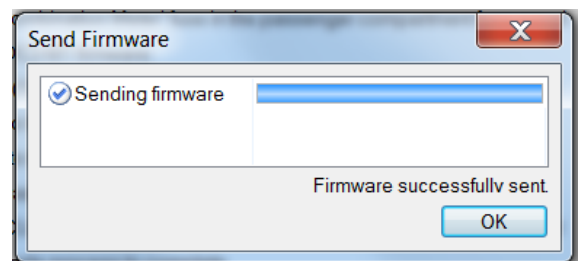
**SDC3-M1 Upgrade Procedure**

In the event that a standard SDC3 needs to be field-programmed to operate with the M1 installation, the firmware may be upgraded using the **MoTeC SDC3 M1 Upgrade** utility as follows:

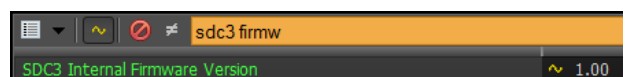
- Run the **MoTeC SDC3 M1 Upgrade** utility.
- Observe the warning and remove Fuses 2 and 7('Combination Meter') in the passenger compartment fuse panel.
- Follow the other steps on screen. When the 'Start Upgrade' button is pressed, select the M1 ECU serial number and CAN Bus 2 (if the adaptor loom kit is used).
- A prompt will indicate that the device firmware is 1.26 (legacy version). Press the 'Rollback' button.



- A progress bar will show the firmware update is in progress. Once complete a prompt will be displayed:



- The M1 may now be connected in Tune and the **SDC3 Internal Firmware Version** observed.



## ► SDC3-M1 CAN MESSAGING

The SDC3-M1 firmware operates as a slave to the M1 ECU and does not incorporate the same CAN messaging as the legacy SDC3 firmware.

The following messages may be incorporated into MoTeC dash displays:

Channel	CAN Bus	CAN ID	Offset	Length	Values
SDC3 Mode	2	0x380	1	1	1 = Open 2 = Mode 1 3 = Mode 2 4 = Mode 3 5 = Mode 4 6 = Lock
SDC3 Button Press	2	0x164	0	1	0 = Up 2 = Down 4 = Mode
Solenoid Current Avg	2	0x164	1	1	0.1A per bit
Solenoid Current Min	2	0x164	2	1	0.1A per bit
Solenoid Current Max	2	0x164	3	1	0.1A per bit
Solenoid Voltage +	2	0x164	4	1	0.1V per bit
Solenoid Voltage -	2	0x164	5	1	0.1V per bit
Output Duty Cycle	2	0x164	6	2	0.1% per bit
Fault Flags	2	0x165	0	1	1 = Open Circuit Fault 2 = Output Stuck Fault 4 = CAN diagnostic fault
Diagnostic Flags	2	0x165	1	1	1 = Output Circuit Fault 2 = Current Limit Fault
Battery Volts	2	0x165	2	2	0.01V per bit
Internal Temperature	2	0x165	4	2	Signed 1° per bit
Firmware Version	2	0x165	6	2	e.g. 123 = V1.23

► **PINOUT – M150 CONNECTOR A – 34 WAY****Mating Connector:** Tyco Superseal 34 Position Keying 2 (MoTeC #65067)

Pin	Designation	Full Name	OE Pin	Function
A01	AT5	Analogue Temperature Input 5	A04	Intake Air Temp
A02	AT6	Analogue Temperature Input 6	B24	Cruise Stalk
A03	AV15	Analogue Voltage Input 15	F08	Gear Shift Actuator Pressure (option)
A04	AV16	Analogue Voltage Input 16	F09	Gearbox Position (option)
A05	AV17	Analogue Voltage Input 17	F10	Fuel Lift Pressure (option)
A06	IGN_LS9	Low Side Ignition 9	B14	Sec air valve relay 2
A07	IGN_LS10	Low Side Ignition 10	B15	Sec air valve relay 1
A08	IGN_LS11	Low Side Ignition 11	C08	Sec air pump relay
A09	IGN_LS12	Low Side Ignition 12	C09	A/C Relay
A10	SEN_5V0_C1	Sensor 5.0V C		
A11	LA_NB1	Lambda Narrow Input 1		
A12	LA_NB2	Lambda Narrow Input 2		
A13	KNOCK3	Knock Input 3		
A14	KNOCK4	Knock Input 4		
A15	DIG2	Digital Input 2	C33	A/C Pressure Switch
A16	DIG3	Digital Input 3	F06	Gear Paddle Up Switch (option)
A17	DIG4	Digital Input 4	F07	Gear Paddle Down Switch (option)
A18	SEN_5V0_C2	Sensor 5.0V C	G04	GPS 5V Supply
A19	SEN_5V0_B2	Sensor 5.0V B	B21,B22	
A20	LIN	LIN Bus		
A21	RS232_RX	RS232 Receive	G02	GPS Receive
A22	RS232_TX	RS232 Transmit		
A23	DIG1	Digital Input 1	C31	Neutral Pos Switch
A24	BAT_NEG3	Battery Negative	D02	Ground
A25	BAT_NEG4	Battery Negative	D01	Ground
A26	SEN_0V_C1	Sensor 0V C	F01	Gear Shift Sensor 5V Supply (option)
A27	SEN_0V_C2	Sensor 0V C	G01	GPS 0V Supply
A28	CAN3_HI	CAN Bus 3 High		
A29	CAN3_LO	CAN Bus 3 Low		
A30	CAN2_HI	CAN Bus 2 High	C27	Vehicle 500kbit/sec CAN +
A31	CAN2_LO	CAN Bus 2 Low	C35	Vehicle 500kbit/sec CAN -
A32	BAT_NEG5	Battery Negative	D06,D26	Ground
A33	SEN_0V_B1	Sensor 0V B	A29	
A34	SEN_0V_A1	Sensor 0V A	A14, A24	

► **PINOUT – M150 CONNECTOR B – 26 WAY****Mating Connector:** Tyco Superseal 26 Position Keying 3 (MoTeC #65068)

Pin	Designation	Full Name	OE Pin	Function
B01	OUT_HB9	Half Bridge Output 9	D23	Tumble Valve RH Closer
B02	OUT_HB10	Half Bridge Output 10	D22	Tumble Valve RH Opener
B03	UDIG8	Universal Digital Input 8	C32	Start Signal
B04	UDIG9	Universal Digital Input 9	A33	Power Steering Oil Pressure Switch
B05	UDIG10	Universal Digital Input 10	B19	Ignition Switch
B06	UDIG11	Universal Digital Input 11	B20	Brake SW1
B07	UDIG12	Universal Digital Input 12	B28	Brake SW2
B08	INJ_LS5	Low Side Injector 5	C18	Fan 1 Relay
B09	INJ_LS3	Low Side Injector 3	C21	Throttle Relay
B10	AV9	Analogue Voltage Input 9	A27	Secondary Air Combination Valve LH Position
B11	AV10	Analogue Voltage Input 10	B32	Fuel Tank Pressure
B12	AV11	Analogue Voltage Input 11		
B13	BAT_POS2	Battery Positive	C01	
B14	INJ_LS6	Low Side Injector 6	C29	Fan 2 Relay
B15	INJ_LS4	Low Side Injector 4	B03	A/C Off signal
B16	AV12	Analogue Voltage Input 12		
B17	AV13	Analogue Voltage Input 13		
B18	AV14	Analogue Voltage Input 14		
B19	BAT_POS3	Battery Positive	C01	Switched BAT_POS from throttle relay
B20	OUT_HB7	Half Bridge Output 7	D13	Tumble Valve LH Closer
B21	OUT_HB8	Half Bridge Output 8	D12	Tumble Valve LH Opener
B22	INJ_PH9	Peak Hold Injector 9	B13	Crank Monitor
B23	INJ_PH10	Peak Hold Injector 10	C17	Drain Valve
B24	INJ_PH11	Peak Hold Injector 11	C28	Pressure Control Solenoid
B25	INJ_PH12	Peak Hold Injector 12	C11	MIL Lamp
B26	SEN_5V0_A2	Sensor 5.0V A		

► **PINOUT – M150 CONNECTOR C – 34 WAY****Mating Connector:** Tyco Superseal 34 Position Keying 1 (MoTeC #65044)

Pin	Designation	Full Name	OE Pin	Function
C01	OUT_HB2	Half Bridge Output 2	D04	Throttle Servo Motor Output
C02	SEN_5V0_A1	Sensor 5.0V A		
C03	IGN_LS1	Low Side Ignition 1	D18	Ignition Cylinder 1 Output
C04	IGN_LS2	Low Side Ignition 2	D19	Ignition Cylinder 2 Output
C05	IGN_LS3	Low Side Ignition 3	D20	Ignition Cylinder 3 Output
C06	IGN_LS4	Low Side Ignition 4	D21	Ignition Cylinder 4 Output
C07	IGN_LS5	Low Side Ignition 5	D29	Purge Solenoid 1
C08	IGN_LS6	Low Side Ignition 6	D27	Wastegate Solenoid
C09	SEN_5V0_B1	Sensor 5.0V B	A19	
C10	BAT_NEG1	Battery Negative	A05	Ground
C11	BAT_NEG2	Battery Negative	D07	Ground
C12	IGN_LS7	Low Side Ignition 7	C12	Fuel Pump Control
C13	IGN_LS8	Low Side Ignition 8	C22	Tachometer
C14	AV1	Analogue Voltage Input 1	B23	Throttle Pedal Sensor Main
C15	AV2	Analogue Voltage Input 2	B31	Throttle Pedal Sensor Tracking
C16	AV3	Analogue Voltage Input 3	A18	Throttle Servo Position Sensor Main
C17	AV4	Analogue Voltage Input 4	A28	Throttle Servo Position Sensor Tracking
C18	OUT_HB1	Half Bridge Output 1	D05	Throttle Servo Motor Output
C19	INJ_PH1	Peak Hold Injector 1	D08	Fuel Cylinder 1 Primary Output
C20	INJ_PH2	Peak Hold Injector 2	D09	Fuel Cylinder 2 Primary Output
C21	INJ_PH3	Peak Hold Injector 3	D10	Fuel Cylinder 3 Primary Output
C22	INJ_PH4	Peak Hold Injector 4	D11	Fuel Cylinder 4 Primary Output
C23	INJ_LS1	Low Side Injector 1	C23	ECU Power Relay Output
C24	INJ_LS2	Low Side Injector 2	C20	Start Relay Output
C25	AV5	Analogue Voltage Input 5	A06	Inlet Manifold Pressure Sensor
C26	BAT_POS1	Battery Positive	C01	Switched BAT_POS from throttle relay
C27	INJ_PH5	Peak Hold Injector 5	C30	Starter Cut Relay
C28	INJ_PH6	Peak Hold Injector 6	F03	Gear Shift Actuator Pump (option)
C29	INJ_PH7	Peak Hold Injector 7	F04	Gear Shift Actuator Up (option)
C30	INJ_PH8	Peak Hold Injector 8	F05	Gear Shift Actuator Down (option)
C31	OUT_HB3	Half Bridge Output 3	D14	Inlet Cam Solenoid LH
C32	OUT_HB4	Half Bridge Output 4	D16	Inlet Cam Solenoid RH
C33	OUT_HB5	Half Bridge Output 5	D30	Exhaust Cam Solenoid LH
C34	OUT_HB6	Half Bridge Output 6	D24	Exhaust Cam Solenoid RH



 **PINOUT – M150 CONNECTOR D – 26 WAY**

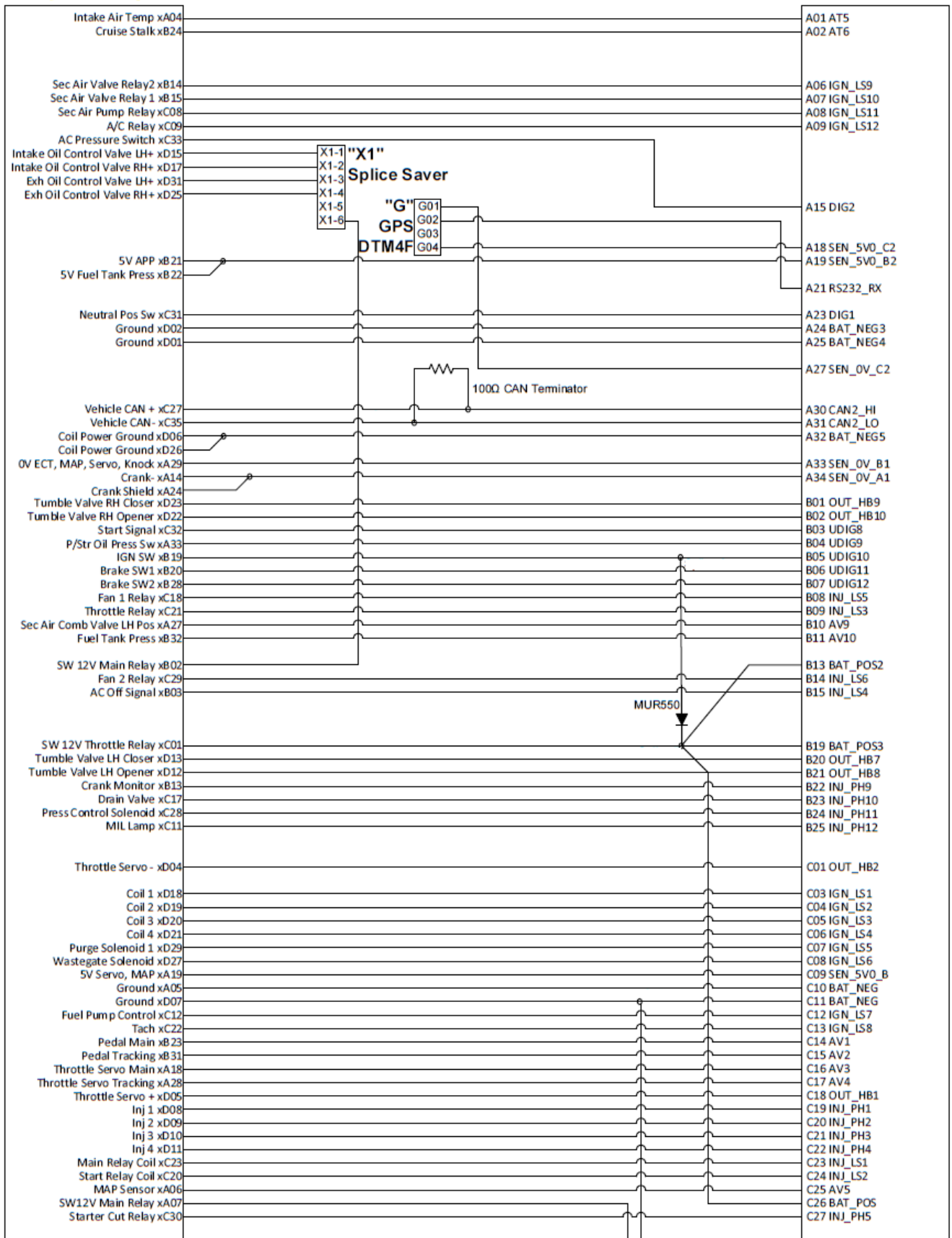
**Mating Connector:** Tyco Superseal 26 Position Keying 1 (MoTeC #65045)

Pin	Designation	Full Name	OE Pin	Function
D01	UDIG1	Universal Digital Input 1	A13	Engine Speed Sensor
D02	UDIG2	Universal Digital Input 2	A21	Inlet Cam Position LH
D03	AT1	Analogue Temperature Input 1	B18	Inlet Air Temperature Sensor
D04	AT2	Analogue Temperature Input 2	A34	Coolant Temperature Sensor
D05	AT3	Analogue Temperature Input 3	B17	Fuel Temperature Sensor
D06	AT4	Analogue Temperature Input 4	B12	Driver Cruise Switch
D07	KNOCK1	Knock Input 1	A15	Knock Sensor 1
D08	UDIG3	Universal Digital Input 3	A11	Inlet Cam Position RH
D09	UDIG4	Universal Digital Input 4	A31	Exhaust Cam Position LH
D10	UDIG5	Universal Digital Input 5	A12	Exhaust Cam Position RH
D11	UDIG6	Universal Digital Input 6	C25	Clutch Switch
D12	BAT_BAK	Battery Backup	B05	BAT_HOT
D13	KNOCK2	Knock Input 2		
D14	UDIG7	Universal Digital Input 7	B33	Fuel Pump Diagnostic
D15	SEN_0V_A2	Sensor 0V A	A22	
D16	SEN_0V_B2	Sensor 0V B	B29,B30,B34,B35,C06,A25	
D17	CAN1_HI	CAN Bus 1 High	L03	MoTeC 1 Mbit/sec CAN
D18	CAN1_LO	CAN Bus 1 Low	L02	MoTeC 1 Mbit/sec CAN
D19	SEN_6V3	Sensor 6.3V		
D20	AV6	Analogue Voltage Input 6	B26	MAF Signal
D21	AV7	Analogue Voltage Input 7	A16	Tumble Generator Valve Position LH
D22	AV8	Analogue Voltage Input 8	A26	Tumble Generator Valve Position RH
D23	ETH_TX+	Ethernet Transmit+	Ethernet Green/White	
D24	ETH_TX-	Ethernet Transmit-	Ethernet Green	
D25	ETH_RX+	Ethernet Receive+	Ethernet Orange/White	
D26	ETH_RX-	Ethernet Receive-	Ethernet Orange	

ADAPTOR LOOM WIRING SCHEMATIC – sheet 1

"xA, xB, xC & xD"  
STI  
Tyco 135 pin

"A, B, C & D"  
M150  
Tyco 26&34 pin



ADAPTOR LOOM WIRING SCHEMATIC – sheet 2

