

PWC Plug-In ECU Kit

- Yamaha FX-SHO, FZS/FZR
- Kawasaki Ultra 250X, 260X
- Sea-Doo RXP/RXPX/RXT
- Hydrospace S4



INSTALLATION MANUAL



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Quick Start Guide

Throughout this manual we use the following icons to indicate information only valid for a particular PWC:

 Yamaha

 Kawasaki

 Sea-Doo

 Hydrospace S4

Installation

The PWC Plug-In ECUs are supplied as a complete replacement kit including a Base Map to provide a tune for the craft that will result in direct power gain.

Warning:

Your dealer must ensure that your M400 Marine ECU has the correct firmware loaded (currently V3.52P or later) and that a suitable configuration file (Base Map) is loaded, **before** you fit the kit to your PWC.

Failure to do this may result in a PWC which **may not power up, may not start, or may permanently damage the ignition coils.**

Detailed installation instructions can be found in the section relevant for your PWC.

You should read:

- Yamaha Installation 3
- Kawasaki Installation 8
- Sea-Doo 2004-2009 Installation 14
- Sea-Doo 2010 Installation 20
- Hydrospace S4 Installation 26

Data Logging

To take full advantage of the possibilities of the system, data logging can provide you with valuable knowledge about the performance and reliability of the engine and craft.

Note: The PWC Plug-In ECU systems provide data logging for a free

evaluation period of the first 8 hours engine running time. After this evaluation period data logging is available as an Upgrade.

This manual will explain how to obtain the logged data from your PWC.

You should read:

- Software Installation 30
- Data Logging 32

Expanding the System

To get even more out of your PWC, you will find information in this manual on how you can expand your system.

You should read:

- Options to Expand the System 35
- Appendices 37

More Information

If you would like to explore more in depth information for your installation, you will find tips and links for further reading in the last appendix.

You should read:

- How to Get More Information 80

Introduction

The PWC Plug-In ECUs are direct replacements for factory ECUs on a select number of popular PWC models. They are based around the M400 Marine ECU.

Note: ECUs (Engine Control Units) are often referred to as Ignition Systems. Complete with a wiring loom and mounting brackets, PWC Plug-Ins are convenient and cost effective to install because they eliminate the need to rewire the PWC. They simply plug into the factory wiring harness using the original sensors, fuel system and factory dash.

Features

The M400 Marine ECU comes with a range of features as standard and several options available as upgrades to customise and grow your system. These additional features are activated through a simple password acquired from MoTeC, at any time when you need it. See [Upgrades](#).

Engine Tuning Features





- Windows based ECU Manager tuning software with user definable screen layouts.
- Individual cylinder tuning of both fuel delivery and ignition timing.
- Selectable channels for table axes.
- Fully configurable axis points on all tables.
- Free access to wideband Lambda and data logging for initial tuning. Available for the first 8 hours engine running time.
- Possibility to communicate directly with OEM dash.
- Suitable for engines requiring the latest complex control functions, such as drive by wire throttle control.
- Capable of all other modern control functions, such as:
 - Launch control
 - Overrun boost enhancement (anti-lag)
 - Boost control
 - Nitrous injection
- Fully configurable sensor inputs including custom calibrations.
- Configurable receiving and transmitting data via the CAN bus.
- Capable of receiving data from multiple Lambda measurement devices via CAN.

- Integrated advanced diagnostics, including injector and crank trigger diagnostics.
- Switchable between multiple configurations.
- Ref/Sync capture displayed on the built-in digital oscilloscope.

Data Acquisition

- Internal data logging (500 kB) with fast download via CAN.
- Three engine histogram logs including a tell-tale log.
- State of the art **i2 Standard** or **i2 Pro** data analysis software.

Compatibility

-  Yamaha WaveRunner FX SHO, FZR and FZS.
-  Kawasaki Ultra 250X and 260X Jet Ski.
-  Sea-Doo RXP, RXP-X, RXT, and RXT-X
-  Hydrospace S4

Required Accessories

UTC (only required to connect the ECU to a laptop).

System Overview

Each system is tailored to the specific PWC and consists of

- M400 Marine ECU.
- Installation Set, including adaptor loom and required devices.
- Mounting Set, including all brackets and fasteners to install the ECU and peripheral devices.

Yamaha Installation

System

ECU

- M400 Marine ECU

Installation Set

- 1 x Adaptor Loom
- 1 x KTC (K-Line to CAN module)
- 1 x Immobiliser Bypass



Mounting Set

- 2 x ECU mounting brackets
- 4 x mounting bolts
- 1 x rubber backing pad



On request the Yamaha PWC Plug-In ECU is available with the M800 Marine ECU.

Installation

ECU and KTC


The M400 Marine ECU replaces the factory ECU in the electrical box which is located behind the engine. Place a rubber insert under the M400 and align the ECU mounting brackets with the existing bolt holes in the plastic bulkhead. The KTC device can be zip-tied to a suitable anchoring position.



Immobiliser Bypass

The Yamaha Installation Set includes the Immobiliser Bypass which replaces the original Yamaha Immobiliser and renders the PWC permanently unlocked. To install the Immobiliser Bypass, simply unplug the Yamaha Immobiliser and plug the MoTeC Immobiliser Bypass into the loom. The Immobiliser is located behind the front storage compartment bulkhead, on the right front side of the hull.

Optional Installation - Cooling Kit

When a MoTeC Plug-In ECU is fitted, the increased engine power could result in over-heating (See  Cooling).

Removing the standard engine thermostat will improve the cooling slightly. The thermostat is located at the rear of the cylinder head.

To further assist engine cooling, extra cooling lines can be run from the jet unit to the engine. Cooling kits can be purchased from PWC parts suppliers such as R&D and Riva.

Acceptable results have been reported using R&D Cooling Kit # 660-18001. (<http://www.rd-performance.com/newProducts/yamaha/fzr.asp>)

PWC Operational Differences

The PWC Plug-In ECU closely mimics the standard OEM operation. However, MoTeC would like to draw your attention to some operational differences when a PWC Plug-In ECU is installed.

ECU Operation

The M400 Marine ECU engine control functionality is the same as the standard factory ECU; all normal operations of the PWC are possible, with the exception of No Wake Mode and Cruise Control.

Drive by Wire Throttle

All Yamaha WaveRunner models are fitted with a Drive by Wire throttle (Electronic Throttle). This is a safety related device. If it is not functioning correctly contact your MoTeC dealer for further advice.

Warning:
Never alter any of the Electronic Throttle settings in the ECU. Incorrect operation can potentially be dangerous and result in serious injury.

Instrument Cluster Operation

The M400 Marine ECU will control the Yamaha instrument clusters and mimic the original factory dash operation.

The ECU controls the dash via the KTC (K-Line to CAN) data adaptor; the KTC receives CAN messages from the ECU, and then transmits K-Line messages to the instrument cluster.

The fixed CAN address and the CAN messages custom data set are provided in the Base Map and should not be changed.

To prevent engine damage the following dash alarms and rev limits are provided:

Sensor	Value	Dash alarm	Rev Limit
Engine Temperature	approx. 88 °C (190 F)	yes	3300 rpm
Muffler Temperature	96 °C (205 F)	yes	None
Oil Pressure	None	yes	4500 rpm

Note: These alarms and rev limits are similar to the factory settings.

Cooling

When a PWC Plug-In ECU is fitted the engine power is increased. The standard Yamaha cooling system might not be sufficient in its supply of water to the engine and over-heating can occur.

It is important to check if the cooling system is working adequately. The maximum engine temperature should be 88 °C (190 F).

If your engine overheats the dash alarm will come on and the revs will be limited to 3300 rpm.

Note: There are three separate engine temperature monitors on the Yamaha. The engine temperature switch, mounted on the front right side of the engine block, is used to control the dashboard alerts and RPM limiter. The alarm temperature of this switch is 88 °C and is not adjustable.

The engine temperature sensor, mounted on the rear right side of the block, will reduce the drive-by-wire throttle when engine temperature exceeds 105 °C.

A further precaution is controlled by the Full Throttle Timer. When the engine uses full throttle for extended periods, the engine tuner can adjust two compensation tables to reduce engine temperature. The fuel mixture can be enriched using Fuel Comp 1 table and the ignition timing can be retarded using Ignition Comp 2 table.

Tip: The logged data will be useful to check the engine temperature. See [Data Logging](#) on how to access the logged data.

The optional installation of a cooling kit will help with engine cooling.

Power Control Strategy

The standard Yamaha WaveRunner uses an Immobiliser and Start Button to power up the craft. If the Immobiliser is unlocked, pressing the Start Button on the left handlebar will start and run the engine.

The installation of the PWC Plug-In ECU bypasses the Immobiliser rendering the PWC permanently unlocked. Otherwise it follows the same strategy with some provisions:


- If the engine is not started or is stopped for a period longer than 30 seconds, the M400 Marine ECU turns off its own power. Power is not re-applied until the Start button is pressed again for an engine start.
- When making tuning adjustments to the M400 Marine ECU using ECU Manager software, an ECU reset may be required. In this case, power is removed from the ECU and the CAN connection to the PC software is halted. To re-connect, press the Start Button for a short time until the engine has cranked, or for a longer time if you want the engine running.

The CAN connection should re-establish and you may continue with tuning adjustments.

Power-up Adaptor Wire

If the ECU needs to be powered for longer than 30 seconds without the engine running, for example when downloading large logging files or making adjustments, the ECU power should be controlled externally.

For this purpose, a separate wire is available from the Adaptor Loom. Connect this wire to ground via a switch, to turn on the ECU power relay.

Note: Do not use ground wires from the M400 pins B14, B15 or B16 for this earth. Use either pins A10 or A11 or a chassis ground. (see Appendices for  [Pin List by Function](#))

When finished, this wire should be lifted from ground to return to normal power control operation, so the ECU has control of the power relay. Failure to do so will cause the battery to go flat.

Security

The standard Yamaha Immobiliser system uses a Key Fob transmitter to Lock/Unlock the PWC. If the immobiliser is locked, the Start button will not crank the engine, thus preventing operation.

When the PWC Plug-In ECU is installed an Immobiliser Bypass device renders the craft permanently unlocked.

It is important to secure the craft when not in use, for example by removing the Immobiliser Bypass.

Kawasaki Installation

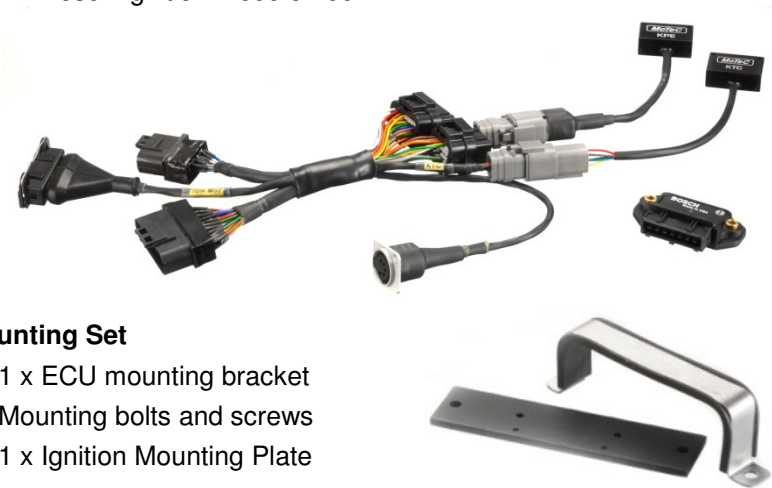
K System

ECU

- M400 Marine ECU

Installation Set

- 1 x Adaptor Loom
- 1 x KTC (K-Line to CAN module)
- 1 x KPE (Pulse Extender)
- 1 x Bosch Ignition Module 200



Mounting Set

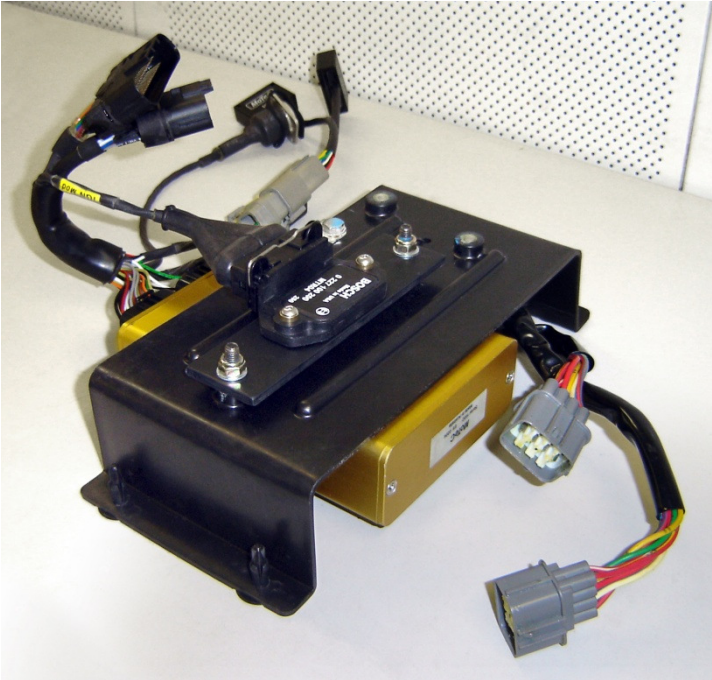
- 1 x ECU mounting bracket
- Mounting bolts and screws
- 1 x Ignition Mounting Plate

On request the Kawasaki PWC Plug-In ECU is available with the M800 Marine ECU.

K Installation

The M400 Marine ECU replaces the factory ECU on the ECU mounting bracket which is located behind the front bulkhead in the front storage compartment. Place the stainless steel clamp over the M400 and align with the existing bolt holes in the plastic bulkhead.

The KTC and KPE devices can be zip-tied to a suitable anchoring position.





The Ignition Module is fitted to the Ignition Mounting Plate.

Note: This module generates significant heat and requires the use of dielectric grease between the module and mounting plate to ensure proper heat transfer. Firm fixing of the mounting bolts is also necessary for proper heat transfer.

The mounted module/plate assembly is placed on the underside of the M400 mounting bolts, behind the ECU mounting bracket. Nylock nuts are then used to secure the ignition assembly.

Due to the extra weight of the combined assembly there are 4 extra mounting bolts and nuts supplied to bolt the factory plastic support bracket back into the ski.

These bolts take the place of the plastic push lock clips that are used by Kawasaki.

Output Test Function

To test if all outputs are correctly wired to the relevant injectors and coils, the ECU Manager software has an output test function available. If you would like to use this function in a Kawasaki installation refer to the notes in the Appendices (**K** Output Test Function).

▣ PWC Operational Differences

The PWC Plug-In ECU closely mimics the standard OEM operation. However, MoTeC would like to draw your attention to some operational differences when a PWC Plug-In ECU is installed.

▣ ECU Operation

The M400 Marine ECU engine control functionality is the same as the standard factory ECU; all normal operations of the PWC are possible, with the exception of Learner Key Mode.

▣ Instrument Cluster Operation

The M400 Marine ECU will control the Kawasaki instrument clusters and mimic the original factory dash operation.

The ECU controls the dash via the KTC (K-Line to CAN) data adaptor; the KTC receives CAN messages from the ECU, and then transmits K-Line messages to the instrument cluster.

The fixed CAN address and the CAN messages custom data set are provided in the Base Map and should not be changed.

To prevent engine damage the following dash alarms and rev limits are provided:

Sensor	Value	Dash alarm	Rev Limit
Oil Temperature	155 °C (311 F)	Yes	3300 rpm
Water Temperature	118 °C (244 F)	Yes	3300 rpm
Intercooler Temperature	160 °C (320 F)	Yes	None
Oil Pressure	No Oil Pressure and RPM > 3000	Yes	3300 rpm

Note: These alarms and rev limits are similar to the factory settings.

▣ Cooling

When a PWC Plug-In ECU is fitted the engine power is increased. The standard Kawasaki oil and water cooling system might not be sufficient and engine over-heating can occur.

If the engine overheats a relevant dash alarm will come on and the revs will be limited to prevent engine damage.

Tip: The logged data will be useful to check both oil and engine temperatures. See [Data Logging](#) on how to access the logged data.

🔑 Power Control Strategy

The standard Kawasaki JT1500F (Ultra 250/260x) uses an Ignition Key with an immobiliser function to power up the craft. If the Ignition Key is inserted, pressing the Start Button on the left handlebar will start and run the engine. The installation of the PWC Plug-In ECU solution still uses the Ignition Key but without the immobiliser function. It follows the same strategy with some provisions:

- If the engine is not started, or stopped for longer than 15 seconds, the M400 Marine ECU turns off its own power. Power is not re-applied until the Start Button is pressed again for an engine start.
- If tuning adjustments are being made to the M400 Marine ECU via the PC connection using ECU Manager software, an ECU reset may be required. In this case, power is removed from the ECU and the CAN connection to the PC software is halted. To re-connect, remove the Ignition Key and then re-insert. The CAN connection should re-establish and you may continue with tuning adjustments

🔑 Security

The Ultra 250X/260X uses an encoded Ignition Key which is paired with the factory ECU.

The PWC Plug-In installation does not include the immobiliser function. It is important to secure the craft when not in use for example by removing the KPE device from the wiring harness.

Note: There are two almost identical devices plugged into the loom, a KTC device and a KPE device.

🔑 Idle Stepper Motor Setting (V3.52P or later)

On a new installation of the PWC Plug-In ECU the initial idle RPM may be very high when the engine is first started.

This is because the stock ECU 'parks' the stepper motor in an open position when the Ignition Key is removed, and then closes the stepper down to a 'start' position when the Key is inserted.

MoTeC ECUs control the idle stepper motor without reference to its initial position when the Jet Ski is powered up. The stepper may still be parked in the open position upon the first start, resulting in high idle RPM.

There are two strategies which reduce this condition:

1 – Preset the idle stepper before removing the stock ECU.

As the stock ECU repositions the idle stepper to a parked position when stopped, it can help if the idle stepper motor is unplugged before the Key is removed. To do this the engine should be running in the water at a stable idle speed, with the engine at normal operating temperature. Unplug the stepper motor plug which is located on the throttle body, and then remove the Key.

With the stepper in its normal operating position the PWC Plug-In ECU can now be installed, and the stepper motor plugged in prior to running the engine. This procedure need only be followed once, as the M400 ECU does not park the stepper motor when the key is removed.

2 – Make temporary changes to the idle control settings to close the idle stepper.

After initial installation of the Plug-in Adaptor Loom it may be necessary to make temporary changes to the idle control settings until stable conditions are achieved. The best option for a new installation is to make the stepper close a little each time the engine is started. Then the standard idle control settings may be re-set for further use.

- In **Functions | Idle Control | Setup**, set the 'Activate RPM' to 5000.
- In **Functions | Idle Control | Initial Position**, set all values to -50.

If you have -50 set for the initial position and after about 6 starts the engine is still idling fast, the answer may be the idle air bypass in the throttle body (very difficult to adjust).

Once a good starting idle has been achieved, re-set the control values:

- In **Functions | Idle Control | Setup**, set the 'Activate RPM' to 2400.
- In **Functions | Idle Control | Initial Position**, set all values to 0.

Sea-Doo 2004-2009 Installation

⊗ System

ECU

- M400 Marine ECU

Installation Set

- 1 x Adaptor Loom
- 1 x STC-S (Sea-Doo Serial to CAN module)
- 1 x DMCF (Sea-Doo Dual Mag Converter)
- 1 x IGN4 Ignition Module



Mounting Set

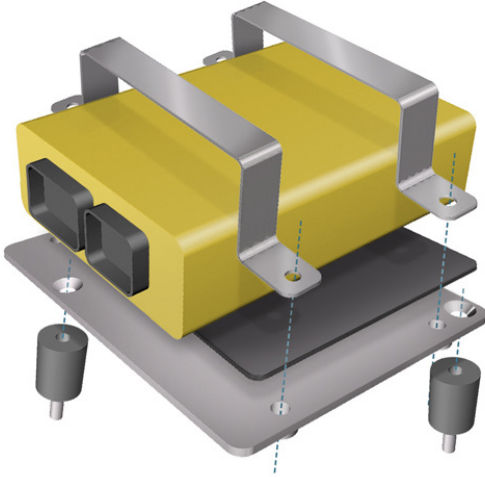
- 1 x Sea-Doo ECU Mounting Plate
- 2 x ECU mounting brackets
- 3 x Anti-vibration mounts
- Mounting bolts and screws
- 1 x Rubber backing pad.



On request the Sea-Doo PWC Plug-In ECU is available with the M800 Marine ECU.

🔩 Installation

The M400 Marine ECU replaces the factory ECU on top of the engine. Remove the factory ECU (four M6 bolts) and screw three anti-vibration mounts into three of the mounting holes (see picture).



Screw the Sea-Doo ECU mounting plate to the anti-vibration mounts using Loctite 243 and M6x10 stainless steel countersunk screws.

Then, place the rubber backing pad on the plate and secure the M400 Marine ECU with the Mounting brackets using four M6x16 stainless steel cap screws and four M6 stainless steel spring washers.

Finally, connect the adaptor loom harness between the M400 ECU and the factory wiring harness.

Note – the Sea-Doo connectors are labelled A and B and are keyed so that only the correct plug can be inserted. If the slide-lock on the plug will not slide shut, then the plug is fitted into the wrong connector.

For the ECU to function normally all supplied devices must be connected:

- STC-S device plugged into 6 pin socket labelled 'STC'
- IGN4 device plugged into 6 pin socket labelled 'COIL' and 4 pin socket labelled 'IGN'.
- DMC-F device plugged into 12 pin socket labelled 'DMC'.

These devices can all be secured by zip-ties.



🔧 Configuration File

The Sea-Doo PWC Plug-in ECU is compatible with all RXP, RXPX, RXT, and RXTX models from 2004 to 2009. However there are numerous harness differences between 2004-2005, 2006, and 2007-2009 models. Each of these requires different M400 configuration files (Base Maps). If the incorrect configuration file is loaded, the PWC may operate incorrectly or have limited dashboard functions.

The three configuration file versions are designated 2004, 2006 and 2007.

- 2004 Configuration files match original ECU part numbers: 420664942, 420664947.
- 2006 Configuration files match original ECU part numbers: 420664946
- 2007 Configuration files match original ECU part numbers: 420665785, 420665789, 420665861

To mimic all original Sea-Doo functions including dashboard alerts, the Sea-Doo PWC Plug-In ECU requires M400 firmware version 3.52P or higher.

Ⓢ PWC Operational Differences

The PWC Plug-In ECU closely mimics the standard OEM operation. However, MoTeC would like to draw your attention to some operational differences when a PWC Plug-In ECU is installed.

Ⓢ ECU Operation

The M400 Marine ECU engine control functionality is the same as the standard factory ECU; all normal operations of the PWC are possible, with the exception of Learner Key Mode and Knock Sensing.

Ⓢ Instrument Cluster Operation

The M400 Marine ECU will control the Sea-Doo Instrument cluster and mimic the original factory dash operation.

The ECU controls the dash via the STC (Serial to CAN) data adaptor; the STC receives serial RS232 messages from the ECU, and then transmits CAN messages to the instrument cluster.

The serial RS232 transmit settings and the CAN custom data set are provided in the Base Map and should not be changed.

To prevent engine damage the following dash alarms and rev limits are provided:

Sensor	Value	Dash Alarm	Rev Limit
Fuel Tank Level	< 10% capacity	Yes	None
Battery Voltage	<11.6 V or >15.2 V	Yes	None
Engine Temperature	110°C	Yes	4000 rpm
Exhaust Temperature	110°C	Yes	4000 rpm
Oil Pressure	No Oil Pressure and RPM > 3300	Yes	4000 rpm

Note: These alarms and rev limits are similar to the factory settings.

🔌 Power Control Strategy

The standard Sea-Doo RXP, RXP-X and RXT use an Ignition Lanyard with an immobiliser function to power up the craft. If the Ignition Lanyard is inserted, pressing the Start/Stop Button on the left handlebar will start and stop the engine.

The installation of the PWC Plug-In ECU solution still uses the Ignition Lanyard but without the immobiliser function. It follows the same strategy as the 2007 model Sea-Doo crafts:

- Power is continuously applied to the ECU while the Lanyard is connected. Tuning adjustments, log downloads, and ECU configuration file downloads may all be performed without interruption.
- If the engine is not started, or is stopped for longer than 4 seconds, the M400 Marine ECU sounds the warning beeper in repeated bursts of 4 short pulses.
- Power is removed from the ECU **only** by removing the Ignition Lanyard.

🔒 Security

The Sea-Doo RXP, RXP-X and RXT use an encoded Ignition Lanyard which is paired with the factory ECU.

The PWC Plug-In installation does not include the immobiliser function. It is important to secure the craft when not in use for example by removing the IGN4 device from the wiring harness.

🔌 Idle Stepper Motor Setting (V3.52P or later)

If the PWC shows stalling behaviour when the throttle is closed suddenly, it may help to reset the throttle stop screw for a higher base idle RPM setting.

The standard throttle stop screw has a tamper-proof cover and is very securely glued to the throttle body with loctite. The screw can be very carefully removed (warning - risk of breakage), and replaced with an M5 set screw with M5 lock nut.

To reset a newly installed stop screw

- Connect to the ECU Manager program on a PC.
- Observe the Throttle Position (TP%) in the Sensors list, or press 'V' for the Sensor View screen.
- Wind in the stop screw until the throttle position reads just over zero.
- Wind back until exactly zero is shown.

To set the new idle stop position

- Wind in the stop screw an additional 1.5 turns.
- Altered this setting as required to achieve 1850 RPM idle on the ski **in the water, once the engine has been warmed up.**

Note: TP HI and TP LO settings should not be changed, regardless of where the stop screw is positioned.

⊗ Fuel Pump current

While the stock fuel pump draws a small amount of current, the situation may arise with higher fuel pressures or alternate pumps where the current draw is more than the Adaptor Loom is designed for.

If this occurs a reduction in fuel pressure may be evident when the ECU senses over-current and stops fuel pump operation.

If the fuel pressure is raised with the stock fuel pump it may be necessary to add an external Fuel Pump Relay to the loom, to accommodate higher pump current.

Alternatively, if a replacement pump is fitted with a higher current draw, again it may be necessary necessary to add an external Fuel Pump Relay to the loom, to accommodate higher pump current.

Sea-Doo 2010 Installation

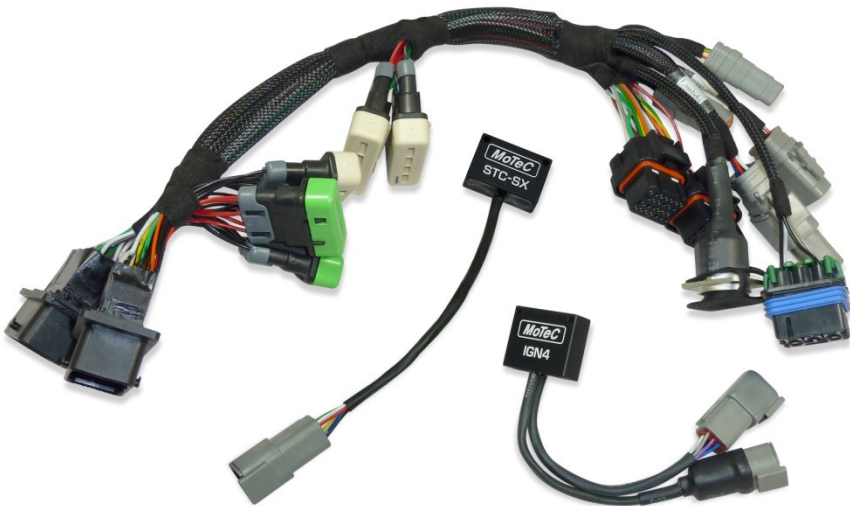
System

ECU

- M400 Marine ECU

Installation Set

- 1 x Adaptor Loom
- 1 x STC-SX (Sea-Doo 2010 Serial to CAN module)
- 1 x IGN4 Ignition Module



Mounting Set

- 1 x Sea-Doo 2010 ECU Mounting Plate
- 2 x ECU mounting brackets
- 3 x Anti-vibration mounts
- Mounting bolts and screws
- 1 x Rubber backing pad.



On request the Sea-Doo PWC Plug-In ECU is available with the M800 Marine ECU.

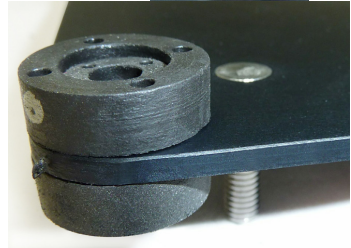
Ⓢ Installation

The M400 Marine ECU replaces the factory ECU on top of the engine. Remove the factory ECU (three T25 Torx screws) and pre-assemble the supplied mounting plate **before** the M400 ECU is fitted:

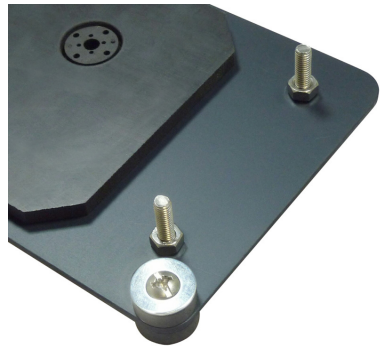
- Screw 4 supplied M6 Stainless nuts on the studs protruding from the top of the mounting plate. These serve as captive spacers. (see right)



- Invert the plate and ensure that the 3 rubber rings are seated on the rubber bushes which are fed from the top side of the plate. (see picture at right)



- Place the plate with rubber inserts over the plastic mounting bracket on the PWC.
- Firmly screw 2 x 6mm cap screws with washers in the lower 2 positions, and 1 x countersunk screw without washer in the central position. Do not over tighten.
- Ensure that the rubber mat with hole is mounted over the centre countersunk screw.



- Fit the waterproof relay to the top right screw post which protrudes from the mounting plate.
- Fit the M400 ECU and place the 2 stainless steel brackets onto the 4 screw posts, after first fitting the rubber trim strips to the underside of the brackets.
- Secure the brackets (and relay) with 4 x M6 washers and 4 x M6 Nylock nuts.





- Now plug in the Adaptor Loom – first, Plug B into the stock wiring harness, then Plug A.
- Next plug the M400 ECU into the Adaptor Loom.
- Ensure that all supplied devices are connected: M400, STC-SX, IGN4, Relay. These devices can all be secured by zip-ties.



Warning – the M400 ECU MUST have firmware version 3.52P or later loaded BEFORE this Adaptor Loom is powered up. If you have not loaded the firmware you should unplug the IGN4 device and remove all three of the injector/ignition fuses (#7, 8, and 9) from Fuse Box 1, and THEN load the 3.52P firmware.

Warning – the M400 ECU should have the relevant start file installed before the IGN4 device and Injector/Ignition fuses are re-installed.



🔌 Configuration File

The Sea-Doo 2010 PWC Plug-in ECU is compatible with all RXTX models from 2010. These models differ from 2004-2009 models in that they use a different stock ECU which includes Electronic Throttle Control (Drive-by-Wire) and also offer Brake and Suspension options on varying models. Both the ECU and the harness connector are different and the 2010 Adaptor Looms are **not** interchangeable with the 2004-2009 Adaptor Looms.

- 2010 Configuration files match original ECU part numbers: 420664942, 420664947.

To mimic all original Sea-Doo functions including dashboard alerts, the Sea-Doo PWC Plug-In ECU requires M400 firmware version 3.52P or higher.

Ⓢ PWC Operational Differences

The PWC Plug-In ECU closely mimics the standard OEM operation. However, MoTeC would like to draw your attention to some operational differences when a PWC Plug-In ECU is installed.

Ⓢ ECU Operation

The M400 Marine ECU engine control functionality is less complex than the standard factory ECU; only one mode is supported. The handlebar Mode switching does not operate as in the stock craft.

Ⓢ STC-SX Device

This craft depends heavily upon CAN bus communication for correct operation. Both the Instrument Cluster and Brake System (see below) use CAN data for critical decisions. The M400 ECU **transmits and receives** relevant data via the STC-SX device using Custom Data Set 1. **On no account should this table be changed** as Brake System or Instrument Cluster malfunction may result.

If for any reason these systems do not operate correctly, the configuration file and the STC-SX device should be checked first.

Ⓢ iBR Brake System Operation

The iBR system works in conjunction with the Brake Lever, ECU and Instrument Cluster to determine how the brake will operate. The interaction is complex and not user-adjustable. **On no account should Custom Data Set 1 be changed** as Brake system malfunction may result.

If for any reason the iBR unit is not satisfied with data received from the other components, the Instrument Cluster will illuminate the red iBR warning light and the brake system will no longer operate.

In this situation the craft must be shut down and restarted before the iBR system will be fully functional: Remove the Lanyard, wait 10 seconds, then re-install the Lanyard and re-start the engine.

Ⓢ Instrument Cluster Operation

The M400 Marine ECU will control the Sea-Doo Instrument cluster and mimic the original factory dash operation.

The ECU controls the dash via the STC-SX (Serial to CAN) data adaptor; the STC-SX receives CAN messages from the ECU, and then re-transmits CAN messages to the instrument cluster.

The CAN transmit settings and the CAN custom data set are provided in the Base Map and should not be changed.

The dash alarms are not user-adjustable – they are pre-set in the dashboard. The M400 provides relevant information (engine temperature, etc.) and the dashboard raises alarms when required. For this reason all dash alarms will operate identically to the stock ECU.

🔌 **Power Control and Engine Start Strategy**

The standard Sea-Doo 2010 models use an Ignition Lanyard with an immobiliser function to power up the craft. A cumbersome start procedure is required where the Start Button must be pressed before the Lanyard is inserted, then a double-beep indicates that the Jet Ski will start.

The PWC Plug-In ECU solution does not have these requirements. Once the Lanyard is inserted, the Start/Stop button will work at any time. No double-beep indication is given by the dash.

Power control follows a different strategy:

- Power is continuously applied to the ECU while the Lanyard is connected. Tuning adjustments, log downloads, and ECU configuration file downloads may all be performed without interruption.
- Power is removed from the ECU **only** by removing the Ignition Lanyard.
- There is no automated power-down function. **The Lanyard should always be removed immediately after stopping the engine.**

🔌 **Connecting to a PC with MoTeC UTC cable**

The Sea-Doo 2010 models use an STC-SX device which communicates with the M400 Marine ECU via CAN at 500kBits/Sec. To connect the system to a PC using a MoTeC UTC cable requires that the ECU Manager PC software has the CAN communications speed set to 500kBit/S:

- Launch the ECU Manager program with the PWC powered off.
- On the menu bar select **Tools / Options**.
- Click on the **Communication** tab.
- Click on the **CAN data rate** pulldown, select 500 kbit, and press **OK**.
- The main screen will now show 'CAN data rate: 500k' in the lower left side.
- Turn on the PWC and proceed.

Note – most MoTeC devices uses 1mBit/s as the default CAN speed, whereas many OEM devices use 500kbit/s.

Hydrospace S4 Installation

H System

ECU

- M400 Marine ECU

Installation Set

- 1 x Adaptor Loom
- 1 x Bosch Ignition Module 200



Mounting Set

- 1 x ECU mounting bracket
- Mounting bolts and screws
- 1 x Rubber backing pad.
- 1 x Mounting plate drill template

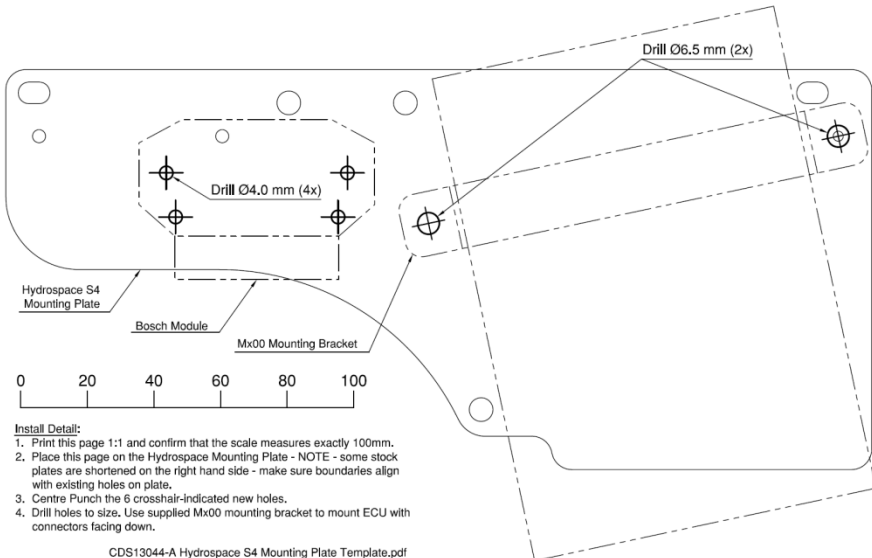


On request the Hydrospace PWC Plug-In ECU is available with the M800 Marine ECU.

[H] Installation

The M400 Marine ECU replaces the factory ECU on a mounting plate beside the engine.

Remove the factory ECU (3 x M4 bolts) and drill 6 holes into the existing mounting plate using the mounting plate template. The template is supplied on a 1:1 scale and can also be downloaded from motec.com.au (CDS13044-A Hydrospace S4 Mounting Plate Template).



Fit the supplied Ignition Module to the mounting plate.

Note: This module generates significant heat and requires the use of dielectric grease between the module and mounting plate to ensure proper heat transfer. Firm fixing of the mounting bolts is also necessary for proper heat transfer.

Then, place the rubber backing pad on the plate and secure the M400 Marine ECU with the Mounting bracket using two M6x16 stainless steel cap screws and two M6 Nylock nuts.

Finally, connect the adaptor loom harness between the M400 ECU and the factory wiring harness.

The entire assembly can now be lowered into position beside the engine, and fixed into place with two M6 lock nuts.

H *Configuration File*

The Hydrospace S4 PWC Plug-in ECU is compatible with all known versions of the S4 model. The stock S4 model can be operated with numerous boost levels. A number of configuration files are available with different ECU boost control strategies, See [Base Maps](#)

H *PWC Operational Differences*

The M400 Marine ECU engine control functionality is the same as the standard factory ECU; all normal operations of the PWC are possible.

MoTeC has added a launch control function using the blue button on the left side handlebar (see Launch Mode Button). Once optimised by the tuner this allows for precise and powerful launch performance.

H *Instrument Cluster Operation*

The standard Hydrospace does not include an instrument cluster, MoTeC has added provision in the Adaptor Loom for an SLM (Shift Light Module). This can be controlled from the M400 and offers many advantages. It includes LMA - Launch Mode Assist –, a visual alert system to optimise launch performance in a racing environment. The supplied Configuration files have this feature already included.



H *Power Control Strategy*

The Hydrospace S4 uses an ignition lanyard which powers up the craft. With the lanyard inserted, pressing the start button on the left side handlebar will start the engine, and either pressing the red button or removing the lanyard will stop the engine.

Note: the lanyard should always be removed when the engine is stopped to avoid flattening the battery.

[H] Launch Mode Button

The existing left handlebar includes an unused blue push button which MoTeC has designated for Launch Mode. Full throttle can be applied prior to a race start to build up turbo boost, whilst limiting RPM to 2250. When the blue button is released, full power is delivered very quickly resulting in rapid acceleration.

The original blue button is wired through a temperature switch. This switch is mounted in the exhaust manifold prior to the turbo and will trip at 70 °C, which would disable the Launch Mode function. This is impractical for race conditions.

To ensure that Launch Mode is available at all times, install a bypass plug to short circuit the two pins of the temperature switch connector (same connector as a Bosch injector).

Software Installation

PC Recommendations

MoTeC recommends a dedicated laptop for your PWC car with the following specifications:

- 32 bit operating system: Windows XP, Vista or Windows7
- Screen size: 1024 x 768
- Processor speed: 1-2 GHz Pentium
- 2 GB RAM
- 256 MB graphics card
- 2 USB ports
- Ethernet port

Most current laptops will meet the specifications above and this will ensure all MoTeC software will run on it.

ECU Manager Software (V3.52P or later)

To install ECU Manager Software

- Go to the MoTeC website at www.motec.com and navigate to downloads/software/latestreleases
- OR -
Locate the Manager software on the MoTeC Resource Disc.
- Save the selected file in your preferred location (for example desktop).
- When downloading is finished, double click on the file and select run.
- Follow the instructions on the InstallShield Wizard.
- To start the program after installation, click on the new Manager icon on the desktop or click Start > All Programs > MoTeC > M400 M600 M800.

Updating ECU Manager Software

Software updates are made available to give access to the latest features. Download the latest software version from the website and follow the software installation instructions to update to the new version.

Connecting the ECU to a PC

The PC communicates with the ECU via the CAN bus and connects to the USB port on the PC.

This requires a MoTeC UTC (USB to CAN) device. The UTC plugs into the CAN connector provided on the adaptor loom (5 pin connector) and includes a standard USB cable to connect to the PC.

Note: Seadoo 2010 models have on-board CAN operating at 500kBit/Sec. To communicate with a PC the ECU Manager Software must be set to the same speed (see page 25 for details).

i2 Data Analysis Software

i2 data analysis software is used to analyse the logged data that has been recorded by the ECU. A combination of graphs, gauges and reports can be analysed simultaneously. The *i2* environment can be customised to specific user requirements.

The software can be downloaded for free from the website.

To install the *i2* software

- Go to the MoTeC website at www.motec.com and navigate to downloads/software/latestreleases
- OR -
Locate the software on the MoTeC Resource Disc.
- Save the selected file in your preferred location (for example desktop).
- When downloading is finished, double click on the file and select run.
- Follow the instructions on the InstallShield Wizard.
- To start the program after installation, click on the new *i2* icon on the desktop or click Start > All Programs > MoTeC > ***i2* Standard**.

There are two levels of analysis functionality available; ***i2* Standard** which is included, and ***i2* Pro** which requires the optional Pro Analysis upgrade. See [Upgrades](#) for more information.

Data Logging

To take full advantage of the possibilities of the system, data logging can provide you with valuable knowledge about the performance and reliability of the engine and craft. The PWC Plug-In ECU systems have the data logging option enabled for a free evaluation period of the first 8 hours of engine running time. After this, the Data Logging upgrade is required. See [Upgrades](#). In the Base Map, a logging configuration is supplied. This configuration will log diagnostic channels needed for trouble shooting and will allow for 5 to 15 minutes of logging.

To download the log file

Ensure you have ECU Manager software installed.

The M400 Marine ECU must stay powered while downloading the data. In most instances the log file can be downloaded within the normal ECU shut down period. However, for very large files it might be necessary to manually power up the ECU. See the relevant [Power Control Strategy](#) section for more information.

1. Connect the ECU to the PC. See [Connecting the ECU to a PC](#).
2. Open ECU Manager software.
3. On the **Utilities** menu, click **Get Logged Data**.
4. Click **Yes** to confirm you would like to clear the logging memory.
5. Click **OK** when prompted for vehicle details.
6. The next screen contains three tabs: **Events**, **Venue** and **Vehicle**. The details on the events tab are essential; the other two tabs are optional.

Tip: It is good practice to fill in all relevant details as this will be your reference to the circumstances under which this file was recorded when you refer to this file in the future,

7. Enter a **Vehicle ID** to identify your PWC.

Important:

There are two files created; one with extension `.ldx` and one with extension `.ld`. The `.ldx` file is smaller than 1 KB (<1000 B), while the `.ld` file is much larger. If you would like somebody else to look at your log file, please make sure you provide the `.ld` file.

The default location for the files is C:MoTeC/Logged Data.

Tip: The log files are named using a time stamp. When selecting the log files using `i2` (see next section), all details you have entered will be listed. This is often the easiest way to select the required file.

To select the log file - using i2

Ensure you have **i2** data analysis software installed.

1. Open **i2** Data analysis software and open a **Circuit** project.
2. Double click on the file you would like to view.
All details you entered when downloading the logged data will be listed in the middle window.

Tip: To get started with using **i2** to analyse your own logged data, there are extensive help files included in the software. You can also download seminar notes on the use of **i2** from the MoTeC website. See [How to Get More Information.](#)

To send a log file by email

1. On the **File** menu, click **Open Log File**.
2. Right click on the file you would like to send.
Note: This file must be open, indicated with a green tick on the file icon.
3. Click **Copy**, open your email recipient (e.g. MS Outlook) and paste the file into the email
- OR -
Click **Send To** and then click **Mail Recipient**.

Change the Logging Settings

The provided logging configuration in the Base Map will provide 5 to 15 minutes of logging. If you would like to increase this time, you need to reduce the number of channels logged, or reduce the logging rate for the logged channels.

To change the logging configuration

See the relevant Power Control Strategy section to ensure the M400 Marine ECU stays powered while downloading the data.

1. Connect the ECU to the PC. See [Connecting the ECU to a PC.](#)
2. Open ECU Manager software.
3. On the **File** menu, click **Save As** and choose a new file name.
This will save the changes you are going to make in a new file and prevent accidentally overwriting the standard Base Map.

Tip: It is good practice to add an incrementing number to the file name to keep track of the files you are creating.

4. On the **File** menu, click **Edit Comments**.
Tip: Filling in comments will help to identify the file when you refer to it in the future.

5. On the **Adjust** menu, click **Data Logging Setup**.
6. Click **Engine Sensors** and select the sensor you would like to change.
7. To include the sensor in the logging, enter a value for the **Samples per Second** at which you would like to log this sensor
- OR -
To exclude the sensor from the logging, enter **0** for the **Samples per Second**.
As you are changing the settings a new logging time will be calculated. This is shown in the bar under the logging parameters.
8. Press **N** to browse through all the pages with the other available logging settings until finished.
A maximum of 64 items can be selected for logging.
9. On the **File** menu, click **Save**.
10. On the **File** menu, click **Send File to ECU**.

Tips:

- While changing the logging settings, actual logging will be disabled until you disconnect the ECU from the PC. To guarantee that logging will resume MoTeC suggests that after you have finalised your logging settings in ECU Manager you select another table, for example a fuel or spark map. For a quick way to do this, press **F5** to display the fuel map.
- Ensure that a maximum of 64 channels are selected for logging. If more channels are selected, only the first 64 selected channels are logged.

Options to Expand the System

GPS

The M400 Marine ECU can receive GPS data via RS232 communication, which allows wiring MoTeC's 5 Hz GPS-G1 (#41300) direct into the ECU's existing RS232 receive port. This GPS feature is an extremely useful addition for PWCs because conventional speed detection methods are inaccurate.

The following GPS based channels are available: Speed, Time, Longitude, Latitude, Altitude, Satellites, Quality, HDOP (Range Error).

For wiring information see the relevant calibration notes in the appendices.

To configure the GPS in ECU Manager software

1. On the **Adjust** menu, click **General Setup**.
2. Click **Communications** and then **RS232 Telemetry Setup**.
3. Enter Telemetry Baud Rate **19201**.
4. Enter Telemetry Data Set **0** to turn the dataset **Off**.

Upgrades

The M400 Marine ECU comes with a range of features as standard and several options available as upgrades to customise and grow your system. These additional features are activated through a simple password acquired from your MoTeC dealer, at any time when you need it.

Data Logging

To take full advantage of the possibilities of the system, data logging can provide you with valuable knowledge about the performance and reliability of the engine and craft.

The PWC Plug-In ECU systems have the data logging option enabled for a free evaluation period of the first 8 hours of engine running time. After this, the Data Logging Upgrade is required which allows recording of all ECU data to the 500 kB internal logging memory.

Wideband Lambda

Additional tuning of all PWC Plug-In ECU installations is best performed with a Lambda sensor.

The PWC Plug-In ECU systems have the Lambda option enabled for a free evaluation period of the first 8 hours of engine running time. After this, the

Lambda Upgrade is required which allows the use of a single on-board wideband Lambda controller for NTK UEGO or Bosch LSU sensors.

PWC exhaust systems use a cooling water jacket to surround the exhaust manifold and some of the exhaust muffler and associated tubing. The exhaust gases pass through a water canister which can charge the exhaust manifold with water vapour. This water vapour can drastically shorten the life-span of Lambda sensors, sometimes to less than one hour.

Important: We do not advise the fitting of Lambda sensors unless you are prepared to replace them frequently.

For wiring information see the relevant Pin List in the appendices.

Suitable mounting positions for Lambda sensors are shown in the appendix *Lambda Sensor Installation*.

Pro Analysis

This upgrade provides access to advanced ***i2 Pro*** data analysis software with multiple graph overlays, X-Y plots, advanced maths functions, synchronised video (manual alignment), and flexible layouts to accommodate virtually any user preference. Requires the Data Logging upgrade.

You can try the ***i2 Pro*** software by downloading it from the website www.motec.com.au and use the included demo file.

Appendices

Specifications

Outputs

- 4 x Injector outputs—high or low ohm
- 4 x Ignition outputs
- 8 x Auxiliary outputs—for functions such as camshaft control, drive by wire throttle, boost control, nitrous injection, idle speed stepper motor and many more.

Inputs

- 8 x Analogue voltage inputs—fully configurable including custom calibrations, e.g. to use for:
 - jet outlet pressure
 - jet intake pressure
 - steering position
 - lateral G force
- 6 x Analogue temperature inputs— fully configurable including custom calibrations, e.g. to use for:
 - multiple configuration maps
 - extra air temperature
 - extra water temperatures
 - exhaust temperature
- 1 x Wideband Lambda input—for Lambda measurement and control.
- 4 x Digital/speed inputs—for use with OEM factory speed paddle wheel and function activation e.g. launch control, anti lag and dual RPM limit.

Communications

- 1 x CAN
- 1 x RS232— e.g. to use with GPS
The 5 Hz MoTeC *GPS-G1* can be wired direct to the M400 Marine ECU for logging of accurate speed and position.

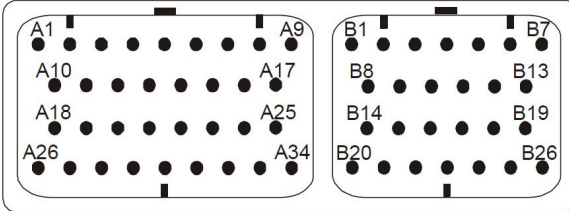
Physical

- Case size 147 x 105 x 40 mm
- Weight 900 gram
- 1 x 34 pin and 1 x 26 pin waterproof connector with gold plated contacts.

Yamaha

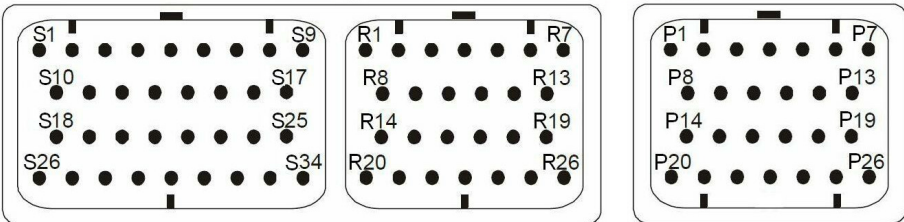
Connectors

M400 Marine ECU Connector



Looking into the connector on the ECU

Yamaha Factory Connector



Looking into the connector on the ECU

Note: Do not refer to the pin numbers moulded into the back of the Yamaha connectors as some of the numbers are repeated on each connector.

📌 Pin List by Function

M400 Pin		Yamaha Pin	Function
Power			
VBAT	A26	R1, R13, R19, P7, P21, K6	12 V Switched (ECU Relay) <i>Optional: Lambda Heater Supply</i>
GND	A10	S10, S15, S18, R20	ECU Earth
GND	A11	S10, S15, S18, R20	ECU Earth
8V ENG	A12	not used	<i>Optional: 8 V to SKM Module</i>
5V ENG	A02	R18, R23, R24	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V ENG	B16	R14, R15, R8, R9	0 V Sensor Supply
8V AUX	A13	C3	8 V to CAN Connector
5V AUX	A09	P25, P26, B11 via 4K7	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V AUX	B15	not used	<i>Optional: Lambda Sensor or GPS Ground</i>
0V COMM	B14	C1, K1	0 V for CAN and KTC devices
Output			
Inj1	A19	S6	Injector Cylinder 1
Inj2	A20	S7	Injector Cylinder 2
Inj3	A21	S31	Injector Cylinder 4
Inj4	A22	S32	Injector Cylinder 3
Inj5	A27	not used	Not Available in M400
Inj6	A28	not used	Not Available in M400
Inj7	A29	not used	Not Available in M400, M600
Inj8	A30	not used	Not Available in M400, M600 <i>Optional: Available for Knock Module SKM - Knock Window</i>
Ign1	A03	S33	Ignition Cylinder 1
Ign2	A04	S34	Ignition Cylinder 2

M400 Pin		Yamaha Pin	Function
Ign3	A05	S8	Ignition Cylinder 4
Ign4	A06	S9	Ignition Cylinder 3
Ign5	A07	not used	Not Available in M400
Ign6	A08	not used	Not Available in M400
Aux1 ¹	A18	R26	Drive By Wire Motor -
Aux2 ¹	A01	S26	Drive By Wire Motor +
Aux3 ¹	A23	S29	Fuel Pump Relay
Aux4 ¹	A24	P20	ECU Relay External Power-up Wire
Aux5	A31	not used	<i>Optional: Lambda Sensor Heater Control</i>
Aux6 ¹	A32	S28	ETV Relay
Aux7	A33	not used	
Aux8 ¹	A34		Not an output – table is used for Oil Pressure Dashboard Alarm indication.
Inputs			
Ref	B01	P8	Ref Sensor (Magnetic)
Sync	B02	P3	Sync Sensor (Hall)
AT1 ²	B03	P15	Air Temperature
AT2 ²	B04	P23	Engine Temperature
AT3 ^{2,5}	B05	P13	Muffler Water Temperature
AT4 ²	B06	S27	Oil Pressure Switch
AT5 ²	B07	S12	Engine Temperature Switch
AT6 ^{3,5}	B19	P18	Reverse Switch
AV1	A14	R16	Throttle Position
AV2	A15	R17	Throttle Position 2
AV3	A16	R10	Throttle Position Driver 2
AV4	A17	R11	Throttle Position Driver
AV5 ⁵	A25	P17	Steering Lock Pressure Sensor

M400 Pin		Yamaha Pin	Function
AV6 ²	B20	P16	Manifold Pressure Sensor
AV7 ⁵	B21	P19	Handlebar Switch
AV8 ⁵	B22	S11	Handlebar Switch
DIG1	B08		Speed ⁴
DIG2 ⁵	B09	S2	Handlebar Switch
DIG3 ¹	B10	S20	Ignition Switch
DIG4	B11	P5, A9 via 4K7	Tip over Switch
La1S	B25	not used	<i>Optional: Available for Lambda Sensor</i>
La1P	B26	not used	<i>Optional: Available for Lambda Sensor</i>
La2S	B12	not used	<i>Optional: Available for Knock Module SKM - Knock Signal</i>
La2P	B13	not used	
Communications			
RS232-TX	B17	P24	Handlebar Switch
RS232-RX	B18	not used	<i>Optional: Available for GPS Receive Data ⁴</i>
CAN-LO	B24	C4, K4	CAN line to KTC dash adaptor
CAN-HI	B23	C5, K5	CAN line to KTC dash adaptor
0V COMM	B14	C1, K1	0 V for CAN and KTC devices
Additional Yamaha Loom Pins			
Unused		S01, S03, S04, S05, S13, S14, S16, S17, S19, S21, S22, S23, S24, S25, S30	
Unused		R02, R03, R04, R05, R06, R07, R12, R22, R25	

M400 Pin		Yamaha Pin	Function
Unused		P02, P04, P06, P09, P10, P11, P12, P14, P22	
K-Line (K2)		R21	K-Line to KTC adaptor pin K2
Knock		P1	<i>Optionally: Available for Knock Module SKM - Knock Input</i>

1 – 5: See Calibration and Wiring Notes

Calibration and Wiring Notes

Note 1 – Calibration Functions

The following pins are calibrated in the Base Maps with the function and parameters as mentioned in the table.

M400 Pin		Yamaha Pin	Function	Parameters
Aux1	A18	R26	5: Drive by wire	
Aux2	A01	S26	0: Off	
Aux3	A23	S29	101: Fuel Pump	Delay 2.0 Polarity 0 Output Mode 0
Aux4 Aux6	A24 A32	P20 S28	3: Aux Table	PWM/Switched 1 Output Mode 0 Polarity 0 Frequency 10 Minimum Duty Cycle 0 Maximum Duty Cycle 100 Hysteresis 0
Aux8	A34		3: Aux Table	PWM/Switched 0 Output Mode 0 Polarity 0 Frequency 10 Minimum Duty Cycle 0 Maximum Duty Cycle 100 Hysteresis 0
DIG3	B10	S20	8: Ignition Switch	Logic Polarity 1 Delay 0.0 Latch 0

Note 2 – Calibration Tables

For the following pins the calibration table is available in the provided Base Maps.

M400 Pin		Yamaha Pin	Function
AT1	B03	P15	Air Temperature
AT2	B04	P23	Engine Temperature
AT3	B05	P13	Muffler Water Temperature
AT4	B06	S27	Oil Pressure Switch
AT5	B07	S12	Engine Temperature Switch
AV6	B20	P16	Manifold Pressure Sensor

Note 3 - AT6 Reverse Switch and Dual RPM Limit

The Yamaha Base Maps include a Rev Limiting function which is activated when the Reverse Switch is engaged on the craft. If this switch malfunctions, or if the switch is not installed, the Dual RPM limit of 4000 rpm may be permanently engaged.

If your ski appears to limit revs at 4000 rpm, first check the wiring and fitment of the Reverse Switch and then check the operation.

The Reverse Switch is wired via harness connector P18 to pin B19 on the M400 Marine ECU.

In ECU Manager software, this appears in Digital Input Functions as Sw In 6 (AT6).

To check the Reverse Switch operation

1. On the **View** menu, click **Raw Input Values**.
2. Click the **AT** tab and check the AT6 value.
For normal operation (non-reverse), AT6 should be approximately 0.03 volts. When the reverse switch is engaged, AT6 should be approximately 4.95 volts.
If this is not the case, you can disable the Dual RPM Limit function from the Base Map.

To disable the Dual RPM Limit

1. On the **Adjust** menu, click **Digital Input Functions**.
2. Click **Sw In 6 (AT6) - Dual RPM** and then click **Function**.
3. Enter **0** (zero).
4. Press **R** to restart the ECU, or power cycle the ECU.

Note 4 - Speed

The PWC speed sensor is wired directly to the dashboard. To acquire this information, a separate wire is required from the factory harness to M400 Marine ECU pin Dig1 (B8). The supplied Base Map includes a speed calibration which can be enabled if this sensor is wired.

For more accurate speed measurements, MoTeC recommends the use of a GPS system.

MoTeC's 5 Hz GPS-G1 (#41300) can be wired directly into the ECU's RS232 receive port.

GPS wiring

M400 Pin		GPS Pin	Function
0V AUX	B15	1	Bat –
RS232-RX	B18	2	RS232 GPS Data
	N/C	3	
5V AUX 5V ENG	A09 A02	4	5 V

Note 5 – Available Wiring

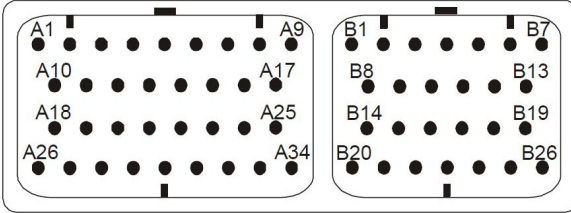
These pins are wired into the adaptor loom, but are not essential for PWC operation. These wires can be allocated to other functions as required.

M400 Pin		Yamaha Pin
AT6	B19	P18
AV5	A25	P17
AV7	B21	P19
AV8	B22	S11
DIG2	B09	S2

Kawasaki

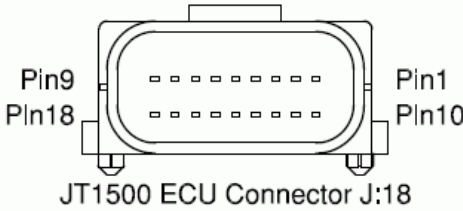
K Connectors

M400 Marine ECU Connector

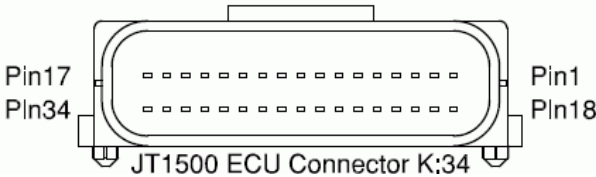


Looking into the connector on the ECU

Kawasaki Factory Connector



JT1500 ECU Connector J:18



JT1500 ECU Connector K:34

Looking at front of the connectors

Pin List by Function

M400 Pin		Kawasaki Pin	Function
Power			
VBAT	A26	K17,D06	12 V Switched (System Relay) <i>Optional: Lambda heater supply</i>
GND	A10	J05,C04	ECU Earth
GND	A11	J14,F01	ECU Earth
8V ENG	A12	not used	<i>Optional: 8 V to SKM Module</i>
5V ENG	A02	K09,F08	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V ENG	B16	K05,K15,K32	0 V Sensor Supply
8V AUX	A13	E03	8 V to CAN Connector
5V AUX	A09	not used	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V AUX	B15	not used	<i>Optional: Lambda Sensor or GPS Ground</i>
0V COMM	B14	D01,E01	0 V for CAN and KTC devices
Outputs			
Inj1	A19	J08	Injector Cylinder 1
Inj2	A20	J17	Injector Cylinder 2
Inj3	A21	J13	Injector Cylinder 4
Inj4	A22	J04	Injector Cylinder 3
Inj5	A27	not used	Not Available in M400
Inj6	A28	not used	Not Available in M400
Inj7	A29	not used	Not Available in M400,M600
Inj8	A30	not used	Not Available in M400,M600 <i>Optional: Available for Knock Module SKM - Knock Window</i>
Ign1	A03	C07	Coil 1 Trigger to BIM200 Module
Ign2	A04	C02	Coil 2 Trigger to BIM200 Module
Ign3	A05	not used	
Ign4	A06	not used	

M400 Pin		Kawasaki Pin	Function
Ign5	A07	not used	Not Available in M400
Ign6	A08	not used	Not Available in M400
Aux1 ¹	A18	not used	<i>Optional: Lambda Sensor Heater Control</i>
Aux2 ¹	A01	J06	Main (ECU) Relay
Aux3 ¹	A23	F04	System Relay via KPE Device
Aux4 ¹	A24	J15	Fuel Pump Relay
Aux5 ¹	A31	K01	Idle Stepper Motor
Aux6 ¹	A32	K18	used for Idle Stepper Motor
Aux7 ¹	A33	K02	used for Idle Stepper Motor
Aux8 ¹	A34	K19	used for Idle Stepper Motor
Inputs			
Ref	B01	K22	Ref Sensor (Magnetic)
Sync	B02	K07	Sync Sensor (Hall)
AT1 ²	B03	K28	Air Temperature
AT2 ¹	B04	K20	Engine Stop Button
AT3 ²	B05	K03	Oil Pressure Switch
AT4	B06	not used	
AT5	B07	not used	
AT6	B19	not used	
AV1	A14	K30	Throttle Position
AV2 ²	A15	K23	Manifold Pressure Sensor
AV3 ²	A16	K11,F07	Engine Temperature
AV4 ²	A17	K13,F06	Oil Temperature
AV5 ²	A25	K08,F05	Intercooler Water Temperature
AV6	B20	not used	
AV7	B21	not used	
AV8	B22	not used	
DIG1	B08	K26	Tip over Switch
DIG2	B09	K21	Steering Lock Switch

M400 Pin		Kawasaki Pin	Function
DIG3	B10	not used	
DIG4	B11	not used	
La1S	B25	not used	<i>Optional: Available for Lambda Sensor</i>
La1P	B26	not used	<i>Optional: Available for Lambda Sensor</i>
La2S	B12	not used	<i>Optional: Available for Knock Module SKM - Knock Signal</i>
La2P	B13	not used	
Communications			
RS232-TX	B17	not used	
RS232-RX	B18	not used	<i>Optional: Available for GPS Receive Data³</i>
CAN-LO	B24	D04,E04	CAN line to KTC dash adaptor
CAN-HI	B23	D05,E05	CAN line to KTC dash adaptor
0V COMM	B14	D01,E01	0 V for CAN and KTC devices
Additional Kawasaki Loom Pins			
Unused		J01,J03,J07,J10,J12,J18	
Unused		K04,K06,K10,K12,K14,K16,K24,K25,K27,K31,K33,K34	
		J09	BIM200 Module drive for Coil 1 C06
		J16	BIM200 Module drive for Coil 2 C01
		J02	System Relay Drive from KPE F03
		J11	Key trigger to KPE F02
K-Line	K2	K29	K-Line to KTC adaptor pin D02

1-3: See Calibration and Wiring Notes

▣ Calibration and Wiring Notes

▣ Note 1 – Calibration Functions

The following pins are calibrated in the Base Maps with the function and parameters as mentioned in the table.

M400 Pin		Kawasaki Pin	Function	Parameters
Aux1	A18	not used	9: Lambda Heater	
Aux2	A01	J06	118: Power Hold	On Time 20 Polarity 0 Output Mode 0
Aux3	A23	F04	118: Power Hold	On Time 15 Polarity 0 Output Mode 0
Aux4	A24	J15	101: Fuel Pump	Delay 2.0 Polarity 0 Output Mode 0
Aux5	A31	K01	8: Idle Stepper	Max Step Rate 200 Polarity 0
Aux6	A32	K18	0: Off	
Aux7	A33	K02	0: Off	
Aux8	A34	K19	0: Off	
AT2	B04	K20	4: Dual RPM limit	Logic Polarity 0 Low RPM Limit 100 RPM Rise Rate 0 Ignition Retard 30
DIG1	B08	K26	29: Monitor	

📌 Note 2 – Calibration Tables

For the following pins the calibration table is available in the provided Base Maps.

M400 Pin		Kawasaki Pin	Function
AT1	B03	K28	Air Temperature
AT3	B05	K03	Oil Pressure Switch
AV2	A15	K23	Manifold Pressure Sensor
AV3	A16	K11, F07	Engine Temperature
AV4	A17	K13, F06	Oil Temperature
AV5	A25	K08, F05	Intercooler Water Temperature

📌 Note 3 – Speed

For accurate speed measurements, MoTeC recommends the use of a GPS system.

MoTeC's 5 Hz GPS-G1 (#41300) can be wired directly into the ECU's RS232 receive port.

GPS wiring

M400 Pin		GPS Pin	Function
0V AUX	B15	1	Bat –
RS232-RX	B18	2	RS232 GPS Data
	N/C	3	
5V AUX 5V ENG	A09 A02	4	5 V

Output Test Function

To test if all outputs are correctly wired to the relevant injectors and coils, the ECU Manager software has an output test function available (on the **Utilities** menu, click **Test Outputs**).

If you would like to use this function in a Kawasaki installation, three relay control pins must be physically grounded, by removing them from the M400 ECU plugs and jumping to ground.

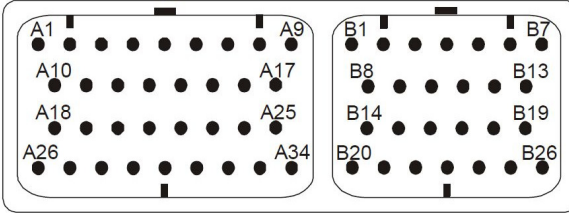
1. Unplug the M400 ECU connectors.
2. Press the single white tab on the underside of the plug until it clicks to unlock the pin locking plate from Connector A (white plastic inserts in the plug),
3. Extract pins A01 (white 18AWG), A23 (orange 20AWG), and A24 (yellow 20AWG) from the rear of the connector using firm pressure.
4. Press the dual white tabs on the top side of the plug until it clicks to lock the pin locking plate,
5. Re-insert the ECU plugs into the M400.
6. When ready to power up the ECU and test the outputs, jumper all three wires to ground.

Once testing is completed, reverse the above procedure to re-insert the three wires into the M400 connector.

Sea-Doo 2004-2009

Connectors

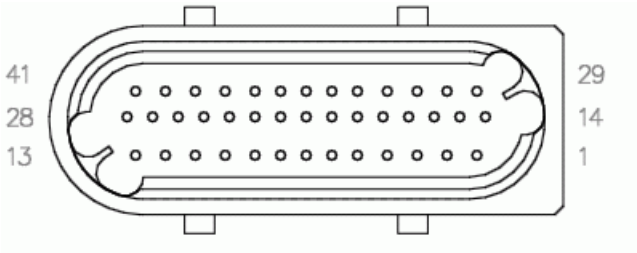
M400 Marine ECU Connector



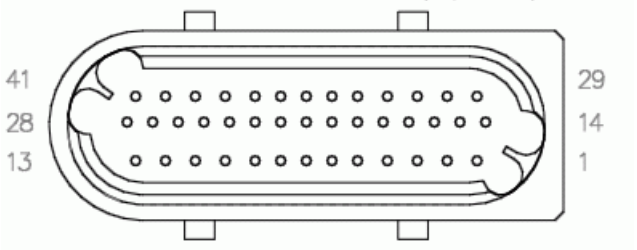
Looking into the connector on the ECU

Sea-Doo Factory Connectors

RXP/ RXPX/ RXT A Connector (top view)



RXP/ RXPX/ RXT B Connector (top view)



Looking into the plugs on the adapter loom

🔌 Pin List by Function

M400 Pin		Sea-Doo Pin	Function
Power			
VBAT	A26	B11,F06,K01	12 V Switched (System Relay) <i>Optional: Lambda Heater Supply</i>
GND	A10	B1,B2,B20,B32, C05	ECU Earth
GND	A11	B22,B35,B39,B 41	ECU Earth
8V ENG	A12	not used	<i>Optional: 8 V to SKM Module</i>
5V ENG	A02	A39,A40	5 V Sensor Supply <i>Optional: GPS Power</i>
0V ENG	B16	A19, A20, A21, A23, A25, A26, A27, A28, K12	0 V Sensor Supply
8V AUX	A13	E03	8 V to CAN Connector
5V AUX	A09	not used	5 V Sensor Supply <i>Optional: GPS Power</i>
0V AUX	B15	not used	<i>Optional: Lambda Sensor or GPS Ground</i>
0V COMM	B14	E01,F01	0 V for CAN and STC devices
Outputs			
Inj1	A19	A15	Injector Cylinder 1
Inj2	A20	A33	Injector Cylinder 2
Inj3	A21	A14	Injector Cylinder 3
Inj4	A22	not used	
Inj5	A27	not used	Not Available in M400
Inj6	A28	not used	Not Available in M400
Inj7	A29	not used	Not Available in M400, M600

M400 Pin		Sea-Doo Pin	Function
Inj8	A30	not used	Not Available in M400, M600. <i>Optional: Available for Knock Module SKM - Knock Window</i>
Ign1	A03	D01	Coil 1 Trigger to IGN4 Module
Ign2	A04	D02	Coil 2 Trigger to IGN4 Module
Ign3	A05	D03	Coil 3 Trigger to IGN4 Module
Ign4	A06	not used	
Ign5	A07	not used	Not Available in M400
Ign6	A08	not used	Not Available in M400
Aux1 ¹	A18	not used	<i>Optional: Lambda Sensor Heater Control</i>
Aux2 ¹	A01	B29	Fuel Pump
Aux3 ¹	A23	A13,B18	Oil Shutoff Valve (2004) , not used (2006), Buzzer (2007)
Aux4 ¹	A24	B31	Starter Solenoid
Aux5 ¹	A31	A36	Idle Stepper Motor
Aux6 ¹	A32	A35	used for Idle Stepper Motor
Aux7 ¹	A33	A38	used for Idle Stepper Motor
Aux8 ¹	A34	A37	used for Idle Stepper Motor
Inputs			
Ref	B01	A05	Ref Sensor (Magnetic)
Sync	B02	A34	Sync Sensor (Hall)
AT1 ²	B03	A07	Air Temperature
AT2 ²	B04	A11	Engine Temperature
AT3 ²	B05	A10	Exhaust Water Temp Sensor
AT4 ²	B06	B34,A31	Crankcase Pressure Switch (2004), not used (2006), VTS Trim Level (2007)
AT5 ²	B07	A06	Oil Pressure Switch

M400 Pin		Sea-Doo Pin	Function
AT6 ¹	B19	B19	Start/Stop Button
AV1 ²	A14	A24	Throttle Position
AV2 ²	A15	A12	Manifold Pressure Sensor
AV3 ²	A16	B08,K06	External Water Temperature (2007)
AV4 ²	A17	B13	Fuel Tank Level (2007)
AV5	A25	not used	
AV6	B20	not used	
AV7	B21	not used	
AV8	B22	not used	
DIG1 ¹	B08	K08	Speed via DMCF Device K08
DIG2 ¹	B09	B09	Tip over Switch
DIG3 ¹	B10	B07,B30	VTS Trim Up Button (2007)
DIG4 ¹	B11	B23,B33	VTS Trim Down Button (2007)
La1S	B25	not used	<i>Optional: Available for Lambda Sensor</i>
La1P	B26	not used	<i>Optional: Available for Lambda Sensor</i>
La2S	B12	not used	<i>Optional: Available for Knock Module SKM - Knock Signal</i>
La2P	B13	not used	
Communications			
RS232-TX	B17	F03	Serial line to STC dash adaptor F03
RS232-RX	B18	not used	<i>Optional: Available for GPS Receive Data</i>
CAN-LO	B24	E04	Used only for CAN Comms to PC @1000 kbit/s
CAN-HI	B23	E05	Used only for CAN Comms to PC @1000 kbit/s
0V COMM	B14	E01,F01	0 V for CAN and STC devices

M400 Pin	Sea-Doo Pin	Function
Additional Sea-Doo Loom Pins		
Unused	A02, A03, A04, A08, A16, A17, A18, A22, A30, A32	
Unused	B03, B04, B05, B10, B12, B14, B15, B16, B21, B25, B36, B37, B40	
Coil 2	A01	Coil2 Drive from IGN4 Module C02
Coil 3	A29	Coil3 Drive from IGN4 Module C03
Coil 1	A41	Coil1 Drive from IGN4 Module C01
Knock Sensor	A09	<i>Optional: Knock Sensor signal to SKM Knock Module</i>
Water Speed	B06	Water Speed Signal to DMCF K05 (2007)
ECU Power Relay	B17	Relay Drive - not used as Lanyard controls ECU power
Lanyard	B26	Lanyard Sense - not used as Lanyard controls ECU power
Dash CAN Hi	B27	STC CAN to Dash @250 kbit/s F04
Dash CAN Lo	B28	STC CAN to Dash @250 kbit/s F05
DESS Immo	B38	DESS Comms - not used
K-Line	B24	K-Line - not used

1-3: See Calibration and Wiring Notes

🔧 Calibration and Wiring Notes

🔧 Note 1 – Calibration Functions

The following pins are calibrated in the Base Maps with the function and parameters as mentioned in the table.

M400 Pin		Sea-Doo Pin	Function	Parameters
Aux1	A18	not used	9: Lambda Heater	
Aux2	A01	B29	101: Fuel Pump	Delay 3.0 Polarity 0 Output Mode 0
Aux3	A23	A13,B18	(2004) 3: Aux Table	PWM/Switched 0 Output Mode 0 Polarity 0 Frequency 200 Minimum Duty Cycle 0 Maximum Duty Cycle 100 Hysteresis 0
Aux3	A23	A13,B18	(2006) 0: Off	
Aux3	A23	A13,B18	(2007) 107: Driver Warning	Hold Time 0 Delay to On Time 0.0 Include Diag Errors 0 Logic Polarity 0 Output Mode 0 Power Hold 0 On Alert 1
Aux4	A24	B31	115: Status	Selection 40 Logic Polarity 0 Output Mode 0 Flash 0 Flash Rate 0.0
Aux5	A31	A36	8: Idle Stepper	Max Step Rate 200 Polarity 0
Aux6	A32	A35	0: Off	
Aux7	A33	A38	0: Off	

M400 Pin		Sea-Doo Pin	Function	Parameters
Aux8	A34	A37	0: Off	
AT6	B19	B19	31: Start/Stop Switch	Polarity 1
DIG1	B08	K08	1: Speed Measure	Measurement Type 3 Calibration 1116 Active Edge 0 Noise Window 0 Noise Increment 0 Noise Limit 0
DIG2	B09	B09	8: Ignition Switch	Logic Polarity 0 Delay 1.0 Latch 0
DIG3	B10	B07,B30	29: Monitor	Polarity 0
DIG4	B11	B23,B33	29: Monitor	Polarity 0

Note 2 – Calibration Tables

For the following pins the calibration table is available in the provided Base Maps.

M400 Pin		Sea-Doo Pin	Function
AT1	B03	A07	Air Temperature
AT2	B04	A11	Engine Temperature
AT3	B05	A10	Exhaust Water Temp Sensor
AT4	B06	B34,A31	(2004) Crankcase Pressure Switch (2007) VTS Trim Level
AT5	B07	A06	Oil Pressure Switch
AV1	A14	A24	Throttle Position
AV2	A15	A12	Manifold Pressure Sensor
AV3	A16	B08,K06	(2007) External Water Temperature
AV4	A17	B13	(2007) Fuel Tank Level

Note 3 – Speed

For accurate speed measurements, MoTeC recommends the use of a GPS system.

MoTeC's 5 Hz GPS-G1 (#41300) can be wired directly into the ECU's RS232 receive port.

GPS wiring

M400 Pin		GPS Pin	Function
0V AUX	B15	1	Bat –
RS232-RX	B18	2	RS232 GPS Data
	N/C	3	
5V AUX 5V ENG	A09 A02	4	5 V

GPS Speed Display on dashes.

Late model Sea-Doo crafts (2007+) transmit the Water Speed from the M400 ECU to the dash (Custom Dataset 1, Item 4).

With a GPS Receiver connected, this dash display can be reconfigured as a GPS Speed display.

To setup the display for GPS Speed

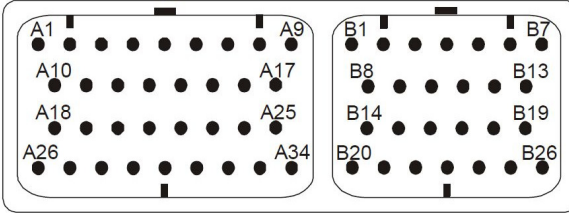
1. On the **Adjust** menu, click **General Setup**
2. Click **Communications** and then click **Setup Custom Data Sets**.
3. Select **Item 4 – Left Ground Speed (LG Spd)** and then click **Change**.
4. Select the **Show Non-Sensor Channels** check box.
5. Enter **GPS Speed** in the Search Text box and click **OK**.
6. Click **OK** to leave the Custom Data Set screen.
7. Save the altered configuration with a new name.

Note: Sea-Doo dashboards show a maximum speed of 70 MPH or 113 km/h. This limitation is unaltered with the installation of the Sea-Doo Adaptor Loom.

Sea-Doo 2010

Connectors

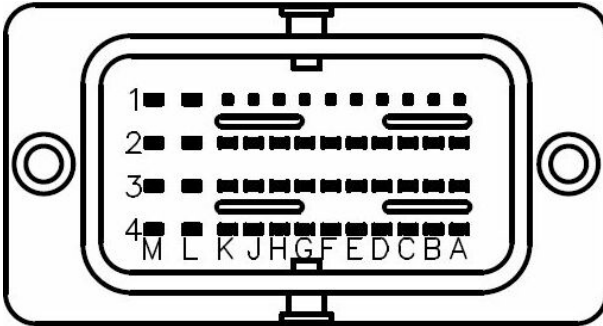
M400 Marine ECU Connector



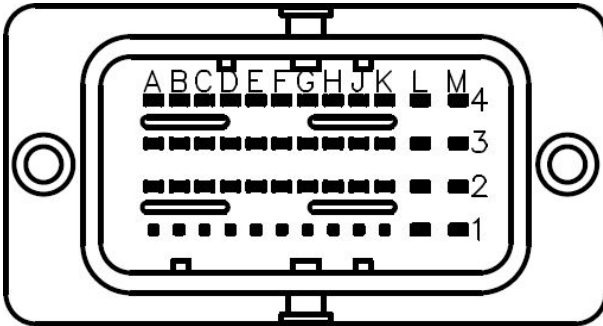
Looking into the connector on the ECU

Sea-Doo Factory Connectors

RXTX 2010 A Connector (top view)



RXTX 2010 B Connector (top view)



Looking into the plugs on the adapter loom

🔌 Pin List by Function

M400 Pin		Sea-Doo Pin	Function
Power			
VBAT	A26	B-M4, S06, L05	12 V Switched (System Relay) Lambda Heater Supply
GND	A10	B-F2, B-L1, B-M2, C05	ECU Earth, IGN4 Earth
GND	A11	B-M3, R85,R87	ECU Earth, Fuel Pump Relay Earth
8V ENG	A12	not used	<i>Optional: 8 V to SKM Module</i>
5V ENG	A02	A-K4, A-B4, B-J3, B-K1	5 V Sensor Supply <i>Optional: GPS Power</i>
0V ENG	B16	B-K3, B-H3, B-B3, A-A2, A-C4, A-D4, A-H2, A-J2, A-K2, A-J3, A-J4	0 V Sensor Supply
8V AUX	A13	E03	8 V to CAN Connector
5V AUX	A09	A-F4	5 V Sensor Supply
0V AUX	B15	L01	Lambda Sensor Ground
0V COMM	B14	A-G2, E01,S01	0 V for CAN and STC devices
Outputs			
Inj1	A19	A-B3	Injector Cylinder 1
Inj2	A20	A-K1	Injector Cylinder 2
Inj3	A21	A-J1	Injector Cylinder 3
Inj4	A22	not used	
Inj5	A27	not used	Not Available in M400
Inj6	A28	not used	Not Available in M400
Inj7	A29	not used	Not Available in M400, M600
Inj8	A30	not used	Not Available in M400, M600. <i>Optional: Available for Knock Module SKM - Knock Window</i>

M400 Pin		Sea-Doo Pin	Function
Ign1	A03	D03	Coil 1 Trigger to IGN4 Module
Ign2	A04	D02	Coil 2 Trigger to IGN4 Module
Ign3	A05	D01	Coil 3 Trigger to IGN4 Module
Ign4	A06	not used	
Ign5	A07	not used	Not Available in M400
Ign6	A08	not used	Not Available in M400
Aux1 ¹	A18	A-L2	Throttle Motor (-)
Aux2 ¹	A01	A-L1	Throttle Motor (+)
Aux3	A23	B-E4, B-H2	System Relay Drive
Aux4 ¹	A24	B-L4	Starter Solenoid
Aux5 ¹	A31	L04	Lambda Heater Control
Aux6 ¹	A32	R86	Fuel Pump Relay
Aux7	A33	not used	
Aux8	A34	not used	
Inputs			
Ref	B01	A-H1	Ref Sensor (Magnetic)
Sync	B02	A-E2	Sync Sensor (Hall)
AT1 ²	B03	A-H3	Air Temperature
AT2 ²	B04	A-A1	Engine Temperature
AT3 ²	B05	A-H4	Exhaust Water Temp Sensor
AT4	B06	Not used	
AT5 ²	B07	A-E3	Oil Pressure Switch
AT6 ¹	B19	B-D1	Start/Stop Button
AV1 ²	A14	A-F3	Throttle Position
AV2 ²	A15	A-G4	Manifold Pressure Sensor
AV3 ²	A16	A-K3	Throttle Position 2
AV4 ²	A17	B-A3	Throttle Lever
AV5	A25	B-E1	Throttle Lever 2

M400 Pin		Sea-Doo Pin	Function
AV6	B20	not used	
AV7	B21	not used	
AV8	B22	not used	
DIG1 ¹	B08	not used	
DIG2 ¹	B09	A-G1	Tip over Switch
DIG3 ¹	B10	not used	
DIG4 ¹	B11	B-H1	OTAS Switch
La1S	B25	L02	Lambda Sensor Sense Voltage
La1P	B26	L08	Lambda Sensor Pump Current
La2S	B12	not used	<i>Optional: Available for Knock Module SKM - Knock Signal</i>
La2P	B13	not used	
Communications			
RS232-TX	B17	not used	
RS232-RX	B18	not used	<i>Optional: Available for GPS Receive Data</i>
CAN-LO	B24	E04, S04, B-C2	CAN Comms @500 kbit/s
CAN-HI	B23	E05, S05, B-C1	CAN Comms @500 kbit/s
0V COMM	B14	A-G2, E01,S01	0 V for CAN and STC devices

Additional Sea-Doo Loom Pins			
Unused			A-A3,A-A4,A-B1,A-B2,A-C1,A-C2,A-D1,A-D2,A-D3,A-E1,A-E4,A-F1,A-F2,A-G3,A-L3,A-L4,A-M3
Unused			B-A1,B-A4,B-B1,B-B4,B-C3,B-C4,B-D2,B-D3,B-D4,B-E2,B-E3,B-F1,B-F3,B-F4,B-G1,B-G2,B-G3,B-G4,B-H4,B-J1,B-J2,B-J4,B-K2,B-K4,B-L2,B-L3
Coil 1		A-M4	Coil1 Drive from IGN4 Module C03
Coil 2		A-M2	Coil2 Drive from IGN4 Module C02

M400 Pin		Sea-Doo Pin	Function
Coil 3		A-M1	Coil3 Drive from IGN4 Module C01
Knock Sensor		A-C3	<i>Optional: Knock Sensor signal to SKM Knock Module</i>
Fuel Pump Relay		B-M1	Output of Fuel Pump Relay
ECU Power Relay		B-H2	Relay Drive - not used as Lanyard controls ECU power
Lanyard		B-E4	Lanyard Sense - not used as Lanyard controls ECU power
DESS Immo		B-B2	DESS Comms - not used
K-Line		B-A2	K-Line - not used

1-3: See Calibration and Wiring Notes

🔧 Calibration and Wiring Notes

🔧 Note 1 – Calibration Functions

The following pins are calibrated in the Base Maps with the function and parameters as mentioned in the table.

M400 Pin		Sea-Doo Pin	Function	Parameters
Aux1	A18	A-L2	5: Drive by Wire	
Aux2	A01	A-L1	0: Off	
Aux3	A23	B-E4, B-H2	0: Off	
Aux4	A24	B-L4	115: Status	Selection 40 Logic Polarity 0 Output Mode 0 Flash 0 Flash Rate 0.0
Aux5	A31	L04	9: Lambda Heater	Lambda Sensor 1
Aux6	A32	R86	101: Fuel Pump	Delay 3.0 Polarity 1 Output Mode 1
Aux7	A33		0: Off	
Aux8	A34		0: Off	
AT6	B19	B-D1	31: Start/Stop Switch	Polarity 1 Stop Delay 0.2 Setup - Lo Level 5.2 Setup - Hi Level 5.3

🔧 Note 2 – Calibration Tables

For the following pins the calibration table is available in the provided Base Maps.

M400 Pin		Sea-Doo Pin	Function
AT1	B03	A-H3	Air Temperature
AT2	B04	A-A1	Engine Temperature

AT3	B05	A-H4	Exhaust Water Temp Sensor
AT5	B07	A-E3	Oil Pressure Switch
AV1	A14	A-F3	Throttle Position
AV2	A15	A-G4	Manifold Pressure Sensor
AV3	A16	A-K3	Throttle Position 2
AV4	A17	B-A3	Throttle Lever
AV5	A25	B-E1	Throttle Lever 2

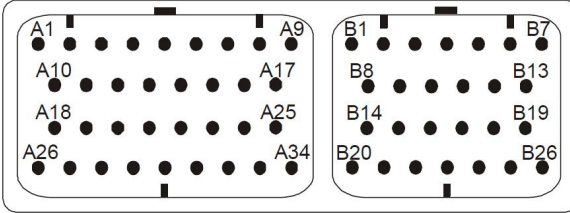
ⓘ Note 3 – Speed

Sea-Doo 2010 models incorporate GPS speed within the stock dash. This is available to the M400 on the CAN communications bus and compares in accuracy to MoTeC's own GPS devices.

Hydrospace S4

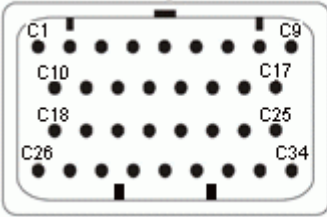
H Connectors

M400 Marine ECU Connector



Looking into the connector on the ECU

Hydrospace Factory Connector



Looking into the connector on the ECU.

H Pin List by Function

M400 Pin		Hydro S4 Pin	Function
Power			
VBAT	A26	C08,C09	12 V Switched (System Relay), Lambda Heater Supply
GND	A10	C02,D04	ECU Earth, Ignition Module Earth
GND	A11	C21	ECU Earth
8V ENG	A12	not used	<i>Optional: 8 V to SKM Module</i>
5V ENG	A02	C30	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V ENG	B16	G01,M01	0 V Sensor Supply
8V AUX	A13	E03	8 V to CAN Connector
5V AUX	A09	not used	5 V Sensor Supply, <i>Optional: GPS Power</i>
0V AUX	B15	C06	0 V Sensor Supply
0V COMM	B14	E01,F01	0 V for CAN and SLM devices
Outputs			
Inj1	A19	C31	Injector Cylinder 1
Inj2	A20	C32	Injector Cylinder 2
Inj3	A21	not used	Injector Cylinder 4
Inj4	A22	not used	Injector Cylinder 3
Inj5	A27	not used	Not Available in M400
Inj6	A28	not used	Not Available in M400
Inj7	A29	not used	Not Available in M400,M600
Inj8	A30	not used	Not Available in M400,M600 <i>Optional: Available for Knock Module SKM - Knock Window</i>
Ign1	A03	D07	Coil 1 Trigger to BIM200 Module
Ign2	A04	D02	Coil 2 Trigger to BIM200 Module
Ign3	A05	not used	
Ign4	A06	not used	

M400 Pin		Hydro S4 Pin	Function
Ign5	A07	not used	Not Available in M400
Ign6	A08	not used	Not Available in M400
Aux1 ¹	A18	G04	Lambda Sensor Heater Control
Aux2 ¹	A01	C33	Pop-Off Valve
Aux3 ¹	A23	C26	Main (ECU) Relay
Aux4 ¹	A24	C29	Wastegate Solenoid
Aux5 ¹	A31	C34	Fuel Pump Relay
Aux6	A32	not used	
Aux7	A33	not used	
Aux8	A34	not used	
Inputs			
Ref	B01	C15	Ref Sensor (Magnetic)
Sync	B02	C23	Sync Sensor (Hall)
AT1 ²	B03	C20	Air Temperature
AT2 ²	B04	C13	Engine Temperature
AT3 ¹	B05	C19	Temp Switch via Blue Handlebar Button
AT4 ¹	B06	C08 via diode	Lanyard Connected / Red Button
AT5	B07	M02	<i>Optional: available for ancillary function</i>
AT6	B19	M03	<i>Optional: available for ancillary function</i>
AV1 ²	A14	C12	Throttle Position
AV2 ²	A15	C11	Manifold Pressure Sensor
AV3	A16	not used	
AV4	A17	not used	
AV5	A25	not used	
AV6	B20	not used	
AV7	B21	not used	
AV8	B22	not used	
DIG1	B08	not used	
DIG2	B09	not used	

M400 Pin		Hydro S4 Pin	Function
DIG3	B10	not used	
DIG4	B11	not used	
La1S	B25	G02	Lambda Sensor Vs
La1P	B26	G08	Lambda Sensor Ip
La2S	B12	not used	<i>Optional: Available for Knock Module SKM - Knock Signal</i>
La2P	B13	not used	
Communications			
RS232-TX	B17	not used	
RS232-RX	B18	not used	<i>Optional: Available for GPS Receive Data³</i>
CAN-LO	B24	E04,F02	CAN line to SLM Shift Light Module
CAN-HI	B23	E05,F03	CAN line to SLM Shift Light Module
0V COMM	B14	E01,F01	0 V for CAN and SLM devices
Additional Hydrospace Loom Pins			
Unused		C03,C04,C05, C16,C17,C18, C22,C24,C25, C27,C28	
		C01	BIM200 Module drive for Coil 1 D06
		C10	BIM200 Module drive for Coil 2 D01
		C07	Spare 0 V Signal lead (not used)

1-3: See Calibration and Wiring Notes

H Calibration and Wiring Notes

H Note 1 – Calibration Functions

The following pins are calibrated in the Base Maps with the function and parameters as mentioned in the table.

M400 Pin		Hydro S4 Pin	Function	Parameters
Aux1	A18	G04	9: Lambda Heater	Lambda Sensor 1
Aux2	A01	C33	3: Aux Table	PWM/Switched 0 Output Mode 0 Polarity 0 Frequency 10 Minimum Duty Cycle 0 Maximum Duty Cycle 100 Hysteresis 0
Aux3	A23	C26	3: Aux Table	PWM/Switched 1 Output Mode 0 Polarity 0 Frequency 10 Minimum Duty Cycle 0 Maximum Duty Cycle 100 Hysteresis 0
Aux4	A24	C29	1: Boost Control	Frequency 50 Polarity 0 Output Mode 0
Aux5	A31	C34	101: Fuel Pump	Delay 0.5 Polarity 0 Output Mode 0
Aux6	A32		0: Off	
Aux7	A33		0: Off	
Aux8	A34		0: Off	
AT3	B05	C19	4: Dual RPM limit	Logic Polarity 0 Low RPM Limit 2400 RPM Rise Rate 0 Ignition Retard 26

AT4	B06	C08 via diode	10: Brake	Logic Polarity 1 Source 0 Channel 1 Lo Level 5.1 Hi Level 5.2
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[H] Note 2 – Calibration Tables

For the following pins the calibration table is available in the provided Base Maps.

M400 Pin		Hydro S4 Pin	Function
AT1	B03	C20	Air Temperature
AT2	B04	C13	Engine Temperature
AV1	A14	C12	Throttle Position
AV2	A15	C11	Manifold Pressure Sensor

[H] Note 3 – Speed

For accurate speed measurements, MoTeC recommends the use of a GPS system.

MoTeC's 5 Hz GPS-G1 (#41300) can be wired directly into the ECU's RS232 receive port.

GPS wiring

M400 Pin		GPS Pin	Function
0V AUX	B15	1	Bat –
RS232-RX	B18	2	RS232 GPS Data
	N/C	3	
5V AUX 5V ENG	A09 A02	4	5 V

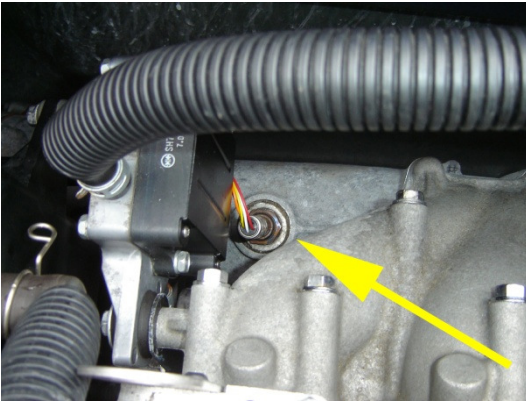
Lambda Sensor Installation

PWC exhaust systems use a cooling water jacket to surround the exhaust manifold and some of the exhaust muffler and associated tubing. The exhaust gases pass through a water canister which can charge the exhaust manifold with water vapour. This water vapour can drastically shorten the lifespan of Lambda sensors, sometimes to less than one hour.

Important: We do not advise the fitting of lambda sensors unless you are prepared to replace them frequently.

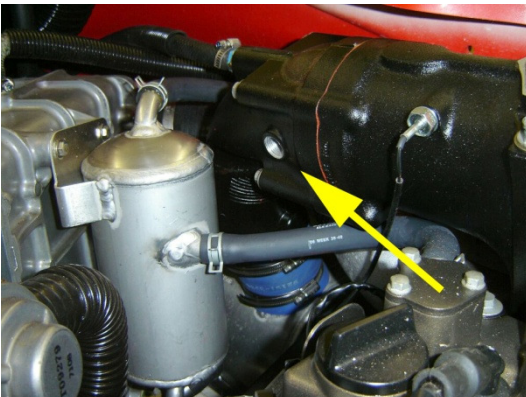
Yamaha Lambda Sensor

Suitable sensor mounting position is towards the rear of the exhaust manifold.



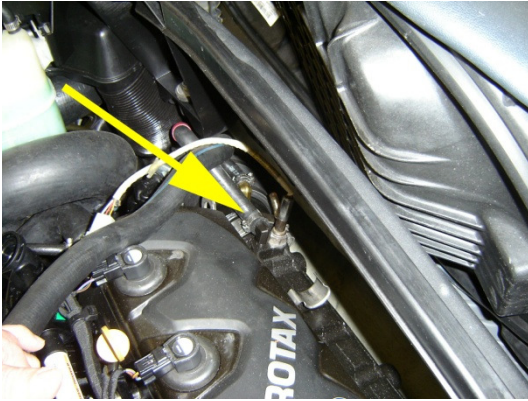
Kawasaki Lambda Sensor

Suitable sensor mounting position is on the inboard side of exhaust elbow casting on circular flat.



S *Sea-Doo Lambda Sensor (all model years)*

Suitable sensor mounting position is at rear of exhaust manifold, next to water fitting.



S *Lambda Aim Error Display (Sea-Doo 2007-2009 only)*

Sea-Doo models from 2007-2009 transmit the VTS Trim level from the M400 ECU to the dash (Custom Dataset 1, Item 3).

With the Lambda sensor installed, this dash display can be reconfigured as a Lambda Aim Error display. This will provide very useful feedback whilst tuning.

The display can be set up, so that if Lambda is on Aim, the bar graph will be centred. An Aim error of 0.10 will move the bar to the top or bottom of the gauge.

This function uses the IGN5 table which is included in the Base Map.

To setup the display for Lambda aim error

1. On the **Adjust** menu, click **General Setup**.
2. Click **Communications** and then **Setup Custom Data Sets**.
3. Select Item **3 – Trim Level (VTSLev)** and then click **Change**.
4. Select the **Show Non-Sensor Channels** check box.
5. Enter **Ign Out5 Duty Cycle** in the Search Text box and click **OK**.
6. Click **OK** to leave the Custom Data Sets screen.
7. Save the altered configuration file with a new name.

Note – this function is not possible with Sea-Doo 2010 models.

[H] Hydrospace S4 Lambda Sensor

The standard exhaust manifold casting is fitted with a Lambda mounting position.



Base Maps

These are available from the MoTeC website at www.motec.com/pwcplugin/basemaps.

Glossary

MoTeC Devices

ACL	Advanced Central Logger
ADL2	Advanced Dash Logger - second generation
ADL3	Advanced Dash Logger - third generation
BR2	Beacon Receiver
BTX	Beacon Transmitter
CIM	Computer Interface Module
CLS	Central Logging System
DBW4	Drive By Wire expander
E816	Input/Output Expander
E888	Input/Output Expander
i2	MoTeC data analysis software, standard version
i2 Pro	MoTeC data analysis software, professional version
IEX	Ignition Expander
LTC	Lambda to CAN module
LTCd	Lambda to CAN Dual module
M2R	ECU dedicated to run 2 rotor engines
M4	ECU for engines with up to 4 cylinders or up to 2 rotors
M400	ECU for modern engines with up to 4 cylinders or up to 2 rotors
M48	ECU for engines with up to 8 cylinders and 2 rotors
M600	ECU for modern engines with up to 6 cylinders or up to 3 rotors
M800	ECU for modern engines with up to 12 cylinders or up to 4 rotors
M880	ECU for modern engines with up to 12 cylinders or up to 4 rotors
MDC	Mitsubishi Diff Controller
MDD	Mini Digital Display
MLS	ECU dedicated to run Chevrolet LS1 and Lexus/Toyota V8s
PCI cable	PC Interface cable
PDM15	Power Distribution Module with 15 outputs
PDM16	Power Distribution Module with 16 outputs
PDM30	Power Distribution Module with 30 outputs

PDM32	Power Distribution Module with 32 outputs
PLM	Professional Lambda Meter
Plug-In ECU	ECU for direct replacement of a factory ECU
RTC	Real Time Clock
SDC	Subaru Diff Controller
SDL	Sport Dash Logger
SGA	Strain Gauge Amplifier
SLM	Shift Light Module
SUU	Software Update Unit
TCM	Traction Control Module
VIM	Versatile Input Module

Other

Calibration	The process of converting an electrical value into a physical value e.g. Volts into kilometres per hour
CAN	Controller Area Network - communication protocol
CDI	Capacitive Discharge Ignition
ECU	Engine Control Unit
GPS	Global Positioning System
MAF	Mass Air Flow
MAP	Manifold Absolute Pressure
PID	Proportional, Integral and Derivative gain
PWM	Pulse Width Modulated.
RPM	Revolutions Per Minute
RS232	Recommended Standard 232, communication protocol
RX	Receive
TDC	Top Dead Centre
TX	Transmit

How to Get More Information

A good place to start is the website at www.motec.com

In the Product area of the website you will find information on engine management, data acquisition and Lambda measurement.

In the Downloads area of the website you will find:

- Manuals including the general M400 ECU Manual.
- Latest software where you can download ***i2 Standard*** data analysis software, or a trial version of the ***i2 Pro*** version.
- Seminar notes from the training seminars MoTeC runs on ECU installation and tuning and ***i2*** data analysis software.

Forums

Also on the MoTeC website you will find a Forum with a [*thread dedicated to PWCs*](#).

Another useful forum is [*greenhulk.net/forums*](http://greenhulk.net/forums)

