TORO Professional Diagnostics

Yanmar
SmartAssist-Direct
Version 2.x

ECU Programming Guide
System Operation, Diagnostics, and Programming

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Part No. 16223SL

Table of Contents

Introduction 2
Engine Fault Codes 3
“P” Codes 8
FMI (Failure Mode Indicator) Descriptions 9
Regeneration 10
Serial Number for Updated Recovery Software 11
Regeneration Reject Codes 11
Yanmar ECU Updating/Reprogramming Instructions 13
Returning Software to the Yanmar Server 14
Retrieving Engine Software from the Yanmar Server and Downloading to your Computer 15
Updating ECU Software 19
Return Software to the Yanmar Server 24
Reprogramming Instructions for a New Replacement ECU 28
Retrieving Engine Software from the Yanmar Server and Downloading to Your Computer 31
Installing Software to a New Engine ECU 36
Return Software to the Yanmar Server 40
Recovering Aborted ECU Programming Event 41
Set Value Copy 47
To Save the Data from an old ECU: 47
To Write the Data to a new ECU: 50
Saving an ECU File 54
Exporting Data File 58

Introduction

This user's guide is intended to provide ECU programming instruction using Yanmar's SmartAssist-Direct software (Version 2). This software is intended to assist with troubleshooting electrical issues and updating ECU software on Yanmar TNV Tier 4 engines.

This user's guide is designed to help you know when and why you need to make repairs. It will highlight particular problems that you may encounter and any special procedures that you may need to follow.

The information contained in this guide is supplementary and is not intended to be a replacement for other source material. To ensure information is current, relevant, and accurate, always refer to the latest product/serial number-specific service manuals, service bulletins, operator's manual, and parts books when necessary.
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Engine Fault Codes

A list of SPN/FMI to “P” codes is provided in Table 1. They are sorted by SPN, then FMI, and the third column is the “P” code that Yanmar uses in their manuals.

Table 1

SPN	FMI	Code	Description
28	0	P1126	Accelerator sensor 3 failure (Foot pedal in open position)
28	1	P1125	Accelerator sensor 3 failure (Foot pedal in closed position)
28	3	P0223	Accelerator sensor 2 (Excessive sensor output)
28	4	P0222	Accelerator sensor 2 (Insufficient sensor output)
29	3	P0228	Accelerator sensor 3 (Excessive sensor output)
29	4	P0227	Accelerator sensor 3 (Insufficient sensor output)
29	8	P1227	Pulse sensor failure (Pulse communication)
51	3	P02E9	Intake throttle opening sensor fault (High voltage)
51	4	P02E8	Intake throttle opening sensor fault (Low voltage)
91	3	P0123	Accelerator sensor 1 (Excessive sensor output)
91	4	P0122	Accelerator sensor 1 (Insufficient sensor output)
100	1	P1198	Low oil pressure fault alarm
100	4	P1192	Oil pressure switch open circuit
102	3	P0238	EGR low pressure side sensor fault (High voltage)
102	4	P0237	EGR low pressure side sensor fault (Low voltage)
102	13	P0236	EGR low pressure side sensor (Abnormal learning value)
105	3	P040D	Intake manifold temperature sensor fault (High voltage)
105	4	P040C	Intake manifold temperature sensor fault (Low voltage)
108	3	P2229	Atmospheric pressure sensor fault (High voltage)
108	4	P2228	Atmospheric pressure sensor fault (Low voltage)
108	10	P1231	Atmospheric pressure sensor characteristic fault
110	0	P0217	Cooling water temperature sensor temperature abnormal high (Overheat)
110	3	P0118	Cooling water temperature sensor fault (High voltage)
110	4	P0117	Cooling water temperature sensor fault (Low voltage)
157	0	P0088	Actual rail pressure rise error
157	3	P0193	Rail pressure sensor fault (High voltage)
157	4	P0192	Rail pressure sensor fault (Low voltage)
157	15	P0093	Rail pressure deviation error during the actual rail pressure rise
157	16	P000F	PLV open valve
157	18	P0094	Rail pressure deviation error during the actual rail pressure drop
167	1	P1568	Charge alarm
167	5	P1562	Charge switch open circuit

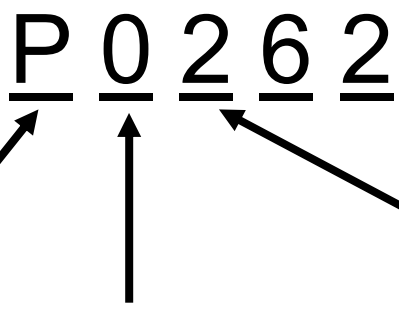
SPN	FMI	Code	Description
172	3	P0113	New air temperature sensor fault (High voltage)
172	4	P0112	New air temperature sensor fault (Low voltage)
173	3	P0546	Exhaust manifold temperature sensor fault (High voltage)
173	4	P0545	Exhaust manifold temperature sensor fault (Low voltage)
174	0	P0168	Fuel temperature sensor temperature abnormal high
174	3	P0183	Fuel temperature sensor fault (High voltage)
174	4	P0182	Fuel temperature sensor fault (Low voltage)
190	0	P0219	Overspeed
237	13	U3002	VI (CAN message) reception data fault
237	31	U0168	VI (CAN message) reception time out
412	0	P1490	EGR gas high temperature alarm
412	3	P041D	EGR gas temperature sensor fault (High voltage)
412	4	P041C	EGR gas temperature sensor fault (Low voltage)
630	12	P0601	EEPROM memory deletion error
633	3	P0629	High-pressure pump drive circuit (High side VB short-circuit)
633	5	P0627	High-pressure pump drive circuit (Open circuit)
633	6	P1642	High-pressure pump drive circuit (High side GND short-circuit)
651	3	P1271	Injector of 4th cylinder short circuit
651	5	P0204	Injector of 4th cylinder open circuit (Inherent location of the injector)
651	6	P0271	Injector of 4th cylinder coil short circuit
652	3	P1268	Injector of 3rd cylinder short circuit
652	5	P0203	Injector of 3rd cylinder open circuit (Inherent location of the injector)
652	6	P0268	Injector of 3rd cylinder coil short circuit
653	3	P1265	Injector of 2nd cylinder short circuit
653	5	P0202	Injector of 2nd cylinder open circuit (Inherent location of the injector)
653	6	P0265	Injector of 2nd cylinder coil short circuit
654	3	P1262	Injector of 1st cylinder short circuit
654	5	P0201	Injector of 1st cylinder open circuit (Inherent location of the injector)
654	6	P0262	Injector of 1st cylinder coil short circuit
1202	2	U0426	Immobilizer : System fault
1209	3	P0473	EGR high pressure side sensor fault (High voltage)
1209	4	P0472	EGR high pressure side sensor fault (Low voltage)
1209	13	P0471	EGR high pressure side sensor (Abnormal learning value)
1485	2	P068A	Main relay early opening
1485	7	P068B	Main relay contact stuck
2791	0	P0404	EGR over-voltage fault
2791	1	P1404	EGR under-voltage fault
2791	7	P1409	EGR feedback malfunction
2791	9	U0401	EGR ECM data fault

SPN	FMI	Code	Description
2791	12	P0403	Open circuit between the EGR motor coils
2797	6	P1146	Injector drive circuit (Bank1) short circuit
2798	6	P1149	Injector drive circuit (Bank2) short circuit
2950	3	P1658	Power short circuit of throttle valve drive H bridge output 1
2950	4	P1659	GND short circuit of throttle valve drive H bridge output 1
2950	5	P0660	No-load of throttle valve drive H bridge circuit
2950	6	P1660	Overload on the drive H bridge circuit of throttle valve
2951	3	P1661	VB Power short circuit of throttle valve drive H bridge output 2
2951	4	P1662	GND short circuit of throttle valve drive H bridge output 2
3242	0	P1436	DPF inlet temperature sensor temperature abnormal high
3242	3	P1428	DPF inlet temperature sensor fault (High voltage)
3242	4	P1427	DPF inlet temperature sensor fault (Low voltage)
3250	0	P1426	DPF intermediate temperature sensor temperature abnormal high
3250	1	P0420	DPF intermediate temperature sensor temperature abnormal low temperature
3250	3	P1434	DPF intermediate temperature sensor fault (High voltage)
3250	4	P1435	DPF intermediate temperature sensor fault (Low voltage)
3251	0	P2452	DPF differential pressure sensor differential pressure abnormal high
3251	3	P2455	DPF differential pressure sensor fault (High voltage)
3251	4	P2454	DPF differential pressure sensor fault (Low voltage)
3251	13	P2453	DPF differential pressure sensor (Abnormal learning value)
3609	3	P1455	DPF high pressure side sensor fault (High voltage)
3609	4	P1454	DPF high pressure side sensor fault (Low voltage)
3695	14	P1425	Reset regeneration prohibition
3719	0	P1424	Backup mode
3719	7	P1446	Recovery regeneration prohibition
3719	9	P1445	Recovery regeneration failure
3719	16	P1421	Stationary regeneration standby
3720	0	P1420	Ash cleaning request 2
3720	16	P242F	Ash cleaning request 1
4257	12	P0611	Injector drive IC error
522243	5	P0543	Startup assist relay interrupted
522243	6	P0541	Startup assist relay GND interrupted
522323	0	P1101	Air cleaner clogged alarm
522329	0	P1151	Oil/water separator alarm
522400	2	P0336	Crank signal malfunction
522400	5	P0337	No crank signal
522401	2	P0341	Cam signal malfunction
522401	5	P0342	No cam signal

SPN	FMI	Code	Description
522401	7	P1341	Angle offset failure
522571	3	P1641	High-pressure pump drive circuit (Low side VB short-circuit)
522571	6	P1643	High-pressure pump drive circuit (Low side GND short-circuit)
522572	6	P062A	High-pressure pump drive circuit (Drive current (high level))
522572	11	P1645	High-pressure pump drive circuit (Pump overload error)
522573	0	P2463	Overaccumulation (Method C)
522574	0	P1463	Overaccumulation (Method P)
522575	7	P2458	Regeneration defect (Stationary regeneration failure)
522576	12	P160E	EEPROM memory read error
522577	11	P2459	Regeneration defect (Stationary regeneration not performed)
522578	12	P160F	EEPROM memory writing error
522579	12	P1405	Short circuit between the EGR motor coils
522580	12	P0488	EGR position sensor malfunction
522581	7	P148A	EGR stuck open valve malfunction
522582	7	P049D	EGR initialization malfunction
522583	1	P1410	EGR high temperature thermistor malfunction
522584	1	P1411	EGR low temperature thermistor malfunction
522585	12	P1613	CY146 SPI communication fault
522588	12	P1608	Excessive voltage of supply 1
522589	12	P1617	Insufficient voltage of supply 1
522590	12	P1609	Sensor supply voltage error 1
522591	12	P1618	Sensor supply voltage error 2
522592	12	P1619	Sensor supply voltage error 3
522596	9	U0292	TSC1 (CAN message) reception time out (SA1)
522597	9	U1301	TSC1 (CAN message) reception time out (SA2)
522599	9	U1292	Y_ECR1 (CAN message) reception time out
522600	9	U1293	Y_EC (CAN message) reception time out
522601	9	U1294	Y_RSS (CAN message) reception time out
522603	9	U1296	VH (CAN message) reception time out
522605	9	U1298	Y_ECM3 (CAN message) reception time out
522609	9	U1300	Y_ETCP1 (CAN message) reception time out
522610	9	U010B	CAN1 (for EGR): Reception time out
522611	9	U1107	Exhaust throttle (CAN message from the exhaust throttle time out)
522617	12	U1401	EGR target value out of range
522618	9	U1302	EBC1 (CAN message) reception time out
522619	9	U1303	Y_DPFIF (CAN message) reception time out
522623	7	P1647	Dual accelerator sensor (open position) failure
522624	7	P1646	Dual accelerator sensor (closed position) failure
522730	12	U0167	Immobilizer : CAN Communication fault

SPN	FMI	Code	Description
522744	4	P1626	Actuator drive circuit 1 short to ground
522746	12	P1438	Exhaust throttle (Voltage fault)
522747	12	P1439	Exhaust throttle (Motor fault)
522748	12	P1440	Exhaust throttle (Sensor system fault)
522749	12	P1441	Exhaust throttle (MPU fault)
522750	12	P1442	Exhaust throttle (PCB fault)
522751	19	P1443	Exhaust throttle (CAN fault)
522994	4	P1633	Actuator drive circuit 2 short to ground
523249	5	P0008	No signal on both crank and cam speed sensor
523460	7	P1670	Rail pressure fault (Operation time error during RPS limp home)
523462	13	P1648	IQA corrected injection amount for injector of 1st cylinder error
523463	13	P1649	IQA corrected injection amount for injector of 2nd cylinder error
523464	13	P1650	IQA corrected injection amount for injector of 3rd cylinder error
523465	13	P1651	IQA corrected injection amount for injector of 4th cylinder error
523468	9	P1665	Rail pressure fault (Controlled rail pressure error after PLV valve opening)
523469	0	P1666	Rail pressure fault (The times of PLV valve opening error)
523470	0	P1667	Rail pressure fault (The time of PLV valve opening error)
523471	6	P1467	Actuator drive circuit 3 short to ground
523473	12	P1469	AD converter fault 1
523474	12	P1470	AD converter fault 2
523475	12	P1471	External monitoring IC and CPU fault 1
523476	12	P1472	External monitoring IC and CPU fault 2
523477	12	P1473	ROM fault
523478	12	P1474	Shutoff path fault 1
523479	12	P1475	Shutoff path fault 2
523480	12	P1476	Shutoff path fault 3
523481	12	P1477	Shutoff path fault 4
523482	12	P1478	Shutoff path fault 5
523483	12	P1479	Shutoff path fault 6
523484	12	P1480	Shutoff path fault 7
523485	12	P1481	Shutoff path fault 8
523486	12	P1482	Shutoff path fault 9
523487	12	P1483	Shutoff path fault 10
523488	0	P1484	Recognition error of engine speed
523489	0	P1668	Rail pressure fault (The actual rail pressure is too high during PRV limp home)
523491	0	P1669	Rail pressure fault (Injector B/F temperature error during PLV4 limp home)

“P” Codes



Injector of 1st cylinder coil short circuit

1st Digit

P = Powertrain

B = Body

C = Chassis

U = Network

2nd Digit

0 = Standard (Generic)

1 = Manufacturer Specific

3rd Digit

1 = Fuel & Air Metering
(Emission management)

2 = Injector circuit

3 = Ignition System

4 = Auxiliary emission Control System

5 = Vehicle speed & idle control System

6 = Computer & output circuit

7 = Transmission

8 = Transmission

FMI (Failure Mode Indicator) Descriptions

The FMI code is used to provide more information about a fault. It represents the detection method, not the actual cause of how the component failed.

FMI	Content
0	The data is valid, but exceeds the normal operation range. (Upper limit exceeded)
1	The data is valid, but does not reach the normal operation range. (Lower limit exceeded)
2	The data is unstable, intermittent, and inappropriate. (Intermittent fault)
3	The voltage exceeds the normal operation range or short-circuited on the high-voltage side. (Signal fault upper limit)
4	The voltage does not reach the normal operation range or short-circuited on the low-voltage side. (Signal fault lower limit)
5	The current does not reach the normal operation or the circuit is open. (Electric current fault low)
6	The current does exceeds the normal operation or the circuit is grounded. (Electric current fault high)
7	The machine system is not reacting or misaligned. (Machine system fault)
8	The rotational speed or pulse width/cycle is faulty. (Rotational speed, pulse width fault)
9	The update ratio is faulty. (Smart sensor and actuator fault)
10	The rate of change is faulty. (Rate of change fault)
11	The error code is unknown. (Incorrect sub-system error code)
12	There is a problem in the intelligent device/component. (Intelligent device problem)
13	Unable to calibrate. (Calibration disabled)
14	This is a special command. (Special command)
15	Normal. (Normal)

Regeneration

The YANMAR DPF system has five modes of regeneration:

- Normal (Self) Regeneration

  Self regeneration occurs when the engine is operated at high speed and higher loads. As the exhaust temperatures rise, the particulate matter (PM) is continuously combusted and burned. There is no use of the intake throttle valve and no post injection used during self regeneration.

- Assist Regeneration

  Once the ECU measures soot levels >8g/L, an assist regeneration will be commanded. Assist regeneration uses the intake throttle to limit the amount of fresh air into the engine. This increases the exhaust temperature to allow for the PM to be burned off. Assist regeneration will run for a set time or until PM levels fall below the threshold. If PM is not reduced after 10 minutes, a reset regeneration will be commanded.

- Reset Regeneration

  Reset regeneration is commanded by the engine ECU every 100 engine hours, and as needed if the assist regeneration cannot lower the PM amount in a prescribed time. Reset regeneration uses a combination of the intake throttle valve and a post fuel injection event to raise the temperature within the exhaust to burn the PM.

- Stationary Regeneration

  Stationary regeneration is a back-up system in the event that the other regeneration methods above cannot sufficiently burn off the PM. The machine must be taken out of service to perform stationary regeneration. Stationary regeneration uses the intake throttle valve and post injection to raise the temperature in the exhaust to burn off PM. During stationary regeneration, the ECU will increase the engine speed to 2000 or 2200 RPM.

- Recovery Regeneration

  If a stationary regeneration fails to sufficiently burn off the PM and the soot levels are still too high, or the operator fails to perform a stationary regeneration within 8 hours of being alerted by the InfoCenter, the engine enters limp home or back-up mode, and the engine RPM derates. There will be two fault codes that **cannot** be cleared: P1424 Backup Mode and P1463 Overaccumulation (Method P).

  Recovery regeneration is an extended stationary regeneration and is one of the methods that will return the engine to normal operation from back-up mode. Recovery regeneration is available on engines starting in 2015. The effective engine serial range is shown in Table 2. Earlier serial number engine ECUs can be reprogrammed to add the recovery regeneration mode. Reprogramming the engine ECU is outlined in this guide.

Serial Number for Updated Recovery Software

Table 2 lists the beginning engine s/n of engines that were programmed with updated software to provide an optional recovery regeneration mode that can be activated through the InfoCenter. This will allow a last chance regeneration when they fail to do a stationary regeneration. This can be done without connecting the Yanmar SmartAssist tool.

Table 2

Engine Model	Starting E/N
3TNV88C-DTR	02426
3TNV88C-DTR2	02254
3TNV88C-DTR3	02248
3TNV88C-DTR4	04098
3TNV86CT-DTR	00391
4TNV86CT-DTR	03789
4TNV98CT-NTRL	16420

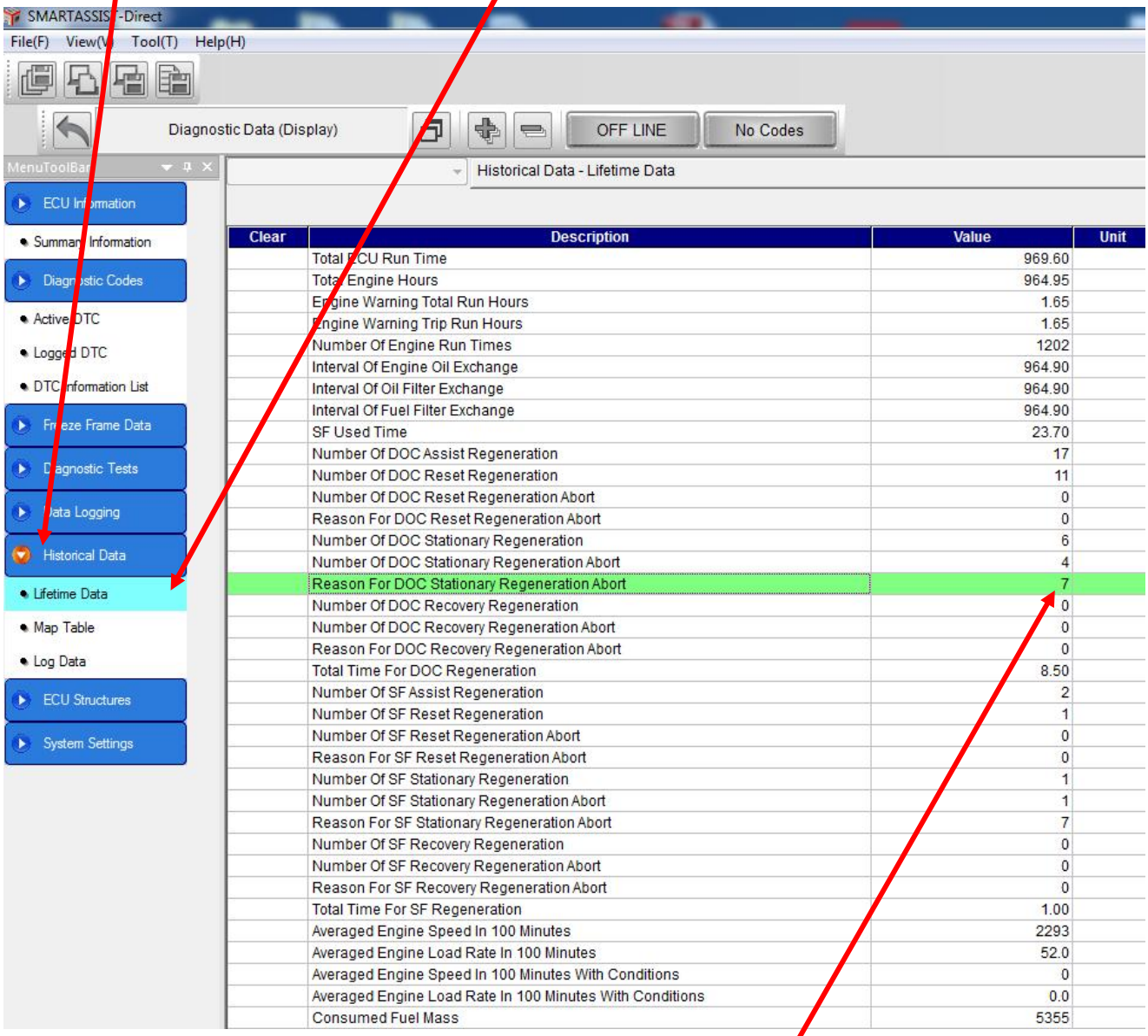
Regeneration Reject Codes

If a reset, stationary, or recovery regeneration is commanded by the ECU and the regeneration fails, a reason code is stored in the engine ECU. The reason codes for a regeneration being aborted are provided in Table 3.

Table 3

Reason Codes for Regeneration Abort	
1	Increase PM
2	Timeout (Cant Decrease PM)
3	Unexecution for a long time
4	DPF Temperature too Low
5	Requirement of Stationary Regeneration by Operator
6	PM High (>10g/l)
7	PM too High (>12g/l)
8	Interlock Open
9	Inhibit Switch Open
10	Accelerator Operation in Stationary or Recovery Regeneration
11	Key Switch Off
12	DPF Regeneration Prohibition by Failsafe Action

Click **Historical Data** and then clicking **Lifetime Data to** view the regeneration history for the engine.



Clear	Description	Value	Unit
	Total ECU Run Time	969.60	
	Total Engine Hours	964.95	
	Engine Warning Total Run Hours	1.65	
	Engine Warning Trip Run Hours	1.65	
	Number Of Engine Run Times	1202	
	Interval Of Engine Oil Exchange	964.90	
	Interval Of Oil Filter Exchange	964.90	
	Interval Of Fuel Filter Exchange	964.90	
	SF Used Time	23.70	
	Number Of DOC Assist Regeneration	17	
	Number Of DOC Reset Regeneration	11	
	Number Of DOC Reset Regeneration Abort	0	
	Reason For DOC Reset Regeneration Abort	0	
	Number Of DOC Stationary Regeneration	6	
	Number Of DOC Stationary Regeneration Abort	4	
	Reason For DOC Stationary Regeneration Abort	7	
	Number Of DOC Recovery Regeneration	0	
	Number Of DOC Recovery Regeneration Abort	0	
	Reason For DOC Recovery Regeneration Abort	0	
	Total Time For DOC Regeneration	8.50	
	Number Of SF Assist Regeneration	2	
	Number Of SF Reset Regeneration	1	
	Number Of SF Reset Regeneration Abort	0	
	Reason For SF Reset Regeneration Abort	0	
	Number Of SF Stationary Regeneration	1	
	Number Of SF Stationary Regeneration Abort	1	
	Reason For SF Stationary Regeneration Abort	7	
	Number Of SF Recovery Regeneration	0	
	Number Of SF Recovery Regeneration Abort	0	
	Reason For SF Recovery Regeneration Abort	0	
	Total Time For SF Regeneration	1.00	
	Averaged Engine Speed In 100 Minutes	2293	
	Averaged Engine Load Rate In 100 Minutes	52.0	
	Averaged Engine Speed In 100 Minutes With Conditions	0	
	Averaged Engine Load Rate In 100 Minutes With Conditions	0.0	
	Consumed Fuel Mass	5355	

The reason code for a regeneration being aborted is shown in the **Value** column. In this case, the code is “7”, which corresponds to “PM too High (>12g/l)” in Table 3.

Yanmar ECU Updating/Reprogramming Instructions

Yanmar ECU software can be updated using Yanmar SmartAssist diagnostic software. Updating the software maybe needed to correct software issues, or add additional features like the recovery regeneration mode.

NOTE: The engine ECU software must FIRST be downloaded from the Yanmar site—you do not need to be connected to the machine for this process. You will need:

1. An Internet connection
2. Engine information from the engine ECU decal:
    a. Engine model number
    b. 5-Digit E/N number

Reprogramming the engine ECU is a three-step process:

1. The Engine ECU software must be checked out from the Yanmar server before it can be uploaded to the engine ECU. It is model and engine serial number dependent, meaning you need the engine model and E/N to check out the software. Checking out the software from Yanmar ensures that you are getting the very latest software. This process requires an Internet connection to your computer.

2. Uploading the new software to the engine ECU: An Internet connection is not required for this process. Yanmar SmartAssist is connected to the engine ECU and the software is updated. Programs running the background can cause Yanmar SmartAssist to stop working. If the reprogramming process is interrupted, the engine ECU will fail the to be programmed and will no longer work.

3. After successfully reprogramming the engine ECU. The ECU software must be checked back in to the Yanmar server. An Internet connection is needed for this operation. There are two ways to return the software:

    a. The next time you start the SmartAssist program and are connected to the Internet, the ECU file is automatically returned to the Yanmar server.

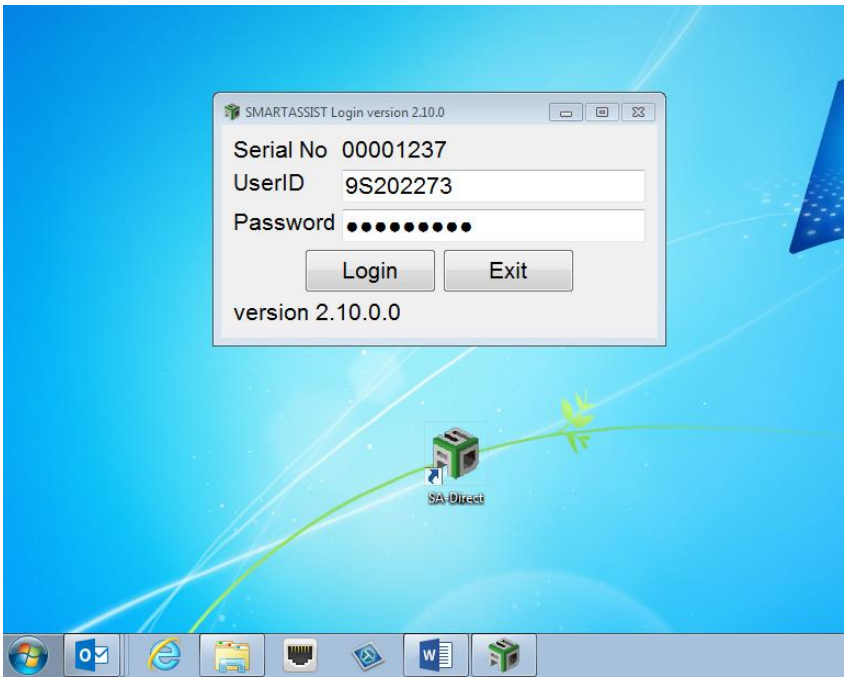
    b. After programming, you can manually send back the file, with an Internet connection.

Returning Software to the Yanmar Server

Step 1.

Double-click the SmartAssist icon to start the program. Enter your User ID (if required) and password and then click **Login**.

NOTE: An Internet connection is required.



Step 2.

From the Start Menu

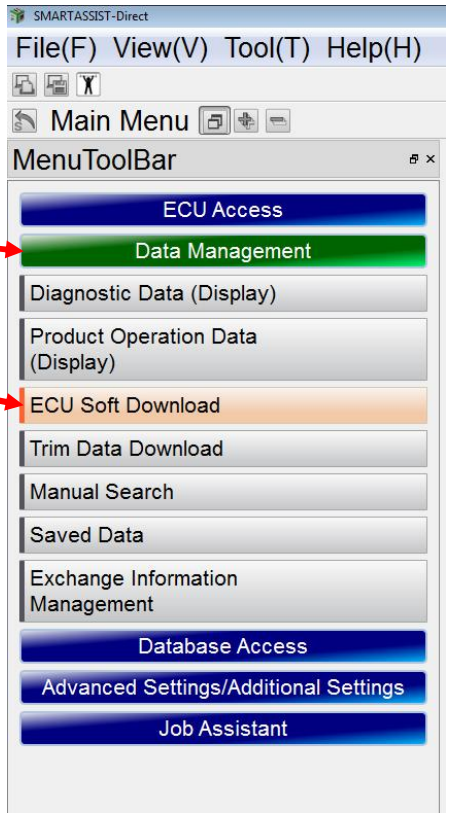
1. Click **Industrial Engine.**

2. Click **Engine.**

Retrieving Engine Software from the Yanmar Server and Downloading to your Computer

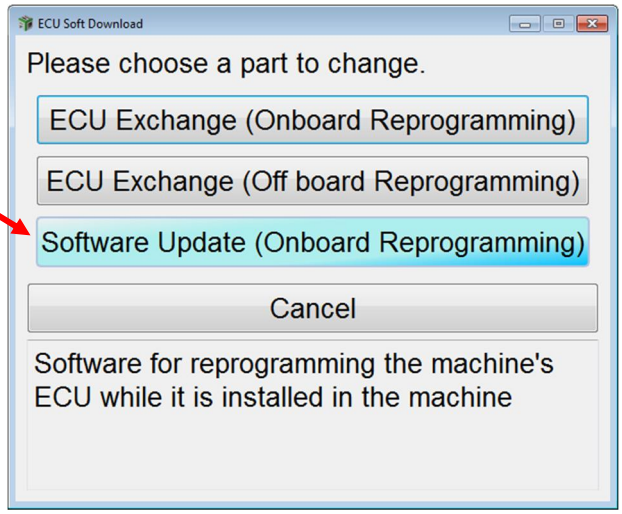
Step 3.

1. At the **Main Menu**, click **Data Management** in the menu on the left side.
2. Click **ECU Soft Download** from the **Data Management** drop-down menu.



Step 4.

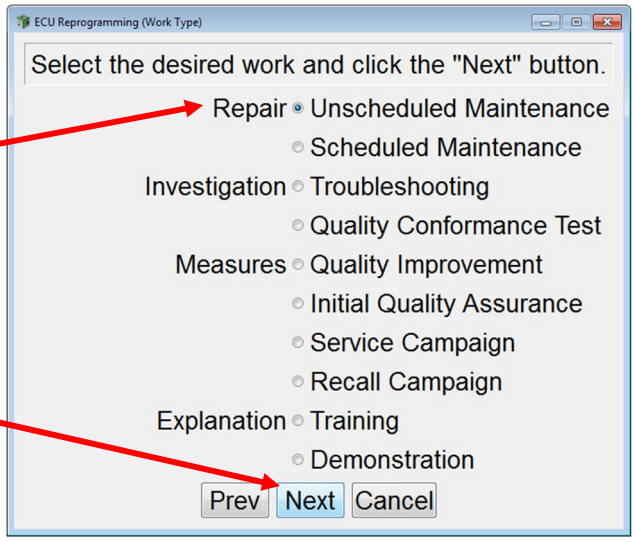
On the **ECU Soft Download** window,
click **Software Update (Onboard Reprogramming)**.



Step 5.

1. Select the operation type that best describes why the software is being updated. Generally, **Unscheduled Maintenance** is appropriate.

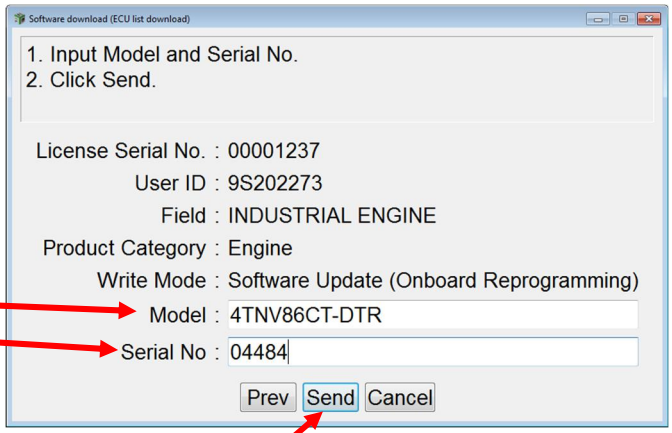
2. Click **Next**.



Step 6.

1. Enter the Engine Model No and Five-Digit Serial No (E/N Number) from the engine ECU label into the boxes shown below.

Note: All letters are capitalized and the **Serial No** on the form is the **E/N** number from the ECU label.

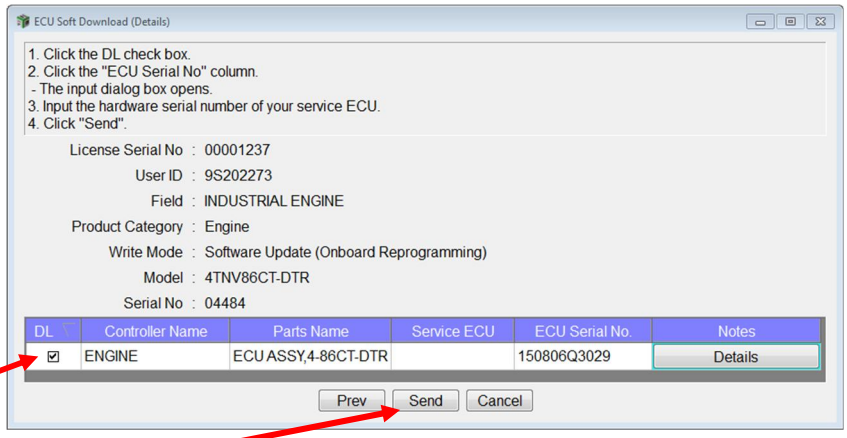


2. After Model and E/N numbers are entered, click **Send**.

"The ECU Soft is being downloaded…" message appears.

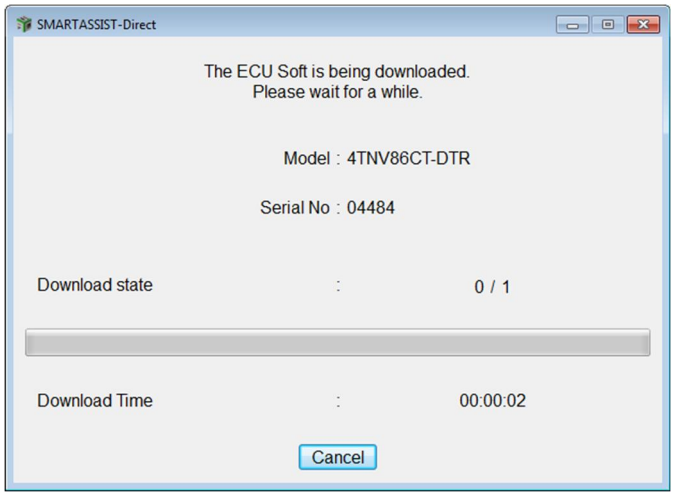
Step 7.

Verify that the Engine Model and Serial No. is correct.



If so:

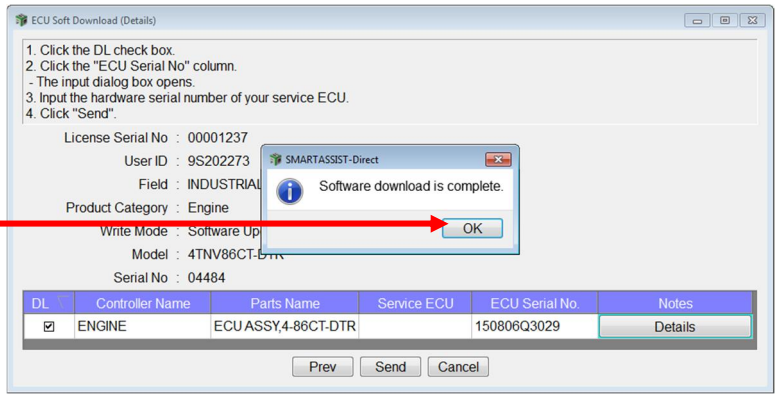
1. Select the check box in the **DL** column. A check mark should appear.
2. Click **Send**.
3. Software is being downloaded to your computer.



Step 8.

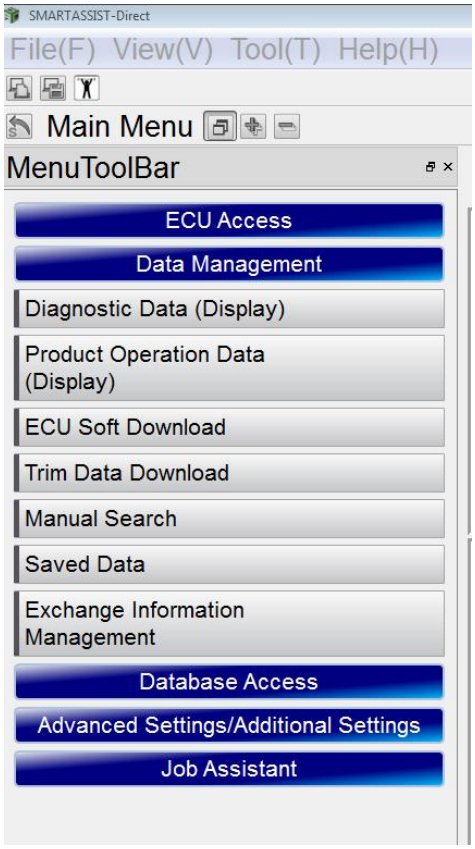
When the ECU software has finished downloading to your computer, a “Software download is complete.” message is displayed.

Click **OK** to continue.



Step 9.

After clicking **OK** in Step 8, you will be returned to the **Main Menu**.



NOTE: An Internet connection is <u>not</u> required for remaining steps.

Updating ECU Software

Important Information! Read Before Continuing.

1. Connect the Yanmar diagnostic cable to the machine and to your computer
2. Reprogramming takes approximately 20 to 30 minutes to complete. Make sure your computer has enough battery power or is plugged in.
3. Make sure no other software is running on your computer while ECU software is updating.
4. An Internet connection is NOT required to update ECU software.

NOTE: During reprogramming, if the diagnostic cable becomes unplugged or your computer loses power, SmartAssist will abort the programming. SmartAssist will no longer respond, the engine ECU will not work, and the machine will not start.

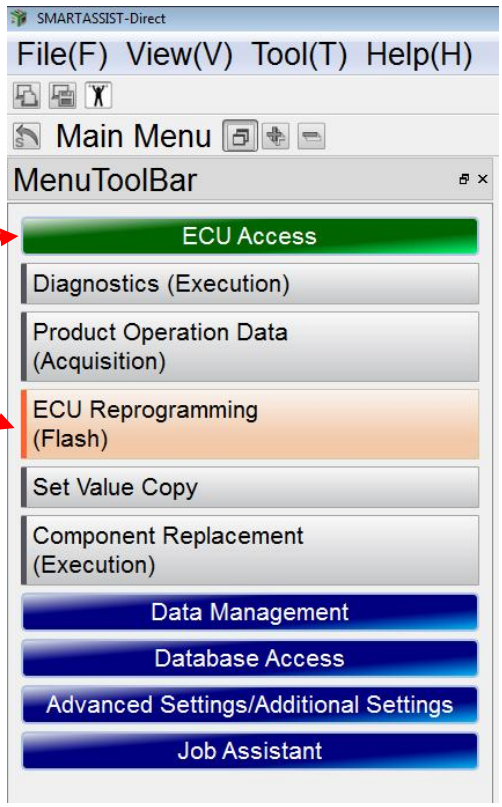
In the event that this happens, Stay Calm! Go to the Recovering Aborted ECU Programming Event section on page 41 in this manual for specific instructions on how to recover.

Continuing on to updating the software in the ECU:

Step 10.

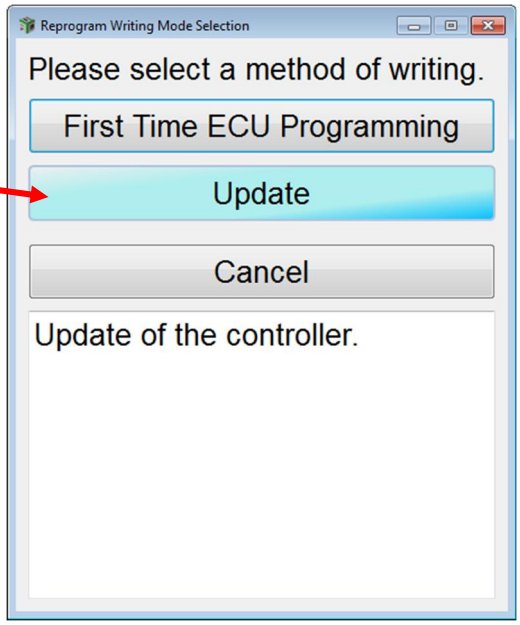
On the Main Menu window:

1. Turn machine ignition key to ON.
2. Click **ECU Access**.
3. Click **ECU Reprogramming (Flash)**.



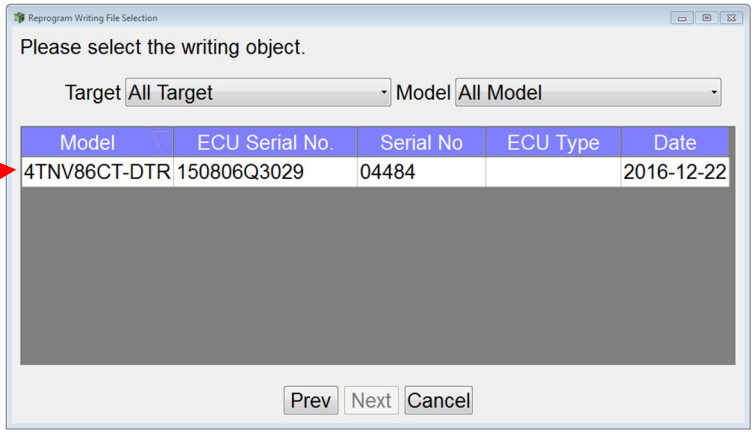
Step 11.

1. Click **Update** on the **Reprogramming Writing Mode Selection** window.

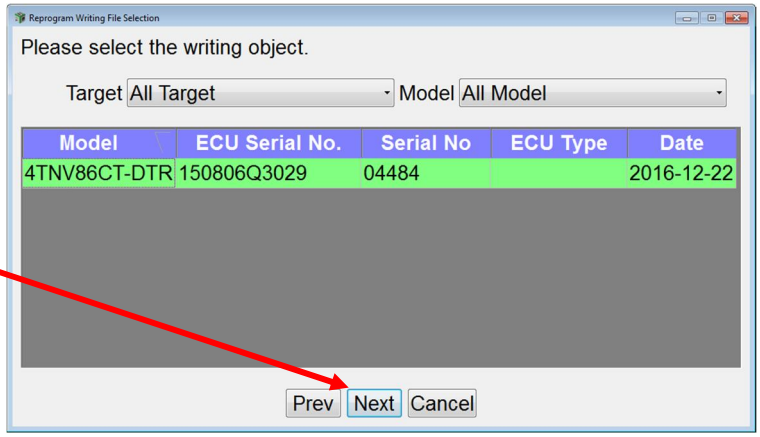


Step 12.

1. Click on the line with the model number and the line will be shaded green.

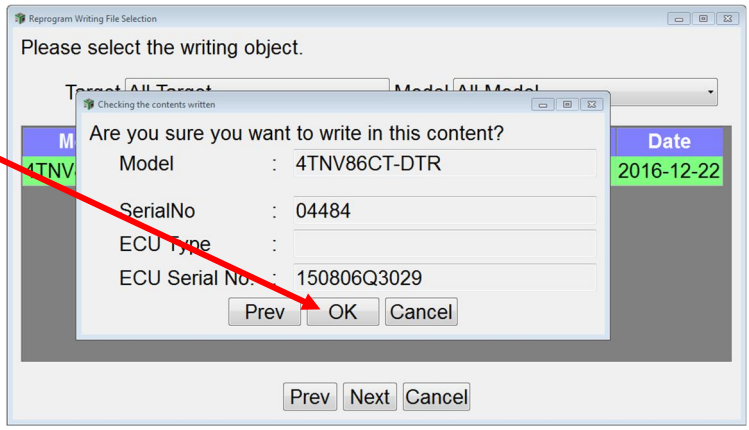


2. When the line is shaded green, the **Next** button becomes active. Click **Next**.



Step 13.

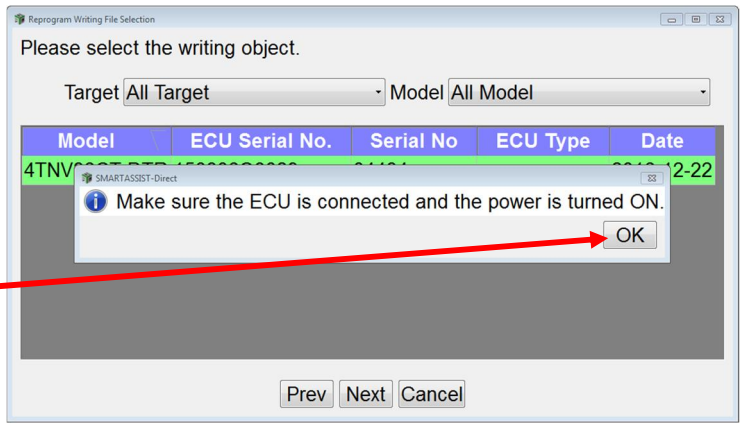
1. If the model and serial numbers are correct, click **OK**.



Note: Verify that the Ignition key is in the ON position.

Note: Once you click **OK,** SmartAssist will start updating the ECU software.

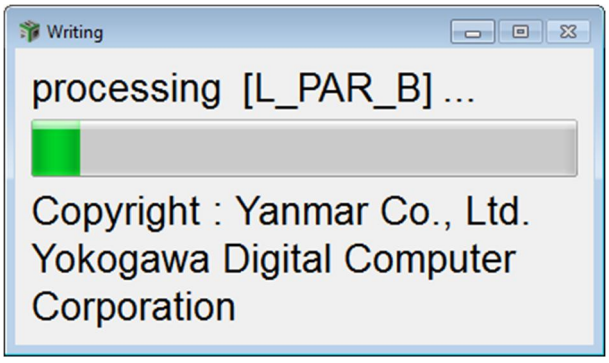
2. Click **OK**.



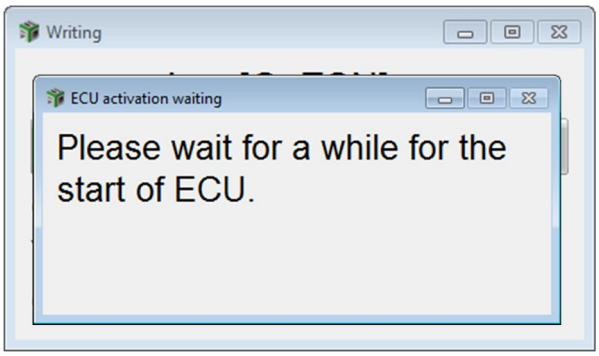
⚠ Note: Programming will take approximately 20 minutes—be patient.
⚠ Note: Power must not be interrupted to machine or computer while programming!
⚠ Note: This version of SA-D 2.x is much more robust and other programs in the background should not interfere with programming.

Step 14.

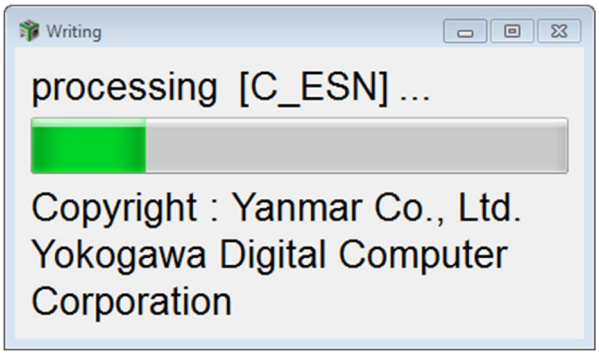
1. This progress meter will start to display that the ECU is being updated.



2. After a few seconds, the “Please wait…” message will appear letting you know that SmartAssist is connecting with ECU. It will disappear in a 5 to 10 seconds.

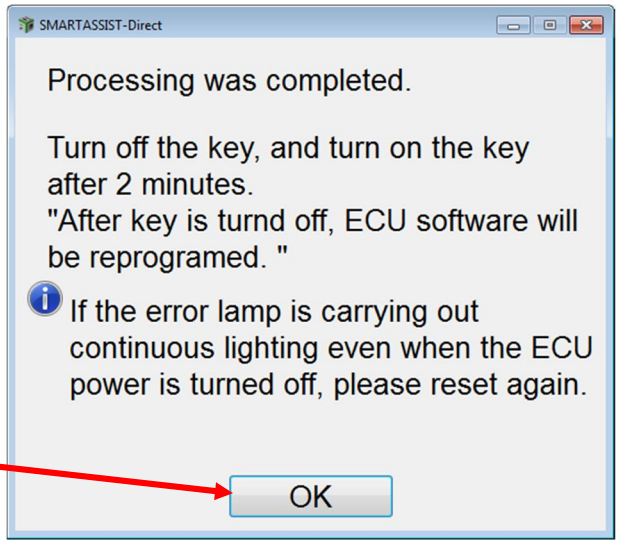


3. Programming will continue and status will be displayed on a progress bar.



Step 15.

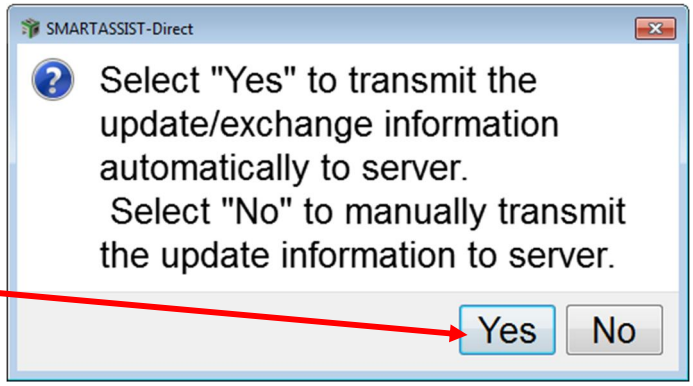
When this window appears, the ECU has been successfully updated. Turn the Ignition key OFF for at least 30 seconds. After 30 seconds, turn ignition key back to the ON position and click **OK**.



The engine ECU software update is now complete.

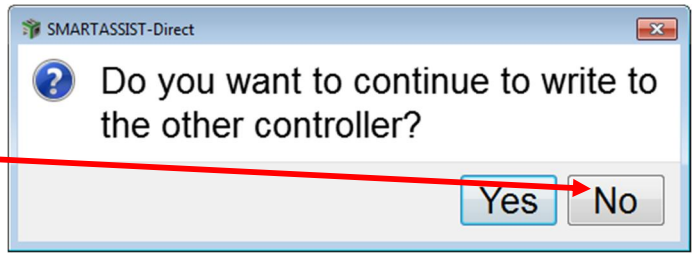
Step 16.

Click **Yes** to allow SmartAssist to automatically return the ECU software file back to the Yanmar server the next time you log into SmartAssist.



Step 17.

Click **No**.



You will be returned to the **Main Menu**.

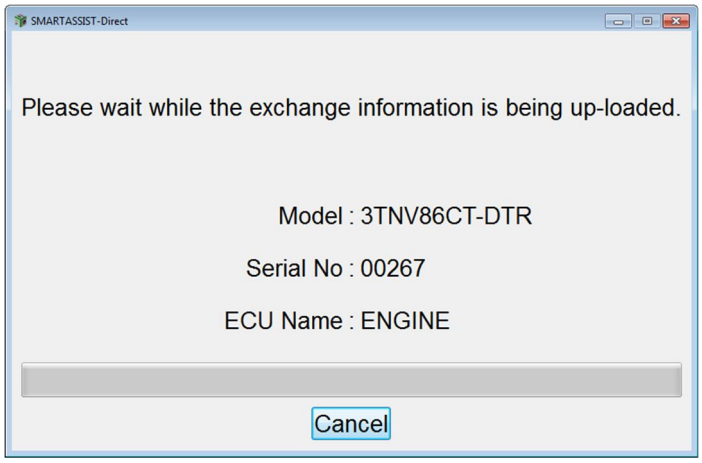
Return Software to the Yanmar Server

After a successful ECU programming, the software is still checked out and resident on your computer and needs to be returned back to the Yanmar Server. To return the software, you will need to have an Internet connection.

There are two ways to return the software back to Yanmar Server:

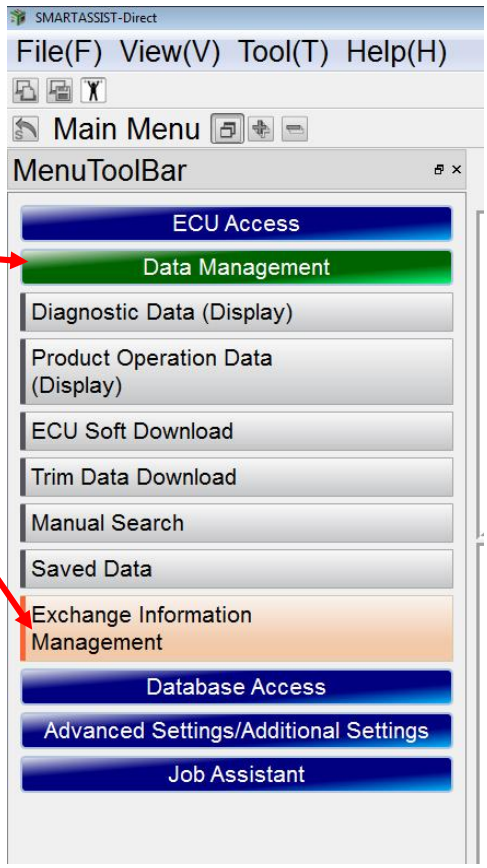
1. Once you are back to the **Start** menu, click **Industrial Engine**, and then click **Engine**.

2. A “Please wait…” message appears to let you know that the software is being sent back. Note: This window is displayed only for a short time then it disappears.

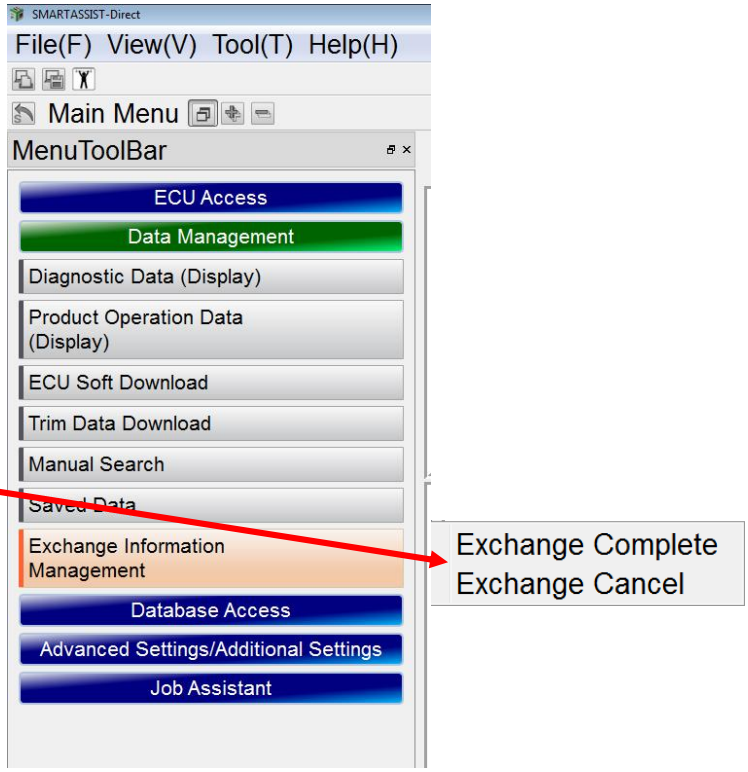


NOTE: If the “Please wait…” message does not appear, then you will need to manually return the software as explained in the following steps.

The file can be returned manually to the Yanmar server:

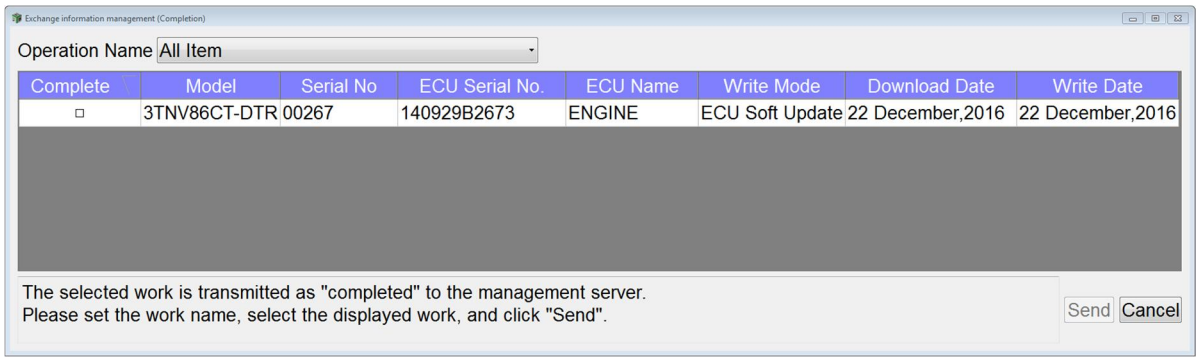


1. Click **Data Management**.
2. Click **Exchange Information Management.**

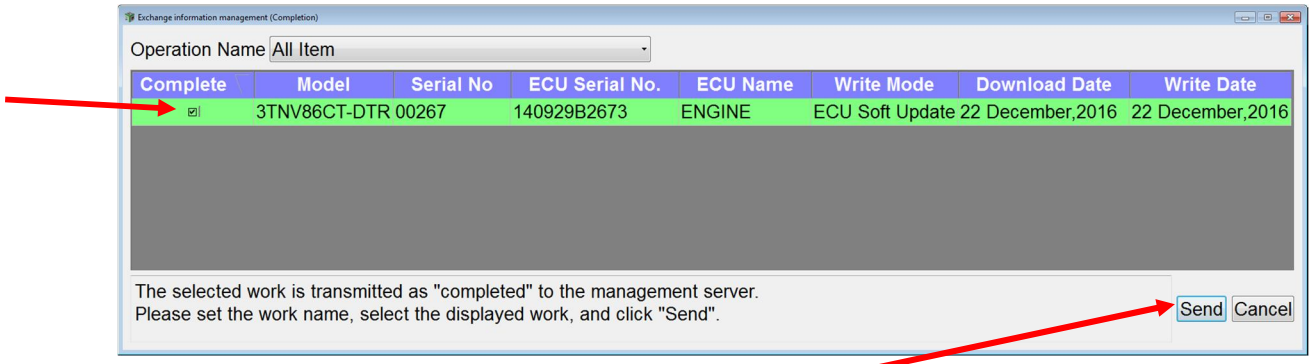


3. If the software was successfully updated to the ECU, click **Exchange Complete**. Otherwise if the software was not used, click **Exchange Cancel**.

4. The successfully completed ECU file will be listed in the window shown below.

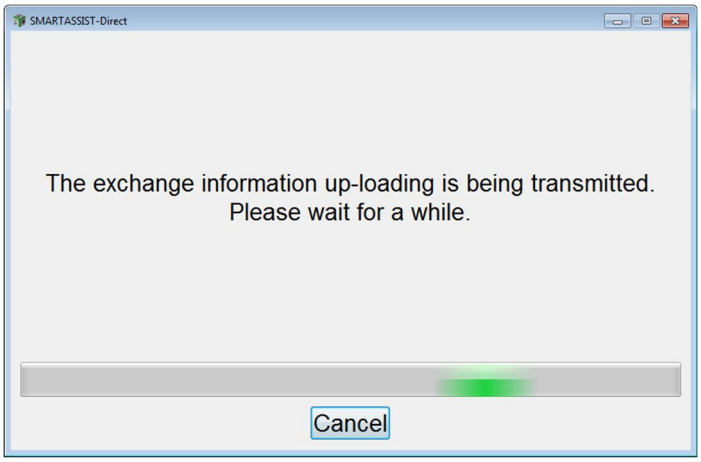


5. Select the check box under the **Complete** heading. A check mark will appear and the line will be shaded green. The **Send** button will be active.

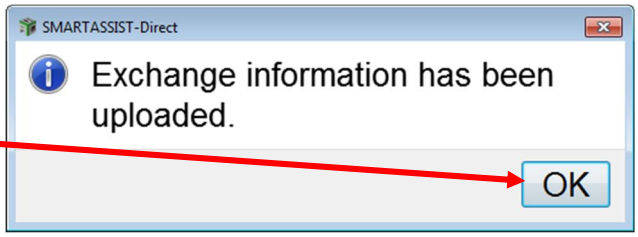


6. Click **Send**.

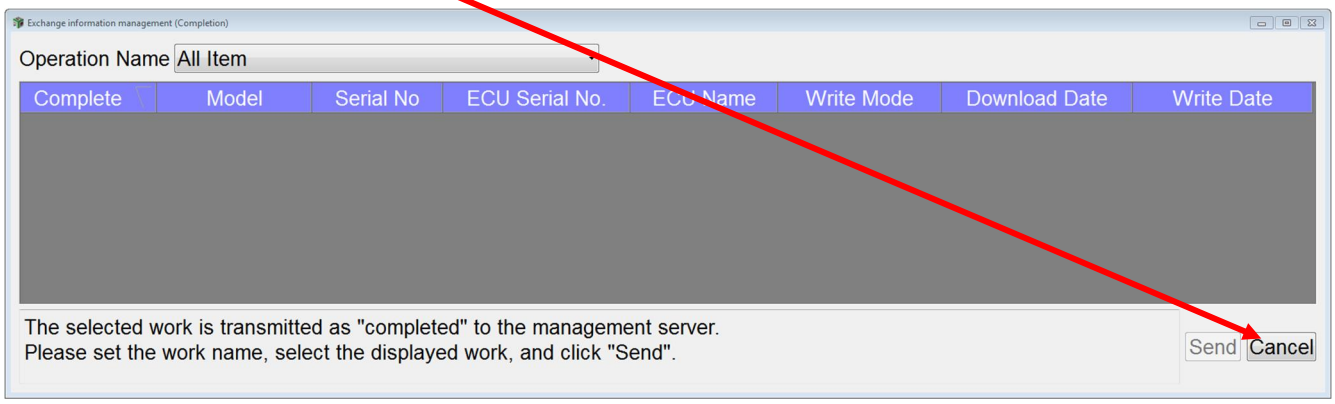
7. The file will now be returned to Yanmar server.



8. When file is successfully returned to Yanmar the following message will appear. Click **OK**.



9. Click **Cancel** and you will be returned to the **Main menu**.



Reprogramming Instructions for a New Replacement ECU

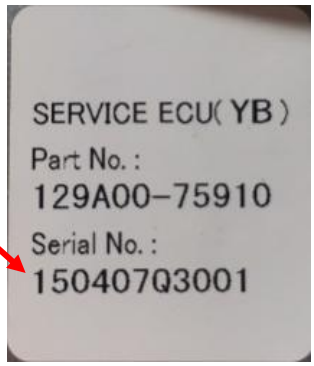
A new Yanmar ECU has no software installed. Software is installed using Yanmar SmartAssist diagnostic software.

NOTE: Once a new ECU has software installed, it will only work on that specific engine. The software ***cannot*** be removed, or reprogrammed for another engine. **Make sure the engine needs an ECU before programming new one.**

NOTE: Before removing a suspect ECU, if you are able to communicate with the suspect ECU, perform a "Set Value Copy" procedure which will save all the historical data from the ECU so it can be uploaded to the new ECU.

NOTE: It is important to note that the engine ECU software must FIRST be downloaded from the Yanmar server site. You do not need to be connected to the machine for this process. You will need:

1. An Internet connection
2. To record engine information from the old (or failed) Engine ECU Decal:
    a. Engine Model Number
    b. 5-Digit E/N number
    c. Serial No. from New ECU



Programming the Engine ECU is a four-step process:

1. The Engine ECU software must be checked out from the Yanmar server before it can be uploaded to the new service ECU. It is engine model and serial number dependent, meaning you need the engine model and E/N to check out the software. Checking out the software from Yanmar ensures that you are getting the very latest software release. This process requires an Internet connection to your computer.

2. Uploading the software to the new service ECU. An Internet connection is not required for this process. Yanmar SmartAssist is connected to the engine ECU and the software is updated. It is important that while uploading the software to the Engine ECU that no other software programs are running on your computer at the same time. Other programs running the background can cause Yanmar SmartAssist program to stop working. If the reprogramming process is interrupted, the Engine ECU will fail to be programmed and will no longer work.

3. After successfully programming the new service ECU. The ECU software must be checked back in to the Yanmar server. An Internet connection is needed for this operation. There are two ways to return the software:

    a. The next time you start the SmartAssist program and are connected to the Internet, the ECU file is automatically returned to the Yanmar server.

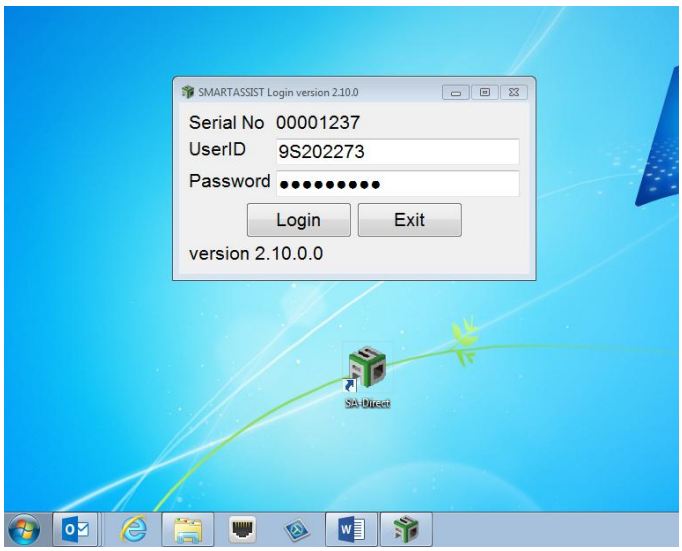
    b. After programming, you can manually send back the file, with an Internet connection.

4. After successfully programming the new service ECU, the label on the new service ECU must be filled out and covered with a protective film that is supplied with the controller.

Step 1.

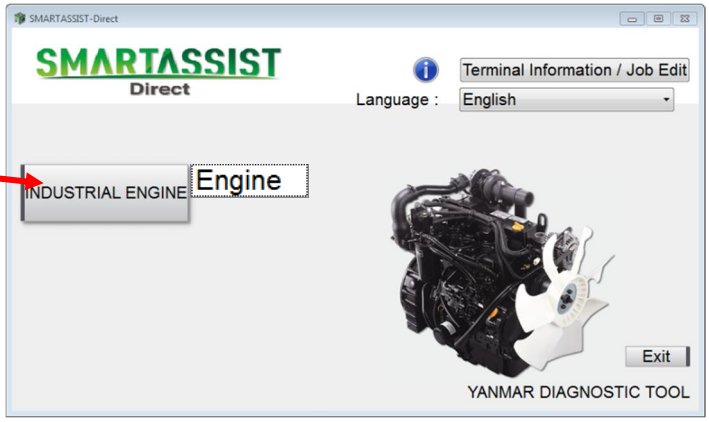
Double-click the SmartAssist icon to start the program. Enter your User ID (if required) and password and click **Login**.

NOTE: An Internet connection is required.



Step 2.

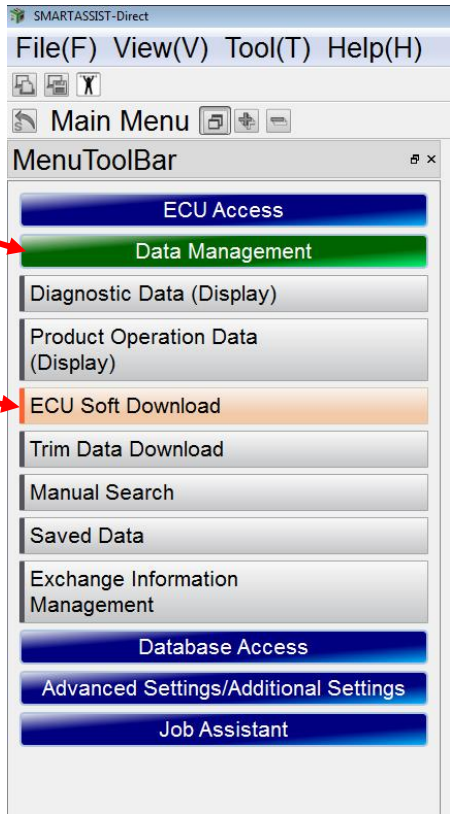
1. Click **Industrial Engine**.
2. Next, click **Engine**.



Retrieving Engine Software from the Yanmar Server and Downloading to Your Computer

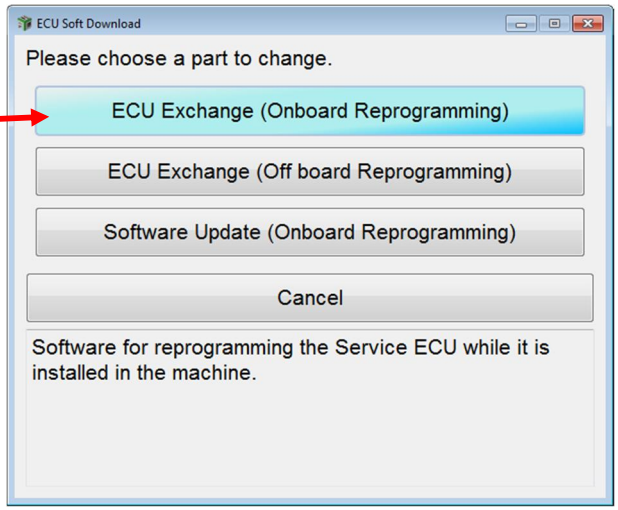
Step 3.

1. At the Main Menu, click **Data Management**.
2. Click **ECU Soft Download** from the **Data Management** drop down.



Step 4.

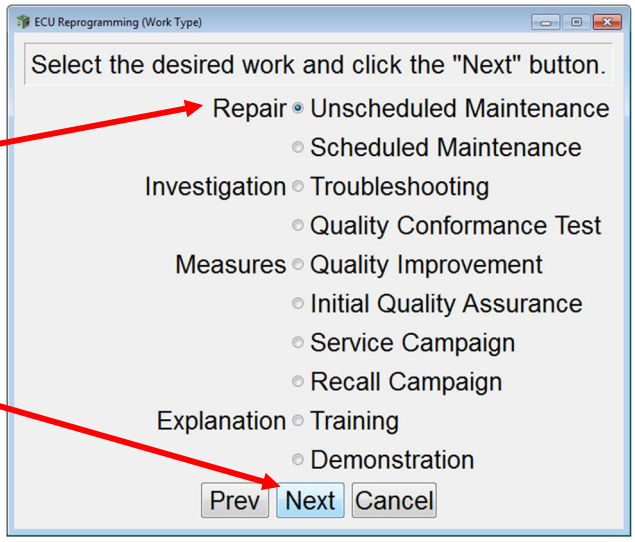
On the **ECU Soft Download window,** click **ECU Exchange (Onboard Reprogramming)**.



Step 5.

1. Select the operation type that best describes why the software is being updated. Generally **Unscheduled Maintenance** is appropriate.

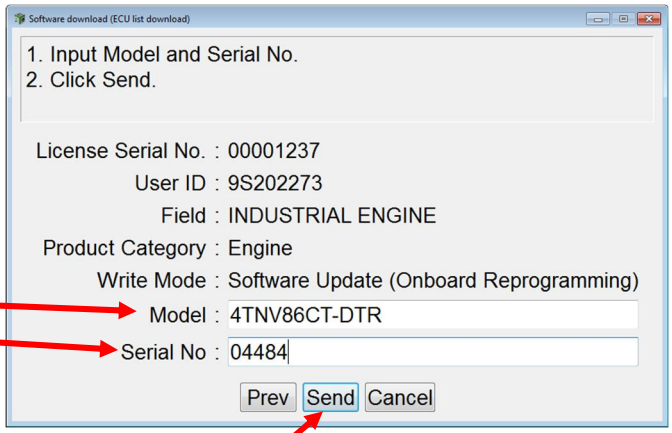
2. Click **Next**.



Step 6.

1. Enter the Engine Model No and 5-digit Serial No (E/N Number) from the engine ECU label into the boxes shown below.

Note: All letters are capitalized and the **Serial No.** is the **E/N** number from the ECU label.

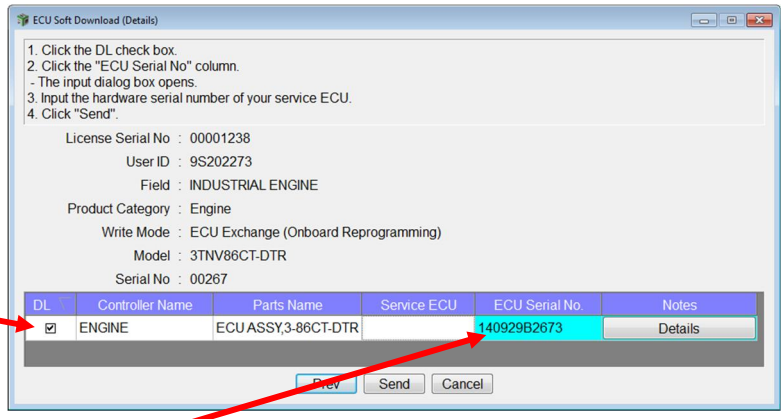


2. After Model and E/N numbers are entered; click **Send**.

3. An "…ECU Soft is being downloaded…" message appears.

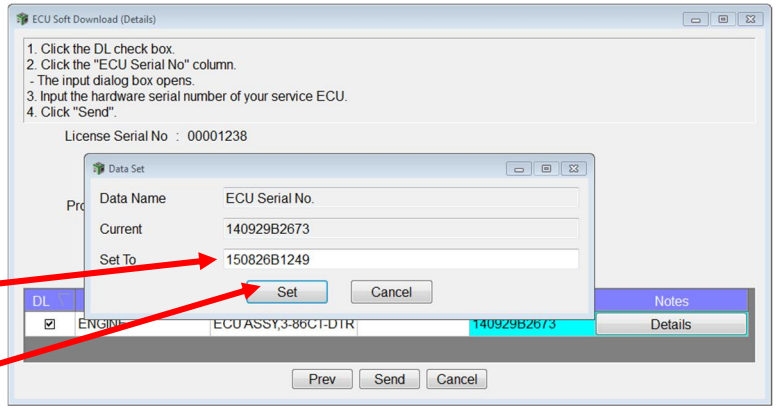
Step 7.

1. Select the check box in the **DL** column. A check mark should appear.



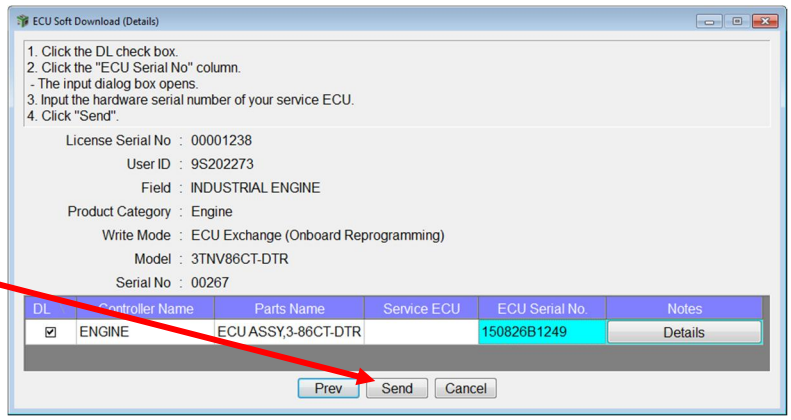
2. Click on the highlighted area under **ECU Serial No**. This will bring up a window to enter the new ECU Serial Number:

3. Enter new S/N from the new ECU's decal.

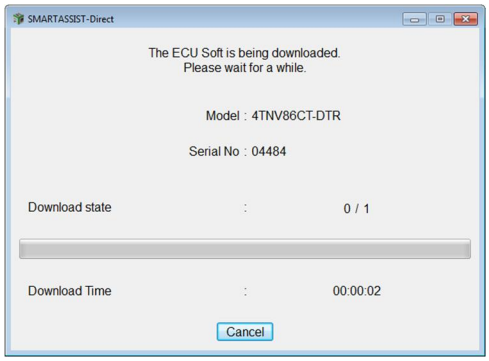


4. Click **Set**.

5. Click **Send**.



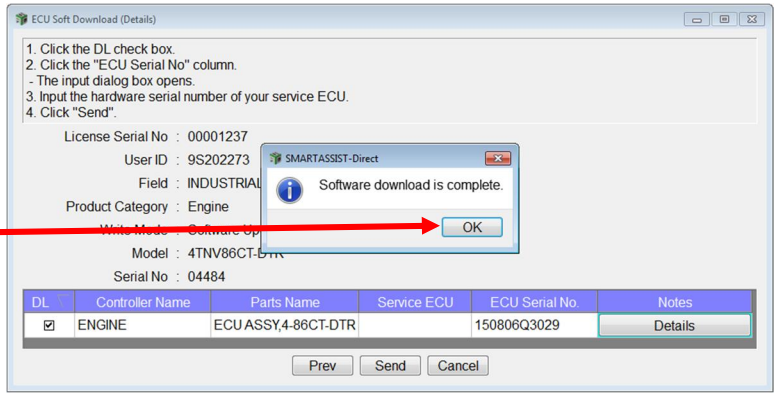
6. Software is being downloaded to your computer.



Step 8.

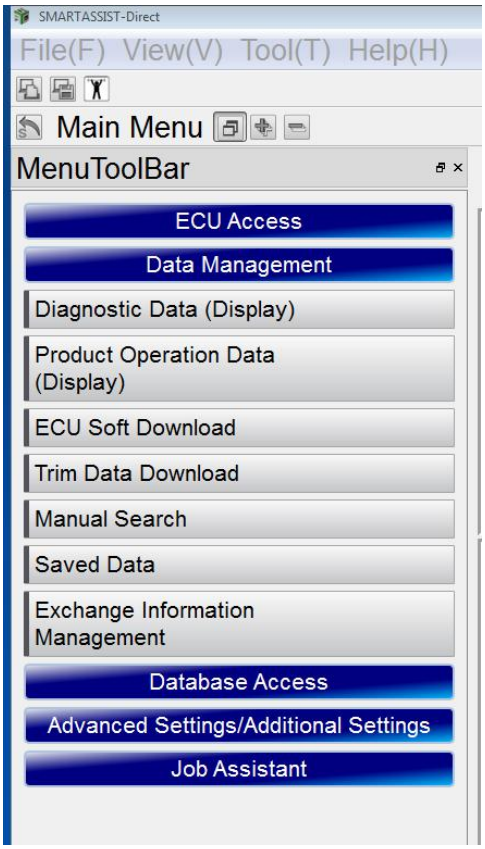
When the ECU software has finished downloading to your computer, a "Software download is complete." message appears.

Click **OK** to continue.



Step 9.

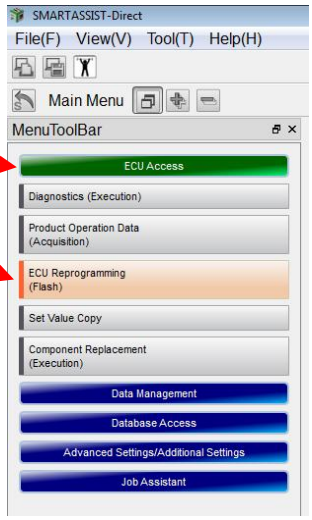
After clicking **OK** in Step 8, you are returned to the **Main Menu**.



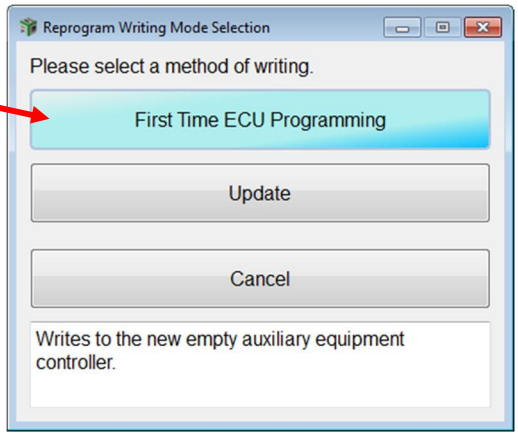
NOTE: An Internet connection is not required for remaining steps.

Installing Software to a New Engine ECU

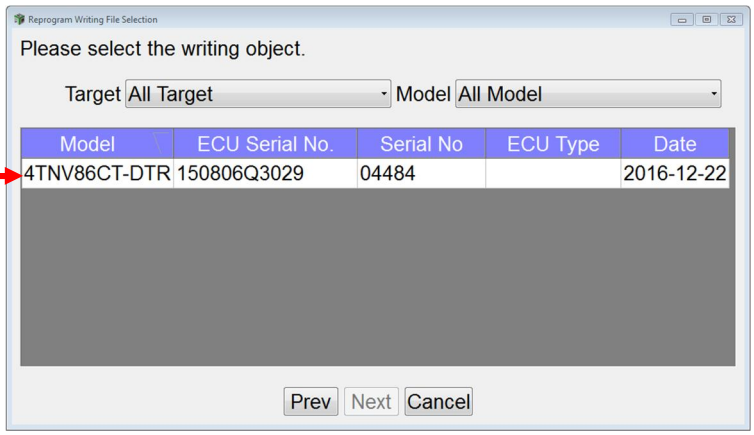
1. From the **Main Menu**, click **ECU Access**, and then click **ECU Programming (Flash)**.



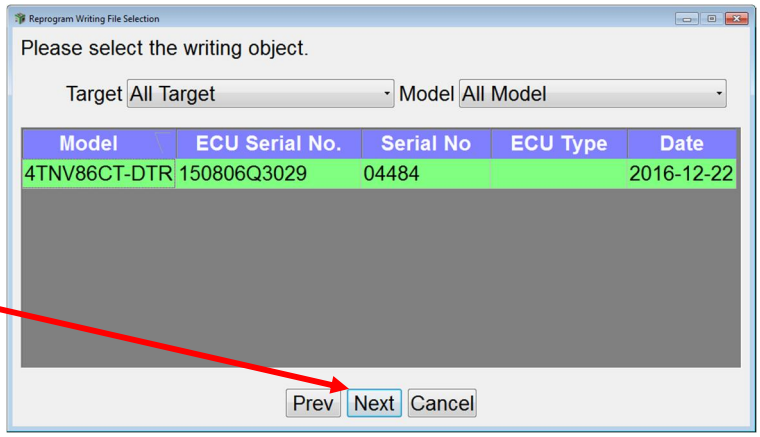
2. From the **Reprogram Writing Mode Selection** window, click **First Time ECU Programming**.



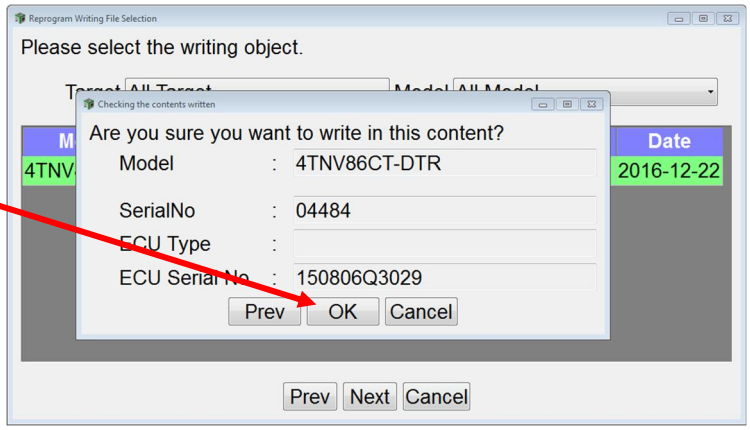
3. Click on the line with the model number and the line will be shaded green.



4. When the line is shaded green, the **Next** button becomes active. Click **Next**.



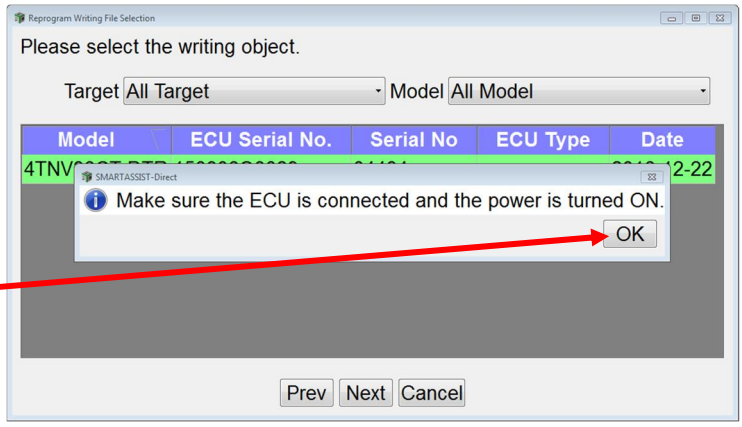
5. Click **OK**.



Note: Verify that the Ignition key is in the ON position.

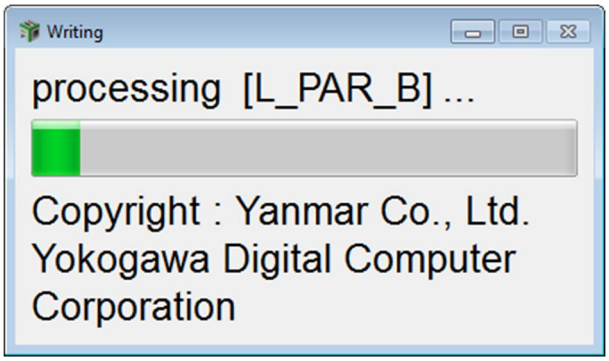
Note: Once you click **OK,** SmartAssist will start updating the ECU software.

6. Click **OK**.

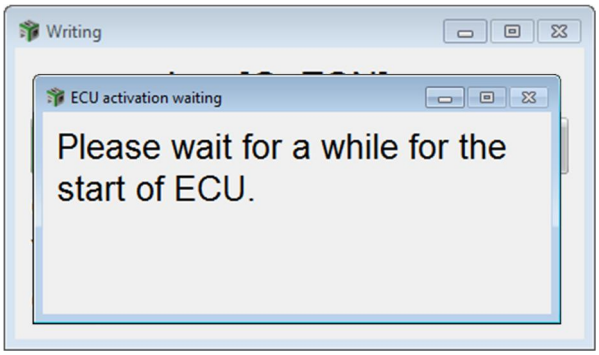


⚠ Note: Programming will take approximately 20 minutes, be patient.
⚠ Note: Power must not be interrupted to machine or computer while programming!
⚠ Note: This version of SA-D 2.x is much more robust and other programs in the background should not interfere with programming.

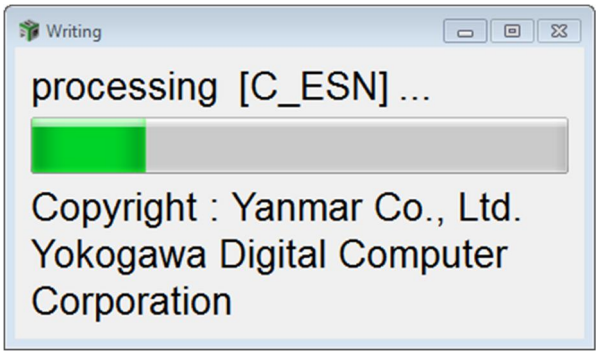
7. Programming will continue and status will be displayed on a progress bar.



8. After a few seconds this window will appear letting you know that SmartAssist is connecting with ECU. It will disappear in 5 to 10 seconds.



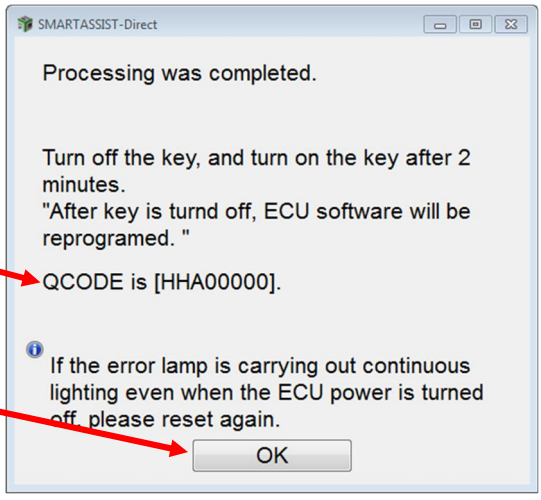
9. Programming will continue and progress will be displayed on status bar.



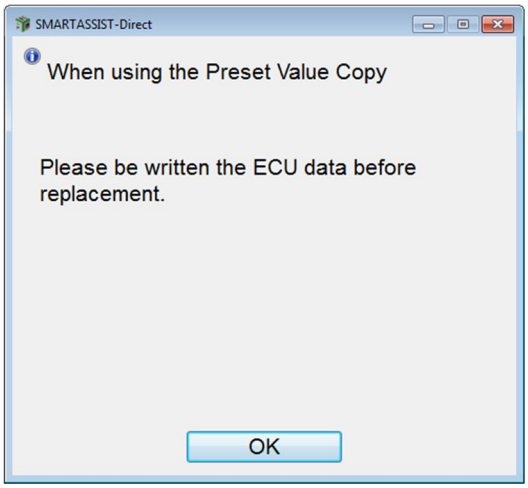
10. When this window appears, the ECU has been successfully updated. Turn the Ignition key off for at least 30 seconds.

    Write down the QCODE. It will be recorded on the new ECU decal.

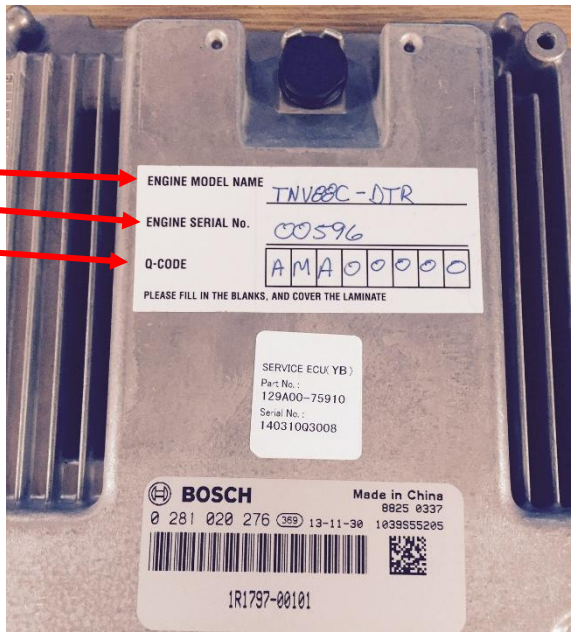
11. Click **OK**.



12. If you did a Set Value Copy that recorded all the ECU information from the old ECU, Now you would go to Set Value Copy and load this information into the new ECU.

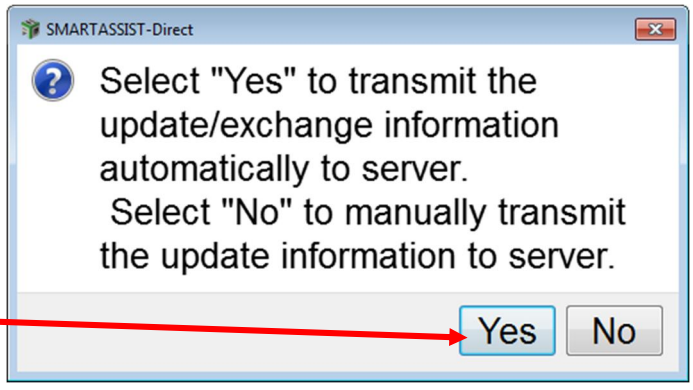


13. Fill out the new ECU decal with:
    a. Model Number
    b. Serial Number (EN)
    c. Q-Code.

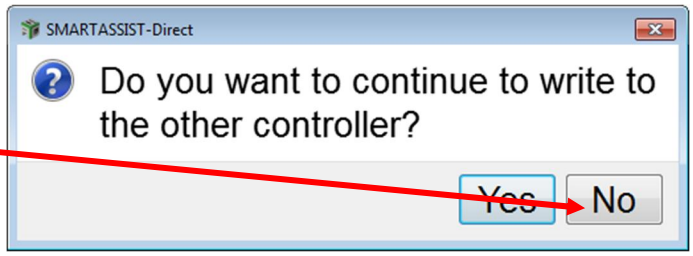


The engine ECU software update is now complete.

14. Click **Yes** to allow SmartAssist to automatically return the ECU software file back to the Yanmar server the next time you log into SmartAssist.



15. Click **No**.



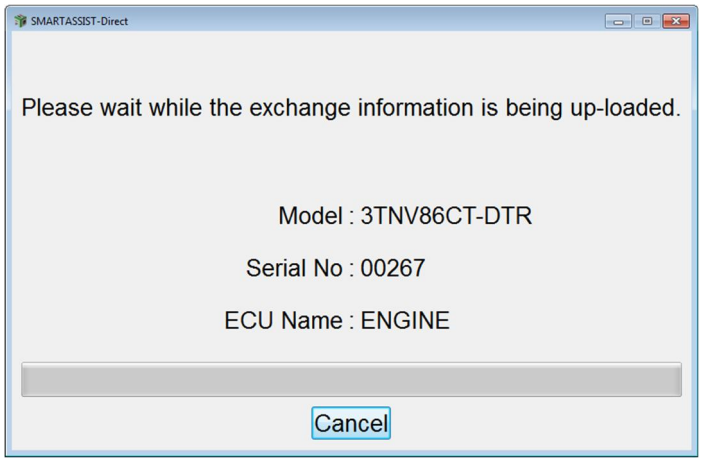
You will be returned to the **Main Menu**.

Return Software to the Yanmar Server

After a successful ECU programming, the software is still checked out and resident on your computer and needs to be returned back to the Yanmar Server. To return the software, you will need to have an Internet connection.

1. Once you are back out to the **Start Menu**, click on **Industrial Engine** then click **Engine**.

2. A “Please wait…” message appears. This message is displayed for a short time then it disappears.



Recovering Aborted ECU Programming Event

While programming a Yanmar engine ECU and something happens during programming to cause SmartAssist to stop programming the engine ECU, the ECU can no longer resume programming by normal instruction.

The important thing to remember is to stay calm. Do not start closing windows or disconnecting SmartAssist from the machine.

The following procedure gets SmartAssist to recover the ECU and start the programming process again.

IMPORTANT: The ECU can be recovered if you follow this procedure exactly. Please understand that not following this procedure could end with an ECU that will no longer function at all, and a new ECU will needed.

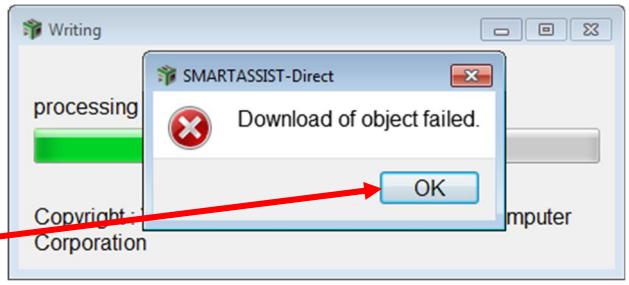
If SmartAssist stops programming an ECU, the first step is to determine why it occurred. The most common reasons for this failure are:

1. Machine power is interrupted (Key turned off) or the diagnostic cable becomes unplugged
2. Computer power failed (Battery died or power cord was disconnected)
3. Another application on your computer started running or you navigated away from the SmartAssist program while it was uploading software to ECU.
4. Machine CAN bus issues

How do we know when programming has been aborted?

There are two ways to determine if programming has stopped unexpectedly.

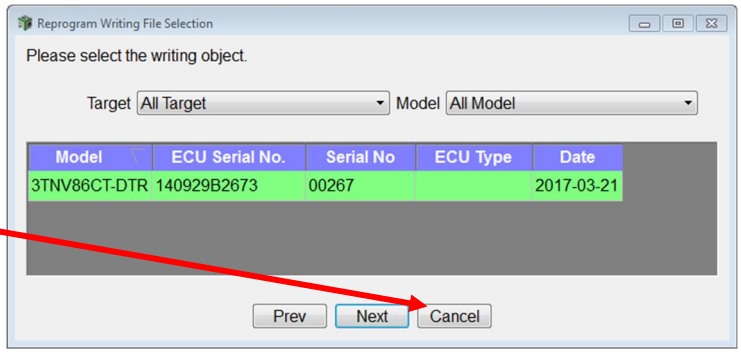
1. If the ECU loses power, (key off) or the diagnostic cable becomes disconnected, a “Download of object failed” message appears.



2. Click **OK**.

In either case, first determine why it failed (plug cable in, plug in computer AC power, etc.).

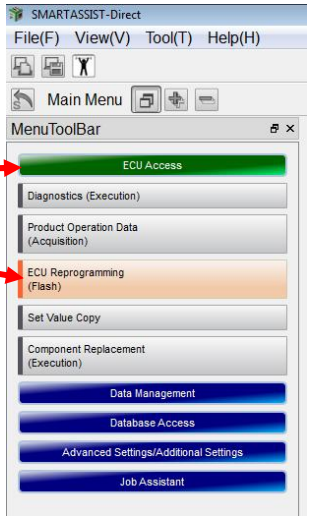
Click **Cancel**.



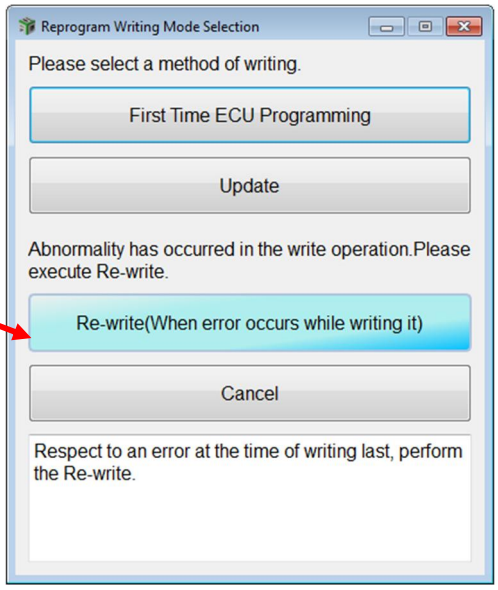
You will be returned to the **Main Menu**.

From the **Main Menu**:

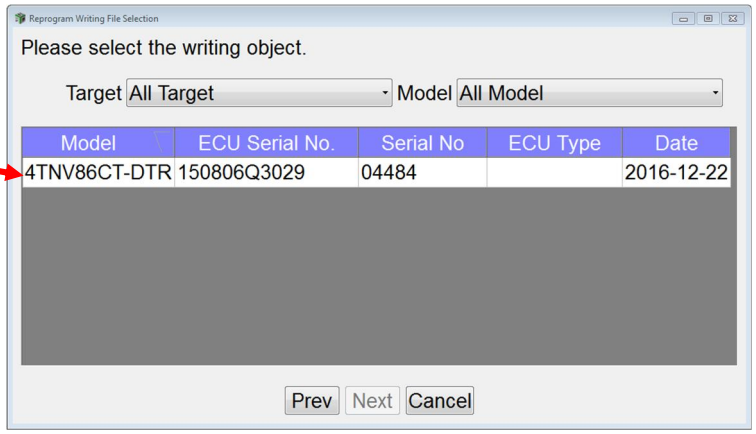
1. Turn the machine ignition key to ON.
2. From the **Main Menu**, click **ECU Access**, and then click **ECU Programming (Flash)**.



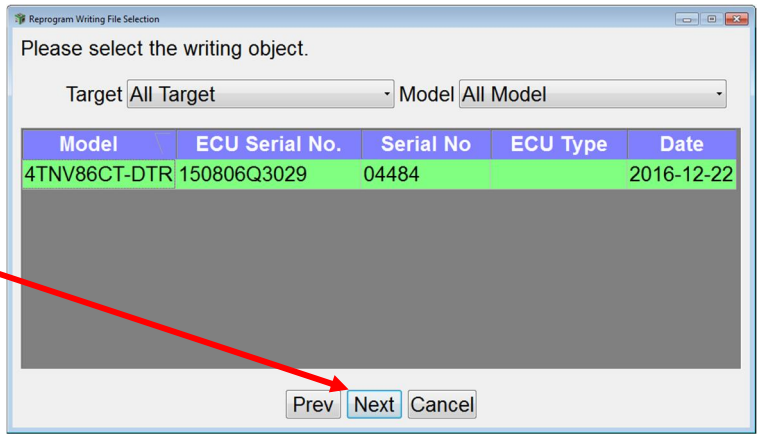
3. Click **Re-write (When error occurs while writing it)**.



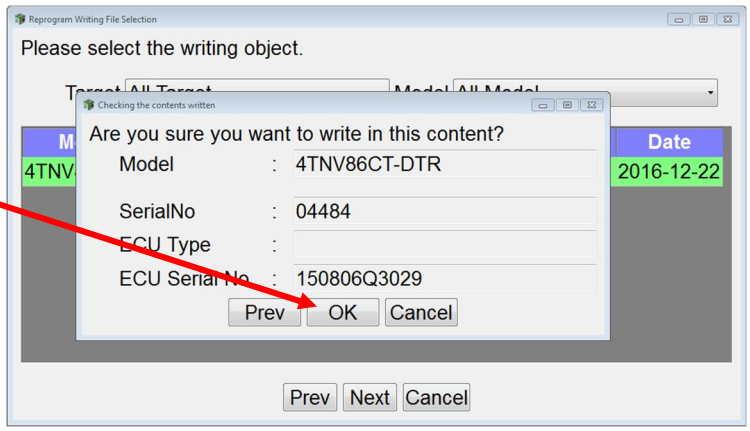
4. Click the line with the model number and the line will be shaded green.



5. When the line is shaded green, the **Next** button becomes active. Click **Next**.



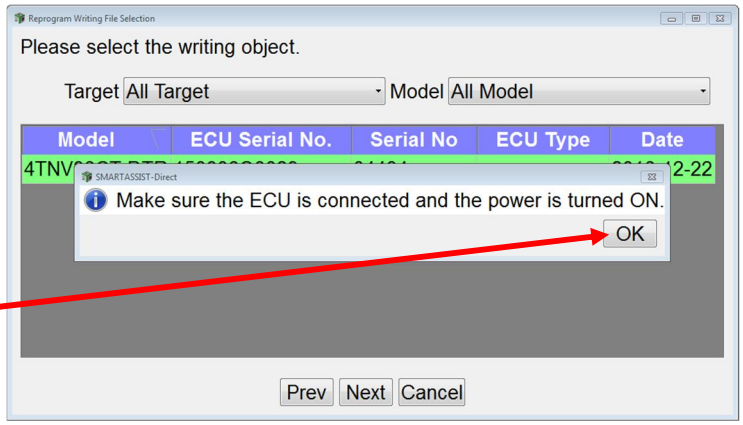
6. Click **OK**.



Note: Verify that the ignition key is in the ON position.

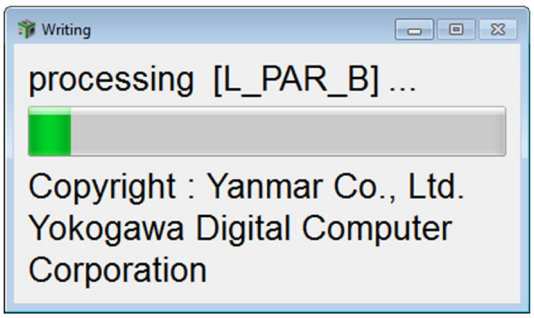
Note: Once you click **OK**, SmartAssist will start updating the ECU software.

7. Click **OK**.

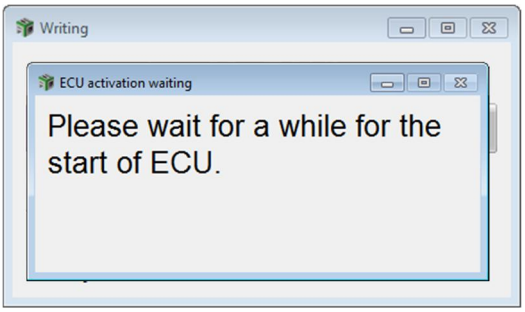


⚠ Note: Programming will take approximately 20 minutes, be patient.
⚠ Note: Power must not be interrupted to machine or computer while programming!
⚠ Note: This version of SA-D 2.x is much more robust and other programs in the background should not interfere with programming.

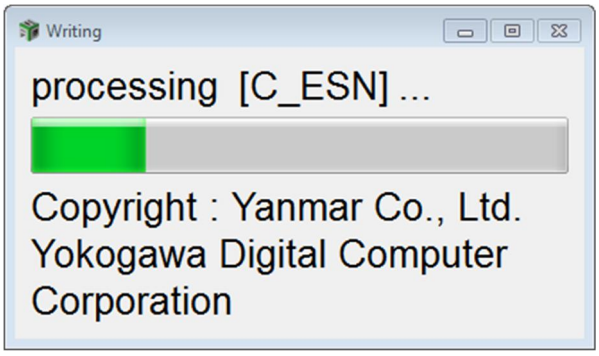
8. This progress bar will display that the ECU is being updated.



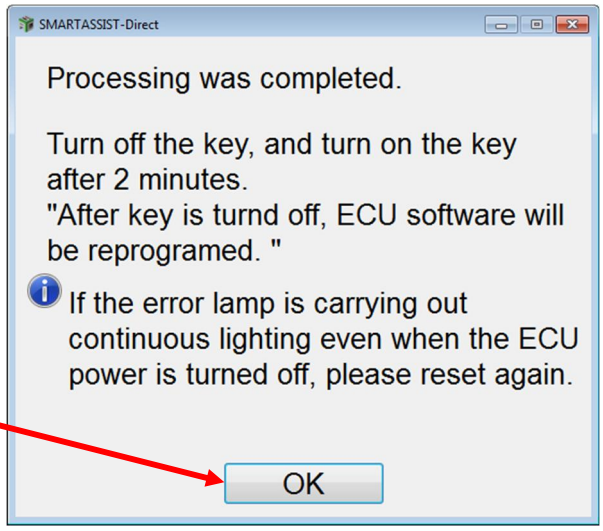
9. After a few seconds, a “Please wait…” message will appear letting you know that SmartAssist is connecting with ECU. It will disappear in 5 to 10 seconds.



10. Programming will continue and the progress bar will display that the ECU is being updated.

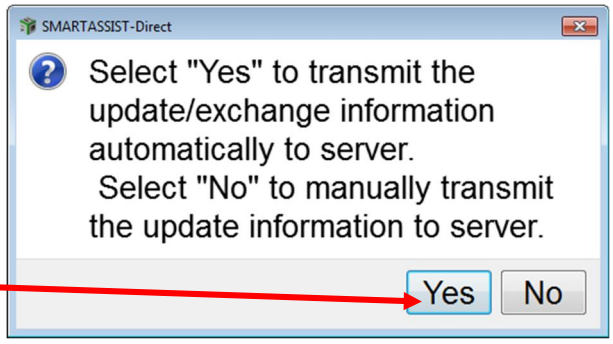


11. When this window appears, the ECU has been successfully updated. Turn the Ignition key off for at least 30 seconds. After 30 seconds, turn ignition key back to the ON position and click **OK**.

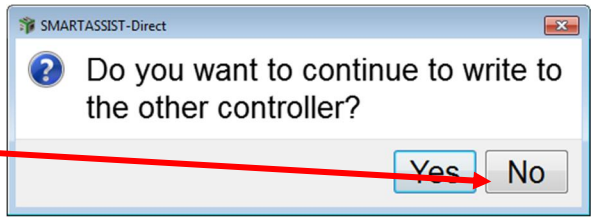


The engine ECU software update is now complete.

12. Click **Yes** to allow SmartAssist to automatically return the ECU software file back to the Yanmar Server the next time you log into SmartAssist.



13. Click **No**.



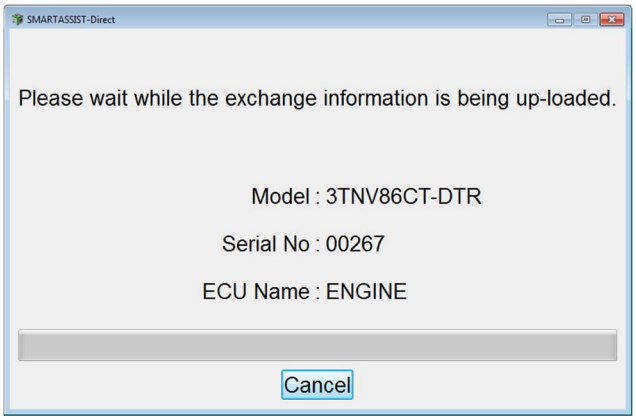
You will be returned to the **Main Menu**

After a successful ECU programming, the software is still checked out and resident on your computer and needs to be returned back to the Yanmar Server. To return the software, you will need to have an Internet connection.

Returning the software back to Yanmar Server:

1. Once you are back out to the **Start Menu**, click **Industrial Engine** and then click **Engine**.

2. A “Please wait…” message will appear to tell you that it is sending back the software. The window will only be shown for a short time, then it disappears.



Set Value Copy

All of the engine data that is stored in the ECU can be download and saved using the Set Value Copy procedure in SmartAssist. This data can be uploaded into a new ECU so engine history is preserved.

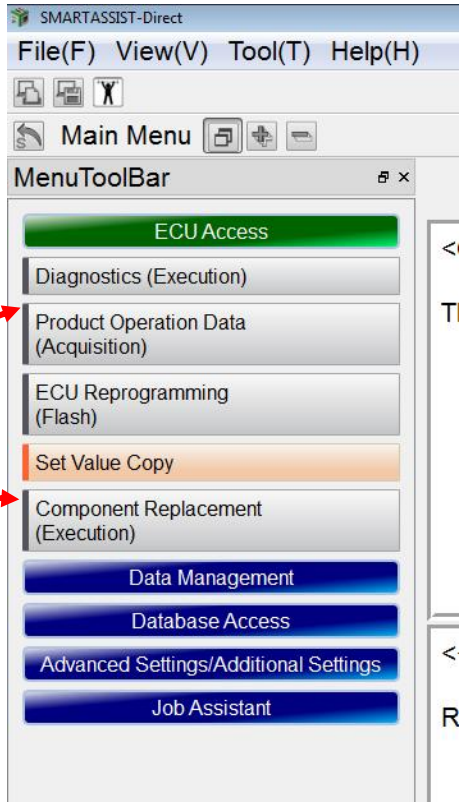
<u>To Save the Data from an old ECU:</u>

Step 1.

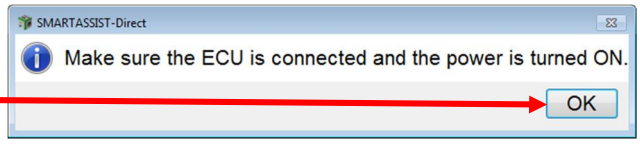
Connect the diagnostic cable to the engine ECU and start SmartAssist.

Step 2.

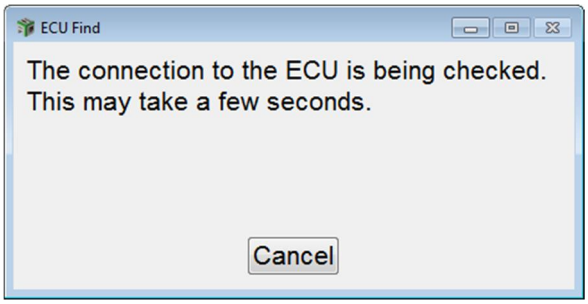
1. From the **Main Menu**, click **ECU Access**.
2. Click **Set Value Copy**.



3. Click **OK**.

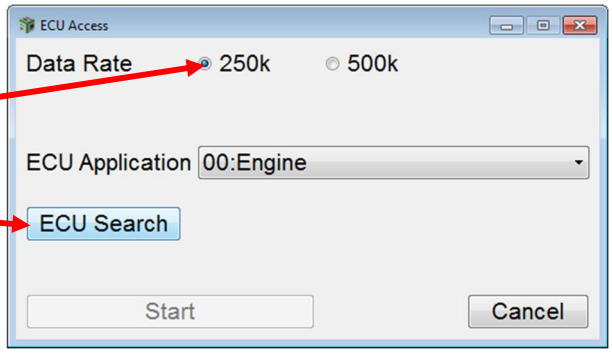


4. After clicking **OK**, this window appears briefly and then disappears

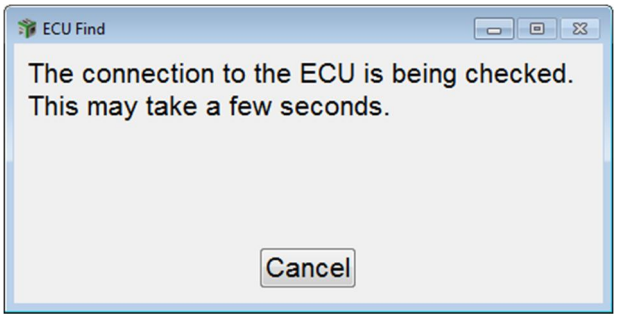


Step 3.

1. Select **250k** to set the **Data Rate**..
2. Click **ECU Search**.

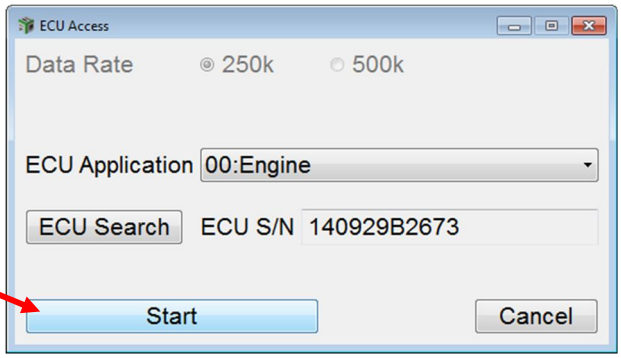


3. SmartAssist is checking the connection to the ECU. Once this is done, this window disappears and the **Start** button will become active as shown in next step.

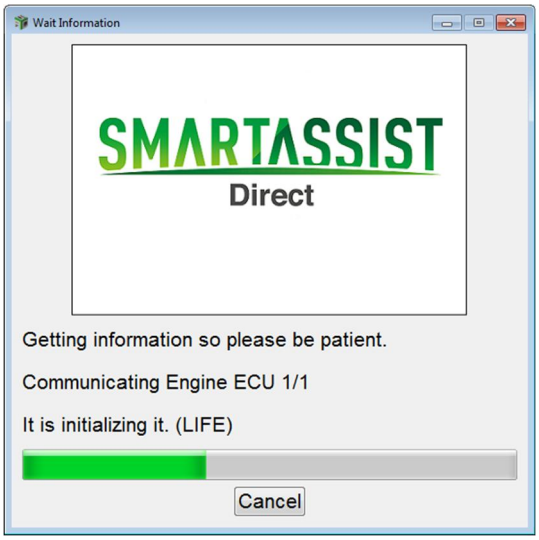


Step 4.

Click **Start**.

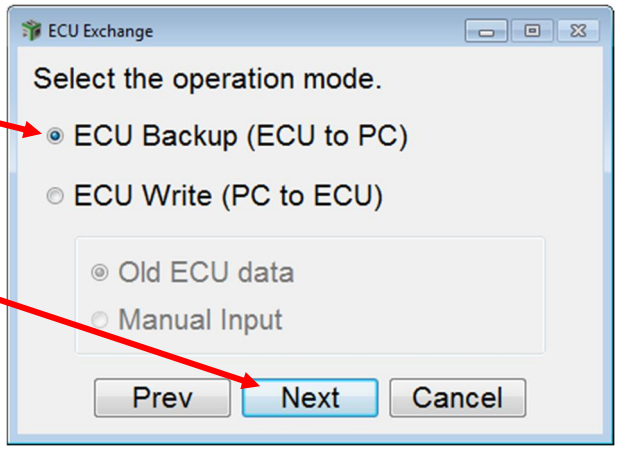


SmartAssist is now connecting with the engine ECU.



Step 5.

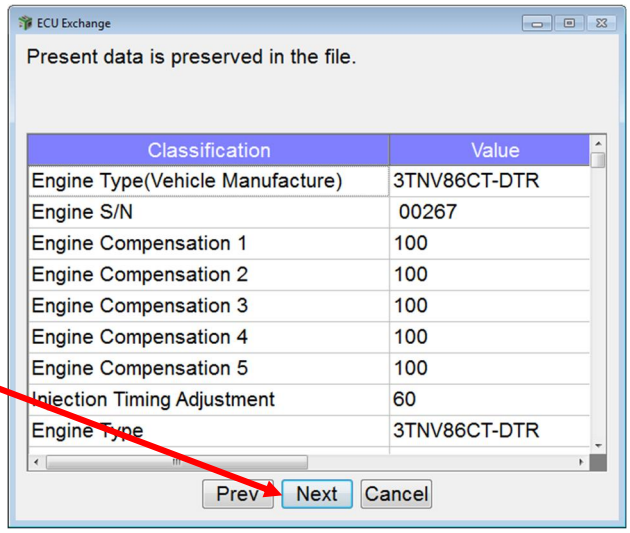
1. Select **ECU Backup (ECU to PC)**.
2. Click **Next**.



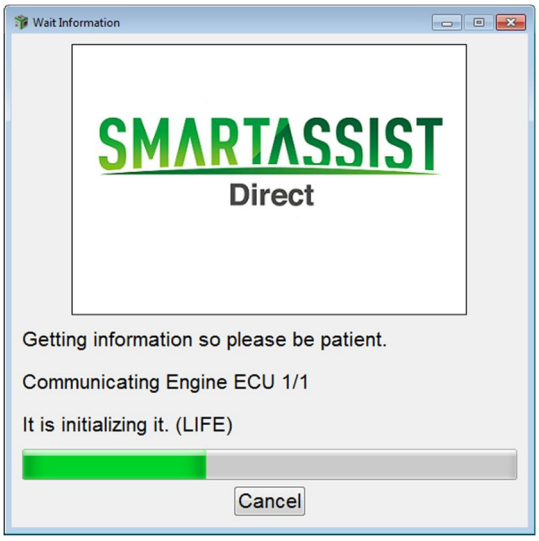
Step 6.

The data that will be saved is shown in the window.

1. Click **Next**.

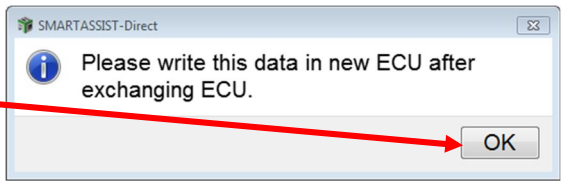


2. SmartAssist will now connect with the engine and copy all the data from the ECU.



Step 7

A “Please write this data…” message appears to remind you to write this data back to the new ECU after it is installed. Click **OK**.



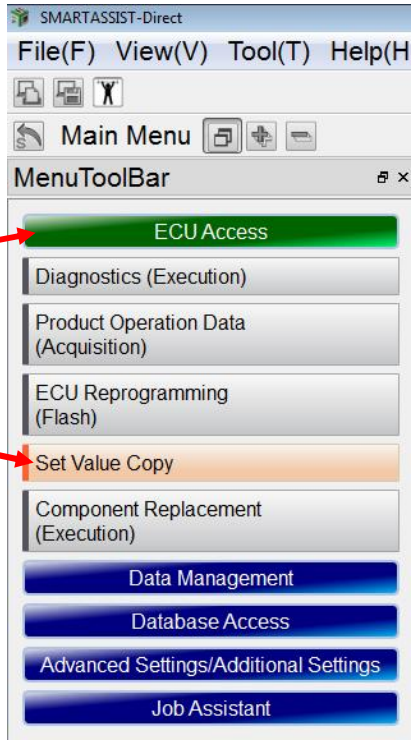
Step 8

1. Install the new engine ECU in to the machine.
2.
3. Program the new Engine ECU with the current software.

<u>To Write the Data to a new ECU:</u>

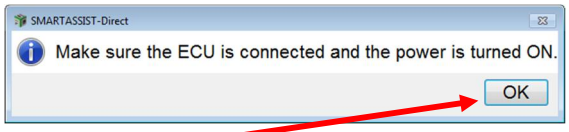
Step 1.

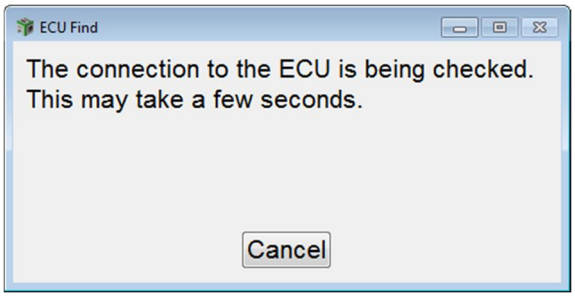
1. Once at the **Main Menu**, click **ECU Access**.
2. Click **Set Value Copy**.



Step 2.

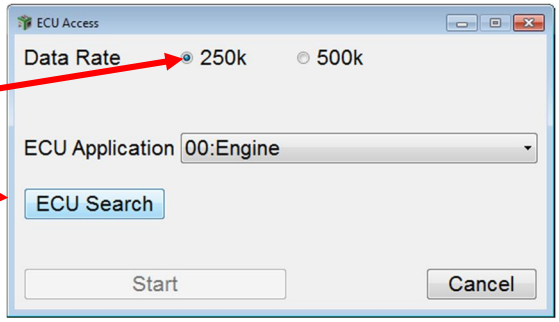
The following messages appear.
Click **OK** when the key is turned to the ON position.



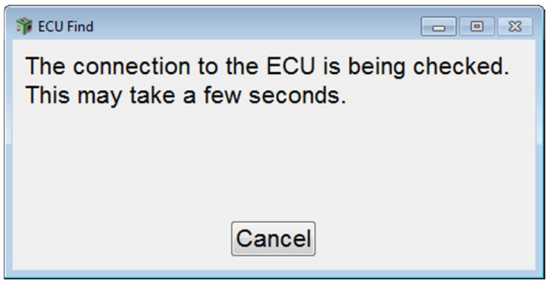


Step 3.

1. Select **250k** to set the **Data Rate**.
2. Click **ECU Search**.

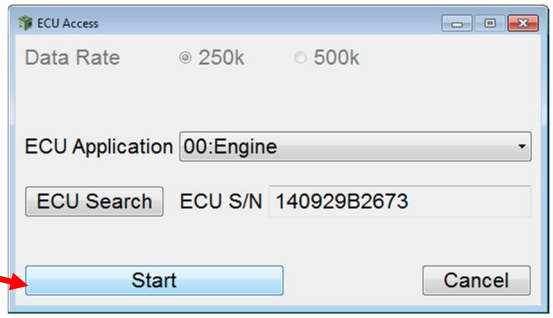


SmartAssist is checking connection to ECU, once this is done, this screen disappears and the **Start** button will be active as shown in the next step.

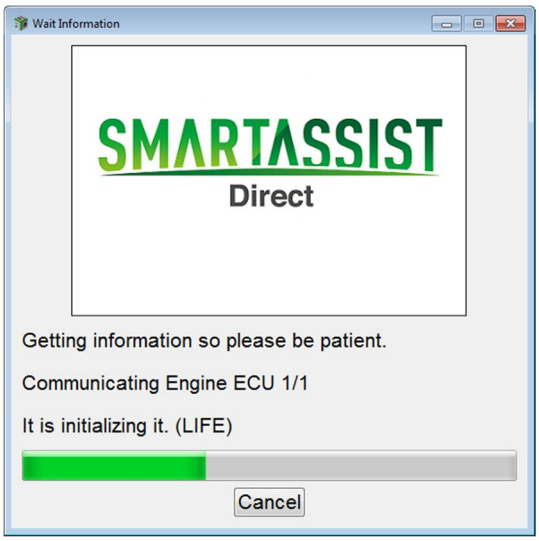


Step 4.

1. Click **Start**.



SmartAssist is now connecting with the engine ECU.

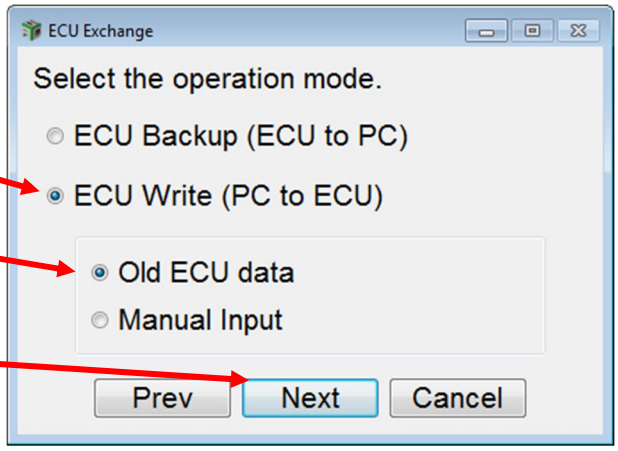


Step 5.

Select **ECU Write (PC to ECU)**.

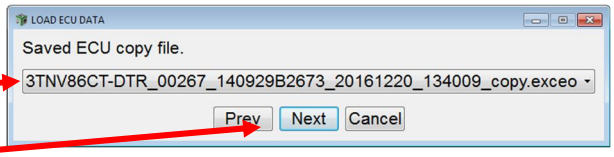
Select **Old ECU Data**.

Click **Next**.



Step 6.

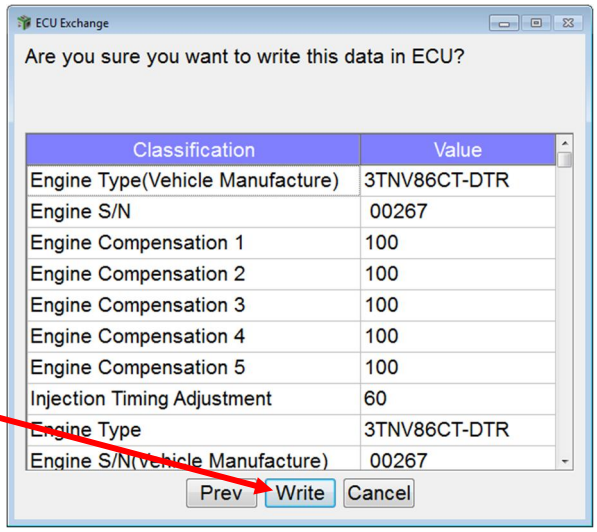
1. Select the file to be saved from the drop down list. The engine model and s/n must match the model and s/n on the ECU decal.
2. Click **Next**.



Step 7.

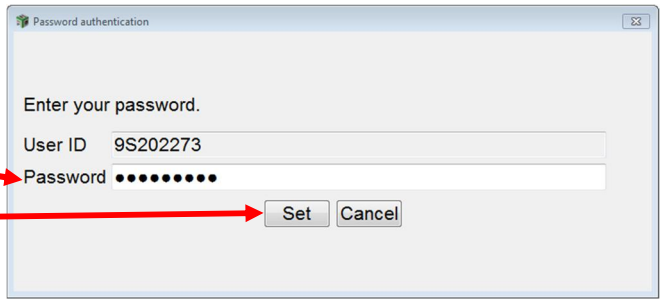
Data to be written back to the ECU is shown in the window.

Click **Write**.



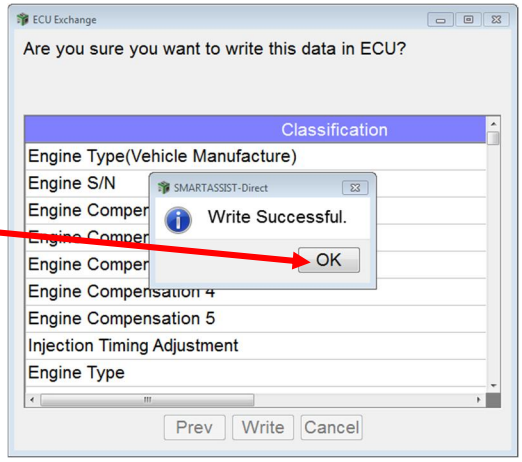
Step 8.

1. Type your SmartAssist password
2. Click **Set**.



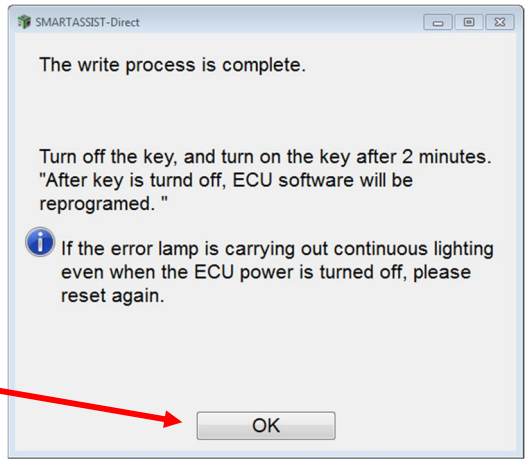
Step 9.

1. A “Write successful.” message appears.
2. Click **OK**.



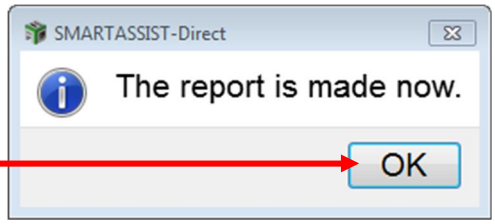
Step 10.

1. Turn the ignition key to OFF.
2. Wait at least 30 seconds and turn ignition key back to ON.
3. Click **OK**.



Step 11.

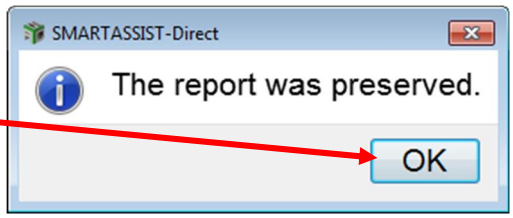
1. SmartAssist creates a report that Set Value Copy was successful.
2. Click **OK**.



Step 12.

SmartAssist saves the report.

Click **OK**.



Step 13.

Set Value Copy is finished and SmartAssist will return to the **Main Menu**.

Saving an ECU File

When connecting to an engine that is experiencing an issue, it can be helpful to save a file from the ECU to use for troubleshooting or to have as a record of how the machine is performing. Saving a file before and after work was preformed will help validate the fix and provide a history of the engine.

This data is also useful for the Toro TAC team or Yanmar service techs when trying to resolve an engine issue.

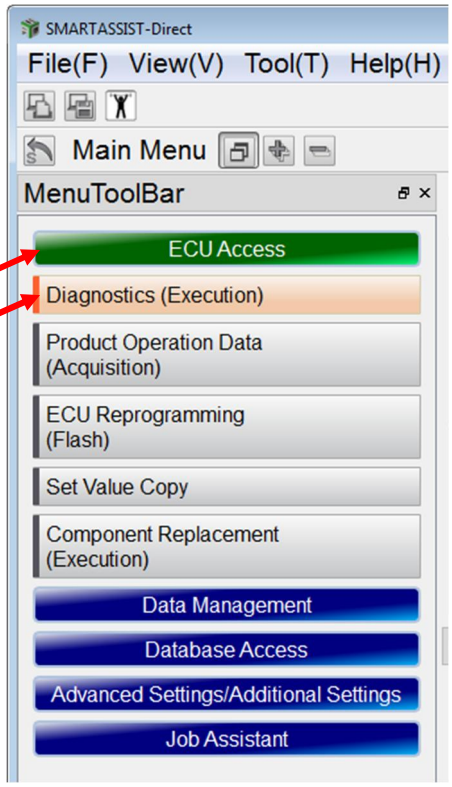
Saving an Engine ECU file is a simple process:

Step 1.

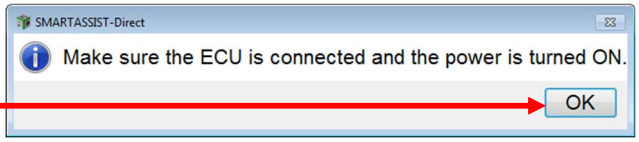
Connect the diagnostic cable to the engine ECU and start SmartAssist.

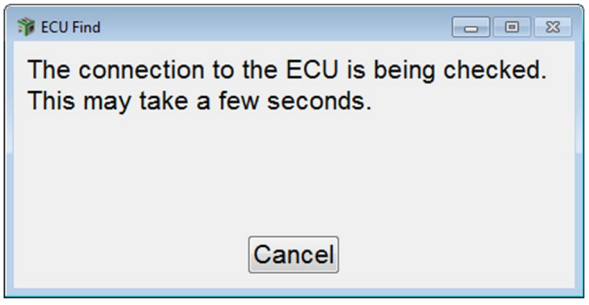
Step 2. Once :

1. On the Main Menu, click **ECU Access**.
2. Click **Diagnostics (Execution)**.



3. Verify that the ignition key is in the ON position
4. Click **OK**.

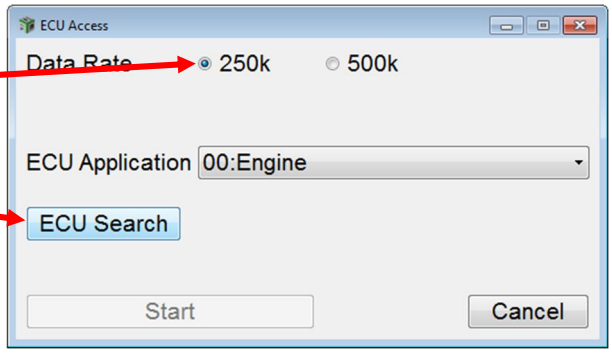




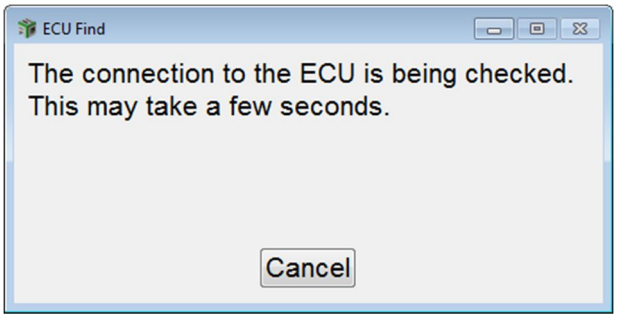
Step 3.

Select **250k** to set the **Data Rate**.

Click **ECU Search**.

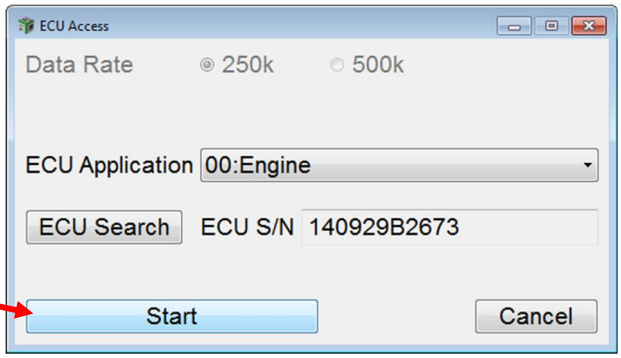


SmartAssist is checking connection to the ECU Once this is done, this screen disappears and the **Start** button becomes active.

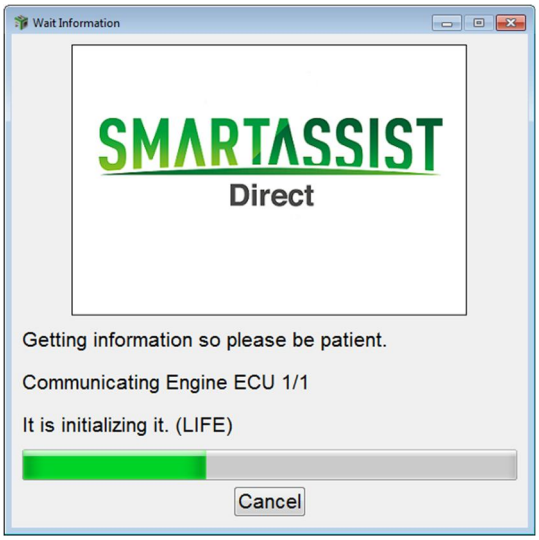


Step 4.

Click **Start**.



SmartAssist is now connecting with the engine ECU.

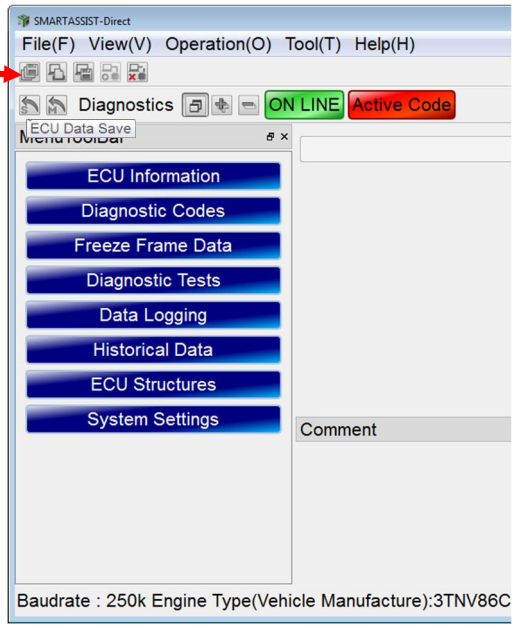


Step 5.

ECU Data Save can be done with the key on and engine off, or with the engine running. It just depends on the issue you are having whether to save the file with the engine running or not.

Step 1.

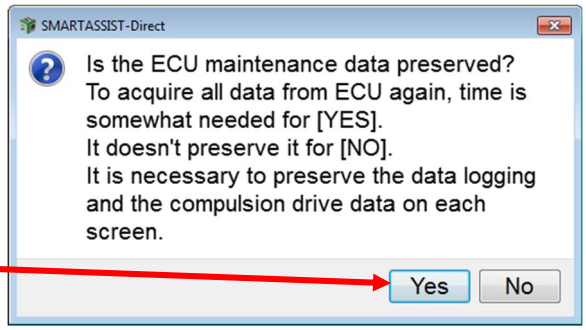
To save a file, click the **ECU Data Save** icon.



Step 6.

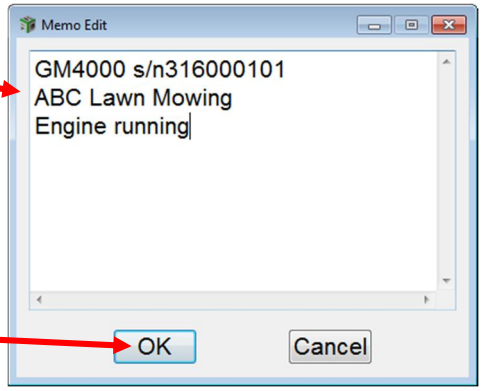
A “Is the ECU…” message appears to prompt you to save the file.

Click **Yes**.



Step 7.

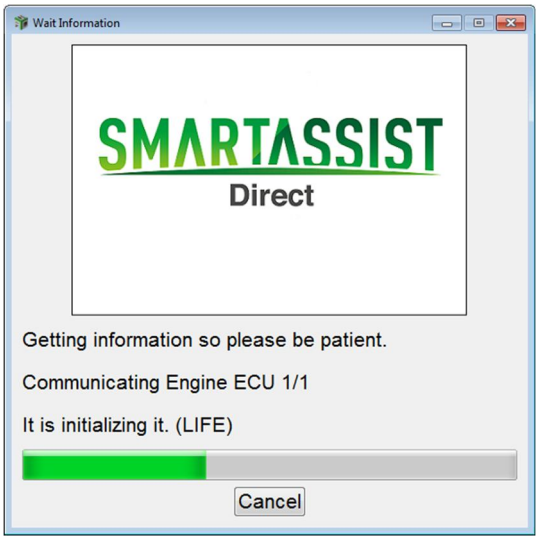
1. A **Memo Edit** window appears. Type the machine model, s/n, customer name, and a comment if the engine is running or not.



2. Click **OK**.

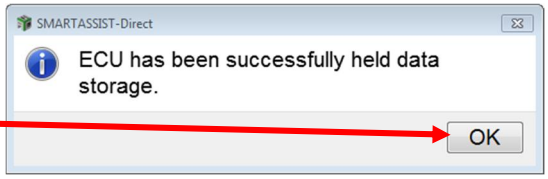
Step 8.

SmartAssist is now connecting to the engine ECU and saving the engine information.



Step 9.

Click **OK**.



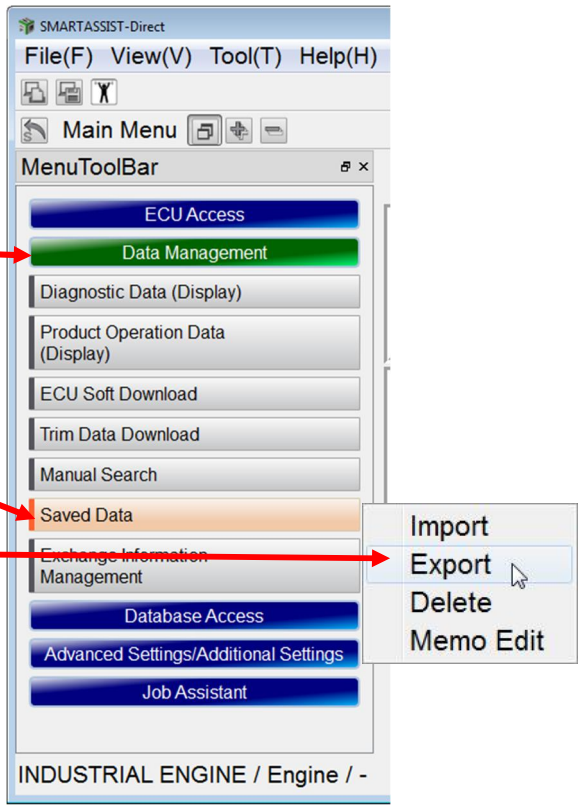
The ECU data file is now saved in the SmartAssist application. It will need to be exported from SmartAssist to your computer desktop so it can be emailed. See Exporting Data File on page 58.

Exporting Data File

Step 1.

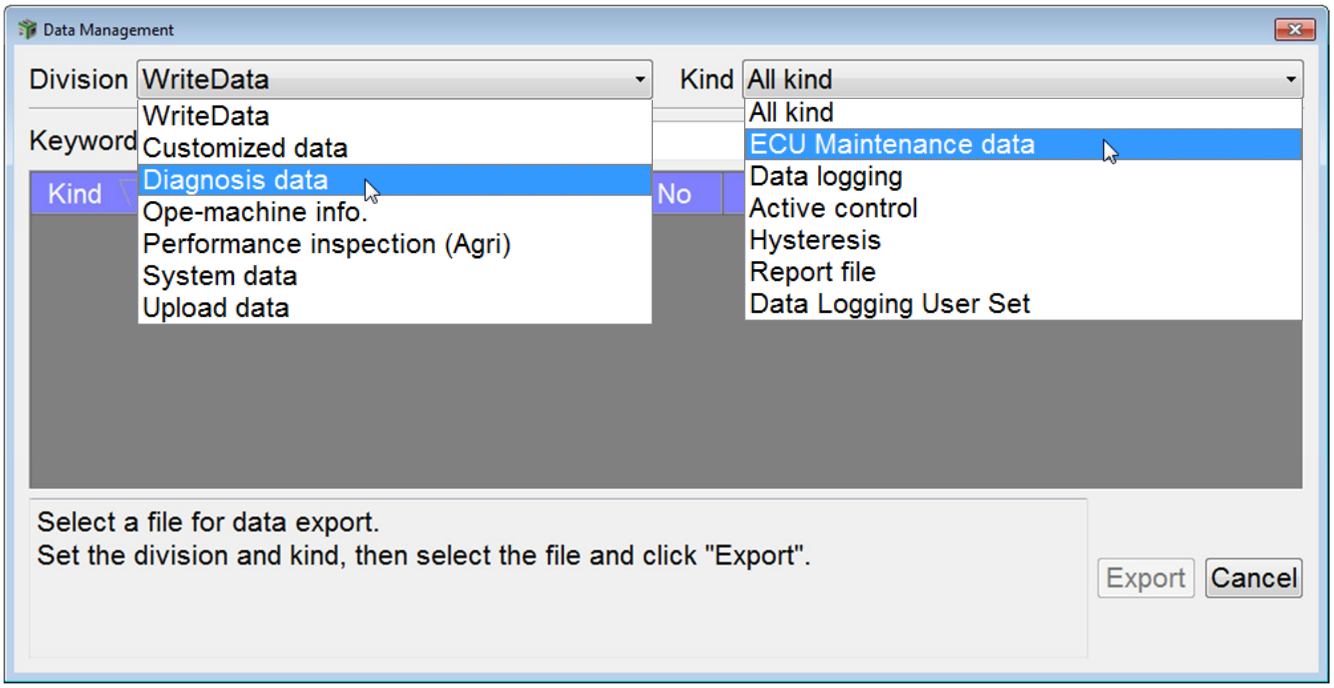
From the **Main Menu**:

1. Click **Data Management**.
2. Click **Saved Data**.
3. Click **Export**.

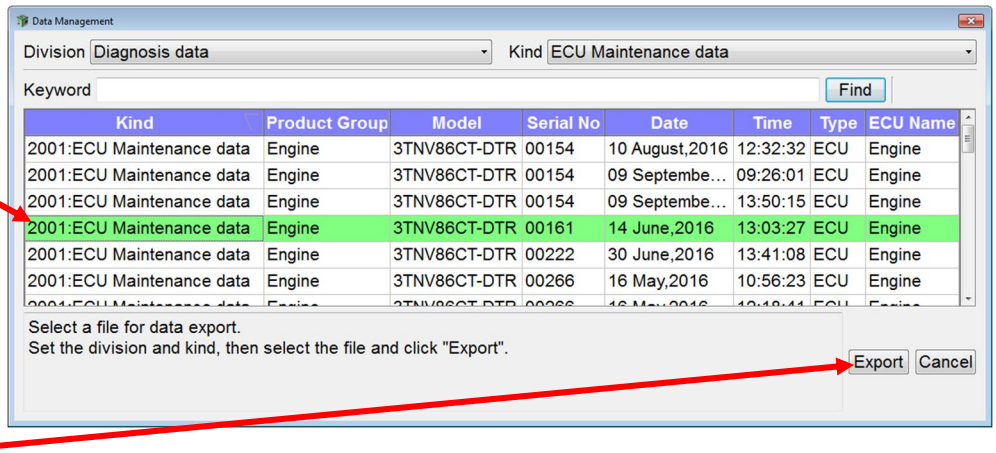


Step 2.

1. From the **Division** drop down list, select **Diagnosis data**.
2. From the **Kind** drop down list, select **ECU Maintenance data**.



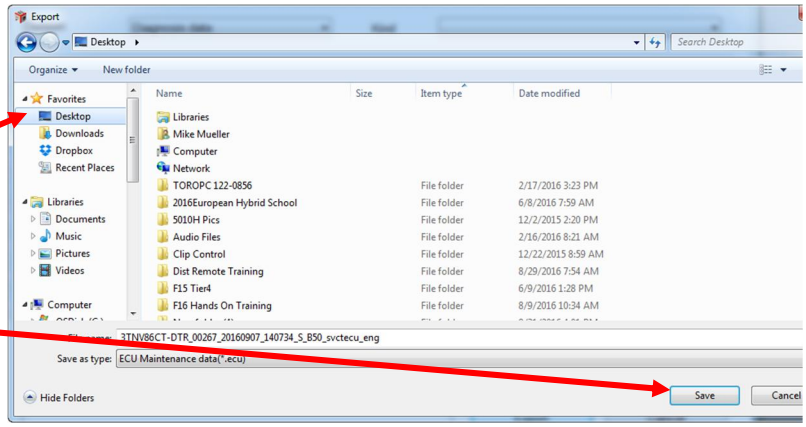
Step 3.



1. Select the file to export. Select the line by clicking on it and it will be shaded green.
2. Click **Export**.

Step 4.

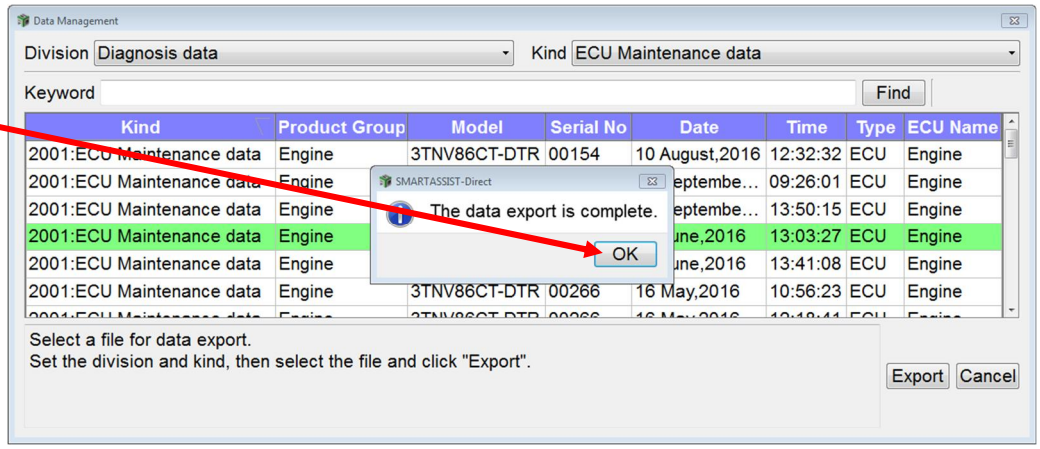
Select where you want the file to be saved. Your computer desktop is a good place. The file is automatically named with the engine model and s/n.



1. Select **Desktop**.
2. Click **Save**.

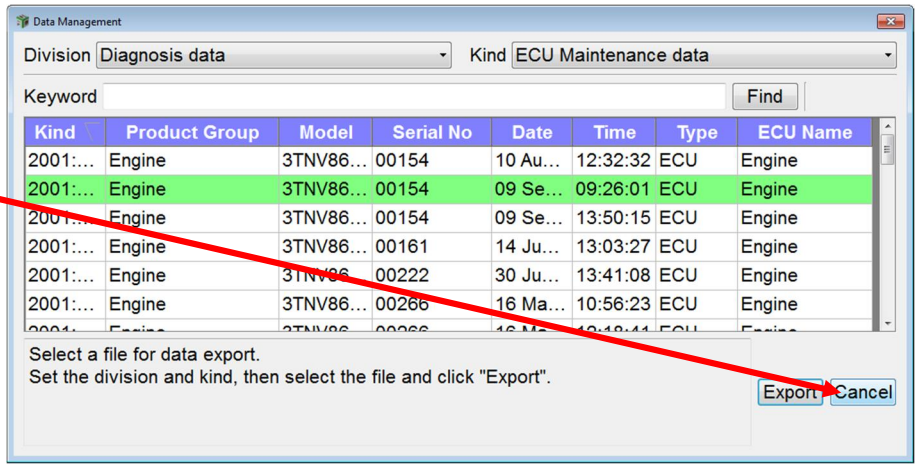
Step 5.

1. Click “**OK**”.



Step 6.

Click **Cancel** .



Now you are at the **Main Menu** and the exported file will be located on your desktop. Attach file to an email and send.