



Engine Control Unit documentation Serial control



Serial control Documentation

Date: November, 2020

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Status: Final

Owner: AMT Netherlands

| Revision | Date | Major modifications | Chapter |
|----------|-----------|--|----------------|
| 20110615 | Jun, 2011 | Init document. Split from master document | All |
| 20111207 | Dec, 2011 | Added serial communication input values for OPS & THR | 2.2.2, 2.2.3 |
| 20120118 | Jan, 2012 | Changed offset throttle from 16 to 32 | |
| 20120306 | Mar, 2012 | Added sequence of sending serial data stream | |
| 20121222 | Dec, 2012 | Added new engine to software | |
| 20140617 | Jun, 2014 | Change DATA1 information | |
| 20150203 | Feb, 2015 | Bits 5&6 changed for max RPM | 2.2.2 |
| 20150620 | Jun, 2015 | Added new engine to software | All |
| 20160412 | Apr, 2016 | Corrected schematic ECU-PC-EDT and table bit status | 2.2.2 |
| 20170411 | Apr, 2017 | Correction of document 20150203 | 2.2.2 |
| 20181210 | Dec, 2018 | Scope of document change to only V2 and V3 ECU types. Change calculation values different engine types. | 1.3 2.2 |
| 20190527 | May, 2019 | Minor text Additional protocol information | 2.2.1 2.3.1 |
| 20190604 | Jun, 2019 | Adding text sequence normal, alternating and error data sets | 2.1.1 |
| 20201124 | Nov, 2020 | Time frame complete package of data changed | 2.3.1 |



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1 Introduction

1.1 Objective of this document

This document contains the information of the serial communication implemented in the ECU hardware. The target group of this document is AMT-Netherlands and third parties.

1.2 Cohesion of documents

Together with the Engine Control Unit (ECU) specifications and the communication specification a complete set of specification documents is formed. Development is and will be based upon this set of documents.

1.3 Scope of this document

This document is suited for ECU types V2(firmware Vx35...Vx38) and V3 (Vx01...Vx25 or Vx41...Vx99) of AMT Netherlands. Wherever possible any deviations for other than AMT-Netherlands developments will be indicated.

1.4 About this document

This document starts with general requirements for the system and is followed by sections that deal with the signals and features of the ECU.

1.5 Links to other documents

The following sources serve as input for this document:

- AMT requirements..... AR
- Specification: Hardware ECU..... SH
- Specification: Software ECU SS

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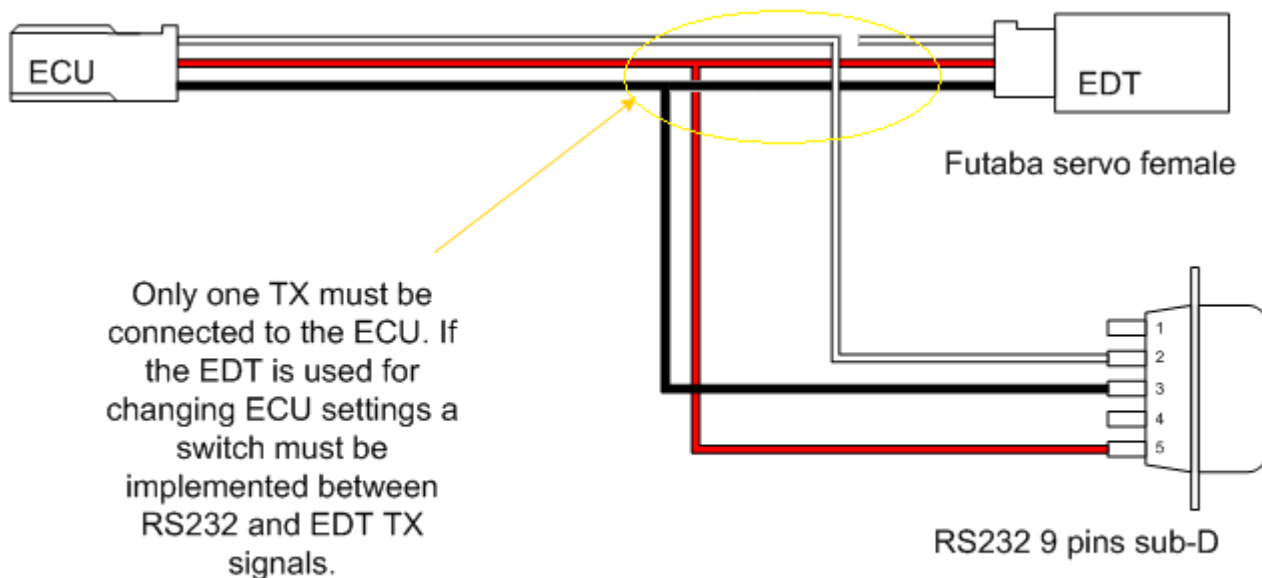
2 Serial control

2.1 General

Besides receiver pulses and analog control a third option is possible, via a serial protocol. The EDT connection is used to send data to the ECU with OPS and THR information.

For safety reasons a constant stream of data is required. If this stream is missing for a period, adjustable by a parameter, the turbine will be stopped.

To interface the EDT and serial communication at the same time next wiring harness is needed.



If an EDT is used which can alter the settings of the ECU the TX of the EDT can't be connected directly to the ECU. A collision will take place between the TX signals of the RS232 connection and from the EDT. If both connections are preferred a switch must be implemented for switching between TX signal of the RS232 connection and the TX signal of the EDT.



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2.2 EDT data

The ECU reports its status and condition via a serial protocol. This serial protocol is based on the industrial standard RS232.

After power up the ECU transmitted the software version, the software date and a number of settings. After this, the normal serial data is transmitted.

2.2.1 General specifications

| Item | Description |
|----------------|---|
| Level | Standard RS232 level -12V to 12V |
| Baud rate | Standard the ECU setting is 2400. This gives an average of 48 bytes per second. Other settings: 2400-4800-9600-19200-38400-57600-115200. If firmware Vx01-Vx25 or Vx43-Vx99 is used the lowest baud rate is 9600. |
| Protocol setup | 8 data bits, no parity, 1 stop-bit |
| Data stream* | 0xFF,{data1},{data2},{data3},{data4},{data5} |

*Value of the data bytes 1 to 5 is always between 0 and 0xFE (254). After 10 data sets of normal information an alternating data set is send. If the ECU is in error mode only the error data set is send and the alternating data set is skipped.

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2.2.2 Normal information data set

| Byte | Unit | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|------|--|------|---|---|---|---|--|--|--|-------------|---|---|---|---|---|---|---|---|--|-----------------|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|-----------------------------------|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|-----------------------------------|---|---|---|---|---|---|---|---|---------------------------------|-----------------------------------|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|------------------------------------|---|---|---|---|---|---|---|---|------------------------------------|---|---|---|---|---|---|---|---|------------------------------------|---|---|---|---|---|---|---|---|-------------------|---|---|---|---|---|---|---|---|-------------------|---|---|---|---|---|---|---|---|-------------------|---|---|---|---|---|---|---|---|-----------------|---|---|---|---|---|---|---|---|----------------|---|---|---|---|---|---|---|---|----------------|---------------|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|-----------------|---|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|------------|---|---|---|---|---|---|---|---|------------------|---|---|---|---|---|---|---|---|--------------------------------|---|---|---|---|---|---|---|---|---------------------|
| Leader | | Value always 0xFF (255) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 1 (Status) | | <div>This data byte describes the state of the ECU and which type of engine is installed.</div> <div>If B2, B1 and B0 are zero (low) then the bits B7 to B3 will indicated which engine is installed.</div> <table><tr><th colspan="8">Bits</th><th>Description</th></tr><tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th><th></th></tr><tr><td colspan="9">Switch position</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Error (See Error information set)</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>0</td><td>1</td><td>Operator Switch in Emergency stop mode</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>0</td><td>Operator Switch in Auto stop mode</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>0</td><td>0</td><td>Operator Switch in Running mode</td></tr><tr><td colspan="9">Engine ID (alternate information)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>PEGASUS engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>OLYMPUS engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>MERCURY engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>MERCURY engine ID</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>PEGASUS engine ID</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>OLYMPUS engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>TITAN engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>NIKE engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>LYNX engine ID</td></tr><tr><td colspan="9">Engine status</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>S</td><td>S</td><td>S</td><td>Start clearance</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>S</td><td>S</td><td>S</td><td>Starting</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>S</td><td>S</td><td>S</td><td>Started up</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>S</td><td>S</td><td>S</td><td>Idle calibration</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>S</td><td>S</td><td>S</td><td>Full operation running turbine</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>S</td><td>S</td><td>S</td><td>Maximum RPM reached</td></tr></table> <div>X = Status of engine S = state as in Operator Switch (001 = emer. Stop, 010 = auto stop, 100 = run)</div> | Bits | | | | | | | | Description | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | Switch position | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Error (See Error information set) | X | X | X | X | X | 0 | 0 | 1 | Operator Switch in Emergency stop mode | X | X | X | X | X | 0 | 1 | 0 | Operator Switch in Auto stop mode | X | X | X | X | X | 1 | 0 | 0 | Operator Switch in Running mode | Engine ID (alternate information) | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | PEGASUS engine ID (older versions) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | OLYMPUS engine ID (older versions) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | MERCURY engine ID (older versions) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | MERCURY engine ID | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | PEGASUS engine ID | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | OLYMPUS engine ID | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | TITAN engine ID | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | NIKE engine ID | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | LYNX engine ID | Engine status | | | | | | | | | 0 | 0 | 0 | 0 | 1 | S | S | S | Start clearance | 0 | 0 | 0 | 1 | 0 | S | S | S | Starting | 0 | 0 | 1 | 0 | 0 | S | S | S | Started up | 0 | 1 | 0 | 0 | 0 | S | S | S | Idle calibration | 0 | 1 | 1 | 0 | 0 | S | S | S | Full operation running turbine | 1 | 1 | 1 | 0 | 0 | S | S | S | Maximum RPM reached |
| Bits | | | | | | | | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Switch position | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Error (See Error information set) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | 0 | 0 | 1 | Operator Switch in Emergency stop mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | 0 | 1 | 0 | Operator Switch in Auto stop mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | 1 | 0 | 0 | Operator Switch in Running mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Engine ID (alternate information) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | PEGASUS engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | OLYMPUS engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | MERCURY engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | MERCURY engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | PEGASUS engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | OLYMPUS engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | TITAN engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | NIKE engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | LYNX engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Engine status | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 1 | S | S | S | Start clearance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | S | S | S | Starting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 0 | S | S | S | Started up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 0 | 0 | S | S | S | Idle calibration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | 0 | 0 | S | S | S | Full operation running turbine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 0 | 0 | S | S | S | Maximum RPM reached | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 2 (RPM value) | RPM | <div>RPM = value * 500 (Engine ID: PEGASUS, OLYMPUS, TITAN, NIKE, LYNX)</div> <div>RPM = value * 700 (Engine ID: MERCURY)</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 3 (EGT value) | °C | EGT = value * 4.6 – 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 4 (Throttle setting) | % | THR = value / 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 5 (Vout value) | Volt | <div>VOUT = value * 6.25 / 255 (Engine ID: MERCURY , PEGASUS)</div> <div>VOUT = value * 8.30 / 255 (Engine ID: OLYMPUS, TITAN, NIKE, LYNX)</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Engine Control Unit documentation

Serial control

2.2.3 Error information data set

| Byte | Unit | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Leader | | Value always 0xFF (255) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 1 (Status) | | This data byte describes the state of the ECU and when it's in the error mode this value is ZERO. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 2 (Error code) | | <div><div>RPM value is overruled with the error code of the ECU. Next table gives the relation between error code and the bits which are set. Multiple error can occur. In this case more the one bit is set.</div><table><tr><th colspan="8">Bits</th><th>Description</th></tr><tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th><th></th></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>rpm low</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>X</td><td>switch channel not present</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>X</td><td>X</td><td>throttle channel not present</td></tr><tr><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>X</td><td>X</td><td>X</td><td>EGT error</td></tr><tr><td>X</td><td>X</td><td>X</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>rpm high</td></tr><tr><td>X</td><td>X</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>supply low</td></tr><tr><td>X</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>supply low for Auto Start System</td></tr><tr><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table><div>X = 1 or 0</div></div> | Bits | | | | | | | | Description | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | X | X | X | X | X | X | X | 1 | rpm low | X | X | X | X | X | X | 1 | X | switch channel not present | X | X | X | X | X | 1 | X | X | throttle channel not present | X | X | X | X | 1 | X | X | X | EGT error | X | X | X | 1 | X | X | X | X | rpm high | X | X | 1 | X | X | X | X | X | supply low | X | 1 | X | X | X | X | X | X | supply low for Auto Start System | 1 | X | X | X | X | X | X | X | |
| Bits | | | | | | | | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | X | X | 1 | rpm low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | X | 1 | X | switch channel not present | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | X | 1 | X | X | throttle channel not present | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | X | 1 | X | X | X | EGT error | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | X | 1 | X | X | X | X | rpm high | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | X | 1 | X | X | X | X | X | supply low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | 1 | X | X | X | X | X | X | supply low for Auto Start System | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | X | X | X | X | X | X | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 3 (EGT value) | °C | EGT = value * 4.6 – 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 4 (Throttle setting) | % | THR = value / 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 5 (Vout value) | Volt | <div>VOUT = value * 6.25 / 255 (Engine ID: MERCURY , PEGASUS)</div> <div>VOUT = value * 8.30 / 255 (Engine ID: OLYMPUS, TITAN, NIKE, LYNX)</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Engine Control Unit documentation

Serial control

2.2.4 Alternate information data set

| Byte | Unit | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Leader | | Value always 0xFF (255) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 1 (Engine ID) | | <div>If B2, B1 and B0 are zero (low) then the bits B7 to B3 will indicated which engine is installed.</div> <table><tr><th colspan="8">Bits</th><th>Description</th></tr><tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th><th></th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>PEGASUS engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>OLYMPUS engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>MERCURY engine ID (older versions)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>MERCURY engine ID</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>PEGASUS engine ID</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>OLYMPUS engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>TITAN engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>NIKE engine ID</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>LYNX engine ID</td></tr></table> | Bits | | | | | | | | Description | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | PEGASUS engine ID (older versions) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | OLYMPUS engine ID (older versions) | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | MERCURY engine ID (older versions) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | MERCURY engine ID | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | PEGASUS engine ID | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | OLYMPUS engine ID | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | TITAN engine ID | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | NIKE engine ID | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | LYNX engine ID |
| Bits | | | | | | | | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | PEGASUS engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | OLYMPUS engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | MERCURY engine ID (older versions) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | MERCURY engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | PEGASUS engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | OLYMPUS engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | TITAN engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | NIKE engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | LYNX engine ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 2 (idle voltage) | Volt | <div>PWOMIN = value * 6.25 /255 (Engine ID: MERCURY , PEGASUS)</div> <div>PWOMIN = value * 8.30 / 255 (Engine ID: OLYMPUS, TITAN, NIKE, LYNX)</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 3 (max rpm voltage) | Volt | <div>PWOMAX = value * 6.25 / 255 (Engine ID: MERCURY , PEGASUS)</div> <div>PWOMAX = value * 8.30 / 255 (Engine ID: OLYMPUS, TITAN, NIKE, LYNX)</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 4 (ECU info) | | <div>Bitwise information** will be alternated with the value 254 for compatibility reasons:</div> <div>Bit 0: 0 = None BLDC, 1 = BLDC version of the ECU</div> <div>Other bits are not defined yet.</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 5 (battery voltage) | Volt | <div>VSUP= 7 + (value * 6.25 / 255)</div> <div>(Engine ID: MERCURY , PEGASUS)*</div> <div>VSUP = 7 + (value * 9.30 / 255)</div> <div>(Engine ID: OLYMPUS, TITAN, NIKE)*</div> <div>VSUP = 18+ (value * 12.00 / 255)</div> <div>(Engine ID: LYNX)*</div> <div>VSUP = 5 + (value / 10)</div> <div>(Engine ID: ALL)**</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Firmware Vx35...Vx42

**Firmware Vx01...Vx25 and Vx43...Vx99



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2.2.5 ECU set-up data set

| Byte | Unit | Description |
|----------------------------|------|---|
| Leader | | Value always 0xFF (255) |
| Data 1 (ECU set-up) | | Value always 0x05 (5) |
| Data 2 (high byte)* | ms | Input pulse width information from the switch channel |
| Data 3 (low byte)* | | |
| Data 4 (pulse difference)* | ms | Pulse width minimum: $PW_{min} = ((256 * PW_{TH}) + PW_{TL}) - 62464$ $PW_{max} = PW_{min} + PW_{DIFF} * 16$ |
| Data 5...17 | | A string of 12 bytes is transmitted (ASCII) which containing the software version and the production date. Format: "X.NN YYMMDD " (old) "XX.NN YYMMDD " (new) Software version and engine type. 1.NN: Pegasus engine (obsolete) 2.NN: Pegasus engine (obsolete) 3.NN: Olympus engine 4.NN: Pegasus engine 5.NN: Mercury engine 6.NN: Olympus engine 7.NN: Pegasus engine 8.NN: Mercury engine 9.NN: Olympus engine 10.NN: Titan engine 12.NN: Nike engine 14.NN: Lynx engine |

*Only to be used when Radio Controlled pulse method is switch on as input value



Engine Control Unit documentation

Serial control

2.3 Serial communication implementation

2.3.1 Protocol implementation (firmware: Vx25...Vx42)

| | | | | | | | | | | | |
|------|-----|-----|-----|-----|--|------|-----|-----|-----|-----|--|
| 0xFF | OPS | THR | OPS | THR | | 0xFF | OPS | THR | OPS | THR | |
|------|-----|-----|-----|-----|--|------|-----|-----|-----|-----|--|



Pause between messages.

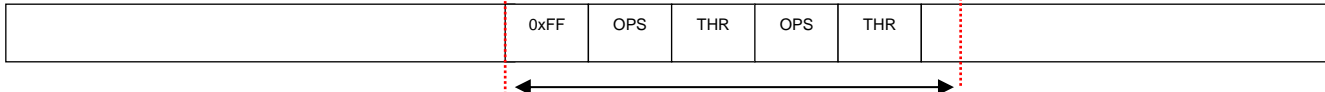
The message will start with a 255 byte value to indicate that new OPS (switch) and THR (throttle) info is coming. OPS and THR will be sending twice and the ECU software will determine if both bytes of the OPS and THR are the same. When these bytes are not the same the message is ignored and the error counter increased.

To make sure data will be excepted without errors next implementation must be guaranteed. This means that a serial control data stream must be send directly after last byte of EDT data stream is received.

EDT data stream

| | | | | | | | | | | |
|------|-------|-------|-------|-------|-------|--|------|-------|-------|-------|
| 0xFF | Data1 | Data2 | Data3 | Data4 | Data5 | | 0xFF | Data1 | Data2 | Data3 |
|------|-------|-------|-------|-------|-------|--|------|-------|-------|-------|

Serial control data stream

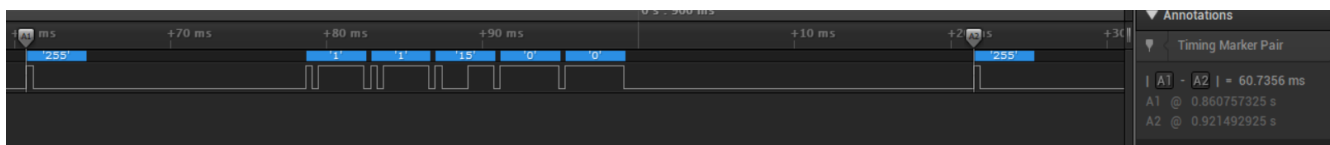


*Max. 65msec

Calculation:

- Databyte has 1*startbit, 8*databits, no parity and 1*stopbit so in total 10 bits.
- Time per byte: $(1 / 2400) * 10 = 4,16\text{msec}$.
- Minimum time serial data stream: $5(\text{data bytes}) \times 10\text{bits} = 50\text{ bits}$ or $5(\text{data bytes}) * 4,16 = 20,8\text{msec}$.

Measuring a frame of 5 bytes at 2400Baud takes 60msec to complete. Delays between the bytes causes by the sequential software implementation.



Screen shot real life frame (Vx38).

*Frame time is valid for software versions Vx36 and Vx38. Vx37 frame time is 63ms. For older firmware versions the frame time can differ must be measured if this frame time must be known.



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2.3.2 Protocol implementation (firmware: Vx01-Vx25 or Vx43-Vx99)

Due to a different implementation the pause between the messages is almost gone. Also, receiving information via the serial communication channel will be handled asynchrony to the send information.

Make sure that the control message (0xFF, OPS, THR, OPS, THR) is send at least every 100ms.

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Serial control

2.3.3 General specifications

| Item | Description |
|----------------|--|
| Level | Standard RS232 level -12V to 12V |
| Baud rate | Standard the ECU setting is 2400. This gives an average of 48 bytes per second. Other settings are 2400-4800-9600-19200-38400-57600-115200. |
| Protocol setup | 8 data bits, no parity, 1 stop-bit |
| Data stream* | 0xFF,{data1},{data2},{data3},{data4} |

*Value of the data bytes 1 to 4 is always between 0 and 0xFE (254).

2.3.4 Engine control data set

2.3.4 Engine control data set

| Byte | Unit | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|------|--|------|---|---|---|---|--|--|--|-------------|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|-----------------------------------|---|---|---|---|---|---|---|---|---------------------------------|---|---|---|---|---|---|---|---|--------------------------|
| Leader | | Value always 0xFF (255) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 1 (OPS Status) | | <div>This data byte describes the state of the Operation Switch (OPS).</div> <table><tr><th colspan="8">Bits</th><th>Description</th></tr><tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th><th></th></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Operator Switch in Emergency stop mode</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>Operator Switch in Auto stop mode</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>Operator Switch in Running mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>CTF (special functions)*</td></tr></table> | Bits | | | | | | | | Description | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Operator Switch in Emergency stop mode | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | Operator Switch in Auto stop mode | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | Operator Switch in Running mode | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | CTF (special functions)* |
| Bits | | | | | | | | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Operator Switch in Emergency stop mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | Operator Switch in Auto stop mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | Operator Switch in Running mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | CTF (special functions)* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 2 (THR value) | % | <div>This data byte describes the throttle setting.</div> <div>Data2 = (THR * 2) + 32</div> <div>Example: 50% → (50 * 2) + 32 = 132</div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 3 (OPS status) | | See Data 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Data 4 (THR value) | % | See Data 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*If OPS value is 145 (CTF) during running mode, engine will stop after serial delay time (address 192) is elapsed.



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Serial control

2.3.5 Sample code

Below an example how the source code could be. Function PutC is a function which sends out a byte via the serial port opened in advanced.

```
Void SendCommandToECU( unsigned char switch_value, unsigned char throttle_value )
{
    // Make sure that this is send at least every 50ms
    PutC( 255 ); // Send this value via RS232 to ECU
    PutC( switch_value );
    PutC( throttle_value );
    PutC( switch_value );
    PutC( throttle_value );
}
```

Call to the function:

```
SendCommandToECU( 17, 32 ); // OPS = Emergency stop, THR = 0%
```



Engine Control Unit documentation Serial control

Appendix A Glossary

| | |
|------|---|
| AMT | Advanced Micro Turbine the Netherlands |
| AR | AMT requirements |
| BLDC | Brush Less Direct Current |
| ECU | Engine Control Unit |
| EGT | Exhaust Gas Temperature |
| EMC | Electro Magnetic Compatibility |
| ESD | Electro Static Discharge. |
| FET | Field Effect Transistor |
| HAL | Hardware abstraction layer |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MC | Machine Controller |
| MTBF | Mean Time Between Failures |
| MTTF | Mean Time To Failure |
| OH | Old ECU hardware specifications |
| OPS | Operational switch |
| OS | Old ECU software specifications |
| PCB | Printed Circuit Board |
| PLL | Phase Locked Loop. |
| RPM | Revolutions per minute |
| Rx | Receive |
| Tbd | Too be defined |
| THR | Throttle |
| TSOP | Thin Small Outline Package |
| Tx | Transmit |
| UART | Universal Asynchronous Receiver Transmitter |
| UI | User Interfac |