



## Engine Control Unit documentation Serial control



# Serial control Documentation

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**Date:** June, 2019  
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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

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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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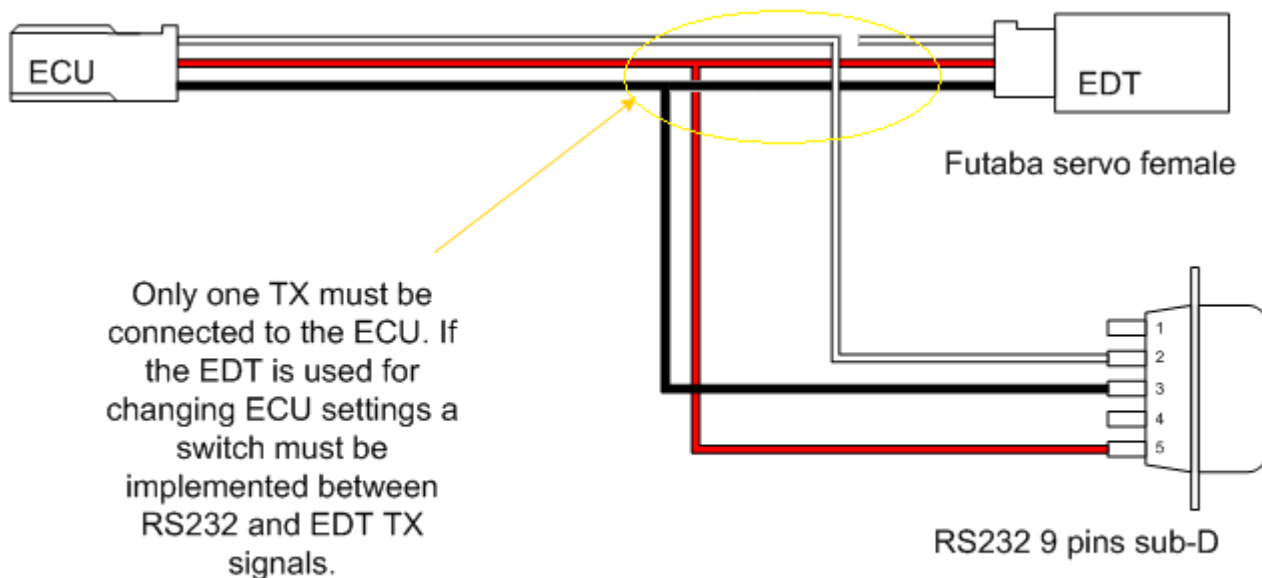
## 2 Serial control

### 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)		<p>This data byte describes the state of the ECU and which type of engine is installed.</p> <p>If B2, B1 and B0 are zero (low) then the bits B7 to B3 will indicated which engine is installed.</p> <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> <p>X = Status of engine S = state as in Operator Switch (001 = emer. Stop, 010 = auto stop, 100 = run)</p>	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
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0	0	1	0	0	0	0	0	TITAN engine ID																																																																																																																																																																																																																		
0	0	1	0	1	0	0	0	NIKE engine ID																																																																																																																																																																																																																		
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1	1	1	0	0	S	S	S	Maximum RPM reached																																																																																																																																																																																																																		
Data 2 (RPM value)	RPM	RPM = value * 500 (Engine ID: PEGASUS, OLYMPUS, TITAN, NIKE, LYNX) RPM = value * 700 (Engine ID: MERCURY)																																																																																																																																																																																																																								
Data 3 (EGT value)	°C	EGT = value * 4.6 – 50																																																																																																																																																																																																																								
Data 4 (Throttle setting)	%	THR = value / 2																																																																																																																																																																																																																								
Data 5 (Vout value)	Volt	VOUT = value * 6.25 / 255 (Engine ID: MERCURY , PEGASUS) VOUT = value * 8.30 / 255 (Engine ID: OLYMPUS, TITAN, NIKE, LYNX)																																																																																																																																																																																																																								

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#### 2.2.3 Error information data set

Byte	Unit	Description																																																																																										
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>																																																																																										



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#### 2.2.4 Alternate information data set

Byte	Unit	Description																																																																																																			
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





## Engine Control Unit documentation

### Serial control

#### 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: $PW_{min} = ((256 * PWTH) + PWTL) - 62464$ $PW_{max} = PW_{min} + PWIDIFF * 16$
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

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

Max. 30msec

#### Calculation:

- 2400Baud = 2400bps →  $2400 \times 0.030 = 72$  bits per 30msec.
- Databyte has 1\*startbit, 8\*databits, no parity and 1\*stopbit so in total 10 bits.
- Time per byte:  $(1 / 2400) \times 10 = 4,16$ msec.
- Time serial data stream:  $5(\text{data bytes}) \times 10\text{bits} = 50$  bits or  $5(\text{data bytes}) \times 4,16 = 20,8$ msec.

A data stream at 2400Baud fits within the max. time frame of 30msec.

#### 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.

## Engine Control Unit documentation

### 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><math>\text{Data2} = (\text{THR} * 2) + 32</math></div> <div>Example: 50% → <math>(50 * 2) + 32 = 132</math></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.



## Engine Control Unit documentation

### 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