Short presentation of Advance88

Release: V1.20 – 10/05/2022
http://www.skynam.com

SYBELE by Skynam Machine management

The Advance88 is an engine management ECU with an extremely high computing power, very many inputs and configurable outputs, allowing a more than flexible and effective use.

GENERAL CHARACTERISTICS

Power supply range 5.5 to 18 volts DC
Consumption on stop: 0 milliampere
Two completely separated 5 volts sensors power supplies: each up to 200 milliamperes,
Size (mm) and weight (g) 150x180x40, 650
Connector 121-way TE-Connectivity type Automotive
ECU maps and tables: sizes adjustable by the user, with no size limit.
Flex fuel (Ethanol content) measurement and engine tuning.

COMMUNICATIONS

Four CAN-Buses:
- Tuning and networking of ECUs (externalized sensors and commands) by main CAN-BUS WinjNet (™ Skynam).
- Three auxiliary CAN-Buses on external CAN-BUS 2.0B (11 or 29 bits identifiers selection for every frame), speed of transmission 125 Kbits to 1 Mbits, for access to an OEM CAN-BUS, a Dashboard or for third party data recording.

HACKER PROTECTION

Tunings protected by selectable locking.
Unlocking only possible by the licensed owner of the ECU.
Total deletion of the data if attempt of violation.

LOAD CALCULATIONS

- throttle position / rpm,
- intake pressure / rpm (with or without turbo),

PRE-FILLED ENGINE TUNING

- The base ignition advance and injection time maps are provided with values allowing an easy engine starting up. They must be then specifically adapted to the engine by the motorist (self-learning for injection time).

- All other maps of the ECU are pre-filled with values allowing a good engine operation in the majority of the cases, notably the maps of starting up enrichment and rising in temperature, of altimetric adaptation, …
- The PIDs of motorized throttle management, of turbo management, of camshafts positioning management and of fuel high pressure management (for direct injection engines) are also pre-filled and most of the time require no or little supplementary adaptation.

ENGINE MULTIMAPPING

Groups of modification allow modifying the engine tuning including while the engine is runing, for example to have several tunings according to a rotator position or a CAN-Bus command or a modification of fuel type, or any other calculation.
Three groups of modification are available, allowing, with the original tuning, to obtain four different engine tunings.
A group of modification is constituted by a map of modification of ignition advance, by a map of modification of injection time, by a map of modification of richness target and a map of modification of turbo pressure and turbo speed targets (if turbo exists).

MANAGEMENT OF ENGINE CYLINDERS

The number of cylinders can be 1, 2, 3, 4, 5, 6, 8, 10, 12
The angular distribution of cylinders can be
- regular: the angle between cylinders is regularly distributed on the engine cycle. For a 4-cylinder, it is 180°, for a 6-cylinder, it is 120°...
- specific by calibration: the specific angle can be calibrated in 1/100th of degree.

MANAGEMENT OF ENGINE CYLINDERS BANKS

The ECU can be configured for inline engines (1 bank of cylinders) or for 'V' or flat engines (2 banks of cylinders), by a simple allocation tuning of the cylinders to bank 1 or bank 2.
Per bank of cylinders:
- One measure of throttle position and one motorized throttle.
- Management of variable valves lift position (VVL).
- Management of the intake and exhaust camshafts position (VVT).
- Management of fuel pressure (high or low).
- One measure of intake pressure and turbo speed with twin turbo management.
- One Lambda sensor and one richness correction.
- One knock sensor

As an ignition advance and injection time correction is allowed for each cylinder, it is of no need to have a per bank correction.

STATIC SENSORS INPUTS

- 1 internal input measures the power supply tension.
- 4 logic inputs On-Off switch type
- 6 resistive inputs (CTN-CTP or logics), with internal pull-up resistor bridge to 5 volts
- 8 analogic inputs 0-5 volts, with internal pull-down resistor (black-out detection)
- 10 selectable analogic or resistive inputs
- 4 SENT or PWM or frequency inputs
- 2 knock sensors with differential inputs
- 16 inputs from Can-Bus (e.g. switches and rotators provided by Dashboard)

Sensors:
- battery tension,
- Switches and rotators:
    - Switch of race configuration (inhibits launch limiter and ALS),
    - Brake pedal switch (or by pressure measurement),
    - Clutch pedal switch (or by pressure measurement),

- Traction control sensitivity selection by rotator or by CAN-Bus (no limit of number of positions),
- Vehicle speed limiter selection by rotator or by CAN-Bus (no limit of number of positions),
- Three switches for Cruise control (on/off, accelerate, decelerate) or by CAN-Bus,
- Engine protection prohibition switch,

- Sequential gearbox:
  - Gear shifting switch configurable logical (On-Off) or analogic (strain gauge),
  - Gear position sensor,
- Positions:
  - Calibratable pedal position (two tracks allowed),
  - Calibratable throttle positions (one per cylinders bank allowed with two tracks allowed for each),
  - Calibratable variable valves lift positions (intake camshaft of each cylinder bank),
  - Calibratable turbo servo or VGT position (one per cylinder-bank allowed + staged turbo),
- Pressures:
  - Intake pressure (one per cylinder-bank allowed),
  - Atmospheric or dynamic pressure,
  - Oil pressure,
  - Fuel low pressure (one per cylinder-bank allowed),
  - Fuel high pressure - direct injection (one per cylinder-bank allowed),
  - Phase pressure,
- Temperatures:
  - Engine temperature (coolant or air refresh),
  - Intake temperature,
  - Oil temperature,
  - Fuel temperature,
  - Exhaust temperatures (one per cylinder allowed),
- Richness:
  - Wideband or narrowband Lambda sensors (one per cylinder-bank allowed),
- Knock:
  - Knock sensor signals (two channels with differential inputs - better resistance to spikes),
- Ethanol content:
  - Fuel Ethanol content sensor (frequency or analogic input)
- Auxiliary sensors:
  - programmable auxiliary inputs to create specific sensors (for example position of intake flaps, pressures, temperatures and different switches).

Digital filtering:

Every measure of the ECU has a programmable digital filtering (essential for example for removing pressures instabilities).

Parameterization of the inputs:

Every measure of the ECU (pressures, pedals, throttles, speeds, …) can be allocated to one of the physical inputs of the ECU, or has a value received by the CAN from an external sensor, or from a calculated value, including from an auxiliary CAN-BUS.

Allows to make calculations on several inputs before converting the result of these calculations in the chosen measure.

SPEED SENSORS INPUTS

Speeds inputs are self-adaptive in signal level and shape: A specific microprocessor is allocated to each input to handle and shape its analogic signal.

- 1 measure of rpm on flywheel, programmable inductive – Hall,
- 1 measure of main camshaft phase, programmable inductive – Hall,
- 3 measures of auxiliary camshaft phase, programmable inductive – Hall,
- 4 auxiliary measures, Hall effect or magneto-resistive.

Integrated 1KOhm pull-up resistor to 5 volts when using Hall sensors.

Measurements:

- measure of rpm and phase of crankshaft on configurable type of flywheel,
- measure of angle of phase mark on main camshaft on configurable type of marks,
- measure of angle of phase mark on auxiliary camshafts on configurable type of marks,
- measure of turbos speeds on programmable number of pulses per round,
- measures of wheels speeds on programmable number of pulses per round,
- measure of vehicle speed,
- measures of auxiliary speeds on programmable number of pulses per round,

Crankshaft flywheel singularities:

- From 8 to 60 teeth
- Singularity: N-2, N-1, N, N+1, Multitooth, with up to 4 repetitions (e.g. Audi, BMW, Porsche, Mercedes, Peugeot, Renault RS, Ford, Opel, Toyota, Yamaha, Mitsubishi, Kia, …)

Camshaft flywheel singularities:

- From 1 to 16 teeth
- Singularity: On teeth state, On teeth position, N-1, N+1 (same OEM list than crankshaft)

PHASE PRESSURE

The ECU can phase on cylinder 1 TDC with a pressure sensor reading the pressure in one of the cylinders inlets ducts (more often on Yamaha engines). Self-adaptive tuning of pressure level.

DYNAMIC PHASE

When the engine does not own any phase sensor, the ECU can phase on the engine by using a method of dynamic phase synchronization at each engine start.

FAULTS STRATEGIES

For every measure of the ECU (pressures, pedals, throttles, speeds, …), it is easy to define a strategy of fault detection, a strategy of value replacement in case of failure, or to use the original strategies supplied by the ECU.

DIAGNOSTIC

The ECU records the faults on the measures, the blackout or the short circuit, occasional or repeated, and allows the deletion of these failures when required by the motorist.

More, it remembers the system defects, miss of +30, loss of power supply, watch dog reset, …These systems failures require a particular attention and indicate an important problem of assembly or manipulation.

With alarm lights or Dashboard failure state display.

MONITORING

Programmable recording of values overshoots on the measures or the calculations selected by the motorist:

- in extreme value,
- in duration on the extreme value,
- in total duration,
- in number of overshoots.

Erasure by software (with possible protection).

Alarm light programmable:

- immediate or with programmable delay,
- cumulative (on the total duration) with programmable switch on and off.

ENGINE PROTECTION

A switch allows to deactivate the engine protections.

Two general types of protection exist:

- engine stop protections, used in the event of a serious engine problem

- engine torque protections, in the event of a simple exceeding of limit, are reducing the engine torque (by decreasing the motorized throttle positions, the valves lifts, and the turbo pressures and speeds)
- With alarm lights or Dashboard protection state display.
- In addition, an engine stop regulation can be requested so as not to stop abruptly the engine during an engine stop protection, for example to allow the turbos to cool before the complete stop.

1) Engine stop protection on:

- low oil pressure (following engine speed and startup state)
- high oil t °
- high engine t°
- high intake t°
- high exhaust t°
- too high exhaust temperatures difference between cylinders
- low fuel pressure

2) Engine torque protection on:

- demand by high exhaust t°
- demand by high intake t°
- demand by high oil t°
- demand by high engine t°
- demand by high intake pressure
- demand by high Turbo speed (each of the three turbos)

INJECTION

Up to 10 channels with fixed type of command

- saturated command (On-Off),
- for the Peak and Hold commands or direct injection commands, it is necessary to add a Skynam external injectors driver.

Selectable types of injection:

- sequential phased (needs phase sensor or dynamic synchro),
- sequential not phased (no phase sensor nor dynamic synchro needed),
- phased direct injection (needs phase sensor or dynamic synchro),
- mixed direct injection (called ramp 1) and port injection (called ramp 2),
- semi sequential (no phase sensor nor dynamic synchro needed).

Following the type of injection, the injection phase is done on beginning or end of injector command. Phase from 0-720° in function of the engine speed and load.

Injectors dead time correction:

Tunable in function of the on-board tension and of the fuel pressure.

Injection time calculation:

- In function of the engine speed and load, microsecond resolution, multimapping, ALS
- Cylinder per cylinder correction,
- Enrichment procedure at engine start depending on the engine t°, the elapsed engine rounds and the engine speed reached,
- Correction by engine t°, intake t°, exhaust t°, atmospheric pressure, richness, accelerating pumps, Ethanol content, rpm limiter, traction control, vehicle speed limiter, complementary commands hook.
- Correction by fuel pressure (notably in direct injection),
- Correction by rpm limiter (by launch procedure and by hard cut),
- Accelerations correction (accelerating pump),
- Correction of richness by looping on Lambda sensor(s) according to the richness target map, with tunable correction range limits.

Injection time self learning:

- A complete function of injection map self learning is based on the richness target map function of the load and the engine speed and on the reading of the Lambda sensor(s).

INJECTION RAILS

Injectors can be grouped in one or two rails. Both rails can have different types of injectors.
Each injection rail possesses its own accelerating pump and its own injection phase.
Is also used for mixed injection: direct injection plus port injection.
Two types of double rail operation are possible:

- rail 1 to 2: allows to move gradually from a rail to the other one. When we increase the rail 2, the rail 1 is decreased in the same way to compensate. When both rails have different types of injectors, the fuel quantity remains stable with the use of a fuel flow coefficient.
- rail 1 to 1+2: allows to add gradually the rail 2 to the rail 1. Configuration used to inject more fuel in the engine when we engage the rail 2.

IGNITION

Up to 8 channels to command ignition power modules (the Advance does not directly drive the coils).
Types of selectable ignition

- static phased (needs phase sensor or dynamic synchro) one spark every 720°
- static not phased (no phase sensor nor dynamic synchro needed) one spark every 360°
- twin spark (no phase sensor nor dynamic synchro needed) one spark every 360°

Ignition advance calculation:

- In function of the engine speed and load, 1/10° resolution, multimapping, ALS
- Cylinder per cylinder correction,
- Correction by engine t°, intake t°, exhaust t°, atmospheric pressure, knock detection, Ethanol content, rpm limiter, traction control, vehicle speed limiter, gear shifting, complementary commands hook.
- Correction by rpm limiter (by launch procedure and by hard cut),
- Correction by knock detection.

Coil loading angle calculation:

- Tunable in microseconds in function of the on-board tension (8v, 10v, 12v, 14v, 16v)
- Skynam provides the coil loading times of a large number of the most popular coils

KNOCK CORRECTION

The Advance owns two differential measurement channels of knock sensors:
1) Knock detection adjustment:
- Each cylinder can be individually assigned to any one of the two sensors.
- Auto-calibration function of the average signal level of each sensor.
- Autocalibration function of balancing the signal level between the cylinders, because the cylinders farther from the knock sensor which measures them give a less strong signal than the cylinders which are close to it.
- Center frequency of the knock signal gradually adjustable from 1 KHz to 20 KHz
- Adjustable angular detection window.
- Selection of the type of reaction during a failure (or disconnection) of a knock sensor.

2) Adjusting the knock correction:
- Maximum ignition advance correction map in function of engine speed and load.
- Maps of ignition advance reduction speed and ignition advance increase speed in function of engine speed and load.

3) Correction of knock:
The knock correction is carried out by a knock correction map in function of engine speed and load: The ECU itself, by a continuous self-learning, fills this map with the level of advance correction needed. Having a knock correction map allows the ECU to memorize which correction of the main ignition advance map has to be made.
It is much more efficient and safe than simply removing advance each time a knock noise is detected.

FLEX FUEL

Complete adjustment of the engine tuning according to the fuel Ethanol content measured with the Ethanol sensor.

Sensor reading inhibition if the fuel flow passing through the sensor is insufficient for a correct reading of the Ethanol content.

Ethanol calculations:

- Correction of injected quantity according to Ethanol content, engine t°, engine load and engine speed.
- Ignition advance correction based on Ethanol content, engine t°, engine load and engine speed.
- Specific injected quantity at engine starting according to the Ethanol content and the engine t°.
- Specific ignition advance at engine starting according to the Ethanol content and the engine t°.
- Specific richness target according to the Ethanol content and the engine load.
- Specific turbo pressure and turbo speed targets according to the Ethanol content and the throttle position.

AUXILIARY COMMANDS

Up to 26 programmable auxiliary commands

- 12 half-bridge, allowing 6 full-bridges. Each half-bridge can also be used as open drain command.
- 2 Peak and Hold fully configurable (peak current level up to 16 Amps and hold current level up to 8 Amps, duration of the peak up to 5000 µs, type of changeover from peak to hold)
- 11 open drain commands,
- 1 LED output,

Types of control:

- ON-OFF
- PWM from 10 Hz to 10 kHz
- engine synchronous (engine phased pulses - number of pulses per engine cycle selectable, with cyclical ratio and phase maps adjustment).

The outputs commands are used for:

- turbos management (twin or triple turbos allowed) with or without servo motor commands,
- 2 low pressure fuel pumps,
- 2 high pressure fuel pumps (direct injection),
- 2 motorized throttles,
- 2 variable valves lifts,
- intake air bypass solenoid valve (2 or 3 wires),
- intake air bypass stepper motor (4, 5 or 6 wires),
- 4 camshafts proportional positioning (VVT) with one or two solenoid valves each
- electric motors positioning (with looping on a position measurement), for example proportional intake or exhaust valves, or other devices with precise angular positioning.
- electric motors of rotation (adjustable speed, with possible looping on speed inputs),
- On-Off fans or speed controlled fans,
- electric water pump with variable speed,
- shift light,
- alarms,
- programmable type by the motorist.

FISA FUEL PUMP

Managed in the standards FISA regulation:

- runs 5 seconds at ECU switch on and stops if the engine does not run,
- runs as soon as the engine starts,
- Stops as soon as the engine stops.

FUEL PRESSURE

Fuel high pressure management for direct fuel injection engines.

Fuel low pressure management for the standard engines.

Each engine bank can have its own fuel pressure management, or we can control one a master and one slave pump.

Fuel pressure command calculation:

- Fuel pressure base target from engine speed and load, ALS positioning
- Separated target calculation on idle state.

The management of fuel pressure is made by an extended PID in PWM (of which the frequency is dynamically modifiable) or in engine synchronous command (e.g. Audi-VW FSI engines).

MOTORIZED THROTTLES

Management of up to 2 twin motorized throttles in parallel (1 per bank of cylinders)
Throttle position target calculation:

- From torque demand (accelerator pedal or Cruise control) and engine speed, ALS positioning
- Correction on engine start
- Correction by engine t°
- Correction by traction control, vehicle speed limiter, gear shifting

Commands by extended PIDs with static friction compensation and PWM frequency selection.

VARIABLE VALVE LIFT (VVL)

Management of proportional variable valves lift on intake camshafts (1 per bank of cylinders):
Direct management the electric motors of valve lift via an extended PID looping on the lift position measurement.
Valve lift position target calculation:

- From torque demand (accelerator pedal or Cruise control) and engine speed, ALS positioning
- Correction on engine start
- Correction by engine t°
- Correction by traction control, vehicle speed limiter, gear shifting

TURBOS

Management of:

- 1 turbo,
- 2 twin turbos in parallel (1 per bank of cylinders)
- 2 staged turbos
- 3 turbos, with two in parallel and the third staged with both first ones

For each turbo, command of leak solenoid valves or of servo motor (and VGT).
Management of turbo flaps (intake, exhaust and intermediate flaps), On-Off or proportional positioning

- The management is done according to the intake pressures and the turbos speeds, with dynamic switching of one to the other one.
- For 'V' engines with separated intake per bank, reading of 1 pressure sensor per bank, to manage each of the twin turbos with its own pressure.

Turbos command calculation:

- Turbo pressure base target from torque demand and engine speed.
- Turbo pressure and turbo speed targets multimapping.
- Turbo pressure and turbo speed targets correction by atmospheric (altimetric) pressure, engaged gearbox position (boost by gear), and Ethanol content.

Commands by extended PIDs with PWM frequency selection and overshoot limitation control.

POST COMBUSTION (ALS)

Additional air supply is provided by motorized throttle or variable valves lifts or air intake solenoid valve or air intake stepper motor.
To avoid engine and turbo damages due to high exhaust gas temperature, the ALS is controlled by time and by exhaust temperature.

- Turbo pressure and turbo speed targets are specific during ALS phases.
- Intake and exhaust camshaft position targets are specific during ALS phases.
- Fuel high pressure target is specific during ALS phases (direct injection).

CAMSHAFTS POSITION (VVT)

Proportional positioning of 4 camshafts:

- two intake and two exhaust,

Camshaft position calculation:

- Intake camshafts position target from engine speed and load, ALS positioning
- Exhaust camshafts position target from engine speed and load, ALS positioning

The command of every camshaft can be done in two ways:

- by the management of one solenoid valve.
- by the management of two solenoid valves (type BMW M3), of which one advances the camshaft and one delays it.

Commands by extended PIDs with PWM frequency selection.

ENGINE SPEED LIMITER

The cylinders cutoff can be done on:

- **ignition only:** only the ignition is cutoff. This is the smoothest and most responsive cut and does not overheat the cylinders.
- **injection only:** only the injection is cut.
- **injection and ignition together:** injection and ignition are cut at the same time. It is not advised to use this mode
- **ignition then injection:** ignition is cut normally and injection will be cut 100 rpm above the limiter.
- **injection then ignition:** injection is cut normally and ignition will be cut 100 rpm above the limiter.

- Selectable Hard cut or Soft cut.
- Several configurable launch limiters, selectable by rotator or by CAN-Bus (no limit of number of positions).
- During the launch procedures, it is possible to reduce the ignition advance and to enrich the engine. This allows to have high turbo pressure even before the vehicle takes off for a cannonball start.
- Several configurable race limiters, selectable by rotator or by CAN-Bus (no limit of number of positions)
- The change from the launch limiter to the race limiter is done at a configurable slip speed, selectable by rotator or by CAN-Bus (no limit of number of positions).
- Soft cut: gradual cylinder per cylinder cutoff, and turning (always begins the cutoff sessions with a different cylinder to avoid always heating the same cylinder).
- Hard cut: all the cylinders are cutoff at the same time, with tunable hysteresis to uncut the cylinders with tunable modification of ignition advance and injection time.

DECELERATION CUTOFF

On injection or ignition, or no cutoff.
Cutoff base engine speed tunable.

IDLE MANAGEMENT

The ECU manages the idle engine speed if an air actuator exists (motorized throttle, variable valves lift, intake air bypass stepper motor or intake air bypass solenoid valve)

- A calibration allows to prohibit the management of idle speed.
- Calibrations allow to give the idle engine speed target and its modification as a function of the engine temperature.

Idle management done by extended PID.

SEQUENTIAL GEARBOX

Up to 10 gears with a selectable organization (automotive or special mode).
Gearshift switch can be logical (by grounding) or analogic (by programmable tension levels) or calculated (example: throttle or pedal speeds on foot release).

The time of intervention is adjustable by two maps, one for upshifting and one for downshifting. In both cases, the time is tunable for each gear position and by any other calculated or measured parameter (for example, modify the time of intervention for the gear position according to the engine speed or the engine torque).
The type of intervention on gearshift is programmable:
1) Upshift:
- ignition cutoff up to complete gear shifting
- modification of the ignition with slope on return to normal (by maps with selectable inputs)

2) Downshift:
- ignition cutoff up to the dog declutching (for fast downshifting while braking hard)
- modification of motorized throttle position or of valves lifts (autoblip), which allows to accelerate the engine to ease the downshift.

ROAD GEARBOX

Up to 10 gears can be detected.
To read the engaged gear positions on a road gearbox, the ECU reads the gearbox tailshaft speed (in rpm) by means of a speed sensor, and it compares this speed with the engine speed.
Reading the gearbox tailshaft speed (rpm) can be done directly on the gearbox output (preferred method) but also by reading the speed of a driving wheel or of the vehicle speed if it gives the tailshaft gearbox speed.

CRUISE CONTROL

Cruise control allows the driver to request to the ECU to continue to drive the vehicle at the speed at which it already is, by simply pressing a button. The driver can then release the accelerator pedal without the vehicle speed changing.
If during Cruise control, the driver presses the accelerator pedal, causing a higher torque demand than that requested by the Cruise, the ECU gives this higher demand. This allows the driver to temporarily accelerate the vehicle.

Cruise control can only operate if the throttle is motorized.
Then the Cruise control can only operate if 4 switches are existing:
- the brake pedal, which stops Cruise control, returning the control to the accelerator pedal.
- the Cruise engagement switch, which allows to start or stop the Cruise control. At the time the Cruise control is engaged, the ECU records the current vehicle speed and uses it as the Cruise speed target.
- the Cruise acceleration switch, which increases the vehicle speed
- the Cruise deceleration switch, which reduces vehicle speed

In more, it is strongly recommended to install and enable the clutch pedal switch. This allows during the Cruise a good downshifting of the gearbox positions, without damaging the clutch discs, because during the Cruise control, if the driver presses the clutch pedal, the ECU cancels the engine torque.

TRACTION CONTROL

The Traction Control is based on a comparison between the speed of the driving wheels and the speed of the non-driving wheels:
The ECU can therefore only perform Traction Control if the driving wheels speed and the non-driving wheels speed are either measured, or calculated from the engine speed and the engaged gear position for the driving wheels, and of a modelization for the non-driving wheels.

Several traction control sensitivities are tunable and the selection is done by rotator or by CAN-Bus (no limit of number of positions).
When Traction control is active, the ECU can intervene on the engine with
- a modification of ignition advance
- a modification of injection time
- an ignition cut-off level (gradual cut-off)

- an injection cut-off level (gradual cut-off)
- a modification of the motorized throttle position (if it exists)
- a modification of the valves lifts position (if they exist)
- a modification of the turbo speed (each of the 3 existing turbos)
- a modification of turbo pressure (each of the 3 existing turbos)

VEHICLE SPEED CONTROL

The speed limitation is based on a comparison between the speed limitation target and the real vehicle speed.
The ECU can therefore only perform the speed limitation if the vehicle or wheel speed is either measured, or calculated from the engine speed and the engaged gear position.

Several vehicle speed limits are tunable and the selection is done by rotator or by CAN-Bus (no limit of number of positions).
When Vehicle speed control is active, the ECU can intervene on the engine with
- a modification of ignition advance
- a modification of injection time
- an ignition cut-off level (gradual cut-off)
- an injection cut-off level (gradual cut-off)
- a modification of the motorized throttle position (if it exists)
- a modification of the valves lifts position (if they exist)
- a modification of the turbo speed (each of the 3 existing turbos)
- a modification of turbo pressure (each of the 3 existing turbos)

AVANCED FUNCTIONS

The Advance offers the motorist the possibility to develop its own strategies.
The development of these strategies does not require either the learning or the knowledge of a programming language.
Their programming uses a specific technique developed by Skynam called **SKYMCOD ™ mapped, intuitive and effective Programming**.
1) Pilot modules (see specific documents of Advance tuning)
2) Auxiliary PIDs (see specific documents of Advance tuning)
3) Programmable auxiliary measures
4) Parameterization of the inputs of measures
5) Filtering of the measures
6) Programmable strategies of failure of the measures
7) Programmable auxiliary commands
8) Complementary commands hooks (see specific documents of Advance tuning)
9) CAN-BUS auxiliary values

ECU LOOM

81 WAY LONG CONNECTOR				
J121		FUNCTION	COMMENTARY	CHARACTERISTICS
1	OUT	AUXILIARY COMMAND 7+	Peak & Hold positive commande	Tunable regulated current max 16 Amps peak - 8 Amps Hold
2	OUT	AUXILIARY COMMAND 7-	Peak & Hold negative commande	Tunable regulated current max 16 Amps peak - 8 Amps Hold
3				
4	OUT	AUXILIARY COMMAND 8+	Peak & Hold positive commande	Tunable regulated current max 16 Amps peak - 8 Amps Hold
5	OUT	AUXILIARY COMMAND 8-	Peak & Hold negative commande	Tunable regulated current max 16 Amps peak - 8 Amps Hold
6	CAN	CAN4_H	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
7	CAN	CAN3_H	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
8	IN	INPUT PWM-SENT 4	Input PWM or SENT communication sensors	Measurement range 0-5 volts
9	IN	SPEED INPUT 4	Speed input 4 - Hall or magnetoresistive	External resistor to put following sensor type
10	IN	LOGIC INPUT 4	Logical input 0 volt	Measurement range 0-18 volts
11	IN	PHASE SENSOR D	Auxiliary camshaft phase sensor input	Inductive-Hall selection, gain automatic adaptation
12	IN	RPM +	Crankshaft rpm sensor input	Inductive-Hall selection, gain automatic adaptation
13				
14	OUT	INJECTION I	Ground command open drain - 9th injected channel	5 Amperes (12A peak)
15	OUT	INJECTION H	Ground command open drain - 8th injected channel	4 Amperes (10A peak)
16	OUT	INJECTION G	Ground command open drain - 7th injected channel	4 Amperes (10A peak)
17	OUT	INJECTION F	Ground command open drain - 6th injected channel	4 Amperes (10A peak)
18	OUT	INJECTION E	Ground command open drain - 5th injected channel	4 Amperes (10A peak)
19	OUT	INJECTION J - AUX COMMAND 18	Ground command open drain - 10th injected channel	5 Amperes (12A peak)
20	OUT	AUXILIARY COMMAND 16	Ground command open drain	3.5 Amperes (8A peak)
21	OUT	AUXILIARY COMMAND 12	Ground command open drain	3.5 Amperes (8A peak)
22	OUT	AUXILIARY COMMAND 6A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
23	OUT	AUXILIARY COMMAND 4A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
24	OUT	AUXILIARY COMMAND 2A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
25	CAN	CAN4_L	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
26	CAN	CAN3_L	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
27	IN	INPUT PWM-SENT 3	Input PWM or SENT communication sensors	Measurement range 0-5 volts
28	IN	SPEED INPUT 3	Speed input 3 - Hall or magnetoresistive	External resistor to put following sensor type
29	IN	LOGIC INPUT 3	Logical input 0 volt	Measurement range 0-18 volts
30	IN	PHASE SENSOR C	Auxiliary camshaft phase sensor input	Inductive-Hall selection, gain automatic adaptation
31				
32				
33				
34	OUT	INJECTION D	Ground command open drain - 4th injected channel	4 Amperes (10A peak)
35	OUT	INJECTION C	Ground command open drain - 3rd injected channel	4 Amperes (10A peak)
36	OUT	INJECTION B	Ground command open drain - 2nd injected channel	4 Amperes (10A peak)
37	OUT	INJECTION A	Ground command open drain - 1st injected channel	4 Amperes (10A peak)
38	OUT	AUXILIARY COMMAND 17	Ground command open drain	3.5 Amperes (8A peak)
39	OUT	AUXILIARY COMMAND 15	Ground command open drain	3.5 Amperes (8A peak)
40	OUT	AUXILIARY COMMAND 11	Ground command open drain	3.5 Amperes (8A peak)
41	OUT	AUXILIARY COMMAND 6B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
42	OUT	AUXILIARY COMMAND 4B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
43	OUT	AUXILIARY COMMAND 2B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
44	CAN	CAN1_H	CAN WinjNet	With integrated 120 Ohms resistor
45	CAN	CAN2_H	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
46	IN	INPUT PWM-SENT 2	Input PWM or SENT communication sensors	Measurement range 0-5 volts
47	IN	SPEED INPUT 2	Speed input 2 - Hall or magnetoresistive	External resistor to put following sensor type
48	IN	LOGIC INPUT 2	Logical input 0 volt	Measurement range 0-18 volts
49	IN	PHASE SENSOR B	Auxiliary camshaft phase sensor input	Inductive-Hall selection, gain automatic adaptation
50	5V OUT B	5V SENSORS POWER SUPPLY B	5 volts B output for rpm-phase-Sent-Pwm sensors supply	Regulated 5 volts (total max 400 mA on the two 5 volts B outputs)
51	GROUND OUT	OUTPUT SUPPLY GROUND	Output ground for LED Diag and Can-Bus Wininet	Internally connected to pin 117
52				
53	OUT	IGNITION D	12volts push-pull command - 4th ignition channel	50 milliamperes
54	OUT	IGNITION C	12volts push-pull command - 3rd ignition channel	50 milliamperes
55	OUT	IGNITION B	12volts push-pull command - 2nd ignition channel	50 milliamperes
56	OUT	IGNITION A	12volts push-pull command - 1st ignition channel	50 milliamperes
57	OUT	AUXILIARY COMMAND 19	Ground command open drain	125 milliamperes (500mA peak)
58	OUT	AUXILIARY COMMAND 14	Ground command open drain	3.5 Amperes (8A peak)
59	OUT	AUXILIARY COMMAND 10	Ground command open drain	3.5 Amperes (8A peak)
60	OUT	AUXILIARY COMMAND 5A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
61	OUT	AUXILIARY COMMAND 3A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
62	OUT	AUXILIARY COMMAND 1A	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
63	CAN	CAN1_L	CAN WinjNet	With integrated 120 Ohms resistor
64	CAN	CAN2_L	Auxiliary CAN (external)	Without integrated 120 Ohms resistor
65	IN	INPUT PWM-SENT 1	Input PWM or SENT communication sensors	Measurement range 0-5 volts
66	IN	SPEED INPUT 1	Speed input 1 - Hall or magnetoresistive	External resistor to put following sensor type
67	IN	LOGIC INPUT 1	Logical input 0 volt	Measurement range 0-18 volts
68	IN	PHASE SENSOR A	Main camshaft phase sensor input	Inductive-Hall selection, gain automatic adaptation
69	SUPPLY OUT	OUTPUT POWER SUPPLY +15	After key 12 volts output for rpm-phase sensors supply	Internally connected to pin 119
70	GROUND OUT	OUTPUT SUPPLY GROUND	Output ground for Sent-Pwm sensors	Internally connected to pin 117
71	GROUND OUT	OUTPUT SPIKES PROTECT GROUND	Interferences protection ground (shield) output for rpm-phase sensors	Internally connected to pin 114
72	OUT	IGNITION H	12volts push-pull command - 8th ignition channel	50 milliamperes
73	OUT	IGNITION G	12volts push-pull command - 7th ignition channel	50 milliamperes
74	OUT	IGNITION F	12volts push-pull command - 6th ignition channel	50 milliamperes
75	OUT	IGNITION E	12volts push-pull command - 5th ignition channel	50 milliamperes
76	OUT	LED DIAG-ALARM	LED command	10 milliamperes
77	OUT	AUXILIARY COMMAND 13	Ground command open drain	3.5 Amperes (8A peak)
78	OUT	AUXILIARY COMMAND 9	Ground command open drain	3.5 Amperes (8A peak)
79	OUT	AUXILIARY COMMAND 5B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
80	OUT	AUXILIARY COMMAND 3B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)
81	OUT	AUXILIARY COMMAND 1B	Disconnectable Vbat push-pull command	4 Amperes (10A peak)

40 WAY SHORT CONNECTOR				
J121		FUNCTION	COMMENTARY	CHARACTERISTICS
82	IN	MIXED INPUT 9	analogic - resistive selectable input	Measurement range 0-5 volts
83	IN	MIXED INPUT 5	analogic - resistive selectable input	Measurement range 0-5 volts
84	IN	MIXED INPUT 1	analogic - resistive selectable input	Measurement range 0-5 volts
85	IN	RESISTIVE INPUT 5	0-5 volts resistive input	Measurement range 0-5 volts
86	IN	RESISTIVE INPUT 1	0-5 volts resistive input	Measurement range 0-5 volts
87	IN	ANALOG INPUT 5	0-5 volts analogic input	Measurement range 0-5 volts
88	IN	ANALOG INPUT 1	0-5 volts analogic input	Measurement range 0-5 volts
89	IN	INPUT KNOCK 1-	Knock sensor input	Differential input
90	IN	MIXED INPUT 10	analogic - resistive selectable input	Measurement range 0-5 volts
91	IN	MIXED INPUT 6	analogic - resistive selectable input	Measurement range 0-5 volts
92	IN	MIXED INPUT 2	analogic - resistive selectable input	Measurement range 0-5 volts
93	IN	RESISTIVE INPUT 6	0-5 volts resistive input	Measurement range 0-5 volts
94	IN	RESISTIVE INPUT 2	0-5 volts resistive input	Measurement range 0-5 volts
95	IN	ANALOG INPUT 6	0-5 volts analogic input	Measurement range 0-5 volts
96	IN	ANALOG INPUT 2	0-5 volts analogic input	Measurement range 0-5 volts
97	IN	INPUT KNOCK 1+	Knock sensor input	Differential input
98	5V OUT B	5V SENSORS POWER SUPPLY B	5v B output for sensors supply	Regulated 5 volts (total max 400 mA on the two 5 volts B outputs)
99	IN	MIXED INPUT 7	analogic - resistive selectable input	Measurement range 0-5 volts
100	IN	MIXED INPUT 3	analogic - resistive selectable input	Measurement range 0-5 volts
101	GROUND OUT	SENSORS GROUND	Ground output for sensors supply	
102	IN	RESISTIVE INPUT 3	0-5 volts resistive input	Measurement range 0-5 volts
103	IN	ANALOG INPUT 7	0-5 volts analogic input	Measurement range 0-5 volts
104	IN	ANALOG INPUT 3	0-5 volts analogic input	Measurement range 0-5 volts
105	IN	INPUT KNOCK 2-	Knock sensor input	Differential input
106	5V OUT A	5V SENSORS POWER SUPPLY A	5v A output for sensors supply	Regulated 5 volts (max 400 mA)
107	IN	MIXED INPUT 8	analogic - resistive selectable input	Measurement range 0-5 volts
108	IN	MIXED INPUT 4	analogic - resistive selectable input	Measurement range 0-5 volts
109	GROUND OUT	SENSORS GROUND	Ground output for sensors supply	
110	IN	RESISTIVE INPUT 4	0-5 volts resistive input	Measurement range 0-5 volts
111	IN	ANALOG INPUT 8	0-5 volts analogic input	Measurement range 0-5 volts
112	IN	ANALOG INPUT 4	0-5 volts analogic input	Measurement range 0-5 volts
113	IN	INPUT KNOCK 2+	Knock sensor input	Differential input
114	GROUND IN	POWER ENGINE GROUND	Ground input for power commands	
115	GROUND IN	POWER ENGINE GROUND	Ground input for power commands	
116	GROUND IN	POWER ENGINE GROUND	Ground input for power commands	
117	GROUND IN	SUPPLY ENGINE GROUND	Ground supply for ECU	
118	SUPPLY IN	PERMANENT SUPPLY +30	12 volts permanent power supply	6-18 volts
119	SUPPLY IN	AFTER KEY SUPPLY +15	After key 12V power supply	6-18 volts
120	SUPPLY IN	AFTER KEY SUPPLY +15	After key 12V power supply	6-18 volts
121	SUPPLY IN	AFTER KEY SUPPLY +15	After key 12V power supply	6-18 volts