Electronic superglow
User manual

Version 1.0

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Contents

1 Introduction

Congratulations, you just offered a new youth to your Toyota !

This manual will help you through the installation, use and troubleshoot of the electronic superglow but first some context about what this module is and is not.

The legacy toyota superglow timing module was designed entirely with analog components which leveraged resistance variations with temperature in several ways to time the different glowing phases of the preheat plugs. This system is known for its lack of robustness and some of its typical failures would lead to burnt glow plugs.

This electronic replacement board was designed to offer similar timing capabilities but with increased robustness and additional safeguards to protect the plugs and avoid a complete preheat failure. It uses a digital micro-controller which enables new processing capacities.

It was originally designed for a 24V BJ42 (3B engine) but is compatible with both 24V and 12V systems.

2 Installation

The timing module is located on the passenger side, under the glove box. It is necessary to remove the timing module from the car to replace the board.

2.1 Module and board disassembly

1. Remove both nuts holding the timing module

2. Unplug the 9 pin and single pin connectors. Depending on your superglow module you may have a single 13 pin connector instead.

3. On the underside of the module, bend the tabs holding the lower part outside. You should now be able to open the timing module. You may need a pair of pliers but it can be done by hand too. Be gentle with the tabs or you may break them.

4. With the help of pliers, bend the tabs holding the board outwards. The board should now be free from its casing.

2.2 Connector replacement (optional)

There are multiple options regarding the connectors:

- For maximum **authenticity**, you may unsolder the board connector from your legacy board and keep the harness connector. A hot air rework station is highly recommended if not mandatory. It also guarantees compatibility with your harness connector.

- For maximum **robustness** and reliability you may choose to change both the board and the harness connector. In that case the board will be shipped with the new connector directly soldered and the harness connector ready to crimp.

- For maximum **ease of installation** you may choose to change only the board connector and keep the existing harness connector. In that case the board will be shipped with the new connector directly soldered and you will need to slightly grind a plastic tab inside the board connector to allow it to mate with the legacy harness connector.

Board connector disassembly

1. Using a vise or any other holding device, firmly attach the board in the upright position.

2. With your air gun, heat up the screws one by one. When the solder melts unscrew them.
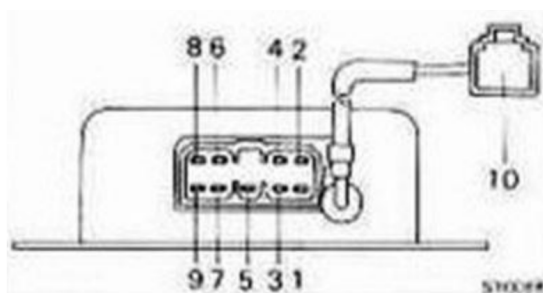
3. With your air gun heat all the pins at once. Put a flat screwdriver between the board and the connector and apply pressure to separate them. Be patient, the connector will loosen up.

Harness connector replacement

1. First of all, take pictures of the installed harness connector from multiple angles. They may come handy later on.

2. On a paper, make a drawing of the connector and the color of each individual wire connected.

3. Try to remove the wires from the connector. If it is impossible, cut them as close to the connector as possible.

4. Re-crimp the wires and insert them in the new connector. Beware of the order, several wires may have the same color !!
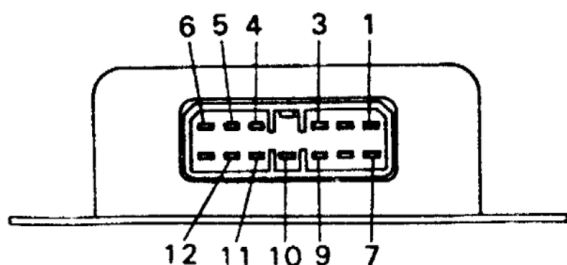
2.3   Connectors pinout

2.3.1   9 pin

Pin	Connection
1	Water temperature sensor +
2	High glow relay
3	Current sensor +
4	Regulator L terminal
5	GND (water temperature sensor)
6	12/24 V input
7	Dashboard indicator
8	Low glow relay
9	Current sensor -
10	Starter relay

Figure 1: 9 pin connector layout

2.4   13 pin

Pin	Connection
1	High glow relay
2	N/C
3	Dashboard indicator
4	12/24 V input
5	Low glow relay
6	Current sensor -
7	Water temperature sensor +
8	N/C
9	Regulator L terminal
10	GND (water temperature sensor)
11	Starter relay
12	Current sensor +
13	N/C

Figure 2: 13 pin connector layout

2.5   Module and board assembly

1. Put the board inside the lower part of the case. Beware of the orientation.

2. Bend the locking tabs inward. Apply little pressure only, be careful not to damage the board with your pliers.

3. Connect the wire behind the single wire connector to the block connector on the bottom left part of the board labeled *DEM*.

4. Re-assemble both parts of the case, bend the holding tabs.

5. Plug the connectors

6. Put the module back at its position, and tighten both nuts.

2.6   Wilson switch

A *wilson* switch port is available on the top left part of the board. Connect here both wires of a push switch that will trigger high glow when activated. The board does not need to be powered up or even functional for this switch to work.

<u>WARNING:</u> Use a manual switch under your own responsibility. Extended manual glow plug triggering can damage or break your plugs !

2.7   Status leds, light conduit

On the bottom right part of the board are located two status leds that indicate when a glow relay is active. During normal operation when the module case is closed the leds will be hidden. In case you want to have direct information of the board actions you can install a light conduit (included in the package) by drilling a 3.5mm hole in the case.

3 Normal operation

3.1 Feature selection

Using the 4 switch box on the upper-right corner of the board it is possible to choose which features will be used. When the switch is on the side with the **"ON"** label it means the feature is **activated**
Note: The feature selection must be made before the system is powered-up. Any change made after power-up will not be taken into account.

3.1.1 Current

Enable this feature to have the current sensing stop the high glow phase when the plugs have reached operational temperature. If this feature is not activated, a timer will be used instead.

3.1.2 Summer

Enable this feature to reduce the maximum glow duration (both high and low). This can protect your plugs in the summer time when the temperatures are high and if you fear your water temperature sensor is defective.

3.1.3 Water

Enable this feature to use the water temperature sensor to compute optimal glow duration. Disable it if you think the sensor is broken.

3.1.4 Safety

This feature enables a powerless timer that lasts a minute and allows the board to keep track of the last high glow activation, even if key contact is open and the board does not get power. It is useful to protect your glow plugs if:

- Startup failed and you power-off/power-on the car to re-trigger glow.

- The power supply or ground wires to the board are unstable and it reboots on its own.

With this feature enabled, at startup, if a high glow was performed during the last 30 seconds, glow will be low directly.

3.2 Glow sequence

During normal operation the board goes through several phases:

1. **Power ON** : Contact is applied, consequently the board boots up.

2. **Configuration** : The feature selection switch, water temperature sensor, starter and regulator status inputs are read. The necessity for preheat, timings and maximum timing are computed.

3. **Glow high** : If the configuration phase decides glow is required, maximum voltage is sent to the plugs until either one of these conditions is reached:

   - Maximum duration is reached
   - Current sensor computation show that plugs reached their operating temperature

4. **Glow low** : If the configuration phase decides glow is required, and after high glow stops, maximum voltage is sent to the plugs through a resistor (reducing the glow plug bus bar voltage) so that they perform their heating function. This phase stops when the computed glow timing is reached.

5. **Idle** : After glow stops, or if glow is not needed, the board stays in idle and cannot go back to glow.
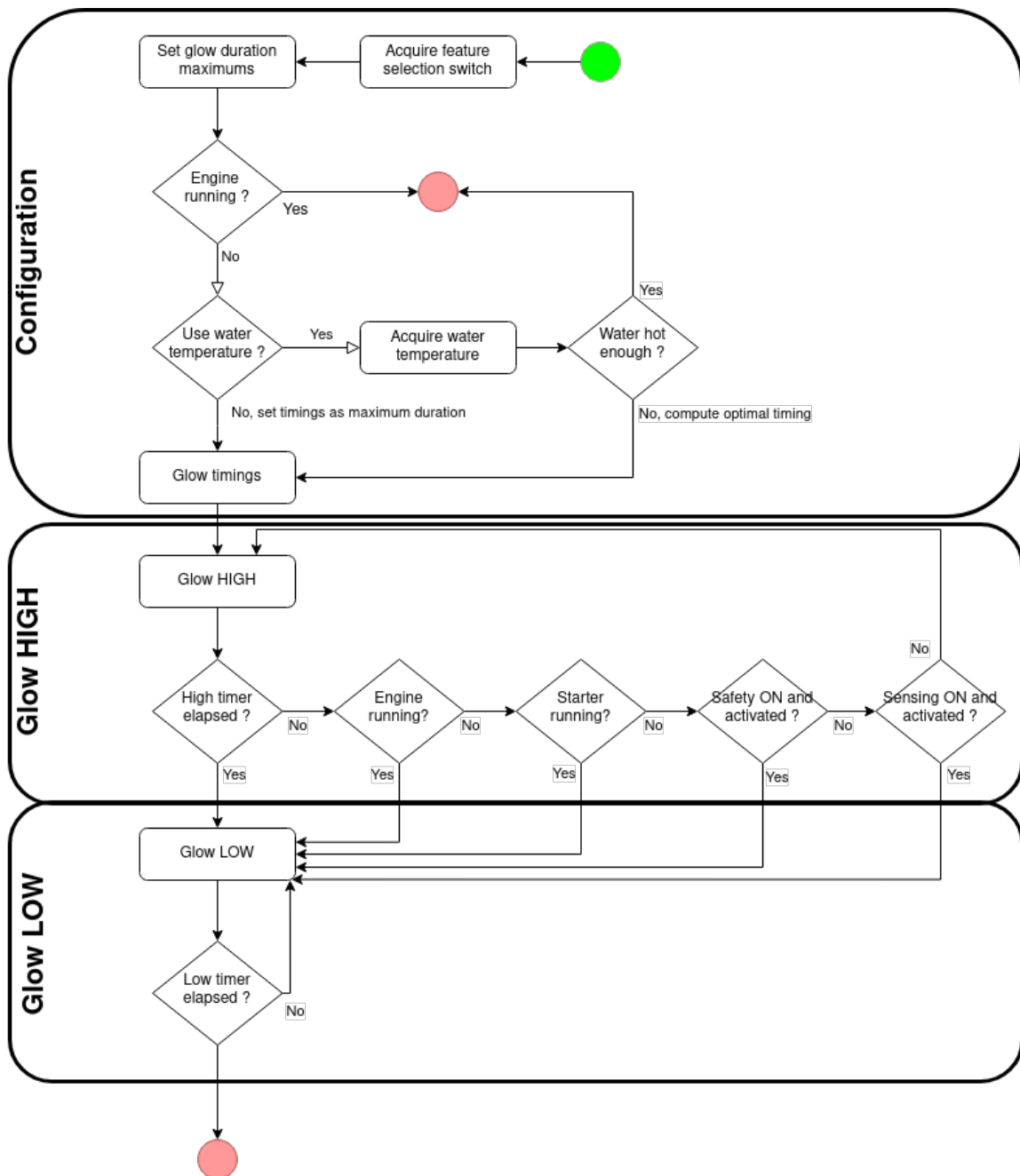
Figure 3: Logic diagram

4 Troubleshoot

4.1 Watchdog & Error codes

Throughout the operation, a *watchdog* monitors several parameters. If abnormal be-
haviour is observed, an error is displayed by the red led on the board at the end of the
glowing process.

The error codes will be displayed 3 times with a pause in between:
S : SHORT | **L** : LONG

- **SSLLSS** : [CRITICAL] Glow plug voltage detected while no glowing was commanded

- **SSLLLSS** : [CRITICAL] Glow plug voltage too high while in glow LOW mode

- **SSLLLLSS** : No voltage at glow plugs while in glow mode

- **SSLLLLLSS** : Water temperature sensor error

In case of a critical error, the glowing stops immediately and the orange dashboard preheat indicator will blink indefinitely. It is advised to unplug the board and cut power to avoid burning the plugs and troubleshoot the reason for unexpected glow plug activation.

4.2 Common issues

Problem	Cause
The board reboots constantly	Supply voltage issue. Check grounding quality and supply voltage with a voltmeter
The glow HIGH phase is skipped every time	Either caused by safety function error or regulator / starter pins misread. Put the *SAFETY* feature OFF and check starter and regulator voltages.
The glow HIGH phase is too short	Can be caused by the current sensing memory function. Put the *CURRENT* feature OFF and try again. When the board boots with the current feature off, the current sensing parameters are reset. Try activating the current function again.

5   Computer interface

This section will detail the debugging and software customization possibilities. It is not intended as a guide for beginners but rather as a hint to makers and specialists that already have the required knowledge.

WARNING: Modifying the software delivered with your product is not recommended and may damage your *electronic superglow board* as well as your car ! The manufacturer denies any responsibility for the damage caused by software change.

5.1   Hardware and software prerequisites

The board exposes a 6 pin header on its bottom right which can be used, in conjunction with a *FT232* USB to serial UART adapter to communicate with the micro-controller. Such adapters are very common and can be found on ebay, aliexpress,...

5.2   Serial debugging

Serial debugging is a very powerful tool to understand what is wrong with your superglow system, to check that it is behaving as expected, or simply because you are curious.
When connected to a computer, open a serial prompt using the software of your choice.
Baud rate: 28800
All along the configuration and glow process, debugging information is printed such as measured input voltage, computed water temperature, glow timing and status, state changes, software version, errors, ...

5.3   Software update

You may update the software of your product using the UART adapter described in 5.1.

1. Download software from : FIXME

2. Use AVRDude to flash the new software

5.4   Custom software

In case you have the required knowledge and the will to make modifications to the glow process you may ask for the source code. Contact is given in section 7.
Please not that source code access is not guaranteed and will be granted at the designer's sole discretion.

6   Compatibility

6.1   Engines

The electronic superglow is compatible with the following engines:

- B: 2B, 3B, 13B, 13B-T, 11B

- H: 2H, 12H-T

- L: 2L, 2L-T

6.2   Timing modules - Part numbers

The electronic superglow can be used as a direct replacement to modules with P/N:

- 28521-57010 (24V)

- 28521-68030 (12V)

The electronic superglow can be used as a replacement, **with connector adaptation** to modules with P/N:

- 28521-57051 (24V)

- 28521-68070 (12V)

- Any 28521 module for either 12V or 24V.

- To confirm compatibility contact the designer (See section 7)

7   Contact

You may contact the designer through this email: esuperglow@slvtr.fr