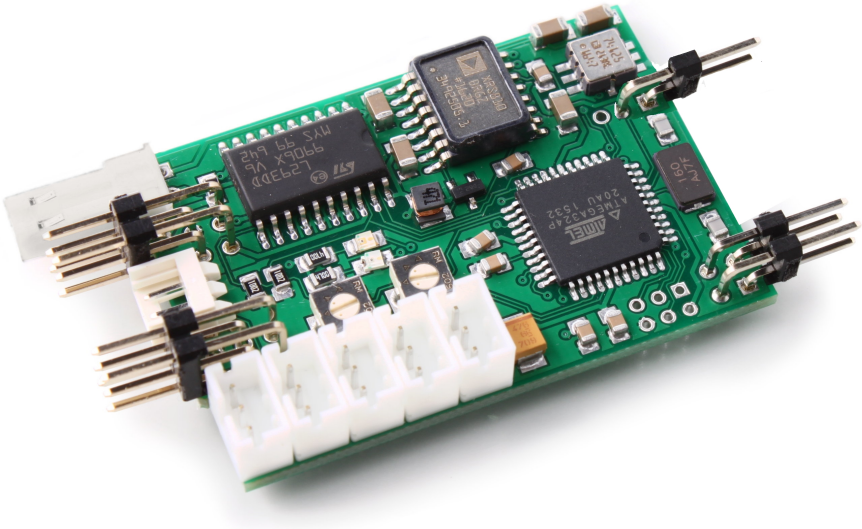
TVC-GSU-11

gun stabilizer module for models with Tamiya DMD T-07

The module has been specifically designed to incooperate the Tamiya DMD T-07's for Leopard 2A6 model. The module stabilizes the horizontal and the vertical movement of the gun. This is acccomplish by using modern gyro- and inertialsensor technology.

The module can be operated so that there is no further RC channel needed. This allows 4 channel transmitters to (with the necessary for the DMD mechanical trimmers) can be used are used. Alternatively, one chanel can be used to activate the stabilization, the horizontal and vertical sensitivity via transmitter. Then up to three additional channels are needed.



1 Note

Installation of the module requires intermediate to advanced modeling skills. Soldering skills are required to connect the wiring. Inexperienced modelers and persons aged under 16 years old should seek the assistance of an experienced modeler. Always switch off power when working on the wiring. Especial take care when connecting more than one receiver energy source. Prevent the device from getting wet. Check loads before connecting them to the modul at a current limited, or fuse protected source.

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2 Overview

2.1 Technology Used

The controller is microprocessor controlled. The processor works at 16MHz clock frequency. The inertial sensors are so-called MEMS sensors (Micro Electro Mechanical Systems), i. the micromechanical gyro / inertia system is completely in implemented a semiconductor.

A gyroscope is used as the sensor for the rotation axis stabilization. The maximum detectable angular velocity is $\pm 300 \frac{°}{s}$. The sensor gives signal proportional to the angular velocity. This signal becomes the position integrated. Principle-related quantization errors grow over the time a position error, so that the horizontal deflection drifts. This especially noticeable at standstill. This behaviour is, as mentioned, by the principle conditioned and occurs also in the original.

For measuring the angular position of the Earth gravitational field is used an acceleration sensor. To suppress high-frequency accelerations are in the software implemented digital filters and attenuators (moving averaging). The damping parameters of the tower rotation and the cradle are over each one servo channel during operation of the model adjustable.

2.2 Scope of Delivery

The module comes with all necessary plugs and adapters.

When 4 chanel RC operation is choosen, a switch is needed to turn stabilization function on/off. This switch is not included.

- the module
- five plugable servo leads (unused chanels can be left unplugged)
- y-style power supply adapter with Tamiya battery connectors . The adapter can be used with a seperate battery or can be plugged between main battery and DMD unit.
- 2,54mm jumper for programming
- 2,54mm jumper for orientation selection

- 2mm jumper for shortening the rear deflector switch within the DMD

3 Functional Description

The automatic stabilization can be turned on via a proportional channel of the remote control or via a contact on the module. The green LED (LED2) indicates the activated state. Additionally an output will be turned on when stabilization is activated, it can be used to e.g. connect a laser-module. The output switches the battery voltage and can be loaded with 500mA.

The rear deflector function and automatic loading remain operable in automatic mode.

3.1 Operation with Stabilization switched off

When switched off, the tower can be used as usual with the channels for tower rotation and gun elevation control.

3.2 Automatic Stabilization of the Tower Rotation

If the stabilization is active, the horizontal orientation of the tower will be automatic maintained by the module. Only when the transmitter stick for turret turn is operated, the automatic control stops until the manual intervention ends, then immediately starts stabilization within the new position.

The tower rotation will take effect after a time of approx. 200ms. This is necessary take into account the DMD's double action of the tower rotation channel and not even with short operation of the channel moving the turret instead of switching the light function.

The sensitivity of the control can be adapted to the model. This can either be done remote using a proportional channel on the radio, or through a trimmer on the module.

3.3 Automatic Stabilization of the Gun Elevation

If the stabilization is active, the vertical orientation of the tower will be automatic maintained by the module.

Here not only by the manual override, but also the DMD triggered reload simulation and deflection are still functional.

The sensitivity of the control can be adapted to the model. This can either be done remote using a proportional channel on the radio, or through a trimmer on the module.

4 Installation

The model should be in operational state according to the Tamiya manual. In particular, the height adjustment and rear deflector function must be operational condition. Do not install the module if this is not the case.

4.1 Installation Position

The module must be fixed and mounted parallel to the bottom of the tower. Where exactly the module is placed in the tower is not decisive, only the alignment is important.

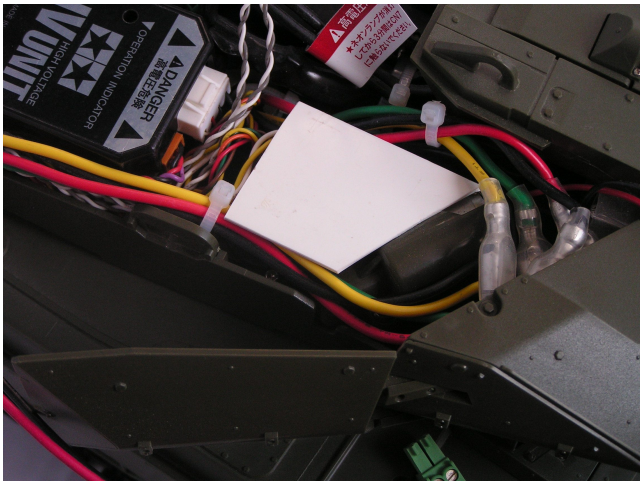

Figure 1: From our point of view the best position to mount the module in a Leopard 2A6. A ABS base plate has been glued onto the housing of the turret turn motor.Then the module is attached with double-sided adhesive tape.

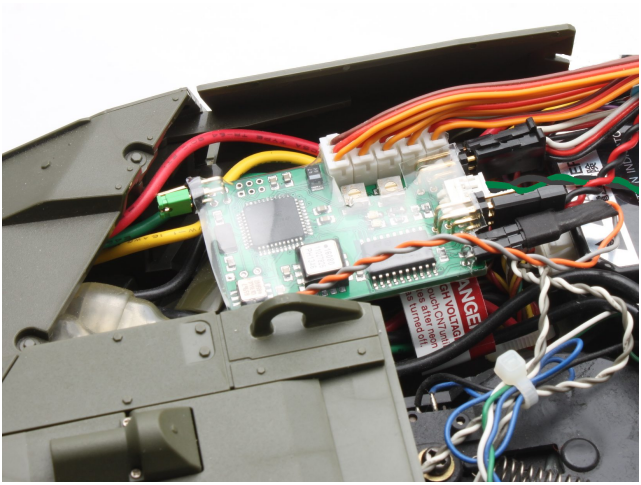

Figure 2: Location of the module in the tower of the Leopard 2A6

If you want to use the model as the basis for a Leopard 2A5 version, the space in the tower is reduced. In this case, the module can also be installed rotated by 90 degrees.

- Leopard 2A6: The green jumpers must be in the direction of the main gun. X12 remains open.
- Leopard 2A5: The green jumpers must be aligned to the right (from the main weapon's point of view). X12 is plugged

4.2 Connections

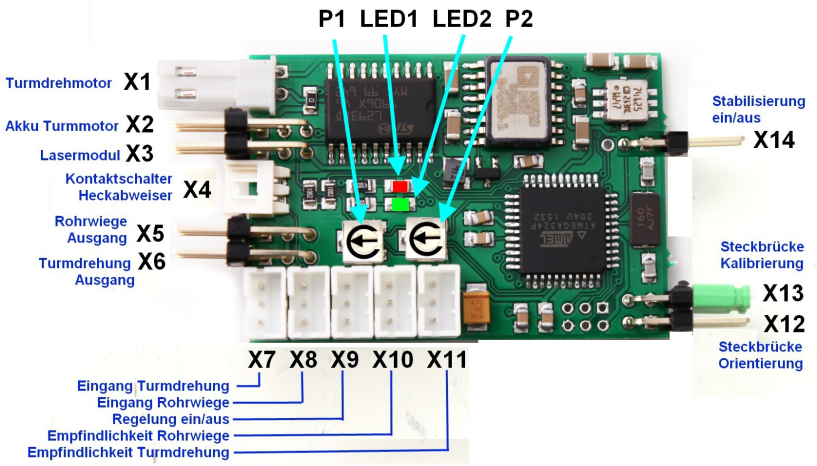

Figure 3: Function of the connectors

connector	function	connected to	optional
X1	turret motor	gray / orange cable to turret motor	no
X2	drive battery	battery for turret motor	no
X3	laser module	laser module	yes
X4	rear deflector	rear switch plug with black / green	no
X5	gun elevation	gun elevation servo	no
X6	tower rotation output	J4 of the DMD	no

Table 1: Assignment of motor, servo, battery connector

connector	function	connected to	optional
X7	turret rotation	receiver turret chanel	no
X8	gun elevation	J5 of the DMD	no
X9	stabilization on / off	receiver channel switching the control	yes
X10	sensitivity gun elevation	receiver channel sensitivity gun elevation	yes
X11	sensitivity turret rotation	receiver channel sensitivity turret rotation	yes

Table 2: assignment of the proportional control inputs

The optional channels are detected when the module is switched on. Plugging the channels during operation does not work. If you take one detected channel during operation, a failure is detected.

If you do not need individual channels, you can unplug them from the connector housing to safe space.

connector	function	plugged	unplugged
X12	orientation	longitudinal axis	transverse axis
X13	calibration	programming mode	operating mode
X14	control on / off	on	off

Table 3: Assignment of the connectors

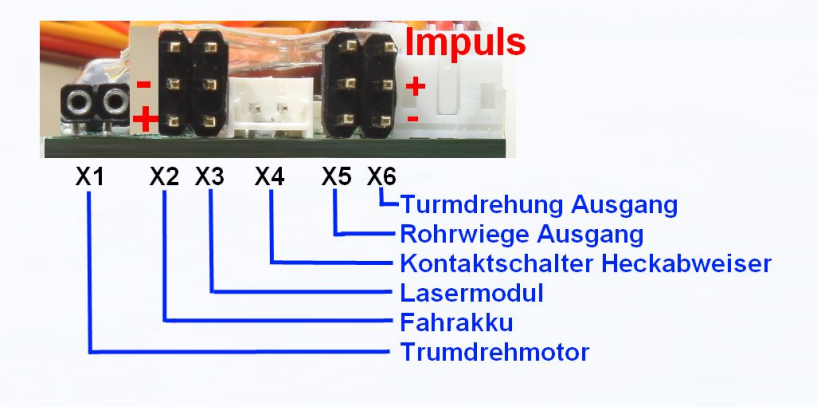

Figure 4: Belegung der Steckverbinder

4.2.1 Stabilization on / off

The stabilization function can be switched on and off. You can do this using a remote control channel (X9) or input X14. The module checks when switching on whether a signal from the receiver is present at X9. If that is the case, the stabilization will be via this channel of the remote control activated. In the transmitter the channel should be assigned to a switching channel, but it also works with a rotary encoder / slider. If no receiver signal is detected there (and only then), the input X14 will be evaluated. Are the contacts connected by X14 is the stabilization active. If the contacts

are open, stabilization is inactive.

When stabilization is activated, the green LED (LED2) lights up and output X3 becomes active. Here a target laser can be connected. The Output can also be used indicate the switching state of the stabilization from the outside. Therefore a LED (with resistor) can be connect.

4.2.2 Tower Rotation

Instead of connecting the receiver output for the tower rotation with DMD (J4), the servo cable (X7) must be connected. To maintain playing the turret turn sound, a V-cable is integrated into the module. The DMD channel for tower rotation (J4) is plugged into the servo socket (X6).

The built-in speed controller stabilization acts directly on the tower rotary motor. Therefore, the plug of the turret motor (gray-orange wire) must be unplugged from the DMD and and plugged into the module (X1).

To adjust the inertia of the tower rotation a proportional channel (X11) is used. After switching on, the inertia is 50% of the maximum value. If X11 is not connected to the receiver, the setting is made using the trimmer P2.

The microswitch, which detects the rear area of the tower position, takes place to the DMD (white plug, black-green cable, formerly J19) to the module (X4). On J19 the supplied 2mm jumper has to be plugged.

Note Do not leave the input for the rear deflector (X4) open. Since the switch in the Tamiya model is a normally closed contact, the module recognizes the open input as active and the downward movement is always limited.

4.2.3 Gun Elevation

The servo channel for the gun elevation (X8) of the stabilization electronics must be connected to servo output of the DMD (J5). The gun elevation servo has to be plugged into servo socket X5.

The inertia of the gun elevation (X10) can be set via a proportional channel. After switching on the inertia is 50% of the maximum value. If X10 is

not plugged when powering the module, the adjustment is made via the trimmer P1.

4.2.4 Power Supply of the Module

The digital part of the controller is powered by the 5V of the receiver, which in turn supplied via the DMD. The power supply of the power amplifier of tower rotary motor is fed in separately via X2. Usually you will supply it from the battery in parallel to the DMD.

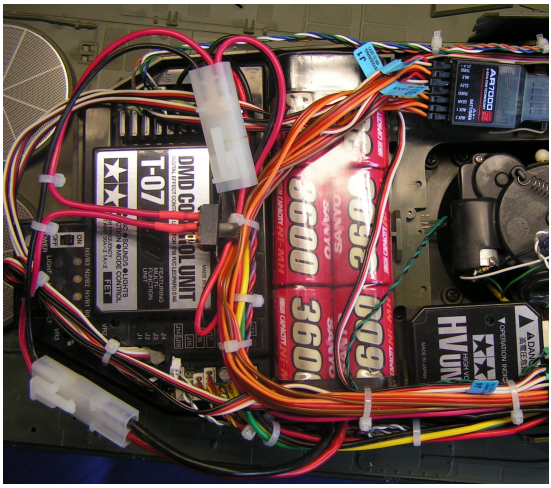

Figure 5: Y-junction with main power switch

Please note the polarity of the supply voltage. The regulator is not protected against reverse polarity

Since the motor output stages in the module require a quiescent current of approx. 2mA you should disconnect the battery. A possible solution to this problem can be seen in the picture above, an adapter cable with a main power switch. It disconnects the DMD and TVCGSU11 from the battery.

Our observation at Tamiya's Leopard 2A6 is that the tower rotation speed (angular velocity) is less than the rotational speed of the chassis around the Vertical axis. Therefore, the weapon stabilization can not keep track when driving fast. The drive motor for the tower rotation is too slow.

To achieve higher dynamics in the tower rotation, the tower rotary motor

can be operated with a higher voltage. In this case, an additional Battery with higher voltage is connected to the weapon stabilizer. Alternatively, a motor with higher power can be installed.

5 Example Radio Assignment

In this chapter we show the assignment at our transmitter GFMC-FS-8-1. Basically, this also applies to other radios.

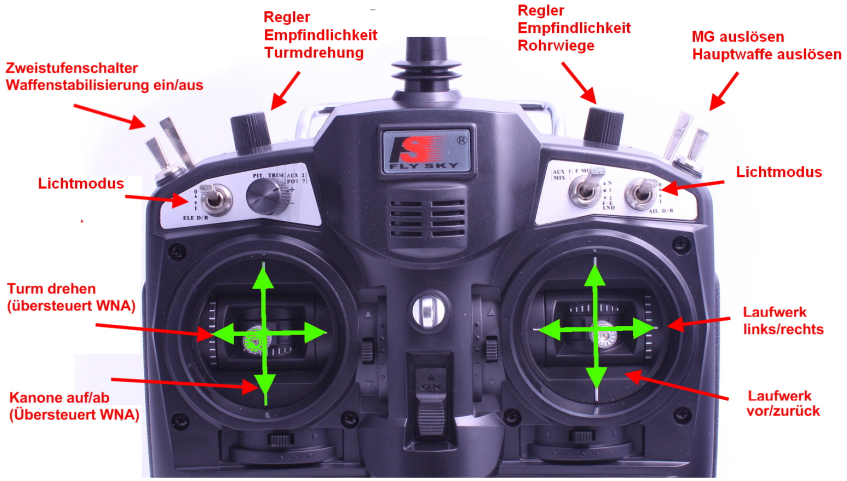

Figure 6: Example assignment of a transmitter

The special thing about the GFMC-FS-8-1 is that it triggers the Tamiya functions by simulating the mechanical trimmer operation. Thereby the special functions can be triggered via switches. The right one Stick is assigned to the drive, the left stick to the tower.

receiver channel	function	connected to
1	drive left / right	DMD J1 Steer
2	drive forward / backwards	DMD J2 Throttle
3	gun up / down	DMD J3 GUN
4	turret left / right	GSU11 X7
5	stabilization on / off	GSU11 X9
6	sensitivity gun elevation	GSU11 X10
7	sensitivity tower rotation	GSU11 X11

Table 4: Assignment of the recipient

channel	function	connected to
CH1	drive left / right	P1
CH2	drive forward / backwards	P2
CH3	cannon up / down	P4+S7+8
CH4	tower left / right	P3+S5+6
CH5	control on / off	S1+2
CH6	sensitivity gun elevation	P5
CH7	sensitivity turret	P6

Table 5: Channel assignment in the transmitter

6 Commissioning

6.1 Important Note

Familiarize yourself with the behavior of stabilization! Especially when transporting and carrying the switched-on model relatively high angular velocities, which compensates the position control immediately.

Please switch off the model for transport!

6.2 Calibration and Operation

During calibration, the module learns the neutral positions of the DMD and the Transmitter. You only need to run this calibration again if you want to

- change the assignment of the receiver channels
- change the neutral Position for the gun elevation at the DMD (VR1)
- perform the calibration of the DMD on the transmitter

When switching on and calibrating, the module measures the zero point Inertial sensors, therefore the model must be leveled when switched on.

6.2.1 Calibration

For calibration, the jumper must be inserted in X13.

1. Insert the programming jumper
2. Switch on the transmitter
3. move sticks for turret and gun-elevation and the sensitivities Adjust center position. Put the on / off switch in the middle position.
4. switch on the model
5. the LED1 (red) lights up
6. The LED2 (green) flashes until the controller detects the center position of the channels. If the zero point detection is not possible, the LED does not light up.

7. The LED2 (green) goes out and the LED1 (red) lights up permanently
8. Switch off the model
9. Remove the programming jumper

The process does not start until the DMD is started and a signal on J19 outputs. The calibration process takes about five seconds.

6.2.2 Operation

The switch-on process is the same as for the calibration. Only is the jumper not plugged. Check if you can turn stabilization on and off. The LED2 (green) indicates this.

6.3 Problems and Causes

problem	cause
The stabilization does not leave calibration mode	Check if all Servo Inputs (X7-X11) are plugged correctly. Have special focus on J5, because there is no polarity marking. Make sure the module is levelled and does not move
The stabilization can not be switched on	Check the switch in the transmitter is in the middle position. If it is a Two-step switch is, test switching in both positions
After switching on the stabilization the turret motor runs endlessly	Change the polarity of the motor X1
The gun elevation controls during stabilization in the wrong direction	check the mounting direction of the module
After switching on the stabilization the gun elevation swings	reduce the sensitivity
After switching on the stabilization the turret turning motor swings	reduce the sensitivity or reduce battery voltage
the gun elevation moves in the manual control not below the 0 degree position	Check the seat of the bridge at the rear deflector contact J19 of the DMD
The cradle moves during stabilization and manual control not below the 0 degree position	Check the seat of the rear deflector contact at X4

Table 6: problems and causes

7 Options

For models without DMD we recommend the TVC-GSU-12. This includes additionally e.g. a gun recoil servo control and simulates the automatic loading sequence.

In addition, the TVC-GSU11 has to consider some DMD T-07 special features (regarding the kind of using the trimmers), which are not needed in models without DMD.

8 Glossary of terms

BEC **B**attery **E**liminator **C**ircuit
This circuit replaces a extra Battery needed for the receiver and connected servos, by generating a fixed voltage from the drive battery.

ESC **E**lectronic **S**peed **C**ontroller
This is a unit to control the speed and direction of a DC motor.

LED **L**ight **E**mmitting **D**iode
A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. Benefits of LEDs are low power requirement and long life. Disadvantages is the more complicated wiring, compared to a classic bulb, it has a polarity and a resistor is needed to limit the current.

Scalebus The Scalebus is a development of **SGS electronic** to connect controllers and modules to compose solutions for complex RC models.

SBus The Sbus has been introduced by **Futaba** to simplify the wiring between RC Receivers and servos / esc.

SBus The SBus was introduced by the company **Futaba** to simplify the wiring between receiver and servos/controllers. This is especially useful for models with many controllers.

IBus The IBus was introduced by the company **Flysky** to simplify the wiring between receiver and servos/controllers. This is especially useful for models with many controllers.

SUMD The SUMD sum signal has been introduced by the company **Graupner** to simplify the wiring between receiver and servos/controllers. This is especially useful for models with many controllers.

Abbre-vation	meaning	explanation
Stick	**S**tick	Stick not self centering
StickS	**S**tick **S**elfcentering	self centering Stick
TSMS	**T**hree **S**tage **M**omentary **S**witch	self centering momentary switch with three stages
TSS	**T**hree **S**tage **S**witch	switch with three stages
Pot	**Pot**entiometer	linear- or rotary knob
PotC	**Pot**entiometer with **C**enter key	linear- or rotary knob with a center key

Table 7: Abbrevation for the manipulators in the transmitter housing

9 Technical Data

Nennspannung	6-24V
Nenn-Motorstrom	5 Ampere
PWM Frequenz	2kHz
Abmessungen	40x70x10mm
Softwareversion	V0.8.2

10 Important

This equipment described above has been tested and inspected for quality and function. And it is intended for installation and use only as described above. This equipment does not contain any user serviceable parts. The supplier accepts no responsibility, financially or otherwise, for damages caused by use or misuse of the equipment described above. The equipment must be protected from exposure to water to prevent short circuit. Do not open the equipment or attempt to change function, wiring, or documentation in any way. Do not connect to incorrect voltage or reverse the battery polarity. Do not use in a careless or abusive fashion around persons or property. Do not attempt to repair. Any legitimate use, e.g. Installation in a model makes the user responsible to ensure that the operating instructions and non-liability agreement are provided to the purchaser of the module described above.

Do operate the device only in the permissible operating conditions. Do not make any changes to the controller through. The device shall not be exposed to splashing water or rain (causing a short circuit).

10.1 Warning

Due to choking hazard caused by small parts that may be swallowed, this product is not suitable for children under 6 years of age.

10.2 Environmental protection

For defective devices, repair is possible in many cases. Please contact us. If you do decide to dispose of the device, you will be making a contribution to environmental protection if you return the device to a municipal collection point for recycling. Electronic devices do not belong in household waste.

10.3 Address

SGS electronic
Zeppelinstraße 36
47638 Straelen
Germany / Europe

10.4 Contact

Web www.sgs-electronic.de
Email info@sgs-electronic.de

Ust-IdNr.: DE 249033623
WEEE-Reg.-Nr.: DE 90290947

10.5 Document date

This document was created on 2024-03-05 18:08:03+01:00

10.6 Documentation

We reserve the right to make updates, changes or additions to the information and data provided.

The documentation that accompanies your product applies.

Please note that documents obtained later via download may not correspond to the status of your module.