

TVC-TRF-10 (MBT V2)

Full option module with sound for RC-battle tanks
in 1/16th to 1/25th scale

This module was developed to enable complete control of battle tanks. This revised second edition of the module has been extended by the following features:

- integrated battleunit
- polyphonic sound
- random sounds
- model change (up to three models can be controlled with one transmitter)
- light control can be switched by RC
- automatic turn off



For different tanks there are versions available with sounds for::

#258120 HT1: Tiger 1
#258122 HT3: Panther
#258125 HT5: Panzer III
#258126 HT6: Walker Bulldog

#258121 HT2: T-34
#258123 HT4: Stug III

#258102 MT1: Leopard 1
#258107 MT6: Abrams

#258103 MT2: Leopard 2
#258110 MT9: T-55

Note:

Installation of the module requires intermediate to advanced modeling skills. Soldering skills are required to connect the wiring. Inexperienced modelers and persons under 16 should seek the assistance of an experienced modeler.

Overview:

This module will provide the following functions:

- proportional drive motor control with mixing
- proportional turret rotation with servo output and speed control
- proportional barrel elevation with servo output and speed control
- cannon fire and recoil with strobe LED flash and servo output
- MG LED
- polyphonic sounds for all functions (engine start/stop/idle, 14 drive stages, main gun, MG, turret turn, barrel elevation)
- automatic control of brake light, flashing light, rotating flasher
- battle-function
- model selection for up to three models
- automatic control of smoke pump and heating element

The controller is rated for an input of 7.2V to 12V. A 10A fuse protects the module and the battery from over current. The module has 2 microprocessors with fail safe functions to prevent unintended operation of the model.

The module is equipped with a BEC circuit, that supplies the module itself, the receiver and the servos with a regulated 5V voltage.

scope of delivery:

- 9 servo leads for X10 to X17 and/or X20 to X21
- speaker connection cable for X70
- connectors for X01, X02 and X60
- servo patch cable to connect the module to the receiver
- 10 resistors to connect LED

Function:

A proportional radio transmitter is required. It needs at least four channels and max. six channels. The channels 5 and 6 can be plugged optional. The functions of the channels are as follows:

Channel 1 - Proportional left/right with integrated V-mixer. The integrated mixer slows the inside track to a full stop. Deflection of the stick while stopped causes the vehicle to pivot steer. (This channel provides turn signal information)

Channel 2 - Proportional forward/reverse. This channel also provides the information for brake and reverse lights, and smoke generator.

Channel 3 - Proportional cannon elevation. With rapid stick operation to full deflection the MG (upper limit) or the primary weapon (lower limit) is fired. For the MG a lamp/LED flickers to the sound, for the main gun an LED is flashed. For the main gun a motor output is switched, and an LED flashes. Recoil is also simulated with rapid retreat and slow return of a servo output.

Channel 4 Proportional turret rotation

Channel 5 Controlling the light mode

Using this channel, the rotating flasher and the flasher can be controlled. In addition there are two lamp outputs that can be used for individual switch functions, e.g. light or beamers lamps.

If this channel leaves unplugged, all outputs are turned off. The rotating flasher outputs are only active if a BattleUnit hit happens and the outputs for the flashers become active when turning the model left/right.

Channel 6 turn model of / change model

Case the model is switched off by leaving the neutral position, the model stops acting when channels 1 to 5 are controlled and the engine off sound is played.

This feature can be used to play the engine start/stop sound by the RC. But it can be used to switch between up to three different models. To archive that, the appropriate model must be switched on, when the channel 6 switch is positioned in a unique position. The modul stores this position as „turn on“ position. Leaves the switch this position, the model becomes passive and can not be moved. However, in this state it can still be fired by other tanks and model reacts to this by rumbling, hit indicator and the hit counter increments.

To to this it is obvious, that you need receivers with the same channel crystals. When using 2.4GHz receivers, they must be bound to the same transmitter.

The use of this channel is optional.

Connection of the servo wires at the receiver

<i>channe l</i>	<i>connector</i>	<i>optional</i>	<i>Function</i>
1	X50	no	steering
2	X51	no	throttle
3	X52	no	cannon elevation and firing
4	X53	no	turret rotation
5	X54	yes	light mode control
6	X55	yes	model select

channels 1 to 4 must be connected to the receiver, channel 5 and 6 can be used optional.

Automatic functions:

Cannon:

When the cannon is fired, the following actions take place:

- the sound of the main gun is played
- the gun flash LED output is switched for about. 200milliseconds
- the gun motor output is switched for about. 800Milliseconds. This output can be used to trigger a barrel recoil unit with stop switch.
- a servo output provides a rapid recoil and slow return to fire position. The complete cycle must operate before firing the weapon again.
- there is a rumble in the drives
- the modul transmits an infrared battle unit signal

MG:

The MG light flashes at approximately two times per second when shooting and the sound module plays the recorded MG sounds.

automatic engine stop:

In case the radio is unoperated for about 2 minutes, the modul turns off the engine and plays the engine stop sound. Additionally the exhaust simulation is switched off. (parking mode)

To wake the modul, just move the throttle stick, then the engine startup sound will be played and all functions are available again.

When the modul is parking mode, random sounds are played. E.g. this can be sound from construction machines, music or walkie talky noise. These sounds, like all others on the modul, can be changed.

You can also change to the parking mode by turning off the radio. When doing this, no random sound is played.

TIP:

If you use a failsafe receiver, the receiver delivers signal output when the radio is turned off. For that reason the modul can not detect the unpowered radio. Please turn off failsafe function or use a normal receiver.

Automatic functions:

Exhaust simulation module:

The module will control a liquid smoke heater and pump/fan . The smoke liquid heater is switched on when the model receives a valid radio signal. The outputs for the blowers and pump are operated as a function of acceleration and speed. At idle the smoke is inactive. As the model accelerates, smoke increases proportional to setting and duration of the throttle. During steady throttle travel the output is reduced by 50% (by means of PWM)

Reverse light:

The reverse light output is linked to channel 2 and is automatic. When the throttle lever (channel 2) is in neutral or straight-ahead position the reverse light circuit is turned off.

“Rotating” flasher light:

The flasher runs constantly at close to 1.5 cycles per second. The flasher can be controlled by light mode 2.

Turn signals:

Starting from a minimum of 10% throttle the signal lights will flash left or right as required. In lifting and clearing mode the light operate as hazard lights. Because turn signal is not reasonable when digging, this automatic function can be turned off, controlled by light mode 2.

Brake light:

The brake light is automatic. Lights go out automatically with resumed throttle.

Installation:

Before installing the model it is best to connect the components on the workbench. Familiarize yourself with the operation of the components. Pay particular attention to the maximum travel of the servos.

You do not have to connect all loads. For basic operation it is sufficient to power the modul and to connect all servo inputs that are not „optional“ to the receiver.

It is recommended to connect the speaker in this early state, because you can hear the action that should be activated.

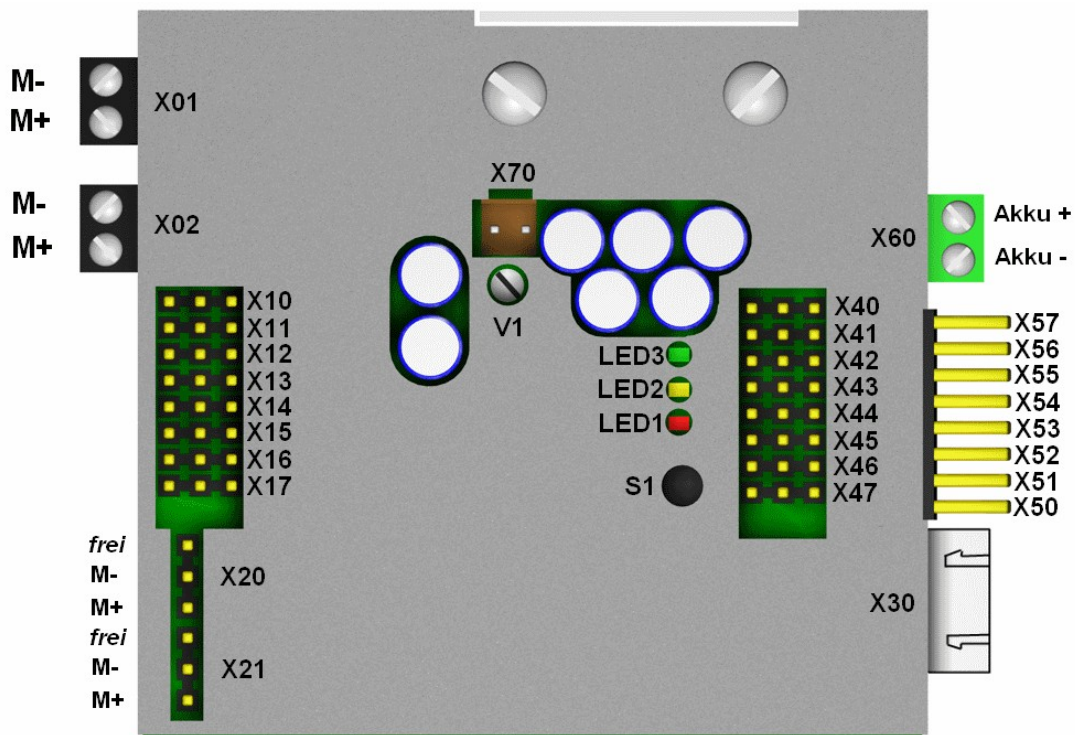


Abbildung 1: Connector Overview

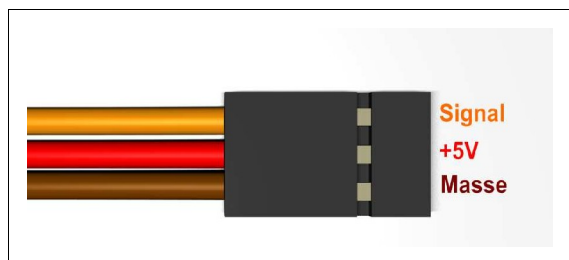
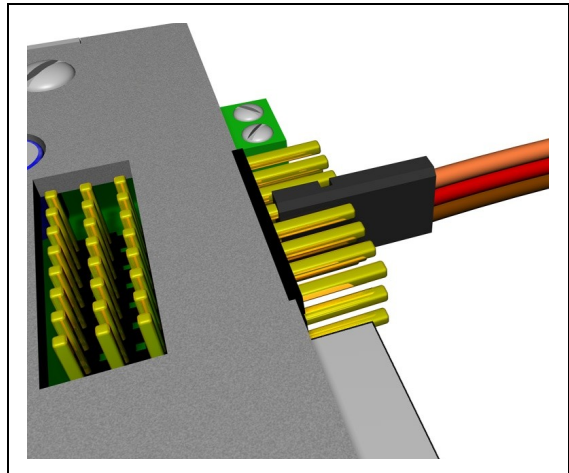
In the following section the position and orientation of the connectors are explained. The exact function of each connector is described later in detail.

connection of the servo inputs to the receiver (X50 to X57):

The connection to the receiver is made using patch cables. One side is plugged into the modul and one side is connected to the receiver. If the delivered cables does not match the length needed, they can simply be replaced by longer or shorter versions.

The adjacent picture shows how the connectors are plugged into the modul.

The ground (black or brown line of the servo cable) is closest to to the bottom of the module.



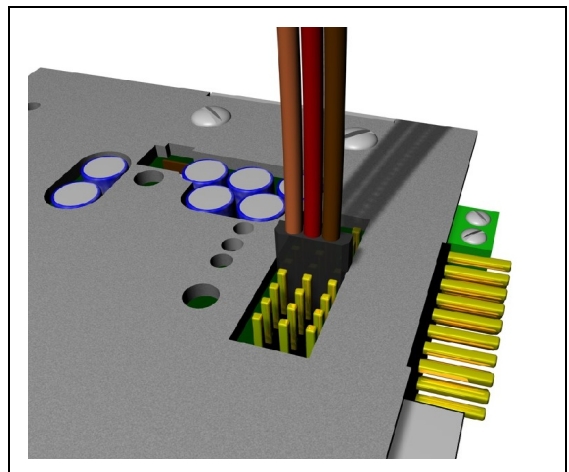
connection of the servo outputs (X40 to X47):

The servos that are controlled by the modul are connected to the connectors X40 to X47.

Servos from Robbe/Futaba or Graupner/JR can be connected directly to the module. The ground (black or brown line of the servo cable) is closest to to the exterior of the module.

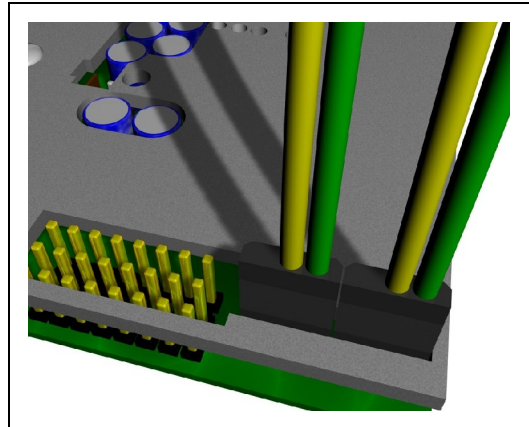
The last servo position is stored with the module memory. Because of that you do not have to expect bis servo moves when powering the modul. However, when powering the model, a short servo move may happen.

Make sure your servos can achieve the required position. When servo travel is blocked current flow can be 300-500 mA instead of the usual 40mA at rest. This can lead to hight temperatures of the modul, because the BEC has to deliver high currents.



connection of the motors (X20 and X21):

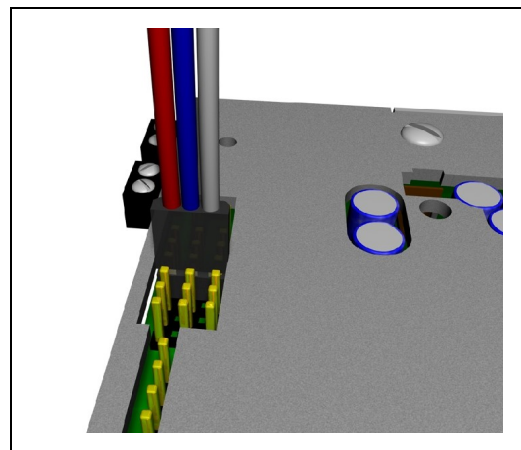
The motors that are connected to X20 and X21 leave the upper contact unconnected.



connection of the switch outputs X10 to X17:

The switch outputs are used for light- and simple motor functions. The outputs are switched to ground (blue and grey).

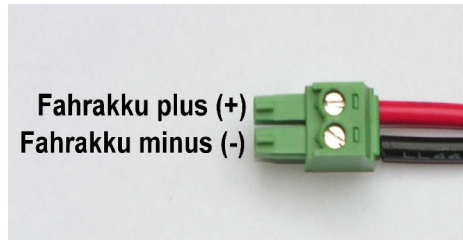
The left connection (red) is connected to battery +. This is the same voltage provided to the green connector. It is protected by a fuse.



TIP: The left connection (permanent +) is the same for all eight connectors. To reduce lead count, you can use one + for several loads.

Connection of batteries cable:

The connection is made with the green contact block. The connector is (X60). It is a good practice to install a switch between battery and the



battery cable shown with polarity

power connector. For your convenience you can choose our cable set 3013.

On the bottom side of the pcb are four fuses.

They protect the groups:

- speed controller (X01 and X02)
- speed controller (X20 and X21), switch outputs (X10 to X17)
- audioamplifier and cpu
- servo outputs (X40 to X47)

Connection of drive motors:

The drive motors are attached to **X01** and **X02** at the black plug in connectors. The motors must be properly radio-interference-suppressed (install capacitors if required).

The motor outputs are marked so that when connecting the motor to +, the corresponding chain run in forward direction. The best way to connect the motors is as follows:

- prepare the model-chassis and a battery
- jack up the chassis
- connect the battery direct to the right motor. Mark the motor lead, that must be connected to the positive pole of the battery, to run the track in forward direction. Mark the positive lead with M+ and the negativ lead with M-.
- do it the same way with the left motor
- connect the leads of the right motor to **X01** as shown in the picture above.
- connect the leads of the left motor to **X02** as shown in the picture above.

Case you have done so and the direction is still not correct, use the servo reverse setting of you transmitter to fix it. Same for the steer channel.

Note:

please don't confuse the servo leads connected to the throttle and the steer channel.

Connect the turret and cannon elevation motor/servos:

the turret rotation motor can be plugged to **X21**.

the cannon elevation motor can be plugged to **X20**.

The motor must be connected to the indicated terminals as per the illustration.

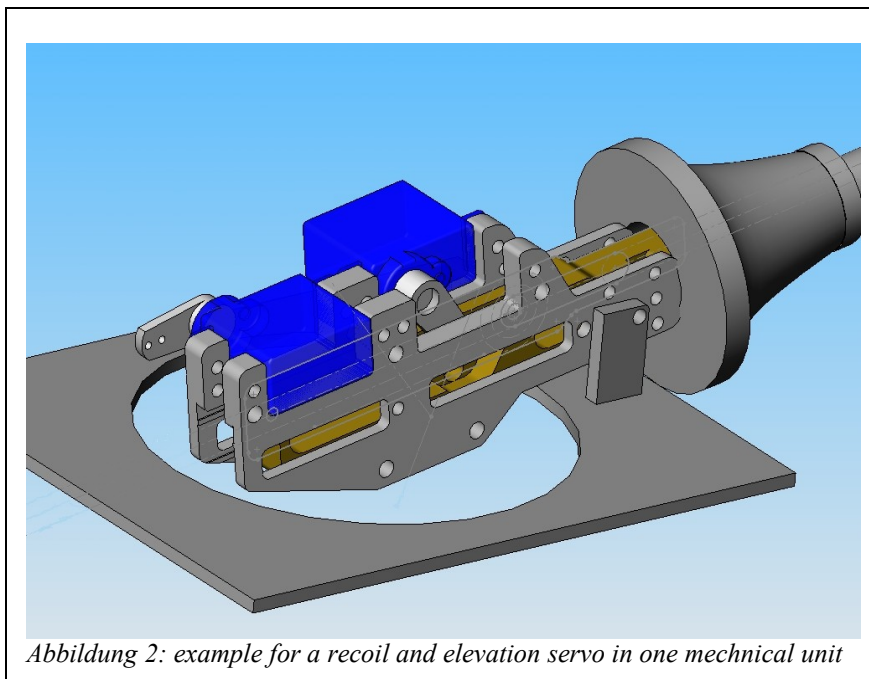
In addition to these 2 motor outputs the Module provides 2 servo outputs for turret rotation (**X42**) and cannon elevation (**X41**). These operate in parallel to the motor outputs. The servo functions are damped for realistic movement results.

The servo is supplied by the integrated BEC. Servos from Robbe/Futaba or Graupner/JR can be connected directly to the module. The ground (black or brown Line of the servo cable) points to the exterior of the Module. The speed and direction are proportional to stick deflection.

Connect the recoil servo:

The servo for the recoil is connected to **X40**.

It is supplied by the integrated BEC. Servos from Robbe/Futaba or Graupner/JR can be connected directly to the module. The ground (black or brown Line of the servo cable) points to the exterior of the Module.



Connecting the speaker:

The speaker connects at the brown 2 pole connector (**X70**) in the center of the board. We recommend a 4 ohm speaker. An 8 or 16 ohm speaker may be used but this will result in reduced sound volume. The volume may be adjusted at the potentiometer (**V1**) directly below the connector.

The speaker needs to be installed in a box to prevent a feedback loop. The presence of a box also improves bass response and sound volume. The box should have as much volume as practical and should not hinder airflow from the face of the speaker.

Connection of lighting and exhaust systems:

The lighting and exhaust system outputs are at battery voltage. Devices must be suitable for that voltage. If LED's are used appropriate resistors must be installed. These outputs can switch inductive loads such as relays.

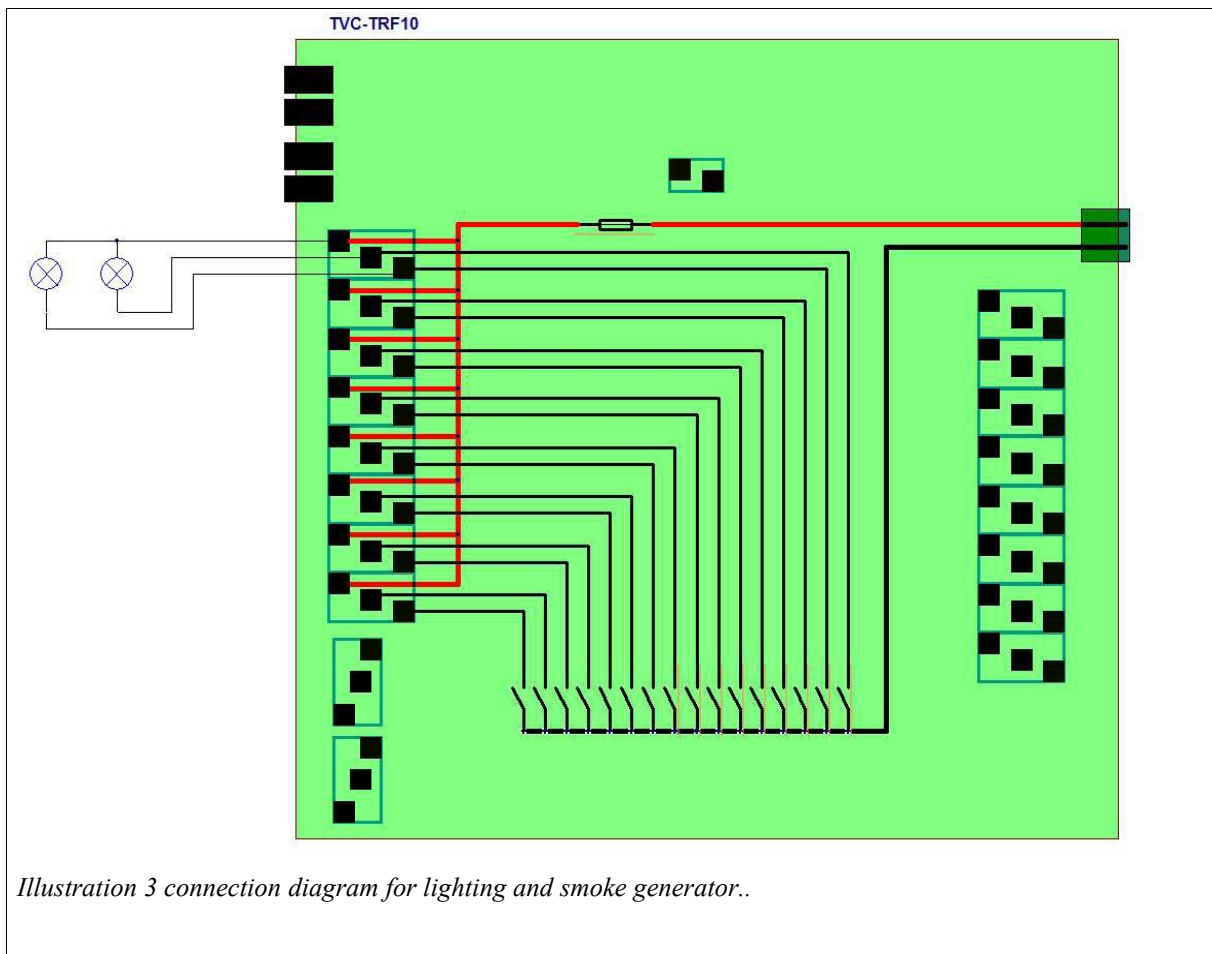


Illustration 3 connection diagram for lighting and smoke generator..

connector	Left post	Middle post	Right post
X10	(+) MG LED	(-)negative battery terminal	(-) MG LED
X11	(+) rotating flasher 1+2	(-) rotating flasher 1	(-) rotating flasher 2
X12	(+) rotating flasher 3+4	(-) rotating flasher 3	(-) rotating flasher 4
X13	(+) cannon	(-) cannon recoil	(-) cannon LED
X14	(+) aux 1 and aux 2	(-) aux 1	(-) aux 2
X15	(+) reverse light and brake light	(-) combat brake light	(-) brake light
X16	(+) signal	(-) signal left	(-) signal right
X17	(+) Exhaust system	(-)Exhaust system heater	(-) Exhaust system motor

Allocation of terminal posts for the lights, exhaust fan, and heater X10 to X17

Function of the light mode control

There are two light modes light mode 1 and light mode 2.

Lightmode 1 for auxillary output 1 and 2. They can be used for combat light, beam light or any other consumer.

The lightmode 1 is changed by tipping the stick forward. The mode is count up , $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 1$, and so on.

When keeping the stick for about 2 seconds, the lightmode is reset to 1(all off).

<i>light mode 1</i>					
state	1	2	3	4	1
auxlight 1	off	On	off	On	off
auxlight 2	off	off	On	On	off

The **lightmode 2** controls the automatic functions of the warnblinker and the rotating flasher. The lamp function is given by the table below.

The modes are called :

- road traffic 1
- road traffic 2
- road traffic 3
- combat 1

For example the turn flasher is not activated automaticly in combat mode, while it is activated in road traffic 1 and 2 when steering.

The lightmode 2 is changed by tipping the stick backwards. The mode is count up , road traffic1 \rightarrow road traffic2 \rightarrow road traffic3 \rightarrow combat 1 \rightarrow road traffic1, and so on.

When keeping the stick for about 2seconds, the lightmode 2 is reset to road traffic1.

light mode 2					
state	road traffic 1	road traffic 2	road traffic 3	combat 1	...
brake light	auto	auto	auto	off	
combat brake light	off	off	off	auto	
blinker left and right	Auto left/right	Auto left/right	Warning flasher	off	
rotating light	off	on (rotating)	on (rotating)	off	

The light modes states are stored when changing the operation mode. When the model is switched off by the model selector channel, all light states are unchanged. When the model is parked by turning of the transmitter, all light are turned off.

TIP 1:

The four rotating lights are also activated in a random way for about three seconds when the tank is hit by the battlesystem

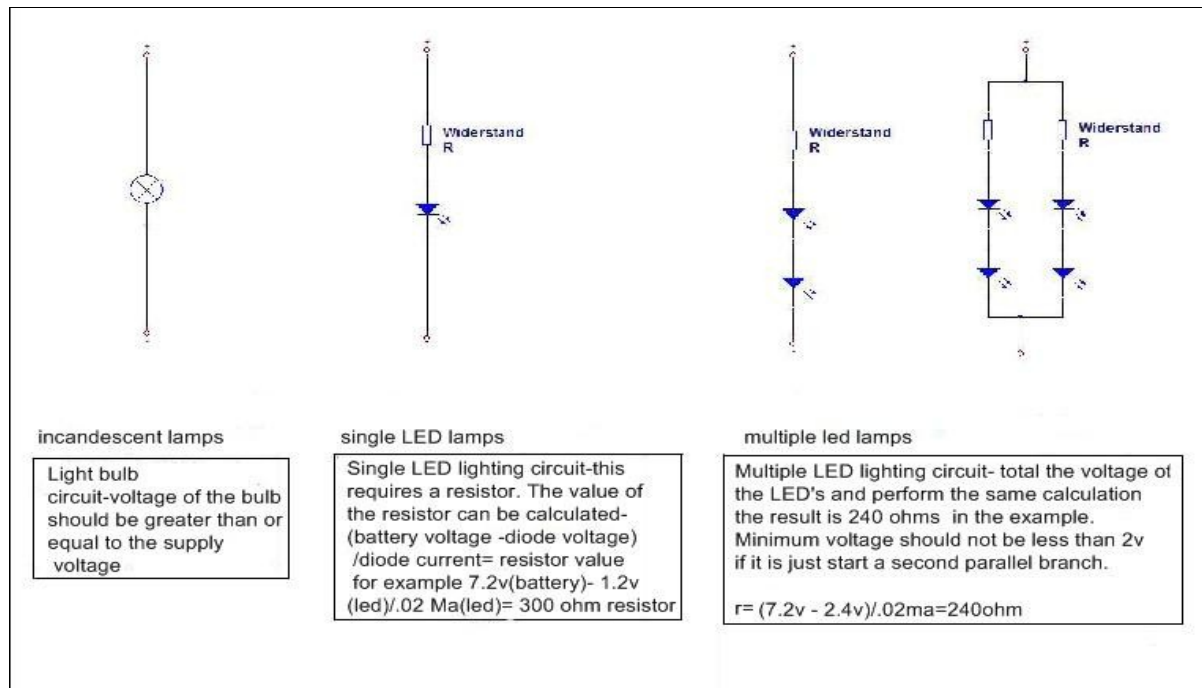
TIP 2:

Typically, a three-stage switch is used on the transmitter. Proportional channels with linear knobs may complicate the selection of the light mode, because the indexing is done by briefly returning to the center position. This may be difficult with linear knobs.

When connecting LED, please use suitable resistors. In the diagram below the correct way to calculate the resistor value is show.

In any case you should connect the quite common resistors delivered with the modul.

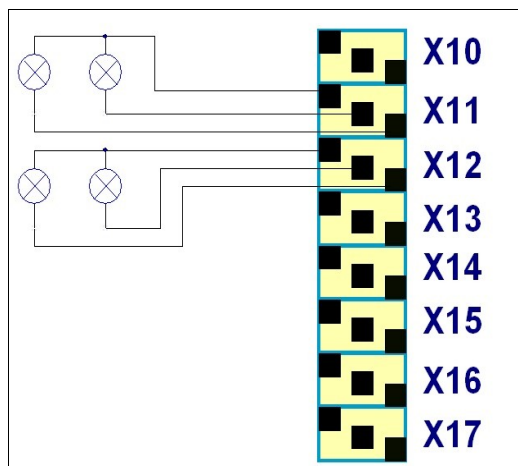
Note: Please never connect LED without resistor to the modul. This will destroy the LED and/or the modul.



Example: rotating flasher

The modul controls a rotating flasher with four lamps. Two lamps are connected to **X11** and two lamps are connected to **X12**.

Remember that the lighting outputs are at battery voltage. So when the modul is powered with 12V the lamps must be rated for 12V.



Initialization:

- turn on the transmitter.
- connect the battery.
- all control sticks and trims must be centered.
- turn on the receiver. The LED lights for approximately 1 second.
- the speed controls sense center point of the channels and the LED on the board flashes. If the operation is not successful the LED does not light. To repeat the operation turn the receiver off and on again
- if the LED shines the model is ready for operation.

This process is repeated at every start. The start position of the controls are set as center . This applies to all channels.

When doing the calibration, the optional channels can be left unconnected. In this case the modul detects the channels to be unused. You can not connect an optional channel after the calibration finished.

Case one of the not optional channels leaves unconnected, the calibration will not end and the LED keeps on flashing.

operation modes:

The green LED 3 on the modul shows the active operation mode. The LED flashes like this.

- | | |
|-------------------------------|-----------|
| - normal drive mode: | 1 flash |
| - parking mode: | 2 flashes |
| - model unselected (passiv): | 3 flashes |
| - destroyed (battle unit): | 4 flashes |
| - damaged (battle unit): | 5 flashes |
| - invulnerable (battle unit): | 6 flashes |

Connecting the Battleunit

The full option modul supports the connection of the infrared battlesystem TVC-BU12 or TVC-HRF-BU. The battle system is compatible to the battlesystem of Tamiya Inc.

The battlesystem TVC-BU12 is combined from two parts, an infrared-transmitter-unit and a socket for the infrared receiver (mushroom). The unit is equipped with a receiver made by Heng-Long. But the Tamiya system can be used either. The modul comes with a socket that can be mounted in the commanders hatch. The transmit LED must be oriented in parallel to the main gun.

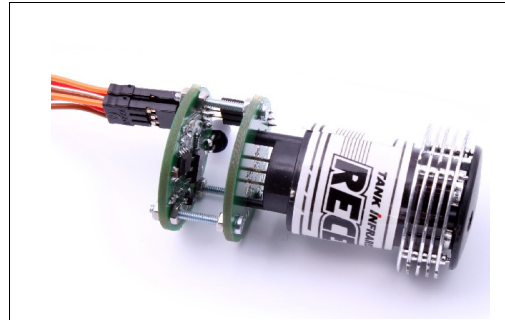


Abbildung 4: TVC-BU12 mit HL-Empfänger

The TVC-HRF-BU is made to interface Heng long models. It adapts the existing battle unit receiver socket and the build in transmit LED to the FO modul

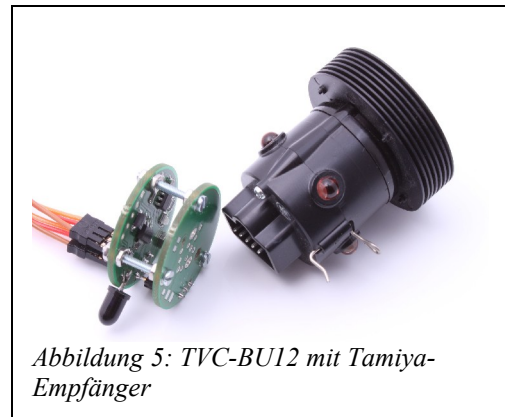


Abbildung 5: TVC-BU12 mit Tamiya-Empfänger

The Battleunit is connected by two servo leads. They are marked with one / two black lines. The lead marked with one line is the transmitter and must be connected to **(X56)**. The lead marked with two lines is dedicated to the receiver and has to be plugged to **(X57)**.

Function

On each impact the modul plays a hit sound, and in addition the chassis rumbles by controlling the drive motors. The four roundlight outputs are flickering randomly for about 3 seconds to indicate the hit. After the first impact the engine sound changes.

TIP:

If you do not connect the roundlight at your model, you can connect four super bright LED's or light bulbs at half the rated voltage of the battery

and mount them e.g. near the air inlet. The visual effect is very good, and there is an optical hit indication in addition to the acoustic.

Depending on the type of model, it reacts differently to the fire of other models. This is to simulate the different armor of various types of tanks. The more hits the model gets, the more limited is the mobility of the model. First step is limitation of mobility to 50%, then to 25% and when completely destroyed, it is reduced to 0%.

	truck	Light tank / APC	Medium Tank	Heavy tank
1. hit	0,00% (destroyed)	50,00%	50,00%	50,00%
2. hit		25,00%	50,00%	50,00%
3. hit		0,00%(destroyed)	50,00%	50,00%
4. hit			25,00%	50,00%
5. hit			25,00%	25,00%
6. hit			0,00%(destroyed)	25,00%
7. hit				25,00%
8. hit				25,00%
9. hit				0,00% (destroyed)

It is also dependent on model type, how long reloading takes and how long it takes after complete destruction to recover (repair time). During the repair period, the model is not controllable and the engine sound is turned off. After this repair time the hit counter is reset and the model is fully operational again.

Thus the model does not spontaneously run after the repair time, the control stick for throttle and steering must be in neutral zone before it starts again.

After repair, the model is invulnerable for a certain time. So you can retreat the tank again from the battle zone.

In this invulnerable state the tank can not control the tower and is not able to shoot.

	truck	Light tank / APC	Medium Tank	Heavy tank
reload time	-	3 sec	5 sec	9 sec
recovery time	15 sec	15 sec	15 sec	15 sec
Invulnerable time	20 sec	15 sec	12 sec	10 sec

Mode indicator:

LED 3 (green) on the module indicates the hit status. If the vehicle is damaged, LED flashes five times. Once the vehicle was destroyed and the repair time is running, the LED flashes four times. In invulnerable state, the LED flashes six times.

Resetting the damage grade:

As described above, the model will get limited in its mobility by enemy fire. To do not influence the game, no limitations to the duration of the states are made.

But case the game is stopped by your combat partner, the player's own model remains back with limited mobility.

To reset the model to full mobility, there are two different ways:

1. using the transmitter

turn off the transmitter, wait for the engine off sound, and turn the transmitter on again.

2. cycle model power

Turn the model off and on again

TIP:

Please keep in mind that the first way can not work if you use failsafe receivers.

Changing the sound

The module is delivered with a sound.
So changing the sound is optional.

If you want to change the sound, you need a PC, the FMC software and a USB/Scalebus interface (USB-IF-FMC).

connection:

The FO-modul is connected via the Scalebus with the interface module USB-IF-FMC to the PC.

The interface isolates the circuit of the model from your PC / laptop. Therefore, the FO-modul in the model must be powered by the battery.

Operation:

To put the module in the download mode, the button **(S1)** must be switched when powering the modul. The button **(S1)** is located under the red power status LED (LED1). It will light the red LED for about 2 sec.

! Caution !

Once the module goes into download mode, the first action is to delete the the sound memory. After that, a new sound **must** be reloaded.

During the download, the red LED flashes in quick. Once data is received from the PC the green LED (LED3) is switched on. When both LED are turned off, the download is complete. After that the battery voltage must be recycled.

comparable modules:

- solution with less outputs TVC-TRF-05
FO-Modul without smoke simulation outputs, less light outputs, no servo control and no battle function.
- solution with for bigger models TVC-MF10
- special modules for anti aircraft tanks, recovery tanks and APC's

optional accessories:

- TVC-HRF-AD adapter board for HengLong models (without Battleunit)
- TVC-HRF-BU battleunit adapter board for HengLong models
- TVC-BU-12 Battleunit with Infrared Receiver and Transmitter
- FO-AD-10 adapter board with screw terminals

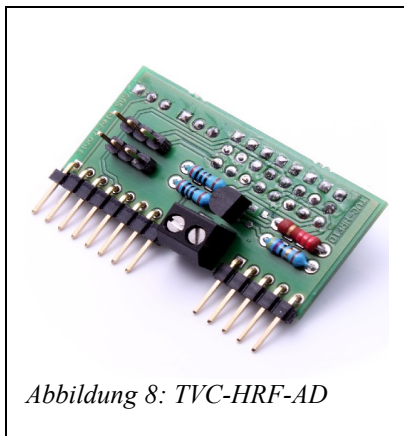


Abbildung 8: TVC-HRF-AD

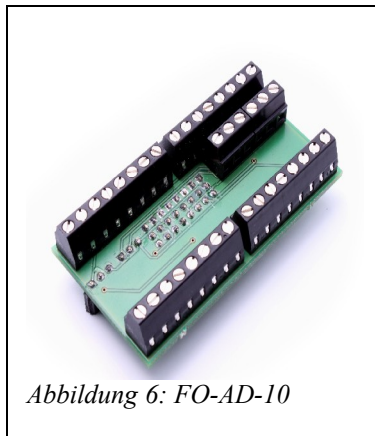


Abbildung 6: FO-AD-10

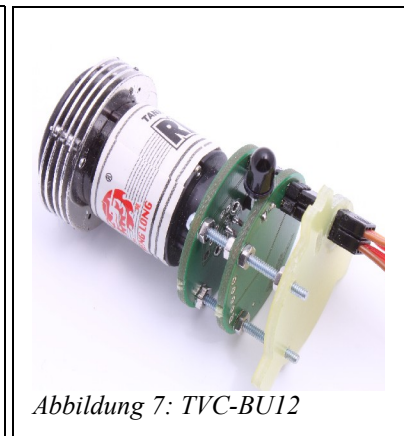


Abbildung 7: TVC-BU12

- FMC-IF-USB Scalebus – USB Interface for sound programming
- TVC-GSU12 gun stabilization unit
- GFMC-SBR10 Infrarot-Scalebusrepeater, a wireless infrared connection between turret and chassis
- TVC-RG-10 smoke unit for big models

practical tips:

neutral position

Please use a self centering type joystick or a three stage switch for mode selection. Use of a non self centering stick will result in problems with mode selection due to imprecise neutral position selection.

failsafe receiver

The module calibrates the neutral position of the channels every time you turn on power.

If you use a failsafe receiver, please adjust it to deliver the same signals that are delivered when the sticks are in neutral position. Or turn off the failsafe function. Otherwise, the module calibrates the wrong neutral positions.

Do not use provisionally methods of connectivity

Solder or screw all the electrical connections. Provisionally connections can cause high contact resistance, which can lead to problems especially with the battery connection.

Technische Daten:

Nenn-Motorstrom Antrieb	5 Ampere pro Motor
Nenn-Motorstrom Turm und Rohrwiege	0,8 Ampere pro Motor
Nenn-Ausgangstrom Schaltfunktionen	0,4 Ampere pro Kanal
Nennleistung Audioverstärker	8W/7V 14W/12V
Versorgungsspannung	7,2 bis 16 V
Zulässiger BEC Strom	500mA
PWM Frequenz	2KHz
Typische maximale Verlustleistung	3 Watt
Typischer Spannungsabfall in der Endstufe	1.5 Volt
Maximale Betriebstemperatur	60°C
Abmessungen	66x72x15mm (ohne Steckverbinder)

Important!

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).

Notice !

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.

SGS electronic Dipl.-Ing. Rainer Stelzer

www.sgs-electronic.de