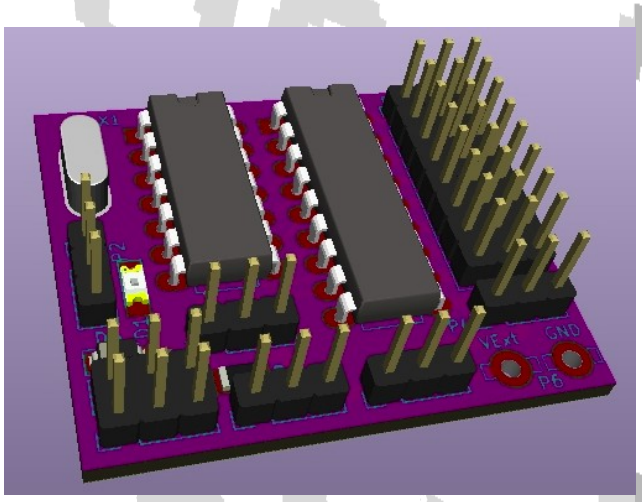
MS8-Xany



More than a simple 8-output MultiSwitch decoder for OpenAVRc

MS8-Xany MultiSwitch user manual

Table of Content

1 THIS DOCUMENT

1.1 Versions

Version	*Date*	*Reason for update*
0.1	20/12/2018	Creation
0.2	01/06/2020	Tulip holder for ATtiny84, diode serigraphy correction

1.2 Copyright

1.3 Disclaimer

The **OpenAVRc** team is not responsible for any damage that may result from the misuse or possible malfunction of the **OpenAVRc** transmitter, the **MS8-Xany** decoder module and/or associated software.

It is therefore up to the end user to estimate, assume the risks and comply with the legislation in force depending on the country of use.

1.4 Contents

This document describes the making of the **MS8-Xany** decoder module as well as the settings for its use with the **OpenAVRc** transmitter.

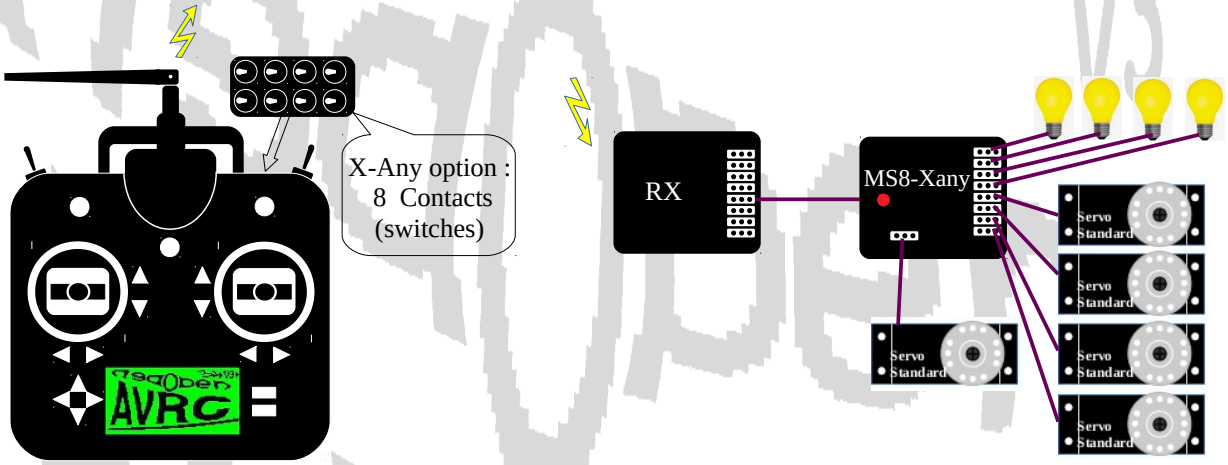
MS8-Xany is a MultiSwitch decoder module with 8 digital outputs.

In addition to the classic MultiSwitch function, **MS8-Xany** can be set up so that its outputs drive standard servos with digital commands (0/1).

Finally, **MS8-Xany** can provide an auxiliary proportional channel for driving a standard proportional servo.

2 PRESENTATION OF MS8-XANY

2.1 Overview



2.2 MS8-Xany decoder specifications

Specification	Value / Feature	Notes
Power supply	+3.3V to +6.6V	Set the "receiver voltage" jumper to "=" or "↓" according to the value of the voltage supplied by the receiver
X-Any Protocol	-Universal digital protocol used by OpenAVRc for remote accessories - Integrity check with 8-bit checksum - Works with all protocols, including 2.4GHz: - PPM Protocol - SPIRfMod Protocols - MultiMod Protocols	Unlike many MultiSwitches, **MS8-Xany** also works with 2.4GHz HF modules
8 Digital Outputs	- Commanded in Digital mode by transistor output	Outputs configured in "Digital" mode (MultiSwitch)
Output voltage	- Internal: receiver voltage - External: external voltage 5 to 24V	Selectable by jumper (common to 8 outputs)
Free wheeling diodes	Free wheeling diodes between the 8 outputs and + output power	Selectable by jumper (common to 8 outputs)
8 servo outputs	- Digitally driven - End positions can be configured - Duration of movement between end positions is configurable	- Outputs configured in "Servo" mode - Reversal of servo travel possible by changing extreme values - Ability to use receiver voltage - Possibility to use an external voltage (compatible with servos)
1 proportional servo output	Proportional control of a servo from 988µs to 2008µs (0 to 255 steps of 4µs)	Presence of servo control is dynamically detected by **MS8-Xany**: nothing to configure except at the OpenAVRc transmitter side
Red LED lights when signal is lost	After 1.5 seconds without correct signal	Not managed if proportional servo used (shared connection)
Failsafe	- All outputs go to 0 in case of RC signal loss - The proportional servo retains its current position	Synchronized with red LED turning on
TTL serial port	USB cable connector / FTDI TTL	For advanced configuration using a "Serial Terminal" application

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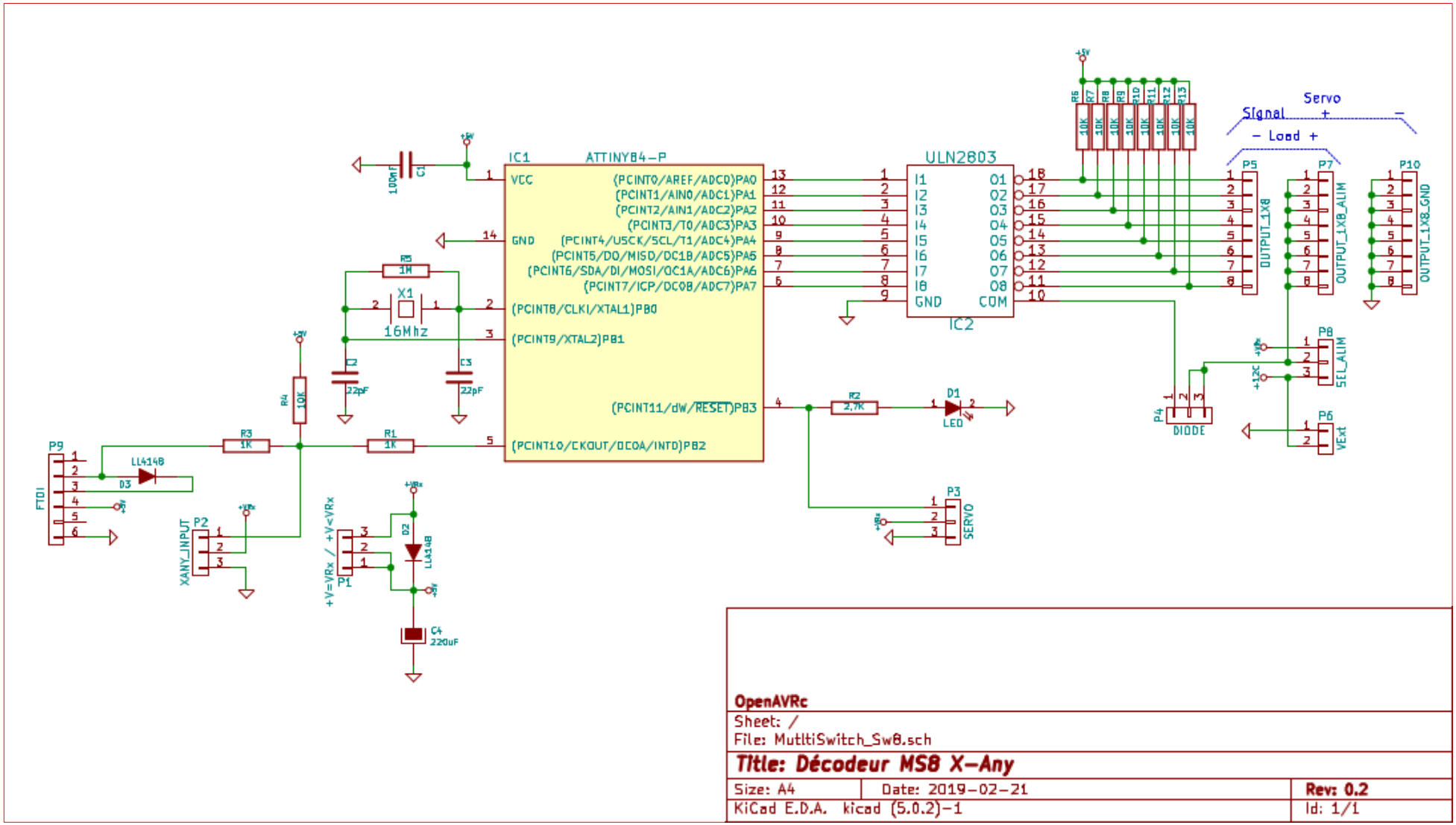
3 MS8-XANY SCHEMATIC DIAGRAM



4 Making the MS8-XANY DECODER

4.1 Printed circuit board

TO DO

4.2 Tulip holder for integrated circuits

4.2.1 Tulip holder for ATtiny84

ATTENTION :

The ***ATtiny84*** shall be programmed **before** mounting it on the **MS8-Xany** printed circuit board.

That's why, it is hghly recommended to mount it on a 14 points tulip holder :

It is also possible to use 2 portions (of 7 points) of a breakable tulip bar :

In both cases, check carefully the orientation of the ***ATtiny84*** before powering the **MS8-Xany**.

4.2.2 Tulip holder for ULN2803

In case of bad wiring for the outputs, the ***ULN2803*** may be destroyed.

In order to facilitate its replacement, it is highly recommended to mount it on 18 points tulip holder :

It is also possible to use 2 portions (of 9 points) of a breakable tulip bar :

In both cases, check carefully the orientation of the ***ULN2803*** before powering the **MS8-Xany**.

4.3 Uploading firmware and configuring fuses

The programming of the microcontroller ***ATtiny84*** is done in 2 phases (in this order):

1. Upload firmware
2. Configure fuses

4.3.1 Uploading Firmware in ATtiny84

ATTENTION :

The P9 connector (labelled FTDI) **is not** a **programming** connector, but is a **parametring** connector for **MS8-Xany** (See §Advanced Mode / Servo Control).

Using an AVR microcontroller ICSP programmer, upload the **MS8_Xany_Vx_y.hex** file to the ***ATtiny84***.

All the programming phase (**Firmware loading** + F**uses configuration**) is preformed **before** mounting the ***ATtiny84*** on its tulip holder.

4.3.2 Configuring the fuses on ATtiny84

The fuses are contained in special ATtiny84 registers that allow you to define certain parameters, such as the type of oscillator used, the role of certain pins and many other things.

On the ATtiny84, there are 3 "fuse" registers.

These "fuse" registers are also set using an ICSP programmer.

The values to be set into the 3 "fuse" registers of ATtiny84 are as follows:

- EXT_FUSE : **0xff**
- HIGH_FUSE : **0xdf**
- LOW_FUSE : **0xfe**

With HIGH_FUSE at **0xdf**, the Reset pin of the ATtiny84 remains configured as Reset function. If necessary, it is possible to reprogram the ATtiny84 with an ICSP programmer. In this case, the proportional servo function (S0 output) and the "Signal Lost" LED are not managed.

4.3.3 Very important note about the value of the fuses

Still using an ISCP programmer, it is possible to configure HIGH_FUSE to **0x5f**, in which case the reset pin of the ATtiny84 is configured as an input / output pin, the proportional servo function (S0 output) and the "Signal Lost" LED will then be managed.

In this case, it is no longer possible to reprogram the ATtiny84 directly with an ICSP programmer since the Reset function of the ATtiny84 is needed.

To program back the reset pin of the ATtiny84 so that it has Reset function, it is necessary to apply a calibrated 12V signal to the reset pin. It is then necessary to use a small box of "Fuse Resetter" type.

After doing this, the ATtiny84 becomes programmable again using an ICSP programmer.

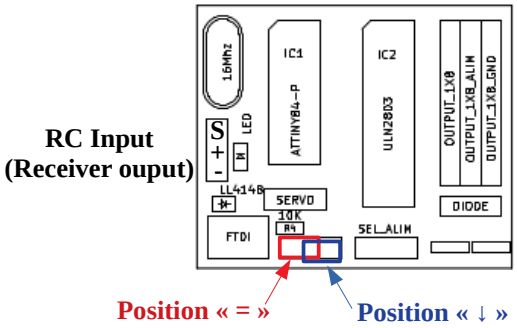
5 Usage

5.1 Connecting to a receiver

Before connecting **MS8-Xany** to the receiver, it is imperative to measure the voltage supplied by the receiver.

If the available voltage between the - and + pins of the 3-pin connector of the channel used is:

1. Lower than 5.7V, set the jumper "receiver voltage" to "="
2. Higher than 5.7V, set the jumper "receiver voltage" to "↓"



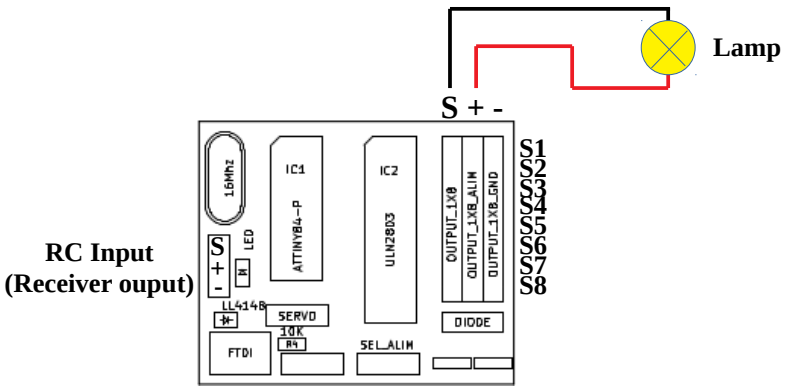
5.2 Standard Mode : MultiSwitch / Digital switch

After uploading the firmware, MultiSwitch is the default mode: the digital switching mode of the 8 **S1** to **S8** outputs. So there is nothing else to configure to operate in MultiSwitch mode.

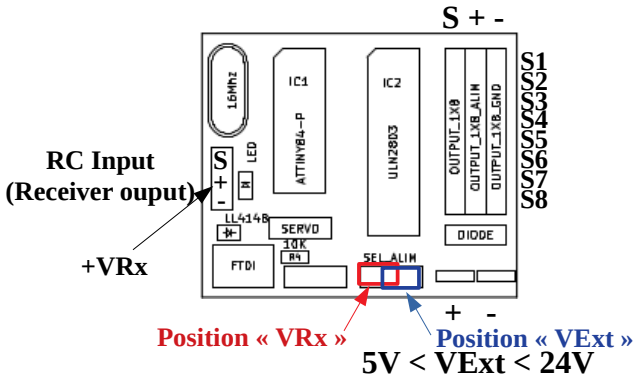
5.2.1 Wiring the loads on the outputs

The **MS8-Xany** is then used as a standard MultiSwitch module:

- The "loads" (like: a lamp) are connected to the **S1** to **S8** outputs between the pins "**S**" and "**+**", the 8 row points of "**-**" at the edge of the board is not used in this case.



5.2.2 Selecting the supply voltage for the S1 to S8 outputs



It is possible to supply the S1 to S8 outputs (supply to **+**) from:

1. **+VRx** voltage supplied by the receiver (Beware of the current consumption on the outputs!)

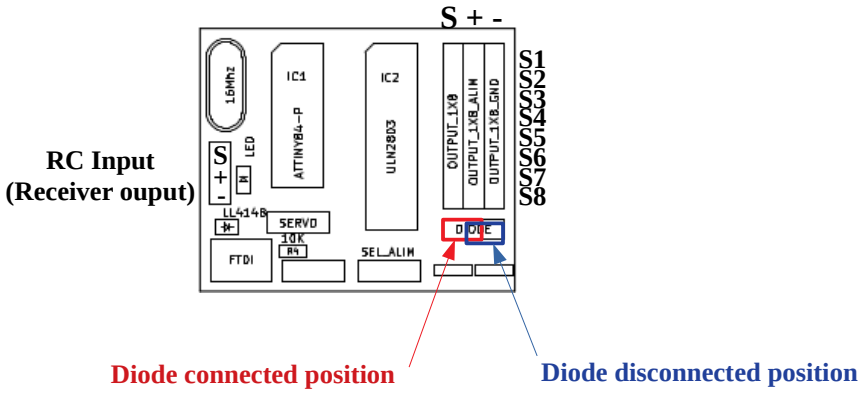
   → Power selection jumper on "**VRx**"

2. An external **VExt** voltage (**5V** to **24V**) applied to the 2-pin connector at the bottom right of the board

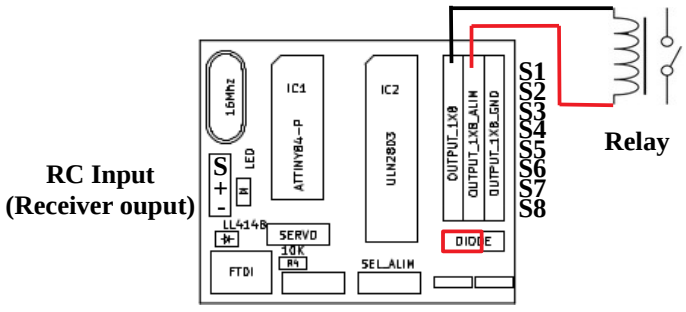
   → Power selection jumper on "**VExt**"

5.2.3 Free wheeling diodes

If the "loads" connected to the outputs are inductive (eg relays), the internal free wheeling diodes shall be connected, otherwise there is a risk to destroy the ULN2803.

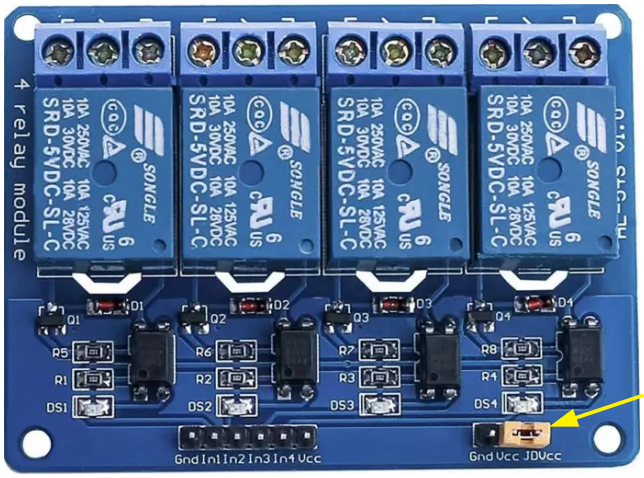


5.2.4 Direct relay control with integrated diodes in the ULN2803

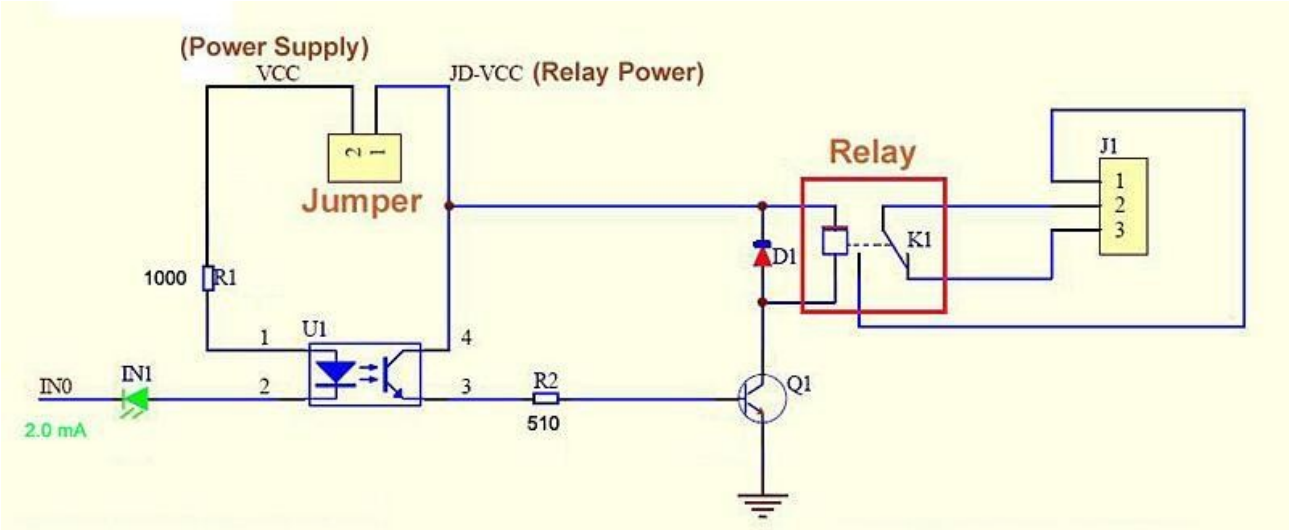


5.2.5 Controlling opto-isolated relays

There are very cheap "relay modules" often called "Arduino Relay Module". These modules include an opto-coupler allowing a total isolation between the control voltage and the supply voltage of the coils of the relays.



The equivalent circuit diagram of one relay channel is given below:

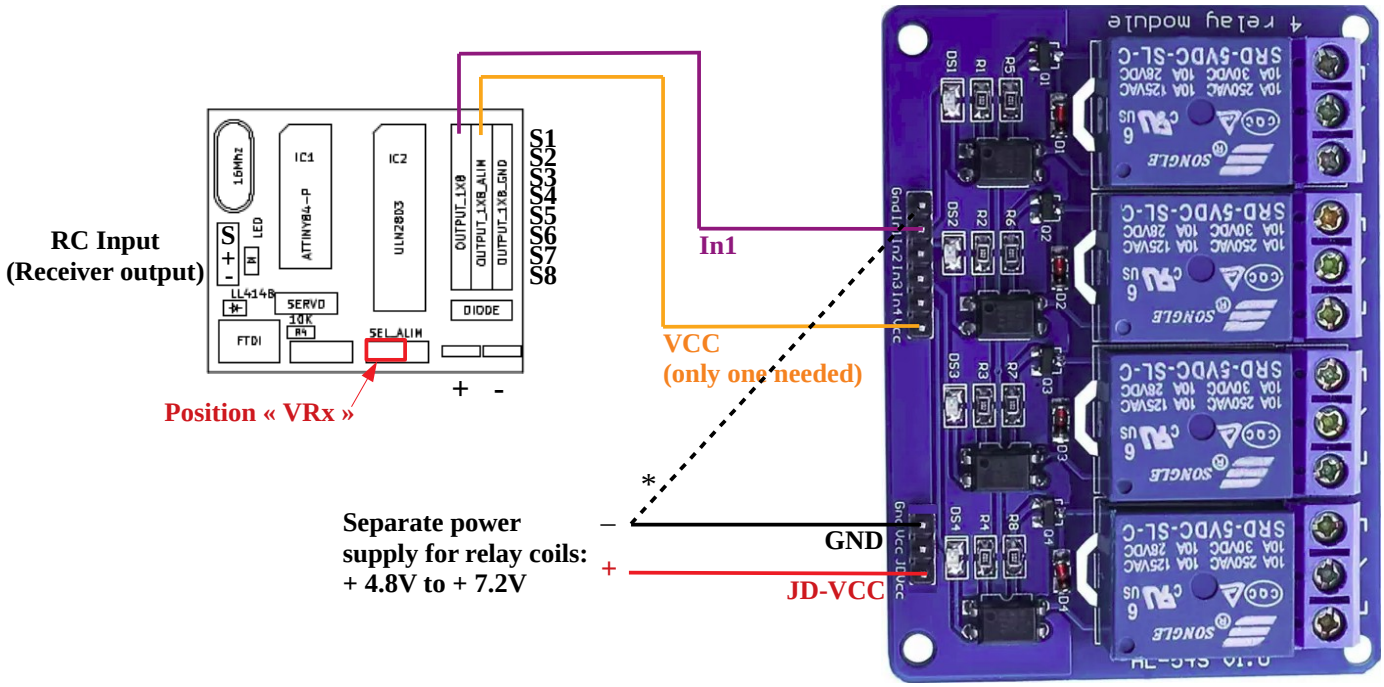


- **VCC** is the opto-coupler control voltage: accessible on the connector on the edge of the board
- **JD-VCC** is the control voltage of the relay coils: accessible on one of the jumper connector pins

Important Note:

To achieve full isolation between VCC and JD-VCC, the yellow jumper shall be removed.

5.2.6 Recommended connections for 5V opto-isolated relays



- The optocouplers are powered by the receiver voltage (total consumption: around 10 mA)
- VCC of the relay board is connected to one of the OUTPUT_1X8 supply pins
- In1 of the relay board is connected to the S1 output
- In2 of the relay board is connected to the S2 output, etc.
- Relay coils are powered by a separate power supply (+ 4.8V to + 7.2V)

→ Since the power supplies are completely isolated, the receiver voltage will not be disturbed during relay switching: no risk of losing RC control.

***** : On some "relay module" models, there is no **GND** pin near the **JD-VCC**. In this case, use the **GND** pin close to the **In1** pin on the other connector.

5.3 X-Any configuration at the OpenAVRc transmitter side

Refer to the **OpenAVRc** manual to configure the X-Any instance with the following parameters:

1. The channel number shall correspond to the channel number on which the **MS8-Xany** decoder will be connected to the receiver
2. The number of repetitions will be first set to 3 (as soon as it will work, it will be possible to reduce this value to reach the maximum reactivity allowed by your HF set).
3. Configure "Sw." with Sw.8: this will transmit the state of the 8 contacts
4. If the proportional servo will be used on **MS8-Xany**, select one of the proposed choices by « Prop. », this will add the transmission of the proportionnal value.

5.4 Advanced Mode / Servo Control

The **MS8-Xany** decoder has an access for advanced configurations: a TTL serial port.

To use it, it is necessary to disconnect the RC input of **MS8-Xany** to not disturb the operation of serial access.

It is this serial access that will allow the use of servos connected to the S1 to S8 outputs.

In this case, the "**+**" output voltage must be compatible with the servos!

5.4.1 Using the serial port on MS8-Xany

To access the serial port of **MS8-Xany**, you need a USB / TTL serial cable eg "FTDI" type.

The necessary pins on the USB cable / TTL series are:

- GND,
- +5V
- TX
- RX

The USB / TTL serial cable must be able to provide + 5V supply to **MS8-Xany** because during advanced configuration, **MS8-Xany** shall be disconnected from the receiver (shared pin).

1. Connect USB side of the USB / TTL serial cable to an USB port on a PC

2. On the PC, open a Serial Terminal, for example, PuTTY, TeraTerm, HyperTerminal, GtkTerm, or CoolTerm with the following parameters: 19200 baud, 8 data bits, 1 stop bit, no parity.

Depending on the Serial Terminal, it may be necessary to enable automatic line feeds on receipt of CR / LF to have a good display.

3. Connect the TTL side of the USB / TTL serial cable to the **MS8-Xany** 6-pin connector, this will power **MS8-Xany** (check that there are not too large consumers connected to the outputs, since it is the USB on the PC which provides the power supply + 5V)

4. Within 3 seconds after connecting to **MS8-Xany**, press the "Enter" key on your keyboard, the message "MS8 VX.Y" should appear on the Serial Terminal as shown below. If this is not the case, disconnect the USB / TTL serial cable from the 6-pin connector of **MS8-Xany** and repeat step 3 above.

Example of connection with GtkTerm Terminal on Linux

5.4.2 *MS8-Xany command messages*

The list of messages supported by **MS8-Xany** is given in the following table:

←**Command/**→**Response**	**Action**	**Notes**
←Enter →MS8 Vx.y	If sent within the 3 seconds after power on, the decoder enters Terminal mode	If failed and 3 seconds elapsed, unplug and reconnect the 6-pin USB / TTL serial cable connector
←S0? →S0=Pos:4usStepOffset	Returns the current position in µs and the 4usStepOffset command which is the number of steps of 4µs (value between 0 and 255) to be added to 988 to have the pulse width in µs for the proportional servo	Pulse width (us) = 988 + (4usStepOffset x 4)
←S0=Pos →S0	Sets the position in µs for proportional servo	Returns ERR, if value not between 988 and 2008
←Sx? →Sx=D:C or →Sx=S;Pos0;Pos1;Dur:C	If x is between 1 and 8, returns the configuration of the output No. x and the state "C" of the associated current Command (0 or 1) - If the output is configured as MultiSwitch Digital output, the answer is: Sx = D: C D = Digital (Digital) - If the output is configured as a Servo output, the response is: Sx = S;Pos0;Pos1;Dur:C with Pos0 = the position in µs for the state 0, Pos1 = the position in µs for the state 1, and Dur = the duration (in ms) of the movement of the servo between Pos0 and Pos1	Returns ERR, if - Value x not between 0 and 8 - Pos0 or Pos1 < 600 - Pos0 or Pos1 > 2400 Sample answers: S1=S;1000;2000;5000:0 S2=S;2300;600;8500: 1
←Sx=D →Sx	Sets the output x to be Digital	
←Sx=S;Pos0;Pos1;Dur →Sx	Sets the output x as servo with Pos0 µs for 0, Pos1 µs for 1, and Dur ms	The real value in ms is internally recalculated by **MS8-Xany** taking into account the different resolutions / limitations and may be different when displayed.
←Sx=C →Sx	If x is between 1 and 8, "C" defines the State (0 or 1) for the output x, whether the type is either Digital or Servo	Very handy for testing using the serial access without RC.
←Q	Exit Terminal Mode: **MS8-Xany** can be connected to receiver	Do not forget to disconnect the USB / TTL cable!

5.4.3 Real configuration example

In the example below:

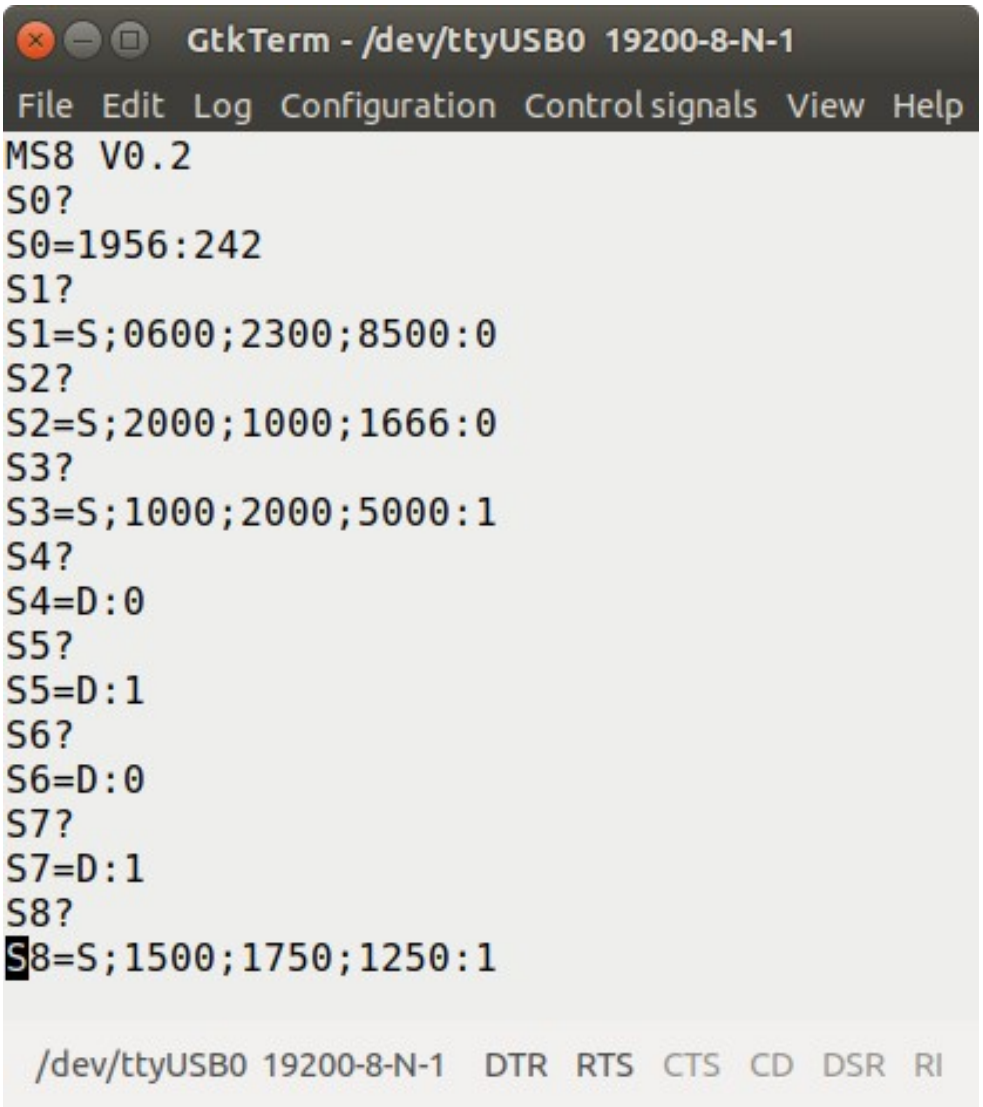
- The pulse width for the servo connected to the proportional S0 output is:

  [988 + (242 x 4)] = 1956 µs

  → the command (= the number of 4 µs steps to add to 988 µs) would be 242 for the pulse width of 1956 µs

- The outputs S1, S2, S3 and S8 are Servo type, their commands are respectively 0, 0, 1 and 1

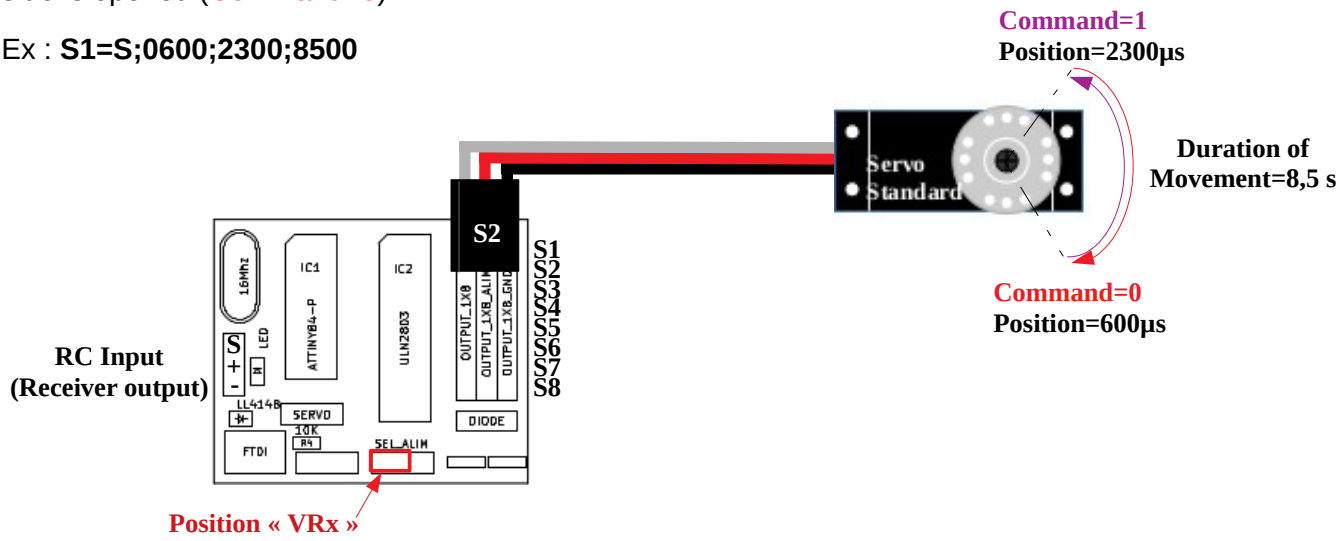
- The outputs S4, S5, S6 and S7 are Digital type (MultiSwitch) type, their states are respectively 0, 1, 0 and 1



1. **Counterclockwise servo movement**

If the contact N°1 at transmitter side is closed (Command=1), the pulse of the servo connected to the output N°1 goes from 600 µs to 2300 µs (→ a movement of around 180°) in 8,5 seconds, and goes from 2300 µs to 600 µs (→ a movement of around 180°) in 8,5 seconds if the contact N°1 at transmitter side is opened (Command=0).

Ex : **S1=S;0600;2300;8500**



2. **Clockwise servo movement**

With **MS8-Xany**, it's possible to obtain a movement in the opposite direction : just swap the extreme positions (Pos0 and Pos1).

If the contact N°2 at transmitter side is closed (Command=1), the pulse of the servo connected to the output N°2 goes from 2000 µs to 1000 µs (→ a movement of around 100°) in 1,67 seconds, and goes from 1000 µs to 2000 µs (→ a movement of around 100°) in 1,67 seconds if the contact N°2 at transmitter side is opened (Command=0).

Ex : **S2=S;2000;1000;1666**