2.4 GHz wireless remote control system

Output unit KSR2.4

Operation Guide

Version 3.0 (Oct. 2021)

- This product requires electrical and radio knowledge for setup and operation.
- To ensure proper and safe operation, please read this operation guide thoroughly prior to use.
- Please keep this operation guide for future reference.

Contents

1. Outline

KSR2.4 is an output unit with 6 control contacts for wireless remote control system which can be realized by combining with the input unit KST2.4S or telecommand module NK-2.4Y

The communication mode is 1:1 only and neither 1:N nor N:1 is possible.

Frequency hopping scheme enables simultaneous use of multiple systems within one area. Also, you can always check the communication status with the Link LED.

2. Features and applications

Features

- ARIB STD-T66, FCC Part 15 compliant
- 6 control contacts
- Frequency hopping scheme enabling simultaneous use of multiple systems within one area
- Communication status monitor via Link LED
- CRC-16 and Hamming distance of 6 to minimize malfunction
- 6-photo MOS relay outputs to allow direct driving of large capacity loads
- 3 output operation modes (One-shot, Toggle, Momentary)
- 1 : 1 communication with KST2.4S or NK-2.4Y
- Communication range 100 m LOS (depends on the operation circumstances and the equipment to be controlled.)

Applications

- Control of construction, civil engineering, forestry machinery
- Control of traffic light for road construction
- Operation of agricultural machinery
- Electric shutter, electric blind, garage door
- Rotary lights, alarm devices
- Calling device

3. System example

3.1 Using KST2.4S on the input side

KSR2.4

KST2.4S

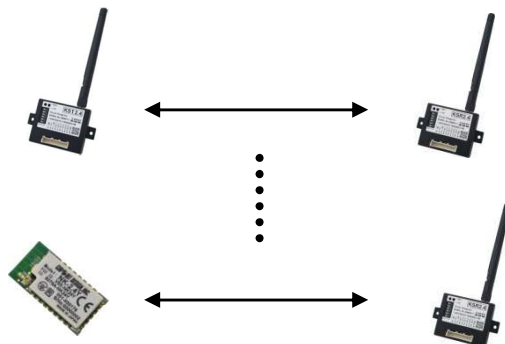* Up to 6 control contacts

3.2 Using NK-2.4Y on the input side

NK-2.4Y (Input mode)

KSR2.4
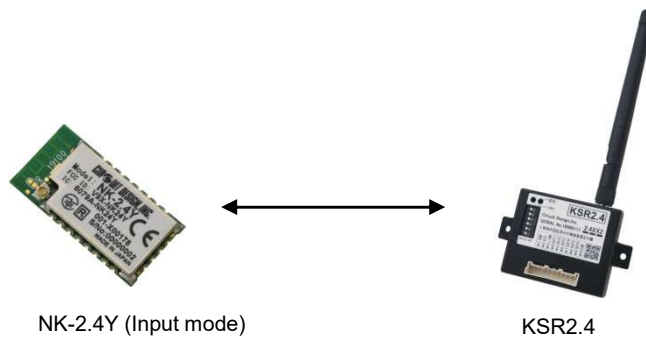
* Up to 6 control contacts

3.3 Operation of multiple systems in one area

* Up to 10 systems are feasible for simultaneous operation in one area.

4. Main specifications

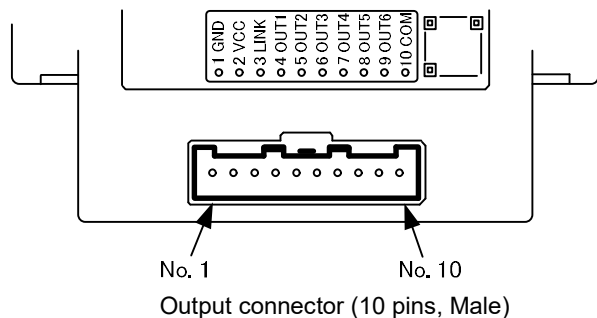| Item	Specification	Remarks
Compatible standards	ARIB STD-T66 FCC Part 15	Contains FCC / MIC certified NK-2.4Y.
Frequency range	2403 to 2479 MHz	
Communication method	Frequency hopping, two-way	
Modulation method	GFSK	
Communication bit rate	250 kbps	
Error check method	Payload CRC16 + Packet CRC16	
Hamming distance	6	
RF output power	1.6 mW or less	
Number of outputs	Contact output 6 + LINK output 1	
Output operation mode	3 modes (one-shot, toggle, momentary)	
Contact output rating	Photo MOS relay Max 35 V, 200 mA (DC) for each output	
Power supply	DC 6 to 24 V (Absolute maximum voltage 36V)	
Current consumption	80 mA or less	When all photo MOS relay outputs are ON Without load
Operating temperature range	-20 °C to +60 °C	
External dimensions	55 x 45 x 12.5 mm	Excluding protrusion and mounting base
Weight	26 g	Excluding antenna and cable harness
Accessories	Dedicated cable harness x 1 (500 mm, 10 pins)	
Specified antennas	Sold separately. Using antennas other than specified may invalidate compliance with radio laws.	ANT-2400-SF ANT-2400-SFW ANT-2400-SMW

5. External dimensions
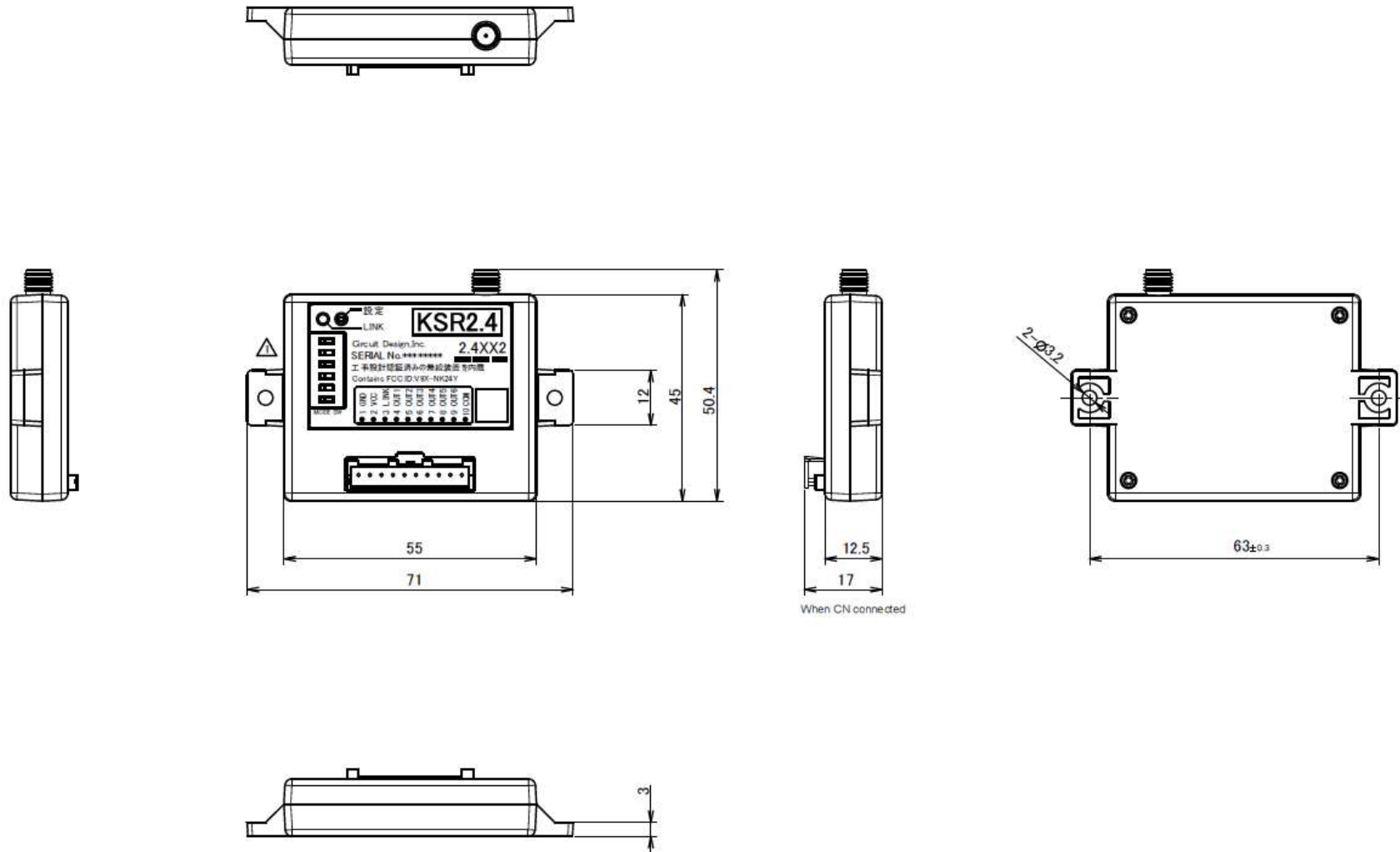
6. Part names and functions

6.1 External view

Output connector (10 pins, Male)
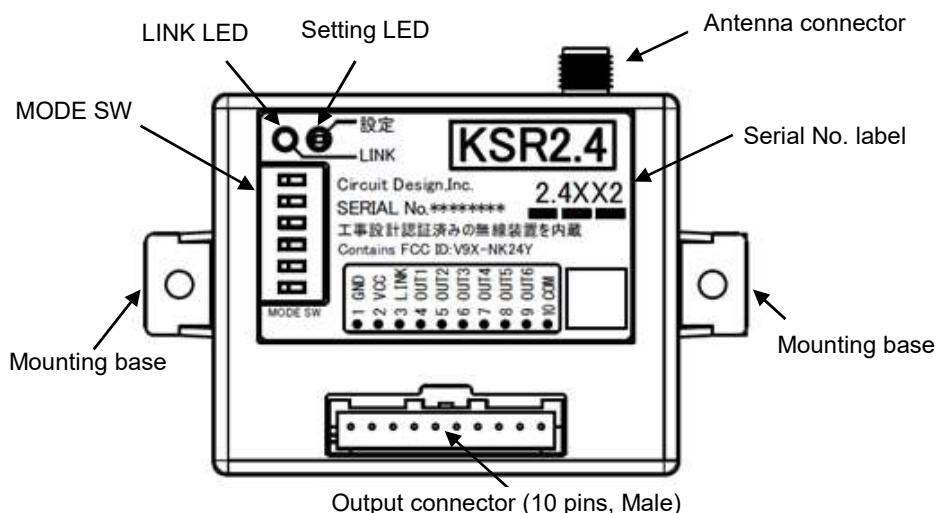
|	
Antenna connector	Reverse SMA connector (male). The specified antenna should be used. Turn only the nut to install the antenna.
LINK LED	LED (green) to check the communication status with the input unit. 　Lit: Communication is normal and stable use is possible. 　Blinking: Communication has been lost. 　Off: The power of the KSR2.4 is not turned on.
Setting LED	LED (orange) to indicate the operating status in pairing operation mode. Please refer to "8.3 Pairing with the input unit" for details. .
MODE SW	Sets pairing operation, output operation modes and the output time in the One-shot mode.
Output connector	10-pin connector for the dedicated cable harness. Insert the connector securely until it is locked. For details, refer to "6.2 Connector specification".
Mounting base	When fixing KSR 2.4 with screws, use 3 mm screws (M3 screw etc.) and washers. (Tightening torque reference value when attached to an iron plate: 6 kgf·cm or less)
Serial No. label	Do not remove.
Cable harness (accessory)	The connector is XAP-10V-1 (JST) and the cable is a wiring harness CAVUS 0.5 used for automobiles. The cable length is 500 mm.
Protection sheet (accessory)	Protective sheet for the MODE SW and LEDs. To prevent incorrect operation and to protect against static electricity, always cover the MODE SW and LEDs with this sheet when installing the KSR2.4 to the equipment.

6.2 Connector specification

Output connector (10 pins, Male)

Pin No.	Name	I/O	Cable color	Terminal description
1	GND for power supply	I	Black	Connect to the GND of the power supply.
2	VCC	I	Red	Power supply terminal. Connect to a regulated power supply within DC 6 to 24 V range. If it is used with a voltage other than the specified voltage, the output becomes unstable. Supply the power via an overcurrent protection fuse.
3	LINK	O	Brown	Output for monitoring communication status. Linked: GND Link search: GND /OPEN repeating (200 ms/1300 ms) Connect the cathode side of the LED to the LINK terminal when using an external communication status monitor LED. Adjust the current value of the LED by connecting an external resistor in series. The internal circuit of the LINK terminal is an open collector output of a transistor (RN 1707 or equivalent), and a current limiting resistor (330 Ω) is used in series.
4	OUT1	O	Orange	Contact outputs. High-level or low-level output is selectable. A load up to DC 35 V / 200 mA can be controlled with photo MOS FET output. It is ideal for driving external relays and controlling contact signals. OUT1 to OUT6 are insulated (floating) from the internal circuit of the KSR2.4. When driving relays, please take measures such as adding diodes for surge absorption.
5	OUT2	O	Yellow	
6	OUT3	O	Green	
7	OUT4	O	Blue	
8	OUT5	O	Purple	
9	OUT6	O	Gray	
10	COM	O	White	Common terminal for OUT1 to OUT6. Connect to the power supply for driving loads or GND according to the specification of the external contact output. Between the COM and the GND, an electrostatic protection element with a varistor voltage of 100 V is used.

7. Output circuit

7.1 Internal equivalent circuit

OUT1 to OUT6 output circuit

LINK output circuit
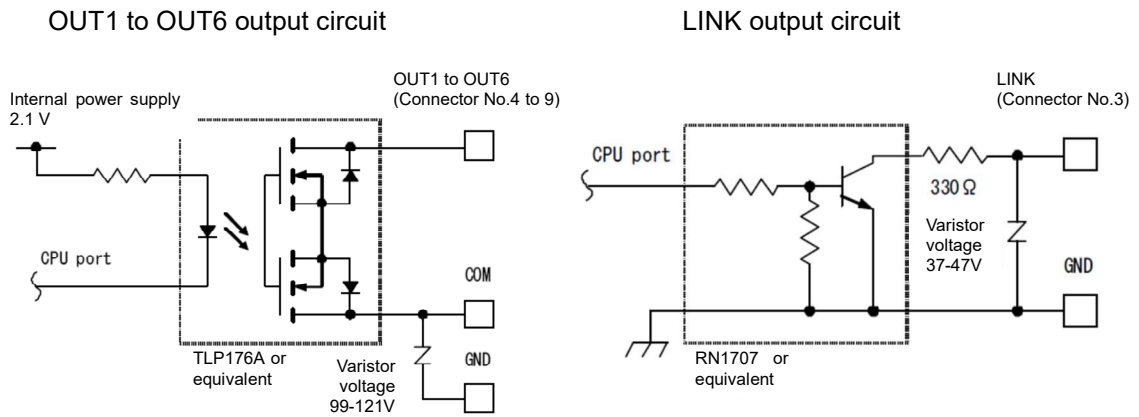
7.2 Cautions

* Ensure that the KSR2.4 is turned off when wiring to each terminal and confirm there is no misconnection before turning on the power again.

* The outputs of the KSR2.4 are not surge protected. When driving inductive loads such as relays, please conduct surge prevention such as using surge absorption diodes on the load side.

8. MODE SW setting

SW1

SW6

MODE SW

OFF ◀─▶ ON
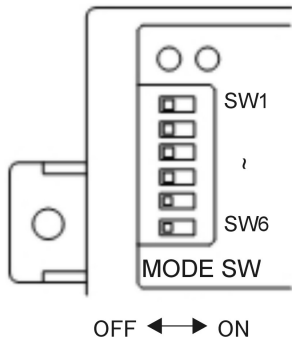
The MODE SW is used to set the pairing mode and the output operation mode, and change the output time in the one-shot mode.
Please use a small screwdriver or tweezers for MODE SW setting.

* SW5 and 6 are not used.

8.1 Output operation mode setting

The output operation mode is set with the SW2 and SW3. For details of each output operation mode, refer to "9. Output operation mode".

The setting of the output operation mode is enabled when the KSR2.4 is turned on. The setting will not change if you change the switch setting after starting up.

		MODE SW setting	
		SW2	SW3
Output operation mode	Momentary	OFF	OFF
	One-shot	OFF	ON
		ON	ON
	Toggle	ON	OFF

8.2 Output time setting for one-shot mode

The output time used in the one-shot mode can be set with the SW4.

Other output operation modes are not affected by this setting.

		Setting
		SW4
One-shot mode Output time	500 ms	OFF
	200 ms	ON

8.3 Pairing with the input unit

Before using the KSR2.4, it needs to be paired with the target input unit. The KSR2.4 communicates on a 1: 1 basis.

・The KSR2.4 is shipped from the factory without pairing.
・When pairing is newly performed with another input unit, the previous pairing will be overwritten.

ID code registration procedure		LEDs
Preparation	Turn off the power of the KSR2.4. Set the MODE SW1 to ON.	
Step 1	Turn on the power of the KSR2.4.	Setting LED: On
Step 2	Set the MODE SW1 of the KSR2.4 to OFF.	Setting LED: On
Step 3	Turn on the power of the input unit in the pairing mode. *Refer to the operation guide of the input unit.	
Step 4	Perform "Transmission to start pairing" with the input unit. *Refer to the operation guide of the input unit.	Setting LED: Off LINK LED: On
Step 5	Perform "Transmission of pairing complete information" with the input unit. *Refer to the operation guide of the input unit.	Setting LED: On LINK LED: On
End	After a while, the KSR2.4 returns to normal operation (standby state).	LINK LED: Blink

9. Output operation modes

The KSR 2.4 operates in the specified mode out of three output operation modes, Momentary mode, One-shot mode, and Toggle mode. The output operation mode can be set with the MODE SW. For details, refer to "8.1 Output operation mode setting".

9.1 Momentary mode

The OUT1 of the KSR 2.4 turns on while the Input 1 of the input unit is turned on. For the Input 2 to 6 of the input unit, the corresponding OUT 2 to 6 of the KSR2.4 operate in the same way.
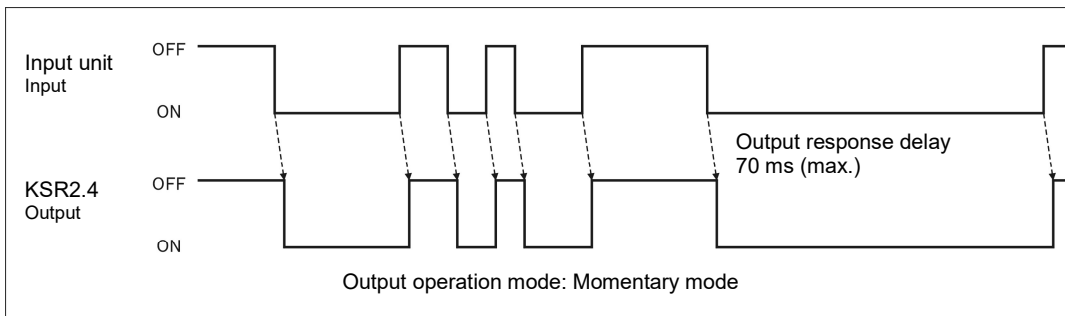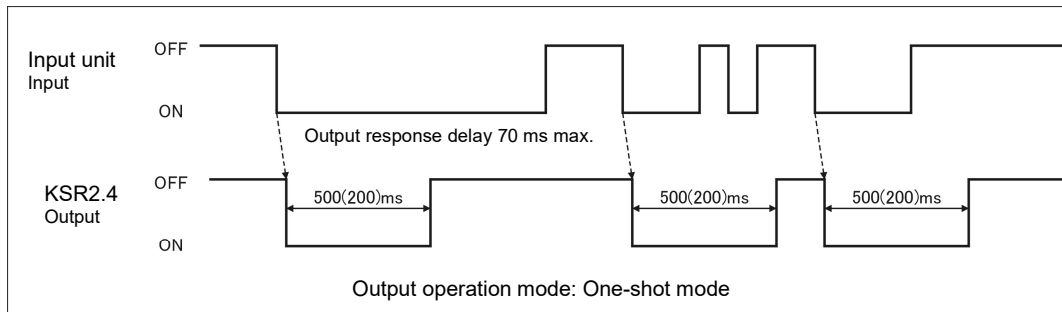

Input unit		KSR2.4 Output
NK-2.4Y Input	KST2.4S Input	
IN1 ON/OFF	IN1 ON/OFF	OUT1 ON/OFF
IN2 ON/OFF	IN2 ON/OFF	OUT2 ON/OFF
IN3 ON/OFF	IN3 ON/OFF	OUT3 ON/OFF
IN4 ON/OFF	IN4 ON/OFF	OUT4 ON/OFF
IN5 ON/OFF	IN5 ON/OFF	OUT5 ON/OFF
IN6 ON/OFF	IN6 ON/OFF	OUT6 ON/OFF

* If communication is disconnected while the input of the input unit is ON, the output becomes OFF after about 400 ms. Even if communication is re-established while the input is still ON, the output will not turn ON. At this time, the LINK LED and LINK output blink rapidly (ON / OFF). Please turn off the input once to resume control.

9.2 One-shot mode

Turning on the Input1 of the input unit turns on the OUT1 of the KSR 2.4 for 500 ms. For the Input 2 to 6, the corresponding OUT2 to 6 will turn ON for 500 ms.


Output operation mode: One-shot mode

Input unit		KSR2.4 Output
NK-2.4Y Input	KST2.4S Input	
IN1 ON	IN1 ON	OUT1 500（200 ）ms ON
IN2 ON	IN2 ON	OUT2 500（200） ms ON
IN3 ON	IN3 ON	OUT3 500（200） ms ON
IN4 ON	IN4 ON	OUT4 500（200） ms ON
IN5 ON	IN5 ON	OUT5 500（200） ms ON
IN6 ON	IN6 ON	OUT6 500（200） ms ON

* The output time of the One-shot mode can be set to 500 ms or 200 ms with the MODE SW 4.
  See "8.2 Output time setting for one-shot mode".

* The delay time from the input operation to the output response is 70 ms at maximum. It is the same in other output operation modes.

9.3 Toggle mode

Turning on the Input1 of the input unit turns on the OUT1 of the KSR2.4. When the Input1 is turned ON again, the OUT1 turns OFF. For the Input 2 to 6, the corresponding OUT 2 to 6 operate in the same way.

Output operation mode: Toggle mode
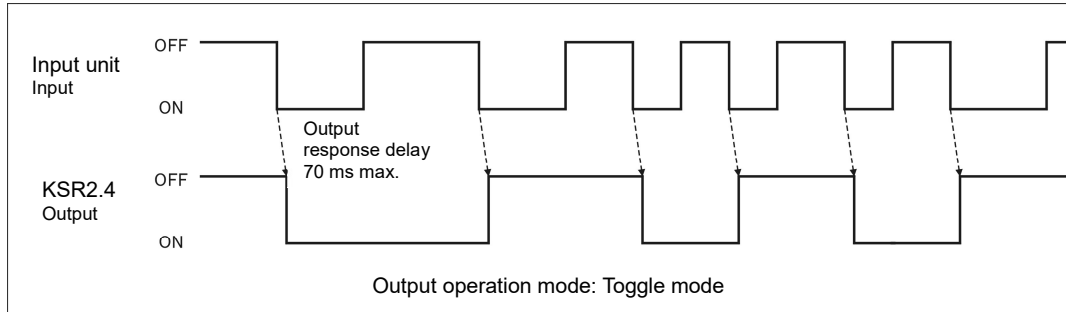
Input unit		KSR2.4 Output
NK-2.4Y Input	KST2.4S Input	
IN1 ON	IN1 ON	OUT1 ON/OFF switching
IN2 ON	IN2 ON	OUT2 ON/OFF switching
IN3 ON	IN3 ON	OUT3 ON/OFF switching
IN4 ON	IN4 ON	OUT4 ON/OFF switching
IN5 ON	IN5 ON	OUT5 ON/OFF switching
IN6 ON	IN6 ON	OUT6 ON/OFF switching

* While the output is turned on in the toggle mode, if communication with the input unit is disconnected, or if the power of the input unit is turned off, the output turns off after 10 seconds. If communication is resumed within 10 seconds, the output will continue to be ON.
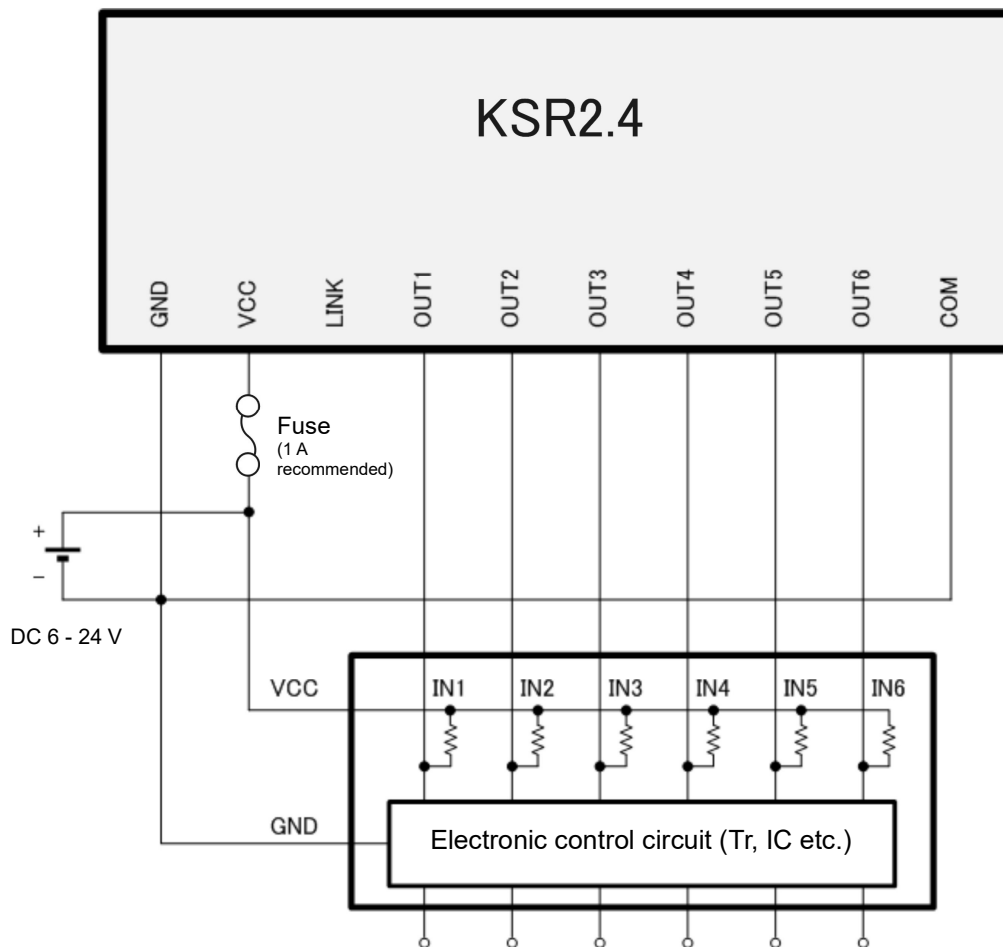
10. Connection example

Connection examples for the KSR2.4 outputs (OUT1 to 6).

10.1 Connection example 1

In this connection example, the power supply of the KSR2.4 and the power supply of the small load (electronic circuit such as Tr, IC etc.) connected to the KSR2.4 are common.
Use the supply voltage of the load within the range of 6 to 24 V DC which is the specification of the KSR2.4.
To prevent overcurrent, be sure to insert a fuse in the KSR2.4 power supply line (excluding the load).

10.2 Connection example 2

If it is necessary to isolate the KSR2.4 from the relay connected to the KSR2.4, please use separate power supply as shown below. The load rating of each output terminal of the KSR2.4 (relay coil side in the figure below) should be 35 V / 200 mA or less.
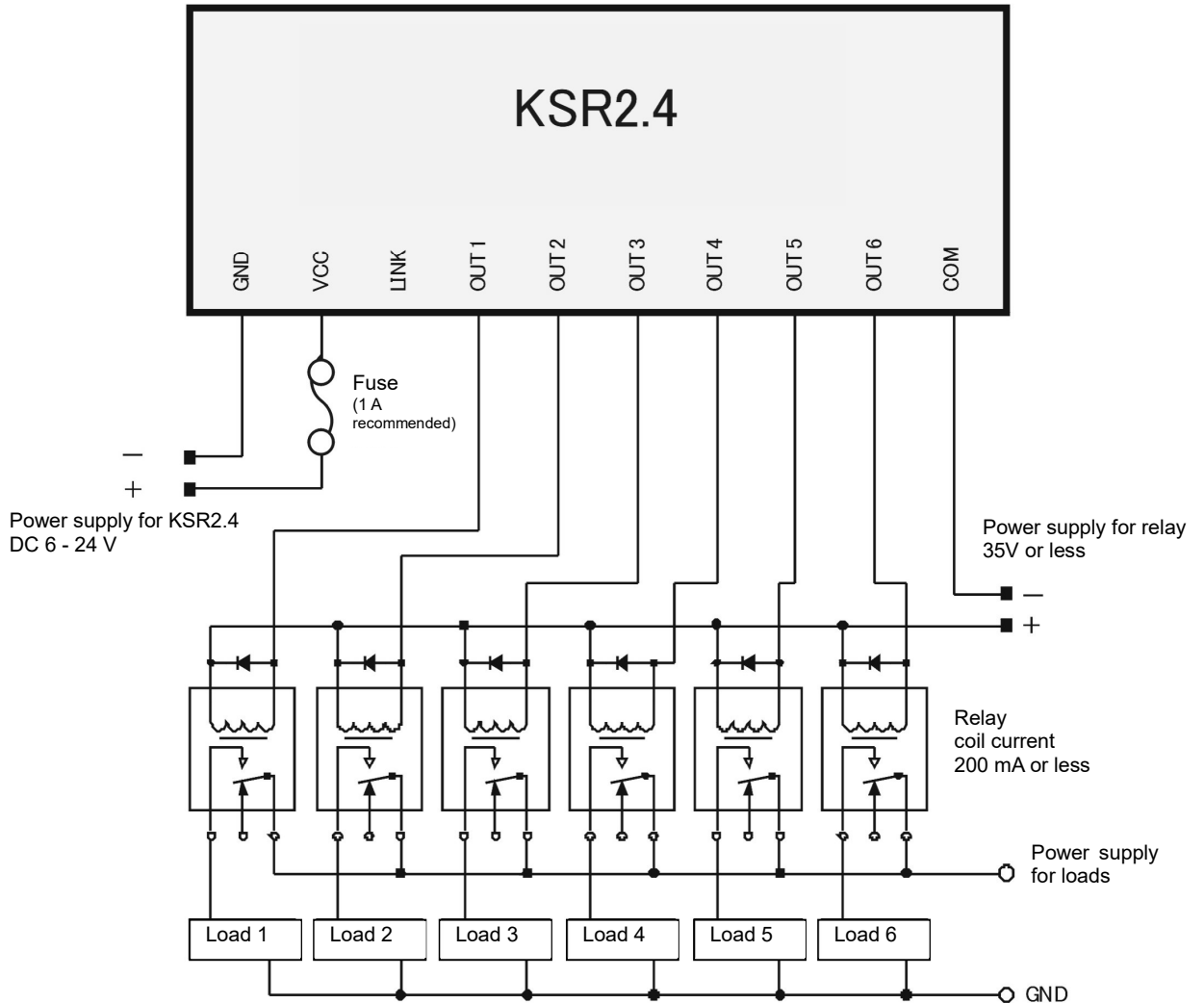
* The above figure is an example when the COM terminal is connected to the GND.

* When driving relays, please use a surge absorption diode for each relay coil (see the above figure)

Regulatory compliance information

Regulatory Statement for FCC

The KSR2.4 contains an FCC certified module NK-2.4Y (FCC ID: V9X-NK24Y).

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

Caution: Any changes or modifications not expressly approved by the party responsible for product compliance could void the user's authority to operate the equipment.

Caution: Exposure to radio frequency radiation
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that is deemed to comply without testing of specific absorption rate (SAR)

Important notice

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Cautions

- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.

Warnings

- Do not take apart or modify the equipment.
- Do not remove the product label.

Revision History

Version	Date	Description	Remark
1.0	Mar.2018		
1.1	May.2020	Correction of the Document.	
3.0	Oct. 2021	Updated for use in combination with NK-2.4Y & KST2.4S	