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PARASAFE®
PS CA1201

Handling Instructions

PARASAFE®, the Emergency Parachute System for Commercial Drones

Global "sukima" ideas NIPPON KAYAKU

Thank you very much for purchasing PARASAFE®.
PARASAFE® is a device to be attached to drones. When a drone becomes uncontrollable in the air or has a system failure, PARASAFE® can reduce the descending speed with a parachute, and ease the impact of the drone's collision with human or objects on earth, by sending electric signals manually to a deployment device inside PARASAFE® to inject and spread the parachute.

About the warning display

In order to use PARASAFE® safely and prevent injury or damage to our customers and other persons and/or to their property, the following contains the safety precautions that you must observe. Fully understand the following display and graphic signs and then read the main text and observe the stated matters.

Below are definitions of the words used in this guide to signal that there is a safety risk that you must take precautions against.

Danger

If you ignore this sign and handle PARASAFE® incorrectly, it can result in the risk of serious injury or death.

Warning

If you ignore this sign and handle PARASAFE® incorrectly, it could result in a risk of serious injury or death from fire or otherwise.

Caution

If you ignore this sign and handle PARASAFE® incorrectly, it could result a risk of minor or moderate injury or property damage.

Contents

Ⅰ. Before use

In these Handling Instructions, we will explain the system and appropriate usage of PARASAFE®. Matters that need to be complied with for safety at the time of use are written in these Handling Instructions. Therefore, please be sure to read these Instructions fully before use and follow them so that you use PARASAFE® properly and safely.

Although PARASAFE® helps to reduce the risk of injury or accidental damage caused by drone failures, the fall or breakage of the drone and crush accidents cannot be completely prevented. Also, please do not use PARASAFE® for anything other than the purpose of reducing accidental injury or damage from drone failures. PARASAFE® will not operate properly when the radio communication between the drone and the transmitter or personal computer (for drone control) is not connected.

Although we have prepared this document with all things considered, if you find any errors, missing information or have any questions, please contact us (Ⅶ. Emergency contact details). Also, the content in this Guideline sometimes can change without prior notice. For PARASAFE® latest information, please contact us on the PARASAFE® official web site, https://parasafe.us/

Please inspect PARASAFE® before use. Though PARASAFE® is checked before shipment, please check the following before use, because something may happen after shipment.

Check list

- ☐ The contents of PARASAFE® are all included in proper quantities (Ⅱ－１． Contents).
- ☐ There are no cracks in the parachute device and trigger device and no damage to cables.
- ☐ The lid of parachute device is firmly closed and there are four (4)-way pins inserted without a gap.
- ☐ There is no bent or broken safety pin on the trigger device.
- ☐ The safety pin of trigger device can be removed/inserted.
- ☐ After connection of the trigger device and drone, the LED can be lit and indicates without any problems.

⚠ Warning

This sign shows a content that if you ignore this sign and handle PARASAFE® incorrectly, possibility of death, severe injury or possibility of fire may occur.

- Do not take PARASAFE® out of its packing container forcibly. The cables of PARASAFE® may break and PARASAFE® may not operate properly.
- Do not subject PARASAFE® to a shock such as by dropping it from a high place or by beating it strongly. PARASAFE® may get damaged and not operate properly.

Precautions for use

- When taking the trigger device out of its packing container, be careful not to bend cord too much or pull the trigger device forcibly.
- The trigger device is a manual trigger. There is no fall detection sensor.

II. Configuration and name of components

1. Contents

Parachute device	1piece
Trigger device	1piece
Safety pin (Already inserted in the trigger device)	1piece

Parachute device

Trigger device

Safety pin

1.	M4 bolt x 4 pieces	：For attaching the parachute device and drone
2.	M3 bolt, washer, lock nut × 4 units	：For attaching trigger device to drone
3.	Wiring connector for PWM signal × 1 piece	：SUMIKO TEC CB01 male 3 pin
4.	Drone attachment line × 1 set	：For attaching to main D Ring (Strength: over 5880 N)
5.	MTS Test Harness	：For verifying MTS works correctly
6.	D Ring	：For attaching Bridle lines to Parachute
7.	Low strength cable tie	: For bundling excess drone attachment line

1.

2.

3.

4.

5.

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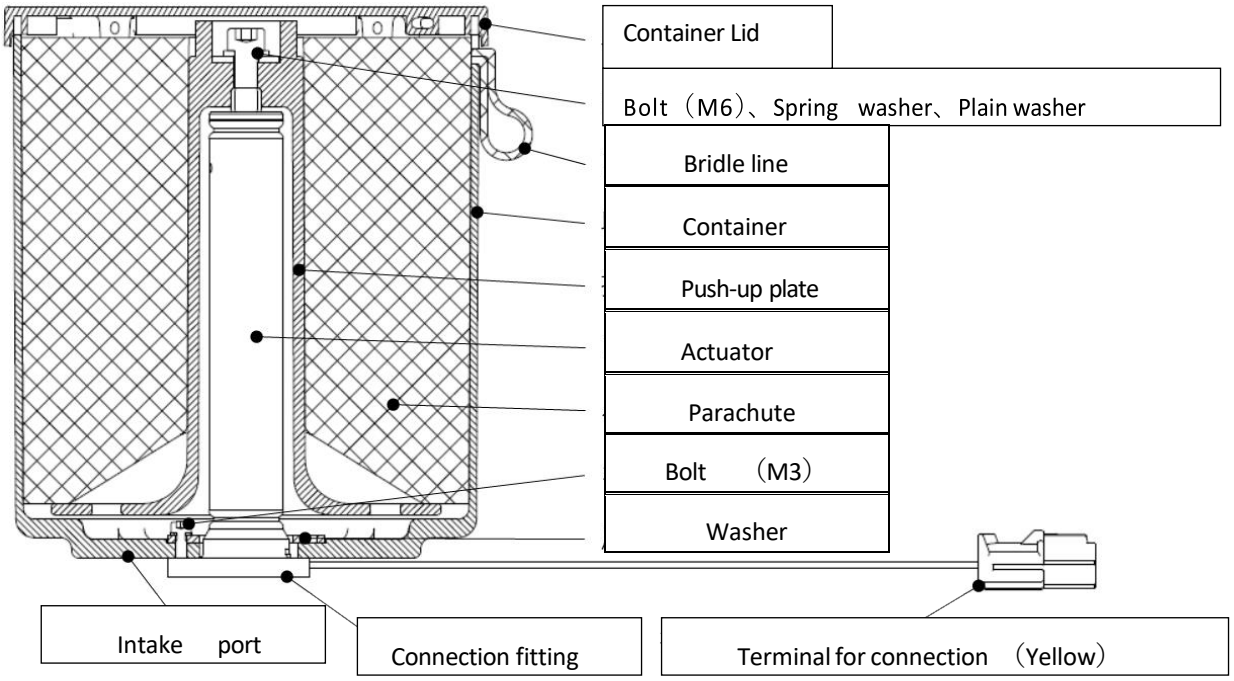
7.

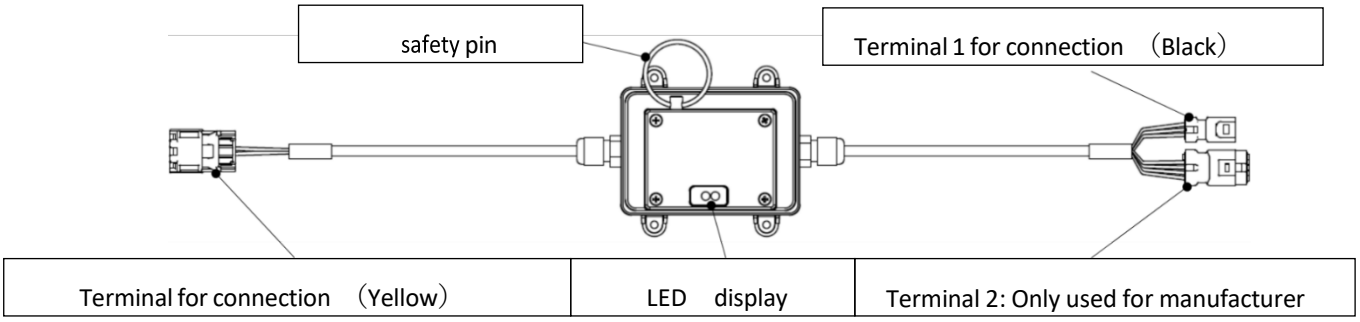
2. Cross section drawing and name of components

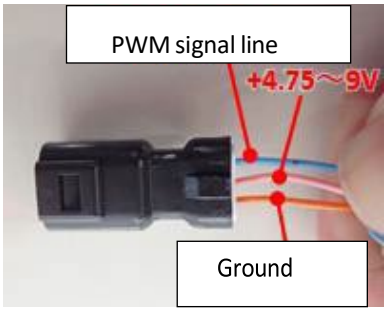
【Parachute device】



※NOTE: Please do not pull out or push in the bridle line forcibly. The bridle line is a part used to connect the parachute and drone.

【Trigger device】





【Composition of each parts】

Parts	Classification
Trigger Device	Electronic part and plastic
Container	Plastic
Container lid	
Parachute	
Push - up plate	
Washer	Metal
Bolts	
Actuator	Metal and lead wire

Ⅲ. How to use

1. How to attach PARASAFE®

⚠ Danger

Please do not ignore this sign and handle PARASAFE® incorrectly otherwise there is an increased risk of injury.

- Please make sure to read these Handling Instructions before attaching PARASAFE® to drone and using PARASAFE®. If you attach and/or use PARASAFE® incorrectly, an unexpected accident may happen.
- Do not energize PARASAFE® in a way not stated in this Handling Instructions.
  If you energize PARASAFE® using resistant measuring instrument or others, PARASAFE® may operate incorrectly.
- Do not pull out the safety pin of trigger device until right before the drone flight starts.
  Transmitter or personal computer (for drone control) may malfunction and lead to an unexpected accident involving PARASAFE®.
- When assembling drone, PARASAFE® and preparing for flight, please do not allow your face or part of your body to get close to the upper surface of parachute device.

  Unexpected accident may occur by incorrect assembly or misuse.
- Please do not remove the safety pin at any time other than for flight.
- Before the drone flight or during storage of drone, please make sure that the safety pin is securely inserted fully into the trigger device. If the safety pin is not securely inserted into the trigger device, unexpected accident may occur.

⚠ Warning

If you ignore this sign and handle PARASAFE® incorrectly, possibility of death or injury or fire may occur.

- When you attach or remove PARASAFE®, please perform them under appropriate work environment and working tools. If you perform these under inappropriate work environment (Fire, high temperature, electrical noise), PARASAFE® may incorrectly operate (burst).
- If you do not use an appropriate working pool, PARASAFE® may fall from the drone.
- Do not alter or remodel the upper side of PARASAFE® such as stickers, put objects and fix it on the upper side of PARASAFE®(parachute ejecting part).
  Parachute may not operate properly or fixed object may pop out by the force of operation and collide with person or object or other unexpected accident may occur.
- Do not attach PARASAFE® to a drone whose specification is other than the specification written in "VI. Specifications" If you attach PARASAFE® to a drone which has more weight (includes payload) than assumed, it may be unable to reduce the occurrence of damage in case of accident. PARASAFE® is only for unmanned drones.
- Carry out inspections on PARASAFE® before attaching PARASAFE® to a drone.
- Carry out inspections on drones before commencing drone flight.
- If you detect any abnormality using PARASAFE®, stop using PARASAFE® immediately. If you use PARASAFE® which has an abnormal condition, PARASAFE® may incorrectly operate or burst.
- Do not pull the cables of PARASAFE® (parachute device or trigger device) hard or twist them. Cables of PARASAFE® may disconnect and may not operate properly.
- Attach PARASAFE® (drilling process) after you have checked the specification of the drone. If not, the strength of the drone may deteriorate and result in an unexpected accident, such as PARASAFE® falling off from drone during flight. If necessary, please consult the drone manufacturer on position and method of attachment.
- Please be sure to connect bridle line of PARASAFE® and drone. If not connected or the connection is inappropriate, the parachute may not properly spread or other unexpected accident may occur. If necessary, please consult the drone manufacturer on position and method of attachment.

⚠ Caution

If you ignore this sign and handle PARASAFE® incorrectly, it could injure people or cause property damage.

- Keep children and pets away from you when are you attaching or removing PARASAFE® to the drone.
- Implement anti-static measures at the time of attaching or removing PARASAFE® to drone. Please take anti- static measures (install tools, use electro conductive tables, wear anti-static clothes and gloves. If not, PARASAFE® may improperly operate (or burst). Also, protection glasses and helmets are strongly recommended for your safety.
- As for accessories of PARASAFE® (safety pin and trigger device), do not use products other than official ones which are packed together with the parachute. If you use products other than official ones, it may lead to improper operation (or burst), or other unexpected accidents.
- At the time of attaching PARASAFE® to drone or removing PARASAFE® from drone, do not operate drone. The rotating propellers may hurt your hands or other unexpected accidents may occur.

Precautions for use

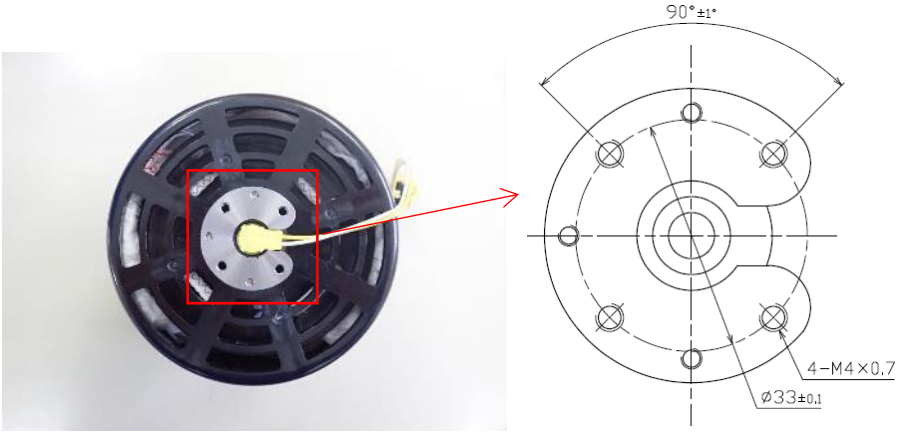
- If bridle line has slipped inside the body of PARASAFE®, do not try to drag it out. PARASAFE® may get damaged and be unable to use. (Contact customer service.)
- Do not pull-out bridle line of PARASAFE® forcibly PARASAFE® may get damaged and be unable to use

【Parachute device attachment procedures】

① Prepare a space for drone and PARASAFE® which fulfills the following condition.

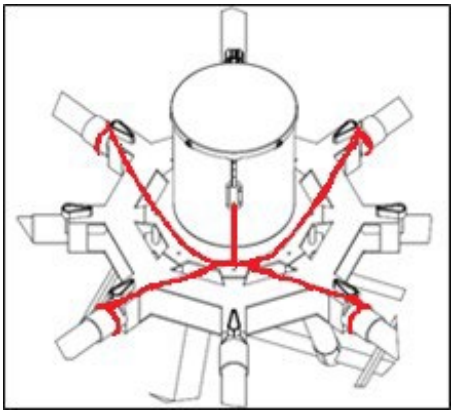
- A flat space where you can attach connection fitting to the bottom of parachute device.
- A space where there is no interfering object which blocks intake of the bottom of parachute device.
- A space where there is no interfering object on the upper part of parachute device.
- Upper surface or ceiling which has enough strength to fire the parachute device.
- A space where you attach drone harness lines (Strength: more than 5880N)

② ①Form 4 through-holes that can insert M4 bolt as shown in the picture below.



③ Tighten with M4 bolt (included) between the connection fitting hole of the bottom surface of parachute device and through hole of drone which you have prepared in ②.
（※Fitting depth of a screw shall be 5~15mm and recommended tightening torque shall be 1.5Nm）

④ Attach bridle line of parachute device to drone.



Attachment Example
In order to fasten the parachute to the drone secure the drone mounting line (red) firmly to the drone as shown in the example.
To avoid interference with the propeller and other equipment, secure drone mounting line (red) with the included low strength cable ties.

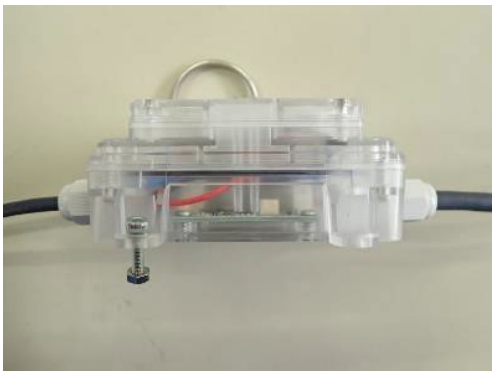
【Procedure for mounting the trigger device】

① Prepare a space which can meet the following condition, regarding the length of both cords of the parachute device and trigger device.

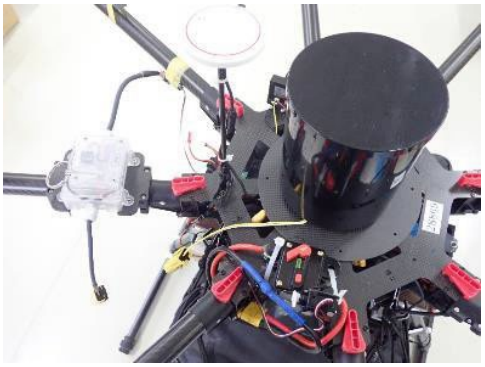
- Flat surface on which the trigger device can be mounted
- Space to allow insertion/removal of safety pin from outside
- Space where the LEDs on the trigger device can be viewed externally
- Space for attaching/detaching both connection terminals of the trigger device
- Space to avoid excessive bending of both cords of the trigger device

② On the surface prepared in ①, provide four holes where M3 bolts can be inserted as shown in the figure below.

③ Align the holes of the trigger device with the holes provided in ② and tighten them with the included M3 bolts, washers, and lock nuts. (* Tightening torque of 0.63N·m is recommended)



④ Insert and remove safety pin once. Confirm that there is a click, then insert safety pin all the way in.

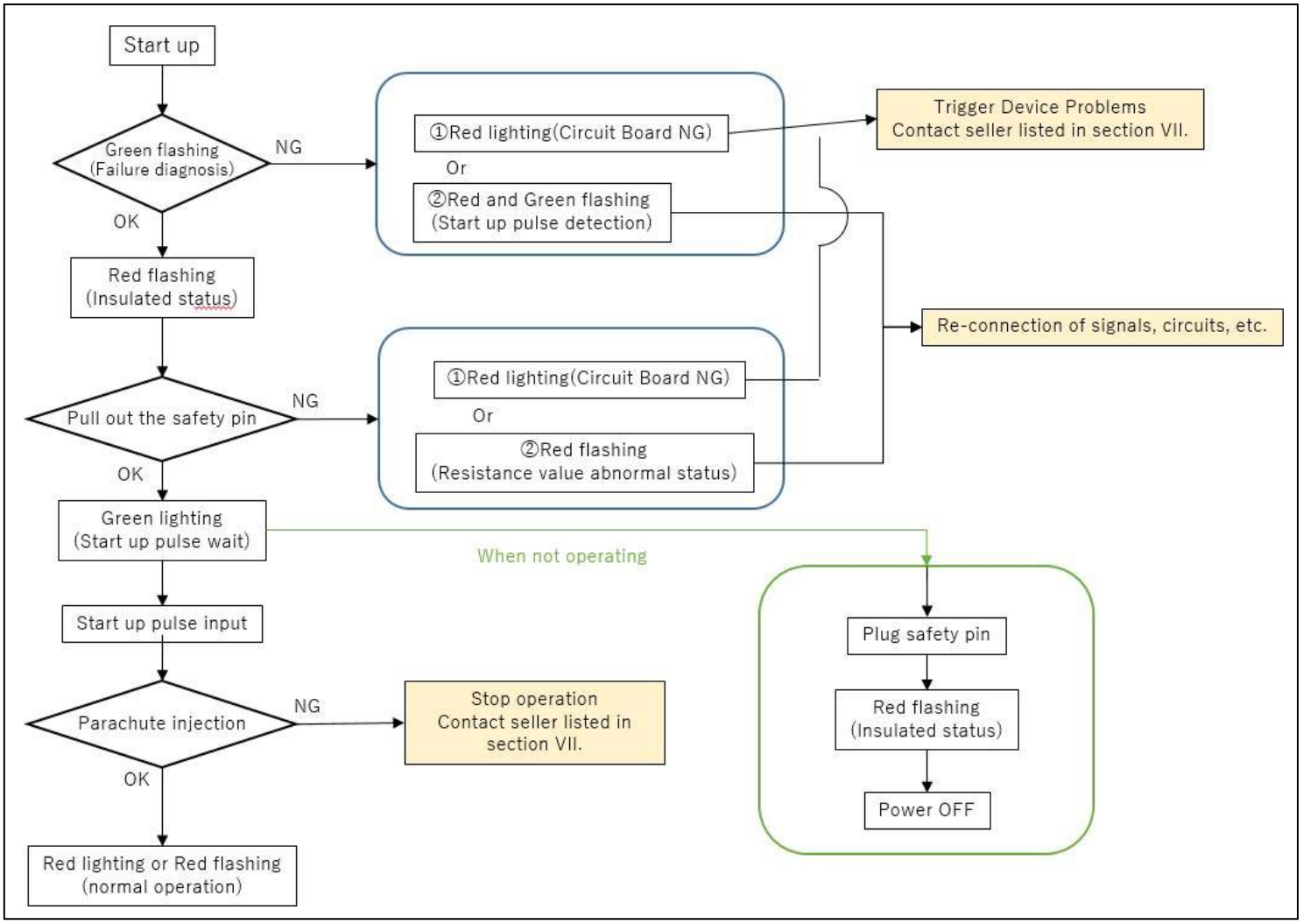


2. Preparation before flight

⚠ Warning

- Connect PARASAFE® to the power supply before use, and turn off/disconnect the power supply after use.

【 Flow Chart after Trigger Device Start up】



LED status table for Trigger Device

LED display		Status	Countermeasures
Green flashing		The status in which the presence or absence of a failure of a board component is diagnosed immediately after the trigger device starts up. (Normal status)	Wait for about 5 seconds after trigger device starts up.
Red flashing		1. Safety pin is plugged status : Trigger device does not activate. (Normal condition insulated status) 2. Safety pin pull out status: Circuit is abnormal. (Resistance value abnormal status) 3. After activate: Normal activate completed. (Normal status)	1. Safety pin is plugged status By pulling out the safety pin, Activate pulse wait status. 2. Safety pin pull out status: Because there is an abnormality in the resistance value on the circuit, check the connection status. If abnormal is not resolved, do not use this trigger device. 3. No need for further action.
Green lighting		It is the status which can activate by input the PWM signal. (Normal status, Standby status)	No need for further action.
Red/Green flashing.		It is status which is the detected PWM signal of the activate pulse when power supply is started up. Trigger device cannot start up by abnormal status. (Input signal abnormal status)	Check the input signal to the trigger device. If it is not in the activate pulse, turn power off and on again.
Red lighting		1. Before activate or pre-flight status: Circuit board is abnormal. (Abnormal status) 2. After activate: Normal activate completed. (Normal status)	1. Before activate or pre-flight status Do not use this trigger. 2. After activate status: No need for further action.

Other: If parachute does not eject after activate pulse input.

Stop operation, please contact seller in section VII,

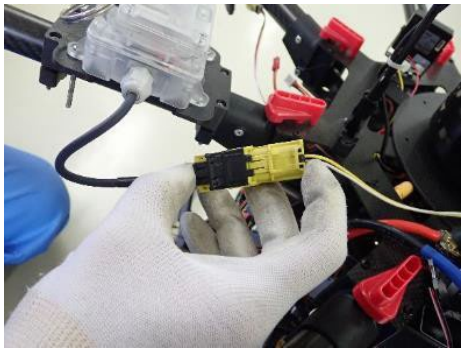
【Procedure before flight】

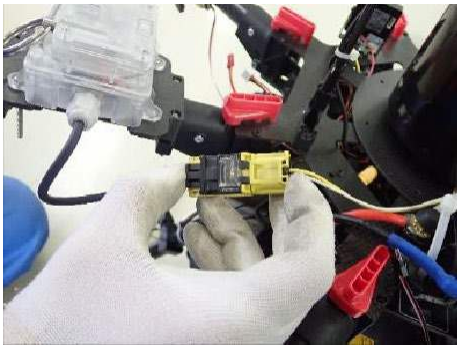
① Assign one channel for the activation of this product in the configuration of transmitter that controls drone, or through the autopilot.

② Turn on the transmitter.

③ Connect terminal 1 for connection (Black) of trigger device to terminal for connection on drone side (terminal of the channel assigned by ①), and turn on the receiver.

④ Check that the safety pin is not pulled out. Connect terminal for connection (Yellow) of parachute device and MTS Test Harness, and insert it until it clicks into place.



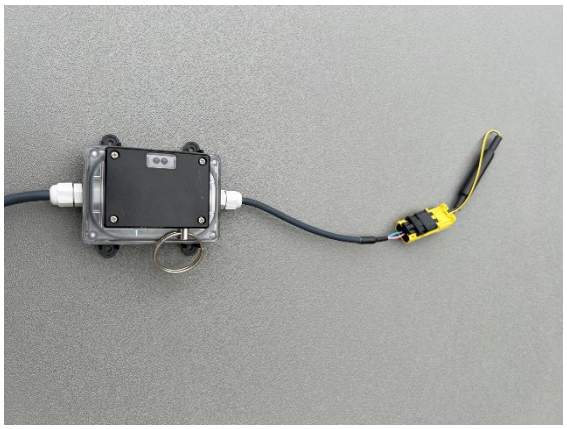


⑤ Pull out safety pin immediately before flight and check LED lights up in green.

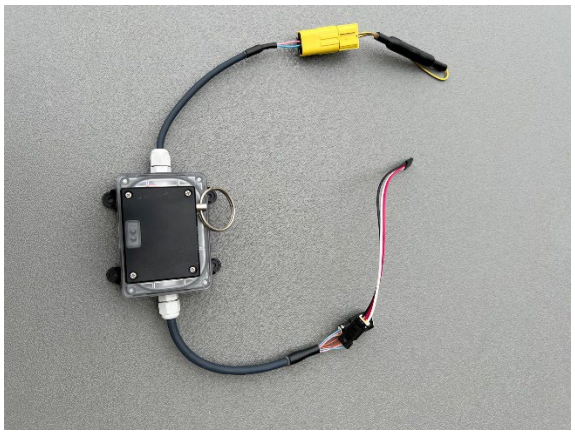
⑥ If desired, conduct a test “fire” of the MTS to ensure that manual function is correct with associated LEDs from MTS. The Test Harness will allow for any number of tests.

⑦ If all testing checks out, disconnect the Test Harness and connect the trigger device to parachute device prior to flight.

⑧ It is recommended to test the MTS with your drone configuration with the Test Harness especially if using the autopilot to command the trigger firing and ESC shutdown.



MTS with the test harness connected



MTS with test harness and wiring connector connected

3. How to operate during flight and after landing

⚠ Danger

If you ignore this sign and handle PARASAFE® incorrectly, death, severe injury, or fire may occur.

- Do not activate PARASAFE® except in an emergency. If PARASAFE® is accidentally activated while drone in operation, it may become entangled with a part of Drone and fall, resulting in an unexpected accident.

⚠ Warning

If you ignore this sign and handle PARASAFE® incorrectly, death, severe injury, or fire may occur.

- Before flying drone, make sure that there is enough battery power remaining in drone, transmitter, or control PC. PARASAFE® may not operate properly due to insufficient battery.
- Please refrain from using PARASAFE® (using drone) during stormy weather.
  A strong wind may cause drone to descend (fall) to an unexpected location, resulting in an unexpected accident. In addition, there is a danger of unexpected accidents such as improper operation of PARASAFE® due to water intrusion into the main body.
- Always unplug safety pin before flying drone.
  Flying drone without unplugging safety pin may result in inability to operate in an emergency and an unexpected accident.
- Always check the flight conditions when flying drone. If you don't, unexpected accidents may occur, such as dropping onto the ground before parachute deploys due to delayed operation of PARASAFE®.
- Do not operate drone after parachute deployment. Drone (propellers, arms, etc.) may become entangled with parachute or other unexpected accidents may occur.
- If a deployed parachute gets entangled with a person or an object, cut it with scissors or take other steps to deal with it. If you attempt to remove it in a hurry, the parachute may become entangled with a part of your body and fall, resulting in an unexpected accident.

【Procedure for flight】

① When a drop is detected during flight, make sure the propellers are fully stopped and transmitter is switched on to activate PARASAFE®. (* If propellers are operated without stopping all the way, parachute line may become entangled with propellers and the parachute will not work as intended.)

② After confirming that parachute has deployed and landed, go to landing point and collect parachute.

【Procedure after landing】

① Insert safety pin into trigger device when flight is finished.

② Disconnect trigger device from drone's power supply.

③ Turn off transmitter.

4. How to store PARASAFE®

⚠ Warning

If you ignore this sign and handle PARASAFE® incorrectly, death, severe injury, or fire may occur.

- When storing PARASAFE® alone, do not remove it from the package. Otherwise, PARASAFE® may fall or be damaged from a height and may not operate properly.

⚠ Attention

If you ignore this sign and handle PARASAFE® incorrectly, it could injure people or cause property damage.

- Do not expose PARASAFE® to high temperatures or fire, or storage or use it in a high-temperature environment. Storing PARASAFE® in an inappropriate environment (fire or high temperature) may cause PARASAFE® to malfunction (burst).
- Do not pull the safety pin out unless you are flying drone.
- Do not use PARASAFE® that has been stored (unused) for a long period of time (*Warranty period: 1 year). Failure to do so may result in an unexpected accident

5. Precautions during use

⚠ Warning

If you ignore this sign and handle PARASAFE® incorrectly, death, severe injury, or fire may occur.

- PARASAFE® cannot completely prevent damage to drone, people, objects, etc.
  PARASAFE® is a device that reduces impact by decelerating and descending with a parachute which it collides with a person or property on the ground. Use extreme caution when flying drone.
- Once used (actuated), PARASAFE® cannot be reused.
- Disassembly or modification of PARASAFE® (actuator) is prohibited
- Do not disassemble, modify or repair PARASAFE®. Failure to do so may cause PARASAFE® to suddenly operate (burst) or other unexpected accidents.
  Disassembly or modification of this product (actuator) is prohibited by law. [Explosives Control Law]
- PARASAFE® is a parachute for drone. Do not use for any other purpose.
  Otherwise, unexpected accidents such as sudden activation (burst) of PARASAFE® or improper operation of parachute may occur.

Ⅳ. What to do when failure occurs

- In case of fire, immediately keep a distance of 10m or more from the product. Failure to observe this precaution may result in injury from flying objects, etc. of PARASAFE®. Take appropriate measures in event of a fire, such as contacting the fire department in your jurisdiction.

Ⅴ. How to dispose of PARASAFE®

1. Disposal of PARASAFE® after deployment

⚠ Caution

If you ignore this sign and handle PARASAFE® incorrectly, it could injure people or cause property damage.

- Immediately after operation, internal parts may become hot temporarily. To prevent unexpected accidents such as burns, wear gloves and handle the product carefully. After activation, dispose of PARASAFE®. as industrial waste in accordance with local regulations. (To disassemble prior to disposal, refer to the parts classification table on page 6 of this manual.)

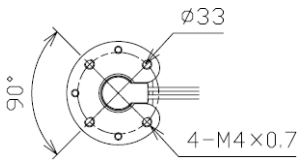
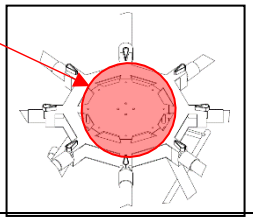
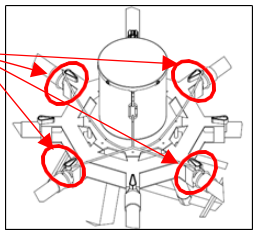
2. Disposal of PARASAFE® which hasn't deployed

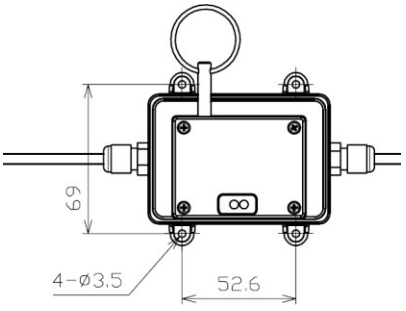
PARASAFE® should not be disposed of as general industrial waste if it hasn't been activated. Contact specialized disposal company or the manufacturer.

If the PARASAFE has been activated or fired, all contents may be disposed as general waste or recycled based on local recycling rules.

Ⅵ. Specifications

【Specifications】

Part Number: PS CA 12-01 Parachute Device		
System	Ejection system	Launch a parachute with a pyro-actuator Launch a parachute in response to input from the trigger device
	Weight	930g
	External Dimensions	Φ130 ㎜×h154 ㎜
	Parachute area	11m^2
	Application	Designed for multi-copter drone with a maximum total flight weight of 25 kg
Mounting conditions	Location of the mounting holes	Mounting bracket 
	Mounting screw	M4 bolts (Strength classification 10.9) × 4 pcs.
	Strength of the parachute device mounting portion	Example of mounting  7100N or more
	Strength of Drone Mounting Line and Mounting Area	Example of a mounting  5880N or more
Operating conditions	Storage	Avoid open flames and direct sunlight and store indoors (at room temperature and humidity recommended)
	Temperature	0℃～40℃
	Altitude	30～150m

Part Number: PS CA 12-01 Trigger Device		
System	Voltage	4.75～9.0V
	Current consumption	Standby: 30 mA Power on: Temporarily consumes up to 200mA
	Terminal 1 for connection (black)	Sumi Tech CB01 male 3-pin
	External Dimensions	L 118mm x D 90mm x H39mm
	Weight	120g
	Dustproof and waterproof	Equivalent to IP54
Trigger signal	Signaling system	PWM
	Voltage range	(Low) 0～0.3V (High) 2.7～5.3V
	Standby pulse	(Pulse width) 1.0±0.25ms (Period) 15ms±1.5ms
	Starting pulse	(Pulse width) 2.0±0.25ms (Period) 15ms±1.5ms
Operating conditions	Operating time	Outputs parachute ejection 0.05 seconds after Activate pulse input
	Operating conditions	Stop all propellers before parachute ejection
	Drone side Connection terminal	Sumi Tech CB01 Female 3-pin
	Mounting	 M3 bolts × 4 bolts for screwing
Safety function	Safety pin	Plug in: The parachute device does not activate. Pull out: The parachute device is activated.

【Performance(reference)】※1

Part Number. : PS CA 12-01	
Rate of descent (When used with a total weight of 25 kg)	6m/s
Altitude loss (Vertical drop distance from start of drop to parachute deployment)	16m
Deployment reliability	All 50 parachutes deployment in 50 studies (Reliability when achieving 95% reliability is 94.00%)

※1 This is an actual measurement value obtained by mounting on a 25 kg multi-copter drone and dropping it from the hovering stage in an outdoor environment, and operating this product.

【Applicable Laws/Regulations/Transport Certification】

Part Number. : PS CA 12-01	
Japan explosives control law	[Damage Reduction Parachute ejection Piston for drone] Within the scope of the notice of exemption
Dangerous goods which is on United Nations Recommendations on the Transport of Dangerous Goods	Conforms to the non-dangerous goods which is on United Nations Recommendations on the Transport of Dangerous Goods Special Permit 289 based.
Environmental impact substances Regulatory compliance	(In accordance with the following regulations) Japan law ・Act on the Evaluation of Japanese Chemical Substances and Regulatory of Their Manufacture, etc. ・Industrial Safety and Health Law ・Law for the Promotion of the Determination and Management of Chemical Substances Discharge in Japan (PRTR Law) Except Japan ・U.S. Toxic Substances Control Act (TSCA) ・Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) ・European REACH Regulations

Applicable laws, regulations, and transport certifications are prepared based on information available at the time of preparation, but may not necessarily be sufficient. It is subject to revision due to new knowledge and tests. This document is provided for your information and may not be absolutely correct or current.

【Warranty】

Part Number. : PS CA 12-01	
Warranty period*2	1 year
Guaranteed temperature range *3	0～40℃
Parachute ejection time*4	0.50 seconds
Ejection operation reliability*5	99.9999% with 95% reliability (equivalent to automotive safety parts)
Parachute tensile strength*6	5880N

*2 This is the period during which we will respond free of charge to any defect in Products at the time of shipment as of the date of sale.

*3 Temperature range in which this product will operate.

*4 Time it takes for the parachute line to extend when parachute device is operated on the ground.

*5 Ignition reliability of parts used in pyro actuators.

*6 This is the tensile strength of the weakest part of the parachute member on the assumption that parachute expands symmetrically and the load is applied evenly to each part of the parachute.

Ⅶ. Emergency contact details and contact information on PARASAFE® inquiries

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