

**NHK MEC**

# ***KE-6a***

***ELECTRONIC CONTROL SYSTEM***

***INSTRUCTION MANUAL***

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# INTRODUCTION

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This manual has been prepared to ensure your correct installation and operation of the KE-6a system. Be sure to read this manual to understand how the system functions and to prevent injury or damage to the product. Always keep the manual within your reach during operation.

This product controls the shift (gear) and throttle (governor). It is recommended therefore to also read the manual of the vessel's engine and gear.

The specifications may be subject to change without notice in view of improvement, resulting in more or less difference between the content of the manual and the product. In case of ambiguity or questions concerning the product or the manual, consult with your dealer.

In case of KE control system transfer of ownership, please make sure to include this instruction manual.

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## SAFETY PRECAUTIONS

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This manual contains precautions under the following headers, which, if not observed, may result in injury or damage to the property. Pay particular attention on these precautions.



### WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.



### CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury or damage to the product.

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## INSTALLATION / REPAIR

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The installation of this product must be performed following all applicable installation and safety codes.

Only authorized personnel should perform disassembly and repair of this product; otherwise the warranty will be voided.

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# PRODUCT SPECIFICATIONS

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## 1. Electric Performance

- Supply voltage  
For DC12V model: DC9V~16V  
For DC24V model: DC16V~31V
- Max. current of actuator: 16A peak, 5A typical (at 49N{5kgf} · 11lbf load)
- Current consumption at stop of actuator: 0.5A or less

## 2. Performance of Actuator

- Thrust  
Max. operating thrust: 147N {15kgf} · 33lbf load  
Constraint load : 343N {35kgf} · 77lbf load
- Shift Stroke  
Forward or Reverse stroke (can be set separately): 26·30·34·40mm

## 3. Throttle Output

- Type1 (Current Output)  
Current output : 4mA to 20mA  
Idle Validation Switch (Normally Closed, Normally Open)  
Capacity: 24V, 2A max.

Note:

For Type 1(Current Output)  
Select the harness throttle P/N NM0641-05.  
(Refer to the page 4, item ⑦.)

- Type2 (Voltage Output)  
Voltage output: 0.2V to 4.45V  
Idle Validation Switch (Normally Closed, Normally Open)  
Capacity: 24V, 2A max.

Note:

For Type 2(Voltage Output)  
Select the harness throttle P/N NM0642-05  
(Refer to the page 4, item ⑦.)

- Type3 (PWM Output)  
PWM output: 8% to 92% Duty Cycle,  
500Hz  
Idle Validation Switch (Normally Closed, Normally Open)  
Capacity: 24V, 2A max.

Note:

For Type 3(PWM Output)  
① Set the dip switch SW1-1, 2 and 3 “ON” .  
(Refer to the page 26.)  
②Select the harness throttle P/N NM0643-05  
(Refer to the page 4, item ⑦.)

## 4. Temperature Range

- (1) Operating temperature:  $-20^{\circ}\text{C} \sim +77^{\circ}\text{C}$
- (2) Storage temperature :  $-40^{\circ}\text{C} \sim +100^{\circ}\text{C}$

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# PRODUCT FUNCTIONS

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- **Shift:** Forward/Reverse operation
- **Throttle:** Acceleration/deceleration
- **Neutral throttle:** Only the throttle is activated to warm up the engine.
- **Control Station Select:** Allows transfer from one control station to another by pressing the SEL button on any control head; up to 4 stations are available.
- **SIGP (Start-in-Gear Protection):** Enables engine start up only when the shift is in the neutral position. A safety feature.
- **Dim display:** Decreases luminance of the lamp on the control head during nighttime.
- **Alarm Codes:** Detect system faults and indicates via flashing LED's on the control head.
- **Buzzer (option):** Combines an audio alarm to LED codes.
- **Mechanical backup (option for shift actuator):** In case of electrical failure, enables mechanical operation of the actuator lever via a mechanical control head.
- **Trolling Option:** Allows control of trolling valve for low speed control. Refer to KE4a trolling instruction manual for details (part # NM0479-00 & NM480-00).

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# PRODUCT COMPLIANCE

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ISO 9001  
QUALITY



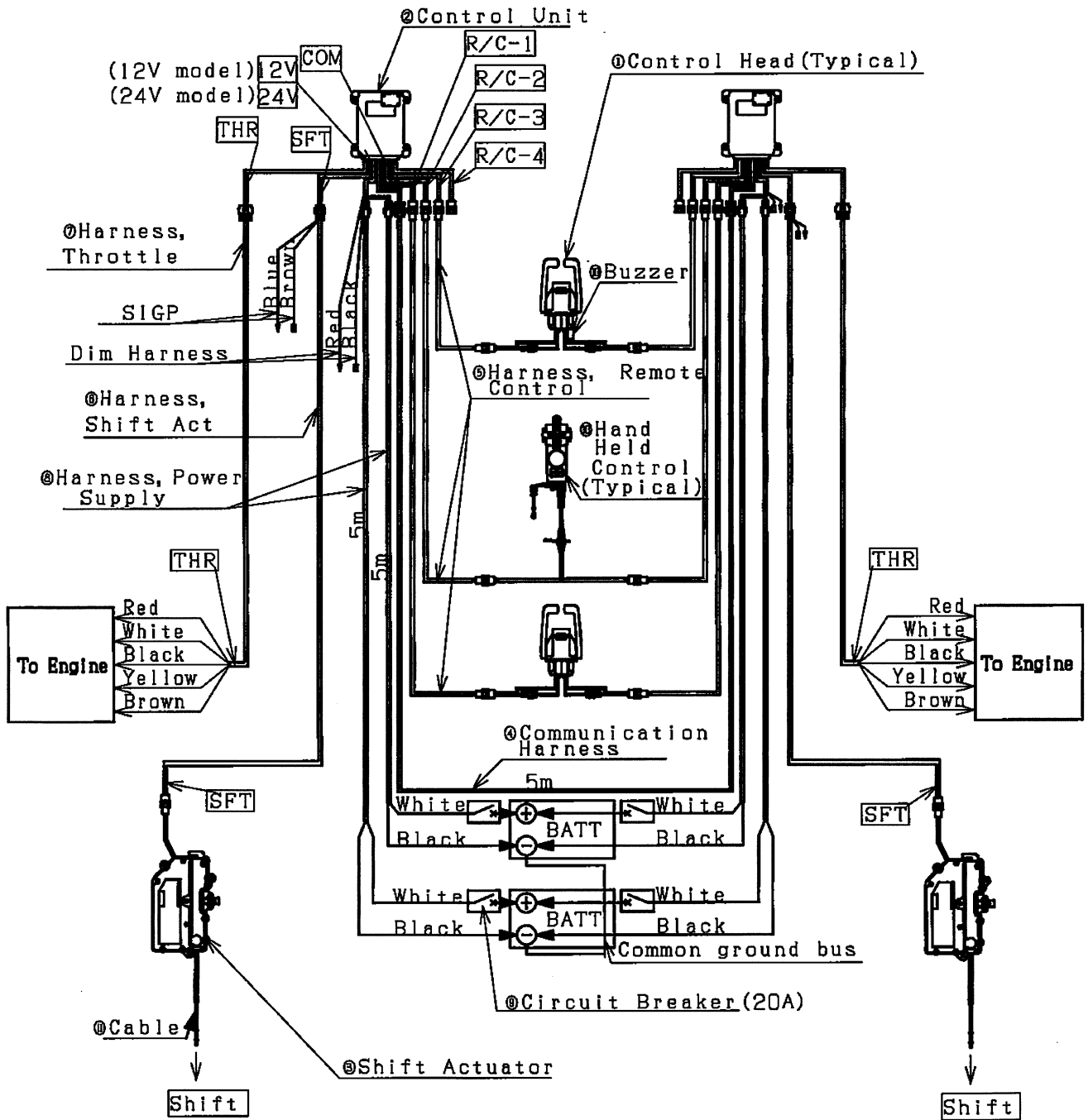
## 1. USA

- **ABYC:** This control system meets applicable requirements of various ABYC standards.
- **CFR:** It also meets Title 46 CFR & Title 33 CFR marine regulations for US Coast Guard requirements.

## 2. INTERNATIONAL

- **TYPE APPROVAL:** This control system has been tested in accordance with the relevant requirements of the GL (Germanischer Lloyd) Type Approval System (certificate 59 985-13 HH). Refer to components list for additional details.
- **ISO:** This control system meets applicable requirements of various ISO test standards. Additionally, the Quality Management System for this product meets ISO 9001 quality standards.
- **CE:** This control system meets applicable requirements of the Recreational Craft Directive

# STANDARD CONFIGURATION



Note: The figure above shows an example of a two engine / two control station system with optional handheld control stations and alarm buzzer.

# COMPONENTS LIST

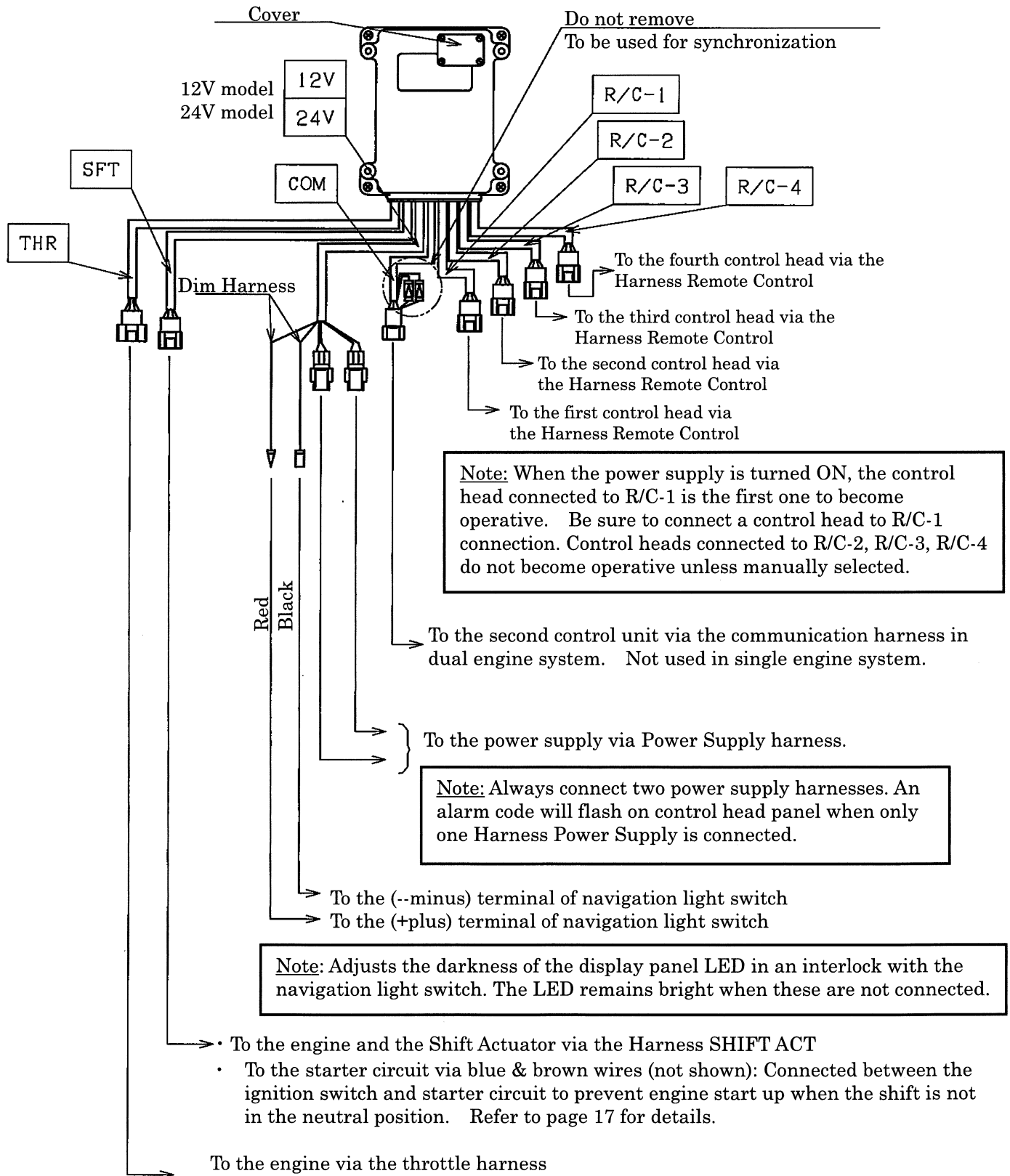
№	NAME	Part No.	Required								Note
			Single engine				Two engines				
			Station No.				Station No.				
			1st	2nd	3rd	4th	1st	2nd	3rd	4th	
①	Control Head	NM0511-00	1	2	3	4	—	—	—	—	
		NM0510-00	—	—	—	—	1	2	3	4	
②	Control Unit 24V model 12V model	NM1450-00	1	1	1	1	2	2	2	2	
		NM1449-00									
③	Shift Actuator	NM0172-00	1	1	1	1	2	2	2	2	
④	Communication Harness 5m	NM0619-05	—	—	—	—	1	1	1	1	
⑤	Harness Remote Control	4m NM0616-04									For length other than those listed in the left, consult your dealer
		6m NM0616-06									
		8m NM0616-08									
		10m NM0616-10									
		12m NM0616-12									
		14m NM0616-14									
		16m NM0616-16									
		18m NM0616-18									
		20m NM0616-20									
		22m NM0616-22	1	2	3	4	2	4	6	8	
		24m NM0616-24									
		26m NM0616-26									
		28m NM0616-28									
		30m NM0616-30									
		32m NM0616-32									
		34m NM0616-34									
36m NM0616-36											
38m NM0616-38											
40m NM0616-40											
⑥	Harness, Shift Act 2m	NM1449-07	1	1	1	1	2	2	2	2	
⑦	Harness Throttle	Type1 5m NM0641-05									for Current output
		Type2 5m NM0642-05	1	1	1	1	2	2	2	2	for Voltage output
		Type3 5m NM0643-05									
⑧	Harness Power Supply	5m NM0414-28									
		10m NM0414-33	2	2	2	2	4	4	4	4	
⑨	Circuit Breaker 20A	NJ0514-00	2	2	2	2	4	4	4	4	Option
⑩	Buzzer 24V model 12V model	NJ0515-00	1	2	3	4	2	4	6	8	Option
		NJ0596-00									
⑪	Push-pull mechanical cable	TFXtreme	1	1	1	1	2	2	2	2	Specify length

**Note:** Refer to the previous page for component identification. Select ⑦ Throttle harness based on the type of throttle output referring the charts on page 2, item 3 “Throttle Output” .

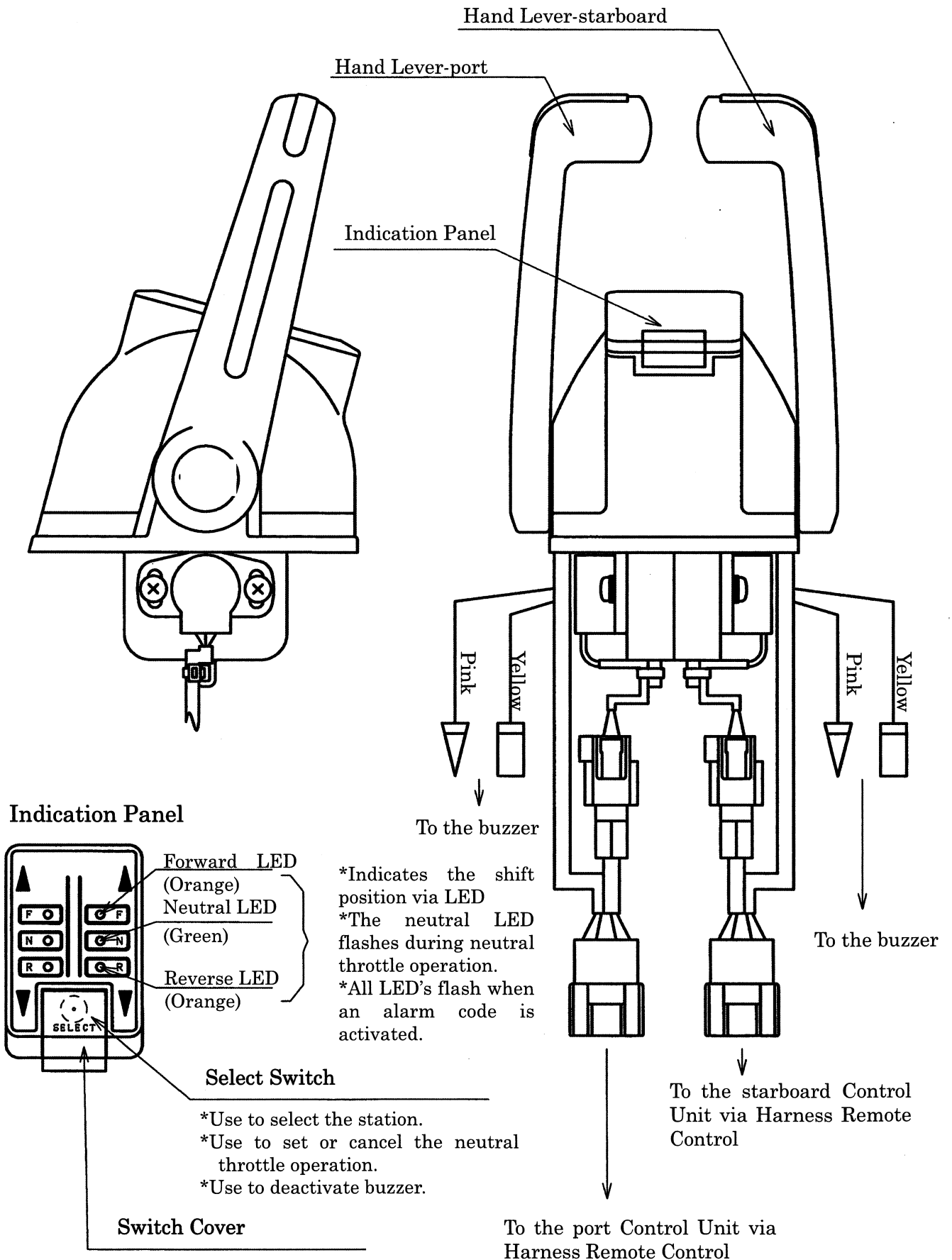


# CONTROL UNIT

Note: The Control Unit is available in two types; one for 24V and the other for 12V. Select the appropriate one for your power supply.



# CONTROL HEAD



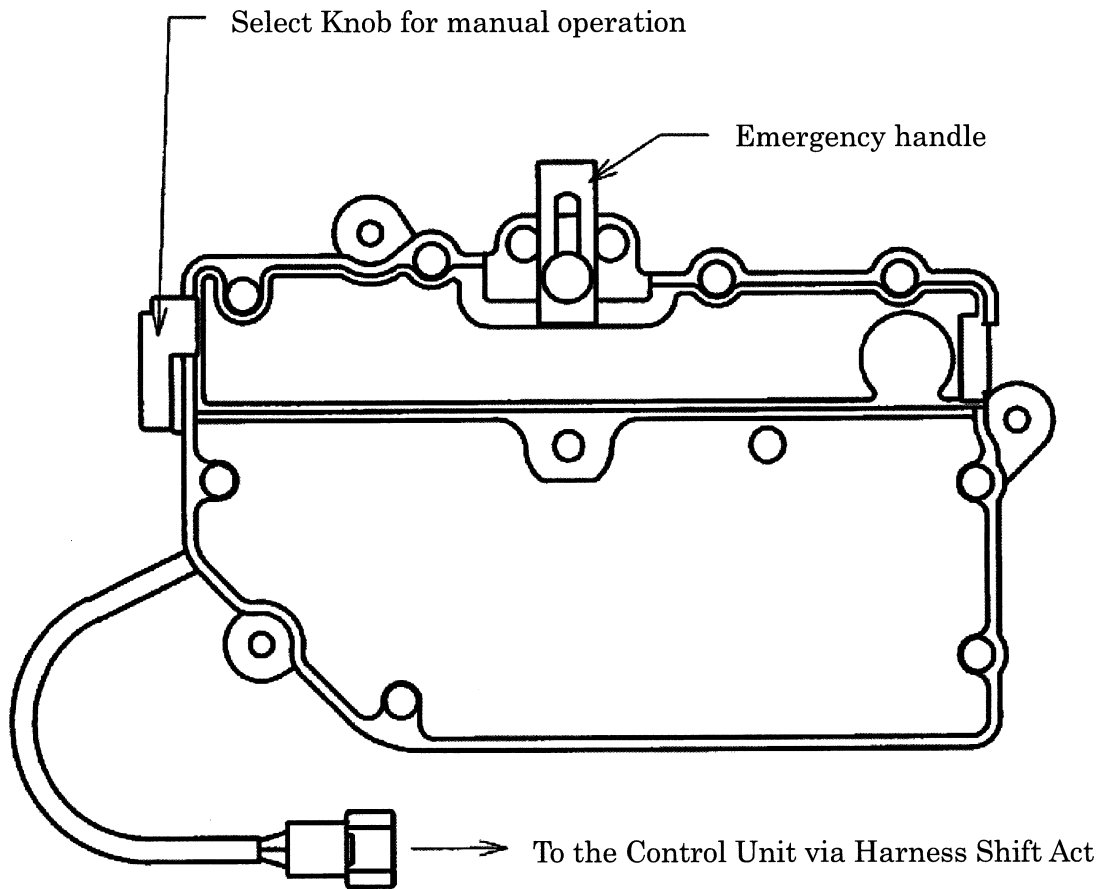
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# SHIFT ACTUATOR

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**⚠ WARNING**

Operate the Selector Knob only in case of emergency (mechanical backup).



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# KE SYSTEM OPERATION

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## Initial Control Operation after Power ON

1. With power ON and the hand lever in the Neutral position, the system will be in the neutral idle condition.
2. The control head connected to remote control connector R/C-1 is considered the master control station and will become operational first.
  - (a) Set the handle lever to the Neutral position.
  - (b) The green neutral LED lights ON indicating the control is operational.

**Note:** If the hand lever(s) are moved to a forward or reverse gear position while power is not applied to the control system, and then power is applied, control system will not become operational until the hand lever(s) are moved back into neutral position. The green neutral LED then lights ON indicating the control is operational.

3. When other control stations are required for operation that are connected to R/C-2, R/C-3 and R/C-4 perform the following actions.
  - (a) Set the hand lever to the Neutral position.
  - (b) Open the switch cover, press and release the select switch.
  - (c) The green neutral LED lights ON indicating the control is operational.

## Head Lever Operation



### CAUTION

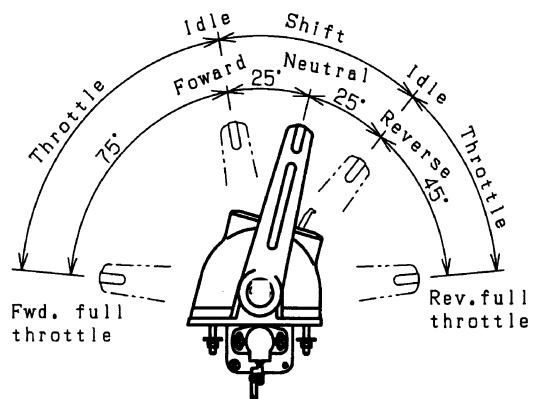
Never operate the hand lever while the engine is not running. Otherwise actuator, cable, and gear may be damaged.



### WARNING

Do not attempt sudden forward to reverse the hand lever(s) operation. Sudden acceleration/ deceleration may cause damage to the boat or cause operator or passengers to be ejected from the boat.

- (1) Moving the hand lever from the neutral position to the forward or reverse detent causes the actuator to shift to forward or reverse gear. Orange forward or reverse LED(s) light to indicate forward or reverse gear position obtained.
- (2) Moving the hand lever past the Forward or reverse detent causes the engine into throttle operation and the boat will accelerate.



### Lever stroke and throttle output

Lever stroke	Throttle output	
	output	Idle validation switch
Forward throttle range	Forward Throttle	Open
Forward idle	Idle Throttle	Closed
Neutral		
Reverse idle		
Reverse throttle range	Reverse Throttle	Open

### Neutral Throttle Operation

1. Set the hand lever to the Neutral position.
2. Open the switch cover located on top the control head and move the hand lever to the forward gear position while simultaneously pressing the station select switch.
3. The green neutral LED flashes and the neutral throttle operation is activated. Neutral throttle operation will remain active until properly deactivated.

### To Cancel Neutral Throttle Operation

1. Set the hand lever to the Neutral position.
2. Open the switch cover and press and release the select switch. After the release of the select switch, the green neutral LED will stop flashing. This indicates deactivation of the neutral throttle operation.

### Station Transfer for 2, 3 and 4 Station Operation from Neutral Position

1. Set the hand lever(s) of the selected control to the neutral position, open the switch cover press and release the select switch. A continuous green neutral LED indicates the control station inactive.

### Station Transfer for 2, 3 and 4 Station Operation from Forward Throttle Position

1. Set the hand lever(s) of the selected control to the neutral position, open the switch cover, press and release the select switch. A continuous green neutral LED indicates the control station is active.
2. The operator has 4 seconds to move hand levers and match the throttle position of the last active control station. A continuous orange forward LED indicates control station is active.

**Note:** Keeping the hand lever of the last active control station in the neutral position, will result in control system automatically returning the control system to a neutral idle condition. A continuous green neutral LED indicates the control station active and system is a neutral idle condition.

# INSTALLING THE CONTROL HEAD

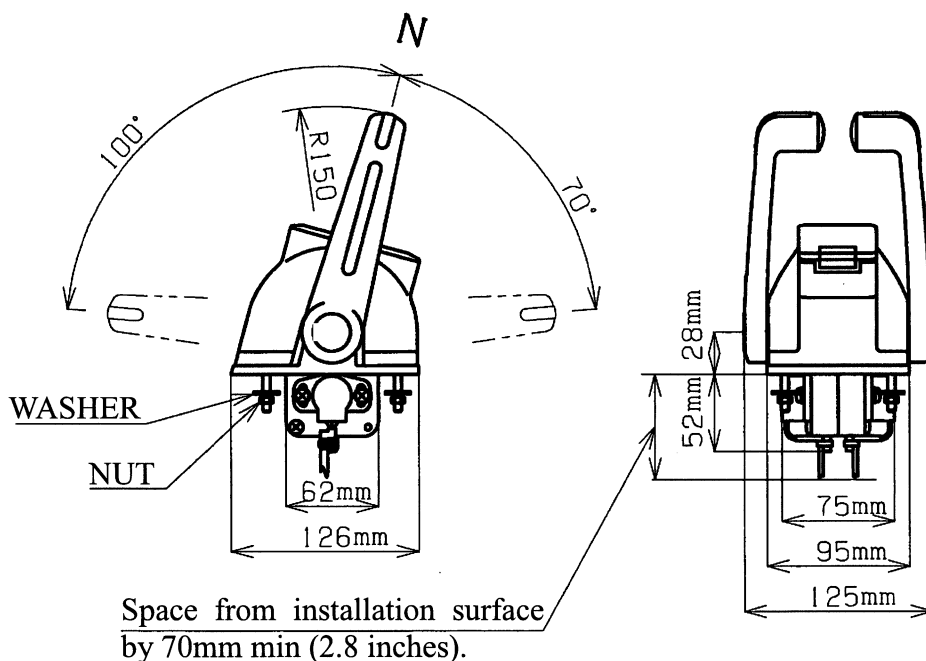
## ⚠ CAUTION

Install the control head in a location accessible for shift & throttle operation at all times.

Select a flat place convenient for operation and installation.

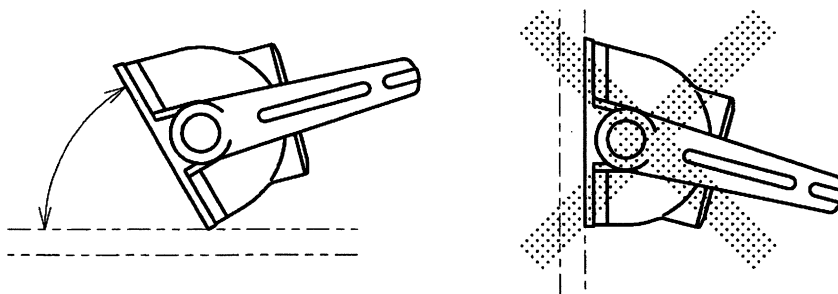
- (1) Drill mount holes by using an attached template.
- (2) Install with attached washers and nuts.

Tightening torque :2.9 ~ 4.4N·m (2.1 ~ 3.2 lbf·ft)



## ⚠ CAUTION

Mount the control head within 60 degrees from horizontal.



# INSTALLING THE CONTROL UNIT

## ⚠ CAUTION

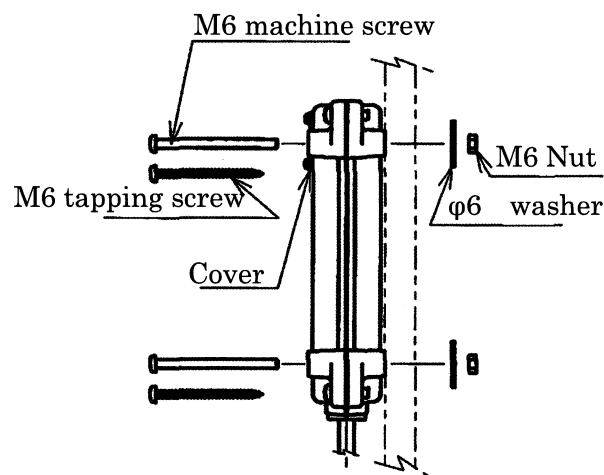
1. Ingress of water into the unit may cause failure
2. Install so that harnesses exit through the bottom and the small cover faces up for easy access to DIP switches.
3. Install in a location where sea wind and water effects are minimized.
4. Avoid a location where the ambient temperature exceeds 77°C.

### Instructions:

1. The actuator harness is 2m (6.5ft) in length. Select the control unit location so that its distance from the actuator is 2m (6.5ft) or less.
2. Drill mounting hole locations guide by the attached template at the back of the manual.
3. Install with included pan head machine screws or tapping screws (see data below)
4. Tighten to 4.9 ~ 7.8 N · m (3.6 ~ 5.7 lbf · ft) of torque.

### Notes:

1. Machine screw mounting plate thickness: 3 ~ 20 mm (1/8 ~ 3/4 in.), mounting hole diameter:  $\phi$  7mm ( $\phi$  1/4 in.).
2. Tapping screw mounting plate thickness: 15 mm min. (5/8 in. min.), pilot hole diameter:  $\phi$  3mm ( $\phi$  1/8 in.).



# INSTALLING THE SHIFT ACTUATOR

## CAUTION

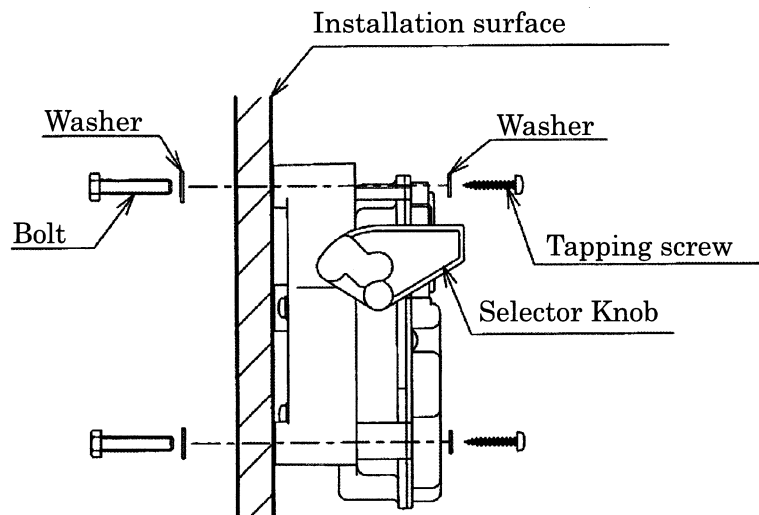
1. Ingress of water into the unit may cause failure.
2. Install in a location convenient for access to manual operation selector knob.
3. Install in a location where sea wind & water effects are minimized.
4. Avoid a location where the ambient temperature exceeds 77°C.

### Instructions:

1. Install the actuator in a place convenient for operation of manual selector knob.
2. The actuator harness is 2m (6.5 ft) in length; select the control unit location so that its distance from the actuator is within 2m (6.5 ft).
3. Drill the mount hole using the attached template.
4. Install with bolts or tapping screws and washers.
5. Tighten to 3.9 ~ 5.9 N · m (2.9 ~ 4.3 lbf · ft) of torque.

### Notes:

1. Bolt Installation plate thickness : 3 ~ 25mm (1/8" to 1")
  2. Mount hole dia :  $\phi$  9mm (  $\phi$  3/8 " )
- or
3. Tapping screw plate thickness : 15mm min ( 9/16 " min)
  4. Pilot hole dia :  $\phi$  3mm (  $\phi$  1/8 " )



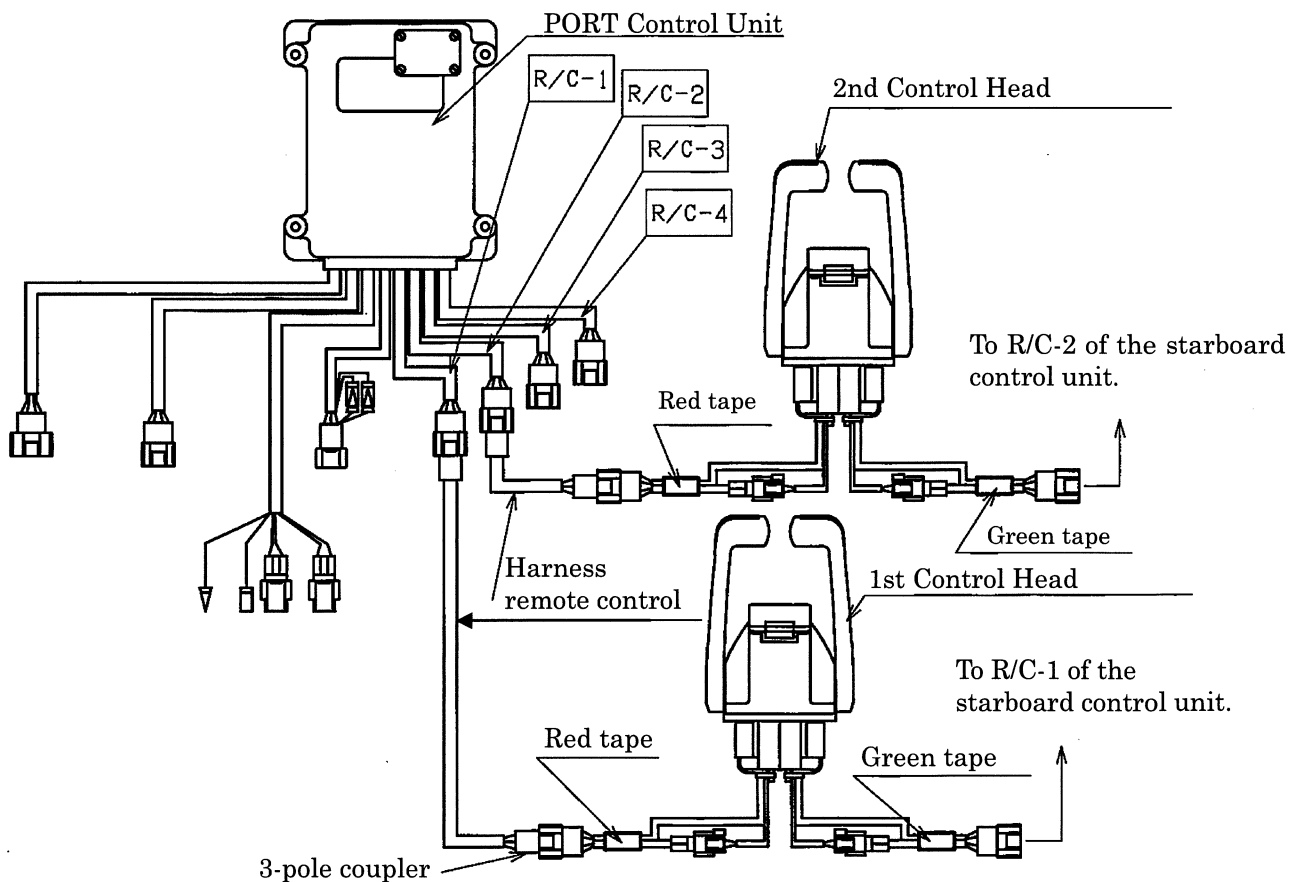


# CONNECTING CONTROL HEAD & CONTROL UNIT

## ⚠ CAUTION

1. All connectors must be mated firmly; the system may fail to operate otherwise.
2. Be sure to connect a control head to R/C-1. When power is applied, the control head connected to R/C-1 is the first one to become operative.

- (1) Connection of the first control head
  - \*Connect the harness remote control to the red-taped harness of the control head and the other end to R/C-1 of the port control unit.
  - \*Connect the harness remote control to the green-taped harness of the control head and the other end to R/C-1 of the starboard control unit.
- (2) Connection of the second control head if applicable
  - \*Carry out connection to R/C-2 of each control as described in (1).
- (3) Connection of the third control head if applicable
  - \*Carry out connection to R/C-3 of each control as described in (1).
- (4) Connection of the fourth control head if applicable
  - \*Carry out connection to R/C-4 of each control as described in (1).
- (5) Connection of the fifth control head if applicable
  - \*Carry out connection to R/C-5 of each control as described in (1).



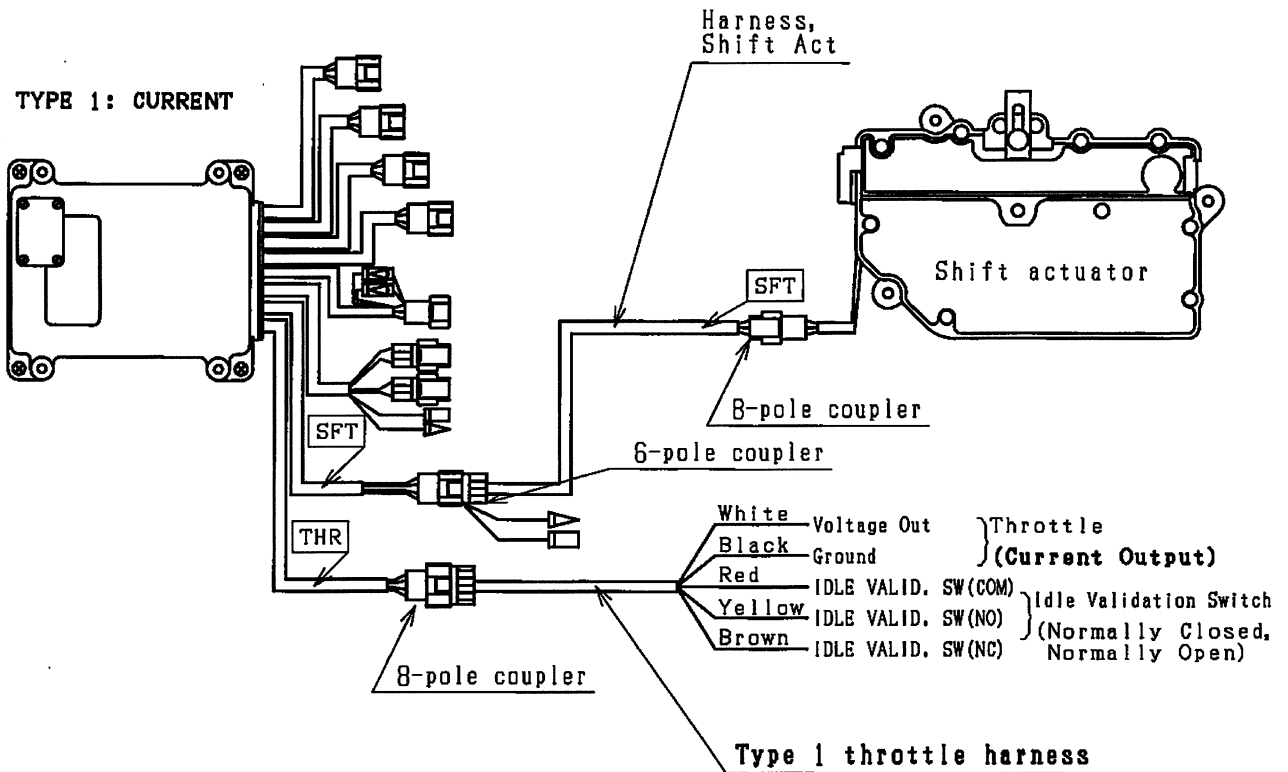
# CONNECTING ENGINE & SHIFT ACTUATOR TO CONTROL UNIT

## ⚠ CAUTION

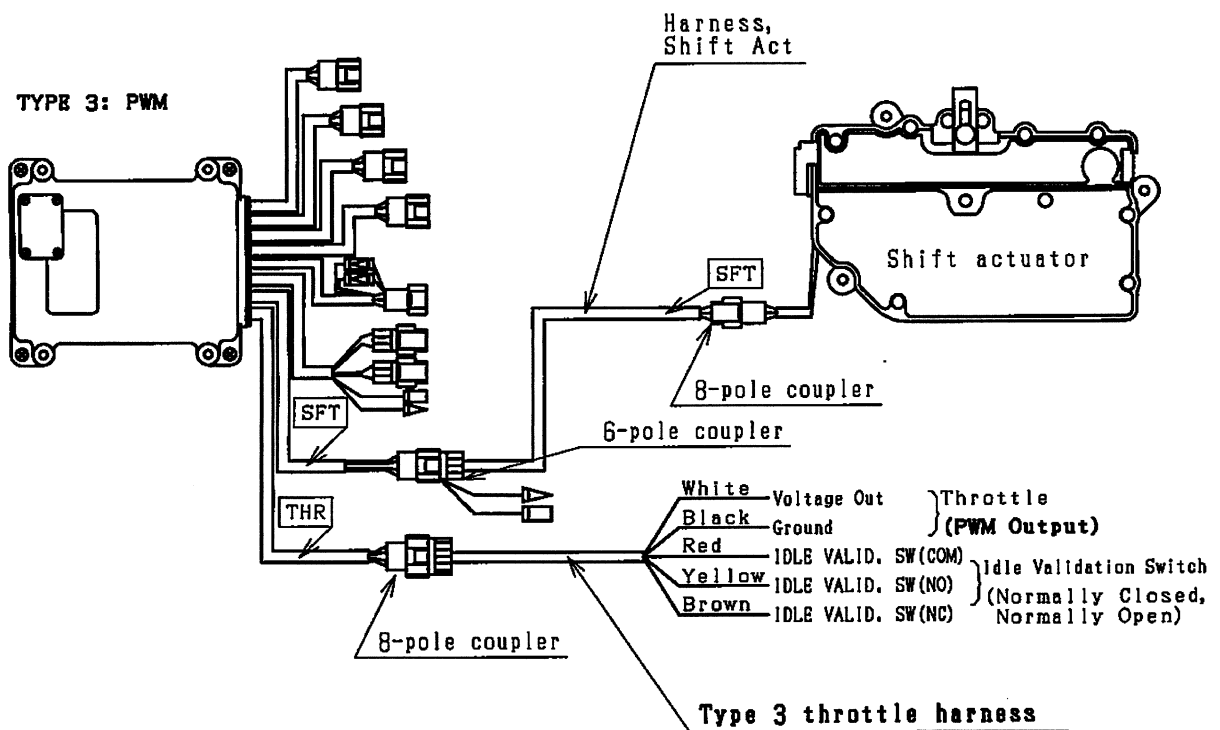
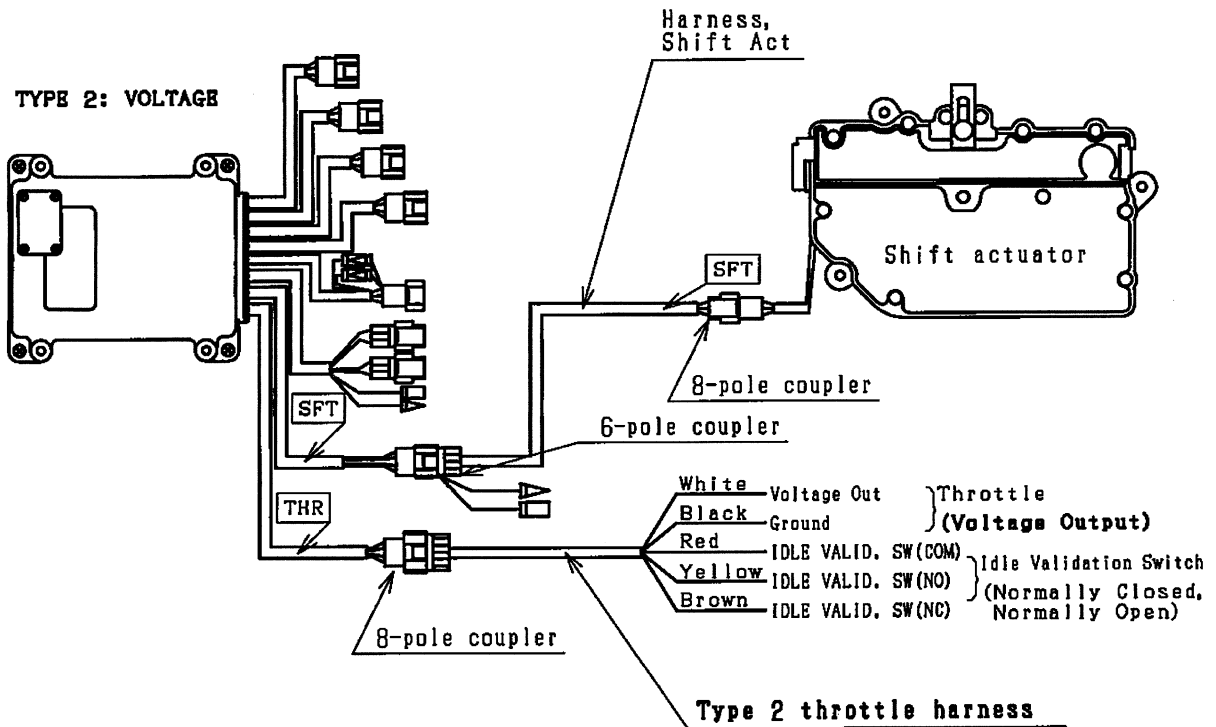
1. Be sure to use the correct throttle harness: Type 1 (current), Type 2 (Voltage) or Type 3 (PWM) to match your engine input requirements; otherwise throttle will not function properly. Consult engine maker if necessary.
2. Connect IVS (red, yellow, brown) *only* if required for your engine setup. Consult engine maker if necessary.

### Instructions:

1. Determine the type of throttle harness (Type 1, 2 or 3) that is required for your engine. Refer to Product Specifications and Components List sections in this manual for part number details.
2. Connect one end of the throttle harness to the throttle (THR) connectors on the control unit.
3. Connect the other end of these harnesses to the engine and gearbox connectors; refer to engine instructions for confirmation if necessary.
4. Connect one end of the shift harness to the control unit and the other end to the shift actuator connector.
5. Connect IVS (red, yellow and brown) if required by engine maker for proper operation.



# CONNECTING ENGINE & SHIFT ACTUATOR TO CONTROL UNIT (continued)



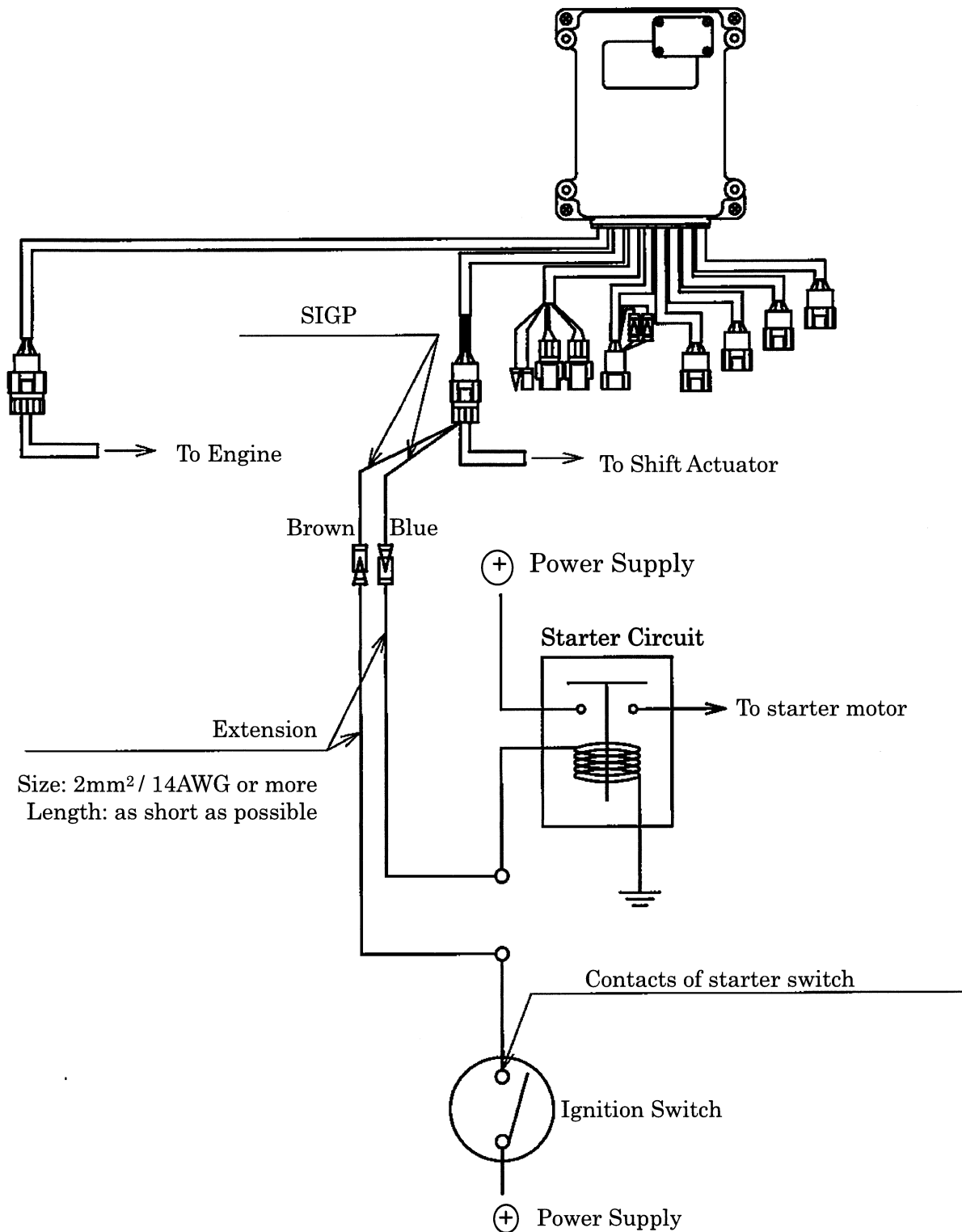
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# CONNECTING SIGP: START-IN-GEAR PROTECTION

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Instructions:

1. Connect between the starter circuit and the ignition switch of the boat.
2. Select extension wires that are as thick (2mm<sup>2</sup>/ 14AWG or more) and short as possible. Excessively long extensions could cause voltage drop, resulting in failure of engine start.



# CONNECTING POWER

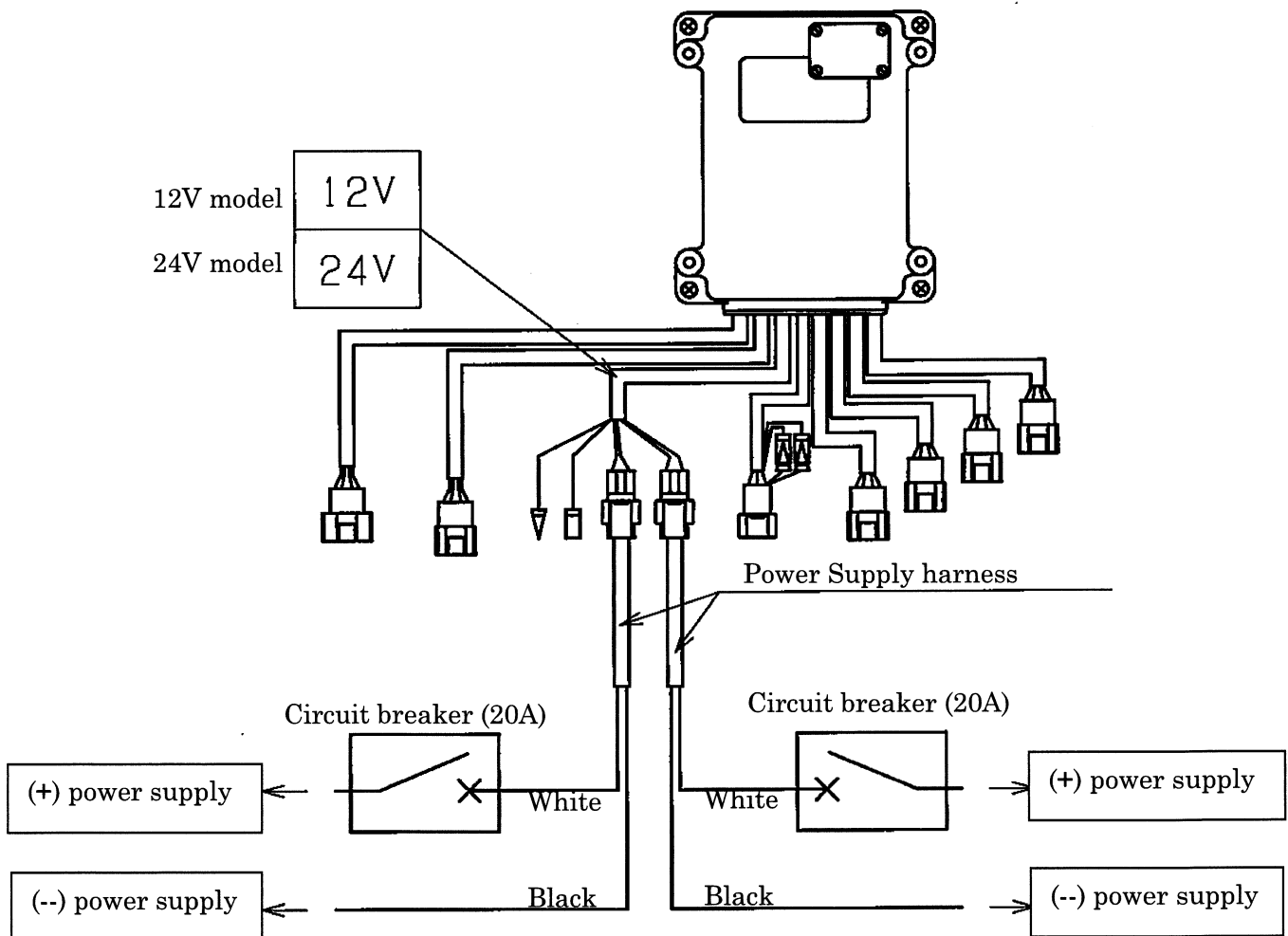
## ⚠ CAUTION

1. As a safety feature, a duplex power line system is provided. Be sure to connect both lines. Alarm code LED's will flash if only one power line is connected.
2. Once the power harness is connected to power (battery), do not attempt to disconnect the power harness from the control unit unless power is first disconnected via circuit breaker or battery switch.

### Instructions:

1. Connect the system power harnesses to the control unit before connecting each power harness to battery (power supply).
2. Connect each black wire of the power harness directly to (- minus) of battery (power).
3. Connect each white wire of the power harness, via the optional 20 amp circuit breaker, via the boat circuit breaker or directly to (+ plus) of battery (power).

Note: If two batteries are provided, it is recommended to separate the power lines between each battery and connect one (plus breaker) to each battery.



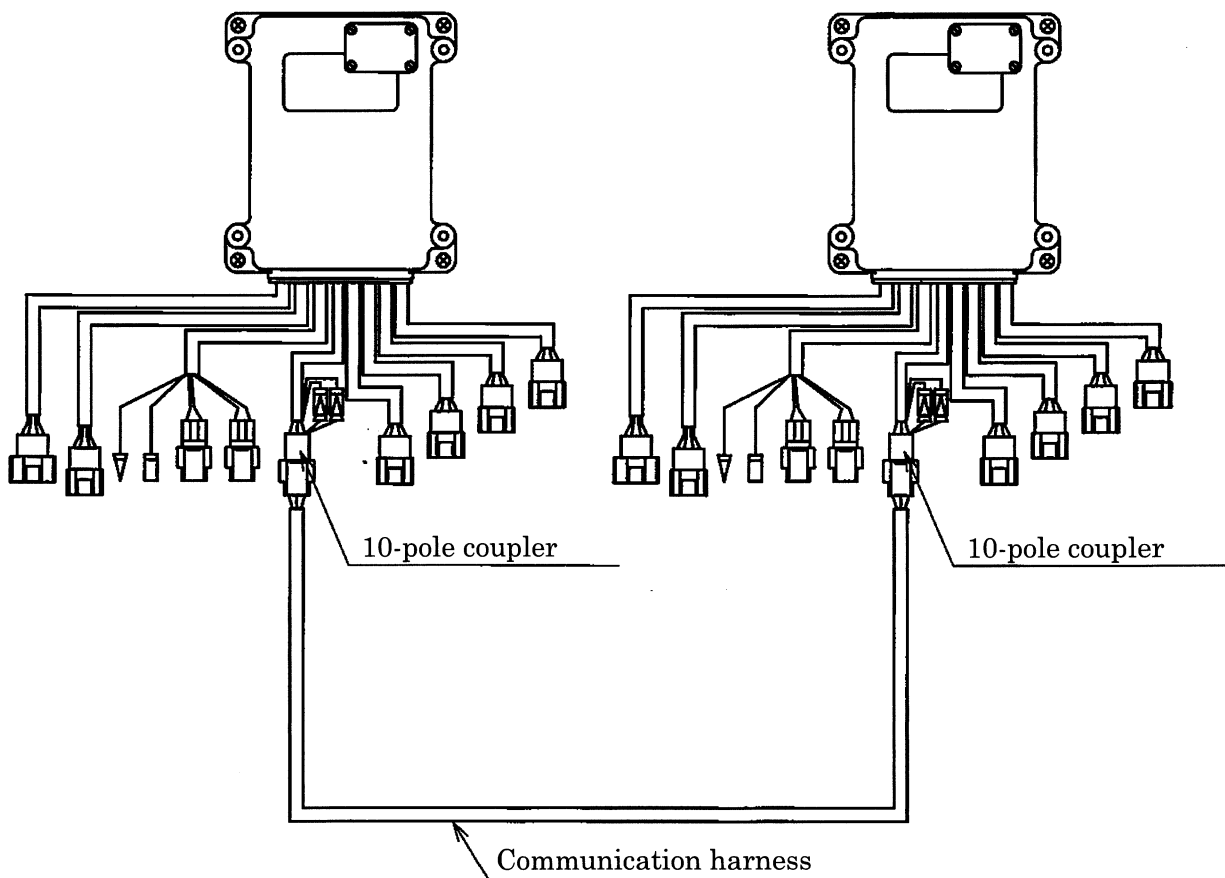
# CONNECTING COMMUNICATION HARNESS

## CAUTION

Turn off circuit breaker or battery switch before connecting to or disconnecting the communication harness from the control unit.

### Instructions:

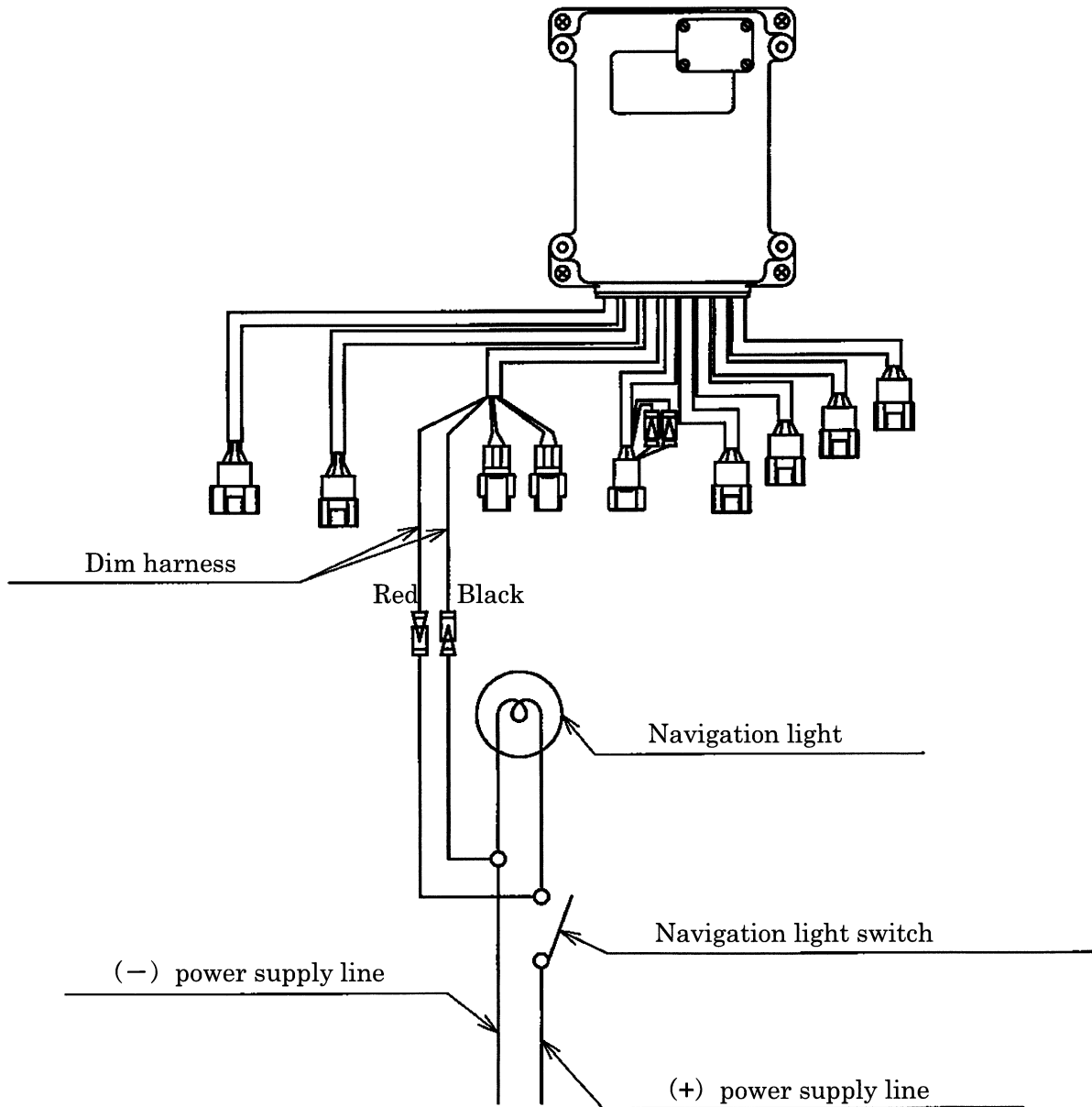
Connect the two control units via the communication harness, which has a 10-pole coupler at each end for a dual engine system.



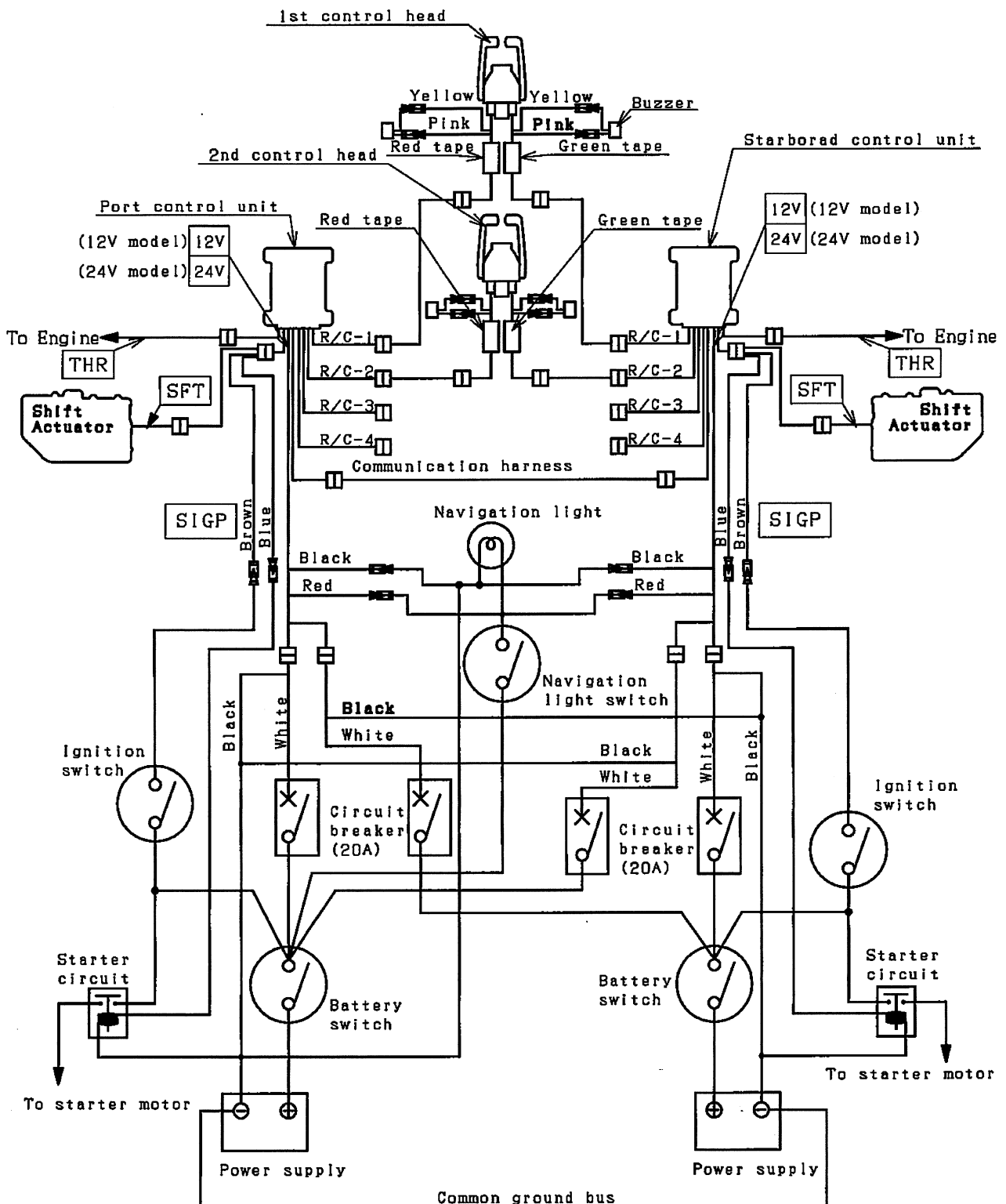
# CONNECTING DIM HARNESS (OPTIONAL)

Instructions:

1. Connect the Dim harness Red line to the(+PLUS) wire of navigation light.
2. Connect the Dim harness Black line to the(-MINUS) wire of navigation light.



# OVERALL WIRING DIAGRAM



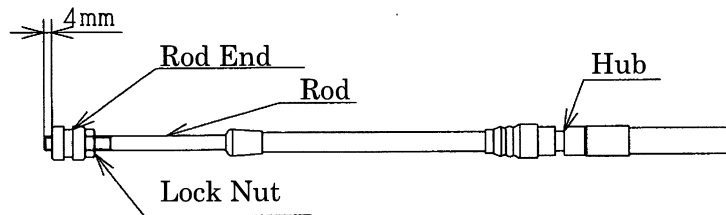
Note: The diagram above shows a case with two engines operated from two control heads with optional buzzer.



# PUSH-PULL CABLE INSTALLATION

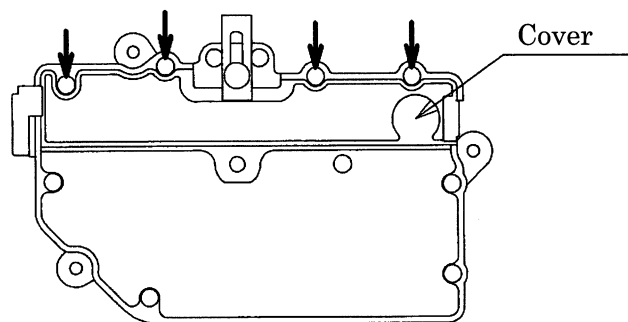
## Instructions: Push-pull cable installation to the actuator:

1. Install the attached rod end to the rod and fasten with lock nut.

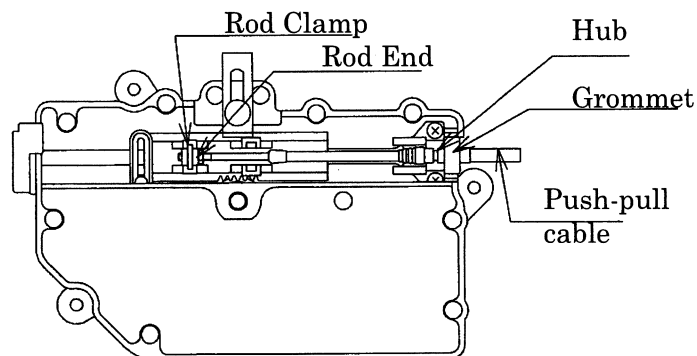


Tightening torque : 2.9~4.4N · m (2.1 ~ 3.2 lbf · ft)

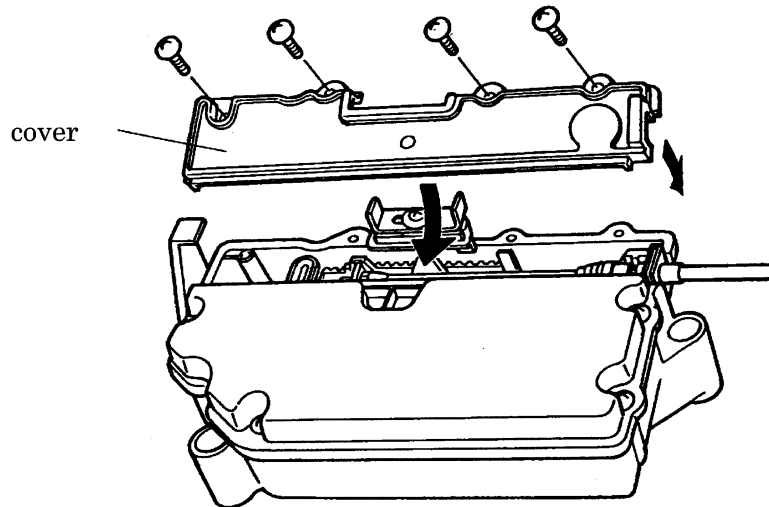
2. Remove four actuator screws shown by arrow and remove the cover.



3. Install waterproof grommet to the push-pull cable. Install the rod end, rod clamp, hub, and waterproof grommet to the actuator mount groove as shown below.



4. Replace the cover onto the actuator with the 4 screws.



Tightening torque : 1.2~1.8N · m (0.9 ~ 1.3 lbf · ft)

### CAUTION

1. Be sure to completely install the push-pull cables in the actuator before installing the other ends to the engine & gear.
2. Also turn OFF power supply to the control unit before installing the push-pull cables to the engine & gear.
3. Install the cables onto the engine as per the engine manual.
4. Please make sure that the system is installed such that the push-pull cable motions correspond properly with the engine and gearbox mode of operation (i.e. stroke direction and distance); otherwise damage could occur.

#### Instructions: Push-pull cable installation to the marine gear (Initialization)

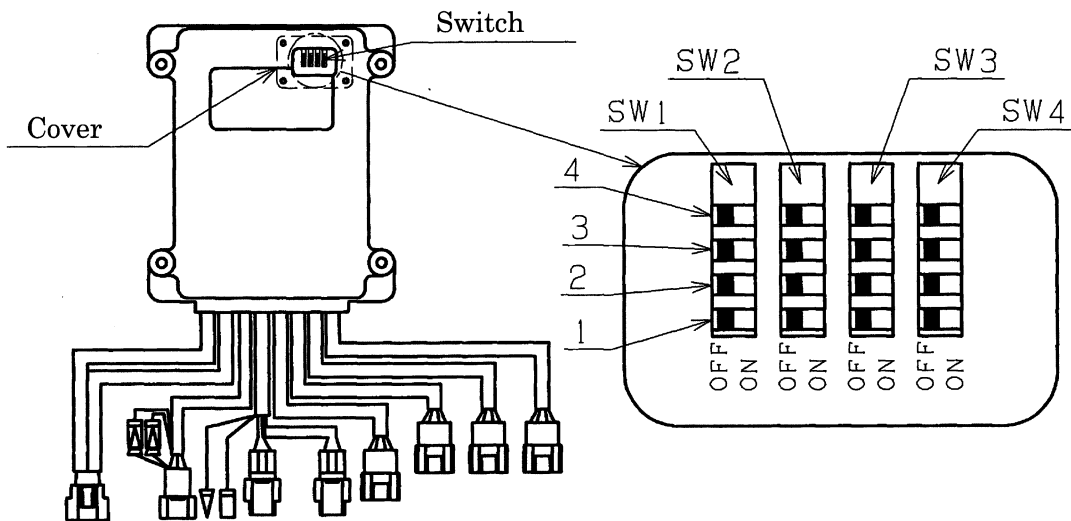
- turn power ON to KE control system
- set the control head connected to R/C-1 to the neutral position
- throttle actuator comes to the neutral position
- positioning is completed when the neutral LED goes ON.
- install the push-pull cables according to the gear instruction manual.

# ADJUSTING THE CONTROL UNIT

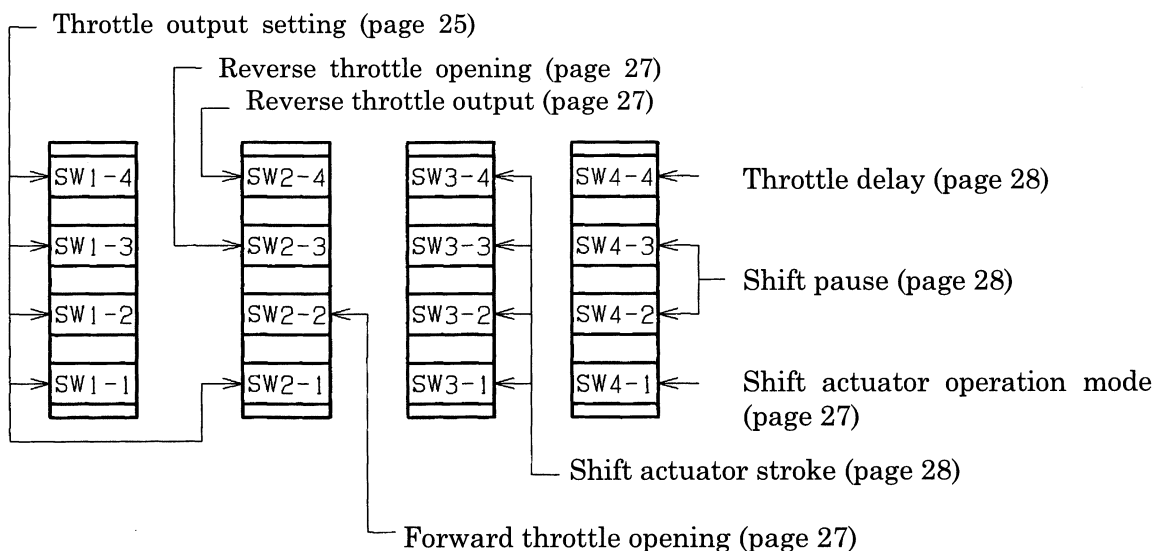
## ⚠ CAUTION

1. Be sure to turn OFF the power to the control unit before removing the push-pull cables from the engine / gear.
2. Once control unit adjustment is completed, re-install the cover for proper seal, torque to 1.0 ~ 1.7 N · m (0.7 ~ 1.2 lbf · ft).
3. Afterwards, carry out positioning of the actuator (see previous page).

**Instructions:** To adjust KE system settings compatibility with engine and gear, remove the control unit small cover (4 screws) and modify the DIP switch configurations, based on the tables below.



### List of switch functions



**Throttle output setup.**

Throttle harness type (1, 2 or 3) and output settings are selected according to engine type. For throttle harness selection details, refer to 'Output' section on page 2 & 'Connecting to Engine' section on pages 15 & 16 of this manual. For throttle output settings, refer to page 19 and to the following tables to determine the proper control unit DIP switch settings. If necessary, contact engine maker for engine input signal requirements to determine the optimal DIP switch settings. Before setting dip switches, make sure power is OFF.

**Table 1: Throttle Type1 (Current Output) Typical Settings**

Engine	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 2-1	Idle Output	Forward Full Throttle Output
MTU(except 183,396) MAN, Volvo	OFF	OFF	OFF	OFF	OFF	4.0mA	20.0mA
Other available Adjustments Example: Cummins KTA, Centry 8	ON	OFF	OFF	OFF	OFF	4.0mA	20.5mA
	OFF	ON	OFF	OFF	OFF	4.0mA	21.0mA
	ON	ON	OFF	OFF	OFF	4.0mA	19.5mA
	OFF	OFF	ON	OFF	OFF	4.0mA	19.0mA
	ON	OFF	ON	OFF	OFF	4.5mA	20.0mA
	OFF	ON	ON	OFF	OFF	4.5mA	20.5mA
	OFF	OFF	OFF	ON	OFF	4.5mA	21.0mA
	ON	OFF	OFF	ON	OFF	4.5mA	19.5mA
	OFF	ON	OFF	ON	OFF	4.5mA	19.0mA
	ON	ON	OFF	ON	OFF	5.0mA	20.0mA
	OFF	OFF	ON	ON	OFF	5.0mA	20.5mA
	ON	OFF	ON	ON	OFF	5.0mA	21.0mA
	OFF	ON	ON	ON	OFF	5.0mA	19.5mA
	OFF	OFF	OFF	OFF	ON	5.0mA	19.0mA
	ON	OFF	OFF	OFF	ON	3.5mA	20.0mA
	OFF	ON	OFF	OFF	ON	3.5mA	20.5mA
	ON	ON	OFF	OFF	ON	3.5mA	21.0mA
	OFF	OFF	ON	OFF	ON	3.5mA	19.5mA
	ON	OFF	ON	OFF	ON	3.5mA	19.0mA
	OFF	ON	ON	OFF	ON	3.0mA	20.0mA
	OFF	OFF	OFF	ON	ON	3.0mA	20.5mA
	ON	OFF	OFF	ON	ON	3.0mA	21.0mA
	OFF	ON	OFF	ON	ON	3.0mA	19.5mA
	ON	ON	OFF	ON	ON	3.0mA	19.0mA
	OFF	OFF	ON	ON	ON	4.0mA	20.0mA
	ON	OFF	ON	ON	ON	4.0mA	20.0mA
	OFF	ON	ON	ON	ON	4.0mA	20.0mA

※Before shipment, the switches are set to OFF(4.0mA to 20.0mA output).

**Table 2: Throttle Type 2 (Voltage Output) Typical Settings**

Engine	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 2-1	Idle Output	Forward Full Throttle Output
Detroit Diesel John Deere Steyr (single input)	OFF	OFF	OFF	OFF	OFF	0.50V	4.50V
Cummins Quantum	OFF	OFF	OFF	ON	ON	0.65V	4.35V
				OFF	ON	0.50V	4.35V
				ON	OFF	0.65V	4.50V
Volkswagen, Iveco FPT	OFF	ON	OFF	OFF	OFF	0.20V	4.53V
				OFF	ON	0.20V	4.35V
				ON	OFF	0.40V	4.53V
				ON	ON	0.40V	4.35V
Scania, including DI13 equipped with coordinator interface	ON	ON	OFF	OFF	OFF	0.40V	3.00V
				OFF	ON	0.40V	2.90V
				ON	OFF	0.50V	3.00V
				ON	ON	0.50V	2.90V
Other available adjustments	ON	OFF	OFF	OFF	OFF	0.90V	4.50V
				OFF	ON	0.90V	4.35V
				ON	OFF	1.05V	4.50V
				ON	ON	1.05V	4.35V
	OFF	OFF	ON	OFF	OFF	0.90V to 1.20V	4.00V
				OFF	ON	0.90V to 1.20V	3.88V
				ON	OFF	1.02V to 1.32V	4.00V
				ON	ON	1.02V to 1.32V	3.88V
	ON	OFF	ON	OFF	OFF	0.30V	4.50V
				OFF	ON	0.30V	3.90V
				ON	OFF	0.75V	4.50V
				ON	ON	0.75V	3.90V
	OFF	ON	ON	OFF	OFF	0.60V	4.10V
				OFF	ON	0.80V	4.20V
				ON	OFF	0.60V	4.40V
				ON	ON	0.80V	4.40V

※Before shipment, the switches are set to OFF(Idle 0.50V, Forward full throttle: 4.50V)

**Table 3: Throttle Type 3 (PWM Output) Typical Settings**

Engine	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 2-1	Idle Output (duty cycle)	Forward Full Throttle Output (duty cycle)
Caterpillar	*	*	*	OFF	OFF	8%	92%
Other available adjustments	*	*	*	OFF	ON	8%	94%
				ON	OFF	6%	92%
				ON	ON	6%	94%

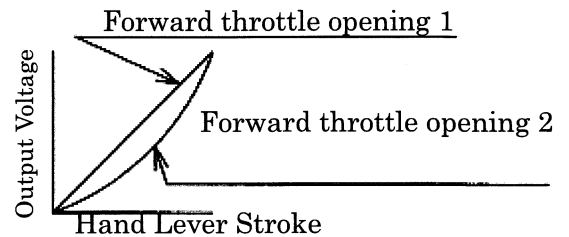
※Before shipment, the switches are set to OFF (Engine Type: Caterpillar).

### Forward throttle opening

Select the following DIP switch configurations for the desired forward throttle opening curve. This function facilitates fine throttle adjustment over the idle to low RPM range and decreases the shock effect if the hand lever is operated suddenly.

SW2-2	FUNCTION
OFF	Forward throttle opening 1
ON	Forward throttle opening 2

※Before shipment, the switch is set to OFF(opening 1).

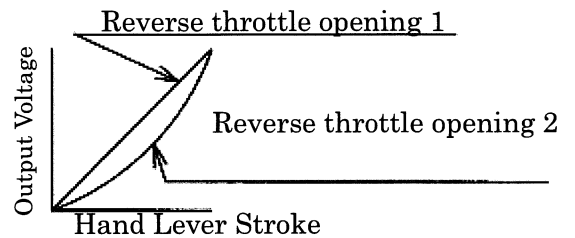


### Reverse throttle opening.

Select the following DIP switch configurations for the desired reverse throttle opening curve.

SW2-3	FUNCTION
OFF	Reverse throttle opening 1
ON	Reverse throttle opening 2

※Before shipment, the switch is set to OFF(opening 1).



### Reverse throttle output

Select the following DIP switch configurations for the desired reverse throttle setting.

SW2-4	FUNCTION
OFF	100% of the forward full open
ON	60% of the forward full open

※Before shipment, the switch is set to OFF (100% of the full forward throttle stroke).

### Shift actuator operation mode

Select the following DIP switch configurations to set whether the clutch is shifted to the forward position by pushing out the cable or by pulling in the cable. (Confirm on the clutch side).

SW4-1	FUNCTION
OFF	Pull to go Forward
ON	Push to go Forward

※Before shipment, the switch is set to OFF (pull to go Forward).

**Shift actuator stroke: Forward**

Select the following DIP switch configurations for the desired forward shift stroke setting.

SW 3-1	SW 3-2	STROKE
ON	OFF	26mm
OFF	ON	30mm
OFF	OFF	34mm
ON	ON	40mm

※Before shipment, both the switches are set to OFF(34mm stroke).

**Shift actuator stroke: Reverse**

Select the following DIP switch configurations for the desired reverse shift stroke setting.

SW 3-3	SW 3-4	STROKE
ON	OFF	26mm
OFF	ON	30mm
OFF	OFF	34mm
ON	ON	40mm

※Before shipment, both the switches are set to OFF(34mm stroke).

**Throttle delay**

Select the following DIP switch configurations for the desired throttle delay setting. This function delays (~ 1-2 secs) the shock effect if the hand lever is operated suddenly from neutral to throttle.

SW4-4	FUNCTION
OFF	No throttle delay
ON	Throttle delay

※Before shipment, the switch is set to OFF(no throttle delay).

**Shift pause**

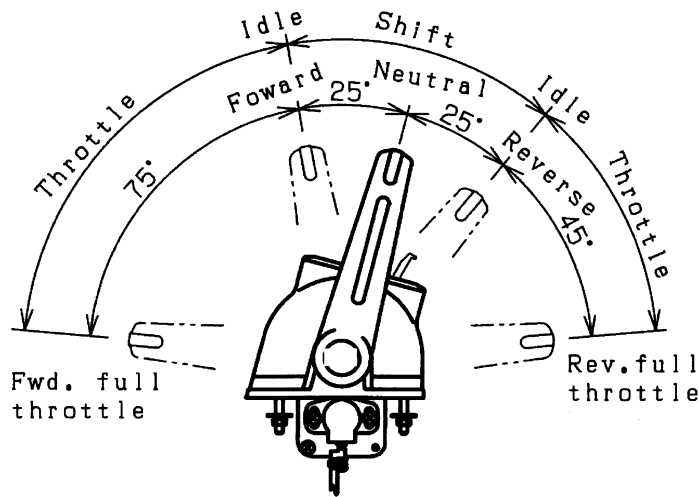
Select the following DIP switch configurations for the desired shift pause setting. This function delays the shock effect if the hand lever is operated suddenly from throttle to neutral.

SW 4-2	SW 4-3	FUNCTION
OFF	OFF	No shift pause
ON	OFF	2 seconds
OFF	ON	4 seconds
ON	ON	6 seconds

※Before shipment, both the switches are set to OFF(no shift pause).

# OPERATION CHECK

Carry out operation check as follows when the installation work is completed.



## ⚠ CAUTION

1. Never operate the hand lever while the engine is not running; otherwise, the actuator, push-pull cable, or engine / marine gear may be damaged.
2. Please make sure that the system is installed such that the push-pull cable motions correspond properly with the engine and gearbox mode of operation (i.e. stroke direction and distance); otherwise damage could occur.

### Shift and throttle operation check

Step	Hand lever operation	Description (engine side)
1	Neutral → Forward	Shift actuator: from neutral to forward position
2	Forward → Forward full open	Throttle: from fully closed to fully open
3	Forward full open → Neutral	Throttle: from fully open to fully closed Shift actuator: from forward to neutral position
4	Neutral → Reverse	Shift actuator: from neutral to reverse position
5	Reverse → Reverse full open	Throttle: from fully closed to fully open
6	Reverse full open → Neutral	Throttle: from fully open to fully closed Shift actuator: from reverse to neutral position

If the correct operation cannot be made, change the operation mode. (refer to “Adjusting the Control Unit”). When the Forward/Neutral/Reverse LED’s flash, refer to “Alarm Codes”.

### Confirmation of SIGP function

Step	Description	OK	Countermeasure if NOT OK
1	Set the hand lever to NEUTRAL and start the engine	Engine starts.	Shorten the SIGP harness. (See page 17)
2	Shift the hand lever to FORWARD and start the engine.	Engine does not start.	Connect the SIGP harness. (See page 17)



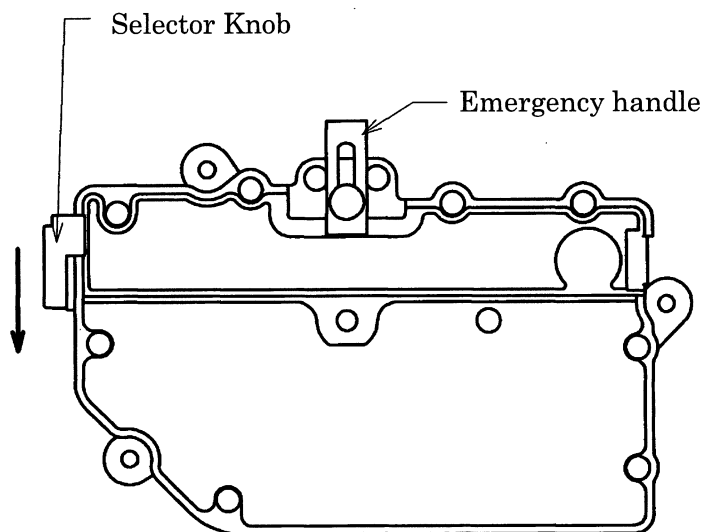
# MANUAL OPERATION METHOD (OPTION)

## CAUTION

Attempt manual operation only in case of emergency (i.e. electrical system failure). Use for immediate return to shore.

### Instructions:

1. Tilt the selector knob in the arrow direction to the end.
2. The actuator can be operated manually via the emergency handle.
3. Return the selector knob to the original position after manual operation is no longer necessary.



# ALARM CODES

In case of a system operation fault, the failure code is indicated via the Forward/Neutral/Reverse LED's flashing frequency on the control head plus via an optional buzzer.

LED Flash Frequency	Possible Cause	Check / Countermeasure	Reference
1  *  Shift Actuator Signal	(1) Shift actuator and control unit are not connected correctly.  (2) Shift actuator set to the manual operation.  (3) Shift actuator harness wire damaged or shorting.  (4) Harness Shift Act/Throttle with wire breakage or shorting.  (5) 12-pole coupler harness of the control unit with wire breakage or shorting.	(1) Reconnect the shift actuator and control unit.  (2) Set the actuator to NEUTRAL and set the selector knob to "Electronic Operation".  (3) Consult dealer for replacement item.  (4) Replace the harness Shift Act/Throttle.  (5) Consult dealer for replacement item.	page 15  page 30  page 15
3  ***  Control Head Signal	(1) Control head is not connected to R/C-1 of control unit  (2) Control head and control unit are not connected correctly.  (3) Three-pole coupler of control head is disconnected.  (4) Control head harness wire damaged or shorting.  (5) Harness remote control wire damaged or shorting.  (6) R/C-1, 2, 3, and 4 harnesses of control unit wire damaged or shorting.	(1) Connect the control head to R/C-1.  (2) Reconnect the control head and control unit.  (3) Connect the three-pole coupler.  (4) Consult your dealer.  (5) Replace the harness remote control.  (6) Consult dealer for replacement item.	page 14  page 14  page 14  page 14

LED Flash Frequency	Possible Cause	Check / Countermeasure	Reference
4  ****  Shift Actuator	(1) Push-pull cable installed without positioning of the shift actuator.  (2) Shift actuator stroke exceeding stroke of clutch. (3) Shift actuator set to the manual operation.  (4) Loose cable end of the shift actuator.  (5) Loose nut of the clutch connection.  (6) Shift actuator harness wire damaged or shorting. (7) Harness Shift Act/Throttle wire damaged or shorting.  (8) 12-pole coupler harness of control unit wire damaged or shorting.  (9) Heavy gear load, resulting in failure of smooth shift actuator operation.	(1) Perform proper cable positioning & initialization of actuator.  (2) Reduce the stroke of shift actuator.  (3) Set the actuator to the neutral position and set the selector knob to "Electronic Operation". (4) Fix the cable end.  (5) Retighten the gear connection nut.  (6)Consult dealer for replacement item. (7) Replace the Harness Shift Act/ Throttle.  (8)Consult dealer for replacement item.  (9) Reduce clutch side load.	page 22  page 24,27  page 30  page 22  page 23  page 15
6  *****  * Power	(1) One of duplex power lines is disconnected.  (2) Either circuit breaker is OFF. (3) Harness power supply coupler is Not connected correctly.  (4) Battery voltage beyond the operating voltage range.  (5) Harness power supply wire Damaged or shorted.  (6) 24 or 12V harness of the control unit is broken.	(1) Connect both lines.  (2) Turn ON both circuit breakers.  (3) Reconnect the coupler of harness power supply.  (4) Use the battery within the operating voltage range.  (5) Replace the harness power supply.  (6) Consult your dealer.	page 18  page 18  page 18  page 2  page 18
7  *****  ** Control Head	(1) Select switch kept pressed.  (2) Control head harness is shorted (3) Harness remote control is shorted  (4) R/C-1, 2, 3, and 4 harnesses of control unit shorting.	(1) Reset the select switch.  (2) Consult your dealer. (3) Replace the harness remote control.  (4)Consult dealer for replacement item.	page 7  page 4,5
8  *****  *** COM	(1) Communication harness wire damaged or shorting.  (2) One of the control units has no power.	(1) Replace the communication harness.  (2) Turn ON circuit breaker.	page 19
9  *****  **** TROLL	(1) Com./power harness wire damaged or shorting and trolling valve disengaged.	(1) Replace the com./power harness and engage trolling valve.	Refer to trolling manual

# TROUBLESHOOTING

Consult this table if problems occur without an associated flashing LED alarm code.

Symptom	Possible Cause	Check / Countermeasure
Not operating even when power supply is ON	(1) Harness power is not connected correctly.  (2) Circuit breaker OFF.	(1) Connect the harness power correctly. (See page 18)  (2) Turn ON circuit breaker.
No control head LED'S ON.	(1) Hand lever is not in neutral during initial operation.  (2) R/C-1 of the control unit is Not connected with the control head.	(1) Set the hand lever to NEUTRAL with power ON.(See Page 9)  (2) Connect the control head to R/C-1. (See page 14)
Any one of forward/neutral/reverse LED not ON.	(1) Wire damage in control head harness. (2) Wire damaged in harness remote control. (3) LED failure.	(1) Consult your dealer.  (2) Replace the harness remote control. (See page 14) (3) Consult dealer for replacement item.
Forward/neutral/Reverse LED'S are ON, but shift clutch does not engage.	(1) Push-pull cable to the shift actuator damaged.	(1) Replace the cable. (See page 22)
Engine does not start.	(1) Low battery voltage. (2) SIGP harness extension wire is too long.	(1) Charge the battery. (2) Shorten the SIGP harness extension wire. (See page 17)
Neutral throttle operation not functional.	(1) Neutral throttle operation is not set correctly.  (2) Faulty select switch.	(1) Carry out setting correctly. (See page 10)  (2) Consult your dealer.

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# MAINTENANCE

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KE-6a control system components contain moving parts and precision sensors. In order to ensure continued safe and reliable system operation in a marine environment, please refer to the following general guidelines on maintenance and service.

## **Control Head & Actuator**

1. Apply marine grease to exposed moving parts.
2. Component replacement is recommended after 100 000 operation cycles or after 5 years of extended use in marine environment.

## **Control Unit & Harnesses**

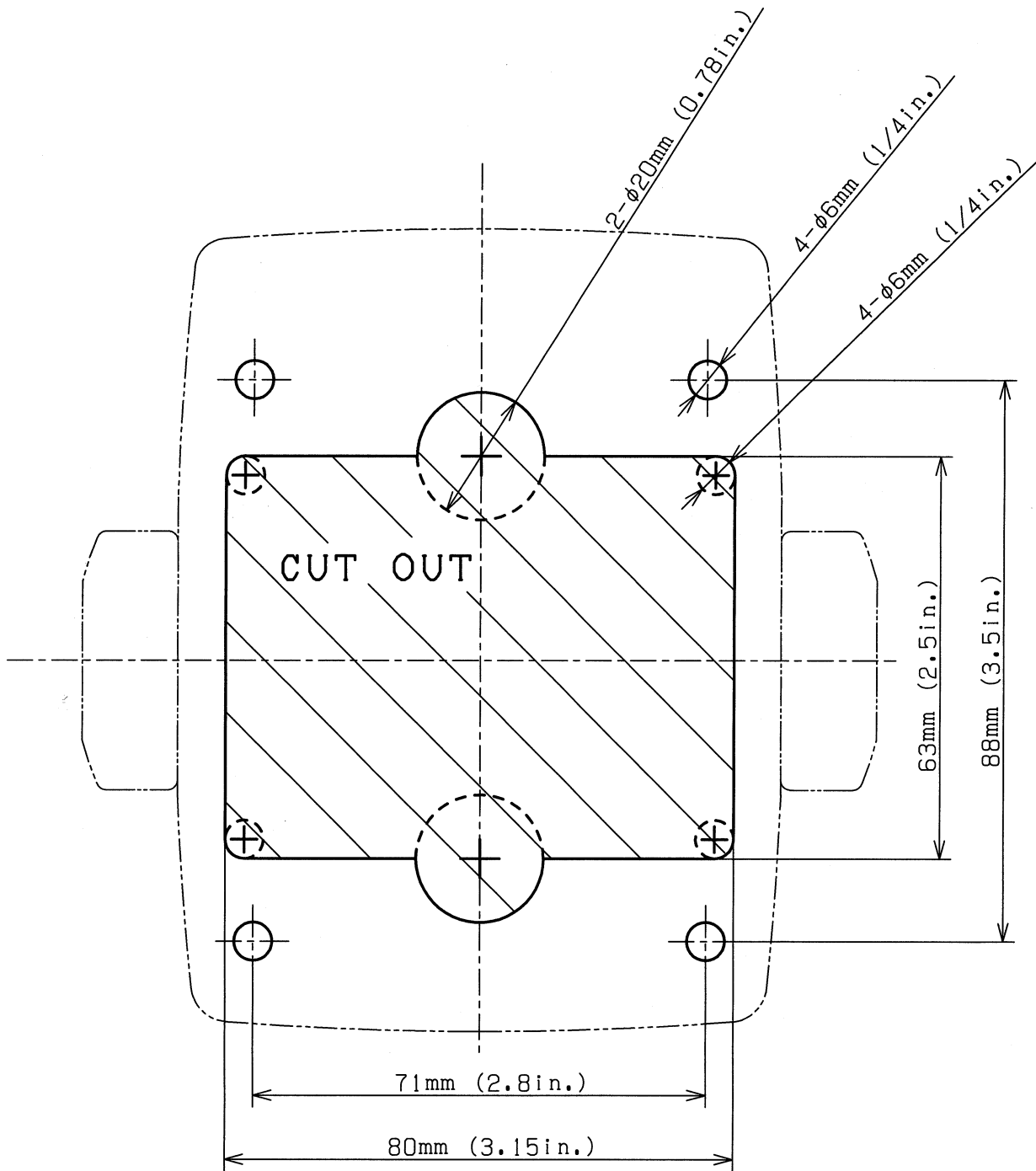
1. Check all harnesses for wiring damage periodically.
2. Check all connectors for proper seating periodically.
3. Component replacement is recommended after 7 years of extended use in marine environment.

## **Mechanical Push-pull cables**

1. Regularly check push-pull cable connections at both ends (actuator end, engine end) for looseness. Also check for smooth push-pull motion during actuator operation.
2. In the case of a ball joint type connection to cable & engine lever, carefully inspect abrasion and apply lubricant grease regularly.
3. For a standard 33C type cable installed with a bending radius of 200mm or less, component replacement of is recommended after 50 000 operation cycles in marine environment.

Note: In the case of KE control system transfer of ownership, please make sure to include maintenance and service information

# CONTROL HEAD TEMPLATE

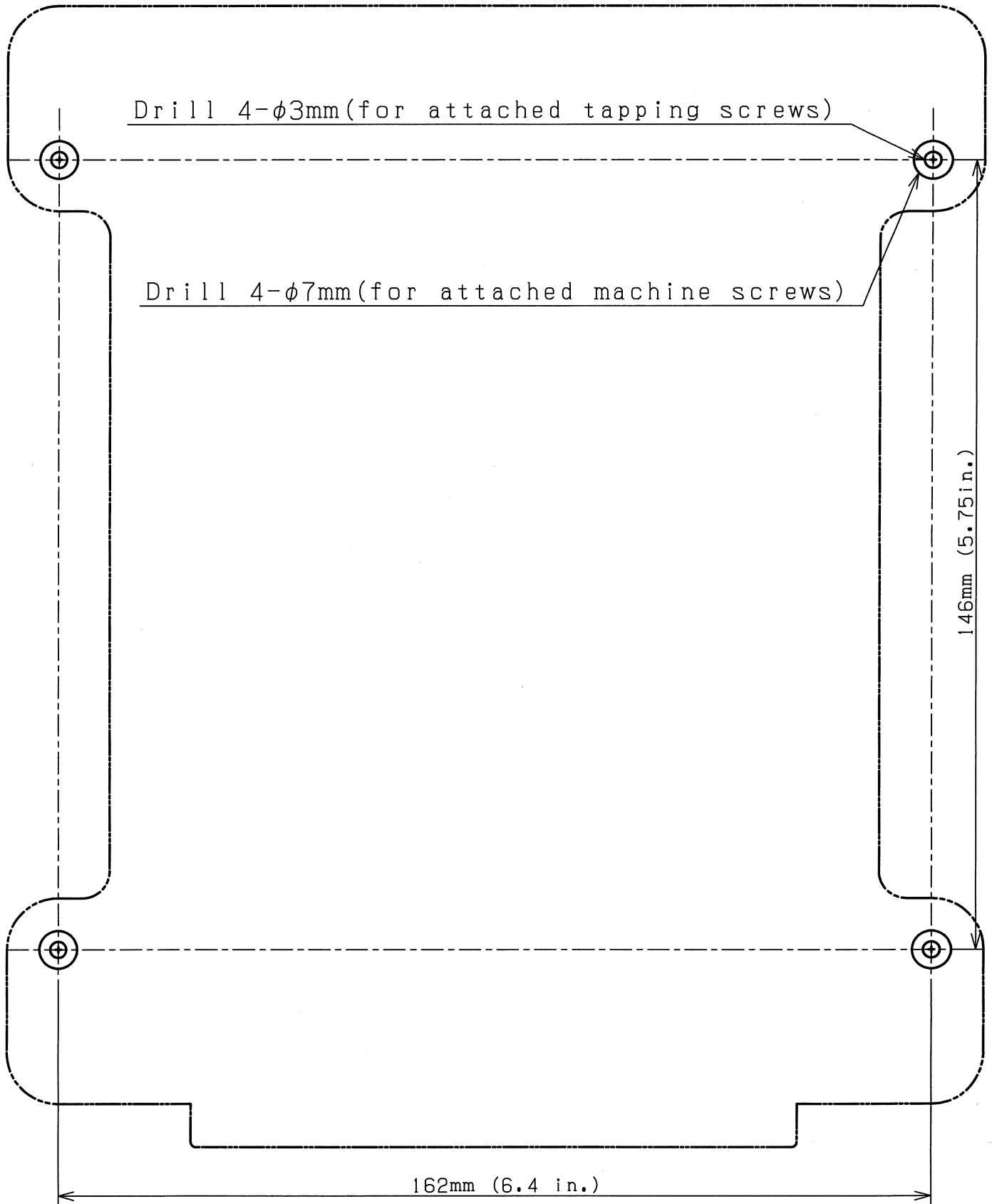




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# CONTROL UNIT TEMPLATE

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