

NHK MEC

KE-5a

ELECTRONIC CONTROL SYSTEM

INSTRUCTION MANUAL

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INTRODUCTION

This manual has been prepared to ensure your correct installation and operation of the KE-5a control system. Be sure to read this manual to understand the content thoroughly with care to prevent injury or damage to the property through abuse. Always keep the manual within your reach during operation. This product controls the shift (gear) and throttle (governor). It is recommended therefore to read the manual of 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.

SAFETY PRECAUTIONS

This manual contains precautions under the following headers, pay particular attention on these precautions.



WARNING

Failure to comply with a Warning may result in an accident of death or serious injury.



CAUTION

Failure to comply with a Caution may result in a minor or moderate injury or damage to the product or properties.

INSTALLATION / REPAIR

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.

PRODUCT SPECIFICATIONS

1. Electrical Performance

(1) Supply voltage (Harness, Power Supply): DC9V~31V

2. Outputs

(1) Type1 (Throttle: Current Output)

(a) Shift (Power Supply Voltage Output)

Forward Switch

Reverse Switch

Neutral Switch

Capacity: 9A max.

(b) Throttle

Current output: 4mA to 20mA

Idle Validation Switch (Normally Closed,
Normally Open)

Capacity: 24V, 2A max.

(2) Type2 (Throttle: Voltage Output)

(a) Shift (Power Supply Voltage Output)

Forward Switch

Reverse Switch

Neutral Switch

Capacity: 9A max

(b) Throttle

Voltage output: 0.2V to 4.5V

Idle Validation Switch (Normally Closed,
Normally Open)

Capacity: 24V, 2A max.

(3) Type3 (Throttle: PWM Output)

(a) Shift (Power Supply Voltage Output)

Forward Switch

Reverse Switch

Neutral Switch

Capacity: 9A max

(b) Throttle

PWM output: 6% to 94% Duty Cycle, 500Hz

Idle Validation Switch (Normally Closed,
Normally Open)

Capacity: 24V, 2A max.

Note:

For Type1 (Current Output)

Select the harness, Throttle P/N NM0641-05.

(Refer to the page 4, item ⑥)

The neutral switch can be utilized set with
SW3-4.

Note:

For Type2 (Voltage Output)

Select the harness, Throttle P/N NM0642-05.

(Refer to the page 4, item ⑥)

The neutral switch can be utilized set with
SW3-4.

Note:

For Type3 (PWM Output)

Set the dip switch SW1-1, 2 and 3“ON”.

(Refer to the page 22.)

Select the harness, Throttle P/N NM0643-05.

(Refer to the page 4, item ⑥)

The neutral switch can be utilized set with
SW3-4.

3. Temperature Range

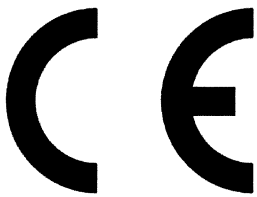
(1) Operating temperature:-20~+77° C

(2) Storage temperature :-40~+100° C

PRODUCT FUNCTIONS

- Shift: Forward/Reverse operation control
- Throttle: Acceleration/deceleration control
- Neutral throttle: Only throttle is activated in order to warm up the engine.
- Control Station Select: Up to 4 control heads + 1 handheld station.
- Start in Gear Protection: Enables engine start up only when the shift is in the neutral position.
- Dim display: Decreases brightness of the lamp on the control head in the night time.
- Alarm Codes: Detected system faults are indicated via flashing LED's on the control head.
- Buzzer (option): Combines audio alarm to LED codes

PRODUCT COMPLIANCE



ISO 9001
QUALITY



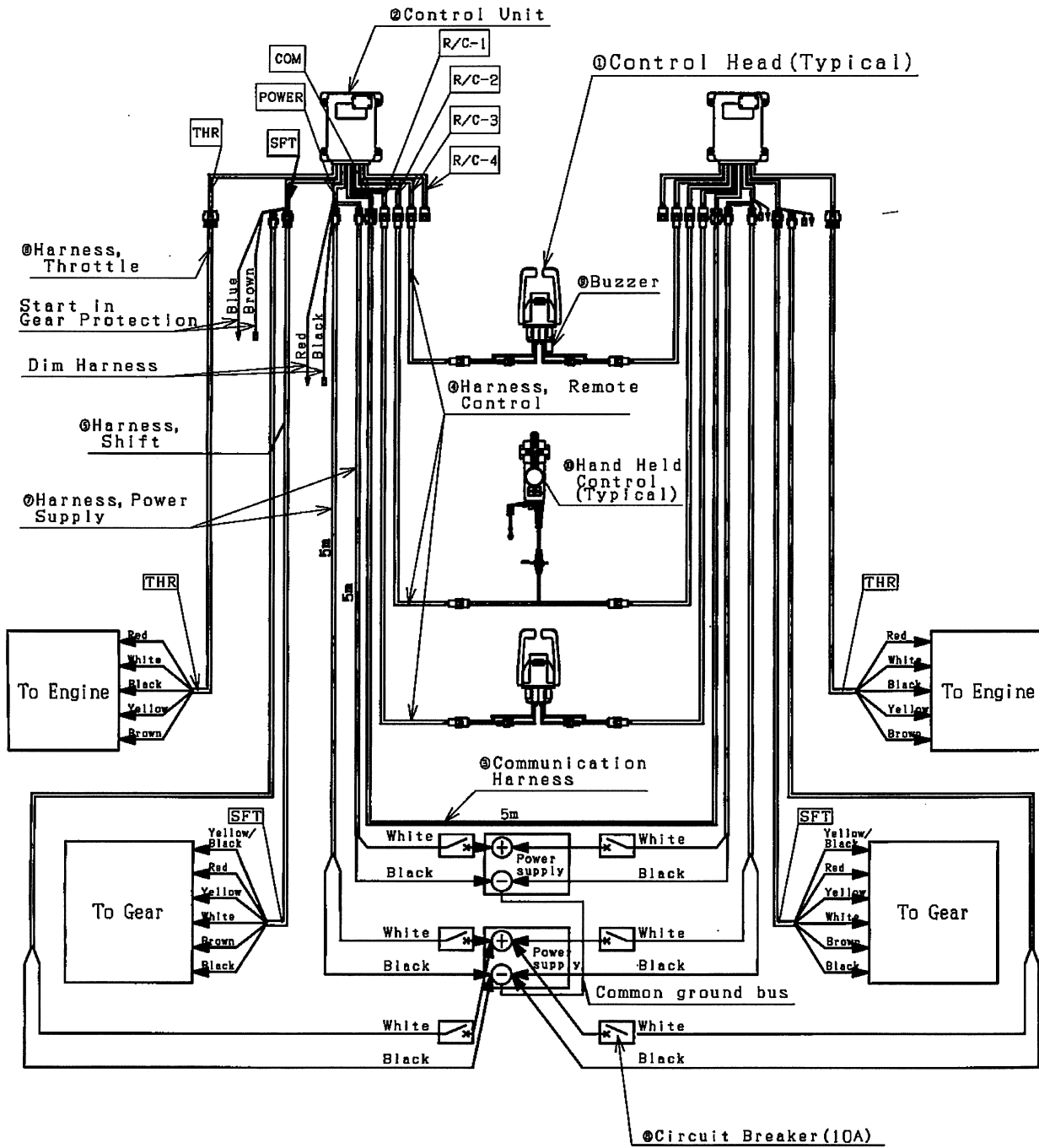
1. USA

- *ABYC*: This control system meets applicable requirements of various ABYC standards.
- *CFR*: It also meets 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).
- *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 CONFIGURATON



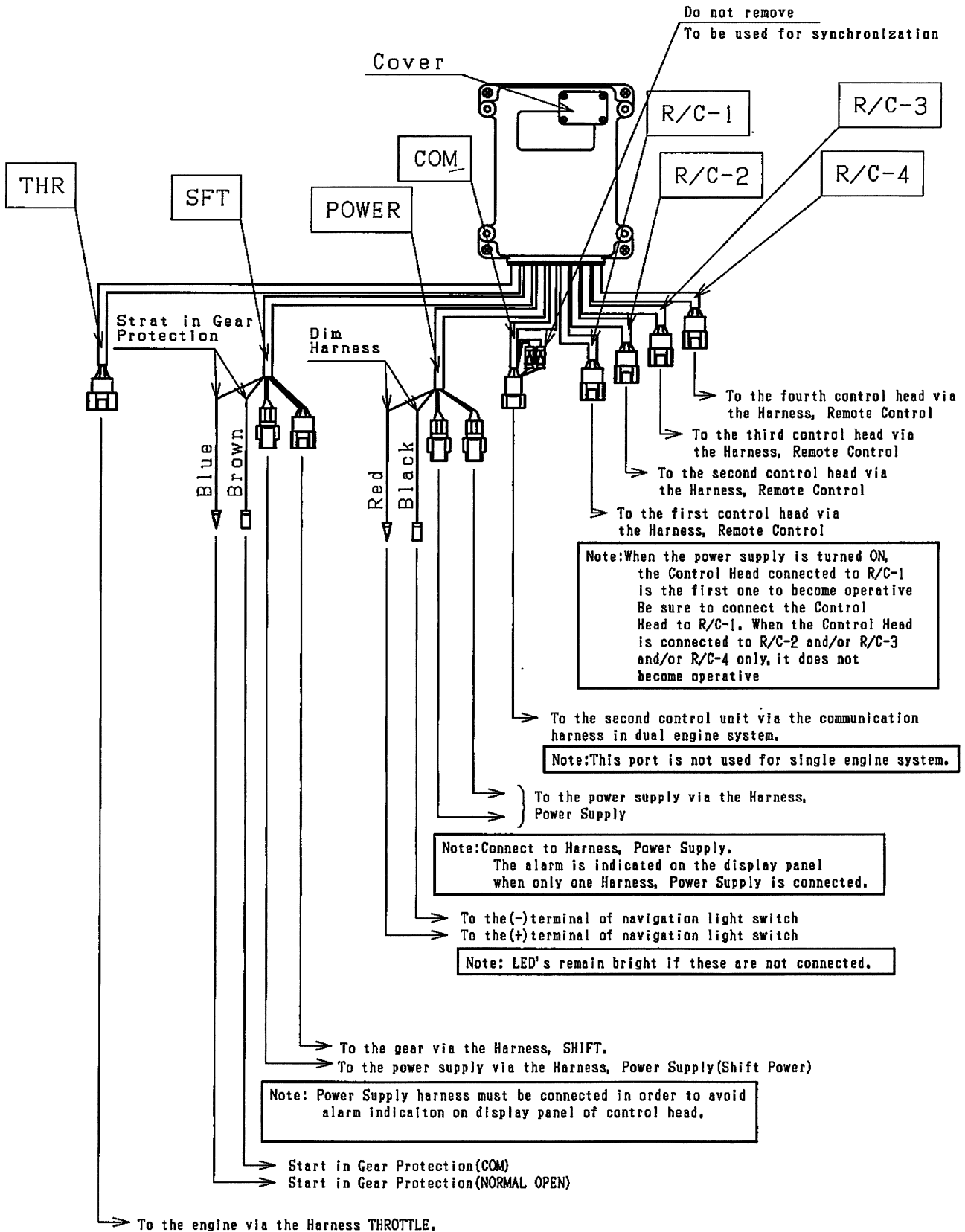
Note: Figure above is an example of a dual engine / 2 control stations system with optional handheld control and alarm buzzer.

COMPONENTS LIST

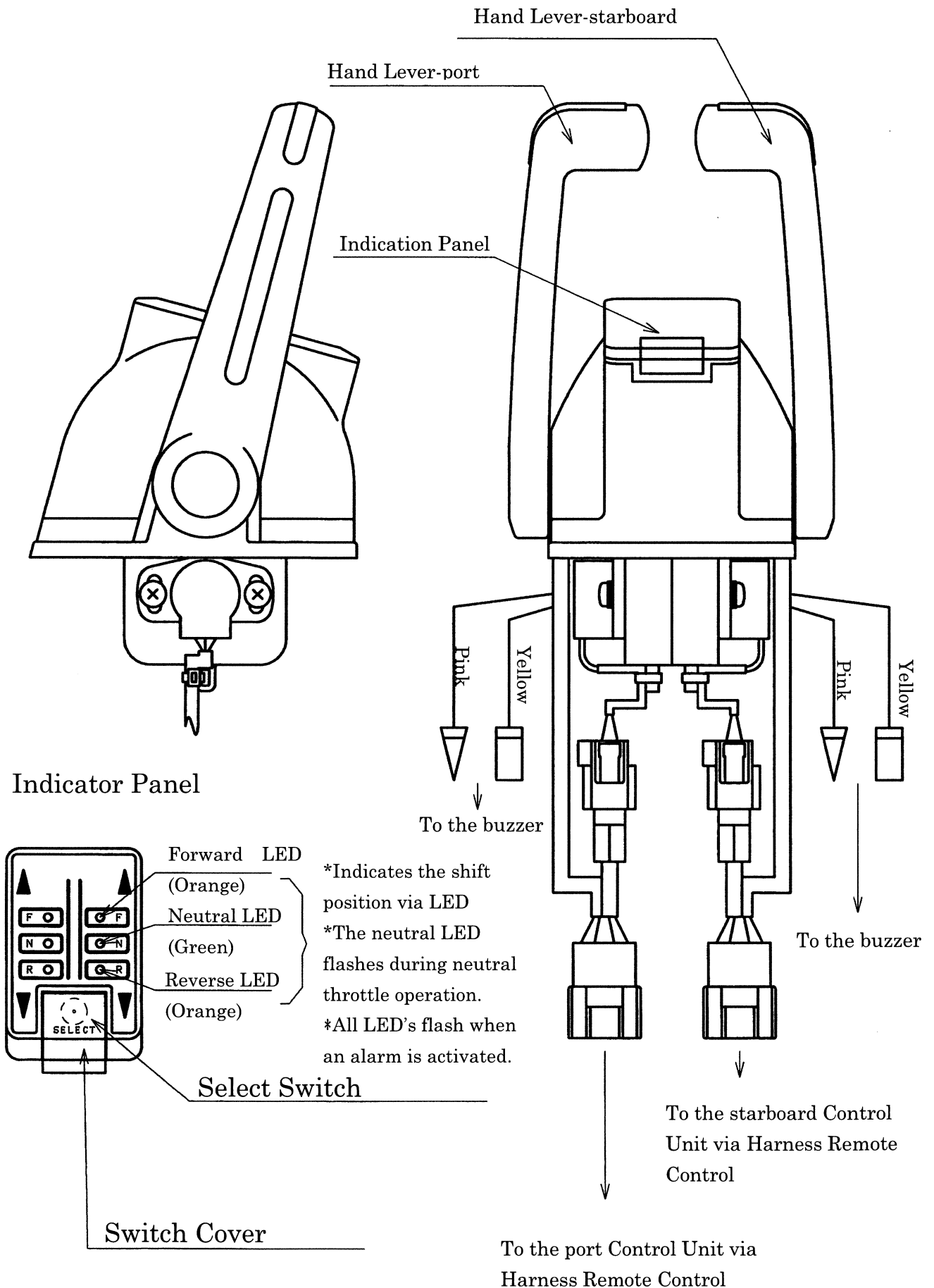
No.	Name		Part No.	Required								Note								
				Single engine				Two engines												
				1st	2nd	3rd	4th	1st	2nd	3rd	4th									
①	Control Head		NM0511-00	1	2	3	4	—	—	—	—									
			NM0510-00	—	—	—	—	1	2	3	4									
②	Control Unit		NM1444-00	1	1	1	1	2	2	2	2									
③	Communication Harness	5m	NM0619-05	—	—	—	—	1	1	1	1									
④	Harness, Remote Control	4m	NM0616-04									For length other than those listed, 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																			
50m	NM0616-50																			
⑤	Harness, Shift		NM0640-05	1	1	1	1	2	2	2	2									
⑥	Harness, Throttle	Type1 5m	NM0641-05	1	1	1	1	2	2	2	2	for Current output								
		Type2 5m	NM0642-05									for Voltage output								
		Type3 5m	NM0643-05									for PWM output								
⑦	Harness, Power Supply	5m	NM0414-28	3	3	3	3	6	6	6	6									
		10m	NM0414-33																	
⑧	Circuit Breaker	10A	NJ0595-00	3	3	3	3	6	6	6	6	Option.								
⑨	Buzzer	24V model	NJ0515-00	1	2	3	4	2	4	6	8	Option.								
		12V model	NJ0596-00																	
⑩	Hand Held Control		Handheld Control can be used in place of Control Head(①). Consult dealer for details								Option.									

Note: Select ⑥ Harness Throttle depending on the type of throttle output referring to the charts on page 2, item 3 "Outputs".

CONTROL UNIT



CONTROL HEAD



KE SYSTEM OPERATION


Initial 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. (A) Set the handle lever to the Neutral position.
(B) The green neutral LED(s) 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 into the neutral position. The green neutral LED(s) then lights ON indicating the control is operational.

3. When other control stations are required for operation that is 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 and press the select switch.
 - (C) The green neutral LED(s) then lights ON indicating the control is operational.

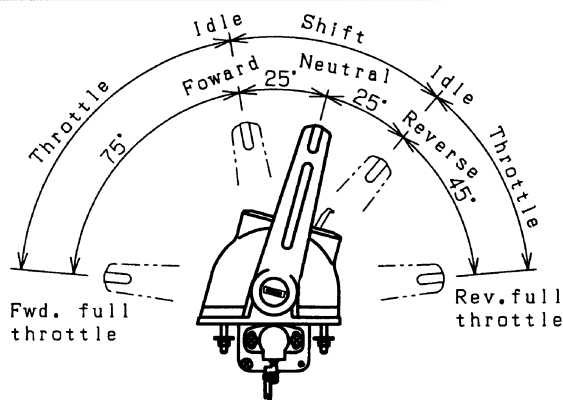
Shift & Throttle operation



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 gear to shift to forward or reverse. The orange forward or reverse LED(s) light ON to indicate forward or reverse gear position obtained.
- (2) Moving the hand lever past the Forward or Reverse detent activates the engine throttle operation and the boat will accelerate.



Lever stroke and output (See p.19 "Adjusting control unit")

Lever stroke	Shift output			Throttle output		
	Forward sw	Reverse sw	Neutral sw	Output	Idle Validation Switch	
Forward throttle range	Voltage	0V	0V	Forward Throttle Output	Normally Closed	Normally Open
Forward idle	Voltage	0V	0V	Idle Throttle Output	Open	Closed
Neutral	0V	0V	Voltage/0V		Closed	Open
Reverse idle	0V	Voltage	0V	Reverse Throttle Output	Open	Closed
Reverse throttle range	0V	Voltage	0V			

Note: The Neutral switch can be utilized and set via SW3-4.

Neutral throttle operation

1. Set the hand lever to the "NEUTRAL" position.
2. Open the switch cover located on the top of the control head and move the hand lever to the forward gear position while pressing the station select switch.
3. The green neutral LED flashes and the neutral throttle operation are 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 green neutral LED will stop flashing indicating deactivation of the neutral throttle operation.

Station transfer for 2, 3 and 4 station operation from a 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(s) indicates the control station is active.

Station transfer for 2, 3 and 4 station operation from a 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(s) 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. Continuous orange forward LED(s) 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. Continuous green neutral LED(s) indicates the control station active and system is in neutral idle condition.

INSTALLING THE CONTROL HEAD

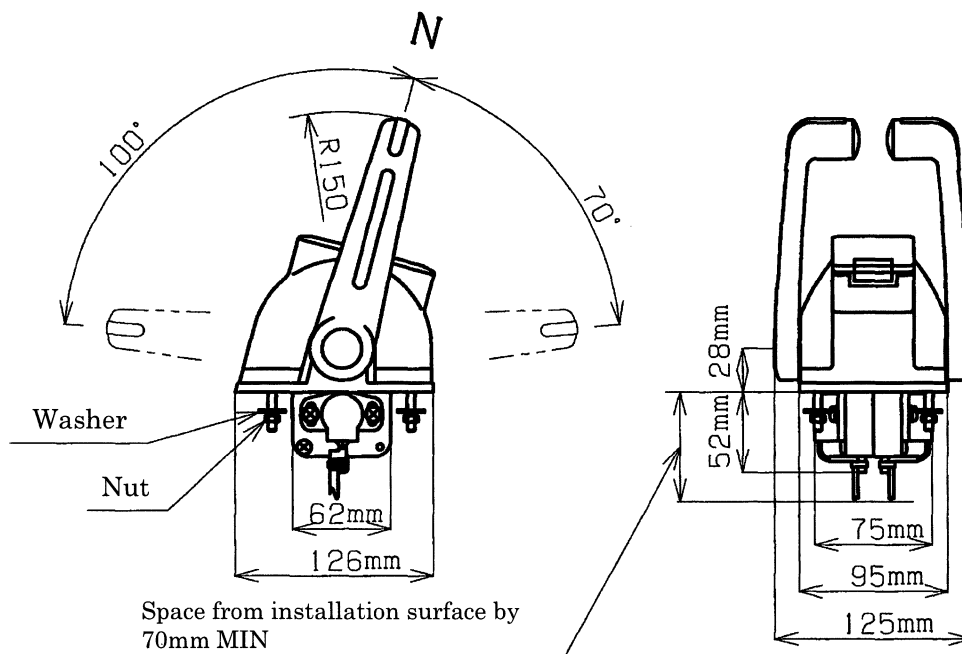
⚠ CAUTION

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

Instructions:

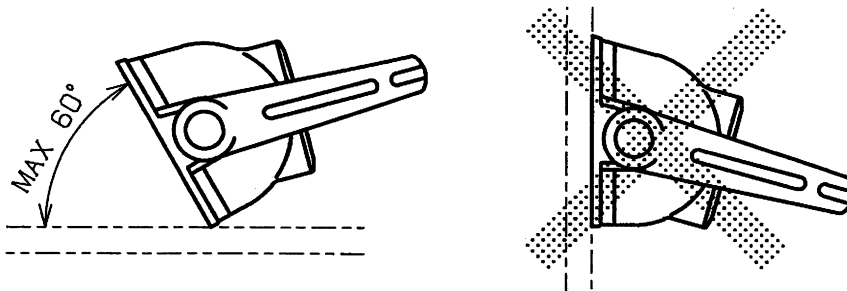
- (1) Select a flat location convenient for operation and installation.
- (2) Drill the mount holes by using an attached template.
- (3) Install with included washers and nuts.

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

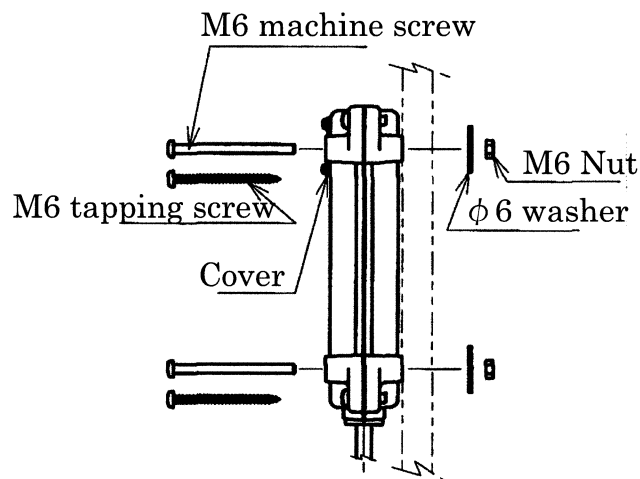
1. Ingress of water into the unit may cause failure
2. Install so that harnesses exit through the bottom and the small cover faces up for easy access to DIP switches.
3. Install in a location where sea wind and water effects are minimized.
4. Avoid a location where the ambient temperature exceeds 77°C.

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: ϕ 7 mm (ϕ 1/4 in.).
2. Tapping screw mounting plate thickness: 15 mm min. (5/8 in. min.), pilot hole diameter: ϕ 3 mm (ϕ 1/8 in.).

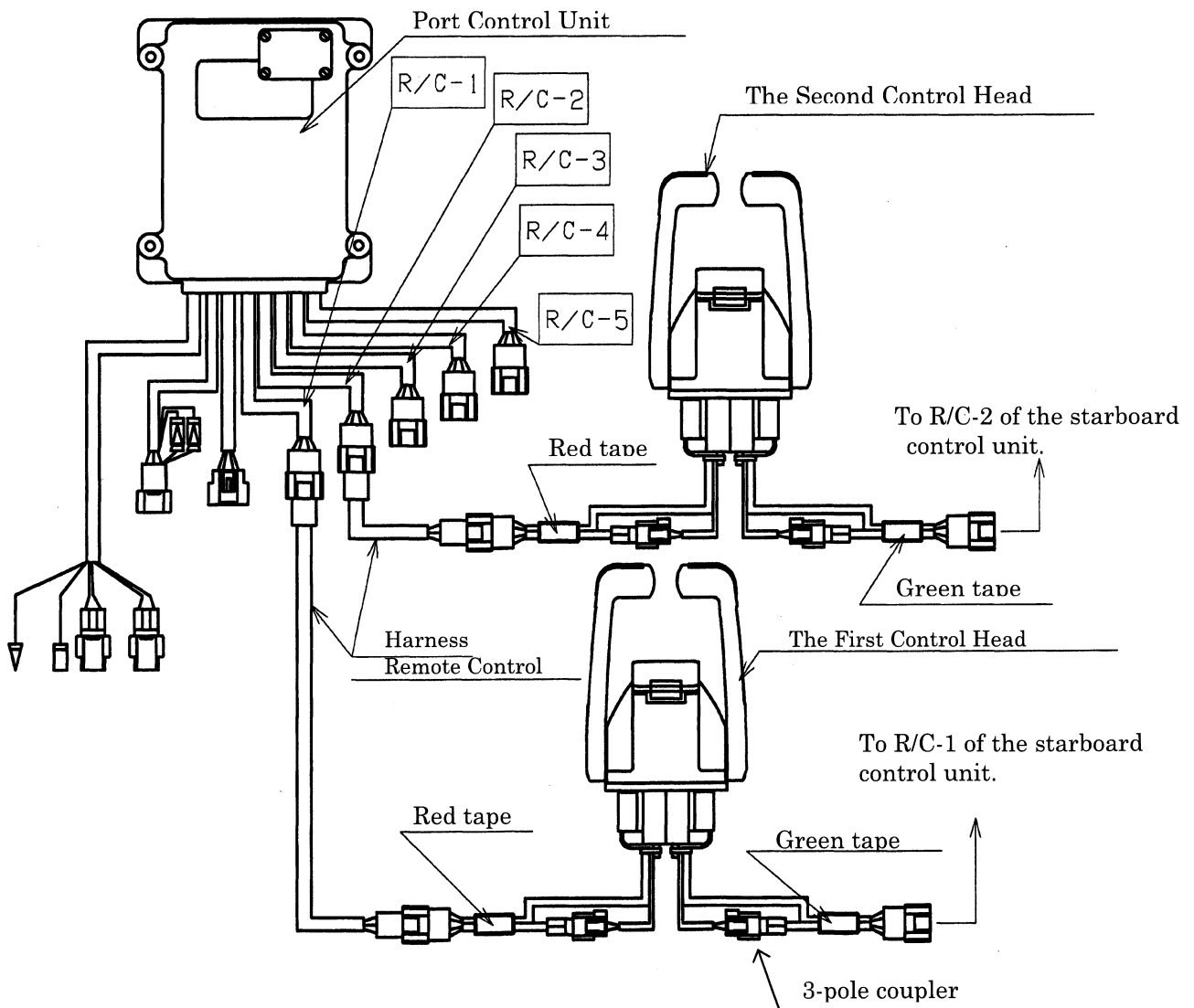


CONNECTING THE CONTROL HEAD & CONTROL UNIT

⚠ 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).



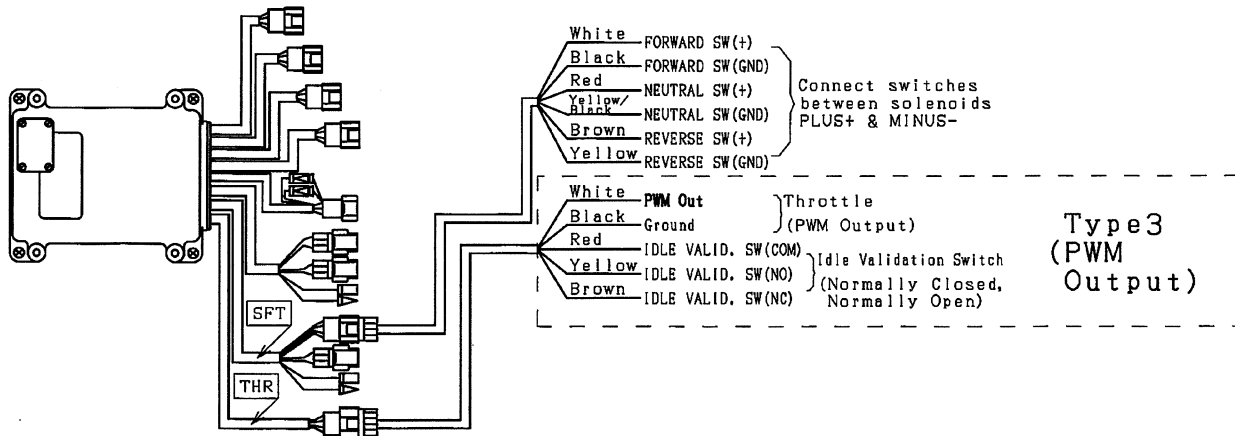
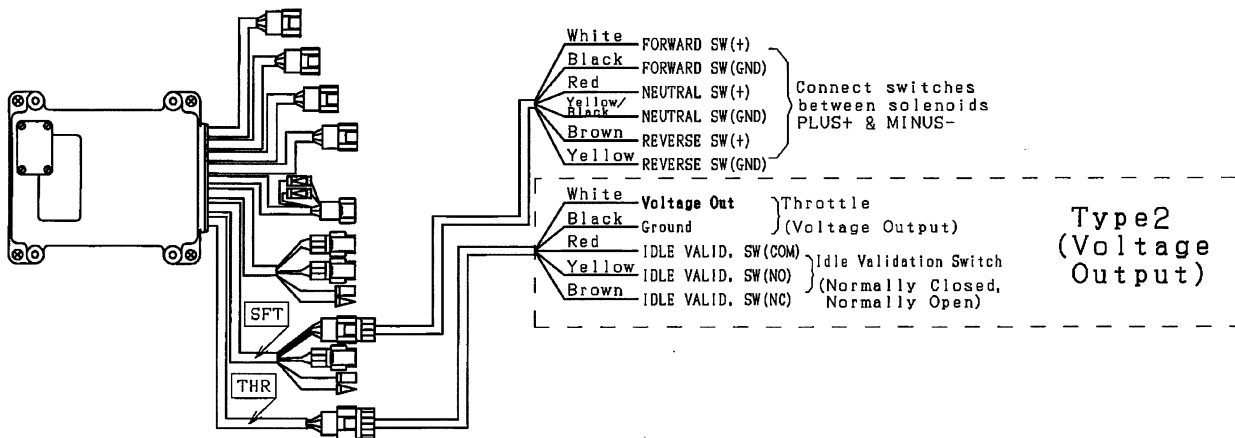
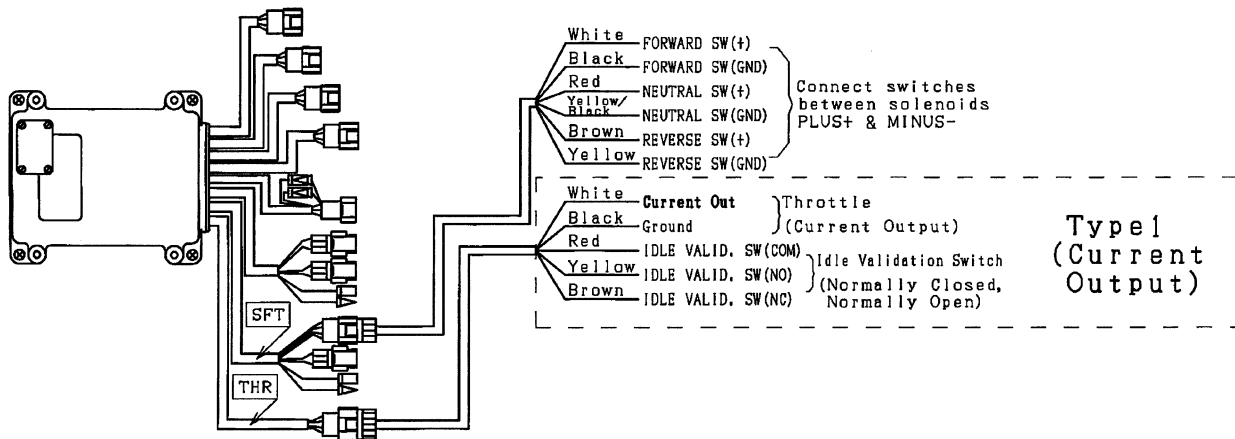
CONNECTING THE ENGINE & CONTROL UNIT

⚠ 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. 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. Connect one end of shift harness and throttle harnesses to the shift (SFT) & throttle (THR) connectors on the KE control units.

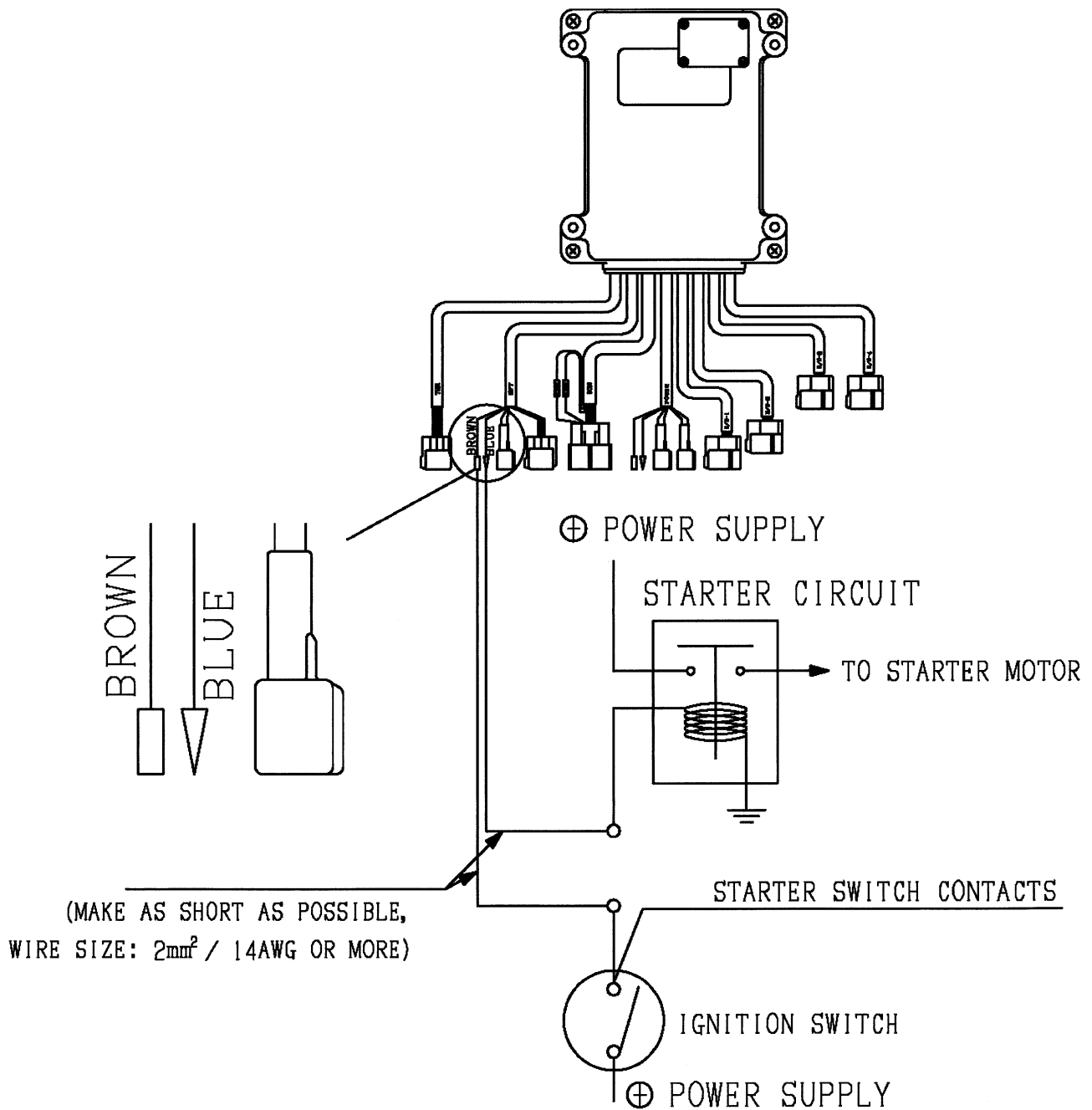
2. Connect the other end of the shift and throttle harnesses to the engine and gearbox connectors respectively. Refer to engine and gearbox maker instruction manuals for additional connection requirements.



CONNECTING SIGP (START-IN-GEAR PROTECTION)

Instructions:

1. Connect between starter & ignition circuits of the boat.
2. Keep extension wires as short and as thick as possible.



CONNECTING POWER

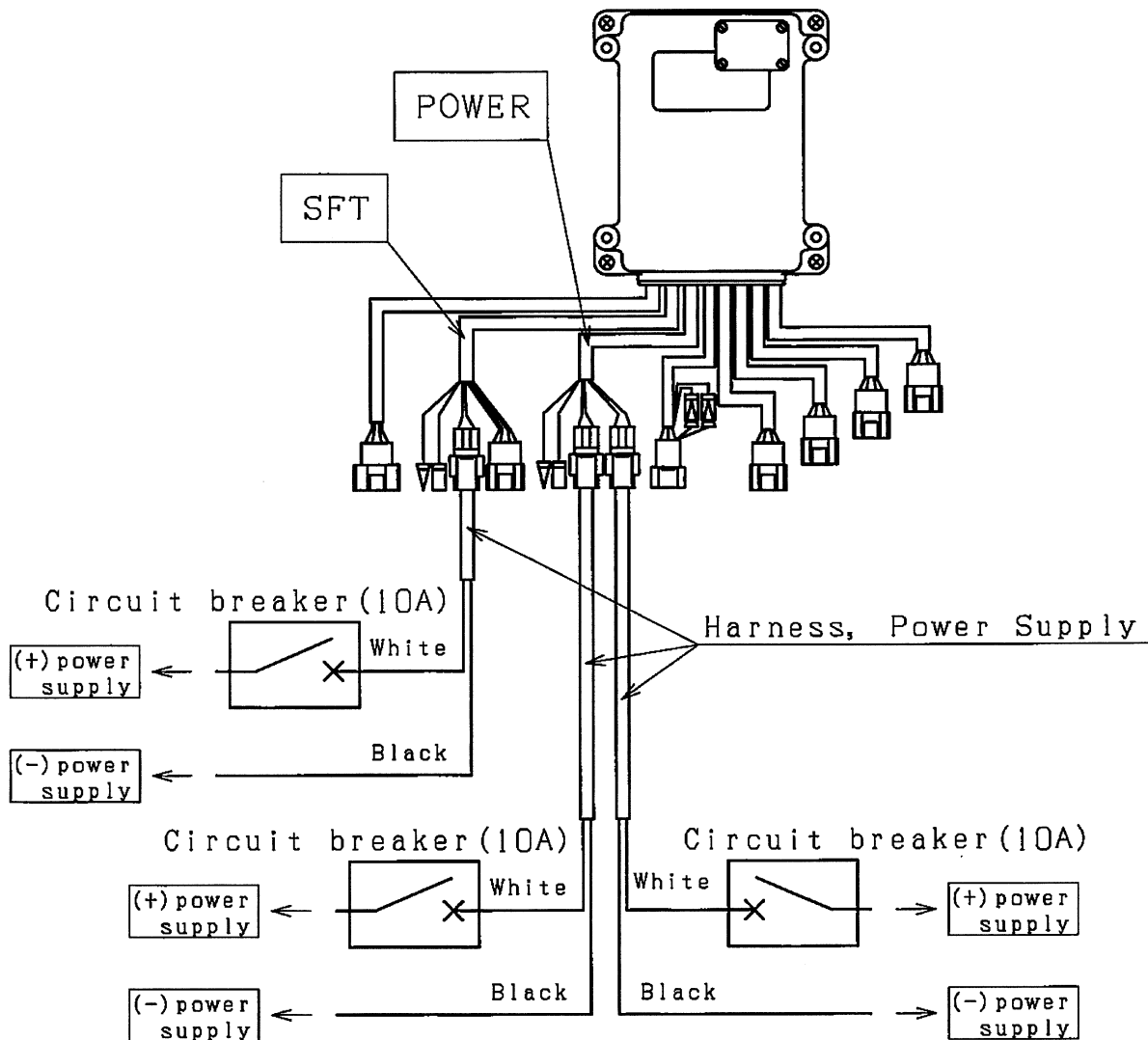
⚠ CAUTION

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 power harness is connected to power (battery), do not attempt to disconnect power harnesses 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 10 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 and connect one power line (plus breaker) to each battery.

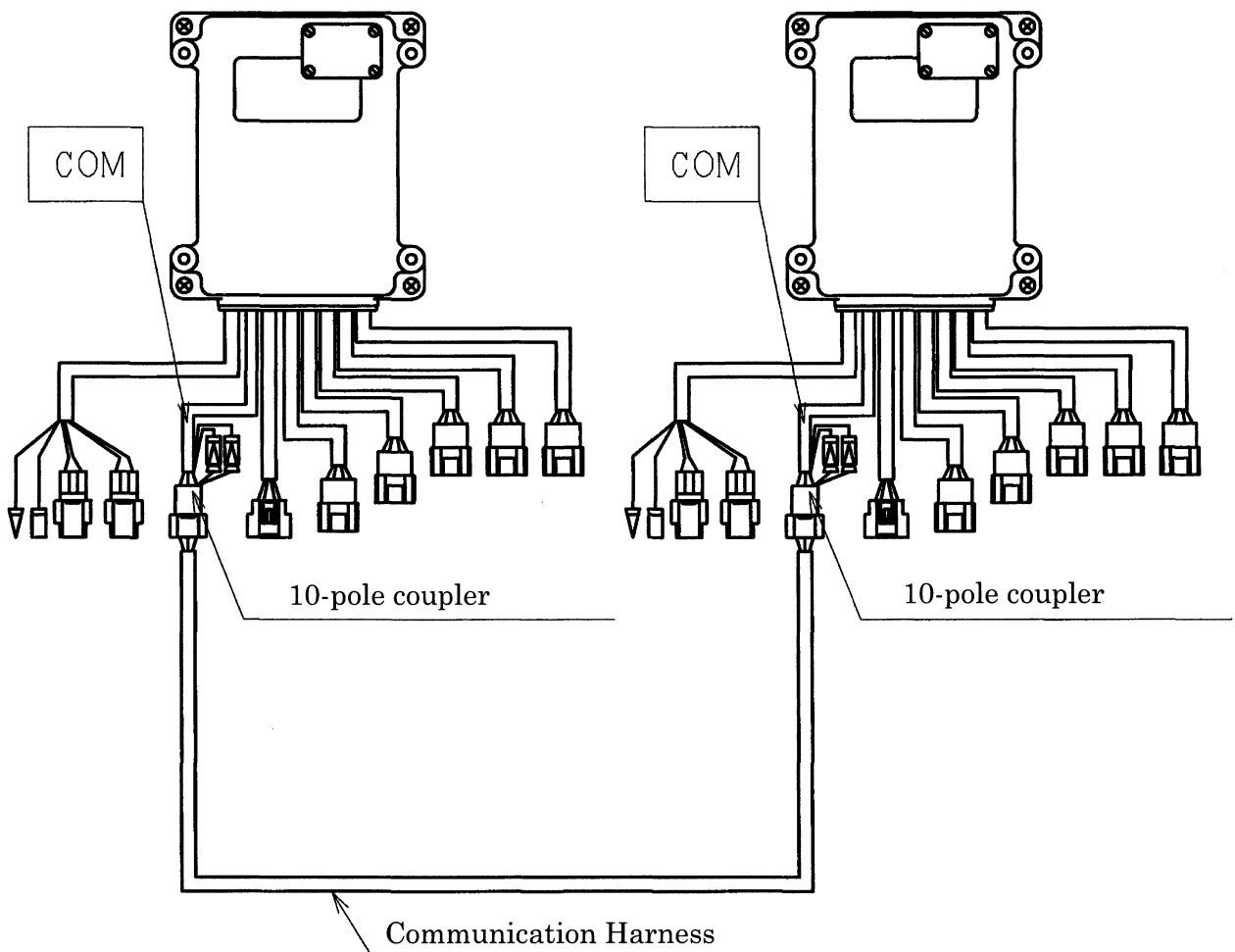


CONNECTING COMMUNICATION HARNESS

 **CAUTION**

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

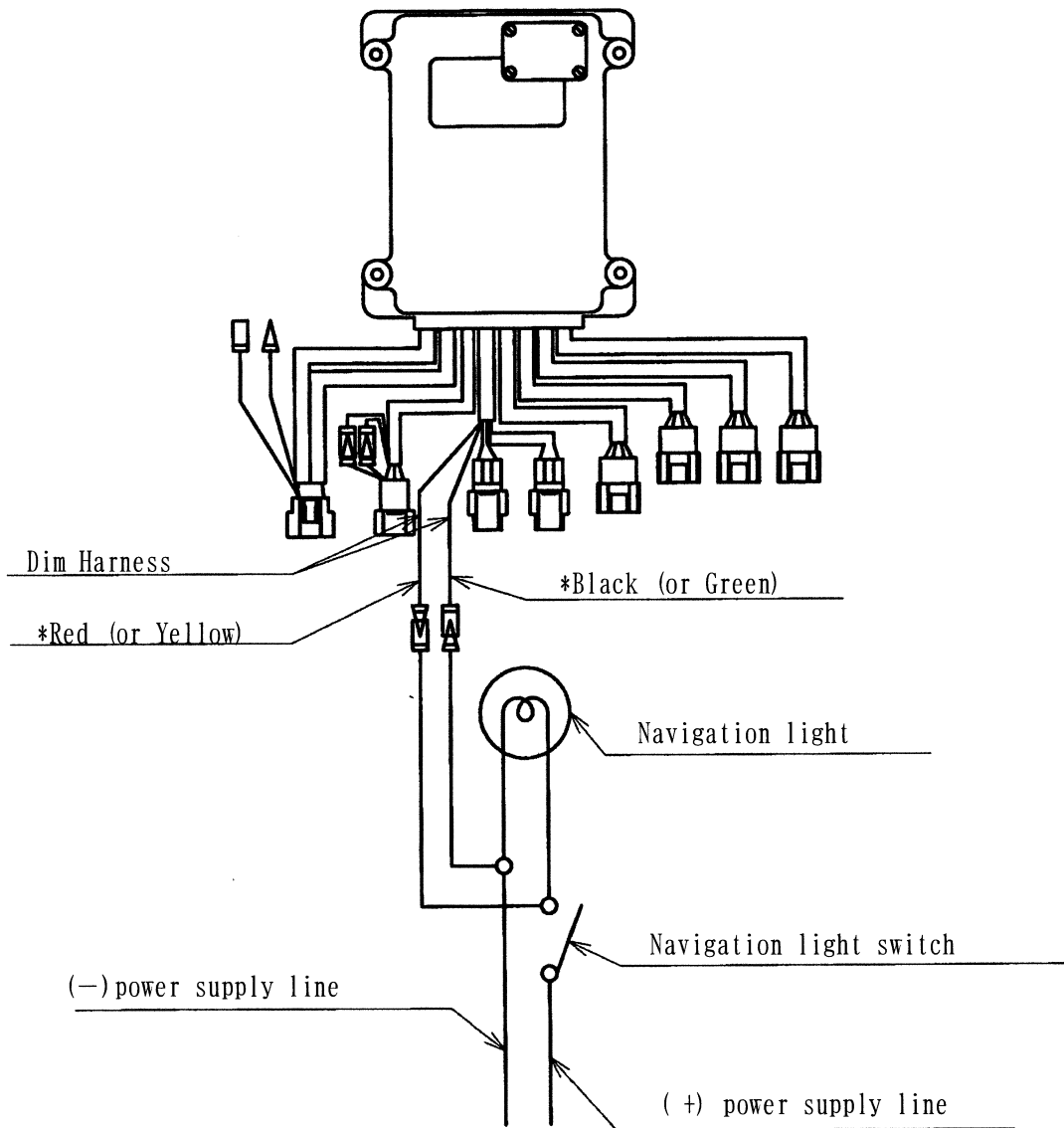
Instructions: Connect the two control units via the communication harness, which has a 10-pole coupler at each end for a dual engine system.



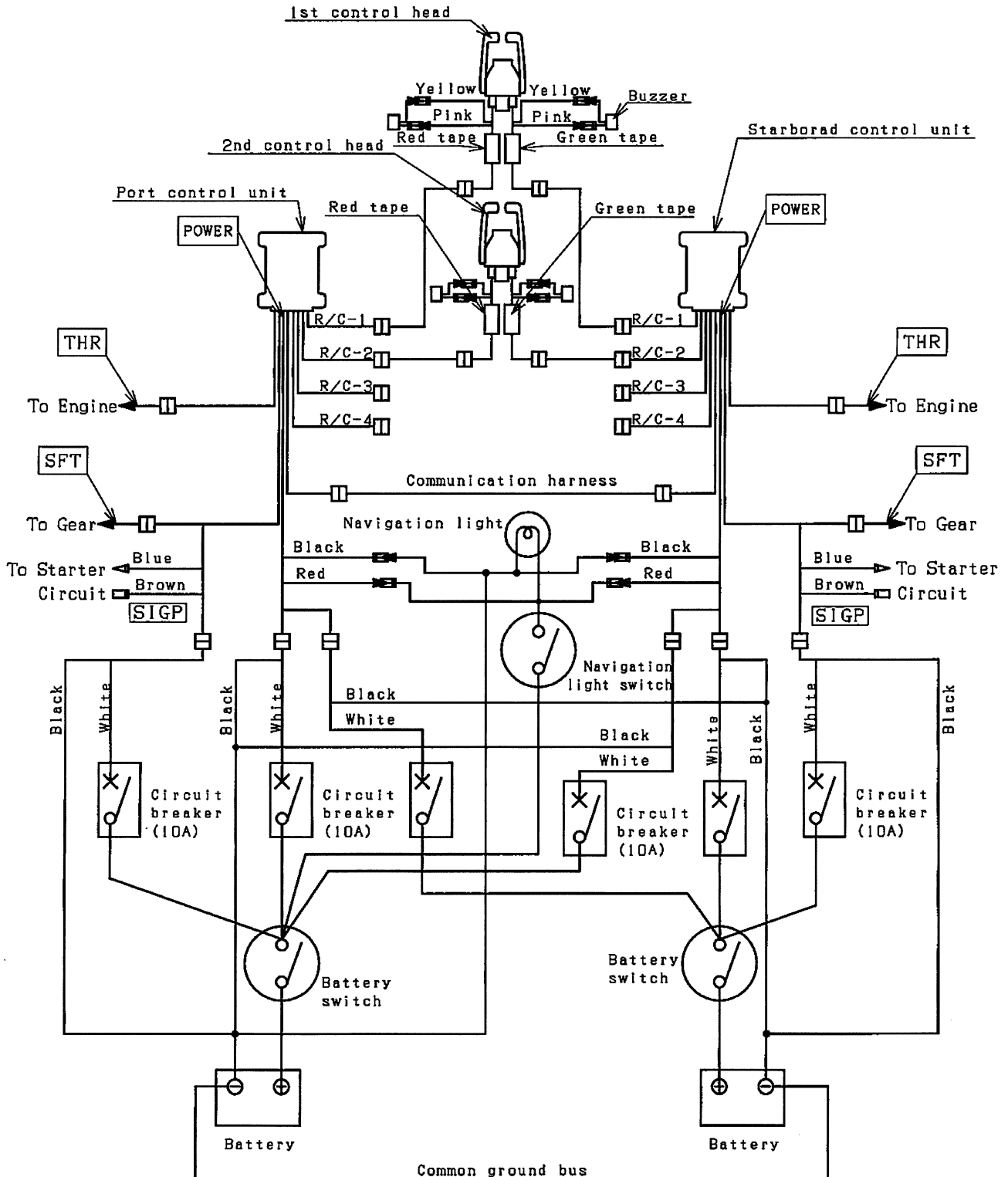
CONNECTING DIM HARNESS (OPTION)

Instructions:

1. Connect the Dim Harness red line to the (+) wire of navigation light.
2. Connect the Dim Harness black line to the (-) wire of navigation light.



OVERALL WIRING DIAGRAM



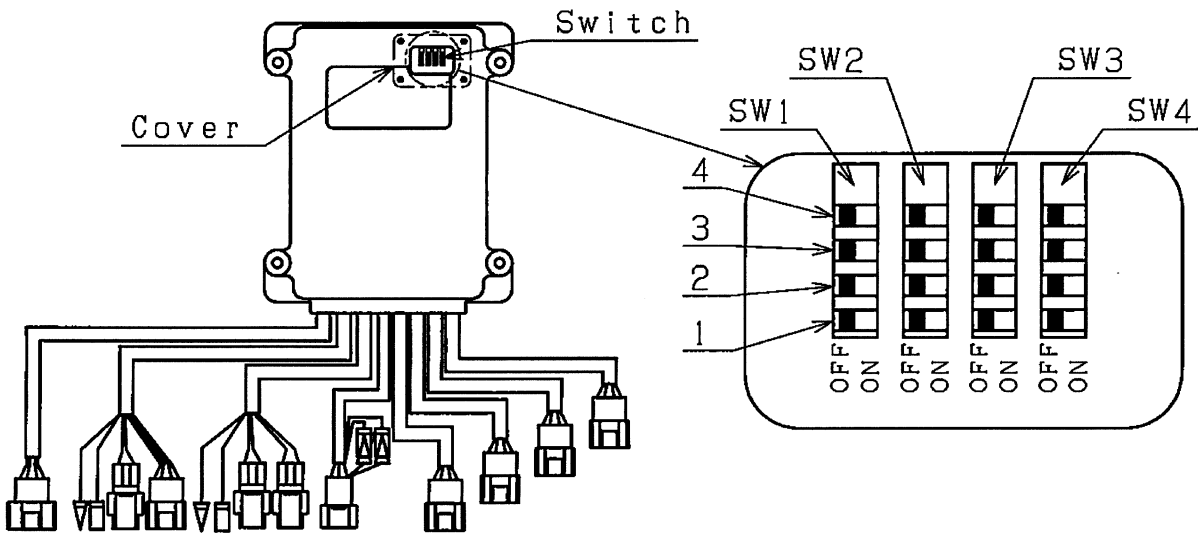
Note: The diagram above shows a case with two engines operated from two control heads with optional buzzer.

ADJUSTING THE CONTROL UNIT

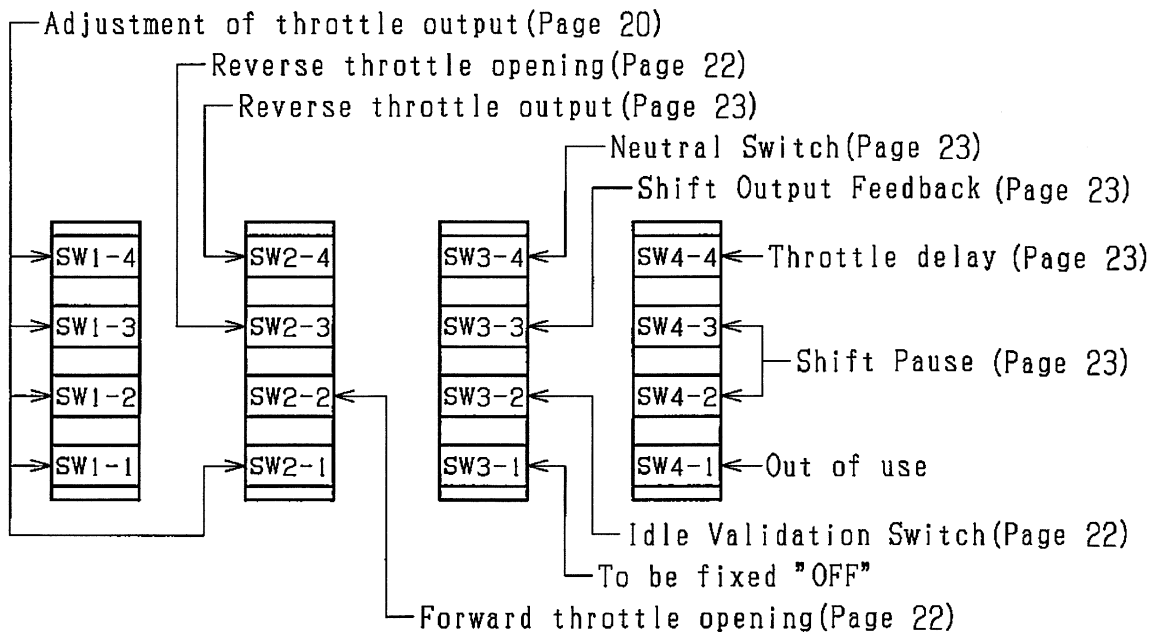
⚠ CAUTION

1. 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).
2. For KE-5/5a systems, SW 3-1 must always be in the OFF position

Instructions: To adjust system settings compatibility with engine and gear, turn power OFF and 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’ on page 13 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	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).

IVS: Idle Validation Switch

The idle switch can be utilized and set via SW 3-2. See “Shift & Throttle operation” on page 8.

SW3-2	FUNCTION
OFF	Effective
ON	Ineffective

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

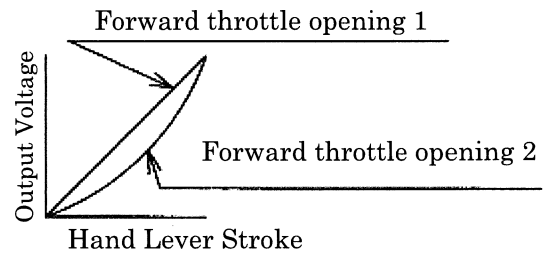
Forward throttle opening

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.

Set with SW2-2.

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

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



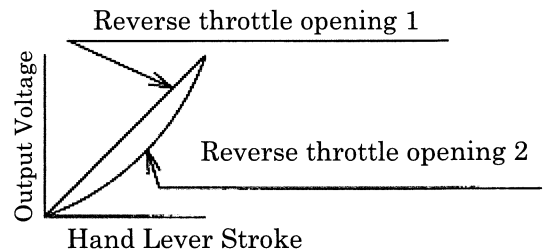
Reverse throttle opening.

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

Set with SW2-3.

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

This is to set the throttle output for the full reverse throttle stroke. Set via SW2-4.

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).

Throttle delay

Select the following DIP switch configurations for the desired throttle delay setting. This function delays the shock effect if the hand lever is operated suddenly from neutral to throttle. Delay time: 1 sec. Set via SW4-4.

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. Set via SW4-2 and 4-3.

SW4-2	SW4-3	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).

Neutral switch

If required for the gearbox, the neutral switch can be utilized and set via SW3-4.

SW3-4	FUNCTION
OFF	Ineffective
ON	Effective

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

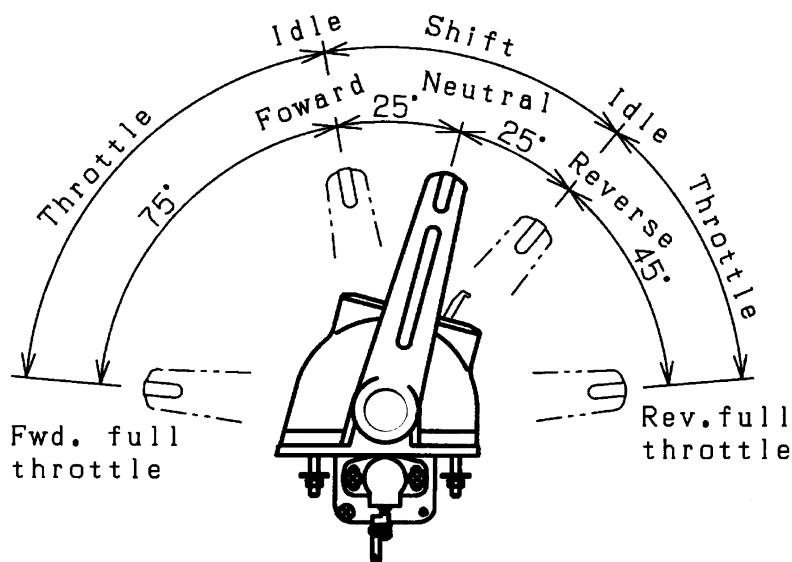
Shift Output Feedback

The Shift Output Feedback can be user set via SW3-3.

SW3-3	FUNCTION
OFF	Ineffective
ON	Effective

OPERATION CHECK

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



Shift and throttle operation check

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

Note: If the correct operation cannot be made, change the operation mode. (See “Adjusting the Control Unit”). If the forward/neutral/reverse LED’s flash, refer to “Alarm Codes”.

Confirmation of SIGP function

Step	Description	OK	Countermeasure if not OK
1	Set hand lever to NEUTRAL and start the engine	Engine starts	Shorten SIGP wiring connection (page 14)
2	Set hand lever to FORWARD and start the engine	Engine does not start	Connect SIGP as per instructions (page 14)

ALARM CODES

In case of a system operation fault, the failure code is indicated via the forward/neutral/reverse LED's flashing frequency an optional buzzer.

Flashing frequency	Cause	Countermeasure	Reference
1 * Shift Signal	(1) Shift power is disconnected. (2) Circuit breaker is OFF. (3) Harness, power supply coupler is not connected correctly. (4) Battery voltage is beyond the operating voltage range. (5) Harness, power supply with wire damage (6) SHIFT harness of the control unit is disconnected or damaged	(1) Connect line. (2) Turn ON circuit breaker. (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 15 page 15 page 15 page 2 page 15
2 ** 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 with wire damage or shorted (5) Harness, remote control with wire damage or shorted (6) R/C-1, 2, 3 and 4 harnesses of control unit with wire damage 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 your dealer.	page 12 page 12 page 12 page 12 page 12
3 *** 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 is outside the operating voltage range. (5) Harness, power supply with wire damage (6) POWER harness of the control unit is damaged	(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 15 page 15 page 15 page 2 page 15

ALARM CODES (continued)

<p>4</p> <p>***</p> <p>Select Switch</p>	<p>(1) Select switch is pressed-in or shorted.</p> <p>(2) Control head harness is shorted.</p> <p>(3) Harness, remote control is shorted.</p> <p>(4) R/C-1, 2, 3 and 4 harnesses of control unit with short</p>	<p>(1) Reset / unlock the select switch.</p> <p>(2) Consult your dealer.</p> <p>(3) Replace the harness remote control.</p> <p>(4) Consult your dealer.</p>	<p>page 7</p> <p>page 4,12</p>
<p>6</p> <p>***</p> <p>**</p> <p>COM</p>	<p>(1) Communication harness with wire damage or shorting</p> <p>(2) One of the control units has no power.</p>	<p>(1) Replace the communication harness.</p> <p>(2) Turn ON circuit breaker(s).</p>	<p>page 16</p>

TROUBLESHOOTING

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

Symptom	Cause	Countermeasure
No operation even though power source is ON.	(1) Harness, power is not connected correctly. (2) Circuit breaker OFF	(1) Connect the harness, power correctly. (See page 15) (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 8) (2) Connect the control head to R/C-1. (See page 12)
F or N or R LED does not light ON.	(1) Wire damage in control head harness (2) Wire damage in harness, remote control (3) Defective LED	(1) Consult your dealer. (2) Replace the harness, remote control. (See page 12) (3) Consult your dealer.
F, N, R LED light ON but shift clutch does not engage.	(1) Harness, shift and throttle is not connected to the clutch correctly. (2) Wire damage in shift harness.	(1) Connect the harness, shift and throttle correctly. (See page 13 and 14) (2) Consult your dealer.
F, N, R LED ON but engine speed does not respond to system.	(1) Harness throttle is not connected to the engine correctly. (2) Wire damage in throttle harness throttle.	(1) Connect the harness, shift and throttle correctly. (See page 13 and 14) (2) Consult your dealer.
Engine does not start.	(1) Low battery voltage. (2) SIGP harness too long.	(1) Charge the battery. (2) Shorten SIGP harness.
Neutral throttle operation cannot be made.	(1) Neutral throttle operation is not set correctly. (2) Failure in select switch	(1) Carry out setting correctly. (See page 7) (2) Consult your dealer.

MAINTENANCE AND SERVICE

KE-5a 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

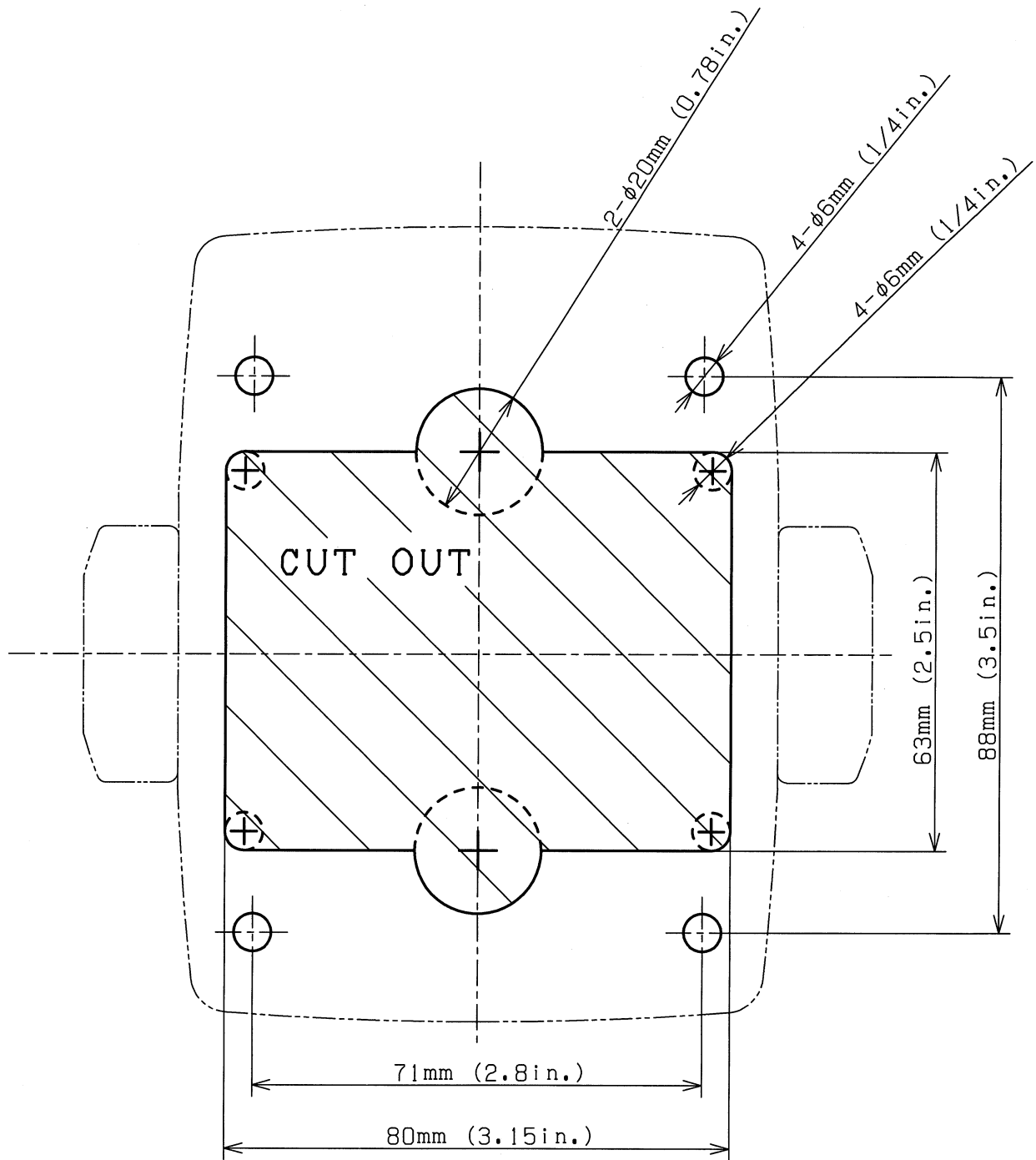
1. Component replacement is recommended after 100 000 operation cycles or after 5 years of extended use in marine environment.

Control Unit & Harnesses

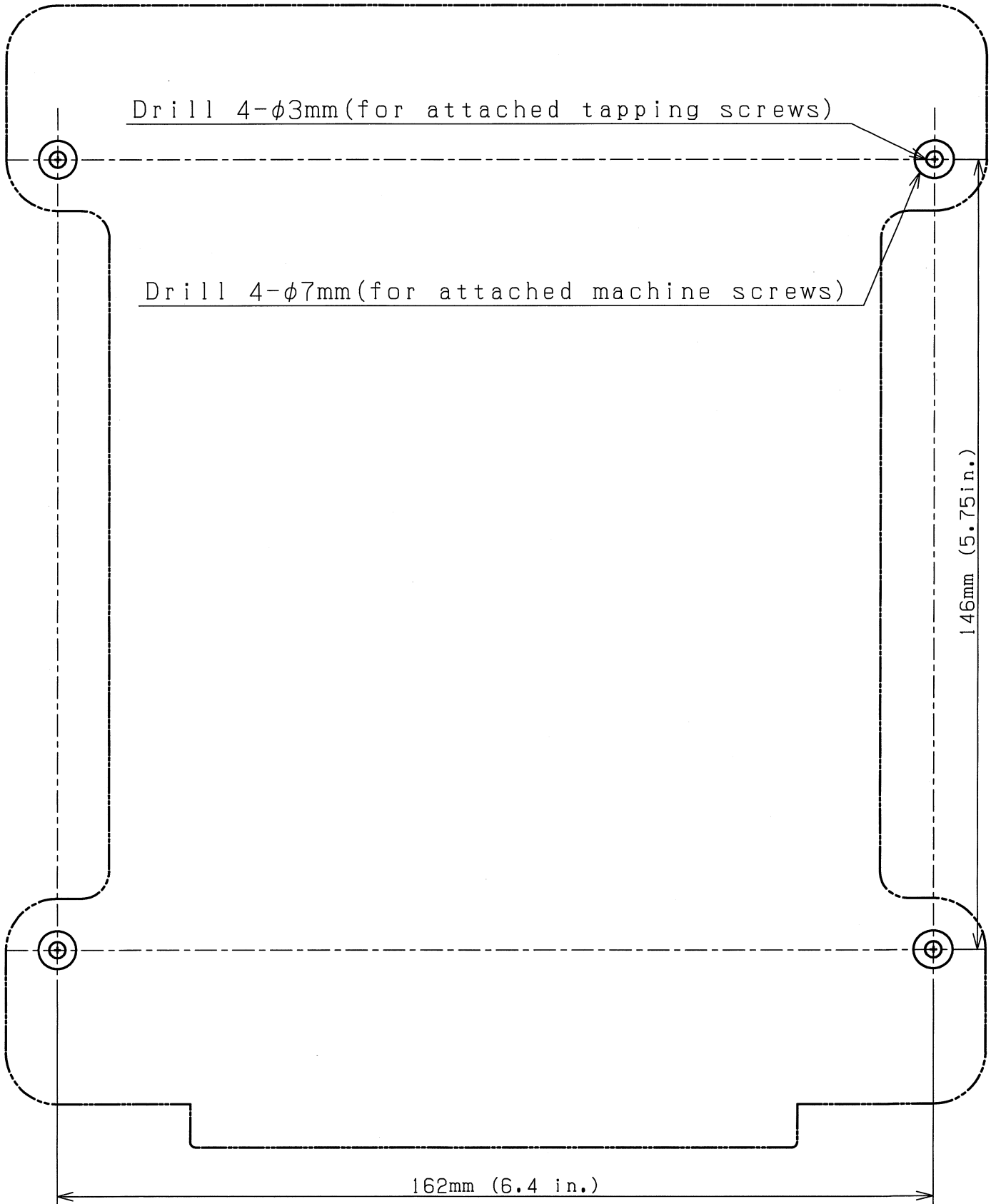
1. Check all harnesses for wiring damage periodically.
2. Check all connectors for proper seating periodically.
3. Component replacement is recommended after 7 years of extended use in marine environment.

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

CONTROL HEAD TEMPLATE



CONTROL UNIT TEMPLATE



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