NHK MEC

KE-4⁺

INSTRUCTION MANUAL



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INTRODUCTION

includes trolling control or handheld control options, please also refer to those additional manuals. functions. electronic remote control system. This manual has been prepared to ensure the correct operation of the standard configuration KE-4+ Always keep the manual within your reach during operation. If your KE-4⁺ system also Be sure to read through this manual to understand the how the system

to also read the instruction manuals of the vessel's engine and marine gear. The KE-4⁺ system controls the shift (gear) and throttle (governor) of the vessel. It is recommended therefore

manual, consult with your dealer. the content of the manual and the product. In case of ambiguity or questions concerning the product or the The specifications may be subject to change without notice (for upgrades), resulting in differences between

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

SAFETY PRECAUTIONS

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



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



properties Failure to comply with a Caution may result in an accident causing light injury or damage to the product or

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 COMPLIANCE



QUALITY ISO 9001



- 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

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

PRODUCT SPECIFICATIONS

H Electrical Performance

Supply voltage: DC 9V to 30V (12V/24VDC common mode)

Max. current of actuator: 16A peak, 5A typical (at 49N{5kgf}) 11lbf load)

Current consumption (stand-by): 0.5A or less

5 Mechanical Performance (Actuator)

- Thrust
- Operating thrust: 147N {15kgf} 33 lbf
- Constraint load : 343N {35kgf} 77 lbf
- Shift: Forward or Reverse stroke (can be set separately) 26 / 30 / 34 / 40 mm
- Throttle: 80mm MAX.

င့်ပ Temperature Range

Operating temperature: -20° C

Storage temperature : −40° C ≀ +100° C

PRODUCT FUNCTIONS

The KE-4+ electronic remote control system is capable of the following functions

1. Main Functions

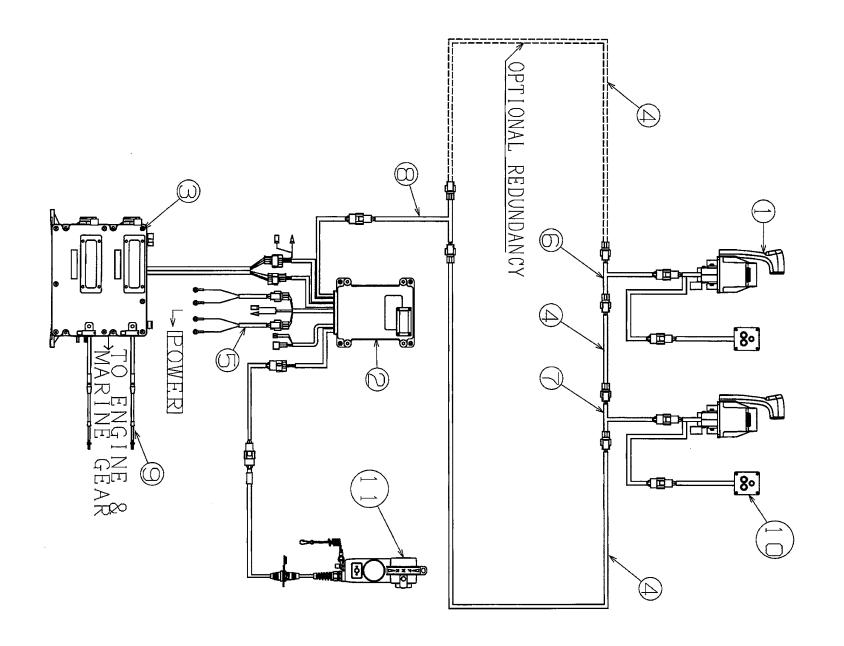
- Shift: Control head lever allows Forward/Neutral/Reverse operations of the vessel
- Throttle: Control head leaver allows the acceleration & deceleration operations of the vessel
- Neutral throttle: Provides throttle only operation in order to warm up the engine
- button on any control head; up to 4 control head stations are available Control Station Select: Allows transfer from one control station to another by pressing the SEL
- head; single lever synch and dual lever synch modes are available Synch: Allows multi-engine speed synchronization by pressing the SYNC button on any control
- SIGP: Enables engine start up only when the vessel is in the neutral position; a safety feature
- accessible on the control unit. variety of engine and gearbox configurations. push-pull cable stroke distances, etc. in order to match the KE- 4^{+} system actuator outputs with a Actuator settings: Allows various settings for actuator operation such as shift & throttle modes, Settings are adjusted via the DIP switches
- Alarm Codes: System errors are automatically detected and indicated via flashing LED-s on the control head; the last error code will also be displayed on the control unit alphanumeric display

The following options can also be added to the KE-4+ electronic remote control system

2. Optional Functions

- Dim display: Decreases brightness of the LED on the control head during nighttime
- <u>Buzzer</u>: Combines an audio alarm to LED alarm codes
- trim control in the case of multiple engines lever; in addition, circuit harness to connect to panel trim control switches for individual engine Trim Circuit (for outboards): Master trim control switch available in the handle of the control head
- incrementally increases idle up to 20% of full throttle <u>Idle control</u>: Provides idle control of the engines via a 2-button switch / 1-LED display
- lacktrianTriple engine control: Provides options for control of center engine actuator from the port lever via a 1-button switch / 2-LED display
- center-starboard) and outside engines (port & starboard) via a 1-button switch / 2-LED display Quadruple engine control: Provides options for control of inside engine actuators (center-port &
- mechanical control head Mechanical backup: In case of electrical failure, enables manual operation of actuator lever via a
- plus trolling unit & trolling actuators Trolling control: Allows trolling speed control of the vessel via a 2-button switch / 1-LED display
- system; attached to the main system via long harnesses Handheld station: Provides a handheld / mobile version of the control head to be added to the
- useful for multi-vessel settings management. used as a substitute for the DIP switch procedure described in the main functions; particularly Software version of the actuator settings; requires a laptop connection. Can be

SINGLE **ENGINE CONFIGURATION**



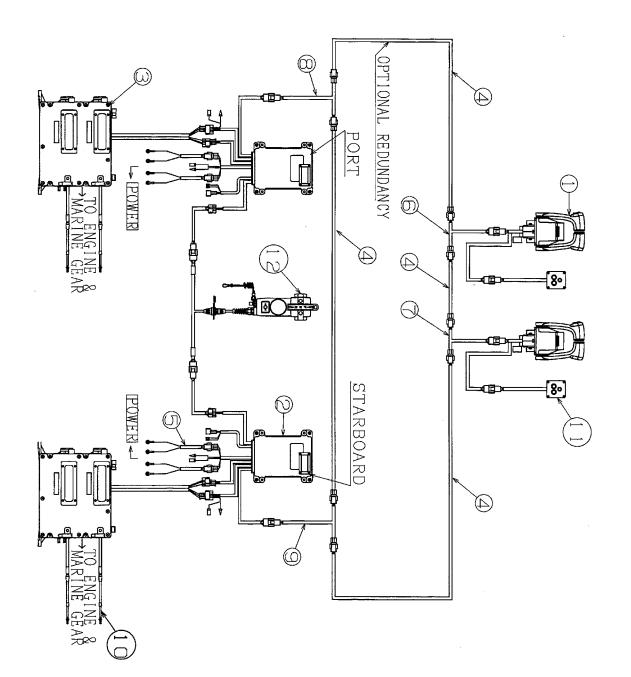
 $\underline{\text{Note}}$: The figure above is an example of a single engine / two control stations system with optional idle control switches and optional handheld control.

COMPONENTS LIST

				NJ0844-00		EMC filter kit (type approval option)
4	3	2	1	NM0647-08		SW extension harness (optional)
4	C	N	-	NJ0515-00	24V	
	5	-	.	NJ0596-00	12V	Buzzer (optional)
	2			NJ0514-00	20A	Circuit Breaker (optional)
31	manus	ntrol	eld co	Refer to handheld control manual		(II) Handheld control (optional)
4	ω	2	_	NJ0765-00		1 Idle Switch (optional)
	2	,,		TFXtreme, 33HPC	TFXtre	Push - pull cable
	_			NM0647-11		® T-harness (SINGLE)
သ	2	_	,	NM0647-10		⑦ T-harness (R/C)
				NM0647-09		⑤ T-harness (R/C-1)
	L			NM0414-33	10m	
	•	s		NM0414-28	5m	⑤ Harness Power Supply
				NM0649-50	50m	
				NM0649-40	40m	
				NM0649-30	30m	
				NM0649-24	24m	performance could degrade
				NM0649-20	20m	otherwise system
				NM0649-18	18m	exceed 80m in total length;
4	c	Þ	-	NM0649-16	16m	Bus harness should not
	ა	ວ	- 4	NM0649-14	14m	★ CAUTION
				NM0649-12	12m	
				NM0649-10	10m	
				NM0649-08	8m	
				NM0649-06	6m	1m = 39 inches
				NM0649-04	4m	
				NM0649-02	2m	4 Bus Harness
	1			NM0183-00		3 Actuator
	_			NM1475-00		② Control unit 12V/24V
				NM1003-00	SST	SST = stainless steel, (i/b style)
4	లు	2	1	NM1001-00	w/ PTT	PTT = power trim/tilt switch (o/b style)
,				NM1002-00	w/o PTT	① Control Head, Single
4	3	2		Part number		Description
ıs	station	No. of stations	∀ .			
е	Engin	Single Engine	S		ist (Single	KE-4+ Component Parts List (Single)
tity	Quan	Required Quantity	Rec			

Note: Refer to previous page for balloon references and system configuration.

DUAL ENGINE CONFIGURATION



Notes:

- <u>:</u> The figure above is an example of a two engines / two control stations system with optional idle control switches and optional handheld control.

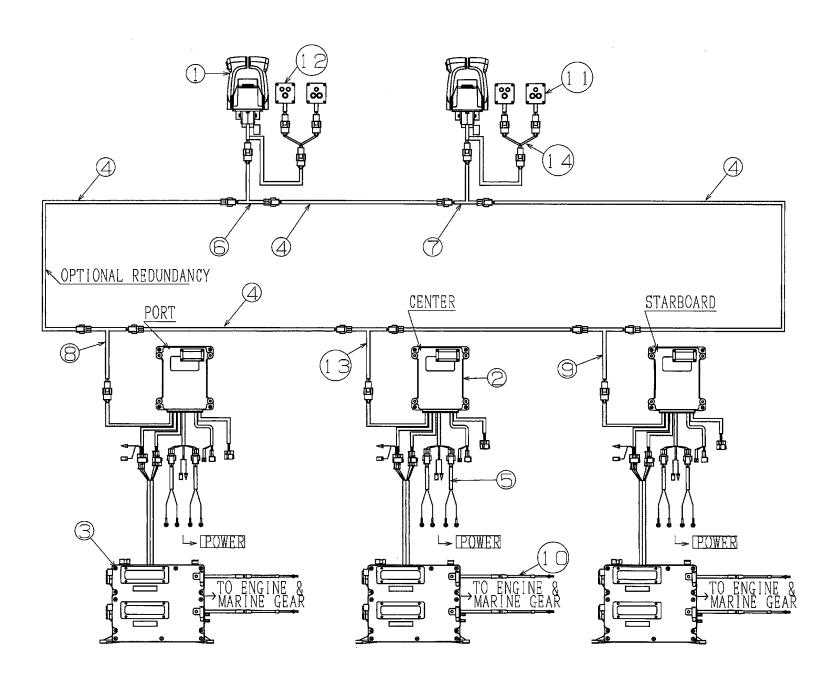
 POWER: See 'Connecting Power' page for battery connection details.
- 2.

COMPONENTS LIST

	2			NJ0844-00		EMC filter kit (type approval option)
4	သ	2	1	NJ0772-00		Trim circuit harness (optional)
4	ယ	2	- -	NM0647-08		SW extension harness (optional)
+	c	1	-	NJ0515-00	24V	
_	ت	ა	<u> </u>	NJ0596-00	12V	Buzzer (optional)
	4			NJ0514-00	20A	Circuit Breaker (optional)
nual	ol mar	contro	lheld	Refer to handheld control manual		Handheld control (optional)
4	3	2	1	NJ0765-00		① Idle Switch (optional)
	4			TFXtreme, 33HPC	TFXtre	Push - pull cable
	1			NM0647-13		(9) T-harness (STBD)
	1	:		NM0647-12		® T-harness (PORT)
သ	2	-	1.	NM0647-10		① T-harness (R/C)
	1	_		NM0647-09		© T-harness (R/C-1)
	H			NM0414-33	10m	
	_			NM0414-28	5m	(5) Harness Power Supply
				NM0649-50	50m	
				NM0649-40	40m	
				NM0649-30	30m	
				NM0649-24	24m	performance could degrade
				NM0649-20	20m	otherwise system
				NM0649-18	18m	exceed 80m in total length;
c	н	c	1	NM0649-16	16m	Bus harness should not
דכי		ω	<u>ာ</u>	NM0649-14	14m	A CAUTION
				NM0649-12	12m	
				NM0649-10	10m	
				NM0649-08	8m	
			_	NM0649-06	6m	1m = 39 inches
				NM0649-04	4m	
				NM0649-02	$2 \mathrm{m}$	Bus Harness
	2			NM0183-00		3 Actuator
	2			NM1475-00		② Control unit 12V/24V
				NM1053-00	SST	SST = stainless steel, (i/b style)
4	ဃ	2	_	NM1052-00	w/o PTT	PTT = power trim/tilt switch (o/b style)
				NM1051-00	w/ PTT	① Control Head, Twin
4	3	2	1	Part number		Description
as	No. of stations	Vo. of				
1e	Dual Engine	Dual)	List (Dual)	KE-4+ Component Parts List (Dual)
ntity	Required Quantity	quire	Re			

Note: Refer to previous page for balloon references and system configuration.

TRIPLE **ENGINE CONFIGURATION**



Notes:

- The figure above is an example of a three engines / two control stations system with optional idle control switch.

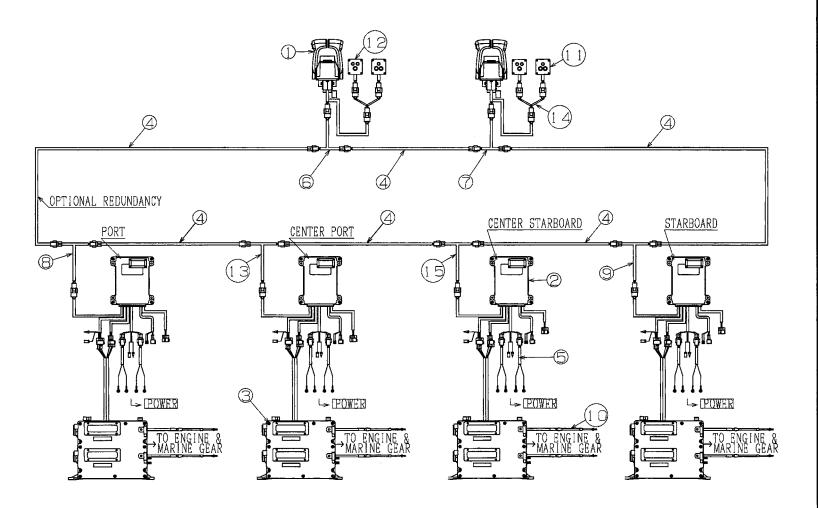
 POWER: See 'Connecting Power' page for battery connection details.

COMPONENTS LIST

	ω			NJ0844-00	option)	EMC filter kit (type approval option)
6 8		4	2	NJ0772-00)	Trim circuit harness (optional)
3 4	-	2		NM0647-08	ional)	(4) SW extension harness (optional)
		1	-	24V NJ0515-00		
ည 		<u> </u>	_	12V NJ0596-00		Buzzer (optional)
	6			20A NJ0514-00		Circuit Breaker (optional)
				NM0647-14		(I) T-harness (CENTER)
3 4		2	1	NJ0767-00		Triple Switch
3 4	ļ	2	1	NJ0765-00		(I) Idle Switch (optional)
	6			TFXtreme, 33HPC		Push - pull cable
	<u>, </u>			NM0647-13		(9) T-harness (STBD)
	ᅩ			NM0647-12		® T-harness (PORT)
2 3	_	1		NM0647-10		7 T-harness (R/C)
	-			NM0647-09		⑥ T-harness (R/C-1)
	-			10m NM0414-33		
	20			5m NM0414-28		(5) Harness Power Supply
	-			50m NM0649-50		2
				40m NM0649-40		
				30m NM0649-30		
				24m NM0649-24		h
				20m NM0649-20	de	performance could degrade
				18m NM0649-18	11,	otherwise system
		+	c	16m NM0649-16	÷'	bus narness should not
<u> </u>				14m NM0649-14		D
				12m NM0649-12		► CAUTION
				10m NM0649-10		•
				8m NM0649-08		
				6m NM0649-06		1m = 39 inches
				4m NM0649-04		
				2m NM0649-02		4 Bus Harness
	ယ			NM0183-00	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3 Actuator
	ယ			NM1475-00		② Control unit 12V/24V
				SST NM1053-00	e)	SST = stainless steel, (i/b style)
3 4		2	Н	w/o PTT NM1052-00		PTT = power trim/tilt switch (o/b style)
				w/ PTT NM1051-00	W	① Control Head, Twin
3 4		2	1	Part number		Description
No. of stations	fsta	Vo. 0				
Triple Engine	le Er	Trip		riple)	KE-4+ Component Parts List (Triple)	KE-4+ Compor
Required Quantity	ed Q	quire	Re			
					The second secon	programme and the second secon

Note: Refer to previous page for balloon references and system configuration.

ENGINE CONFIGURATION



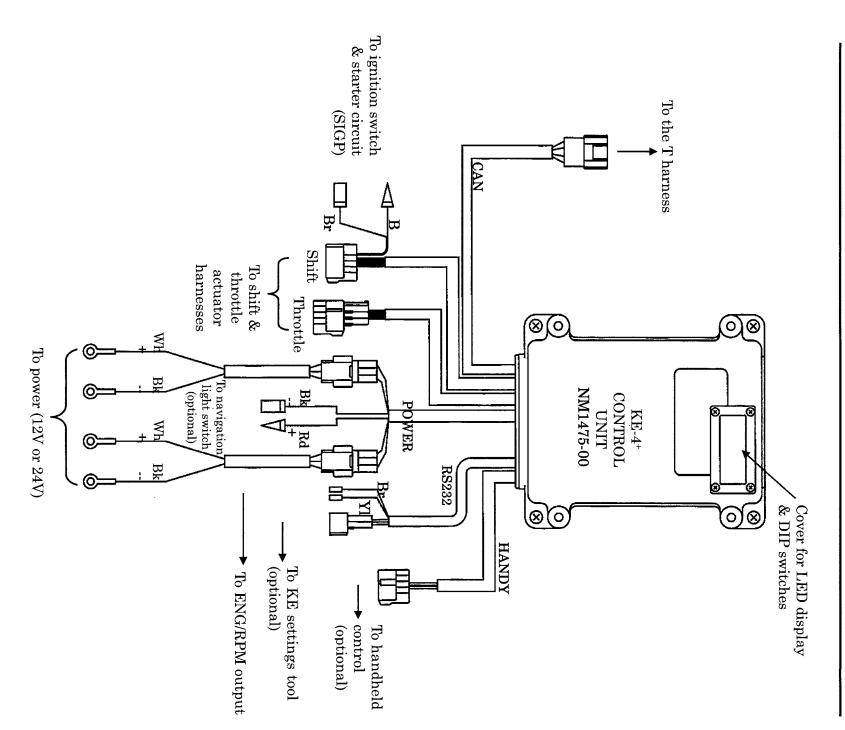
- Notes:
 1. The figure above is an example of a four engines / two control stations system with optional idle control switch.
 2. POWER: See 'Connecting Power' page for battery connection details.

COMPONENTS LIST

		4		NJ0844-00	:	EMC filter kit (type approval option)
8	6	4	2	NJ0772-00		Trim circuit harness (optional)
	_			NM0647-15		(5) T-harness (CENTER-STBD)
4	သ	2	_	NM0647-08		(4) SW extension harness (optional)
4	<u>ن</u>	N	—	NJ0515-00	24V	
•	o O	2	1	NJ0596-00	12V	Buzzer (optional)
	3	8		NJ0514-00	20A	Circuit Breaker (optional)
		1		NM0647-14		(B) T-harness (CENTER)
4	သ	2	1	NJ0768-00		Quad Switch
4	3	2	1	NJ0765-00		① Idle Switch (optional)
	3	8		TFXtreme, 33HPC	TFXtre	⑩ Push - pull cable
		<u></u>		NM0647-13		9 T-harness (STBD)
	,—			NM0647-12		® T-harness (PORT)
ယ	2	<u> н</u>	,	NM0647-10		⑦ T-harness (R/C)
		1		NM0647-09	:	6 T-harness (R/C-1)
				NM0414-33	10m	
	~	n		NM0414-28	5m	(5) Harness Power Supply
				NM0649-50	50m	
				NM0649-40	40m	
				NM0649-30	30m	
				NM0649-24	24m	7
				NM0649-20	20m	performance could degrade
				NM0649-18	18m	otherwise system
•	_	c	H	NM0649-16	16m	bus narness snoutd not
7		π		NM0649-14	14m	Burn hamild and
				NM0649-12	12m	CATITION
				NM0649-10	10m	•
				NM0649-08	8m	
				NM0649-06	6m	1m = 39 inches
				NM0649-04	4m	:
				NM0649-02	$2 \mathrm{m}$	4 Bus Harness
	1	4		NM0183-00		3 Actuator
	H	4		NM1475-00		② Control unit 12V/24V
				NM1053-00	SST	SST = stainless steel, (i/b style)
4	ట	2	1	NM1052-00	w/o PTT	PTT = power trim/tilt switch (o/b style)
				NM1051-00	w/ PTT	① Control Head, Twin
4	ယ	2	1	Part number		Description
S	No. of stations	o. of s	z			
(B)	Quad Engine	luad l	6	.	¹ist (Qua	KE-4+ Component Parts List (Quad)
tity	Required Quantity	uired	Req	.		

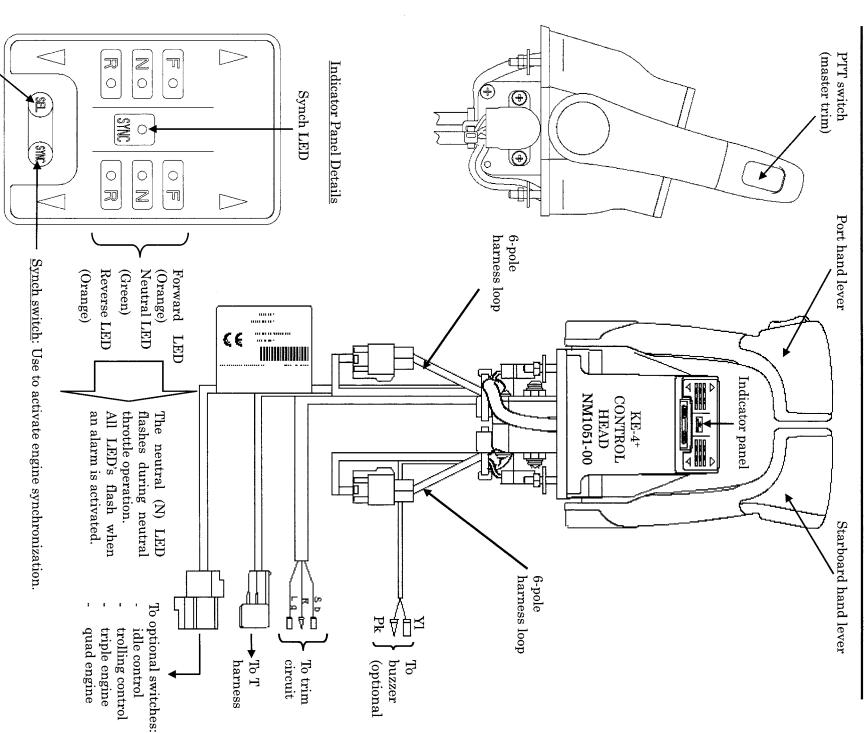
Note: Refer to previous page for balloon references and system configuration

CONTROL UNIT



Note: The Control Unit is a common-mode type that can be used with either 24V or 12V power.

CONTROL HEAD



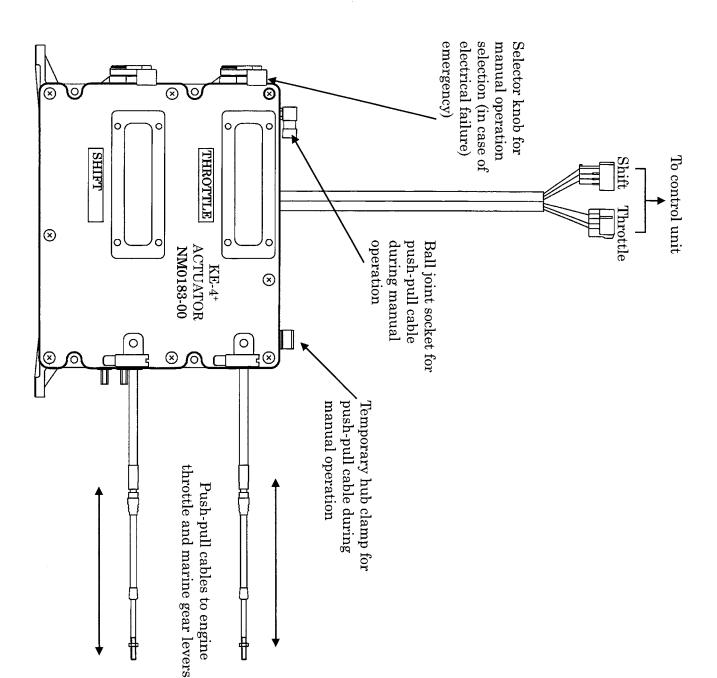
<u>Select switch</u>: Press to select station, set/cancel neutral throttle operation, & stop the buzzer.

Note: When the power supply is turned ON, the control head connected to R/C-1 T-harness is the first one to become operative. Be sure to connect a control head to R/C-1 T-harness.

ACTUATOR

▲ WARNING

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



Note: The actuator assembly includes both throttle and shift actuators

KE SYSTEM OPERATION

Initial Control Operation after Power "ON"

- With power ON and hand lever in NEUTRAL position, the system is in neutral idle condition.
- 2 The control head connected to R/C-1 T-harness is considered the master control station and will become operational first. To initiate, perform the following operations:
- A. Set the handle lever to the "Neutral" position.
- B. Once the green neutral LED(s) is/are ON, system is operational

hand lever(s) are moved into the NEUTRAL position. The green neutral LED(s) ON status indicates that to the control system and then power is applied, control system will not become operational unit until the the control system is operational Note: If the R/C-1 hand lever(s) are moved to a forward or reverse gear position while power is not applied

- When other control stations are required for operation that are connected to R/C T-harness, perform the following actions:
- A. Set the hand lever to the "Neutral" position
- B. Press and release the select switch.
- C. The green neutral LED(s) then lights ON indicating the control is operational.

Control Head Lever Operation

A CAUTION

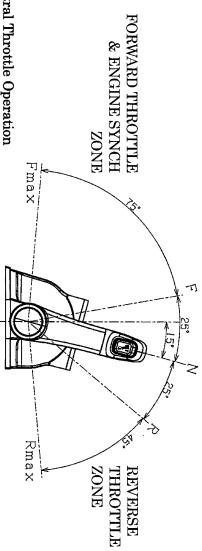
- <u>-</u> and gear could be damaged. Never operate the hand lever while the engine is not running; otherwise actuator, cable,
- Ŋ abrasion condition of the joint and apply lubricant grease onto sliding parts. In the case of a ball joint type connection to engine lever, please regularly inspect the ball joint in case of excessive wear. Replace
- ယ Refer to the push-pull cable installation sections for further reference

WARNING

be ejected from the boat. acceleration/ deceleration may cause damage to the boat or cause operator or passengers to DO NOT ATTEMPT sudden forward or reverse motion via hand lever operation. Sudden

Control Head Lever Operation (cont'd)

- shift to forward or reverse gear. Orange forward or reverse LED(s) light ON to indicate gear position. Moving the hand lever from the neutral position to the forward or reverse detent causes the actuator to
- 2 boat will accelerate. Moving the hand lever past the forward or reverse detent activates engine throttle operation and the GEAR SHIFT ZONE



Neutral Throttle Operation

- Set the hand lever to the neutral (N) position.
- 12 Move the hand lever to the forward gear position while pressing the station select switch.
- ယ The green neutral LED flashes and the neutral throttle operation is activated
- To deactivate, set the hand lever to the neutral position, press and release the select switch. release of the select switch green, neutral LED will stop flashing. neutral throttle operation This indicates deactivation of the After the

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

Set the hand lever(s) of the selected control to the neutral position, press and release the select switch. A continuous green neutral LED(s) indicates that the control station is active.

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

- -Set the hand lever(s) of the selected control to the neutral position, press and release the select switch. A continuous green neutral LED(s) indicates that the control station is ready for activation.
- 2 The operator has approximately 4 seconds to move hand levers and match the throttle position of the the system is in gear condition. last active control station. A continuous orange forward LED(s) indicates control station is active and

system automatically returning the control system to a neutral idle condition Note: Keeping the hand lever of the selected control station in the neutral position will result in control

Synchronization Function

- Set both hand levers to neutral (N) position.
- 2 control unit settings, synchronization will be possible in single or dual lever 2 modes Press SYNC button to activate. A continuous green SYNC LED indicates sync mode. Depending on
- ယ other and in forward mode (refer to image at top of page). DUAL LEVER MODE: Synchronization will be automatic whenever the levers are within 10°
- 4. SINGLE LEVER MODE: Synchronization is automatic with the PORT side lever in forward mode (refer to image at top of page)
- 5 deactivate: Set levers to neutral position and press SYNC button to turn OFF green SYNC LED

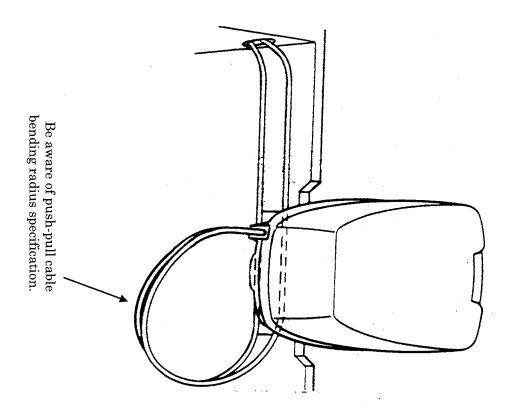
DETERMINATION ${\sf CABLE}$ LENGTH

CAU'LION

the cable or actuator could be damaged. Do not bend the cable to less than the specified radius; otherwise

Instructions:

create a loop shown below. outboard motors, determine the cable length as determined above, then add 1.0 $\,\sim\,$ 1.5m (3.3 ft $\,\sim\,$ 5 ft) to the specified radius. location in as straight a line as possible while avoiding any obstruction, which may cause bending below 1. Measure the distance from the shift and throttle actuator to the engine's shift and throttle connection This distance becomes a guideline to determine the actual cable length.



THE CONTROL ${ m HEAD}$

WARNING

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

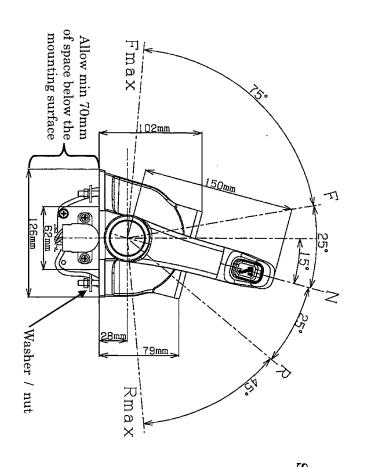
- Select a flat location convenient for installation and operation.
- Drill mounting hole locations guide by the attached template at the back of the manual.
- Instructions:

 1. Select a fl.

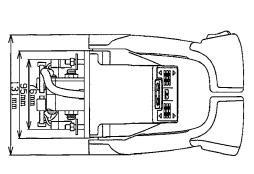
 2. Drill mous

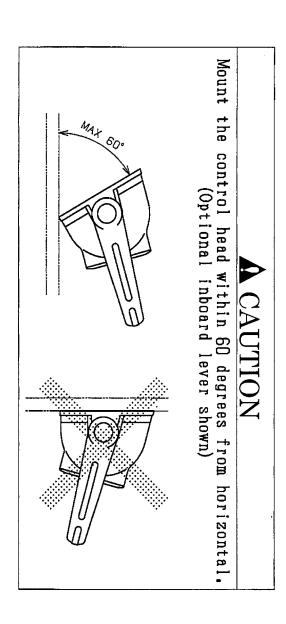
 3. Install wit

 4. Tighten to Install with attached washers and nuts.
- Tighten to 2.9 $\,\sim\,$ 4.4 N·m (2.1 \sim 3.2 lbf • ft) of torque.



Standard outboard levers shown





THE CONTROL

AUTION

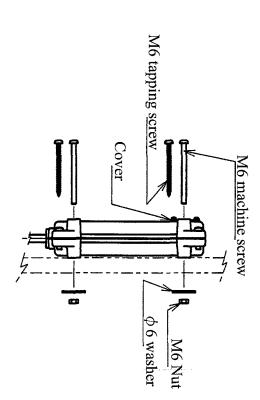
- 2.1 Ingress of water into the unit may cause failure.
- faces up for easy access to DIP switches and viewing of LED indicator. Install so that harnesses exit through the bottom and the small cover
- Install in a location where sea wind & water effects are minimized.
- € 4. Avoid a location where the ambient temperature exceeds 77%.

Instructions:

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

Notes:

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



CAUTION

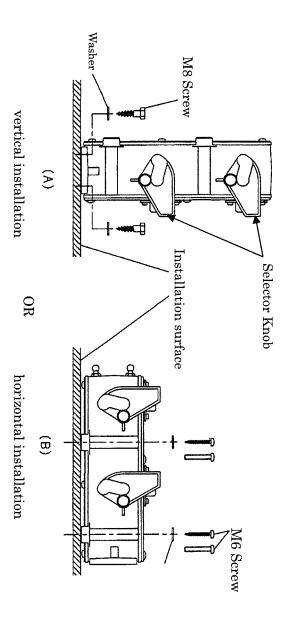
- Ingress of water into the unit may cause failure.
- 2 1 Install in a location convenient for access to manual operation selector
- ယ Install in a location where sea wind & water effects are minimized
- 4 Avoid a location where the ambient temperature exceeds 77°C.

Instructions:

- The actuator harness is 2m (6.5ft) in length. Select the actuator location so that its distance from the control unit is 2m (6.5ft) or less.
- 12 drawings below. Drill mounting hole locations based on the installation type A (vertical) or B (horizontal) as per the
- ငှာ Install with included fasteners or with separately purchased machine screws or tapping screw and washer (see data below).
- Tighten to 3.9 \sim 5.9 N · m (2.9 \sim 4.3 lbf • ft) of torque.

Notes:

- Fastener mounting plate thickness: 20mm min. (3/4in. min),
- 5 Pilot hole diameter: ϕ 5mm (ϕ 1/5in.)



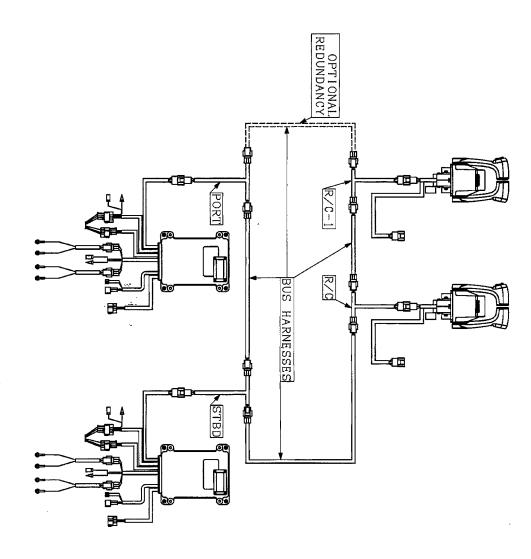
CONTROL HEAD &

CAUTION

- 2 :-All connectors must be mated firmly; the system may fail to operate otherwise. 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 be become operative

Instructions:

- Connect the 8-pin harness connector of the first control head to the R/C-1 T-harness NM0647-09.
- 5 Connect the 8-pin harness connector of the remaining control heads to the R/C T-harness(es) NM067-10.
- ယ Connect the 8-pin harness (CAN) connector of the control units to the appropriate SINGLE, PORT, STBD, CENTER, CENTER-STBD (NM0647-XX) T-harnesses:
- continuous data bus between from the first control head to the last control unit. Finally connect a main bus harness (NM0649-XX) in between each of the T-harness connectors for a
- 5 Optional: Add a spare bus harness (NM0649-XX) in between the last 2 ends to close the loop and create a redundant path.

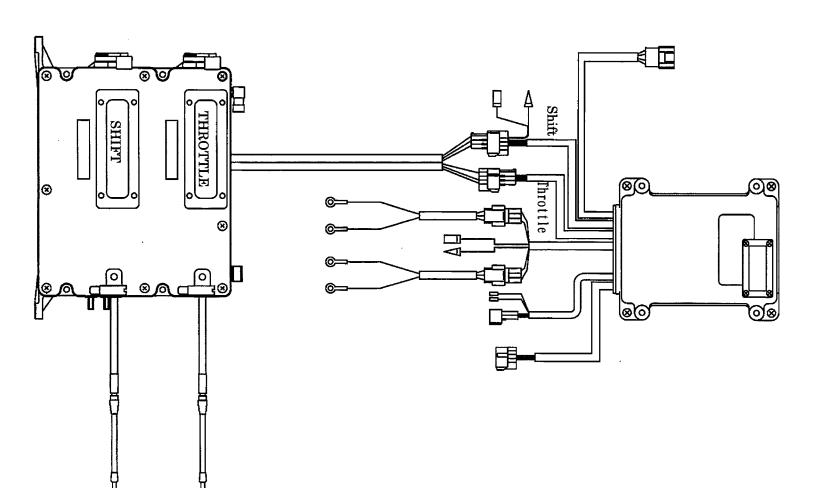


Note: The figure above is an example of a two engines / two control stations system.

CONNECTING CONTROL UNIT & ACTUATOR

Instructions:

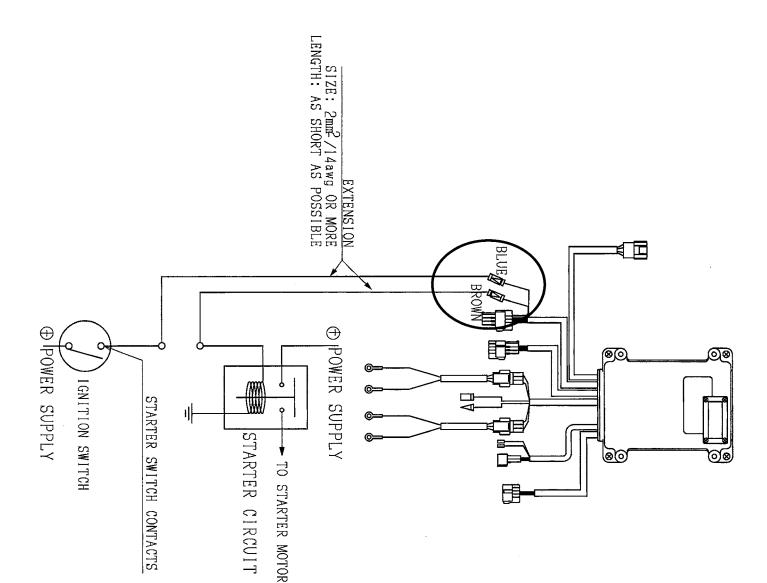
1. Connect the 12-pin connector and 9-pin connector pair to the actuator harness.



CONNECTING SIGP: START IN GEAR PROTECTION

Instructions:

- Connect between the starter circuit and the ignition switch of the boat.
- 2 Select extension wires that are as thick (2mm² / 14AWG or more) and short as possible; excessively long extensions could cause voltage drop, resulting in failure of engine start.



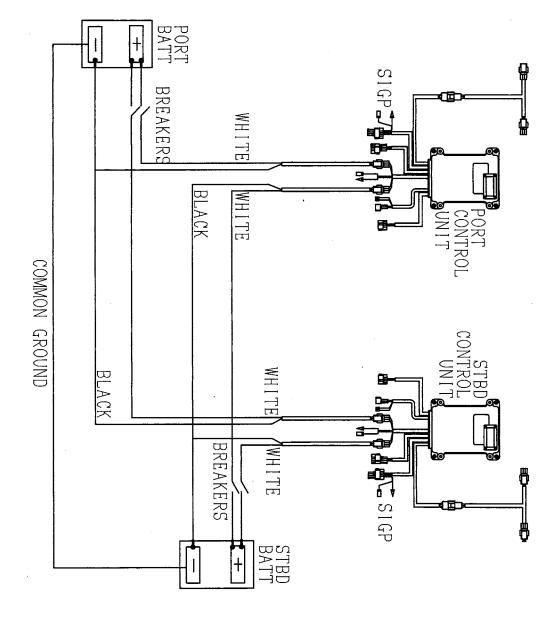
CONNECTING POWER

A CAUTION

- will be a temporary error code if PORT & STBD are not powered ON simultaneously. lines. Alarm code LED's will flash if only one power line is connected. As a safety feature, a duplex power line system is provided. Be sure to connect both Also note that there
- first disconnected via circuit breaker or battery switch Do not attempt to disconnect the power harness from the control unit unless power is

Instructions for safe & reliable power redundancy to the KE control system:

- Connect each black wire of the power harness directly to (-minus) of battery (power).
- 2 circuit breaker or directly to (+ plus) of battery (power). Connect each white wire of the power harness, via the optional 20 amp circuit breaker, via the boat
- ယ Connect the (-minus) pole of each battery together for a common ground

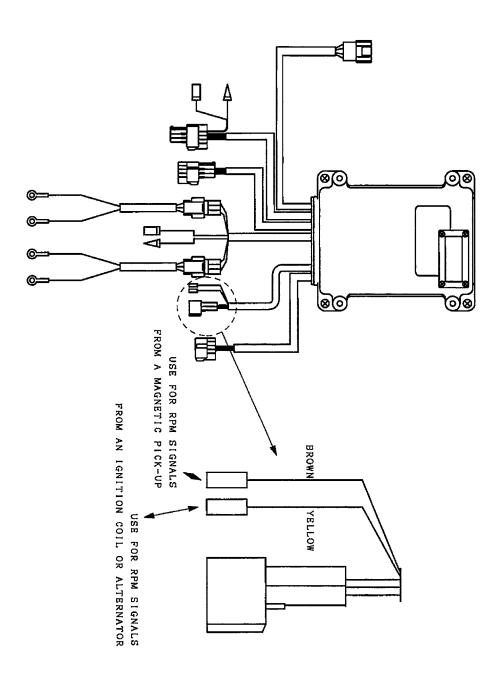


separated between any 2 batteries. Note: In case of triple or quadruple engine setups, the additional control unit power lines can be

CONNECTING SYNCHRONIZATION CIRCUIT

Instructions: (in order for the control unit to read engine synch signal properly)

- circuit (typically diesel engine). Connect the brown wire to the engine rpm (or tachometer) signal in a case of a magnetic pick-up type
- 5 alternator type circuit (typically gasoline engine). Connect the yellow wire to the engine rpm (or tachometer) signal in a case of an ignition coil or
- 3. Refer to 'Adjusting Control Unit' for synch mode setting.

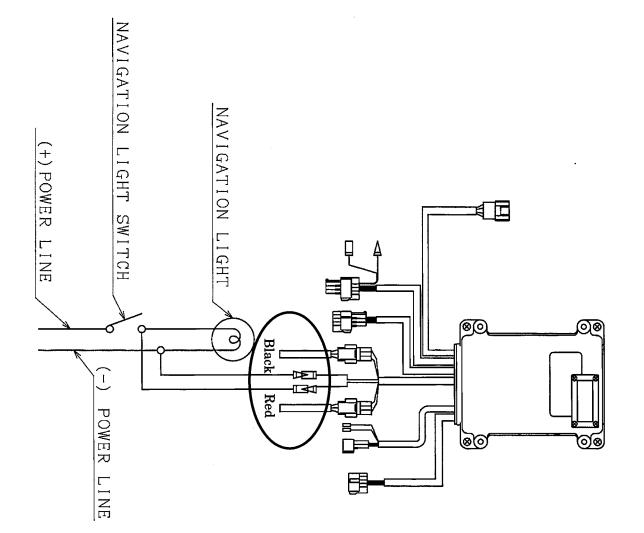


Note: No damage will occur if the case of a wrong connection, synchronization will simply be ineffective.

CONNECTING DIM HARNESS (OPTION)

Instructions:

- Connect the dim harness red wire to the (+) wire of navigation light.
- 2 Connect the dim harness black wire to the (-) wire of navigation light.

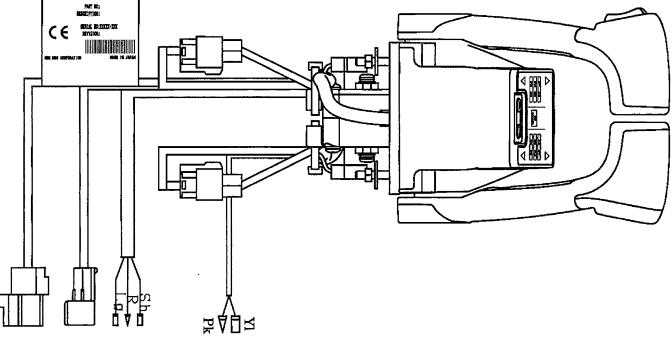


whenever navigation light is ON. Note: Once dim harness is connected, brightness of the control head LED's illumination will be reduced

CONNECTING BUZZER (OPTION)

A CAUTION

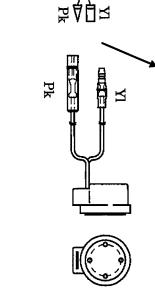
Be sure to select the correct buzzer (12V or 24V) for your power source (battery).



Buzzer (optional)

Instructions:

Connect pink & yellow wires of control head to matching pink & yellow wires of buzzer.

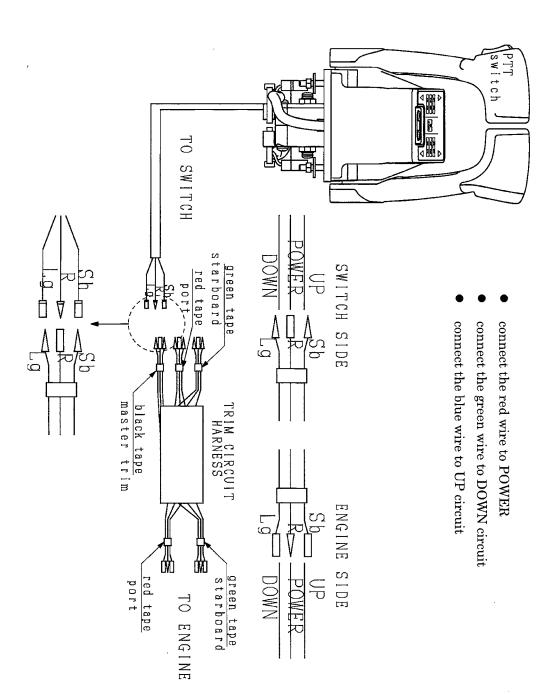




CONNECTING TRIM CIRCU

Instructions:

- switch side of trim circuit harness (included in your PTT kit), as per the circuit below. Connect the KE-4+ PTT switch (master trim) plus the individual engine trim switches to the
- 2 Connect the other side to the engine connections (engine side), as per the circuit below.

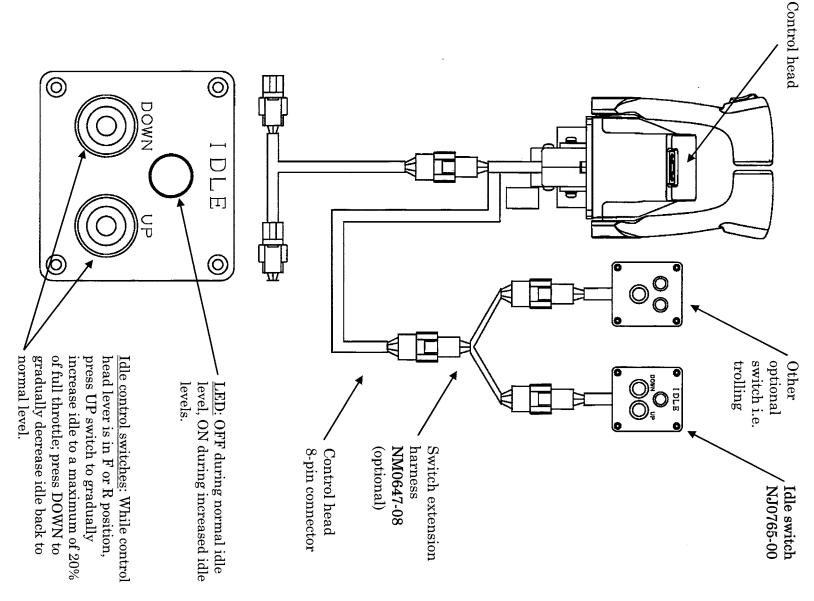


Notes:

- simultaneously. Once connected, the control head PTT switch will provide trim and tilt control of all engines
- Individual trim switch operation will be possible via the engine trim (panel) switches

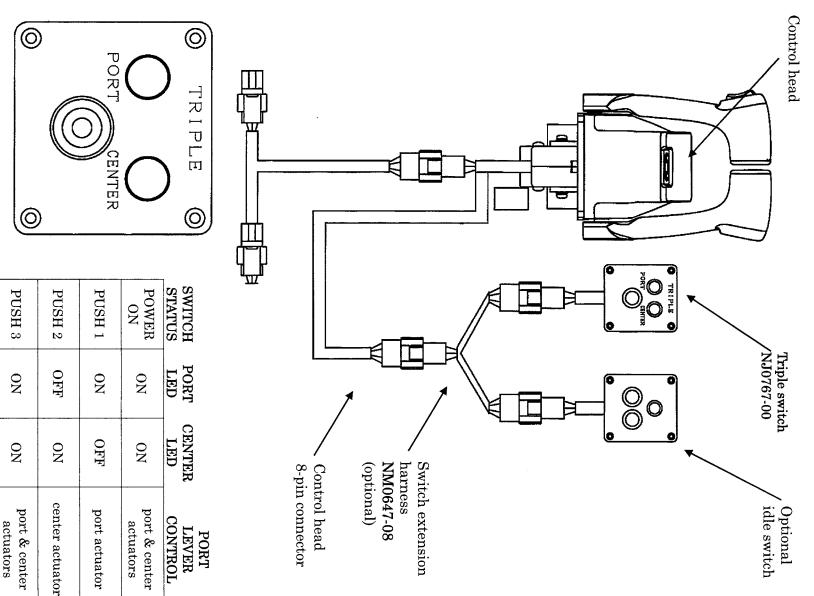
CONNECTING IDLE SWITCH (OPTION)

KE-4⁺ system. idle switch directly or via a switch extension harness if other optional switches are also part of the main Instructions: For each control head / idle switch pair, connect the 8 pin harness of the control head to the



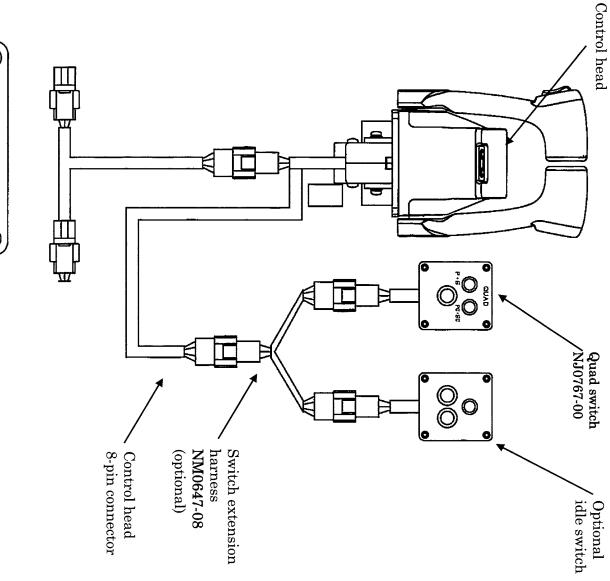
CONNECTING TRIPLE SWITCH (OPTION)

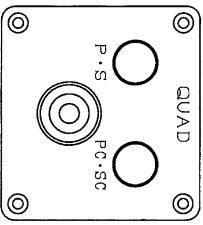
the triple switch directly or via a switch extension harness if other optional switches are also part of the main KE-4+ system. Instructions: For each control head / triple switch pair, connect the 8 pin harness of the control head to



CONNECTING QUAD SWITCH (OPTION)

main KE-4+ system. the quad switch directly or via a switch extension harness if other optional switches are also part of the Instructions: For each control head / quad switch pair, connect the 8 pin harness of the control head to



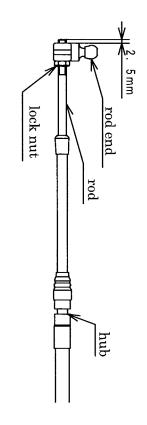


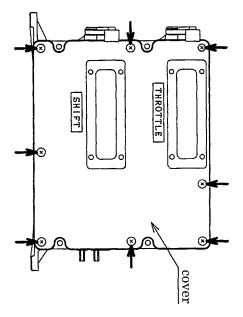
all 4 actuators	ON	ON	PUSH 3
inside actuators	ON	OFF	PUSH 2
outside actuators	OFF	ON	PUSH 1
all 4 actuators	ON	ON	POWER ON
LEVERS CONTROL	PC·SC LED	P·S LED	SWITCH STATUS

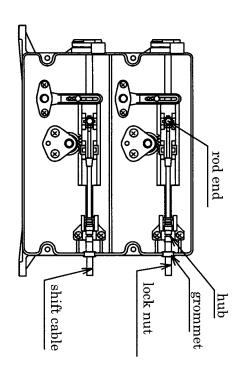
SH-PU TLL CABLE INSTALLATION

Instructions: →push-pull cables to actuator

- Install the rod end to the rod and set with lock nut.
- 2. Tighten to 2.9 \sim 4.4 N·m (2.1 \sim 3.2 lbf·ft)
- ္ပ Remove the eight (8) actuator screws shown with arrows and remove the cover
- 4. Install the waterproof grommet around the cable.
- 57 Install the rod end, hub and waterproof grommet to the actuator mount groove as shown below.
- 6. Re-install the cover onto the actuator with screws.
- 7. Tighten to 1.2 \sim 1.8 N·m (0.9 \sim 1.3 lbf·ft)







PUSH-PULL CABLE INSTALLATION (continued)



- **,...** before installing the other ends to the engine & gear. Be sure to completely install the push-pull cables in the actuator
- 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
- could occur. of operation (i.e. stroke direction and distance); otherwise damage cable motions correspond properly with the engine and gearbox mode Please make sure that the system is installed such that the push-pull

<u>Instructions</u>: → Initialization

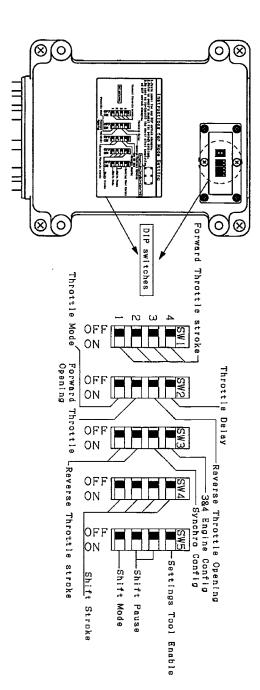
- 8. Turn power ON to the KE system control unit.
- 9. Set the R/C-1 control head lever(s) to neutral position.
- 10. The throttle actuator should now be fully closed and the shift actuator should be in neutral position.
- 11. Positioning is completed once the neutral lamp goes ON. installation to engine & marine gear as per engine manual Push-pull cables are now ready for

ADJUSTING THE CONTROL

▲ CAUTION

- push-pull cables from the engine / gear. Be sure to turn OFF the power to the control unit before removing the
- 2 seal, torque to 1.0 Once control unit adjustment is completed, re-install the cover for proper positioning of the actuator (see previous page) $\sim 1.7 \,\mathrm{N} \cdot \mathrm{m} \,(0.7 \sim 1.2 \,\mathrm{lbf} \cdot \mathrm{ft}).$ Then, carry out

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



Shift actuator mode.

Select the following DIP switch configurations for the desired shift push-pull cable direction setting.

NO	OFF	SW5-1
Push to go forward	Pull to go forward	FUNCTION

^{*}Before shipment, all switches are set to OFF (pull to go forward).

Shift stroke: Forward

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

SW4-1 ON OFF	OFF ON
ON	OFF
OFF	ON
OFF	OFF
NO	ON

^{*}Before shipment, all switches are set to OFF (34mm).

Shift stroke: Reverse

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

ON	OFF	OFF	ON	SW4-3 SW4-4
NO	OFF	ON	OFF	SW4-4
40mm (1.5 in)	34mm (1.3 in)	30mm (1.2 in)	26mm (1.0 in)	STROKE

^{*}Before shipment, all switches are set to OFF (34mm).

Throttle actuator mode

setting. Select the following DIP switch configurations for the desired throttle push-pull cable direction

SW 2-1	FUNCTION
OFF	Pull to open throttle
ON	Push to open throttle

^{*}Before shipment, all switches are set to OFF (pull to open).

Forward throttle stroke

stroke setting characteristics. is operated from forward to full forward, the throttle actuator stroke can be set from 31mm to 73mm via Select the following DIP switch configurations for the desired throttle stroke settings. When the hand lever 3mm intervals, plus an 80mm setting. Refer to the appendix for supplemental information on throttle

^{*}Before shipment, all switches are set to OFF (64mm).

Reverse throttle stroke.

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

SW 3-1	SW 3-2	SW 3-2 FUNCTION
OFF	OFF	60% of the forward full open stroke
ON	OFF	80% of the forward full open stroke
OFF	ON	100% of the forward full open stroke
ON	ON	100% of the forward full open stroke

^{*}Before shipment, all switches are set to OFF (60% of forward)

Synchronization configuration

Select the following DIP switch configurations for the desired synchronization setting

O O TRUD
SW 3-3 FUNCTION
OFF
NO

^{*}Before shipment, all switches are set to OFF (single lever).

Notes:

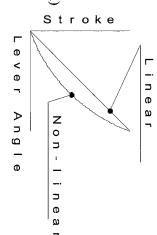
- Be sure to set the DIP switches of both control units for proper synchronization function
- 5 Refer to previous sections in this manual for synch function connection & operation instructions.

Forward throttle opening.

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

ON
Forward throttle non-linear



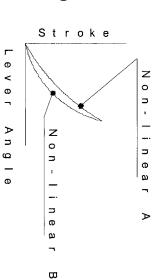


Reverse throttle opening.

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

SW2-3	FUNCTION
OFF	Reverse throttle non-linear A
ON	Reverse throttle non-linear B

^{*}Before shipment, all switches are set to OFF (opening 1)



Throttle delay.

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

ON	OFF	SW 2-4
Throttle delay active.	No throttle delay	FUNCTION

^{*}Before shipment, all switches are set to OFF (no delay).

Shift pause.

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

6 seconds	ON	ON
4 seconds	ON	OFF
2 seconds	OFF	ON
No shift pause	OFF	OFF
SW 5-3 FUNCTION	SW 5-3	SW 5-2

^{*}Before shipment, all switches are set to OFF (no pause)

Select the following DIP switch configurations for the desired triple & quad engine settings. Triple & Quad engine configuration (not active for single or dual engine configuration)

SW 3-4	SW 3-4 FUNCTION
	When outside engine control head lever positions do not match (i.e. PORT Forward,
OFF	STBD Reverse) then inside engine actuator(s) default to Neutral. When control
	head lever positions match, inside actuator(s) also match.
ON	Triple: Center engine actuator follows PORT actuator operation.
ON	Quad: Inside engine actuators follow adjacent outside actuator operation

^{*}Before shipment, all switches are set to OFF (Center engine neutral default)

Settings tool enable (intended for multi-vessel data management via PC connection)

Select the following DIP switch configurations for the desired settings tool setting

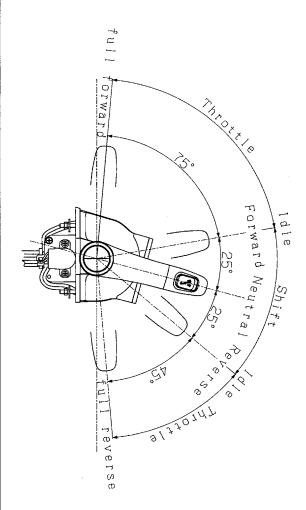
SW 5-4	SW 5-4 FUNCTION
OFF	Settings tool & system log access inactivated
NO	Settings tool & system log access activated.

^{*}Before shipment, all switches are set to OFF (inactive)

It is intended for multi-vessel data management (boat builders, distributors, etc.) and requires a PC Note: This DIP switch is intended to activate a software-controlled version of the settings configuration. connection via a custom cable

OPERATION CHECK

<u>Instructions</u>: Once installation is completed, carry out the following operation check:





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

Shift and throttle operation check

Step	Hand lever operation	Action
1	Neutral → Forward	Shift actuator from neutral to forward
2	Forward \rightarrow Forward full open	Throttle actuator fully closed to fully open
3	Forward full open \rightarrow Neutral	Throttle actuator fully open to fully closed
		Shift actuator from forward to neutral
4	Neutral → Reverse	Shift actuator from neutral to reverse
ហ	Reverse \rightarrow Reverse full open	Throttle actuator from fully closed to fully open.
6	Reverse full open \rightarrow Neutral	Throttle actuator from fully open to fully closed
		Shift actuator from reverse to neutral

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

Confirmation of the SIGP function

Step	Description	OK	Countermeasure if NOT OK
-	Set hand lever to NEUTRAL and turn ignition	Engine starts	Shorten SIGP wiring connection (page 23)
2	Set hand lever to FORWARD and turn ignition	Engine does not start	Connect SIGP as per instructions (page 23)

MANUAL OPERATION (OPTION)

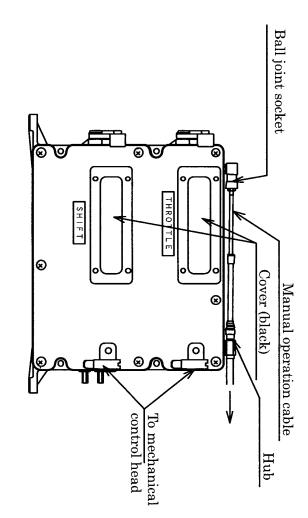
▲ WARNING

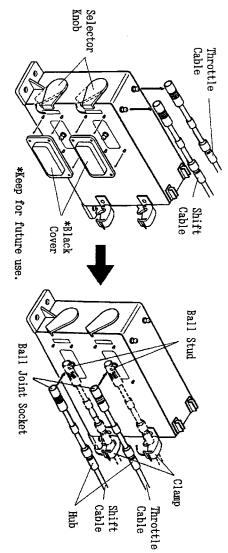
Activate manual operation only in cases of emergency.
Use for immediate return to shore

Note: This feature is intended for use when there is a failure to the electrical system.

Instructions:

- Install the mechanical control head and push-pull cable according to the instruction manual of the optional mechanical control head.
- 52 Install ball joint socket to the output end of the push-pull cable and fix it to the actuator.
- 3. Remove the black cover and expose the ball stud.
- Tilt the selector knob fully in the arrow direction.
- Remove the cable from the position and install its ball joint socket onto the ball stud and the hub onto
- 6. The actuator can then be operated manually via the mechanical control head levers.
- .7 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 plus the alphanumeric LED display on the control unit and an optional buzzer.

4 * * * * Shift Actuator	* * * * Control Head, Bus Harness	2 ** Throttle Actuator Signal	* Shift Actuator Signal	LED Flashing Frequency
 ①Push-pull cable installed without proper positioning. ②Shift actuator stroke exceeding stroke of the gear clutch. ③Shift actuator set to manual operation. ④Loose push-pull cable. ⑤Loose clutch connection or clutch load too heavy for shift actuator. ⑥No motor motion 	 ①Control head 6-pole harness loop not properly connected. ②A. Control head 6-pole harness loop: 1 output line damaged → system still operates. ②B. Control head 6-pole harness loop: 2 output lines damaged → system no longer operates. 	①Throttle actuator and control unit not connected properly. ②A. Throttle actuator harness 1 output line damaged -> system still operates ②B. Throttle actuator harness: 2 output lines damaged -> system no longer operates ③Throttle actuator set to manual operation.	②A. Shift actuator harness: 1 output line damaged / shorted -> system still operates ②B. Shift actuator harness: 2 output lines damaged/short -> system no longer operates ③Shift actuator set to manual operation.	Possible Cause (DShift actuator and control unit not connected properly.
①Perform proper cable positioning & initialization of the shift actuator. ②Reduce shift actuator stroke. ③Set system to NEUTRAL and rotate selector knob to electronic operation. ④Fasten cable rod end, lock nuts. ⑤Verify clutch connection or clutch load (particularly outboard motor dog clutch). ⑥Consult dealer for replacement item.	①Reconnect 6-pole harness loop(s). ②A. Consult dealer for replacement item at earliest convenience. ②B. Consult dealer for replacement item immediately.	①Reconnect the throttle actuator to control unit. ②A. Consult dealer for replacement item at earliest convenience. ②B. Consult dealer for replacement item immediately. ③Set system to neutral and rotate selector knob to electronic operation.	 ②A. Consult dealer for replacement item at earliest convenience. ②B. Consult dealer for replacement item immediately. ③Set system to NEUTRAL and rotate selector knob to electronic operation. 	Check / Countermeasure ①Reconnect the shift actuator to control unit.
Page 33 Page 34 Page 39 Page 32, 39	Page 13 Page 13	Page 22 Page 39	Page 39	Reference Page 22

ALARM CODES (continued)

9 * * * * * * * * * Option Switch	* * * & * * & * * * *	7 * * * * * * * Control Head	6 * * * * Power	* * * * * Throttle Actuator	LED Flashing Frequency
Option switch pressed-in or shorted. I.e. Idle control switch, Triple switch or Quad switch.	①Bus harness damaged ②Any T-harness damaged: control head or control unit. ③Any T-harness connecting harness damaged: control head 8-pole / 6-pin harness or control unit CAN harness, ④optional settings tool setup completed ⑤Power activation timing offset.	©Control head select switch pressed-in or shorted. ©Control head sync switch pressed-in or shorted.	①One of duplex power lines is disconnected. ②System power harnesses not properly connected. ③Source (battery) voltage outside of operating voltage range. ④Power harness damaged. ⑤Control unit power line damaged. ⑥Power activation timing offset.	 ③Throttle actuator set to manual operation. ④Loose push-pull cable. ⑤Loose connection to engine. ⑥No motor motion. 	Possible Cause ①Push-pull cable installed without proper positioning. ②Throttle actuator overloaded.
Reset/unlock the switch or consult dealer for replacement item.	①Consult dealer for bus harness replacement. ②Consult dealer for appropriate T-harness replacement. ③Consult dealer for replacement item. ④cycle power as per settings tool instructions ⑤Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	Reset/unlock the switch or consult dealer for replacement item.	①Check/connect both power lines to power source (battery) and turn ON both power line breakers. ②Reconnect the system power harnesses to the control unit. ③Adjust source (battery) voltage to within specified range. ④Consult dealer for power harness replacement. ⑤Consult dealer for replacement item. ⑥Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	③Set system to NEUTRAL and rotate selector knob to electronic operation. ④Fasten cable rod end, lock nuts. ⑤Verify engine connection. ⑥Consult dealer for replacement item.	Check / Countermeasure ①Perform proper cable positioning & initialization of the throttle actuator. ②Review actuator load conditions.
Pages 13, 29-31	Page 21 Pages 4-13 Pages 4-13 Settings tool manual Page 24	Page 13	Page 24 Page 2 Page 2 Page 5 Page 24 Page 5	Page 39 Pages 32,	Reference Page 33

TROUBLESHOOTING

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

2	31.0		D-6
Symptom	Possible Cause	Cneck / Countermeasure	Kererence
No operation even though power source is ON.	Power harness is not connected properly.	Reconnect both power lines to power source (battery) and turn ON both power line breakers.	Page 24
No control head	①Control head hand lever not in neutral during initial operation.	① Set hand lever to NEUTRAL position with power ON.	Page 15
LED'S ON.	©R/C-1 T-harness not connected to control head.	©Connect R/C-1 T-harness.	Page 21
For Nor R LED	①Control head LED or CAN harness damaged	① Consult dealer for replacement item.	Page 13
does not light ON.	(connects to T-harness). ②Control head T-harness damaged.	② Consult dealer for R/C-1 or R/C T-harness replacement.	Page 21
F, N, R LED light ON but shift clutch does not engage.	Shift actuator push-pull cable damaged.	Replace shift actuator push-pull cable.	Page 32
F, N, R LED ON but engine speed does	Throttle actuator	Replace throttle actuator push-pull	Dag 39
not respond to system.	push-pull cable damaged.		Page 32
Engine does not start.	①Low battery voltage. ②SIGP harness wire too long.	①Charge the battery. ②Shorten SIGP harness wire.	Page 23
Neutral throttle	1Initial control operation	initial	Page 15
operation not functional.	not properly set. ②Select switch damaged.	② Consult dealer for replacement item.	Page 13
Synchronization	①Input signal incorrect.	① Verify synchronization circuit signal type & connection.	Page 25
functional.	apart in dual lever mode	②Adjust levers to be within 10°	Page 16

MAINTENANCE SERVICE

continued safe and reliable system operation in a marine environment, please refer to the following general guidelines on maintenance and service. KE-4+ control system components contain moving parts and precision sensors. In order to ensure

Control Head & Actuators

- 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

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

Mechanical Push-pull cables

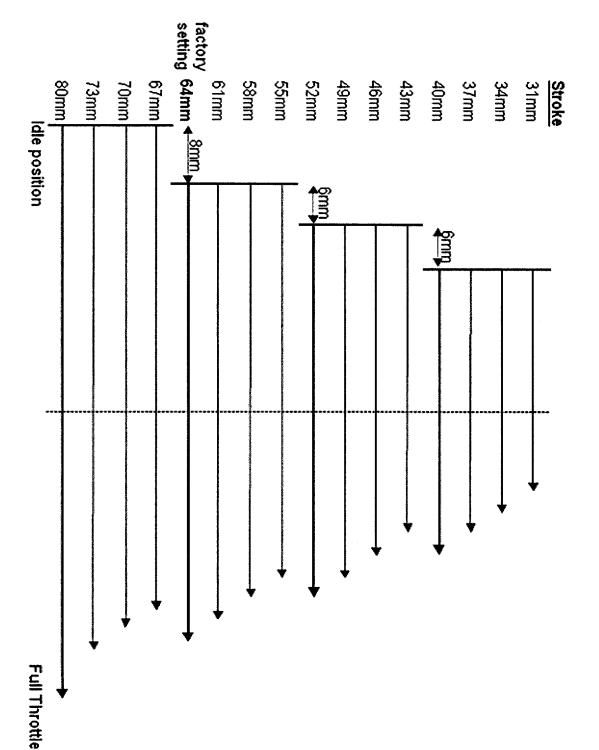
- Also check for smooth push-pull motion during actuator operation. Regularly check push-pull cable connections at both ends (actuator end, engine end) for looseness.
- apply lubricant grease regularly. In the case of a ball joint type connection to cable & engine lever, carefully inspect abrasion and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

maintenance and service information Note: In the case $^{\mathrm{of}}$ \mathbf{KE} control system transfer of ownership, please make sure to include

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THROTTLE STROKE CHARACTERISTICS

actuator stroke settings and installing push-pull cable Please use the throttle actuator stroke characteristics data below as reference when determining the KE throttle

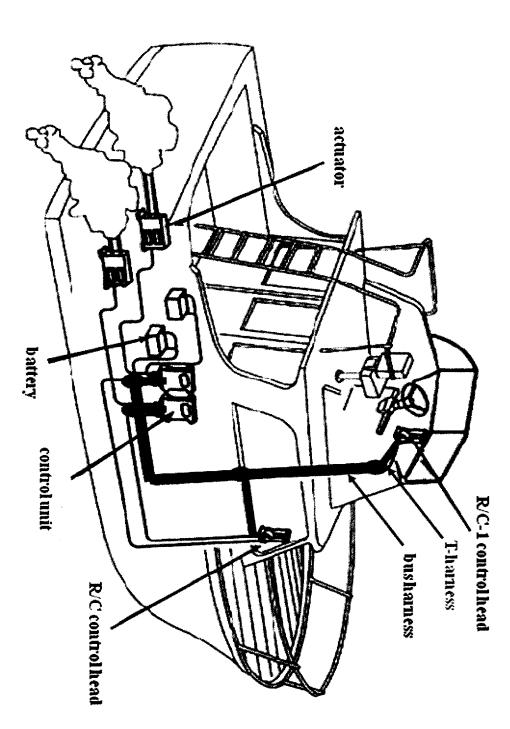


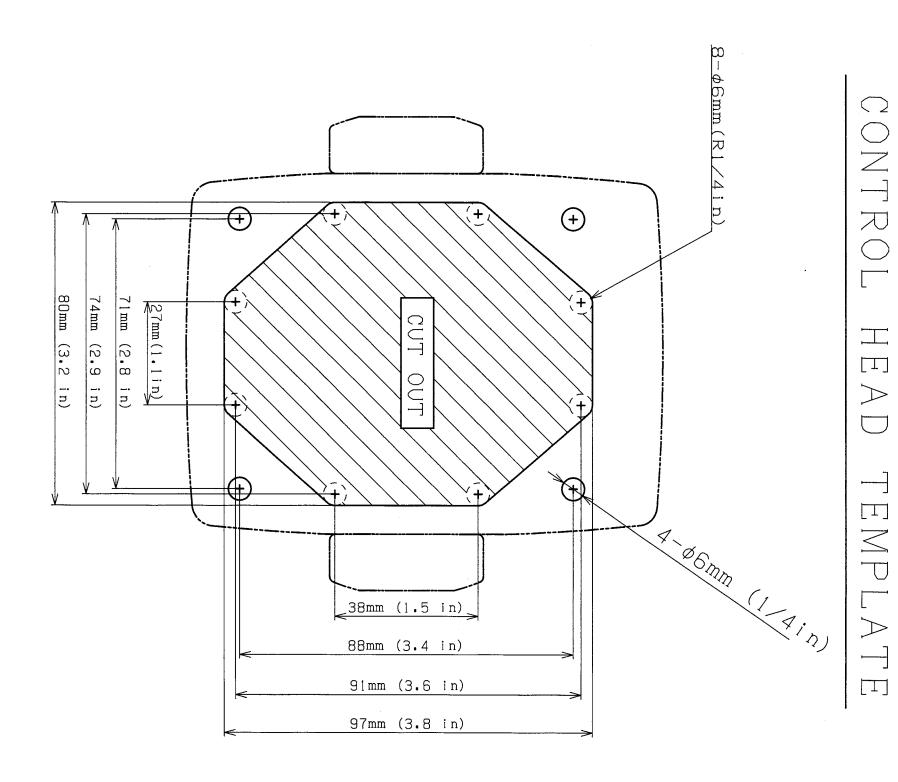
Note:

- reset the throttle actuator idle position at 40mm, 52mm and 64mm positions. In order to allow a balanced stroke operation at higher stroke settings, the KE system will automatically
- 52 end stroke position for proper operation afterwards. The KE system will also recognize over-stroke condition upon the first motion and automatically adjust the

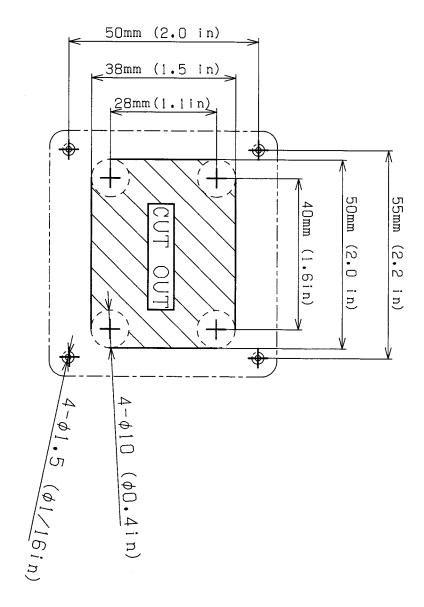
SAMPLE KE-4+ SYSTEM INSTALLATION

Boat example: 2 engines & 2 stations





A4





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