NHK MEC

KE-5XG

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-5XG control system. Be sure to read this manual thoroughly to understand how the system works. 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 owner's manuals of marine engine and gear. The specifications may be subject to change without notice in view of improvement, resulting in some 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

⚠ WARNING (CALIFORNIA PROPOSITION 65)

This product can expose you to Lead (Pb), which is known to the State of California to cause cancer, birth defects or other reproductive harm. For details: www.P65Warnings.ca.gov.

This manual contains cautions via the following headers, pay particular attention to these symbols.

⚠ 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 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 void.

PRODUCT SPECIFICATIONS

1. Electrical Performance

- Supply voltage range: DC9V ~ DC32V
- shift output contact point capacity (normally open) under nominal conditions: 5A max

2. Throttle Outputs

A) **Current:** 3mA to 21mA
B) **Voltage:** 0.2V to 4.53V
C) **PWM:** 6% to 94% duty cycle, 500 Hz
D) **CAN:** SAE J1939 protocol; 250 kbit/s; Tx cycle 50msecs, throttle scale 0.4%/bit; PGN 61443, CAN ID 0CF0 0331

3. Shift Outputs

Shift output will match battery level (12V / 24V) for connection to shift activation solenoid input.

4. Temperature Range

(1) Operating temperature: －25° C ~ ＋77° C
(2) Storage temperature ： －40° C ~ ＋85° C

Notes:

① Control unit circuit does not include a 120-ohm terminator for CAN protocol throttle signal. It is expected that 120Ω terminators will be already embedded in the engine circuit.
② All outputs include optional Idle Validation Switch normally closed / open, 8A max.
③ Use settings to select output appropriate for your engine & gearbox (refer to settings section of this manual for details)

PRODUCT FUNCTIONS

Main

- 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: Transfer between up to 4 control heads + 1 optional handheld station
- SIGP (Start in Gear Protection): Engine starts only when in neutral position, for safety.
- Synch: Allows multi-engine speed synchronization; single lever & dual lever modes available.
- Settings: Allows settings for various configurations.
- Alarm Codes: Detected system faults are indicated via flashing LED's on the control head. Fault log can also be viewed & downloaded via the PC Service Tool.

Options

- Handheld Station: Provides an optional mobile version of control head (up to twin only)
- Dim Display: Decreases brightness of control head LED's at night time.
- Buzzer: Adds an audio alarm to visual LED codes & alphanumeric display
- Idle Control: Provides idle settings of engine via optional switch
- Multi-Engine Control: Up to 4 engines can be controlled via optional switches

PRODUCT COMPLIANCE

ISO 9001 QUALITY

CE

ABYC

TYPE APPROVAL CERTIFIED

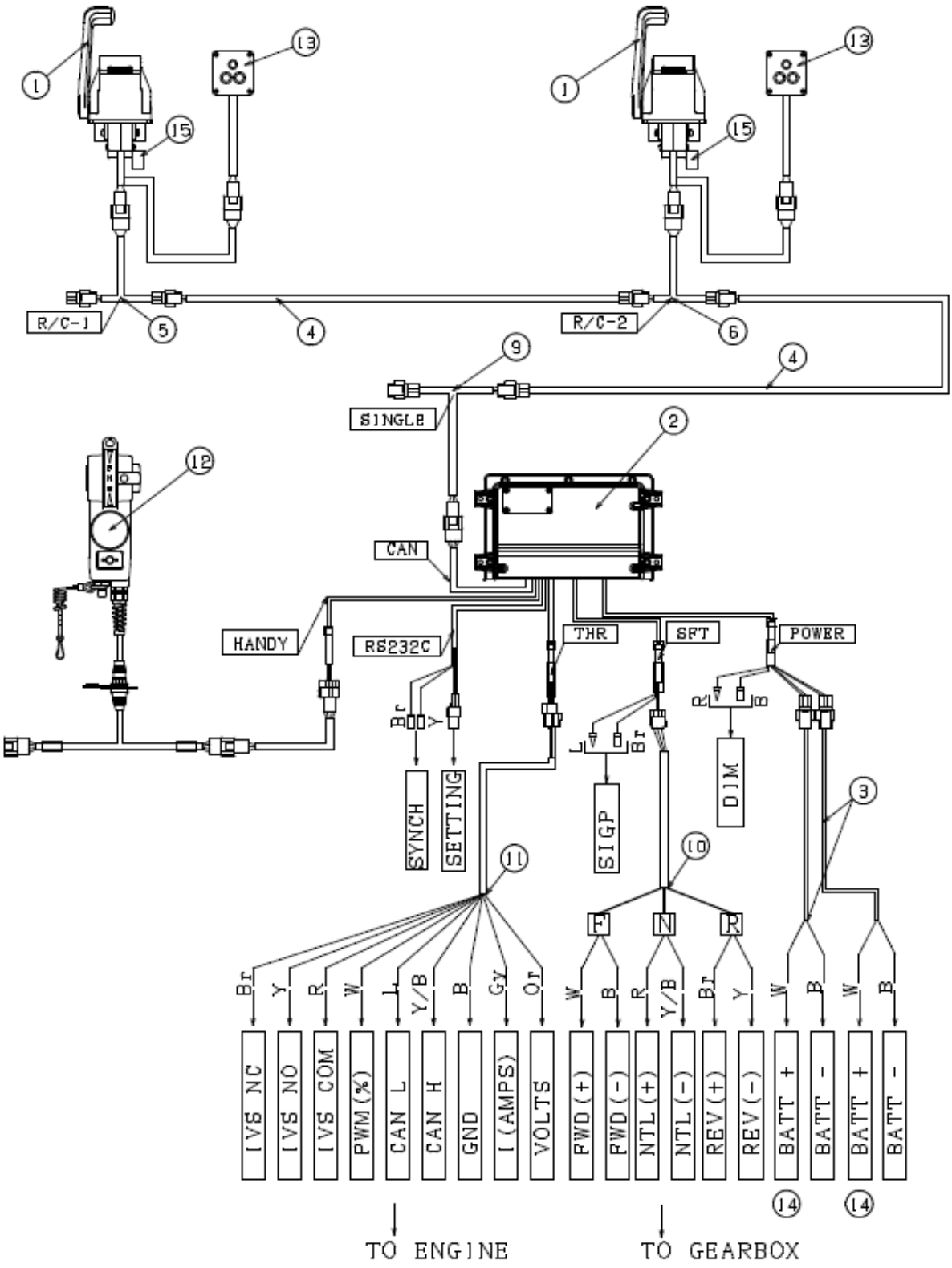
1. USA

- *ABYC*: This control system meets applicable requirements of various ABYC standards.
- *CFR*: Meets Title 46 CFR Part 284 & Title 33 CFR Part 183 marine regulations for US Coast Guard requirements.

2. INTERNATIONAL

- *ISO*: This control system meets applicable requirements of various ISO test standards for performance in addition to ISO 9001 & 14001 Quality Management System standards.
- *CE*: This control system meets applicable requirements of the Recreational Craft Directive & EMC Directive
- *TYPE APPROVAL*: Tested in accordance with relevant requirements of IACS E-10 specifications for type approval certification of recognized associations such as BV, CCS, etc.

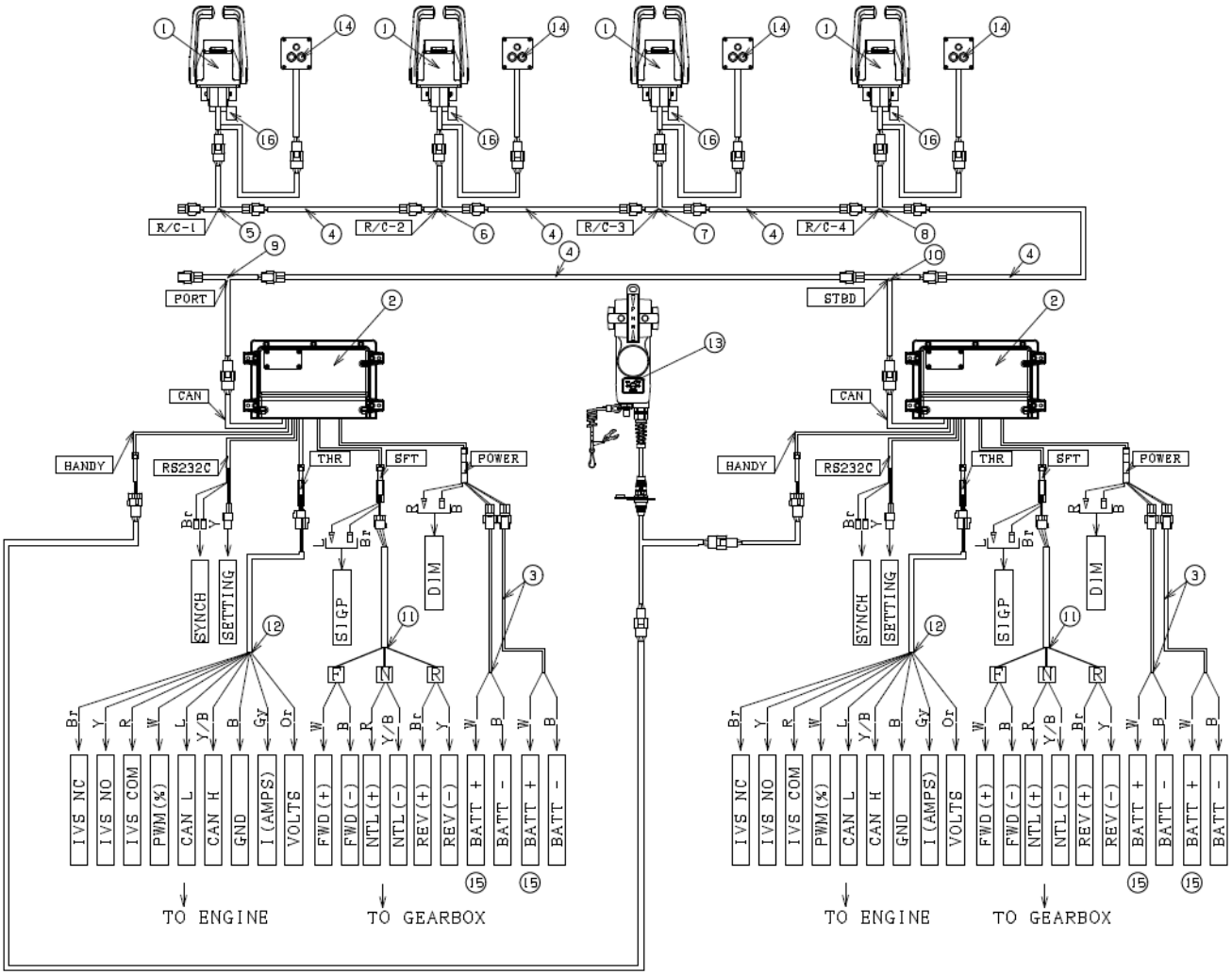
SINGLE ENGINE CONFIGURATON



COMPONENTS LIST: SINGLE ENGINE

KE-5XG Component Parts List (Single)			Required Quantity No. of stations			
Description		Part number	1	2	3	4
Control Head, single lever	NM2011-00, NM2012-00		1	2	3	4
① *SST = stainless steel, (i/b style)*	NM2013-00					
② Control unit 12V/24V		NM3458-00	1			
③ Harness Power Supply	5m	NM0414-28	2			
	10m	NM0414-33				
④ CANbus Harness: 2m, 4m, 6m, 8m, 10m, 12m, 14m, 16m, 18m, 20m, 24m, 30m, 40m, 50m (1m = 39 inches)	NM0649-XX (XX = length in meters)		1	2	3	4
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ (R/C-2) for optional 2nd station		NM0647-17	1			
⑦ (R/C-3) for optional 3rd station		NM0647-18	1			
⑧ (R/C-4) for optional 4th station		NM0647-19	1			
⑨ T-harness (SINGLE)		NM0647-11	1			
⑩ Harness, Shift (5m or 10m)	5m	NM0640-05	1			
	10m	NM0640-10				
⑪ Harness, Throttle (5m or 10m).	5m	NM0666-05	1			
	10m	NM0666-10				
⑫ Handheld control (optional)	Refer to handheld control manual					
⑬ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑭ Circuit Breaker (optional)	10A	NJ0595-00	2			
⑮ Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				
Settings Tool harness	NM1476-01	Refer to SYSTEM SETTINGS				

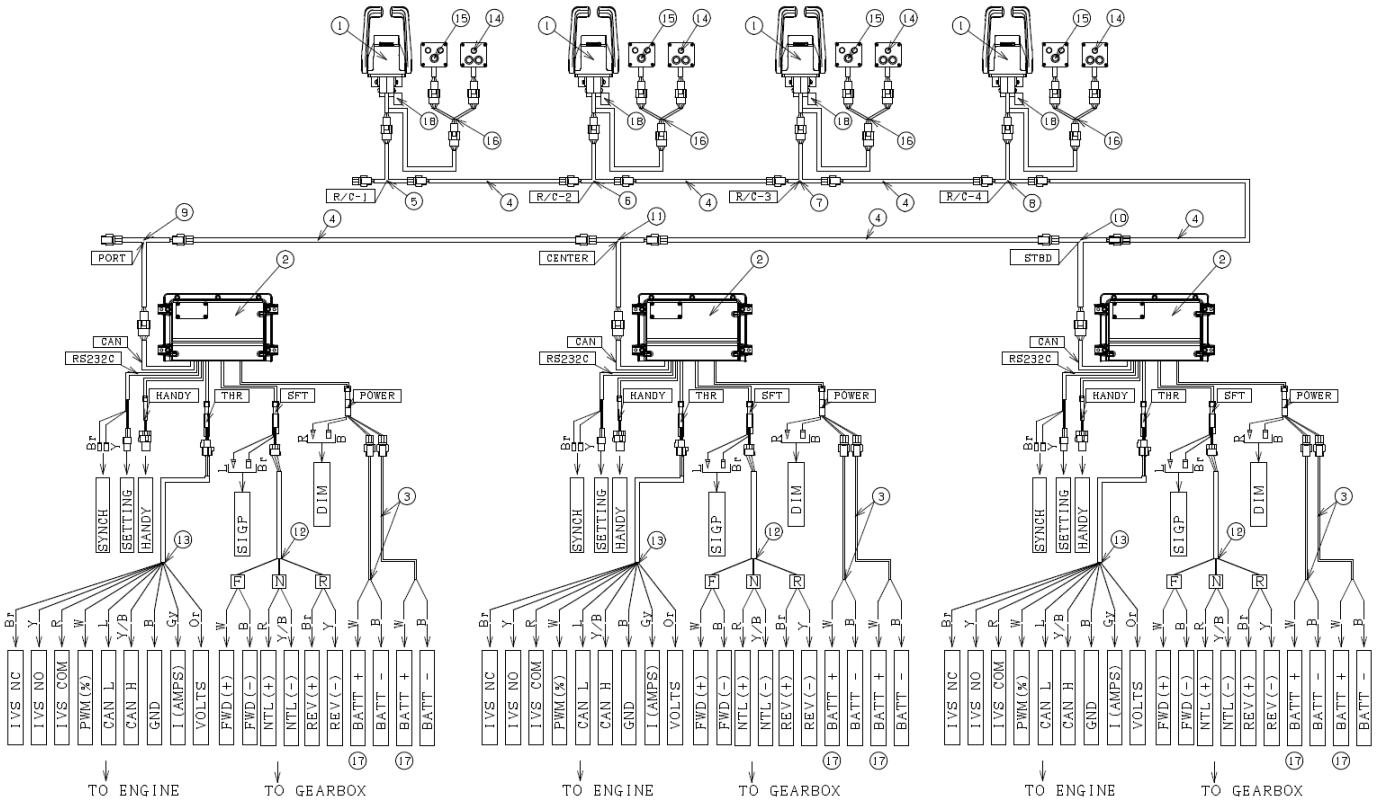
DUAL ENGINE CONFIGURATON



COMPONENTS LIST: DUAL ENGINE

KE-5XG Component Parts List (Dual)			Required Quantity No. of stations			
Description		Part number	1	2	3	4
Control Head, dual lever	NM2061-00, NM2062-00		1	2	3	4
① *SST = stainless steel, (i/b style)*	NM2063-00					
② Control unit 12V/24V		NM3458-00	2			
③ Harness Power Supply	5m	NM0414-28	4			
	10m	NM0414-33				
④ CANbus Harness: 2m, 4m, 6m, 8m, 10m, 12m, 14m, 16m, 18m, 20m, 24m, 30m, 40m, 50m (1m = 39 inches)	NM0649-XX (XX = length in meters)		2	3	4	5
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ (R/C-2) for optional 2nd station		NM0647-17	1			
⑦ (R/C-3) for optional 3rd station		NM0647-18	1			
⑧ (R/C-4) for optional 4th station		NM0647-19	1			
⑨ T-harness (PORT)		NM0647-12	1			
⑩ T-harness (STBD)		NM0647-13	1			
⑪ Harness, Shift (5m or 10m)	5m	NM0640-05	2			
	10m	NM0640-10				
⑫ Harness, Throttle (5m or 10m).	5m	NM0666-05	2			
	10m	NM0666-10				
⑬ Handheld control (optional)	Refer to handheld control manual					
⑭ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑮ Circuit Breaker (optional)	10A	NJ0595-00	4			
⑯ Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				
Settings Tool harness	NM1476-01	Refer to SYSTEM SETTINGS				

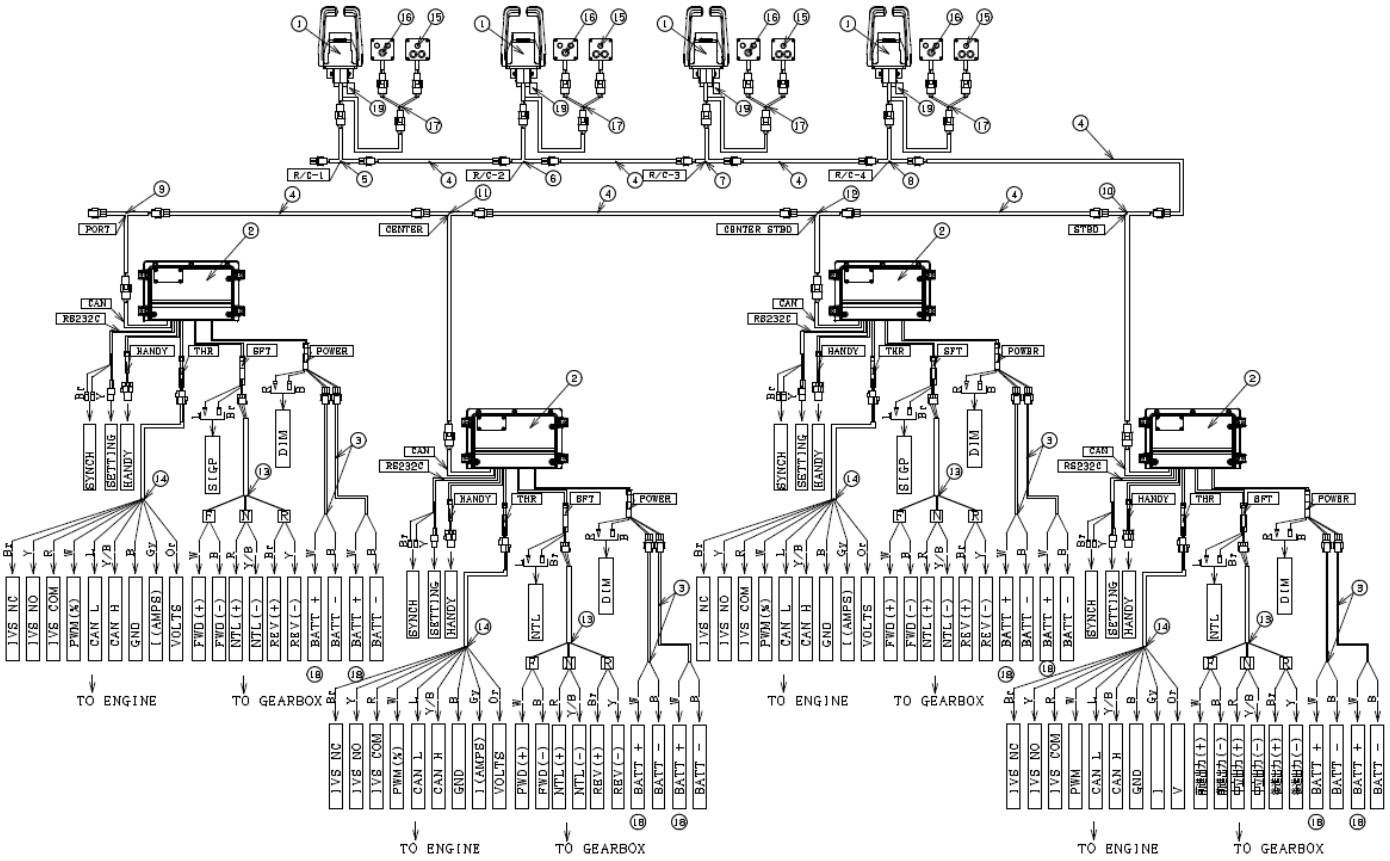
TRIPLE ENGINE CONFIGURATON



COMPONENTS LIST: TRIPLE ENGINE

KE-5XG Component Parts List (Triple)			Required Quantity No. of stations			
Description		Part number	1	2	3	4
Control Head, Single	NM2061-00, NM2062-00		1	2	3	4
① *SST = stainless steel, (i/b style)*	NM2063-00					
② Control unit 12V/24V		NM3458-00	3			
③ Harness Power Supply	5m	NM0414-28	6			
	10m	NM0414-33				
④ CANbus Harness: 2m, 4m, 6m, 8m, 10m, 12m, 14m, 16m, 18m, 20m, 24m, 30m, 40m, 50m (1m = 39 inches)	NM0649-XX (XX = length in meters)		3	4	5	6
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ (R/C-2) for optional 2nd station		NM0647-17	1			
⑦ (R/C-3) for optional 3rd station		NM0647-18	1			
⑧ (R/C-4) for optional 4th station		NM0647-19	1			
⑨ T-harness (PORT)		NM0647-12	1			
⑩ T-harness (STBD)		NM0647-13	1			
⑪ T-harness (CENTER)		NM0647-14	1			
⑫ Harness, Shift (5m or 10m)	5m	NM0640-05	3			
	10m	NM0640-10				
⑬ Harness, Throttle (5m or 10m).	5m	NM0666-05	3			
	10m	NM0666-10				
⑭ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑮ Triple Switch (optional)		NJ0767-00	1	2	3	4
⑯ Sw. Ext. Harness (optional)		NM0647-08	1	2	3	4
⑰ Circuit Breaker (optional)	10A	NJ0595-00	6			
⑱ Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				
Settings Tool harness	NM1476-01	Refer to SYSTEM SETTINGS				

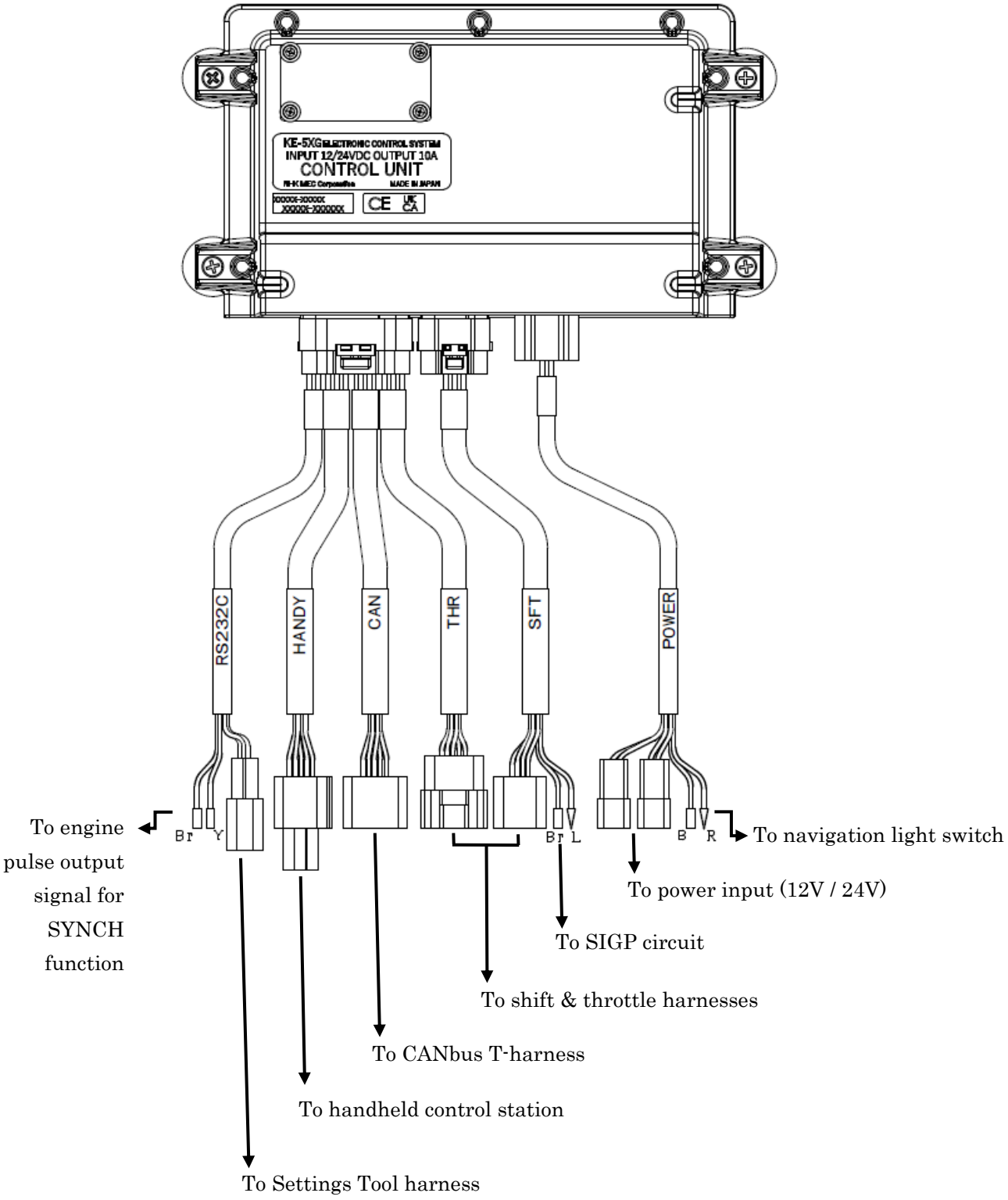
QUAD ENGINE CONFIGURATON



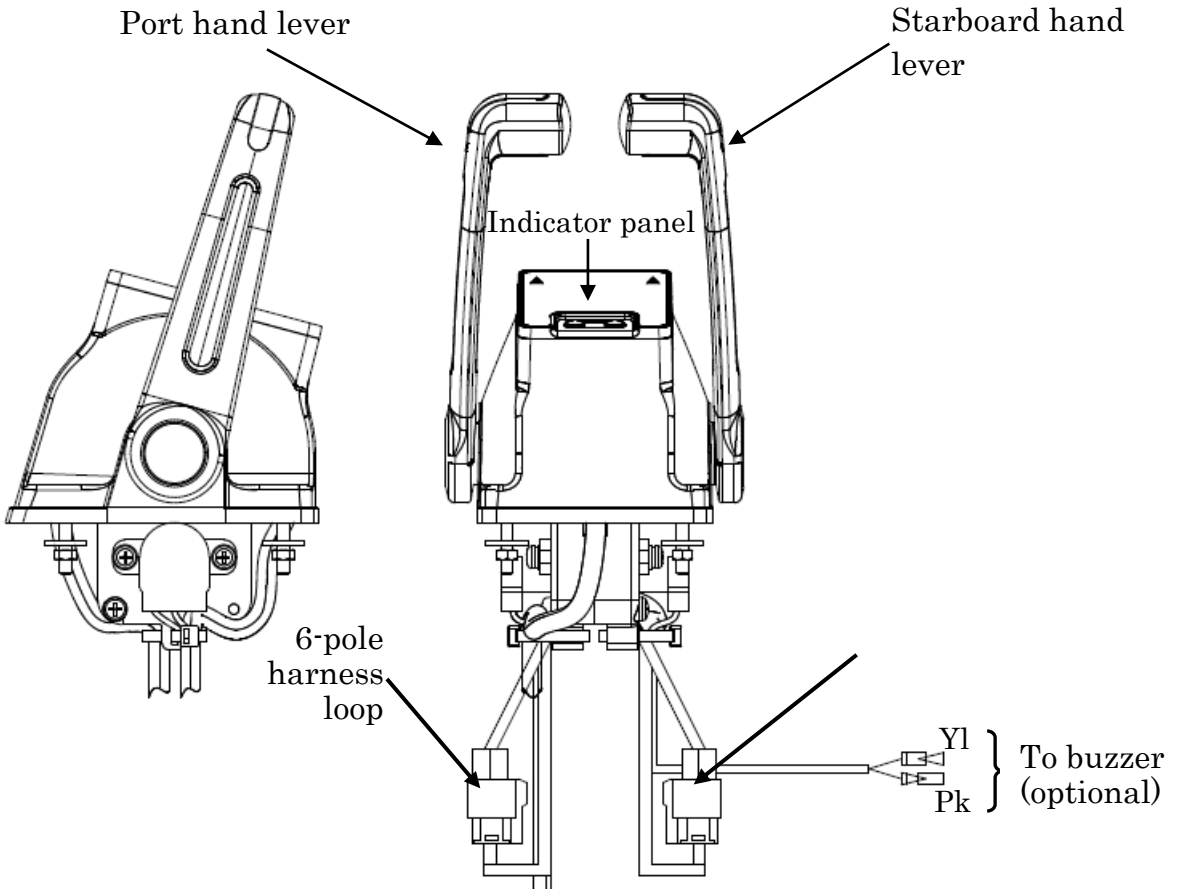
COMPONENTS LIST: QUAD ENGINE

KE-5XG Component Parts List (Quad)			Required Quantity No. of stations			
Description		Part number	1	2	3	4
Control Head, Single		NM2061-00, NM2062-00	1	2	3	4
① *SST = stainless steel, (i/b style)*		NM2063-00				
② Control unit 12V/24V		NM3458-00	4			
③ Harness Power Supply	5m	NM0414-28	8			
	10m	NM0414-33				
④ CANbus Harness: 2m, 4m, 6m, 8m, 10m, 12m, 14m, 16m, 18m, 20m, 24m, 30m, 40m, 50m (1m = 39 inches)	NM0649-XX (XX = length in meters)		4	5	6	7
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ (R/C-2) for optional 2nd station		NM0647-17	1			
⑦ (R/C-3) for optional 3rd station		NM0647-18	1			
⑧ (R/C-4) for optional 4th station		NM0647-19	1			
⑨ T-harness (PORT)		NM0647-12	1			
⑩ T-harness (STBD)		NM0647-13	1			
⑪ T-harness (CENTER)		NM0647-14	1			
⑫ T-harness (CENTER-STBD)		NM0647-15	1			
⑬ Harness, Shift (5m or 10m)	5m	NM0640-05	4			
	10m	NM0640-10				
⑭ Harness, Throttle (5m or 10m).	5m	NM0666-05	4			
	10m	NM0666-10				
⑮ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑯ Quad Switch (optional)		NJ0768-00	1	2	3	4
⑰ Sw. Ext. Harness (optional)		NM0647-08	1	2	3	4
⑱ Circuit Breaker (optional)	10A	NJ0595-00	8			
⑲ Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				
Settings Tool harness	NM1476-01	Refer to SYSTEM SETTINGS				

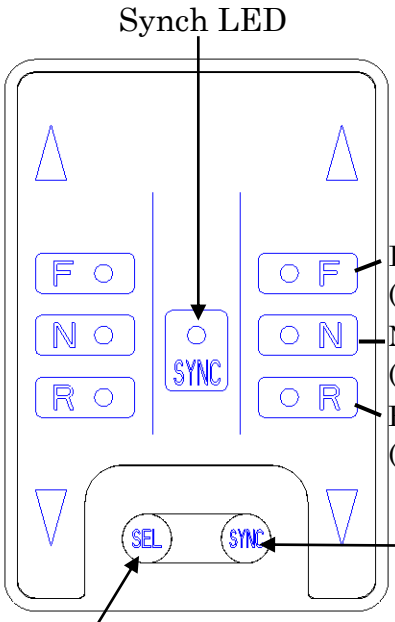
CONTROL UNIT



CONTROL HEAD



Indicator Panel Details



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.

KE CONTROL SYSTEM OPERATION

Initial Operation after Power ON

1. With power ON, and the hand lever(s) in the "Neutral" position, the system will be in the neutral idle condition.
2. (A) Set the handle lever(s) 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.

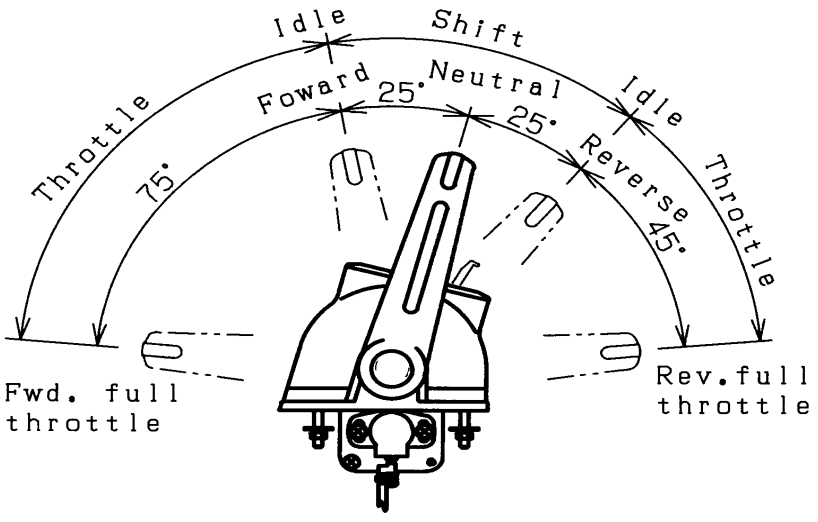
3. When other control stations are connected to R/C T-harness perform the following actions.
   A) Set the hand lever to the Neutral position.
   B) Press & release SELect switch.
   C) The green neutral LED(s) then lights ON indicating the control is operational.

Control Lever 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.



Neutral Throttle Operation

1. Set the hand lever to the neutral (N) position.
2. 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 is activated.
4. To deactivate, set the hand lever to the neutral position, press and release the select switch. After the release of the select switch 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

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

1. 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 last active control station. A continuous orange forward LED(s) indicates control station is active and the system is in gear condition.

Note: Keeping the hand lever of the selected control station in the neutral position during those 4 seconds will result in control system automatically returning the control system to a neutral idle condition.

Synchronization Function

1. Set both hand levers to neutral (N) position.
2. Press SYNC button to activate. A continuous green SYNC LED indicates sync mode. Depending on control unit settings, synchronization will be possible in single or dual lever 2 modes.
3. SINGLE LEVER MODE: Synchronization is automatic with the PORT side lever in forward mode
4. To deactivate SYNC: Set levers to neutral position and press SYNC button to turn OFF green SYNC LED.

INSTALLING CONTROL HEAD

⚠ WARNING

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

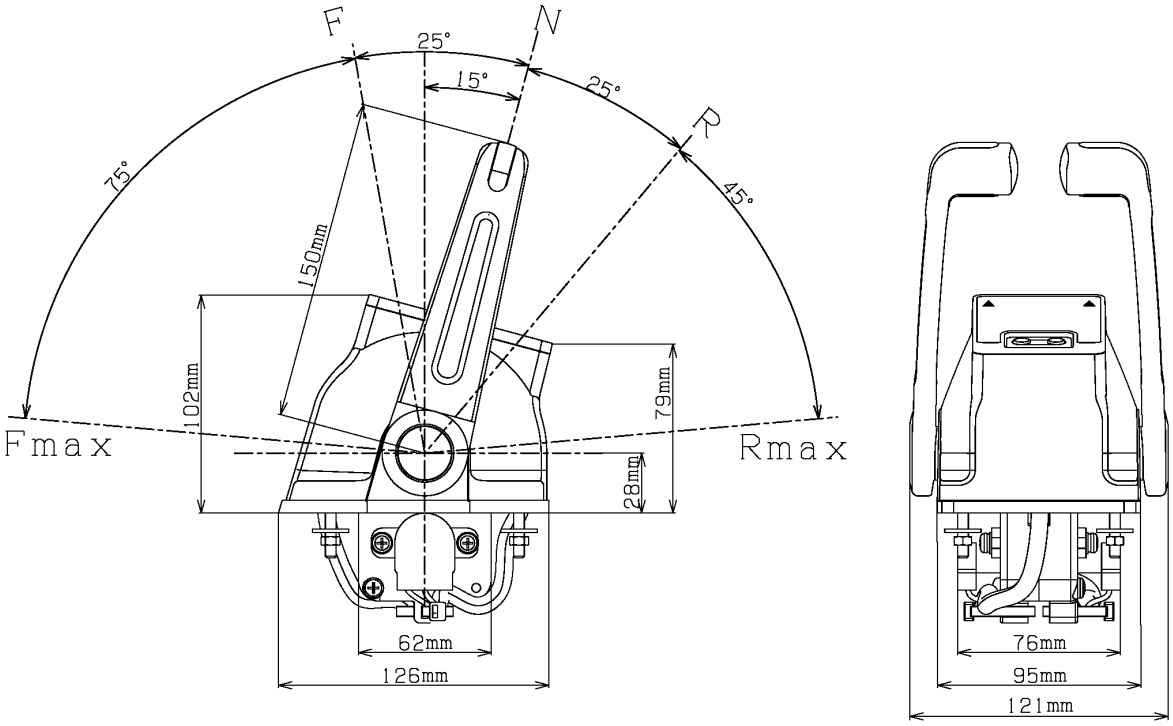
Instructions:

(1) Select a flat location convenient for operation and installation.

(2) Drill the mount holes by using an attached template.

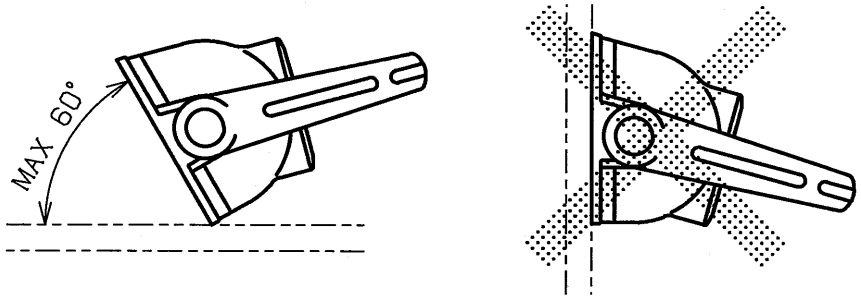
(3) Install with included washers and nuts.

Tightening Torque: 2.9~4.4N・m {2.1~3.2 lbf-ft}



⚠ CAUTION

Mount the control head within 60 degrees from horizontal.



INSTALLING CONTROL UNIT

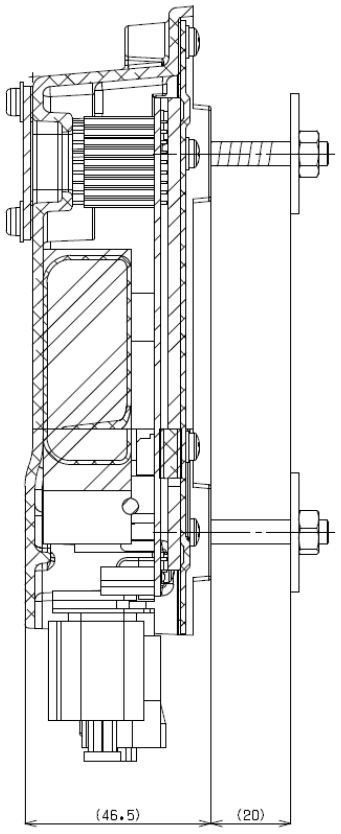
⚠ CAUTION
1. **Ingress of water into the unit may cause failure** 2. **Install so that harnesses exit through the bottom and in a location where sea wind and water effects are minimized.** 3. **Avoid a location where the ambient temperature exceeds 77 ℃. Control unit should be kept cool for optimal performance.**

Instructions:

1. Drill mounting hole locations guide by the attached template at the back of the manual.
2. Install with included pan head machine screws or tapping screws (see data below)
3. Tighten to 4.9 ～ 7.8 N・m (3.6 ～ 5.7 lbf・ft) of torque.

Notes:

1. Machine screw mounting plate thickness: 3mm ～ 20mm (1/8 ～ 3/4 in.), mounting hole diameter: φ7mm (φ1/4 in.).
2. Tapping screw mounting plate thickness: 15mm min. (5/8 in. min.), pilot hole diameter: φ3mm (φ1/8 in.).

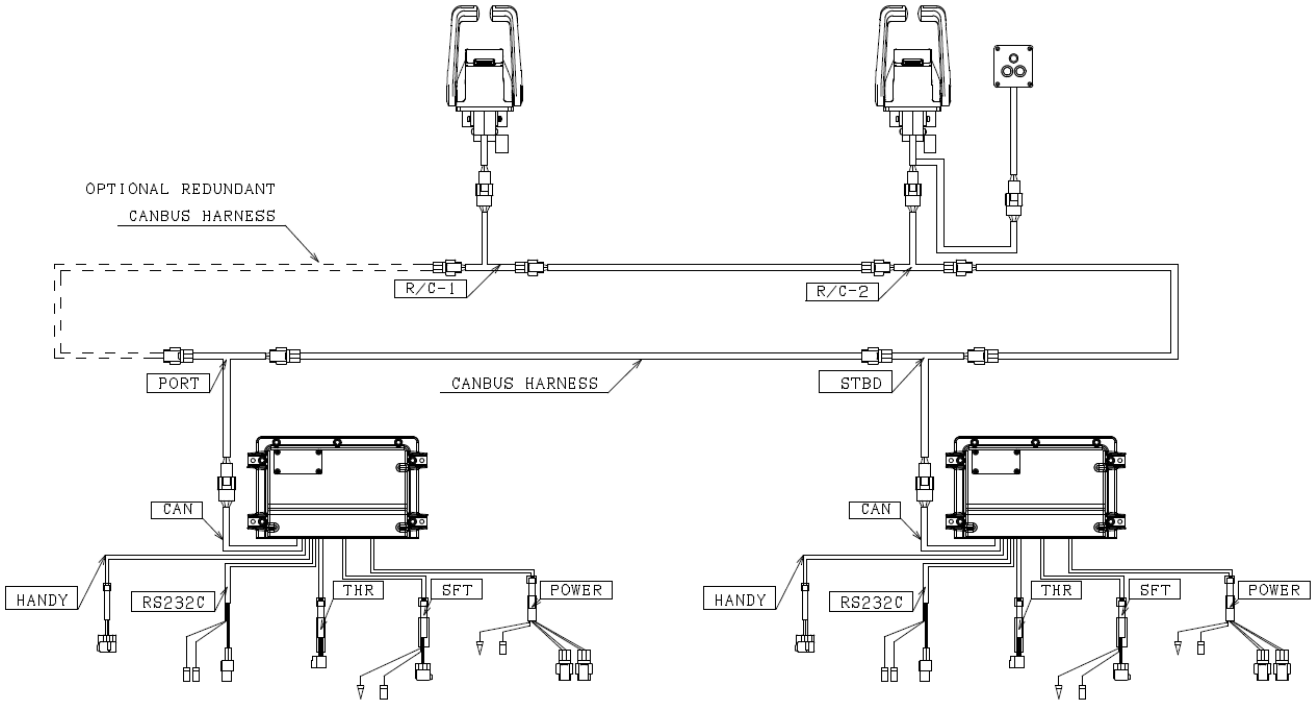


CONNECTING CONTROL HEAD & CONTROL UNIT

⚠ 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 be become operative.** 3. **Locate harnesses such that they are away from accidental compaction damage or cutting.**

Instructions:

1. Connect 8-pin harness connector of the first control head to R/C-1 T-harness.
2. Connect 8-pin harness connector of the optional control heads to R/C-2 (shown), R/C-3 & R/C-4 T-harnesses.
3. Connect the 8-pin harness CAN connector of control units to the appropriate T-harnesses: such as SINGLE, PORT, STBD, CENTER, CENTER-STBD
4. Finally connect a main CANbus harness in between each of the T-harness connectors for a continuous data bus between from the first control head to the last control unit.
5. Optional: Add a spare bus harness 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 ENGINE & CONTROL UNIT

⚠ CAUTION

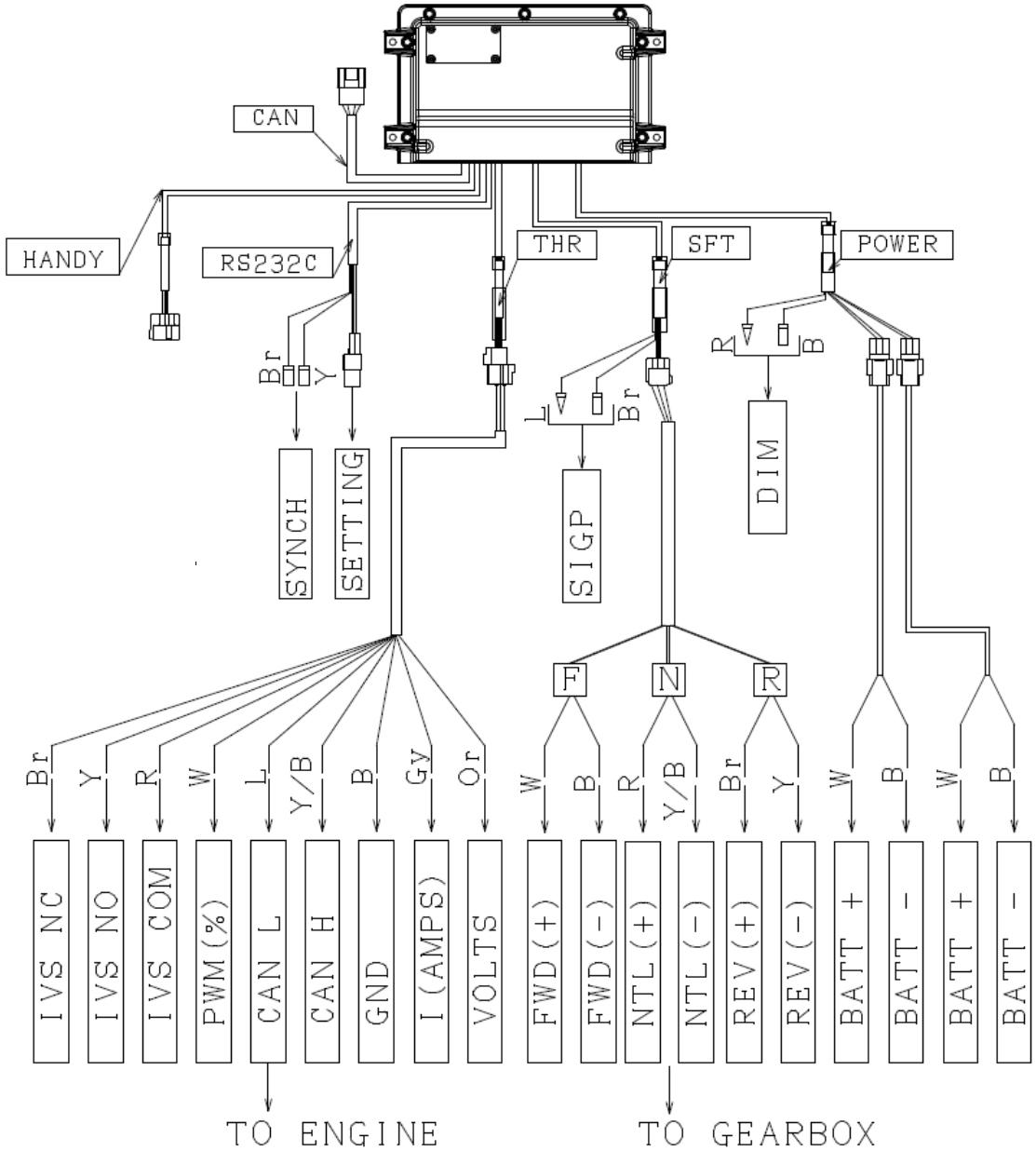
1. Be sure to use the correct throttle harness: Current, Voltage, PWM or CAN (SAE J1939 protocol) to match your engine input signal requirements.

2. Connect Idle Validation Switch connections (red, yellow, brown) only if required for your engine setup. Consult engine maker if necessary.

4. Locate harnesses such that they are away from accidental compaction damage or cutting.

Instructions:

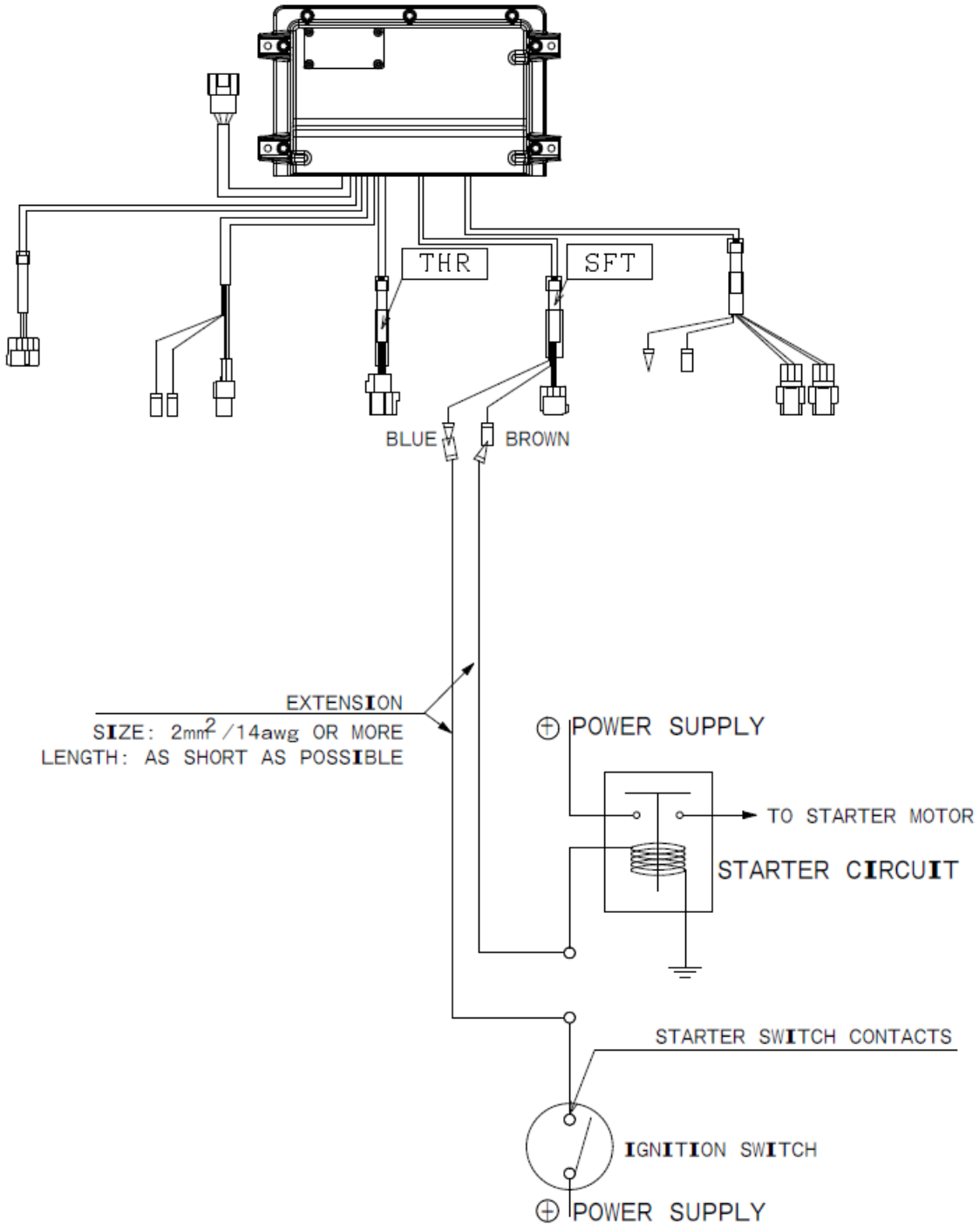
1. Connect one end of shift harness and throttle harness to the shift (SFT) & throttle (THR) connectors on the control units.
2. Connect other end of shift & throttle harnesses to engine and gearbox connectors respectively. Refer to engine and gearbox maker instruction manuals for additional connection requirements.



CONNECTING SIGP
(START-IN-GEAR PROTECTION)

Instructions:

1. Connect KE control SIGP connections between engine starter & ignition circuit of the boat as below. This implements a safety feature that allows engine start only when the KE control system & gearbox are in Neutral position.
2. Keep extension wires as short and as thick as possible to avoid circuit failure.



CONNECTING POWER

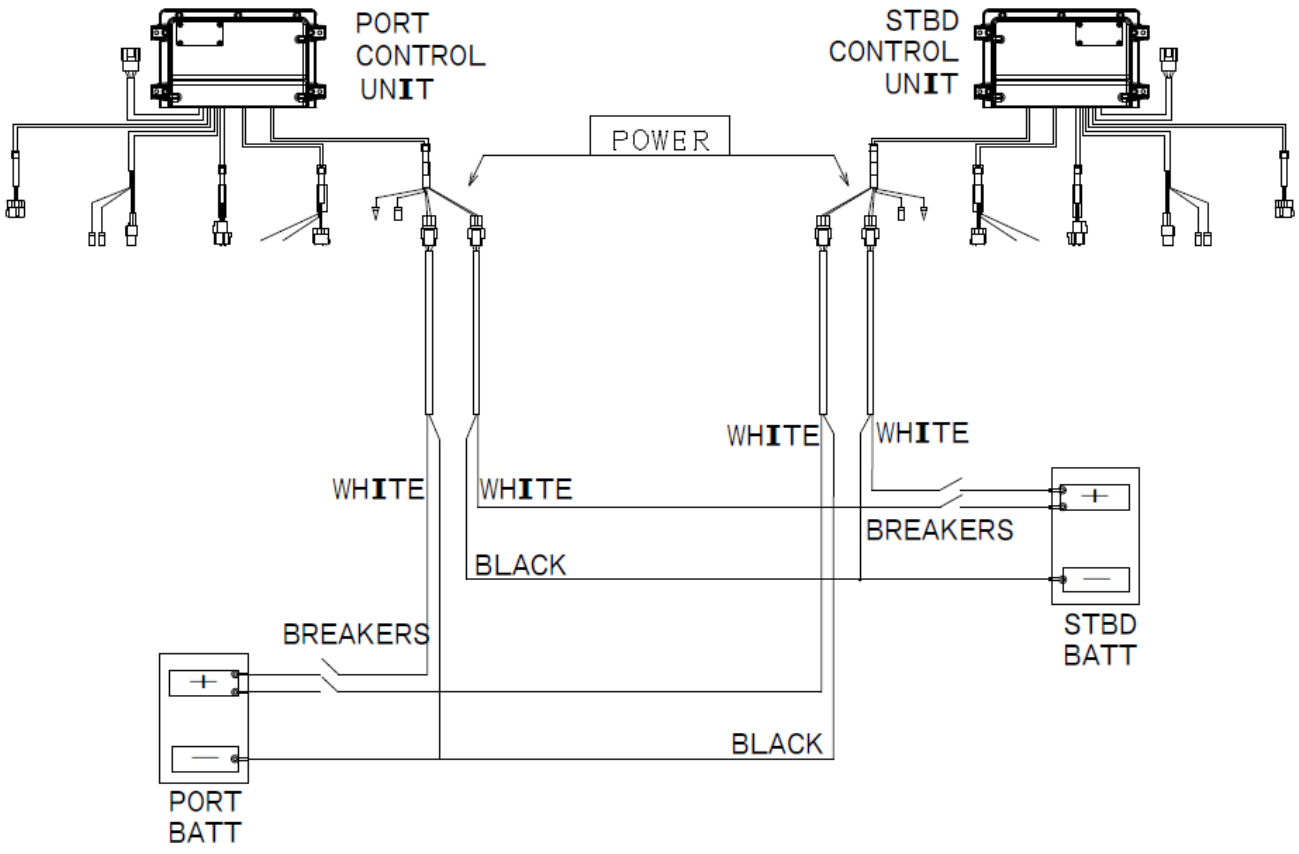
⚠ CAUTION

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), before disconnecting power harnesses from control unit, first disconnect power 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
4. Circuit breaker or directly to (**+ plus**) of battery (power).

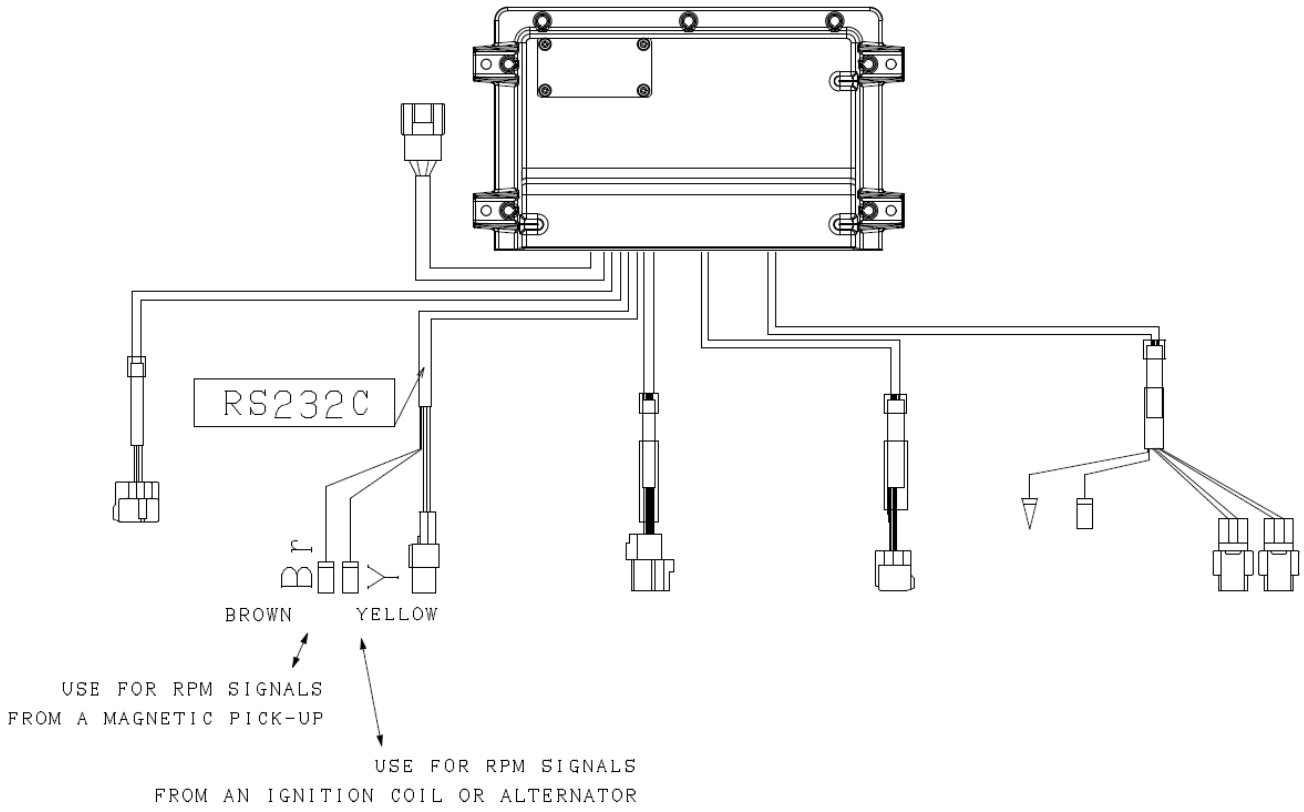
Note: If two batteries are provided, it is recommended to separate the power lines and connect one power line (plus breaker) to each battery, as per dual engine example below.



CONNECTING SYNCHRONIZATION CIRCUIT

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

1. Connect the brown wire to the engine rpm (or tachometer) signal in a case of a magnetic pick-up type circuit (typically diesel engine).
2. Connect the yellow wire to the engine rpm (or tachometer) signal in a case of an ignition coil or alternator type circuit (typically gasoline engine).
3. Repeat connection for each engine & control unit pair.

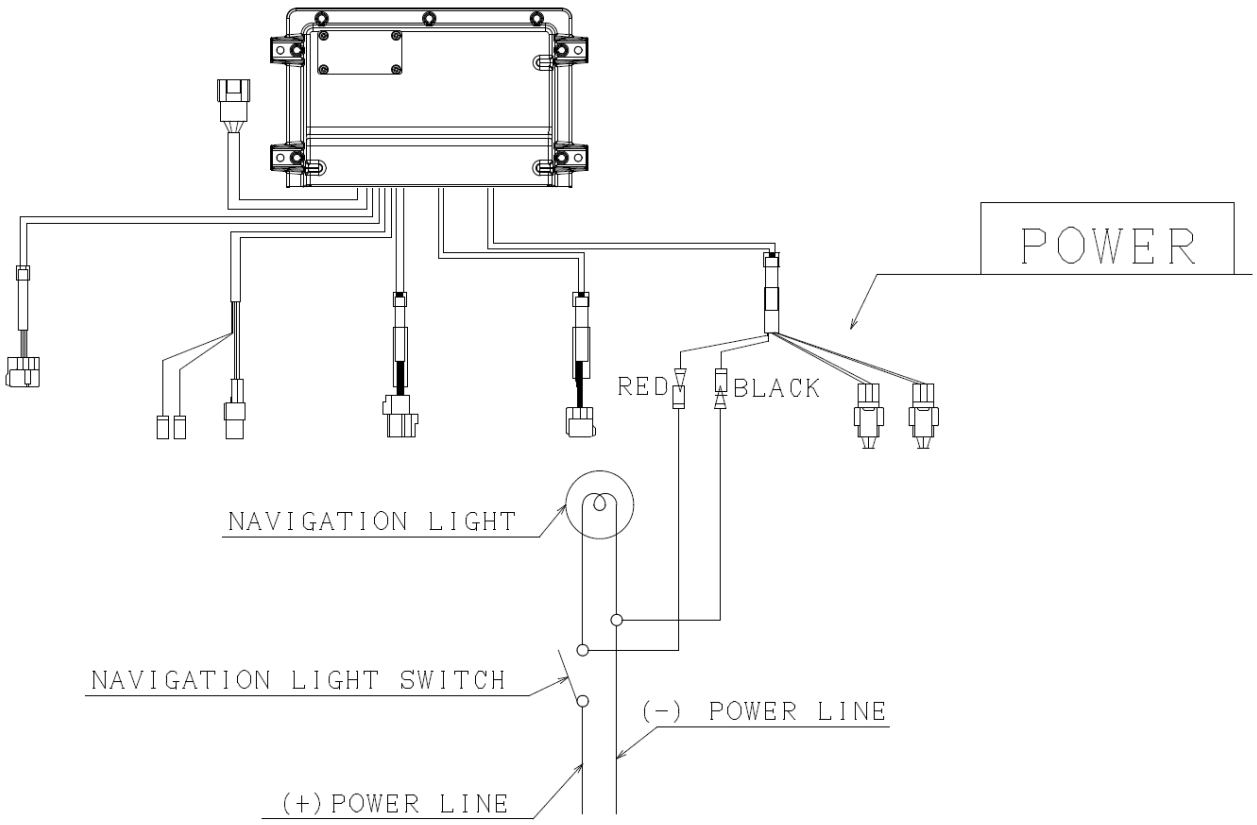


Note: No damage will occur if the case of a wrong connection; synchronization will simply be ineffective.

CONNECTING DIM HARNESS (OPTION)

Instructions:

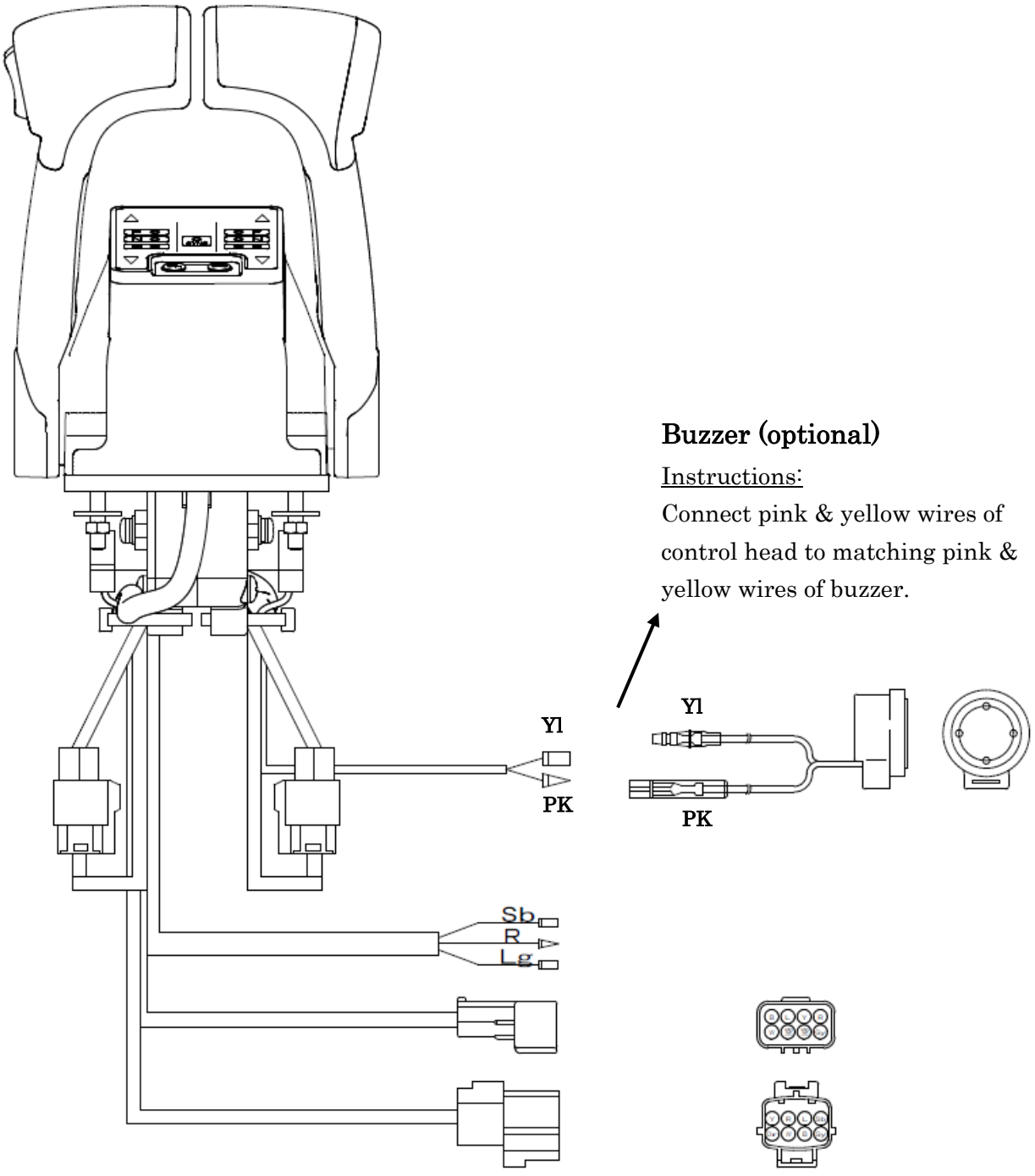
1. Connect the Dim Harness red line to the (+) wire of navigation light.
2. Connect the Dim Harness black line to the (−) wire of navigation light.



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

CONNECTING BUZZER (OPTION)

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



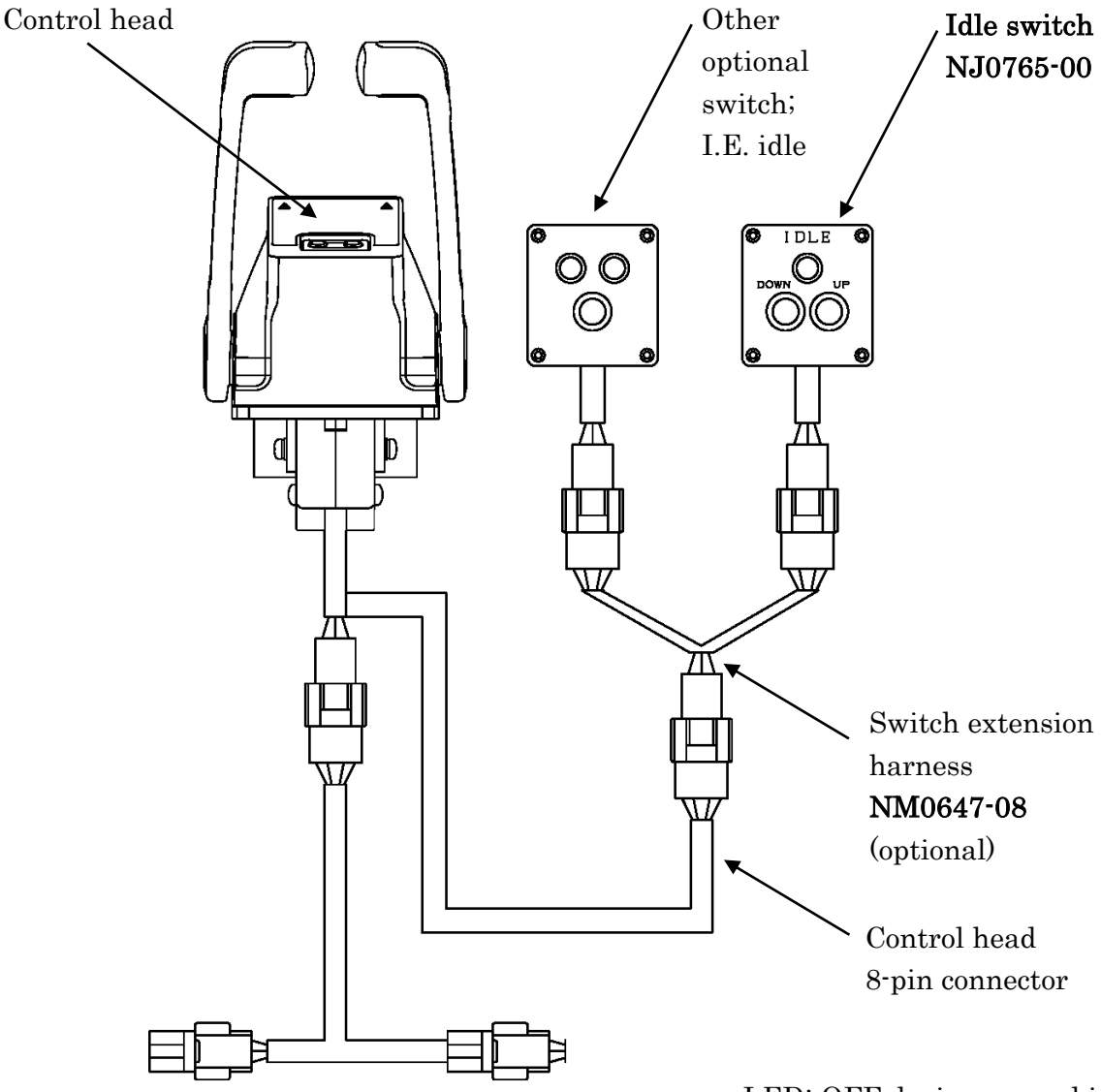
Buzzer (optional)

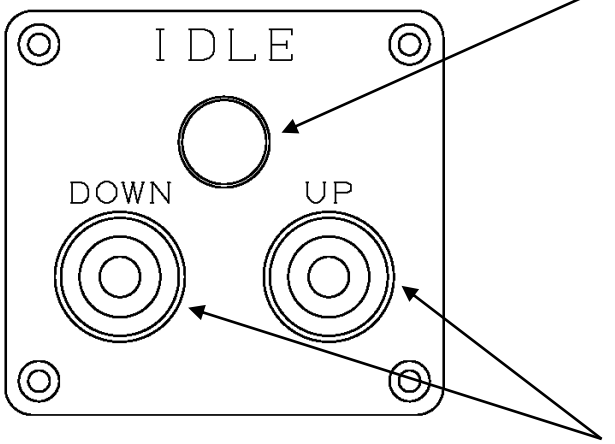
Instructions:

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

CONNECTING IDLE SWITCH (OPTION)

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



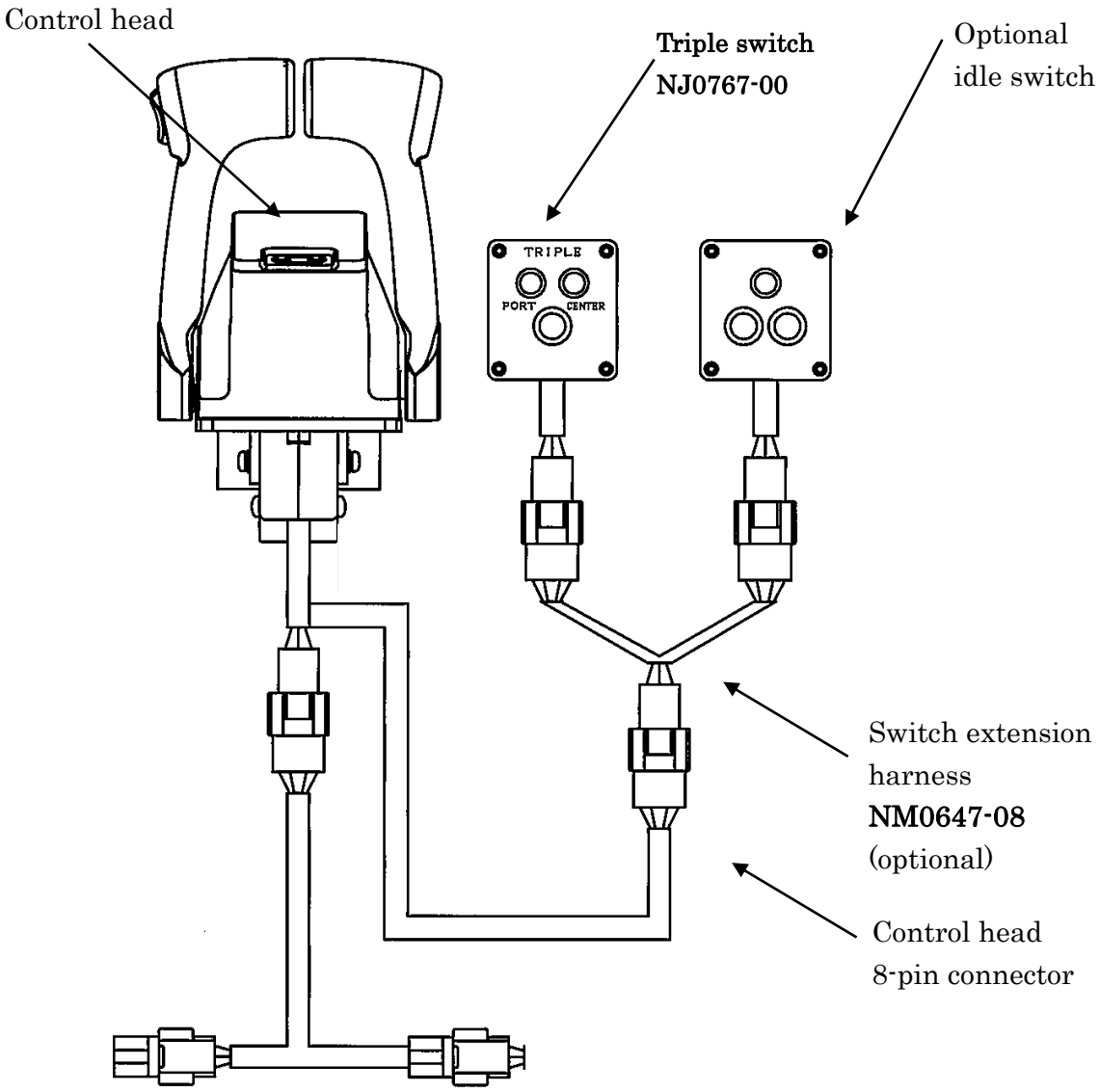


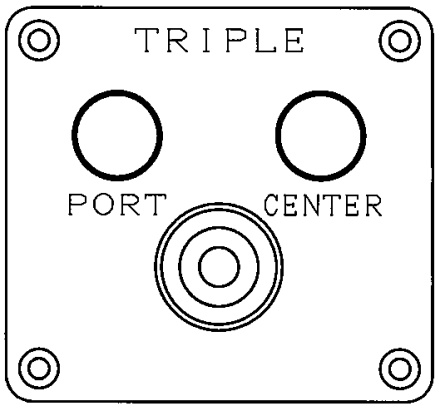
LED: OFF during normal idle level, ON during increased idle levels.

Idle control switches: While control head lever is in F or R position, press UP switch to gradually increase idle to a maximum of 20% of full throttle; press DOWN to gradually decrease idle back to normal level.

CONNECTING TRIPLE SWITCH (OPTION)

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

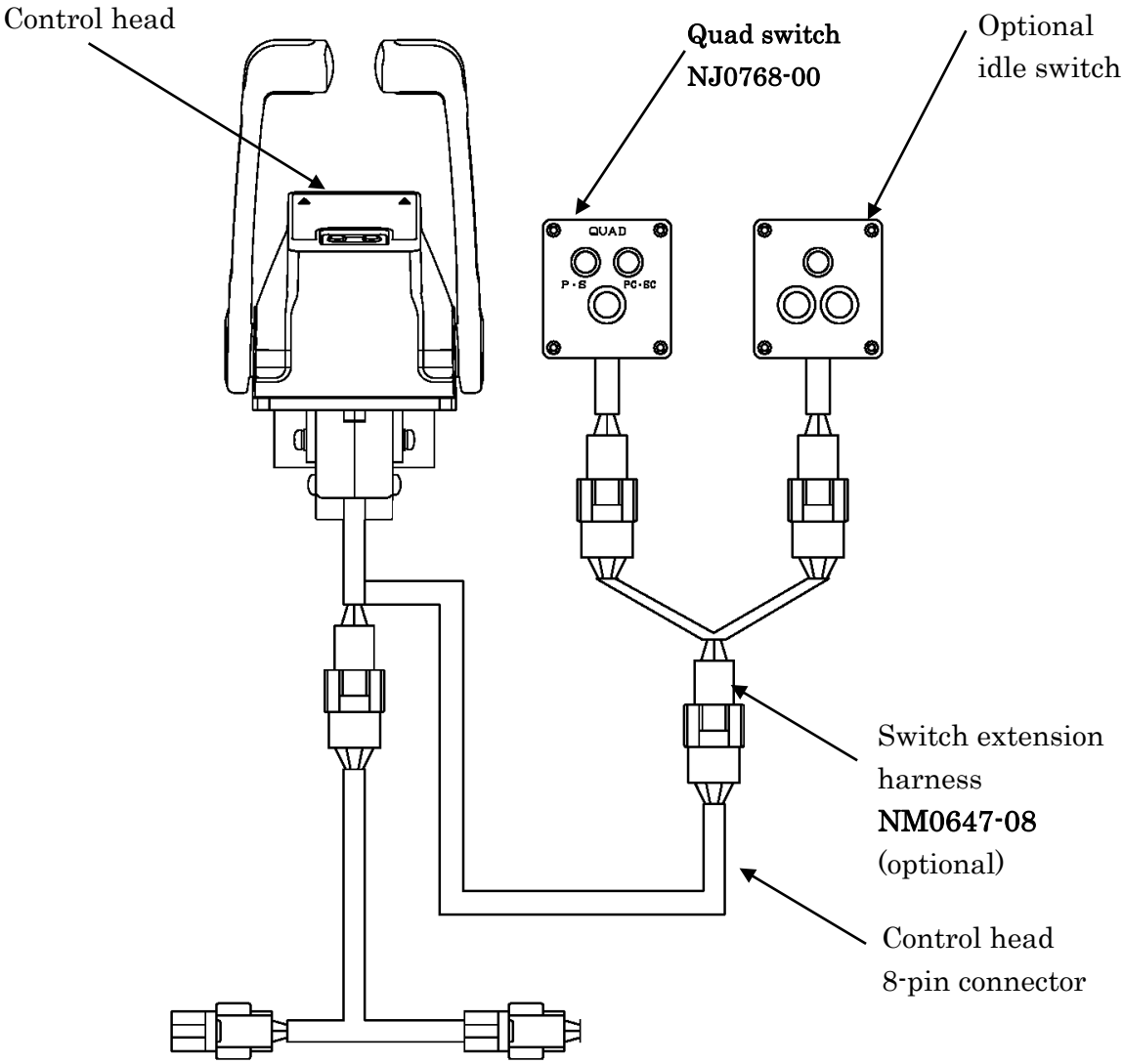


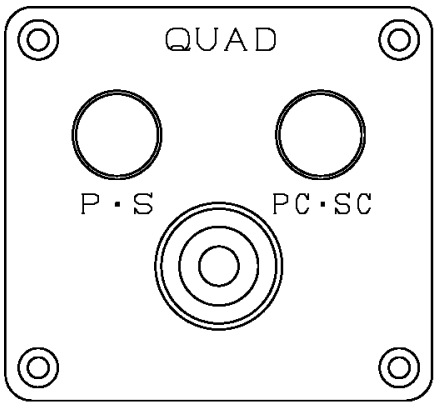


SWITCH STATUS	PORT LED	CENTER LED	PORT LEVER CONTROL
POWER ON	ON	ON	port & center actuators
PUSH 1	ON	OFF	port actuator
PUSH 2	OFF	ON	center actuator
PUSH 3	ON	ON	port & center actuators

CONNECTING QUAD SWITCH (OPTION)

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





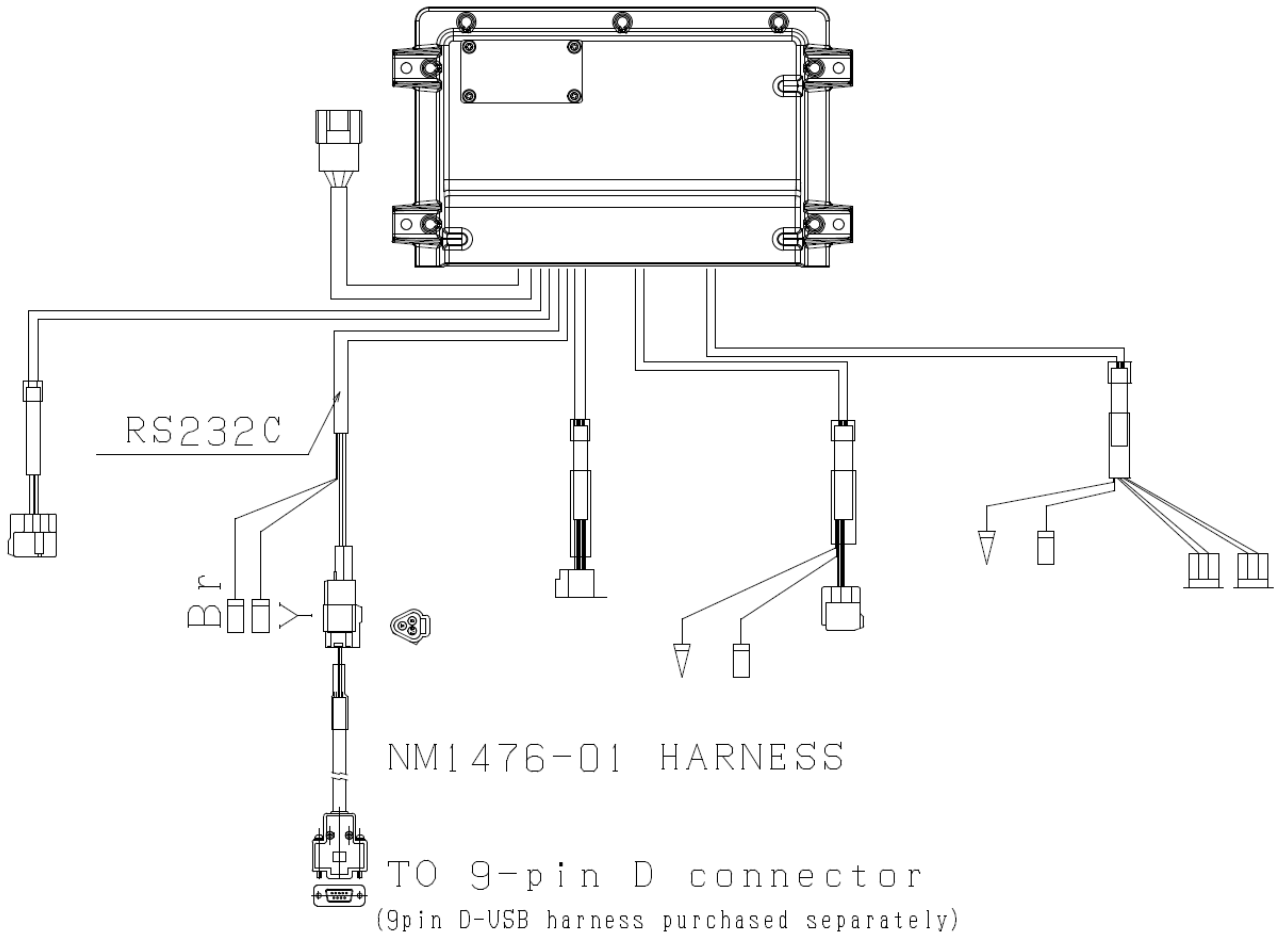
SWITCH STATUS	P·S LED	PC·SC LED	LEVERS CONTROL
POWER ON	ON	ON	all 4 outputs
PUSH 1	ON	OFF	outside outputs
PUSH 2	OFF	ON	inside outputs
PUSH 3	ON	ON	all 4 outputs

SYSTEM SETTINGS

Instructions: System settings software is used to set the control unit for optimum compatibility with engine and gear. KE-XG Settings Tool software file package software can be downloaded via NHK MEC Corp. website: https://www.nhkmec.com/en/product/download/

You will also need a separately purchase standard USB to 9-pin D-connector serial adapter harness to connect to your PC in order to communicate with the KE-XG control unit. If necessary for your purchased adapter, download and install the driver onto your PC.

First, connect one end of harness NM1476-01 to control unit RS232C connection and the other end to the separately purchased USB –serial adapter; then connect the other end of NM1476-01 harness to your PC USB port.



Next, open KE-5XG Settings Tool software on your PC; click on Config Setting, then select USB port ID to activate. The settings menu top page provides pull down menu for each KE-XG system settings. Select the options that are compatible with your engine & gearbox installation; refer to engine manual if necessary.

Config Setting

System : KE-5XG

Initialize config settings

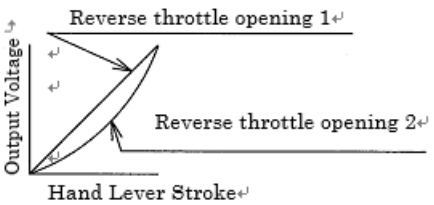
Config Setting	Operational value	Set value
IVS	active	active
Neutral signal	inactive	inactive
Shift feedback	inactive	inactive
Shift pause	0seconds	0seconds
Throttle delay	0seconds	0seconds
Reverse throttle opening	Linear	Linear
Forward throttle opening	Linear	Linear
3 or 4 engines	Lever tracks when PORT/STBD shift outputs m...	Lever tracks when PORT/STBD shift outputs m...
Reverse stroke setting	100%	100%
Forward throttle output(Voltage)	Lo:0.50V / Hi:4.50V	Lo:0.50V / Hi:4.50V
Forward throttle output(PWM)	Lo:8.0% / Hi:92.0%	Lo:8.0% / Hi:92.0%
Forward throttle output(current)	Lo:4.0mA / Hi:20.0mA	Lo:4.0mA / Hi:20.0mA

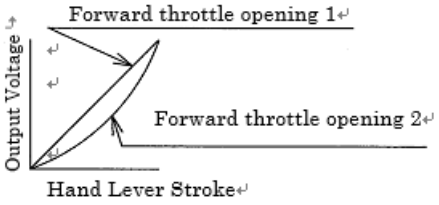
Close

SYSTEM SETTINGS (CONT'D)

Guidelines:

- IVS: activate if engine model requires it
- Neutral signal: activate if marine gearbox neutral signal is required
- Shift feedback: activate means control head LED's represent control unit output (rather than levers)
- Shift pause: delays shock effect if control lever is suddenly operated from throttle to neutral
- Throttle delay: delays shock effect if control lever is suddenly operated from neutral to throttle
- 3 or 4 engines: activate to have shift outputs of inner engines match outer engines
- Reverse stroke: select % of full forward throttle setting
- Throttle openings: select desired throttle opening based on curves below





Typical Throttle settings for engines (based on information at time of print):

- Volvo, MTU, MAN Cummins (KTA): 4mA～20 mA (±1mA depending on model)
- Detroit Diesel, John Deere, Steyr (single input), Cummins (Quantum): 0.5V～4.50V (±0.1V depending on model)
- Volkswagen, Iveco FPT: 0.3V～4.40V (±0.1V depending on model)
- Scania D13: 0.45V～2.95V (±0.1V depending on model)
- CAT C7～C32: 7%～93% (±1% depending on model)
- Nanni Diesel (other CAN models): SAE J1939 protocol (contact dealer to review):

Once you have completed your selection of settings, close the menu, close Settings Tool software and disconnect NM1476-01 harness from the KE-XG control unit. KE-XG control system is now ready for operation.

ALARM CODES

In case of a system operation fault, the failure code is indicated via the forward/neutral/reverse LED's flashing frequency on control head(s) plus optional buzzer.

LED's Flashing Frequency	Possible Cause	Check / Countermeasure	Manual Reference
1 * Shift Actuator Signal	①Shift harness disconnected or damaged; or signal unrecognized	①Check shift harness, connection & signal	Page 19
3 * * * Control Head	①Control head 6-pole harness loop not properly connected. ②1 output line damaged → system still operates. ③2 output lines damaged → system no longer operates.	①Reconnect 6-pole harness loop(s). ②Consult dealer for replacement item at earliest convenience. ③Consult dealer for replacement item immediately.	Pages 13 & 18
6 * * * * * * Power	①One of duplex power lines is disconnected. ②Source (battery) voltage outside of operating voltage range. ③Power harness damaged. ④Control unit power line damaged. ⑤Power activation timing offset.	①Connect/Activate both power lines, power sources & breakers. ②Adjust source (battery) voltage to within specified range. ③Consult dealer for replacement. ④Consult dealer for replacement item. ⑤Activate power for PORT & STBD simultaneously.	Page 21
7 * * * * * * * Control Head	Control head SEL or SYNCH switch pressed-in or shorted.	Reset/unlock the switch or consult dealer for replacement item.	Page 13
8 * * * * * * * * CANbus	①CANbus or T-harness damaged ②Control head or control unit defective	Check harnesses; consult dealer for replacement if necessary.	Page 18
9 * * * * * * * * * Option Switch	Option switch pressed-in or shorted. I.e. Idle control switch, Triple switch or Quad switch.	Reset/unlock the switch or consult dealer for replacement item.	Pages 25, 26, 27.

TROUBLESHOOTING

Symptom	Possible Cause	Check / Countermeasure	Reference
No operation even though power ON.	Power harness is not connected properly.	Activate both power sources & breakers	Page 21
No control head LED's ON.	①Control head hand lever not in neutral during SEL ②R/C-1 T-harness not connected to control head. ③Control head damaged	① Set hand lever to NEUTRAL position with power ON. ②Connect R/C-1 T-harness. ③Consult dealer for replacement	Pages 13 to 16
F, N, R LED light ON but shift clutch does not engage.	①Shift harness damaged ②Control unit defective	①Check shift harness ②Consult dealer for replacement	Page 19
F, N, R LED ON but engine speed does not respond	①Throttle harness damaged. ②Throttle output setting incorrect ③Control unit damaged	①Replace throttle harness ②Review settings via software tool ③Consult dealer for replacement	Page 19
Engine does not start.	①Low battery voltage. ②SIGP harness too long.	①Charge battery. ②Shorten SIGP harness wire	Page 20
Neutral throttle operation not functional.	①Incorrect operation. ②Select switch damaged.	①Perform initial control operation ②Consult dealer for replacement	Page 15
Synchronization operation not functional.	①SYNC switch damaged ②Incorrect connection	①Contact dealer for replacement ②Verify synchronization circuit signal type & connection.	Pages 13, 15 & 22

MAINTENANCE & SERVICE

For continued safe and reliable system operation the following is recommended.

Control Head

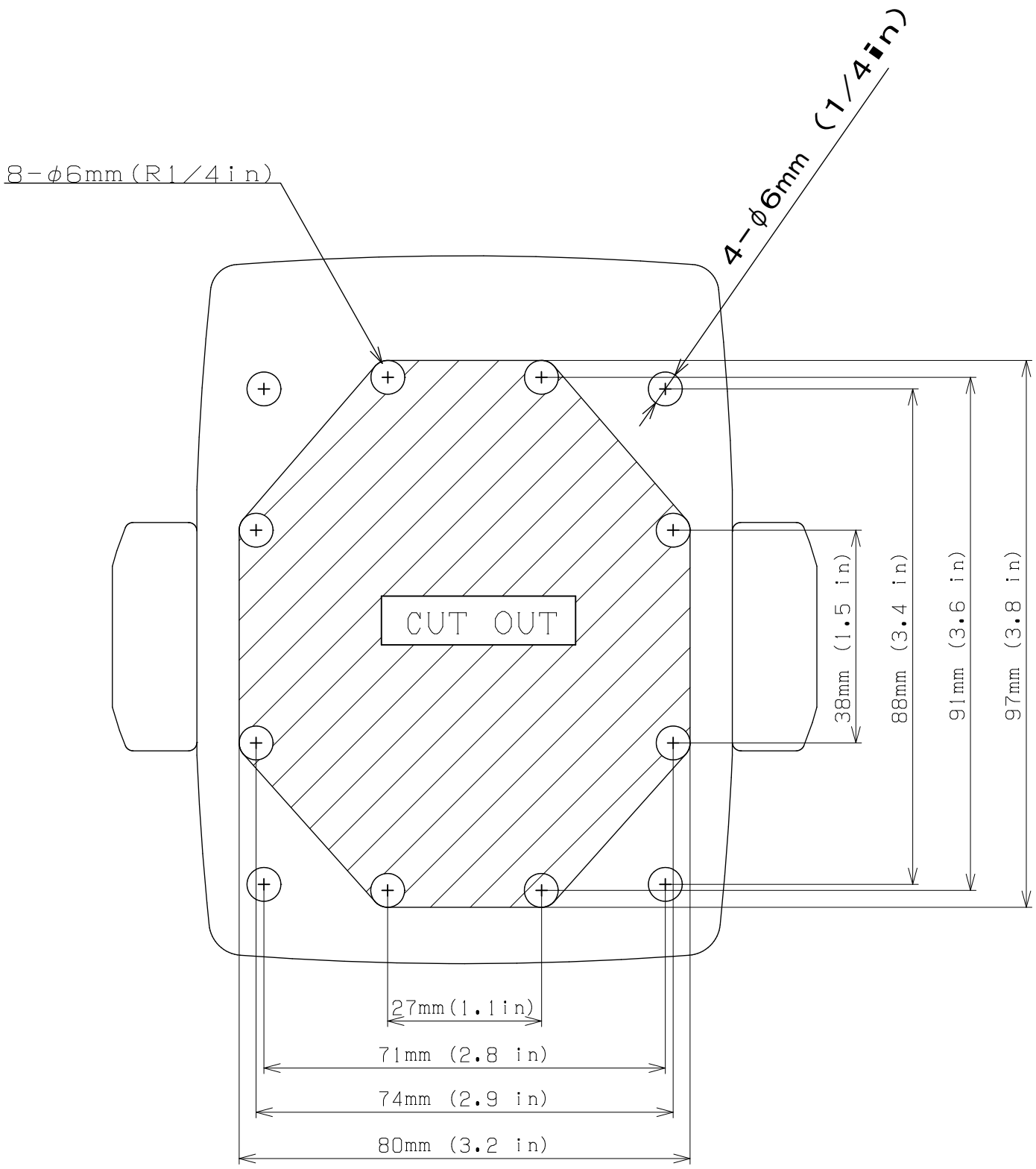
Component replacement is recommended after 100 000 lever operation cycles or after 5 years of extended use in marine environment.

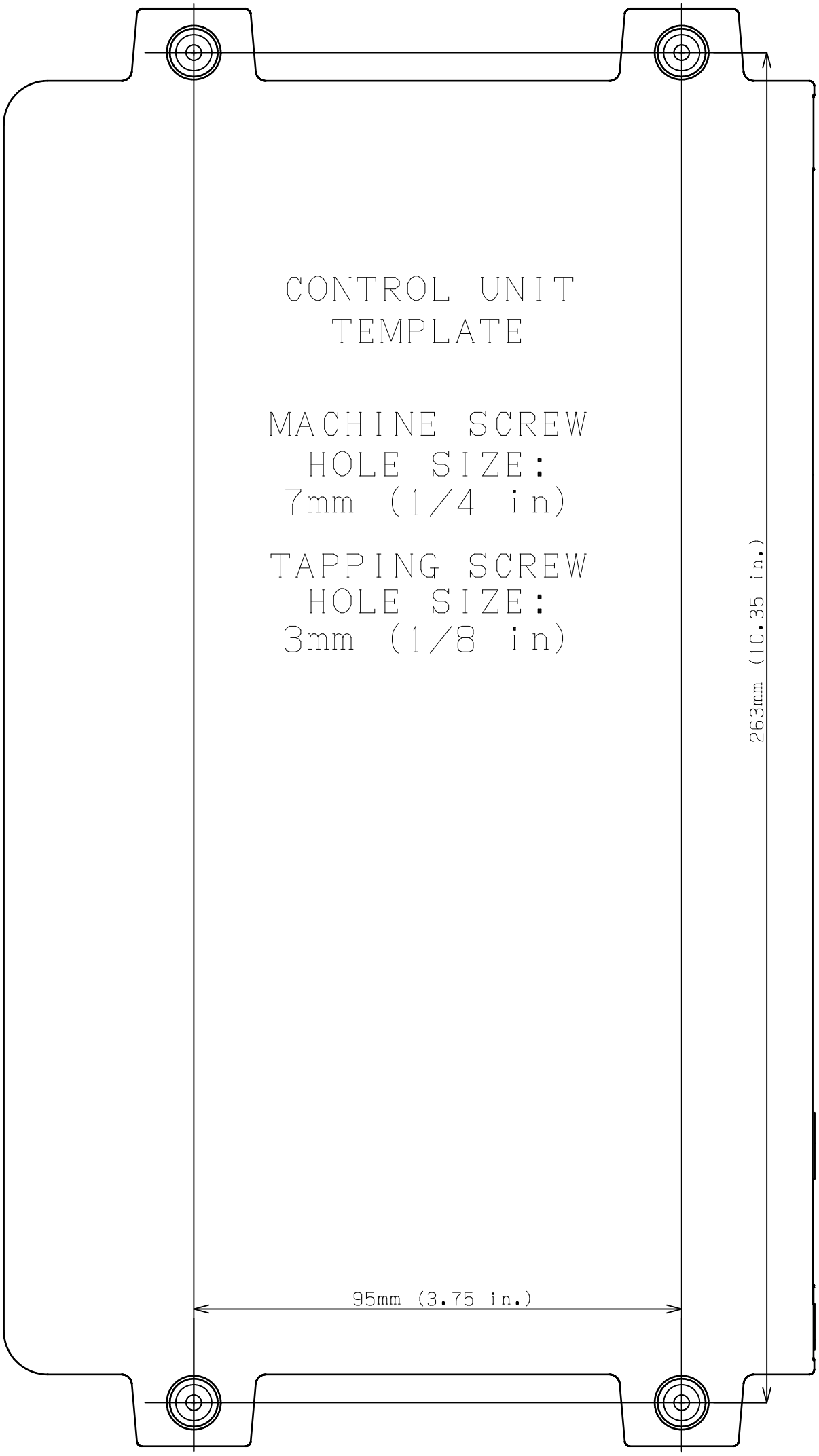
Control Unit & Harnesses

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.

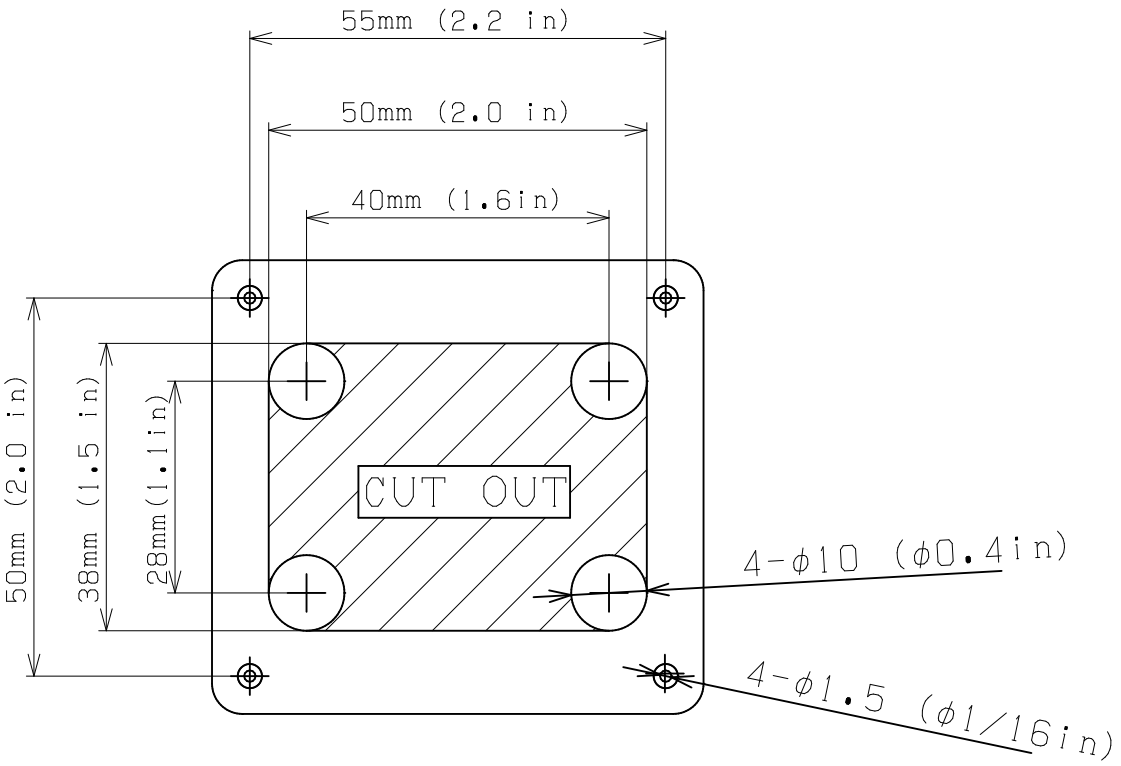
Note: In the case of KE control system transfer of ownership, please make sure to include maintenance and service information

CONTROL HEAD TEMPLATE




CONTROL UNIT
TEMPLATE
MACHINE SCREW
HOLE SIZE:
7mm (1/4 in)
TAPPING SCREW
HOLE SIZE:
3mm (1/8 in)
263mm (10.35 in.)
95mm (3.75 in.)

IDLE / TRIPLE / QUAD / SWITCH TEMPLATE



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M000245-50 23.12 PRINTED IN JAPAN