NHK MEC

KE-6+/7+

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-6+/7+ 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 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

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 voided.

PRODUCT SPECIFICATIONS

1. Electrical Performance

- Supply voltage range: DC9V ~ DC32V
- Current consumption at stop of actuator: 0.5A or less
- Current flow of actuator: 16A peak, 5A average under nominal conditions (49N{5kgf} ・ 11lbf load, mid-range temperature)
- KE-7+ mode shift output contact point capacity (normally open) under nominal conditions: 5A max

2. Mechanical Performance (via actuator)

- Max. operating thrust: 147N {15kgf} ・ 33lbf load
- Constraint load : 343N {35kgf} ・ 77lbf load
- Forward or Reverse shift stroke settings: 26・30・34・40mm
- Throttle stroke: 80mm MAX

3. KE-6+ Mode Throttle Outputs (via shift, throttle or CAN harness)

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

Notes:

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

4. Temperature Range

(1) Operating temperature: −20° C ~ +77° C
(2) Storage temperature : −40° C ~ +100° C

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 and via the 7-seg alphanumeric display on the control unit

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 setting of engines via optional switch
- Multi-engine control : Up to 4 engines can be controlled via optional switches
- Mechanical backup : In case of electrical failure, enables mechanical operation of the actuator via the emergency handle
- System log : History log of alarm codes can be downloaded via optional harness & software
- Trolling : KE+ electric or mechanical trolling optional systems can be added

PRODUCT COMPLIANCE

ISO 9001

QUALITY

CE

MEMBER ABYC Setting Standards for Safer Boating

TYPE APPROVAL CERTIFIED

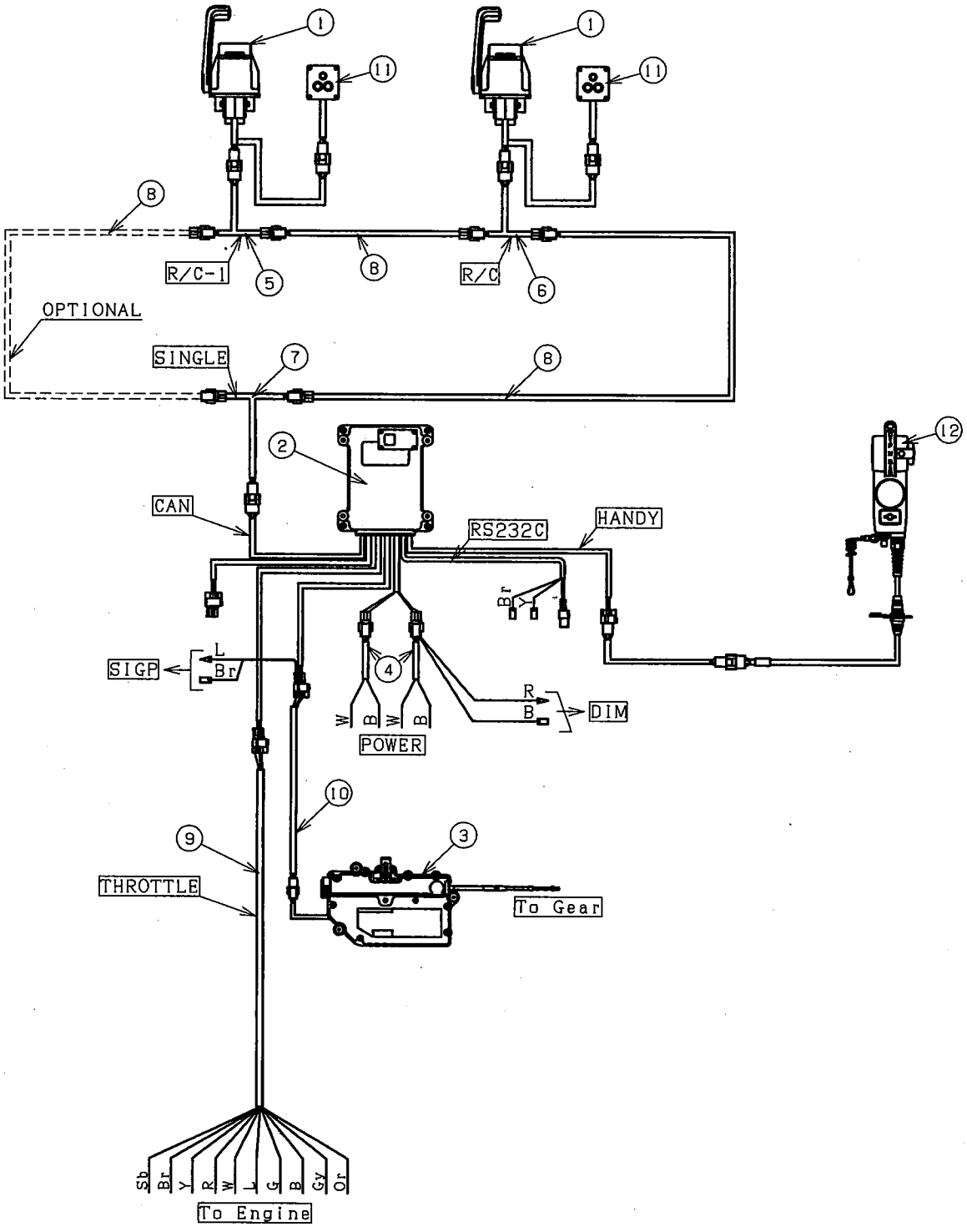
1. USA

- *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 GL/DNV, BV, etc.

KE-6+ SINGLE ENGINE CONFIGURATON



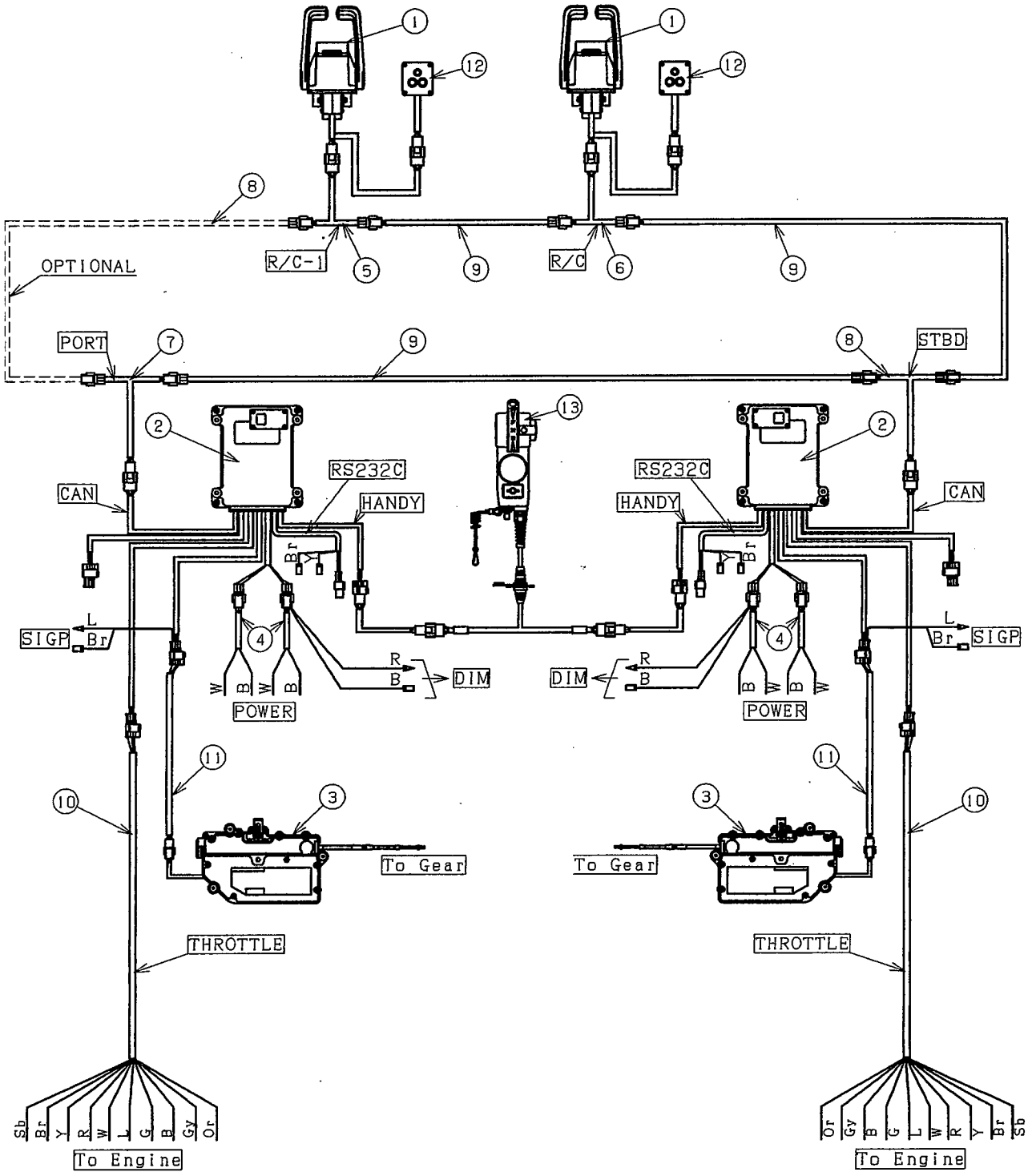
Notes:

1. Figure above is an example of a single engine / 2 control stations system with optional idle control switches and optional handheld control.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-6+ COMPONENTS LIST: SINGLE

KE-6+ Component Parts List (Single)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, single, O/B style OR	NM1001-00, NM1002-00, NM1004-00, NM1005-00		1	2	3	4
① Control head, single, I/B style	NM1003-00 NM1006-00, NM1018-00, NM1019-00					
② Control unit 12V/24V		NM2447-00	1			
③ Actuator, shift/throttle		NM0199-00	1			
④ Harness, power supply	5m	NM0414-28	2			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (SINGLE)		NM0647-11	1			
⑧ Bus harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	1	2	3	4
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑨ Harness, throttle (5m or 10m).	5m	NM0666-05	1			
	10m	NM0666-10				
⑩ Harness, actuator	2m	NM0667-00	1			
⑪ Idle switch (optional)		NJ0765-00	1	2	3	4
⑫ Handheld control (optional)	Refer to handheld control manual					
Circuit breaker (optional)	20A	NJ0514-00	2			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-6+ DUAL ENGINE CONFIGURATON



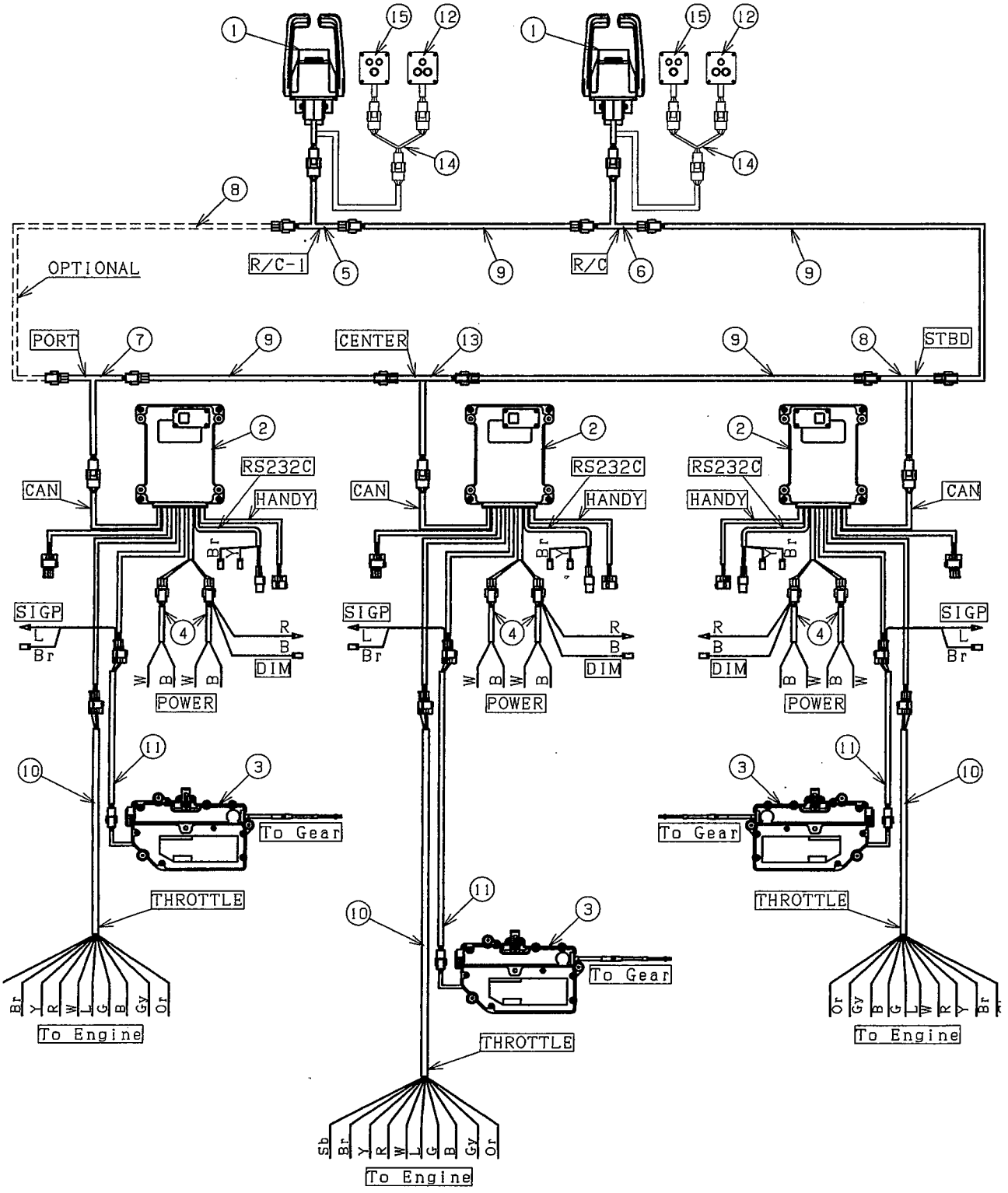
Notes:

1. Figure above is an example of a two engines / two control stations system with optional idle control switches and optional handheld control.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-6+ COMPONENTS LIST: DUAL

KE-6+ Component Parts List (Dual)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR	NM1051-00, NM1052-00 NM1054-00, NM1055-00		1	2	3	4
① Control head, dual, I/B style	NM1053-00, NM1056-00					
② Control unit 12V/24V		NM2447-00	2			
③ Actuator, shift/throttle		NM0199-00	2			
④ Harness, power supply	5m	NM0414-28	4			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	2	3	4	5
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, throttle (5m or 10m).	5m	NM0666-05	2			
	10m	NM0666-10				
⑪ Harness, actuator	2m	NM0667-00	2			
⑫ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑬ Handheld control (optional)	Refer to handheld control manual					
Circuit Breaker (optional)	20A	NJ0514-00	4			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-6+ TRIPLE ENGINE CONFIGURATON



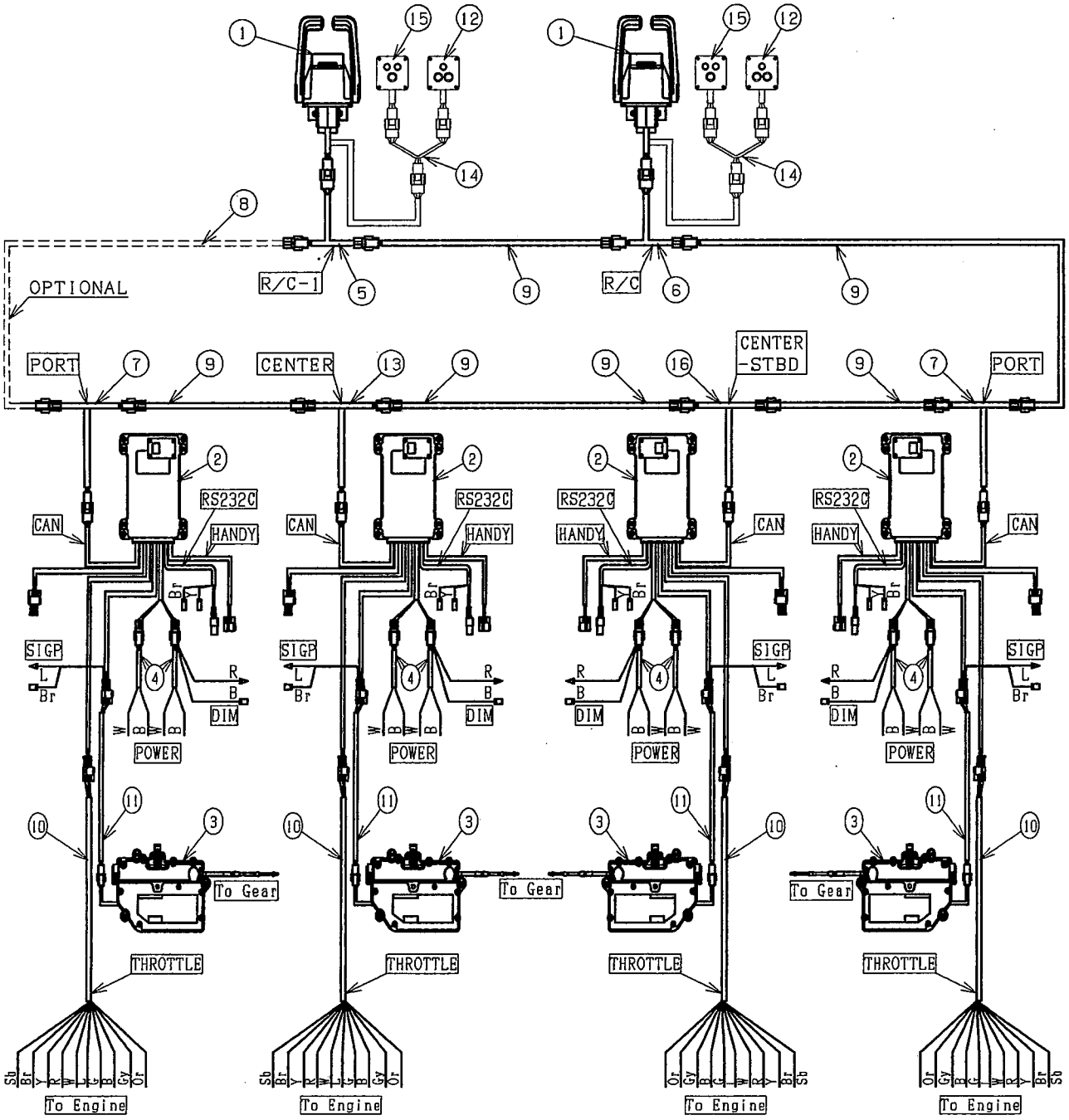
Notes:

1. The figure above is an example of a three engines / two control stations system with optional idle control switch.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-6+ COMPONENTS LIST: TRIPLE

KE-6+ Component Parts List (Triple)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR	NM1051-00, NM1052-00 NM1054-00, NM1055-00		1	2	3	4
① Control head, dual, I/B style	NM1053-00, NM1056-00					
② Control unit 12V/24V		NM2447-00	3			
③ Actuator, shift/throttle		NM0199-00	3			
④ Harness, power supply	5m	NM0414-28	6			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	3	4	5	6
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, throttle (5m or 10m).	5m	NM0666-05	3			
	10m	NM0666-10				
⑪ Harness, actuator	2m	NM0667-00	3			
⑫ Idle switch (optional)		NJ0765-00	1	2	3	4
⑬ T-harness (CENTER)		NM0647-14	1			
⑭ SW extension harness (optional)		NM0647-08	1	2	3	4
⑮ Triple switch		NJ0767-00	1	2	3	4
Circuit Breaker (optional)	10A	NJ0765-00	6			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-6+ QUAD ENGINE CONFIGURATON



Notes:

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

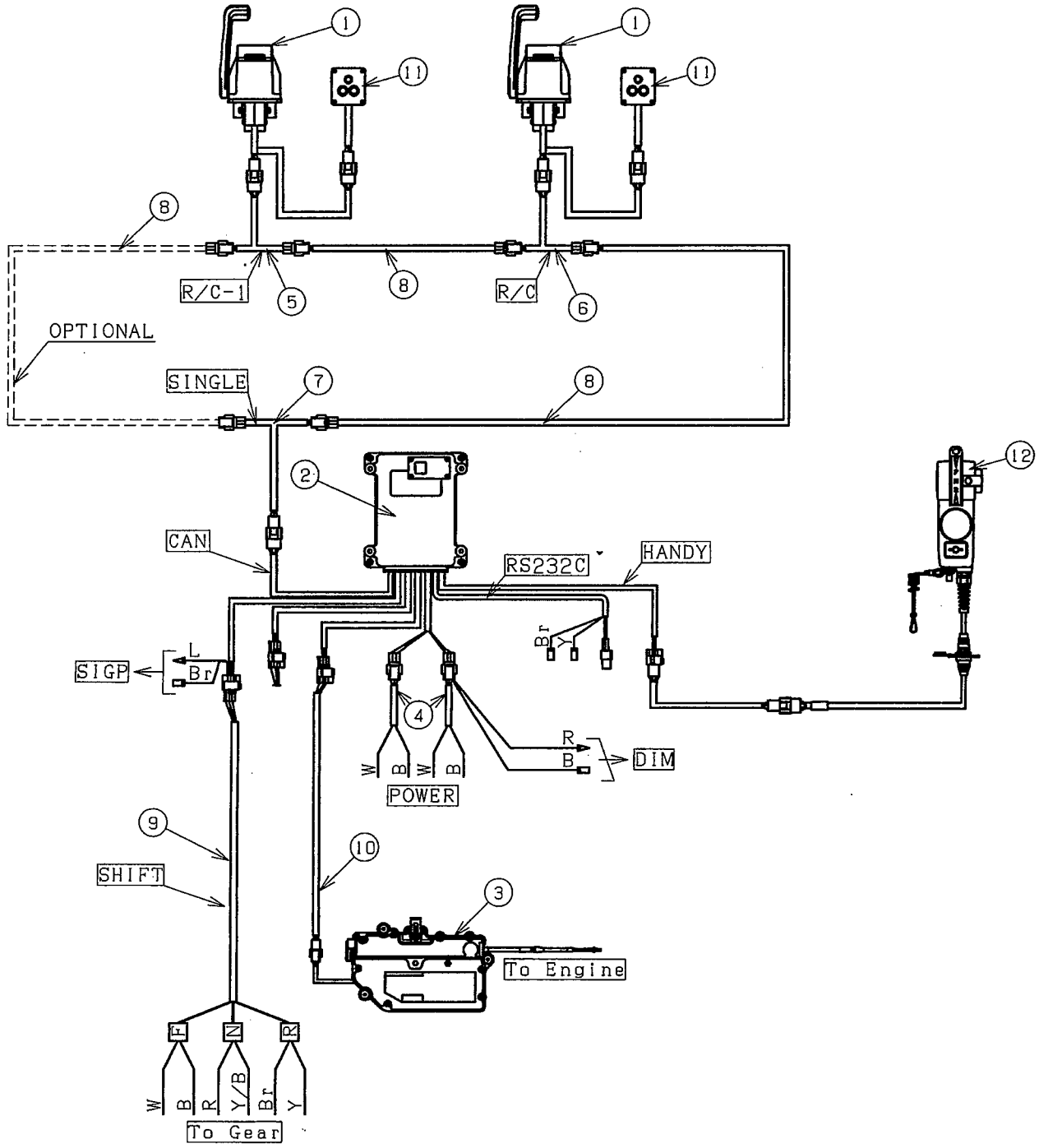
2 Mechanical push-pull cables sold separately

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

KE-6+ COMPONENTS LIST: QUAD

KE-6+ Component Parts List (Quad)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR		NM1051-00, NM1052-00 NM1054-00, NM1055-00	1	2	3	4
① Control head, dual, I/B style		NM1053-00, NM1056-00				
② Control unit 12V/24V		NM2447-00	4			
③ Actuator, shift/throttle		NM0199-00	4			
④ Harness, power supply	5m	NM0414-28	8			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	4	5	6	7
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, throttle (5m or 10m)	5m	NM0666-05	4			
	10m	NM0666-10				
⑪ Harness, actuator	2m	NM0667-00	4			
⑫ Idle switch (optional)		NJ0765-00	1	2	3	4
⑬ T-harness (CENTER)		NM0647-14	1			
⑭ SW extension harness (optional)		NM0647-08	1	2	3	4
⑮ Quad switch		NJ0768-00	1	2	3	4
⑯ T-harness (CENTER-STBD)		NM0647-15	1			
Circuit Breaker (optional)	10A	NJ0765-00	8			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-7+ SINGLE ENGINE CONFIGURATON



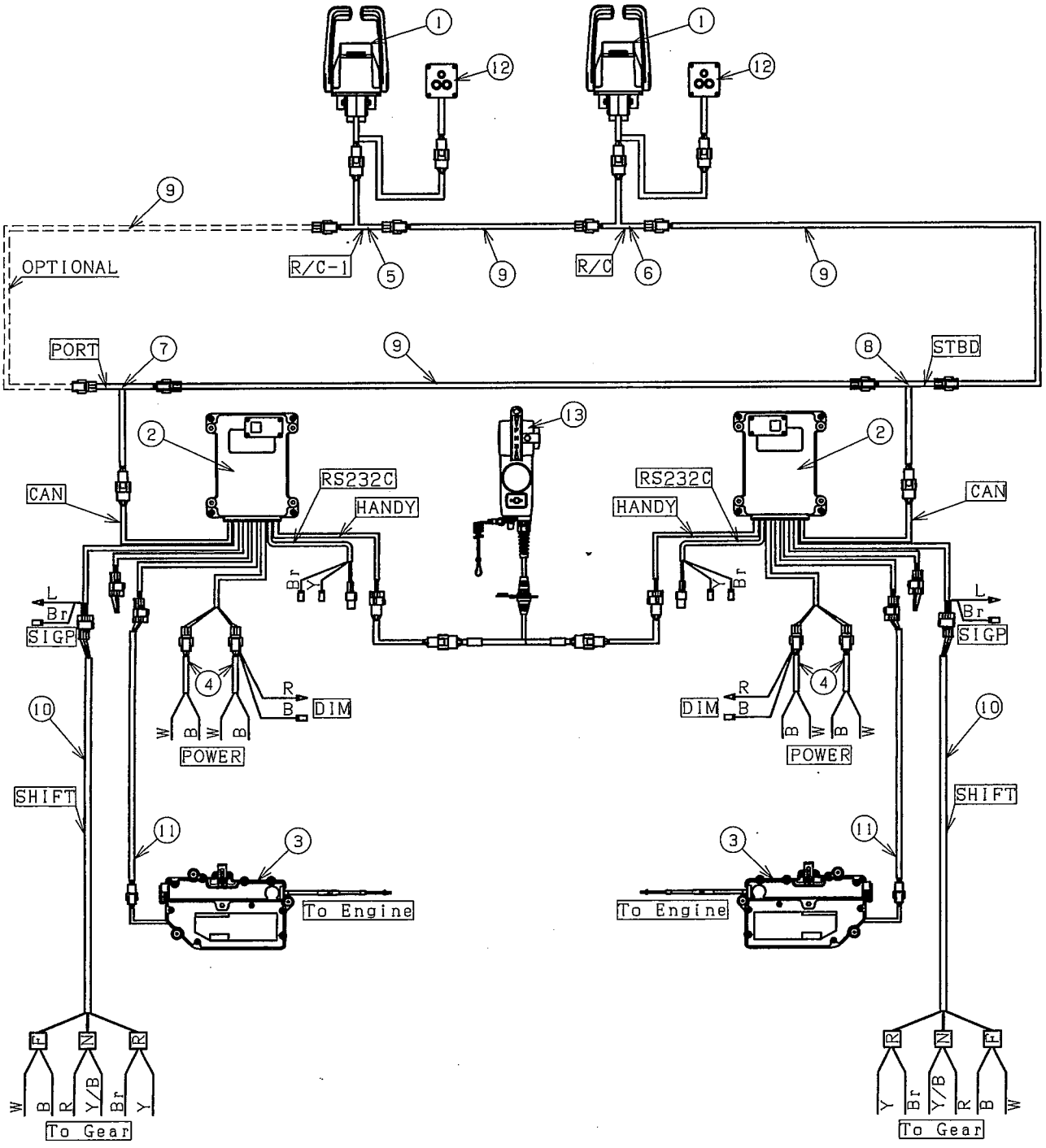
Notes:

1. Figure above is an example of a single engine / 2 control stations system with optional idle control switches and optional handheld control.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-7+ COMPONENTS LIST: SINGLE

KE-7+ Component Parts List (Single)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, single, O/B style OR	NM1001-00, NM1002-00, NM1004-00, NM1005-00		1	2	3	4
① Control head, single, I/B style	NM1003-00 NM1006-00, NM1018-00, NM1019-00					
② Control unit 12V/24V		NM2447-00	1			
③ Actuator, shift/throttle		NM0199-00	1			
④ Harness, power supply	5m	NM0414-28	2			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (SINGLE)		NM0647-11	1			
⑧ Bus harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	1	2	3	4
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑨ Harness, shift (5m or 10m).	5m	NM0640-05	1			
	10m	NM0640-10				
⑩ Harness, actuator	2m	NM0667-00	1			
⑪ Idle switch (optional)		NJ0765-00	1	2	3	4
⑫ Handheld control (optional)	Refer to handheld control manual					
Circuit breaker (optional)	20A	NJ0514-00	2			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-7+ DUAL ENGINE CONFIGURATON



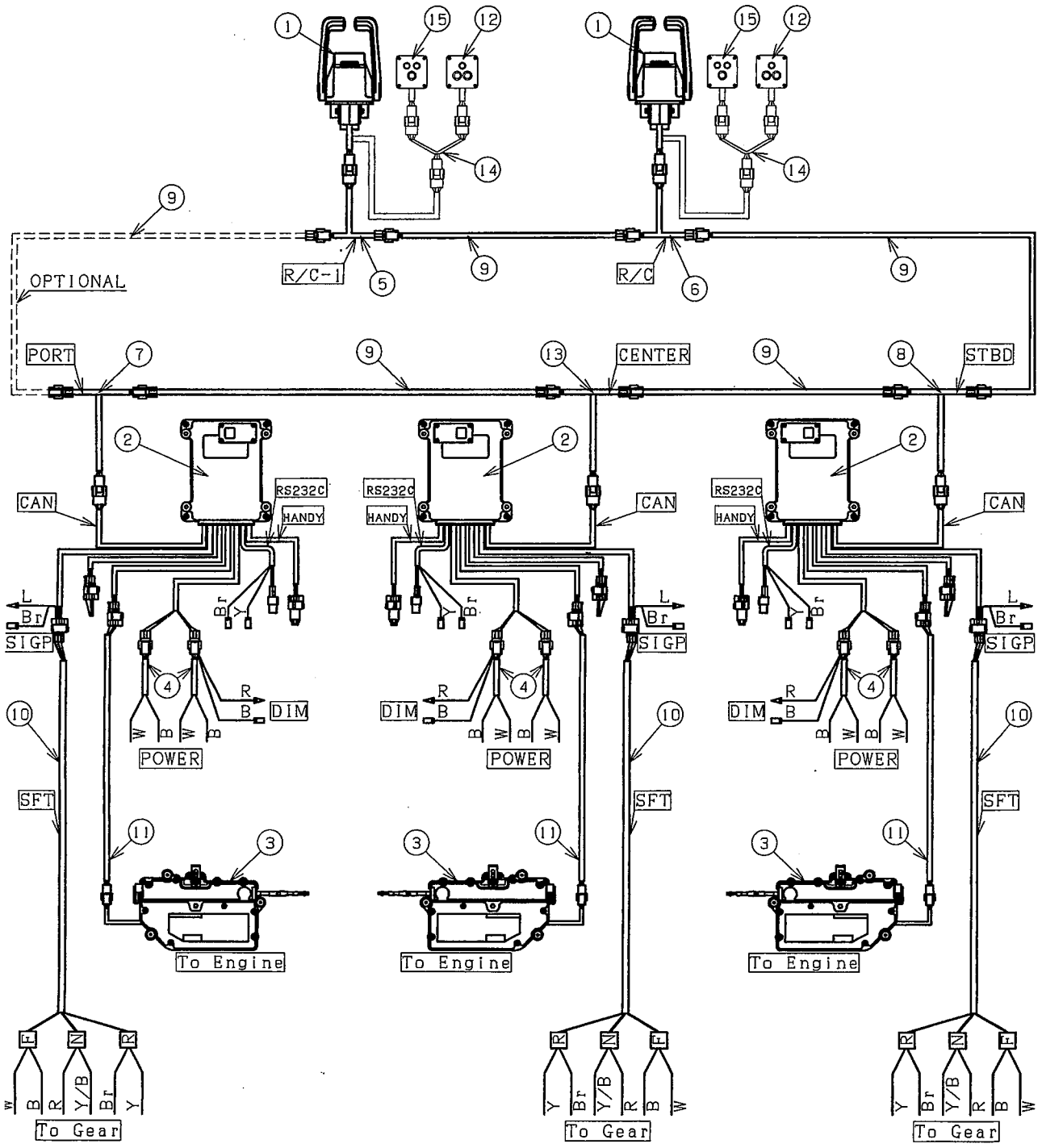
Notes:

1. Figure above is an example of a two engines / two control stations system with optional idle control switches and optional handheld control.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-7+ COMPONENTS LIST: DUAL

KE-7+ Component Parts List (Dual)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR	NM1051-00, NM1052-00 NM1054-00, NM1055-00		1	2	3	4
① Control head, dual, I/B style	NM1053-00, NM1056-00					
② Control unit 12V/24V		NM2447-00	2			
③ Actuator, shift/throttle		NM0199-00	2			
④ Harness, power supply	5m	NM0414-28	4			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	2	3	4	5
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, shift (5m or 10m).	5m	NM0640-05	2			
	10m	NM0640-10				
⑪ Harness, actuator	2m	NM0667-00	2			
⑫ Idle Switch (optional)		NJ0765-00	1	2	3	4
⑬ Handheld control (optional)	Refer to handheld control manual					
Circuit Breaker (optional)	20A	NJ0514-00	4			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-7+ TRIPLE ENGINE CONFIGURATON



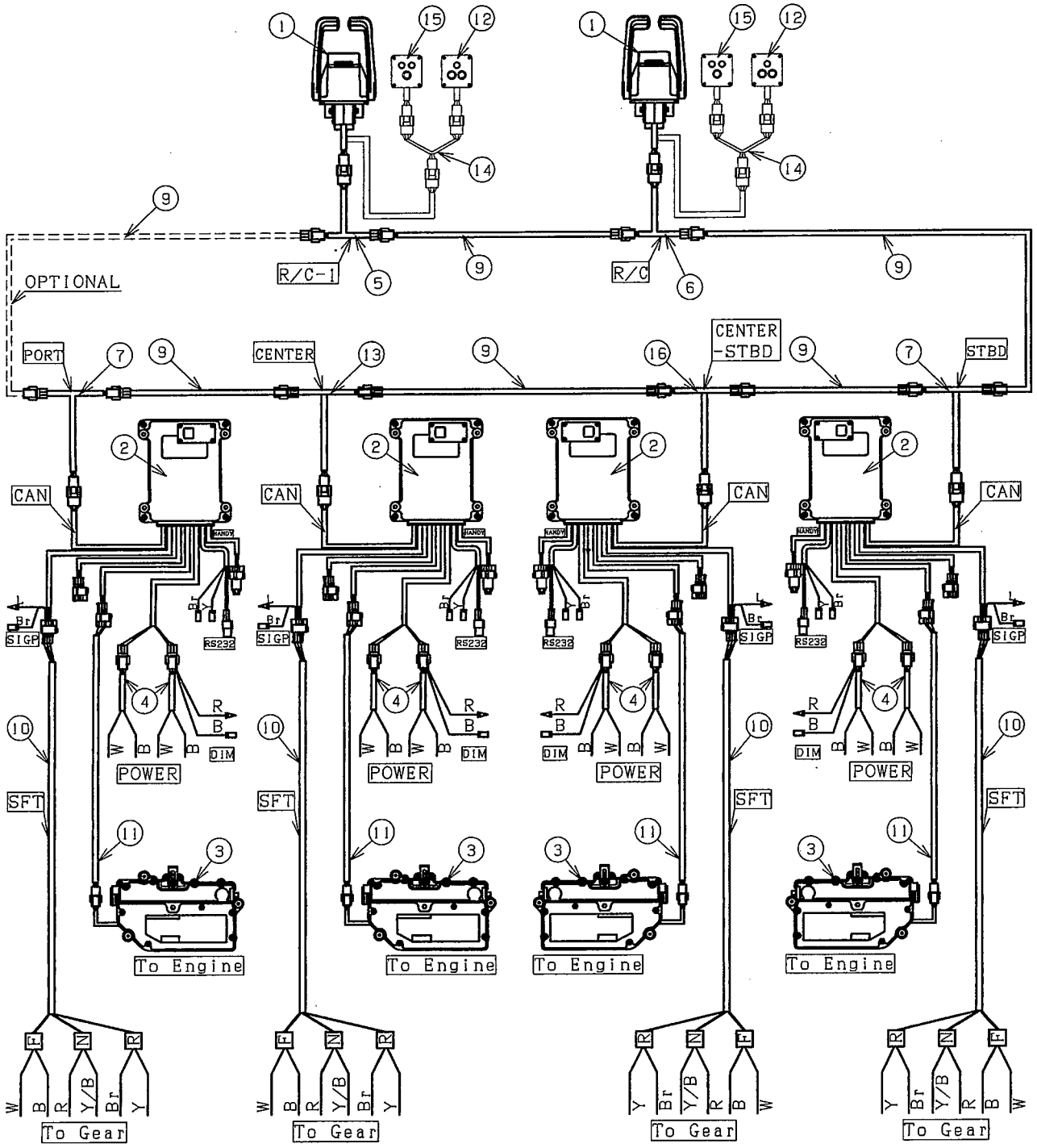
Notes:

1. The figure above is an example of a three engines / two control stations system with optional idle control switch.
2. Mechanical push-pull cables sold separately
3. POWER: See 'Connecting Power' page for battery connection details.

KE-7+ COMPONENTS LIST: TRIPLE

KE-7+ Component Parts List (Triple)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR		NM1051-00, NM1052-00 NM1054-00, NM1055-00	1	2	3	4
① Control head, dual, I/B style		NM1053-00, NM1056-00				
② Control unit 12V/24V		NM2447-00	3			
③ Actuator, shift/throttle		NM0199-00	3			
④ Harness, power supply	5m	NM0414-28	6			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	3	4	5	6
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, shift (5m or 10m).	5m	NM0640-05	3			
	10m	NM0640-10				
⑪ Harness, actuator	2m	NM0667-00	3			
⑫ Idle switch (optional)		NJ0765-00	1	2	3	4
⑬ T-harness (CENTER)		NM0647-14	1			
⑭ SW extension harness (optional)		NM0647-08	1	2	3	4
⑮ Triple switch		NJ0767-00	1	2	3	4
Circuit Breaker (optional)	10A	NJ0765-00	6			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

KE-7+ QUAD ENGINE CONFIGURATON



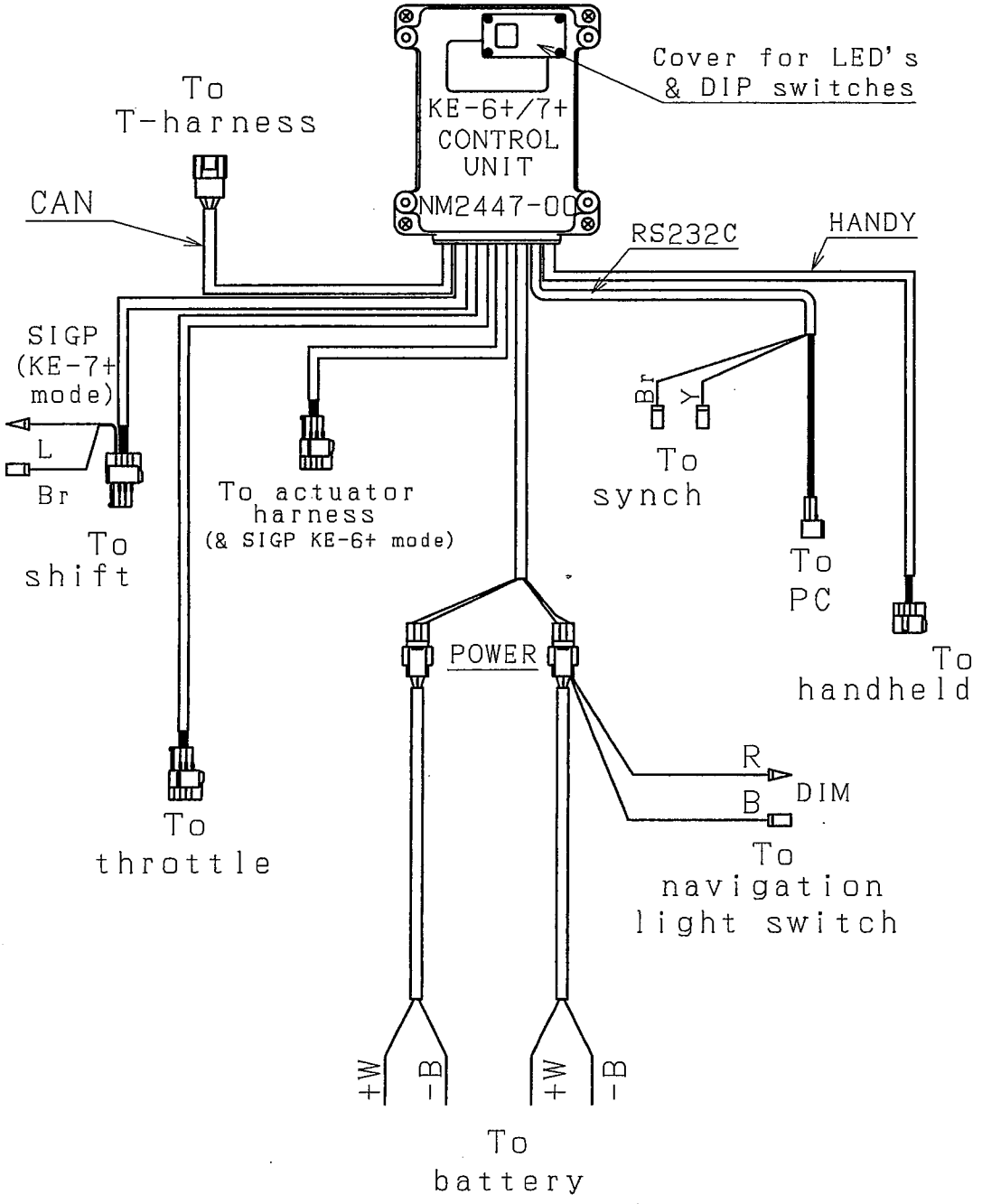
Notes:

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

KE-7+ COMPONENTS LIST: QUAD

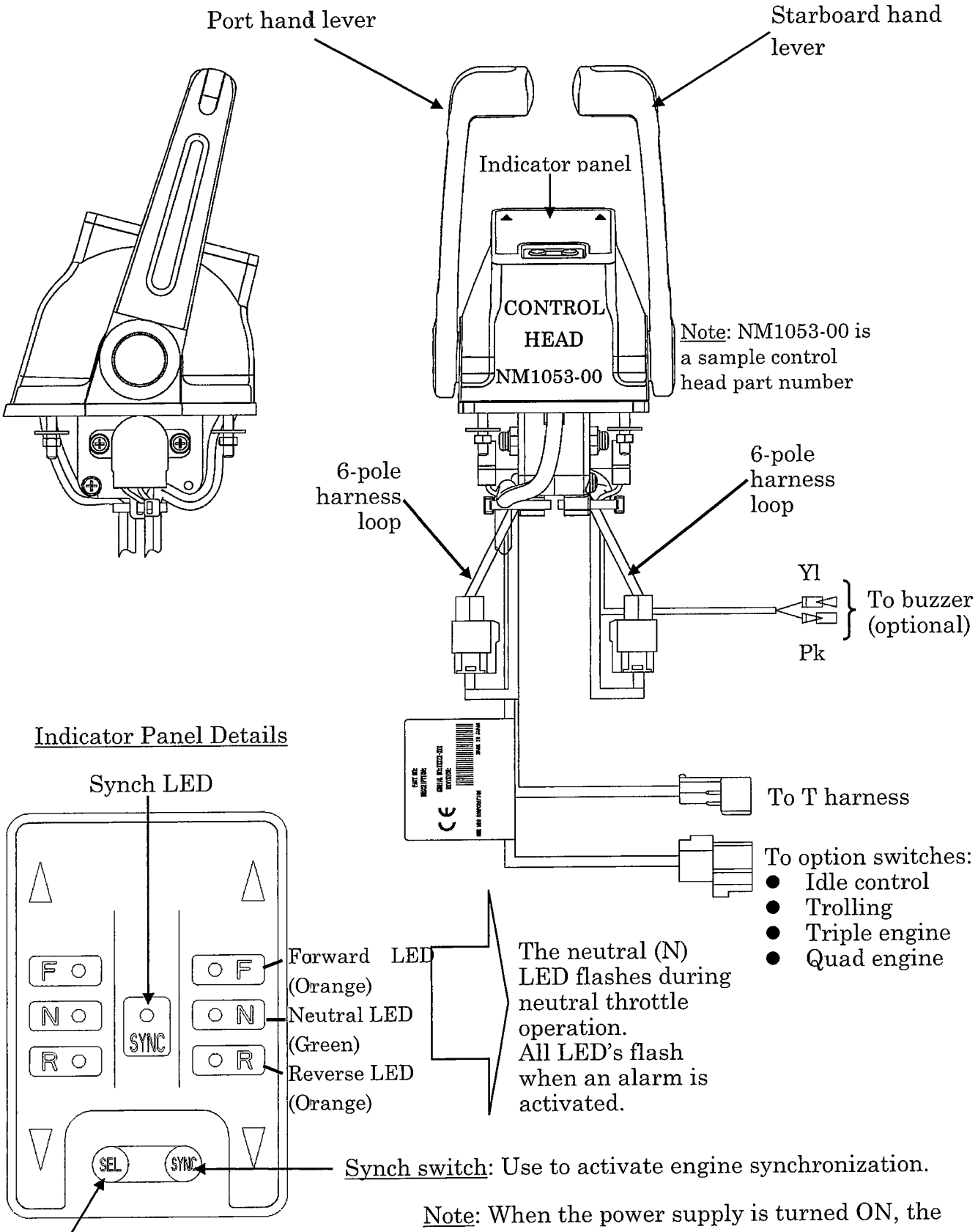
KE-7+ Component Parts List (Quad)			Required quantity based on number of controls stations			
Description		Part number	1	2	3	4
① Control head, dual, O/B style OR		NM1051-00, NM1052-00 NM1054-00, NM1055-00	1	2	3	4
① Control head, dual, I/B style		NM1053-00, NM1056-00				
② Control unit 12V/24V		NM2447-00	4			
③ Actuator, shift/throttle		NM0199-00	4			
④ Harness, power supply	5m	NM0414-28	8			
	10m	NM0414-33				
⑤ T-harness (R/C-1)		NM0647-09	1			
⑥ T-harness (R/C)		NM0647-10	-	1	2	3
⑦ T-harness (PORT)		NM0647-12	1			
⑧ T-harness (STBD)		NM0647-13	1			
⑨ Bus Harness 1m = 39 inches **⚠ CAUTION** Bus harness should not exceed 80m in total length; otherwise system performance could degrade	2m	NM0649-02	4	5	6	7
	4m	NM0649-04				
	6m	NM0649-06				
	8m	NM0649-08				
	10m	NM0649-10				
	12m	NM0649-12				
	14m	NM0649-14				
	16m	NM0649-16				
	18m	NM0649-18				
	20m	NM0649-20				
	24m	NM0649-24				
	30m	NM0649-30				
	40m	NM0649-40				
	50m	NM0649-50				
⑩ Harness, shift (5m or 10m).	5m	NM0640-05	4			
	10m	NM0640-10				
⑪ Harness, actuator	2m	NM0667-00	4			
⑫ Idle switch (optional)		NJ0765-00	1	2	3	4
⑬ T-harness (CENTER)		NM0647-14	1			
⑭ SW extension harness (optional)		NM0647-08	1	2	3	4
⑮ Quad switch		NJ0768-00	1	2	3	4
⑯ T-harness (CENTER-STBD)		NM0647-15	1			
Circuit Breaker (optional)	10A	NJ0765-00	8			
Buzzer (optional)	12V	NJ0251-00	1	2	3	4
	24V	NJ0515-00				

CONTROL UNIT



Note: The control unit is a common-mode type that can be used for KE-6+ control system or for KE-7+ control system; with either 12V or 24V input power

CONTROL HEAD



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.

SHIFT / THROTTLE ACTUATOR

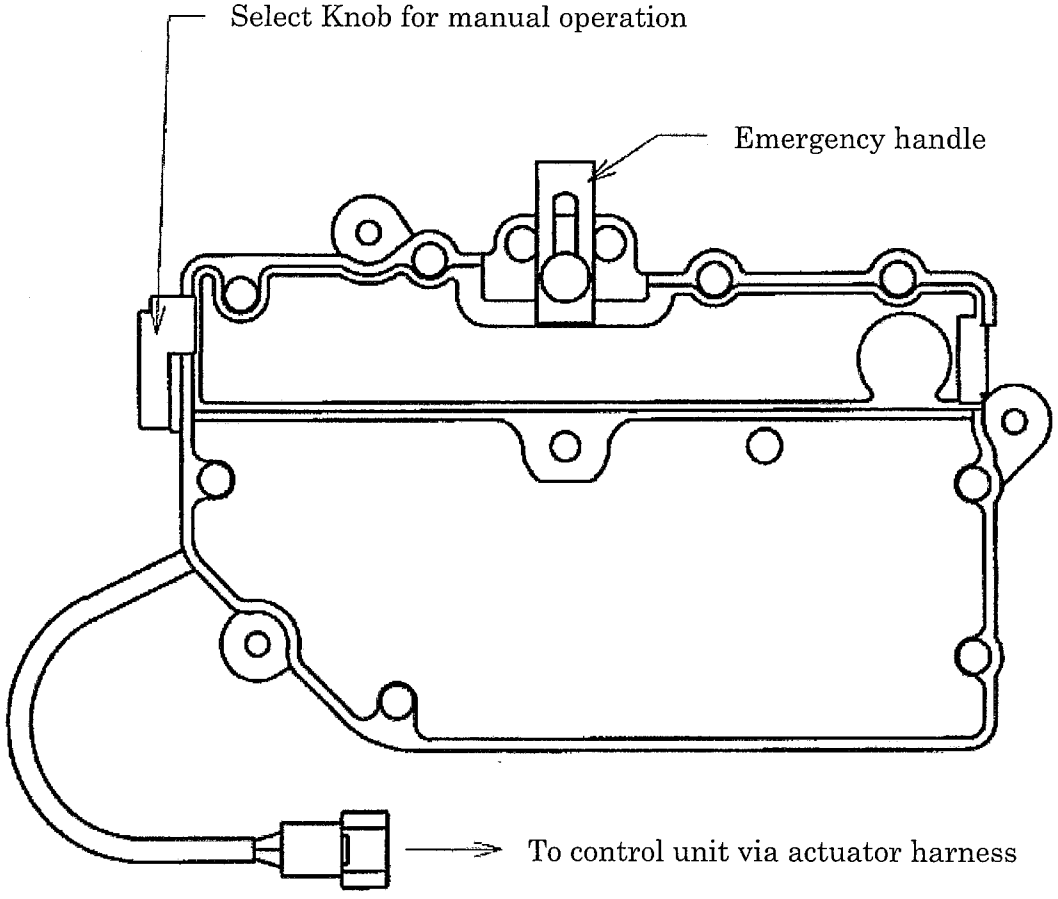
The actuator responds to control head lever commands for shift operation (KE-6+ application) or throttle operation (KE-7+ application). In case of electrical failure, manual operation is possible.

Instructions for Manual Operation:

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

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

Notes: Figure below does not include mechanical push-pull cables that connect to the engine or gearbox; they are sold separately



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.

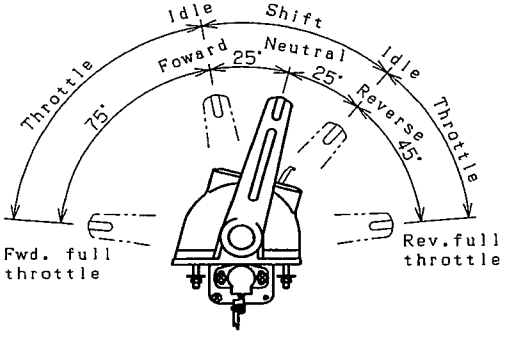
Control Lever Operation

⚠ 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.



Lever Operation and Outputs (Also see Adjusting Control Unit for details")

Lever Operation	Output		
	Output	KE-6+ Mode Idle Validation Switch	
Forward Throttle	Fwd Throttle	Normally Closed	Normally Open
		Open	Closed
Forward Idle	Fwd Shift/Idle	Closed	Open
Neutral	Neutral / Idle		
Reverse Idle	Rev Shift / Idle		
Reverse Throttle	Rev Throttle	Open	Closed

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 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. DUAL LEVER MODE: Synchronization will be automatic whenever the levers are within 10°of each other and in forward mode.
4. SINGLE LEVER MODE: Synchronization is automatic with the PORT side lever in forward mode
5. To deactivate: Set levers to neutral position and press SYNC button to turn OFF green SYNC LED.

INSTALLING THE CONTROL HEAD

⚠ WARNING

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

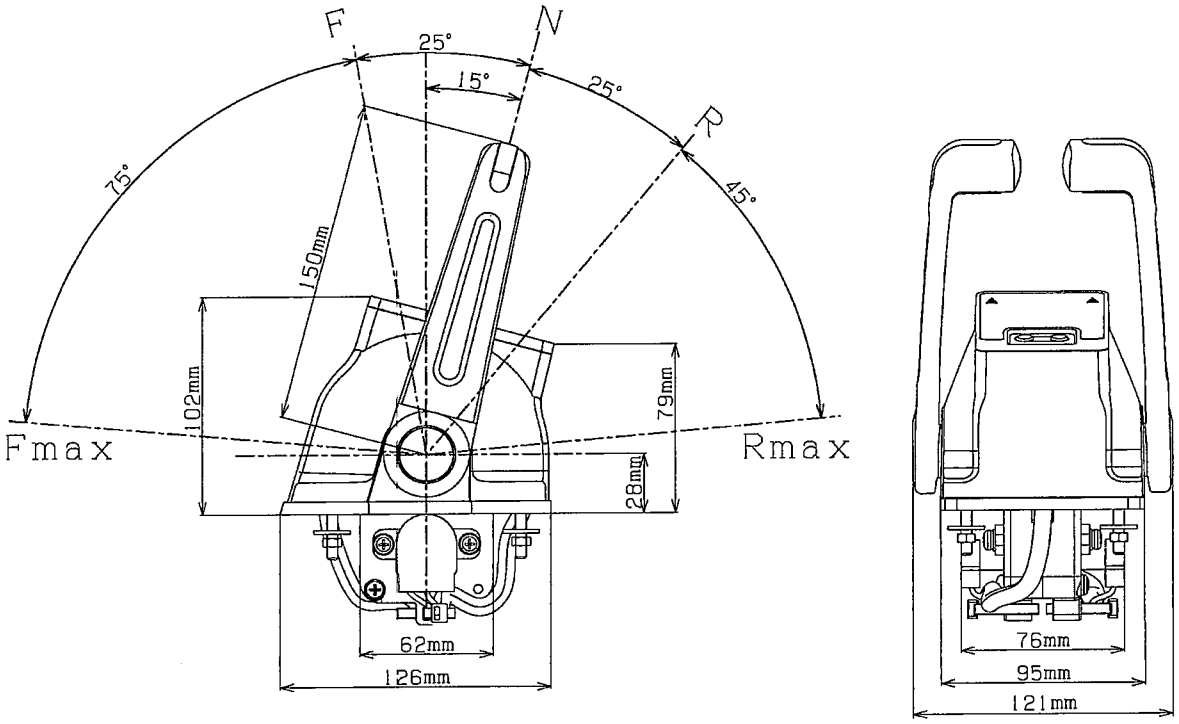
Instructions:

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

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

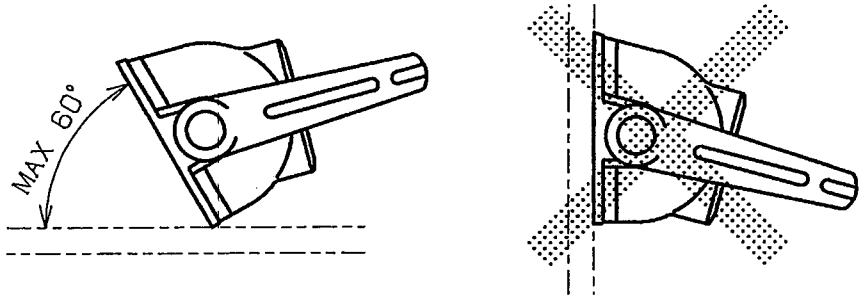
(3) Install with included washers and nuts.

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



⚠ CAUTION

Mount the control head within 60 degrees from horizontal.



INSTALLING THE CONTROL UNIT

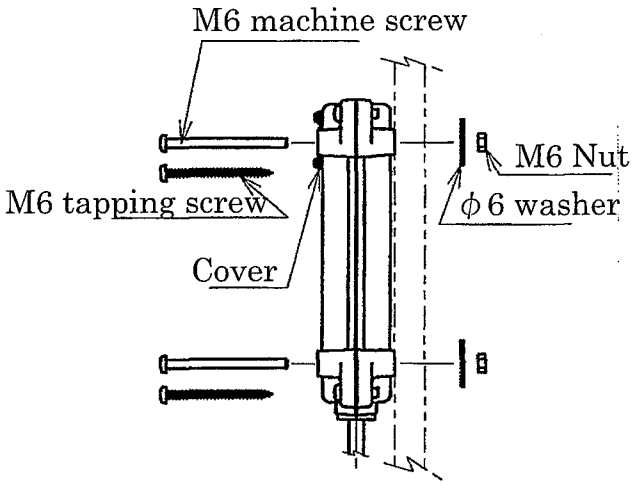
⚠ CAUTION
1. Ingress of water into the unit may cause failure 2. Install so that harnesses exit through the bottom and the small cover faces up for easy access to DIP switches. 3. Install in a location where sea wind and water effects are minimized. 4. Avoid a location where the ambient temperature exceeds 77 ℃. 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: 3 ~ 20 mm (1/8 ~ 3/4 in.), mounting hole diameter: φ7mm (φ1/4 in.).
2. Tapping screw mounting plate thickness: 15 mm min. (5/8 in. min.), pilot hole diameter: φ3mm (φ1/8 in.).



INSTALLING THE ACTUATOR

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

Instructions:

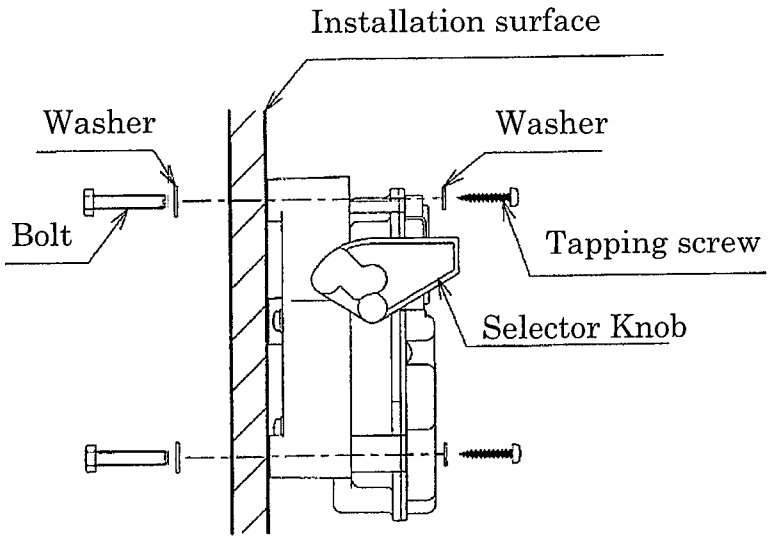
1. Install the actuator in a place convenient for operation of manual selector knob.
2. The actuator harness is 2m (6.5 ft) in length; select the control unit location so that its distance from the actuator is within 2m (6.5 ft).
3. Drill the mount hole using the attached template.
4. Install with bolts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

Notes:

1. Bolt Installation plate thickness : 3 ~ 25mm (1/8" to 1")
2. Mount hole dia : ϕ9mm (ϕ3/8 ")

or

3. Tapping screw plate thickness : 15mm min (9/16 " min)
4. Pilot hole dia : ϕ3mm (ϕ1/8 ")

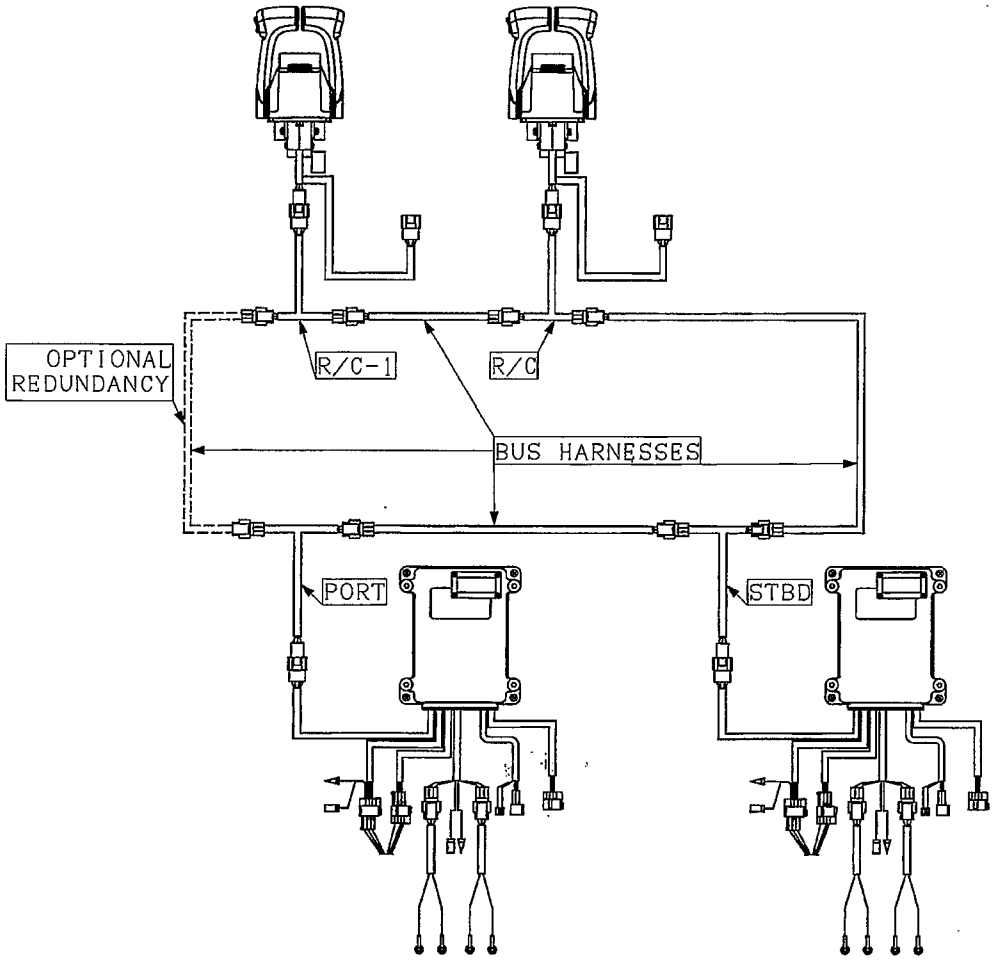


CONNECTING CONTROL HEAD & CONTROL UNIT

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

Instructions:

1. Connect the 8-pin harness connector of the first control head to the R/C-1 T-harness NM0647-09.
2. Connect the 8-pin harness connector of the remaining control heads to the R/C T-harness(es) NM0647-10.
3. Connect the 8-pin harness (CAN) connector of the control units to the appropriate T-harnesses: SINGLE, PORT, STBD, CENTER, CENTER-STBD (NM0647-XX)
4. Finally connect a main bus harness (NM0649-XX) 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 (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.

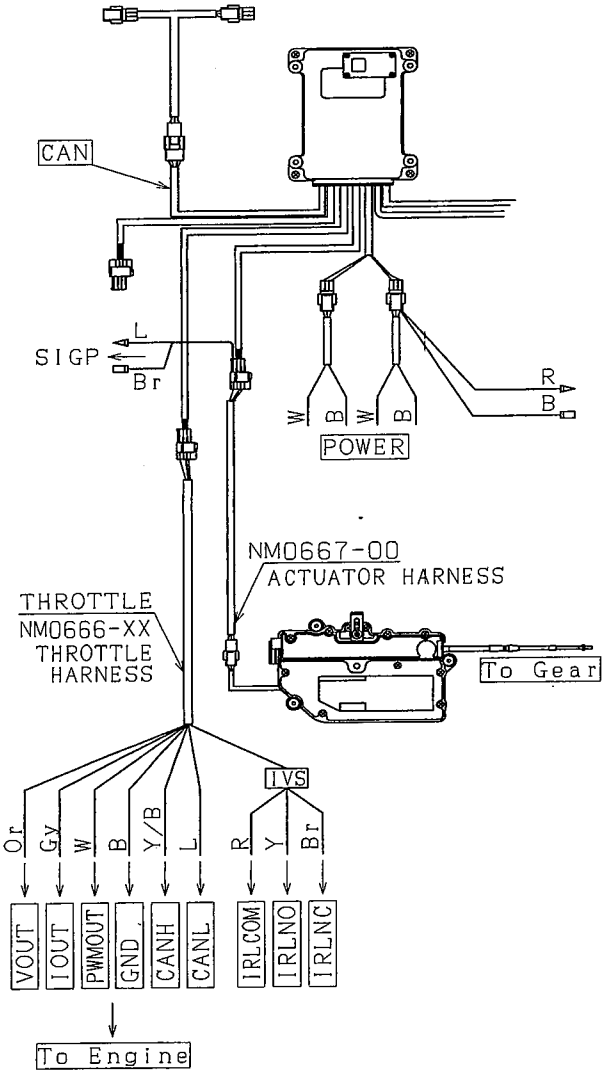
CONNECTING CONTROL UNIT to ENGINE & ACTUATOR: KE-6+ MODE

⚠ CAUTION

1. Be sure to use the correct throttle harness connections: Analog Voltage, PWM or CAN to match your engine input requirements.
2. Connect Idle Validation Switch (red, yellow, brown) only if required for your engine setup.
3. Consult engine maker if necessary.

Instructions:

1. Connect one end of NM0666-XX throttle harness to the throttle connector on the control unit.
2. Connect the other end of the NM0666-XX throttle harness to the engine connector respectively. Refer to engine maker instruction manuals for additional connection requirements.
3. Connect one end of the NM0667-00 actuator harness to the control unit and the other end to the actuator.



HARNESS CODE	OUTPUT DETAILS
V OUT	Voltage throttle
I OUT	Current throttle
PWM OUT	PWM throttle
GND	Analog signal return
CANH & CANL	SAE J1939 protocol
IRL COM	Common point, Idle Validation (GND)
IRL NO	Normally Open Switch, Idle Validation
IRL NC	Normally Closed Switch, Idle Validation

Notes:

1. XX: 05 = 5 meter length; 10 = 10 meter length
2. NO = Normally Open Switch; NC = Normally Closed Switch

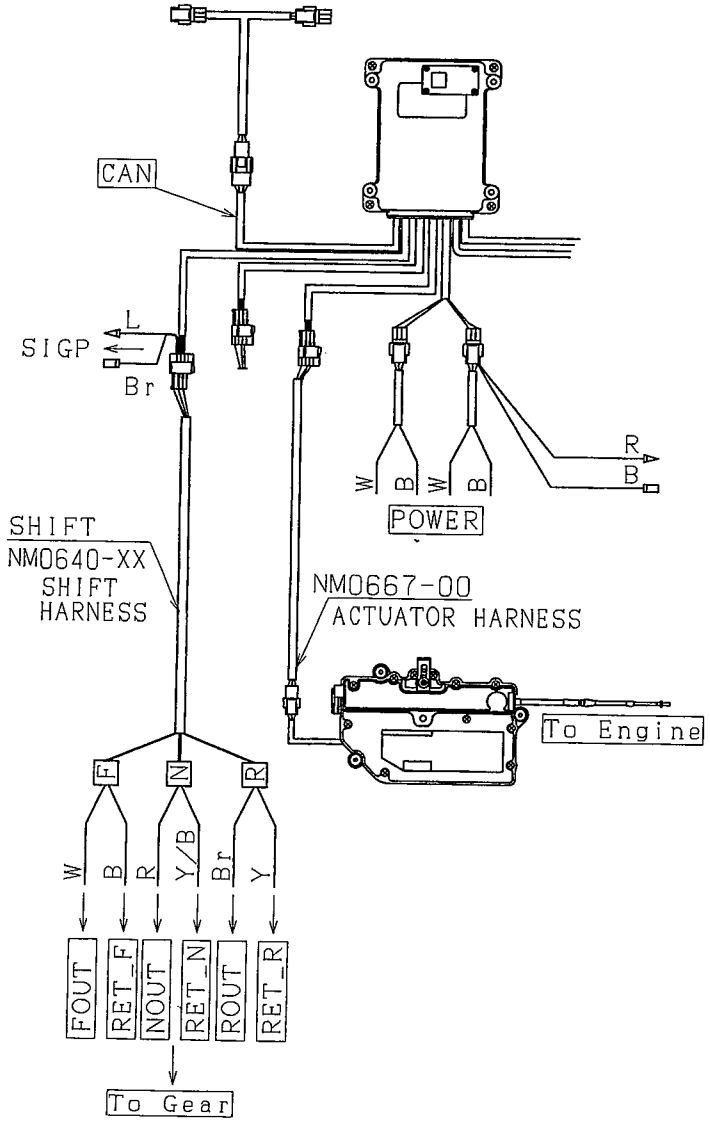
CONNECTING CONTROL UNIT to ENGINE & ACTUATOR: KE-7+ MODE

⚠ CAUTION

If necessary, consult engine /gearbox maker to confirm proper shift connections.

Instructions:

1. Connect one end of NM0640-XX shift harness to the throttle connector on the control unit.
2. Connect the other end of the NM0640-XX shift harness to the engine connector respectively. Refer to engine maker instruction manuals for additional connection requirements.
3. Connect one end of the NM0667-00 actuator harness to the control unit and the other end to the actuator.



HARNESS CODE	OUTPUT DETAILS
F OUT	Forward shift
N OUT	Neutral shift
R OUT	Reverse shift
RET	Return (GND)

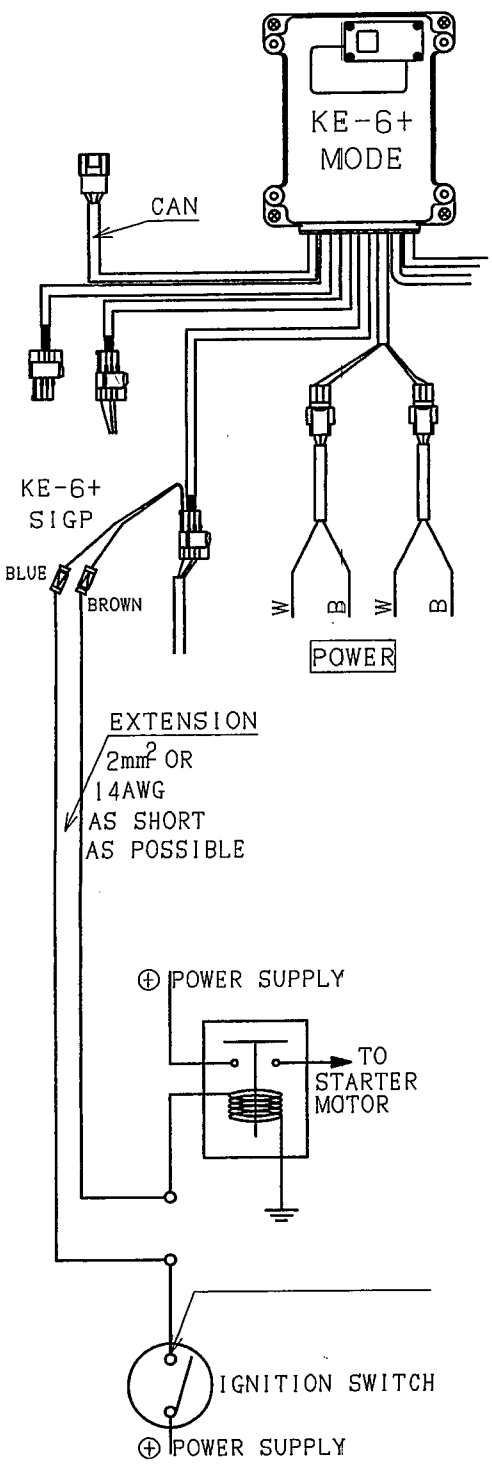
Notes:

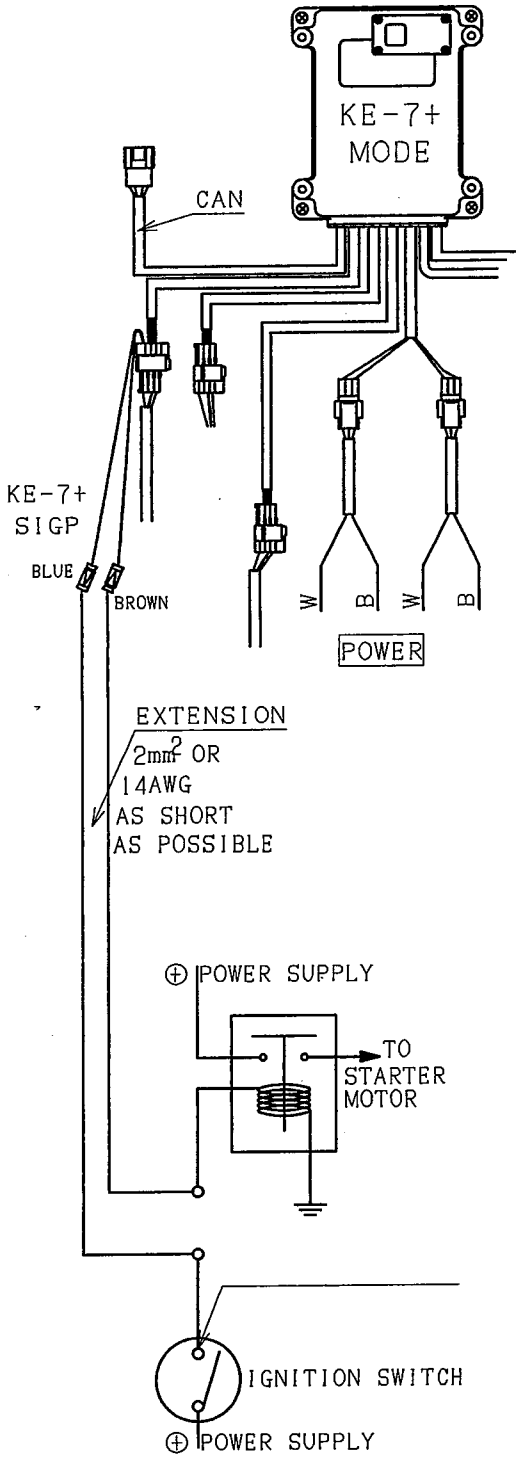
1. XX: 05 = 5 meter length; 10 = 10 meter length
2. NO = Normally Open Switch; NC = Normally Closed Switch

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

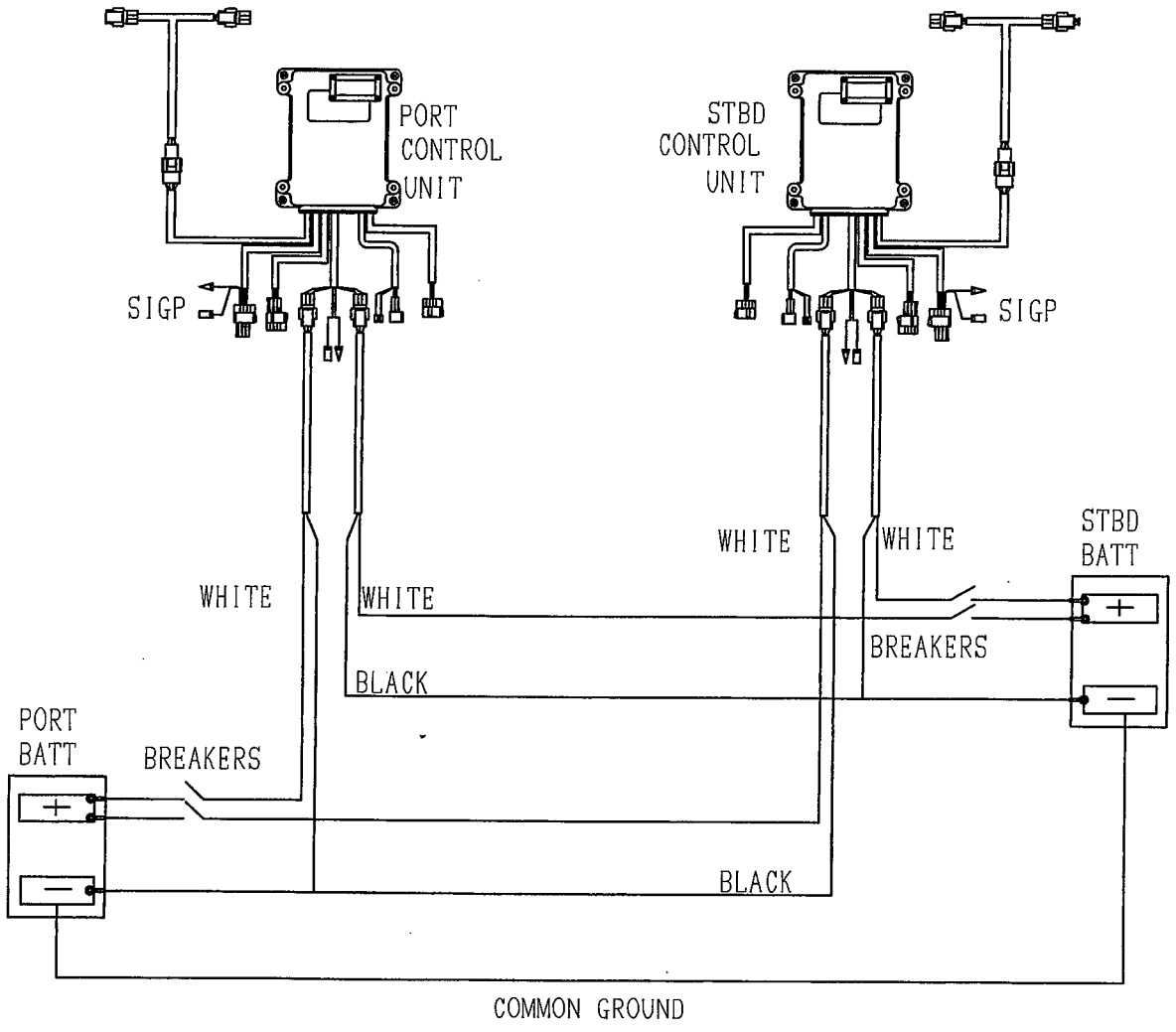
⚠ CAUTION

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 10 amp circuit breaker, via the boat
4. Circuit breaker or directly to (**+ plus**) of battery (power).

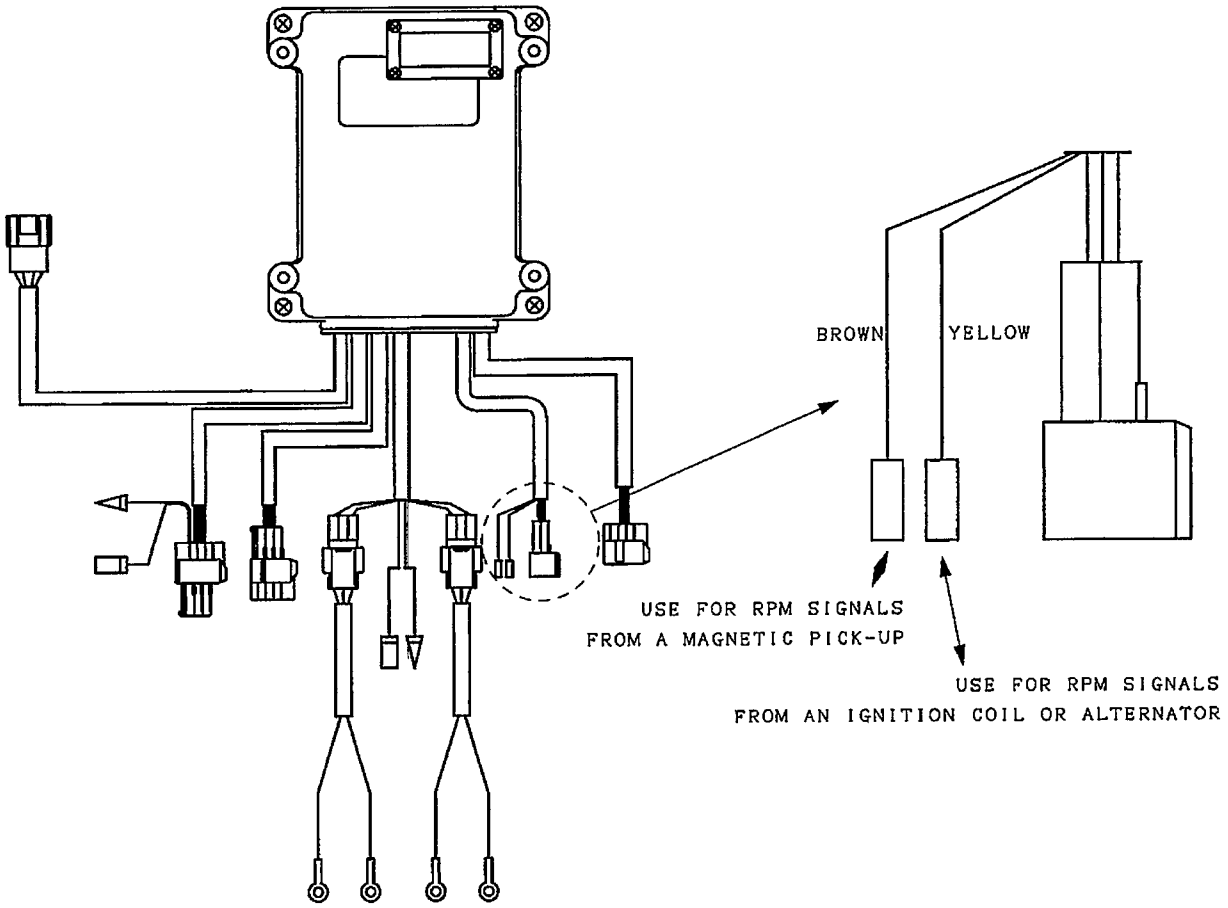
Note: If two batteries are provided, it is recommended to separate the power lines and connect one power line (plus breaker) to each battery.



CONNECTING SYNCHRONIZATION CIRCUIT

Instructions: (in order for the control unit to read engine synch 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. Refer to 'Adjusting Control Unit' for synch mode setting.

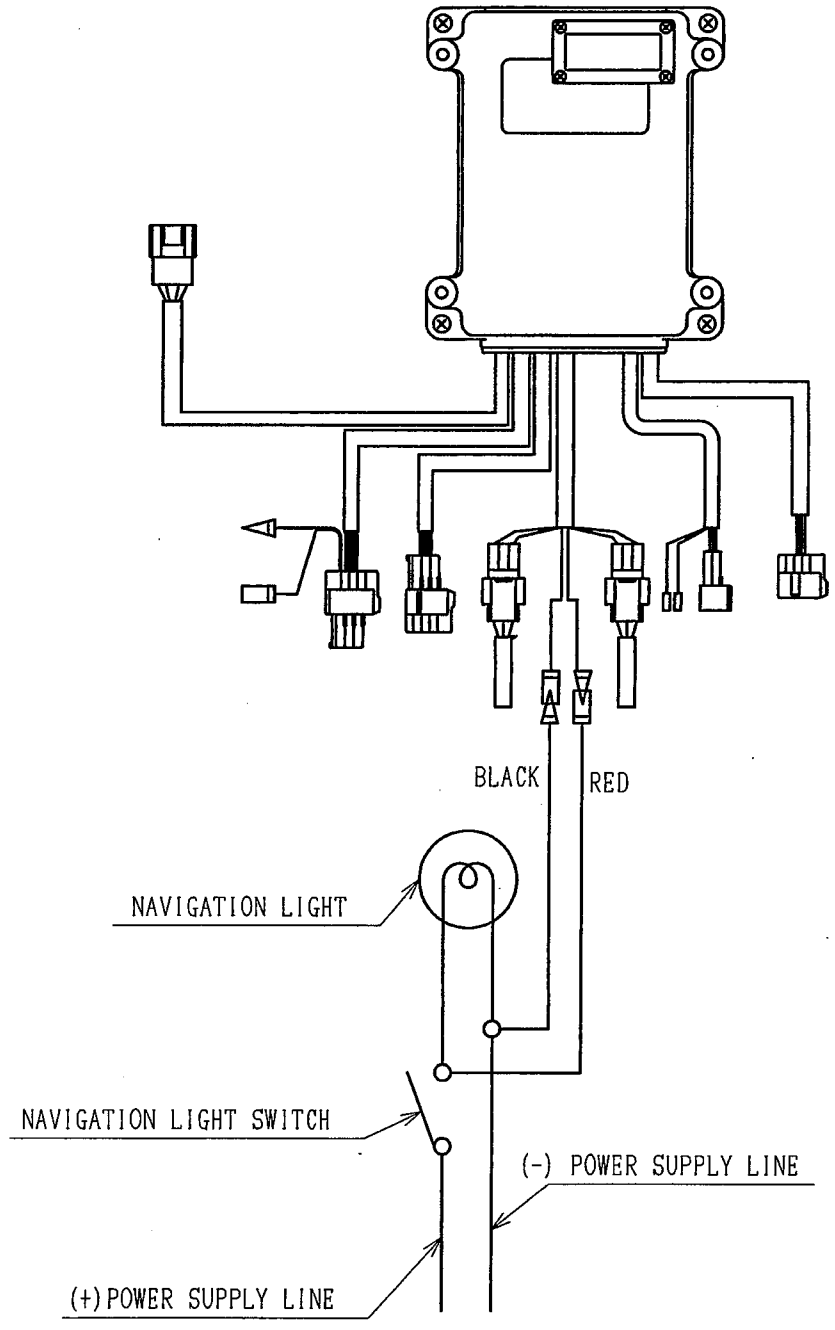


Note: No damage will occur if the case of a wrong connection, synchronization will simply be ineffective.

CONNECTING DIM HARNESS (OPTION)

Instructions:

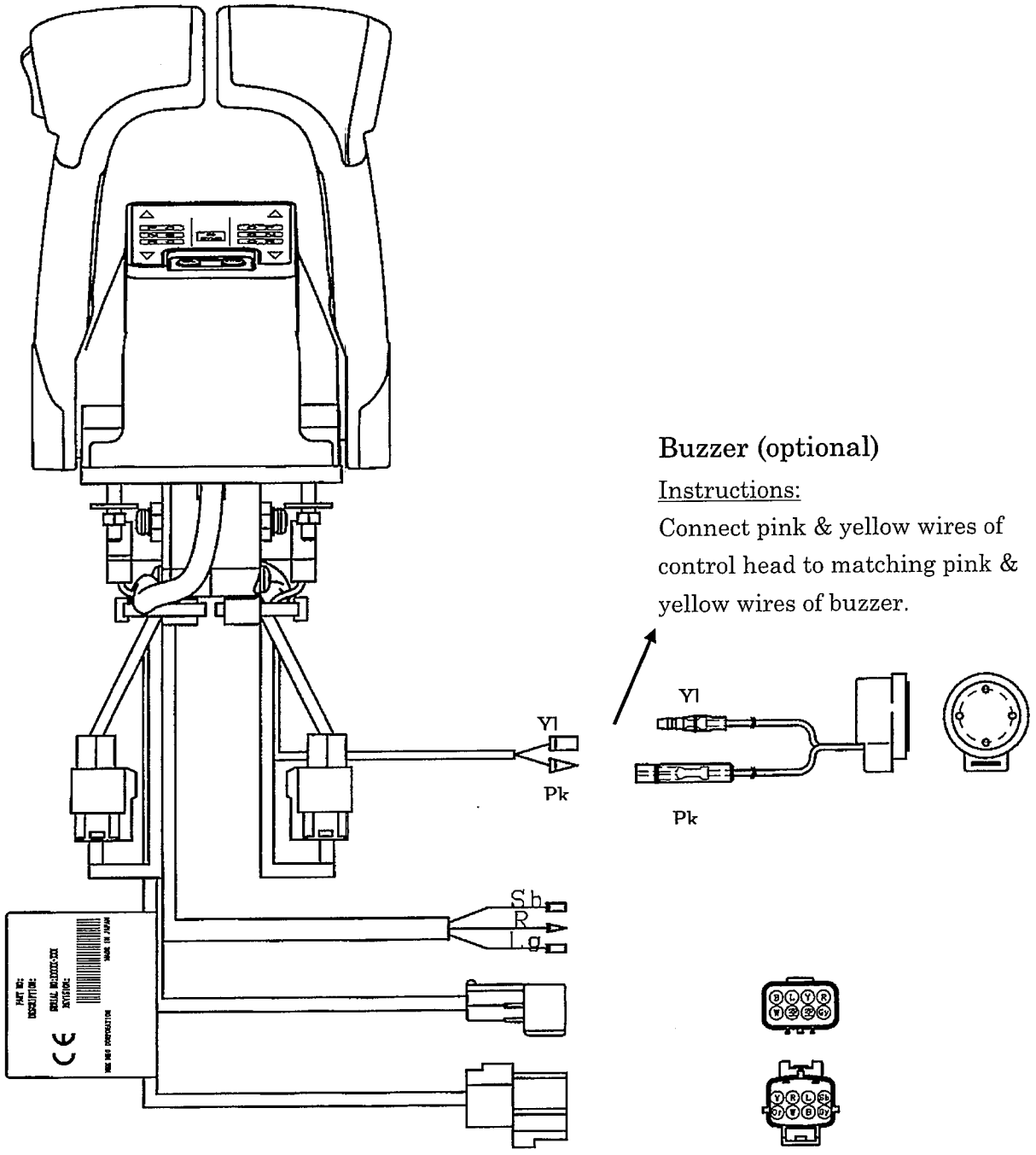
1. Connect the Dim Harness red line to the (+) wire of navigation light.
2. Connect the Dim Harness black line to the (−) wire of navigation light.



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).



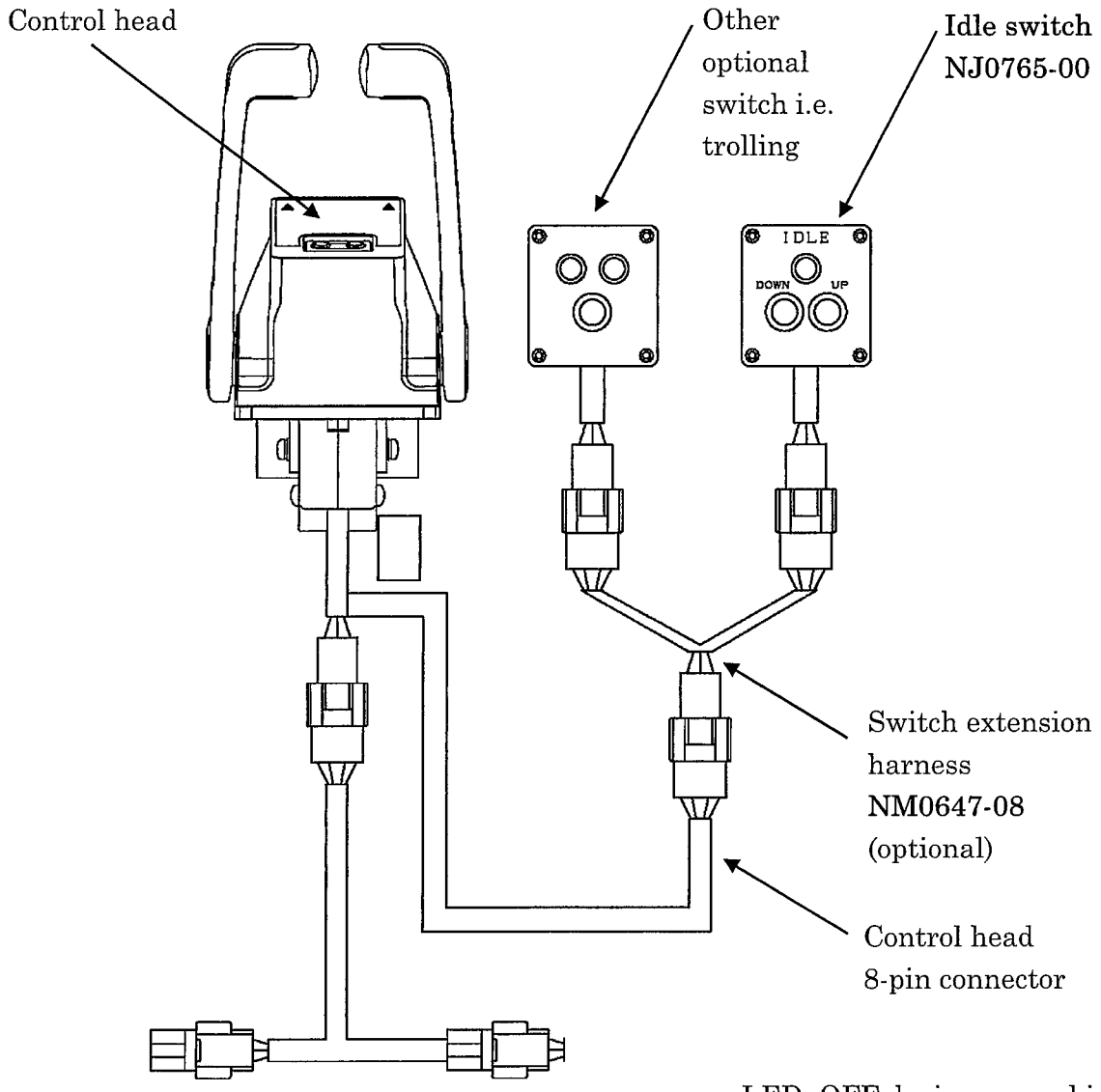
Buzzer (optional)

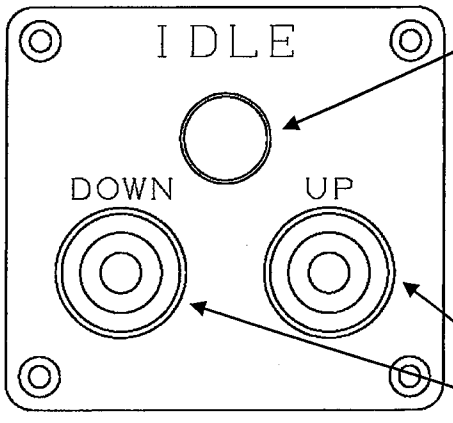
Instructions:

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.



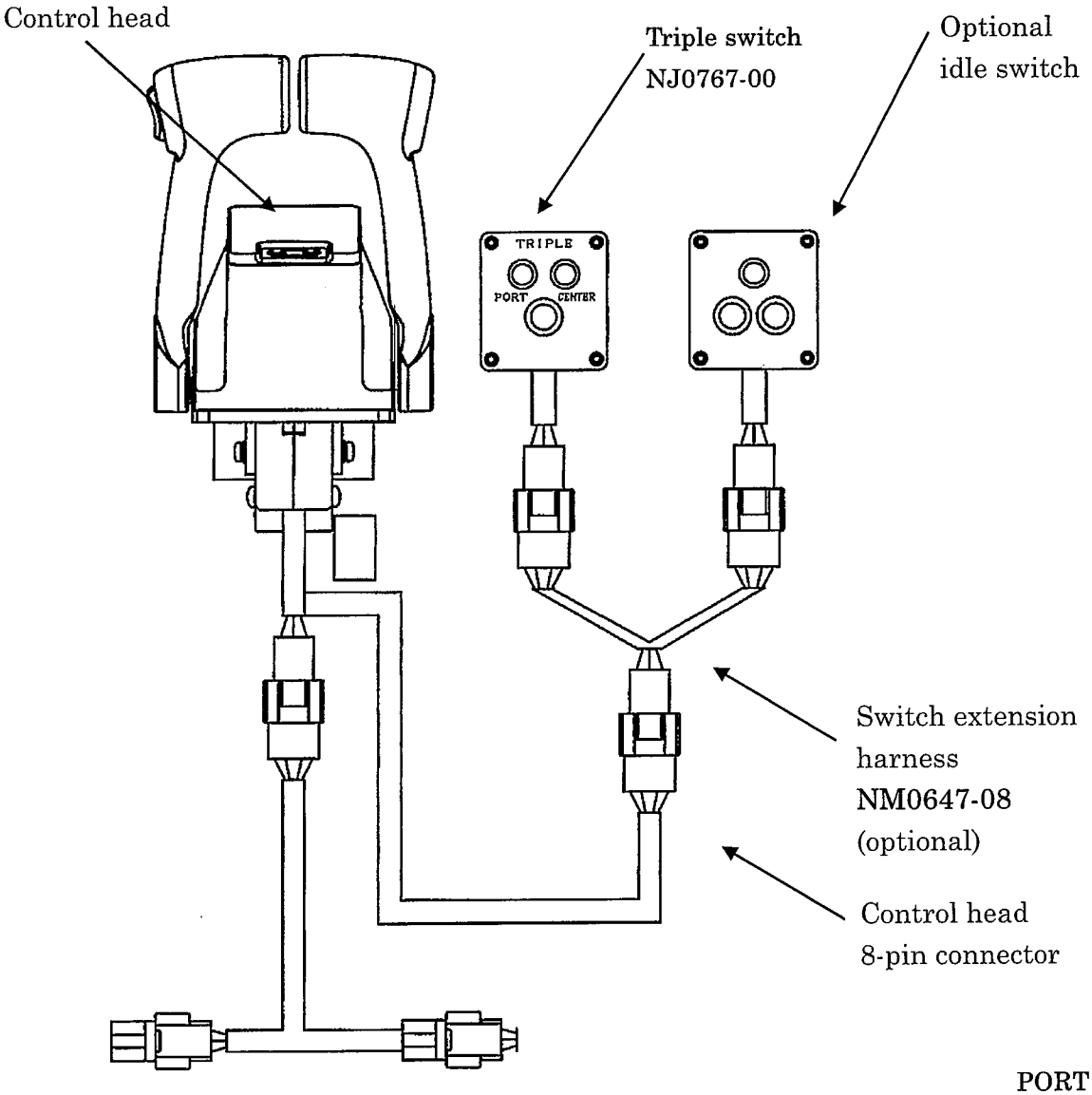


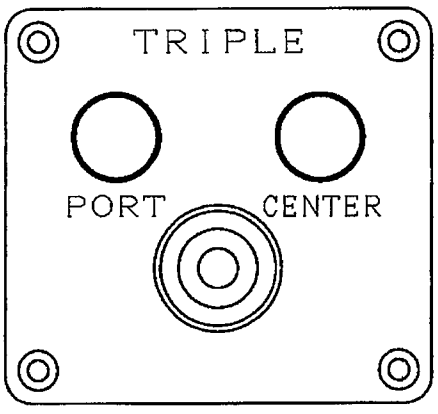
LED: OFF during normal idle level, ON during increased idle levels.

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.

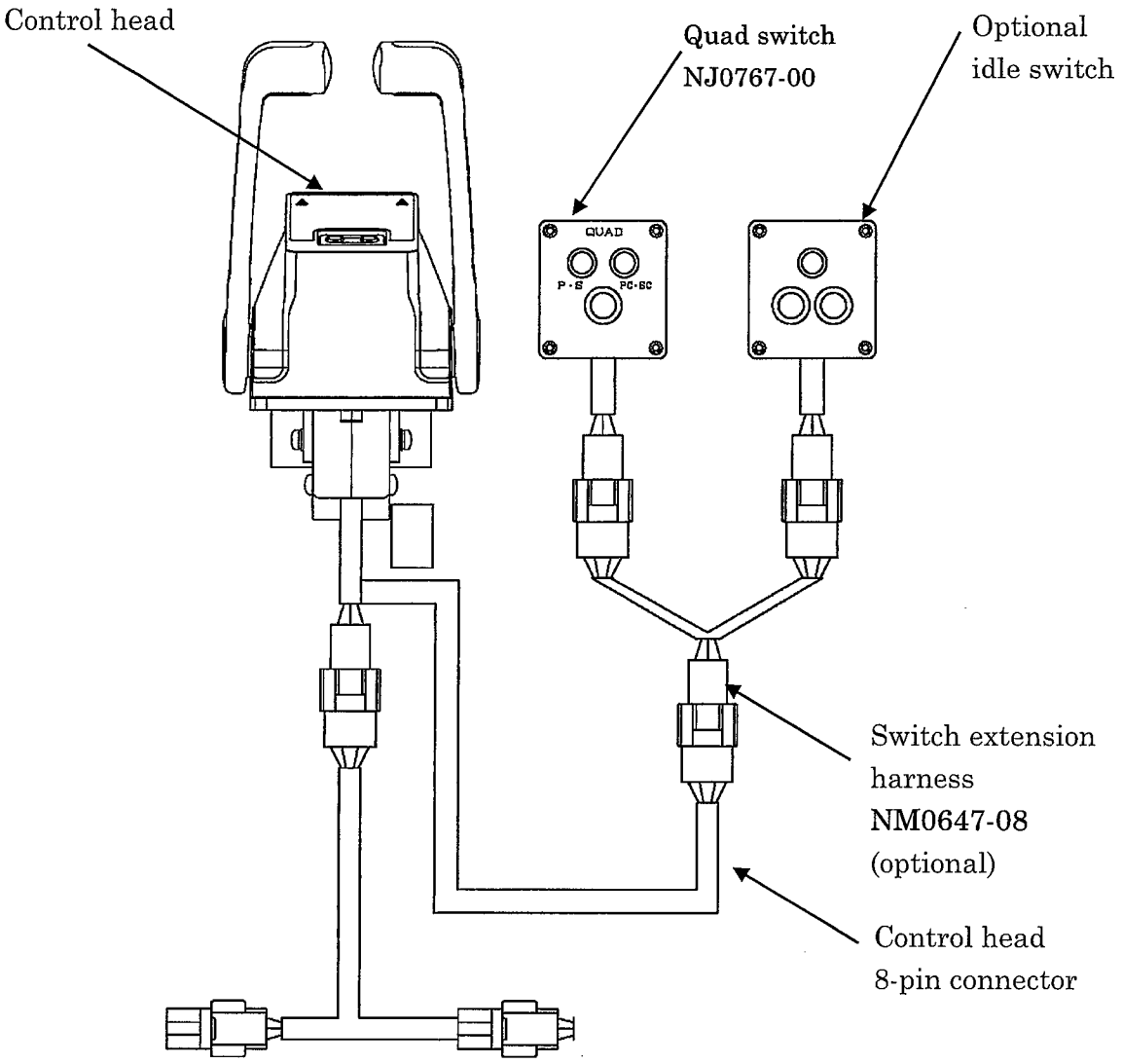


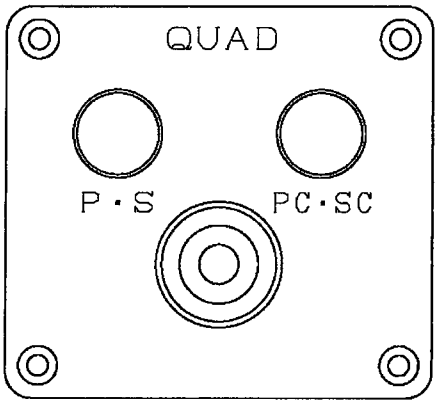


SWITCH STATUS	PORT LED	CENTER LED	PORT LEVER CONTROL
POWER ON	ON	ON	port & center actuators
PUSH 1	ON	OFF	port actuator
PUSH 2	OFF	ON	center actuator
PUSH 3	ON	ON	port & center actuators

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.



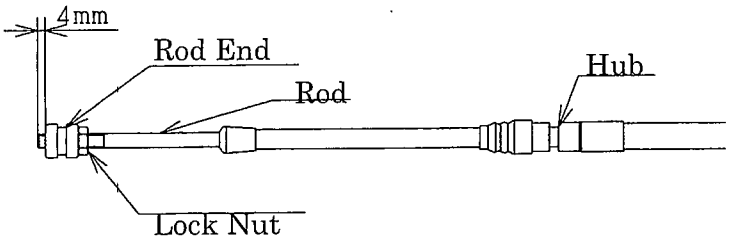


SWITCH STATUS	P·S LED	PC·SC LED	LEVERS CONTROL
POWER ON	ON	ON	all 4 outputs
PUSH 1	ON	OFF	outside outputs
PUSH 2	OFF	ON	inside outputs
PUSH 3	ON	ON	all 4 outputs

PUSH-PULL CABLE INSTALLATION

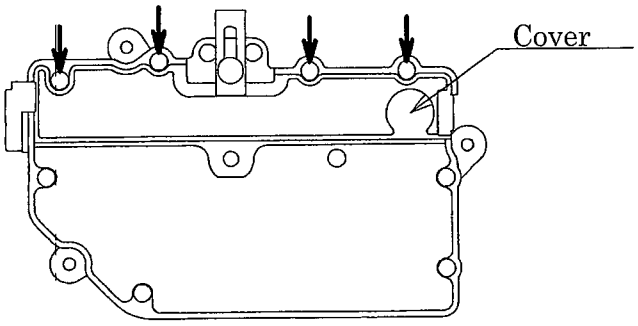
Instructions: **Push-pull cable installation to the actuator:**

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

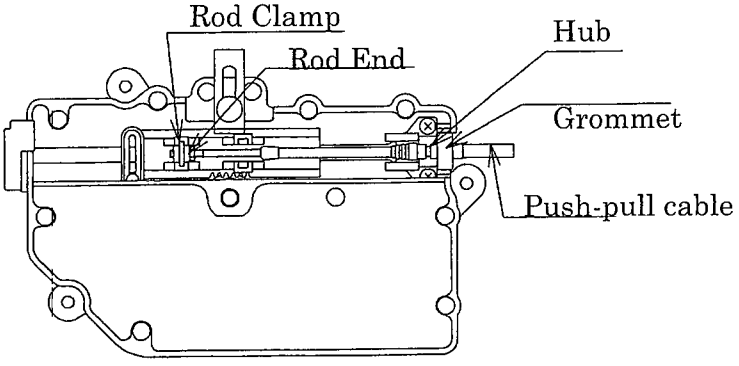


Tightening torque : 2.9~4.4N · m (2.1 ~ 3.2 lbf · ft)

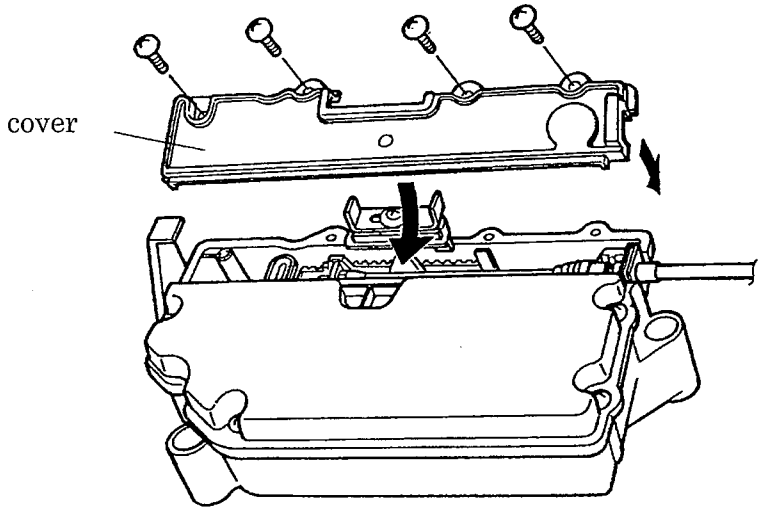
2. Remove four actuator screws shown by arrow and remove the cover.



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



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



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

⚠ CAUTION

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

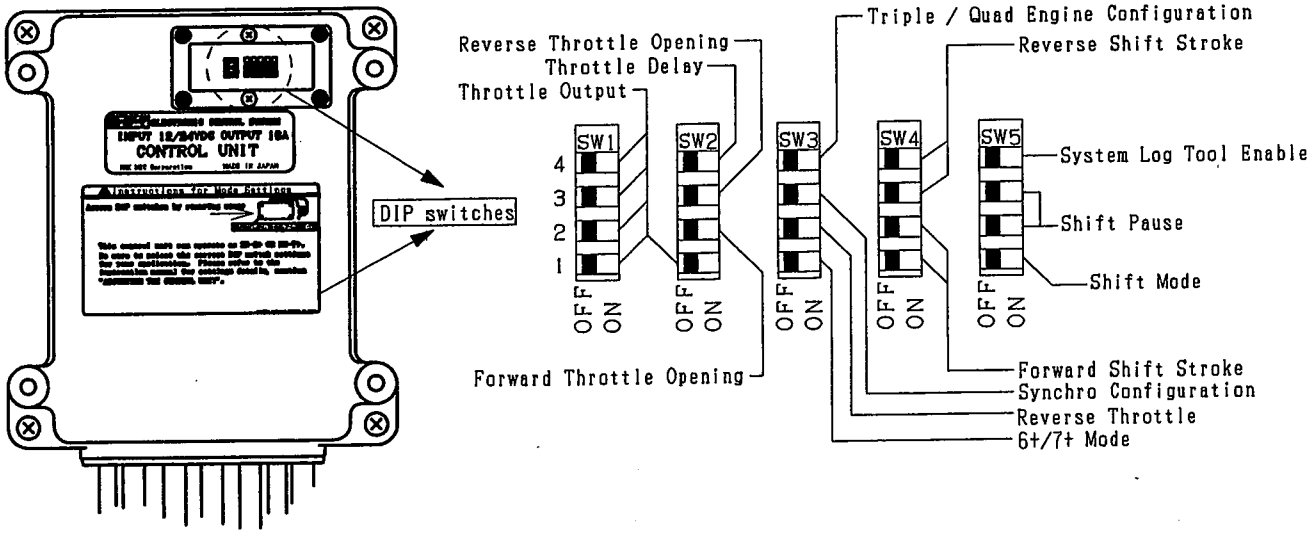
Instructions: Push-pull cable installation to the marine gear (KE-6+ actuator initialization)

- Turn power ON to KE control system
- Set the control head connected to R/C-1 to the neutral position
- Actuator comes to the neutral position
- Positioning is completed when the neutral LED goes ON.
- Install the push-pull cables at the other end according to the gear instruction manual.

ADJUSTING THE CONTROL UNIT: KE-6+

⚠ CAUTION
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).

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.



KE-6+ / 7+ Control System Selection Mode

The control unit is common to both KE-6+ & KE-7+ control systems. Select the following DIP switch configurations to set the control system mode.

SW3-1	FUNCTION
OFF	KE-6+ system
ON	KE-7+ system

※Before shipment, the switch is set to OFF (KE-6+system).

Shift Actuator Operation Mode (KE-6+)

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

SW5-1	FUNCTION
OFF	Pull to go Forward
ON	Push to go Forward

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

Throttle Output Setting: Current (KE-6+)

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 adjustments available: Cummins KTA, Centry 8, etc.	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).

Throttle Output Setting: PWM (KE-6+)

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	NO EFFECT			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 (8% - 92%).

Throttle Output Setting: Voltage (KE-6+)

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 interfac e	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, full throttle: 4.50V)

Throttle Output Setting: CAN / SAE J1939 (KE-6+)

Engine	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 2-1	SAE J1939 protocol
Various	NO EFFECT					250 kbits/s; throttle scale 0.4%/bit; PGN 61443, CAN ID 0CF0 0331

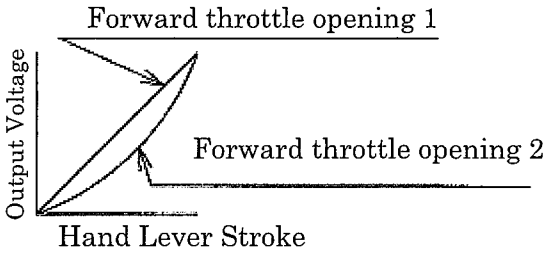
※Before shipment, the switches are set to OFF.

Forward Throttle Opening

This function facilitates fine throttle adjustment over the idle to low RPM range and decreases the shock effect if the hand lever is operated suddenly.

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

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

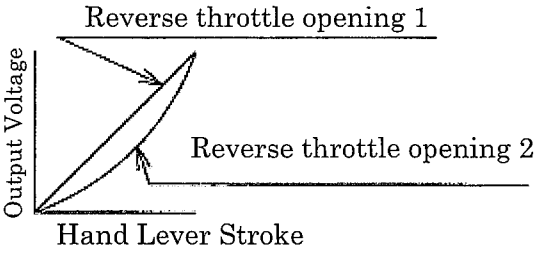


Reverse Throttle Opening.

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

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

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



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.

SW2-4	FUNCTION
OFF	No throttle delay
ON	Throttle delay (1 sec)

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

Reverse Throttle Output

Select the following DIP switch configuration for the desired throttle output in full reverse

SW3-2	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).

Synchronization Configuration

Select the following DIP switch configurations for the desired synchronization setting.

SW 3-3	FUNCTION
OFF	Single lever controls both outputs during synchronization.
ON	Dual lever control

※Before shipment, all switches are set to OFF (single lever).

Notes:

1. Be sure to set the DIP switches of all control units with the same settings for proper synchronization function in a multi-engine configuration.
2. Refer to KE Control Operation section of this manual for synchronization function details.

Triple & Quad Engine Configuration (not active for single or dual engine configuration)

Select the following DIP switch configurations for the desired triple & quad engine settings.

SW 3-4	FUNCTION
OFF	When outer control unit shift outputs do not match (i.e. PORT Forward, STBD Reverse) then inside control unit output(s) default to Neutral. When outer control unit outputs match, inside control unit outputs(s) also match.
ON	Triple: Center engine control unit output matches PORT side control head lever. Quad: Inner control unit outputs match adjacent control unit levers.

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

Shift Actuator Stroke: Forward (KE-6+)

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

SW 4-1	SW 4-2	STROKE
ON	OFF	26mm
OFF	ON	30mm
OFF	OFF	34mm
ON	ON	40mm

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

Shift Actuator Stroke: Reverse (KE-6+)

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

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

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

Shift Pause

This function delays the shock effect if the hand lever is operated suddenly from throttle to neutral.

SW5-2	SW5-3	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).

System Log Tool Enable Mode (Alarm code log access via PC connection)

Select the following DIP switch configurations for desired System Log tool status.

SW5-4	FUNCTION
OFF	System log tool disabled
ON	System log took enabled for troubleshooting purposes

※Before shipment, the switch is set to OFF (System Log Tool disabled).

Note: Requires custom harness for PC connection; contact your dealer for details.

ALARM CODES: KE-6+ APPLICATION

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	Possible Cause	Check / Countermeasure	Reference
1 * Shift Actuator Signal	①Shift actuator and control unit not connected properly. 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.	①Reconnect the shift 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.	Page 14
3 * * * Control Head Signal, Bus Harness	(1) Control head 6-pole harness loop not properly. (2) A. Control head 6-pole harness loop : 1 output line damaged → system still operates. (3) B. Control head 6-pole harness loop : 2 output lines damaged → system no longer operates.	(1)Reconnect 6-pole harness loop(s). (2) A. Consult dealer for replacement item at earliest convenience. (3) B. Consult dealer for replacement item immediately.	Page 13
4 * * * * Shift Actuator	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	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.	Pages 30 & 31 Page 36 Page 14 Pages 30 & 31

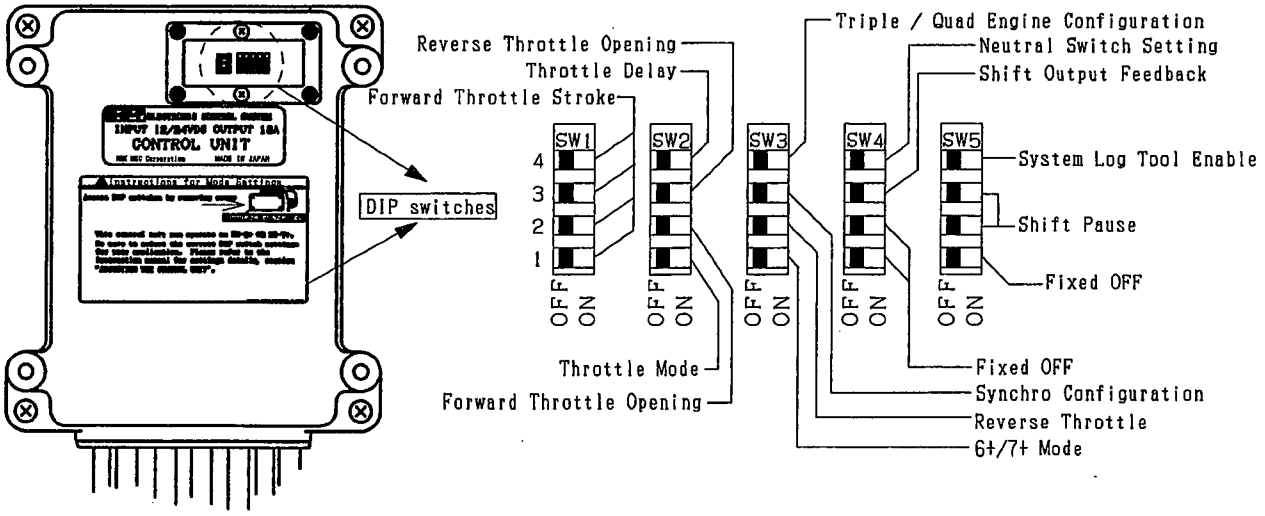
ALARM CODES KE-6+ APPLICATION

6 * * * * * * Power	(1) One of duplex power lines is disconnected. (2) Either circuit breaker is OFF. (3) Power supply harness damaged. (4) Battery voltage is outside the operating voltage range. (5) Power activation timing offset.	(1) Connect both lines. (2) Turn ON both circuit breakers. (3) Replace the power supply harness (4) Use the battery within the operating voltage range. (5) Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	page 23
7 * * * * * * * Control Head	(1) Control head select switch pressed-in or shorted. (2) Control head sync switch pressed-in or shorted.	Reset/unlock the switch or consult dealer for replacement item.	Page 13
8 * * * * * * * * Bus	(1)Bus harness damaged (2)Any T-harness disconnected or damaged: control head or control unit. (3)Any T-harness connecting harness damaged: control head 8-pole / 6-pin harness or control unit CAN harness, (5) Power activation timing offset.	(1) Replace bus harness (2)Reconnect or replace T-harness. (3)Consult dealer for replacement item. (5) Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	Page 20
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.	

ADJUSTING THE CONTROL UNIT: KE-7+

⚠ CAUTION
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).

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.



KE-6+ / 7+ Control System Selection Mode

The control unit is common to both KE-6+ & KE-7+ control systems. Select the following DIP switch configurations to set the control system mode.

SW3-1	FUNCTION
OFF	KE-6+ system
ON	KE-7+ system

※Before shipment, the switch is set to OFF (KE-6+system).

Forward throttle stroke (KE-7+)

Select the following DIP switch configurations for the desired throttle stroke settings. Refer to the appendix for supplemental information on throttle stroke setting characteristics.

SW1-1	SW1-2	SW1-3	SW1-4	STROKE
ON	OFF	ON	ON	31mm (1.2 in)
ON	OFF	OFF	ON	34mm (1.3 in)
ON	OFF	ON	OFF	37mm (1.45 in)
ON	OFF	OFF	OFF	40mm (1.6 in)
OFF	ON	ON	ON	43mm (1.7 in)
OFF	ON	OFF	ON	46mm (1.8 in)
OFF	ON	ON	OFF	49mm (1.9 in)
OFF	ON	OFF	OFF	52mm (2.0 in)
OFF	OFF	ON	ON	55mm (2.2 in)
OFF	OFF	OFF	ON	58mm (2.3 in)
OFF	OFF	ON	OFF	61mm (2.4 in)
OFF	OFF	OFF	OFF	64mm (2.5 in)
ON	ON	ON	ON	67mm (2.6 in)
ON	ON	OFF	ON	70mm (2.75 in)
ON	ON	ON	OFF	73mm (2.9 in)
ON	ON	OFF	OFF	80mm (3.15 in)

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

Shift Actuator Operation Mode (KE-7+)

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

SW2-1	FUNCTION
OFF	Pull to go Forward
ON	Push to go Forward

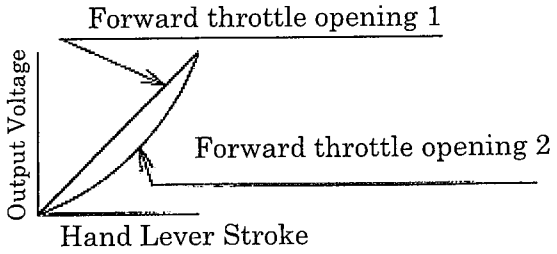
※Before shipment, the switch is set to OFF (pull to go Forward).

Forward Throttle Opening

This function facilitates fine throttle adjustment over the idle to low RPM range and decreases the shock effect if the hand lever is operated suddenly.

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

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

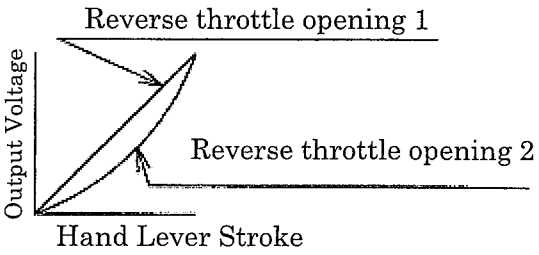


Reverse Throttle Opening.

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

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

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



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.

SW2-4	FUNCTION
OFF	No throttle delay
ON	Throttle delay (1 sec)

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

Reverse Throttle Output

Select the following DIP switch configuration for the desired throttle output in full reverse

SW3-2	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).

Synchronization Configuration

Select the following DIP switch configurations for the desired synchronization setting.

SW 3-3	FUNCTION
OFF	Single lever controls both outputs during synchronization.
ON	Dual lever control

※Before shipment, all switches are set to OFF (single lever).

Notes:

1. Be sure to set the DIP switches of all control units with the same settings for proper synchronization function in a multi-engine configuration.
2. Refer to KE Control Operation section of this manual for synchronization function details.

Triple & Quad Engine Configuration (not active for single or dual engine configuration)

Select the following DIP switch configurations for the desired triple & quad engine settings.

SW 3-4	FUNCTION
OFF	When outer control unit shift outputs do not match (i.e. PORT Forward, STBD Reverse) then inside control unit output(s) default to Neutral. When outer control unit outputs match, inside control unit outputs(s) also match.
ON	Triple: Center engine control unit output matches PORT side control head lever. Quad: Inner control unit outputs match adjacent control unit levers.

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

Shift Output Feedback (KE-7+)

Select the following DIP switch configurations for the desired Output Feedback settings. Effective means that control head LED's will represent control unit output rather than control head lever position.

SW4-3	FUNCTION
OFF	Ineffective
ON	Effective

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

Neutral Switch Activation (KE-7+)

Select the following DIP switch configurations for the desired marine gearbox neutral switch settings.

SW4-4	FUNCTION
OFF	Ineffective
ON	Effective

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

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.

SW5-2	SW5-3	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).

System Log Tool Enable Mode (Alarm code log access via PC connection)

Select the following DIP switch configurations for desired System Log tool status.

SW5-1	FUNCTION
OFF	System log tool disabled
ON	System log took enabled for troubleshooting purposes

※Before shipment, the switch is set to OFF (System Log Tool disabled).

Note: Requires custom harness for PC connection; contact your dealer for details.

ALARM CODES: KE-7+ APPLICATION

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	Possible Cause	Check / Countermeasure	Reference
1 * Shift Signal	Shift harness disconnected or damaged	Reconnect or replace the shift harness.	Page 14
2 * * Throttle Actuator Signal	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.	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.	
3 * * * Control Head Signal, Bus Harness	(1) Control head 6-pole harness loop not properly connected. (2) A. Control head 6-pole harness loop: 1 output line damaged → system still operates. (3) B. Control head 6-pole harness loo : 2 output lines damaged → system no longer operates.	(1)Reconnect 6-pole harness loop(s). (2) A. Consult dealer for replacement item at earliest convenience. (3) B. Consult dealer for replacement item immediately.	Page 13
5 * * * * * Throttle Actuator	①Push-pull cable installed without proper positioning. ②Throttle actuator overloaded. ③Throttle actuator set to manual operation. ④Loose push-pull cable. ⑤Loose connection to engine. ⑥No motor motion.	①Perform proper cable positioning & initialization of the throttle actuator. ②Review actuator load conditions. 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.	

ALARM CODES KE-7+ APPLICATION

6 * * * * * * Power	(1) One of duplex power lines is disconnected. (2) Either circuit breaker is OFF. (3) Power supply harness damaged. (4) Battery voltage is outside the operating voltage range. (5) Power activation timing offset.	(1) Connect both lines. (2) Turn ON both circuit breakers. (3) Replace the power supply harness (4) Use the battery within the operating voltage range. (5) Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	page 28
7 * * * * * * * Control Head	(1) Control head select switch pressed-in or shorted. (2) Control head sync switch pressed-in or shorted.	Reset/unlock the switch or consult dealer for replacement item.	Page 13
8 * * * * * * * * Bus	(1)Bus harness damaged (2)Any T-harness disconnected or damaged: control head or control unit. (3)Any T-harness connecting harness damaged: control head 8-pole / 6-pin harness or control unit CAN harness, (5) Power activation timing offset.	(1) Replace bus harness (2)Reconnect or replace T-harness. (3)Consult dealer for replacement item. (5) Connect power harnesses as per instructions or activate power for PORT & STBD simultaneously.	Page 20
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.	

TROUBLESHOOTING

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

Symptom	Possible Cause	Check / Countermeasure	Reference
No operation even though power source is ON.	(1) Power harness is not connected correctly. (2) Circuit breaker OFF	(1) Connect the Power harness correctly. (2) Turn circuit breaker ON.	Page 23
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 to control head. (3) Damaged LED circuit (4)Damaged CAN bus harness or T-harness	(1) Set the hand lever to NEUTRAL with power ON. (2) Connect the control head to R/C-1. (3) Consult dealer for control head replacement. (4) Replace the T-harness or CANbus harness.	Pages 15 & 16
F, N, R LED light ON but shift clutch does not engage.	(1) Shift harness is disconnected or damaged. (2) Control unit circuit damaged.	(1) Reconnect or replace the shift harness. (2) Consult your dealer for control unit replacement.	Page 21
F, N, R LED ON but engine speed does not respond to KE system.	(1) Throttle harness is disconnected or damaged. (2) Control unit circuit damaged.	(1) Reconnect or replace the throttle harness. (2) Consult your dealer for control unit replacement.	Page 21
Engine does not start.	(1) Low battery voltage. (2) SIGP harness too long.	(1) Charge the battery. (2) Shorten SIGP harness.	Page 22
Neutral throttle operation not possible.	(1) Neutral throttle operation is not set correctly. (2) Defective SELECT switch	(1) Carry out setting correctly. (2) Consult your dealer for control head replacement.	Pages 15 & 16
Synchronization operation not functional.	(1)Input signal incorrect. (2)Levers more than 10°apart (dual lever mode)	(1)Verify synchronization circuit signal type & connection. (2)Adjust levers to be within 10°	Page 16

MAINTENANCE AND SERVICE

KE 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 & 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

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

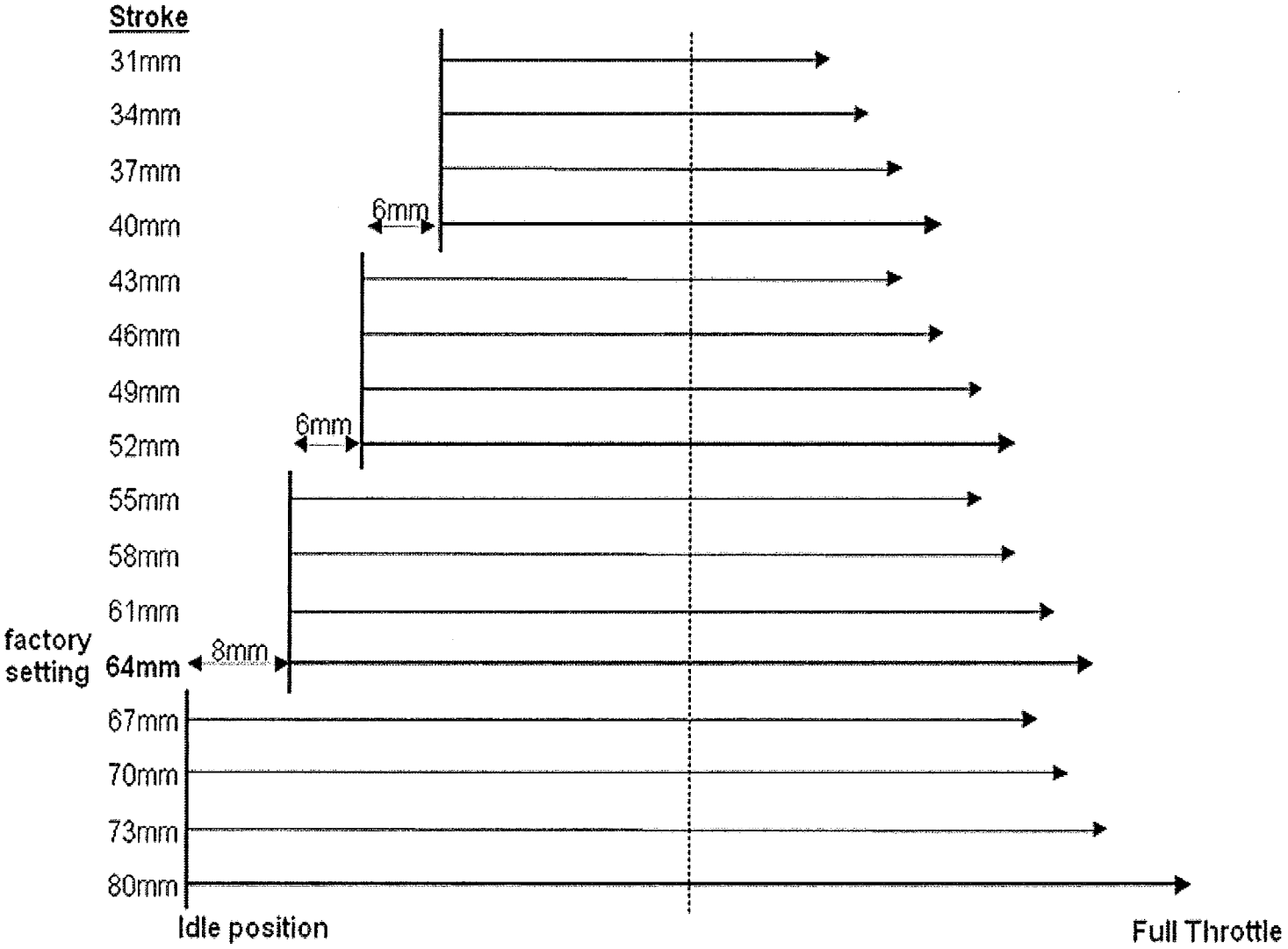
Mechanical Push-pull cables

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

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

THROTTLE STROKE CHARACTERISTICS

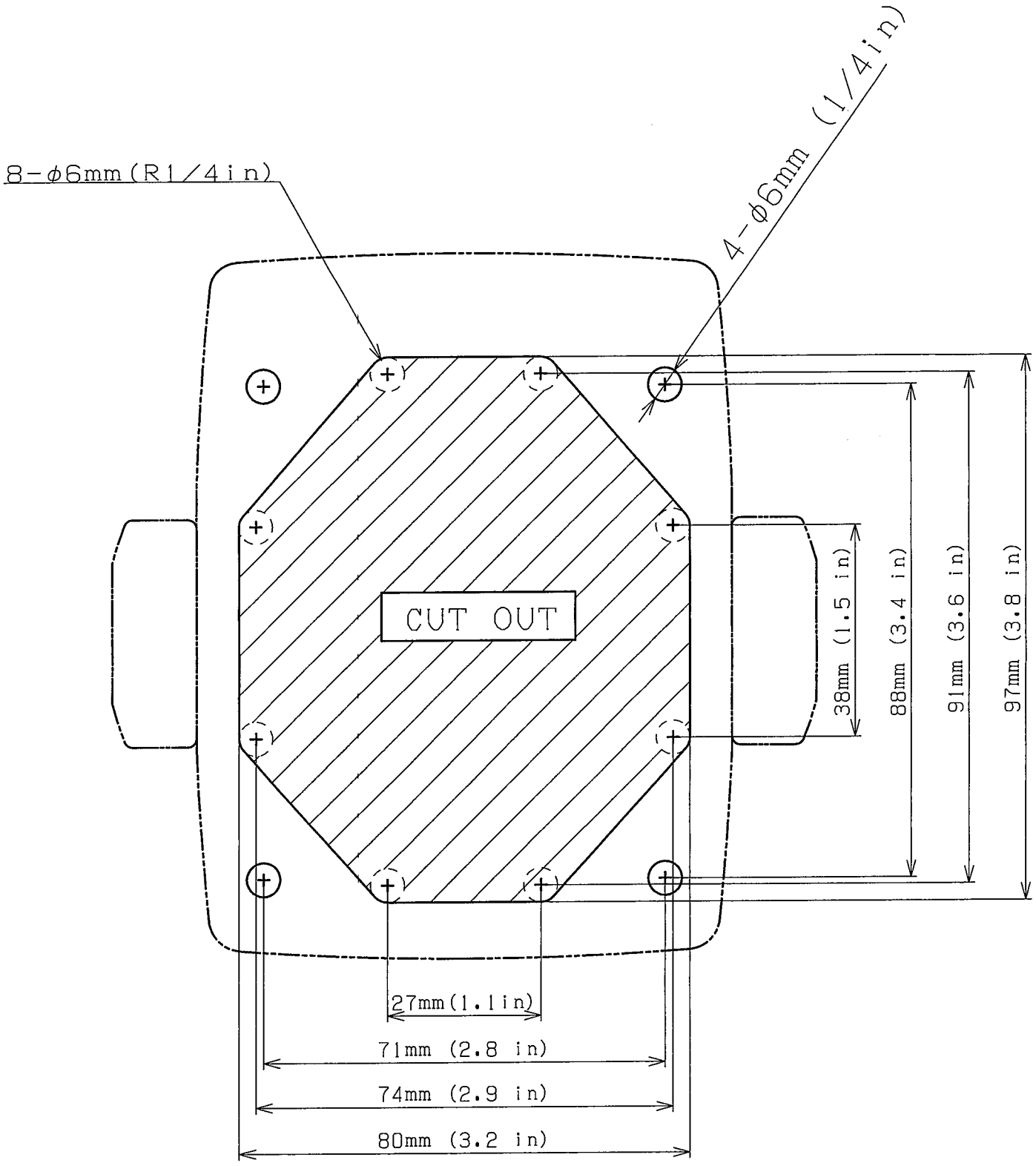
Please use the throttle actuator stroke characteristics data below as reference when determining the KE throttle actuator stroke settings and installing push-pull cable



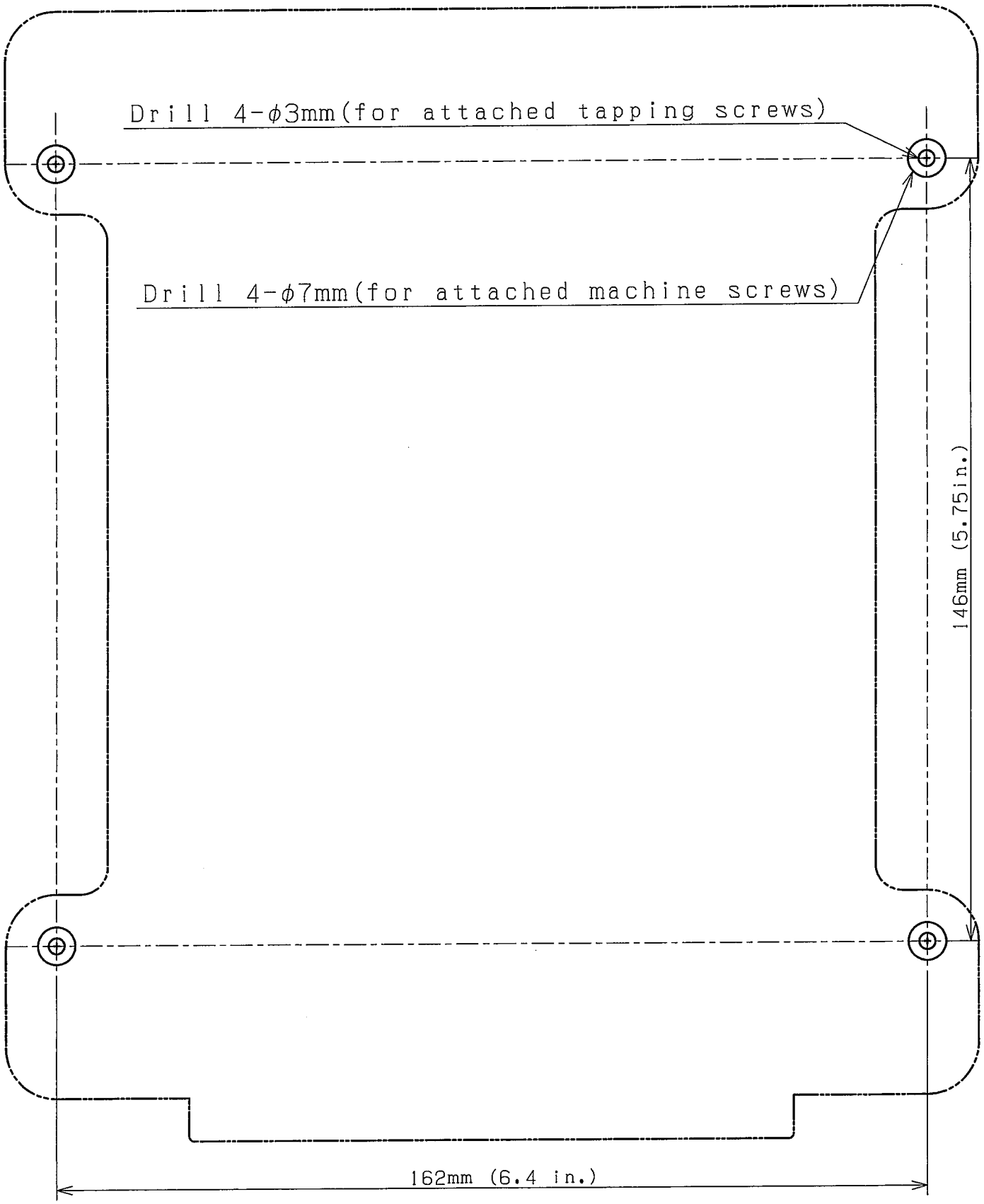
Note:

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

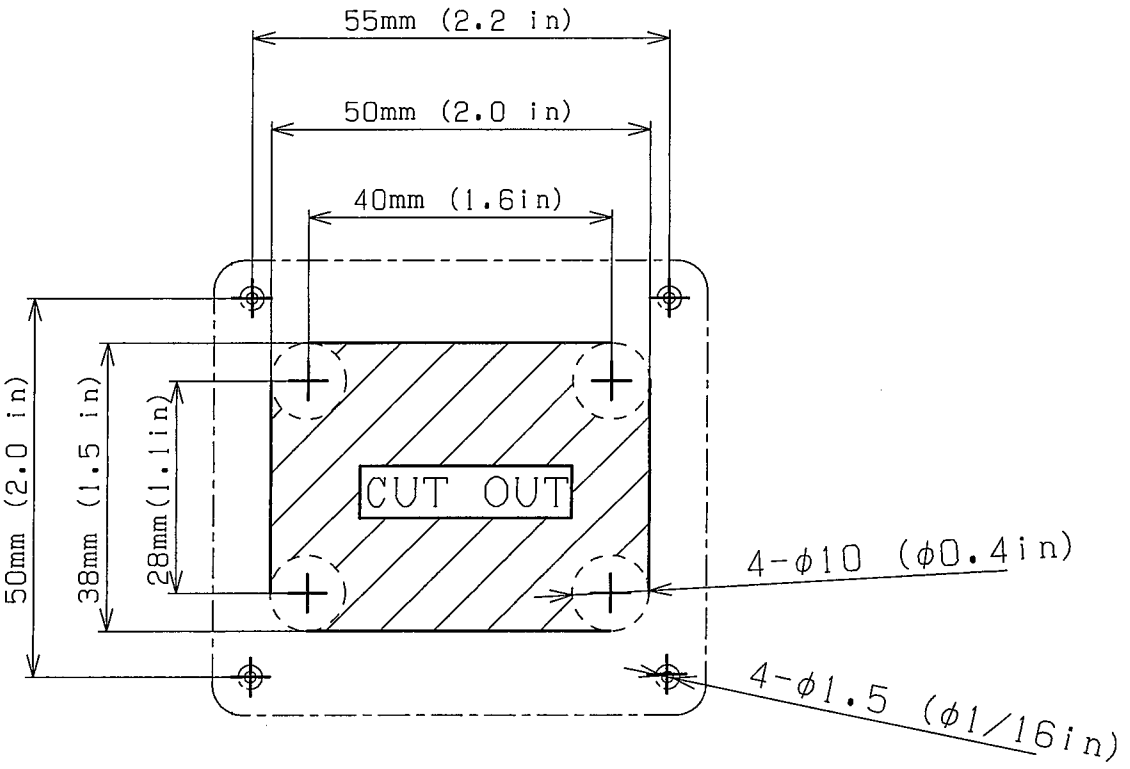
CONTROL HEAD TEMPLATE



CONTROL UNIT TEMPLATE



IDLE / TRIPLE / QUAD SWITCH TEMPLATE



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