

AUTO PILOT SAS-7

Instruction Manual



SAMYUNG ENC CO., LTD.

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Chapter 1 Preview

1. Introduction of SAS-7

1) About SAS-7

SAS-7 is automatic marine navigation system that is produced by Korean domestic technology of SAMYUNG ENC CO., LTD.

SAS-7 will make you ease to control the ship when it is mounted in small vessel with canalizing the whole information like ships location, ships direction, true speed, the route to navigate, the direction to navigate and the direction of magnetic north radar. It is automatically controlled to navigate at users discretion. SAS-7 will fully satisfy your demand.

SAS-7 is small, light weight, and easy to control. Considered the different voltage of every ship, SAS-7 is available from 20 to 40v (24v is highly recommended).

Ships direction error is less than +/-2. it is very precise if various GPS plotters are connected, it will be configured properly at ships condition. Because it is designed to be controlled by remote controller during the navigation. You can continue to work at your work place ships course is monitored by remote controller(water resistance 10M).

2) Possible interference to Electronic Compass from outside

SAS-7 automatic steering wheel use electronic compass sensor to detect ships front direction. Ships current front direction is very important information when use automatic compass Steering and automatic plotter steering.

Ships front direction error give direct influence to automatic steering error so more precise detection of ships front direction is required. If electronic wire is wired near at electronic compass sensor or object with magnetic character (like tools, cellular phone etc) is passing by, it will cause a sudden turning to left or right. Please be careful.

3) ACCURACY ON PLOTTER MODE

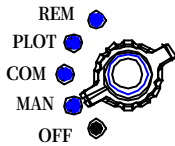
In plotter mode, the steering is controlled by GPS plotter signal that connected to SAS-7. therefore plotter device preciseness gives influence to ships location preciseness. GPS preciseness is the main stream of plotter device but its not absolutely unchangeable. It is under control of GPS satellite, so user is not able to adjust it. More over, that preciseness is change without advancing notice and the change range reaches from tens of meter in minimum level and to hundreds of meter in maximum level.

Besides, ships are always under strong influence of wind and waves, so remember that there is difference between real sailing route and indicated by plotter device route. Range of deviation, It depends on wave height ratio, rudder angle setting and heavy sea condition, could reach about from 20m to 40m.

Considering these variables, you should remember that your current sailing route could deviate off more than 50m from expected route. Please always pay your attention to around your ship.

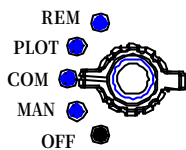
2. SUMMARY SAS - 7

(1) Manual Steering (Used for the place where it is heavy sea and there are many ships around)



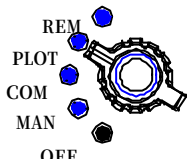
1. Place the steering mode knob at Manual position
2. Steer the ship with manual pilot (Steering Wheel)
3. Display current status as angle indicate and bow direction on LCD display panel.

(2) Compass steering (Adjust wave height ratio and Rudder Angle ratio !)



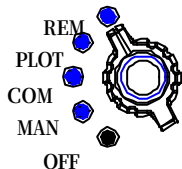
1. Place steering mode knob at "Compass" position. (Remote should be at center position) then, current bearing will be set as destination bearing automatically.
2. When control angle for wave height ratio is big, bearing error becomes large.
3. Be able to adjust remote controller over 5' turning from center position.

(3) Plotter Steering (Adjust wave height ratio and rudder angle ratio)



1. Place steering mode knob at "Plotter" position (Remote should be placed at center position)
2. Auto navigation is possible to the destination set by the plotter. (Going straight navigation to the current direction whenever destination set is absence)
3. Be able to adjust remote controller over 5' turning from center position.

(4) Remote steering (Turn controller slowly)



1. Place steering mode knob at remote position
2. Control the ship by adjusting remote controller
3. Displayed rudder angle indicator, bearing, solenoid working direction etc on the steering controller screen.
4. Displayed bearing on the remote controller screen.

(5) Adjusting Wave height ratio (When normal case : compass=4, plotter=5)

1. Adjusting Wave height ratio should be properly done according to wave height and it should be 1 when the wave height is small, it should be of 9 position when sea is heavy.
2. If the rudder is hunting beyond the desired level due to solenoid valve working depending on hull rolling against heavy wave, in case of adjusting wave height ratio too excessive, bearing error is too big when ship reached the destination with compass steering mode, and route error will be too big when ship is heading to destination with plotter steering mode.

(6) Adjusting rudder angle ratio (adjust according to current, for normal use, position 5)

1. Adjusting rudder angle ratio should be properly done according to ship size, weight, wind and current, it is recommended to set controller at 5 position. Rudder angle ratio will work when system is in auto pilot mode by compass and plotter.
2. In case rudder angle ratio being adjusted too small, ship is deviated off the destined direction and if it is too big, ship head will be hunting left and right side.

7. Product specification

- Power : DC18V ~ 32V (below 15W)
- Temperature Range : -15'C ~ +55'C
- Solenoid output : DC24V, Maximum 3A, Left, right 2 circuit
- Dimension
 - AUTO PILOT Controller : (233mm)/Height (136.5mm)/Depth(163.2mm)
 - Space for wiring connection (50mm)
- Destination bearing set resolution : 1'
- Bearing resolution : 0.5'

CHAPTER 2. CAUTION

1. CAUTION FOR USAGE

- 1) If there happens thunder lightning, dont try to touch the metal part of the power switch. There is danger of electronic shock by lightning strikes.
- 2) Only from 18v to 32v power is available. If it is connected to A.C power or not provided place, it could cause a fire, a electronic shocks or breakdown of device.
- 3) Use the standard Fuze. If non-standardized fuze is used while replacement, it will cause fire and breakdown.
- 4) Don't treat the cable forcefully and dont give a pressure on cable. Damaged cable could be a cause of a fire and electronic shock.
- 5) Don't operate remote, compass and plotter function in case of bad range of vision like in the harbor tiny water way, near at obstacles. Unexpected electronic trouble could cause a collision.
- 6) Full attention required around ship and a course Unexpected trouble could cause a collision.
- 7) In case of emergency, shift the operating switch to manual operating mode.
- 8) Keep away from water, the steering controller and electronic unit are not perfectly waterproof. So it could be cause of fire and electronic shock. When device get wet, turn off power supply and input power switch. After that make a check.
- 9) Don't turn on engine starter, after connecting power supply. It cause a rapid change of voltage and improper operation.

2. CAUTION FOR INSTALLATION

- 1) Don't mount control amplifier at the place where could cause trouble to drive ship.
 - ☞ Avoid high vibrated places, high temperature, sea water and rain otherwise, It will be able to cause a breakdown.
 - ☞ Make it clear how to shift to manual operating mode against emergency mode.
- 2) Install direction sensor away from magnetic device.
 - ☞ sudden change of magnetism cause a unexpected twist.
 - ☞ At least, keep it away 50cm from magnetic device and check it out where under the magnetic influence or not.
 - ☞ Also keep away magnetic classified tools from device.
- 3) Install electronic solenoid coil horizontally.
 - ☞ If not mounted horizontally, It will cause a control trouble.
 - ☞ Don't put a impact on remote against like wall and take care not to drop on the floor.
 - ☞ It could be cause of breakdown.
- 5) Avoid mounting angle sensor exposed to high temperature, high vibration, rain and sea water.
- 6) When do hydro piping work, not to cut copper pipe with a saw.
 - ☞ After finishing piping work, clean pipe and around pipe and then disassemble linked part and do flushing.
 - ☞ Dust and protrusion could outbreak and cause a control trouble.
 - ☞ Only use pipe cutter and cut it in perpendicular with cutter.

- 7) After hydro piping work and installing hydro system, You must wipe out oil tank and change new oil.
 - ☞ Put a permanent magnet to clear waste like metallic dust in the oil tank.
- 8) Do wiring work after turning power switch off.
 - ☞ Operating with power on, It could cause a short circuit and breakdown.
 - ☞ Firmly fasten screws and connector.
- 9) When tune the volume, be careful not to occur short circuit.
- 10) To install it away from radio device (SSB, VHF) according to installation circumstance.
 - ☞ It will be able to be interfered by radio device, so avoid installing near by automatic pilot related line and radio device related line.

CHAPTER 3. SYSTEM INSTALLATION

1. BEFORE SYSTEM INSTALLATION

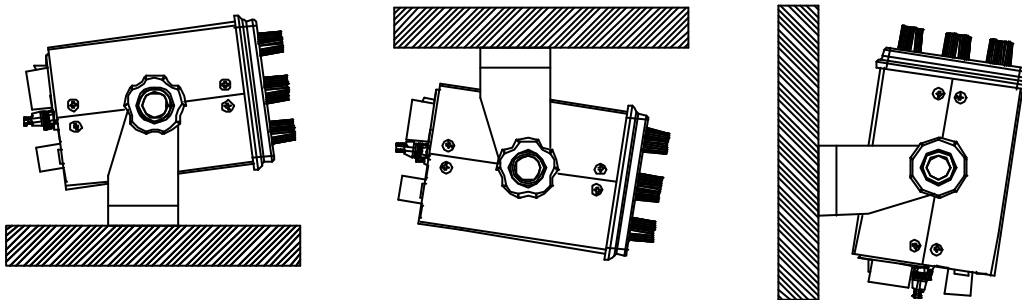
1) Avoid mounting as follows

- ☞ Exposed to rain or sea water
- ☞ Difficult places to check, to repair and to plumb.
- ☞ Exposed to direct rays and hot temperature
- ☞ Exposed to severe vibration like near by engine

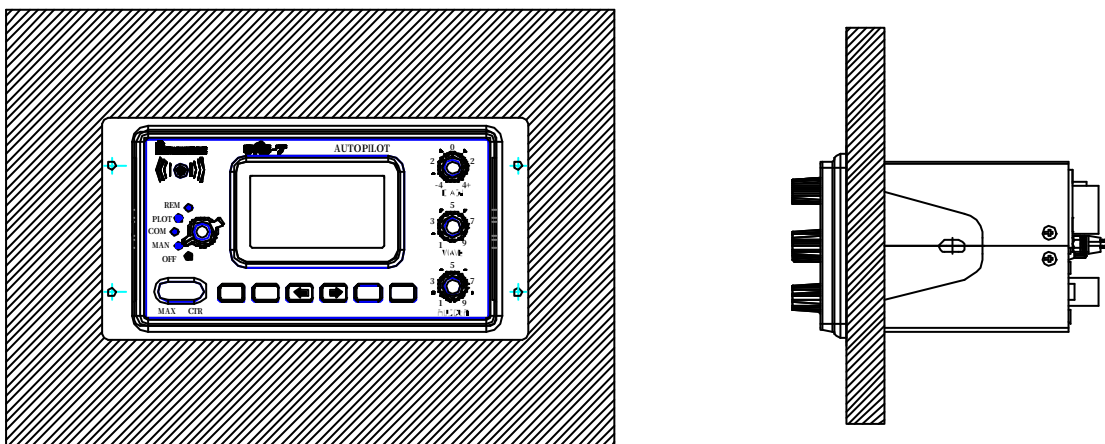
2) External appearance of each unit and install process is referred to external diagram.

2. INSTALLATION OF STEERING CONTROLLER

- 1) Put installation supporter into installation hole and fasten it with nut and bolt or taping screw.
- 2) Fix main body of pilot controller with knob at installation table.
 ※ Warning! Don't install at the place where causing trouble to vessel operation such as disturbing front view. It could cause an accident.
- 3) Flush mounting, wall mounting and table mounting are possible.



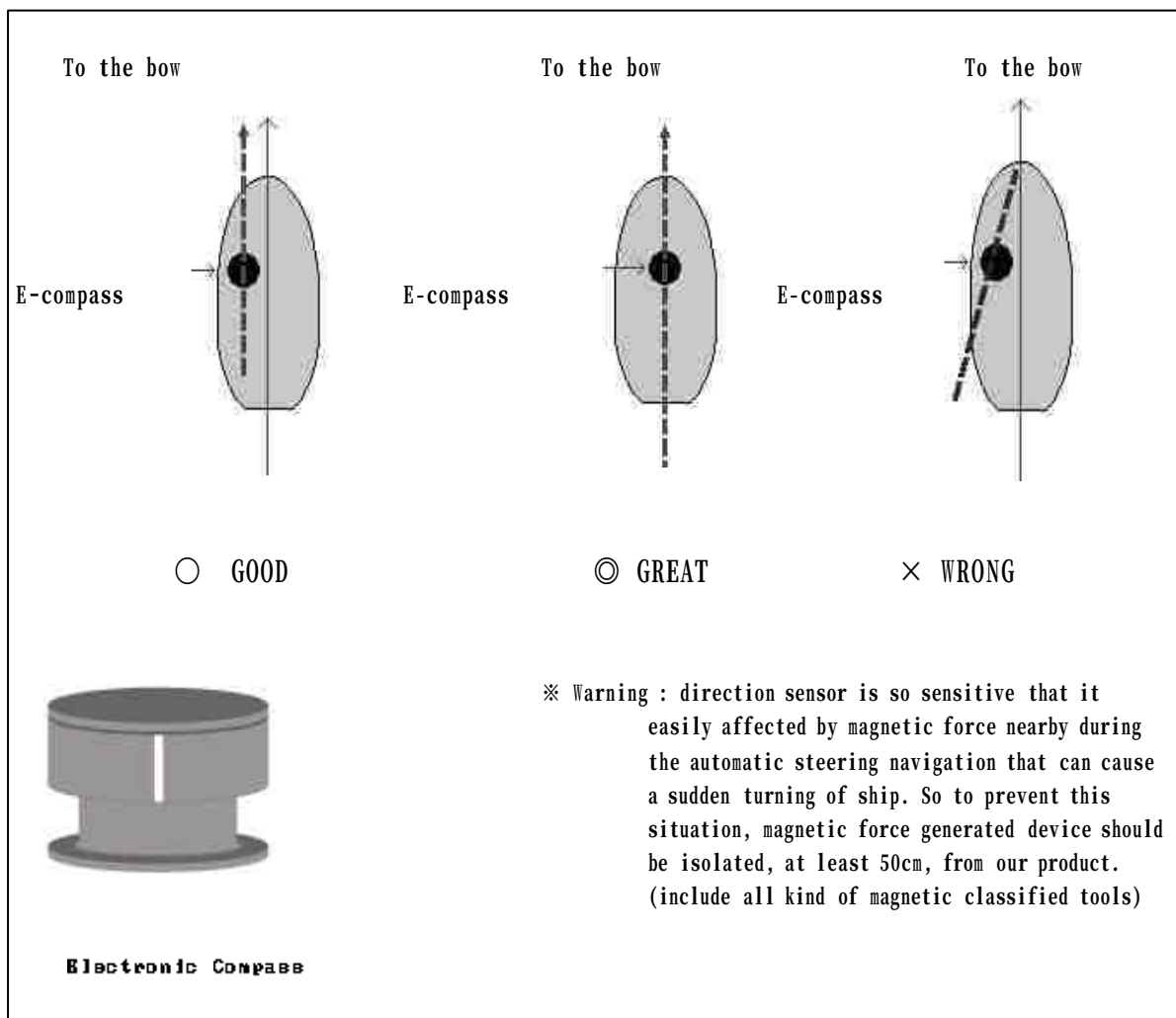
<Fig 3-1. (A) Portable type SAS-7 installation diagram>



<Fig 3-1.(B) Flush type SAS-7 installation diagram>

3. INSTALLATION OF ELECTRONIC COMPASS (DIRECTION SENSOR)

- 1) To install direction sensor, keeping it away from the place where not only there is magnetism affecting to sensor performance but also solenoid valve, motor or electric cable. The most effective place to install is lower part of hull and center of hull.
 ※ Top bridge is strongly recommendable for installation position.
- 2) Install to follow white line on the side of direction sensor. This marked direction have to face the direction of the bow.
- 3) To install direction sensor, fix the sensor bracket to hull or hull structure and sensors direction should be installed as following figures. Minor direction error can be corrected by magnetic difference correcting at initial setting.



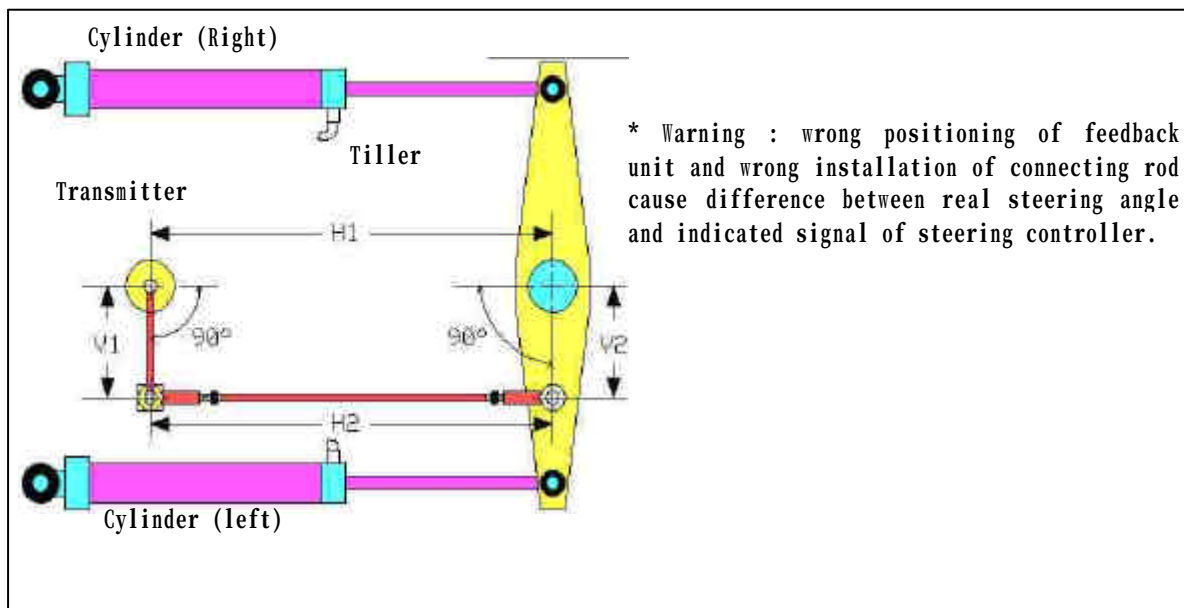
<Fig 3-2. Electronic Compass installation diagram>

4. INSTALLATION OF SOLENOID VALVE

- 1) Install solenoid valve close to manual steering wheel. It makes easy to do piping work for hydraulic system. If its not possible, install it near at oil pump or other places.
- 2) Making 4 holes in 8mm dia. at the position of installation and fix it with bolt and nut.
※ Warning : Install Electronic coil horizontally. Otherwise it can cause poor function.
- 3) Install it in easy position to control the oil regulator located in solenoid valve unit.

5. INSTALLATION TRANSMITTER

- 1) Any directions are available for installation direction of transmitter (angle sensor) but following instructions are recommended.
- 2) Make 4 holes by 9mm dia. at installation table and fix transmitter onto it with bolts and nuts.
※ Warning : Avoid installing places where exposed to a strong vibration, high temperature, sea water and rain. There is danger of device breakdown.
- 3) Make a hole or fix the bolt (size : 8mm dia/length 30mm) at the same distance (refer to below figure V1) with transmitter side' connecting rod from the center of the tiller and link it with connecting rod, then tiller's steering angle and transmitter's steering angle will become same. If user want its angle to be accurate, adjust V1 with adjusting screw until V1 and V2 comes to same.
- 4) Install connecting rod horizontally by adjusting height of transmitter (angle sensor).
- 5) Install steering wheel angle to become central position. When tiller is located to central position. (after installation, adjust it with adjusting screw (H2 interval) maximum adjustment range of connecting rod is within 20mm, if you need more adjustment than 20mm, replace it with other.)
- 6) After finishing installation, the distance between H1 and H2 have to be equivalent (V1 and V2 also) as followings figure.



<Fig 3-3. Transmitter (Angle Sensor) Installation drawing>

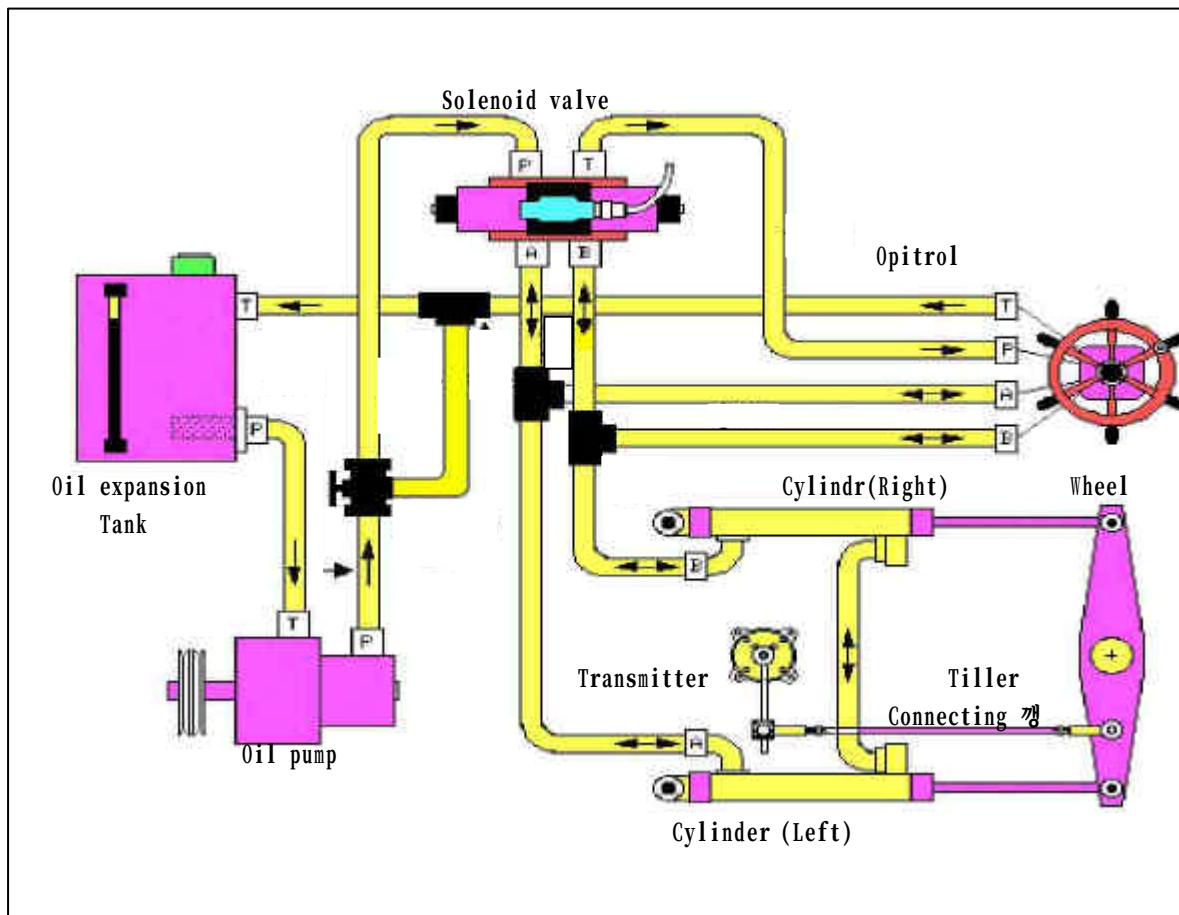
CHAPTER 4. OIL-PRESSURE PLUMBING

1. PRIOR TO PLUMBING

- 1) Refer to the Piping Diagram to ensure that there is nothing wrong about the piping.
- [1] Connect carefully the joints of the copper pipe and each part to the direction of the sleeve.
- [2] In cutting the copper tube, use a pipe cutter only and cut the up-and-down at a right angle.
* CAUTION: Cutting with a saw will create any chips that cause the breakdown.
- [3] Fix the copper pipe with a proper press-button device.
* Note: Fix it at every 1m in case of straight line and at every 30Cm in case of curve.
- [4] After completing the piping, clean the surroundings of the pipes and disassemble the linked part and brush off the inner copper pipe.
- [5] After finishing brushing, reassemble it and make some air evacuation according to the manual of the steering wheel.
- [6] Oil filter should be installed in the oil tank.
(By placing a permanent magnet inside the oil tank, the iron substance can be removed.)
- [7] Clean the oil tank and the pipes. Then change the oil with new replacement oil.
- [8] When piping with rubber oil hoses, the ends of the hoses should be firmly connected.
- [9] Complete all the procedures and connect it to the steering wheel controller(it refers to "electrical wiring".) and start the engine and check if the tiller works normally through turning the adjustor of the remote control. If it moves to the opposite direction, correct it for SAS-7 use of SOLENOID electrical wiring(This is connected to the terminal plate) and connect it to the properly working spot.
- [10] In installing oil-pressure pipes, if there is any part that contacts against the hull, tighten it firmly by using such fasteners as PCV belt. In case of the copper pipe, wrap it with rubber and then tighten it.
- [11] The followings are the abbreviations used in the pipe distribution diagram.
 - T : This refers to the pipe connecting part which is linked to the oil tank.
 - P : This refers to the pipe connecting part which is linked to the oil pump.
 - A : Also expressed 'L' (the opitrol of the manual steering wheel), this refers to the pipe connecting part where the tiller moves clockwise (Ship will turn left) when the oil pressure is made in A pipe.
 - B : Also expressed 'R' (the opitrol of the manual steering wheel), this refers to the pipe connecting part where the tiller moves counter-clockwise (Ship will turn right) when the oil pressure is made in B pipe.

3. PIPE DIAGRAM AFTER INSTALLATION OF SOLENOID VALVE

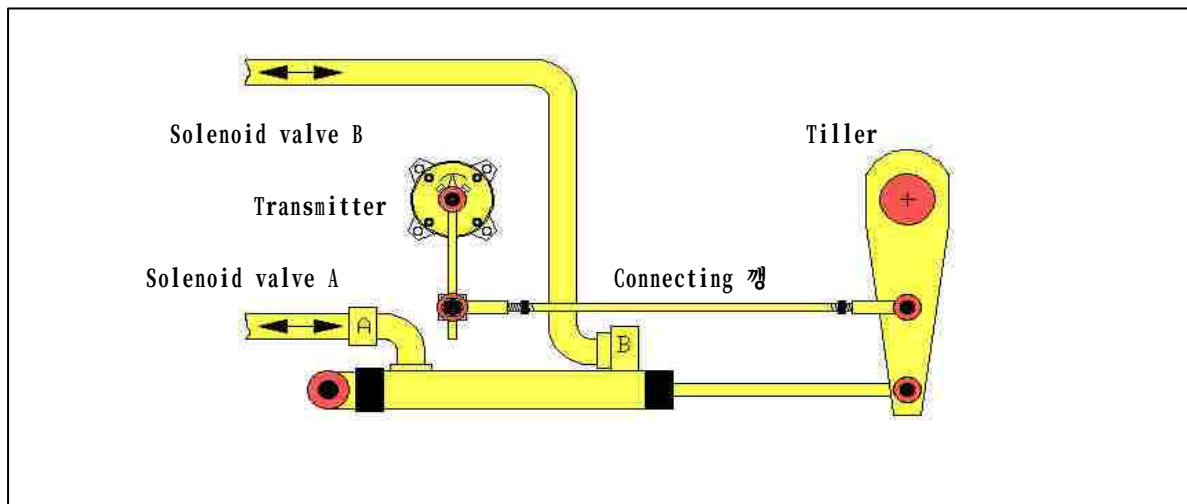
- 1) Please refer to the following procedures to connect the solenoid valve in the existing oil pressure pipes.
- [1] Separate "P" pipe from the oil pump. (The "P" pipe is linked to the opitrol)
- [2] Connect "P" of the oil pump and the oiler (Relief valve). Then connect "P" of the solenoid valve to the opposite side where "P" of the oil pump "P" is set in.
- [3] Connect "T" of the solenoid to "P" of the opitrol.
- [4] Separate the pipes linked between "A(R)" of the opitrol and "A" of the left side cylinder.
- [5] Use T-type joint to connect "A" of the solenoid valve, "A(R)" of the opitrol and "A" of the left side cylinder together.
- [6] Separate the pipes linked between "B(L)" of the opitrol and "B" of the right side cylinder.
- [7] Use T-type joint to connect "B" of the solenoid valve, "B(L)" of the opitrol and "B" of the left side cylinder together.
- [8] Use T-type joint to connect "T" of the oil tank, the oiler and "T" of the opitrol together.



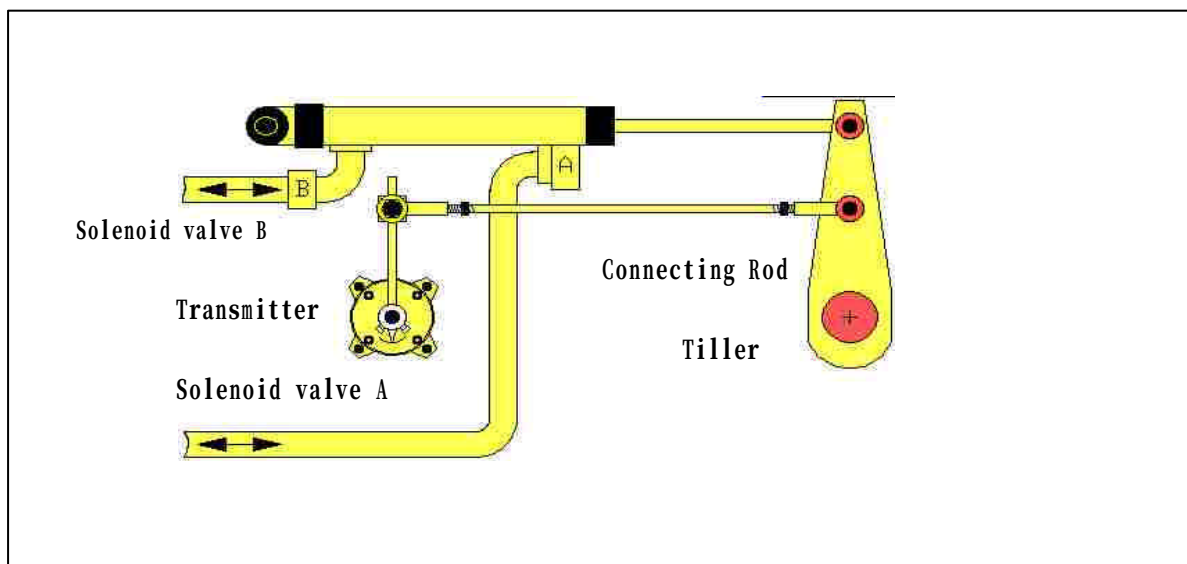
<Fig 4-2.Piping diagram after installation of solenoid valve >

4. PIPING DIAGRAM FOR SINGLE-TYPE CYLINDER

1) When the oil-pressure is given in the pipes connected to the solenoid, the Left(B) pipe is the pipe to which the ship direction turns left while the Right(A) pipe is the pipe to which the ship direction turns right. So it should be piped as shown below.



<Fig 4-3. Installation drawing of left single type Cylinder>



<Fig 4-4. Installation drawing of right single type Cylinder>

CHAPTER 5. ELECTRIC WIRING

1. PRIOR TO WIRING

1) Before setting the wires, please abide by the following instructions. Improper handling may cause any serious electric shocks or damages to the equipment.

[1] Make sure that the power supply is closed.

[2] Check out DC 24V of the power terminal(Black, White, G). Never connect the opposite way. The polarities of power are white for (+) and black for (-).

[3] For linking the terminal box, confirm the terminal signal and the cable position and then, work on the exact connection.

[4] After completing piping, check the status of the terminal box once again.

2. INTERFERENCE OF RADIO EQUIPMENT

1) It is often vulnerable to the interferences of radios. Keep away the autopilot-related cables from other cables if possible.

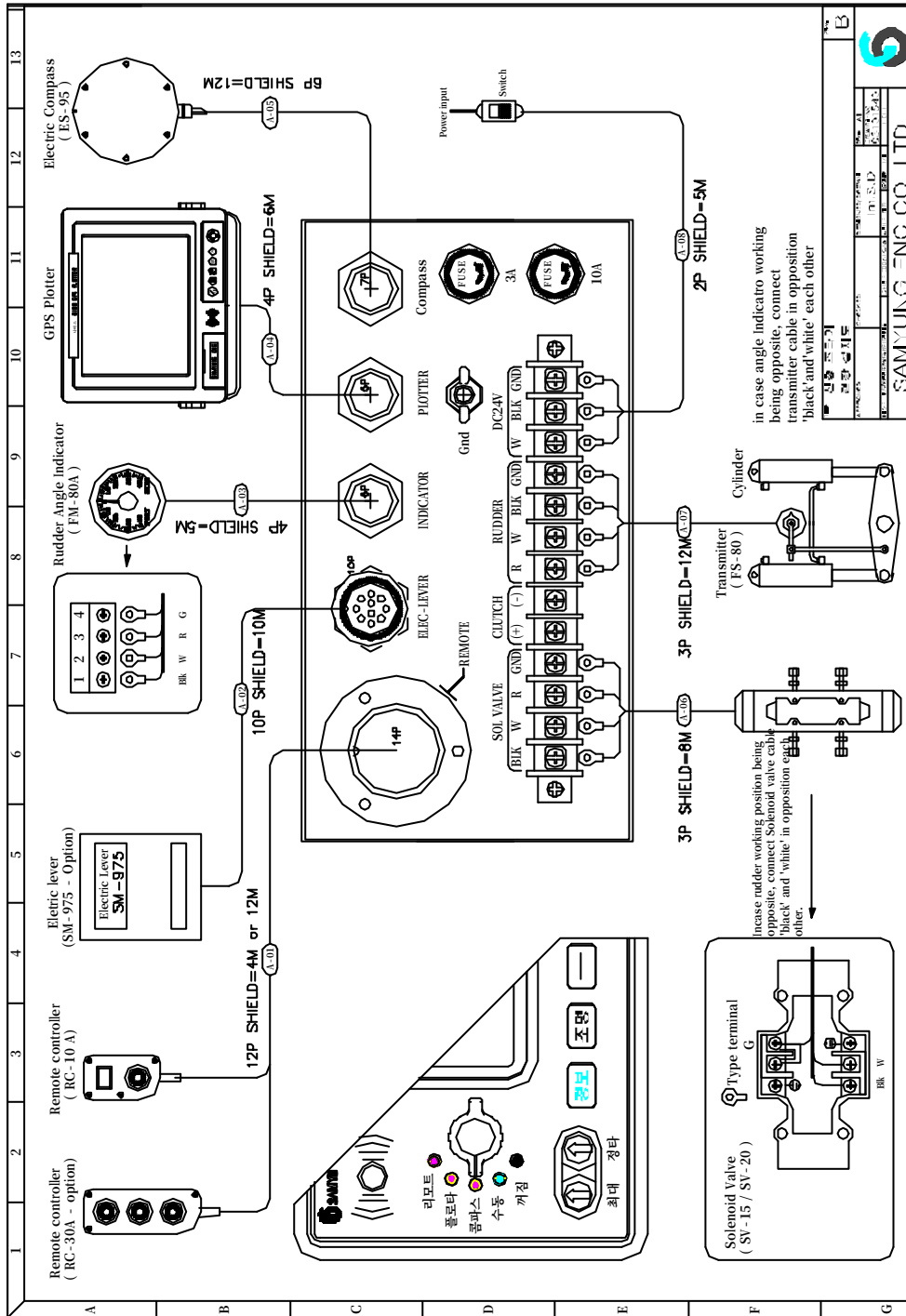
2) In case that the autopilot is interfered by radio equipment, for the most part, the interference is expressed through the change of the bow direction. If there is any change of the bow direction while any transmitting is made by any radios, it means the system is interfered. In order to avoid this, please keep the followings in mind.

[1] Keep the steering wheel, the direction sensor from antenna as far as possible.

[2] Keep the autopilot-related cable from other radio cables as far as possible.

[3] Do not install the steering wheel around the coaxial cables stretching from radio equipment to their antennas).

3. ELECTRIC WIRING DIAGRAM



< Fig 5-1. ENTIRE WIRING DIAGRAM >

4. Instructions for supplying power for the first time

- 1) Please be careful about the following instructions when the power is supplied for the first time.
 - [1] Check if the plumbing is correctly designed.
 - [2] Make sure that the specifications of the equipment, including the battery voltage are correct.
 - [3] Set the mode convert switch of the steering controller to the manual operation mode.
- 2) If the engine start is turned after turning on the power, there are some possibilities that a drastic change or any abnormal malfunction may happen.
- 3) Turning on the power will make the buzzer ring, LCD display of the panel center will show the changed mode status in current use (the selected mode). If it does not show anything even after the power is on, the fuse is considered to be broken down. Find out the cause as fuses are installed at the back of the main unit, each one for 3A and for 10A respectively. Then replace it with a spare fuse if necessary.

5. Adjustment after installation

1. For better performance, it is required to make some adjustment for every part after installing all the units. This section gives an explanation about the initial adjustment to be made. In case that the oil-pressure is being created from the drive, please start the engine.

[1] Adjustment of the angle indicator.

[Maximum] VR = The sensitivity(FULL SCALE) adjustment of the angle indicator(METER)

[Correct angle] VR = The neutral(CENTER) adjustment of the angle indicator(METER)

- A. Adjust the opitrol to move the cylinder to the neutral and set the ohm meter at 0(zero) and adjust [Correct angle] VR to make the angle indicator positioned to the neutral.
- B. Use the opitrol to move the cylinder to the left or the right at a maximum. Adjust [Maximum] VR to set the ohm meter at +40 degree.

2. Adjustment of solenoid valve.

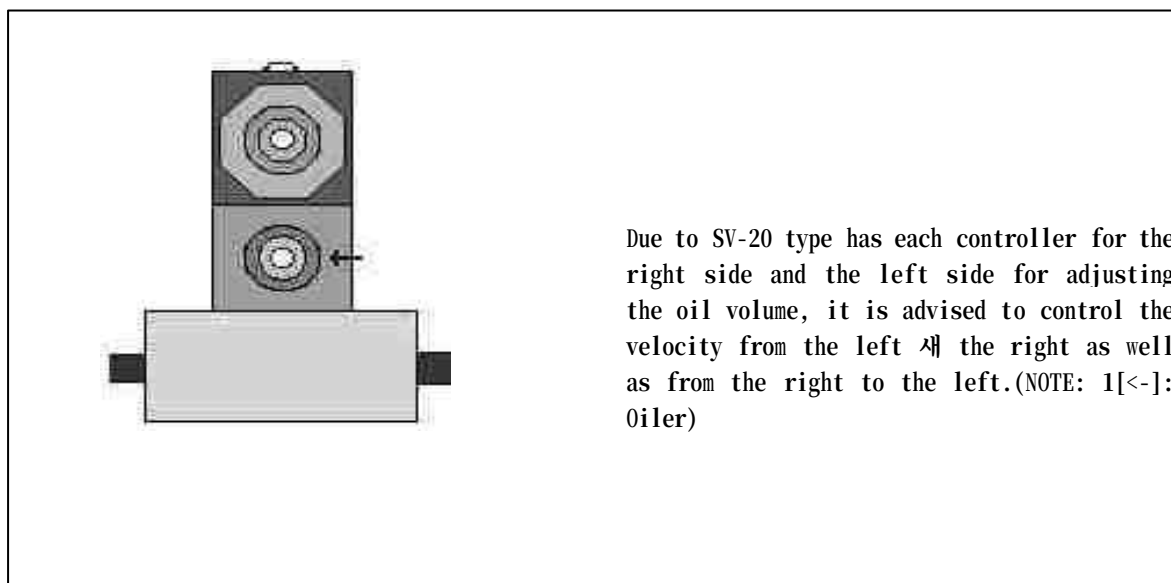
This is not directly related with the safety and if there is anything wrong about the adjustment, the equipment may have any problems in the functions. Therefore, make sure that the adjustment is made after installing the oil-pressure circuit and electric circuit.

※ CAUTIONS : If you operate the solenoid valve under the condition of adjusting too little oil of the oiler or closing oiler, the heat will occur in the oil-pressure.

[1] SV-20 Type

- A. After finishing all the installation procedures, set the steering controller of the remote control at 0(zero) and position the steering mode switch of the steering controller to the remote mode. At this moment, if the rudder moves to the most left or to the most right, switch the connections of the black and the white of the solenoid wires.
- B. Observing the movement of the rudder, position the steering controller of the remote control, to the most left (-40 degree) and wait until the rudder reaches to the most left side. Then watching the clock, turn the steering controller of the remote control to the most left position (+40

- degree) rapidly.
- C. Check the time of the rudder's moving from the most left to the most right. Adjust the time to take 10 - 15 sec. with the oiler of the solenoid valve.
- D. repeating the above A and B, adjust the time of the rudder's moving from the most left side to the most right side and vice versa (from the most right to the most left) respectively so that it takes 10 - 15 sec. (If you adjust the time required to move from the most left to the most right, the time from the most right to the most left will be also adjusted.)



<Fig 5-2. SV-20 type solenoid valve>

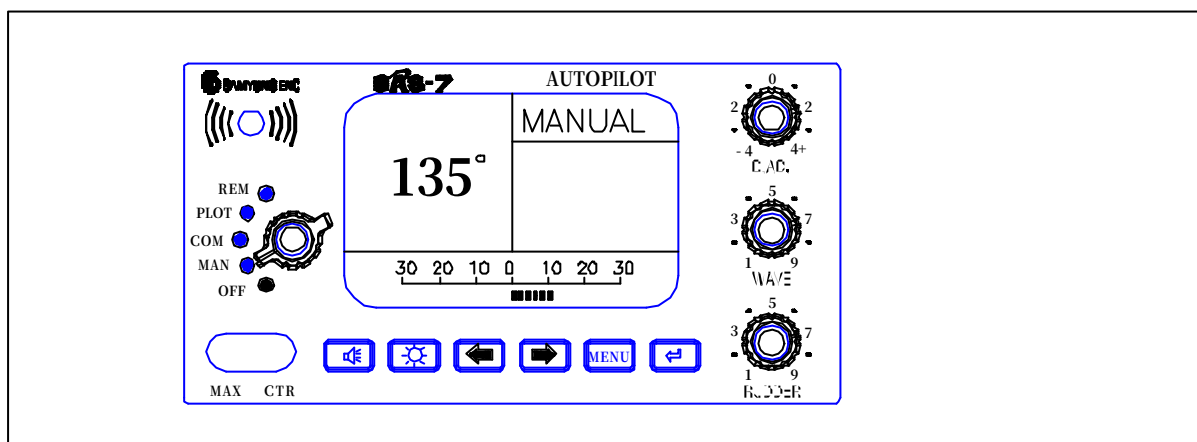
CHAPTER 6. HOW TO INITIALIZE AFTER INSTALLATION

As the equipment is delivered from the factory, going through all the detailed adjustments, users are not required to set up the most functions but there may be some differences in other ships, depending on the their conditions. Therefore, follow the below procedures if necessary.

1. Initial Setup

1) Power/On

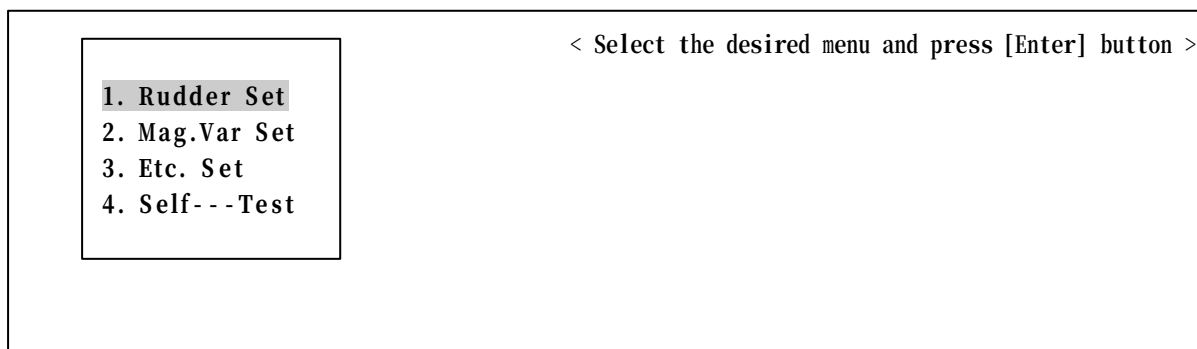
Position the steering mode switch of "Off" to the 'manual' and check that LED lights up.



< Fig 6-1. LCD INITIAL DISPLAY WHEN SAS-7 IS TURNED ON >

- 2) After turning on SAS-7, position the steering mode switch to the 'manual' and if the [menu] button is pressed, < FIGURE 6-2 > Initial Setup will appear.

[CAUTIONS - if an error message appears and an alarm rings, press [Alert] button and then check again the wiring status linked to SAS-7]



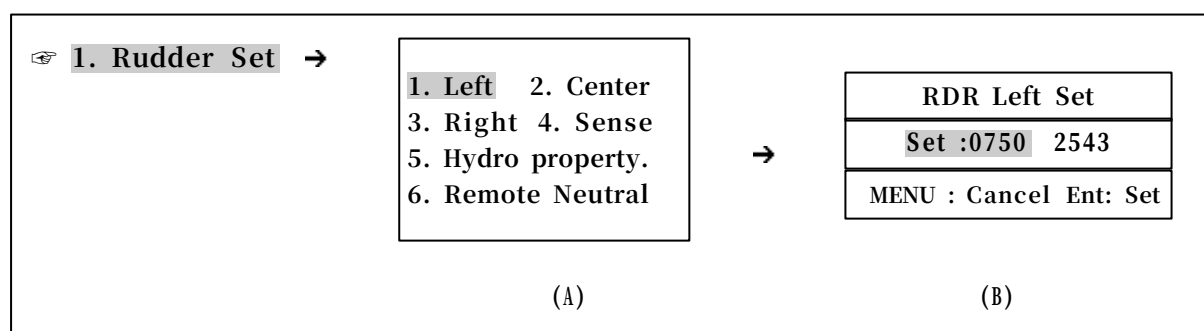
< Fig 6-2. INITIAL SETUP DISPLAY >

1 Rudder Setup

[1] Set up the left position of the rudder.

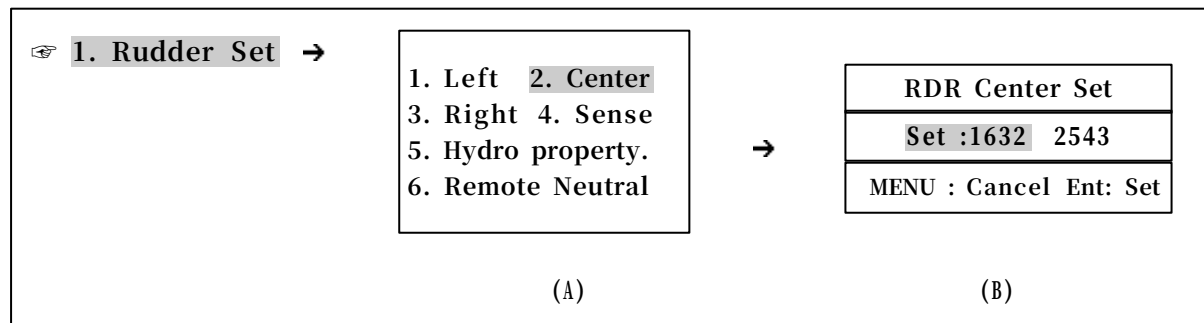
- ① Select [1.Rudder Set] in the menu and press [Enter] button, then < FIGURE 6-3 (A) > will appear on the screen.
- ② Select [1.Left] in the rudder setup menu and press [Enter] button, then < FIGURE 6-3 (B) > will appear on the screen.
- ③ Turning the manual steering wheel, set the rudder position gauge hand to 40 scale, the maximum value of the left side. The set value of the display is supposed to change, depending on the turning angle of the steering. If the gauge hand is exactly set to the 40 left scale, press [Enter] button to store the value.

< CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >



< Fig 6-3. RUDDER LEFT SIDE SETUP MENU >

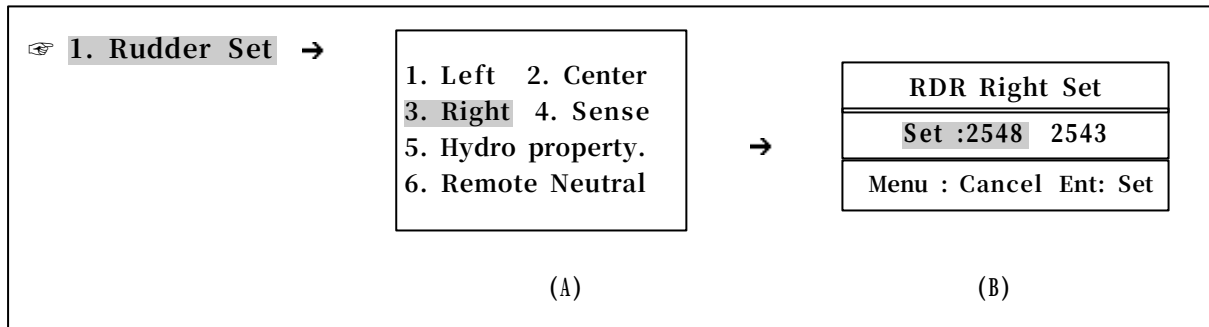
[2] Set up the center position of the rudder.



< Fig 6-4. RUDDER CENTER SETUP MENU >

- ① Select [2.Center] in [Rudder Set] menu and press [Enter] button, then <FIGURE 6-4 (B)> will appear.
 - ② Turning the manual steering wheel, set the rudder position gauge hand to 0 scale.
 - ③ The set value of the display is supposed to change, depending on the turning angle of the steering. If the gauge hand is exactly set to 0 scale, press [Enter] button to store the value.
- < CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >

[3] Set up the right position of the rudder.

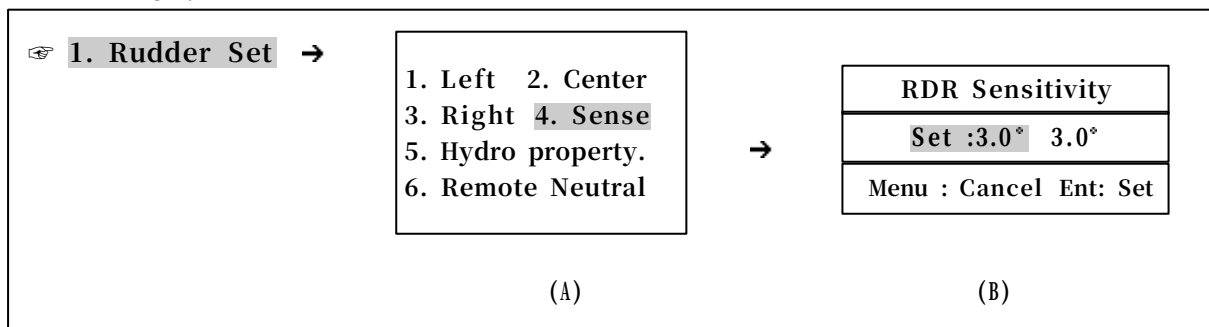


< FIGURE 6-5. RUDDER RIGHT SIDE SETUP MENU >

- ① Select [3.Right] in [Rudder Set] menu and press [Enter] button, then < FIGURE 6-5 (B) > will appear.
 - ② Turning the manual steering wheel, set the rudder position gauge hand to 40 scale, the maximum value of the right side.
 - ③ The set value of the display is supposed to change, depending on the turning angle of the steering. If the gauge hand is exactly set to the 40 right scale, press [Enter] button to store the value.
- < CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >

[4] Set up the sensitivity

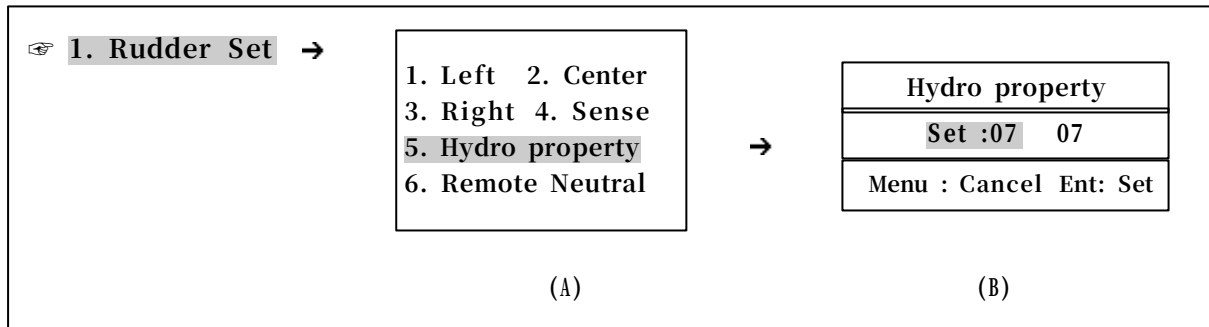
While a ship is under way in the autopilot mode, you can recognize that the rudder continuously swings a little mainly due to wind or tidal current. If this continues for a long time, the cylinder and the oil-pressure related devices may have a shortened lifetime. So the sensitivity of the rudder should be highly raised in such cases.



< FIGURE 6-6. RUDDER SENSITIVITY SETUP MENU >

- ① Select [4.Sense] in [Rudder Set] menu and press [Enter] button, then < FIGURE 6-6 (B) > will appear.
 - ② Press [▶] button in the Rudder Setup of < FIGURE 6-6(B) >, then the set value will increase
- The rudder sensitivity will be dull and it is available to adjust up to the maximum 5.0°.
 - ③ Press [◀] button in the Rudder Setup, then the set value will decrease
- The rudder sensitivity will be high and it is available to adjust up to the minimum 0.5°.
 - ④ The sensitivity value is set to 1.0° when SAS-7 is delivered from the factory.
 - ⑤ Press [Enter] button to store the set value and return to the previous display.
- < CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >

[5] Hydro Property setup

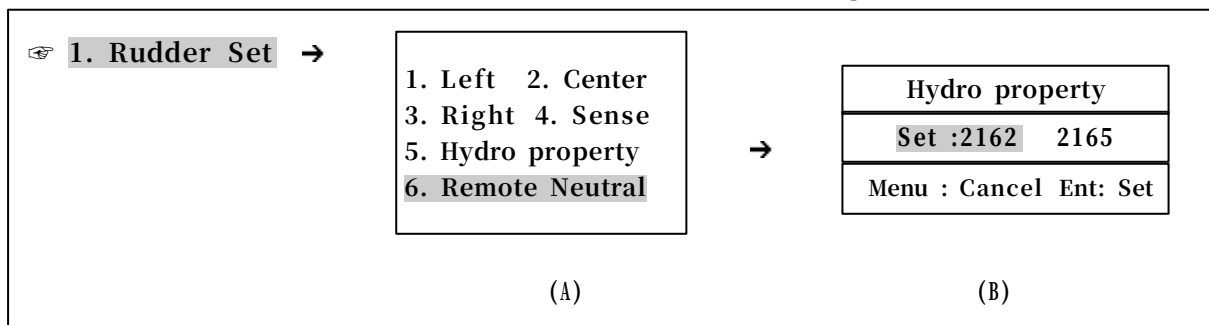


< Fig 6-7. Hydro PROPERTY SETUP MENU >

- ① Select [5.Hydro property] in [Rudder Set] menu and press [Enter] button, then < Fig 6-7 B) > will appear.
 - ② As a compensator of the oil-pressure device, adjust the proper values depending on the control status of the solenoid valve, the properties of the oil pump and the properties of the cylinder, which allows the rudder to have a smooth movement. (If low figures, it works smoothly. If high figures, it works hard.)
 - ③ Press [◀] button, then the set value will decrease. (It is available to adjust up to the minimum 01)
 - ④ Press [▶] button, then the set value will increase. (It is available to adjust up to the minimum 99)
 - ⑤ Press [◀], [▶] buttons to make the desired figures.
 - ⑥ Press [Enter] button to set the value of the oil-pressure properties and return to the previous display.
- < CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >

[6] Remote neutral position setup

If '0' of the remote control and '0' of the rudder do not match, set up [Remote Neutral]



< Fig 6-8. REMOTE NEUTRAL SETUP MENU >

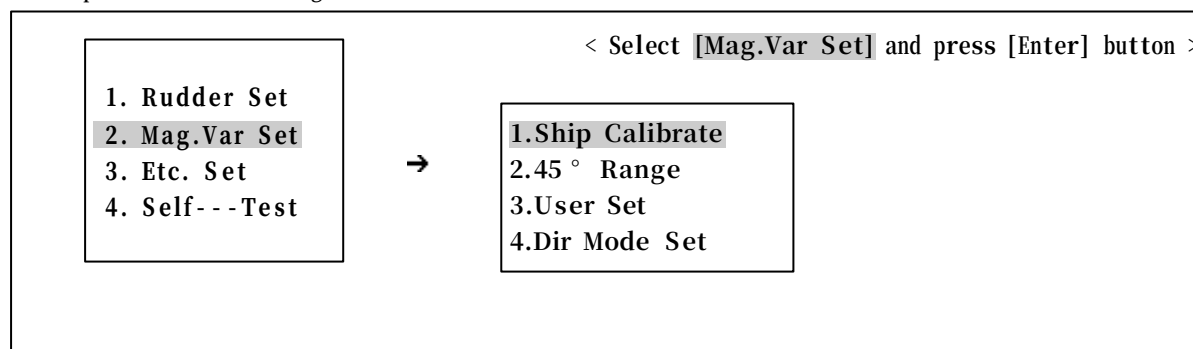
- ① Select [6.Remote Neutral] in [Rudder Set] menu and press [Enter] button, then < Fig 6-8 (B) > will appear.
 - ② Turning the adjuster of the remote control, set it to 0 scale.
 - ③ Press [Enter] button to store the set value of the remote neutral and return to the previous display.
- < CAUTIONS - Press [Enter] button, then the value will be cancelled and the previous menu will be displayed. >

2. Magnetic Variation Set

- 1) When current prow direction is not the same with true direction, revise electronic compass and make it same with true direction. An earth magnetic field of south and north does not match with earth's north/south pole exactly. (The Republic of Korea's variation is around +7°.)

A standard direction for revision should be true north and should be revised by GPS or GPS Plotter.

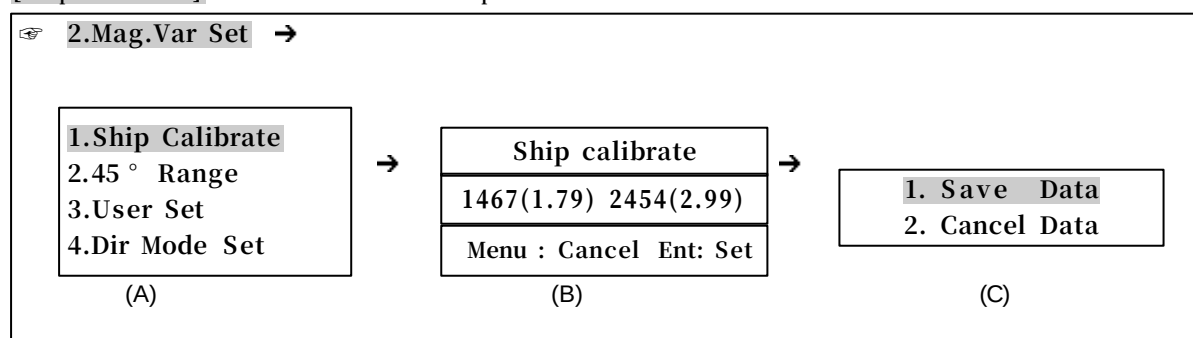
- 2) Revision should be done after full installation and when iron frame which is around electronic compass sensor is changed as well.



<Fig 6-9. Initial Screen of Menu Set>

[1] Ship Calibrate

[Ship Calibrate] Set direction with ship 360° revolution.



<Fig 6-10. Screen of Ship Calibration>

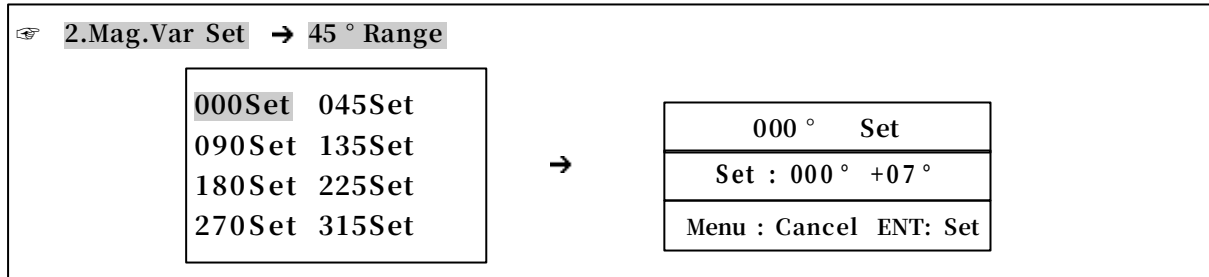
The procedure of [Ship Calibrated] is as follows;

- ① Select SAS-7's [Ship Calibrate] menu.
- ② Take a ship one and half turn slowly , when <Fig. 6-10. (B)> screen is displayed. It changes screen's variation value continuously as prow's direction.
- ③ For the exact revision, go a ship round in a large round.
- ④ If you get revised value after ship 360° revolution, press [ENT]. Will display <Fig 6-10.(C)>.
- ⑤ Press [ENT] to save the revised value.
<Caution! If press [MENU], setting value is cancelled.>
- ⑥ If you saved Correction value, do straight navigation by 45° or 90° Range. Compare this with GPS plotter direction and it is complete Correction if the range of error is $\pm 5^\circ$.

[2] 45 ° Range Correction

[45 ° Range] enable to adjust the compass variation for total 8 directions while trial navigation with 45 ° range under 0 ° standard route.

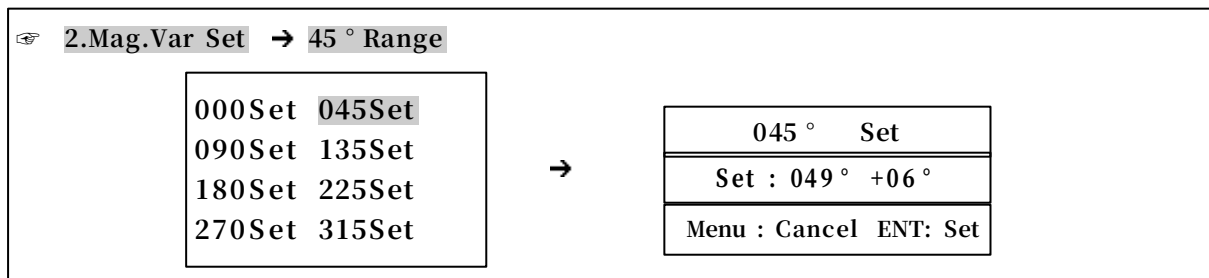
A.000 Set



<Fig 6-11. 000 ° Screen of Correction Set>

- ① Select [000 Set] menu at [45 ° Range] menu of SAS-7.
- ② Make current prow's direction 0 °, navigate for one min. Adjust the difference with direction value by using [▶],[◀].
- ③ Press [ENT] for cancellation of revised value and return to previous menu.
<Caution! Return to previous menu if press [MENU].>

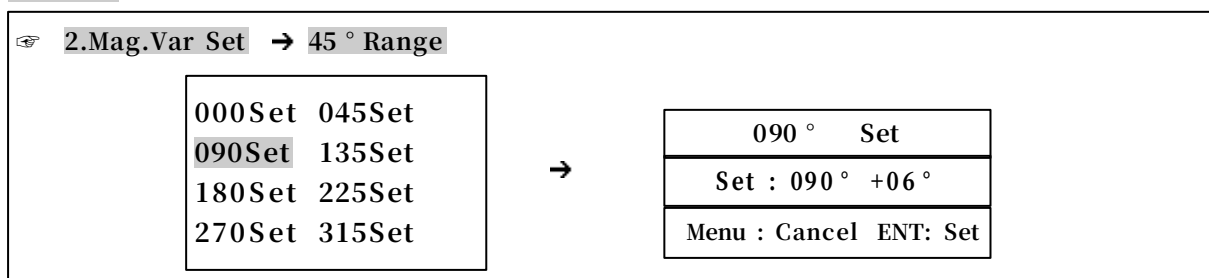
B.045 Set



<Fig 6-12. 045 ° Screen of Correction Set>

- ① Select [045 Set] menu at [45 ° Range] menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using [▶],[◀].
- ③ Press [ENT] for saving revised value and return to previous menu.
<Caution! If press [MENU], setting value is cancelled.>

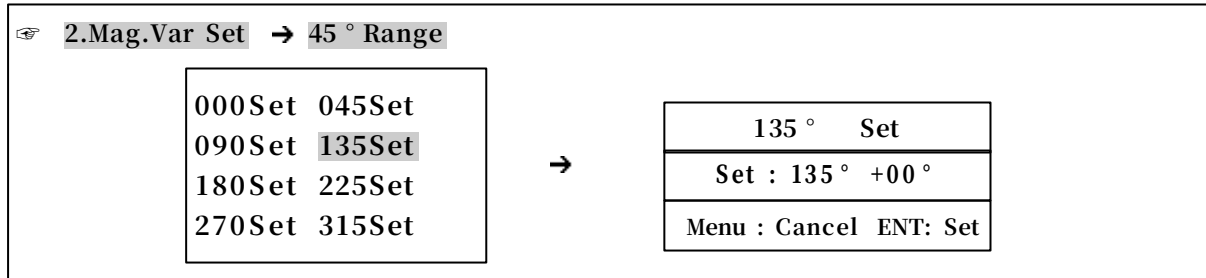
C.090 Set



<Fig 6-13. 090 ° Screen of Correction Set>

- ① Select **[090 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
 <Caution! If press **[MENU]**, setting value is cancelled.>

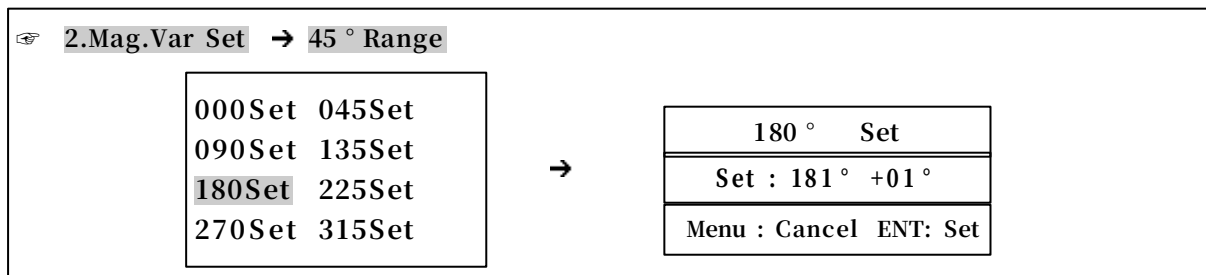
D.135 Set



<Fig 6-14. 135 ° Screen of Correction Set>

- ① Select **[135 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
 <Caution! If press **[MENU]**, setting value is cancelled.>

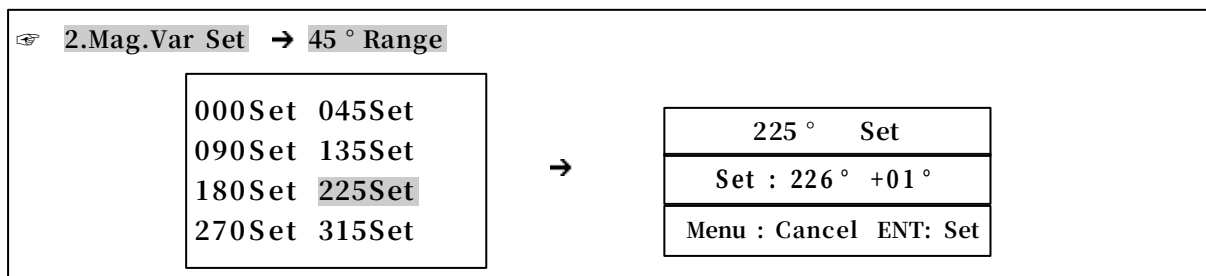
E.180 Set



<Fig 6-15. 180 ° Screen of Correction Set>

- ① Select **[180 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
 <Caution! If press **[MENU]**, setting value is cancelled.>

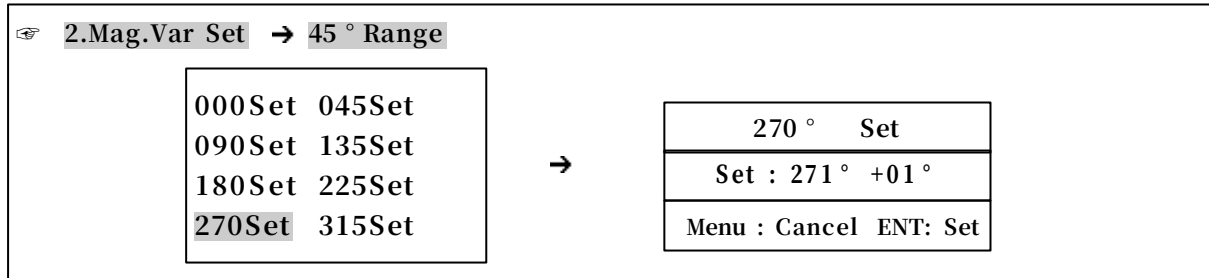
F.225 Set



<Fig 6-16. 225 ° Screen of Correction Set>

- ① Select **[225 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
<Caution! If press **[MENU]**, setting value is cancelled.>

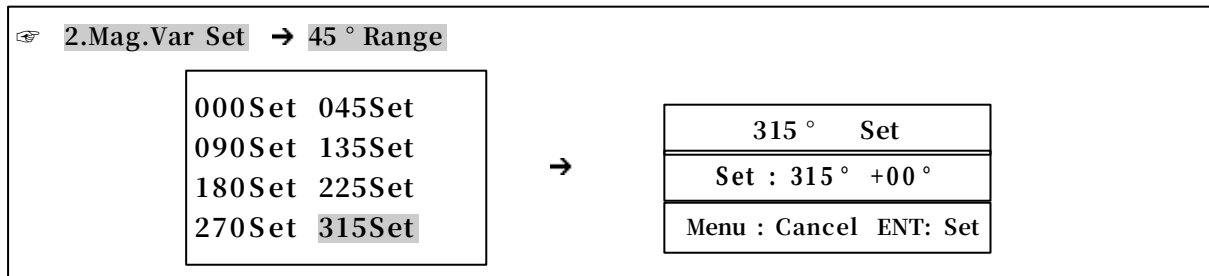
G.270 Set



<Fig 6-17. 225 ° Screen of Correction Set>

- ① Select **[270 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
<Caution! If press **[MENU]**, setting value is cancelled.>

H.315 Set

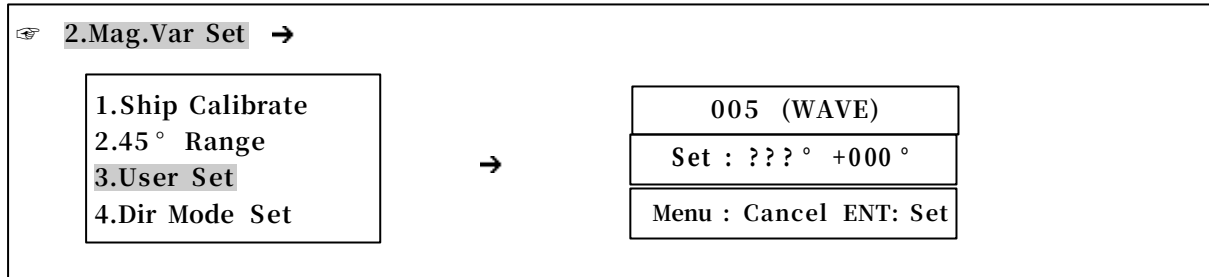


<Fig 6-18. 225 ° Screen of Correction Set>

- ① Select **[315 Set]** menu at **[45 ° Range]** menu of SAS-7.
- ② Make current prow's direction 45 °, navigate for one min. Adjust the difference with direction value by using **[▶]**,**[◀]**.
- ③ Press **[ENT]** for saving revised value and return to previous menu.
<Caution! If press **[MENU]**, setting value is cancelled.>

[3] User Setting

After [Ship Calibrate] set, adjust direction with 5° Range if it needs minute direction value depends on user.

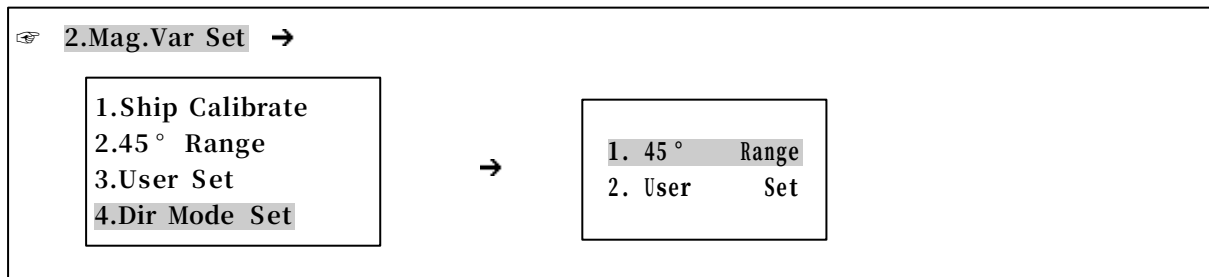


<Fig 6-19. Screen of User set >

- ① Set wave height ratio from 0° to 355° with 5° Range and adjust the difference of present direction by using [▶],[◀]
- ② After a Correction for one direction is finished, press [MENU] button for setting value setting.

[4] Directino Mode Setting

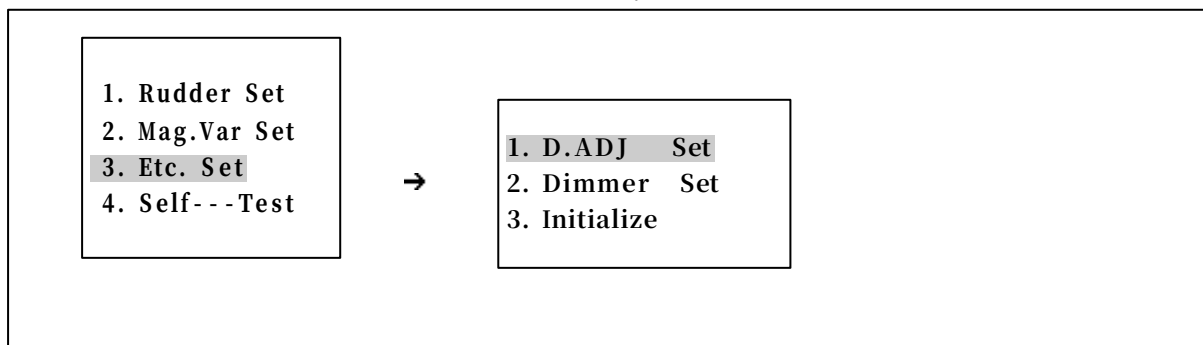
Select wtether uss user revision value or direction value which is revised by 45 Range during navigation.



<Fig 6-20. Screen of Direction Mode Select>

3. Etc. Setting

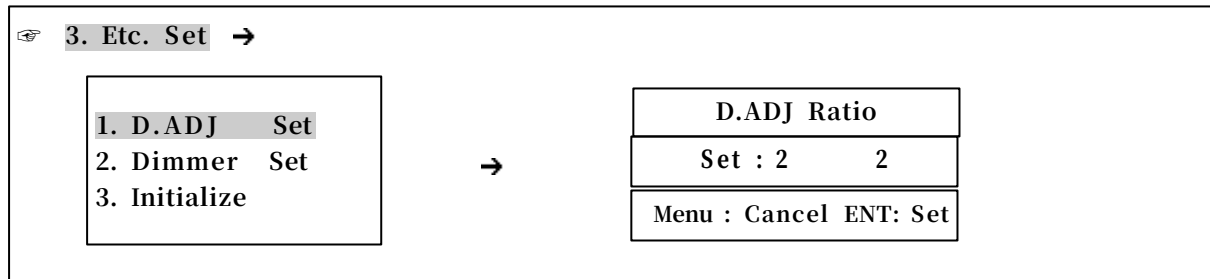
Initial set which is made variation ratio, luminosity and all revised value initial.



<Fig 6-21. Initial Screen Of Menu Set>

[1] Drift angle Adjustment set

It is for more minute Correction during navigation even a variation is adjusted by Magnetic Variation Set.



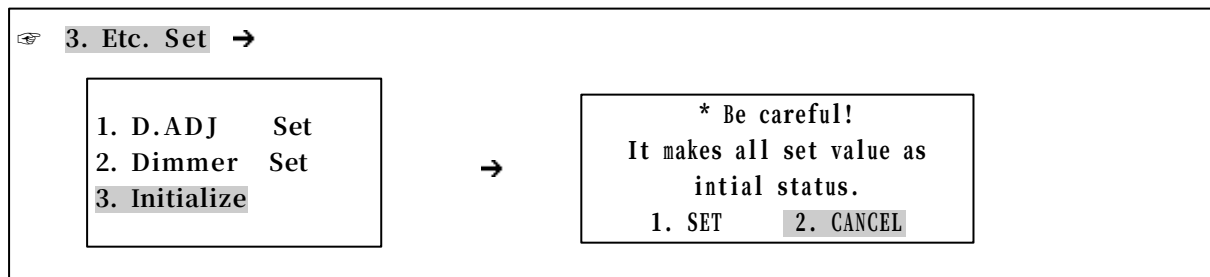
<Fig 6-22. Screen of Drift angle Adjustment ratio>

[2] Dimmer Value Setting

Adjust screen luminosity. It is available to adjust screen luminosity as 4 steps 0 to 3 whenever press [ENT].

[3] Initial Setting

Make all revised value as initial. Reset all revised value of SAS-7 if it made [INITIAL SET].

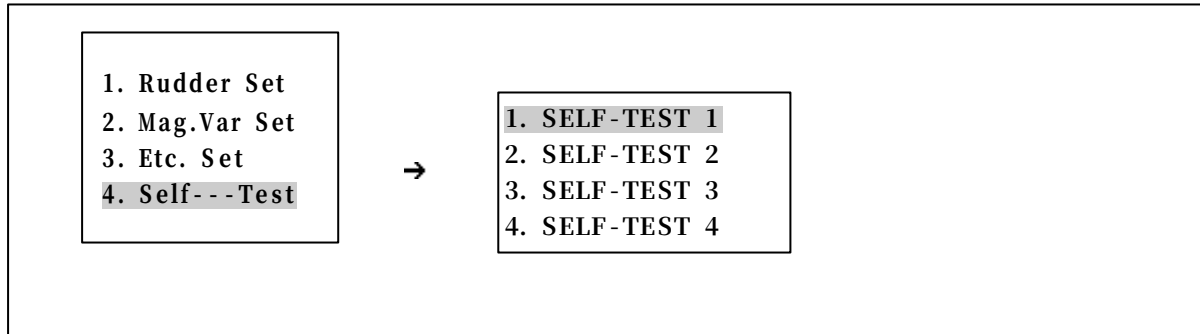


<Fig 6-23. Initial Set Screen>

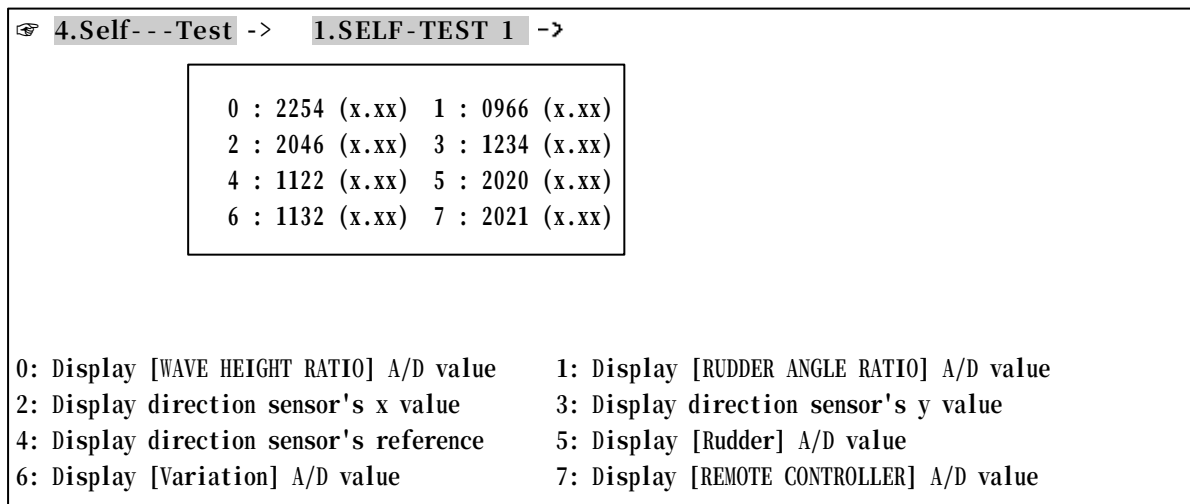
4. SELF-TEST

Available to check the status of Auto Pilot SAS-7. To decide A/S or system troubleshooting, it should be handled by specialized technician.

[1]. Self-test 1



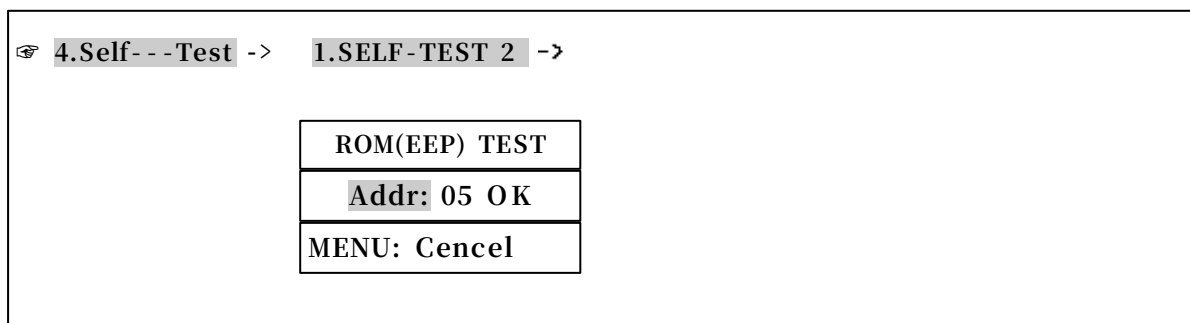
<Fig 6-24. Initial screen for menu set>



<Fig 6-25. Self-test 1>

[2] Self-test 2

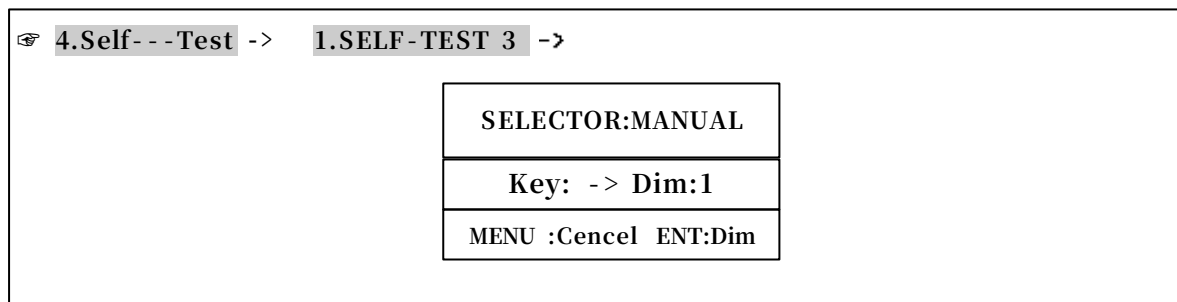
Check ROM's status. Return to menu after ROM scanning.



<Fig 6-26. Self-test 2>

[3]. Self-test 3

Check the status of function key for SAS-7 Auto Pilot.

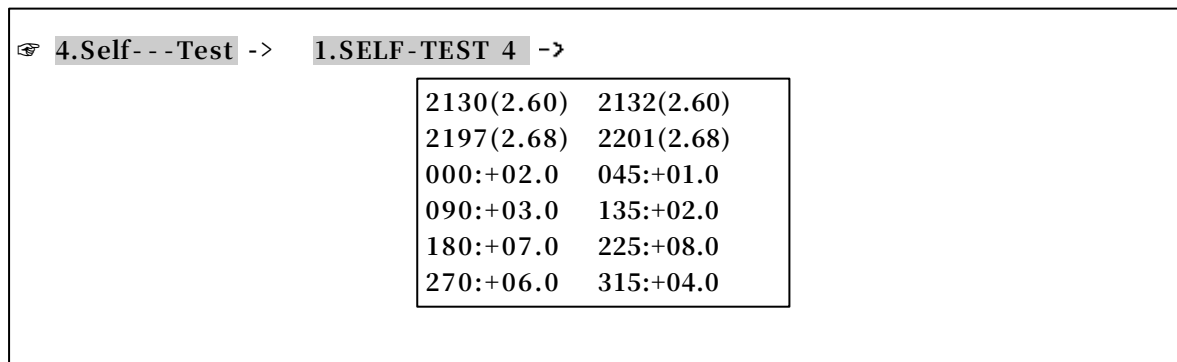


<Fig 6-26. Self-test 3>

- ① Make Selector mode [Manual][Compass][Plotter][Remote] and check key status.
- ② Press the key [Alarm][Lightening][<-][>][ENT] in order and check key status.
- ③ If press [Menu], it will re-start **SAS-7**.

[4]. Self-test 4

Display current value of [Ship Feature Correction] and [45° Range Correction] on SAS-7.



<Fig. 6-27. SELF-TEST 4>

2. Self-test Result

The self tested value can vary each time, and the numbers can be used by specialists in SAMYUNG to figure out the system performance according to diagnosis condition; therefore, when any trouble cannot be shot out, and sent this form to A/S Center, it will be facilitated the A/S procedure faster.

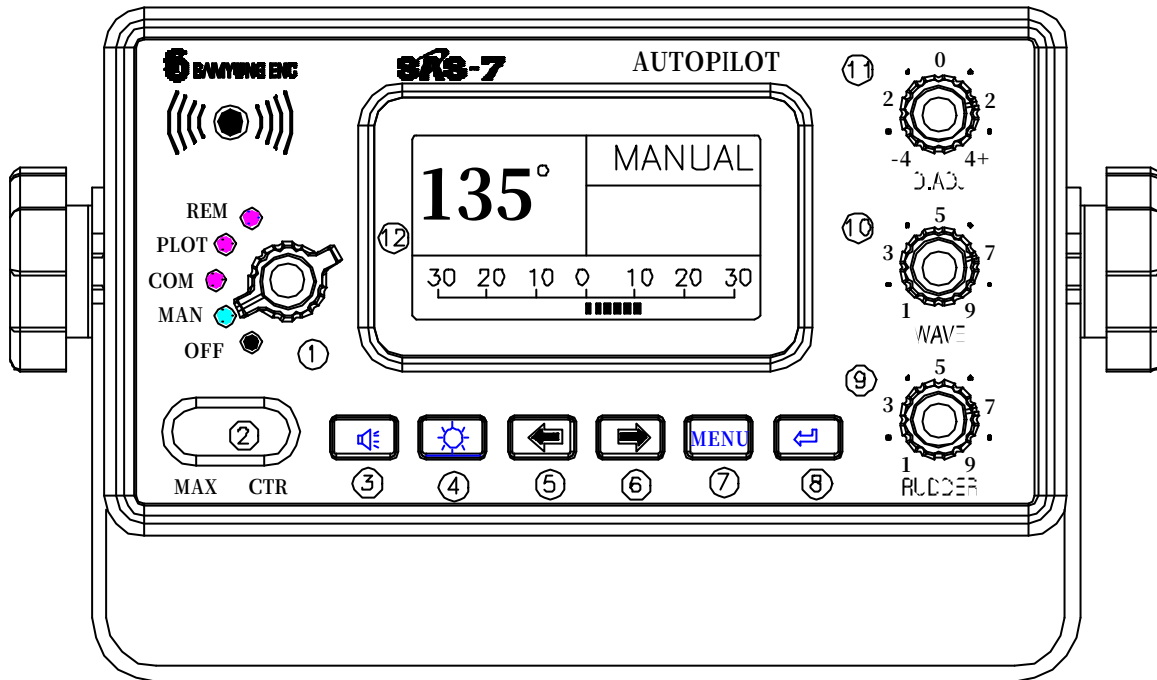
SELF TEST REPORT		Vessel Name	Installed Date
SAS-7 Auto Steering System		System ID Number	Test Date
SAS-7 Auto Steering System		Inspector	
Self-Test Mode #	Contents (Value)	Test Condition	Remarks
1	-	When controller position of wave height ratio is at 1	
	-	When controller position of wave height ratio is at 5	
	-	When controller position of wave height ratio is at 9	
2	-	When controller position of rudder angle ratio is at 1	
	-	When controller position of rudder angle ratio is at 5	
	-	When controller position of rudder angle ratio is at 9	
3		When Angle Sensor value is at -40	
		When Angle Sensor value is at 0	
		When Angle Sensor value is at +40	
4	- -	Direction (Compass) : 0	
	- -	Direction (Compass) : 90	
	- -	Direction (Compass) : 180	
	- -	Direction (Compass) : 270	
5		Remote Controller : -40	
		Remote Controller : 0	
		Remote Controller : +40	
6	-	One min. after power on	
7	-	Variation controller's position at 0	Push Test Condition button or select button then fill up the value.
	-	Variation controller's position at -4	
	-	Variation controller's position at +4	
	-	Button ►	
	-	Button ◀	
	-	Menu Button	
	-	Backward (ENT + Compass at manual mode)	
	-	Alarm Button	
	-	Steering Mode : Manual	
	-	Steering Mode : Remote	
	-	Steering Mode : Compass	
-	Steering Mode : Plotter		
8		Check and list all the numbers says "Malfunctioning"	

Please make out self test report after SAS-7 installation.

Chapter 7 Operating Method

1. Front Panel Function

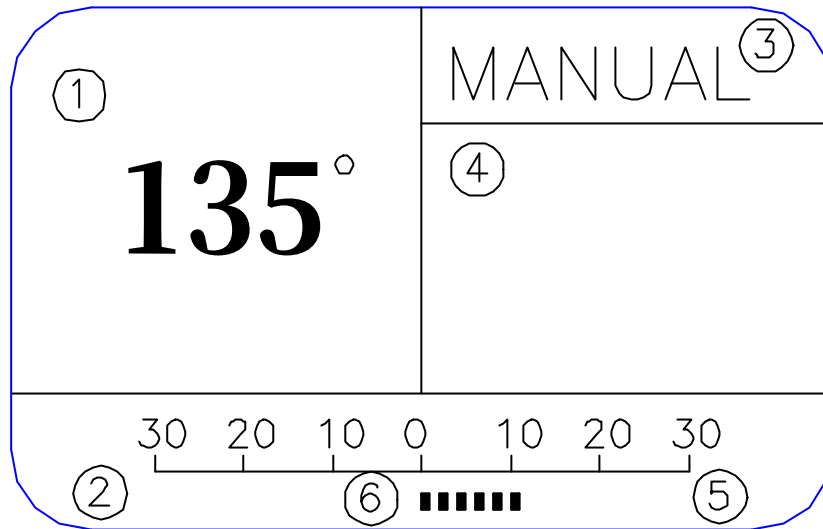
- Describe a name, function of front panel.



<Fig 7-1. SAS-7 Front Pannel>

- ① [Steering Mode] control knob : “Off, Manual, Compass, Plotter, Remote” these five different mode can be set, and excluding "off", 4 different kinds of steering modes are possible.
- ② [Rudder Adj.] button : Used for rudder Correction minutely.
- ③ [ALARM] : Alarm stops when alarming.
- ④ [DIM] : On/Off lightening of LCD display.
- ⑤ [◀] : Correction of destination direction, setting value.
- ⑥ [▶] : Correction of destination direction, setting value.
- ⑦ [MENU] : Select menu.
- ⑧ [ENT] : Enter setting value.
- ⑨ [Rudder Angle Ratio] : Adjust Rudder Angle Ratio at [Compass][Plotter] and available to adjust from 1 to 9 degree.
- ⑩ [Wave Height Ratio] : Adjust Wave Height Ratio at [Compass][Plotter] and available to adjust from 1 to 9 degree. (Depends on wave height.)
- ⑪ [Variation Adj.] : Adjust variation which is set on menu.
- ⑫ LCD (LCD Display) : Display steering operation direction , prow direction, setting direction, steering mode.

2. Front Display On Steering Controller



- ① : Prow direction in current.
- ② : Display operation status of left-side mounted solenoid valve. Ship turns to the left in case of graduation on ⑥.
- ③ : Display current steering mode such as Manual, Compass, Plotter, Remote, Backward.
- ④ : Display destination direction which is willing to sail at Electronic compass mode, Plotter steering mode.
- ⑤ : Display operation status of right solenoid valve. When ⑥'s graduation is at ⑤, a vessel turns to the right, Turn to the left when it is at ②.
- ⑥ : Bar figure which is displayed current rudder direction & angle.
(E.g. A rudder direction is in right with 10 degree on above figure.)
- ⑦ : Display status of position alarm. It is the status of alarm operation in case of "■".
(Press [Alarm], it disappears and press once more for show-up.)

3. Manual Steering

1. Manual steering means there is no control from auto steering device, and ship is under control of operator. Therefore it is same as turn-off the auto steering system.

[1] On the steering control, set the knob to manual.

[2] Row a ship with manual steering(steering wheel).

[3] Display current LCD display's angle and prow direction.

[4] If select button of steering put on [Compass] with pressing [ENT] during navigation, display [Backward] and a ship goes backward.

[5] If selection button of steering mode put on [Manual], available to navigate by manual mode.

4. Compass Steering

※ Warning : Wave height ratio and rudder angle ratio should be adjusted properly.

1) Compass steering is a auto piloting(steering) method that enables the ship to navigate in straight way by setting the destined route making use of compass bearing connected to steering controller.

[1] Put the position of steering mode knob for steering controller at "Compass" position

[2] In screen, angle indicator and bearing and destined bearing and working direction of solenoid valve will be displayed.

[3] In case regulator for remote controller being deviated off over 5' during navigation, then buzzer will activate with alarm and ship will be controlled by remote controller. If user want to return to auto steering mode, please place remote controller at neutral position.

[4] If user want the ship to go astern (to go backward), change over steering mode selection switch from [COMPASS] into [PLOTTER] with ENTER key pressed during navigation.

In this case, "ASTERN" displayed in screen after over 2 seconds being pressed.

* Warning : When "ASTERN" is displayed, 180' will be added to the bearing.

[5] When user places selection switch at [COMPASS] mode again, ship will return to previous bearing.

5. Plotter Steering

Warning : Wave height ratio and Rudder angle ratio should be adjusted properly.

1) Plotter steering is to automatically navigate the ship by using GPS Plotter connected that gives the destined bearing.

[1] Place the steering mode knob at plotter position. (Remote should be at neutral position)

[2] In screen, angle indicator and bearing and destined bearing and working direction of solenoid valve will be displayed.

[3] Ship can be controlled by using remote controller when controller is turned to be off over 5' from neutral position. If user want to go previous mode, then place the controller at neutral position.

[4] If user want the ship to go astern (to go backward), change over steering mode selection switch from [COMPASS] into [PLOTTER] with [ENT] key pressed during navigation. In this case, "ASTERN" displayed in screen after over 2 seconds being pressed.

* Warning : When "ASTERN" is displayed, 180' will be added to the bearing.

[5] When user places selection switch at [PLOTTER] mode again, ship will return to previous bearing.

6. Remote Steering

To row a ship by remote controller

- [1] Put steering mode handle of remote controller.
- [2] It displays a direction of rudder, stem, solenoid operation.
- [3] Display stem direction on remote controller.
- [4] Row a ship by remote control.
- [5] Convert [REMOTE] to [PLOTTER] at pressing [ENT] while navigation. And then vessel goes backward with 'Backward' display.

7. Rudder Angle Ratio Set (Normal use : 5)

- 1] Controlling direction alignment frequency must be adequately followed by conditions, such as ship size, ship weight, strength of wind, wave, current etc. Especially wave, wind and current have important impact, but normally setting the control knob 5 allows optimal navigation. Here the function, direction alignment works during auto steered navigation by electric compass and chart plotter.
- [2] If the direction alignment frequency set up very high, during auto steering navigation, it will takes little time for ship to be relocated to the desired direction.
- [3] If the direction alignment frequency set up very high, during auto steering navigation, it will takes little time for ship to be relocated to the desired direction, but due to frequent movement , ship could shake left to right, and it worse case, ship will move having very angle like zigzag movement.
- [4] Explaining it easy, direction alignment means that when the direction of heading is away from the direction set up, this function will correct the difference. So when the direction of heading 7° away from the desired direction, if correction angle is 7°, the direction alignment frequency is 1.
- [5] If wish to control the direction alignment frequency, use direction alignment frequency control knob, turning the knob to the right makes alignment frequency higher.
- [6] Following table shows direction alignment frequency according to the number set up on the control knob.

Position of Rudder Angle Ratio Controller	Rudder Angle Ratio
1	0.1
2	0.3
3	0.7
4	1.1
5	1.5
6	1.9
7	2.3
8	2.7
9	3.0

8. Wave Height Ratio Set (Normally Compass : 0, Plotter=5)

[1] Controlling wave height ratio must be adequately follows by conditions such as height of wave etc. When the operator feels the wave is giving minimal effect, set the number as 1 and when feels strongest effect set the number as 9.

[2] When prow direction is not correct on setting direction or destination direction during compass or plotter auto steering, it gives revision ratio. A wave height ratio controller has a function to set revision ratio according to a variation of prow direction.

[3] In case wave height ratio is adjusted little, rudder moves with solenoid valve whenever a ship could shake left to right due to wave.

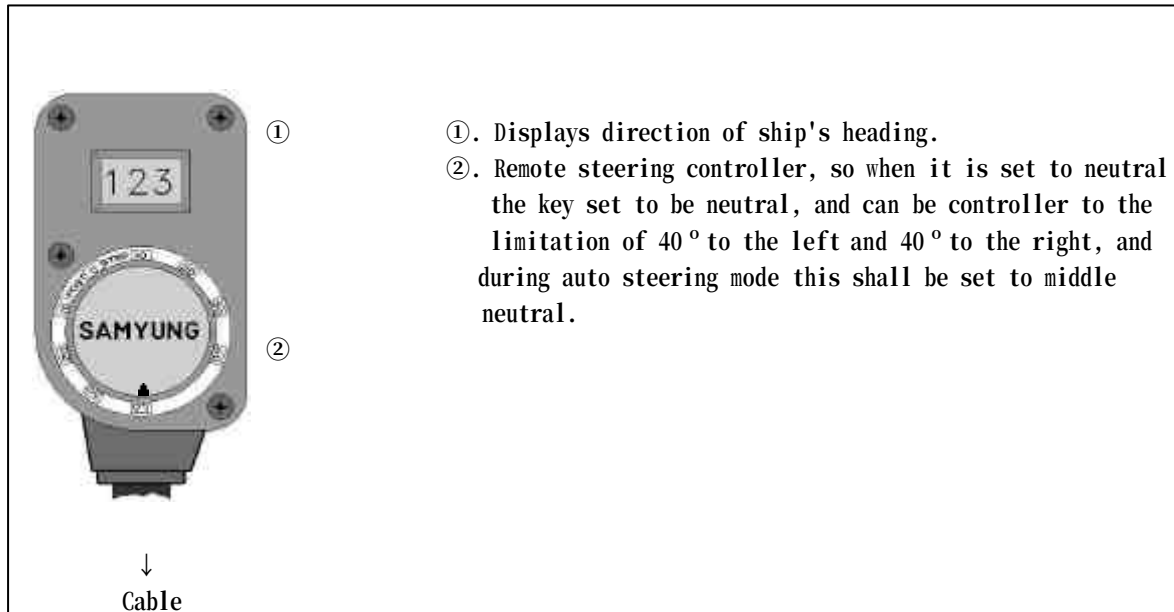
[4] If wave height ratio is adjusted a lot, there is direction error when the ship is arrived in destination by compass steering and there is route error during navigation by plotter steering.

[5] A wave height ratio per controller position is as below table.

Controller Position for Wave Height Ratio	Wave Height Ratio
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8

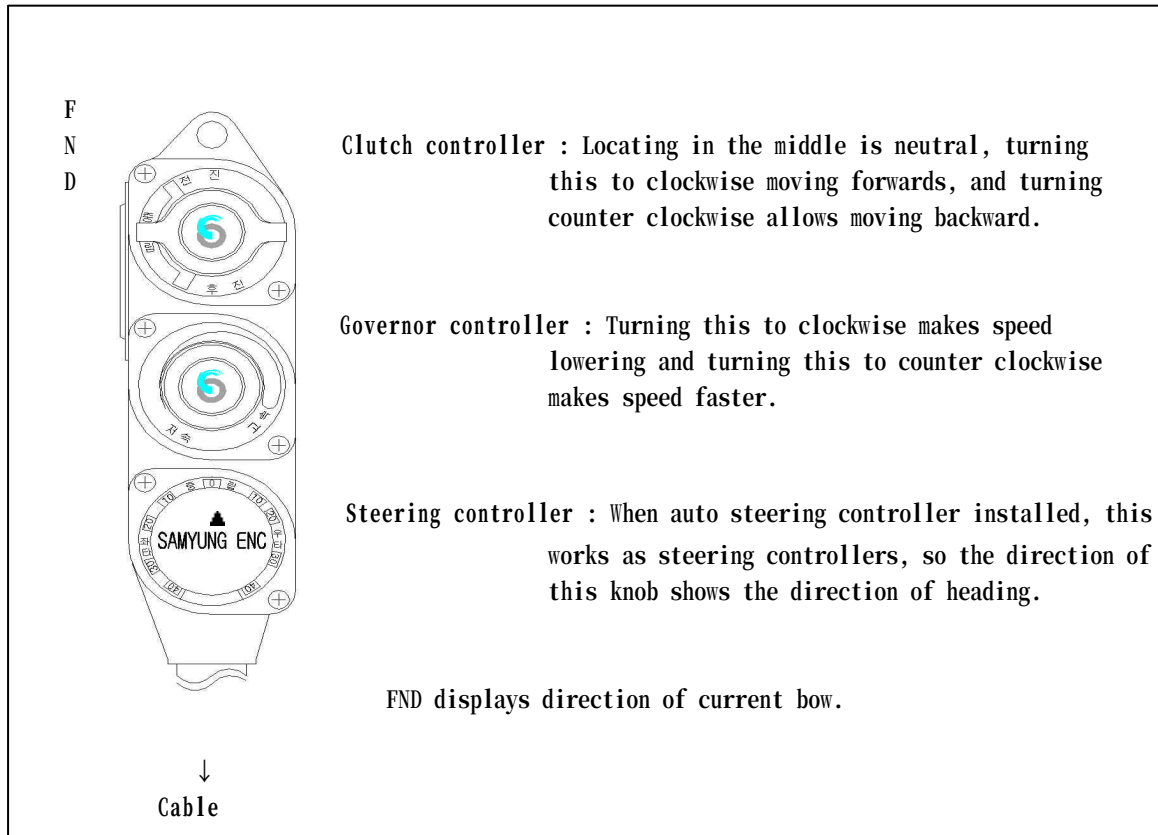
9. Function Of Remote Controller

1) RC-10 Remote Controller which is used for Auto Pilot installation only.



<Fig 7-3. RC-10 Remote Controller>

2) RC-30 Remote Controller which is used for connection installation of steering controller and electric lever(Engine controller).



<Fig 7-4. RC-30 Remote Controller>

CHAPTER 8. WARNING& ALARMING**1. LOCATION WARNING FUNCTION**

- 1) SAS-7 auto steering controller has alarming function, so it makes beeps for 5 seconds at 5-minute intervals to call a users attention . To cancel this function, push the alarm key once, and wish to back to normal push the alarm key again.
- 2) When the power is off then turned on, this will works due to normal set-up.
- 3) On the LCD display, if there is " ■ "symbol, this means alarm works, if the symbol disappears, this means alarm is not in active.
- 4) This function works under electric compass / chart plotter based auto steering mode, but under manual and remote mode, this function will be disabled.

2. REMOTE CONTROLLING ALARMING FUNCTION

Under electric compass / chart plotter operation based steering mode, if turns the control knob more than 5 degrees away from neutral, the alarm beeps.

3. MALFUNCTION DISPLAY FUNCTION

Error	Troubleshooting	Opeation Condition
RUD Er	Mafunctioning on Rudder Acton :Please check the solenoid valve or angle sensor	Remote, Compass, Plotter
COM Er	Malfunctioning on Compass Action : Please check the pick-Up sense connection	Manual, Remote, Compass, Plotter
PLT Er	Connection problem with chart plotter Action : Plsase check the connection of plotter	Plotter

Engine Control Unit

SM-975 electronic lever instruction manual

This is option equipment for SAS-7

Chapter 1 Overview

1. Engine Control (SM-975) is .

An engine related equipment controlling vessels` speed and forward/ backward clutch among vessel automation equipment that is provided by Korean domestic technology of SAMYUNG ENC CO., LTD. SM-975 can be used independently and controlled by remote control. Further, it can be connected with Samyung Auto Steering controller (SAS-7) and GPS chart plotter (Samyung NAVIS series) so that automatic navigation and fishing can be possible.

Since SM-975 controls vessels` engine, safety has been considered as a top priority when it is designed. and It works automatically to be secured from wrong operation of user Use of SM-975 is simple and it can be used at DC 20v to DC 40v (24v is recommended for rated voltage). It is consist of electronic lever which is for actuating lever and remote controls which is for controlling lever.

2. Specification

Power supply : DC 20v ~DC 40v (below 15W)

Operating temperature : - 15 ℃ ~+55 ℃

Lever actuation output power : speed control lever(governor) : 48kg /226Cm (1min.)

Dimension : main unit(electronic lever) ; width(264mm) x height(342mm) x depth(258mm)
necessary space for mounting (height :500mm)

Weight : main unit(electronic lever) ; 18.5kg
remote control ; 2.2kg(cable included)

3. Caution for usage

- [1] Check whether the manual governor controller is rocked or not, before turn it on Turn it on after being off the rock
- [2] If there happens thunder lightning, dont try to touch the metal part of the power switch. There is danger of electronic shock by lightning strikes.
- [3] Only from DC 20v to DC 40v power is acceptable. If it is connected to A.C power or not provided place, it could cause a fire, a electronic shocks or breakdown of device.
- [4] Only permitted fuse is acceptable for steering device. In case of replacement, Use only specified fuse, otherwise it cause fire or malfunction of the equipment.
- [5] Don't treat the cable forcefully. Damaged cable could be a cause of a fire or electronic shock.
- [6] Don't operate it in case of bad range of vision like in the harbor tiny water way, near at obstacles. Unexpected electronic trouble could cause a collision.
- [7] Full attention required around ship and a course Unexpected trouble could cause a collision.
- [8] In case of emergency, please be noted how to change automatic operating mode to manual operating mode.
- [9] Keep away from water, the main unit is not perfectly waterproof. otherwise it could be a cause of fire or electronic shock. When the unit get wet, turn off power supply and input power switch and then It should be checked by authorized engineer.
- [10]Don't turn on the engine starter after power on. It can make a rapid change of voltage and cause improper operation.

4. Terms and abbreviation

1) Terms explanation

Terms as like the follows are used in this instruction manual and the other terms are comply with general terms .

- a) Engine control unit : It is electronic lever ,which controls RPM of engine ,forward/back and neutral switching gear.
- b) Governor(lever) : It is a lever that controls engine speed and called as srotle or accelerator
- c) Clutch(lever) : It is mounted between engine and propeller on ship`s engine system.
Ship`s forward/back and neutral can be selected with it.
- d) Manual lever : It is a control handle for controlling the RPM of engine and Ship`s forward/back and neutral. It is generally consist of separate Clutch and Governor called two-lever style which is operating by manually.
- e) Control cable : It is generally called pushable cable that connects governor and clutch of engine with manual lever which is also connected with electronic lever through the cable

2) abbreviation explanation

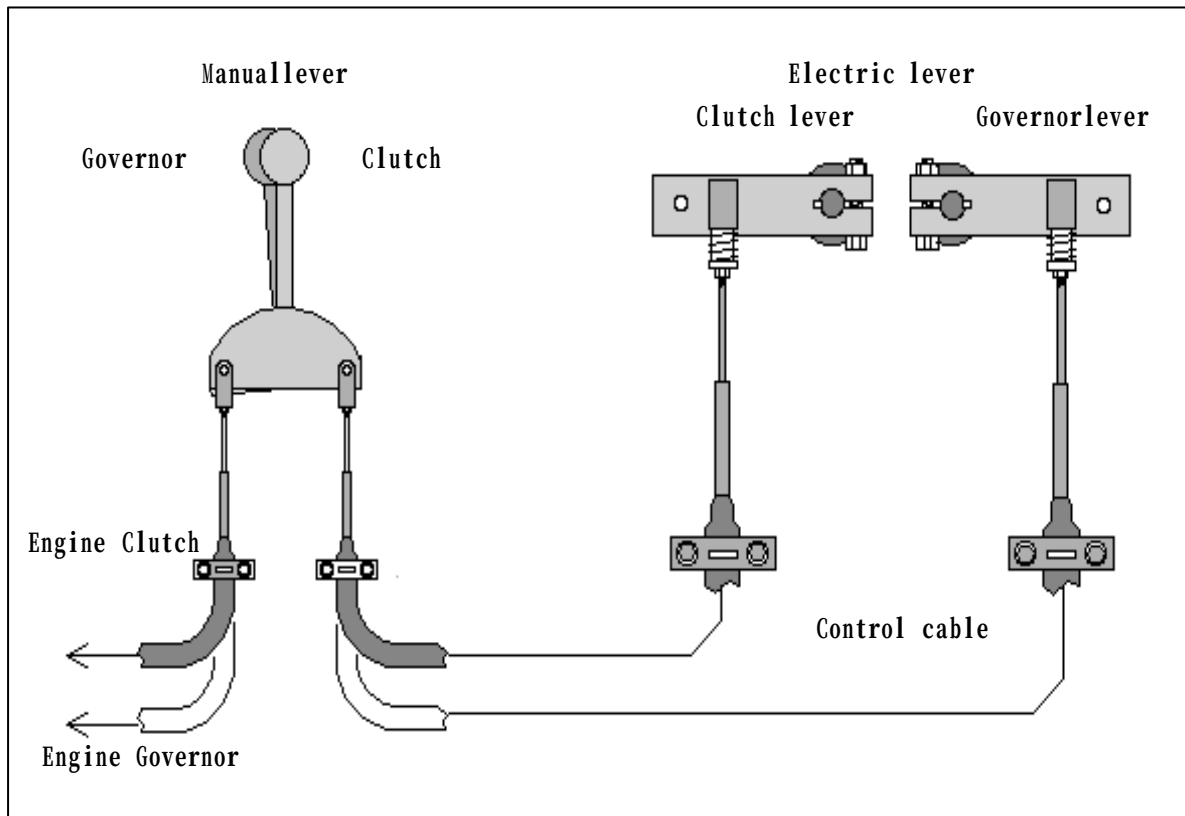
The colours of wires are described as following

Single colour			
Colour number	English	English abbr.	Remarks
0 or 10	Black	Bc	
1	Brown	Br	
2	Red	R	
3	Orange	O	
4	Yellow	Y	
5	Green	Gr	
6	Blue	Bl	
7	Violet	V	
8	Gray	Gy	
9	White	W	
Two colours			
59	Green/White	Gr/W	white line on a green ground

Chapter 2 Installation of the system

1. installation of control cable

Configuration of link cables for engine governor and clutch is as follow picture.

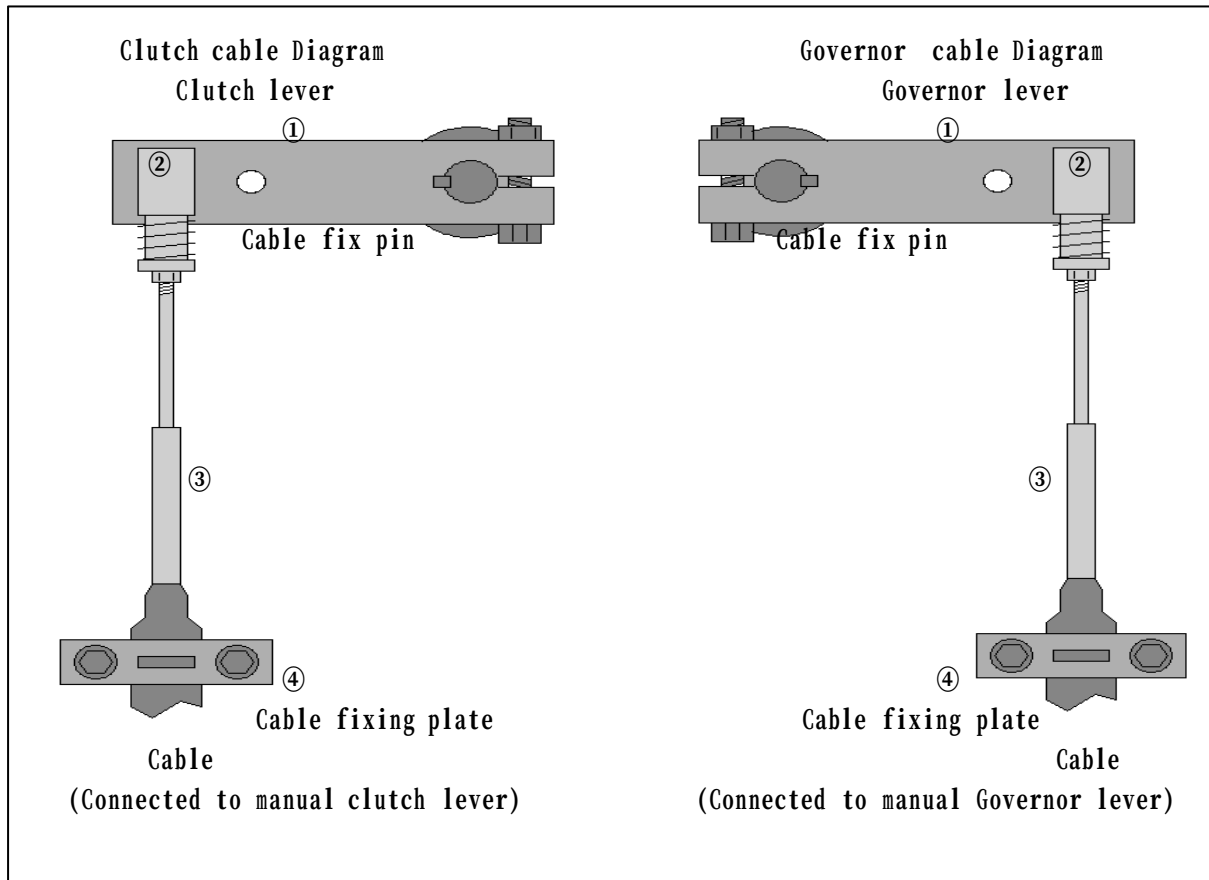


< Fig.2-1 drawing of control cable installation >

1. It shouldn't be installed at the place with heavy vibration , high temperature and exposed to rainwater or sea water.
2. The diameter of control cable has to be less than 50Cm and has not to be installed as being bent.
3. when the engine is connected to manual lever and manual lever to electronic lever through the cable , the above connections has to be done without backlash
* caution : Governor can not be controlled minutely if there is too much backlash on the connections
4. Either switching to forward / maximum speed position by pulling control cable or by pushing the control cable which is connected to electronic lever, there will be no problems of operating
So control cable can be connected as above picture .
* caution : Initial setting that switching to forward / maximum speed position by pulling the control cable should be done after installation

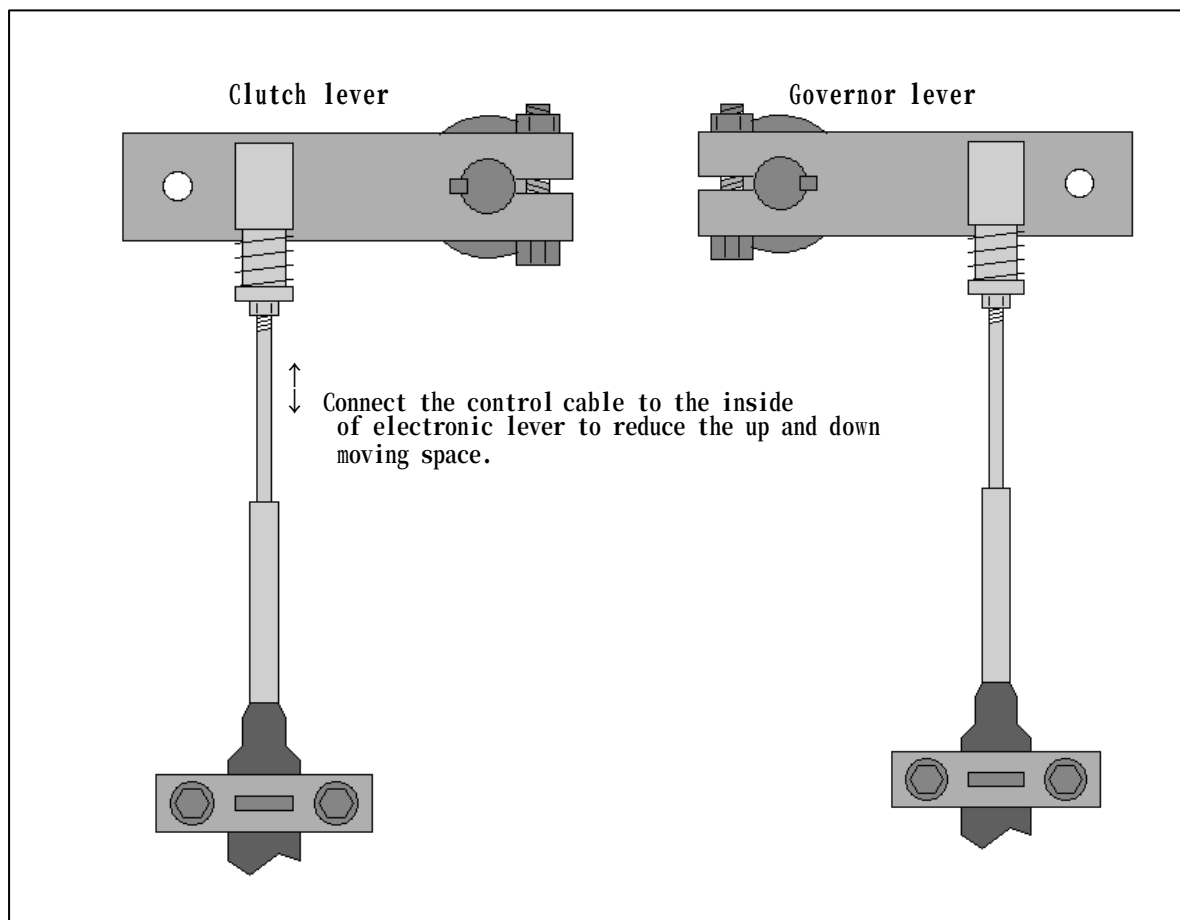
2. The way of connecting control cable to electronic lever

Electronic lever should be installed at a place where the under 50Cm diameter- control cable can be connected to manual lever without bending the control cable.



<Fig. 2-2 connecting control cable>

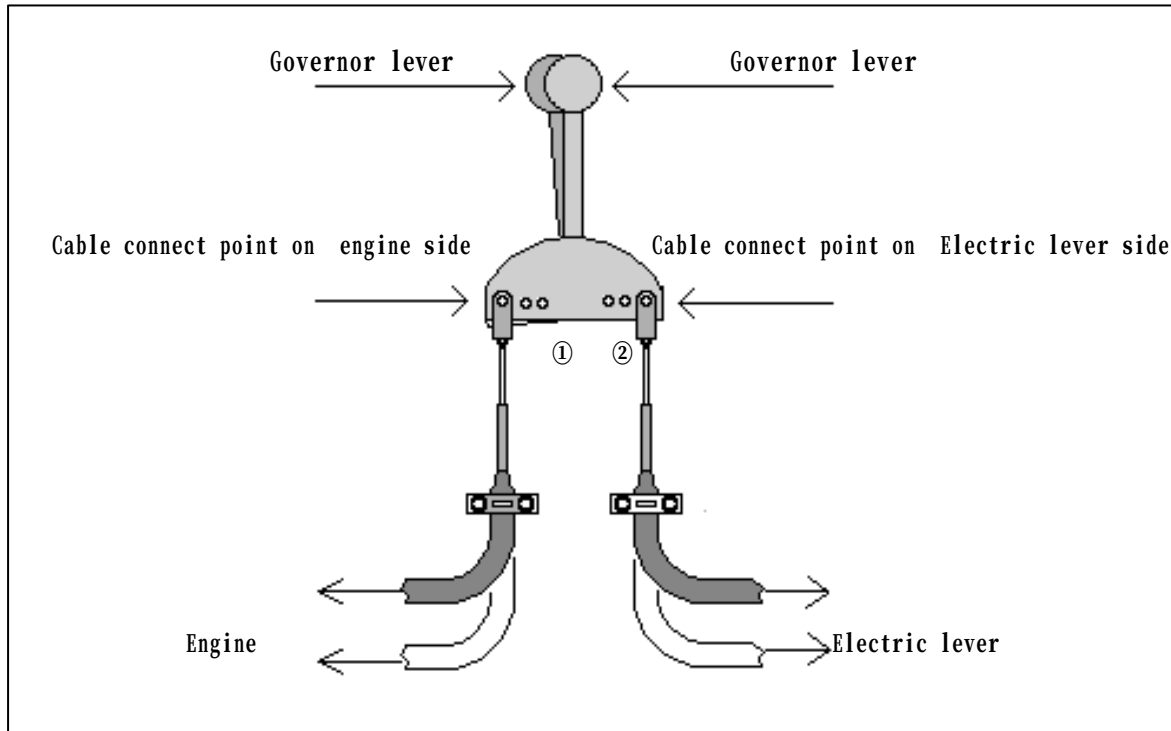
1. When open the lid of electronic lever , you will see two levers as above picture. The left one is clutch lever and the right one is governor lever.
2. When dismantle the manual lever , you will see the control cables that are connected to engine clutch and governor. there is also another connection points on manual lever for control cables that can be connected to electronic lever.
(control cable will be along with main unit when it is released)
3. After assembling the manual lever , put the clutch and the governor of manual lever on middle point of the lever.
4. Mount a cable link-pin "②" on the end of control cable that is connected to manual and tighten up a screw.
5. Put the levers "①" on middle point and connect the clutch cable and governor cable to the levers respectively. (connect "①" with "②" in the above picture.)
6. Fix the cable through the cable fixing plate"④"
7. Check whether the electronic lever is working properly according to the motions of the clutch and governor lever.
8. Mount a cable fixing pin on the outside of electronic lever as the below picture If there is any difference between moving space of manual lever and electronic lever.



<Fig 2-3>

3. The way of connecting control cable to manual lever

Check the installed manual lever first to ensure highest performance when it is connected with electronic lever through the control cable.



<Fig.2-4>

1. For best performance of motion of manual clutch lever , link point of "①" on above picture should be selected properly.
 - a) When the manual clutch lever is on forward position, location of the lever has to be forwarded by pushing it .
 - b) When the manual clutch lever is on neutral position, location of the lever has to be in the middle.
 - c) When the manual clutch lever is on reverse position, location of the lever has to be backed by pulling it
2. For best performance of motion of manual governor lever , link point of "②" on above picture should be selected properly.
 - a) When maximum speed , location of the lever has to be forwarded by pushing it .
 - b) When minimum speed , location of the lever has to be backed by pulling it
3. Position adjustment of manual lever can be done by selecting a link point of "①" and minute adjustment can be done by turning the linking device of the control cable
4. Cable link point of the electronic lever side has to be same as cable link point of the engine side.

4. Electric wiring

1. Please observe the follow instruction before electric wiring. If fail to meet this instruction , electric shock or damage of equipment can occur.

[1] Power should be off.

[2] Check the terminal plate (+ , -) of main unit and don`t connect it reversely.

☞ polarity : white colour -> [+] , black colour -> [-]

※ caution : If power is on when the connection of polarity is reverse , fuse will be broken and if the installed fuse was not a standard one , it could cause a damage on the unit

[3] Check terminal mark and wire colour first and then fix screws in case of the connection of junction terminal

☞ wrong connection could cause a damage on the unit

[4] Check whether there is any contact among terminals after completing electric wiring

[5] Cable shield which is connected to remote control or auto steering controller has to be connected to terminal "C" of electronic lever.

[6] Cut it out in proper length when a cable is longer than needed. Use same kind of cable when a cable is shorter than needed.

[7] Install "power switch" at a place where is easy to access.

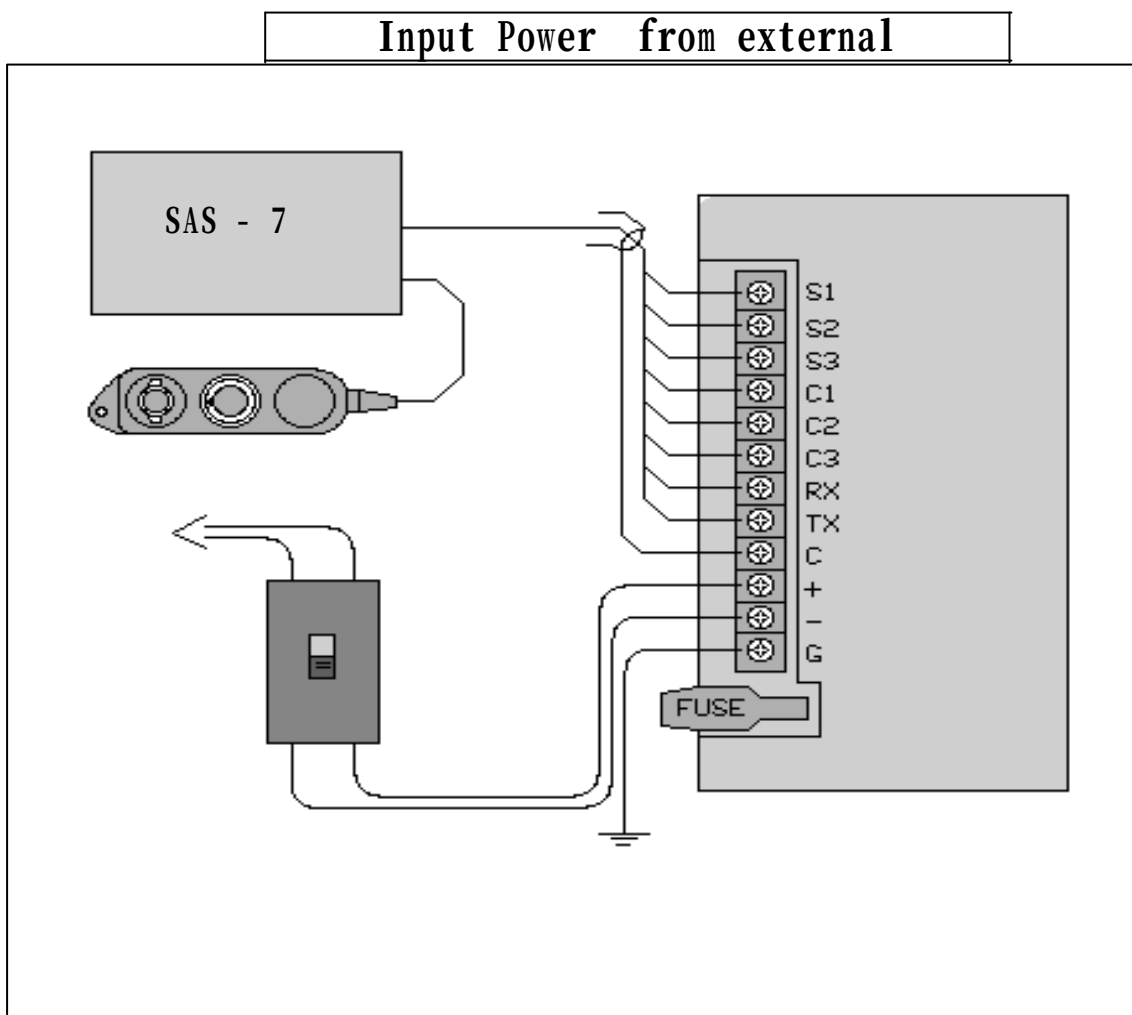
☞ recommendable place is near the manual lever because it is necessary to switch on/off for converting of manual control or Remote control .

[8] Install the unit away from radio transceivers such as SSB ,VHF radio.

☞ Keep away electric wiring of engine control from electric wiring of radio transceivers
It is because the operating of unit can be interfered by radio transceivers

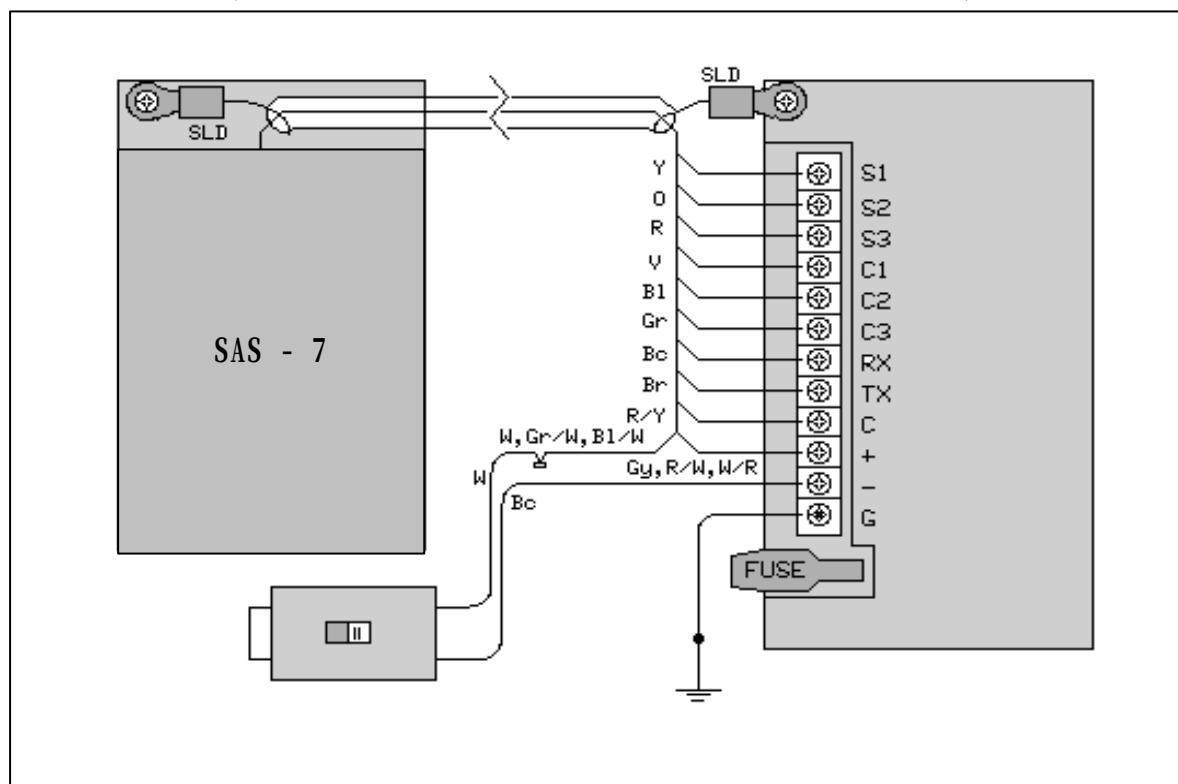
5. Installation drawing of electric wiring (connecting to auto steering controller)

1. In case of electronic lever (engine control unit) installation with auto steering controller(SAS-7) , the way of electric wiring follows as the below picture.
2. Remote control shall be connected to terminal plate of auto steering controller(SAS-7)
3. Use the supplied cable that will come along with units for connection of electronic lever and auto steering controller. If user wants to select cable by himself , shield cable has to be used.
4. When even the electric wiring of power input is connected to auto steering controller , separate power switch is necessary.
5. RX and TX wiring among the electric wiring which is connected to auto steering controller has to be connected reversely. it means that RX terminal of electronic lever should be connected to TX terminal on terminal plate of auto steering controller and vice versa.



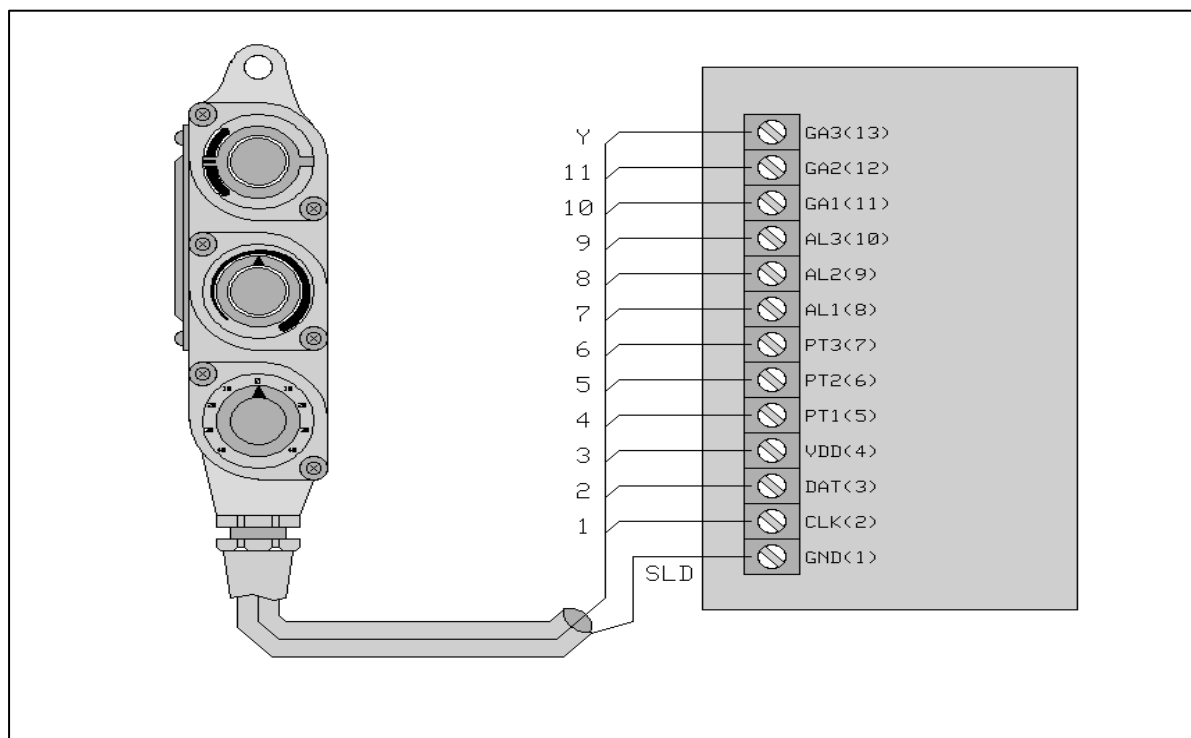
<Fig 2-5>

Input Power from SAS-7



<Fig 2-6>

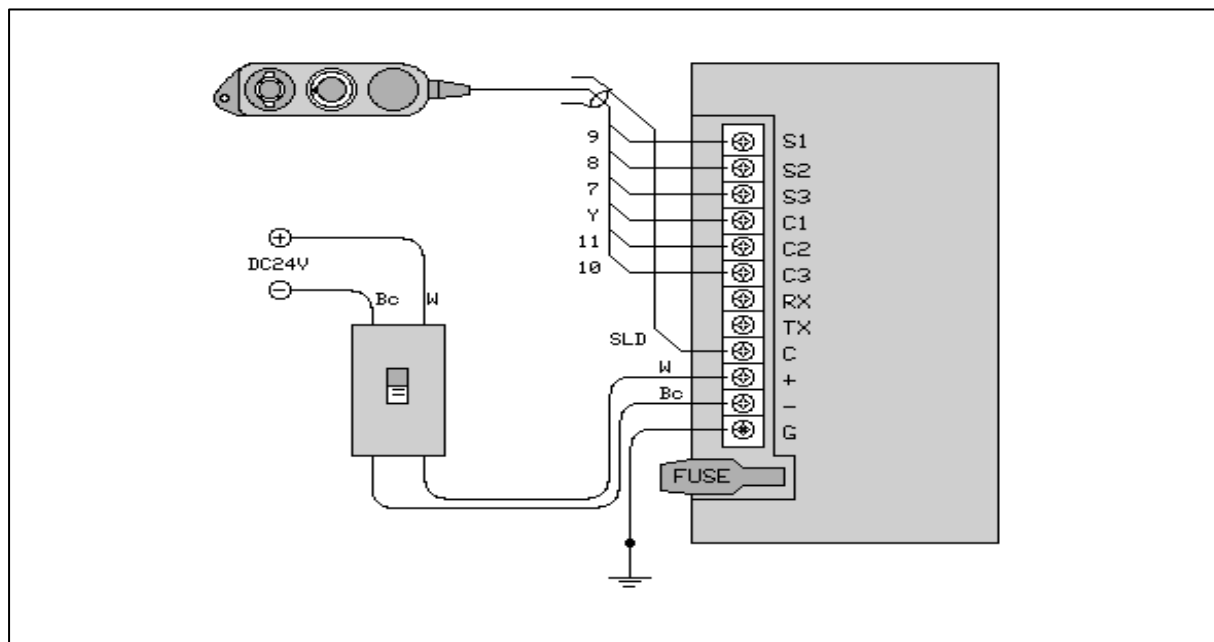
Remote control Wiring



<Fig 2-7>

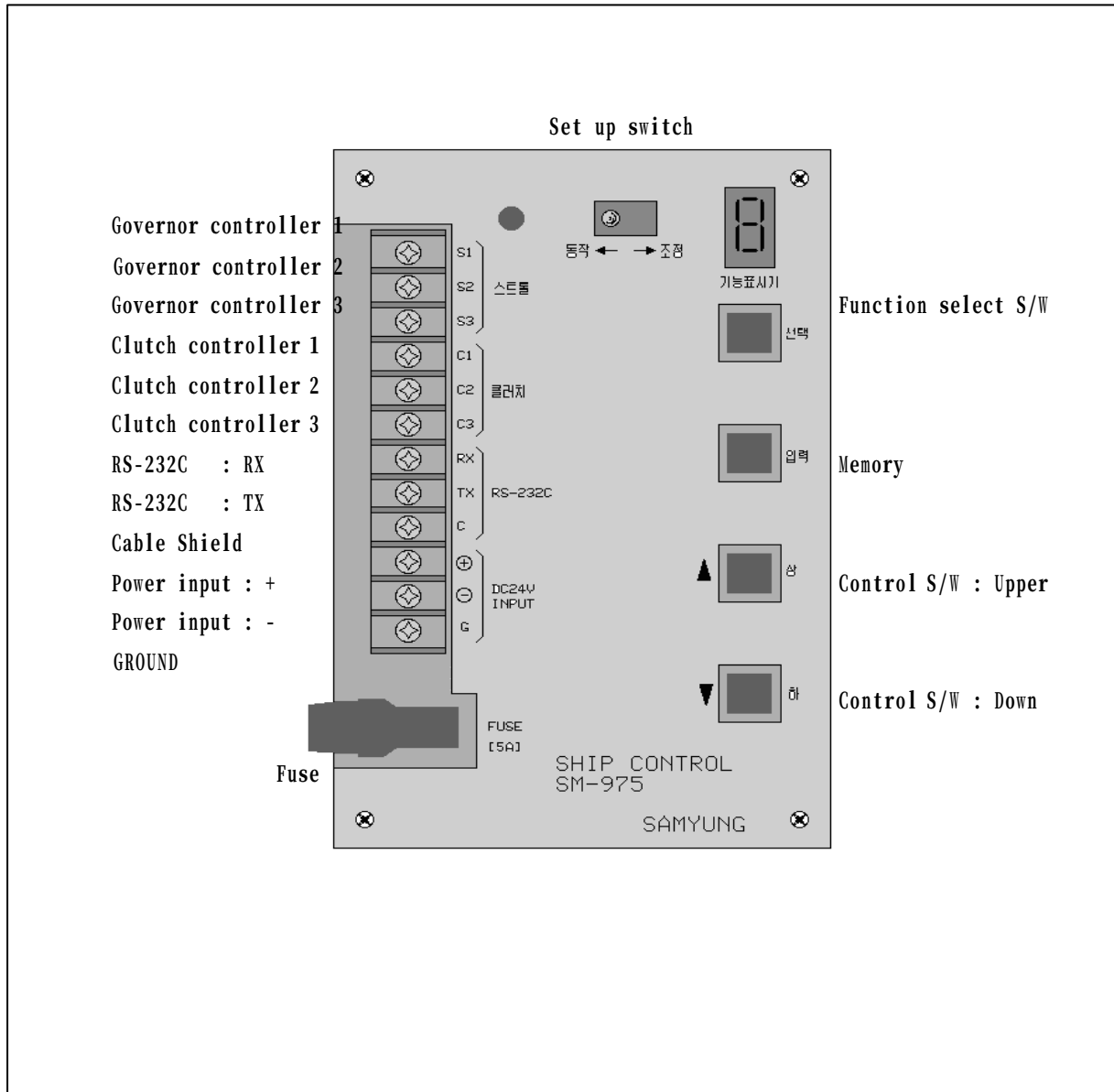
6. Electric wiring diagram (in case of using electronic lever only.)

1. Single installation of electronic lever follows as the below picture.
2. In case of single installation of electronic lever , no need to use the cable related to auto steering controller among cables for remote control.



<Fig 2-8>

7 Junction terminal for electric wiring



<Fig 2-9>

8. Suggestions for initial power inputting

1) Please check the below terms for initial power inputting.

[1] Check whether the control cable is installed properly or not.

[2] Check whether the voltage of battery is 24v (rated voltage) or not.

[3] Check whether the engine is being off or not.

[4] Check whether the clutch of manual lever is set as neutral and governor of manual lever is set as minimum speed or not.

[5] Check whether the clutch and governor location of remote control is same as manual lever's clutch and governor location

[6] Check whether the governor controller's lock of manual lever is unlocked and ,if not, unlock it.

[7] Don't turn on the engine starter after power on.

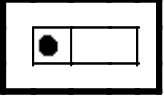
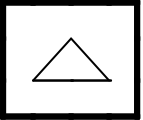
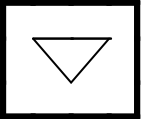
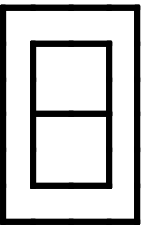
It can make a rapid change of voltage and cause improper operation.

[8] Once the unit is powered on , it will work normally after an instant buzzing. but if the clutch and governor location of remote control is different from manual lever's clutch and governor location , the buzz will going on and remote control won't work until the clutch and governor location of remote control and manual lever become same.

[9] Do the initial setting after checking all the installed devices through watching and hearing the devices

CHAPTER 3. THE INITIAL SET AFTER INSTALLATION

1. Controller for initial set (instruction and function set)

 작동 설정 ← →	Operation/Set:As the initial set switch is used for wiring operation. after completing all installation, set switch to [set]position and control clutchlever, ganvanalever ,clutch sensitivity , gavana sensitivity. After initial set, you should set [operation]position.You should power on with [switch] position, it will operate as set condition.	
 상	The upper : When the initial set is operated, lever and sensitivity controller are as follows. 1.As numbers of FND indicator are one of 1,2,3,4,5,6 it is moved to pulled fushcable while this switch is pressed. 2.As FND indicator number is 7, gavana sensitivity is increased. 3.AS FND indicator number is 8, clutch sensitivity is increased..	
 하	The low : When the initial set is operated, lever and sensitivity controller are as follows. 1.As numbers of FND indicator are one of 1,2,3,4,5,6 it is moved to pulled fushcable while this switch is pressed. 2.As FND indicator number is 7, gavana sensitivity is increased. 3.AS FND indicator number is 8, clutch sensitivity is increased	
선택	Choice : As the initial set is operated, chosen switch is displayed on FND, whenever putting button, 1~8numbers are displayed in order.	
입력	Input : This switch is to memory set value at each set item when the initial set is operated. It is described that the moment of pressed control condition is stored and operates as stored condition at normal operation.	
 기능표시기	FND : As the initial set is operated, chosen item is displayed 1~9each number set item is as follows.	
	0 : Normal operation. <table> <tr> <td data-bbox="384 1509 900 1895"> Instruction Set (Set + Power on) 1.Gavana full speed set 2.Gavana slow speed set 3.Clutch ahead position set 4.Neutral position set before clutch 5.Clutch astern position set 6.Neutral position set after set 7.Gnvana sensitivity control 8.Clutch sensitivity control 9.Standard value set (On delivering, set value) </td><td data-bbox="900 1509 1414 1895"> Function Set (Set+Choice+0ower ON) 1. Gavana automatic scope set. </td></tr> </table>	Instruction Set (Set + Power on) 1.Gavana full speed set 2.Gavana slow speed set 3.Clutch ahead position set 4.Neutral position set before clutch 5.Clutch astern position set 6.Neutral position set after set 7.Gnvana sensitivity control 8.Clutch sensitivity control 9.Standard value set (On delivering, set value)
Instruction Set (Set + Power on) 1.Gavana full speed set 2.Gavana slow speed set 3.Clutch ahead position set 4.Neutral position set before clutch 5.Clutch astern position set 6.Neutral position set after set 7.Gnvana sensitivity control 8.Clutch sensitivity control 9.Standard value set (On delivering, set value)	Function Set (Set+Choice+0ower ON) 1. Gavana automatic scope set.	

2. Operation Set (Set+Power ON)

1) With ship's engine is off, check all electric wire, poterble transmitters wire and fushble cable locking condition, set operation/set switch [set]position.

2) Main power supply switch (install outside of unit) ON , supplies power.

Attn 1: As lover position is set to control lever with press switch, pay attention to not go over top and bottom control scope.

Attn 2: As all control is completed, notice Operation position.

Attn 3: After the initial set, follow normal action and be sure to check that engine-off after all action test.

3)Gavana Full position speed set.

[1] Check if operation/set switch is [set].

[2] Press choice switch to set 1 on indicator

[3] Set Gavana controller of remote controller to set [FULL] position.

[4] Press ▲ switch or ▼ switch to control Gavanalever of Control lever(manual controller) to be [FULL]speed position.

[5] Press Input switch

[6] In case of not the initial set, set operation/set switch to [operation].

Indicator would be displayed 0 at normal operation.

Attn. : Notice if fushble cable is too tightly pulled.

4) Gavana slow speed position set.

[1] Check if operation/set switch is set [set].

[2] Press choice switch to set 2 on indicator

[3] Set Gavana controller of remote controller to set [SLOW] position.

[4] Press ▲ switch or ▼ switch to control Gavanalever of Control lever(manual controller) to be [SLOW]speed position.

[5] Press Input switch

[6] In case of not the initial set, set operation/set switch to [operation]. Indicator would be displayed 0 at normal operation.

Attn. : Notice if fushble cable is too tightly pulled.

5) Clutch AHEAD position set.

[1] Check if operation/set switch is set [set].

[2] Press choice switch to set 3 on indicator

[3] Set Gavana controller of remote controller to set [AHEAD] position.

[4] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to be [AHEAD]position.

[5] Press Input switch

[6] In case of not the initial set, set operation/set switch to [operation].

Indicator would be displayed 0 at normal operation.

Attn. : Notice if fushble cable is too tightly pulled.

6) Clutch ahead neutral position set.

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 4 on indicator.

[3] Set clutch controller of remote controller to [N]position.

[4] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to

be [ASTERN]speed position.

[5] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to be [N]speed position.

[6] Press Input switch

[7] In case of not the initial set, set operation/set switch to [operation].

Indicator would be displayed 0 at normal operation.

Ref : According to ships condition (caused by backlash), it is distinguished control condition between ASTERN to NEUTRAL and AHEAD to NEUTRAL, then set separately AHEAD NEUTRAL or ASTERN NEUTRAL.

7) Clutch ASTERN position set.

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 5 on indicator.

[3] Set clutch controller of remote controller to [ASTERN]position.

[4] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to be [ASTERN]speed position.

[5] Press Input switch

[6] In case of not the initial set, set operation/set switch to [operation].

Indicator would be displayed 0 at normal operation.

Attn: Notice if fushble cable is too tightly pulled.

8) Clutch ASTERN NEUTRAL position set.

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 6 on indicator.

[3] Set clutch controller of remote controller to [N]position.

[4] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to be [ASTERN]speed position.

[5] Press ▲ switch or ▼ switch to control Clutchlever of Control lever(manual controller) to be [N]speed position.

[6]Press Input switch

[7] In case of not the initial set, set operation/set switch to [operation].

Indicator would be displayed 0 at normal operation.

Ref : According to ships condition (caused by backlash), it is distinguished control condition between ASTERN to NEUTRAL and AHEAD to NEUTRAL, then set separately AHEAD NEUTRAL or ASTERN NEUTRAL.

9) Gavana sensitivity set.

Attn : Gavana sensitivity control is required to following process such as, [1 Gavana FULL position set],[2 Gavana SLOW position set], [3 Clutch AHEAD position set],[4 Clutch AHEAD N position set], [5 Clutch ASTERN position set], [6, Clutch ASTERN N position set] ,then set [sensitivity set].

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 6 on indicator.

[3] Sensitivity control by ▲ switch (increase sensitivity, indicator number is increased) or ▼ switch (decrease sensitivity, indicator number is decreased). This is the best suited set on delivery , then other control doesn't need but in case of necessary, the following order is controlled. (sensitivity control is feasible 1 to 5)

A. At normal movement gavana controller of remote controller is in no motion, gavanalever is coming and going to decrease sensitivity.

B. The more gavana controller of remote controller move a lot the more gavanalever move. If it is less move and gavanalever is no movement, set sensitivity high.

[4] Above [3]item control is over, press Input switch.

[5] In case of not the initial set, set operation/set switch to [operation] Indicator would be displayed 0 at normal operation.

10) Clutch sensitivity set.

Attn : Clutch sensitivity control is required to following process such as, [1 Gavana FULL position set],[2 Gavana SLOW position set], [3 Clutch AHEAD position set],[4 Clutch AHEAD N position set], [5 Clutch ASTERN position set], [6, Clutch ASTERN N position set] ,then set [sensitivity set].

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 6 on indicator.

[3] Sensitivity control by ▲ switch (increase sensitivity, indicator number is increased) or ▼switch (decrease sensitivity, indicator number is decreased). This is the best suited set on delivery , then other control doesn't need but in case of necessary, the following order is controlled. (sensitivity control is feasible 1 to 5)

A. At normal movement clutch controller of remote controller is in no motion, clutchlever is coming and going to decrease sensitivity.

B. The more clutch controller of remote controller move a lot the more clutchlever move. If it is less move and clutchlever is no movement, set sensitivity high.

[4] Above [3]item control is over, press Input switch.

[5] In case of not the initial set, set operation/set switch to [operation]. Indicator would be displayed 0 at normal operation.

11) Standard value set (initialize set value on delivery)

Attn : Notice all item which is set by user is deleted and initializes as set value on delivery.

[1] Check if operation/set switch is [set]mode.

[2] Press choice switch to set 6 on indicator.

[3] Press Input switch.

[4] In case of not the initial set, set operation/set switch to [operation], then indicator would be displayed 0 at normal operation.

3. Function Set (set+choice+power ON)

1) With ship's engine is off, check all electric wire, poterble transmitters wire and fushble cable locking condition, set operation/set switch [set]position.

2) With pressed choice switch, switch on power supply switch(install outside of unit) and supply power.

3) Release a hand on pressed choice switch.

Attn : As all control is completed, make sure that return to [operation] position.

4) Gavana auto scope set.

Auto scope means gavana position is set high and engine is high revolving. If turn clutch controller, gavana would be slow and clutchlever is auto-operated at the same level of controller which means to protect engine and clutch.

[1] Press choice switch to set 1 on indicator.

[2] Press ▲ switch or ▼ switch to control gavanalever of Control lever(manual controller) to be position where could control clutch (engine revolving speed)

[3] Press Input switch

[4] In case of not the initial set, set operation/set switch to [operation]. After power off, switch on after 5 seconds. It would be back to normal operation.

Attn : As setting with engine start-off, test auto scope by manual lever before set, control balance with revolving speed of engine.

4. Operation and Function Set Standard Value.

Standard value on delivery is as follows,

<Operation Set Initial value>

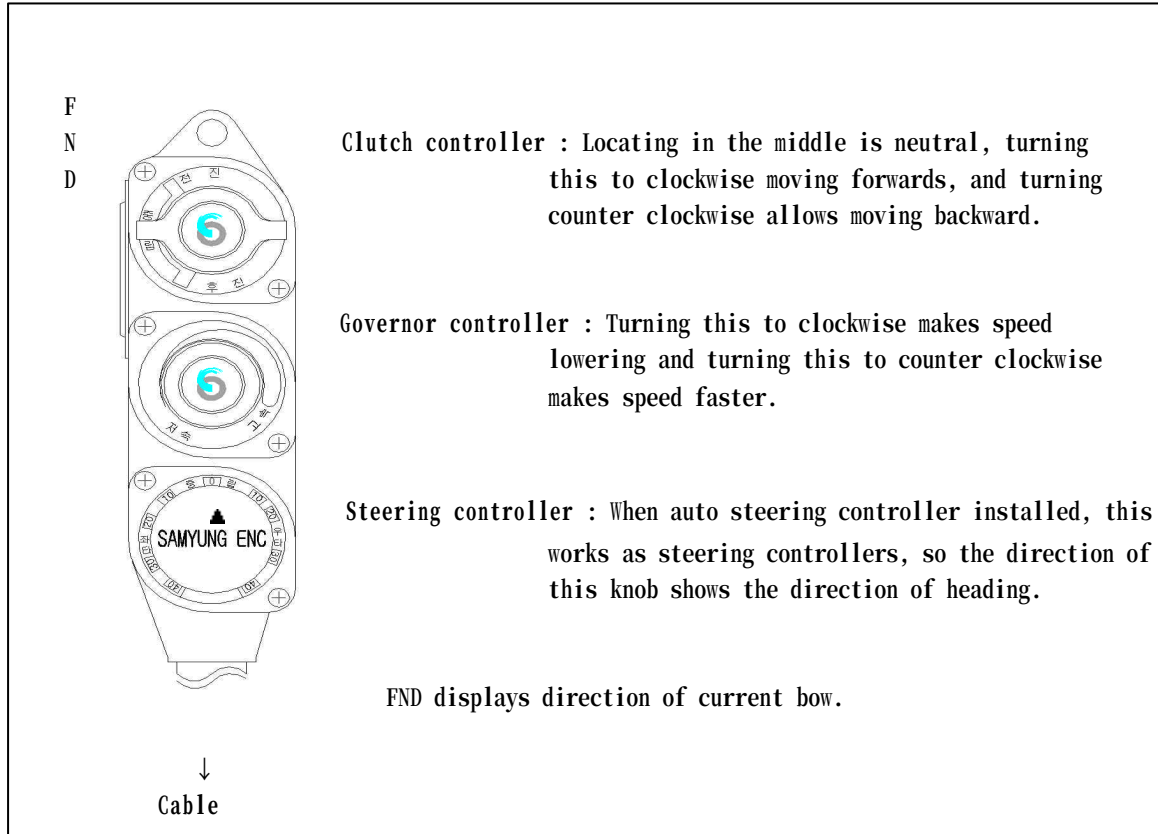
- | | |
|-----------------------------------|--|
| 1. Gavana full speed position | - pull cable to position lever 45 ° |
| 2. Gavana low speed position | - push cable to position lever 45 ° |
| 3. Clutch ahead position | - pull cable to position lever 45 ° |
| 4. Clutch ahead neutral position | - pull on the center of cable to position 45 ° |
| 5. Clutch astern position | - push cable to positio 45 ° |
| 6. Clutch astern neutral position | - push on the center of cable to position 45 ° |
| 7. Cavana sensitivity | - 3 |
| 8. Clutch sensitivity | - 3 |

<Function Set Initial Value>

- | | |
|----------------------|--------|
| 1. Gavana Auto Scope | - 10 % |
|----------------------|--------|

CHAPTER 4. INSTRUCTION

1. Remote Controller Function



<Fig 4-1. RC-30 Remote controller>

2. Control instruction of remote controller (Instruction)

To remote control engine, first after install it, complete the initial set and function set, the following step should be taken.

- 1) Check if clutch of remote and position of gavana are same level of manual lever.
- 2) Check if lock device on gavana lever of manual lever is released.
(If lock device is fastened, it will cause trouble of electric lever.)
- 3) Switch on power switch of electric lever (separate installed switch).
- 4) If Buzzing is for 2 seconds and stop, that is normal. Control engine as clutch and gavana controller by means of remote controller use.
- 5) If buzzing is activating constantly above 4 item, check if manual lever and remote controller position are same level. Buzzer would be stepped and operated normally.

6) Clutch controller is operating regardless of revolving speed. Gavana controller should be handled slowly due to controller revolving speed affect engine revolving speed.

Attn 1: After checking engine revolving speed(auto check), control clutch. If it is more than 10% at low speed, set engine revolving speed to low speed. After 2 seconds, set clutch setting condition.

If clutch is AHEAD or ASTERN but NEUTRAL, after that set clutch approximately after 1 second, set engine revolving speed automatically at same level of gavana control position of remote control. Approximately, as 10% (Gavana slow speed to full speed one-hundredth percentage) is increased at 1 second, full revolving speed is increased at 5 seconds.

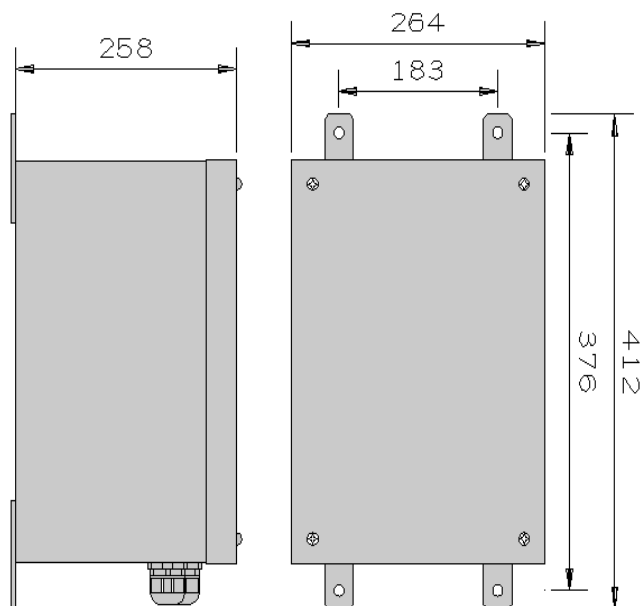
However, if you turn gavana controller in auto accelerated, it will set current controller position.

Attn 2: As using manual control on remote control, power off ,then manual control by manual lever is available.

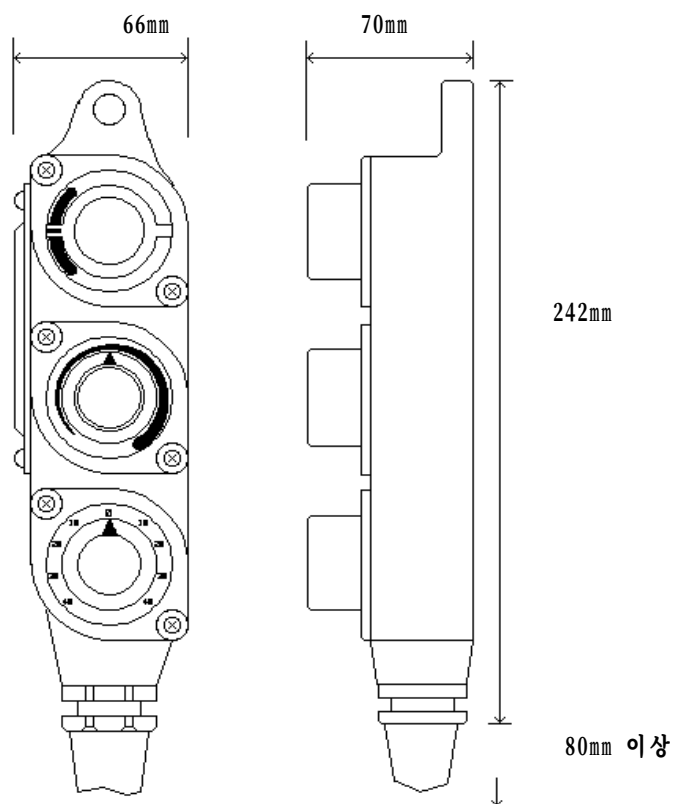
Attn 3: Power on, compare and check between remote control, gavana control position and manual clutch, gavana lover position (auto check). If that is differently positioned, buzzer would be ringing. Remote doesn't control in the time of ringing and only geared by manual lever. (Buzzer would be stopped if it is united and controlled by remote control)

CHAPTER 5. DRAWING - SM-975 -

1. ELECTRIC LEVER SHAPE

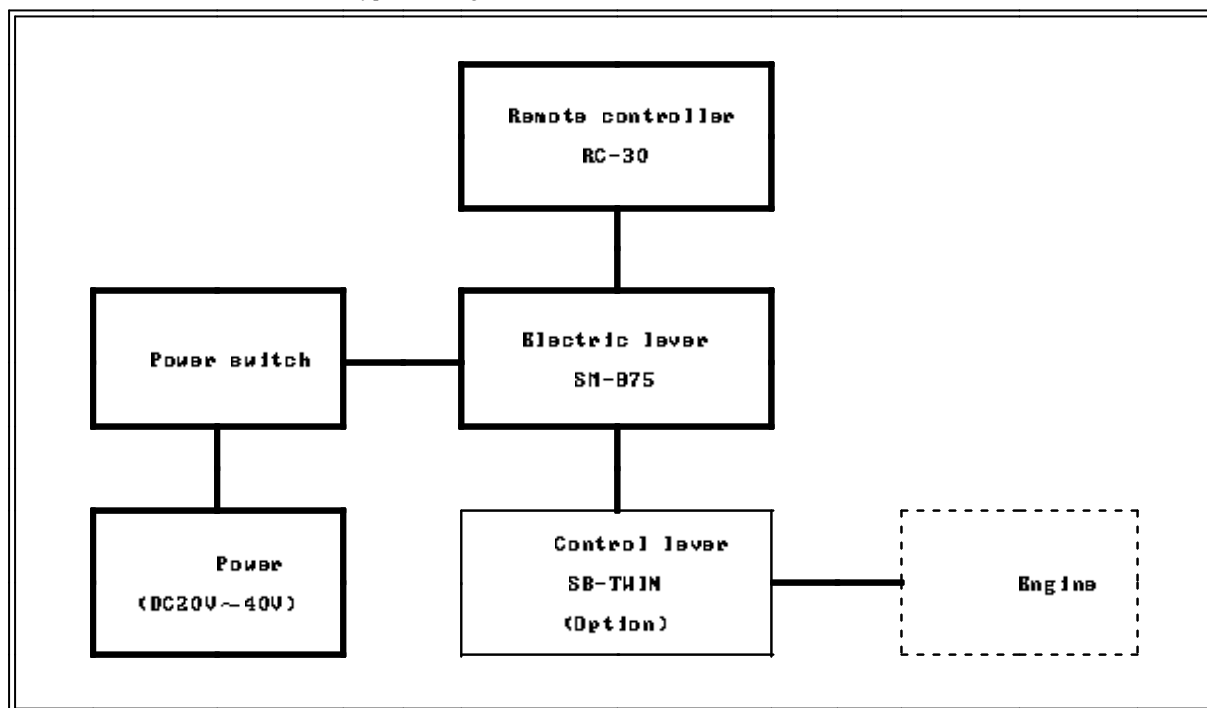


2. REMOTE CONTROLLER SHAPE

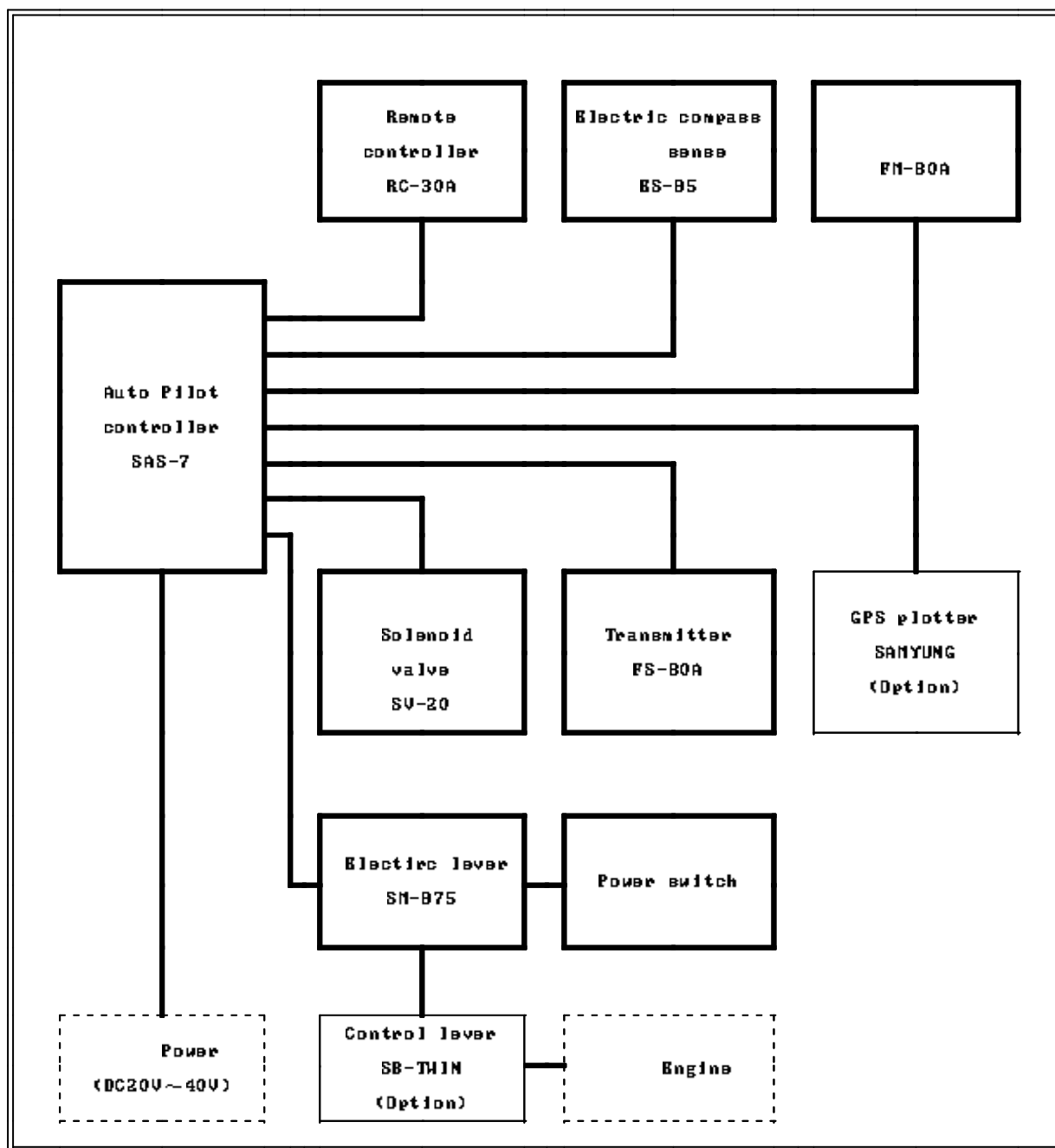


3. SYSTEM CONFIGURATION

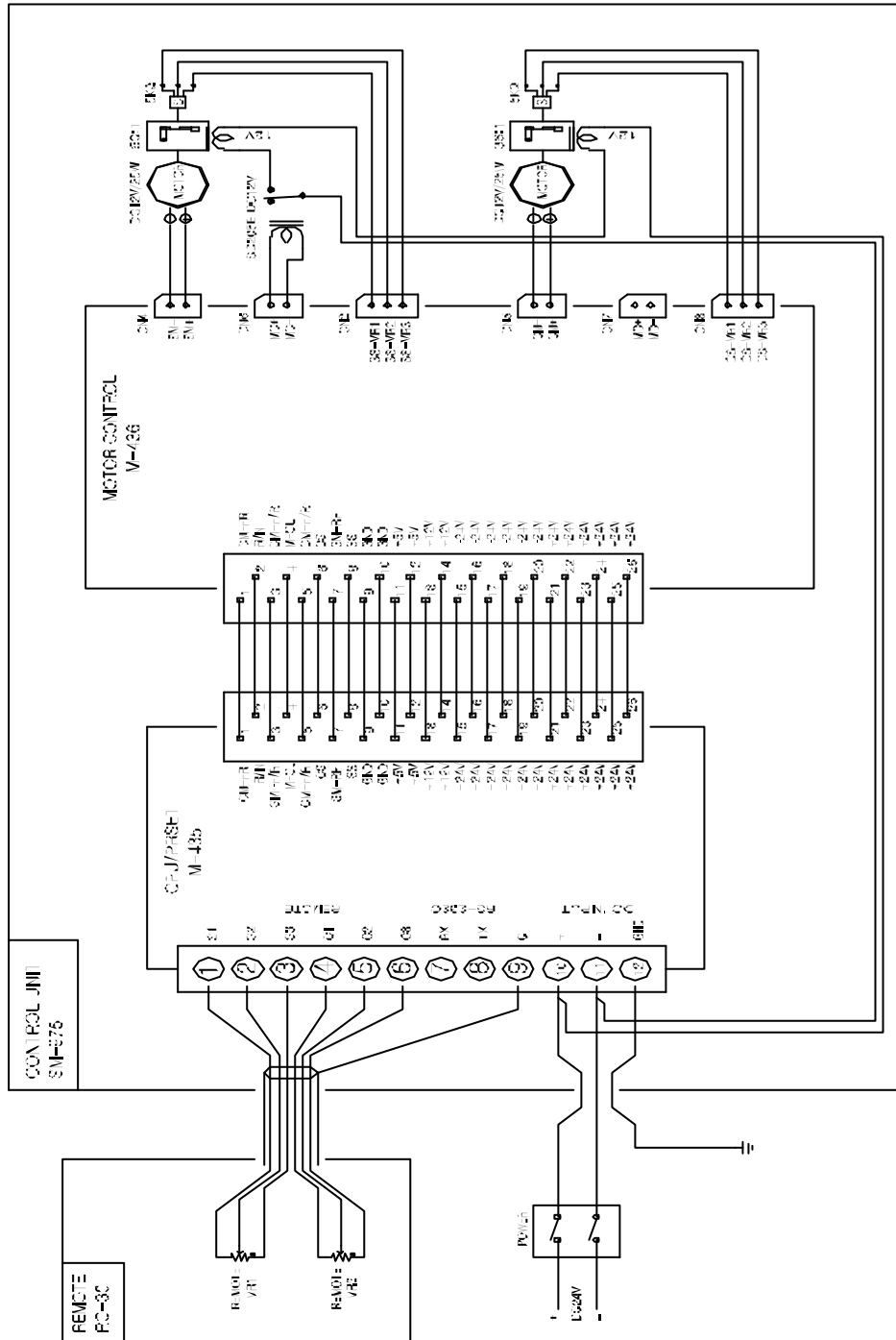
Electric lever stand-alone type configuration (SM-975)



Auto steering and Electric lever (SAS-7+975)

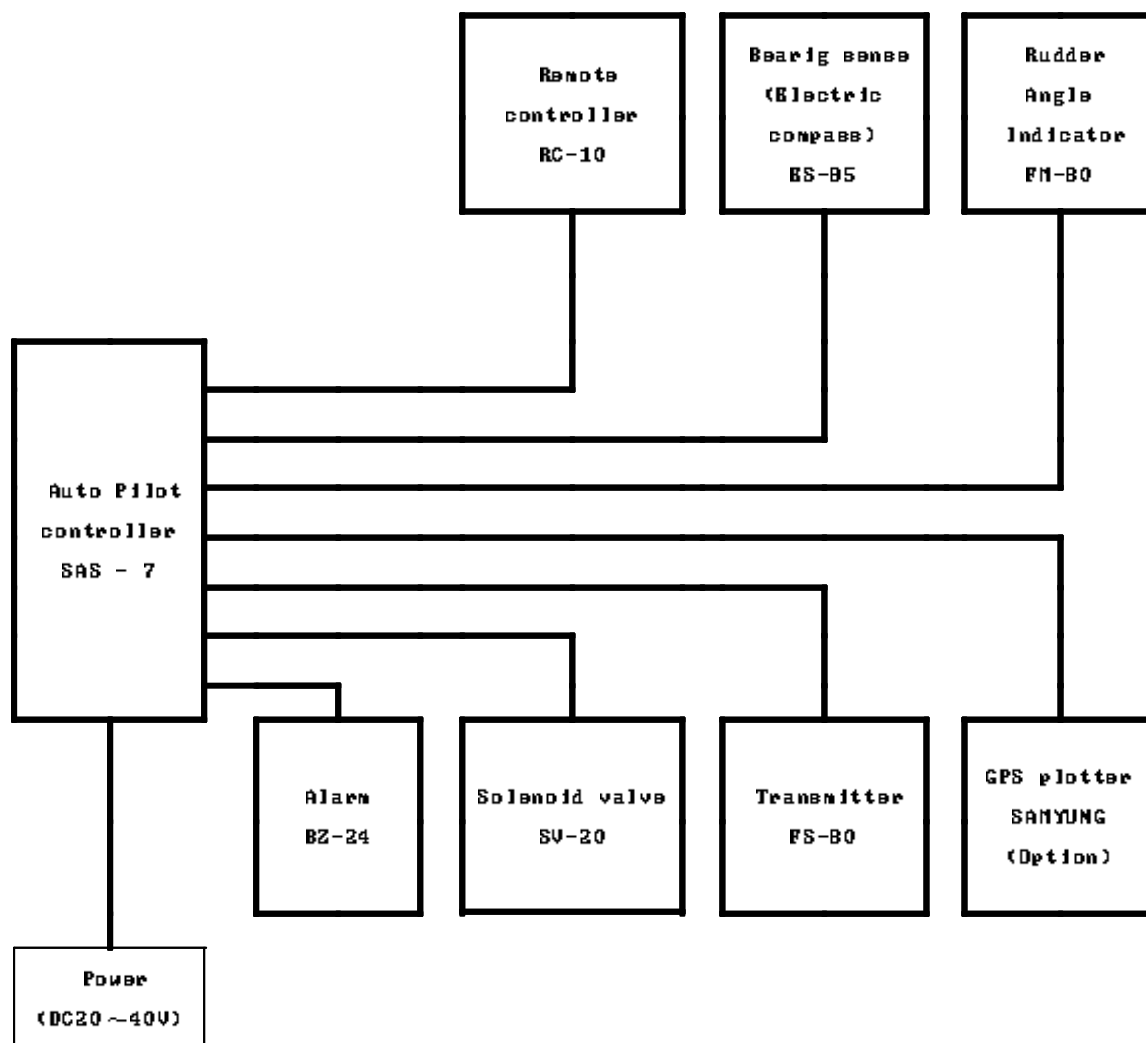


4. ELECTRIC LEVER WIRE CONNECTION DIAGRAM

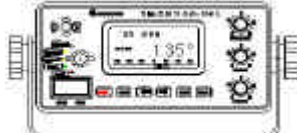


CHAPTER 6. DRAWING - SAS-7 -

1. System configuration



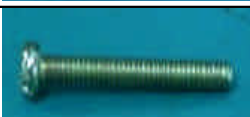
CHAPTER 7. SAS-7 COMPONENT LIST

SAS-7 (1/2)							
NO.	Name of product	Shape	Spec.		Q	Check	Ref.
1	Auto pilot controller		SAS-7		1 EA		
			CODE NO.	SM-5000			
2	Remote controller (Included cable)		RC-10A		1 SET		4M or 12M (12P Shield)
			CODE NO.	SM-5001			
3	Rudder Angle Indicator (Included cable)		FM-80A		1 SET		5M (0.5mm ² X 4C Shield)
			CODE NO.	SM-5002			
4	Electric Compass (Included cable)		ES-95		1 SET		10M (6P Shield)
			CODE NO.	SM-5003			
5	Solenoid,Valve, Fix volt, Nut, Spring Yasa,Yasa (Included cable)		SV-20		1 EA		6 X 30mm 4 SET
			CODE NO.	SM-5004			
6	Transmitter (Included cable)		FS-80A		1 SET		12M (1.25mm ² X 3C Shield)
			CODE NO.	SM-5005			
7	Transmitter Connect Device				1 SET		
			CODE NO.	SM-5006			
8	Transmitter board, Fix volt, Nut, Spring Yasa, Yasa		Ø X 30mm		4 SET		
			CODE NO.	SM-5007			
9	Solenoid Valve Connect Cable		8M (1.25mm ² X 3C)		1 SET		
			CODE NO.	SM-5008			
10	Power Connect Cable		5M (2.0mm ² X 2C)		1 SET		
			CODE NO.	SM-5010			
11	Ground Cable		3M (KIV 5.5mm ²)		1 SET		
12	Rudder Angle Indicator Fix volt		Ø X 30mm		45 EA		
13	FUSE		3A (20mm)		2 EA		

SAS-7 (2/2)

NO.	Name of product	Shape	Spec.	Q	Check	Ref.
14	Fuse		10A (20mm)	2 EA		
			CODE NO. SM-5014			
15	PVC Band		DACT-300	30 EA		300mm
			CODE NO. SM-5015			
16	Interface line		6M (computer 2P shield)	1 EA		
			CODE NO. SM-5016			
17	Brake Switch		30A	1 EA		
			CODE NO. SM-5017			
18	Brake Switch Fix Volt		Ø X 30mm	2 EA		
			CODE NO. SM-5018			
19	Saddle		4N, 5N, 6N	10 EA		
			CODE NO. SM-5019			
20	Hydro Hose 1/2 X 1W		1.5M	3 EA		
			CODE NO. SM-5020			
21	Hydro Hose 1/2 X 1W		1M	1 EA		
			CODE NO. SM-5021			
22	Hydro Hose 1/2 X 1W		0.6M	4 EA		
			CODE NO. SM-5022			
23	Forged Screw Tie		1/2	3 EA		
			CODE NO. SM-5023			
24	Steel Nipple		1/2	4 EA		
			CODE NO. SM-5024			
25	Hose Connect Nipple		1/2	3 EA		
			CODE NO. SM-5025			
26	Steel Nipple (elbow type)		1/2	3 EA		
			CODE NO. SM-5026			
27	Relif Valve		BT-04-H	1 EA		
			CODE NO. SM-5027			
28	SAS-7 Manual			1 Vol		
			CODE NO. SM-5028			

CHAPTER 8. SAS-7 OPTION (SM-975 ADDITION COMPONENT LIST)

SM-975 (1/1)							
NO.	Name of product	Shape	Spec.		Q	Check	Ref.
1	Electric Lever		SM-975		1 EA		
			CODE NO.	SM-5029			
2	Three Wheel Remoter		RC-30		1 EA		
			CODE NO.	SM-5030			
3	Control Cable		2.4m or 3m		1 EA		
			CODE NO.	SM-5031			
4	Electric Lever Installation part						
			CODE NO.				
4-1	Stain Fix volt		5 X 20		5 EA		
			CODE NO.	SM-5032			
4-2	Fuse		5A (20mm)		2 EA		
			CODE NO.	SM-5033			
4-3	Fushble Cable Terminal				2 EA		
			CODE NO.	SM-5034			
4-4	Fushble Cable Terminal Pin				2 EA		
			CODE NO.	SM-5035			
4-5	Fushble Calbe Band				2 EA		
			CODE NO.	SM-5036			
4-6	Fushble Cable Band Support				2 EA		
			CODE NO.	SM-5037			
4-7	Stain Fix volt		4 X 30		2 EA		
			CODE NO.	SM-5038			
4-8	Volt		5 X 10		4 EA		
			CODE NO.	SM-5039			
4-9	Brake Switch		15A		1 EA		
			CODE NO.	SM-5040			
4-10	Caution sticker				1 EA		
			CODE NO.	SM-5041			