

S-JOY

Steering Joystick Controller

ADDITIONAL INSTRUCTION MANUAL

PT900 AUTOPILOT

TCS model Category C

JMR-7200/9200 RADAR

JAN-7201/9201 ECDIS



Japan Radio Co., Ltd.

Preface

In this manual, explains about S-JOY operation connected to ECDIS (Electronic Chart Display and Information System) and RADAR.

This system is composed by JAN-7201/9201 ECDIS, JMR-7200/9200 RADAR, YOKOGAWA Autopilot and S-JOY.

As to the ECDIS operation, refer to the Instruction Manual for ECDIS.

As to the RADAR operation, refer to the Instruction Manual for RADAR.

As to the Autopilot (PT900) operation, refer to the Instruction Manual for Autopilot.

- For the best operation and performance results, read this manual thoroughly before use.
- Keep this manual in a convenient place for future reference.
Make use of this manual when experiencing operation difficulties.
- The information in this manual is subject to change without notice at any time.

Classification of Automatic Sailing

Major Category	Category	Alias	Contents	S-JOY Operation
TCS	Category-A	—	Track control for a single straight route or plural routes containing no turning	Not conform
	Category-B	Assist Turn	Track control for plural routes (except when turning) ■ Turning by operator's pressing the buttons (Assist Turn) ■ Specified turn radius control when turning	Not conform
	Category-C	Full Automatic	Track control for plural routes ■ Automatic turning (Full Automatic) ■ Track deviation correction when turning	Conform
Conventional JRC's Automatic Sailing Control System	—	—	—	Not conform

● Before Operation ●

Pictorial Indication

Various pictorial indications are included in this manual and are shown on these equipment so that you can operate them safely and correctly and prevent any danger to you and / or to other persons and any damage to your property during operation.

Such indications and their meanings are as follows.

Please understand them before you read this manual:



This indication is shown where any person is supposed to be in danger of being killed or seriously injured if this indication is neglected and these equipment are not operated correctly.



This indication is shown where any person is supposed to be injured or any property damage is supposed to occur if this indication is neglected and these equipment are not operated correctly.

Examples of pictorial indication



Electric shock

The △ mark represents CAUTION (including DANGER and WARNING). Detailed contents of CAUTION ("Electric Shock" in the example on the left.) are shown in the mark.



Disassembling prohibited

The ⊘ mark represents prohibition.

Detailed contents of the prohibited action ("Disassembling Prohibited" in Disassembling the example on the left) are shown in the mark.



Disconnect the power plug

The ● mark represents instruction.

Detailed contents of the instruction ("Disconnect the power plug" in the example on the left) is shown in the mark.

Precaution Upon Equipment Operation

WARNING



Do not attempt to disassemble or tamper with this equipment. Otherwise, a fire, an electric shock, or a malfunction may occur.



Do not place a glass or cup containing water, etc., or a small metal object on this equipment. If water or such object gets inside, a fire, an electrical shock, or a malfunction may occur.



In case water or a metal object gets inside the equipment, turn off the power immediately, unplug the power supply cable from an electric outlet, and contact our head office, or a nearby branch or local office to request servicing. Keeping the equipment in operation under such condition may cause a fire, an electric shock or a malfunction.



In case you find smoke, strange smell or unusual heat coming from the equipment, turn off the power immediately, unplug the power supply cable from an electric outlet, and contact our head office, or a nearby branch or local office to request servicing. Keeping the equipment in operation under such condition may cause a fire or an electric shock.

CAUTION



When an abnormality occurred in S-JOY, switch to AUTO, HAND, FU, or NFU steering and stop the S-JOY operation.



In danger of collision, perform “override” to avoid the collision.
When override function is executed, S-JOY automatically becomes standby and does not accept operation.



Do not neglect the confirmation of the own ship's position and bearing during sailing.



Do not set the set radius small beyond necessity in RADIUS mode or PLANNED TURN mode.



In RUDDER mode, a cautionary popup window is displayed for directly controlling steering from Joystick.
Since it is dangerous if rudder is kept turn, change to MIDSHIP or other mode after finishing to turn.



If power is applied to Joystick beyond necessity, It may break.
Do not apply power to Joystick beyond necessity.



Do not operate accidentally by the shake of a ship at stormy weather.



When mode change is carried out operating Joystick, it may become the cause of an operation mistake.
Do not operate it simultaneously.



To navigate in Autopilot, perform the take-over operation in the unit and use the applicable steering device.

CAUTION



When deflection is in the position data between two GPS and changing GPS, position shift error might occur and bearing might be changed a lot. When switching GPS, initially switch the steering mode selection switch to HAND and switch the GPS.



When Gyro is switched while there is a significant difference in ship's headings between two Gyros, the ship's heading may be changed significantly. When switching Gyro, initially switch the steering mode to Manual and then switch the Gyro.



When bow turns to down of screen in North-UP or True motion mode, Joystick operation may be accidentally steered to right-and-left contrary. Operate Joystick on the basis of bow.



To start Planned Turn mode, the start operation is necessary by [OK/START] button. If [OK/START] button is not pressed, bearing is kept. Do not keep carried out in the state.



Enforce the check before commencement of S-JOY before departure for safe voyage. Refer to Chapter 5 about test before working.



When the S-JOY OP UNIT (operation unit) becomes unnecessarily hot, switch the steering mode of Autopilot to AUTO, HAND, FU, or NFU steering and stop the S-JOY operation immediately.



When S-JOY is abnormal such as no-response, cancel use promptly and follow the "trouble shooting" of Chapter 6.



When there is no functional S-JOY OP Unit (operation unit) due to the failure in the S-JOY OP UNIT (operation unit), switch the steering mode of Autopilot to Manual mode and stop the S-JOY operation immediately.



When the power supply for the auto steering unit in Autopilot is disconnected or is restarted for some reason, switch the steering mode selection switch to the Manual mode.



When set heading is abnormal in track mode, cancel Track mode, change to other modes and navigate.

CAUTION



Do not touch the equipment with hands or gloves wet with water.
Otherwise, an electric shock or a malfunction may occur.



Do not close the air inlet of this equipment.
Otherwise, It may be filled with heat, and a fire or a malfunction may occur.

Glossary

1.1 Definition

ACT RAD	Actual Radius
HEADING mode	The mode controlled heading based on setting heading
Leg	Line between two waypoints defining the track
Next-waypoint	The waypoint following the TO-waypoint.
RADIUS mode	The mode controlled based on a setting direction and a setting radius
Reach	Reach is the distance that the ship keeps going straight during the time lag between steering the rudder and the ship's turning.
RUDDER mode	The mode controlled rudder directly by Joystick
PLANNED TURN mode	The mode controlled based on a setting direction and a setting radius The control is started by starting operation.
Set HDG	Setting Heading
Set RAD	Setting Radius
Temporary track	A track that originates at the current position of the ship and joins the pre-planned track.
TO-waypoint	The waypoint which the ship is approaching.
Track control	Control of the ship's movement along a track, where corrections made by the controller to compensate for wind, drift and other influences, are based on the cross track error and not only on the bearing to the destination waypoint (TO-waypoint).
TRACK mode	Navigation Mode by Track control

1.2 Abbreviations

ACC	Actual Course change
ECC	Early course change
ETA	Estimated time of arrival
HDG	Heading
ROT	Rate of turn
S-JOY	Steering Joystick
S-JOY OP	Steering Joystick Operation unit
S-JOY I/O	Steering Joystick I/O unit
TTG	Time to go
TCS	Track control system
WOL	Wheel-over line

Revision History

Rev	Description	Date
First	The contents of this Instruction Manual are applicable to the following PT900 Autopilot software versions or later versions. -AP CDU(CDU): V8225HV_A21 -AP CDU(MPU:ADAPT): V8225HY_A14 -NAV I/F: V8225FU_A28	Feb. 2016
Ed.2	Following items are revised. - Changed contents of S-JOY dialog (Add or change to rudder angle) - Added Setting of waiting time for canceling TRACK ready in section 4.2.6. - Added Track ready state cancel popup in section 6. - Revised Simplified Operation Guide in section 8.	Apr. 2016
Ed.3	Following items are revised. - Added rudder limit change in section 4.2.2 HEADING mode. - Added calculation of Planned ROT and Turn Radius in section 4.2.6 TRACK mode. - Revised Simplified Operation Guide in section 8.	Jan. 2017
Ed4	Following items are revised. -Added Mode selector in section 4.1 -Added method of change-over to S-JOY from the mode selector in section 4.1.1 Change-over to S-joy. -Added method of change-over to Track control from ECDIS menu or S-JOY in section 4.1.2 Change-over to Track control and start of automatic sailing of section 4.4 Differences with the Automatic Sailing Additional Instruction Manual. - Added method of terminating track control from ECDIS or S-JOY in section 4.1.3 Terminating track control and Termination of automatic sailing of section 4.4 Differences with the Automatic Sailing Additional Instruction Manual. -Added Simplified Operation Guide with mode selector in section 8 Simplified Operation Guide.	Mar. 2019

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1 Outline

STEERING JOYSTICK CONTROLLER (abbreviation=S-JOY) is a remote control unit which changes the control mode and set course etc. of Autopilot with watching ECDIS or RADAR screen.

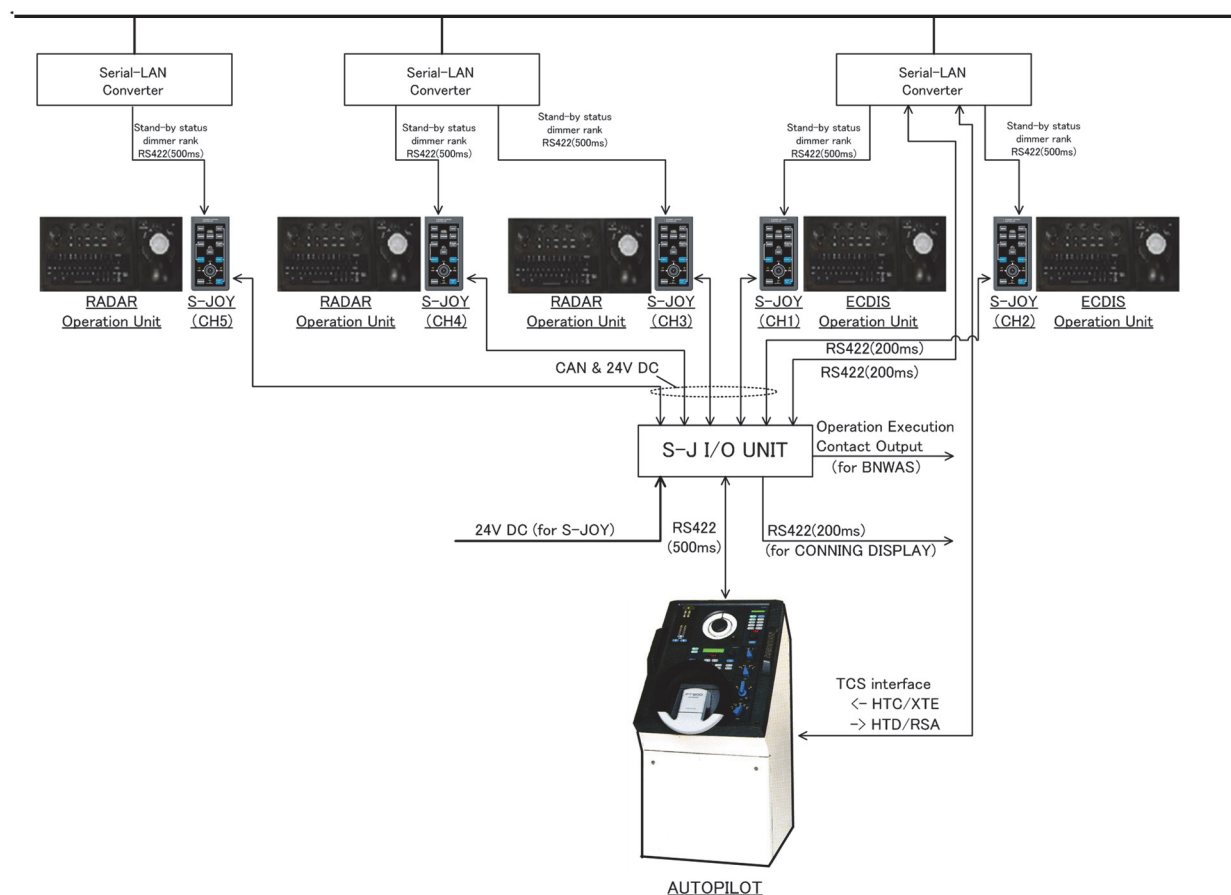
1.1 System configuration

S-JOY combines with provisional PT900 auto-pilot and ECDIS/RADAR (5 or less) and is composed

■ Equipment List of S-JOY

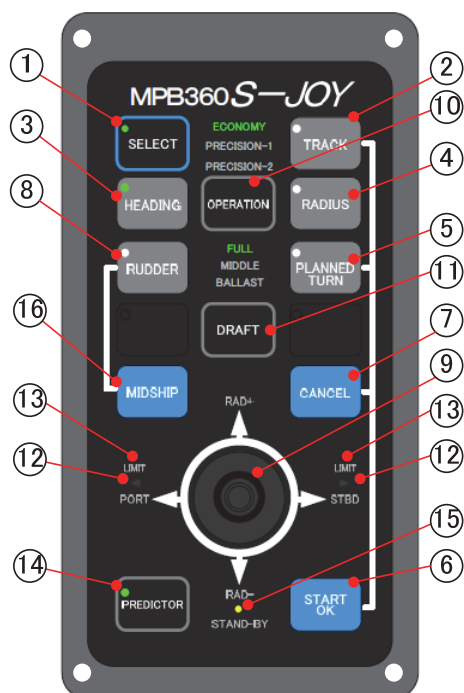
Equipment / Unit	Model	Manufacturer	Qty
Autopilot	PT900	YOKOGAWA	
S-JOY OP UNIT	MPB360		Max. 5 units
S-JOY I/O UNIT	MPN051		1
RADAR	JMR-7200/9200 RADAR Series	JRC	
ECDIS	JAN-7201/9201		

■ System Configuration Drawing

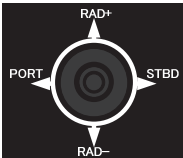


2 Individual Units and their Functions

2.1 S-JOY OP unit (MPB360)



No.	Key	Description	Remarks
①	SELECT 	When this button is pressed while the system selector is set to NO.1 or NO.2, the operation right is transferred to the applicable S-JOY OP UNIT. The LED (Green) on this key is lit in service.	
②	TRACK 	This key is used for transferring to track control. After pressing this key, the LED blinks. Track control is started after satisfaction of several conditions by pressing "START/OK" key in accordance with guidance of ECDIS.	This key is invalid in case of non-TCS specification.
③	HEADING 	This key is used for Heading control based on Set HDG information. When HEADING key is pressed, the present heading is read in autopilot as Set HDG. PD course alteration is performed when Set HDG is changed by Joystick.	
④	RADIUS 	This key is used for Radius control based on Set HDG and Set RAD information. When RADIUS key is pressed, the present heading is read in autopilot as Set HDG. Constant radius course alteration is performed when Set HDG and Set RAD are changed by Joystick.	
⑤	PLANNED TURN 	This key is used for Radius control based on s Set HDG and Set RAD information. When this key is pressed the previous control mode is continued*1 and the system readies to perform the planned turn. (LED on this key, "START/OK" and "CANCEL" keys are blinked at this moment.) To perform Constant radius course alteration, press "START/OK" key after setting of Set HDG and Set RAD by Joystick.	*1) When this key is pressed during RUDDER mode, the control mode will be changed to "HEADING" automatically. Refer to 4.2.3 [Reference]

No.	Key	Description	Remarks
⑥	START/OK 	This key is used for the following conditions. -When transferring to PLANNED TURN or TRACK mode -When the key is blinking according to dialog of ECDIS or RADAR.	
⑦	CANCEL 	This key is used for the following conditions. -To cancel the transferring to PLANNED TURN or TRACK mode. -When the key is blinking according to dialog of ECDIS or RADAR.	
⑧	RUDDER 	This key is used when controlling the rudder angle by Joystick directly. When the key is pressed, the rudder command is kept in present position. The rudder command is changed to the direction in 5 deg/s during operating the joystick to right or left side. When Joystick is returned to mid position, the rudder command is kept in present position.	
⑨	JOYSTICK 	It is used for setting of Set HDG, Rudder Limit, Set RAD, Set RUDDER and the selection of track entering point. -HEADING :Set HDG and Rudder Limit -RADIUS/PLANNED TURN: Set HDG and Set RADIUS -RUDDER :Set RUDDER -TRACK :Selection of track entering point	
⑩	OPERATION 	It is used for selection of Autopilot OPERATION mode The displayed operation mode changes as below every time this key is pressed. PRECISION-2→PRECISION-1→ECONOMY→PRECISION-2	In modes other than AUTO, CSR, or NAV, the display complies with the setting of the Autopilot unit.
⑪	DRAFT 	It is used for selection of Autopilot DRAFT mode The displayed draft mode changes as below every time this key is pressed. FULL → MIDDLE → BALLAST → FULL	
⑫	Steering direction indicator 	It indicates the direction that the rudder is moving. ◀:It is lit when the rudder is moving to PORT ▶:It is lit when the rudder is moving to STBD	
⑬	LIMIT indicator 	It is lit when Set RUDDER reaches the rudder limit.	
⑭	PREDICTOR 	This key is used for ON/OFF setting of the time label on the set course vector or Curved EBL.	
⑮	STAND-BY 	This LED is lit in the following condition. -When the connected ECDIS/RADAR is turned OFF. - A steering mode other than the AUTO mode, CSR mode, or NAV mode is selected. -When the failure occurs with the S-JOY OP UNIT. (Including communication failure between S-JOY I/O UNIT and S-JOY OP UNIT and between ECDIS/RADAR and S-JOY OP UNIT)	
⑯	MIDSHIP 	This key is used for MIDSHIP command in RUDDER mode. During RUDDER mode, this key blinks when the rudder angle is not in MIDSHIP and it lights when the rudder angle is in MIDSHIP (within +/- 1deg).	In Rudder mode, a cautionary popup window is displayed at switching.

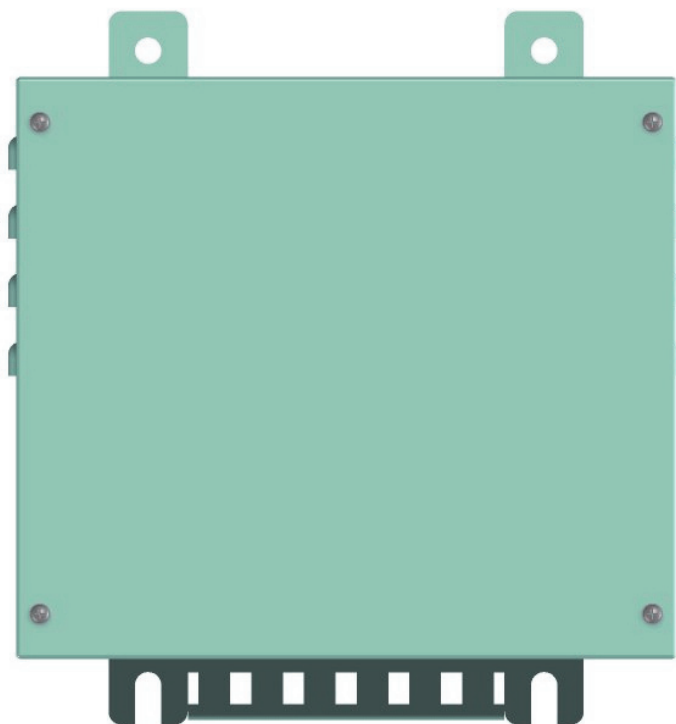
2.1.1 Dimmer setting for S-JOY OP UNIT

The dimmer of S-JOY OP UNIT is synchronously adjusted by ECDIS or RADAR as same as the operation unit of them.

Adjust the dimmer by using the  key of EDCIS or RADAR screen or the  key of ECDIS or the RADAR operation unit.

2.2 S-JOY I/O unit (MPN051)

This unit relays the control line between auto-pilot, ECDIS, RADAR, and each S-JOY OP UNIT and distributes the power supply to each S-JOY OP UNIT together with the control line.



Outline of S-JOY I/O UNIT

3. Start-Up

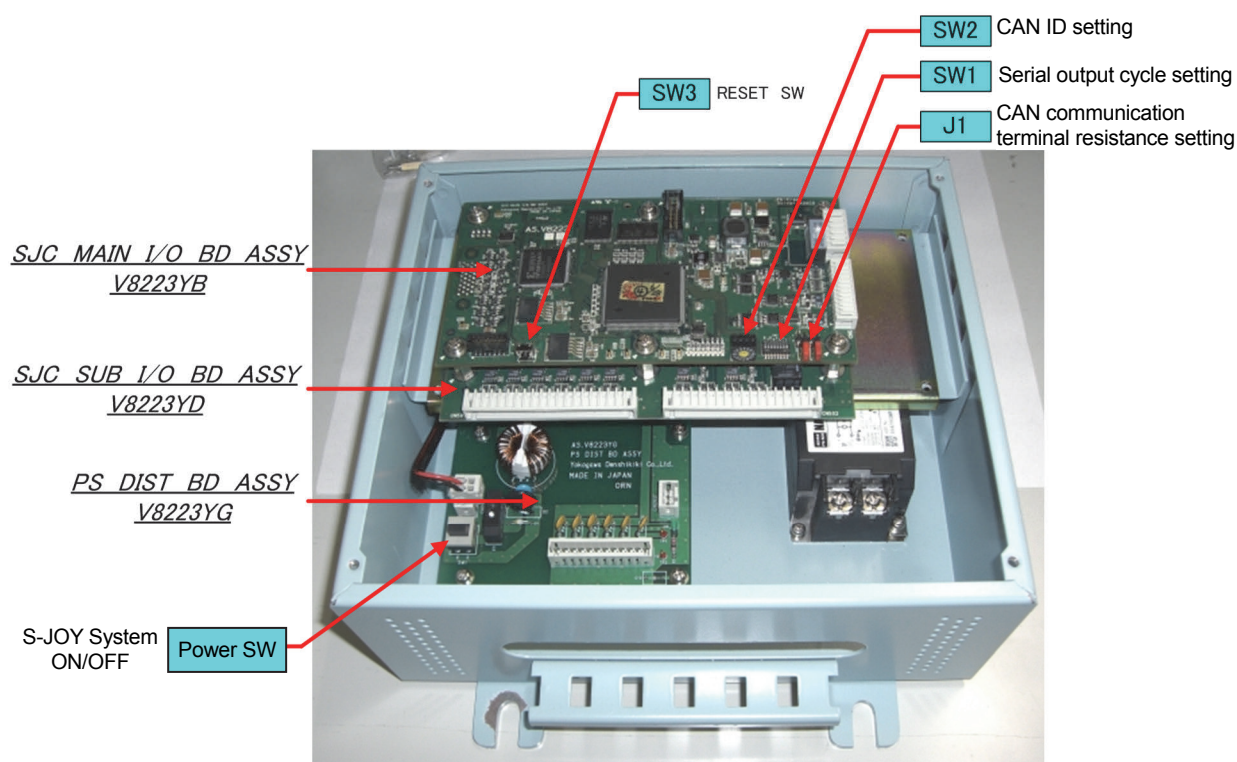
3.1 Providing of the power supply

The power of S-JOY I/O UNIT is supplied from the distribution panel (24V DC) in the bridge independent from RADAR/ECDIS and Autopilot.

Switch ON the power switches inside of the distribution panel in bridge and S-JOY I/O UNIT and supply the power.

The power for each S-JOY OP UNIT is distributed via S-JOY I/O UNIT.

At that time, the power switches of RADAR/ECDIS and AUTOPILOT do not need to be set to ON.



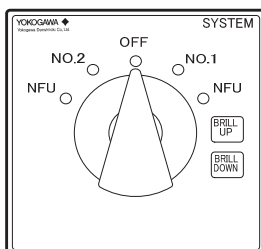
[CAUTION]

When the power of RADAR, ECDIS, or Autopilot to which S-JOY is connected is turned on before the power is supplied to the S-JOY system, an S-JOY communication failure occurs in RADAR, ECDIS, and Autopilot.

4. Operation

4.1 Selector

System selector



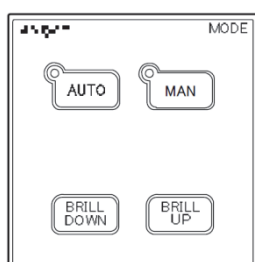
NO.1/NO.2: Follow-up steering

Follow-up steering of HAND, AUTO, FU (P/S wing) or S-JOY is available.

NFU: Non-follow-up steering: Non-follow-up steering by the NFU lever is available.

OFF: System power OFF: Sets the power of the units in the pontoon bridge to OFF except for the ANNUNCIATOR UNIT.

Mode selector



AUTO : Automatic steering

Automatic steering by pressing AUTO key is available

MAN : Manual steering

Manual steering by pressing MAN key is available

[CAUTION]

Select of steering mode is available when the system selector is selected No1 or No2.

4.1.1 Change-over to S-JOY

There are two method of change-over to S-JOY.

-When the Mode selector is installed in the ship

By pressing SELECT of S-JOY OP UNIT while the mode selector is set to AUTO , the mode can be changed to the HEADING mode. The LEDs of the  key of all the S-JOY units that are concurrently connected are lit.

-When the Mode selector is not installed in the ship

By pressing SELECT of S-JOY OP UNIT while the system selector is set to NO.1 or NO.2, the mode can be changed to the HEADING mode. The LEDs of the  key of all the S-JOY units that are concurrently connected are lit.

For detail operation of S-JOY OP UNIT, refer to Section 4.2.

4.1.2 Change-over to Track control

There are two method of change-over to Track control. Method of change-over is selected in the installation menu. (Service engineer can set.)

- Change-over to track control is possible from the ECDIS or the TRACK key of S-JOY.
(ECDIS can change-over to track control when operating ECDIS have TCS operation rights)
- Change-over to track control is possible from the TRACK key of S-JOY only. Start operation is not possible from the ECDIS menu.

If track control start operation is performed by S-JOY in AUTO (CRS) mode, change-over to track control occurs automatically without switching of the mode selector. Then, "Heading to steer" command from ECDIS is indicated on Set course indicator and Auto steering unit starts the track control according to its set course.

For the operation method after track control change-over, refer to Supplement "Automatic Sailing Additional Instruction Manual". Some operations are different from the contents described in the Automatic Sailing Additional Instruction Manual. For the details, refer to "4.4 Differences with the Automatic Sailing Additional Instruction Manual."

[CAUTION]

The above operation is disabled when there is no track control interface between ECDIS and Autopilot.

4.1.3 Terminating track control

To terminate track control, switch the steering mode to the AUTO or MANUAL mode on autopilot or press the track control stop button on ECDIS. (If Change-over to track control is possible from the ECDIS, can stop track control by pressing the track control stop button on ECDIS.)

When terminating track control on S-JOY, change-over from the HEADING/RADIUS/PLANNED TURN/RUDDER key is possible after acquiring the operation right.

4.2 Operation of S-JOY OP unit

[CAUTION]

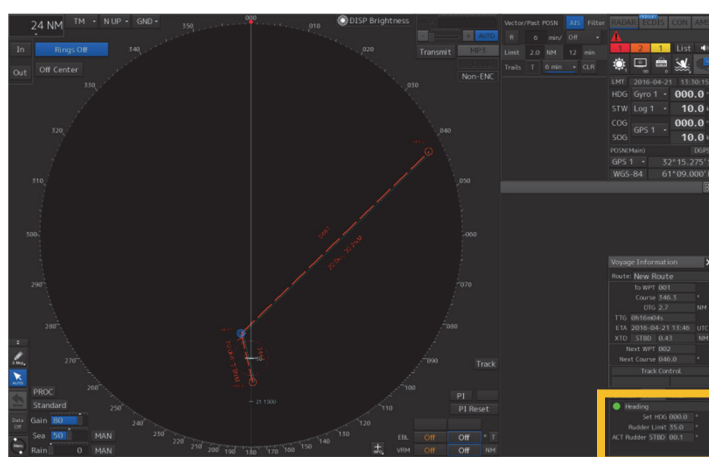
To start the operation by S-JOY OP UNIT, press  key and get the operation right.

Moreover, even if get the right of operation, S-JOY dialog is not displayed but a high priority dialog may be displayed. In that case, please begin operation after displaying S-JOY dialog.

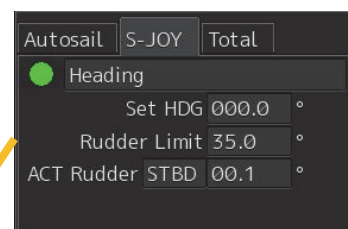
The S-JOY dialog is displayed on RADAR or ECDIS.

Setting values by S-JOY OP UNIT are indicated on S-JOY dialog.

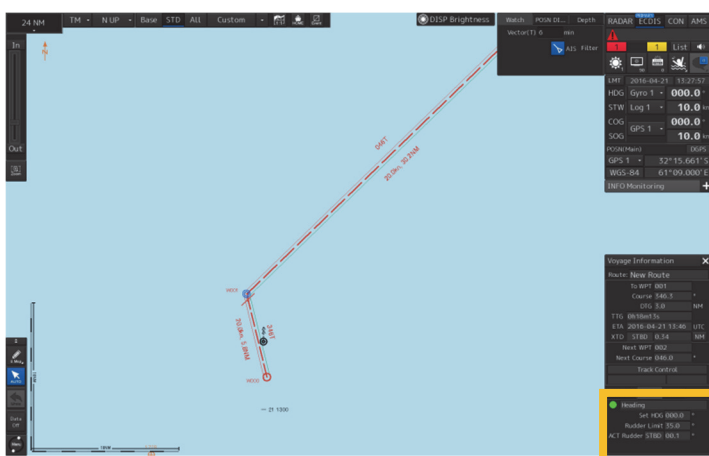
And, setting information is indicated graphically on PPI of RADAR screen or on chart of ECDIS screen.



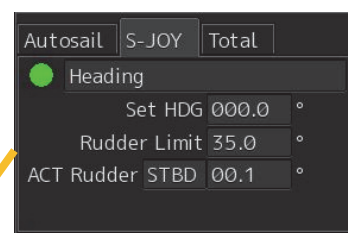
RADAR screen



S-JOY dialog



ECDIS screen



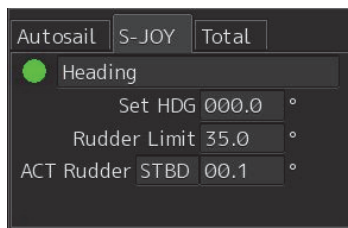
S-JOY dialog

4.2.1 Operation right

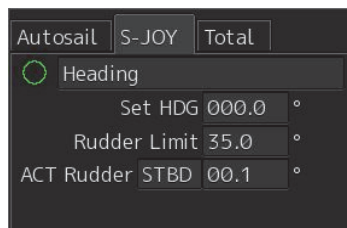
To begin operation with S-JOY, please press  key of S-JOY OP UNIT and get the right of operation.

When getting the right of Operation, ● marker (green) in S-JOY dialog is displayed as the following figure.

When not getting the right of Operation, ○ marker (green line circle) in S-JOY dialog is displayed.



Right of Operation: existence



Right of Operation: nothing

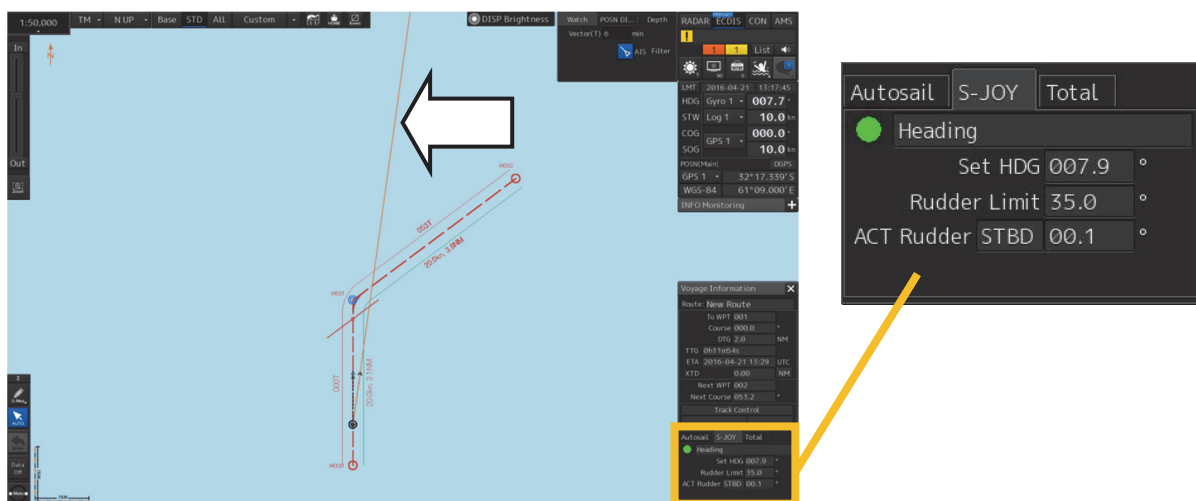
4.2.2 HEADING mode

Can voyage by setting heading (Set HDG) and Rudder Limit with Joystick operation

[Attention]

Please note that turning is started immediately with Joystick operation.

- 1) Pressing  key, LED will light and will be HEADING mode.
The present heading will be set as the "Set HDG" when the key is pressed.
- 2) Operating Joystick to up side, "Rudder Limit" will be increased.
Operating Joystick to down side, "Rudder Limit" will be decreased.
- 3) Operating Joystick to right side, Set HDG vector will move to right.
Operating Joystick to left side, Set HDG vector will move to left.
And Set HDG value is set.



[Reference]

- ① In HEADING mode, since the course alteration based on the rudder limit is performed, set the rudder limit with Auto steering unit if required.
- ② The setting range of "Rudder Limit" is 2 to 35 degree.
- ③ "Rudder Limit" is changed every 1 degree.
The changing value of "Rudder Limit" will be changed as below by Joystick operation time.
 - For 5 seconds by continuously Joystick operation: 4 deg./s.
 - After that, the changing value is accelerated 4deg./s.
- ④ "Set HDG" is changed every 1 degree.
The changing value of "Set HDG" will be changed as below by Joystick operation time.
 - For 5 seconds by continuously Joystick operation: 4 deg./s.
 - After that, the changing value is accelerated 4deg./s.
 (When Joystick is operated for 10 seconds continuously, the changing value is about 100deg.)
- ⑤ Max. "Set HDG" change value= up to +/-240°(In HEADING/RADIUS mode)
Exp.)

- In case of STBD turn, it can be set until 240° if the present heading is 000°. (CW turn)
 - In case of PORT turn, it can be set until 120° if the present heading is 000°. (CCW turn)
- ⑥ Around end of turn, when the deviation between the present heading and “Set HDG” becomes less than 3 degrees for 10 seconds, “Set HDG vector” will be disappeared.
(In HEADING/RADIUS mode)

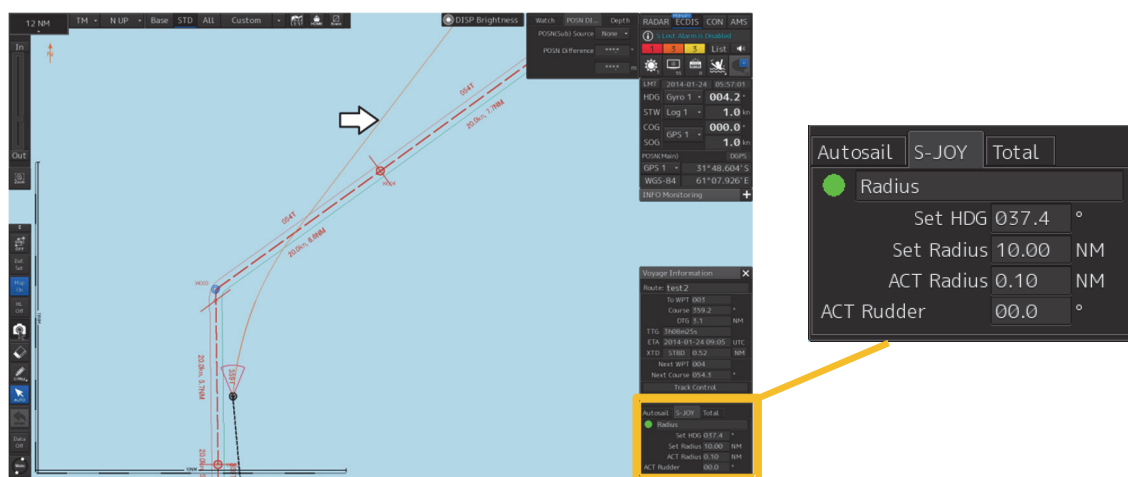
4.2.3 RADIUS mode RADIUS

The route of Curved EBL can be displayed by setting the Set HDG and Set RAD with Joystick, and can navigate on the route.

[Attention]

- Please note that turning is started immediately with Joystick operation.
- If a current influences, it may shift from the planned route.

- 1) Pressing RADIUS key, LED will light and will be RADIUS mode.
The present heading will be set as the “Set HDG” when the key is pressed.
- 2) Operating Joystick to up side, “Set RAD” will be increased.
Operating Joystick to down side, “Set RAD” will be decreased.
- 3) Operating Joystick to right side, Set HDG vector will move to right.
Operating Joystick to left side, Set HDG vector will move to left.
By Joystick operation, Curbed EBL route will be displayed.



[Reference]

- ① In RADIUS mode, the course alteration based on the turn radius is performed. The rudder angle might be beyond the preset rudder angle of Auto steering unit due to the turn radius.
- ② Min. radius which can be set is restricted by “Min. radius setting”^{*2} of Auto steering unit.
- ③ “Set RAD” is changed every 0.1 NM.
The changing value of “Set RAD” will be changed as below by Joystick operation time.
 - For 5 seconds by continuously Joystick operation: 0.4NM/s.
 - After that, the changing value is accelerated 0.4NM/s.
 (When Joystick is operated for 10 seconds continuously, the changing value is about 10NM.)
- ④ Set HDG” is changed every 1 degree.
The changing value of “Set HDG” will be changed as below by Joystick operation time.
 - For 5 seconds by continuously Joystick operation: 4 deg./s.

- After that, the changing value is accelerated 4deg./s/s.

(When Joystick is operated for 10 seconds continuously, the changing value is about 100deg.)

⑤ Max. "Set HDG" change value= up to +/-240° (In HEADING/RADIUS mode)

Exp.)

- In case of STBD turn, it can be set until 240° if the present heading is 000°.(CW turn)

- In case of PORT turn, it can be set until 120° if the present heading is 000°.(CCW turn)

⑥ Around end of turn, when the deviation between the present heading and "Set HDG" becomes less than 3 degrees for 10 seconds, "Set HDG vector" will be disappeared.

(In HEADING/RADIUS mode)

*2: 「Min. turn radius」 is preset in Maintenance mode of autopilot by Yokogawa's service engineer.

4.2.4 PLANNED TURN mode



The route of Curved EBL can be displayed by setting the Set HDG and Set RAD with Joystick, and can start to navigate on the route by [START/OK] key.

This function is convenient when the course change will be implemented after passing the shoal area, lighthouse or buoy etc.

[Attention]

- Please note that turning is not started until pressing  key unlike RADIUS mode.
- If a current influences, it may shift from the planned route.

■ Normal Operation

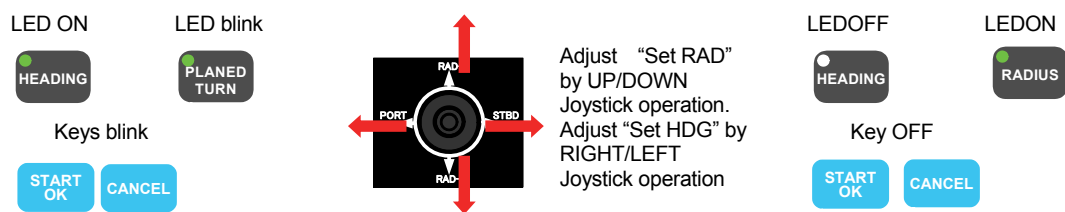
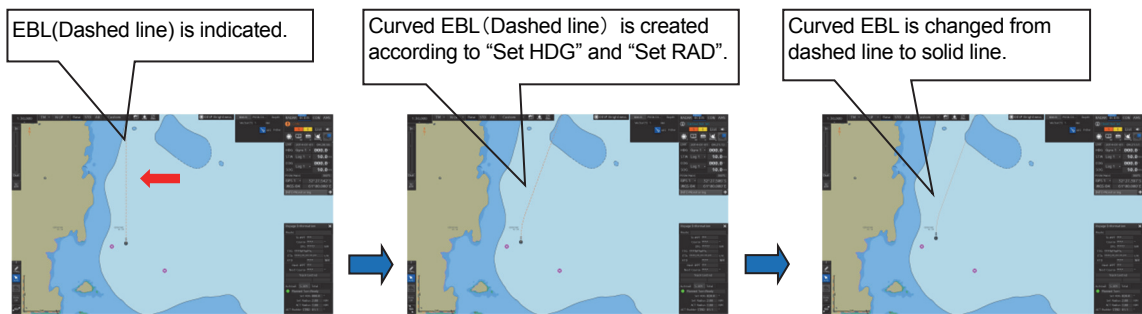
- 1) Pressing  key, LED,  key and  key will blink, and will be ready status of PLANNED TURN mode.

[Note]

During ready condition in PLANNED TURN mode, the mode selected before pressing  key is kept.

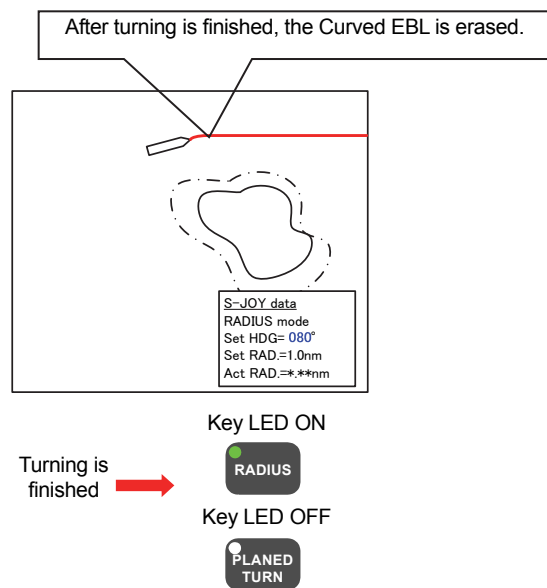
- 2) Operating Joystick to up side, "Set RAD" will be increased.
Operating Joystick to down side, "Set RAD" will be decreased.
- 3) Operating Joystick to right side, Set HDG vector will move to right.
Operating Joystick to left side, Set HDG vector will move to left.
By Joystick operation, Curbed EBL route will be displayed.
- 4) When  key is pressed, the flashing LED of the  key changes to illuminate, and radius turning starts.
Also at the same time, the flashing  and  keys are turned off.
- 5) After radius turning finishes, the LED of the  key turns off and the LED of the  key illuminates. (The Curved EBL also turns off at the same time.)

Step1 After pressing  **Step2** After operating Joystick **Step3** After pressing 



[Note] The Step1 and Step2 are showing the condition of transferring from HEADING to PLANNED TURN mode.

Step4 When finishing turning

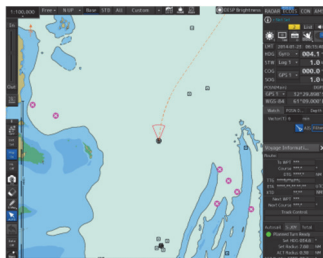


6) When the  key is pressed in the PLANNED TURN standby state in 1) through 4) above, the standby state is cleared and the state is restored to the one before the  key was pressed.

■ When Joystick was operated during PLANNED TURN

When Joystick was operated during PLANNED TURN, "Set HDG" and "Set RAD" are changed by Joystick operation, and the mode changes to the RADIUS mode immediately.

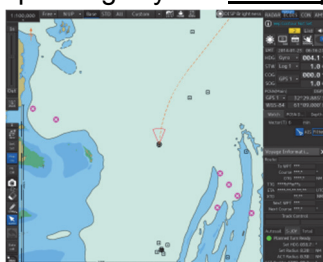
1) During PLANNED TURN



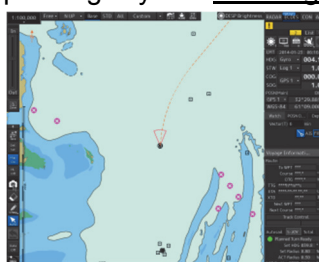
Key LED ON



2) Operating Joystick to the upward



3) Operating Joystick to the right



Joystick operation

Key LED ON



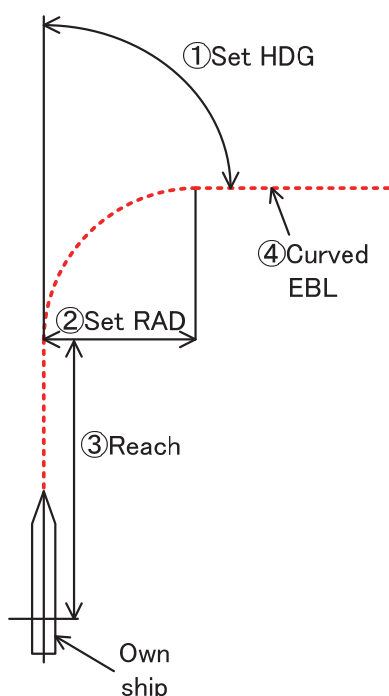
Key LED OFF



The succeeding operation and display are the same as those in the RADIUS mode.

■ How to display the Curved EBL in the PLANNED TURN standby state

The following shows how to display the Curved EBL in the PLANNED TURN standby state in details.



- | | |
|---------------|---|
| ① Set HDG: | The set bearing specified by Joystick |
| ② Set RAD: | The set turning radius specified by Joystick |
| ③ Reach: | Distance up to the reference point of the arc of Curved EBL from the CONNING POSITION that is set by Forwarding Distance of Autopilot. |
| ④ Curved EBL: | Using the CONNING POSITION set in the ECDIS as the origin point, the EBL (Electric Bearing Line) drawn using the parameters from ① to ③ above |

[Reference]

- ① If a key of other control mode was pressed in the PLANNED TURN standby state, control mode selection takes precedence and the standby state is cleared.
- ② If another S-JOY OP UNIT was selected in the PLANNED TURN standby state, the PLANNED TURN standby state is cleared. (Same as the pressing of the [CANCEL] key)
- ③ If the PLANNED TURN key was pressed while in the RUDDER mode, the mode automatically transits to the HEADING mode in order to constantly maintain the ship's head bearing.
- ④ If the PLANNED TURN key was pressed while in the TRACK mode, track control is suspended when the [START/OK] key is pressed.

[CAUTION]

The Curved EBL that is displayed in the RADIUS mode or PLANNED TURN mode is not an active track used for track control.

Route check, safety contour check, tidal current compensation and cross track error compensation are not performed, so be careful while turning.

4.2.5 RUDDER mode

By operating Joystick to the right or left, it is possible to navigate the ship by directly steering the rudder.

[CAUTION]

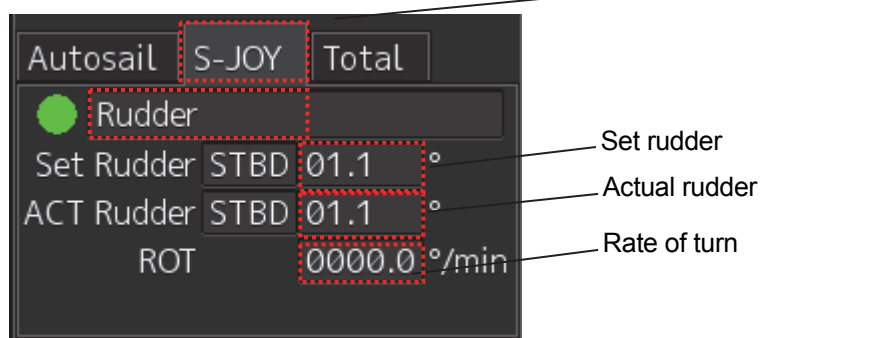
- Turning starts immediately according to Joystick operation, so be careful.
- Even if Joystick has not been operated to the right or left, the set angle is maintained, so be careful.
- If S-JOY dialog is not displayed, check rudder angle by Rudder Angle Indicator.

- 1) When  key is pressed, the LED of the key illuminates, and the mode changes to the RUDDER mode.
The rudder angle when the key was pressed is maintained.
- 2) Be sure that S-JOY DATA is displayed on the screen of the ECDIS or RADAR.
- 3) By operating Joystick to the right, "Set Rudder" moves to the STBD side.
By operating Joystick to the left, "Set Rudder" moves to the PORT side.
- 4) When Joystick is returned to the neutral position, the set rudder angle at that time is maintained.
- 5) While in the RUDDER mode, the  key flashes when the actual rudder angle is not within ± 1 degree.
When the  key is pressed, the set rudder angle becomes MIDSHP and the key illuminates when the actual rudder angle becomes within ± 1 degree.

[Note]

When the RUDDER mode is selected, a cautionary popup window is displayed on ECDIS.

S-JOY DATA Display



[CAUTION]

While in the RUDDER mode, the rudder command can be set up to 35° regardless of the rudder limit setting of the Auto steering unit.
Be sure to carefully check the current "Set Rudder" and "ROT" in the S-JOY DATA display before maneuvering the ship.

4.2.6 TRACK mode



Track control can be started by loading the pre-created route.

Track control can be started only by using the  key of S-JOY UNIT.

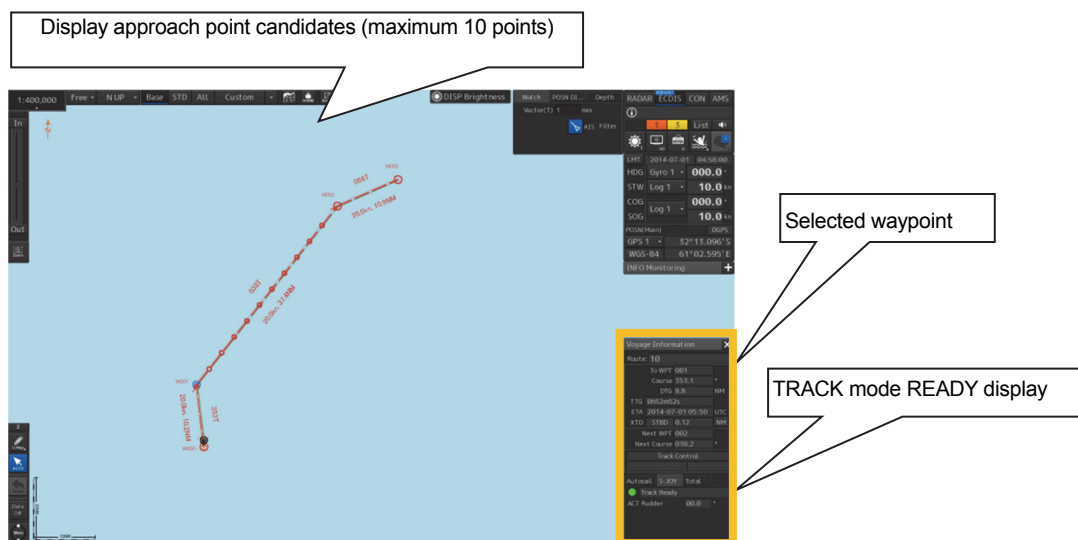
Use the following procedure for the operation.

- The method that uses the  key of the S-JOY OP UNIT
 - 1) Select the route that was created by selecting ECDIS [Menu] - [Route Monitoring].
 - 2) Press the  key of the S-JOY OP UNIT of the ECDIS and obtain operation right.
 - 3) Press the  key. The key LED and the  and  keys flash and the TRACK standby state takes effect.

[Attention]

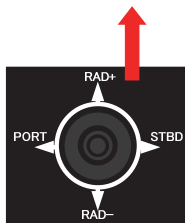
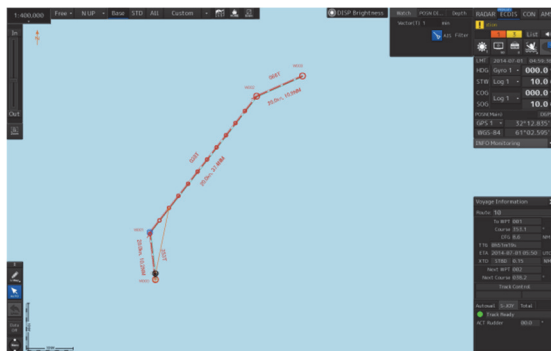
The control mode being selected when the  key was pressed is used continuously at this time.

- 4) The mode display of S-JOY shows TRACK and a maximum of 10 approach point candidates are displayed in each leg of the sea course selected in the ECDIS.
 Approach points are the predicted approach position for every 10 min based on the ship speed currently sailing.
 Approach points can be selected not only for the first leg from selected waypoint but also for the second leg also.

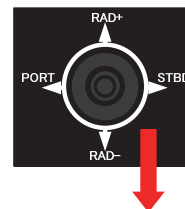
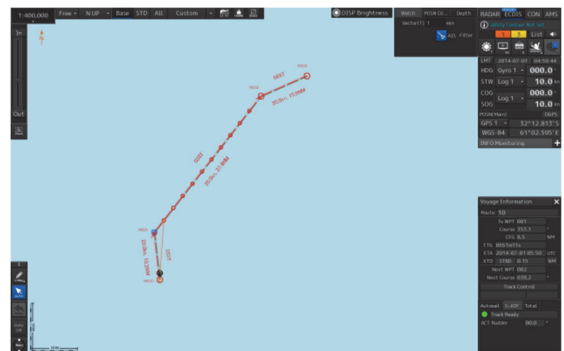


- 5) Move Joystick upward or downward to select an approach point.
 Every time Joystick is operated upward, the temporary sea course (the course from own ship to an approach point) moves to the forward approach point.
 When Joystick is operated downward, the approach point can be returned to own ship.

When Joystick is moved upward

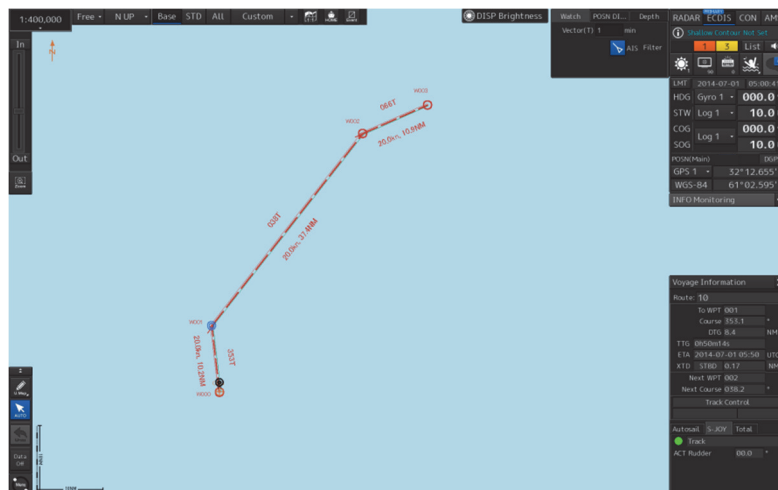


When Joystick is moved downward



- 6) If track control start is OK, press the **START OK** key. The approach point candidates disappear and track control starts along the temporary sea course.

The LED of the **TRACK** key changes from flashing to ON state at this time.



■ Setting of waiting time for canceling TRACK ready state

When the TRACK ready state is continued for a certain time, the TRACK ready state is canceled and the display of approach points disappear.

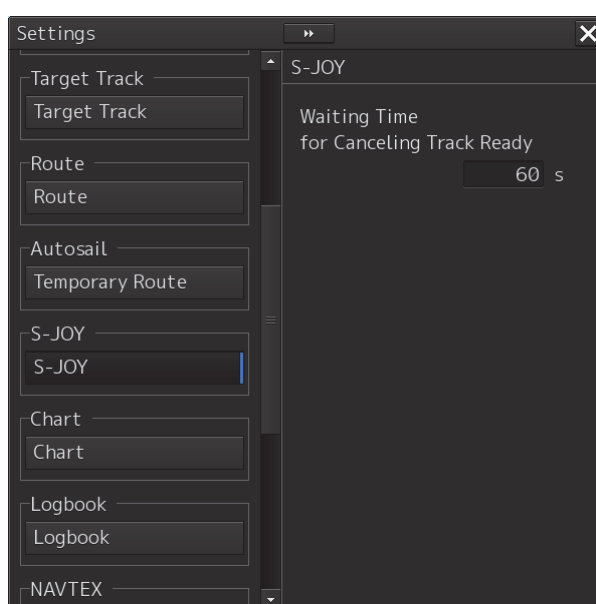
The interval of waiting time for canceling the TRACK ready state can be selected from 15s to 300s.

[Reference]

Please set this setting in a equipment with the TCS right. Regardless existence of operation right, the setting can be set.

(ECDIS and RADAR)

Select menu order of <Menu> ⇒ <Settings> ⇒ <S-JOY> and set Waiting Time for Canceling Track Ready.



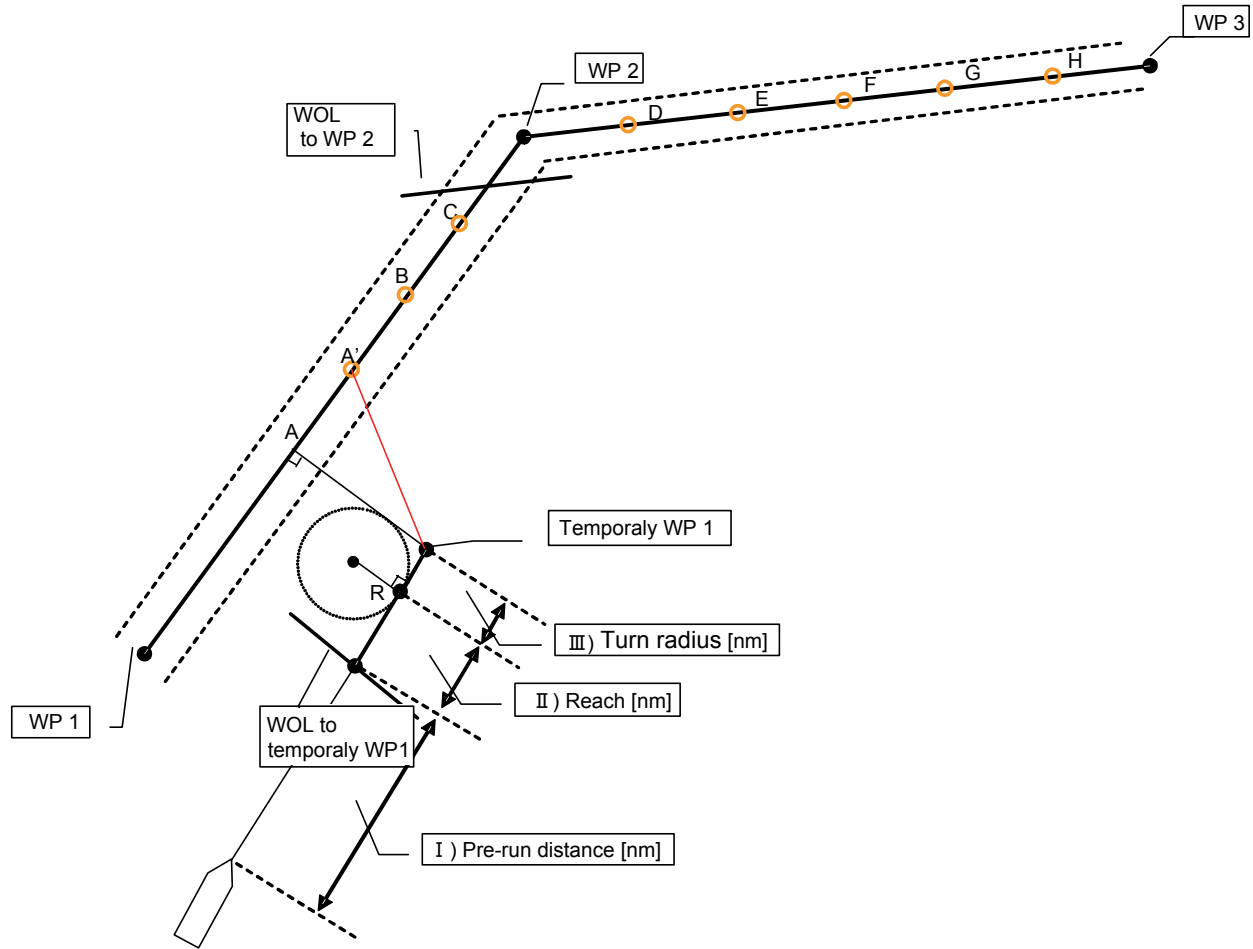
■ Suspending TRACK mode (normal end)

Automatic sailing can be suspended by the following operations.

- ① Switch the Autopilot steering mode to another steering mode.
→ The ship can be maneuvered in the selected steering mode immediately.
- ② Operate the override FU dial. (Rotate $\pm 3^\circ$ or more from the MIDSHIP position.)
→ The FU dial operation is enabled immediately.
- ③ Switch the Autopilot system switch to NFU.
→ The NFU lever operation is enabled immediately.
- ④ Select other control mode on the S-JOY OP UNIT.
→ The ship can be maneuvered in the selected control mode immediately.
- ⑤ When the last turning point has passed (End of Track)
→ S-JOY automatically transits the control mode to the HEADING mode.
(The ECDIS generates an End of Track alarm.)
- ⑥ Press the STEERING MODE button of AP CDU for one second or longer.
→ The following operations are performed depending on the sailing state.
 - When sailing straight: Transits to the HEADING mode.
 - When turning: Terminate the turning operation in RADIUS mode by using the final instruction radius from ECDIS and change to the HEADING mode after ending turning.

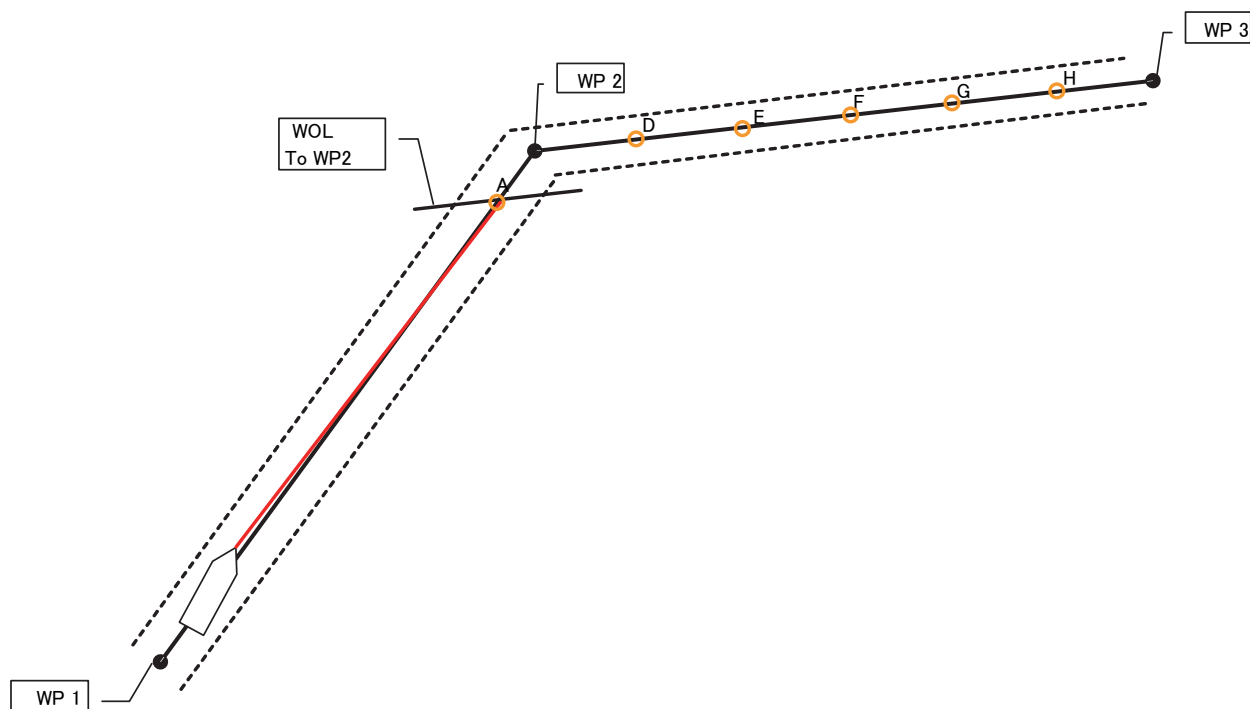
■ Displaying approach point candidates

In case own ship position is out of leg, calculation process of approach point candidates is follows.



1. Calculate point of temporally WP1
Add pre run distance, reach, turn radius (approach radius 90 degree) to calculate point of temporally WP1.
2. Calculate 1st approach point candidate
1st approach point candidate is cross point of leg and perpendicular from temporally WP1 to leg (point A in this figure).
3. In case distance from temporally WP1 to A is less than the Minimum Leg Length, 1st approach candidate is point A' that distance from temporally WP1 to leg is equal to Minimum Leg Length.
4. Make another approach points from A' to WOL of WP2 (point B and C in this figure) that has intervals one sixth of planted ship speed. Another approach points from WP2 to WP3 (point D, E, F, G and H) are calculated by same process. Approach points are calculated up to 10 points.

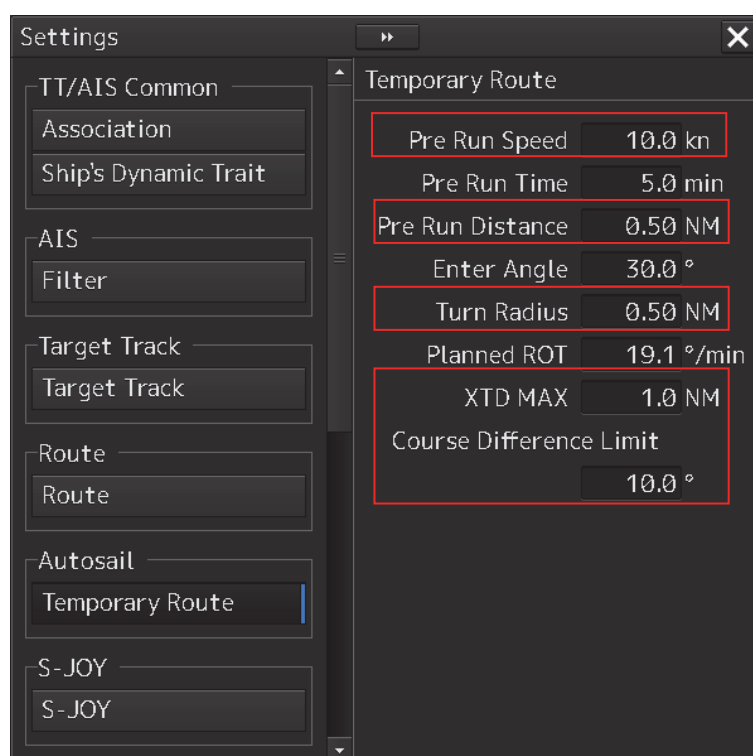
In case own ship position is on the leg, 1st approach candidate is cross point of leg and WOL (point A in figure shown below). Another approach candidates are calculated same as the own ship position is out of leg (point D, E, F, G and H).



<Calculation parameters>

Parameter	Description
Pre run speed	Use Setting parameter of ECDIS ("Pre Run Speed" in figure).
Pre run distance	Use Setting parameter of ECDIS ("Pre Run Distance" in figure).
Reach	Use received value from PT900.
Turn radius	Use Setting parameter of ECDIS ("Turn radius" in figure).
Enter angle	Fixed value "90 degree" (Enter angle of 1 st point is always 90 degree)
Maximum distance of XTD	Use Setting parameter of ECDIS ("XTD MAX" in figure).
Course difference	Use Setting parameter of ECDIS ("Course Difference Limit" in figure).

Parameters Settings window



■ Calculation of Planned ROT and Turn Radius

Planned ROT and Turn Radius in above Settings - Temporary Route window is calculated by the following formula.

$$\text{Planned ROT} [^\circ / \text{min}] = \frac{\text{Pre Run Speed} [\text{kn}] \div 60 [\text{min/h}]}{\text{Turn Radius} [\text{NM}] \times 2\pi} \times 360 [^\circ]$$

$$\text{Turn Radius} [\text{NM}] = \frac{\text{Pre Run Speed} [\text{kn}] \div 60 [\text{min/h}]}{\text{Planned ROT} [^\circ / \text{min}] \times 2\pi} \times 360 [^\circ]$$

■ Temporary route calculating conditions of S-JOY

At the start of TCS with S-JOY, limit checking is performed for the temporary route for the approach point candidates. When the checking results in NG, an Internal Error popup window is displayed. An Internal Error occurs when the temporary route is applicable to any of the following conditions.

<Temporary route calculating conditions of S-JOY>

- The generated route is less than the maximum turning radius (Max Turn Radius)
- The generated route exceeded the minimum turning radius (MIN Turn Radius).
- The generated route is less than the maximum course change (MAX Course Change).
- The speed is less than the maximum planned speed (MAX Speed Limit).
- The speed is faster than the minimum planned speed (MIN Speed Limit).
- The ROT is less than the maximum planned ROT (MAX ROT).
- The ROT exceeded the minimum planned ROT (MIN ROT).
- The leg length exceeded the minimum leg length (Minimum Leg Length).
- The ship position does not exceed WOP.

For each parameter, please refer to Marine Radar Equipment instruction manual (7PZNA4440), Section 19 Adjusting and Setting up Equipment (for Services) , 19.3.4 Setting own ship's parameters. Each setting value is set by the service engineer. For the details, please contact your nearest branch, sales office, or agent.

Parameter setting window (except MIN Turn Radius and Minimum Leg Length)

Max Turn Radius is calculated by (Planned ship speed×3) / (Max Turn Radius×π)

The screenshot shows the 'Installation' window with the 'Ship's Parameters' tab selected. The 'Ship General' section is active, displaying the following parameters:

Parameter	Value	Unit
Ship's Name		
Length	100.0	m
Beam	15.0	m
Height from keel to MAX point	30.0	m
Keel-Trans	5.0	m
MAX Course Change	150.0	°
MAX Speed Limit	30.0	kn
MIN Speed Limit	5.0	kn
MAX ROT	0300.0	° /min
MIN ROT	000.1	° /min
MIN Turn Radius	0.50	NM

Minimum Leg Length Setting window

Settings

TT/AIS Common

Association

Ship's Dynamic Trait

AIS

Filter

Target Track

Target Track

Route

Route

Autosail

Temporary Route

S-JOY

S-JOY

Route

Default

XTL(PORT) 0.20 NM

XTL(STBD) 0.20 NM

Arrival radius 0.50 NM

Speed 20.0 kn

Sail ☒ RL ☐ GC

Turn radius 0.50 NM

Time zone 00:00

Distance calculation mode

☒ Straight ☐ with Turn

Monitoring

☒ Wheel-over line ☐ Arrival circle

MAX Latitude 80°00.000'

Minimum Leg Length for Limit Check:

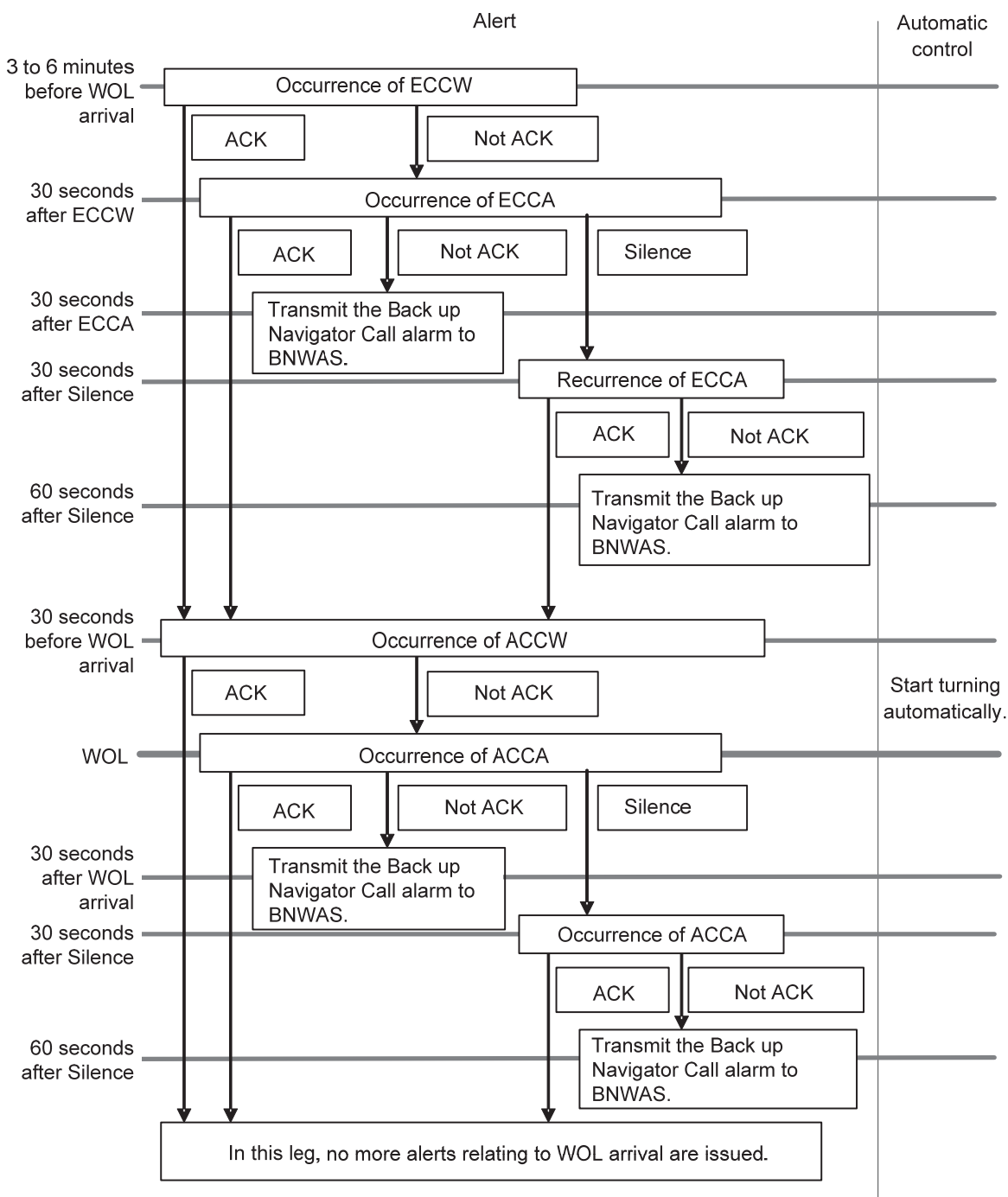
400m = (Ship Length) x 4

Flow after starting auto navigation

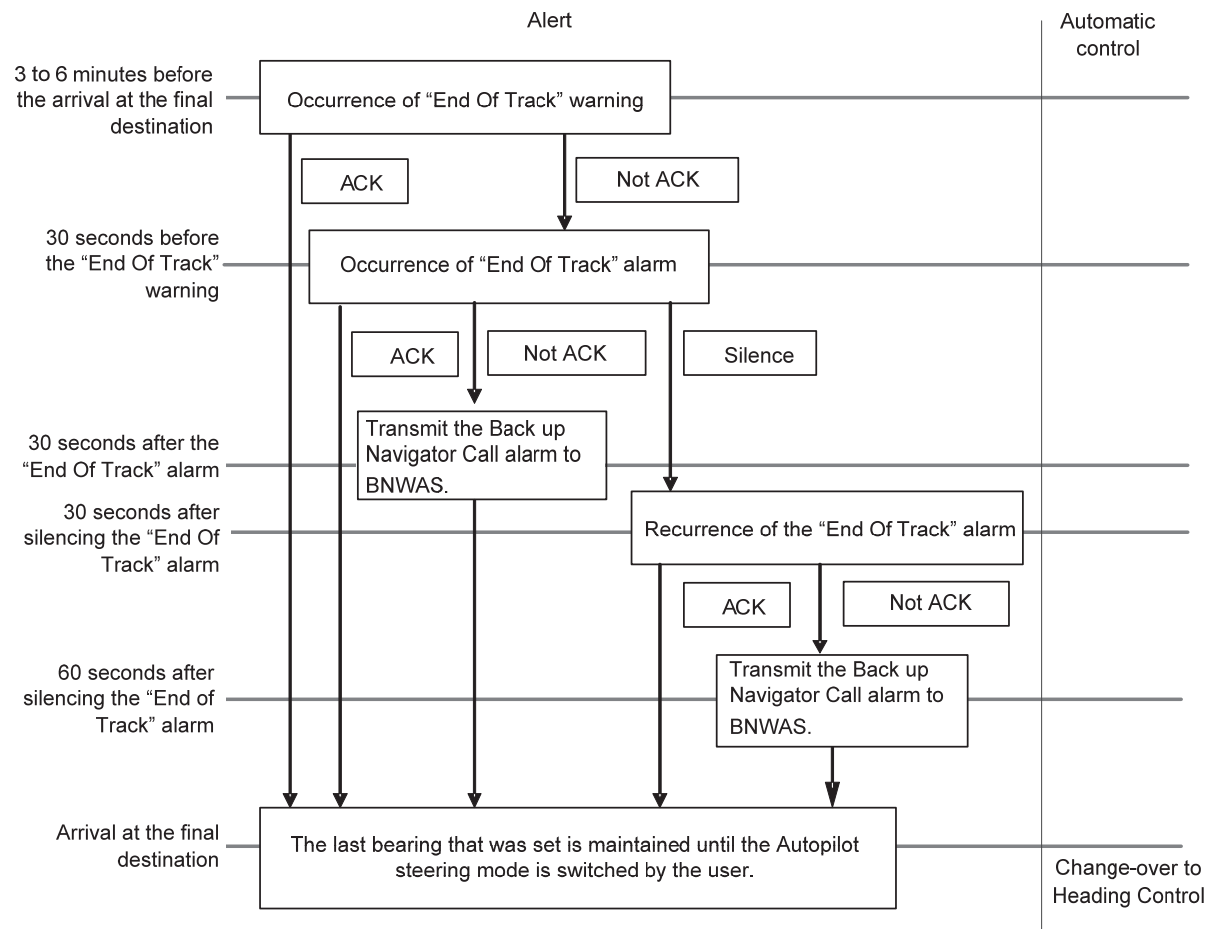
When automatic sailing is started, a cautionary warning or alarm is issued at the turning point as shown in the diagram below.

See below for the flow at turning and the flow at approaching the final destination. Perform ACK operation when a warning or an alarm is issued.

Flow at turning



Flow of the approach to the final destination



4.3 Predictor

4.3.1 Setting ON/OFF for Predictor display

When the  key is pressed, the display of the predicted position of own ship on the ECDIS/RADAR screens can be turned ON/OFF.

When PREDICTOR=ON, the LED of the  key illuminates, and when PREDICTOR=OFF, the LED turns OFF.

When predicted own ship position display is turned ON, the predicted position of up to 6 points forward from own ship can be checked as shown in the figure below.

Predictor can be displayed under the following mode.

Mode	RADIUS	PLANNED TURN	HEADING	RUDDER	TRACK
Predictor	●	●	—	—	—

4.3.2 Setting of display interval for Predictor

Display interval of Predictor can be set.

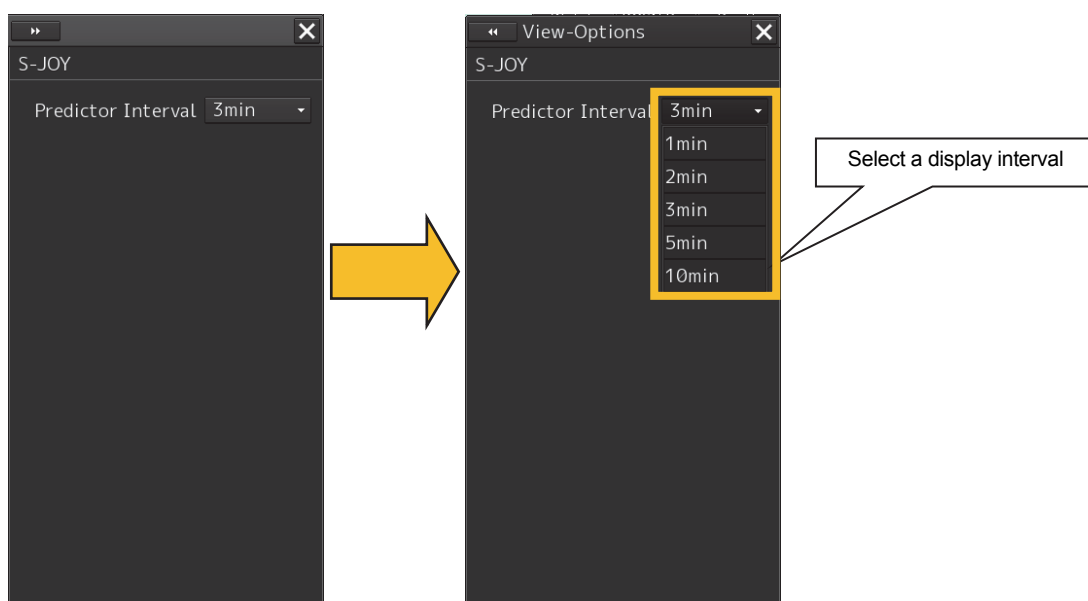
Display Interval can be selected one from 1min, 2min, 3mn, 5min and 10min.

[Preference]

Regardless existence of operation right, setting of predictor interval can be set.

(ECDIS and RADAR)

Select menu order of <Menu> ⇒ <View> ⇒ <Options> ⇒ <S-JOY > and select display interval.



4.4 Differences with the Automatic Sailing Additional Instruction Manual

When S-JOY is connected, there are the following differences with the Automatic Sailing Additional Instruction Manual.

List of differences between the specification relating TCS start with S-JOY and the specification described in the TCS Instruction Manual.

Item	Page in TCS Instruction Manual	TCS specification (S-JOY not used)	TCS specification by using S-JOY
Safety/limit checking error display of the route	vi, 20	Display the result in the Auto Sail dialog and the Check Route dialog (Can be started by selecting Disregard from the safety checking error result of the Route dialog).	The Auto Sail dialog and the Check Route dialog are not displayed (At the occurrence of a route safety/limit error at the start of automatic sailing, only the automatic sailing start disable dialog is displayed. The Check Route dialog can be displayed on the route plan screen only.)
Shortest leg length of the predictable route	vii, 58	(Predictable route planned ship speed × Predictable route planned time) + Predictable route planned distance + Reach	The following condition is also included to the condition described in the right column. ECDIS menu Settings - Route Minimum Leg Length for Limit check setting value
Number of turns of the temporary route	12, 24	1 turn or 2 turns	2 turns
Creation of a temporary route at the start of automatic sailing from the route (leg)	12	Not created from the leg	Although a temporary route is created from the leg, it is cleared at the start of automatic sailing.
Start of automatic sailing	19, 41, 45, 59	Start from the ECDIS menu (Autosail) (Starts after the route is selected from the Auto Sail dialog that is displayed)	There are two method. Method is selected in the installation menu. (Service engineer can set.) -Start from the ECDIS menu (Autosail) or S-JOY. -Start from the S-JOY only. (the Autosail menu is hidden and the Auto Sail dialog is not displayed. Pre-load the route and Start on the S-JOY.)
Temporary route creation conditions	23, 24	The current ship's own position and ship's heading must satisfy the position condition, ship's heading condition, and leg condition of the TCS instruction manual.	In addition to the conditions described in the left column, the limit checking is performed for the temporary route also. (When an limit checking error occurs in all the temporary route candidates, the Internal Error dialog is displayed.)
Termination of automatic sailing	34, 41, 61	Terminate by using the [Track Control Stop] button (or Autosail menu) on the Voyage Information screen of ECDIS.	-When track control can start from the ECDIS menu or S-JOY. Stop from the [Track Control Stop] button of Voyage Information in ECDIS or S-JOY.E12 -When track control can start from S-JOY only. Stop from the S-JOY only. (The [Track Control Stop] button of Voyage Information is hidden.)

5. Test before working

We recommend you to check that there are no abnormalities in S-JOY before working.

Thereby, not only failure of unit but an accident can be prevented.

Since the test is easy, please carry out.

This test is for checking whether an operation key and Joystick are accepted.

Start checking by selecting a steering mode other than S-JOY (does not function even if S-JOY is operated).

No.	Check operation	OK operation	Result
1	Press [SELECT] key.	Invalid buzzer sounds and "Not Allow" is displayed on ECDIS/RADAR screen.	
2	Press [HEADING] key.	Same as the above	
3	Press [RUDDER] key.	Same as the above	
4	Press [TRACK] key.	Same as the above	
5	Press [RADIUS] key.	Same as the above	
6	Press [PLANNED TURN] key.	Same as the above	
7	Press [OPERATION] key.	Same as the above	
8	Press [DRAFT] key.	Same as the above	
9	Press [MIDSHIP] key.	Same as the above	
10	Press [CANCEL] key.	Same as the above	
11	Press [PREDICTOR] key.	Same as the above	
12	Press [START/OK] key.	Same as the above	
13	Move Joystick upward.	Same as the above	
14	Move Joystick downward.	Same as the above	
15	Move Joystick to right.	Same as the above	
16	Move Joystick to left.	Same as the above	

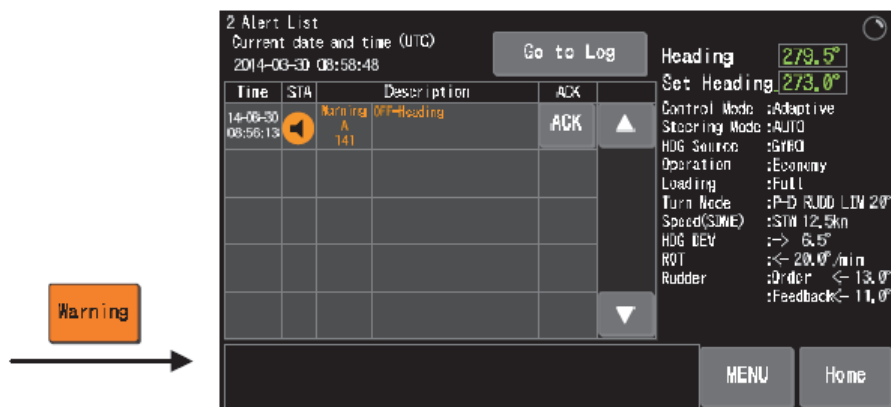
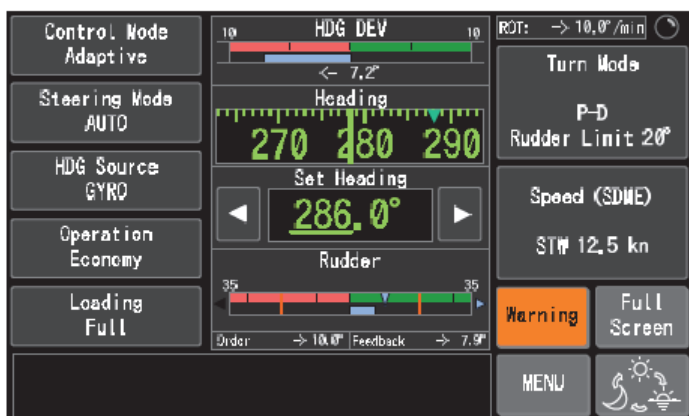
If the test result is not good, refrain use of S-JOY.

Contact our head office, or a nearby branch or local office to request servicing.

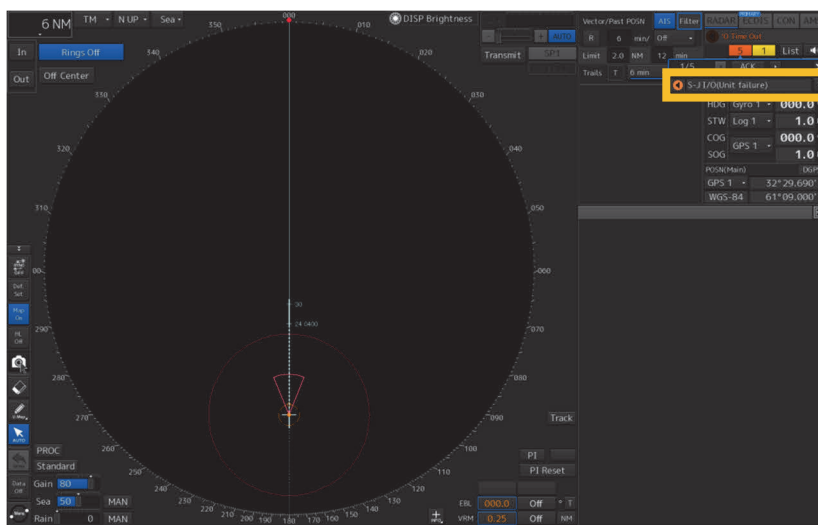
6. Troubleshooting

If error messages related to S-JOY appear on the Autopilot, RADAR or ECDIS and the Steering Joystick Controller does not function correctly, refer to the causes and actions to take described in the table. Follow the instructions in the order of **Step1** and then **Step2**.

If this does not resolve the problems, or there are other abnormalities other than the items below, please contact any of our branches, offices, sales offices or dealers at your nearest location.

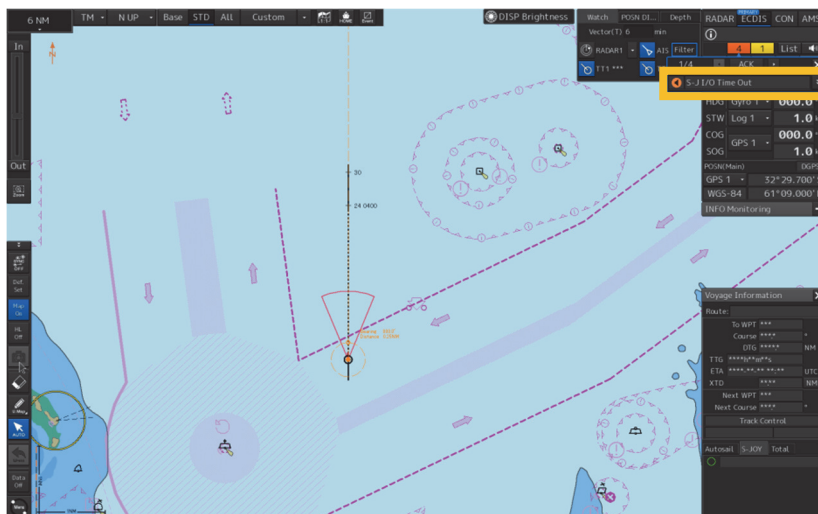


Control & Display unit (AP CDU)



S-J I/O(Unit failure)

RADAR screen



S-J I/O Time Out

ECDIS screen

Error Display Unit	Symptom	Priority	Status	Cause	Action to Take	Failed Unit
Autopilot	[HCS] COMM Error #10 S-JOY (I/O UNIT)	Caution	S-JOY non-control	① Under No.1 MPU (under #11, No.2 MPU), the S-JOY (I/O Unit) input was lost for 10 seconds or more or invalid data was received.	① Switch the steering mode to AUTO or MANUAL.	S-JOY I/O UNIT or Autopilot
	[HCS] COMM Error #11 S-JOY (I/O UNIT) The above error is displayed on the Autopilot and operation cannot be performed from the S-JOY OP UNIT.	Warning	S-JOY control	② S-JOY I/O UNIT abnormality	② Turn ON the power of the S-JOY I/O UNIT again.	
	[HCS] COMM Error #10 S-JOY (OP UNIT)	Caution	S-JOY non-control	① Under No.1 MPU (under #11, No.2 MPU), the S-JOY (OP Unit) input was lost for 10 seconds or more or invalid data was received.	① Switch the steering mode to AUTO or MANUAL.	S-JOY I/O UNIT S-JOY OP UNIT Autopilot Any one of the above.
	[HCS] COMM Error #11 S-JOY (OP UNIT) The above error is displayed on the Autopilot and operation cannot be performed from the S-JOY OP UNIT.	Warning	S-JOY control	② S-JOY OP UNIT abnormality	② Turn ON the power of the S-JOY I/O UNIT again.	
	[HCS] COMM Error #10 GYRO	Caution	Gyro not selected	In AUTO, the Ch-1 bearing input was lost for 3 seconds or invalid data was received in No.1 MPU (under #11, No.2 MPU).	Switch the steering mode to MANUAL and use other bearing information.	Gyrocompass
	[HCS] COMM Error #11 GYRO The above error is displayed on the Autopilot and operation cannot be performed from the S-JOY OP UNIT.	Warning	Gyro selected			
	[HCS] COMM Error #10 Speed	Caution	Log not selected	In AUTO, the ship's speed input was lost for 10 seconds or invalid data was received in No.1 MPU (under #11, No.2 MPU).	Select manual speed input.	Speed Log
	[HCS] COMM Error #11 Speed The above error is displayed on the Autopilot and operation cannot be performed from the S-JOY OP UNIT.	Warning	Log selected			

Error Display Unit	Symptom	Step1 Cause Action to Take	Step2 Cause Action to Take	Failed Unit
RADAR /ECDIS	S-J I/O ⇔ AP (Communication error) The above error is displayed on the ECDIS or RADAR and operation cannot be performed from the S-JOY OP UNIT.	S-JOY I/O UNIT or Autopilot abnormality Turn ON the power of the S-JOY I/O UNIT again.	Communication error between the S-JOY I/O UNIT and the Autopilot due to the disconnected communication circuit or faulty communication circuit Switch the steering mode to AUTO or MANUAL.	S-JOY I/O UNIT or Autopilot
	S-JOY ⇔ S-J I/O (Communication error) The above error is displayed on the ECDIS or RADAR and operation cannot be performed from the S-JOY OP UNIT.	Communication error between the S-JOY I/O UNIT and the S-JOY OP UNIT due to the disconnected communication circuit or faulty communication circuit When multiple S-JOY OP UNITS are connected, they can be used starting from the S-JOY OP UNIT of ECDIS or RADAR without an error. Switch the operation right with the SELECT button to use such units.	S-JOY OP UNIT or S-JOY I/O UNIT abnormality Turn ON the power of the S-JOY I/O UNIT again. When all the S-JOY OP UNITS cannot be used, switch the steering mode to AUTO or MANUAL.	S-JOY OP UNIT or S-JOY I/O UNIT
	S-J I/O (Time Out) The above error is displayed on the ECDIS or RADAR and operation cannot be performed from the S-JOY OP UNIT.	Communication error between the S-JOY I/O UNIT and the ECDIS or RADAR due to the disconnected communication circuit or faulty communication circuit When multiple S-JOY OP UNITS are connected, they can be used starting from the S-JOY OP UNIT of ECDIS or RADAR without an error. Switch the operation right with the SELECT button to use such units.	S-JOY I/O UNIT abnormality Turn ON the power of the S-JOY I/O UNIT again. When all the S-JOY OP UNITS cannot be used, switch the steering mode to AUTO or MANUAL.	S-JOY I/O UNIT or ECDIS or RADAR

Error Display Unit	Symptom	Step1	Step2	Failed Unit
		Cause Action to Take	Cause Action to Take	
RADAR /ECDIS	Autopilot (Unavailable) Error is displayed on ECDIS or RADAR.	Autopilot abnormality Turn ON the power of the Autopilot again.	— Switch the steering mode to AUTO or MANUAL. If still not possible to operate, change to NFU.	Autopilot
	S-J I/O(Unit failure) Error is displayed on ECDIS or RADAR.	S-JOY I/O UNIT abnormality Turn ON the power of the S-JOY I/O UNIT again.	— Switch the steering mode to AUTO or MANUAL.	S-JOY I/O UNIT
	S-JOY(Unit failure) Error is displayed on ECDIS or RADAR.	S-JOY OP UNIT abnormality	Communication failure between S-JOY I/O Unit and ECDIS or RADAR due to disconnection of the communication line or communication circuit fault	S-JOY OP UNIT
		Turn ON the power of the S-JOY OP UNIT again.	When multiple S-JOY OP UNITS are connected, they can be used starting from the S-JOY OP UNIT of ECDIS or RADAR without an error. Switch the operation right by using the SELECT button and use it. When all the S-JOY OP UNITS cannot be used, switch the steering mode to AUTO or MANUAL.	

Display Unit	Indication	Phenomenon	Action to Take
RADAR /ECDIS	STANDBY MODE Change mode by other S-JOY. [OK]	When the ECDIS or RADAR indicator is activated in RADIUS or PLANNED TURN mode, the indicator cannot generate a Curbed EBL route and, therefore, cannot be used from S-JOY.	To use the S-JOY that is activated, change the mode to a mode other than RADIUS or PLANNED TURN mode by using S-JOY that is used in another indicator. Then, acquire the operation right by using the [SELECT] key.
	S-JOY is not available, change autopilot steering mode to the Heading Control or Manual. [OK]	All the S-JOY units that are connected to the indicator are set to a standby state due to a communication error or an equipment failure, disabling the operation from S-JOY.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation.
ECDIS	Autopilot Failure occurred. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	A failure occurred during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.

Display Unit	Indication	Phenomenon	Action to Take
ECDIS	Heading(Sensor Failure) occurred. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the RADIUS. [OK]	A failure occurred in Autopilot during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.
	Speed(Sensor Failure) occurred. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	A failure occurred in Log during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.
	8781=POSN1(Sensor Failure) occurred. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	A failure occurred in GPS during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.

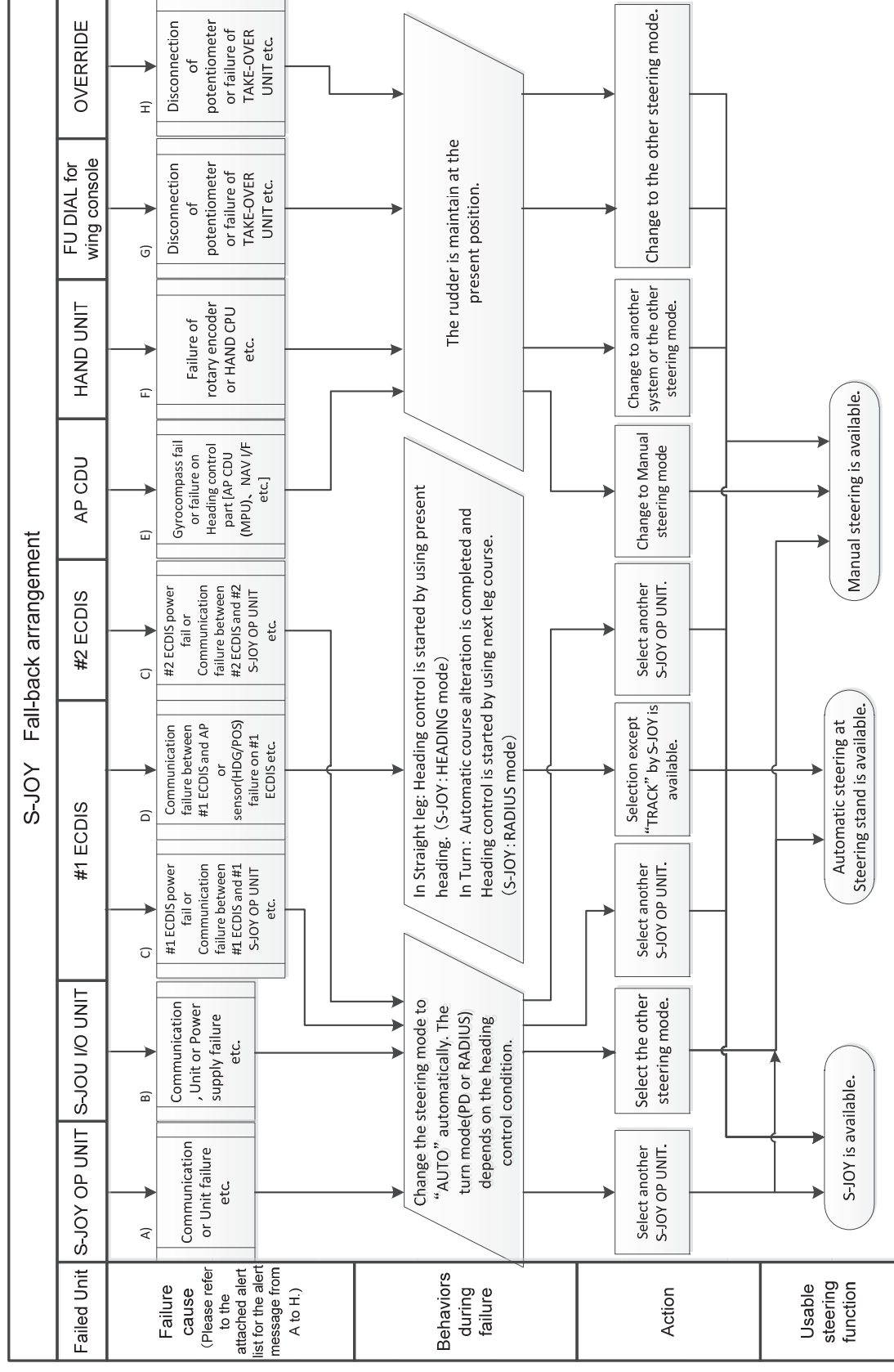
Display Unit	Indication	Phenomenon	Action to Take
ECDIS	Arrived at the end of route. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	Autosailing stopped since the ship reached the final destination during autosailing in TRACK mode.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.
	Position was outside of expected area even after time limit. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	Consecutive position skipping occurred in GPS during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.
	Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	A failure occurred in GPS during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.

Display Unit	Indication	Phenomenon	Action to Take
ECDIS	Autopilot Failure occurred. Track Control stopped. Change autopilot steering mode to the Manual or change S-JOY mode to the HEADING or RADIUS. [OK]	A failure occurred in Autopilot during autosailing in TRACK mode and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation or change the S-JOY to the HEADING or RADIUS mode.
	Can not create the temporary route because an internal error occurred. [OK]	A failure occurred in Autopilot during autosailing and autosailing stopped.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation.
	The waiting time for Track Ready is over. Track Ready has canceled. If you start Track, operate again by using S-JOY. [OK]	Track mode has canceled, because beyond the waiting time for Track ready.	Restart Track mode, if you want.

Display Unit	Indication	Phenomenon	Action to Take
Others	Can not create the temporary route because the course is inappropriate. Turn the course toward the planned course. [OK]	Since the ship's heading and the approaching route leg bearing are greater than the limits at the start of autosailing in TRACK mode, a course cannot be generated.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, operate the ship so that the ship's heading becomes parallel to the route leg bearing and start autosailing.
	Can not create the temporary route because the XTD exceed XTD MAX. Move own ship toward the planned route. [OK]	Since the amount of the cross track error to the approaching route leg is greater than the limit at the start of autosailing in TRACK mode, a course cannot be generated.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, bring own ship close to the route leg and start automatic sailing.
	Can not create the temporary route because own ship may pass through the planned route leg. Select the TO-Waypoint again. [OK]	Since the approaching route leg length is shorter than the limit at the start of autosailing in TRACK mode, a course cannot be generated.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, operate the ship so that the ship's heading becomes parallel to the route leg and start autosailing. Alternatively, bring own ship within the route leg and start autosailing.
	Can not create the temporary route because own ship may pass through the WOL. Select the TO-Waypoint again. [OK]	Since the course exceeds the WOL of the approaching route leg at the start of autosailing in TRACK mode, a course cannot be generated.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, change the intended To WPT and start autosailing.

Display Unit	Indication	Phenomenon	Action to Take
Others	Safety errors are detected on the temporary route. [OK]	The result of safety checking for the course that was generated indicates 'not safe'.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, navigate own ship to a safe area and start autosailing.
	Selected route is not available to start autosailing using S-JOY because this route is not checked safety and limit by current status. Start autosailing from menu. How to start autosailing -Click [Menu]-[Autosail]-[Start] [OK]	A route different from the route that was selected before ship avoiding operation is selected.	Switch the steering mode to AUTO or MANUAL and stop the S-JOY operation. To start autosailing, start autosailing from the menu.
	Rudder control mode. Since it is dangerous if rudder is kept turn, change to MIDSHIP or other mode after finishing to turn. [OK]	This message is displayed for precaution when the RUDDER mode selected.	As soon as completing the turn in RUDDER mode, change the mode to another mode.

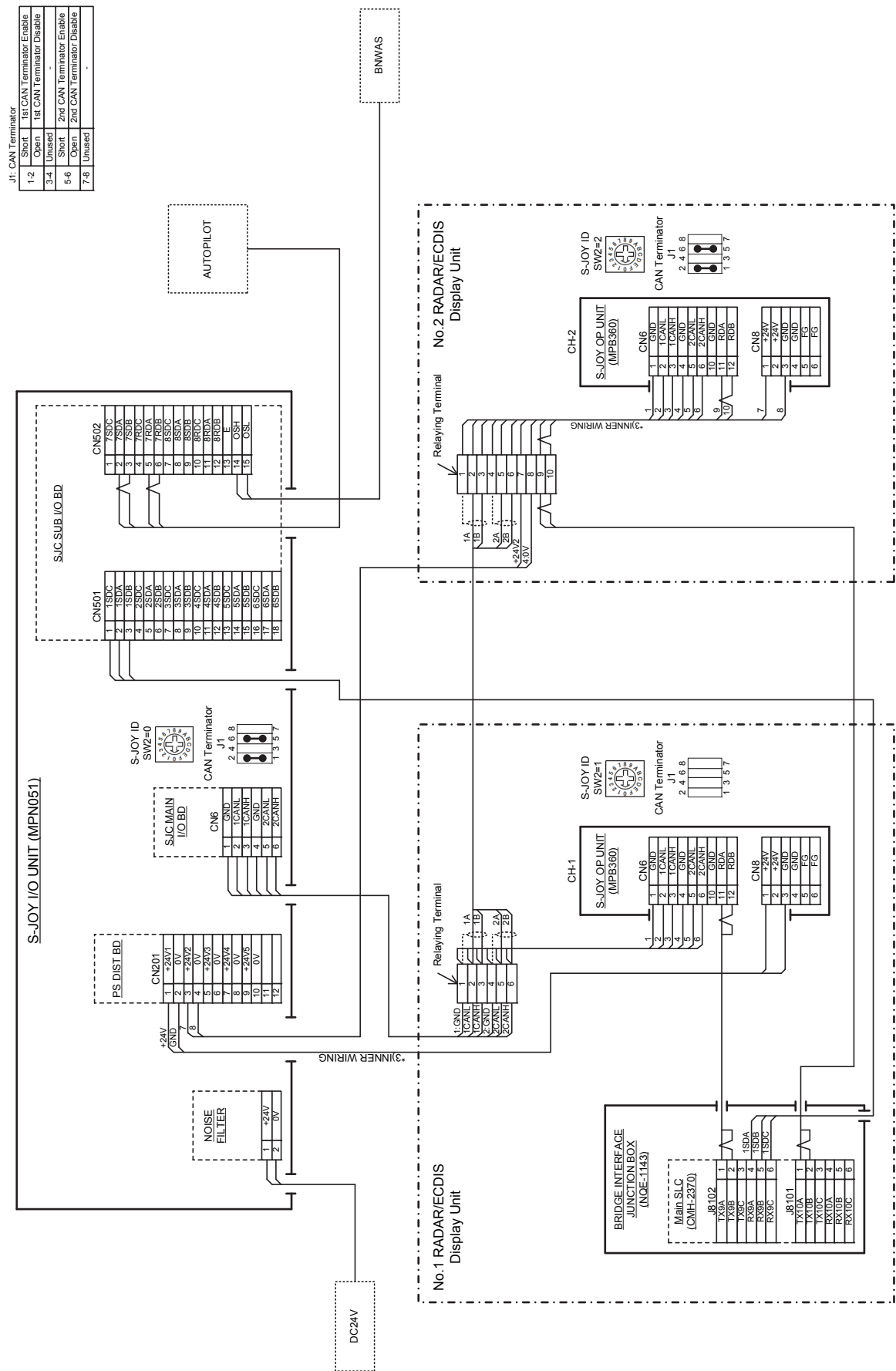
Fallback modes at the occurrence of failures and the countermeasures



No.	Failure section	Failure mode	Fallback mode	Cause	Action	Remarks
1	S-JOY OP UNIT	Failure in the selected S-JOY OP UNIT	The mode is changed to the AUTO mode automatically. (The control mode changes to RADIUS or PD according to the turn or course retention state.)	Communication failure, unit failure, etc.	Switch to the other S-JOY OP UNIT.	When failure occurs in #1 S-JOY OP UNIT, TRACK cannot be started.
2	S-JOY I/O UNIT	Failure in the S-JOY I/O UNIT that is currently using S-JOY	The mode is changed to the AUTO mode automatically. (The control mode changes to RADIUS or PD according to the turn or course retention state.)	Communication failure, unit failure, power failure, etc.	Switch to another steering mode.	
3-1	#1 ECDIS	Communication failure between #1 ECDIS and AP in TRACK mode	Traveling straight line: Start Heading control in the current course. (S-JOY: HEADING mode) Turning: Complete the current turning and continue Heading control in the next course. (S-JOY: RADIUS mode)	Communication failure between #1 ECDIS and AP and #1 ECDIS sensor (HDG/POS) failure	A mode other than TRACK mode can be selected by S-JOY.	
3-2		Communication failure between #1 ECDIS and #1 S-JOY OP UNIT while #1 S-JOY is selected	The mode is changed to the AUTO mode automatically. (The control mode changes to RADIUS or PD according to the turn or course retention state.)	ECDIS power failure and communication failure between #1 ECDIS and #1 S-JOY OP UNIT	Switch to the other S-JOY OP UNIT.	When a power failure occurs in ECDIS, TRACK can be started in #2 ECDIS and #2 S-JOY OP UNIT.
4	#2 ECDIS	Communication failure between #2 ECDIS and #2 S-JOY OP UNIT while #2 S-JOY is selected	The mode is changed to the AUTO mode automatically. (The control mode changes to RADIUS or PD according to the turn or course retention state.)	ECDIS power failure and communication failure between #2 ECDIS and #2 S-JOY OP UNIT	Switch to the other S-JOY OP UNIT.	
5	AP CDU	Failure in automatic steering (control in S-JOY or AUTO mode)	The rudder angle at the occurrence of the failure is maintained.	Failure in the automatic steering section of gyro compass, AP CDU (MPU), or NAV I/F	Switch to manual steering.	
6	HAND UNIT	Failure in selected HAND unit	The rudder angle at the occurrence of the failure is maintained.	Failure in rotary encoder, HAND CPU, etc.	Switch to the other system or another steering mode.	
7	FU DIAL for wing console	Failure in FU DIAL that is currently used	The rudder angle at the occurrence of the failure is maintained.	Disconnection of potentiometer, failure in TAKE-OVER UNIT, etc.	Switch to another steering mode.	
8	OVERRIDE	Failure in OVERRIDE steering	The rudder angle at the occurrence of the failure is maintained.	Disconnection of potentiometer, failure in OVRD OPERATION UNIT, etc.	Switch to another steering mode.	

7. Appendix

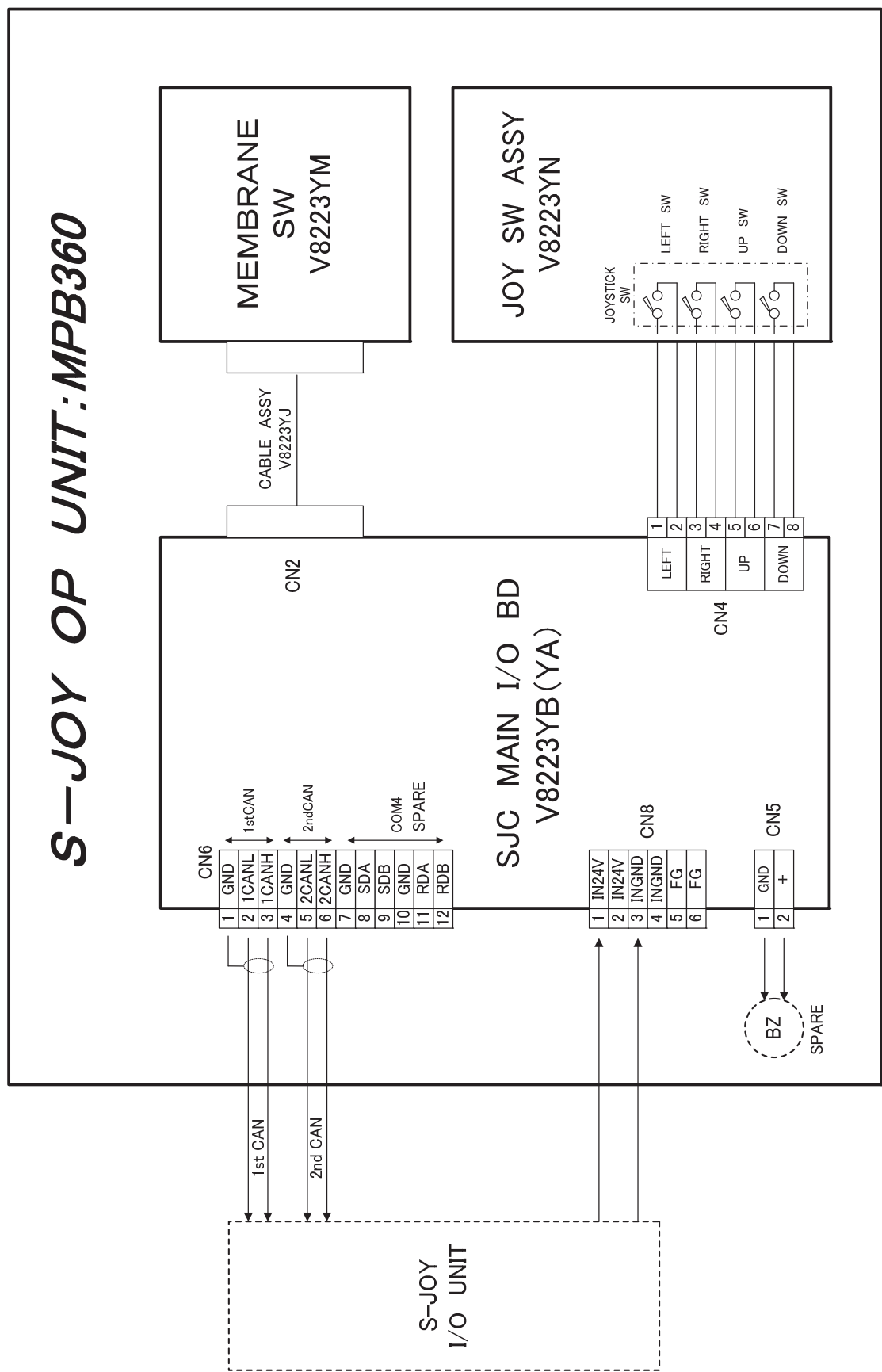
7.1 Wiring diagram



This connection diagram shows that 2 set of S-JOY OP unit (MPB360) are connected.

7.2.1 S-JOY I/O unit

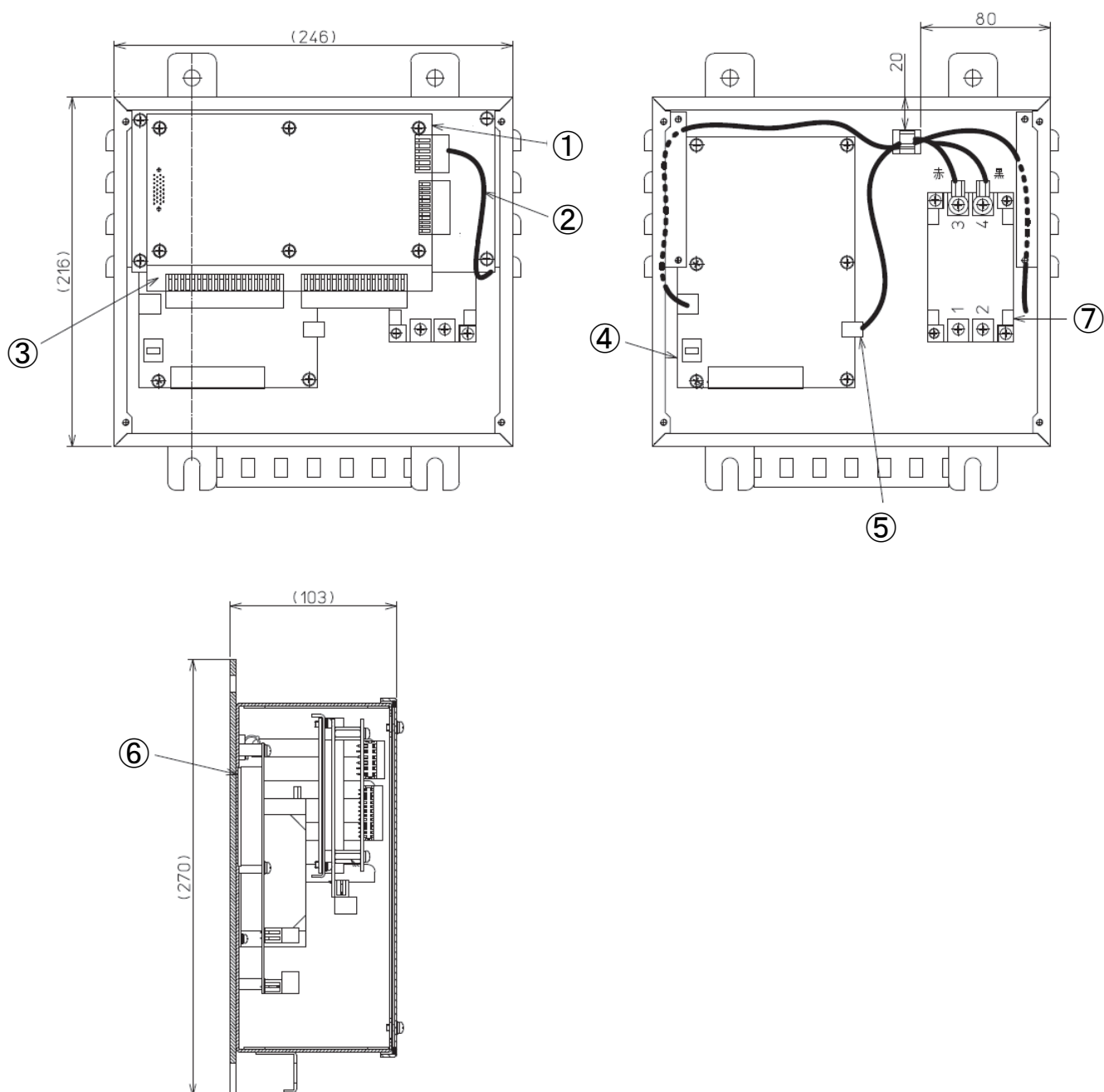




* The internal wiring connections of channels 1 to 5 of the S-JOY OP UNIT are common to all.

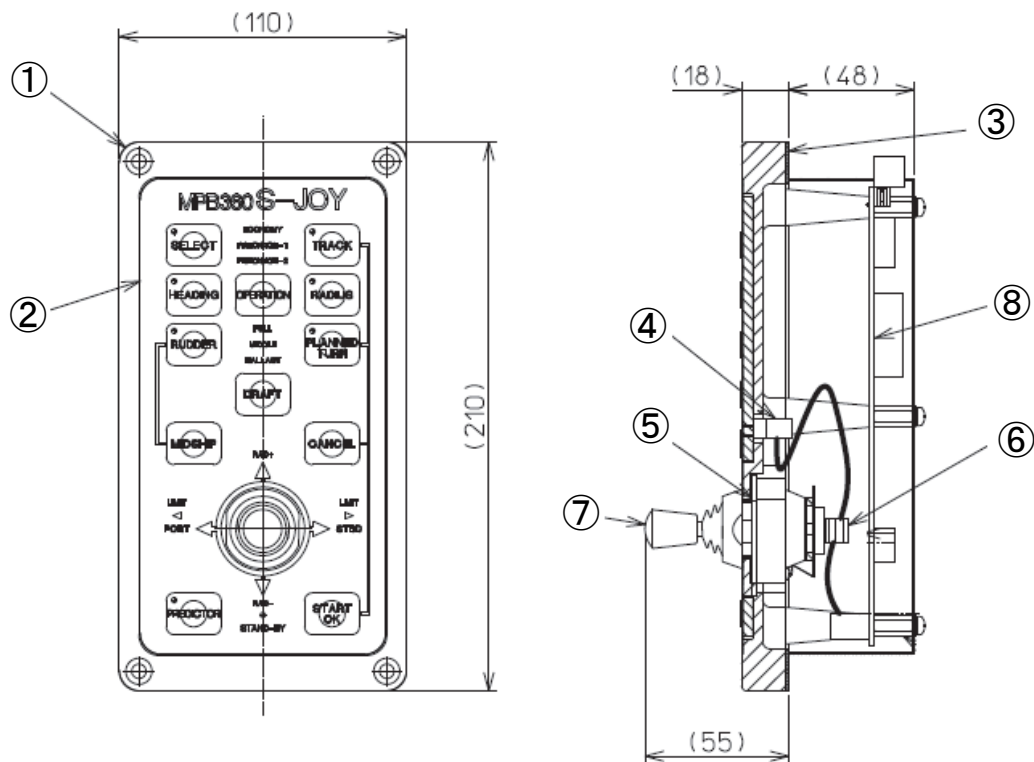
7.3. Parts list

7.3.1 S-JOY I/O unit (MPN051)



No.	PART NAME	PART NO.
1	SJC MAIN I/O BD ASSY	V8223YB
2	CABLE ASSY	V8223YL
3	SJC SUB I/O BD ASSY	V8223YD
4	PS DIST BD ASSY	V8223YG
5	CABLE ASSY	V8223YK
6	CONDUCTION SHEET	V8123HU
7	NOISE FILTER	V8817BH

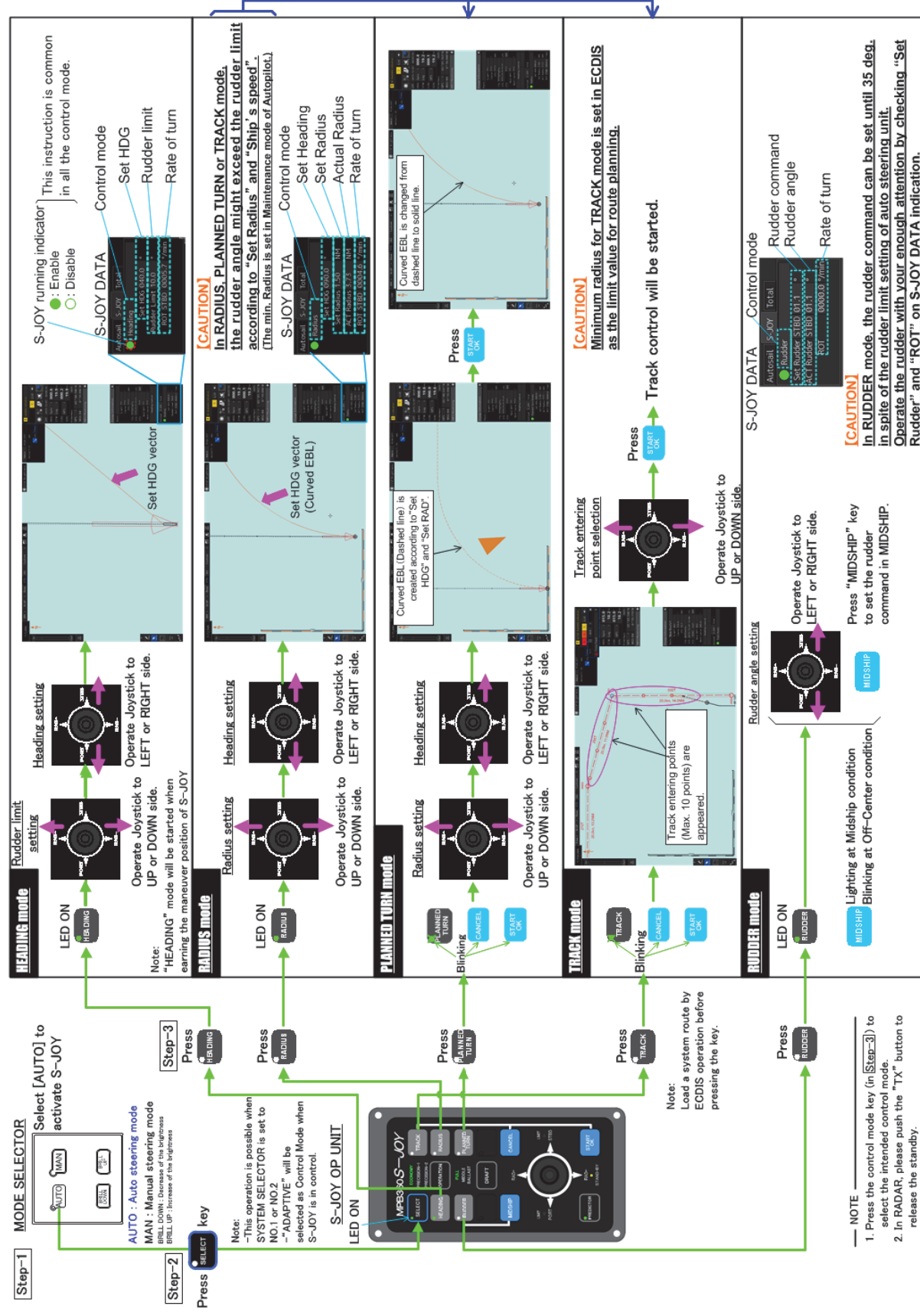
7.3.2 S-JOY OP unit (MPB360)



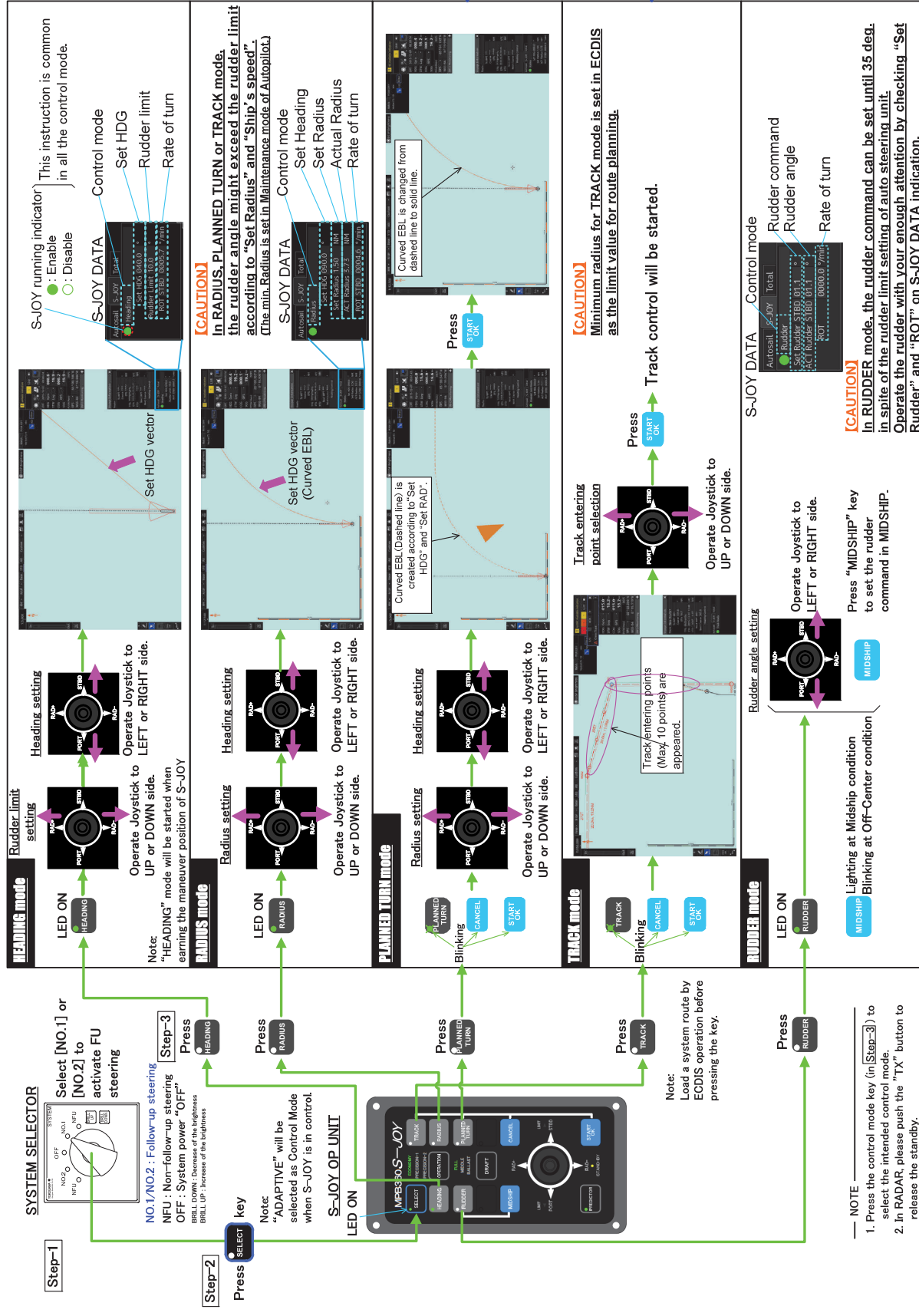
No.	PART NAME	PART NO.
1	FRAME PAINT	V8223WA
2	MEMBRANE SWITCH	V8223YM
3	PACKING	V8223WD
4	CABLE ASSY	V8223YJ
5	PACKING	V8223WF
6	CLAMP	V8813RE
7	JOY SW ASSY	V8223YN
8	SJC MAIN I/O BD ASSY	V8223YB

8. Simplified Operation Guide

8.1 When the Mode selector is installed in the ship



8.2 When the Mode selector is not installed in the ship



アスベストは使用しておりません
Not use the asbestos

For further information, contact:



Since 1915

Japan Radio Co., Ltd.

URL Head office : <http://www.jrc.co.jp/eng/>

Marine Service Department

1-7-32 Tatsumi, Koto-ku, Tokyo 135-0053, Japan

e-mail : tmsc@jrc.co.jp

One-call : +81-50-3786-9201

ISO 9001, ISO 14001 Certified

CODE No.7ZPNA4610A

APR. 2019 Edition 2