

PT900 AUTOPILOT - BASIC ADJUSTMENT -

PRODUCT TRAINING



Sep. 2024
YDK Technologies

CONFIDENTIAL





====Commissioning service====

- ITEM-0: Visual check of Installation by shipyard
- ITEM-1: Cable Check
- ITEM-2: Adjustment of μ Transmitter
- ITEM-3: Adjustment of Control & Power Box
- ITEM-4: Confirmation of AP CDU settings
- ITEM-5: Adjustment of Control Stand
 - ITEM-5-1: CAN ADAPTER BD
 - ITEM-5-2: HAND STEERING UNIT
 - ITEM-5-3: DIAL STEERING UNIT
- ITEM-6: Alert confirmation



PT900 □-□-□-□□

Steering gear

S : Single rudder
T : Twin rudder

System

1 : 1system
2 : 2system

Type of steering gear control(□=No. of pumps)

N□ : Solenoid valves

K□T : Torque motor (By KAWASAKI / FLUTEK / WUHAN KAWASAKI)

Y□A : DD MOTOR (By MISTUBISHI / YOOWON / MASADA)

T : Proportional Solenoid valve(By HATLAPA)

ANA□ : Analog

System style

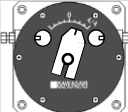
S : Stand-alone,
K : Standard built in Gyro compass
P : Panel mounting
Q : Concept

Control model

A : Adaptive
D : PID



Type of steering gear control

Actuator	YDK type	Control & Power Box	Note
Solenoid valve 	N□, N□F	PC131	▪ ON-OFF control ▪ Constant delivery pump ▪ Dead band adj.
DD MOTOR 	Y□A	MPC133A	▪ Variable pump control ▪ Proportional band adj. ▪ Maximum pump stroke adj.
Torque motor 	K□T	PC134	▪ Actuator failure
Proportional solenoid valve	T□	PC136	



ITEM-0: Visual check of Installation by shipyard



Refer to another documents.

“Proper installation for shipyard”

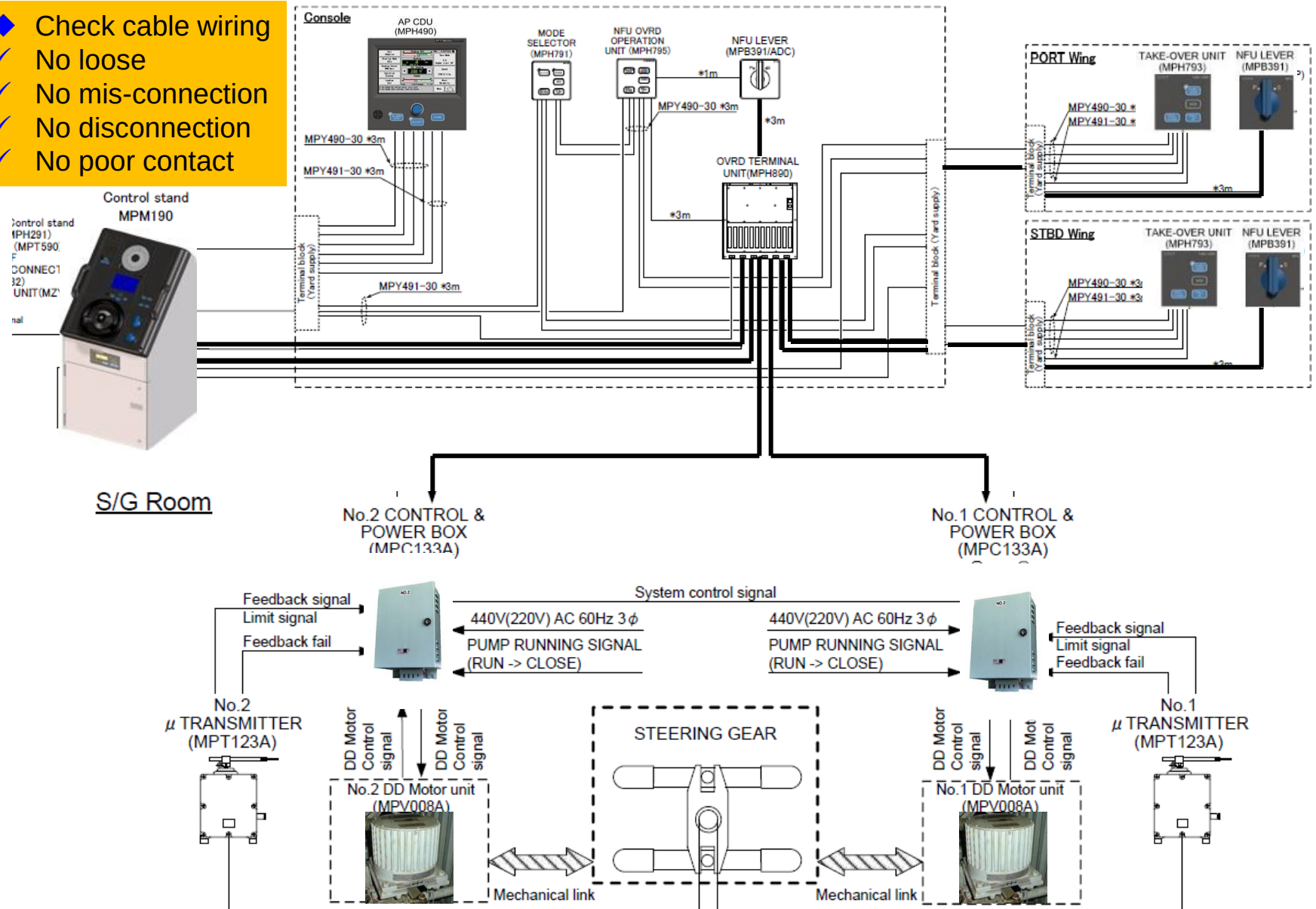


ITEM-1: CABLE CHECK

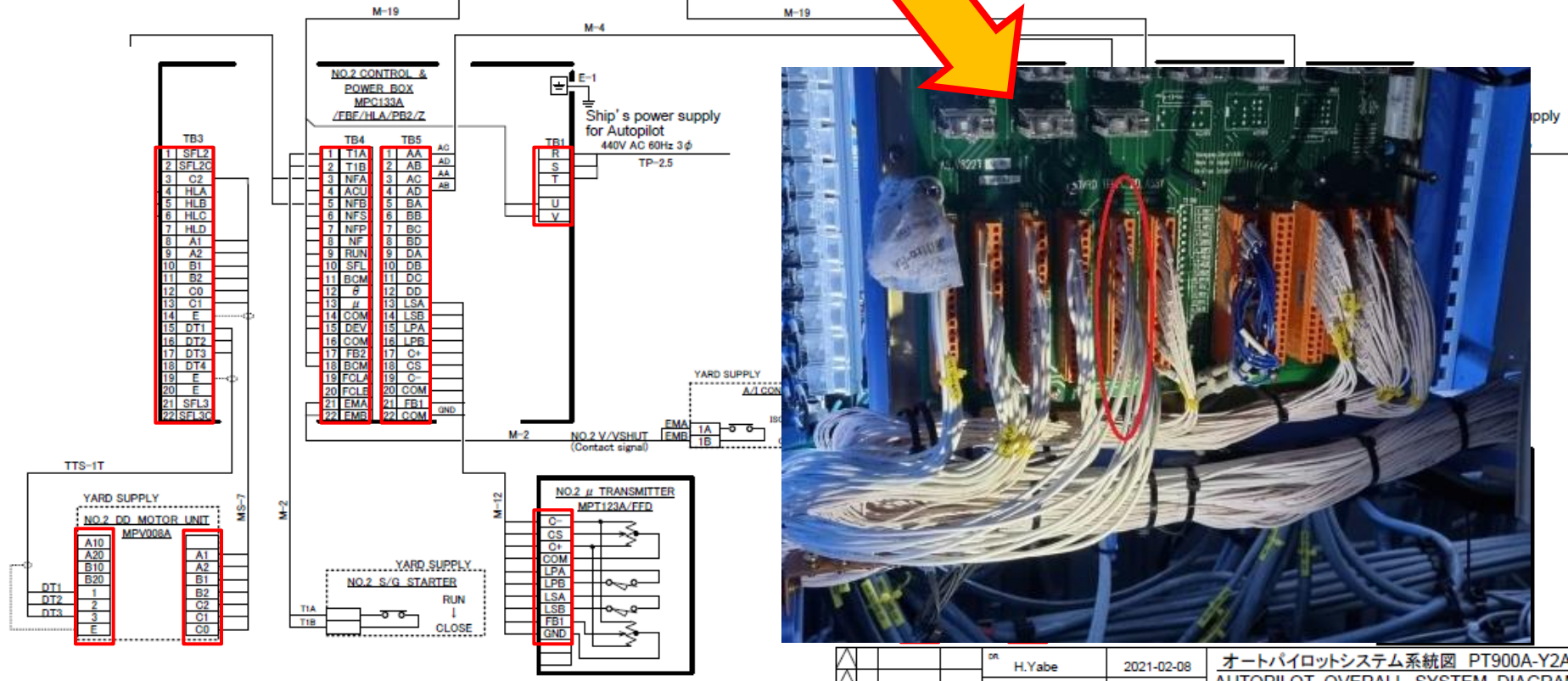
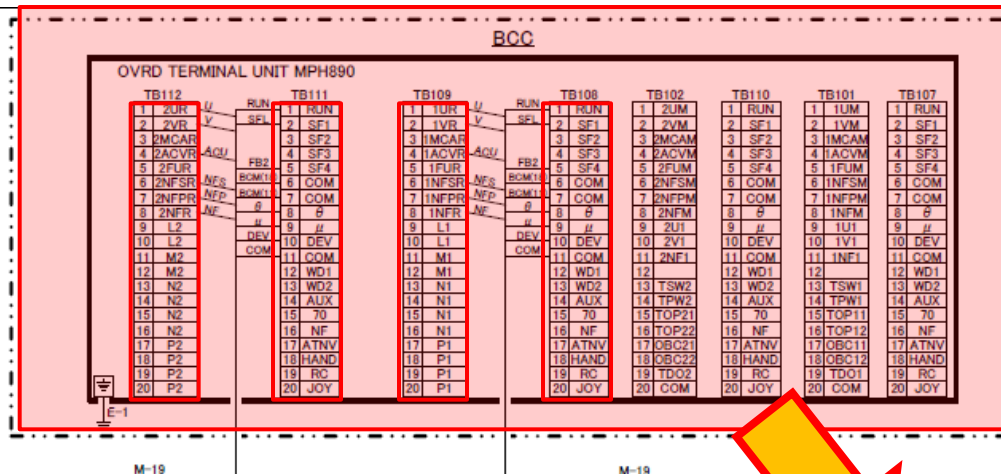
ITEM-1: CABLE CHECK



- ◆ Check cable wiring
- ✓ No loose
- ✓ No mis-connection
- ✓ No disconnection
- ✓ No poor contact



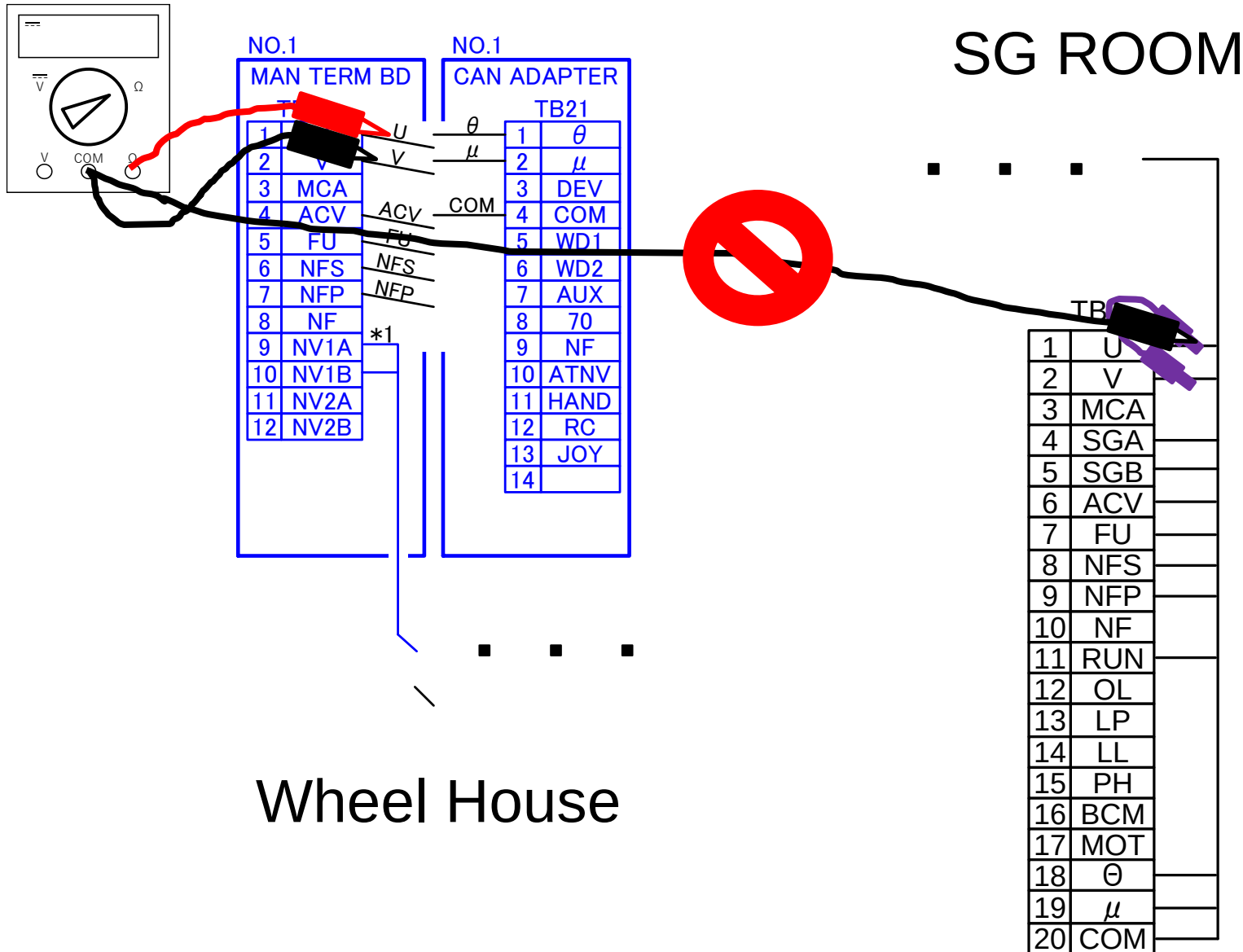
External cable



ITEM-1: CABLE CHECK



Continuity check



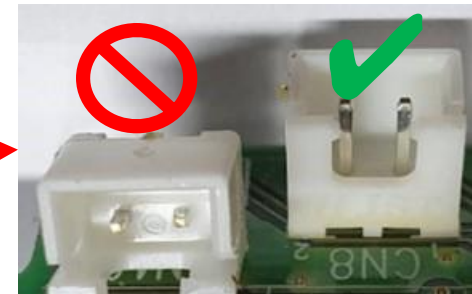
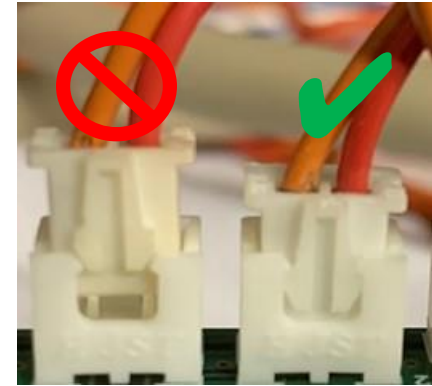
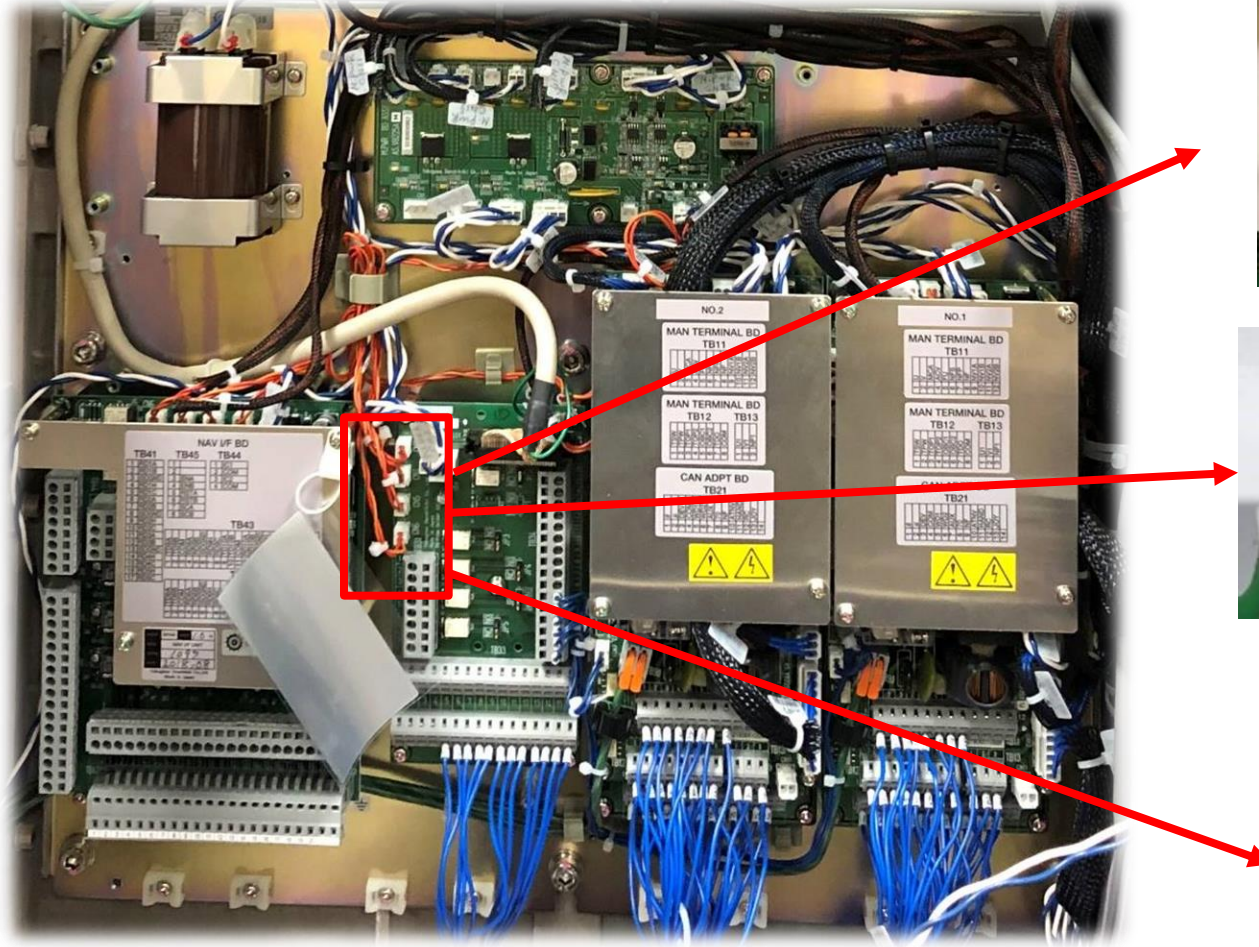
ITEM-1: CABLE CHECK



ITEM-1: CABLE CHECK



Condition check



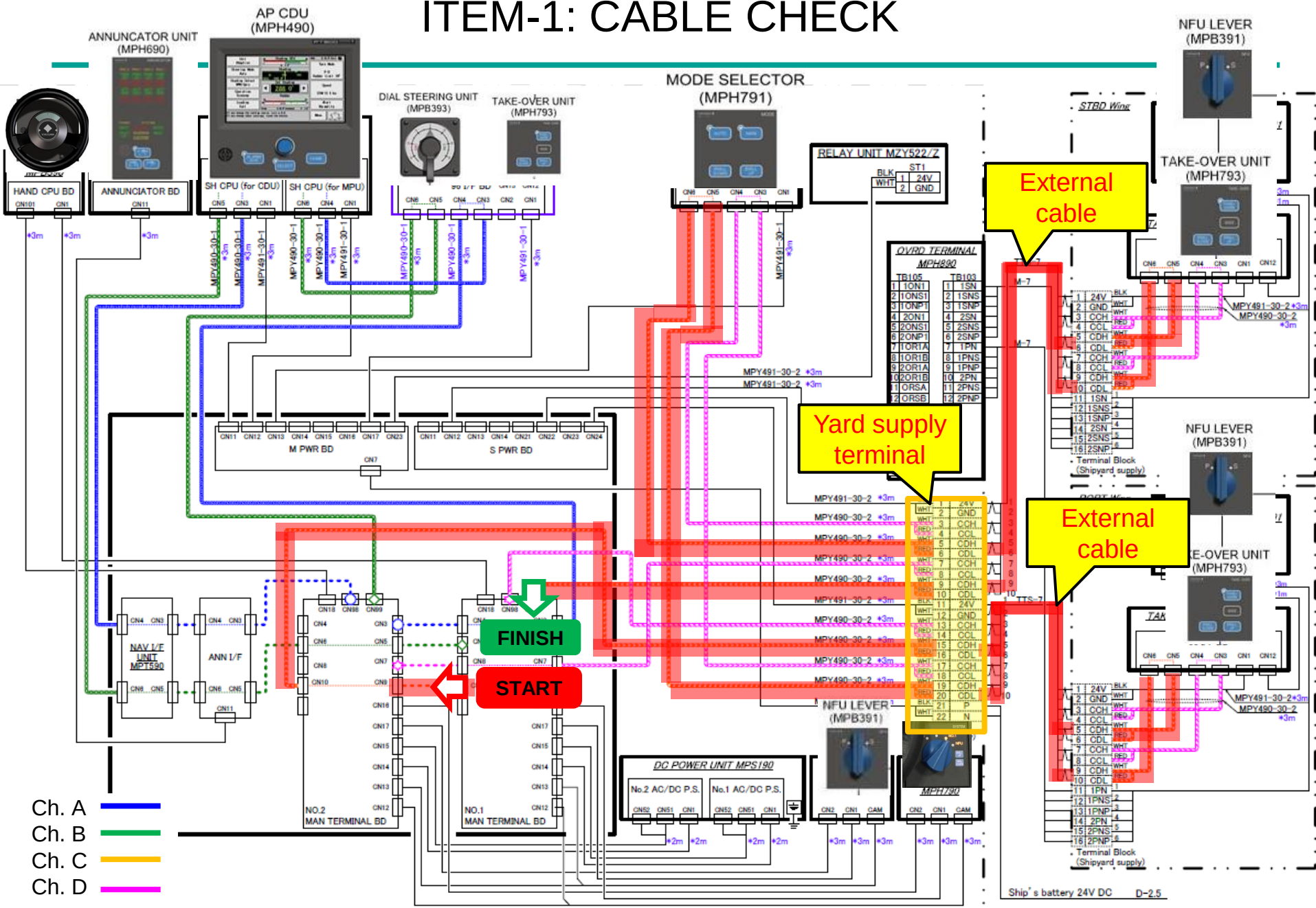
ITEM-1: CABLE CHECK



*If “Can-bus ch.C communication error” is occurred

Time	Description			Set Heading	221.0°
2022-11-09 19:47:27	Warning B 13201	[SCS] COMM Error #9C TAKE OVER(NFU) :Can-bus chC	▲	Control Mode :Adaptive Steering Mode:AUTO HDG Source :GYRO Operation :Economy Loading :Full Turn Mode :P-D RUDD LIM 10° Speed(SDME) :STW 15.8kn HDG DEV : 0.0° ROT : 0.0°/min Rudder :Order -> 0. :Feedback <- 0.	
2022-11-09 19:17:00	Normal B 142	[HCS] #10 Heading difference			
2022-11-09 18:38:48	Warning B 142	[HCS] #10 Heading difference			
2022-11-09 18:15:08	Normal B 142	[HCS] #10 Heading difference			
2022-11-09 18:08:38	Caution B 10858	[SCS] #28 Pump all rest	▼		

ITEM-1: CABLE CHECK





◆ Considerable Failure

Following 2 items are probable cause of communication failure.

- a.) CAN-BUS line connection failure (Mistake or disconnection)
- b.) Dip SW Setting mistake

Therefore, if you come across with communication failure, please check...

1.) CAN-BUS line cable connection

Usually, connection between W/H and Wing through yard terminal is something wrong.

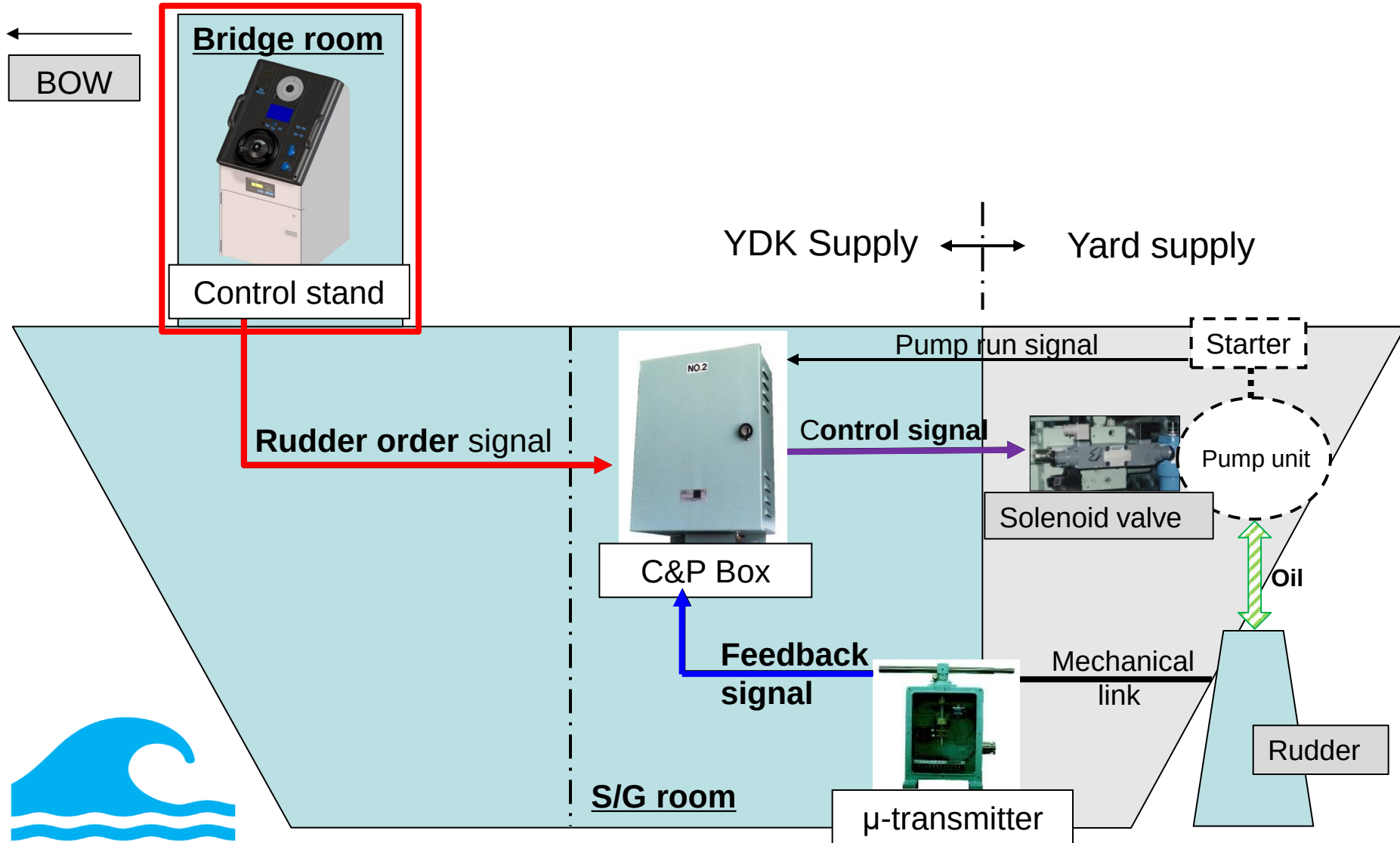
2.) Dip SW settings

MAKE SURE THEY WERE SET PROPERLY.



ITEM-2: ADJUSTMENT OF μ TRANSMITTER

1. System Configuration – (N/NF type) -



1. System Configuration - N/NF type -



Features of μ -Transmitter

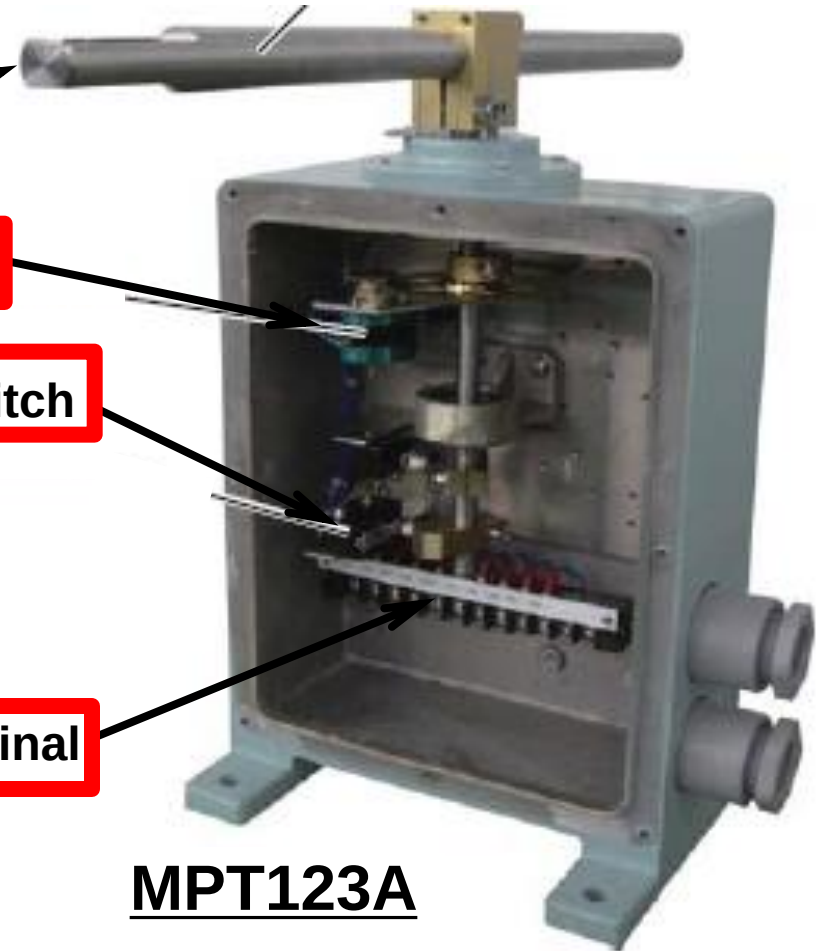
Connecting Lever

Potentiometer

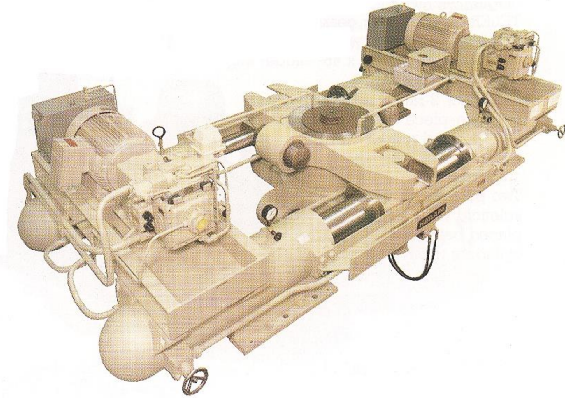
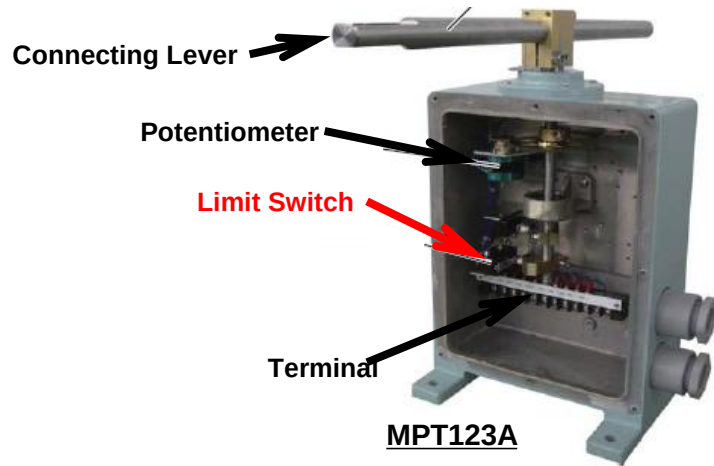
Limit Switch

Terminal

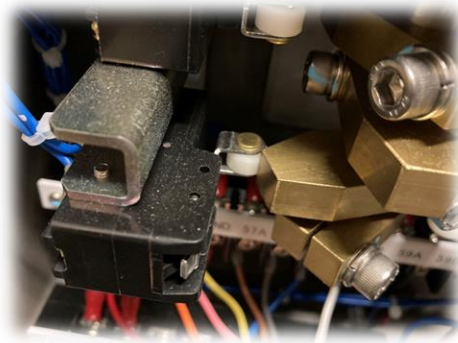
MPT123A



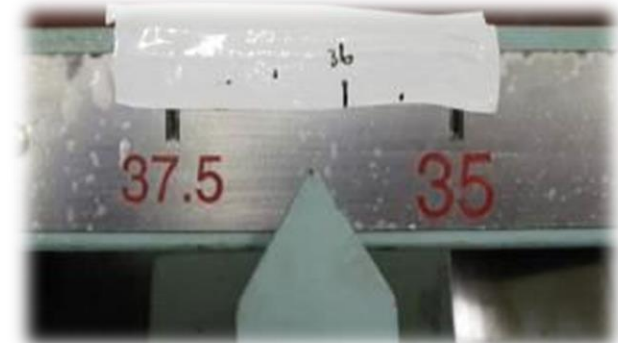
Limit switch on μ -Transmitter



Traget:36.2deg



Midship



Angle limit of HAND STEERING UNIT(Screen4-9-2-5-9) 35.8DEG

Limit SW of μ Transmitter 36.2DEG(36.0~36.5)

REREF VALVE OF STEERING GEAR 37.0DEG

Hard
PORT

Hard
STBD

Location of Limit switch



Type C&P BOX	Steering angle	Location of limit switch
N*,N*F PC131	35deg only	μ TRANSMITTER
	35/45(or 60, 65,70) selectable	μ TRANSMITTER
Y*A MPC133A	35deg only	μ TRANSMITTER
	35/45 selectable	μ TRANSMITTER
K*T PC134	35deg only	STEERING GEAR
	35/45 selectable	μ TRANSMITTER(for 35 deg)



- ◆ Check the function and direction of limit SW in the μ transmitter.
 - Check if rudder stops by pressing the limit SW during rudder turning.
 - Check if rudder turning direction and the pressed limit SW are corresponding.

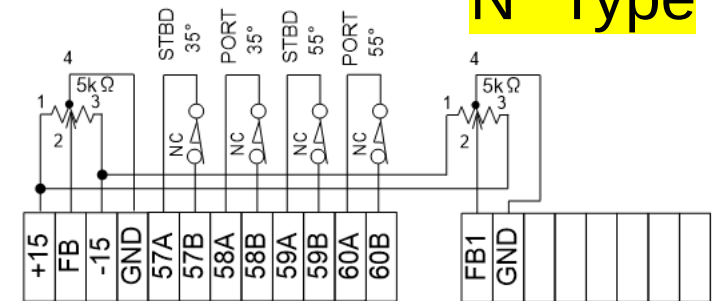
- ◆ Adjust the position where CAM push limit SW in the μ transmitter.
 - Steer the rudder to the PORT 36.2 ± 0.2 .
 - Loosen the screw “C” which fastens the PORT side cam.
 - Adjust the position of cam to push the PORT side limit SW.
 - Fasten the screw “C”.
 - Steer the rudder to the STBD 36.2 ± 0.2 .
 - Loosen the screw “B” which fastens the STBD side cam.
 - Adjust the position of cam to push the STBD side limit SW.
 - Fasten the screw “B”.
 - Carry out the same adjustment for the other μ transmitter.
 - Check if the limit SW securely works at both PORT 36.2 and STBD 36.2 and rudder stops when the TEST VR is fully turned to PORT/STBD side.

Rudder angle limit switch adjustment in μ transmitter

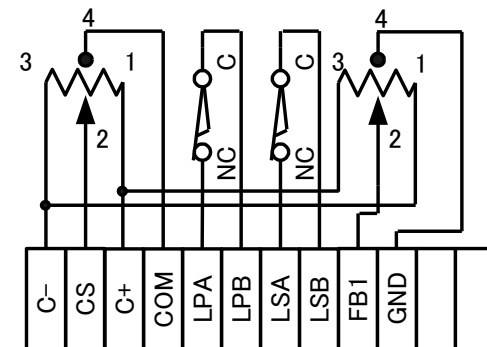


μ Transmitter (MPT123A)

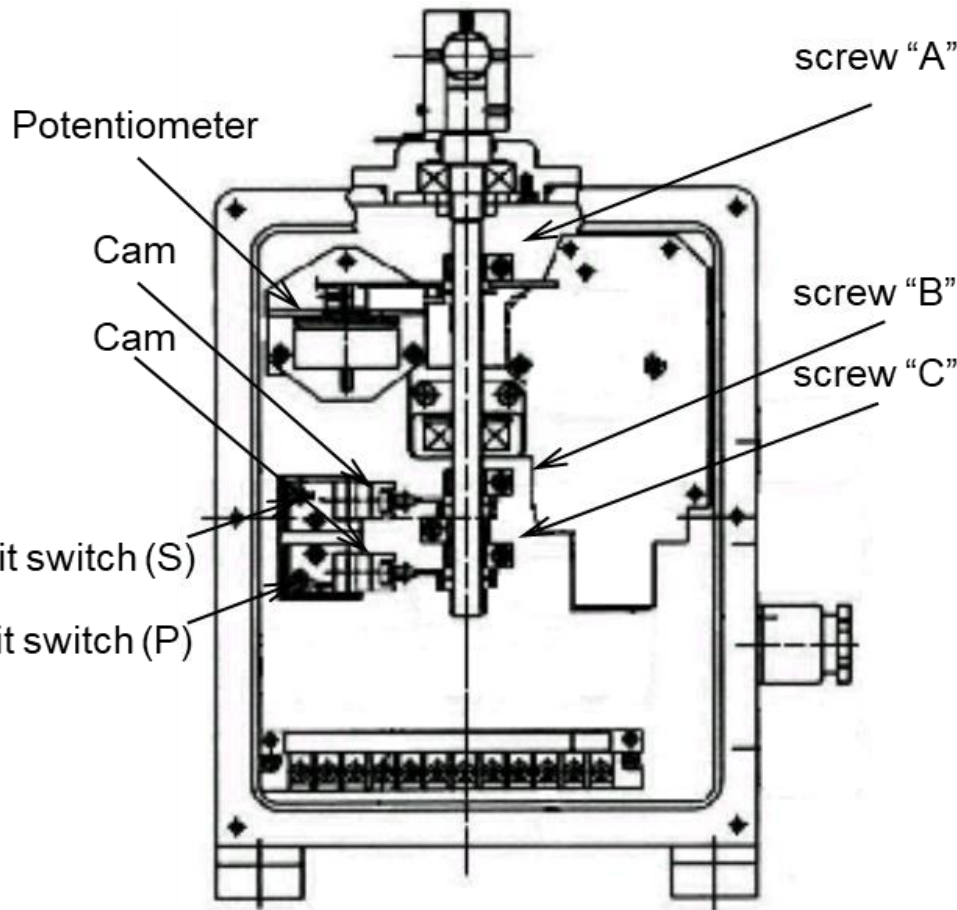
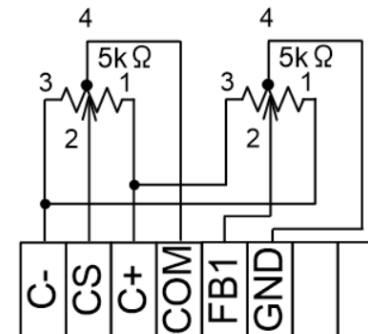
N* Type



Y*A type



K*T type





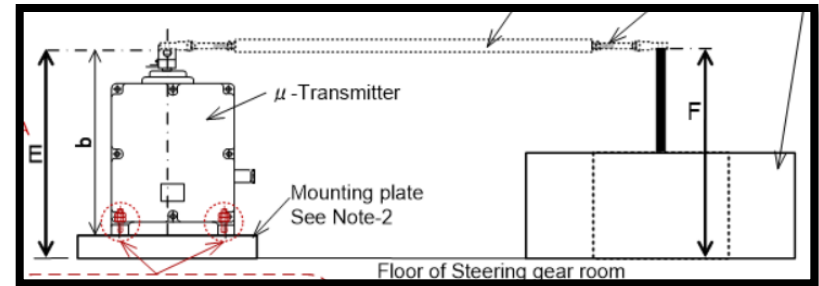
<< Next >>

Adjustment of feedback signal in the
 μ Transmitter

μ transmitter zero point adjustment



- (1) Set the steering gear to the midship position.
- (2) Turn "OFF" the steering gear hydraulic pump.
- (3) Turn "ON" Control & Power Box power supply.
- (4) Check the voltage between **"FB" and "GND"** or **"CS" and "COM"** on the output terminal board of each of the μ transmitters. It should be **less than $0V \pm 10mV$** .

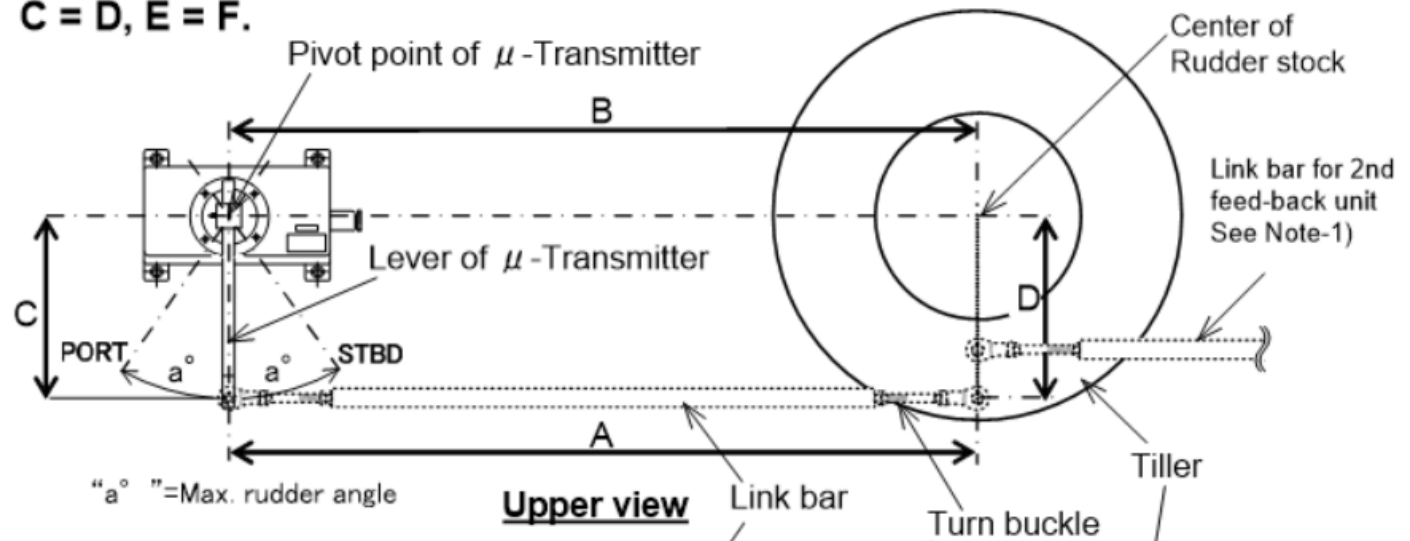


- (5) When the length of the connection rod connecting the μ transmitter lever and the rudder head has not been adjusted, adjust it so that the voltage becomes above (4)

PT120/PT123/MPT123A/PT111

Length of mechanical links between μ -Transmitter and the tiller should be bellows.

$$A = B, C = D, E = F.$$

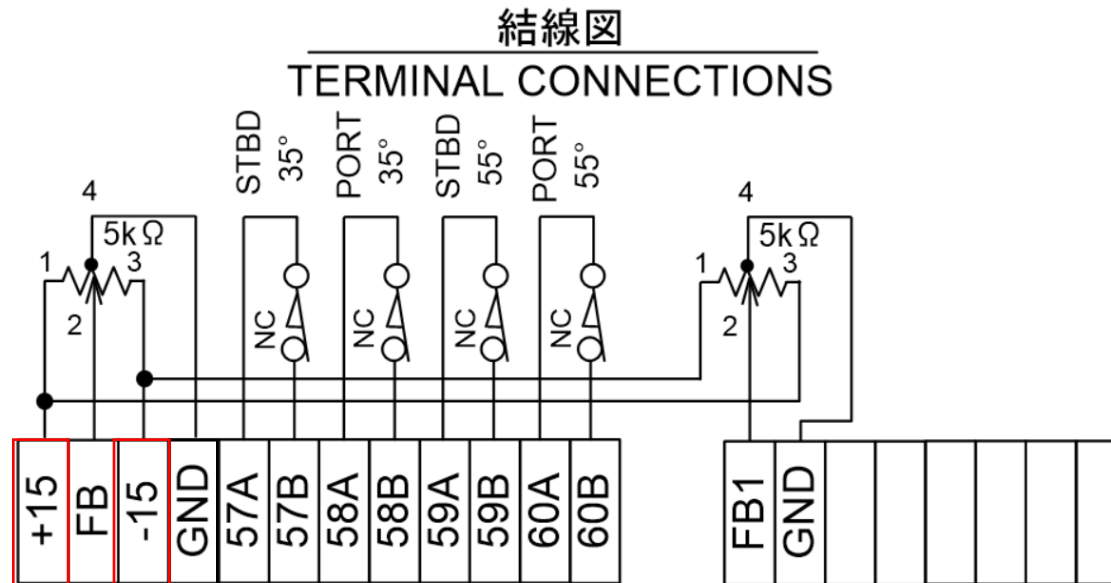




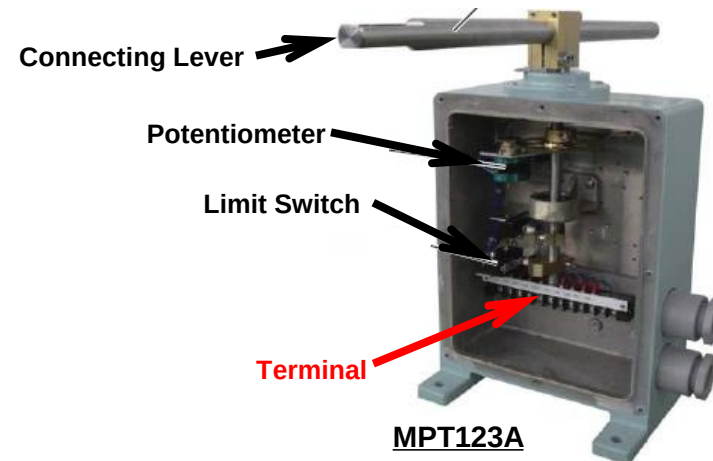
If the feedback volage is NOT less than $0V \pm 10mV$ even though adjusted the length of link bar and μTranmiiter lever,

Carry out the adjustment on next page.

Adjustment of power to potentiometer



- Potentiometer needs power supply. So, you have to check the power supply voltage at first.
- Turn on the C&P BOX
- Check the voltage of “FB” by digital multimeter



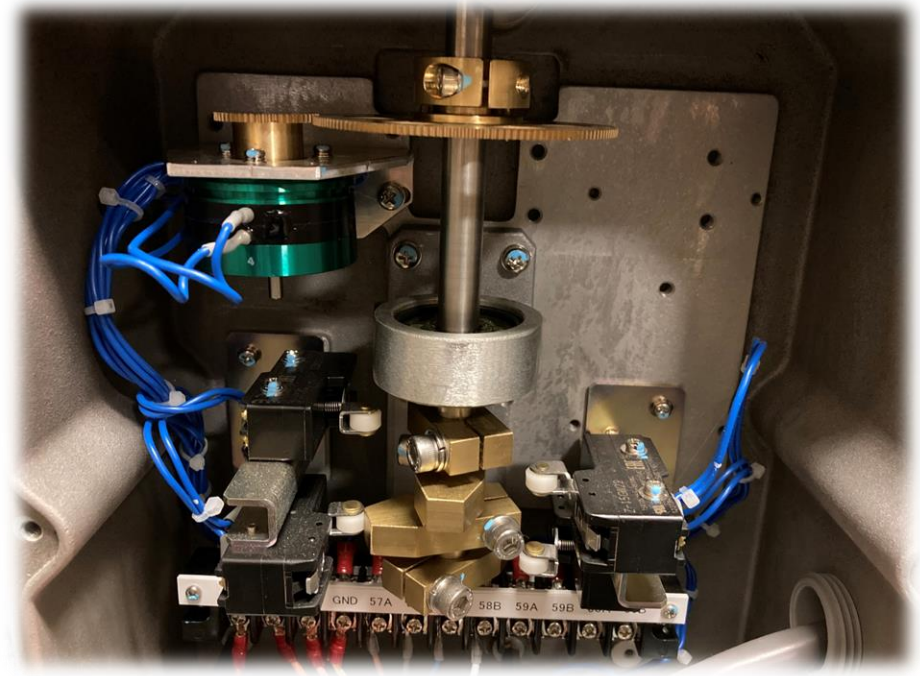
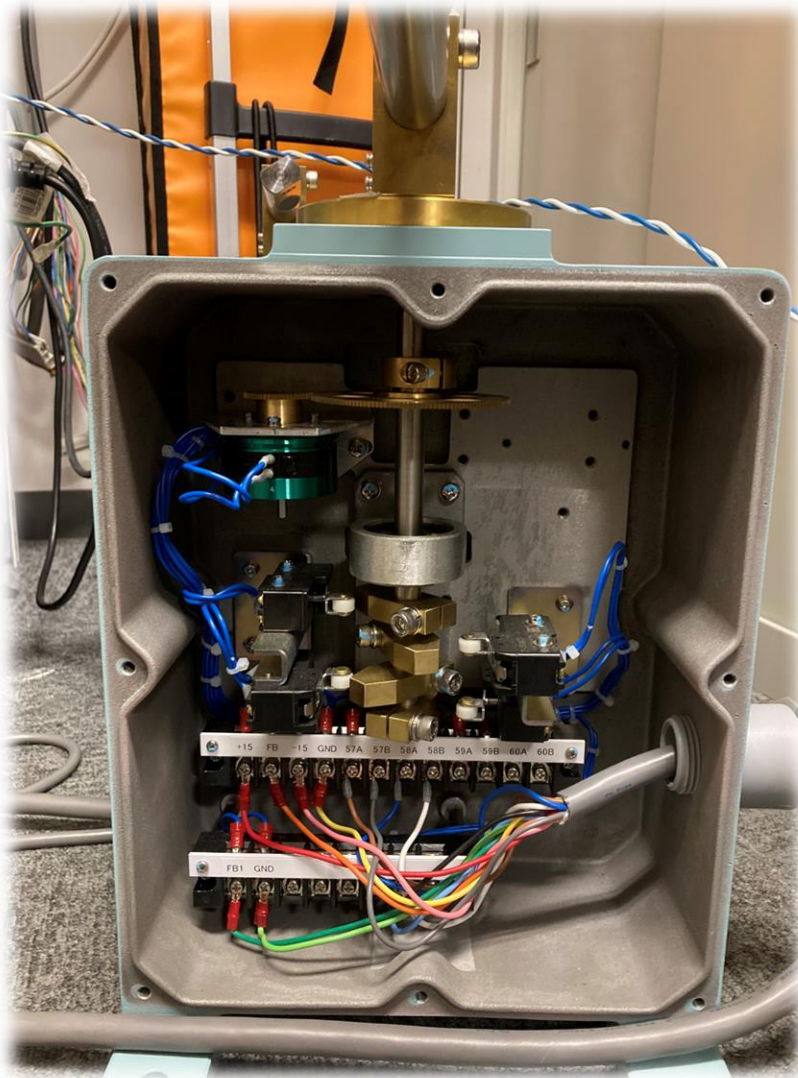
Power supply of power to potentiometer



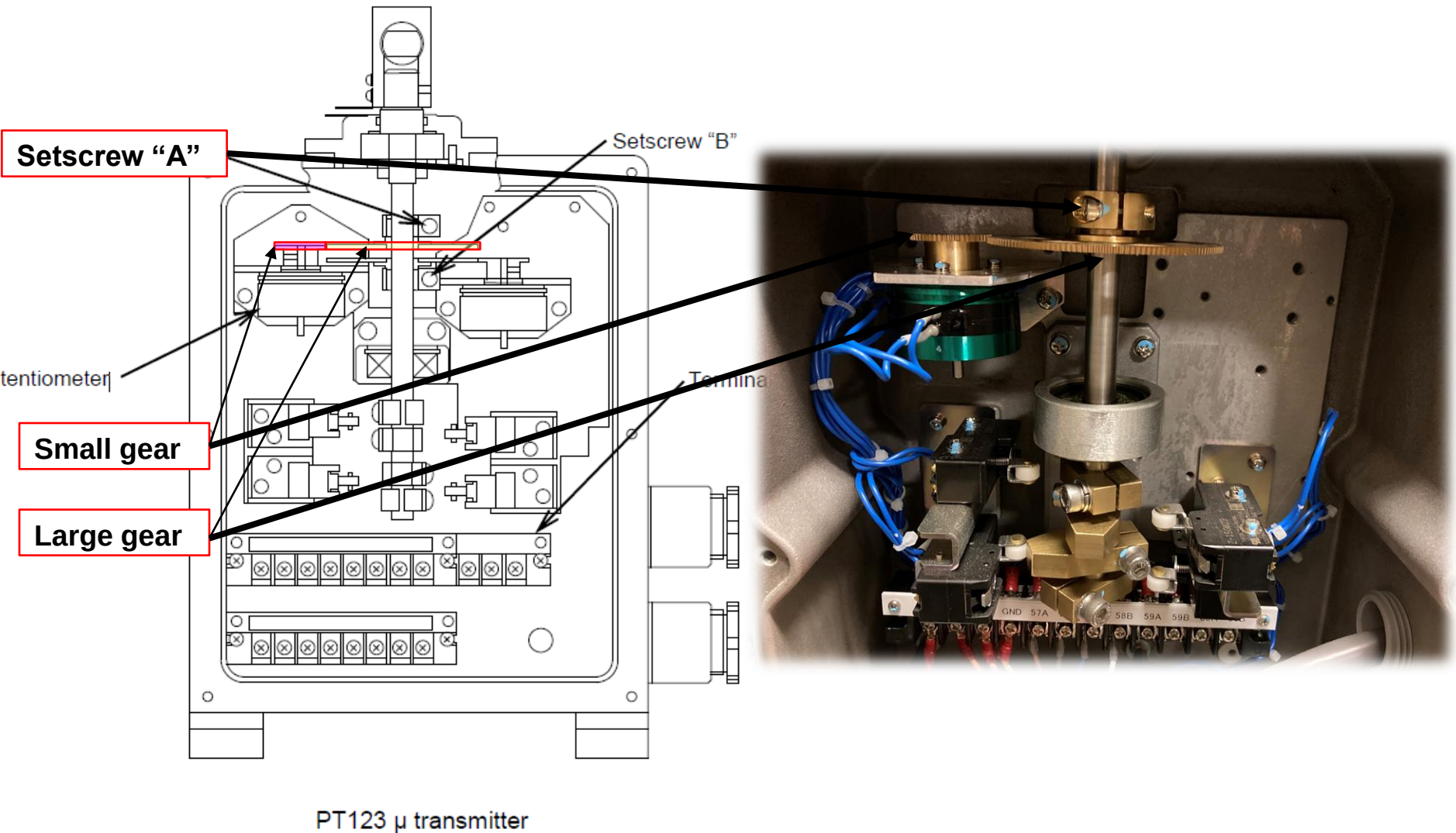
□Precondition

Type C&P BOX	MEASURE Point at Myu-Trans	Volume	Criteria
N*, N*F PC131	+15 and GND	VR1 FB Fail BD	+14.9 $\pm$ 0.02 VDC
	-15 and GND	VR2 FB Fail BD	-14.9 $\pm$ 0.02 VDC
Y*A MPC133A	+C and COM	VR33 Y Control BD	+13.5 $\pm$ 0.02 VDC
	-C and COM	VR32 Y Control BD	-13.5 $\pm$ 0.02 VDC
K*T PC134	+15 and GND	VR34 KT Control BD	+14.5 $\pm$ 0.02 VDC
	-15 and GND	VR33 KT Control BD	-14.5 $\pm$ 0.02 VDC

Adjustment in the potentiometer



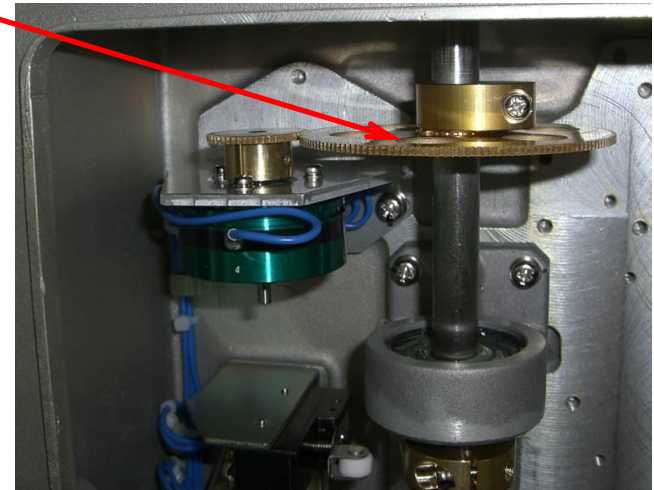
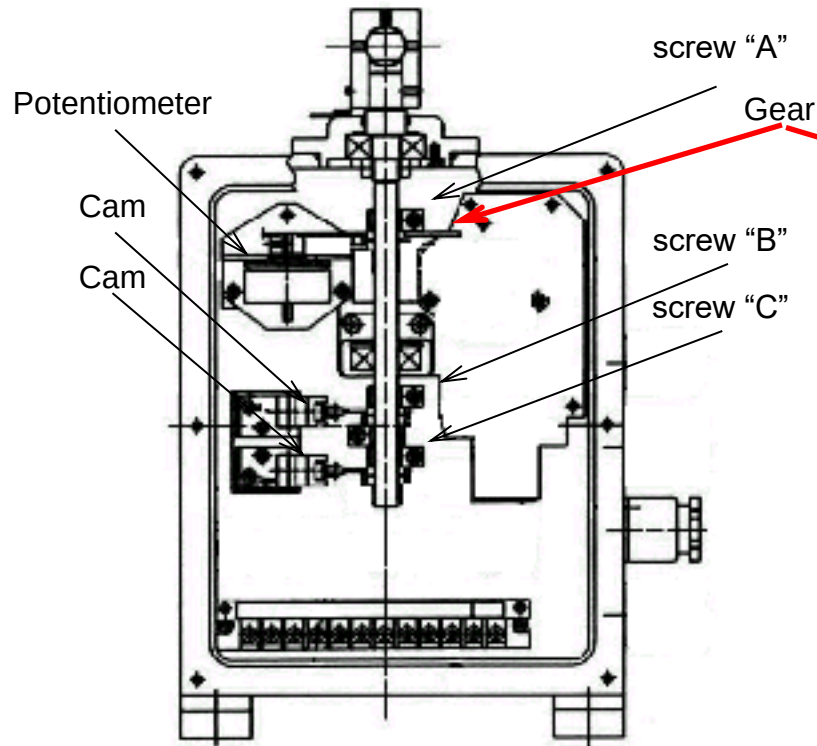
Adjustment in the potentiometer



μ transmitter mechanical zero adjustment



- Steer the rudder to midship position.
- Turn “ON” the C&P Box with steering gear pump turned OFF.
- Check the voltage between “FB” and “GND”
- or “CS” and “COM” if it is less than $0V \pm 10mV$.
- Adjust the mechanical zero point as following
 - Loosen the screw “A”.
 - Turn the gear to set the voltage $0V \pm 10mV$.
 - Fasten the screw “A”.





<< Next >>

Adjustment of feedback signal on
CONTROL & POWER BOX

Zero and Span

Feedback adjustment on C&P BOX



Type C&P BOX	Adj. point	Measure point at C&P BOX	Volume	Criteria
N*, N*F PC131	ZERO	TP6 and TP11(COM)	VR6 (Z2)	0V±10mVDC @Midship
	SPAN	Do.	VR7 (FBN)	±3.0±10mVDC (+:PORT, -:STBD)@30deg
Y*A MPC133A	ZERO	CT35 and CT12or CT21(COM)	VR27 (FB ZERO)	0V±10mVDC @Midship
	SPAN	Do.	VR28 (SPAN)	±3.0±10mVDC (+:PORT, -:STBD)@30deg
K*T PC134	ZERO	CT11 and CT2(COM)	VR26 (ZERO)	0V±10mVDC @Midship
	SPAN	Do.	VR23 (SPAN)	±3.0±10mVDC (+:PORT, -:STBD)@30deg



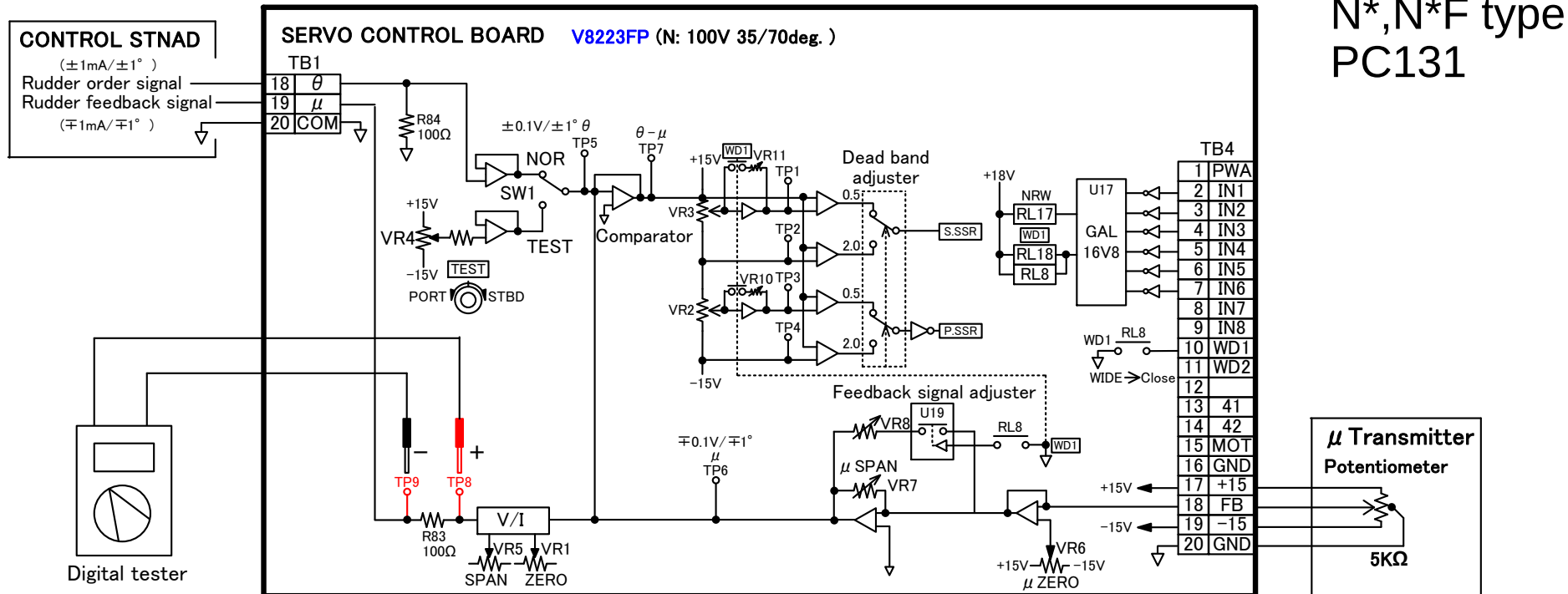
<< Next >>

Adjustment of feedback signal
to pilot stand(bridge)

μ feed-back signal to bridge



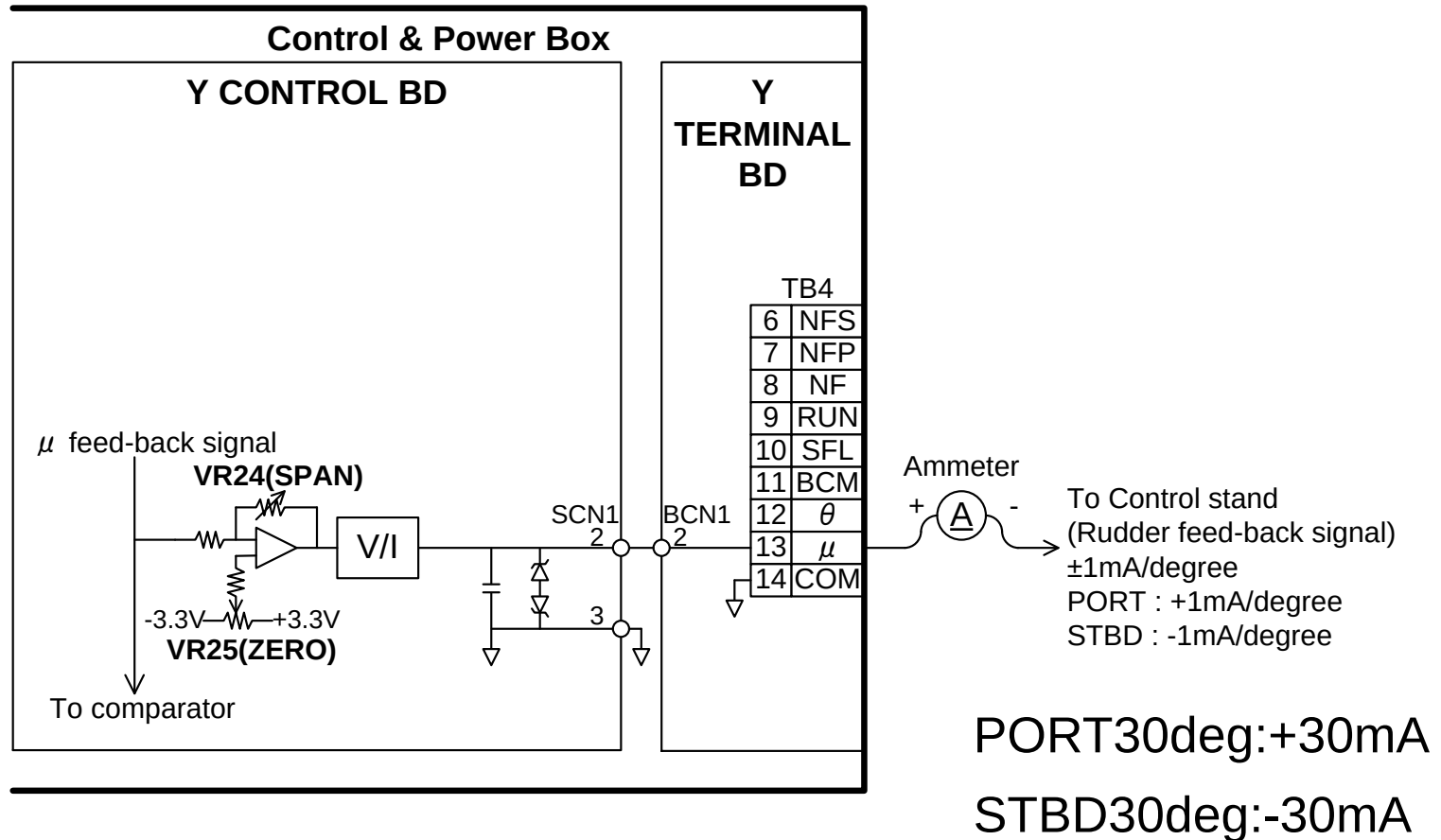
- Connect a digital tester between “TP8 (FBP)” and “TP9 (FBN)” on SERVO CONTROL BD.
- Steer the rudder to the midship position.
- Check if the voltage is within $0 \pm 50\text{mV}$.
 - If this adjustment is NOT appropriate, turn “VR1(Z1)” on SERVO CONTROL BD.
- Steer the rudder to the PORT30 (or STBD30).
- Check if the voltage is within $+3.0 \pm 50\text{mV}$ (or $-3.0 \pm 50\text{mV}$).
 - If this adjustment is NOT appropriate, turn “VR5(S1)” on SERVO CONTROL BD.



μ feed-back signal to bridge



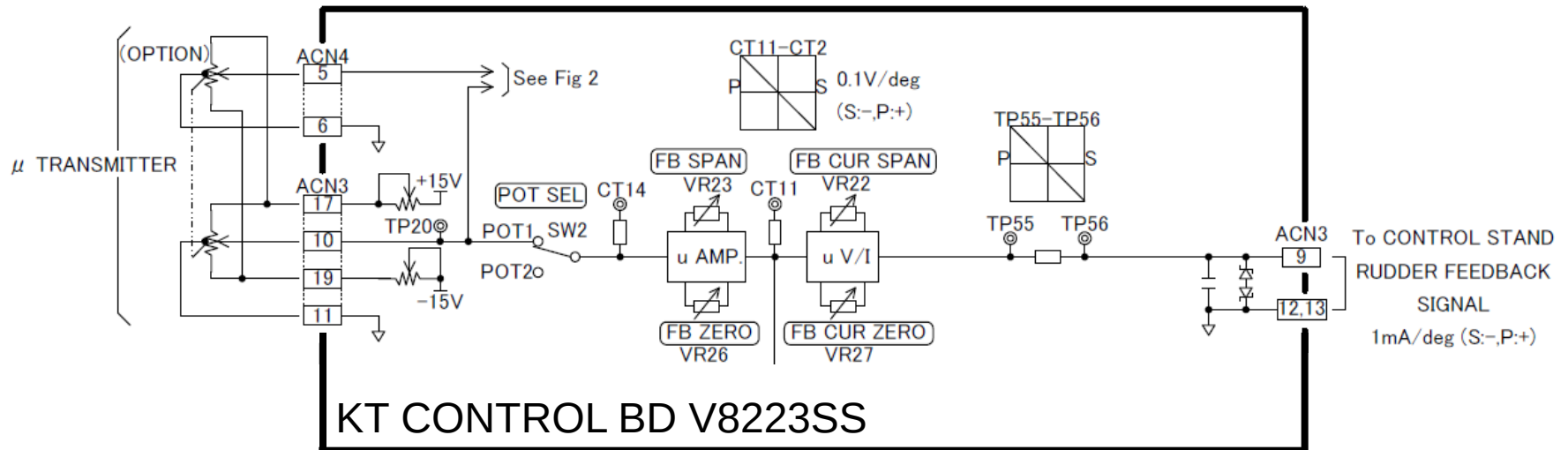
Y*A type
MPC133A



μ feed-back signal to bridge



K*Ttype
PC134



PORT30deg:+30mA

STBD30deg:-30mA

μ feed-back signal to bridge

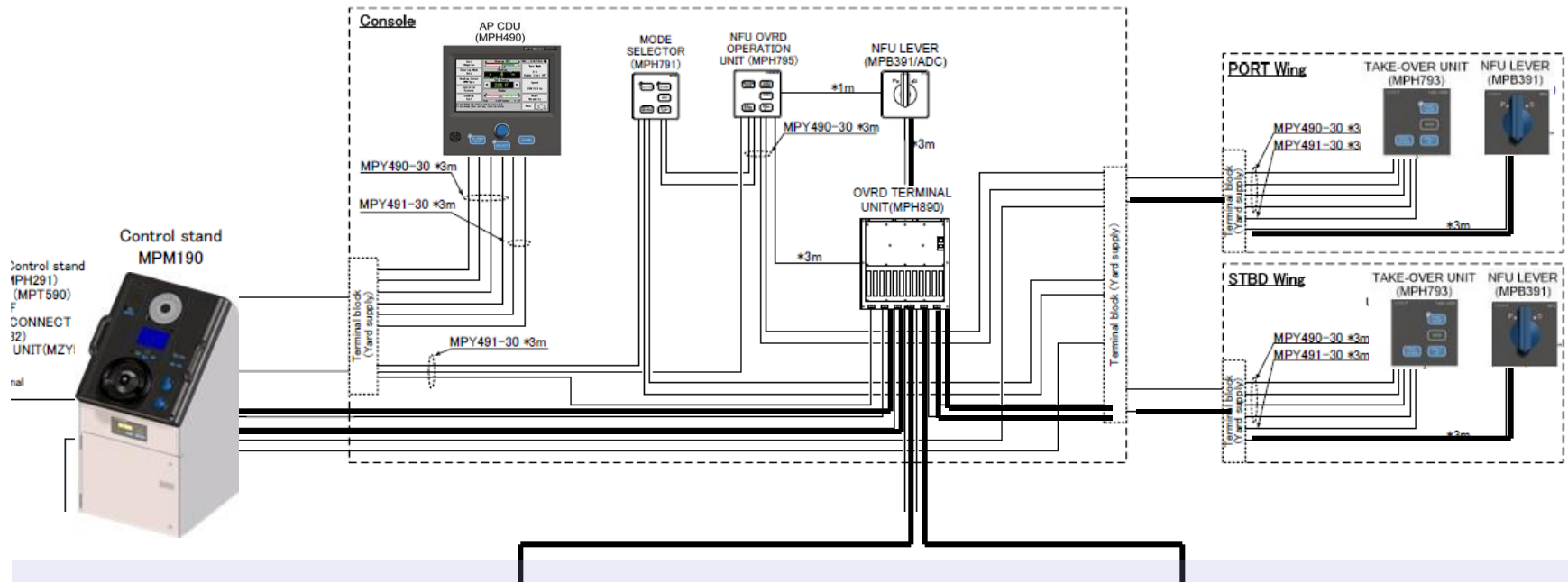


Type C&P BOX	Adj. point	Measure point at C&P BOX	Volume	Criteria
N*, N*F PC131	ZERO	TP8(FBP) and TP9(FPN)	VR1 (Z1)	0V±10mVDC @Midship
	SPAN		VR5 (S1)	±3.0±10mVDC (+:PORT, -:STBD)@30deg
Y*A MPC133A	ZERO	TB4 “μ” Series connection with taster	VR25 (FB ZERO)	0V±0.1mA @Midship
	SPAN		VR24 (SPAN)	±30±0.1mA (+:PORT, -:STBD)@30deg
K*T PC134	ZERO	TB4 “μ” Series connection with taster	VR27	0V±0.1mA @Midship
	SPAN		VR22	±30±0.1mA (+:PORT, -:STBD)@30deg

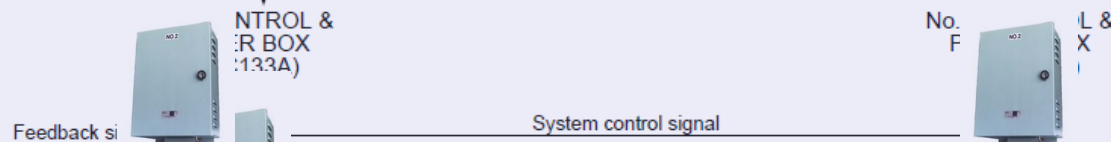


ITEM-3: ADJUSTMENT OF CONTROL & POWER BOX

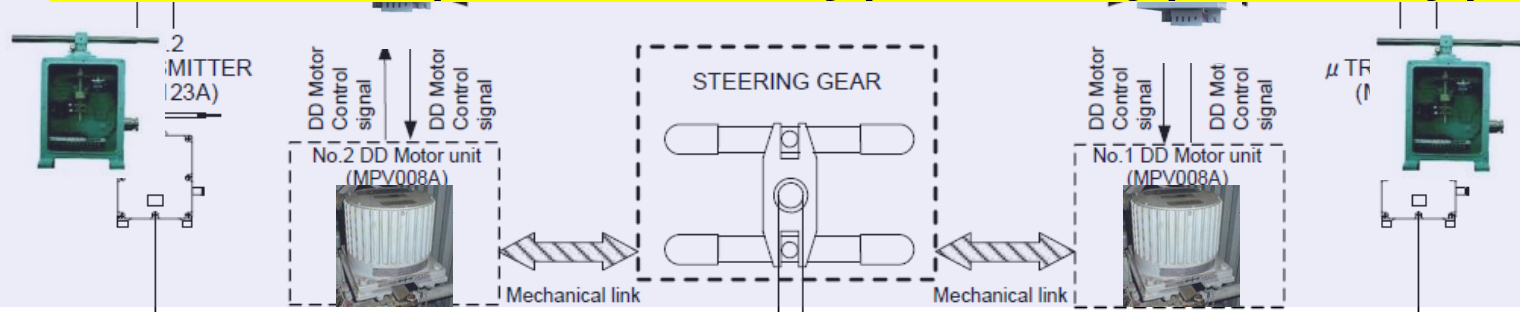
ITEM-3: ADJUSTMENT OF CONTROL & POWER BOX



S/G Room



<We will explain N/NF type, YA type, KT type>





N/NF type

Please refer to following documents.

“Autopilot N/NF type commissioning”



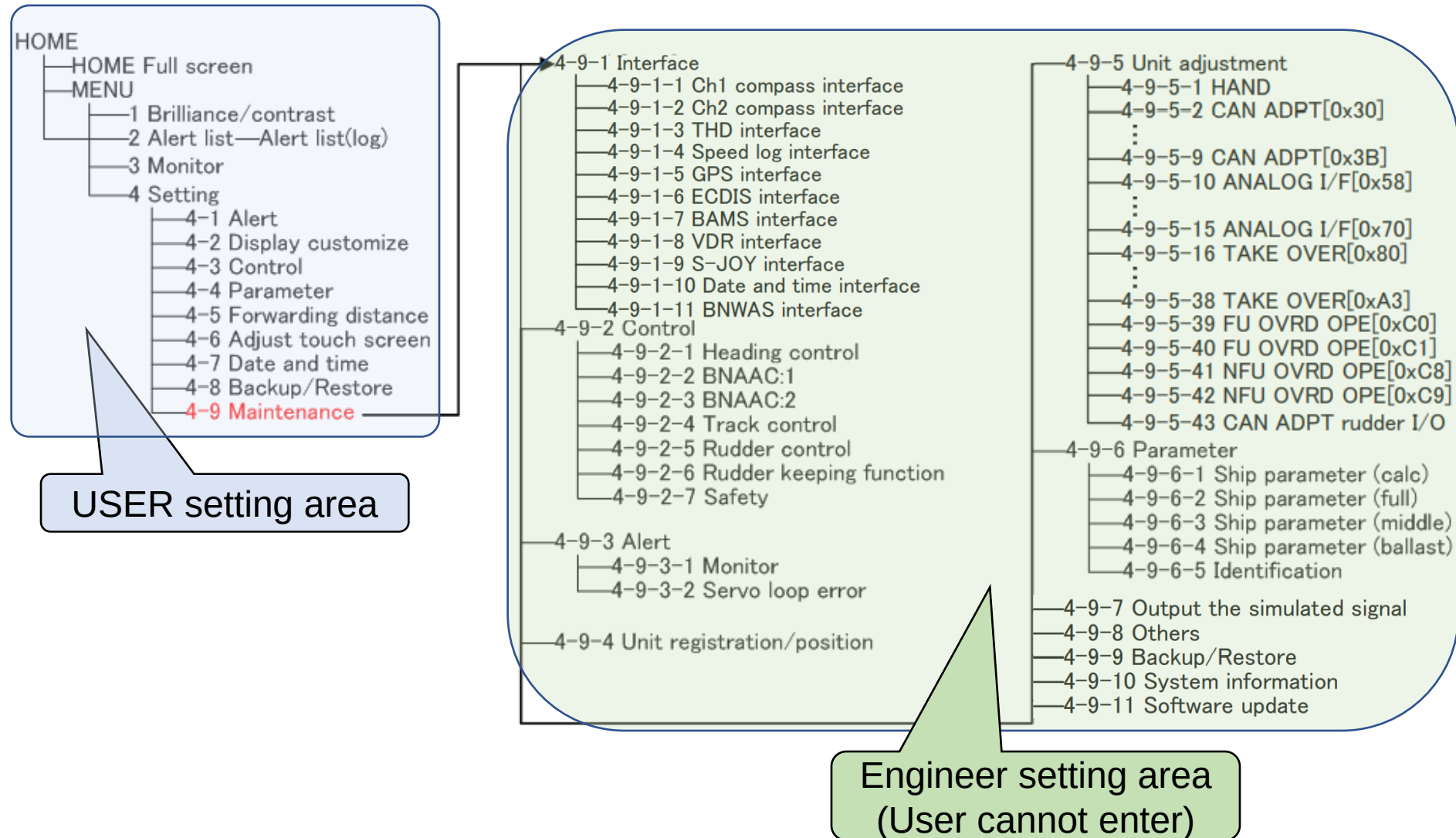
ITEM-4: Confirmation of AP CDU settings

ITEM-4: Confirmation of AP CDU settings



● Maintenance mode item

*This item is applied for software ver. “Bxx” or higher

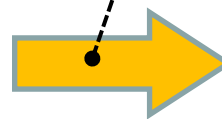
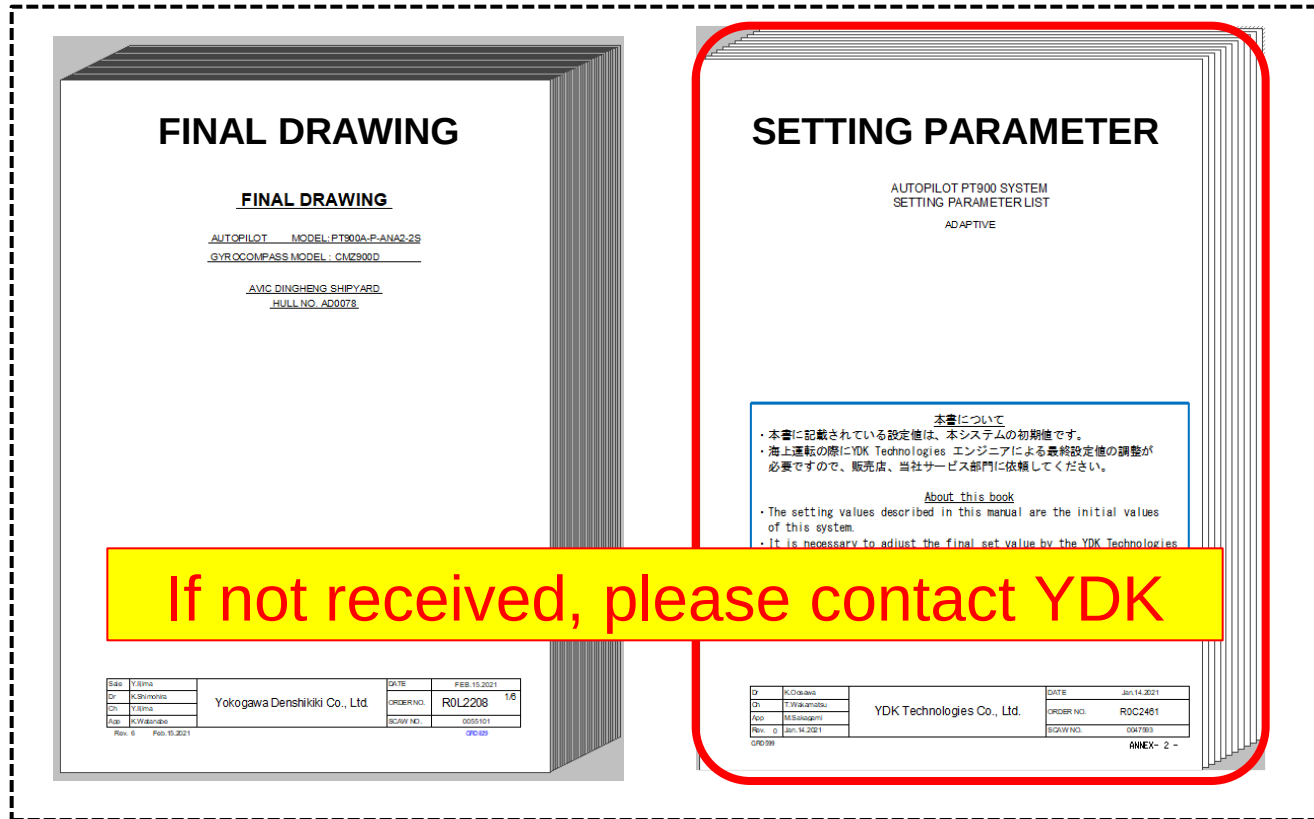


ITEM-4: Confirmation of AP CDU settings



● FINAL DRAWING + SETTING PARAMETER SHEET

****Before commissioning, YDK send you both Drawing and Setting parameter****



ITEM-2: Confirmation of AP CDU settings



● How to check??

- Confirm both settings are equal one by one and fill in.

1. Parameter / 観測パラメータの設定			Maintenance mode
Screen 4-4			
Setting item	First set	Final set	
1 Vx / 観測速度 (m)	23		✓
2 Lx / 観測 (m)	200		✓
3 Bx / 観測 (m)	32		
4 K / 船体位置から計算した位置誤差の割合 (1/s)	0.08		
5 TV / 設定速度誤差の割合 (s)	25		
6 KV / 設定速度誤差の割合 (1/s)	0.08		
7 MQ / カルマンフィルタサイズ共分散値の割合	1.00		
8 Qd / 差分ゲイン係数の割合	1.0		
9 Qp / 差分ゲイン係数の割合	1.0		
10 Q / 差分ゲイン係数の割合	1.0		
11 INT / 船体位置から計算した距離 (安定/不安定) の割合	Stable		
12 DENT / 測定状態 (測定済み/未測定) の割合	Incomplete		
13 RESULT / 測定結果 (安定/不安定) の割合	Stable		

2. Control / 観測の設定		
Screen 4-3		
Setting item	First set	Final set
1 Command radar range of the alarm source / 観測警戒半径	Keeping	
2 Counter radar range limit / 当て観測の警戒半径	Off	
3 Rough seas steering mode / 荒天操舵モードの切替	Off	
4 Aisle adjustment in steering mode switch / 操舵切替時の道幅補正 (deg)	0	
5 Number of radars / 観測数	Single	
6 Course deviation limit function / 航路偏差制限機能	Enable	
7 2-D dead-end compensation function / 航路偏差補正機能	Enable	
8 Exponential smoothing time for ship speed / 観測速度平滑時間 (s)	16	
9 Ch1 compass moving average time / Ch1コンパスの移動平均時間 (s)	Disable	
10 Ch2 compass moving average time / Ch2コンパスの移動平均時間 (s)	14	
11 THD moving average time / THDの移動平均時間 (s)	Disable	
12 MC moving average time / マグネットコンパスの移動平均時間 (s)	14	
13 Radar order moving average time / 観測順序移動平均時間 (s)	3	
14 Filter time constant for ch1 compass/ROT / Ch1コンパスROT用フィルタ時間 (s)	Disable	
15 Filter time constant for ch2 compass/ROT / Ch2コンパスROT用フィルタ時間 (s)	Disable	
16 Filter time constant for THD/ROT / THD ROT用フィルタ時間 (s)	Disable	
17 Deviation correction of external compass / 外部コンパス方位の偏差補正 (deg)	0	
18 EOPF Gain / EOPFゲイン	-----	
19 EOPF Average time / EOPF時間 (s)	-----	
20 EOPF 2-D compensation / EOPF 2-D補正機能	-----	
21 DRIFT comp. Average time / ドリフト補正平均時間 (s)	60	
22 Hand mode selectable / 操舵モードHANDへの選択の可否	Off	
23 BD adjustment / BNAACゲイン調整値	0.0	

Reference data sheet for maintenance
メンテナンス資料

R9H2184

YOKOGAWA
Yokogawa Denhikiki Co., Ltd.

ANNEX - 4 -

AP CDU

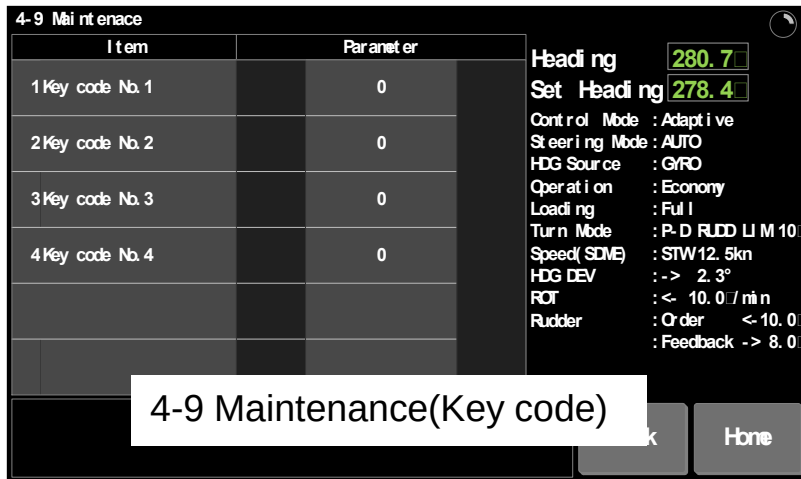


SETTING PARAMETER

ITEM-4: Confirmation of AP CDU settings



● Access of maintenance mode



Key code

No.1

“1”



No.2

“8”



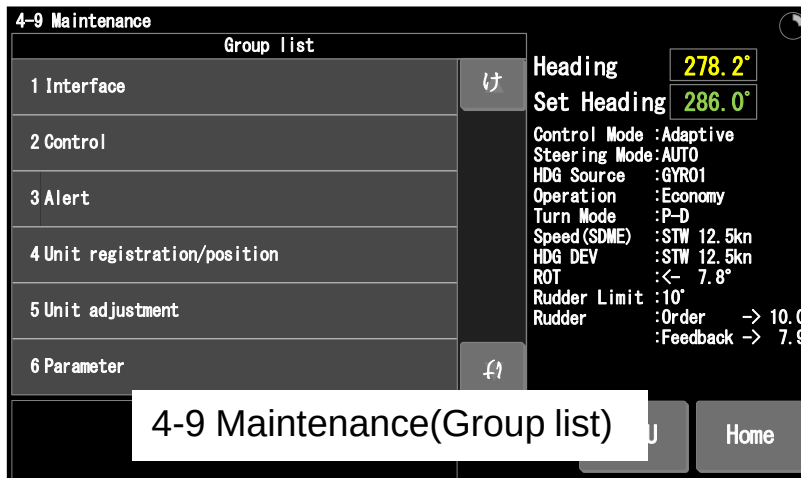
No.3

“3”



No.4

“6”

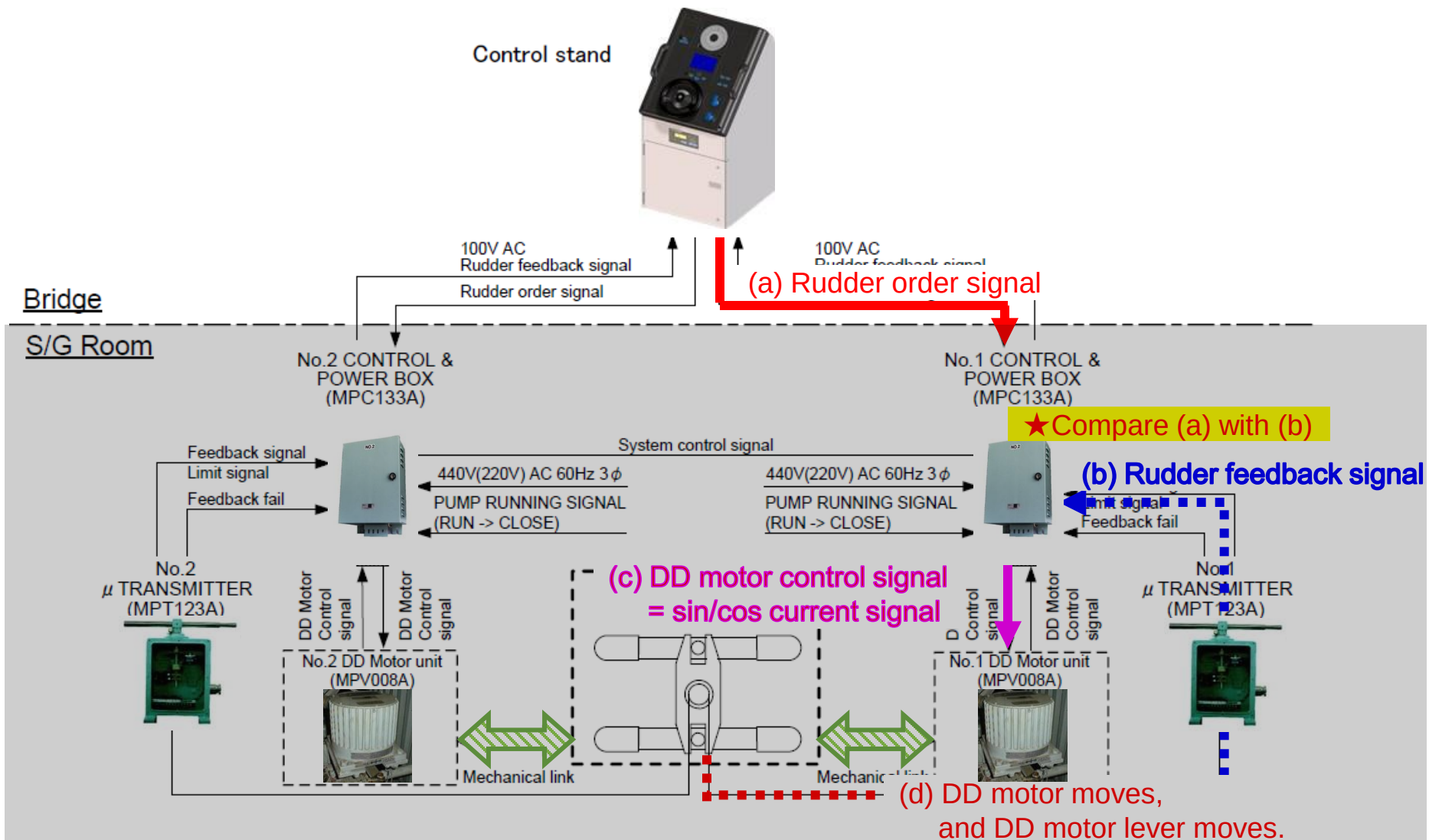




ITEM-5: ADJUSTMENT of control Stand

- ITEM-5-1: CAN ADAPTER BD
- ITEM-5-2: HAND STEERING UNIT
- ITEM-5-3: DIAL STEERING UNIT

ITEM-5: ADJUSTMENT of control Stand

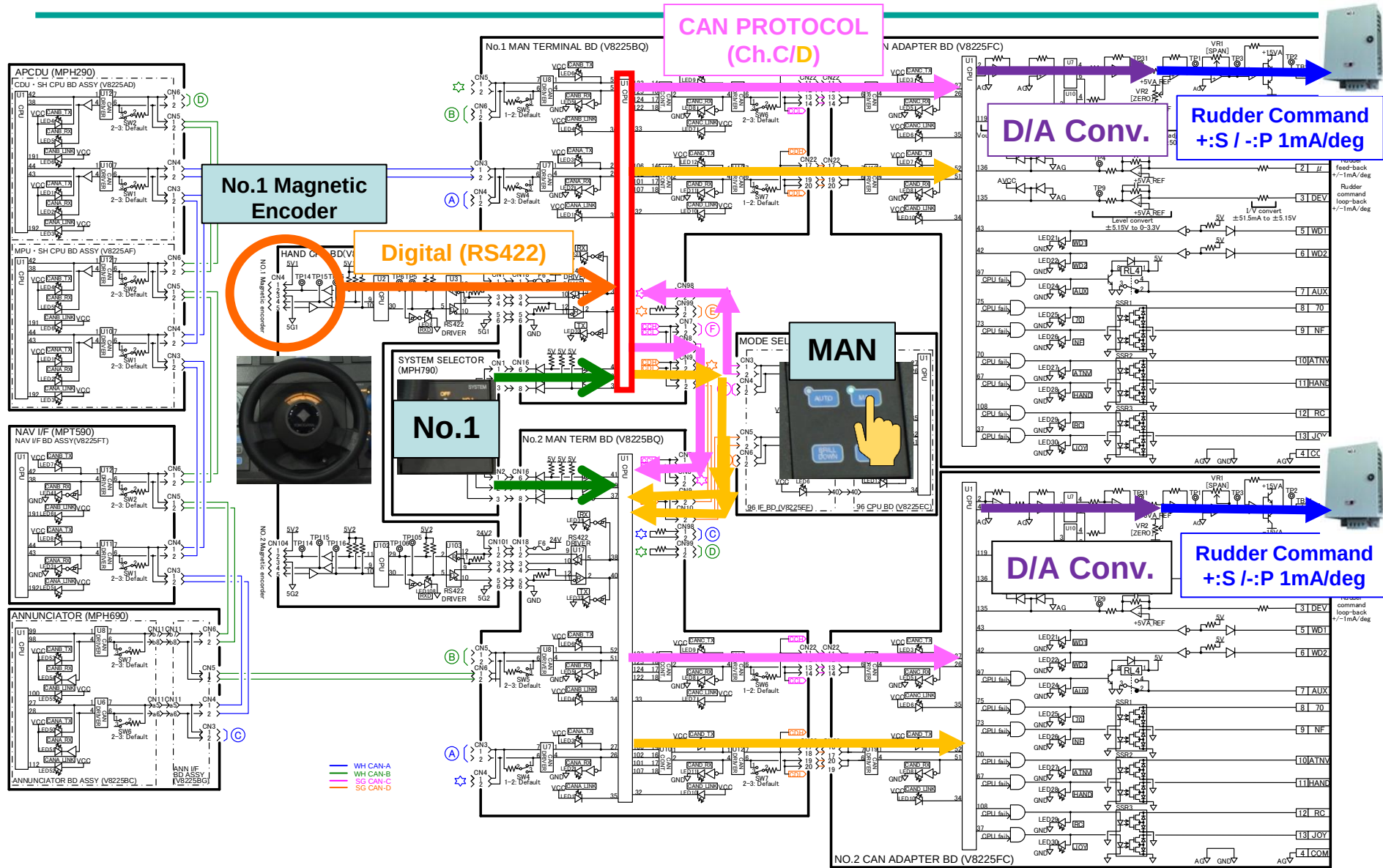




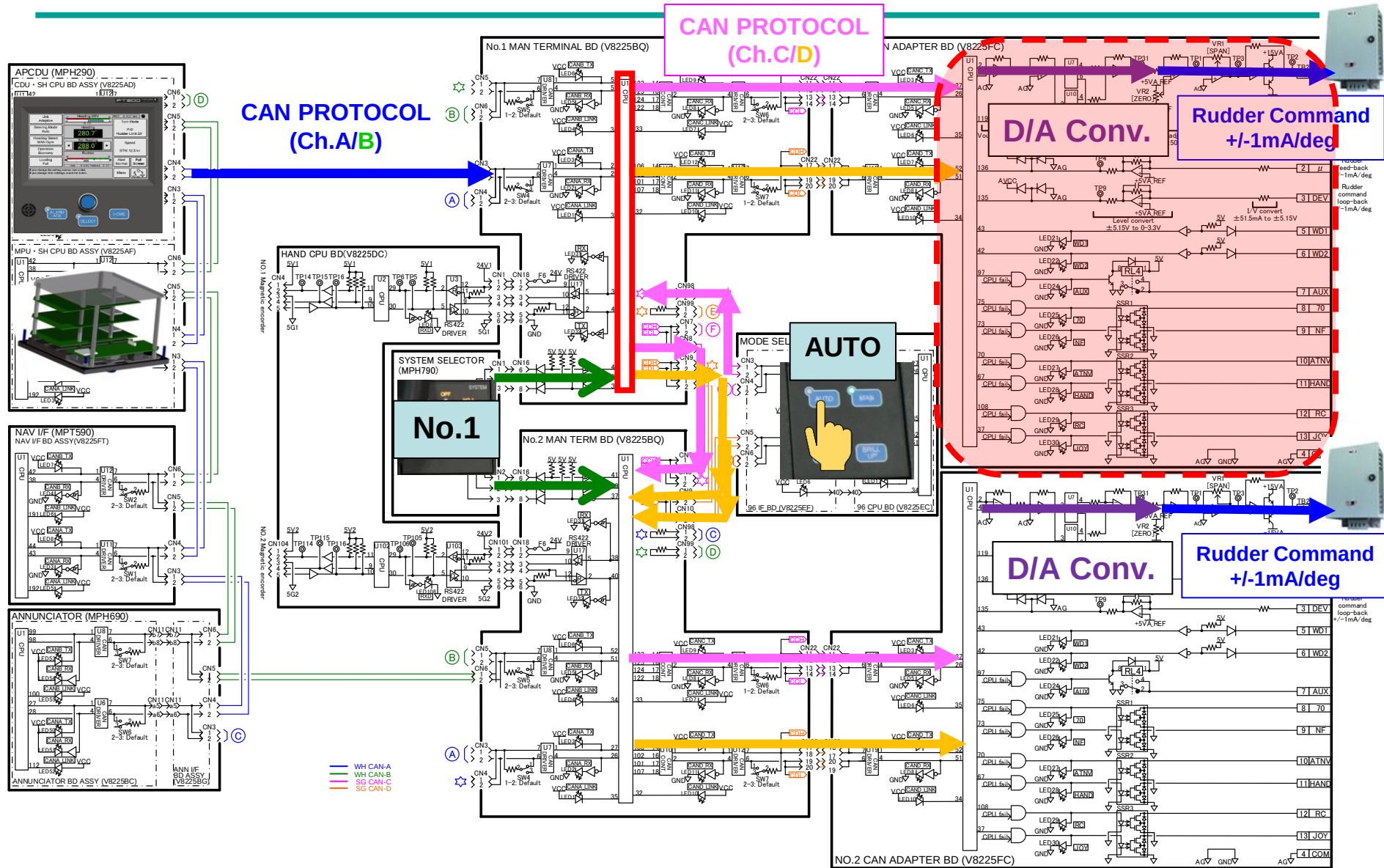
ITEM-5: ADJUSTMENT of control Stand

- ITEM-5-1: CAN ADAPTER BD
- ITEM-5-2: HAND STEERING UNIT
- ITEM-5-3: DIAL STEERING UNIT

SIGNAL CIRCUIT -FU/HAND-



SIGNAL CIRCUIT -FU/AUTO-



ITEM-5-1: CAN ADAPTER BD

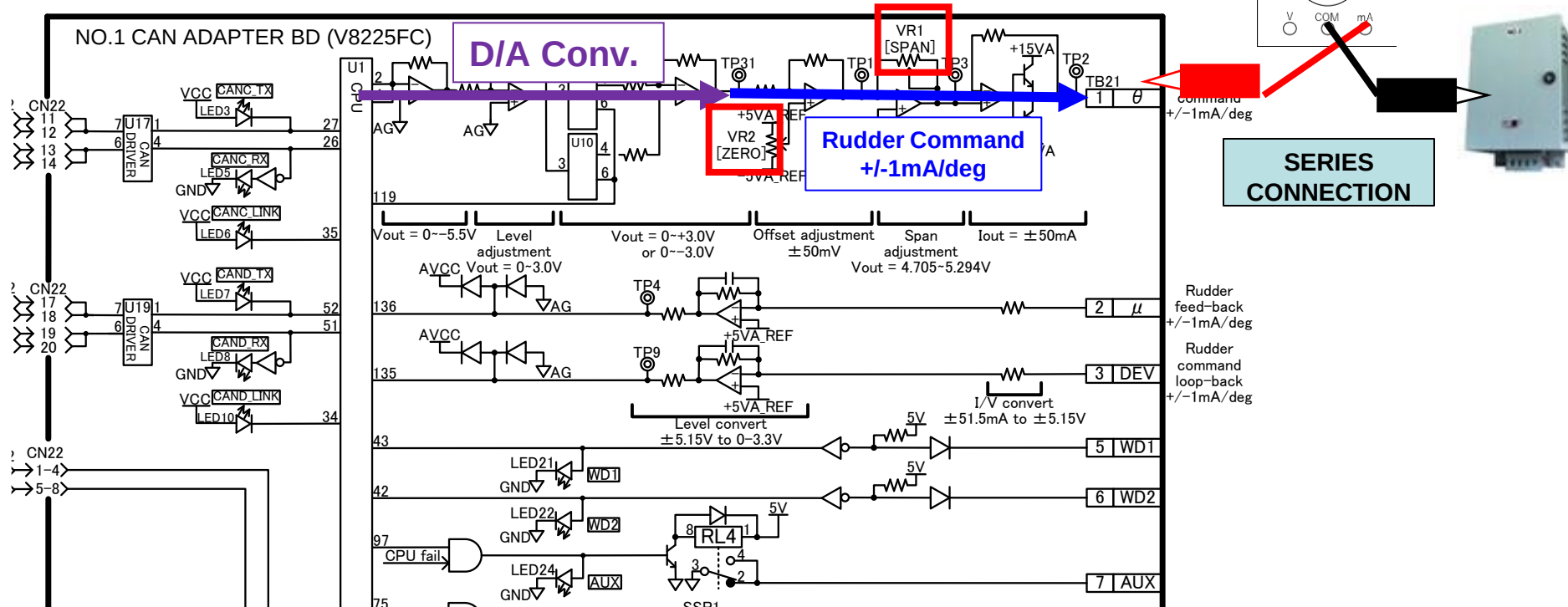


● How to adjust (Hardware)??

Step-00) Connect digital multimeter on CAN ADAPTER BD **TB21_1(θ)** in series

Step-01) Measure current value as per rudder order: **0**, **P30**, **S30 deg**.

Step-02) Adjust **VR1(Zero)**, **VR2(Span)** so that current value is within **±0.05mA** according to target value on CAN ADAPTER BD



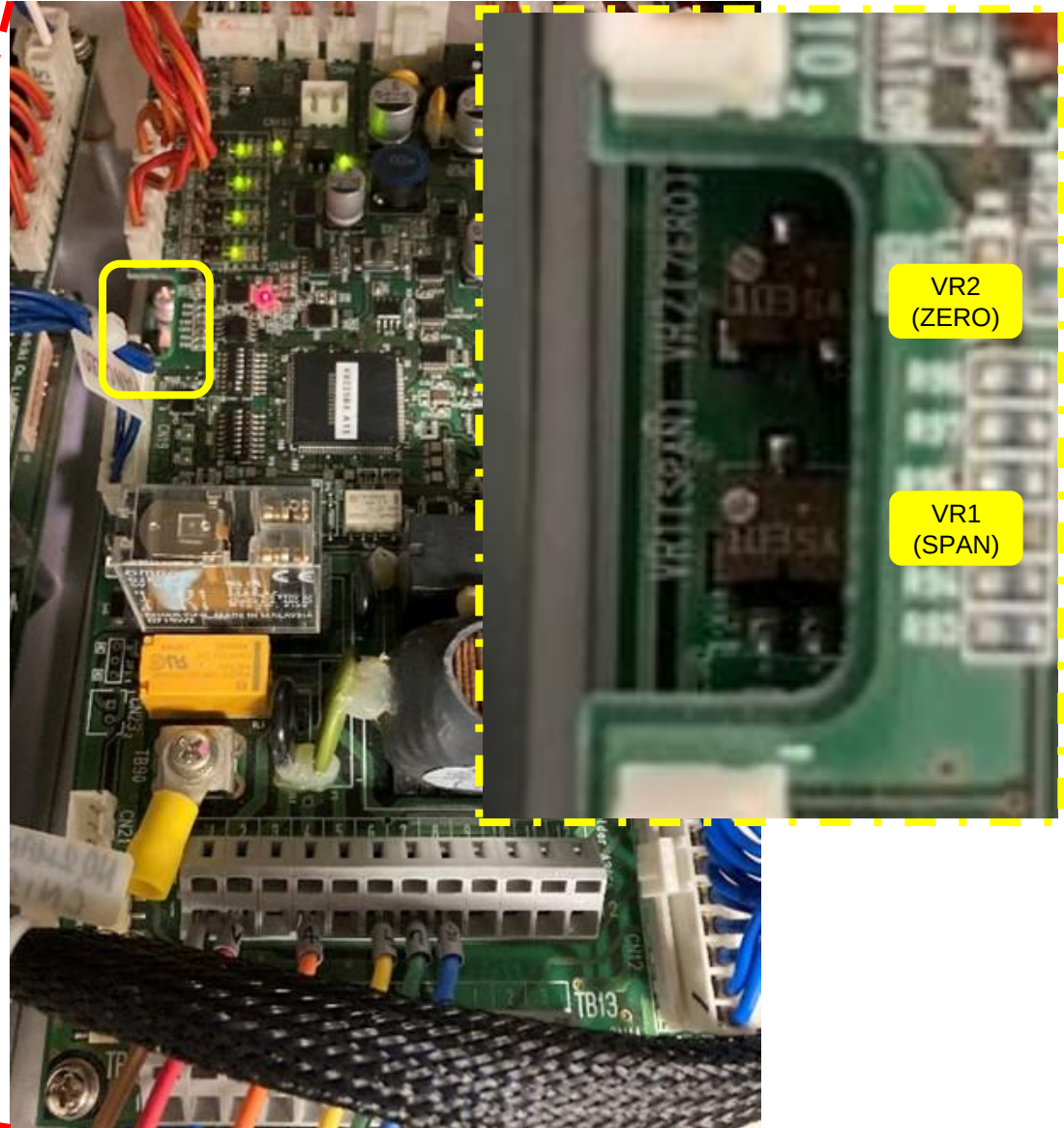
ITEM-5-1: CAN ADAPTER BD



- Adjustment point



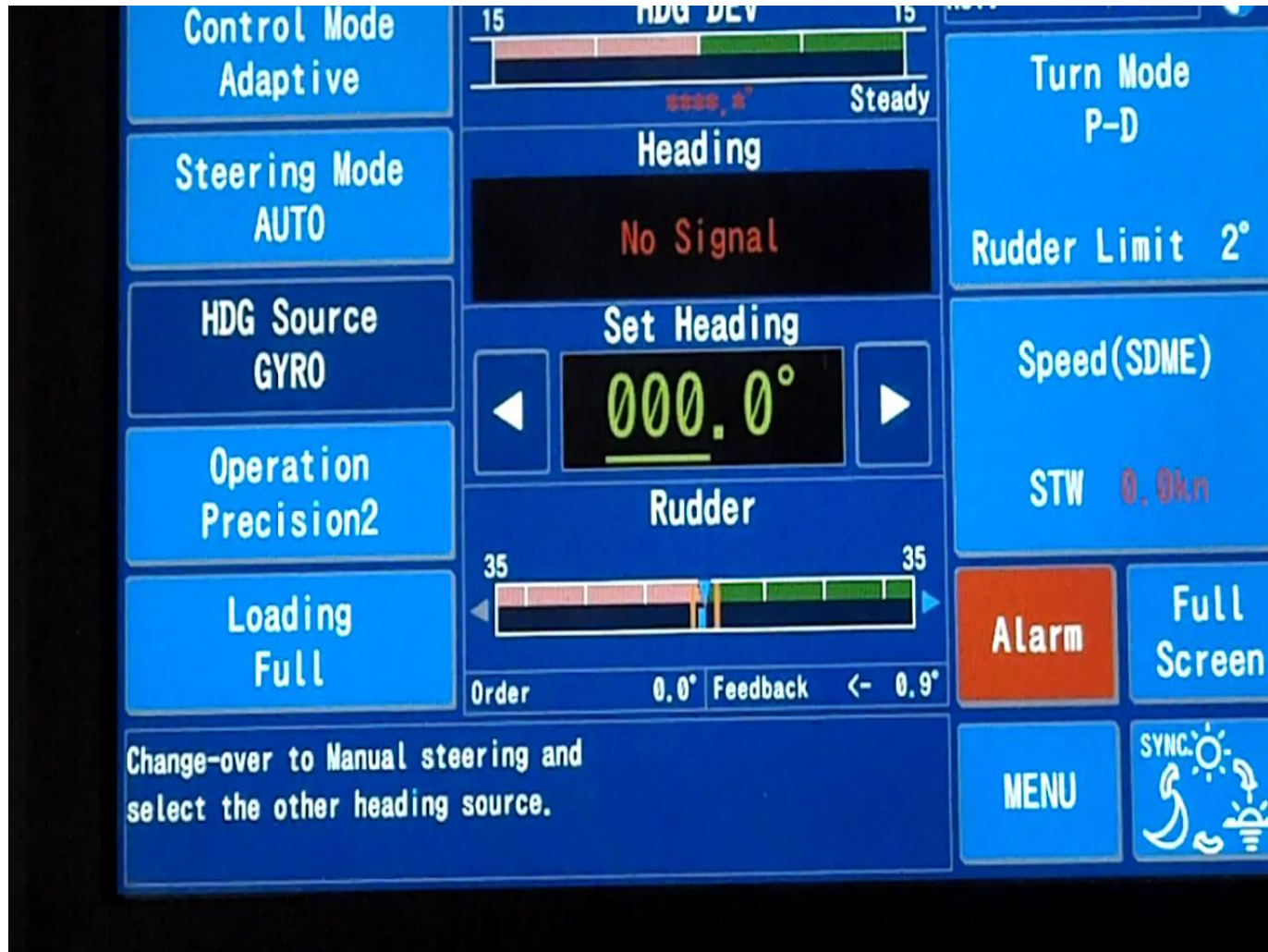
PT900 CONTROL STAND



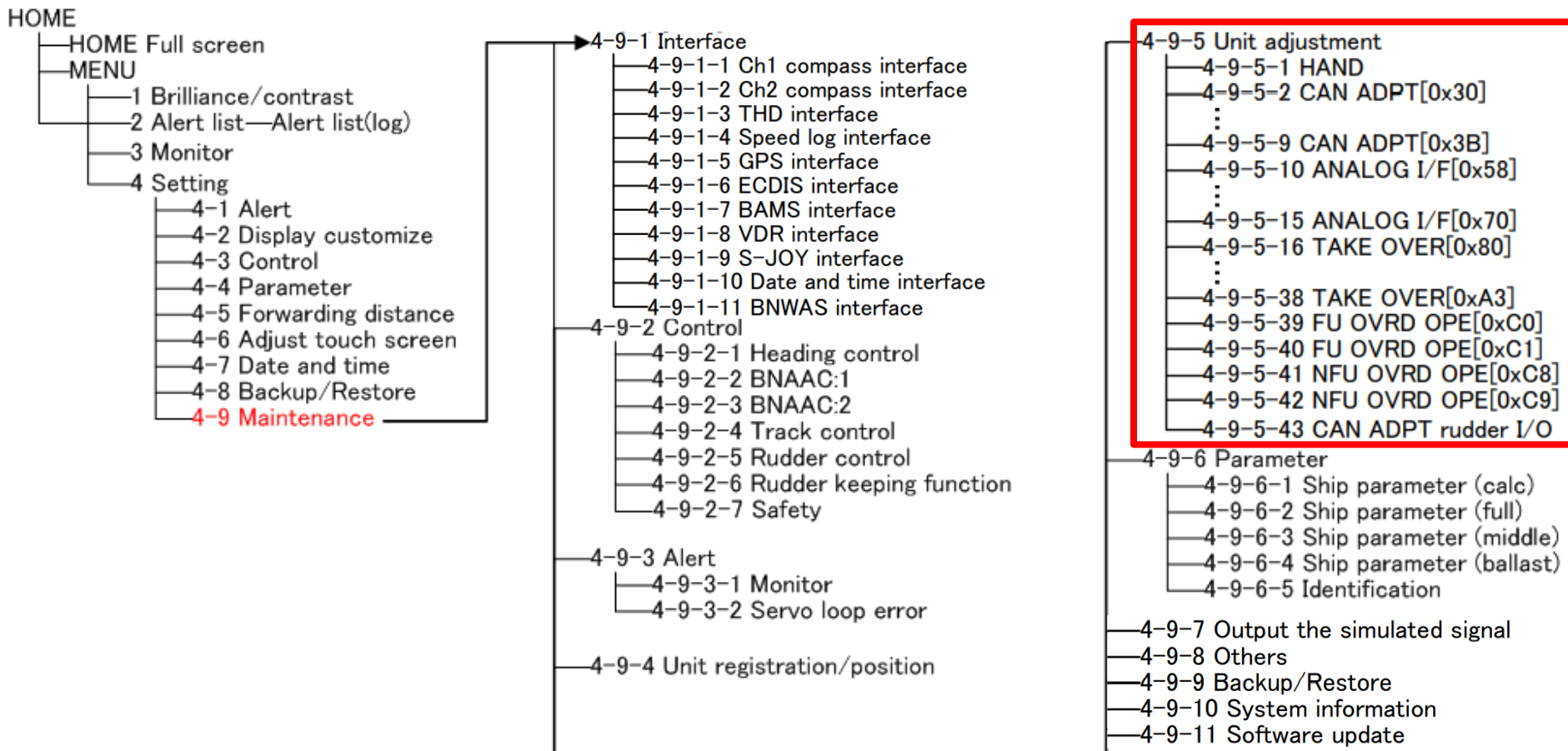
VR1(ZERO)/VR2(SPAN) on CAN ADAPTER BD



- How to adjust (Hardware)??



- Maintenance mode item



*Software ver. “Bxx” or higher



◆ Multi-point adjustment function

****Caution****

It is prohibited to adjust the rudder angle without adjusting Control & Power box, μ transmitter and CAN ADAPTER.

There is a risk of serious steering failure if these adjustment is not performed properly.

Be sure to perform the above adjustments properly. And if difference still exist, perform fine adjustments with this multi-point adjustment function.



● How to check

(Example: difference occurs only at STBD 20deg in HAND mode)

3-4-3 Rudder angle data

Rudder	Order	-> 20.0
o FB1		-> 18.0
o FB2		-> 18.0°
- FB3		***.*
- FB4		***.*

Order	Loopback
No. 1	-> 20.0
No. 2	-> 20.0
No. 3	***.*
No. 4	***.*

Heading

280.7

Set Heading

278.4

Control Mode : Adaptive

Mode : AUTO

: GYRO

: Economy

: P-D

: STW12.5kn

: -> 2.3°

: -> 2.3 / min

nt : 20

: Order <- 20.0

: Feedback <- 18.0

Steering gear

STBD18

Alert: ALRM 0 WARN 0 CAUT: 0 (IND: 0)

No alert

Back

Home



● How to adjust (Software)??

4-9-5-43 CAN ADPT rudder I/O

Item	Parameter
1 CAN ADPT select	0x30
2 Rudder angle to adjust (Start test output)	-> 20°
3 Rudder order offset	+2.00
4 FB & ORD loopback adjustment execution	OFF
Rudder FB offset	

Heading **000.8°**

Set Heading **001.2°**

Control Mode : Adaptive

Steering Mode : MAN (HAND)

HDG Source : GYRO

**Rudder order output
changes when the
value is entered**

Speed : MAN 5kn

HDG DEV : -> 2.3°

ROT : 0.0°/min

Rudder : Order 0.0°

: Feedback 0.0°

Situation	PT900 value (screen[3-4-3])			Rudder angle (actual)
	θ	μ	LB	
Rudder angle mis-match with rudder order.	20°	20°	20°	18°
Rudder angle, μ, and Loopback value mis-match with rudder order.	20°	18°	18°	18°
Only μ value mis-match with other value.	20°	18°	20°	20°
Only loopback value mis- match with other value.	20°	20°	18°	20°

OFF (for this case)



● How to adjust (Software)??

3-4-3 Rudder angle data

Rudder	Order	->20.0
o FB1	->20.0	
o FB2	->20.0	
- FB3	***.*	
- FB4	***.*	

Order Loopback

Nb. 1	->20.0
Nb. 2	->20.0
Nb. 3	***.*
Nb. 4	***.*



Steering gear

STBD20

Heading 280.7

Set Heading 278.4

Control Mode : Adaptive

Steering Mode : AUTO

HDG Source : GYRO

Operation : Economy

Turn Mode : P-D

Speed(SDME) : STW12.5kn

HDG DEV : -> 2.3°

ROT : -> 2.3 / min

Rudder Limit : 20

Check that rudder order (θ), actual rudder angle, rudder feedback (μ), loopback value matches each other.

Back

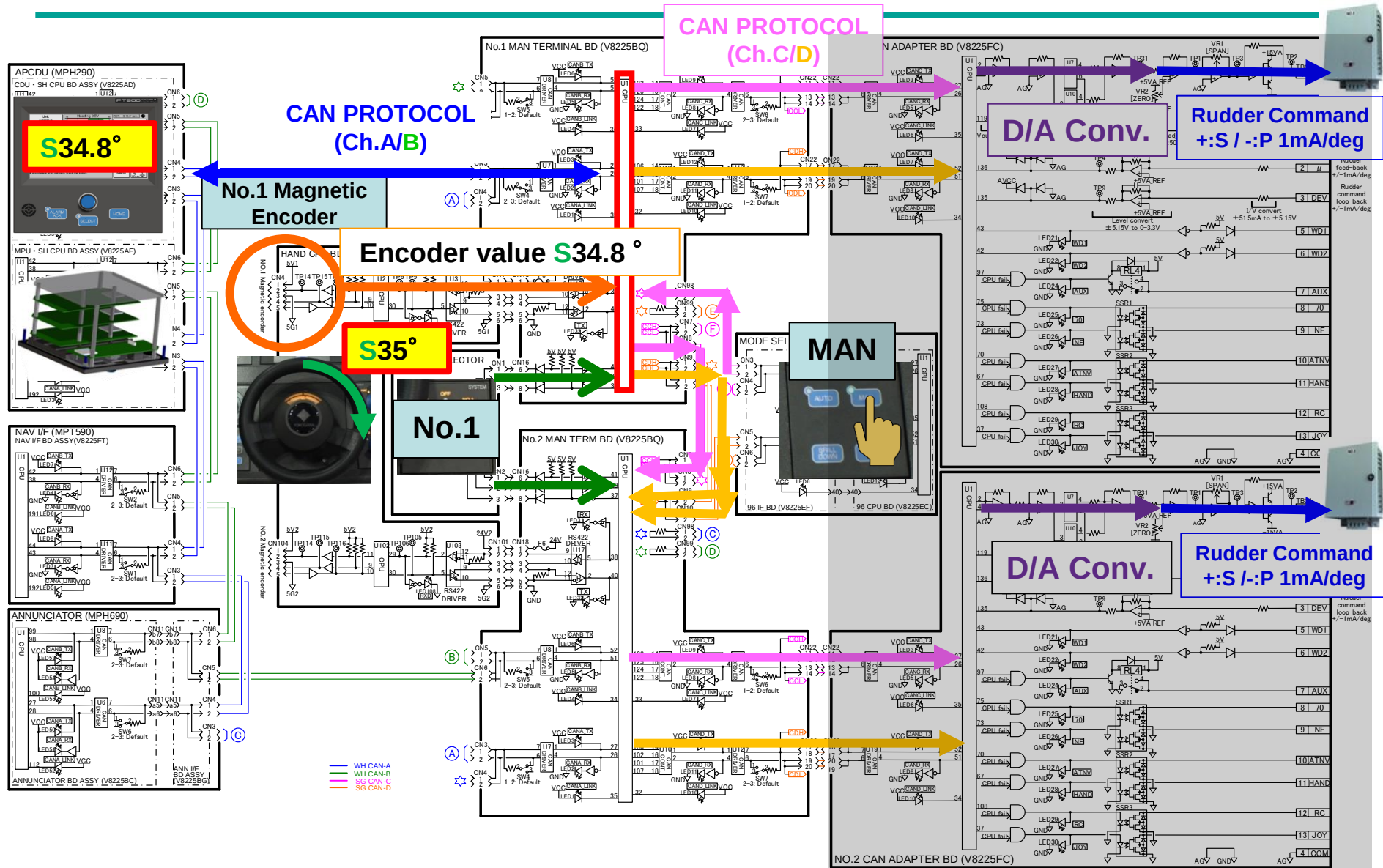
Home



ITEM-5: ADJUSTMENT of control Stand

- ITEM-5-1: CAN ADAPTER BD
- ITEM-5-2: HAND STEERING UNIT
- ITEM-5-3: DIAL STEERING UNIT

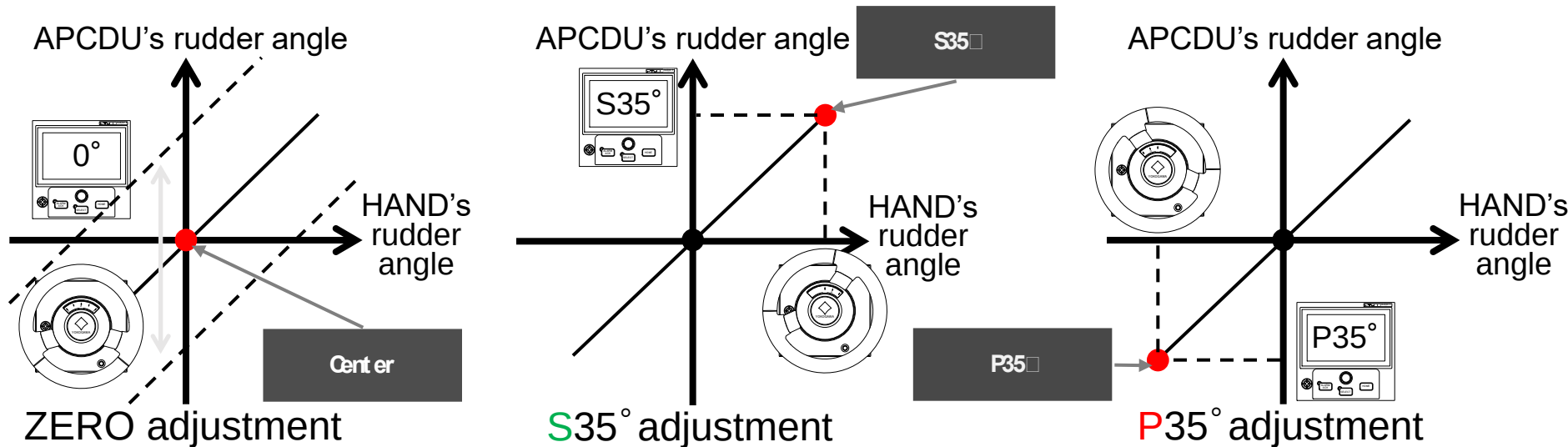
SIGNAL CIRCUIT -FU/HAND-



ITEM-5-2: HAND STEERING UNIT

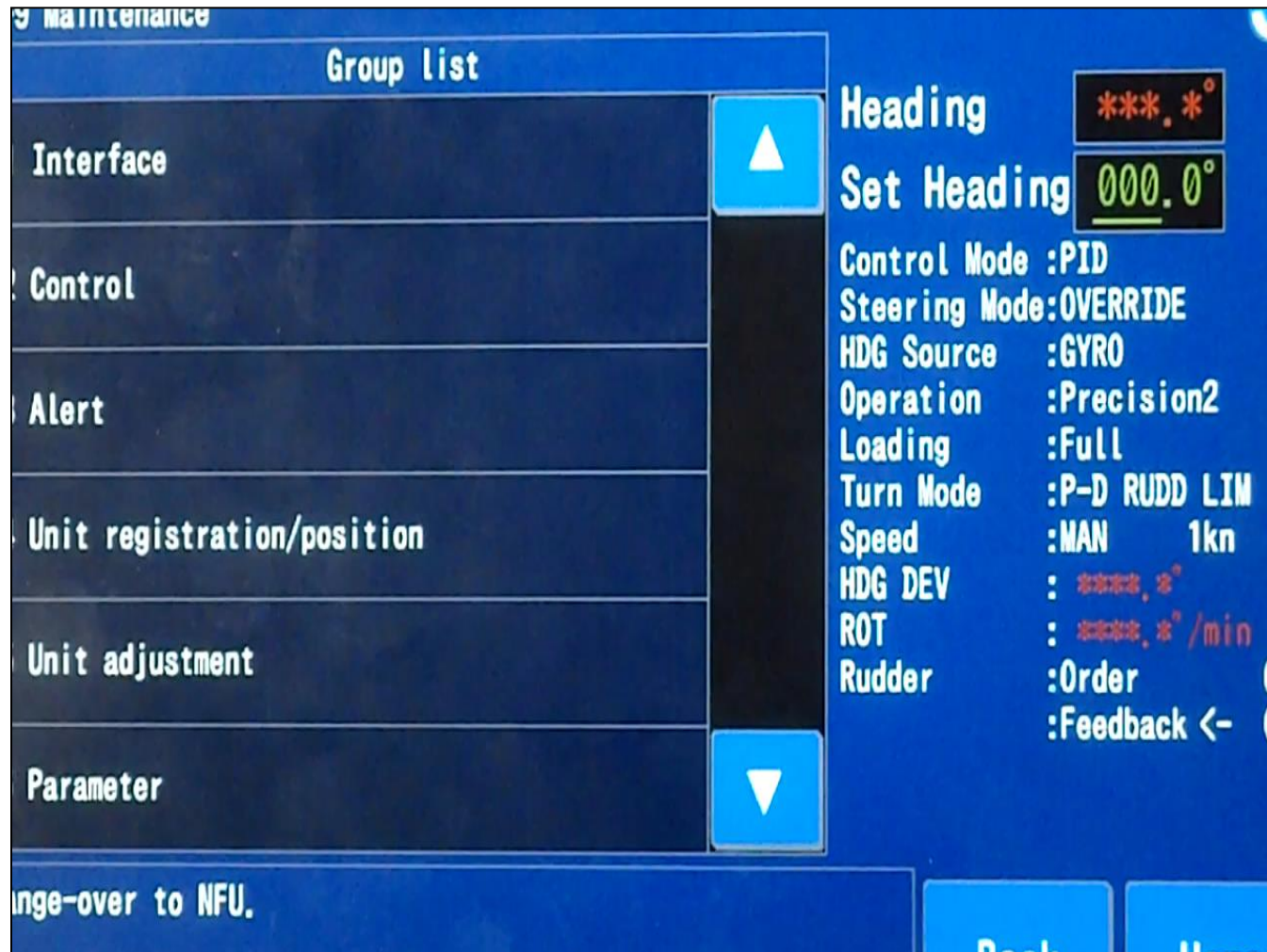


- ◆ This is the adjustment for the deviation of indication between HAND STEERING UNIT and APCDU.
 - This is NOT the adjustment for the deviation between the actual rudder angle signal and rudder order.
- ◆ Adjustment of HAND STEERING UNIT means the ZERO & SPAN setting of magnetic encoder to indicate on APCDU correspondently.
- ◆ All magnetic encoders can be adjusted by one execution.





- How to adjust??





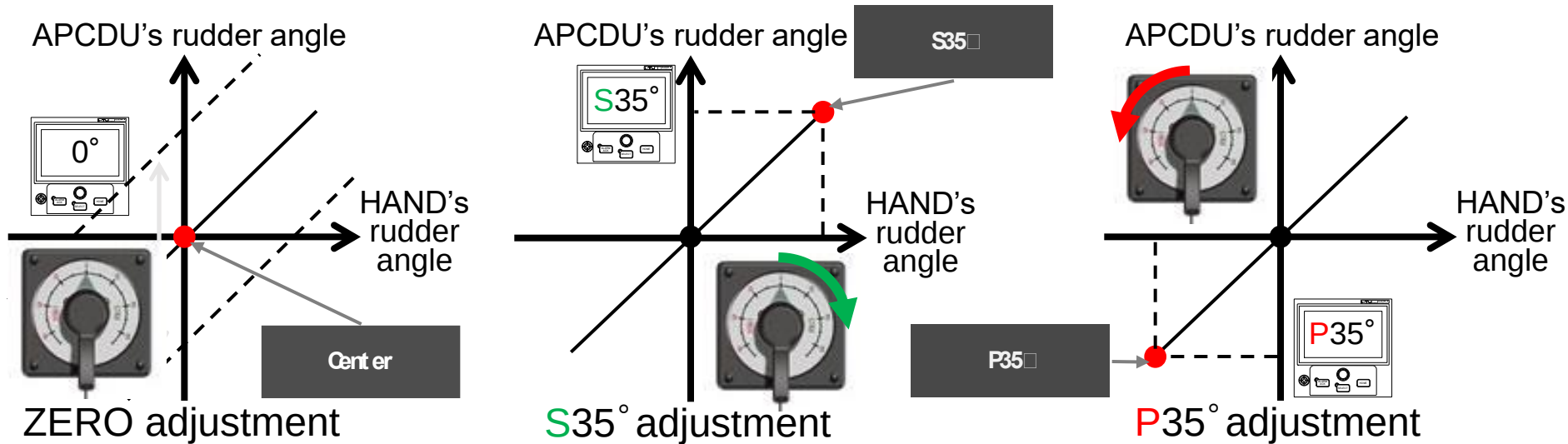
ITEM-5: ADJUSTMENT of control Stand

- ITEM-5-1: CAN ADAPTER BD
- ITEM-5-2: HAND STEERING UNIT
- ITEM-5-3: DIAL STEERING UNIT

ITEM-5-3: DIAL STEERING UNIT



- ◆ There are 2 ways of A/D conversion adjustment for dial steering unit.
- ◆ 1st method is by using AP CDU (This method is similar to the adjustment of HAND STEERING UNIT.)



[4-9-5 Unit adjustment]

4-9-5 Unit adjustment	
Group list	Heading 280.7
1 HAND	Set Heading 278.4
2 CAN ADPT [0x30]	Control Mode : Adaptive
3 CAN ADPT [0x31]	Steering Mode : AUTO
4 CAN ADPT [0x32]	Hdg Source : GYRO
5 CAN ADPT [0x33]	Operation : Economy
6 CAN ADPT [0x38]	Loading : Full
	Turn Mode : P-D RUDD LIM 10
	Speed (SDME) : STW12.5kn
	Hdg DEV : -> 2.3°
	ROT : <- 10.0 / min
	Rudder : Order <- 10.0
	Feedback <- 8.0
MENU Home	

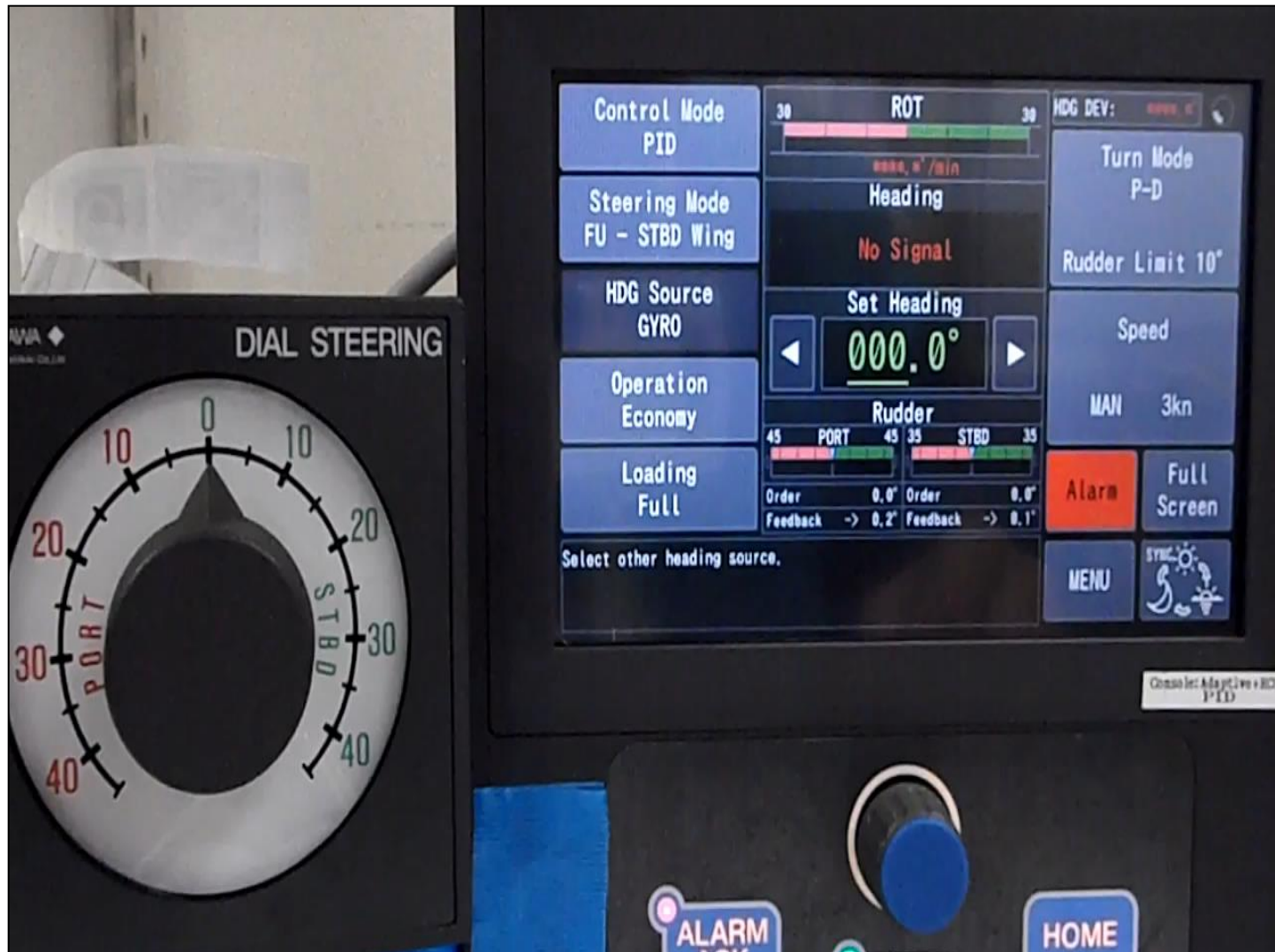
[4-9-5-35 TAKE OVER [0x94]]

4-9-5-35 TAKE OVER [0x94]		
Item	Parameter	Heading 280.7
1 Dial steering adjustment position	Center	Set Heading 278.4
2 Adjustment execution	Off	Control Mode : Adaptive
3 Encoder rudder angle (STED'S)	0.00	Steering Mode : AUTO
4 Encoder rudder angle (PORT)	0.0	Hdg Source : GYRO
5 Dial steering Position 1st	Disable	Operation : Economy
6 Dial steering Position 2nd	35	Loading : Full
		Turn Mode : P-D RUDD LIM 10
		Speed (SDME) : STW12.5kn
		Hdg DEV : -> 2.3°
		ROT : <- 10.0 / min
		Rudder : Order <- 10.0
		Feedback <- 8.0
Back Home		

ITEM-5-3: DIAL STEERING UNIT



- How to adjust??





◆ A/D conversion adjustment (2nd method)

➤ By using TAKE-OVER UNIT (You can adjust without using AP CDU.)

Ex1) 1rudder 35degree

1. Turn off the SYSTEM SELECTOR.
2. Set the dipSW1-bit4 to ON on TAKE-OVER UNIT.
3. Turn on the SYSTEM SELECTOR.
4. Check if LED of take-over key is flashing.
5. Set the DIAL to midship position.
6. Push the take-over key for 2sec. and the buzzer sounds.
7. Set the DIAL to STBD30.
8. Push the take-over key for 2sec. and the buzzer sounds.
9. Set the DIAL to PORT30.
10. Push the take-over key for 2sec. and the buzzer sounds.
11. Check if LED of take-over key turns off.
12. Turn off the SYSTEM SELECTOR.
13. Set the dipSW1-bit4 to OFF on TAKE-OVER UNIT.

Ex2) 2rudders 70degree

1. Turn off the SYSTEM SELECTOR.
2. Set the dipSW1-bit4 to ON on TAKE-OVER UNIT.
3. Turn on the SYSTEM SELECTOR.
4. Check if LED of take-over key is flashing.
5. Set the **both** DIAL to midship position.
6. Push the take-over key for 2sec. and the buzzer sounds.
7. Set the **both** DIAL to STBD20.
8. Push the take-over key for 2sec. and the buzzer sounds.
9. Set the **both** DIAL to STBD60.
10. Push the take-over key for 2sec. and the buzzer sounds.
11. Set the **both** DIAL to PORT20.
12. Push the take-over key for 2sec. and the buzzer sounds.
13. Set the **both** DIAL to PORT60.
14. Push the take-over key for 2sec. and the buzzer sounds.
15. Check if LED of take-over key turns off.
16. Turn off the SYSTEM SELECTOR.
17. Set the dipSW1-bit4 to OFF on TAKE-OVER UNIT.

ITEM-5-3: DIAL STEERING UNIT



- How to adjust??





ITEM-6: ALERT CONFIRMATION

- ITEM-6-0: IACS UR E25 alert
- ITEM-6-1: Off-heading
- ITEM-6-2: Off-course
- ITEM-6-3: Heading monitor



ITEM-6: ALERT CONFIRMATION

- ITEM-6-0: IACS UR E25 alert
- ITEM-6-1: Off-heading
- ITEM-6-2: Off-course
- ITEM-6-3: Heading monitor

ITEM-6-0: IACS UR E25 alert



Sample of YDK final drawing

(e) Programmable system failures (Hardware and Software failures)

Factor	Status	Priority	Message example
Mismatch of SYSTEM SELECTOR selected position compared to another MAN TERMINAL BD	---	CAUTION	[SCS] SYSTEM SEL ERR SEL status mismatch.

Factor	Status	Priority	Message example
Detected HAND mode unavailable status	Selected	ALARM	[SCS] Lost rudder ORD Rudder order is fixed. Switch SYSTEM SEL.
HAND STEERING UNIT detects encoder failure	---	(IND)	[SCS] MTERM1:SYSTEM1 HAND encoder fail. SYS1 HAND mode UNAVBL.

(f) Hydraulic locking

Factor	Status	Priority	Message example
Actuator abnormal signal is received from No. x control & power box	---	ALARM	[SCS] #1 Actuator Response abnormal. Change to NFU STEER.

Note) This alert applies to HLA only if class society accepts torque motor follow-up failure as HLA.(for YA or KT type)

(g) Deviation between rudder order and feedback

Factor	Status	Priority	Message example
Rudder did not follow rudder order	"FU steering" and "Pump running" and "Rudder keeping not executed"	ALARM	[SCS] #1 Rudder I/O Rudder no response. Change to NFU STEER.
Rudder moved to the opposite direction against rudder order		ALARM	[SCS] #1 Rudder I/O Rudder reversal. Change to NFU STEER.
Rudder follow-up speed is slow compared to rudder order		WARNING	[SCS] #1 Rudder I/O Rudder speed slow. Check rudder speed.

ITEM-6-0: IACS UR E25 alert



Alert	How to simulate
b.) Earth fault on AC circuit	Select the [MAN] Mode. Press "TEST" switch (SW9) on No.1 MANUAL TERMINAL BD for 6 seconds or more Confirm following alert indicates on AP CDU [MPH490] WARNING [SCS] SCS power fault #* AC PWR earth fault. Check power cable.
b.) Earth fault on DC circuit(Optional)	Disconnect cable on ANN I/F BD:TB31_No.3(IC) Confirm following alert indicates on AP CDU [MPH490] CAUTION [SCS] SCS power fault BATT PWR eath fault. Check power cable.
c.) Loop failure in closed loop systems: <u>Command loop</u>	Select the [MAN] Mode. Steer the hand steering unit 5 deg or more in [MAN] mode. Disconnect cable of rudder command on No.1 CAN ADAPTER BD: TB21_1(Θ). Or, disconnect cable of rudder command on No.1 Control & Power Box TB4_12(Θ). Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS] #* RUDD I/O fail #* RUDD ORD SIG fail. Change to NFU STEER.
c.) Loop failure in closed loop systems: <u>Feedback loop</u>	Disconnect the cable on CONTROL&POWER BOX TB5_21_(FB1). Steer the hand steering unit 5 deg or more in [MAN] mode. Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS] #* C&P BOX Rudder FB signal fail. Use other pump.
d.) Data communication errors	Set theMODE SELECTOR [MPH791] to [MAN] mode. Disconnect CN1 on HAND CPU BD on HAND STEERING UNIT [MPB390] Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS] Lost rudder ORD Rudder order is fixed. Switch SYSTEM SEL.
d.) Data communication errors (ALARM)	Select the [MAN] mode. Press "CPU"reset switch" (SW8) on selected MANUAL TERMINAL BD for 6 seconds or more Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS] SYSTEM fail. Selected SYSTEM fail. Switch SYSTEM SEL.
e.)Programmable system failures	Select [MAN] mode, and disconnect CN16 connector on selected MAN TERMINAL BD Confirm following alert indicates on AP CDU [MPH490] CAUTION [SCS] SYSTEM SEL ERR SEL status mismatch.

ITEM-6-0: IACS UR E25 alert



Alert	How to simulate
e.)Programmable system failures	Select [MAN] mode, and disconnect CN16 connector on selected MAN TERMINAL BD Confirm following alert indicates on AP CDU [MPH490] CAUTION [SCS] SYSTEM SEL ERR SEL status mismatch.
e.)Programmable system failures	Select [MAN] mode, and disconnect CN4 on HAND UNIT BD. Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS]Lost rudder ORD Rudder order is fixed. Switch SYSTEM SEL.
f.) Hydraulic Locking	Steer the actual rudder by hand wheel unit from midship to S/P 35 deg. In MAN mode. Meanwhile hold No.1 Torque/DD motor at less than maximum pump stroke. Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS] #1 Actuator Response abnormal. Change to NFU STEER
g.)Deviation between rudder order and feedback (No response)	Select [MAN] mode and set hand wheel on midship Disconnect the cable from TB21_2(μ) of the CAN ADAPTER. Or, disconnect the cable from TB4_21 (μ) of CONTROL & POWER BOX. Steer the rudder by using hand wheel more than 5 deg. Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS]#1 Rudder I/O Rudder no response. Change to NFU STEER.
g.)Deviation between rudder order and feedback (Rudder reversal)**YA type**	***YA type*** Select [MAN] mode and set hand wheel on midship Disengage the linkage between DD Motor lever and servo valve. Steer the rudder by using hand wheel more than 5 deg. Move the DDMotor lever in the opposite direction of the hand wheel. Confirm following alert indicates on AP CDU [MPH490] ALARM [SCS]#1 Rudder I/O Rudder no response. Change to NFU STEER.
g.)Deviation between rudder order and feedback (Rudder speed slow)	Select [MAN] mode and set hand wheel on midship Minimize the timer setting of Servoloop alarm.(Screen4-9-3-2:Min.Time) Steer the rudder by using hand wheel more than 5 deg. Confirm following alert indicates on AP CDU [MPH490] WARNING [SCS]#1 Rudder I/O Rudder speed slow. Check rudder speed.



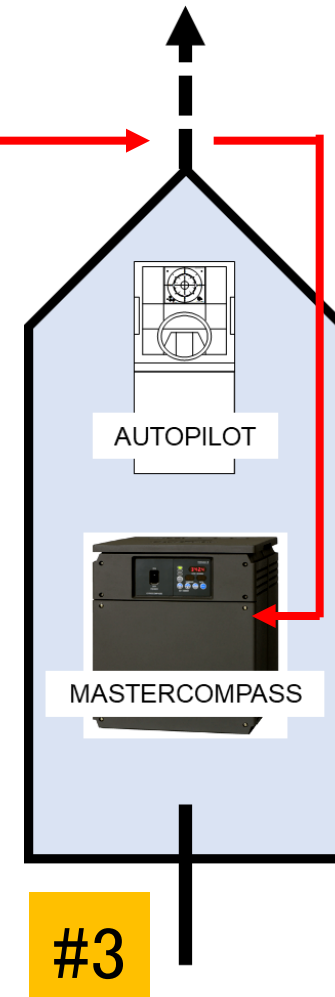
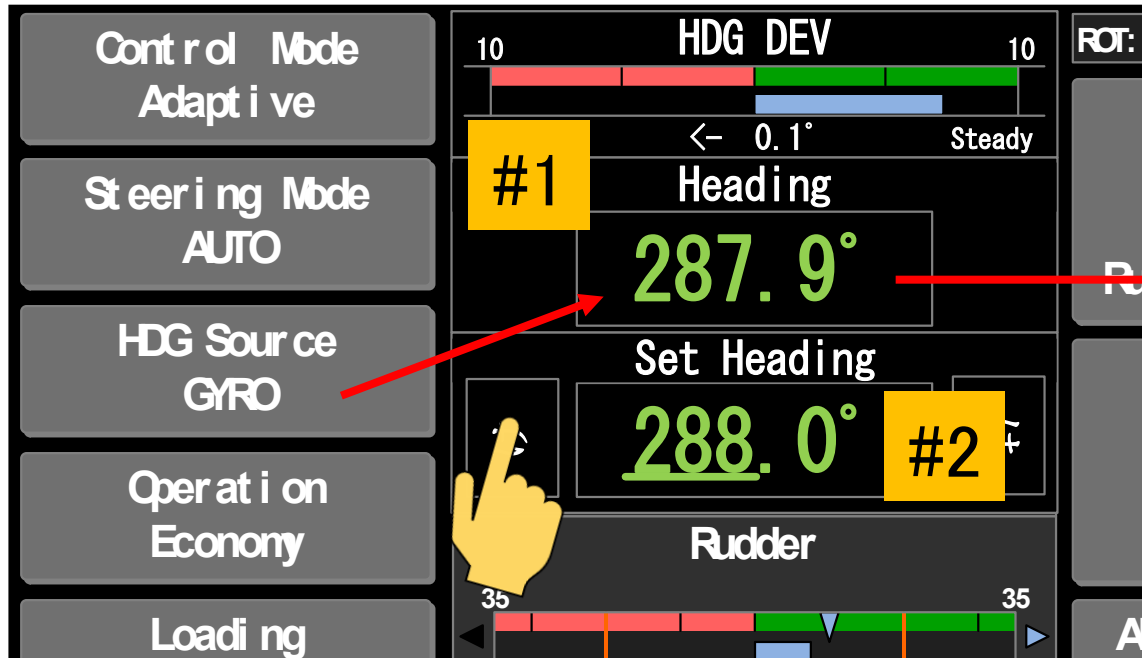
ITEM-6: ALERT CONFIRMATION

- ITEM-6-0: IACS UR E25 alert
- **ITEM-6-1: Off-heading**
- ITEM-6-2: Off-course
- ITEM-6-3: Heading monitor

ITEM-6-1: "Off-heading" alert



◆ What monitors?

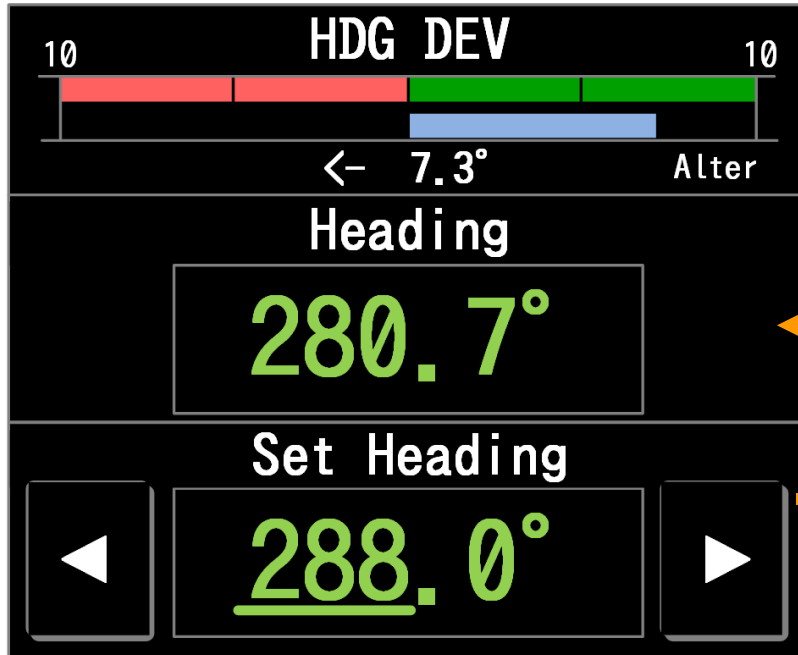


ITEM6-1: “Off-heading” alert

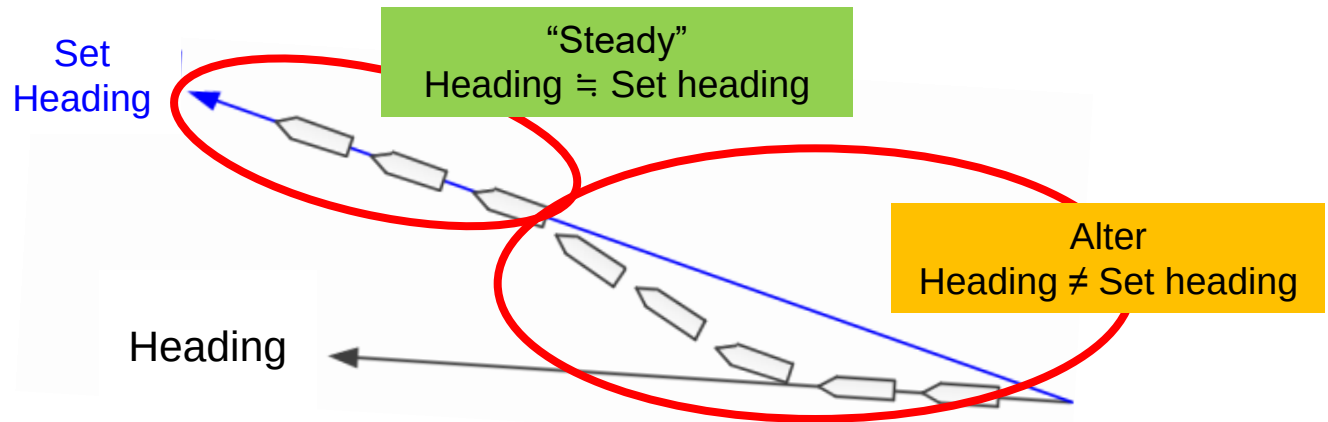
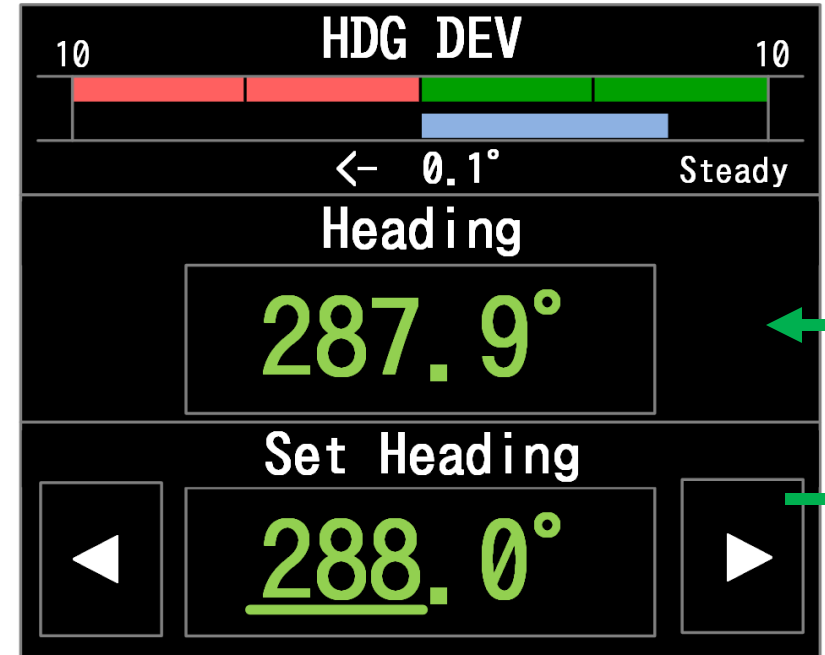


◆ When occurs?

#1



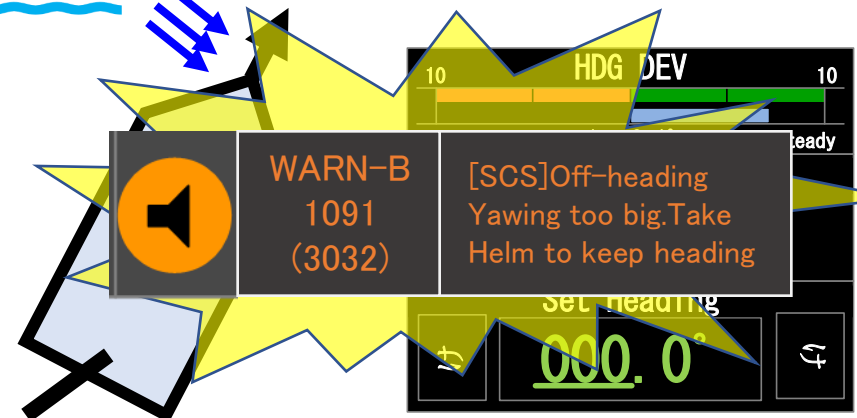
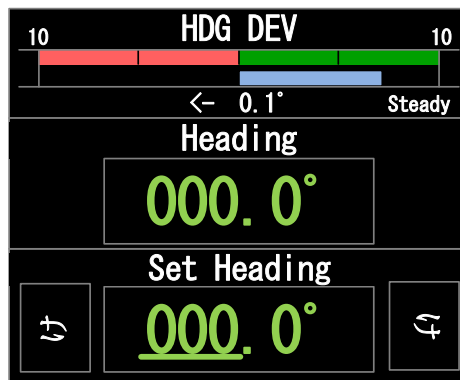
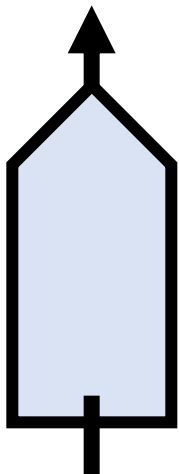
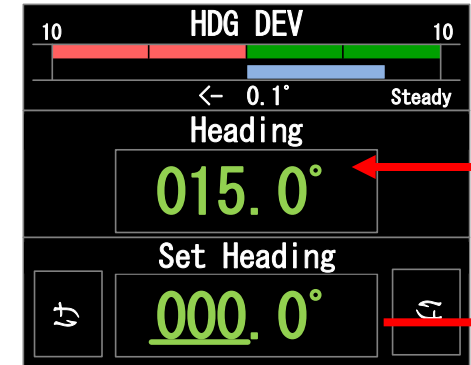
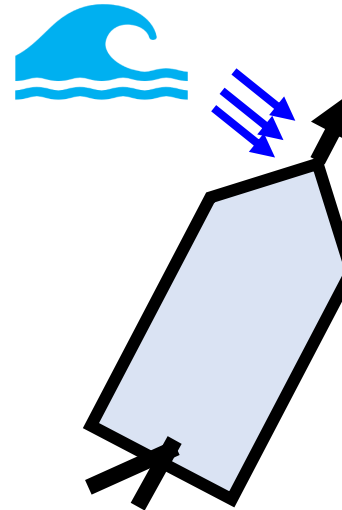
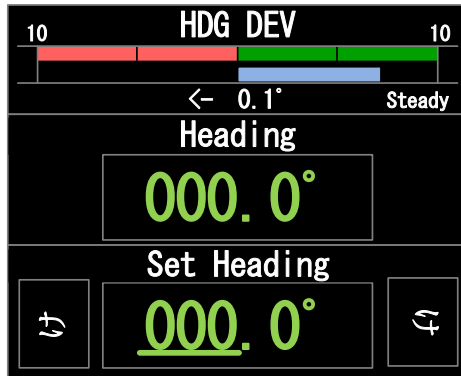
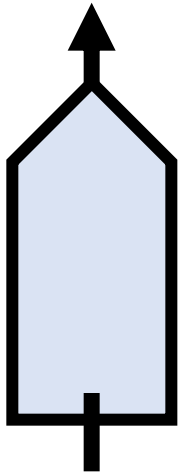
#2



ITEM6-1: “Off-heading” alert



◆ Why occurs?



Continues

ITEM6-1: “Off-heading” alert



◆ How to solve?

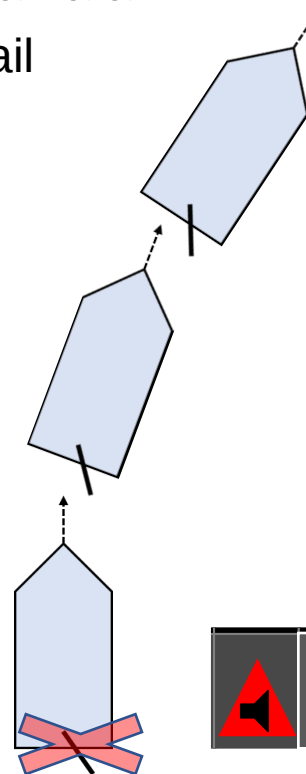
1. Only ITEM6-1: “Off-heading” alert.

- **Change to HAND (manual) mode**
(No correspondence required by
Maker)



2. Occurred with rudder fail alarm

- Correspond to rudder fail is needed.



	WARN-B 1091 (3032)	[SCS]Off-heading Yawing too big.Take Helm to keep heading
	ALRM-B 11161 (3289)	[SCS]#1 RUDD I/O Rudder no response. Change to NFU STEER.

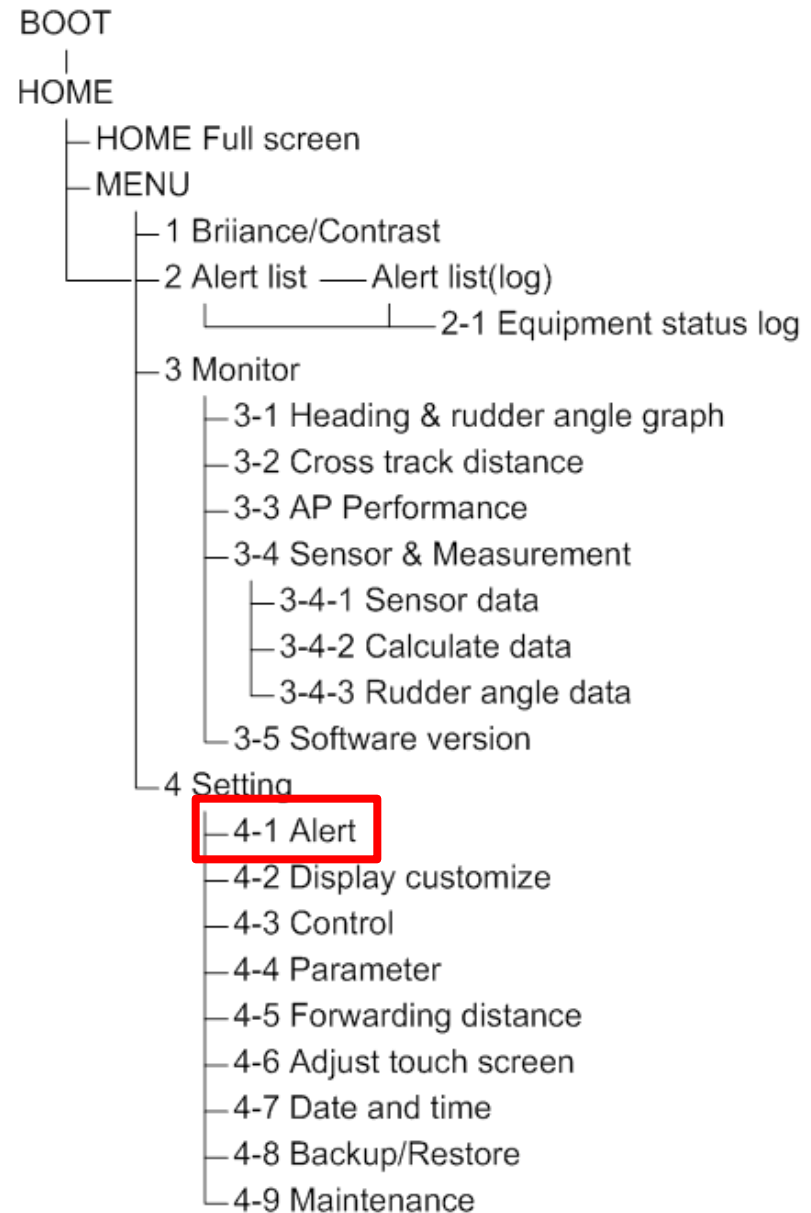
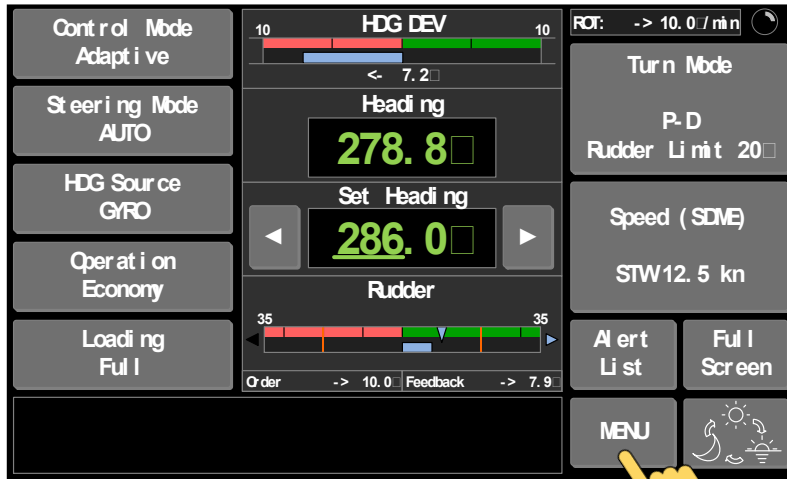
	ALRM-B 11161 (3289)	[SCS]#1 RUDD I/O Rudder no response. Change to NFU STEER.
--	---------------------------	---

ITEM6-1: “Off-heading” alert



◆ How to monitor?

➤ [4-1 Alert]

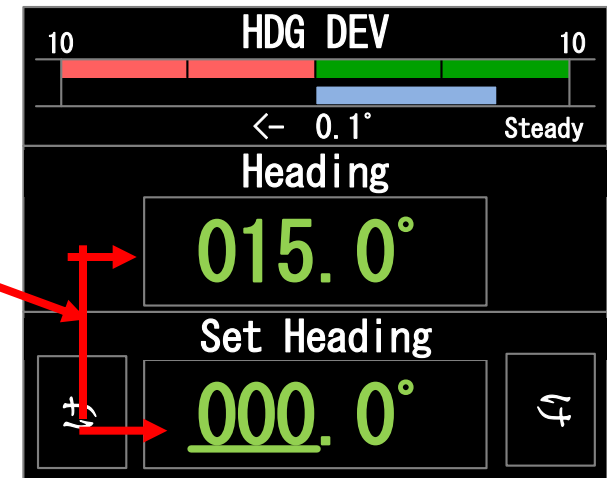
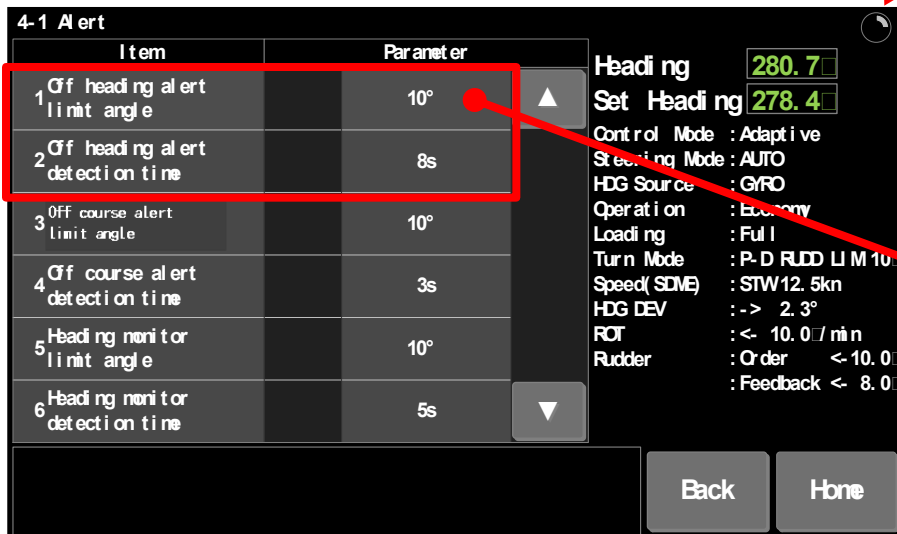
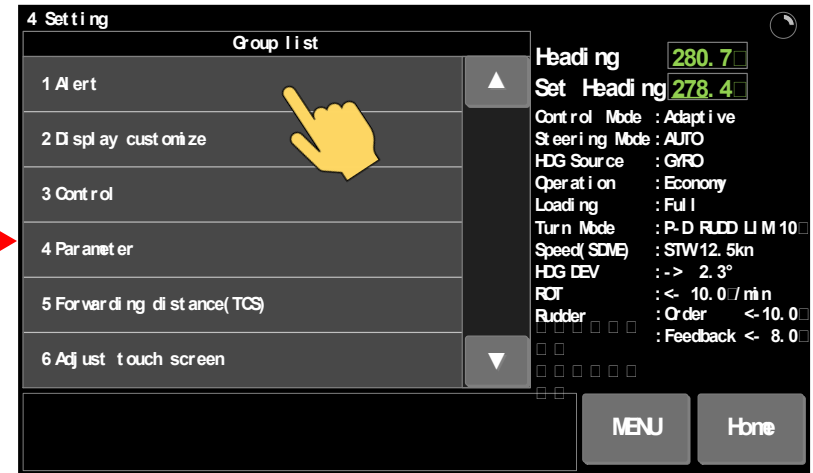
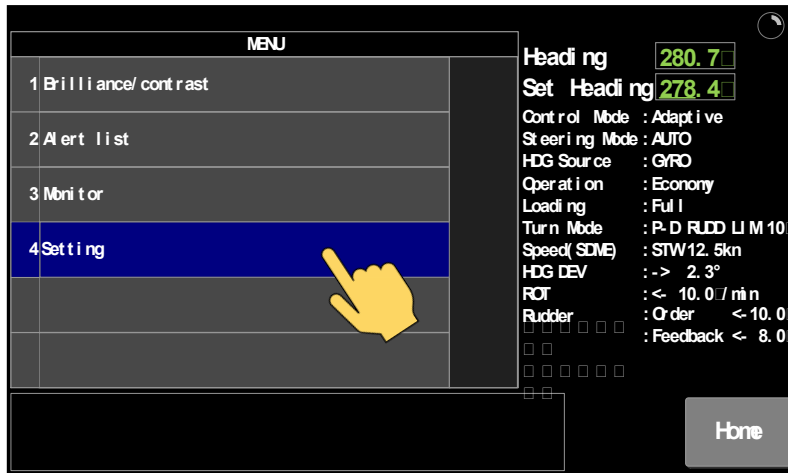


ITEM6-1: “Off-heading” alert



◆ How to monitor?

➤ [4-1 Alert]



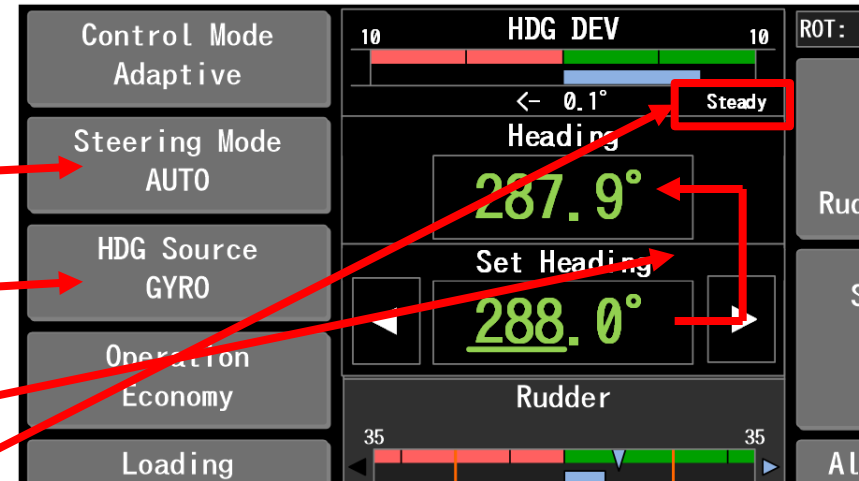
ITEM6-1: “Off-heading” alert



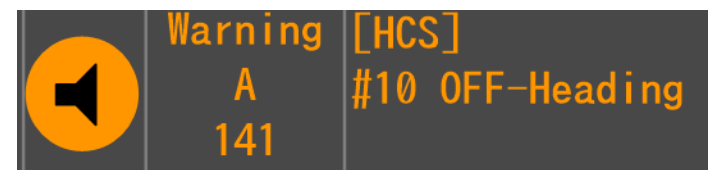
◆ How to test

● Method 1 (PT900 & PT500):

- #1: Select AUTO mode.
- #2: Select GYRO as a heading source of autopilot
- #3: Make “Set Heading” = “Heading”
- #4: Wait until mode become “Steady”.
- #5: Manually turn GYRO heading for more than threshold degree.
- #6: “OFF-HEADING” occurs after set time.



Command code 24
“Manual alignment”



ITEM6-1: “Off-heading” alert



◆ How to test

● Method 2 (Only PT900):

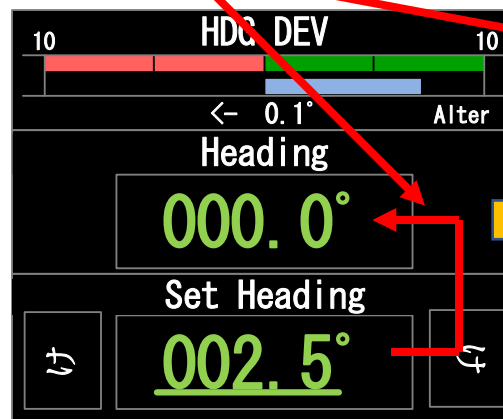
#1: Set “OFF-HEADING” threshold to minimum (2 deg).

#2: Make the difference between “Set Heading” and “Heading” for 2.5 deg.

#3: Wait until mode become “Steady”.

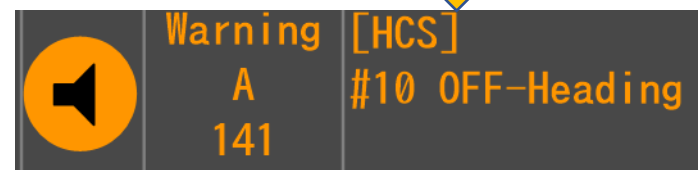
#4: “Off-heading” occurs.

4-1 Alert	
Item	Parameter
1 Off heading alert limit angle	2°
2 Off heading alert detection time	8s
3 Off heading alert	10"



◆ IMPORTANT

The turn mode DOES NOT become “Steady” if you change set heading more than 3 deg. and ITEM4-1: “Off-heading” alert does not occur!!!





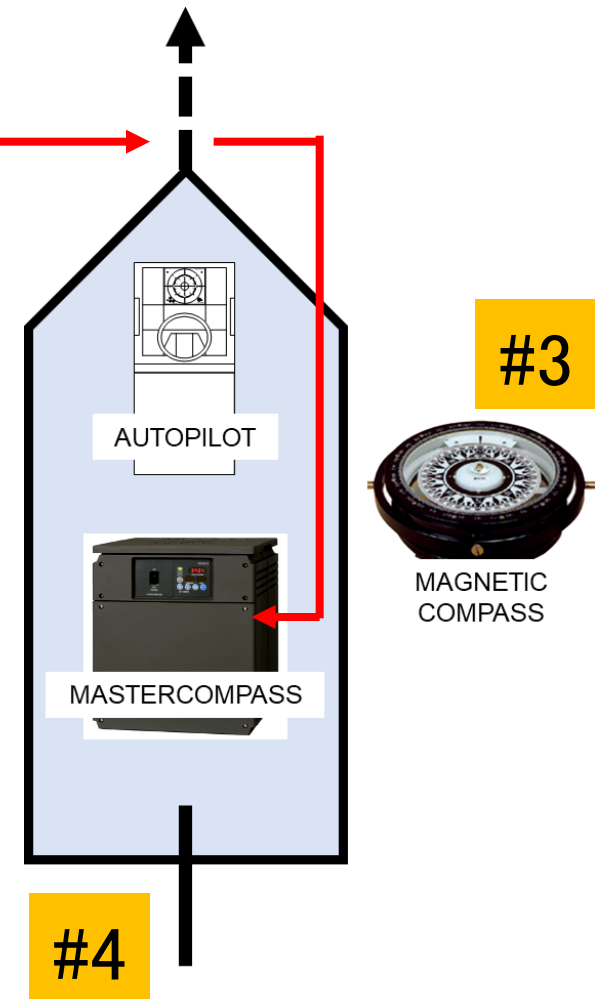
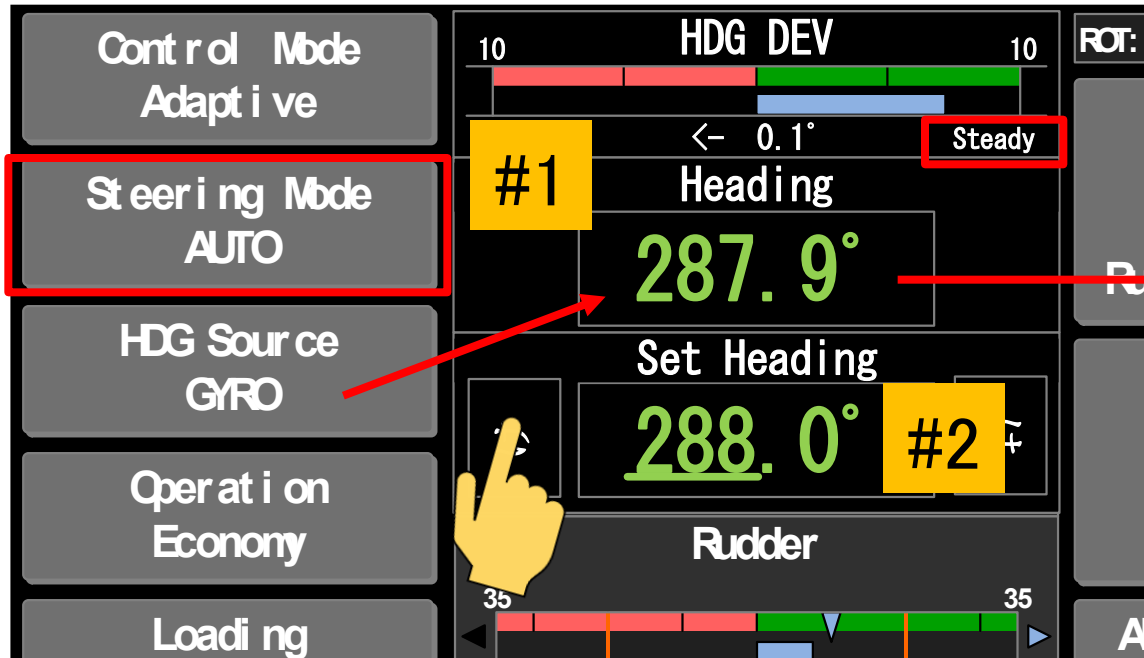
ITEM-4: ALERT CONFIRMATION

- ITEM-6-0: IACS UR E25 alert
- ITEM-6-1: Off-heading
- **ITEM-6-2: Off-course**
- ITEM-6-3: Heading monitor

ITEM6-2: “Off-course” alert



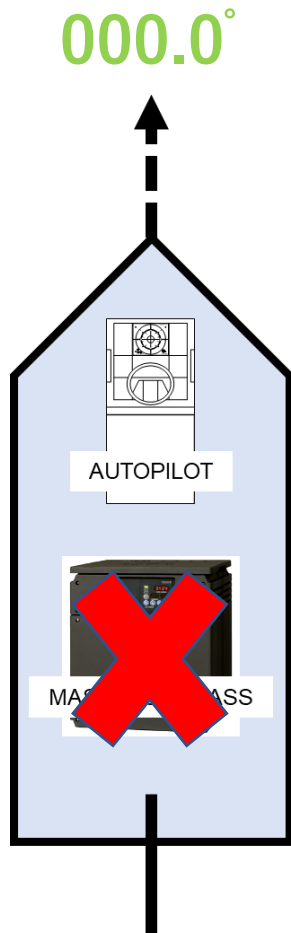
◆ What monitors? / When occurs?



ITEM6-2: “Off-course” alert



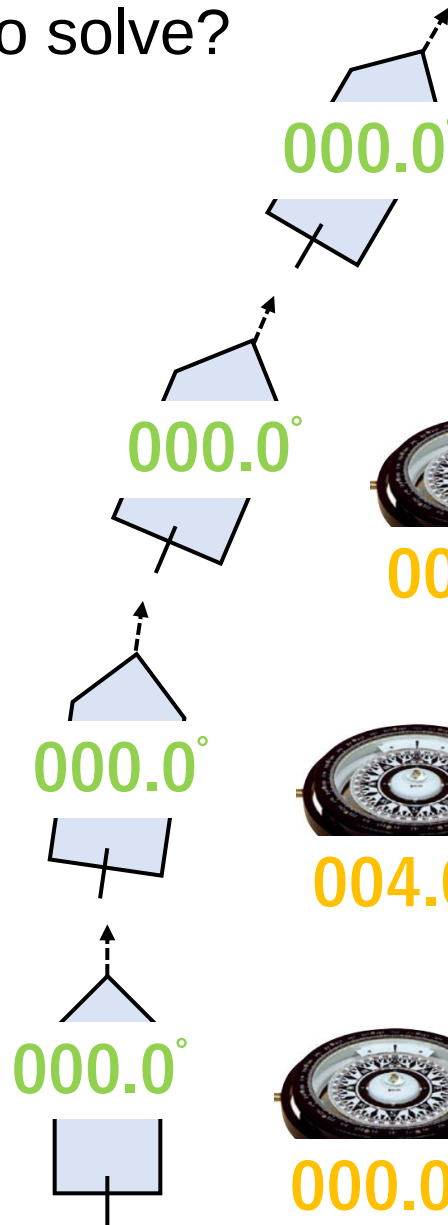
◆ Why occurs? / How to solve?



000.0°



MAGNETIC
COMPASS



000.0°

000.0°

000.0°

000.0°



008.0°



004.0°



000.0°



015.0°

Check Gyrocompass

ITEM6-2: “Off-course” alert



◆ How to monitor?

➤ [4-1 Alert]

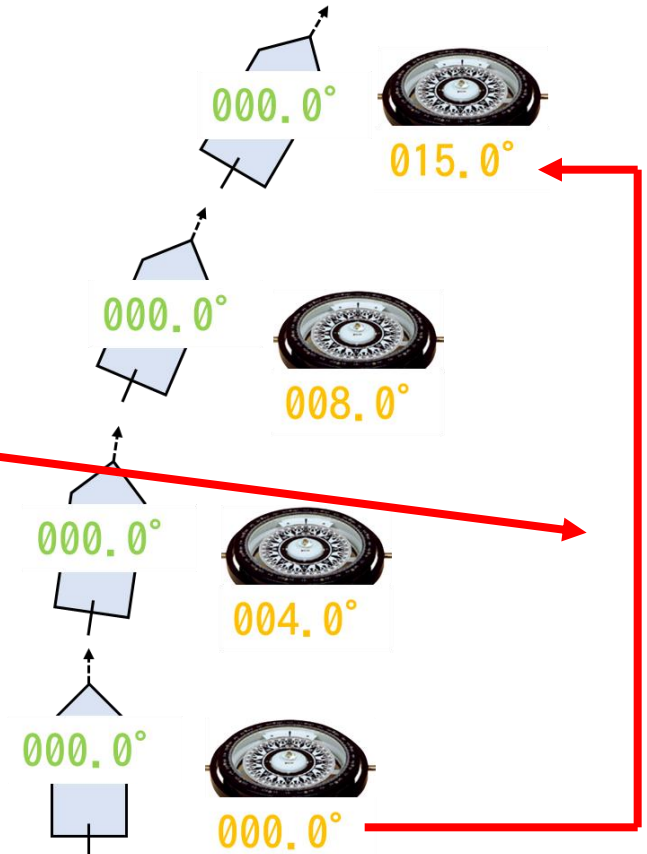
4-1 Alert

Item	Parameter
1 Off heading alert limit angle	10°
2 Off heading alert detection time	8s
3 Off course alert limit angle	10°
4 Off course alert detection time	3s
5 Heading monitor limit angle	10°
6 Heading monitor detection time	5s

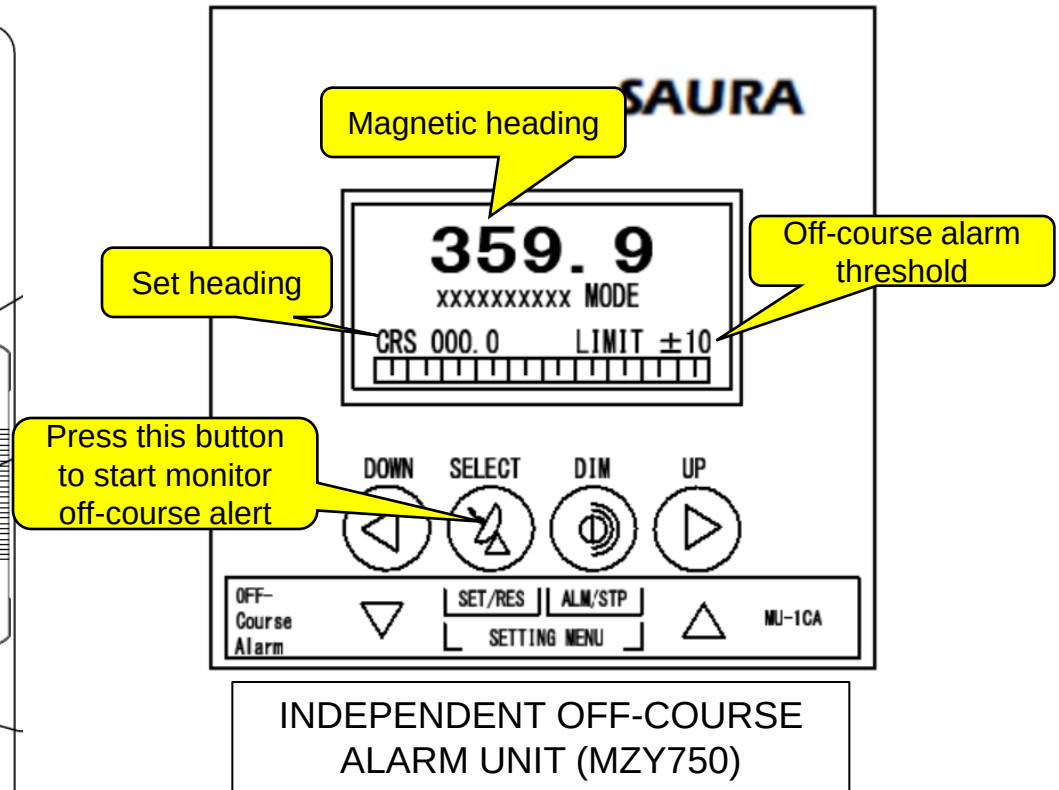
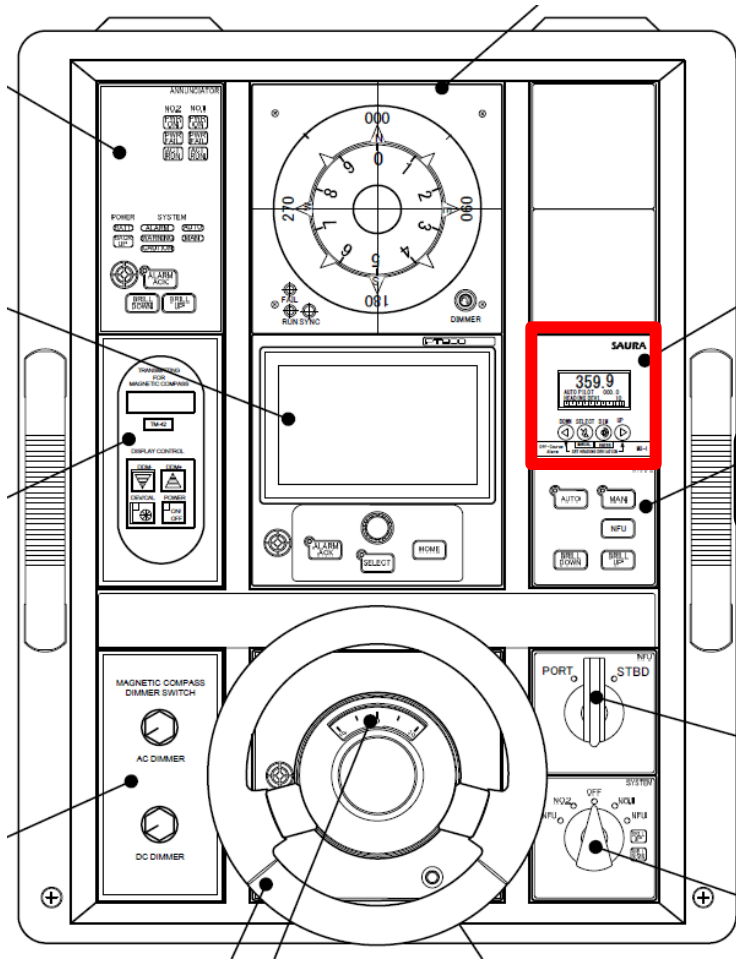
Heading 280.7°
Set Heading 278.4°

Control Mode : Adaptive
Steering Mode : AUTO
HDG Source : GYRO
Operation : Economy
Loading : Full
Turn Mode : P-D RUD LIM 10°
Speed(SDME) : STW 12.5kn
HDG DEV : -> 2.3°
ROT : <- 10.0°/min
Rudder : Order <- 10.0°
Feedback <- 8.0°

Back Home



◆ LOCA unit

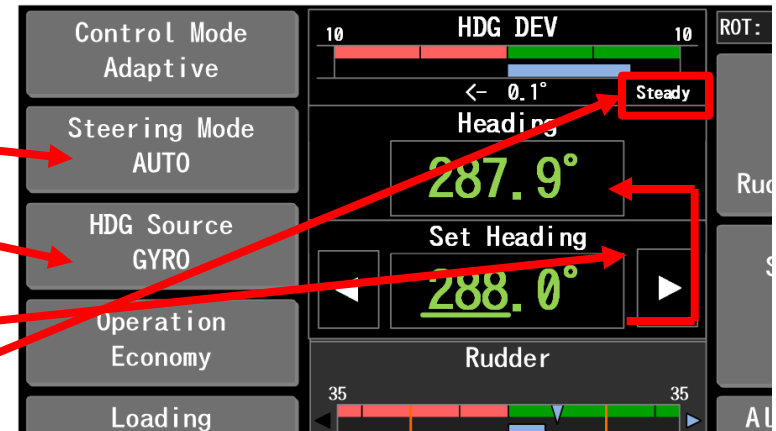


ITEM6-2: “Off-course” alert

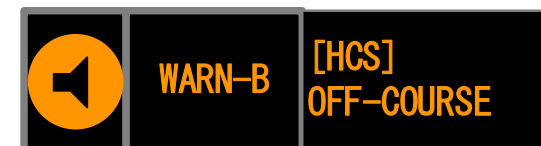


◆ How to test

- #1: Select AUTO mode.
- #2: Select GYRO as a heading source of autopilot.
- #3: Make “Set Heading” = “Heading”.
- #4: Wait until mode become “Steady”.
- #5: Manually turn MAGNETIC COMPASS heading.
- #6: ITEM4-2: “Off-course” alert occurs.



Make difference intentionally or input different correction





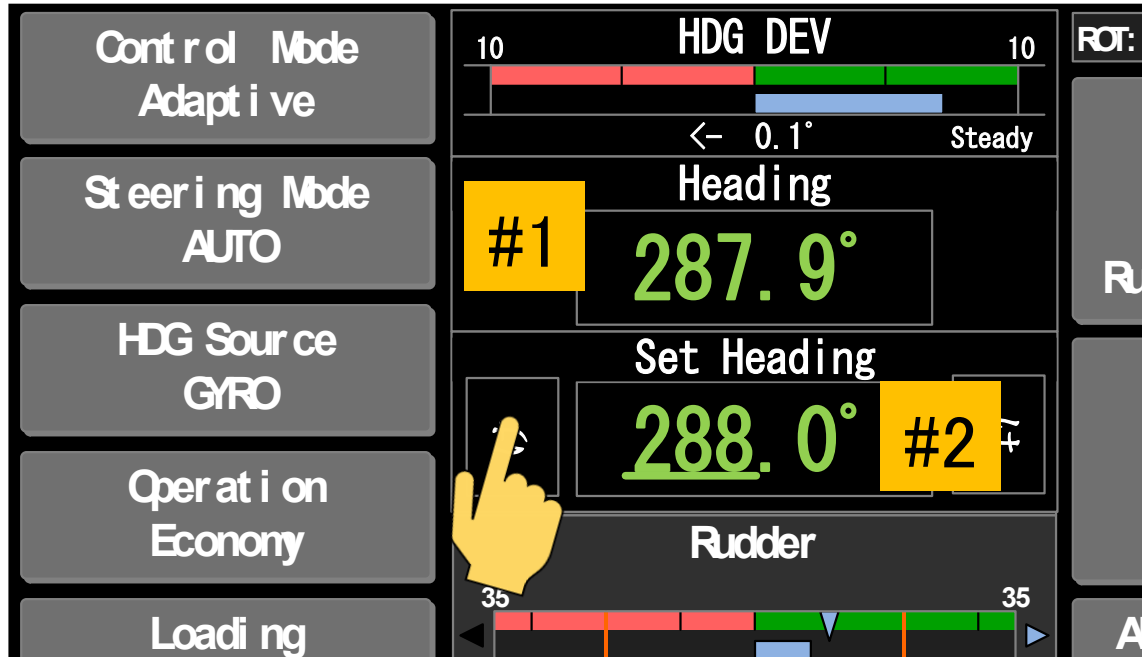
ITEM-6: ALERT CONFIRMATION

- ITEM-6-0: IACS UR E25 alert
- ITEM-6-1: Off-heading
- ITEM-6-2: Off-course
- ITEM-6-3: Heading monitor

ITEM6-3: “Heading Monitor” alert

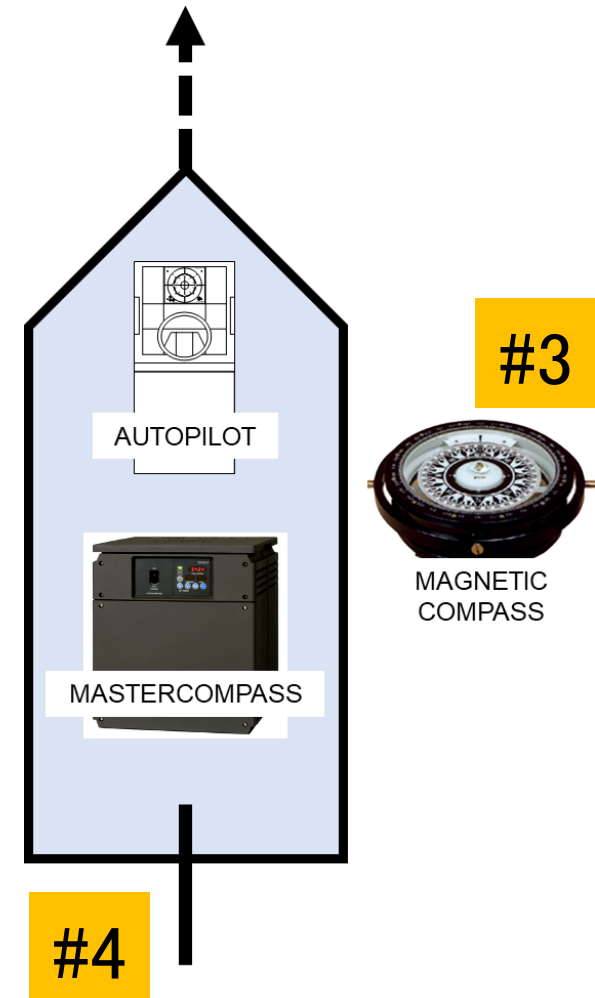


◆ What monitors?



◆ When monitors?

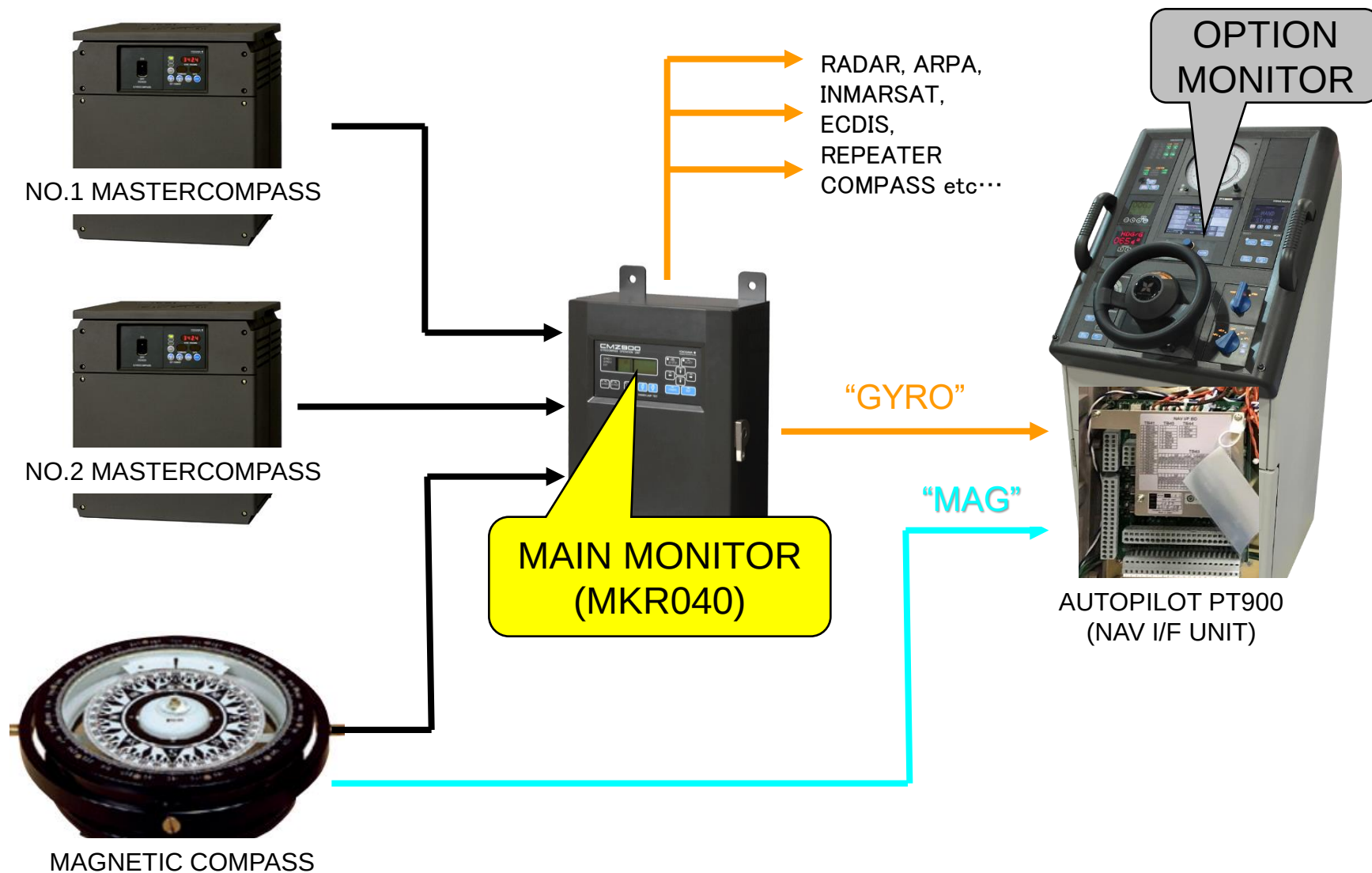
➤ **ALWAYS**



ITEM6-3: “Heading Monitor” alert



◆ Who monitors?





◆ Why monitors?

ISO 11674 (2019)

Ships and marine technology- Heading control systems

4.3.2 Heading monitor

If the ship is required to carry two independent compasses, a heading monitor shall be provided to monitor the actual heading information from independent heading sources.

Heading monitor is not required to be an integrated part of the heading control system.



YDK can provide “heading monitor”
function in gyrocompass system (MKR040)



ITEM6-3: “Heading Monitor” alert



◆ How to monitor? (CMZ900 settings)

GYRO 1	>123.4°	G1/G2 05.0°
GYRO 2	123.4°	G1/E 10.0°
EXT	126.0°	G2/E 10.0°
		DEV ALERT

Command code 28
“Deviation alert”

◆ How to monitor? (PT900 settings)

➤ [4-1 Alert]

4-1 Alert			
	Item	Parameter	
1	Off heading alert limit angle	10°	▲
2	Off heading alert detection time	8s	
No need to set otherwise provided optionally			
5	Heading monitor limit angle	10°	
6	Heading monitor detection time	5s	▼

Heading 28
Set Heading 27
Control Mode :Adap
Steering Mode :AUTO
HDG Source :GYRO
Operation :Econ
Loading :Full
Turn Mode :P-D
Speed(SDME) :STW
HDG DEV :->
ROT :<-
Rudder :Order
Feed

ITEM6-3: “Heading Monitor” alert



◆ How to test

- Manual align either Gyrocompass or Magnetic compass



Command code 24
“Manual alignment”

OR



Make difference intentionally
or input different correction

Overall of heading alert



◆ Overall of heading related alert

Alert	What	When	Who	Why	How	Rule
Off-heading	Deviation of (1) Set HDG (2) Current HDG	-AUTO & -Steady	Autopilot	To monitor course keeping ability	[4-1 Alert]	Requirement
Off-course	Deviation of 2 nd HDG source of (1) Steady mode started (2) Current	-AUTO & -Steady	-Autopilot or -IOCA unit	To monitor the condition of 1 st (Main) HDG source	[4-1 Alert]	No need (Sometimes by special committee)
Heading monitor	Deviation of (1) 1 st HDG (2) 2 nd HDG	Always	-CMZ900 (MKR040) -Autopilot (Option)	To monitor each HDG source	Code: 28	Requirement (Monitoring by autopilot is option)



Next is “Sea trial service”



====Sea trial service====

- ITEM-5: HCS Adjustment @ Sea Trial
- ITEM-6: TCS Adjustment @ Sea Trial
- ITEM-7: Fill in installation certificate
- ITEM-8: Backup & Copy Rigging data



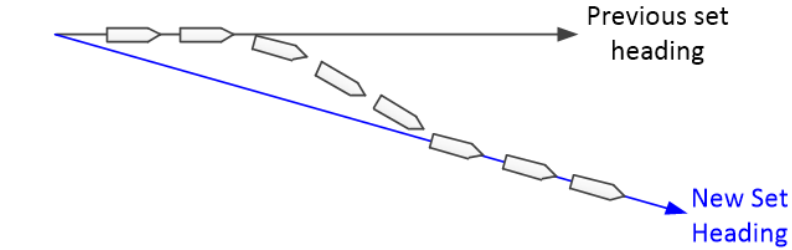
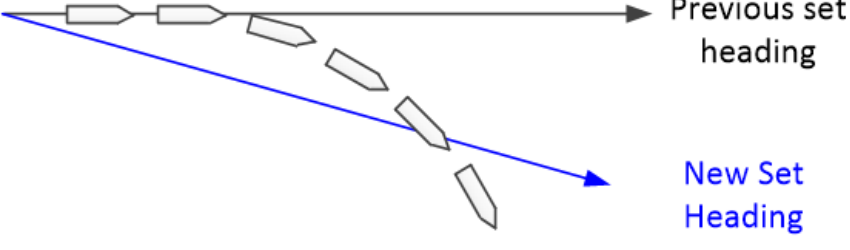
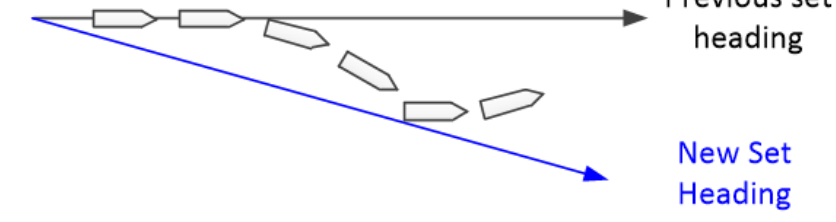
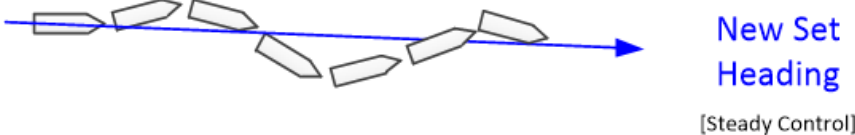
ITEM-5: ~Sea trial~ HCS Adjustment

ITEM-5: HCS ADJUSTMENT at Sea Trial



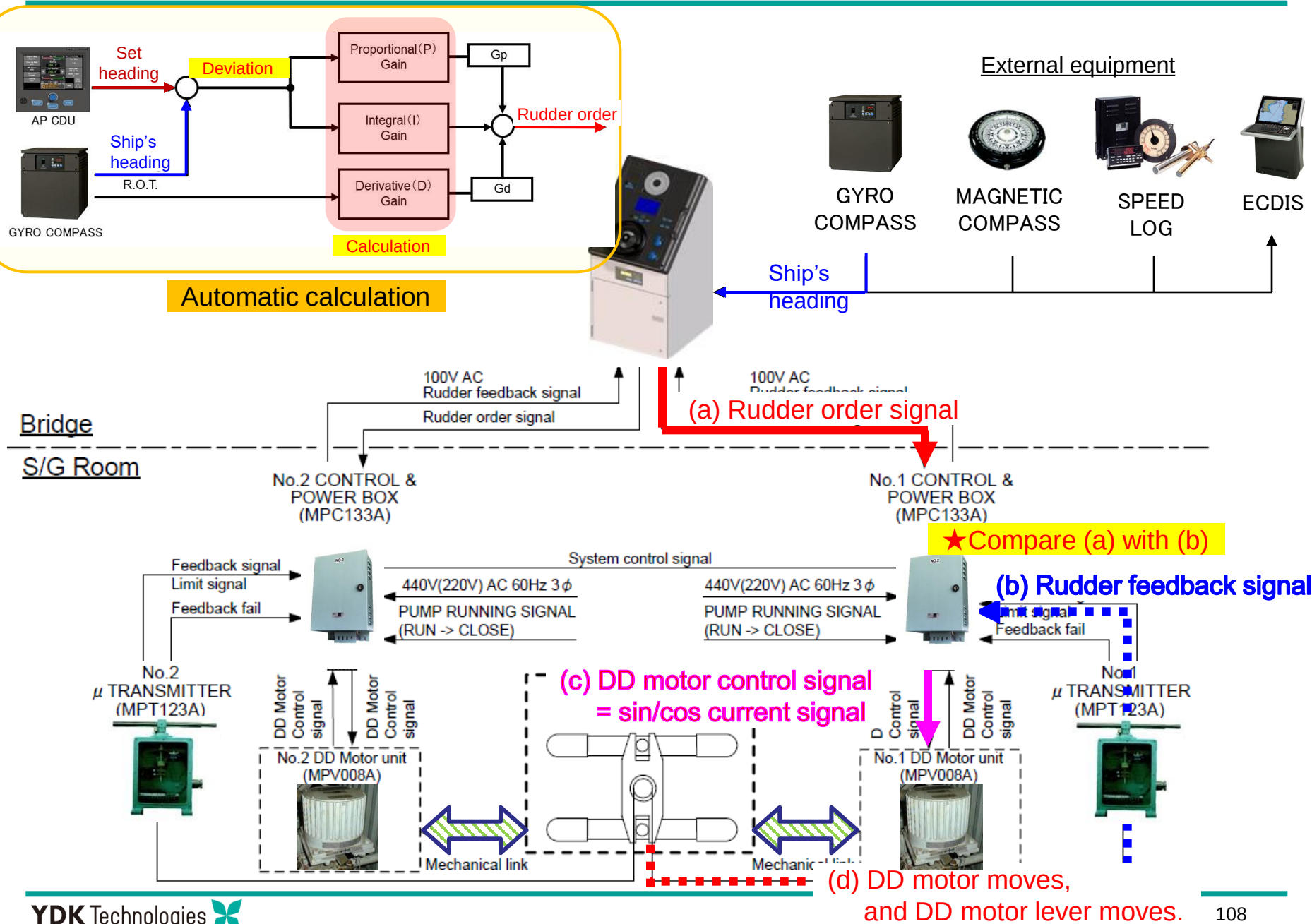
- Auto steering condition

#1

Behavior Pattern	Conditions/Causes
	
	
	
	 [Steady Control]



ITEM-5: HCS ADJUSTMENT at Sea Trial

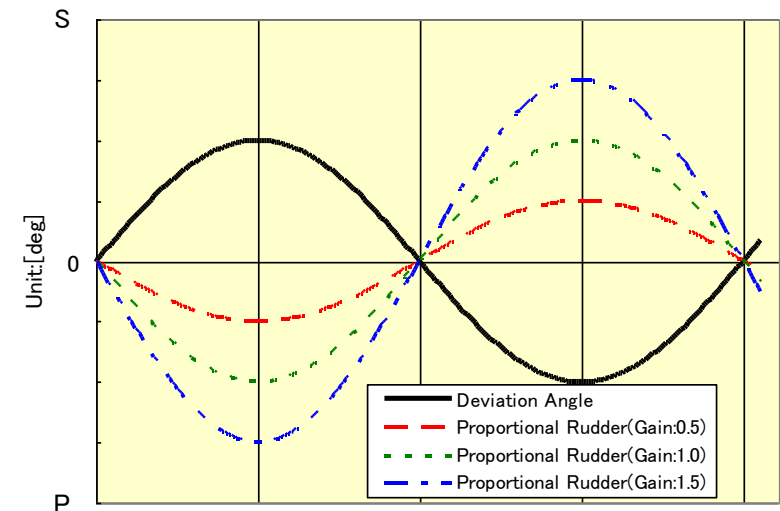
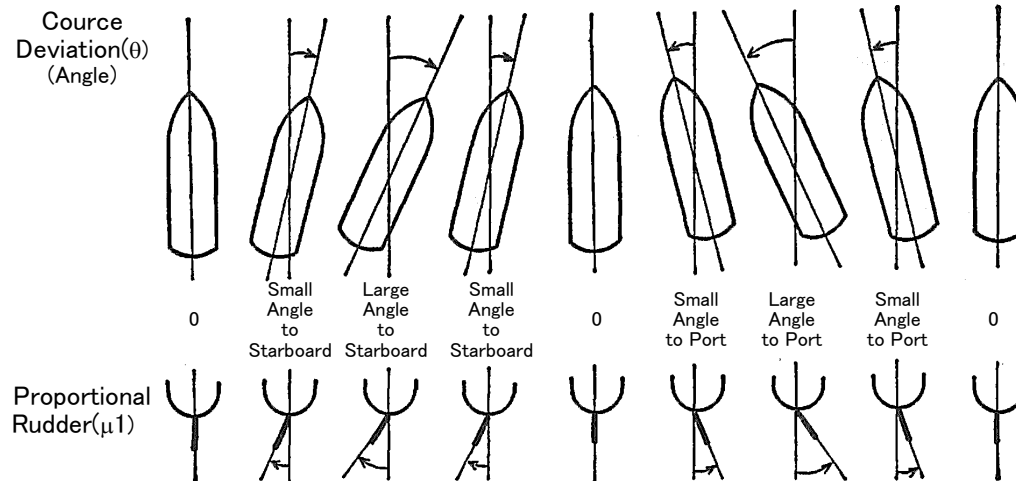




● Parameter Adjustment

P (Proportional) CONTROL

the rudder angle increases according to the course deviation.

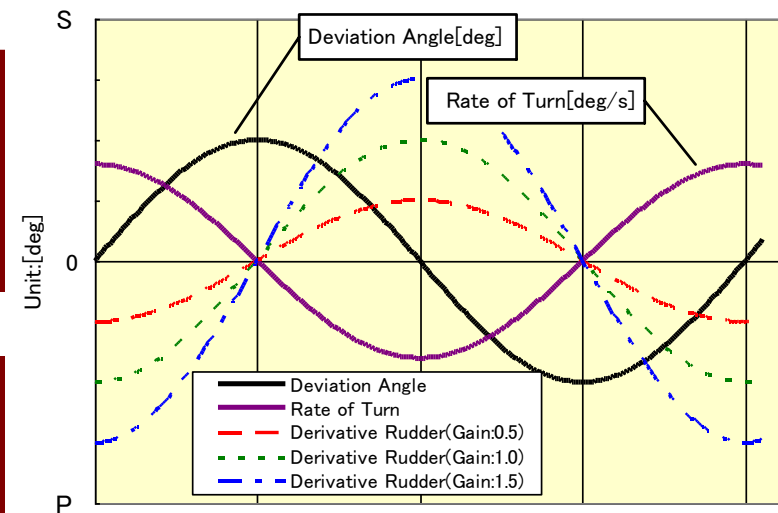
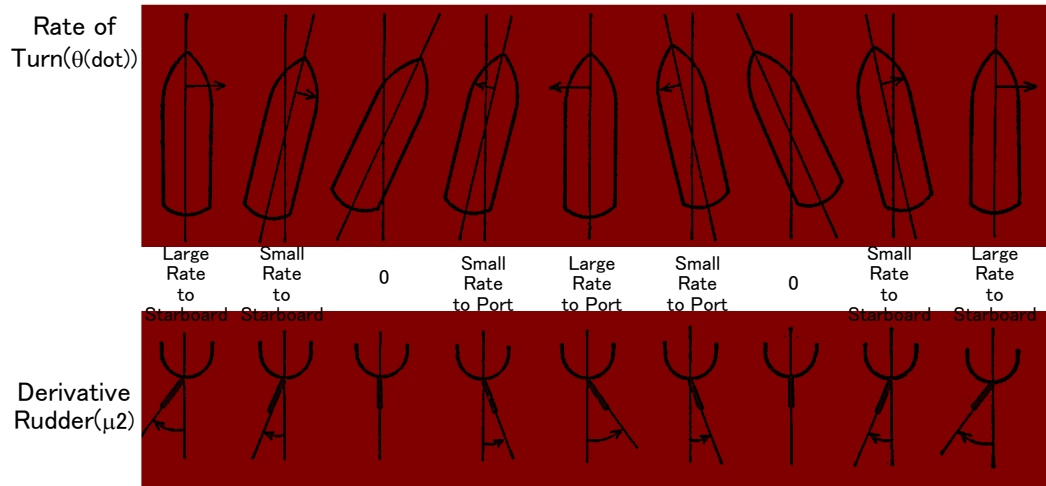




● Parameter Adjustment

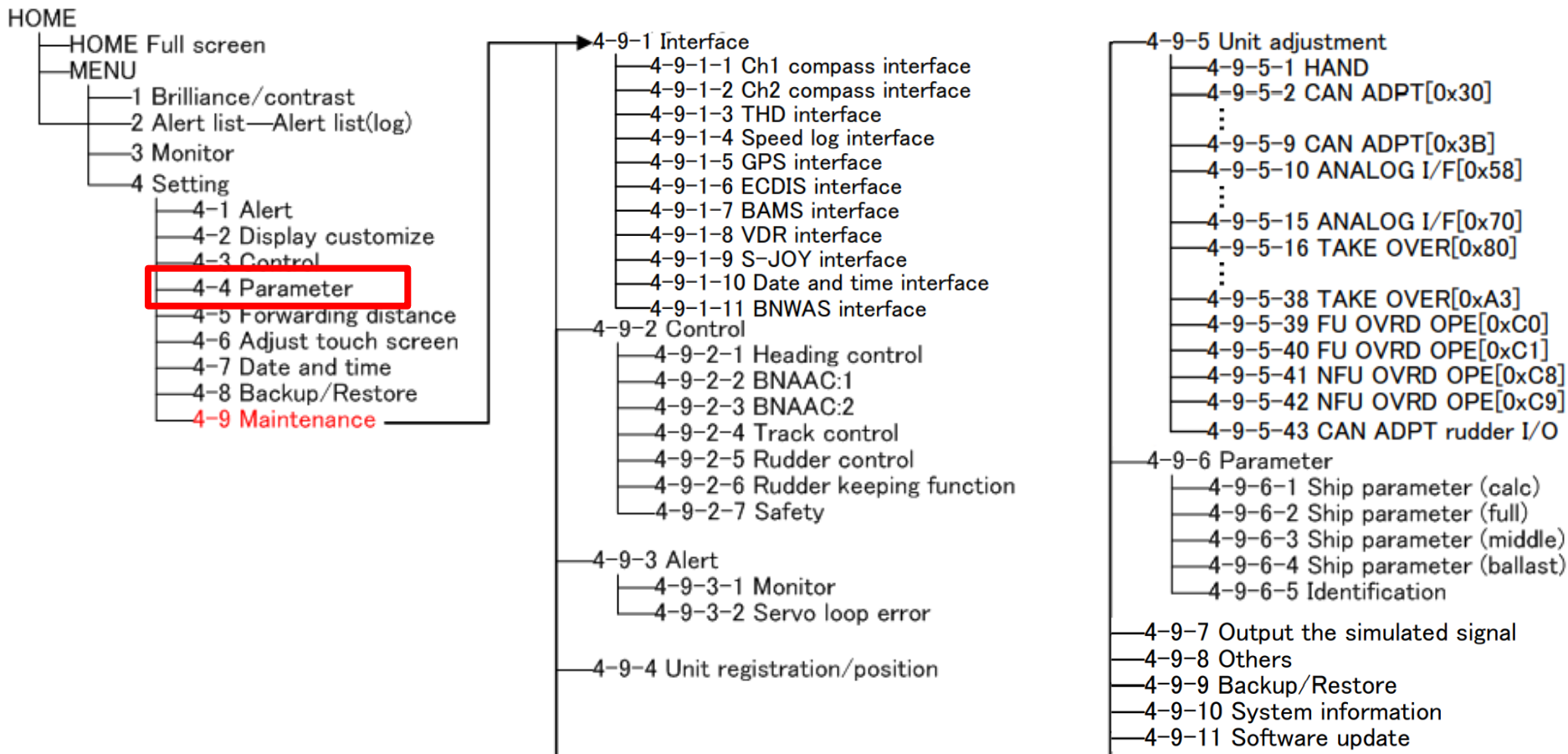
D (Derivative) CONTROL

The rudder angle increases according to the rate of turn





● Parameter Adjustment



*Software ver. "Bxx" or higher



● Parameter Adjustment

4-4 Parameter

4-4 Parameter

Item	Parameter
1 Vs	15kn
2 Lpp	150m
3 Breadth	30m
4 Ki	30m
5 TV	60s
6 KV	0.08 1/s

Heading 280.7
 Set Heading 278.4
 Control Mode : Adaptive
 Steering Mode : AUTO
 HDG Source : GYRO
 Operation : Economy
 Loading : Full
 Turn Mode : P-D RUDD LIM 10
 Speed (SDME) : STW 12.5kn
 HDG DEV : -> 2.3°
 ROT : <- 10.0 / min
 Rudder : Order <- 10.0
 : Feedback <- 8.0

Back Home

★ These items need to be adjusted at the service if the vessel reported the inappropriate behavior of the heading control.

Setting items	Description
1 Vs	Cruising speed (1~65kn)
2 Lpp	Hull length (10~400m)
3 Breadth	Moulded breadth (1~99m)
4 Ki	Initial setting value of static gain
5 TV	Setting value of time constant
6 KV	Setting value of static gain
7 MQ	Kalman filter noise covariance matrix multiplier
8 Gd	Derivative gain multiplier
9 Gp	Proportional gain multiplier
10 Gi	Integral gain multiplier
11 INIT	Stable/unstable results computed from ship particulars
12 IDENT	Parameter updated state (updated/not updated)
13 RESULT	Stable/unstable updated result

ITEM-5: HCS ADJUSTMENT at Sea Trial



● How to check??

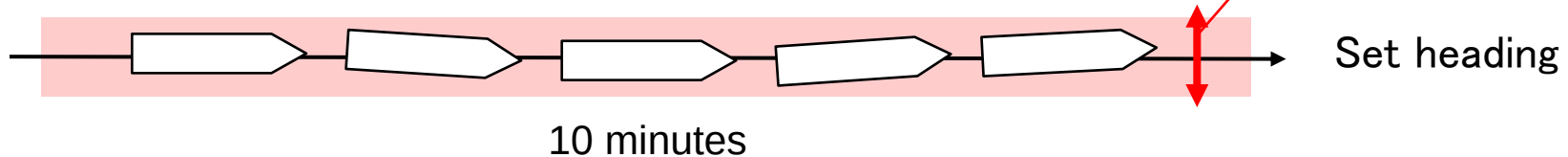
Course keeping

Step-01) Observe auto steering condition under steady condition for **10 minutes**.

Step-02) Check if yawing shall be **within ± 1 deg**

Step-00) Condition is as follows;

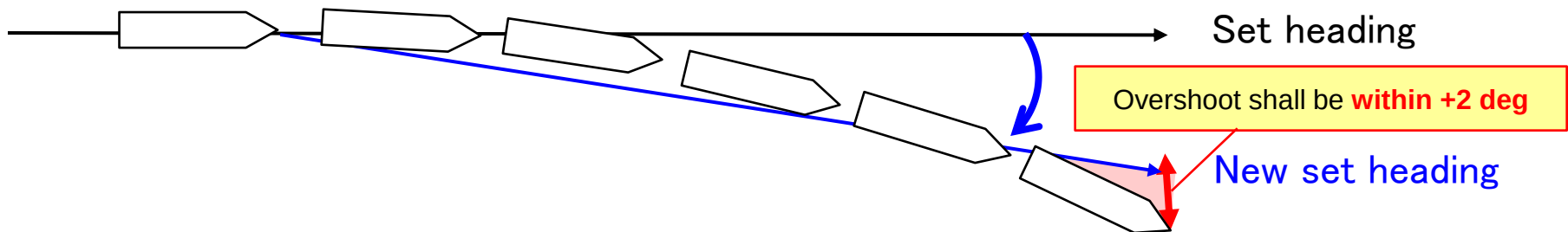
- Rudder angle limit; 10°
- Ship's speed; Regular speed
- Sea condition; Seastate 3 or less than



Overshoot

Step-03) Change set heading **STBD** or **PORT** 20 deg from ship's heading.

Step-04) Check if overshoot shall be **within ± 2 deg**

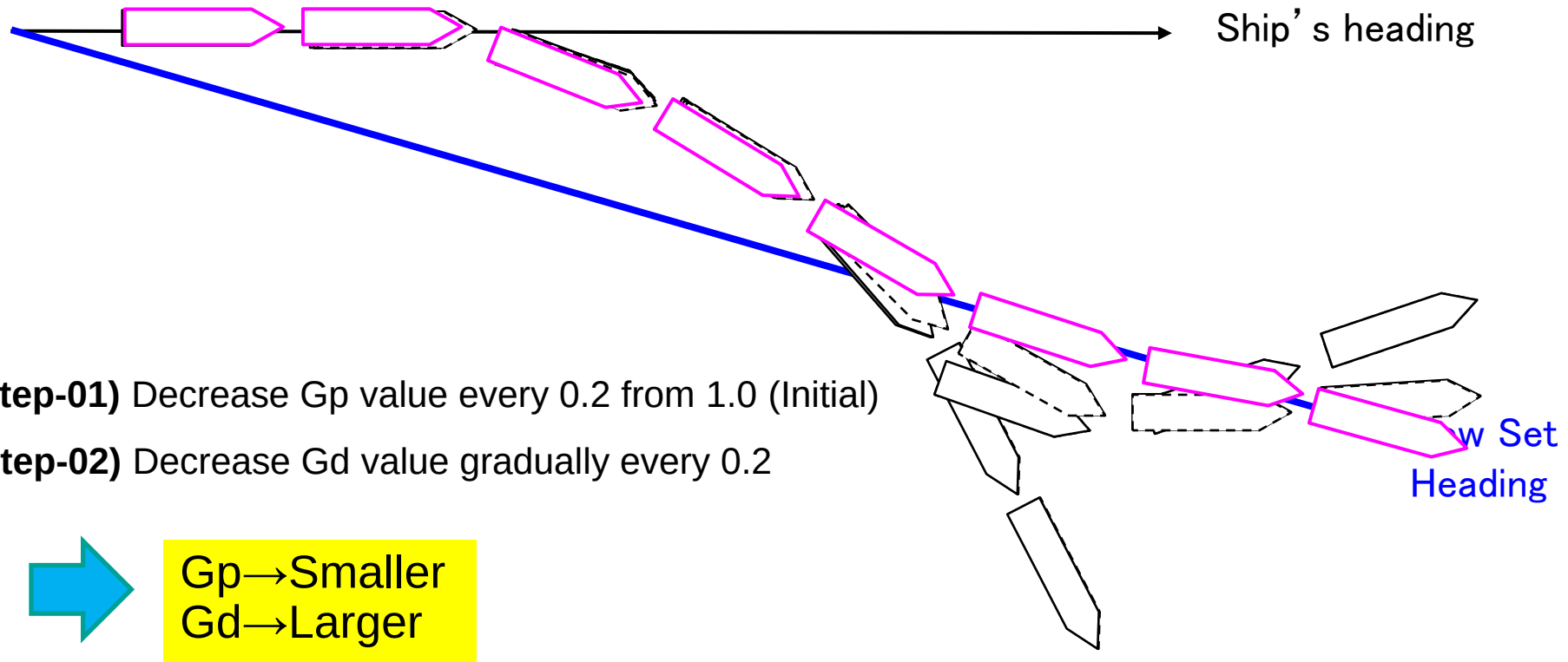


ITEM-5: HCS ADJUSTMENT at Sea Trial



● How to adjust??

***If overshoot is found !!**



Step-01) Decrease Gp value every 0.2 from 1.0 (Initial)

Step-02) Decrease Gd value gradually every 0.2



Gp → Smaller
Gd → Larger

Note)

Gd : setting range: 0.2 to 4.0

Gp : setting range: 0.2 to 4.0

ITEM-5: HCS ADJUSTMENT at Sea Trial

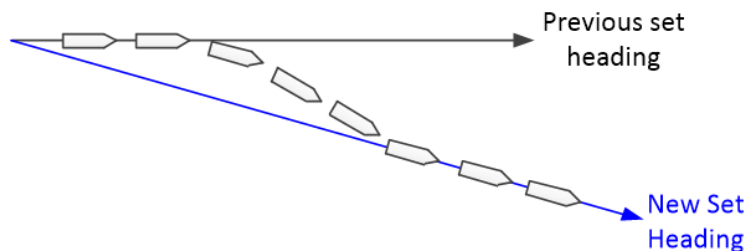


● How to adjust??

#1

Maneuvers to set heading smoothly and course keeping quality is good

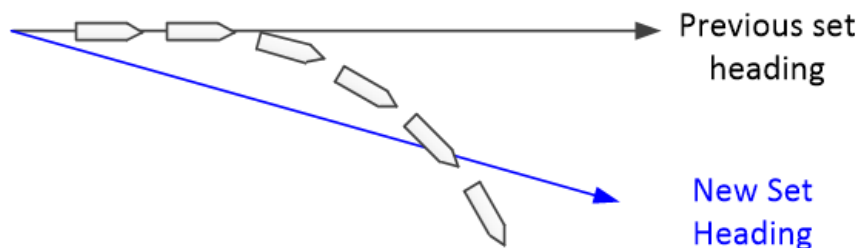
Conditions/Causes



Good

#2

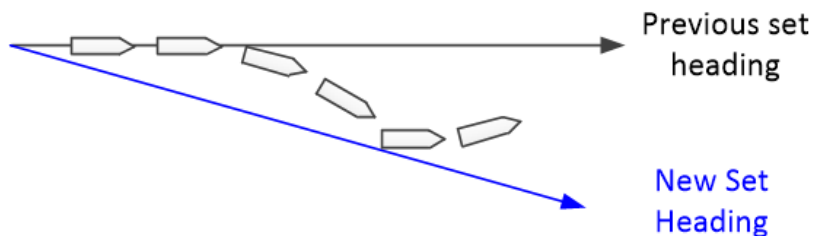
Overshooting is large at altering course



Gp → 
Gd →

#3

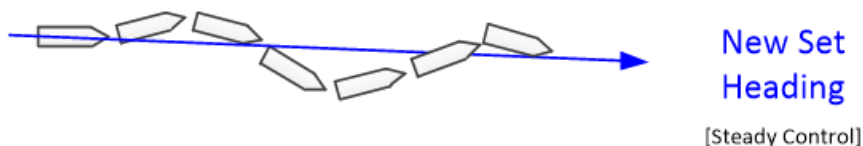
Counter Rudder is big before reaching the set heading



Gp → 
Gd →

#4

Yawing during steady control



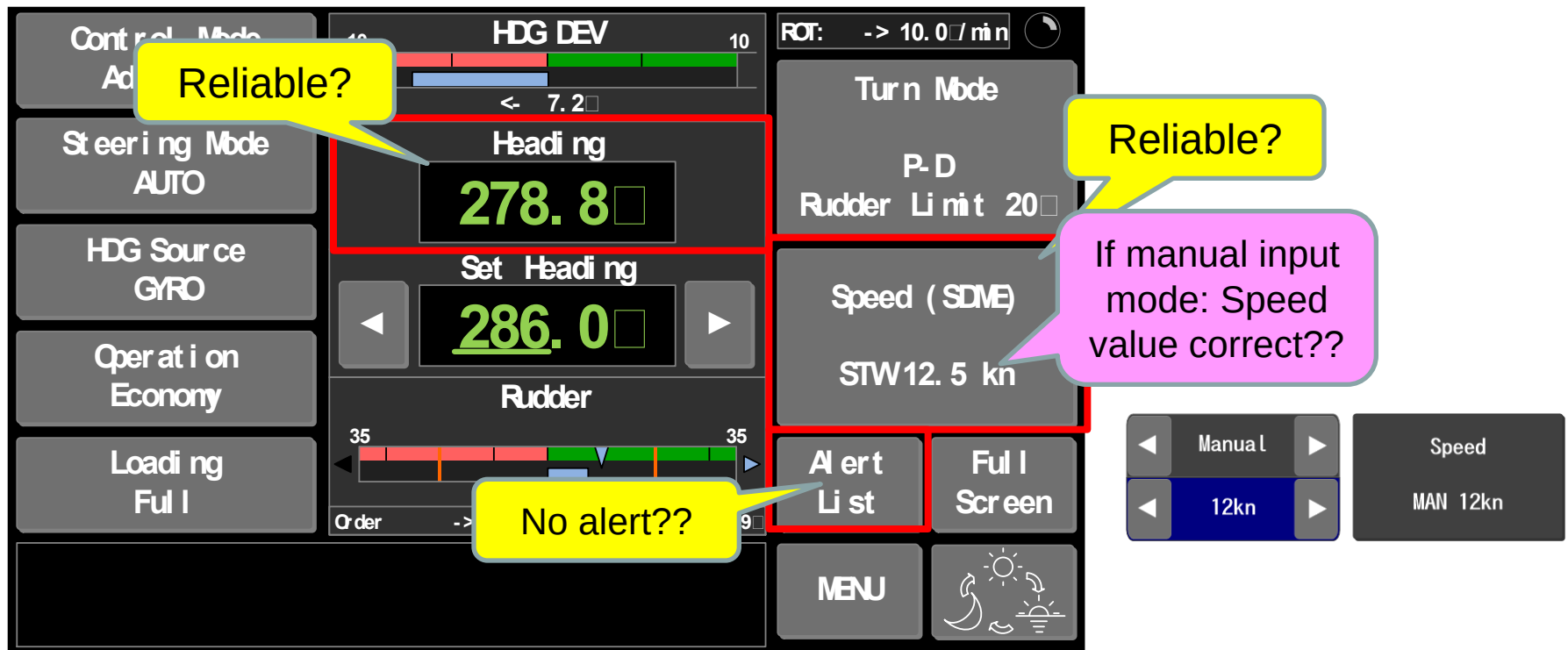
Gd → 

(Gi →  if Gd adjustment is not good)



◆ Other check points

1. Condition of Gyrocompass and Speed log.
 - The signal from this 2 sensors are very effective to auto control.
2. Whether if actual rudder are moving properly.
 - “Servo loop” alarm may occurs if they are not moving properly.

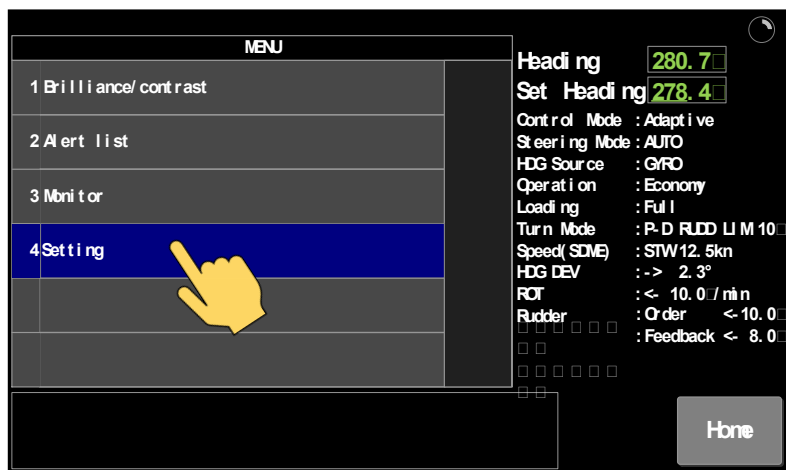
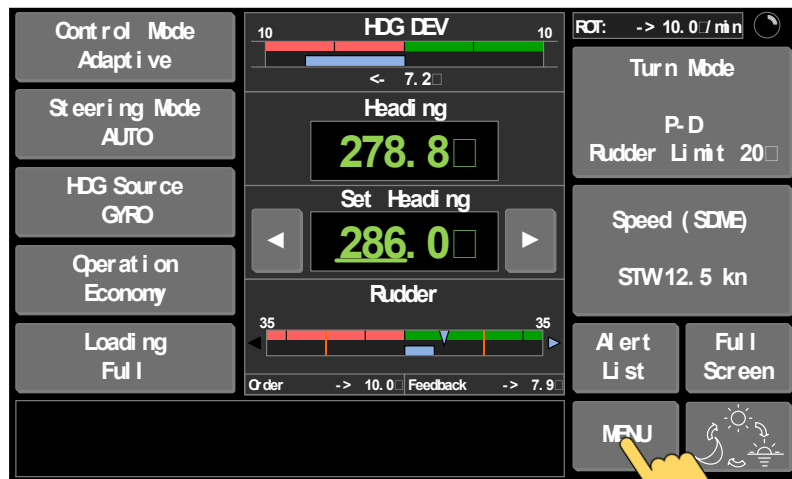


AUTO Steering abnormal



◆ Other relative settings

➤ [4-3 Control]



BOOT

HOME

HOME Full screen

MENU

1 Briiance/Contrast

2 Alert list — Alert list(log)

2-1 Equipment status log

3 Monitor

3-1 Heading & rudder angle graph

3-2 Cross track distance

3-3 AP Performance

3-4 Sensor & Measurement

3-4-1 Sensor data

3-4-2 Calculate data

3-4-3 Rudder angle data

3-5 Software version

4 Setting

4-1 Alert

4-2 Display customize

4-3 Control

4-4 Parameter

4-5 Forwarding distance

4-6 Adjust touch screen

4-7 Date and time

4-8 Backup/Restore

4-9 Maintenance

AUTO Steering abnormal



◆ Other relative settings

➤ [4-3 Control]

Item	Parameter
1 Command rudder angle of the alarm occurs	Midship
2 Counter rudder angle limit	Disable
3 Rough seas steering mode	Disable
4 Helma adjustment in Steering mode switch	0°
5 Number of rudders	Single
6 Course deviation limit function	Enable

Heading: 280.7
Set Heading: 278.4
Control Mode: Adaptive
Steering Mode: AUTO
HDG Source: GYRO
Operation: Economy
Loading: Full
Turn Mode: P-D RUDDER LIMIT 10
Speed (SDME): STW 12.5kn
HDG DEV: -> 2.3°
ROT: -< 10.0 / min
Rudder: Order -< 10.0
Feedback -< 8.0

Back Home

◆ Item 2: Counter rudder angle limit

- **ON:** Enables rudder limit during the turn
Symptom:
- **OFF:** Ignores rudder limit during the turn
Symptom: Take more rudder/Prevent overshoot

ROT: -> 10.0 / min

Turn Mode

P-D
Rudder Limit 20

◆ Item 3: Rough seas steering mode

- **On:** Reduce derivative gain by 1/3
Symptom: Yawing/Take less rudder
- **Off:** No effect

** Always become “Off” when PT900 startup



● Parameter Adjustment

4-4 Parameter

4-4 Parameter

Item	Parameter
1 Vs	15kn ▲
2 Lpp	150m
3 Breadth	30m
4 Ki	30m
5 TV	60s
6 KV	0.08 1/s ▼

Heading 280.7
 Set Heading 278.4
 Control Mode : Adaptive
 Steering Mode : AUTO
 HDG Source : GYRO
 Operation : Economy
 Loading : Full
 Turn Mode : P-D RUDD LIM 10
 Speed (SOW) : STW 12.5kn
 HDG DEV : -> 2.3°
 ROT : <- 10.0 / min
 Rudder : Order <- 10.0
 : Feedback <- 8.0

Back Home

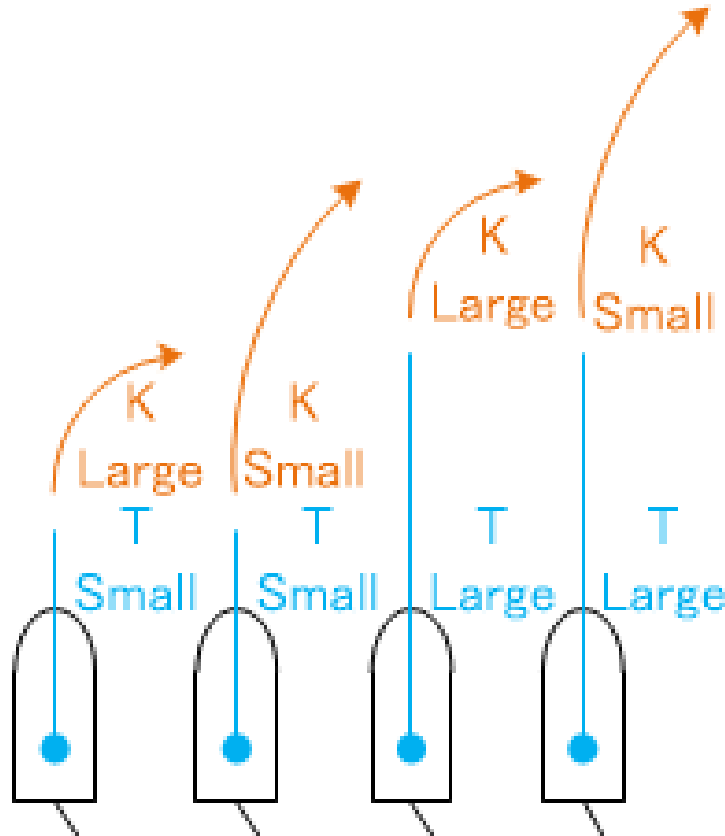
Setting items	Description
1 Vs	Cruising speed (1~65kn)
2 Lpp	Hull length (10~400m)
3 Breadth	Moulded breadth (1~99m)
4 Ki	Initial setting value of static gain
5 TV	Setting value of time constant
6 KV	Setting value of static gain
7 MQ	Kalman filter noise covariance matrix multiplier
8 Gd	Derivative gain multiplier
9 Gp	Proportional gain multiplier
10 Gi	Integral gain multiplier
11 INIT	Stable/unstable results computed from ship particulars
12 IDENT	Parameter updated state (updated/not updated)
13 RESULT	Stable/unstable updated result

ITEM-5: HCS ADJUSTMENT at Sea Trial



● What is TV and KV on [4-4 Parameter] screen?

- T and K indicate the “Maneuverability” of the vessel.



T Small: Vessel can start to turn earlier

T Large: Vessel starts to turn later

K Small: Angular velocity is not good

K Large: Angular velocity is good

- You may calculate T and K as “When the vessel is given the rudder angle “ θ ”, it can start Steady turning motion starts of Angular velocity of ‘K’ after “T” seconds”.
- Otherwise, **no need to adjust**.

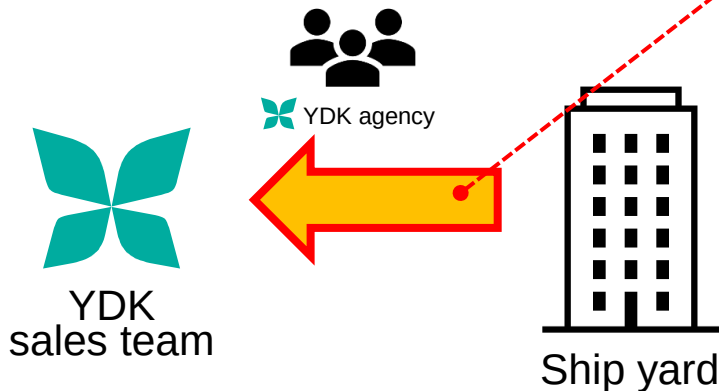
ITEM-5: HCS ADJUSTMENT at Sea Trial



- Ship's parameter

TV and KT are calculated by YDK according to ship's specification.

**If not correct information,
it might cause auto steering failure.*



Dear Sirs,

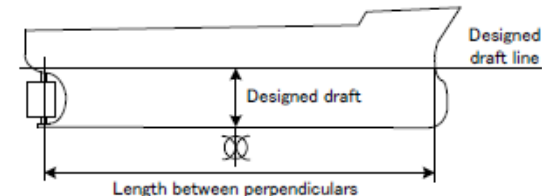
Thank you very much for your adoption of our **Autopilot System** for your new-building vessel.

In order to complete your Autopilot System, we need the following data before the delivery from our factory.

So, please send the information of the bellow items with your approval drawing to us.

Your cooperation shall be much appreciated.

1	Kind of ship	
2	Length between perpendiculars (Lpp)	
3	Moulded breadth (B-mld)	
4	Designed full load draft (D-Full load) (⚠ NOT Molded depth)	
5	Designed full load displacement (Full load displacement) (⚠ NOT Dead weight tonnage (D.W.T.))	
6	Block coefficient (Cb)	
7	Rudder area (Ar) (⚠ In case of Twin rudder, please write both of area.)	
8	Navigation speed (Vs), Service speed (kts)	



If you have any questions concerning this matter, please feel free to contact us.



ITEM-6: ~Sea trial~ TCS adjustment



- Check & Adjust points
 1. Interface Check: Hardware/Software
 2. On-board adjustment
 1. XTE compensation: “Kd”
 2. “Forwarding Distance”
 3. Drift compensation: “Sway time”



- Check & Adjust points

1. Interface Check: Hardware/Software

2. On-board adjustment

1. XTE compensation: “Kd”
2. “Forwarding Distance”
3. Drift compensation: “Sway time”

2. Interface Check: Software



● [3-4-1 Sensor Data]

3-4-1 Sensor data

GYRO1: Nbr næl	HDG 280.7	ROT 0.5 / min
GYRO2: Checksum er r	HDG ***.*	ROT ***.* / min
THD : Ti nne out	HDG ***.*	ROT ***.* / min
LOG : Nbr næl	STW 11.5kn	SOG 9.6kn
GPS : Nbr næl	LAT 39°33.176' N	LCN 117°12.187' E
Nbr næl	COG 283.4	SOG 10.3Kn
Nbr næl	Date 2015-02-13	Ti nne 18:21:13
ECDIS: Nbr næl	St eer i ng mode	Headi ng(N)
	HTS 284.3	C. Track 281.2
	XTE P1.23NM	
BAMS : Nbr næl		
S-JOY: Nbt connect	Mode *****	Order ***.*
	Set HDG ***.*	Set RAD **. ** NM

Headi ng

280.7

Set Headi ng

278.4

Cont rol Mode : Adapt i ve

St eer i ng Mode : AUTO

HDG Source : GYRO

Oper at i on : Economy

Loadi ng : Full

Turn Mode : P-D RUDD LI M 10

Speed(SDME) : STW12.5kn

HDG DEV : -> 2.3°

ROT : <- 10.0 / min

Rudder : Order <- 10.0

Feedback <- 8.0

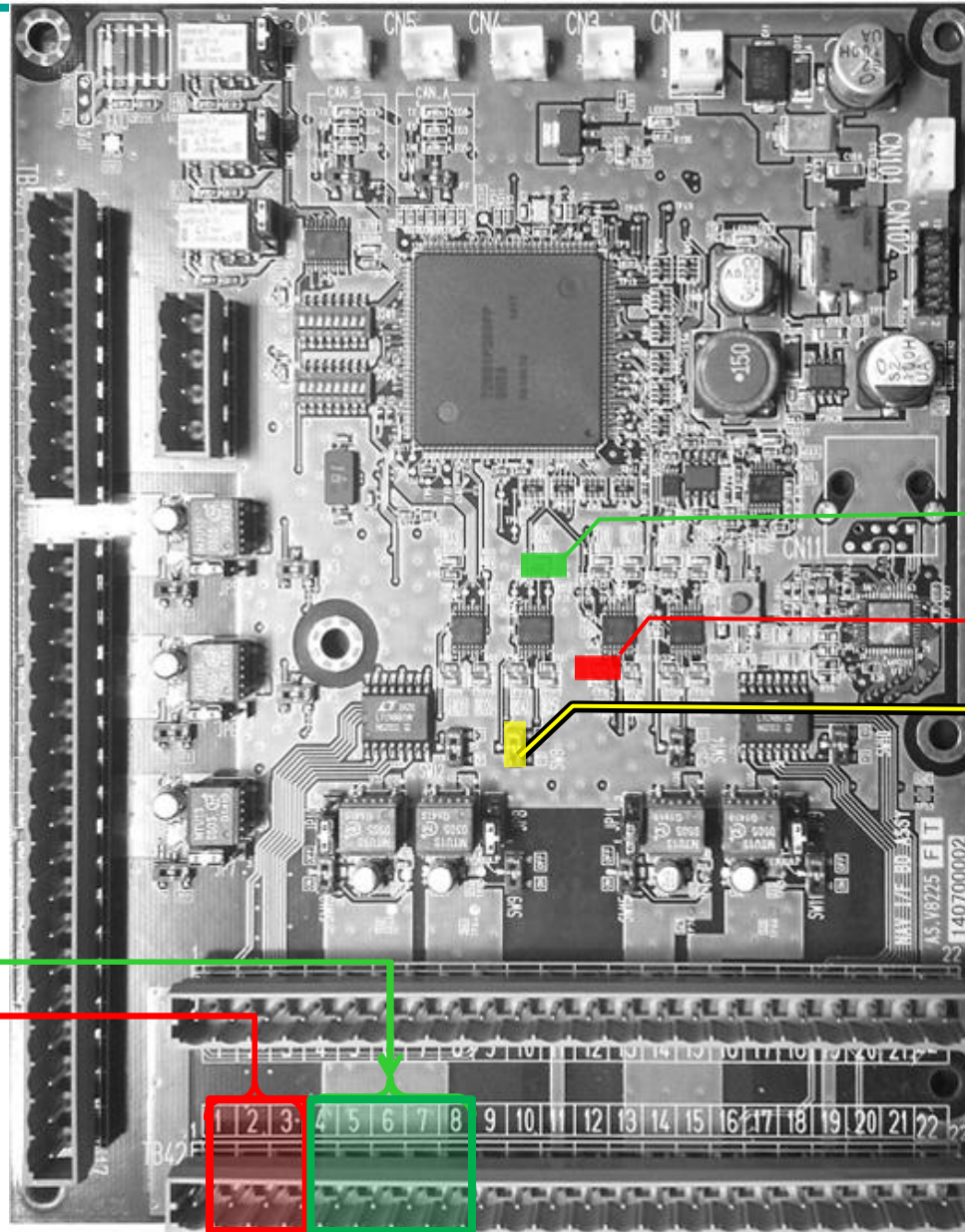
Back

Home

1. Interface Check: Hardware



NAV I/F BD
(V8225FT)



LED15(input)

LED14(output)

SW8

SW8(input bps)

-1 : 4800bps

-2 : 38400bps



ECDIS

2. Interface Check: Software



4-9-1-6 ECDIS interface

Item	Parameter	Heading
1 Connection	Connect	280.7
2 Transfer rate	38400bps	Set Heading 278.4
3 Input data format	Standard	Control Mode : Adaptive
4 Input interval	Off	Steering Mode : AUTO
5 Output interval	1.0s	Hdg Source : Gyro
6 XTE input data format	XTE with Mode	Operation : Economy

Back Home

3. external Interface / 外部インタフェースの設定
Screen 4-9-1 Maintenance mode

Setting item	Ch1 compass Screen 4-9-1-1		Ch2 compass Screen 4-9-1-2		Speed log Screen 4-9-1-4	
	First set	Final set	First set	Final set	First set	Final set
Connection 接続有無	Connect		Connect		Serial	
Transfer rate 伝送速度 (bps)						
Input data format 入力フォーマット						
Input interval (s) 入力間隔 (s)						
Display name 表示名称						
Pulse rate (P/NM) 船速パルスレート (ノット)						
Input HCR sentence HCRセンテンス入力						

- JRC ECDIS: JRC
- Furuno ECDIS: Furuno
- Totem Plus or
Transas ECDIS: Standard

Setting item	THD Screen 4-9-1-3		GPS Screen 4-9-1-5	
	First set	Final set	First set	Final set
Connection 接続有無	Not connect		Not connect	
Transfer rate 伝送速度 (bps)	IEC61162-2 38400bps		IEC61162-1 4800bps	
Input HDT sentence HDTセンテンス入力	Disable		Disable	
Input THS sentence THSセンテンス入力	Disable		Disable	
Input ROT sentence ROTセンテンス入力	Disable		Disable	
Input VTG sentence VTGセンテンス入力	Disable		Disable	
Input GCA sentence GCAセンテンス入力	Disable		Disable	
Input ZDA sentence ZDAセンテンス入力	Disable		Disable	
Input HCR sentence HCRセンテンス入力	Disable			
Input interval 入力間隔 (s)	Off		Off	

Setting item	ECDIS Screen 4-9-1-6	
	First set	Final set
Connection 接続有無	Connect	
Transfer rate 伝送速度 (bps)	IEC61162-2 38400bps	
Set course input data format 設定コース入力フォーマット	JRC	
Input interval 入力間隔 (s)	Off	
Output interval 出力間隔 (s)	1.0	
XTE input data format XTE入力フォーマット	XTE with Mode	

Setting item	BAMS Screen 4-9-1-7	
	First set	Final set
Connection 接続有無	Not connect	
Transfer rate 伝送速度 (bps)	IEC61162-1 4800bps	
ARC output ARCの送信の有無	Disable	
BMS heartbeat monitoring BMSハートビート監視	Disable	

Setting item	VDR Screen 4-9-1-8	
	First set	Final set
Connection 接続有無	Connect	
Transfer rate 伝送速度 (bps)	IEC61162-1 4800bps	
RMS output RMS出力	Disable	
Output interval for VDR 出力間隔 (VDR用) (s)	1.0	

Setting item	S-JOY Screen 4-9-1-9	
	First set	Final set
Connection 接続有無	Connect	
Output interval 出力間隔 (s)	0.5	

◆ Set the adequate value in accordance with the “AUTOPILOT PT900 SYSTEM SETTING PARAMETER LIST”.

◆ \$--XTE,A,A,x.x,a,N,a*hh

Mode indicator Note1

Units, nautical miles

Direction to steer, L/R

Magnitude of XTE

Status: A=data valid
V=Loran warning

Status: A=data valid
V=general warning

Note1) “Mode indicator” is included after IEC61162-1 Ed.2(issued 2000).



- Check & Adjust points

1. Interface Check: Hardware/Software

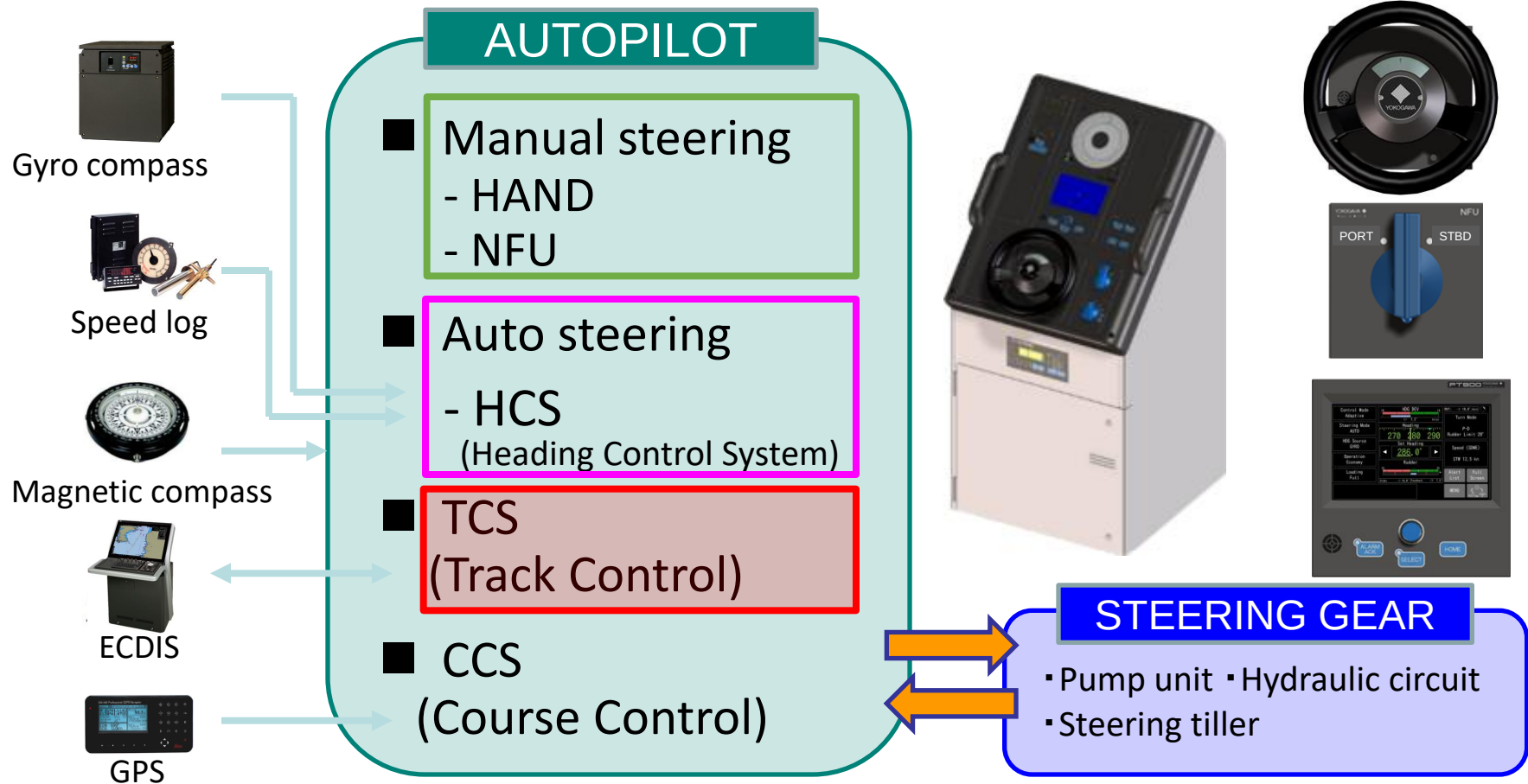
2. On-board adjustment

1. XTE compensation: “Kd”
2. “Forwarding Distance”
3. Drift compensation: “Sway time”

ITEM-6: TCS ADJUSTMENT at Sea Trial



● What is TCS (Track Control System)??



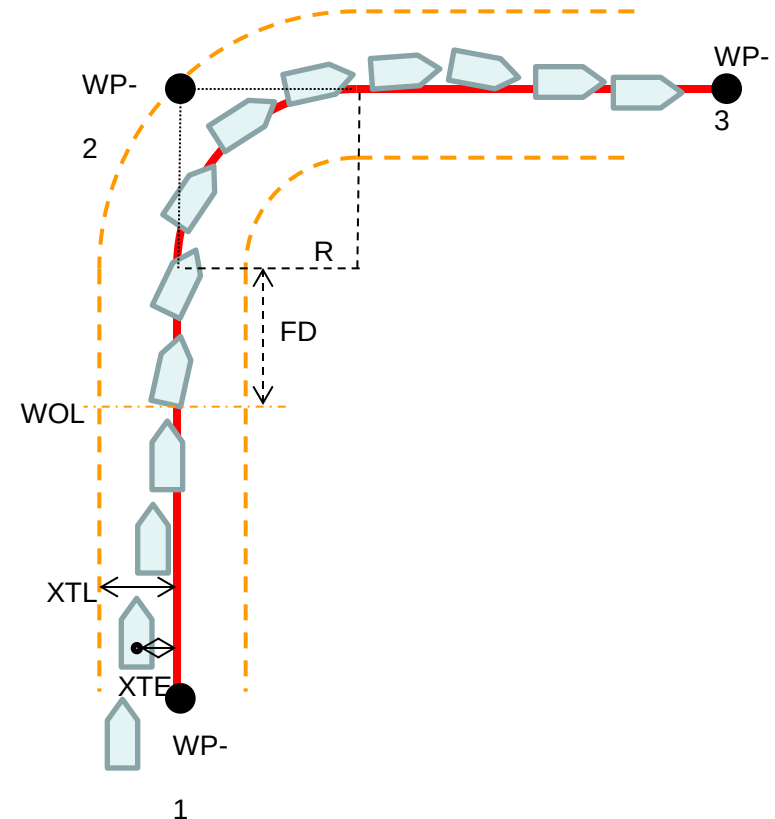


● What is TCS (Track Control System) ?

Track control is to keep planned course on ECDIS

On-board adjustment

1. XTE compensation: “Kd”
2. “Forwarding Distance”
3. Drift compensation: “Sway time”



3. On-board adjustment



● Initial Parameter Check

Maintenance mode			
Settings item		First set	Final set
Track control Screen 4-9-2-4	1 Tracking differential gain multiplier トラッキング中の微分ゲイン乗数	1.00	
	2 Tracking integration gain multiplier トラッキング中の積分ゲイン乗数	1.00	
	3 HTD data at the time of the gyro error ジャイロ異常発生時のHTD送信データ	Null	
	4 Kp XTE 比例ゲイン	100	
	5 Ki XTE 積分ゲイン	0.01	
	6 Kd x 10 XTE 微分ゲイン	550	
	7 Moving average XTE 移動平均のサンプル数	15	
	8 Dead band XTE量の不感帯	Off	
	9 Integral limit XTE 補正量のゲイン (NM)	40	
	10 Angle limit XTE補正量のリミット (deg)	10.0	
	11 Integral delay XTE積分補正無視時間 (s)	60	
	12 TO steps XTEトラッキングゲインステップ変化時のステップ数	20	
	13 TG1 XTEトラッキングゲイン選択が1のときの乗数	0.1	
	14 TG2 XTEトラッキングゲイン選択が2のときの乗数	0.70	
	15 TG3 XTEトラッキングゲイン選択が3のときの乗数	0.85	
	16 TG4 XTEトラッキングゲイン選択が4のときの乗数	1.00	
	17 XTE compensation XTE補正の有効/無効設定	Enable	
	18 Drift compensation ドリフト補正の有効/無効設定	Enable	
Rudder control Screen 4-9-2-5	1 S/U interface PODとのI/F	Normal	
	2 Rudder angle mode 舵角モード	Normal-4	
	3 Rudder angle switching low range 舵角切替の低速域判別用舵速値 (kn)	11	
	4 Rudder angle switching high range 舵角切替の高速域判別用舵速値 (kn)	12	
	5 HDG and rudder graph 船首方位舵角グラフ 舵角範囲 (deg)	80	
	6 Permanent helm (STBD/S) パーマナントヘルム (STBD/S) (deg)	0.0	
	7 Permanent helm (PORT) パーマナントヘルム (PORT) (deg)	0.0	
Rudder keeping function Screen 4-9-2-6	1 Rudder keeping function 舵保持機能	Enable	
	2 Alarm without Control loop error ループ異常以外の異常時の舵保持	Exclusion	
	3 Servo loop error サーボループ異常時の舵保持	Inclusion (AUTO steering)	
	4 Feedback error フィードバック異常時の舵保持	Inclusion	
	5 Rudder erroneous ラダーエラー発生時の舵保持	Exclusion	

4-9-2-4 Track control		
Item	Parameter	
1 Tracking differential Gain multiplier	1.00	▲
2 Tracking integration Gain multiplier	1.00	
3 HTD data at the time of the gyro error	Null	
4 Kp	100	
5 Ki	0.01	
6 Kd x 10	550	▼

Heading **280.7**
 Set Heading **278.4**
 Control Mode : Adaptive
 Steering Mode : AUTO
 HDG Source : GYRO
 Operation : Economy
 Loading : Full
 Turn Mode : P-D RUDD LIM 10
 Speed (SDME) : STW 12.5kn
 HDG DEV : -> 2.3°
 ROT : <- 10.0 / min
 Rudder : Order <- 10.0
 : Feedback <- 8.0

Back
 Home



- Check & Adjust points

1. Interface Check: Hardware/Software

2. On-board adjustment

1. XTE compensation: “Kd”
2. “Forwarding Distance”
3. Drift compensation: “Sway time”

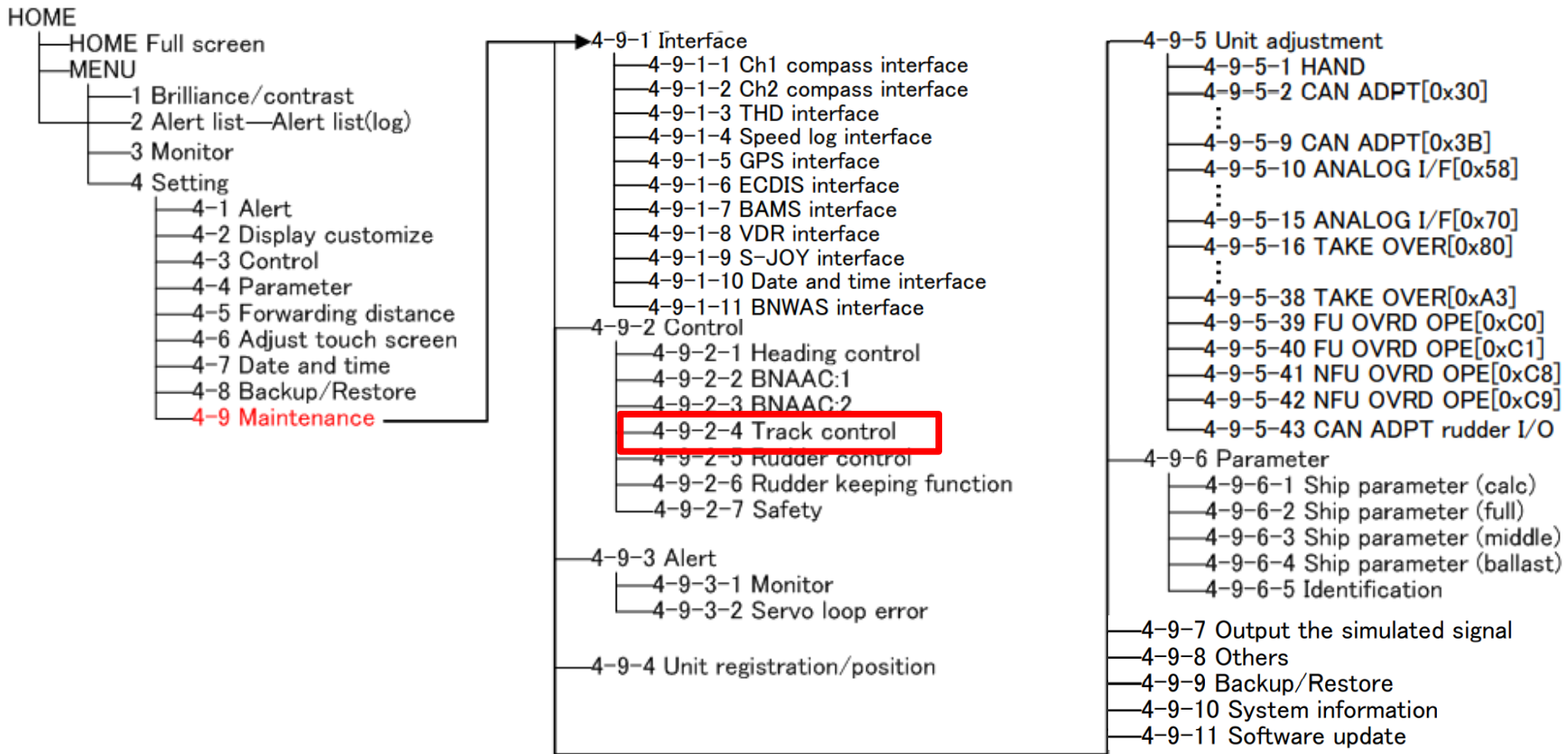
3.1. XTE compensation: “Kd”



● Screen [4-9-2-4] item 6: Kd

...One of a parameter for the “XTE Compensation”*.

➤ Adjust this parameter for the stability of the straight leg.

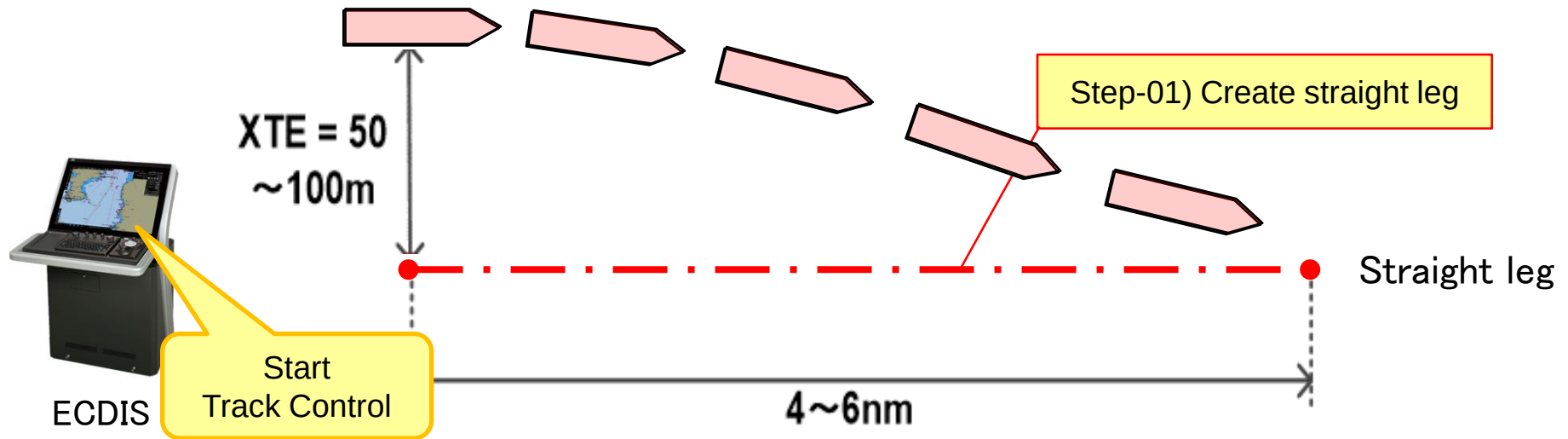


*Software ver. “Bxx” or higher

3.1. XTE compensation: “Kd”



- How to check??



Step-01) Create straight leg; 4~6 NM so that XTE is approx. 50 ~100m on ECDIS.

Step-02) Start Track Control on ECDIS

Step-03) Check if course control is no yawing, bounding.

Step-04) if yawing, bounding, adjust “Kd” on AP CDU ([4-9-2-4 Track Control] screen).

3.1. XTE compensation: “Kd”



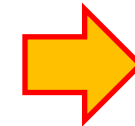
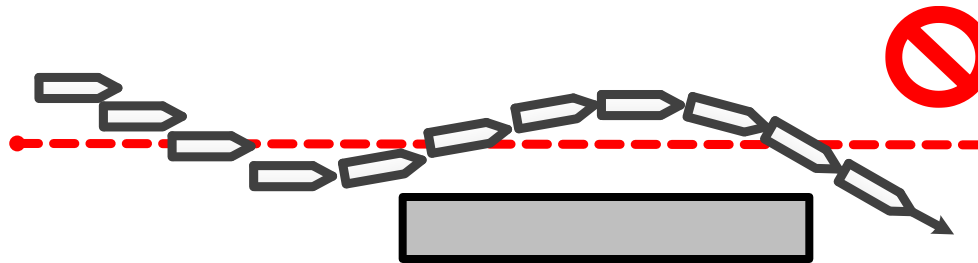
● How to adjust

Initial value: 550

(Should be adjusted around 400 to 750.)

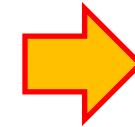
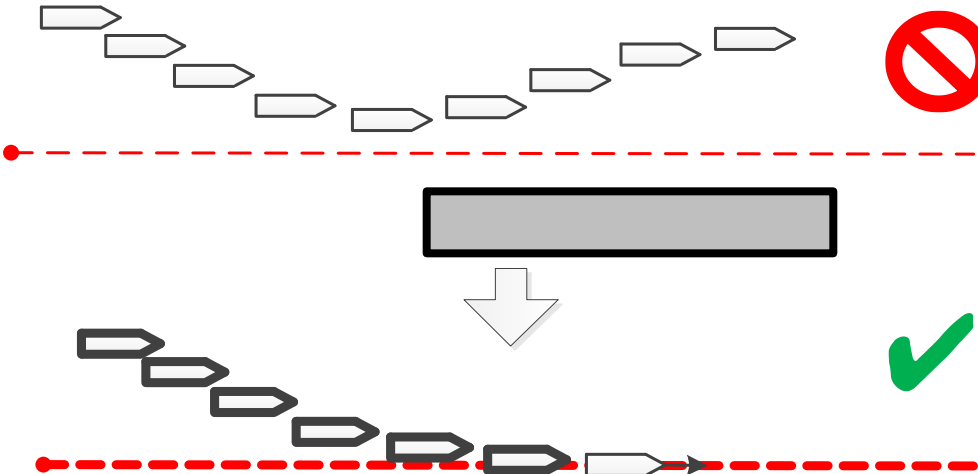
● — ●
ECDIS TCS course

#1



Kd → Smaller

#2



Kd → Larger

According to the accurate [Kd] value, the vessel is succeeded in approaching the straight leg.



- Check & Adjust points

1. Interface Check: Hardware/Software

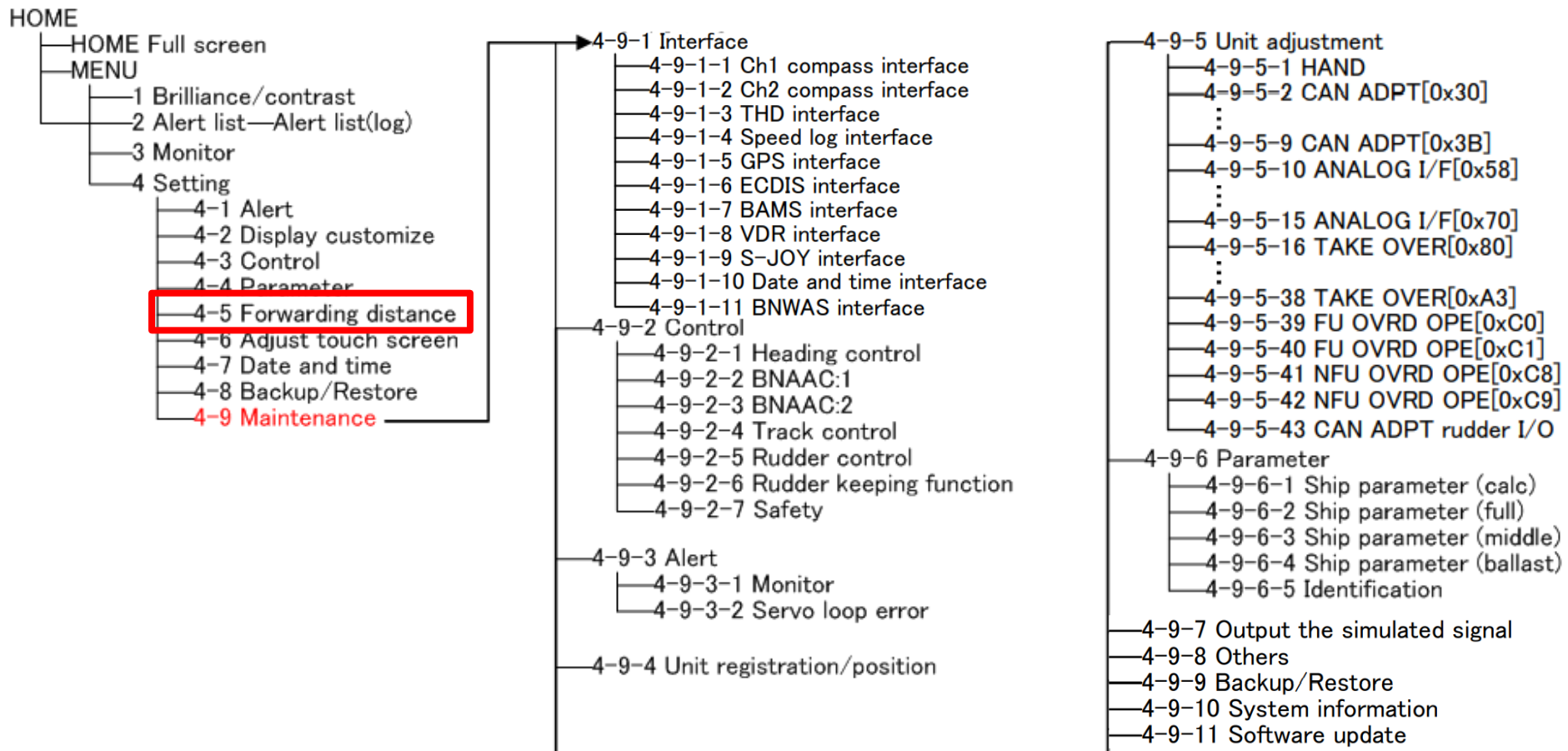
2. On-board adjustment

1. XTE compensation: “Kd”
2. “Forwarding Distance”
3. Drift compensation: “Sway time”

3.2. “Forwarding Distance”



● Screen [4-5] : Forwarding distance

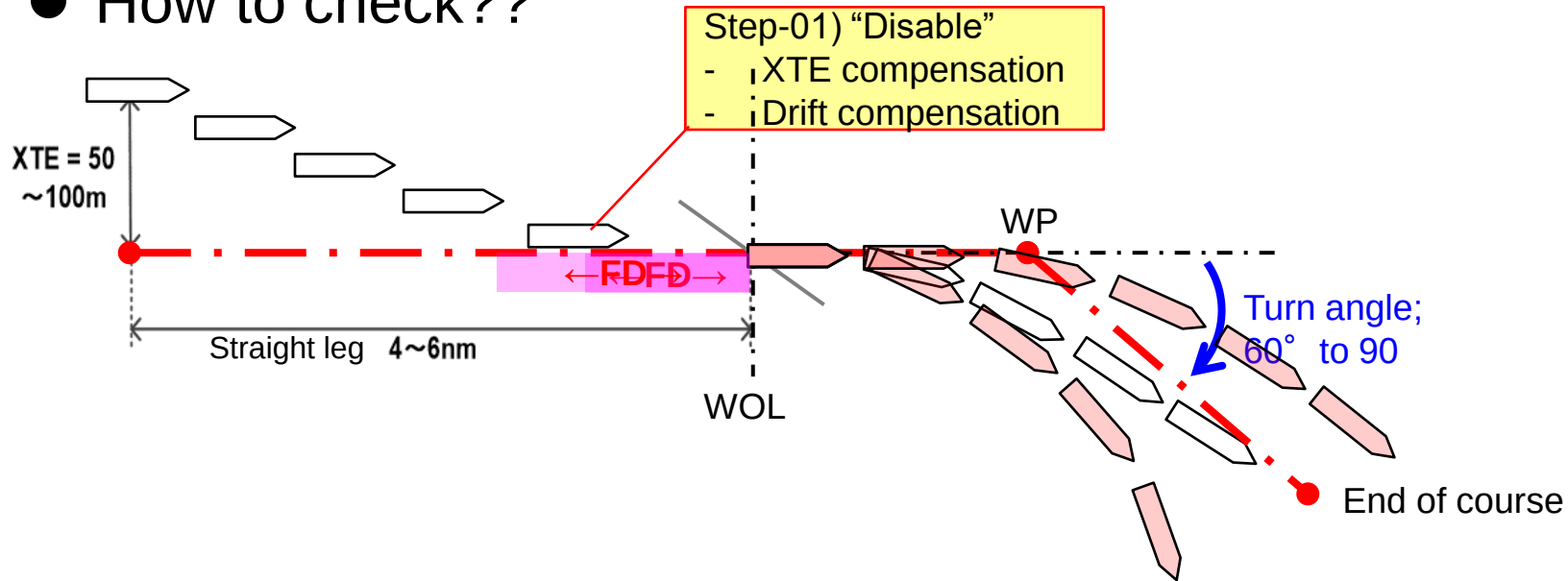


*Software ver. “Bxx” or higher

3.2. “Forwarding Distance”



● How to check??



Step-01) Create straight leg; 4~6 NM until *WOL point + approx. 60° to 90° turn) with XTE; approx. 50 ~100m on ECDIS.

Step-02) Observe course control performance

Step-03) Disable “XTE compensation” and “Drift compensation” on AP CDU ([4-9-2-4 Track Control] screen) when approaching straight leg.

Step-04) Observe until end of turning.

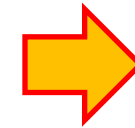
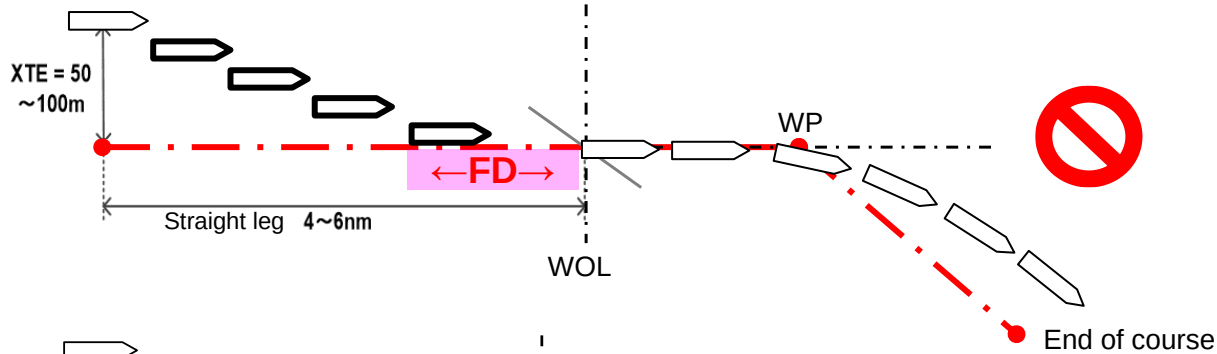
Step-05) If overshoot, undershoot against course is found, adjust “Forwarding Distance” on AP CDU ([4-5 Forwarding distance] screen)

3.2. “Forwarding Distance”



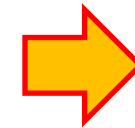
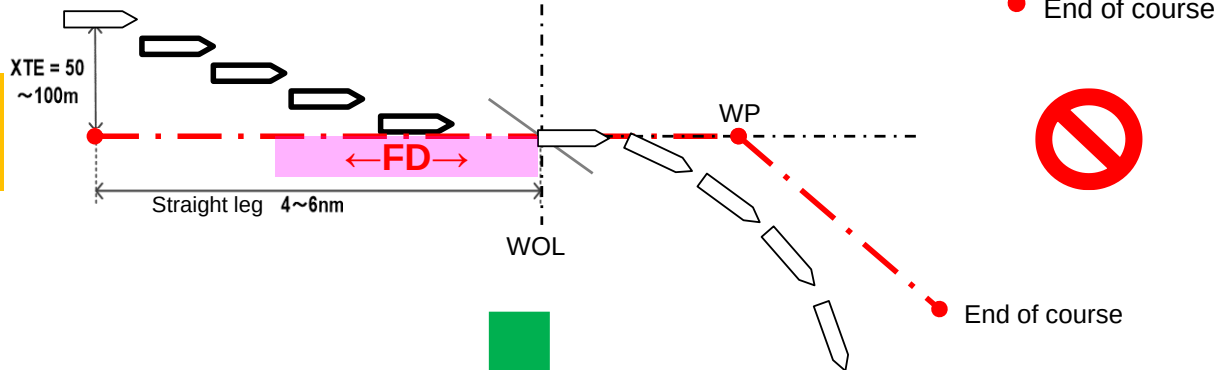
● How to adjust

#1

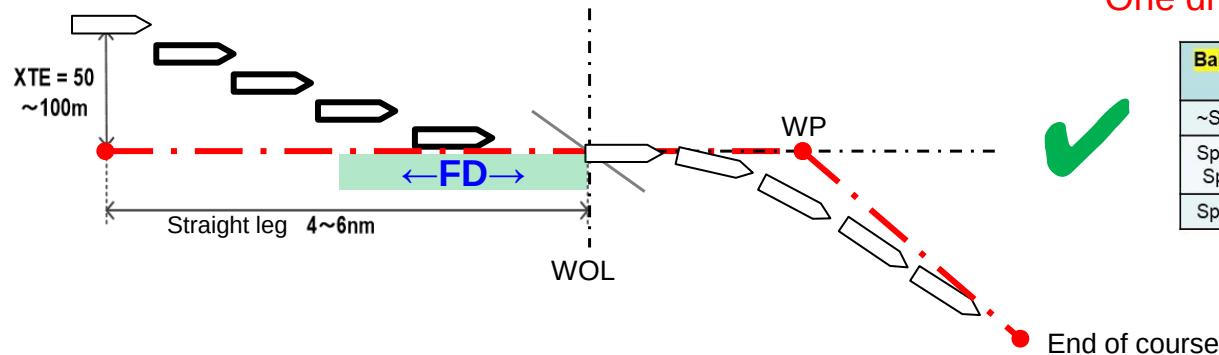


FD→Smaller

#2



FD→Larger



*One draft mode only during sea trial

Ballast	~Rad1	Rad1~ 2	Rad2~		
~Spd1	Middle	~Rad1	Rad1~ 2	Rad2~	
Spd1~ Spd2	Full	~Rad1	Rad1~ 2	Rad2~	
Spd2~	~Spd1	FD1	FD2	FD3	
Spd1~ Spd2	~Spd1	...	...	...	
Spd2~	Spd1~ Spd2	...	...	...	
	Spd2~	...	...	...	

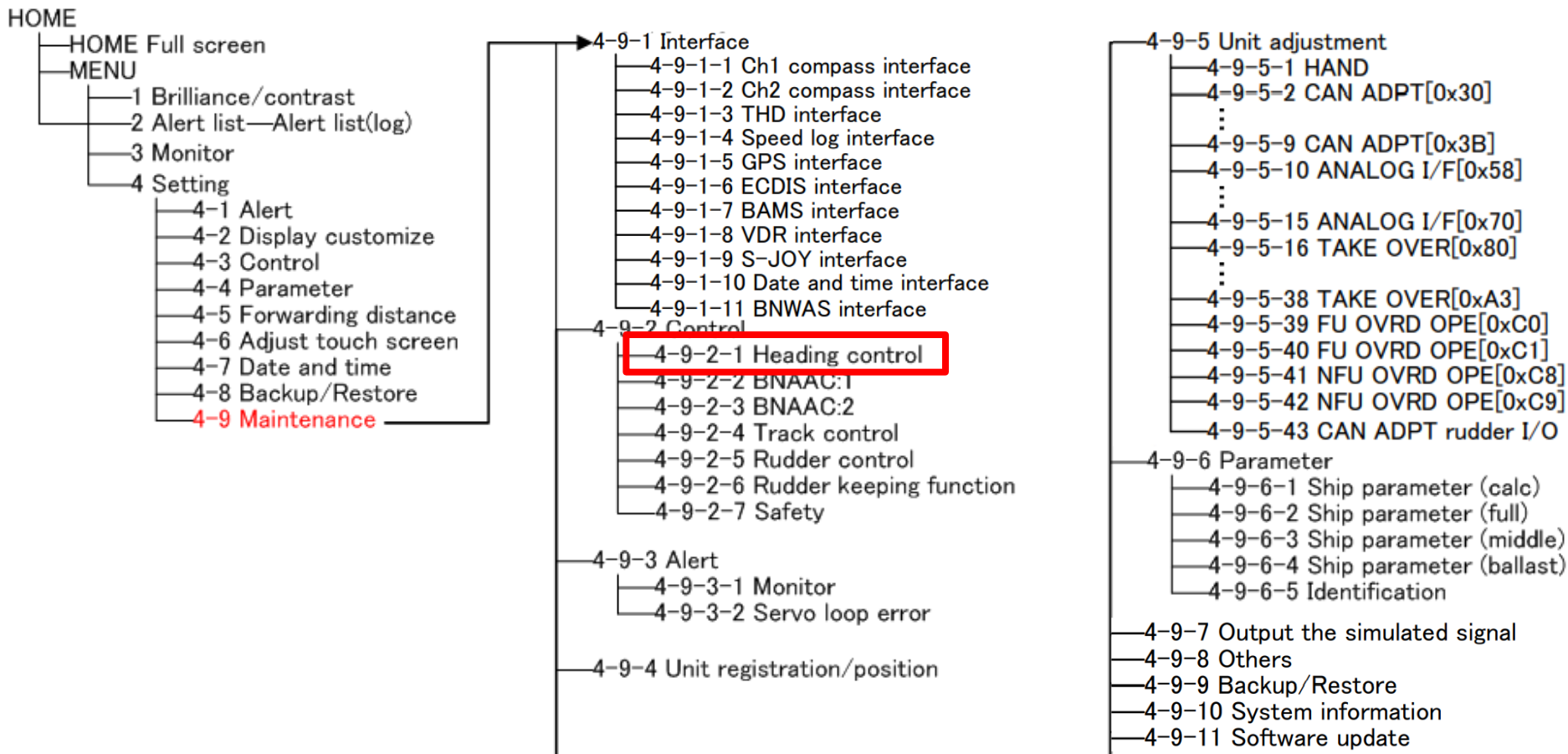


- Check & Adjust points
 - 1. Interface Check: Hardware/Software
 - 2. On-board adjustment
 - 1. XTE compensation: “Kd”
 - 2. “Forwarding Distance”
 - 3. Drift compensation: “Sway time”

3.3. Drift compensation: “Sway time”



● Parameter Adjustment



*Software ver. “Bxx” or higher

3.3. Drift compensation: “Sway time”

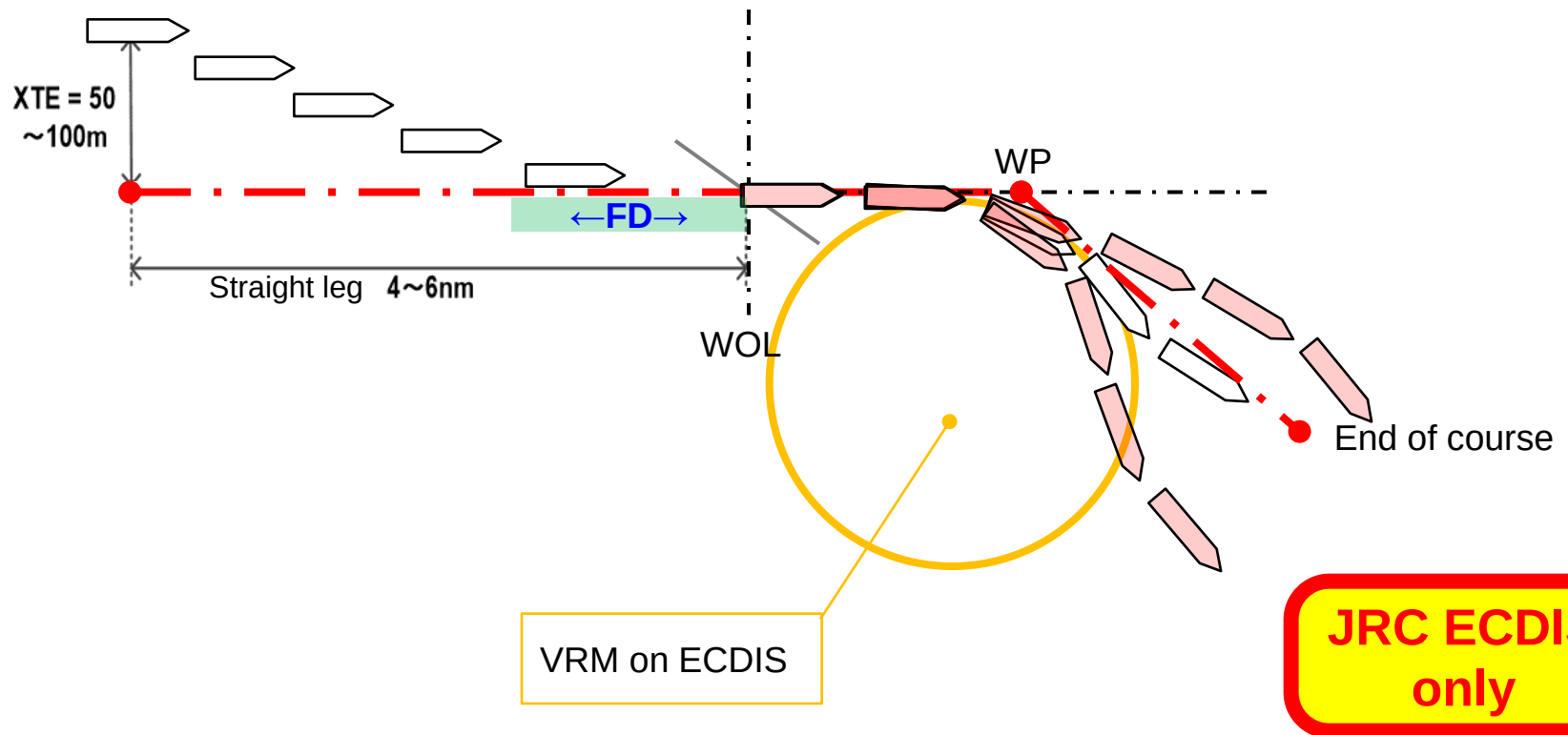


● When to adjust??

Initial value: “Disable”
(Setting range: 1 to 120)

... This is the parameter to offset the extra “DRIFT compensation” generated during the turning.

➤ Adjust this value when the vessel suddenly come inside or go outside toward the course during the turn.





STEP-7: Fill in “Installation certificate”



Microsoft Excel
僂厖儋僂厖僂

- ◆ Send to YDK attaching with commissioning report.



STEP-8: BACK-UP & COPY rigging data

STEP-8: Backup & Copy Rigging data



● [4-9-9 Backup/Restore]

- ◆ After the commissioning & sea trial is finished, please save newest settings as Rigging on this screen.

4-9-9 Backup/Restore

Backup No.		Last update(UTC)	
Rigging	Backup	***	Restore
Factory	Backup	2014-12-12 16:00:00	Restore

Heading 280.7°
Set Heading 278.4°

Control Mode : Adaptive
Steering Mode : AUTO
HDG Source : Gyro
Operation : Economy
Loading : Full
Turn Mode : P-D RUDD LIM 10°
Speed(SDME) : STW 12.5kn
HDG DEV : -> 2.3°
ROT : <- 10.0°/min
Rudder : Order <- 10.0°
: Feedback <- 8.0°

Back Home

Backup

4-9-9 Backup/Restore

Backup

Are you sure want to backup to "Rigging"?

No

Yes, Backup.

Heading 280.7°
Set Heading 278.4°

Control Mode : Adaptive
Steering Mode : AUTO
HDG Source : Gyro
Operation : Economy
Loading : Full
Turn Mode : P-D RUDD LIM 10°
Speed(SDME) : STW 12.5kn
HDG DEV : -> 2.3°
ROT : <- 10.0°/min
Rudder : Order <- 10.0°
: Feedback <- 8.0°

Back Home

Restore

4-9-9 Backup/Restore

Restore

Are you sure want to restore from "Rigging"?

No

Yes, Restore.

Heading 280.7°
Set Heading 278.4°

Control Mode : Adaptive
Steering Mode : AUTO
HDG Source : Gyro
Operation : Economy
Loading : Full
Turn Mode : P-D RUDD LIM 10°
Speed(SDME) : STW 12.5kn
HDG DEV : -> 2.3°
ROT : <- 10.0°/min
Rudder : Order <- 10.0°
: Feedback <- 8.0°

Back Home



END

Thank you for your kind attention!