

# ME-C control system II

Tacho and pneumatic systems

PrimeServ Academy Copenhagen

**MAN PrimeServ**



# Learning objectives

## Upon completion of this module you ...

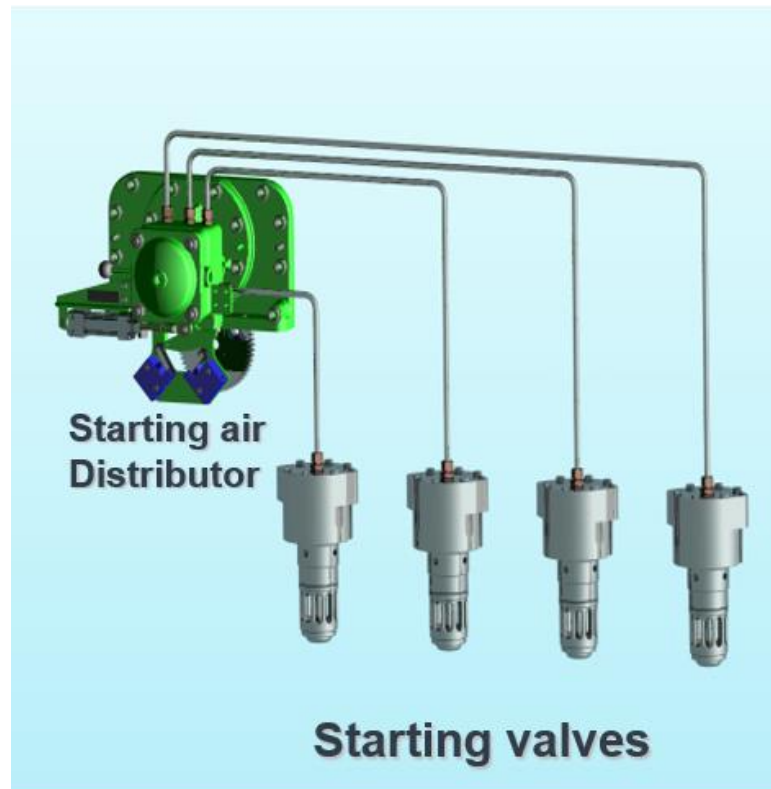
- will be able to recognize the various components in the system.
- will be able to explain the build up of the control system.



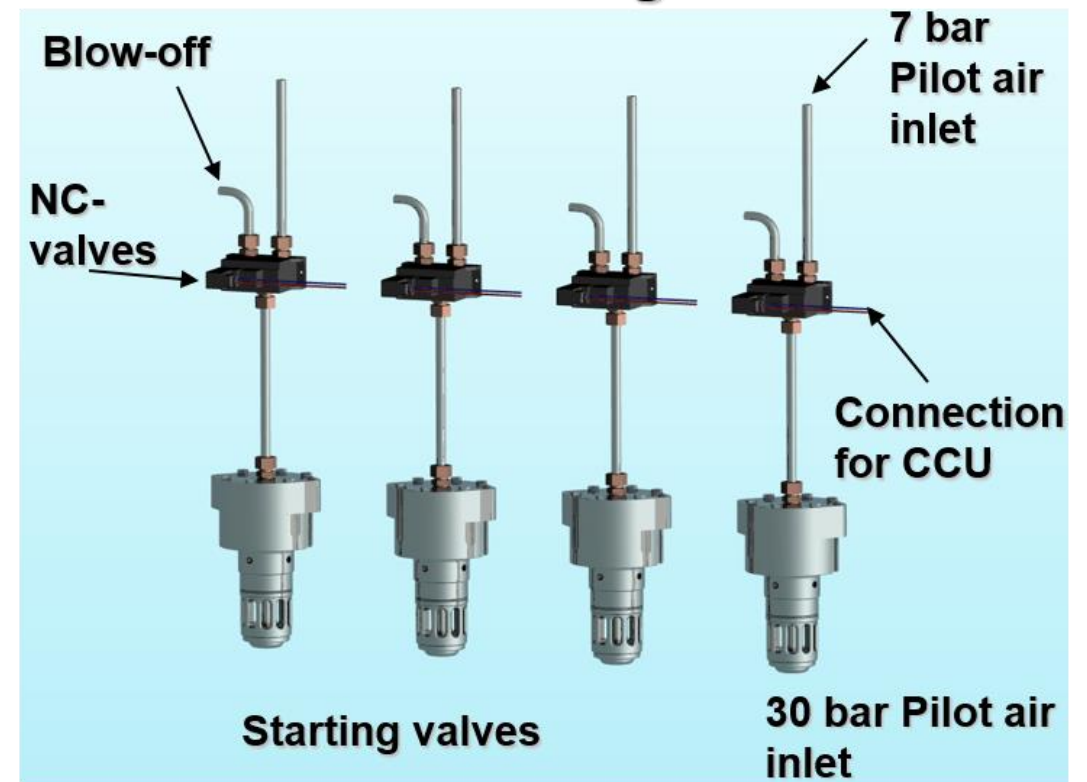
# ME engine control system

Starting and control air systems – MC to ME

## MC-C



## ME-C design





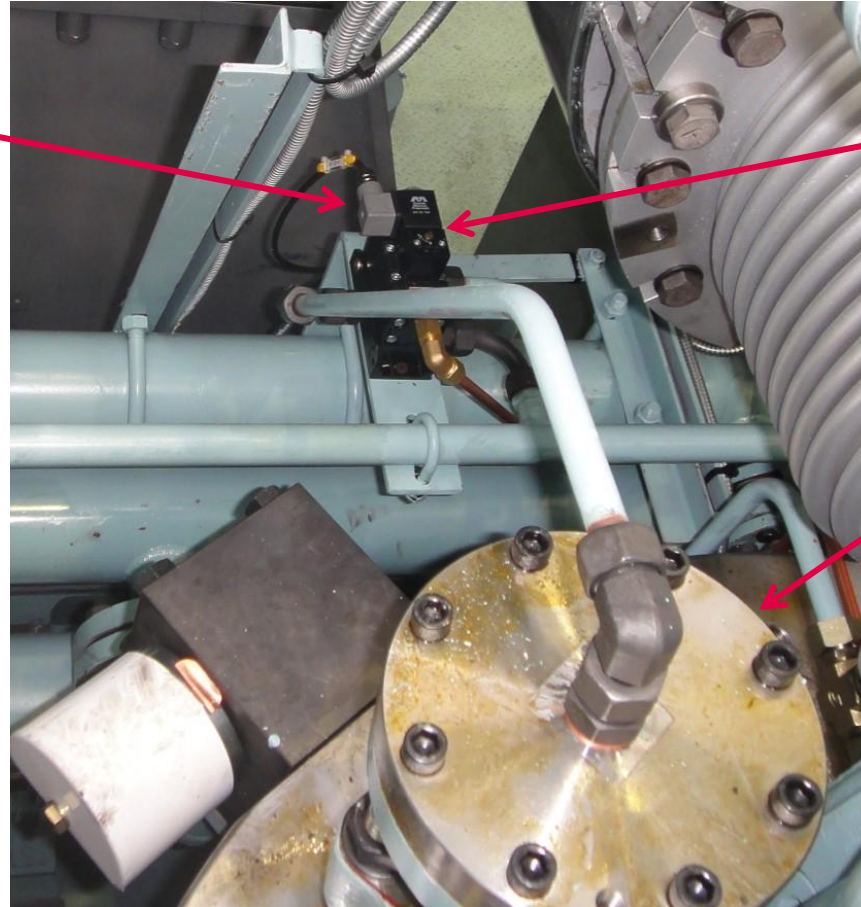
# ME engine control system

Starting and control air systems – Start- and pilot air valve

Connection to CCU

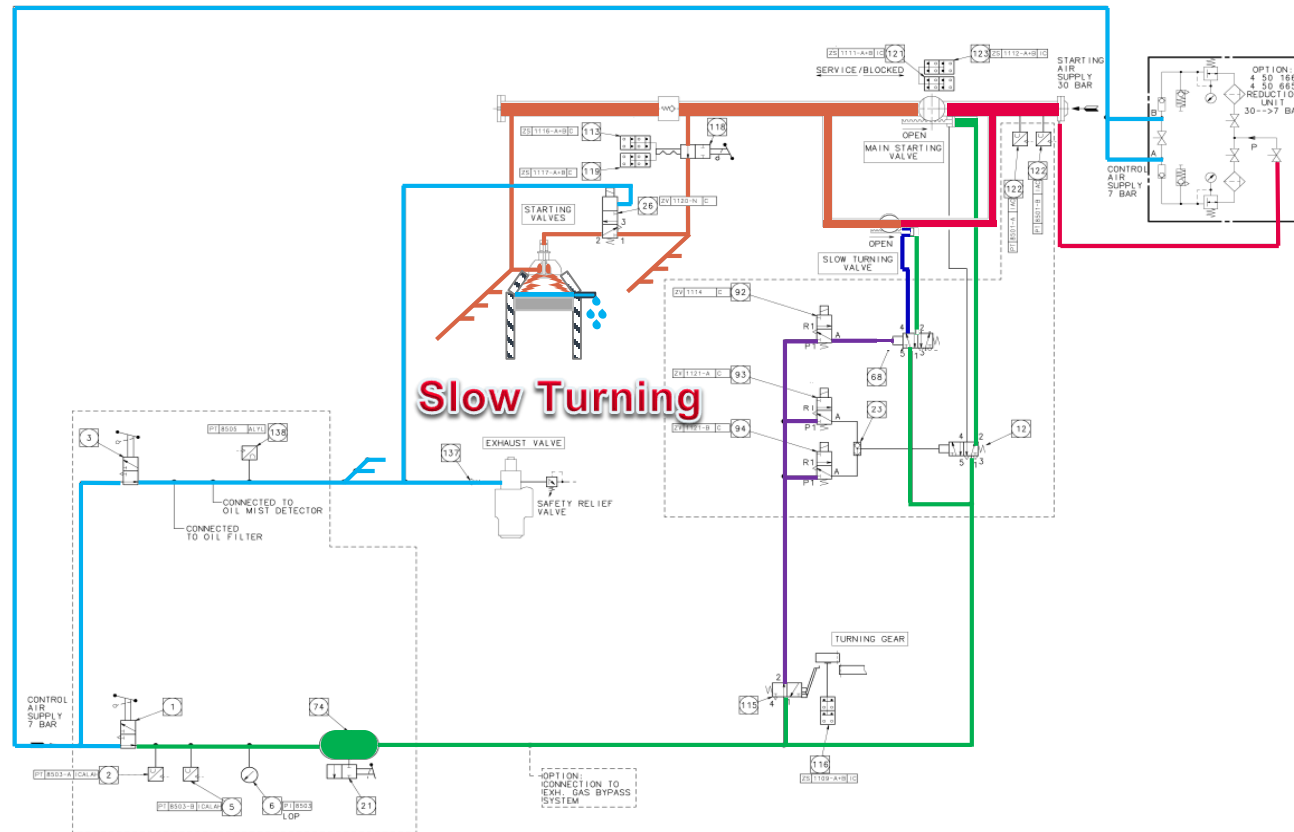
Pilot air valve

Starting air valve



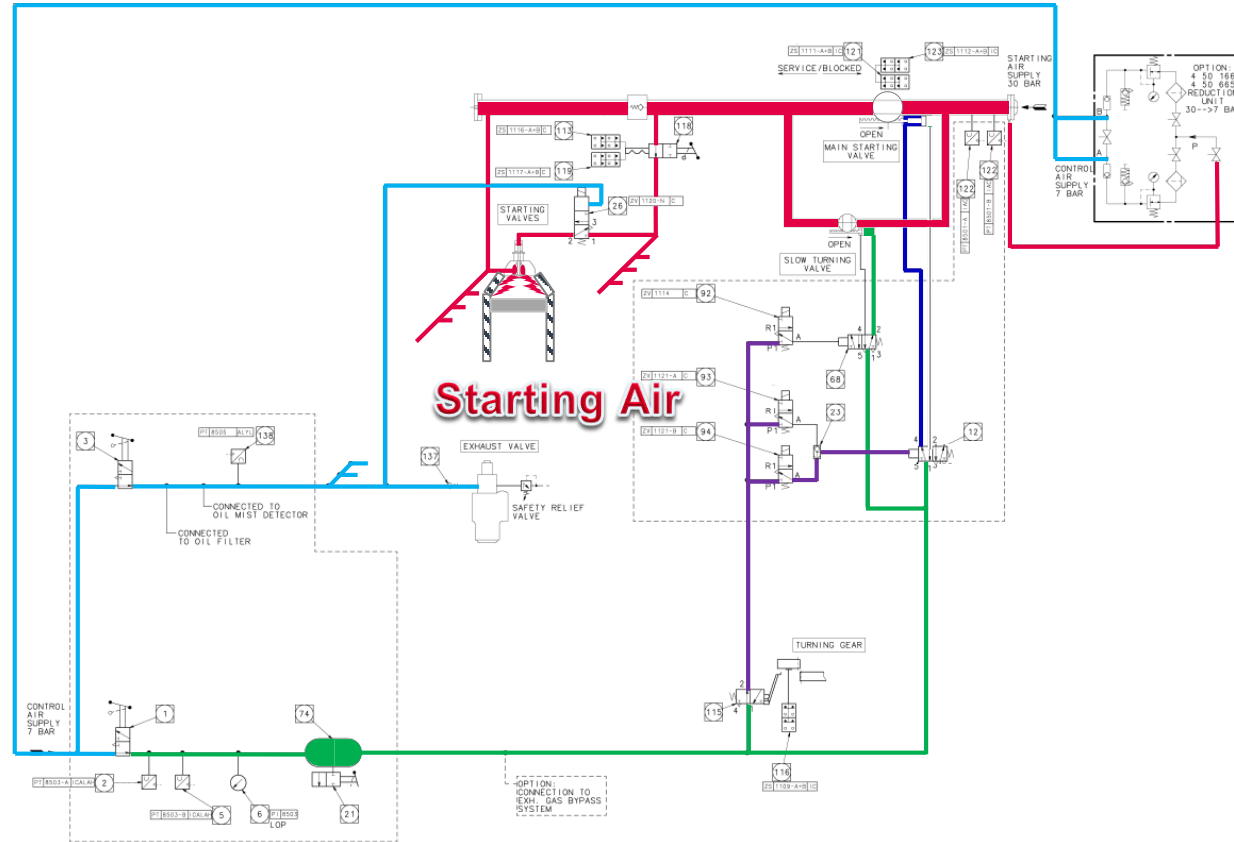
# ME engine control system

## Starting and control air systems – Slowturning



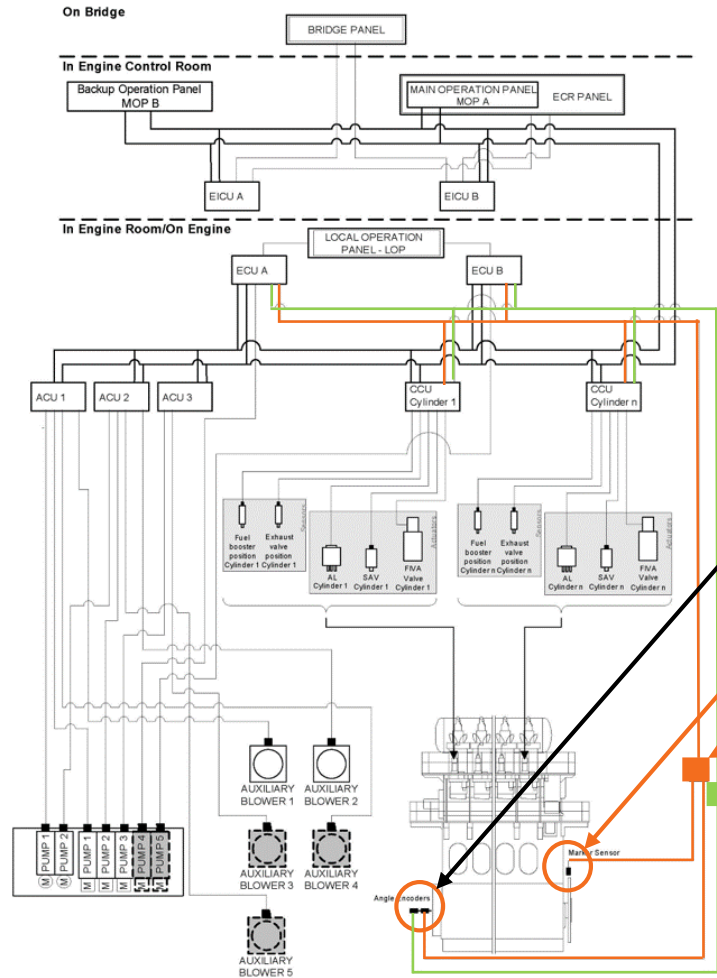
# ME engine control system

## Starting and control air systems – Start/Air run



# ME engine introduction

## Tacho system - Schematic



There are two redundant encoders in the tacho system:

- Encoder A
- Encoder B

Reference sensor at fly-wheel

ECU A

- Tacho signal for monitoring

- Power supply to TSA-A

ECU B

- Tacho signal for monitoring

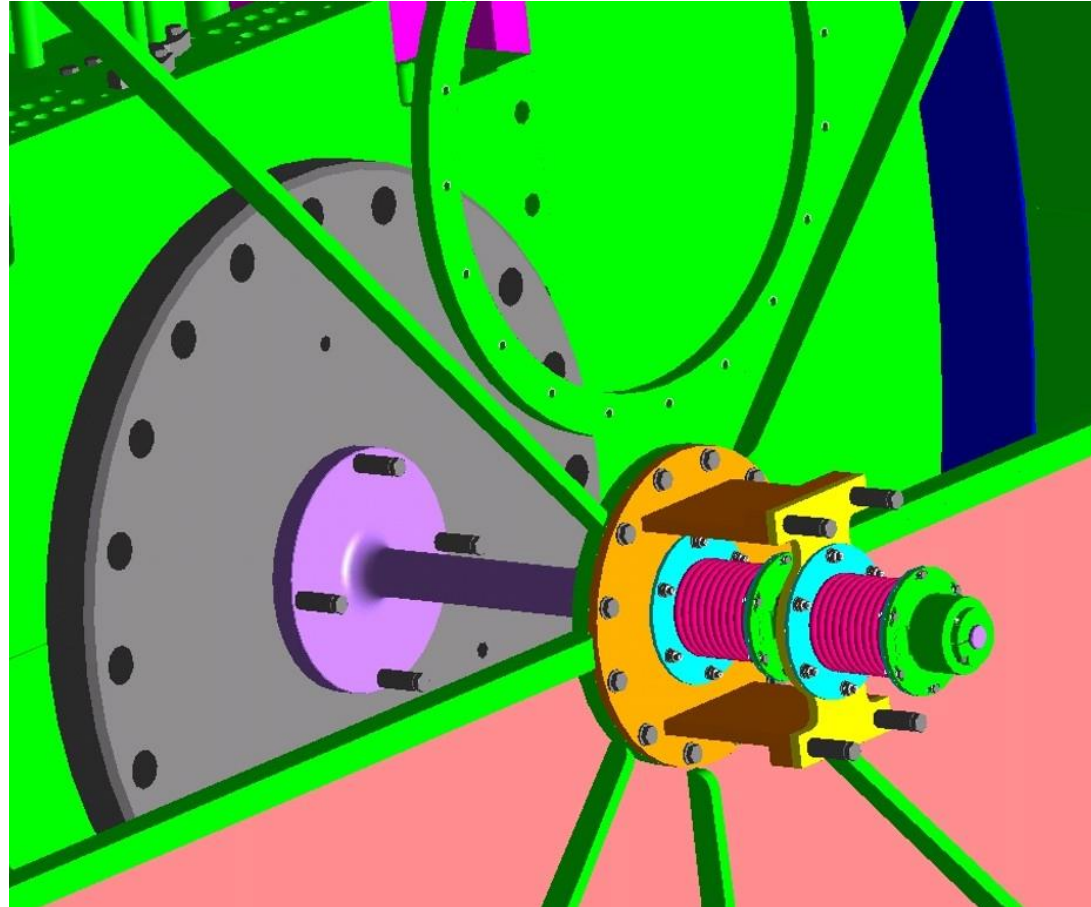
- Power supply to TSA-B

CCU's

- Tacho signal for operation

# ME engine control system

Tacho system





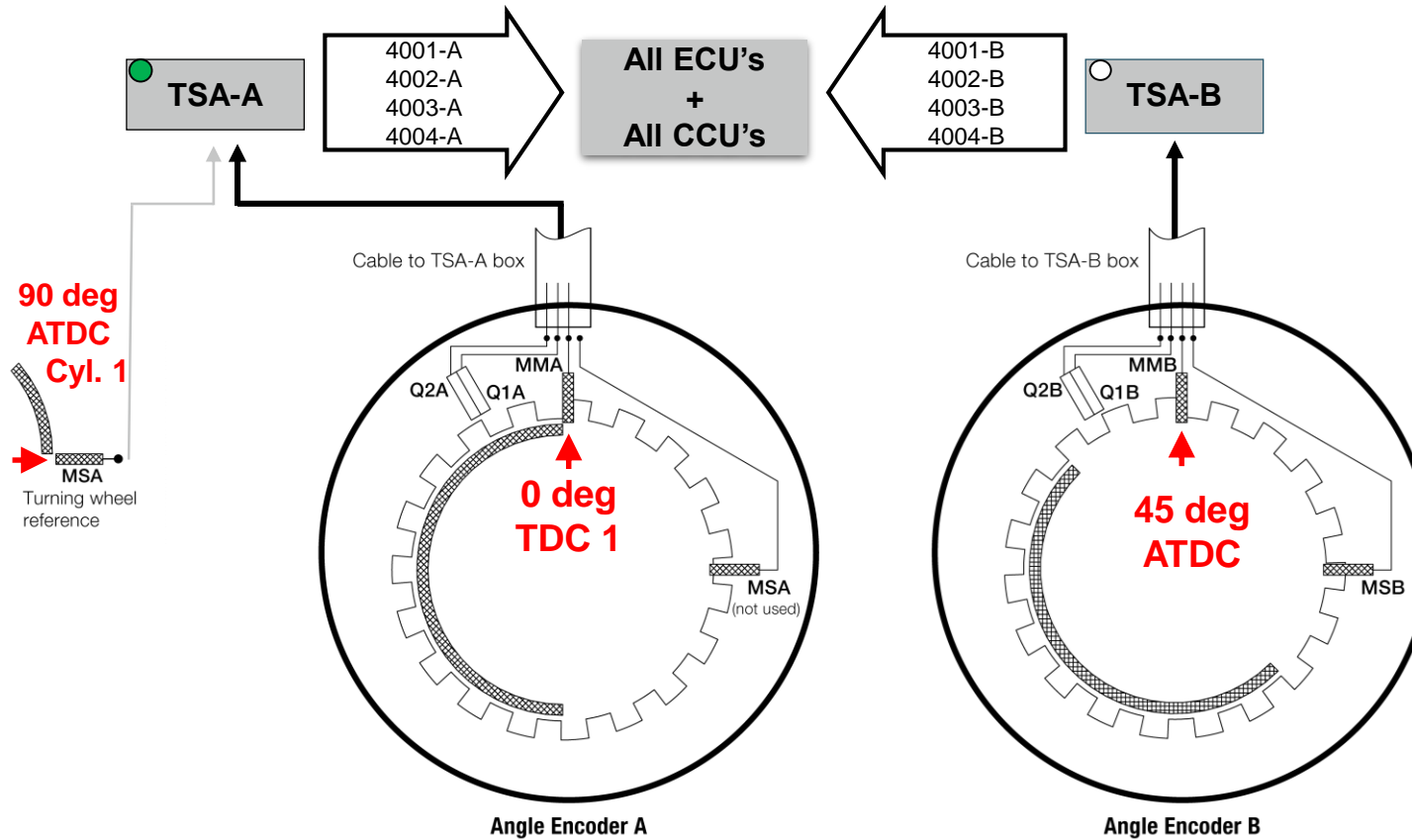
# ME engine control system

Tacho system



# ME engine control system

Tacho system – Angle encoders

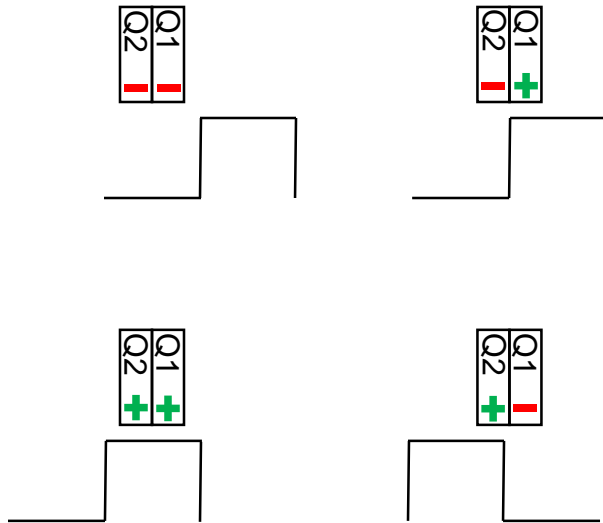


MMA = Marker Master A  
 MSA = Marker Slave A  
 Q1A = Quadrature 1A  
 Q2A = Quadrature 2A

MMB = Marker Master B  
 MSB = Marker Slave B  
 Q1B = Quadrature 1B  
 Q2B = Quadrature 2B

# ME engine control system

## Tacho system – Quadrature sensors



### System A (powered from ECU A)

MMA = Marker Master A  
MSA = Marker Slave A  
Q1A = Quadrature 1A  
Q2A = Quadrature 2A

### System B (powered from ECU B)

MMB = Marker Master B  
MSB = Marker Slave B  
Q1B = Quadrature 1B  
Q2B = Quadrature 2B

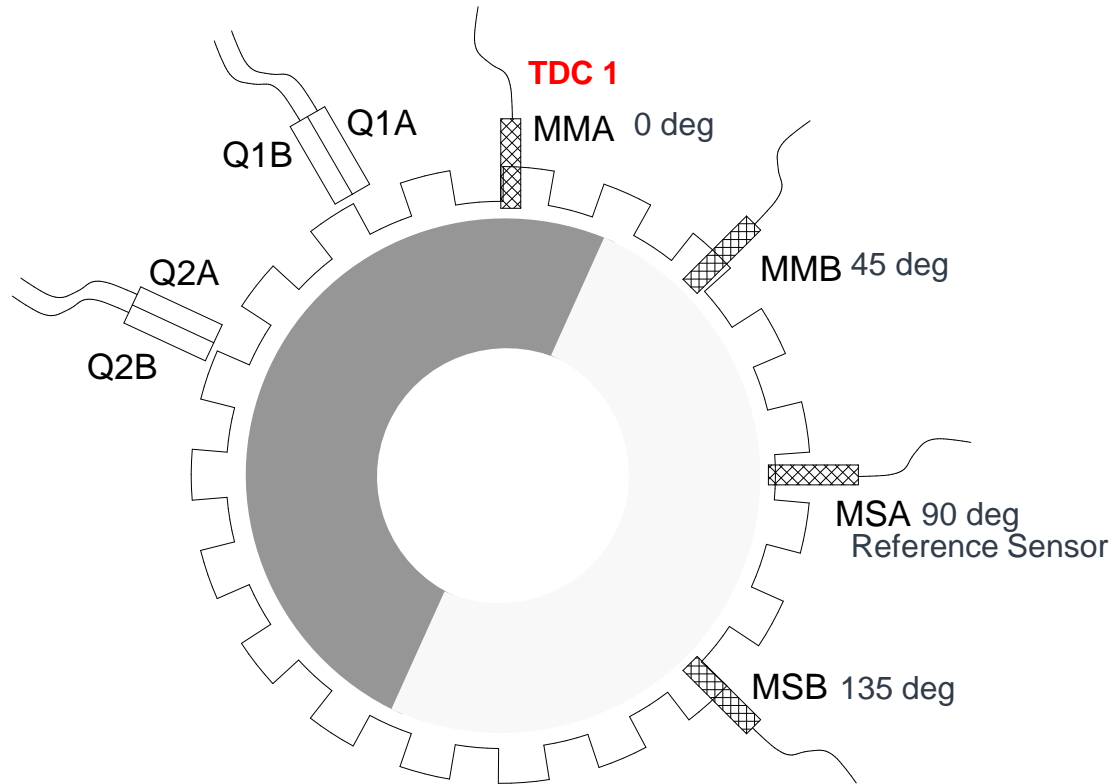
After initial power ON of ECS tacho will not have the position of the crankshaft. Try to start ahead, if it doesn't start, try astern, if still no start, turn by turning gear until system have position, it will have it within 1 revolution.

When start is initiated it will make 3-5 revolutions on air without fuel.

Turning by turning gear will normally only be needed if you only have 1 tacho system (one has failed)

# ME engine control system

Tacho system – Angle encoders



System A (powered from ECU A)

MMA = Marker Master A

MSA = Marker Slave A

Q1A = Quadrature 1A

Q2A = Quadrature 2A

System B (powered from ECU B)

MMB = Marker Master B

MSB = Marker Slave B

Q1B = Quadrature 1B

Q2B = Quadrature 2B

Pos	0-44	45-89	90-134	135-179	180-224	225-269	270-314	315-359
MMA	True	True	True	True	False	False	False	False
MMB	False	True	True	True	True	False	False	False
MSA	False	False	True	True	True	True	False	False
MSB	False	False	False	True	True	True	True	False

# ME engine control system

## Tacho system – Function test

Large dev. from model curve    Normal    ECUA\_51330113    14:44:35    33 18 32 0

Maintenance ▶ Function Test    2013-05-27    15:08:11

HCU    Tacho    HPS

1    An assistant is standing by at the turning wheel    -    OK

**Test of Tacho signals**

Start    Action/Message    Reference    Test Value

1	Turn engine to 2 DEG before TDC at Cyl. 1	A:FF B:FF	A:FF B:FF
2	Reboot CCUs and ECUs	-	
3	Turn engine in ahead direction to 2 DEG after TDC at Cyl. 1	A:TF B:FF	
4	Turn engine in ahead direction to 47 DEG after TDC at Cyl. 1	A:TF B:TF	
5	Turn engine in ahead direction to 92 DEG after TDC at Cyl. 1	A:TT B:TF	
6	Turn engine in ahead direction to 137 DEG after TDC at Cyl. 1	A:TT B:TT	

**Setting Of Fine Adjust Parameters**

Start    Action/Message    Reference    Test Value

1	Perform PMI 0-diagram	-	
2	Minimum speed required for valid measuring Delta Tacho B	>55.0 RPM	
	Delta Tacho-B max measured	-1.00-1.00	
3	Enter Trig offset ahead and setting of ECS parameters	-	

**Support**

Details    Delta Tacho-B    0.00    Tacho Alignment Deviation    0.00

1. Turn to 2 DEG before TDC

TIP: Press Done when the engine is turned to 2 DEG before TDC.

Done    Abort Test

Alarms

Engine

Auxiliaries

Maintenance

System View  
I/O Test

Invalidated  
Inputs

Network  
Status

Function  
Test

Trouble-  
Shooting

Admin

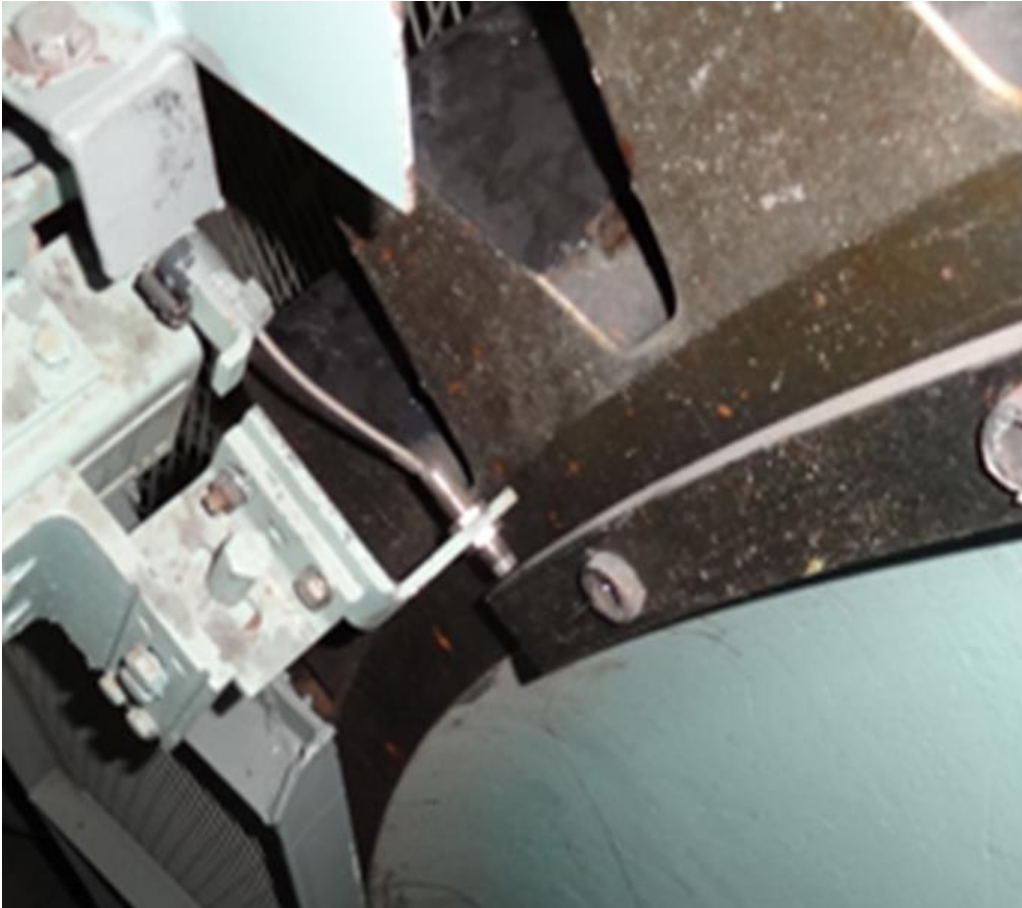
Power Off

Chief



# ME engine control system

Tacho system – reference sensor



# ME engine control system

Tacho system – amplifier boxes



# ME engine control system

Tacho system – Angle encoders channels

Maintenance ▶ System View - I/O Test 2010-08-13 09:04:59 Alarms...

ECU-A

MPC Mode: **Normal**

A Analog Input   
 A Analog Output   
 / Invalidated   
 ! Alarm  
D Digital Input   
 D Digital Output   
 / Not used   
 N/A Not available

#	Info	ID	Description	Process Value	#	Info	ID	Description	Process Value
21	D	2152-A	Local: Increase Limiter	OFF	44	D	4001-B	marker master	False
22	D	2151-A	Local: Stop	ON	45	D	4002-B	marker slave	False
23	D	2114-A	Local: Air Run	OFF	46	D	4003-B	quadrature master	False
24	D	2115-A	Local: Slow Turn	OFF	47	D	4004-B	quadrature slave	False
25	D	2153-A	Local: Take CMD	OFF					
26	A	1006	Local: Speed Set	0.7 RPM					
27	/								
28	/								
29	/								
30	/								
31	/								
32	D	1117-A	Blocked Start Air Distr	OFF	48	/			
33	/				49	/			
34	D	2001-A	Shut Down	OFF	50	/			
35	A	8601-A	Scavenge Air Pressure (	0.00 -	51	/			
36	/				52	D	011501	Lubricator Backup Signa	N/A
37	/				53	/			
38	/				54	/			
39	/				55	/			
40	D	4001-A	marker master	False	61	D	2005-A	Reset Shut Down	ON
41	D	4002-A	marker slave	False	70	A	2184	Governor Index	0.0 %
42	D	4003-A	quadrature master	False	71	A	8501	Start Air Pressure	28.5 -
43	D	4004-A	quadrature slave	False	80	D	1114	Slow Turn Valve	OFF
					81	/			
					82	D	1121-A	Main Start Air Valve	OFF
					83	D	2206-A	Slow Down Local Indicati	OFF
					84	D	2154-A	Local Take Command	OFF
					85	D	2159-A	Increase Limit Indicati	OFF

Alarms...

Engine...

Auxiliaries...

Maintenance ▶

System View  
I/O Test

Invalidated  
Inputs

Network  
Status

Function  
Test

Trouble-  
shooting

Admin...

Power Off ⓪

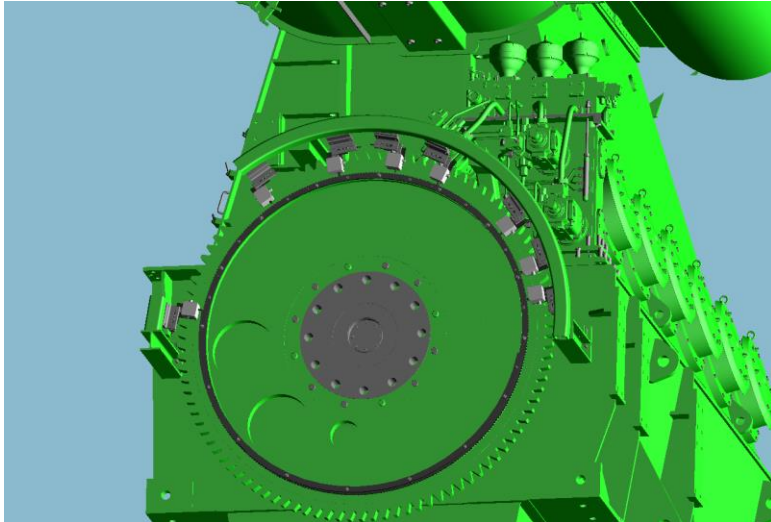
Access

Chief

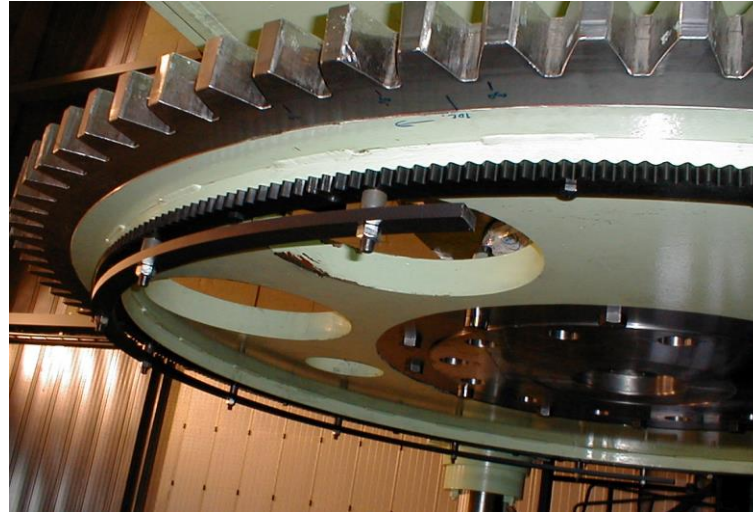


# ME engine control system

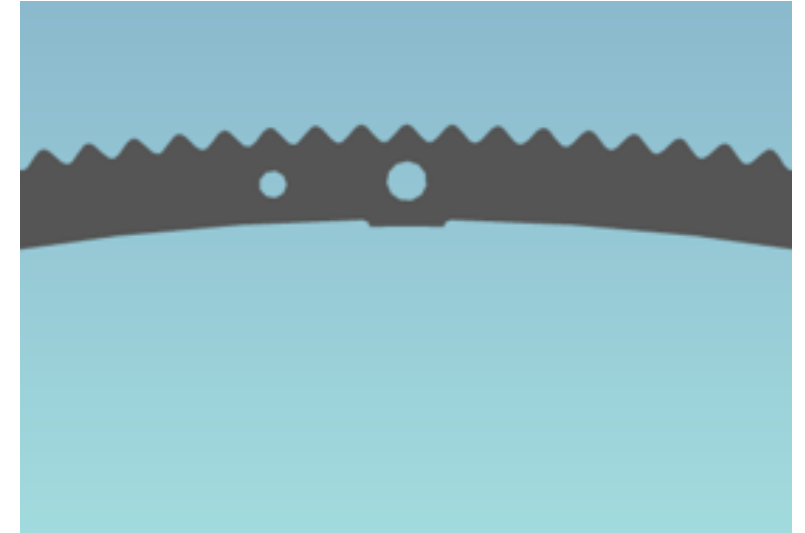
Tacho system – Trigger ring and sensors (option)



Two redundant set of sensors, that each measure engine speed and crankshaft position, for the synchronization of the control events.



Just like in the angle encoders the marker and slave sensors are being activated by a semi - circular ring.



The trigger ring consists of eight equal segments. The trigger ring has a sine - curved tooth profile.

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