

ME-C control system

Tacho systems, MPC and Triton based

PrimeServ Academy Copenhagen

MAN PrimeServ



Learning objectives

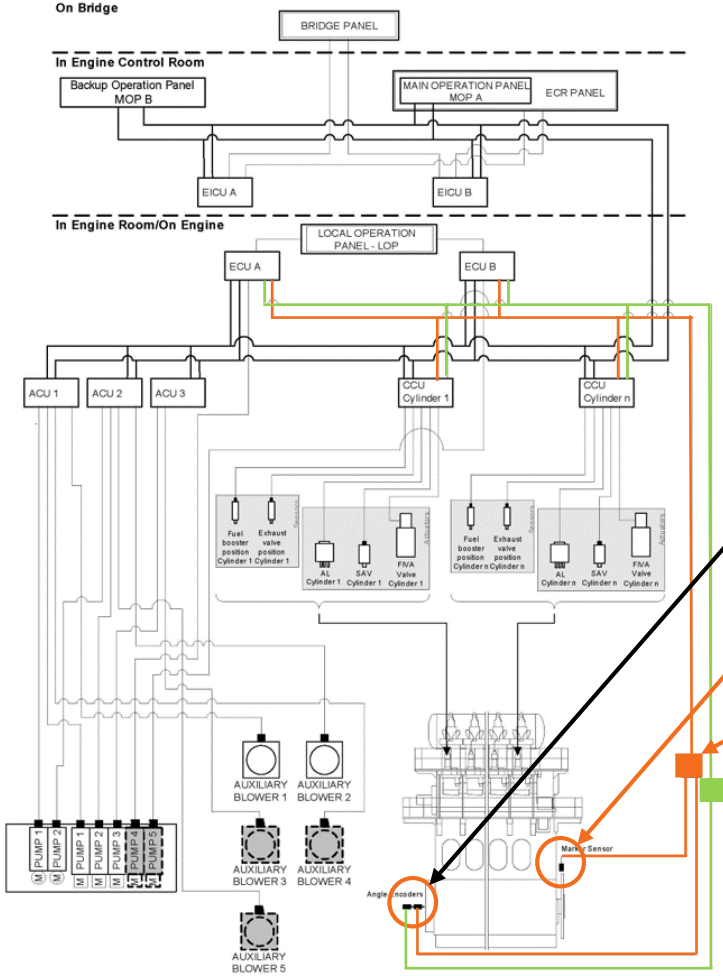
Upon completion of this module you ...

- will be able to recognize the various components in the system.
- will be able to explain the working principle of the system



ME-C control system

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

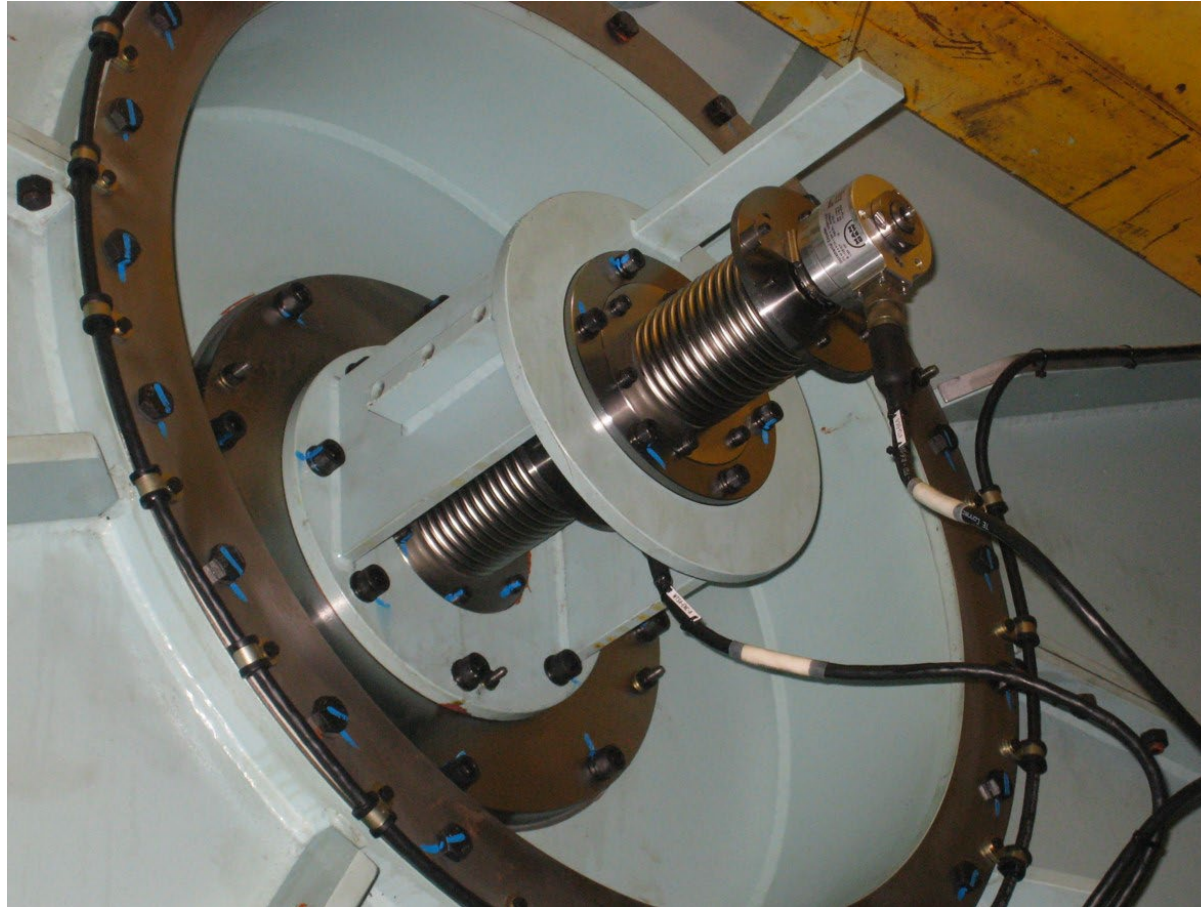
- Power supply to TSA-B

CCU's

- Tacho signal for operation

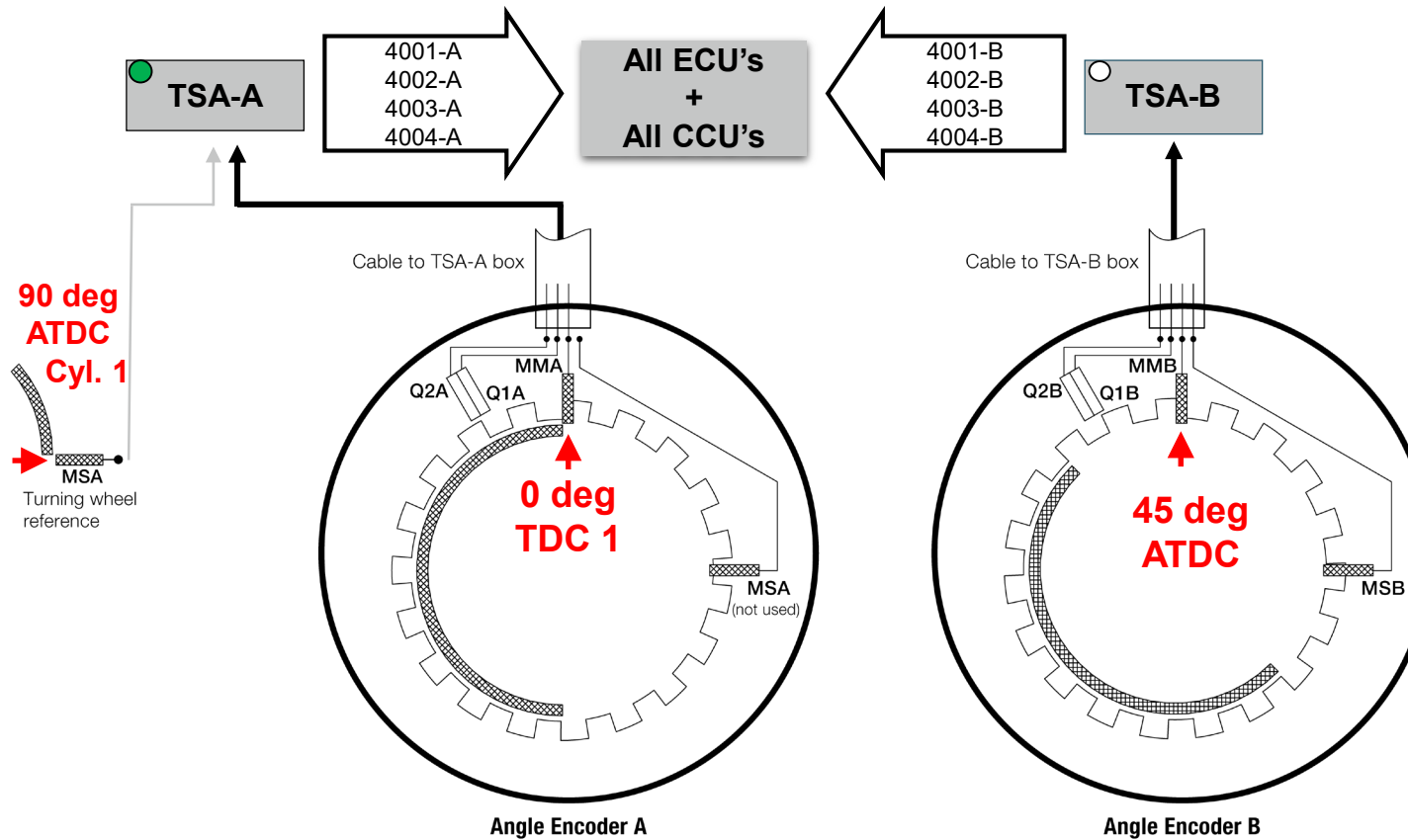
ME-C control system

Tacho system



ME-C control system

Tacho system – Angle encoders



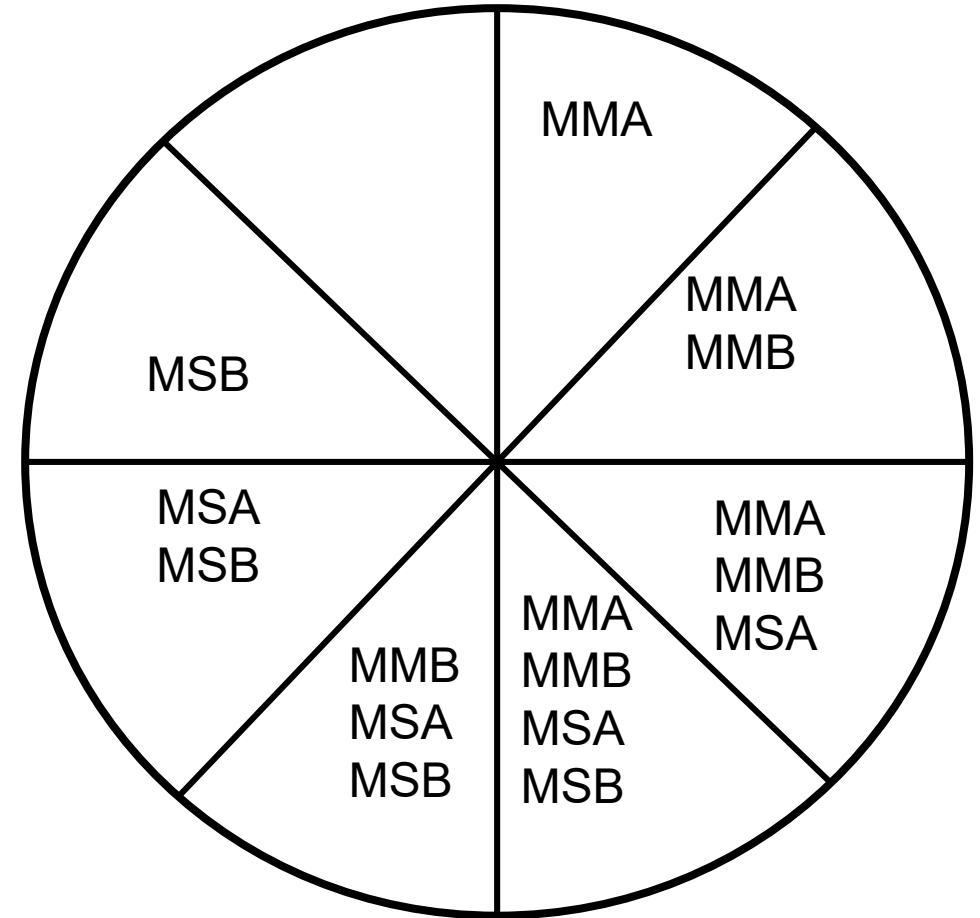
MMA = Marker Master A
 MSA = Marker Slave A
 Q1A = Quadrature 1A
 Q2A = Quadrature 2A

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

ME-C control system

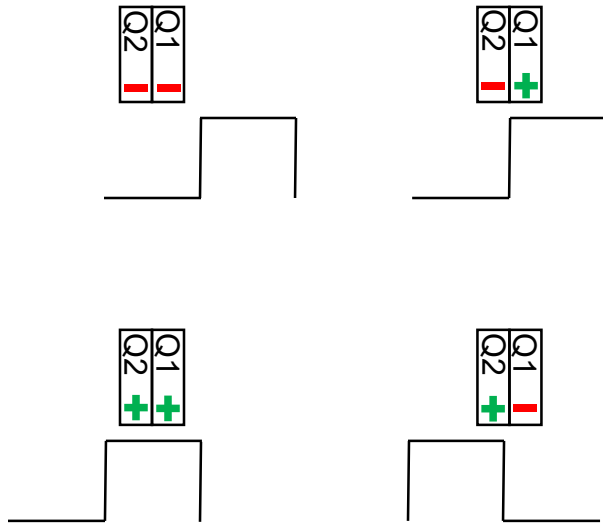
Tacho system – Markers sensors

- 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-C 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

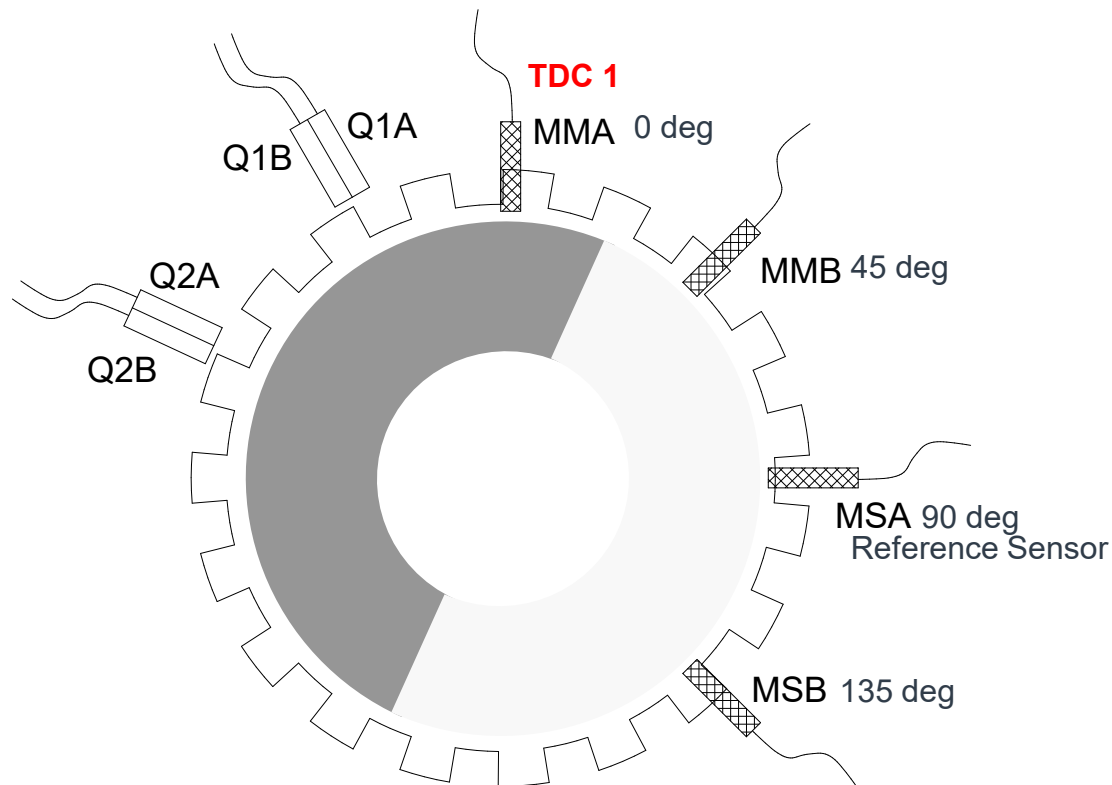
MSB = Marker Slave B

Q1B = Quadrature 1B

Q2B = Quadrature 2B

ME-C 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

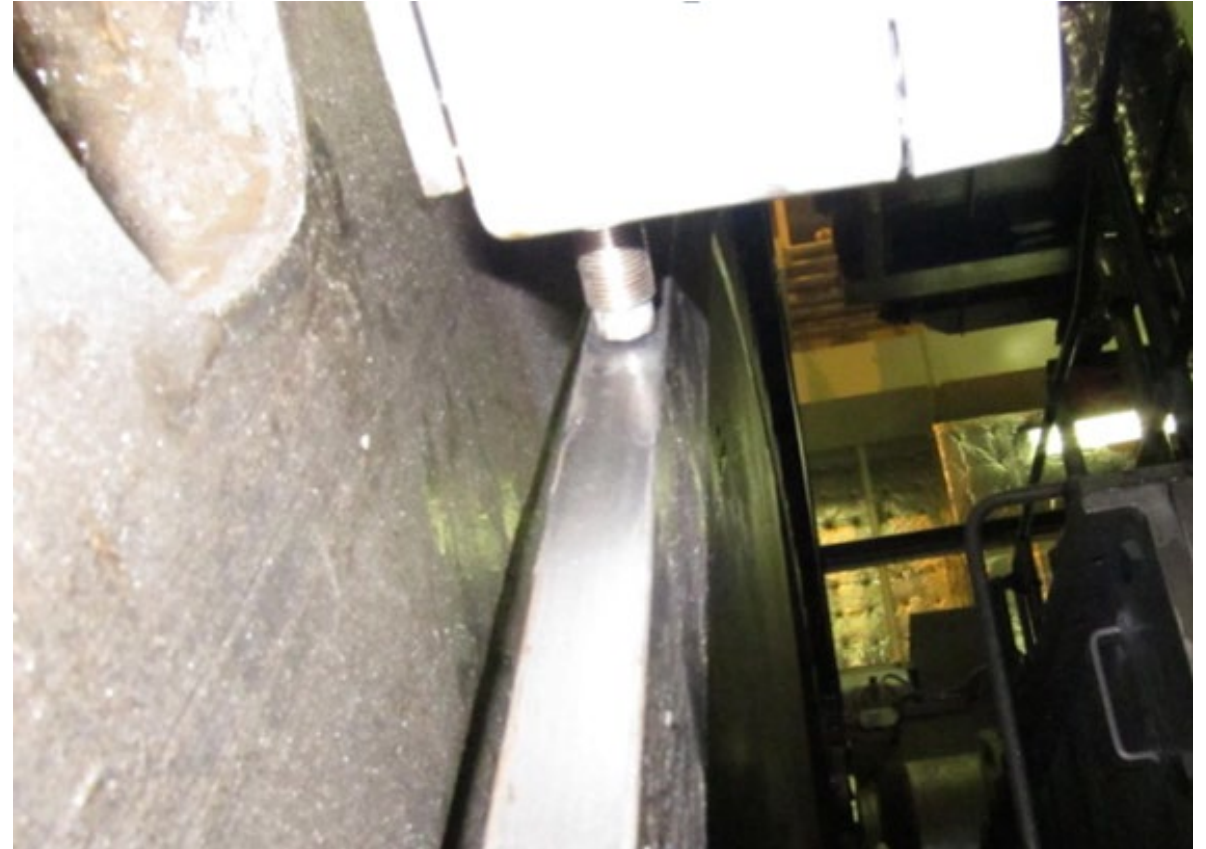
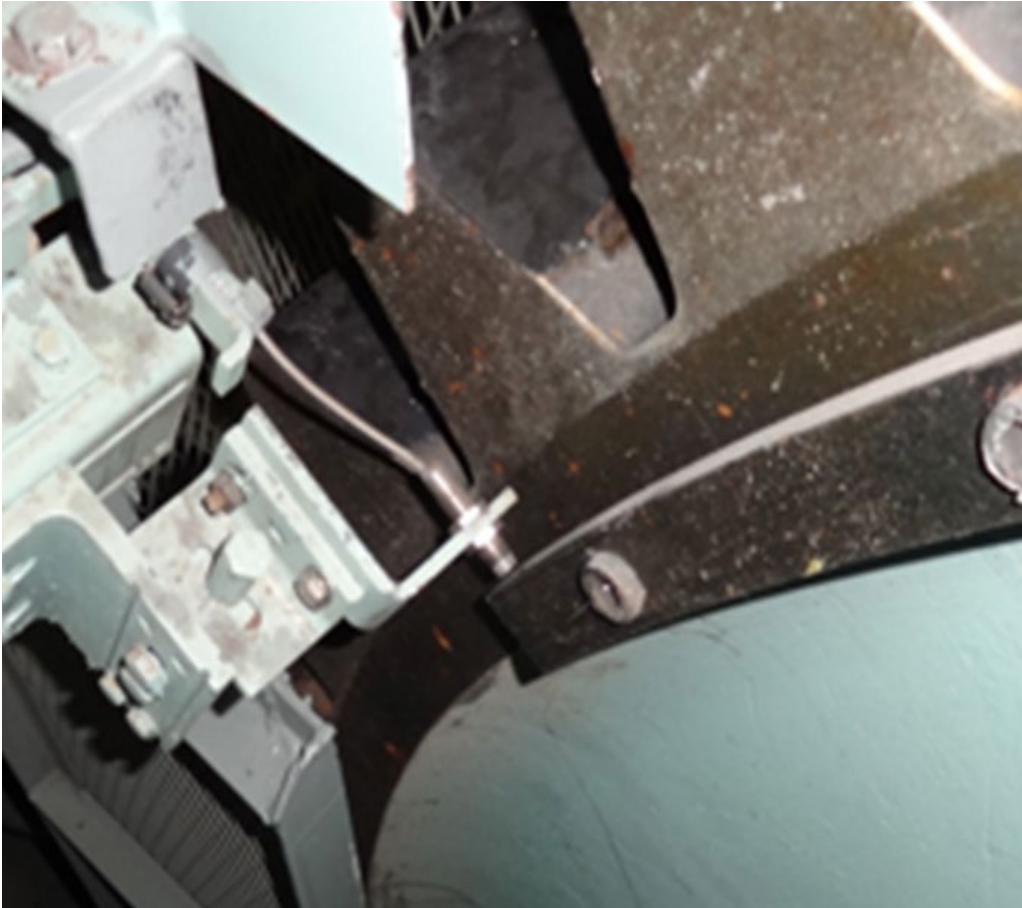
Q1B = Quadrature 1B

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-C control system

Tacho system – reference sensor



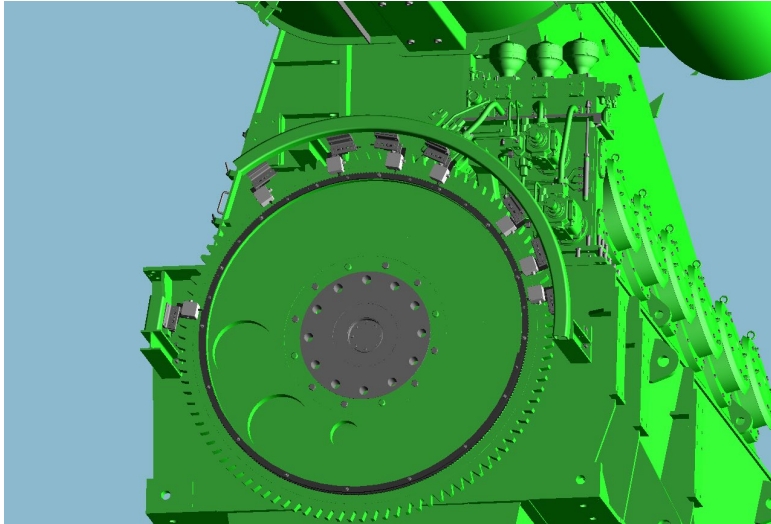
ME-C control system

Tacho system – amplifier boxes

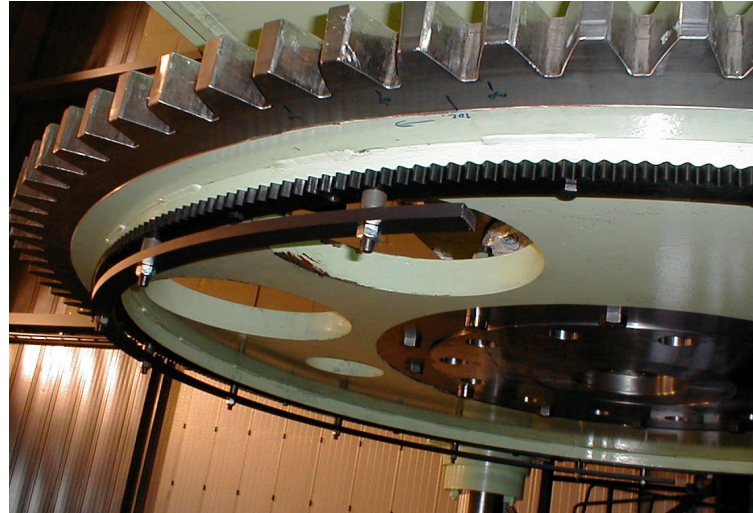


ME-C control system

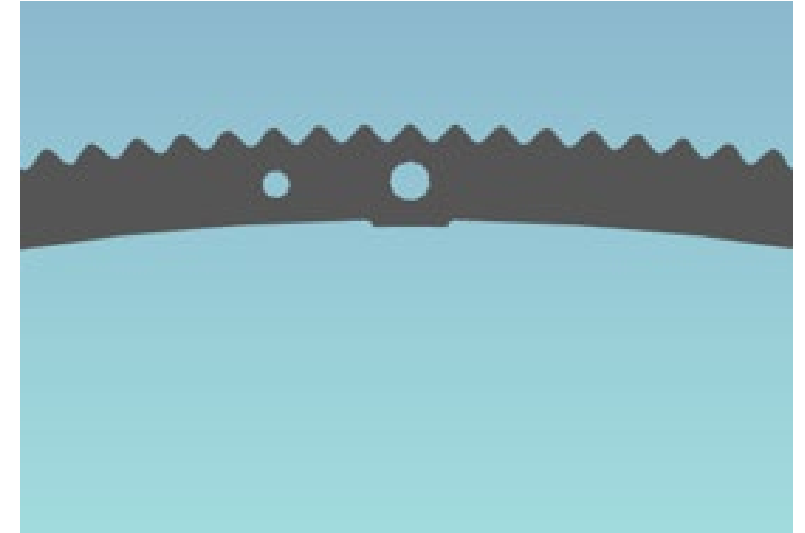
Tacho system – Trigger ring and sensors (option)



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.

ME- C 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 | Troubleshooting | Admin | Power Off | Chief

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

ECU-A

MPC Mode: Normal

Legend: A Analog Input, D Digital Input, A Analog Output, D Digital Output, / Invalidated, / Not used, Alarm, N/A Not available

#	Info	ID	Description	Process Value	#	Info	ID	Description	Process Value
20	/				44	D	4001-B	marker master	False
21	D	2152-A	Local: Increase Limiter	OFF	45	D	4002-B	marker slave	False
22	D	2151-A	Local: Stop	ON	46	D	4003-B	quadrature master	False
23	D	2114-A	Local: Air Run	OFF	47	D	4004-B	quadrature slave	False
24	D	2115-A	Local: Slow Turn	OFF	48	/			
25	D	2153-A	Local: Take CMD	OFF	49	/			
26	A	1006	Local: Speed Set	0.7 RPM	50	/			
27	/				51	/			
28	/				52	D	011501	Lubricator Backup Signa	N/A
29	/				53	/			
30	/				54	/			
31	/				55	/			
32	D	1117-A	Blocked Start Air Distr	OFF	60	/			
33	/				61	D	2005-A	Reset Shut Down	ON
34	D	2001-A	Shut Down	OFF	70	A	2184	Governor Index	0.0 %
35	A	8601-A	Scavenge Air Pressure (0.00 -	71	A	8501	Start Air Pressure	28.5 -
36	/				80	D	1114	Slow Turn Valve	OFF
37	/				81	/			
40	D	4001-A	marker master	False	82	D	1121-A	Main Start Air Valve	OFF
41	D	4002-A	marker slave	False	83	D	2206-A	Slow Down Local Indic	OFF
42	D	4003-A	quadrature master	False	84	D	2154-A	Local Take Command	OFF
43	D	4004-A	quadrature slave	False	85	D	2159-A	Increase Limit Indicati	OFF

Alarms... | Engine... | Auxiliaries... | Maintenance ▶ | System View I/O Test | Invalidated Inputs | Network Status | Function Test | Troubleshooting | Admin... | Power Off | Access | Chief

ME-C control system

Triton based Tacho system – interface units and channels

academy-simulator-india:5920 (ECS_MOP) - VNC Viewer

! 8721-Variable EGB Pos. FB-No Connec Normal SCU1_872104 01:00:13 95 4 0 0

Maintenance ▶ System View I/O Test 2022-05-09 10:05:54

Alarms

Engine

Auxiliaries

Maintenance

System View I/O Test

Invalidated Input Channels

Network Status

Function Test

Trouble-Shooting

Admin

Power Off

System Options

Operator

Legend: Active, This MOP, Ctrl Controlling, T Test, C Configuration, B Blocked, Not Accessible

academy-simulator-india:5920 (ECS_MOP) - VNC Viewer

8721-Variable EGB Pos. FB-No Connec Normal SCU1_872104 01:00:13 95 4 0 0

Maintenance ▶ System View I/O Test 2022-05-09 10:08:44

TIU-A

Status	ID	Description	Process Value
2.X1	4001-A	Encoder MM	OFF
2.X2	4002-A	Encoder MS	OFF
2.X3	4003-A	Encoder Q1	ON
2.X4	4004-A	Encoder Q2	OFF
2.X5	4005-A	Turning wheel sensor	OFF

academy-simulator-india:5920 (ECS_MOP) - VNC Viewer

8721-Variable EGB Pos. FB-No Connec Normal SCU1_872104 01:00:13 95 4 0 0

Maintenance ▶ System View I/O Test 2022-05-09 10:09:48

TIU-B

Status	ID	Description	Process Value
2.X1	4001-B	Encoder MM	OFF
2.X2	4002-B	Encoder MS	OFF
2.X3	4003-B	Encoder Q1	ON
2.X4	4004-B	Encoder Q2	OFF
2.X5	4005-B	Turning wheel sensor	OFF

ME-C control system

Triton based Tacho system – calibration screens

Maintenance > Function Test 2022-05-11 10:49:24

HCU Tacho HPS Speed Handles

State: Turning Running

Alarms Engine Auxiliaries Maintenance System View I/O Test Invalidated Input Channels Network Status Function Test Trouble-Shooting Admin Power Off System Options Chief

Preparation

Start	Action/Message	Reference	Test Value
1	An assistant is standing by at the turning wheel	-	

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	
2	Turn engine in ahead direction to 2 DEG after TDC at Cyl. 1	A:TF B:FF	
3	Turn engine in ahead direction until test is passing or failing	Passed	

Maintenance > Function Test 2022-05-11 10:50:51

HCU Tacho HPS Speed Handles

State: Turning Running

Alarms Engine Auxiliaries Maintenance System View I/O Test Invalidated Input Channels Network Status Function Test Trouble-Shooting Admin Power Off System Options Chief

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	> 0.0 RPM	
3	Enter Trig offset ahead and setting of ECS parameters	Passed	
4	Validate Delta Tacho A/B	Passed	

Disclaimer

All data provided in this document is non-binding.

This data serves informational purposes only and is especially not guaranteed in any way.

Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.

Intellectual property rights

The intellectual property rights of this work are owned and managed by MAN Energy Solutions and are protected both nationally and internationally according to related laws such as copyright law.

This content is for personal learning and non-commercial use only.

You may not modify or reproduce it except for your personal use.

This content is for training purposes only.

This work is the proprietary intellectual property of MAN Energy Solutions.

MAN Energy Solutions owns all rights to this work and the lecture, and this work is only offered by the instructor or via the MAN eAcademy through the MAN Energy Solutions.

Any use of this work at will, without the consent of MAN Energy Solutions, may cause legal problems.

This work is provided for the convenience of course participant, and it does not give intellectual property rights to user.

Thank you very much!

First name, Last name
Technical instructor
PrimeServ Academy [Your Location]

