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Application note A40Z090210-d

Gensys / MDEC

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Introduction

This application note will describes how Gensys can be used with MDEC from MTU by using CAN bus.
The main interest is the remote survey. Gensys get all the parameters from MDEC and then broadcast it threw ModBus (COM4).
Gensys is validated with CAN Modul 303 protocol.

Procedure

The MDEC have to be configured in this way :

- Activation of the CAN communication with Gensys : MDEC variables
 - o 200 set to 450.
 - o 201.01 set to 32.
 - o 201.05 set to 201.

For more information on the configuration of MDEC contact your MTU dealer.

You have to order option 4 to activate the CAN connection.

Download the custom language to have label or number corresponding to the MDEC variable :

- Z090210_2_vxxx.txt corresponding to the English version **or**
- Z090210_3_vxxx.txt corresponding to the French version.

Note : vxxx is the corresponding software version of your Gensys.

Download the text file that will configure your Gensys for this application :

- Z090210i_1.txt.

Do the following wiring :

Label	Gensys terminal	MDEC terminal	Note
Digital output to stop request	C1	25 / X1-h	26 / X1-g must be grounded
Digital output to start request	C2	43 / X1-N	44 / X1-M must be grounded
Digital input to oil pressure contact	J4	45 / X1-L via relay	46 / X1-K must be grounded
CAN High	COM 3 pin 7	49 / X1-G	
CAN Low	COM 3 pin 2	50 / X1-F	
CAN ground	COM 3 pin 5	51 / X1-E	
Analogue speed command	G9	8 / X1-AA	
Analogue speed reference	G11	31 / X1-b	36 / X1-W must be grounded

See the schematics in annexe for complete wiring.

Highlights of the text file :

Variable number	Label	Value	Description
V1076	ESG amplitude	50.0	to have a frequency trip of +/-3Hz.
V1077	ESG offset	0.00	to have the nominal frequency.
V1156	Local language	3	to have the custom language on the Gensys screen.
V1311	PC language	3	to have the custom language on the PC.
V1710	User param 001	10	time to stop request on C1, here we have 1.0 sec.
V1711	User param 002	1500	Nominal speed for MDEC threw CAN bus.
V1712	User param 003	300	Delay before triggered a MTU CAN bus error, here we have 30.0 sec.
V1852	Branch P-oil	352	The analogue oil pressure comes from the MTU CAN bus. (*)
V1853	Brnch T-water	400	The analogue water temperature comes from the MTU CAN bus. (*)
V1854	Branch Speed	331	The speed measure comes from the MTU CAN bus. (*)
V1855	Opt4 protocol	1	To choose the MTU can bus protocol.
V1856	MTU CANbusNode	6	Each device on the MTU CAN bus has a node number. Gensys have the number 6.
V1857	MTUPV110003 CT	0	Protection control for over speed from MDEC (E0332). (**)
V1858	MTUPV110010 CT	3	Protection control for combined alarm yellow from MDEC (E0339). (**)
V1859	MTUPV110014 CT	5	Protection control for combined alarm red from MDEC (E0343). (**)
V1860	MTUPV110029 CT	0	Protection control for low oil pressure from MDEC (E0355). (**)
V1861	MTUPV110030 CT	0	Protection control for very low oil pressure from MDEC (E0356). (**)
V1862	MTUPV110047 CT	0	Protection control for low fuel pressure from MDEC (E0358). (**)
V1863	MTUPV110048 CT	0	Protection control for very low fuel pressure from MDEC (E0359). (**)
V1864	MTUPV110055 CT	0	Protection control for low coolant level from MDEC (E0363). (**)
V1865	MTUPV110099 CT	0	Protection control for low coolant level charge air from MDEC (E0386). (**)
V1866	MTUPV110129 CT	0	Protection control for high coolant temperature from MDEC (E0403). (**)
V1867	MTUPV110130 CT	0	Protection control for very high coolant temperature from MDEC (E0404). (**)
V1868	MTUPV110133 CT	0	Protection control for high charge air temperature from MDEC (E0407). (**)
V1869	MTUPV110143 CT	0	Protection control for high oil temperature from MDEC (E0414). (**)
V1870	MTUPV110168 CT	0	Protection control for low charge air temperature from MDEC (E0422). (**)
V1871	MTUPV110177 CT	0	Protection control for low engine speed from MDEC (E0426). (**)

(*) : the standard sensor required for oil pressure, water temperature and engine speed are useless. The value of this 3 analogue input (E0029, E0030, E0033) will be taken from MTU CAN bus.

(**) : control can take the following values :

- 0 : disable.
- 1 : Generator electrical fault.
- 2 : Mains electrical fault.
- 3 : Alarm.
- 4 : Fault (soft shut down).
- 5 : Security (hard shut down).

MDEC variables :

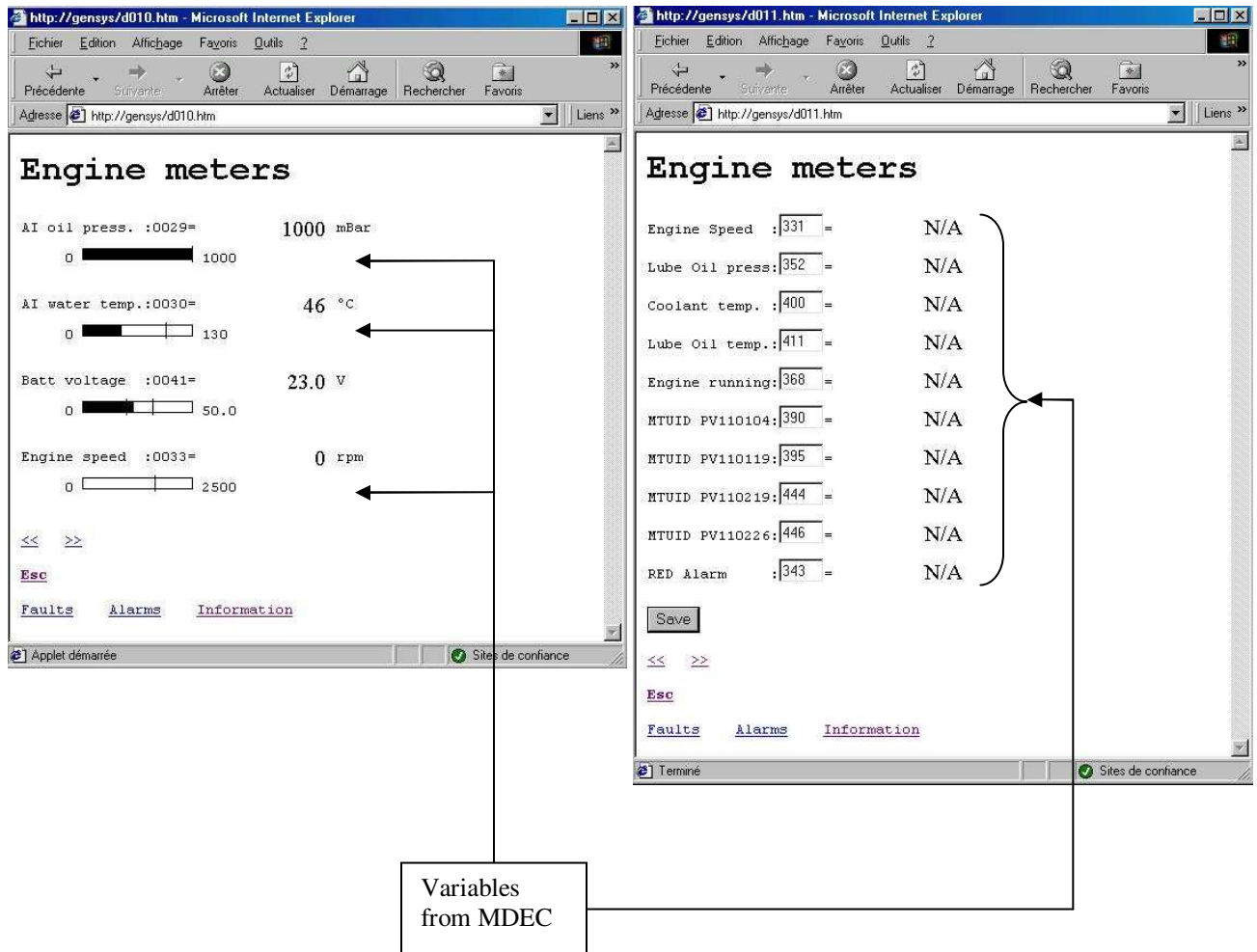
The variables from MDEC can be seen from E0330 to E0484.

The variables that can be write in MDEC are available from E2662 to E2677.

The table in annexe list all the variables with the correspondence between MDEC and Gensys.

Specific screens for MDEC :

In the menu “Display\Engine meters” you have :



Additional information

In the standard configuration Gensys can display all the MDEC variables available on the CAN bus thanks to the specific screen seen above. There is no treatment of this variables, except for certain fault. If you need additional function, you have to program it in the equations.

You have also the possibility to see this variables through the MODBUS. Then you can survey and manage the MDEC variable remotely.

Alarms.

This is one example of the predefined alarm seen above :

E1857 is dedicated to over speed protection from MDEC (E0332). The equation is the following :

TEST (E0332 EQ 1) AND (E1857 NE 0) EQ 1 THEN E2199[E1857]:=1 TEND;

E0332 is the over speed alarm from MDEC.

E1857 is the control.

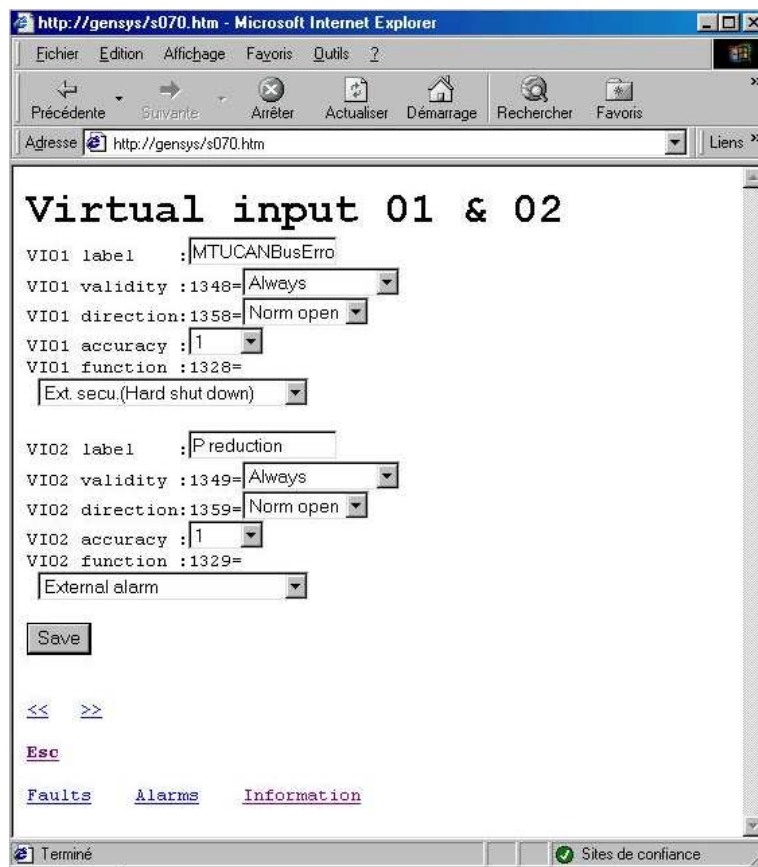
If you set E1857 as security (5), if E0332 is 1 then E2204 (hard shut down) will be 1.

If an alarm from MDEC is not manage is the equations delivered, you can use a virtual input.

For example, you want to have an alarm for “SS Power Reduction Active” (E0338) and use the virtual input 2 (2284). In the menu “Configuration>>>Virtual input”, set the function (E1329) as “External alarm”, and do the following equation :

E2284:=E0338;

You can also change the label of the virtual input to have a comprehensive display.



Fault code numbers.

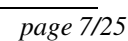
Combined yellow / red alarms are global warning, they can be triggered by one of the fault provided on the CAN bus (see variable list below). If there is no alarm triggered in the list, additional alarms are available : the fault code numbers.

This failure code is given by MDEC (Gensys variable E0372). In case of several failures codes, the variable is refresh each second.

Then, in case of combined alarm, you can know which failure code is activated.

You can see the fault code numbers in annexe.

Schematics



Note 1 : Connect “- battery” to the MDEC and connect “Power supply –“(K3) to the MDEC. Always use a 4mm² wires.

Note 2 : For peak shaving application, a mains power measure is required. This can be done internally thanks to Mains current input (D7/D8), or externally, if you use an external power measure such a CPA connected to the “0-20 mA input” (G1/G3). You have to choose one of the two measures and you can disconnect the other.

Note 3 : The “Mains breaker in” (J1) is useless in the following case :

- Several generators with no voltage regulator.
- Alone on the load.
- In “No change over” mode.

Note 4 : H2 to H4 are connected only if an AVR is used for kVAR sharing and cos ϕ regulation, but it is not necessary.

Note 5 : For load sharing you need to have communication lines. If you use only Gensys, the COM2 is required. If there is another module using analogue load sharing, parallel lines (G4/G6) are required.

Note 6 : Terminals G1 to G3 are required in several generators mode, for synchronization with mains through an external synchronization module (such as GCR).

Gensys / MDEC variables table

(*) : The MDEC variable which have the unit “digit”, requires 2 variables to be printed. To have the MDEC value do the following calculation : $MSB \times 65536 + \text{Variable}$. For example, to have the value of PV110011 (Cylinder Cutout Code) do $E0510 \times 65536 + E0340$. This calculation can't be done in the Gensys equations, but with a remote PC threw MODBus you can have the calculation automatically.

MTU references					Gensys references	
Transmit=T Receive=R MDEC	PV	Transmitted Object	Signal type	Unit	Variable Number	MSB variable (*)
T	PV110001	Stop Activated	binary		E0330	
T	PV110002	Engine Speed (ECU)	analogue	rpm	E0331	
T	PV110003	SS Overspeed (ECU)	binary		E0332	
T	PV110004	Injection Quantity	analogue	mm ³	E0333	
T	PV110005	Idle Speed	analogue	rpm	E0334	
T	PV110006	Nominal Speed	analogue	rpm	E0335	
T	PV110007	Engine Power Reserve	analogue	%	E0336	
T	PV110008	Injection Limitation	binary		E0337	
T	PV110009	SS Power Reduction Active	binary		E0338	
T	PV110010	Combined Alarm Yellow (ECU)	binary		E0339	
T	PV110011	Cylinder Cutout Code	analogue	digit	E0340	E0510
T	PV110012	Speed demand Source	analogue	digit	E0341	E0511
T	PV110013	Speed Demand Fail Mode	binary		E0342	
T	PV110014	Combined Alarm Red (ECU)	binary		E0343	
T	PV110015	Test Overspeed Active	binary		E0344	
T	PV110016	Feedback Speed Demand	analogue	rpm	E0345	
T	PV110017	Feedback Speed Demand Eff.	analogue	rpm	E0346	
T	PV110018	Feedback Increase Speed	binary		E0347	
T	PV110019	Feedback Decrease Speed	binary		E0348	
T	PV110021	Status Start Sequence	bit field		E0349	
T	PV110024	Feedback Local	binary		E0350	
T	PV110025	Max Injection	analogue	mm ³	E0351	
T	PV110026	P-Lube Oil (ECU)	analogue	mbar	E0352	
T	PV110027	P-Lube Oil Limit LO	analogue	mbar	E0353	
T	PV110028	P-Lube Oil Limit LOLO	analogue	mbar	E0354	
T	PV110029	LO P-Lube Oil	binary		E0355	
T	PV110030	SS P-Lube Oil	binary		E0356	
T	PV110046	P-Fuel	analogue	bar	E0357	
T	PV110047	LO P-Fuel	binary		E0358	
T	PV110048	SS P-Fuel	binary		E0359	
T	PV110049	P-Charge Air	analogue	mbar	E0360	
T	PV110050	LO P-Charge Air	binary		E0361	
T	PV110053	P-Fuel (Common Rail)	analogue	mbar	E0362	
T	PV110055	LO Coolant Level	binary		E0363	
T	PV110063	ECU Operating Hours (sec)	analogue	sec	E0364	
T	PV110064	LO P-Fuel (Common Rail)	binary		E0365	
T	PV110065	HI P-Fuel (Common Rail)	binary		E0366	
T	PV110066	SS Override	binary		E0367	
T	PV110068	Engine Running	binary		E0368	
T	PV110072	Injection Quantity 0-120%	analogue	%	E0369	
T	PV110073	Injection Limitation Limit HI	analogue	%	E0370	
T	PV110074	Cylinder Cutout	binary		E0371	
T	PV110075	Actual Failure Codes	analogue		E0372	

T	PV110076	Speed Limit 1	binary		E0373	
T	PV110077	Speed Limit 2	binary		E0374	
T	PV110078	Load Generator ON	binary		E0375	
T	PV110088	Horn	binary		E0376	
T	PV110089	Preaheat Temperature Low	binary		E0377	
T	PV110091	AL BIN-AUX 1	binary		E0378	
T	PV110092	AL BIN-AUX 2	binary		E0379	
T	PV110093	AL BIN-AUX 3	binary		E0380	
T	PV110094	AL BIN-AUX 4	binary		E0381	
T	PV110095	AL P-AUX 1 Limit 1	binary		E0382	
T	PV110096	AL P-AUX 2 Limit 1	binary		E0383	
T	PV110097	AL T-AUX 1 Limit 1	binary		E0384	
T	PV110098	AL T-AUX 2 Limit 1	binary		E0385	
T	PV110099	SS Coolant Level Charge Air	binary		E0386	
T	PV110101	AL Power Amplifier 1 Failure	bit field		E0387	
T	PV110102	AL Power Amplifier 2 Failure	bit field		E0388	
T	PV110103	AL Status Transistor Outputs	bit field		E0389	
T	PV110104	ECU Power Supply Voltage	analogue	volts	E0390	
T	PV110115	ECU Operating Hours	analogue	hours	E0391	
T	PV110116	AL ECU Defect	binary		E0392	
T	PV110117	Engine Speed Camshaft	analogue	rpm	E0393	
T	PV110118	AL Speed Demand Defect	binary		E0394	
T	PV110119	Actual Fuel Consumption	analogue	l/h	E0395	
T	PV110120	Daily Fuel Consumption	analogue	m³	E0396	
T	PV110121	Total Fuel Consumption	analogue	m³	E0397	
T	PV110122	LO ECU Power Supply Voltage	binary		E0398	
T	PV110123	HI ECU Power Supply Voltage	binary		E0399	
T	PV110126	T-Coolant (ECU)	analogue	°C	E0400	
T	PV110127	T-Coolant Limit HI	analogue	°C	E0401	
T	PV110128	T-Coolant Limit HIHI	analogue	°C	E0402	
T	PV110129	HI T-Coolant (ECU)	binary		E0403	
T	PV110130	SS T-Coolant (ECU)	binary		E0404	
T	PV110131	T-Charge Air	analogue	°C	E0405	
T	PV110132	T-Charge Air Limit HI	analogue	°C	E0406	
T	PV110133	HI T-Charge Air	binary		E0407	
T	PV110137	T-Coolant Intercooler	analogue	°C	E0408	
T	PV110138	T-Coolant Intercooler Limit HI	analogue	°C	E0409	
T	PV110139	HI T-Coolant Intercooler	binary		E0410	
T	PV110140	T-Lube Oil	analogue	°C	E0411	
T	PV110141	T-Lube Oil Limit HI	analogue	°C	E0412	
T	PV110142	T-Lube Oil Limit HIHI	analogue	°C	E0413	
T	PV110143	HI T-Lube Oil	binary		E0414	
T	PV110144	SS T-Lube Oil	binary		E0415	
T	PV110152	T-Fuel	analogue	°C	E0416	
T	PV110158	L1L P-Fuel	analogue	bar	E0417	
T	PV110159	L2L P-Fuel	analogue	bar	E0418	
T	PV110162	Engine Speed Limit HI	analogue	rpm	E0419	
T	PV110163	P-Charge Air Limit LO	analogue	mbar	E0420	
T	PV110167	T-Charge Air Limit HIHI	analogue	°C	E0421	
T	PV110168	SS T-Charge Air	binary		E0422	
T	PV110169	T-ECU	analogue	°C	E0423	
T	PV110170	HI T-ECU	binary		E0424	

T	PV110175	Failure Codes	analogue		E0425	
T	PV110177	SS Engine Speed Low	binary		E0426	
T	PV110178	AL ECU Error/Check Error Code	binary		E0427	
T	PV110185	AL Common Rail Leakage	binary		E0428	
T	PV110186	Engine Speed Crankshaft	analogue		E0429	
T	PV110193	Actual Nodes on CAN 2-Bus	analogue		E0430	
T	PV110194	Lost Node on CAN 2-Bus	analogue		E0431	
T	PV110195	Feedback Speed Demand ana. CAN	analogue	rpm	E0432	
T	PV110196	Feedback Speed Demand analog	analogue	rpm	E0433	
T	PV110197	Feedback Speed Demand Frequ.	analogue	rpm	E0434	
T	PV110198	Mean Trip Fuel Consumption	analogue	l/h	E0435	
T	PV110201	P-AUX 1	analogue	mbar	E0436	
T	PV110202	AL P-AUX 1 Limit 2	binary		E0437	
T	PV110203	P-AUX 2	analogue	mbar	E0438	
T	PV110204	AL P-AUX 2 Limit 2	binary		E0439	
T	PV110205	Actual Droop	analogue	%	E0440	
T	PV110212	Info Text	analogue	digit	E0441	E0512
T	PV110213	AL Automatic Engine Stop	binary		E0442	
T	PV110216	Injection Quantity Act.DBR %	analogue	%	E0443	
T	PV110219	Nominal Power	analogue	kW	E0444	
T	PV110223	Fan Speed in %	analogue	%	E0445	
T	PV110226	Feedback Alarm Reset	binary		E0446	
T	PV110227	Actual Nodes on CAN-Bus	analogue	digit	E0447	E0513
T	PV110228	Lost Nodes on CAN-Bus	analogue	digit	E0448	E0514
T	PV110232	BIN AUX1	binary		E0449	
T	PV110233	BIN AUX2	binary		E0450	
T	PV110234	BIN AUX3	binary		E0451	
T	PV110235	BIN AUX4	binary		E0452	
T	PV110239	MG Start Speed Not Reached	binary		E0453	
T	PV110240	MG Runup Speed Not Reached	binary		E0454	
T	PV110241	MG Idle Speed Reached	binary		E0455	
T	PV110251	T-AUX 1	analogue	°C	E0456	
T	PV110252	AL T-AUX 1 Limit 2	binary		E0457	
T	PV110253	T-AUX 2	analogue	°C	E0458	
T	PV110254	AL T-AUX 2 Limit 2	binary		E0459	
T	PV110256	Actual Operating Mode	binary		E0460	
T	PV110257	Status Transistot Outputs	analogue	digits	E0461	E0515
T	PV110266	L1L ECU Power Supply Voltage	analogue	V	E0462	
T	PV110267	L2L ECU Power Supply Voltage	analogue	V	E0463	
T	PV110268	U1L ECU Power Supply Voltage	analogue	V	E0464	
T	PV110269	U2L ECU Power Supply Voltage	analogue	V	E0465	
T	PV110270	LOLO ECU Power Supply Voltage	binary		E0466	
T	PV110271	HIHI ECU Power Supply Voltage	binary		E0467	
T	PV110276	T-AUX 1 Limit 1	analogue	°C	E0468	
T	PV110277	T-AUX 1 Limit 2	analogue	°C	E0469	
T	PV110278	T-AUX 2 Limit 1	analogue	°C	E0470	
T	PV110279	T-AUX 2 Limit 2	analogue	°C	E0471	
T	PV110280	P-AUX 1 Limit 1	analogue	mbar	E0472	
T	PV110281	P-AUX 1 Limit 2	analogue	mbar	E0473	
T	PV110282	P-AUX 2 Limit 1	analogue	mbar	E0474	
T	PV110283	P-AUX 2 Limit 2	analogue	mbar	E0475	
T	PV110284	AL P-Fuel Filter Diff. HI	binary		E0476	

T	PV110290	SD Coolant Level	binary		E0477	
T	PV110293	SD Coolant Level Charge Air	binary		E0478	
T	PV110298	UL T-Fuel	analogue	°C	E0479	
T	PV110299	HI T-Fuel	binary		E0480	
T	PV110300	UL T-ECU	analogue	°C	E0481	
R	PV110401	Speed Demand	analogue	rpm	E2662	
R	PV110404	Disable Cylinder Cut Out 1	binary		E2663	
R	PV110405	Disable Cylinder Cut Out 2	binary		E2664	
R	PV110407	Override	binary		E2665	
R	PV110408	Speed Increase	binary		E2666	
R	PV110409	Speed Decrease	binary		E2667	
R	PV110411	Request Test Overspeed	binary		E2668	
R	PV110414	Engine Stop	binary		E2669	
R	PV110416	Alarm Reset	binary		E2670	
R	PV110417	Lamp test	binary		E2671	
R	PV110421	Demand Speed Limitation	binary		E2672	
R	PV110423	BIN-AUX 1 Input	binary		Not used	
R	PV110424	BIN-AUX 2 Input	binary		Not used	
R	PV110425	BIN-AUX 3 Input	binary		Not used	
R	PV110426	BIN-AUX 4 Input	binary		Not used	
R	PV110427	P-AUX 1 Input	analogue	mbar	Not used	
R	PV110428	P-AUX 2 Input	analogue	mbar	Not used	
R	PV110429	T-AUX 1 Input	analogue	°C	Not used	
R	PV110430	T-AUX 2 Input	analogue	°C	Not used	
R	PV110439	Demand Speed Limitation	binary		E2673	
R	PV110441	Reset Trip Fuel Consumption	binary		Not used	
R	PV110442	Mode Switch	binary		Not used	
R	PV110443	Mode Switch serial	binary		E2674	
R	PV110453	Actual PIM Configuration	binary		Not used	
R	PV110472	CAN Speed Demand Switch	analogue	digit	E2675	E2678
R	PV110473	Torque Feed Forward Signal	analogue	%	E2676	
R	PV110474	Load Signal	analogue	%	E2677	
T	PV331001	Combined Alarm P-Fuel (Rail)	binary		E0482	
T	PV331002	Combined Alarm P-Fuel (Rail)	binary		E0483	
T	PV331003	Combined Alarm P-Fuel (Rail)	binary		E0484	

MDEC fault code numbers

No.	Fault display	Meaning/cause	Counteraction	2000	4000
005	L1 T-CHARGE AIR	Charge air temperature too high (first limit value overshoot)	Engine documentation	✓	✓
006	L2 T-CHARGE AIR	Charge air temperature too high (second limit value overshoot)	Engine documentation	✓	✓
009	L1 T-INTERCOOLER	Charge air coolant temperature too high (Limit1 overshoot)	Engine documentation	✓	✓
015	L1 P-LUBE OIL	Lube oil pressure too low (first limit value undershoot)	Engine documentation	✓	✓
016	L2 P-LUBE OIL	Lube oil pressure too low (second limit value under-shot) -> engine stop	Engine documentation	✓	✓
023	L1 COOLANT LEVEL	Coolant level too low, message appears simultaneously with no. 24	Check coolant level in expansion tank -> Engine documentation	✓	✓
024	L2 COOLANT LEVEL	Coolant level too low, message appears simultaneously with no. 23	Check coolant level in expansion tank -> Engine documentation	✓	✓
030	ENGINE OVERSPEED	Engine overspeed -> emergency stop	Restart the engine, eliminate cause of overspeeding	✓	✓
033	L1 P-FUELFILTER DIFF	Fuel differential pressure too high	Check filter -> Engine documentation	✓	
044	L1 LEVEL INTER-COOLER	Charge air coolant level too low, message appears simultaneously with no. 45	Check coolant level -> Engine documentation		✓
045	L2 LEVEL INTER-COOLER	Charge air coolant level too low, message appears simultaneously with no. 44	Check coolant level -> Engine documentation		✓
051	L1 T-LUBE OIL	Lube oil temperature too high (first limit value overshoot)	Engine documentation	✓	✓
052	L2 T-LUBE OIL	Lube oil temperature too high (second limit value overshoot)	Engine documentation	✓	✓
065	L1 P-FUEL	Fuel infeed pressure too low (first limit value undershoot)	Check low pressure fuel side -> Engine documentation		✓
066	L2 P-FUEL	Fuel infeed pressure too low (second limit value undershoot)	Check low pressure fuel side -> Engine documentation		✓
067	L1 T-COOLANT	Coolant temperature too high (first limit value overshoot); warning	Engine documentation	✓	✓
068	L2 T-COOLANT	Coolant temperature too high (second limit value overshoot); shutdown	Engine documentation	✓	✓
069	L1 T-EXTERN 1	Alarm 'First limit value violated' for ext. temperature channel 1	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
070	L2 T-EXTERN 1	Alarm 'Second limit value violated' for ext. temperature channel 1	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
071	L1 T-EXTERN 2	Alarm 'First limit value violated' for ext. temperature channel 2	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
072	L2 T-EXTERN 2	Alarm 'Second limit value violated' for ext. temperature channel 2	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
073	L1 P-EXTERN 1	Alarm 'First limit value violated' for ext. pressure channel 1	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
074	L2 P-EXTERN 1	Alarm 'Second limit value violated' for ext. pressure channel 1	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
075	L1 P-EXTERN 2	Alarm 'First limit value violated' for ext. pressure channel 2	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
076	L2 P-EXTERN 2	Alarm 'Second limit value violated' for ext. pressure channel 2	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
077	LIM EXT.COOLANT LEV.	Alarm from external coolant level monitor	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
078	LIM INTERCOOLER LEV.	Alarm from external charge air coolant level monitor	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
079	L Bin-EXTERN 3	Alarm from external binary channel 3 (plant)	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
080	L Bin-EXTERN 4	Alarm from external binary channel 4 (plant)	The measured value is read in via the CAN. The alarm is handled in MDEC.	✓	✓
081	RAIL LEAKAGE	Low pressure gradient on starting or high pressure gradient on stopping	High pressure system leaking, air in the system -> Engine documentation		✓
082	RAIL PRESSURE HIGH	Rail pressure above set value -> DBR reduction, injection start later	Interface transformer malfunction or interface transformer wiring B48 -> Engine documentation		✓
083	RAIL PRESSURE LOW	Rail pressure below set value -> DBR reduction	Interface transformer faulty or leakage in the high pressure system -> Engine documentation Message also appears when very large generators are in use and the rundown time exceeds 20 s -> Fault irrelevant		✓
089	ENGINE SPEED LOW	Engine speed has fallen below 200 rpm -> engine stop		✓	✓
090	IDLE SPEED LOW	Fault message during starting, idling speed not reached within the time defined in MP 169.05 (counting starts when speed limit in MP 170.04 is exceeded) -> start termination	Check for further messages	✓	✓
091	RUN UP SPEED LOW	Fault message during starting, runup speed (MP 170.04) not reached within the time defined in MP 169.04 (counting starts on exceeding the speed limit 80 rpm) -> start termination	Check for further messages	✓	✓
092	START SPEED LOW	Start error message, starter speed (MP 169.02) not reached within the time defined in MP 169.03 (counting starts when the starter is activated) -> start termination	Check for further messages	✓	✓
093	PREHEAT TEMP. LIMIT2	Coolant preheating temperature too low (second limit value undershot) -> start termination when MP 170.19 "No Start Break Preheat" is not set	Preheating temperature not reached	✓	✓
094	PREHEAT TEMP. LIMIT1	Coolant preheating temperature too low (first limit value undershot)	Preheating temperature not reached	✓	✓
099	DUMMY FAILURE	Dummy n			✓
100	EDM NOT VALID	Measuring point data checksum error in EDM	Electronics service	✓	✓
101	IDM NOT VALID	Measuring point data checksum error in IDM	Electronics service	✓	✓
102	INVALID FUEL CONS. 1	Accumulated fuel consumption checksum error in EDM (redundant data record 1)	Electronics service	✓	✓
103	INVALID FUEL CONS. 2	Accumulated fuel consumption checksum error in EDM (redundant data record 2)	Electronics service	✓	✓
104	OP HOURS1 NOT VALID	Operating hours counter checksum error in EDM	Electronics service	✓	✓
105	OP HOURS2 NOT VALID	Operating hours counter checksum error in IDM	Electronics service	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
106	ERR REC1 NOT VALID	Fault memory checksum error in EDM (redundant data record 1)	Electronics service	✓	✓
107	ERR REC2 NOT VALID	Fault memory checksum error in EDM (redundant data record 2)	Electronics service	✓	✓
118	L1 SUPPLY VOLT. LOW	If the supply voltage is below set lower limit value 1 (MP 101.01) the value calculated from the DBR curve is multiplied by 0.8 and injection start is delayed by 5°	Check battery/generator	✓	✓
119	L2 SUPPLY VOLT. LOW	If the supply voltage is below set lower limit value 2 (MP 101.03) the value calculated from the DBR curve is multiplied by 0.8 and injection start is delayed by 5°	Check battery/generator	✓	✓
120	L1 SUPPLY VOLT. HIGH	If the supply voltage is above set upper limit value 1 (MP 102.01) the value calculated from the DBR curve is multiplied by 0.8 and injection start is delayed by 5°	Check battery/generator	✓	✓
121	L2 SUPPLY VOLT. HIGH	If the supply voltage is above the set upper limit value 2 (MP 102.03) the engine is stopped, if configured (in MP 102.14 = T)	Check battery/generator	✓	✓
122	L1 T-ELECTRONIC	ECU temperature too high (first limit value exceeded)	Check electronics environment (heat accumulation)	✓	✓
134	15V POS ECU DEFECT	Internal electronics failure -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
136	15V NEG ECU DEFECT	Internal electronics failure -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
137	L1 5V BUFFER TEST	This fault can have various causes: 1. Pressure sensor fault 2. Sensor wiring 3. Internal electronics failure	Fault analysis for internal electronic fault: Disconnect connectors X2 and X3, ECU is faulty if fault message remains. Fault analysis of pressure sensors: Disconnect pressure sensors one after the other and pinpoint which sensor causes the fault. If both measures prove unsuccessful the fault lies in the cable harness.	✓	✓
138	SENSORPOWERDEFECT	This fault can have various causes: 1. Pressure sensor fault 2. Sensor wiring 3. Internal electronics failure	Fault analysis for internal electronic fault: Disconnect connectors X2 and X3, ECU is faulty if fault message remains. Fault analysis of pressure sensors: Disconnect pressure sensors one after the other and pinpoint which sensor causes the fault. If both measures prove unsuccessful the fault lies in the cable harness.	✓	✓
139	L1 TE BUFFER TEST	Internal electronics failure -> Sensor defect – alarm for dependent sensors, temperature values are set to default values	1. Sensor defect -> Electronics service 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
140	TE BUF. ECU DEFECT	Internal electronics failure -> Sensor defect – alarm for dependent sensors, temperature values are set to default values	1. Sensor defect -> Electronics service 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
142	BANK1 ECU DEFECT	Internal electronics failure -> engine does not start, electronics faulty, test with engine at standstill only	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
144	BANK2 ECU DEFECT	Internal electronics failure -> engine does not start, electronics faulty, test with engine at standstill only	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
145	15V_GOOD ECU DEFECT	Internal electronics fault -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
147	AD-TEST1 ECU DEFECT	Internal electronics failure -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
149	AD-TEST2 ECU DEFECT	Internal electronics failure -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
151	AD-TEST3 ECU DEFECT	Internal electronics failure -> engine stop due to electronics failure	Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
170	MI MODULE FAIL	Module in maintenance indicator faulty or missing	Check whether the MI is properly installed -> Electronics service	✓	✓
171	MI NOT ACTIVE	Maintenance indicator no longer active	Check whether the MI is properly installed -> Electronics service	✓	✓
173	MODULE WRITE LIMIT	EEPROM write limit reached	Electronics service	✓	✓
180	CAN1 NODE LOST	At least one Alive PDU on CAN 1 monitored by the ECU is missing -> connected device out of order		✓	✓
181	CAN2 NODE LOST	At least one Alive PDU on CAN 2 monitored by the ECU is missing -> connected device out of order		✓	✓
183	CAN NO PU-DATA	A CAN mode is selected in which communication is initialized with the help of the PU data module. However, the required PU data module is missing or invalid.	Test the devices connected to the CAN Download again via BDM -> Electronics service	✓	✓
184	CAN PU-DATA EE-FAIL	A programming error occurred in one or both modules on attempting to copy a received PU data module in both EEPROM modules.	Electronics service	✓	✓
185	CAN LESS MAILBOXES	Insufficient receiving mailboxes ready on one or both CAN controllers on initializing the receiving identifiers.	Electronics service	✓	✓
186	AN1 BUS OFF	CAN controller 1 in bus off state -> automatic switching to CAN 2	Causes are e.g. short-circuit, major disruptions or baud rate incompatibility	✓	✓
187	CAN1 ERROR PASSIVE	CAN controller 1 has signalled a warning	Causes are e.g. missing nodes, minor disruptions or temporary bus overloading	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
188	CAN2 BUS OFF	CAN controller 2 in bus off state -> automatic switching to CAN 1	Causes are e.g. short-circuit, major disruptions or baud rate incompatibility	✓	✓
189	CAN2 ERROR PASSIVE	CAN controller 2 has signalled a warning	Causes are e.g. missing nodes, minor disruptions or temporary bus overloading	✓	✓
201	SD T-COOLANT	Sensor defect (coolant temperature)	Short-circuit or wire breakage, check sensor and wiring to B6 -> Electronics service	✓	✓
202	SD T-FUEL	Sensor defect (fuel temperature)	Short-circuit or wire breakage, check sensor and wiring to B33 -> Electronics service	✓	✓
203	SD T-CHARGE AIR	Sensor defect (charge air temperature)	Short-circuit or wire breakage, check sensor and wiring to B9 -> Electronics service	✓	✓
205	SD T-COOLANT INTERC.	Sensor defect (charge air coolant temperature)	Short-circuit or wire breakage, check sensor and wiring to B26 -> Electronics service	✓	✓
208	SD P-CHARGE AIR	Sensor defect (charge pressure)	Short-circuit or wire breakage, check sensor and wiring to B10 -> Electronics service	✓	✓
211	SD P-LUBE OIL	Sensor defect (lube oil pressure)	Short-circuit or wire breakage, check sensor and wiring to B5 -> Electronics service	✓	✓
215	SD P-RAIL FUEL	Sensor defect (Rail pressure) -> high pressure governor emergency operation	Short-circuit or wire breakage, check sensor and wiring to B48 -> Electronics service		✓
216	SD T-LUBE OIL	Sensor defect (lube oil temperature)	Short-circuit or wire breakage, check sensor and wiring to B7 -> Electronics service	✓	✓
220	SD COOLANT LEVEL	Sensor defect (coolant level)	Short-circuit or wire breakage, check sensor and wiring to F33 -> Electronics service Note: If a sensor cable connector has been temporarily disconnected and then reconnected (e.g. next to the ECU), this fault message is signalled for a further approx. 60 min. The fault can be immediately cleared by switching the system off and back on.	✓	✓
223	SD LEVEL INTER-COOLER	Sensor defect (charge air coolant level)	Short-circuit or wire breakage, check sensor and wiring to F57 -> Electronics service Note: If a sensor cable connector has been temporarily disconnected and then reconnected (e.g. next to the ECU), this fault message is signalled for a further approx. 60 min. The fault can be immediately cleared by switching the system off and back on.		✓
229	SD ENG.SPEED SENSORS	Sensor defect crankcase speed and sensor defect camshaft speed	Compare alarms 230 and 231	✓	✓
230	SD CRANKSHAFT SPEED	Sensor defect (crankshaft speed)	Short-circuit or wire breakage, check sensor and wiring to B13 -> Electronics service	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
231	SD CAMSHAFT SPEED	Sensor defect (camshaft speed)	Short-circuit or wire breakage, check sensor and wiring to B1 -> Electronics service	✓	✓
240	SD P-FUEL	Sensor defect (fuel pressure)	Short-circuit or wire breakage, check sensor and wiring to B34 -> Electronics service		✓
245	SD POWER SUPPLY	Internal ECU failure	Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
246	SD T-ELECTRONIC	Internal ECU failure	Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
250	SD CAN SPEED DEMAND	Sensor defect CAN (Speed Demand) -> no set speed signal, the speed is either set to a fault value (MP 180.05) or remains set to the actual speed depending on the setting at MP 180.14.		✓	✓
266	SD SPEED DEMAND AN.	Sensor defect (analog speed setting) -> speed is set to a fault value or remains set to the actual speed (adjustable, MP 180.14)	Short-circuit or wire breakage, check set speed transmitter and wiring -> Electronics service	✓	✓
267	SD SP.DEM.TEST BENCH	Used in test stand mode only: Sensor defect (analog speed setting) -> speed is set to a fault value or remains set to the actual speed (adjustable, MP 180.14)	Short-circuit or wire breakage, check set speed transmitter and wiring -> Electronics service	✓	✓
271	SD T-EXTERN 1	Missing Data CAN (T-EXTERN 1)	Electronics service (external device faulty)	✓	✓
272	SD T-EXTERN 2	Missing Data CAN (T-EXTERN 2)	Electronics service (external device faulty)	✓	✓
273	SD P-EXTERN 1	Missing Data CAN (P-EXTERN 1)	Electronics service (external device faulty)	✓	✓
274	SD P-EXTERN 2	Missing Data CAN (P-EXTERN 2)	Electronics service (external device faulty)	✓	✓
275	SD EXT.COOLANT LEVEL	Missing Data CAN (EXT.COOLANT LEVEL)	Electronics service (external device faulty)	✓	✓
276	SD INTERCOOLER LEVEL	Missing Data CAN (charge air coolant level)	Electronics service (external device faulty)	✓	✓
277	SD BIN-EXTERN 3	Missing Data CAN (BIN-EXTERN 3)	Electronics service (external device faulty)	✓	✓
278	SD BIN-EXTERN 4	Missing Data CAN (BIN-EXTERN 4)	Electronics service (external device faulty)	✓	✓
301	TIMING CYLINDER A1	Cylinder A1: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
302	TIMING CYLINDER A2	Cylinder A2: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
303	TIMING CYLINDER A3	Cylinder A3: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ or - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
304	TIMING CYLINDER A4	Cylinder A4: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
305	TIMING CYLINDER A5	Cylinder A5: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
306	TIMING CYLINDER A6	Cylinder A6: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
307	TIMING CYLINDER A7	Cylinder A7: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
308	TIMING CYLINDER A8	Cylinder A8: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
309	TIMING CYLINDER A9	Cylinder A9: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
310	TIMING CYLINDER A10	Cylinder A10: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
311	TIMING CYLINDER B1	Cylinder B1: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
312	TIMING CYLINDER B2	Cylinder B2: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
313	TIMING CYLINDER B3	Cylinder B3: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
314	TIMING CYLINDER B4	Cylinder B4: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
315	TIMING CYLINDER B5	Cylinder B5: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
316	TIMING CYLINDER B6	Cylinder B6: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
317	TIMING CYLINDER B7	Cylinder B7: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
318	TIMING CYLINDER B8	Cylinder B8: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
319	TIMING CYLINDER B9	Cylinder B9: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
320	TIMING CYLINDER B10	Cylinder B10: - FPGA fault status = 2 - Time-of-flight $t < 600 \mu s$ - Time-of-flight $t > 1400 \mu s$	Replace solenoid valve if this occurs frequently -> Engine documentation	✓	✓
321	WIRING CYLINDER A1	Cabling fault cylinder A1 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
322	WIRING CYLINDER A2	Cabling fault cylinder A2 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
323	WIRING CYLINDER A3	Cabling fault cylinder A3 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
324	WIRING CYLINDER A4	Cabling fault cylinder A4 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
325	WIRING CYLINDER A5	Cabling fault cylinder A5 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
326	WIRING CYLINDER A6	Cabling fault cylinder A6 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
327	WIRING CYLINDER A7	Cabling fault cylinder A7 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
328	WIRING CYLINDER A8	Cabling fault cylinder A8 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
329	WIRING CYLINDER A9	Cabling fault cylinder A9 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
330	WIRING CYLINDER A10	Cabling fault cylinder A10 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
331	WIRING CYLINDER B1	Cabling fault cylinder B1 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
332	WIRING CYLINDER B2	Cabling fault cylinder B2 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
333	WIRING CYLINDER B3	Cabling fault cylinder B3 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
334	WIRING CYLINDER B4	Cabling fault cylinder B4 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
335	WIRING CYLINDER B5	Cabling fault cylinder B5 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
336	WIRING CYLINDER B6	Cabling fault cylinder B6 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
337	WIRING CYLINDER B7	Cabling fault cylinder B7 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
338	WIRING CYLINDER B8	Cabling fault cylinder B8 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
339	WIRING CYLINDER B9	Cabling fault cylinder B9 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
340	WIRING CYLINDER B10	Cabling fault cylinder B10 -> misfiring	SV short-circuit or +SV line shorted to electronic ground (Requirement: Engine block grounded) Replace solenoid valve or cable harness -> Engine documentation	✓	✓
341	OPEN_LOAD CYL. A1	Fault (interruption) in cabling of cylinder A1 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
342	OPEN_LOAD CYL. A2	Fault (interruption) in cabling of cylinder A2 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
343	OPEN_LOAD CYL. A3	Fault (interruption) in cabling of cylinder A3 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
344	OPEN_LOAD CYL. A4	Fault (interruption) in cabling of cylinder A4 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
345	OPEN_LOAD CYL. A5	Fault (interruption) in cabling of cylinder A5 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
346	OPEN_LOAD CYL. A6	Fault (interruption) in cabling of cylinder A6 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
347	OPEN_LOAD CYL. A7	Fault (interruption) in cabling of cylinder A7 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
348	OPEN_LOAD CYL. A8	Fault (interruption) in cabling of cylinder A8 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
349	OPEN_LOAD CYL. A9	Fault (interruption) in cabling of cylinder A9 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
350	OPEN_LOAD CYL. A10	Fault (interruption) in cabling of cylinder A10 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
351	OPEN_LOAD CYL. B1	Fault (interruption) in cabling of cylinder B1 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
352	OPEN_LOAD CYL. B2	Fault (interruption) in cabling of cylinder B2 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
353	OPEN_LOAD CYL. B3	Fault (interruption) in cabling of cylinder B3 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
354	OPEN_LOAD CYL. B4	Fault (interruption) in cabling of cylinder B4 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
355	OPEN_LOAD CYL. B5	Fault (interruption) in cabling of cylinder B5 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
356	OPEN_LOAD CYL. B6	Fault (interruption) in cabling of cylinder B6 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
357	OPEN_LOAD CYL. B7	Fault (interruption) in cabling of cylinder B7 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
358	OPEN_LOAD CYL. B8	Fault (interruption) in cabling of cylinder B8 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
359	OPEN_LOAD CYL. B9	Fault (interruption) in cabling of cylinder B9 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
360	OPEN_LOAD CYL. B10	Fault (interruption) in cabling of cylinder B10 -> misfiring	Check cabling and solenoid valve for interruption Replace solenoid valve or cable harness -> Engine documentation	✓	✓
361	POWER STAGE FAIL 1	Internal electronics failure (if fault permanently applied) -> possible quantity limitation	PA circuit faulty or free-wheeling transistor short-circuit Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
362	POWER STAGE FAIL 2	Internal electronics failure (if fault permanently applied) -> possible quantity limitation	PA circuit faulty or free-wheeling transistor short-circuit Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
363	STOP POWER STAGE 1	Internal electronics failure (FPGA messages 4,5,9,11,12) -> engine stop	1.SVline shorted to electronic ground by resistance less than 1 Ohm (engine block applied to electronic ground) Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
364	STOP POWER STAGE 2	Internal electronics failure (FPGA messages 4,5,9,11,12) -> engine stop	1.SVline shorted to electronic ground by resistance less than 1 Ohm (engine block applied to electronic ground) Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
365	STOP MV-WIRING	Solenoid valve wiring fault -> engine stop	SVline shorted to electronic ground (engine block applied to electronic ground) Replace cable harness -> Engine documentation	✓	✓
381	TRAN.OUT1 PLANT DEF	TAA1 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
382	TRAN.OUT2 PLANT DEF	TAA2 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓

No.	Fault display	Meaning/cause	Counteraction	2000	4000
383	TRAN.OUT3 PLANT DEF	TAA3 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
384	TRAN.OUT4 PLANT DEF	TAA4 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
385	TRAN.OUT5 PLANT DEF	TAA5 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓
386	TRAN.OUT6 PLANT DEF	TAA6 faulty	1. Wire breakage or short-circuit Replace cable harness -> Engine documentation 2. Electronics faulty Replace Engine Control Unit ECU See ID: T-E-G24-0001 Page 40	✓	✓