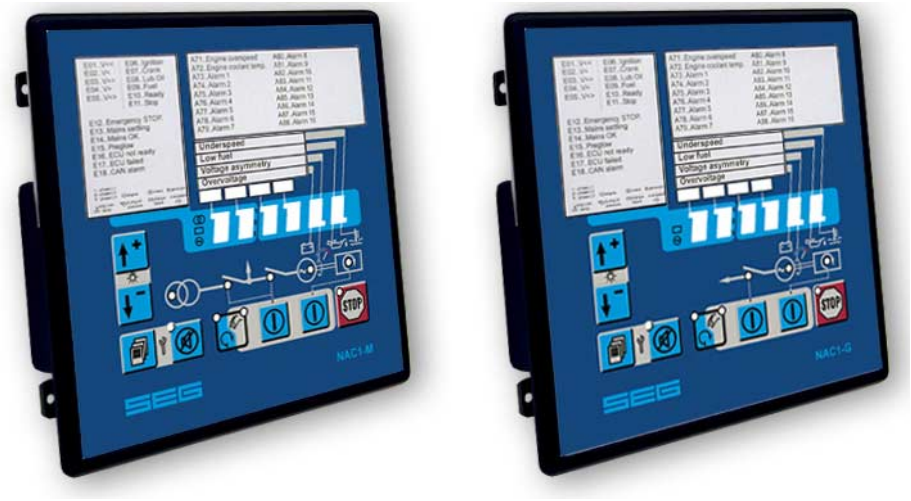
WOODWARD

SEG

NAC1 Genset Control SoftwareVersion 2.0



CE

WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed (overtemperature, or overpressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

CAUTION

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

Important definitions

WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.

NOTE

Provides other helpful information that does not fall under the warning or caution categories.

Revision History

Rev.	Date	Editor	Change
NEW	05-09-xx	TP	Release based on 37218A-draft01

Content

Illustrations and Tables

Illustrations

Tables

1 General Information

1.1 Related Documents

Type		English	German
NAC1 Series			
NAC1 – Manual	this manual ⇨	37350	-
Additional Manuals			
FL-SOFT3 – User Manual PC program for configuration, parameter visualisation, remote control, data logging, language upload, alarm and user management, and event recorder management. This manual describes the use of FL-SOFT3 software.		37305	GR37305
FL-SOFT3 – Engineering Manual PC program for configuration, parameter visualisation, remote control, data logging, language upload, alarm and user management, and event recorder management. This manual describes the programming of FL-SOFT3 software.		37306	GR37306

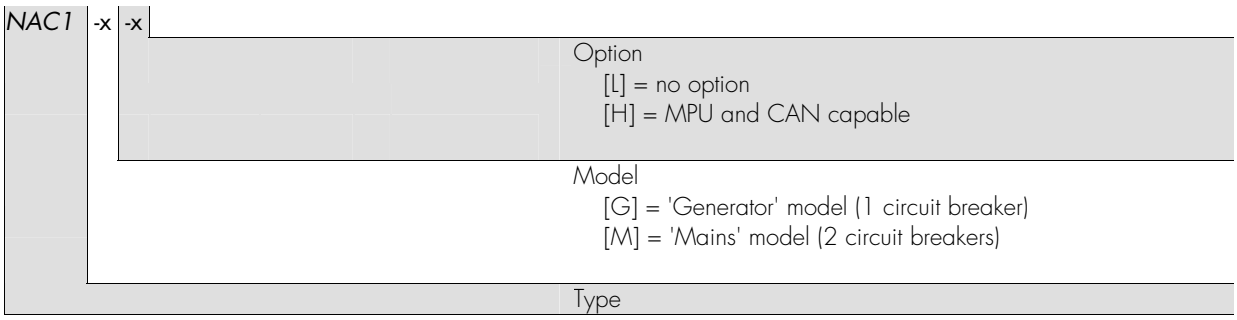
Table 1-1: Manual - overview

1.2 Overview

The *NAC1* Series generator set controller provides the following functions:

- Gen-set control
- Engine and generator protection
- Engine data measurement -
    - o including oil pressure and temperature, coolant temperature, battery voltage, speed, service hours, etc.
- Generator voltage measurement
- Engine crank sequencing
- Alarm display with circuit breaker trip and engine shutdown
- AMF (automatic mains failure) standby genset control with automatic engine start on a mains failure detection and open transition breaker control
- CAN bus communications to engine controllers

Type designation is as follows:



Examples:
NAC1-G-L (standard *NAC1* with 1 CB)
NAC1-M-H (standard *NAC1* with 2 CBs, MPU & CAN)

Intended Use The control unit must only be operated as described in this manual. The prerequisite for a proper and safe operation of the product is correct transportation, storage, and installation as well as careful operation and maintenance.

NOTE

This manual has been developed for a unit fitted with all available options. Inputs/outputs, functions, configuration screens and other details described, which do not exist on your unit may be ignored.

The present manual has been prepared to enable the installation and commissioning of the unit. Because of the large variety of parameter settings, it is not possible to cover every possible combination. The manual is therefore only a guide. In case of incorrect entries or a total loss of functions, the default settings can be taken from the enclosed list of parameters.

2 *NAC1* Series Overview

The *NAC1* Series consists of four models which are intended for different applications and requirements. This manual covers all available versions of the *NAC1* Series. Please take information about the differences between the units from this section.

Functionality \ NAC 1	[G-L]	[G-H]	[M-L]	[M-H]
Generator measurement	✓	✓	✓	✓
Mains measurement	–	–	✓	✓
GCB	✓	✓	✓	✓
MCB	–	–	✓	✓
MPU (pickup) Input	–	✓	–	✓
CAN bus (J 1939 protocol)	–	✓	–	✓

Table 2-1: NAC1 series product features

NOTE

Some parameters of the *NAC1* Series can only be configured using the FL-CABLE-RS232 and a notebook/PC with the software FL-SOFT3. These parameters are indicated with an FL in the parameter description under Parameters starting from page 65 and can not be configured at the unit directly.

The configuration with FL-SOFT3 via the FL-CABLE-RS232 is described under Configuration Using the PC on page 62.

The FL-CABLE-RS232 is not part of the *NAC1* shipment and sold separately.

IMPORTANT NOTE ABOUT COUNTERS

The counters for

- Operation hours
- Maintenance Interval
- Number of starts

can be recalibrated with FL-SOFT3 and the configuration files belonging to the unit. If 3rd party users are not allowed to change these values, you can easily remove the parameters which enable changing the counters by editing the FL-SOFT3 configuration files as described under Editing the Configuration File on page 63.

3 Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimise or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before performing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).

2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.

3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.

4. Opening the controFL cover may void the unit warranty.
   Do not remove the Printed Circuit Board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:

   - Ensure that the device is completely de-energised (all connectors must be disconnected).
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, connectors, or components with conductive devices with your hands.
   - When replacing a PCB, keep the new PCB in the protective antistatic bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the protective antistatic bag.

CAUTION

To prevent damage to electronic components caused by improper handling, read and observe the precautions in manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

4 Housing

4.1 Dimensions/Panel Cut-Out

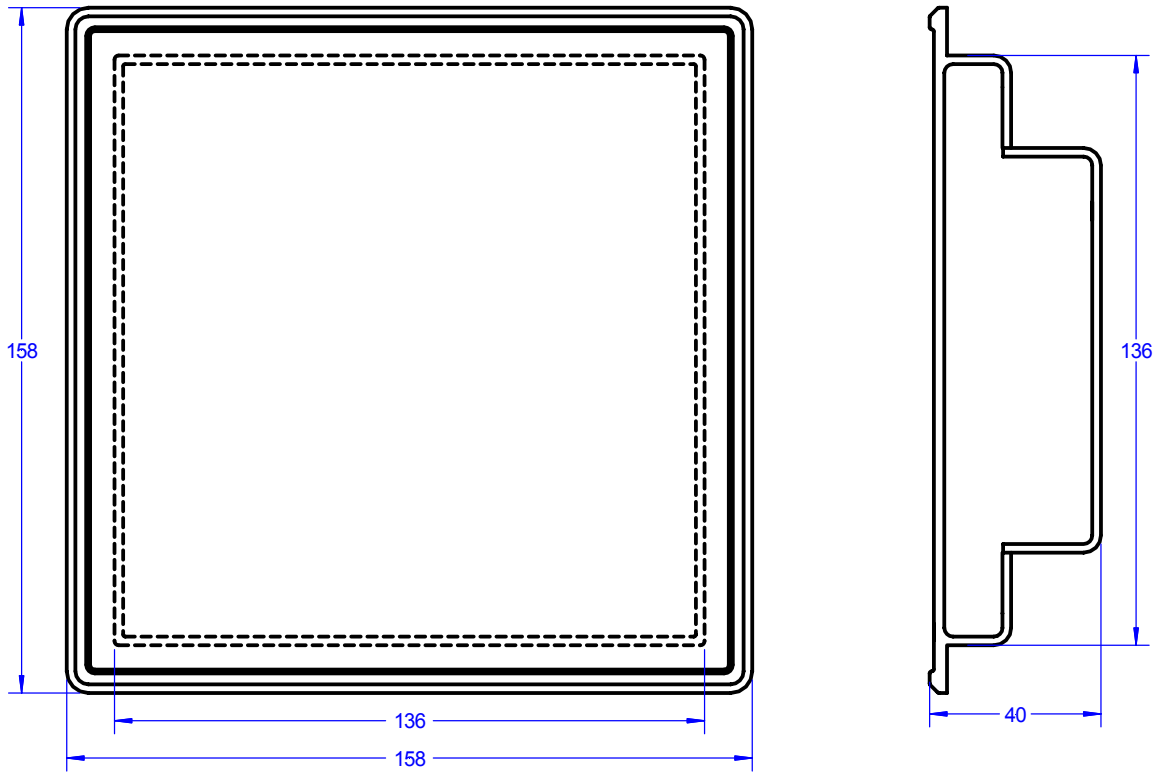


Figure 4-1: Housing - panel cut-out

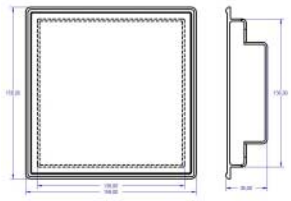
Description		Dimension	Tolerance
Height	Total	158 mm	–
	Panel cut-out	138 mm	+ 1.0 mm
	Housing dimension	136 mm	
Width	Total	158 mm	–
	Panel cut-out	138 mm	+ 1.0 mm
	Housing dimension	136 mm	
Depth	Total	40 mm	–

Table 4-1: Housing - panel cut-out

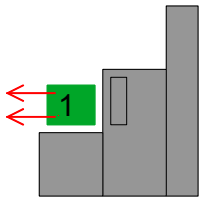
4.2 Installation

For installation into a door panel, proceed as follows:

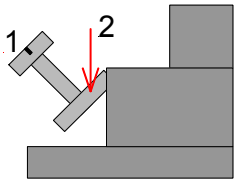
1. Panel cut-out
   Cut out the panel according to the dimensions in Figure 4-1.



2. Remove terminals
   Loosen the wire connection terminal screws on the back of the unit and remove the wire connection terminal strips if required (1).

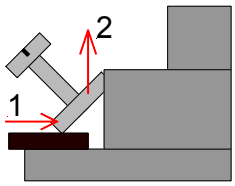


3. Loosen clamping screws
   Loosen the four clamping screws (1) until they are almost flush with the clamp inserts and tilt the clamp inserts down by 45° (2) to remove them from the housing. Do not completely remove the screws from the clamp inserts.

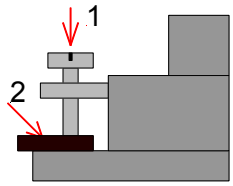


4. Insert unit into cut-out
   Insert the unit into the panel cut-out. Verify that the unit fits correctly in the cut-out. If the panel cut-out is not big enough, enlarge it accordingly. Ensure that the gasket is placed properly if used. Ensure that the paper strip is not pinched between gasket and panel to maintain isolation.

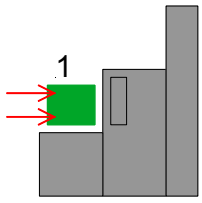
5. Attach clamp inserts
   Re-install the clamp inserts by tilting the insert to a 45° angle (1). Insert the nose of the insert into the slot on the side of the housing. Raise the clamp insert so that it is parallel to the control panel (2).



6. Tighten clamping screws
   Tighten the clamping screws (1) until the control unit is secured to the control panel (2). Over tightening of these screws may result in the clamp inserts or the housing breaking. Do not exceed the recommended tightening torque of 0.1 Nm.



7. Reattach terminals
   Reattach the wire connection terminal strips (1) and secure them with the side screws.



Note: If the gasket is damaged, it needs to be replaced. Use only the original gasket kit for replacement.

5 Wiring Diagrams

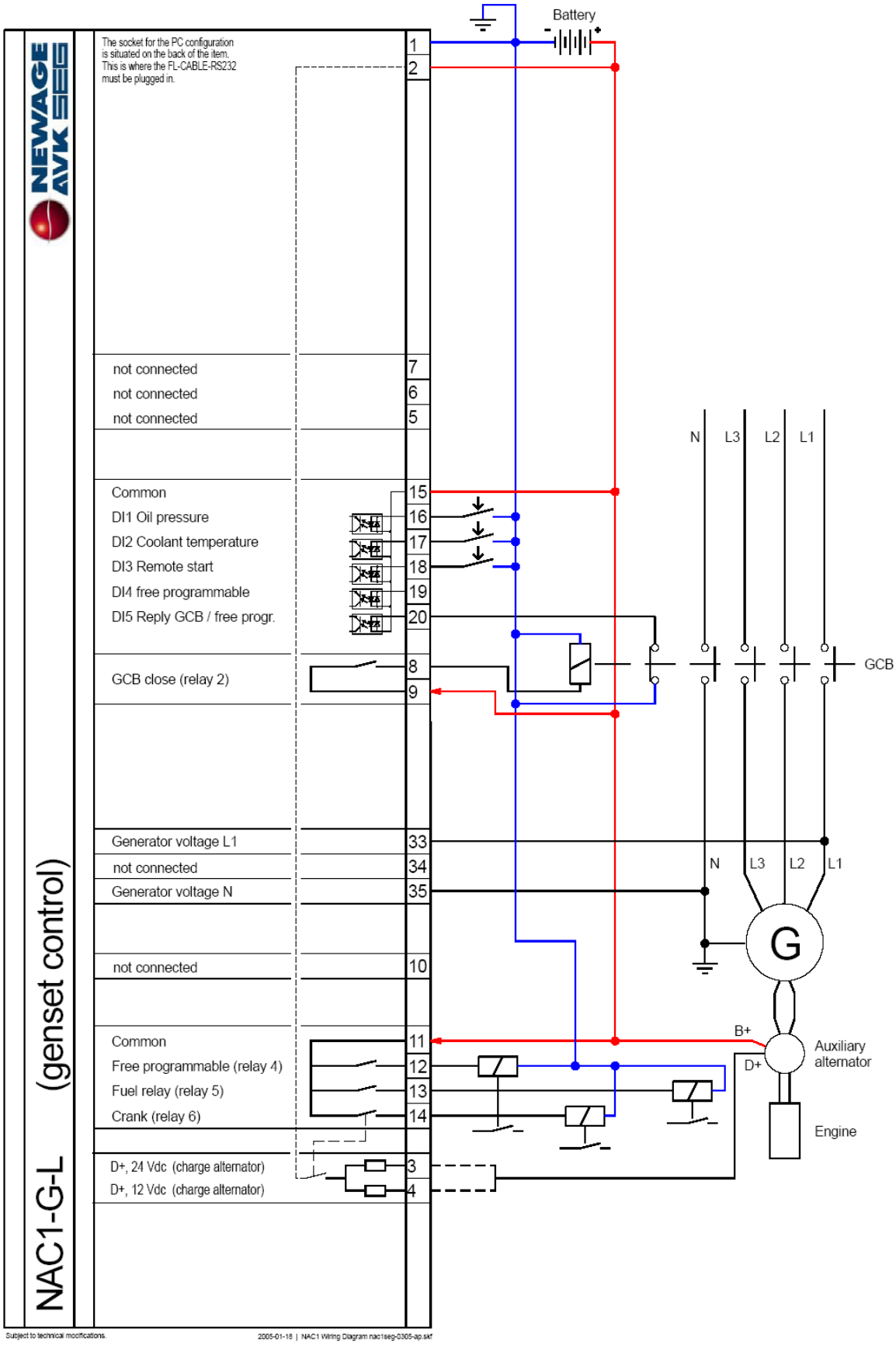


Figure 5-1: Wiring diagram - NAC1-G-L

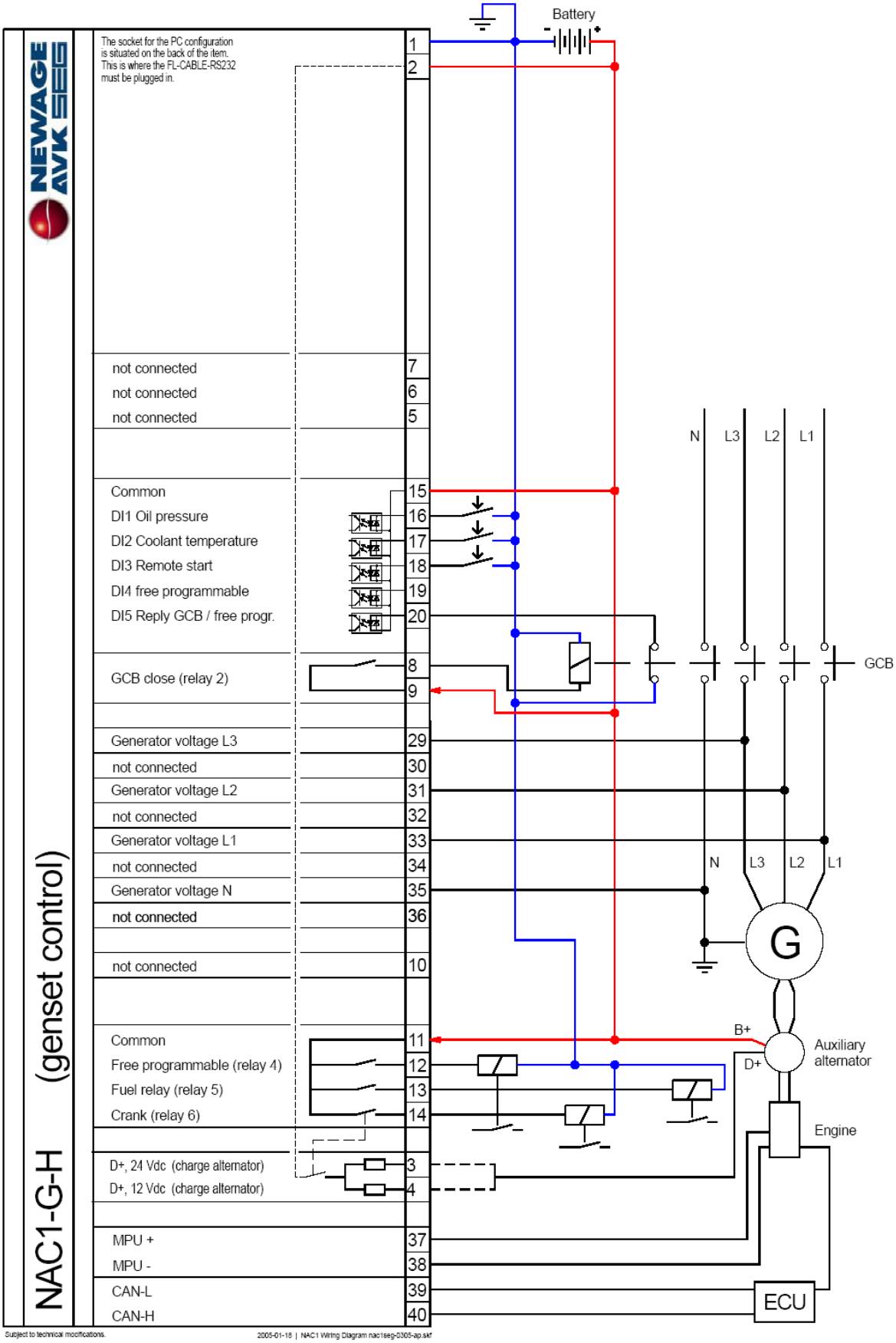


Figure 5-2: Wiring diagram - NAC1-G-H

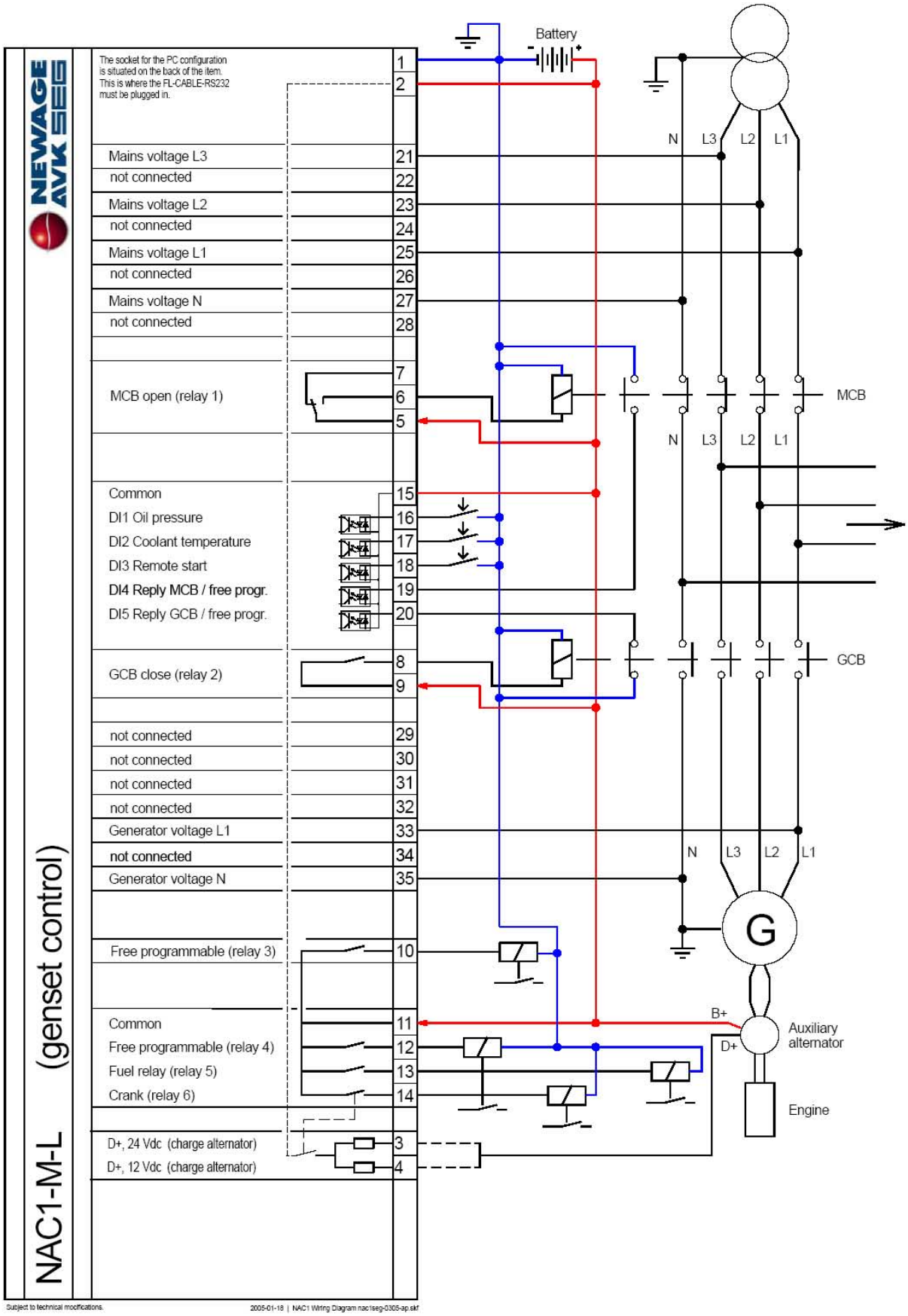


Figure 5-3: Wiring diagram - NAC1-M-L

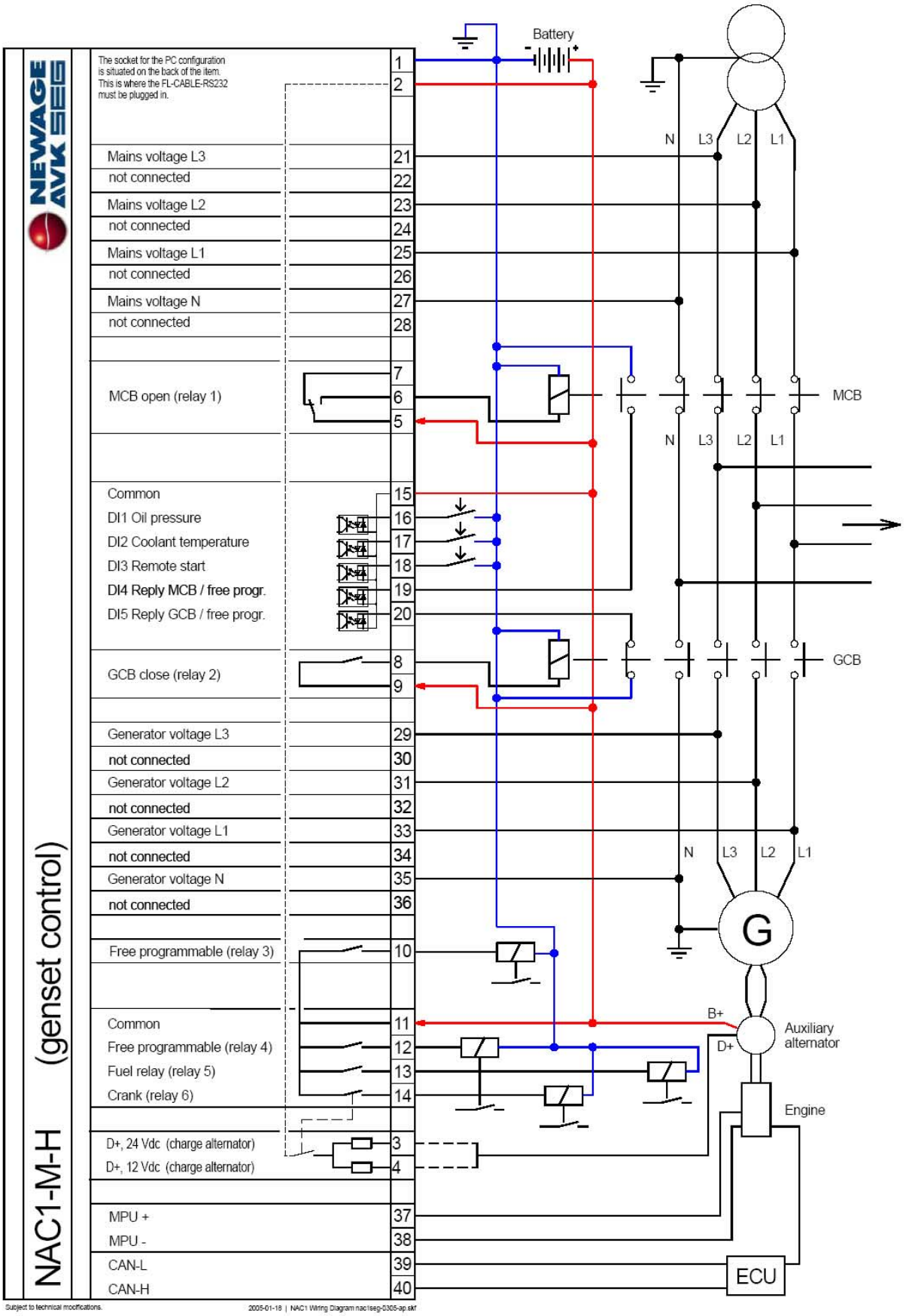


Figure 5-4: Wiring diagram - NAC1-M-H

6 Connections

6.1 Terminal Arrangement

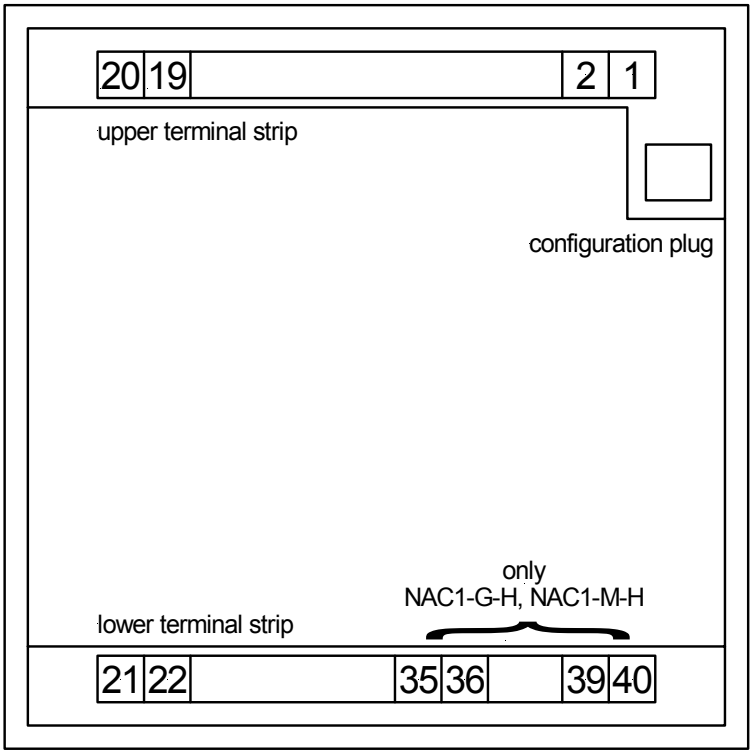


Figure 6-1: NAC1 back view - terminal arrangement

6.2 Power supply

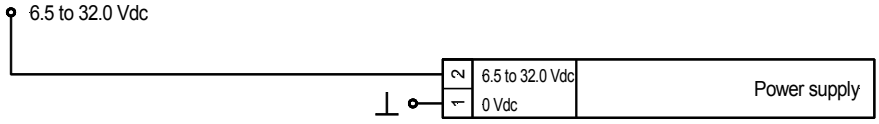


Figure 6-2: Power supply

Terminal	Description	A_{max}
1	0 Vdc reference potential	2.5 mm²
2	6.5 to 32.0 Vdc	2.5 mm²

Table 6-1: Power supply - terminal assignment

For a proper operation of the device, a minimum initial voltage of 10.5 Vdc is necessary when switching on the *NAC1*. After this, a continuous operating voltage between 6.5 and 32 Vdc is possible to operate the *NAC1* safely. The control unit is capable of handling voltage drops to 0 V for a maximum of 10 ms.

CAUTION

Ensure that the engine will be shut down by an external device in case the power supply of the *NAC1* control unit fails. Failure to do so may result in damages to the equipment.

6.3 Charging Alternator

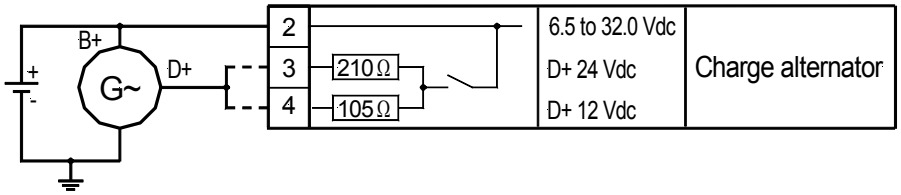


Figure 6-3: Charging alternator input/output

Terminal	Description	A_{max}
2	Battery B+	2.5 mm²
3	Charging alternator input D+ 24 Vdc	2.5 mm²
4	Charging alternator input D+ 12 Vdc	2.5 mm²

Table 6-2: Charging alternator input/output - terminal assignment

CAUTION

Terminal 3 must be used for charging voltages exceeding 16 Volts. Connecting the terminals 3 and 4 incorrectly, may result in damage to the unit.

NOTE

The charging alternator D+ acts as an output for pre-exciting the charging alternator during engine start-up only. During regular operation, it acts as an input for monitoring the charging voltage. Refer to Firing Speed Detection on page 57 for more information.

6.4 Voltage Measuring

The *NAC1* Series allows the use of different voltage measuring methods for generator and mains voltage depending on the model. These are described in the following text.

Measuring method	Description
3Ph 4W	Measurement is performed Line-Neutral (WYE connected system). Phase voltages and the neutral must be connected for proper calculation. The measurement, display and protection are adjusted according to the rules for WYE or delta connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, and V_{L31}, or • V_{L1N}, V_{L2N}, and V_{L3N}.
3Ph 3W	Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. The measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, V_{L31}.
1Ph 2W	Measurement is performed for single-phase systems. The measurement, display and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • V_{L1N}.
1Ph 3W	Measurement is performed for single-phase systems. The measurement, display and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • V_{L1N}, V_{L3N}.

Table 6-3: Voltage measuring principles

The above described voltage measuring methods are shown with appropriate wiring examples for the different models for generator and mains voltage measuring in Figure 6-4 to Figure 6-11.

NOTE

Please note that not all measuring methods can be performed with all models of the *NAC1* Series. The methods of measurement are indicated in the wiring diagrams for the respective models.

NOTE

FL-SOFT3 and a FL-CABLE-RS232 are required to configure the voltage measuring methods for all versions of the *NAC1* Series.

6.4.1 Voltage Measuring: Generator

a.) Voltage Measuring: Generator 3Ph 4W, [G-H], [M-H]

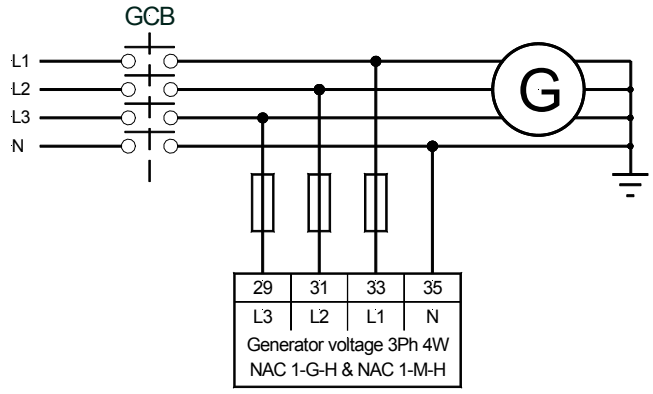


Figure 6-4: Voltage measuring - generator 3Ph 4W

b.) Voltage Measuring: Generator 3Ph 3W, [G-H], [M-H]

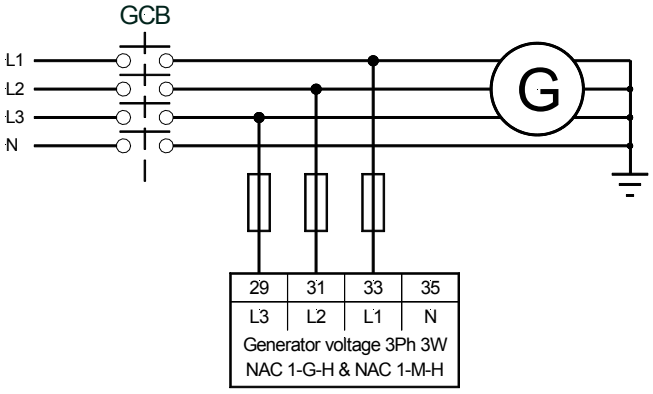


Figure 6-5: Voltage measuring - generator 3Ph 3W

c.) Voltage Measuring: Generator 1Ph 3W, [G-H], [M-H]

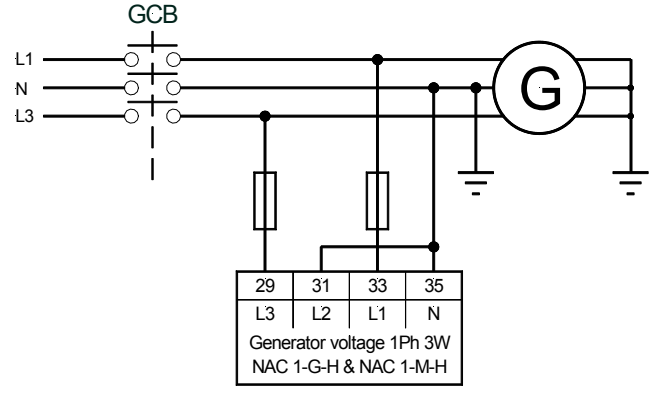


Figure 6-6: Voltage measuring - generator 1Ph 3W

d.) Voltage Measuring: Generator 1Ph 2W, [G-L], [G-H], [M-L], [M-H]

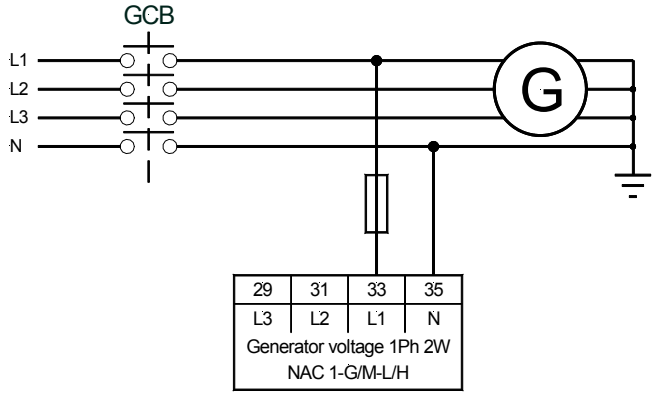


Figure 6-7: Voltage measuring - generator 1Ph 2W

Terminal	Description		$A_{max.}$
29	Generator voltage - phase L3	480 Vac	2.5 mm²
31	Generator voltage - phase L2	480 Vac	2.5 mm²
33	Generator voltage - phase L1	480 Vac	2.5 mm²
35	Generator voltage - phase N	480 Vac	2.5 mm²

Table 6-4: Voltage measuring - terminal assignment - generator voltage

6.4.2 Voltage Measuring: Mains, [M-L], [M-H]

a.) Voltage Measuring: Mains 3Ph 4W

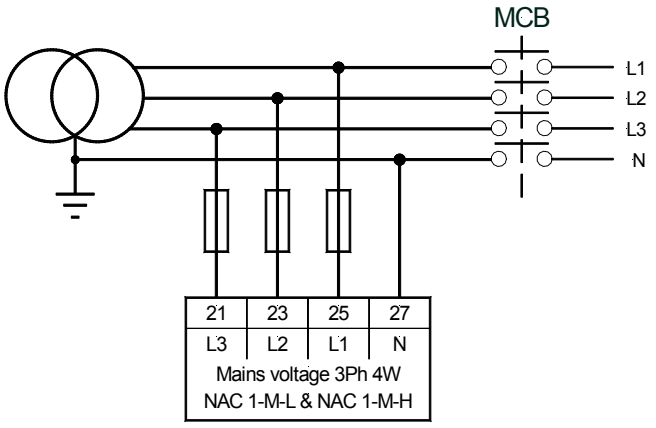


Figure 6-8: Voltage measuring - mains 3Ph 4W

b.) Voltage Measuring: Mains 3Ph 3W, [M-H]

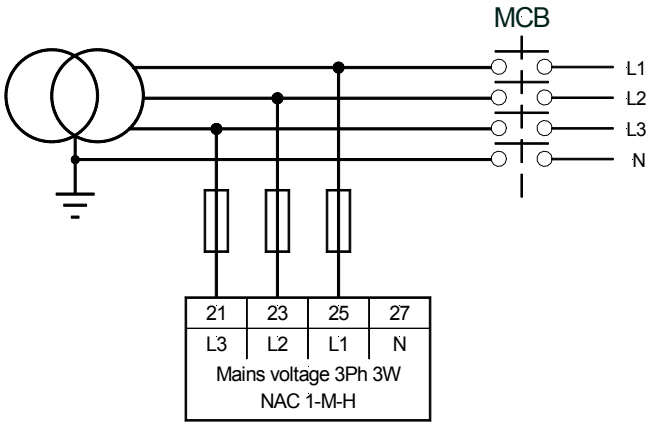


Figure 6-9: Voltage measuring - mains 3Ph 3W

c.) Voltage Measuring: Mains 1Ph 3W, [M-H]

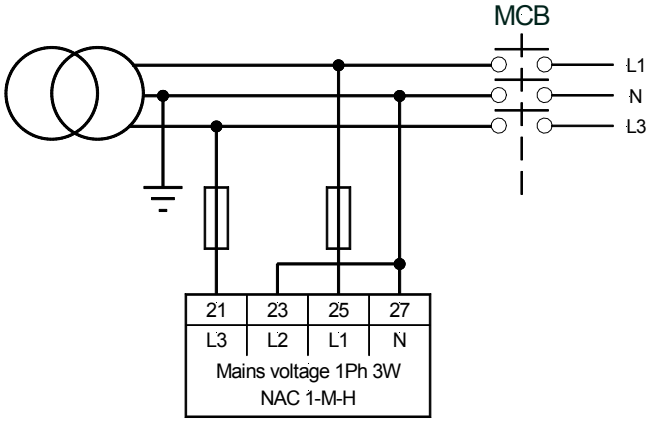


Figure 6-10: Voltage measuring - mains 1Ph 3W

d.) Voltage Measuring: Mains 1Ph 2W, [M-H]

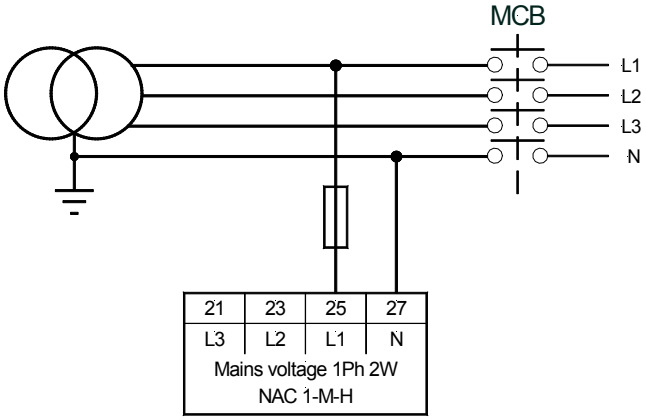


Figure 6-11: Voltage measuring - mains 1Ph 2W

Terminal	Description		$A_{max.}$
21	Mains voltage - phase L3	480 Vac	2.5 mm²
23	Mains voltage - phase L2	480 Vac	2.5 mm²
25	Mains voltage - phase L1	480 Vac	2.5 mm²
27	Mains voltage - phase N	480 Vac	2.5 mm²

Table 6-5: Voltage measuring - terminal assignment - mains voltage

6.5 MPU (Pickup) [G-H], [M-H]

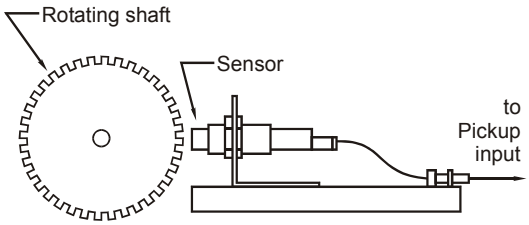


Figure 6-12: MPU - principle overview

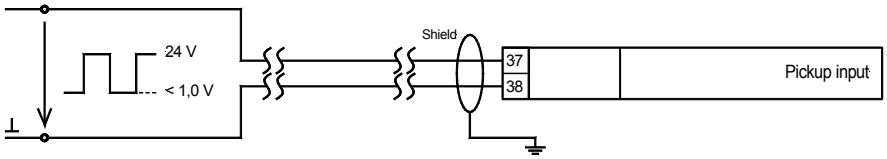


Figure 6-13: MPU input

Terminal	Description		A_{max}
37	MPU input	inductive/switching	2.5 mm²
38		GND	2.5 mm²

Table 6-6: MPU - terminal assignment

NOTE

The shield of the MPU connection cable must be connected on one side to a ground terminal of the cabinet near the *NAC1*. The shield must not be connected at the MPU side of the cable.

NOTE

The input frequency of the MPU must be limited to 14 kHz.

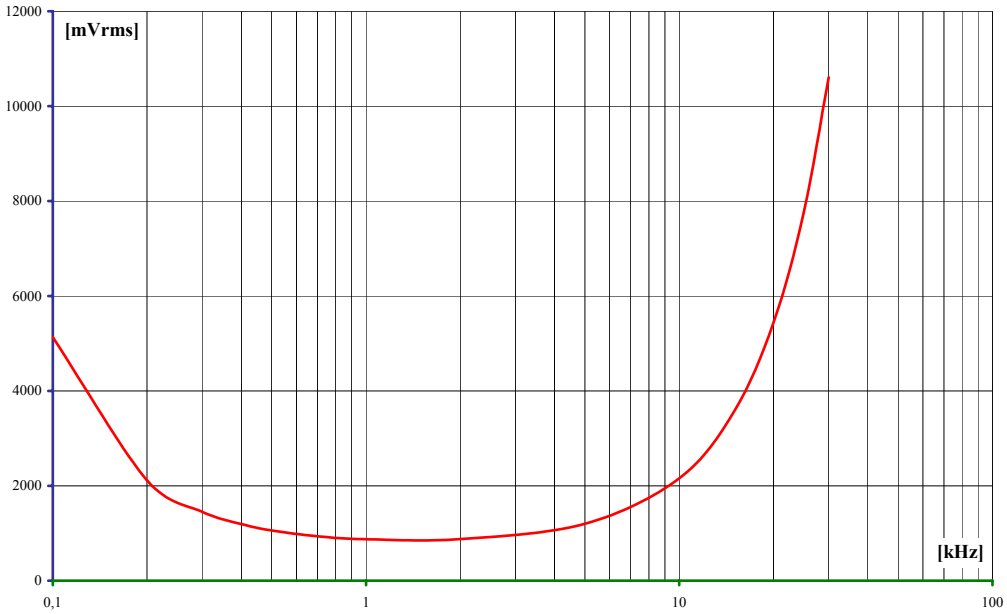


Figure 6-14: Minimum required input voltage depending on frequency

6.6 Discrete Inputs

6.6.1 Discrete Inputs: Bipolar Signals

The discrete inputs are galvanically isolated allowing for a bipolar connection. The discrete inputs are able to handle positive or negative signals.

NOTE

All discrete inputs must use the same polarity, either positive or negative signals, due to the common ground.

a.) Discrete Inputs: Positive Signal

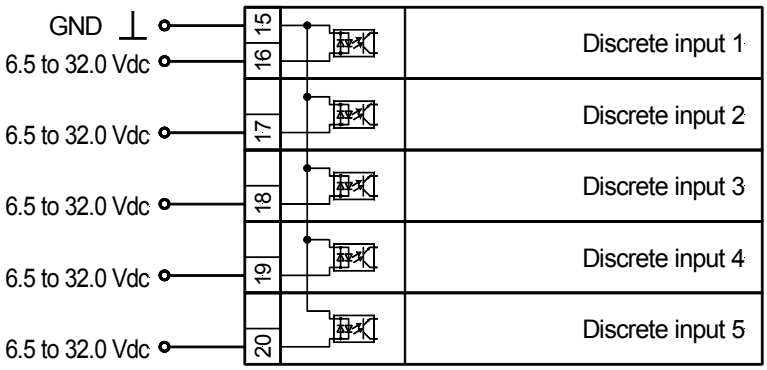


Figure 6-15: Discrete inputs - alarm/control input - positive signal

Terminal		Description			A_{max}
Term.	Com.			Type ⇩	
16	15	Discrete input [D1]	Low oil pressure	fixed	2.5 mm²
17		Discrete input [D2]	High coolant temperature	fixed	2.5 mm²
18		Discrete input [D3]	Remote start	fixed	2.5 mm²
19		Discrete input [D4]	Reply MCB or alarm input	SW	2.5 mm²
20		Discrete input [D5]	Reply GCB or alarm input	SW	2.5 mm²

SW..alarm input switchable via software, if parameter "Ignore CB reply" is set to "YES"

Table 6-7: Discrete input - terminal assignment - alarm/control input - positive signal

NOTE

The parameter "Ignore CB reply" (described on page 67) may only be configured via FL-SOFT3.

b.) Discrete Inputs: Negative Signal

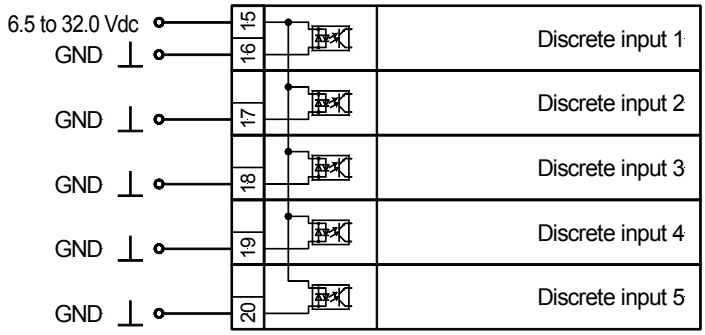


Figure 6-16: Discrete inputs - alarm/control input - negative signal

Terminal Com.	Terminal Term.	Description		Type ⇩	A_{max}
15	16	Discrete input [D1]	Low oil pressure	fixed	2.5 mm²
	17	Discrete input [D2]	High coolant temperature	fixed	2.5 mm²
	18	Discrete input [D3]	Remote start	fixed	2.5 mm²
	19	Discrete input [D4]	Reply MCB or alarm input	SW	2.5 mm²
	20	Discrete input [D5]	- Reply GCB or alarm input	SW	2.5 mm²

SW..alarm input switchable via software, if parameter "Ignore CB reply" is set to "YES"

Table 6-8: Discrete input - terminal assignment - alarm/control inputs - negative signal

6.6.2 Discrete Inputs: Operation Logic

Discrete inputs may be configured to be used for normally open (N.O) and normally closed (N.C.) contacts.
The default condition for N.O. is that the voltage signal is low. If the N.O. contact closes, the signal becomes high and the *NAC1* will detect an appropriate alarm or status.
The default condition for N.C. is that the voltage signal is high. If the N.C. contact opens, the signal becomes low and the *NAC1* will detect an appropriate alarm or status.

The N.O. or N.C. contacts may be connected to the signal terminal or to the ground terminal of the discrete input. See previous chapter .Discrete Inputs: Bipolar Signals on page 25 for details.

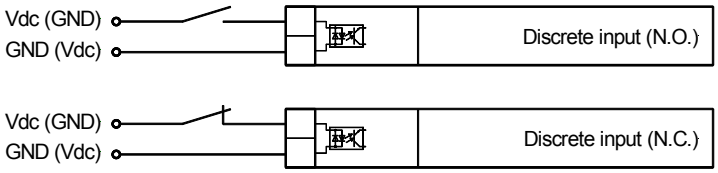


Figure 6-17: Discrete inputs - alarm/control inputs - operation logic

For the *NAC1* Series, the discrete inputs 1-3 are configured to a factory default and cannot be changed. The discrete inputs 4 and 5 are freely configurable depending on the parameter "Ignore CB reply". If this parameter is set to "YES", the discrete inputs are freely configurable, and the operation logic may be configured either to N.O. or N.C.

NOTE

The parameter "Ignore CB reply" (described on page 67) may only be configured via FL-SOFT3.

6.7 Relay Outputs

The *NAC1* Series provides up to six (6) galvanically isolated relay outputs. Some relay outputs have fixed assignments and cannot be configured.

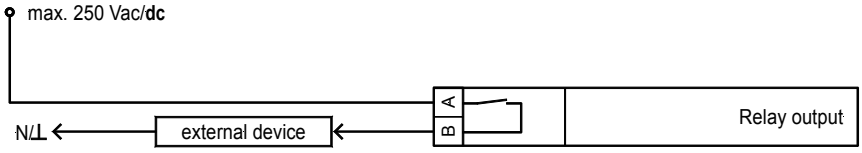


Figure 6-18: Relay outputs

Terminal		Description			$A_{max.}$
Term.	Com.				
A	B		Type ⇩		
5/6	7	Relay output [R1] [M-L], [M-H]	Command: open MCB	fixed	2.5 mm²
8	9	Relay output [R2]	Command: close GCB	fixed	2.5 mm²
10	11	Relay output [R3] [M-L], [M-H]	one from the configurable parameter list		2.5 mm²
12	11	Relay output [R4]	one from the configurable parameter list		2.5 mm²
13	11	Relay output [R5]	Fuel relay	fixed	2.5 mm²
14	11	Relay output [R6]	Crank	fixed	2.5 mm²

Table 6-9: Relay outputs - terminal assignment, part 1

The following conditions, located in Table 6-10, may be assigned to the relay outputs R3 **[M-L]**, **[M-H]** and R4 (refer to Relay Outputs). If a signal is selected for an *NAC1* version without this feature, the relay will not be triggered.

generator overfrequency	generator underfrequency	generator overvoltage
generator undervoltage	mains phase rotation mismatch **[M-L], [M-H]**	overspeed **[G-H], [M-H]**
underspeed **[G-H], [M-H]**	start fail	unintended stop
maintenance hours exceeded	battery undervoltage	charge alternator low voltage
discrete input 1	discrete input 2	discrete input 3
discrete input 4	discrete input 5	preglow
mode : automatic operation	all alarm classes	stopping alarm
engine released	horn	delayed close MCB **[M-L], [M-H]**
delayed close GCB		

Table 6-10: Relay outputs – configurable parameters

6.8 Interfaces

6.8.1 Overview

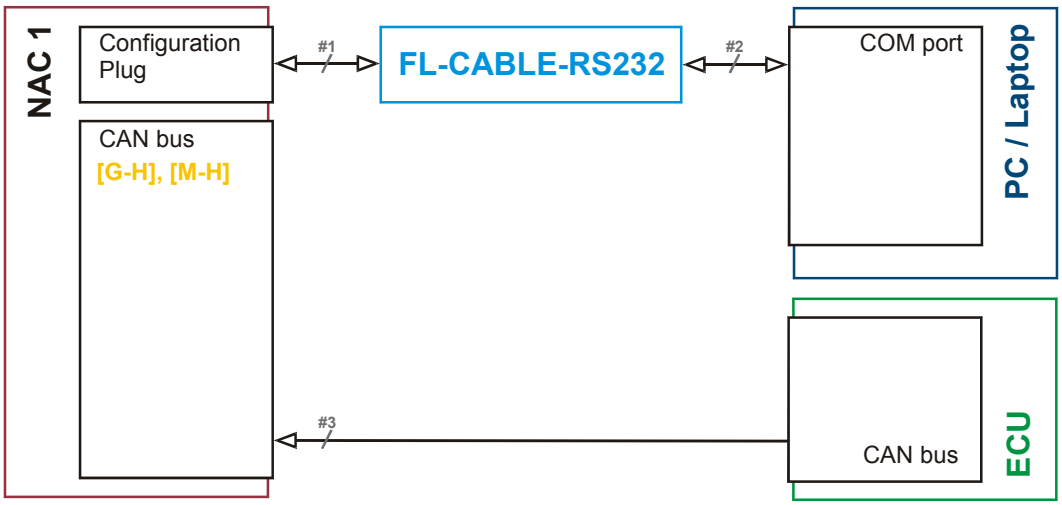


Figure 6-19: Interfaces - overview

No.	Connection from …	to …
#1	NAC 1 [FL-CABLE-RS232 connector]	FL-CABLE-RS232
#2	FL-CABLE-RS232	PC [COM-Port]
	PIN 1	PIN 4 (connect with PIN 8)
	PIN 2	PIN 3
	PIN 3	PIN 2
	PIN 4	PIN 1
	PIN 5	PIN 5
	N/A	N/A
	PIN 7	PIN 8 (connect with PIN 4)
	PIN 8	PIN 7
	PIN 9	PIN 9
		Connect PIN4/8
#3	NAC 1 [CAN terminals]	ECU [CAN port]
	Terminal 39 - CAN-L	CAN-H
	Terminal 40 - CAN-H	CAN-L
	CAN termination resistor between terminals 39/40	CAN termination resistor

Table 6-11: Interfaces - connection overview

NOTE

The FL-CABLE-RS232 is intended for service operation only. Do not operate the *NAC1* with the FL-CABLE-RS232 plugged into the unit during regular operation.

NOTE

The CAN interface is only used for the visualisation of J1939 data from the ECU.

6.8.2 CAN Bus - [G-H], [M-H]

a.) Wiring

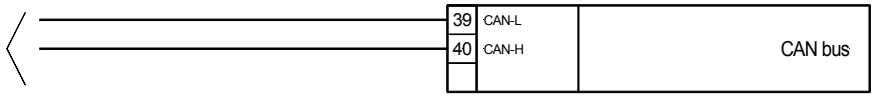


Figure 6-20: Interfaces - CAN bus

Terminal	Description		A_{max}
39	CAN bus	CAN-L	2.5 mm²
40		CAN-H	2.5 mm²

b.) Shielding

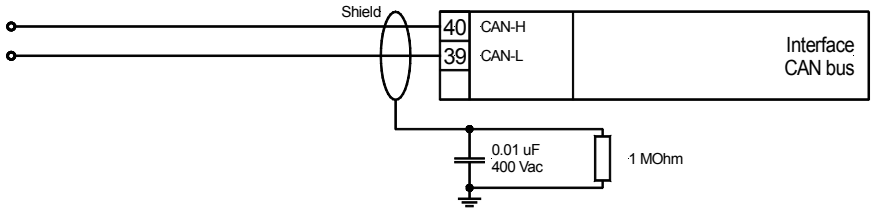


Figure 6-21: Interfaces - CAN bus - wiring of shielding

Please note that the CAN bus must be terminated at each end of the bus! Figure 6-22 is a schematic of the CAN bus with the termination resistors installed.

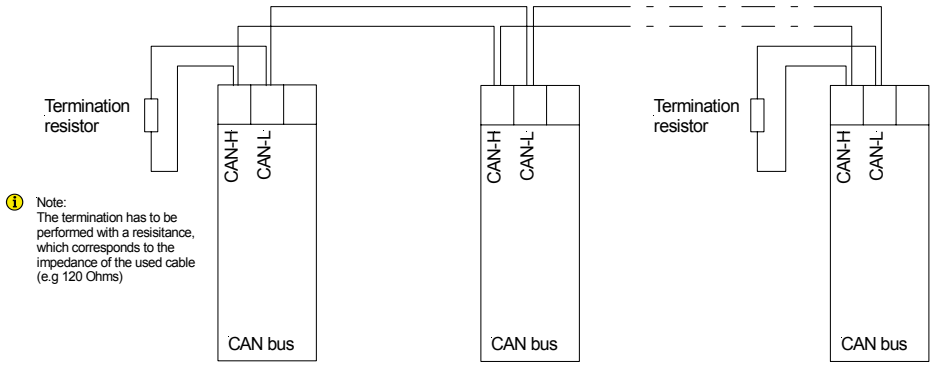


Figure 6-22: Interfaces - CAN bus – schematic wiring and termination

c.) Possible CAN Bus Problems

If no data is transmitted on the CAN bus, check the following common reasons for CAN bus communication problems:

- T structure bus is utilised
- CAN-L and CAN-H are interchanged
- Not all devices on the bus are using identical Baud rates
- Terminating resistor are missing
- Baud rate to high for wiring length

d.) Maximum CAN bus Length

The maximum length of the communication bus wiring is dependent on the configured Baud rate. Refer to Table 6-12 for the maximum bus length (Source: CANopen; Holger Zeltwanger (Hrsg.); 2001 VDE VERLAG GMBH, Berlin und Offenbach; ISBN 3-8007-2448-0).

Baud rate	Max. length
1000 kbit/s	25 m
800 kbit/s	50 m
500 kbit/s	100 m
125 kbit/s	250 m
50 kbits/s	1000 m
20 kbit/s	2500 m

Table 6-12: Maximum CAN bus length

The maximum specified length for the communication bus wiring might not be achieved if wire of poor quality is utilised, there is high contact resistance, or other conditions exist. Reducing the baud rate may overcome these issues.

6.8.3 FL-CABLE-RS232 - Direct Configuration Cable

NOTE

Please note that the configuration via the direct configuration cable FL-CABLE-RS232 is possible starting with Revision B (first delivered July 2003). If you have an older model please contact technical sales.

NOTE

The connection cables delivered with the FL-CABLE-RS232 must be used to connect between the control unit and the computer to ensure a proper function of the *NAC1*. Utilisation of an extension or different cable types for the connection between *NAC1* and FL-CABLE-RS232 can result in a malfunction of the *NAC1*. This may possibly result in damage to components of the system. If an extension of the data connection line is required, only the serial cable between FL-CABLE-RS232 and notebook/PC may be extended.

Unplug the FL-CABLE-RS232 after configuration to ensure a safe operation!

7 Operation and Navigation

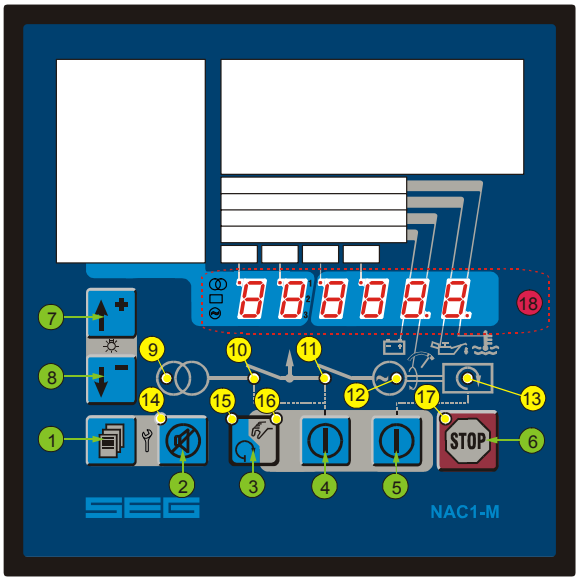


Figure 7-1: Front panel and display

Figure 7-1 illustrates the front panel/display which includes push-buttons, LEDs and the alphanumerical 7 segment LED display. A short description of the front panel is given below.

NOTE

This push-button is ALWAYS enabled and will stop the engine when pressed.

1 2 3 4 5 6 7 8

Push-buttons

The push buttons on the front panel are assigned to fixed functions of the unit.

9 10 11 12 13 14 15 16 17

LEDs

The LEDs indicate operating states of the unit and alarm messages. The right LED indicates that alarm messages are present in the unit.

18

7 segment LED display

This alphanumerical display is used to display all measured values, operating parameters, and alarm messages. A description of this display is detailed later in this manual.

7.1 Operation and Display

7.1.1 Purpose of the Status LEDs

The *NAC1* has several status LEDs to indicate the operating state. The LEDs indicate the following conditions:

LED 9 (on): Mains voltage present (only NAC1-M-L and NAC1-M-H)
LED 9 (flashing): Mains voltage and/or frequency are not within the Breaker Closure Limits (see page 55)
LED 10: Mains circuit breaker (MCB) closed (only NAC1-M-L and NAC1-M-H)
LED 11: Generator circuit breaker (GCB) closed
LED 12 (on): Generator in operation
LED 12 (flashing): Generator voltage and/or frequency are not within the .Breaker Closure Limits. (see page 55)
LED 13 (on): Engine in operation
LED 13 (flashing): Engine in operation, but engine monitoring delay time (see page 69) not yet expired
LED 14: Alarm message present
LED 15: Genset in automatic operation
LED 16: Genset in manual operation
LED 17: Genset stopped

A function test of all LEDs and the seven-segment display may be conducted by pressing the 7 and 8 buttons simultaneously.

7.1.2 Operating the NAC 1

- When the *NAC1* control unit is powered up and the genset is not operating, LED 17 is illuminated and the MCB is closed (only NAC1-M-L and NAC1-M-H).
- The control unit may be started in automatic mode or have the operation mode changed from automatic to manual by pressing the Auto - Manual button 3. LED 15 (automatic) or LED 16 (manual) will indicate the current mode of operation by the corresponding LED being illuminated.
- The Breaker Control button 4 enables the operator to open or close the circuit breaker(s) depending on the current state of the breaker and the control unit being in manual operation mode. This button is disabled in automatic operation mode.
- The Start/Stop Engine button 5 will start and stop the engine when the control unit is in manual operation mode. This button is disabled when the control unit is in automatic operation mode.
- The Stop button 6 is always enabled and when pressed while in the automatic mode will shut the engine down after the configured cool down period has expired. Pressing this button twice will shutdown the genset immediately.
- Active alarm messages may be acknowledged with the Alarm button 2. Alarm conditions are indicated when LED 14 is illuminated.
- When the *NAC1* is in normal operation, the operator may view the monitored parameters by using the Scroll button 1. The monitored values will be displayed on the 7-segment display 18 (a detailed description of the displayed operating values may be found later in this manual).

7.1.3 Acknowledging Alarm Messages

LED 14 will flash when an alarm is active. The alarm message will be displayed in the 7-segment display 18. Pressing the alarm button 2 will acknowledge the alarm, reset the alarm relay (if relay is configured for alarm input), and the LED will change from flashing to continuously illuminated. If more than one fault condition is present, the operator may display these messages by pressing the Scroll button 1. The alarm may be deleted by pressing and holding the Alarm button 2 a second time until the LED 14 is no longer illuminated. If the fault condition is still present, the LED 14 will remain illuminated and the unit stays in a locked mode according to the appropriate alarm condition.

7.1.4 Configuring the NAC 1

To enter the configuration mode, press the Scroll 1 and Alarm 2 buttons simultaneously. Pressing the Scroll button 1 will display the various parameters that may be changed. The displayed values for the parameters may be changed by pressing the 7 and 8 buttons (a detailed description of the parameters begins on page 65 of this manual). If the operator presses and holds these buttons, the rate of change for the value will increase. After the parameter has been adjusted to the desired value, enter it into the control unit by pressing the Scroll button 1 once. After a parameter has been changed and entered into the control unit, the operator may advance to the next parameters by pressing the Scroll button 1 a second time. To exit the configuration mode, press the Scroll 1 and Alarm 2 buttons simultaneously again.

7.1.5 Display of the Operating Values

The *NAC1* Series control units are able to display various measured values during operation depending on the respective *NAC1* model. You may advance through the single value displays using the Scroll button 1.

The values are displayed numerically, while the engineering unit, source, and phase are coded in the seven-segment display 18 if applicable. See the example below:

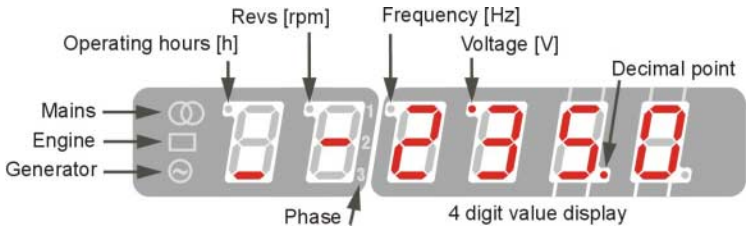


Figure 7-2: 6 digit 7 segment LED display

- The first digit (counted from left) indicates what is being measured, (mains, engine, or generator). The top horizontal segment indicates mains, the middle horizontal segment indicates engine, and the bottom horizontal segment indicates generator.
- The second digit indicates the measured phase. The top segment indicates L1, the middle horizontal segment indicates L2, and the bottom horizontal segment indicates L3. If only one line is displayed for phase measurement, a phase to neutral measurement is displayed. If two lines are displayed, a phase to phase measurement is shown.
- Digits 3-6 indicate what the measured value of the displayed parameter is.
- The indicators located at the top left of the first four digits of the display indicate the engineering unit of measure to be utilised. The indicators are assigned the following engineering units of measure.
  - Digit 1: Operating hours [h]
  - Digit 2: Revolutions [rpm]
  - Digit 3: Frequency [Hz]
  - Digit 4: Voltage [V]

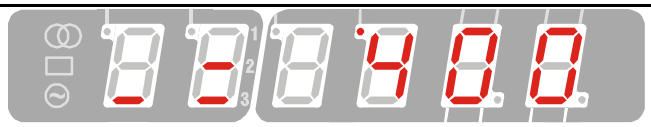
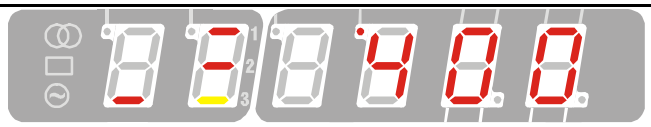
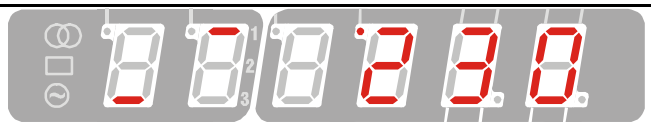
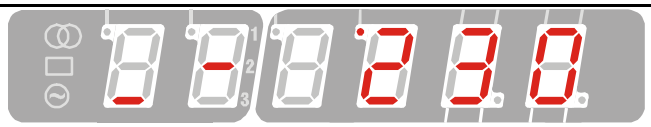
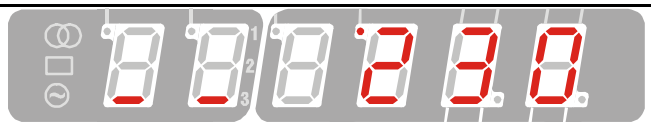
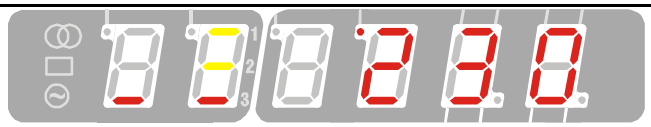
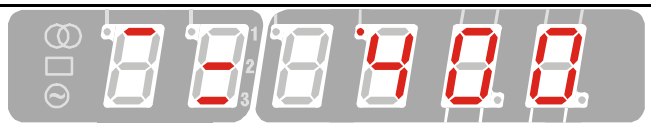
With this information, the example in the figure above reads as follows:
Voltage at generator between phase L2 and N is at 235.0 volts
Digit 1: Generator
Digit 2: Measurement between phase L2 and N
Digits 3 to 6: Numerical value 235.0
Indicator at digit 4: Voltage [V]

Digits 5 and 6 of the display are used to display eight different alarm states. The upper and lower vertical segments are used to indicate the various alarm states. Refer to Alarm Messages. on page 37 for the description of the alarm messages.

For customisation of your *NAC1* front using the paper strips, refer to Front Customisation on page 98.

7.1.6 Cycling Through the Displayed Operating Values

If the *NAC1* is in normal operation, the operator may advance through the different operating parameters using the Scroll button (1). The parameters are displayed in the order shown below (some parameters will not display if the related function is disabled or not available on the control unit):

Parameter	Display	Applies to	
Generator voltage V_{12} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage V_{23} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage V_{31} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage Average of the phase-phase voltages (two of the three phase-phase indicators are displayed alternately)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage V_{1N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓
Generator voltage V_{2N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage V_{3N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Generator voltage Average of the phase voltages (one of the three phase indicators is displayed alternately)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage V_{12} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage V_{23} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage V_{31} (phase-phase)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage Average of the phase-phase voltages (two of the three phase indicators are displayed alternately)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-

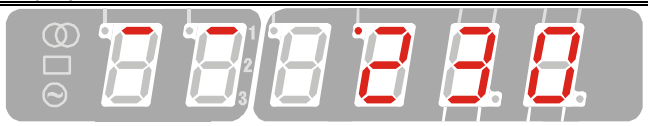
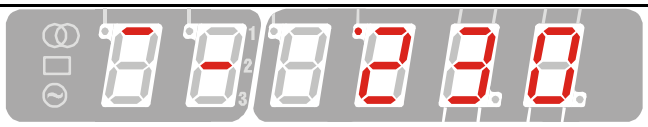
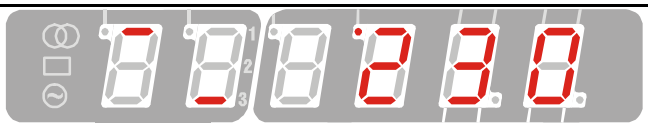
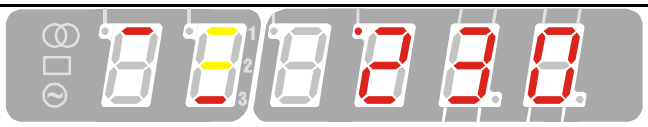
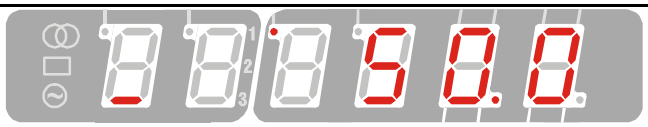
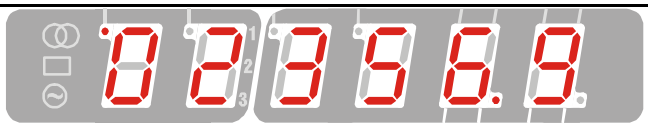
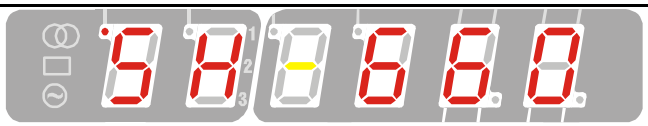
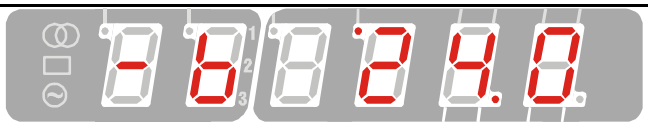
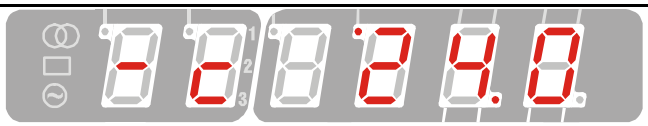
Parameter	Display	Applies to	
Mains voltage V_{1N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage V_{2N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage V_{3N} (phase voltage)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Mains voltage Average of the phase voltages (one of the three phase indicators is displayed alternately)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Rated generator frequency		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓
Rated mains frequency		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	-
		NAC1-G-L	-
Engine speed (display is not shown if the MPU is disabled)		NAC1-M-H	✓
		NAC1-M-L	-
		NAC1-G-H	✓
		NAC1-G-L	-
Operating hours counter (display is six-digit with one decimal)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓
Hours to next maintenance (a negative value indicates excess hours, maintenance overdue)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓
Battery voltage		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓
Charging voltage (display is suppressed if the charging voltage monitoring is disabled)		NAC1-M-H	✓
		NAC1-M-L	✓
		NAC1-G-H	✓
		NAC1-G-L	✓

Table 7-1: Display of operating values

If the Scroll button  is pressed again, the display returns to generator voltage V_{12}.
The display automatically returns after 180 second to generator voltage V_{12} being displayed if a button isn't pressed.

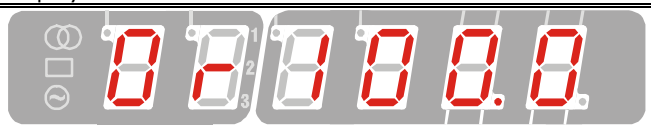
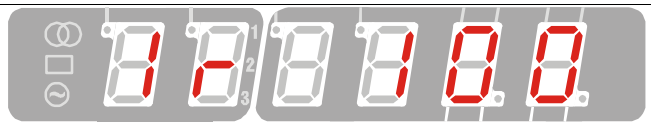
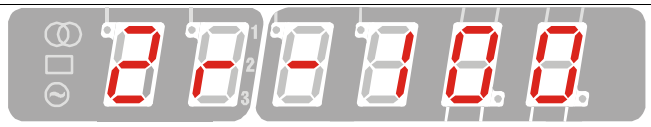
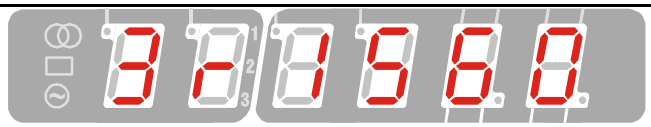
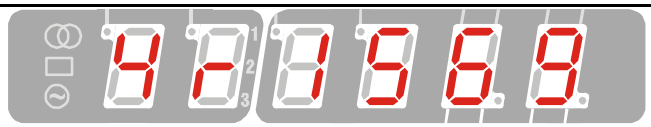
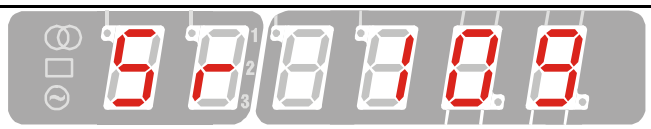
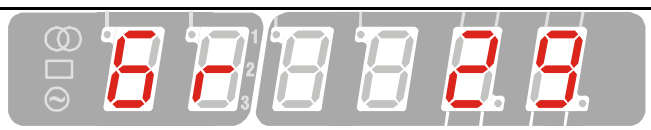
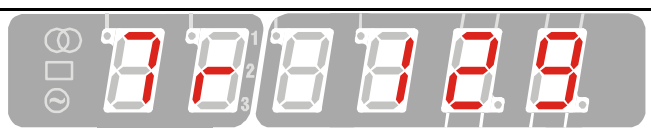
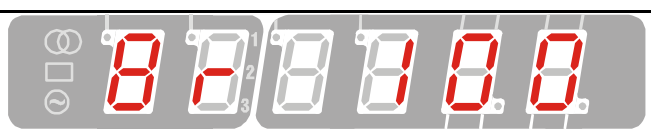
7.1.7 J1939 Visualisation [G-H], [M-H]

The *NAC1* with the X package is able to display standard J1939 messages, which are sent by the engine control to the *NAC1* via the CAN bus. The values are displayed on the unit and in FL-SOFT3. The PC/laptop running FL-SOFT3 must be connected via the FL-CABLE-RS232 (refer to page 29). It is also possible to display Scania S6 and Deutz EMR2 messages in FL-SOFT3. The J1939 visualisation can be configured with parameter **90**, J1939 device type. If this parameter is configured to Standard, the standard J1939 messages are displayed on the unit immediately following the operating values as described in the chapter Display of the Operating Values on page 34.
You find detailed information about the J1939 protocol under J1939 Protocol Descriptions starting on page 96.

NOTE

Only signals, which are present, will be displayed. If a signal is not sent to the control unit, the display of this value is not shown. If the sent values exceed the specified range, the displayed value is not defined.

The following J1939 messages can be displayed by the *NAC1*. The J1939 messages follow the operating values and can be viewed in the following order using the Scroll button 1. The values are updated by pressing the scroll button.

J1939 message		Display	Range	
1	Throttle position		0 to 100 %	
			Display	000.0
			SPN	91
			PGN	61443
2	Percent load at current RMP		0 to 250 %	
			Display	000
			SPN	92
			PGN	61443
3	Actual engine % torque		-125 to 125 %	
			Display	0000
			SPN	513
			PGN	61444
4	Engine speed		0 to 8032 rpm	
			Display	0000
			SPN	190
			PGN	61444
5	Total engine hours		0 to 9999 h	
			Display	0000
			SPN	247
			PGN	65253
6	Engine coolant temp		-40 to 210 °C	
			Display	000
			SPN	110
			PGN	65262
7	Fuel temperature		-40 to 210 °C	
			Display	000
			SPN	174
			PGN	65262
8	Engine oil temperature		-273 to 1735 °C	
			Display	0000
			SPN	175
			PGN	65262
9	Engine oil level		0 to 100 %	
			Display	000
			SPN	98
			PGN	65263

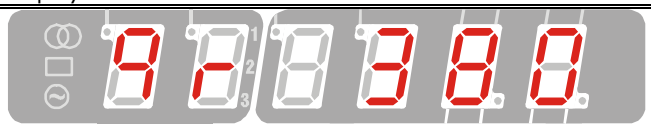
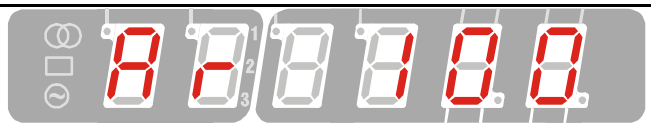
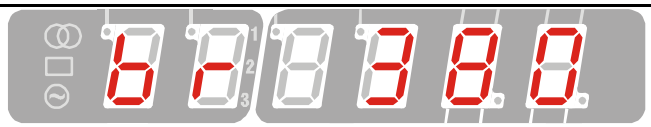
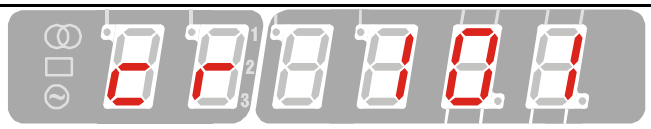
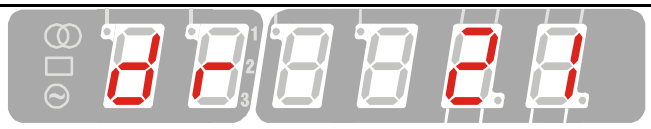
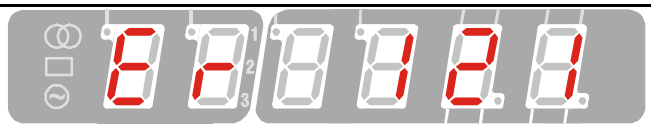
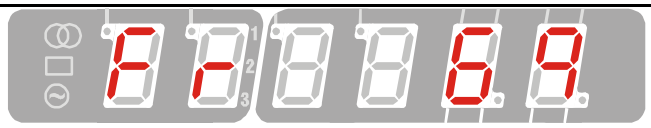
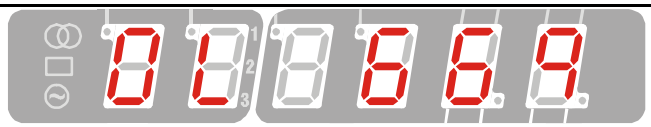
J1939 message		Display	Range	
10	Engine oil pressure		0 to 1000 kPa	
			Display	0000
			SPN	100
			PGN	65263
11	Coolant level		0 to 100 %	
			Display	000
			SPN	111
			PGN	65263
12	Fuel rate		0 to 3213 L/h	
			Display	0000
			SPN	183
			PGN	65266
13	Barometric pressure		0 to 125 kPa	
			Display	000
			SPN	108
			PGN	65269
14	Air inlet temperature		-40 to 210 °C	
			Display	000
			SPN	172
			PGN	65269
15	Boost pressure		0 to 500 kPa	
			Display	000
			SPN	102
			PGN	65270
16	Intake manifold temp.		-40 to 210 °C	
			Display	000
			SPN	105
			PGN	65270
17	Exhaust gas temperature		-273 to 1735 °C	
			Display	0000
			SPN	173
			PGN	65270

Table 7-2: J 1939 messages

In case of a defective sensor or a broken wire the *NAC1* displays four dashes instead of the J1939 value following the respective J1939 identifier.

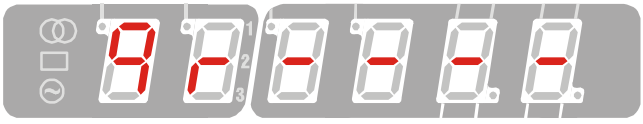


Figure 7-3: J1939 fault display

The above display shows that the engine oil pressure (identifier 9r) sensor is defective or the cable from the sensor to the ECU is unplugged or broken. A defective sensor or a broken wire is also displayed in FL-SOFT3. The display appearing in this case is described under J1939 Protocol Descriptions starting on page 96.

7.1.8 Alarm Messages

If the *NAC1* detects a fault condition, LED 14 starts to flash. The alarm message is displayed in the seven-segment display 18 with a blinking "A" for alarm, an alarm number, and the respective alarm segment, if applicable. The alarm may be acknowledged by pressing the Alarm button 2. The flashing LED and "A" will change to a continuously illuminated state and the relay will be reset. If more alarm conditions are present, the operator may advance through the different alarm messages using the Scroll button 1. By pressing the Alarm button 2 again, the alarm may be cleared unless the fault condition is still present.
Figure 7-4 shows the additional alarm states using the vertical segments of the last two digits of the seven-segment display 18. The four top segments are pre-assigned with the alarms shown in Figure 7-4, but are freely configurable via FL-SOFT3 for common alarms from a list of alarms located in Table 7-4. The customer-defined paper strip label allows for a customised front display panel. The lower four segments are permanently assigned to engine alarms (battery undervoltage (alarm no. 50A), engine over/underspeed (no. 20A/21A), oil pressure (no. 60A), and coolant temperature (no. 61A)).

Symbol	Alarm
	Battery undervoltage
	Engine over-/underspeed
	Oil pressure
	Coolant overtemperature

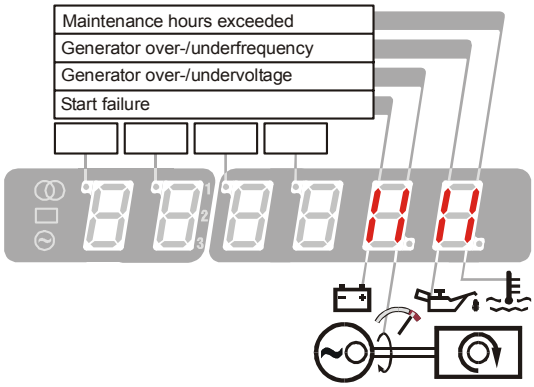


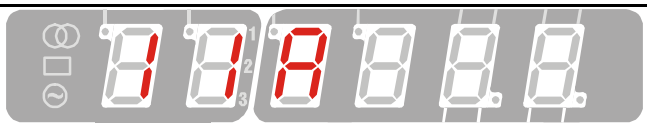
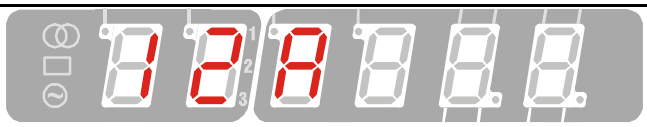
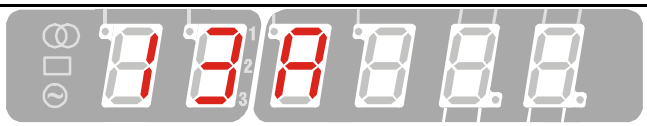
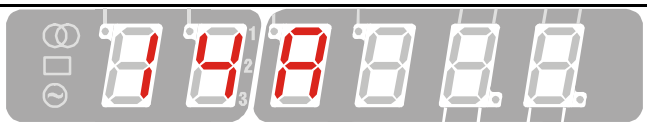
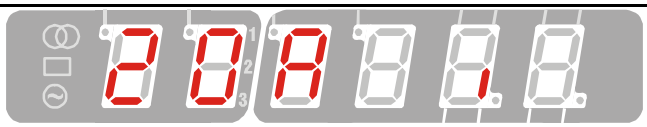
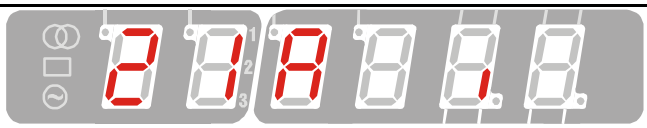
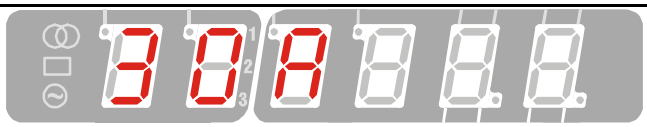
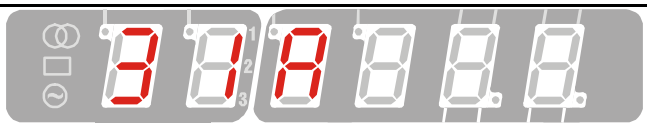
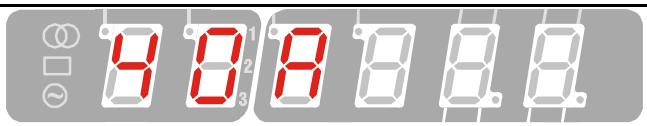
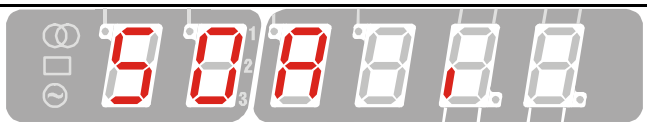
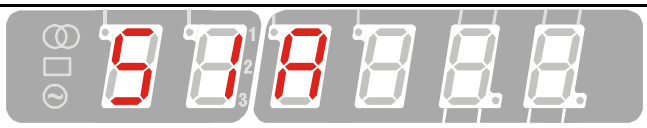
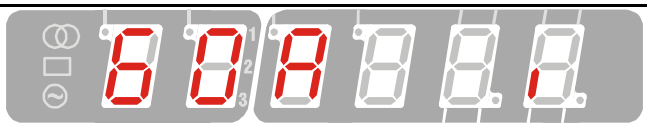
Figure 7-4: Additional alarm display

The alarm messages are assigned to different alarm classes depending on their importance and required reaction. You find more information about this under „Alarm Classes“ on page 95. The following alarm classes exist:

Class	Description	Reaction of the system
B	Alarm	The operation is not interrupted but a centralised alarm is issued.
F	Shutdown	The GCB will be opened immediately and the engine will be stopped without cool down.

Table 7-3: Alarm classes

The following table displays the possible alarm messages:

Alarm		Alarm class	Display	Applies to	
10	Generator overfrequency	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
11	Generator underfrequency	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
12	Generator overvoltage	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
13	Generator undervoltage	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
14	Mains rotation field mismatch	B: Alarm		M-H	✓
				M-L	✓
				G-H	-
				G-L	-
20	Engine overspeed	F: Shutdown		M-H	✓
				M-L	-
				G-H	✓
				G-L	-
21	Engine underspeed	F: Shutdown		M-H	✓
				M-L	-
				G-H	✓
				G-L	-
30	Start fail	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
31	Unintended stop	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
40	Maintenance hours	B: Alarm		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
50	battery undervoltage	B: Alarm		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
51	Charge failure	B: Alarm		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
60	DI1: Oil pressure	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓

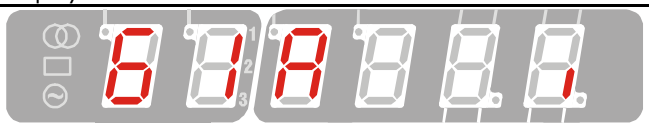
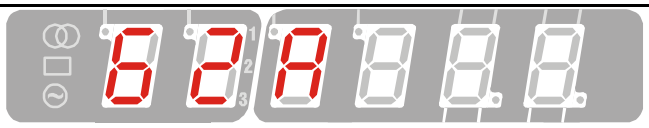
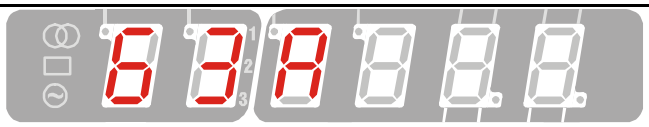
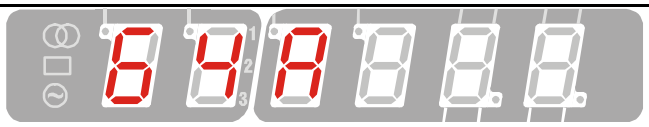
Alarm		Alarm class	Display	Applies to	
61	DI2: Coolant temperature	F: Shutdown		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
62	DI4: MCB reply or free configurable	Control input/ Selectable B or F		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
63	DI5: GCB reply or free configurable	Control input/ Selectable B or F		M-H	✓
				M-L	✓
				G-H	✓
				G-L	✓
64	J1939 CAN Error	Selectable B or F		M-H	✓
				M-L	-
				G-H	✓
				G-L	-

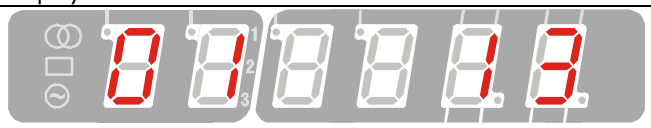
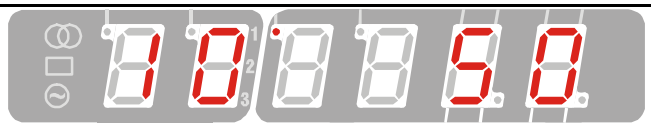
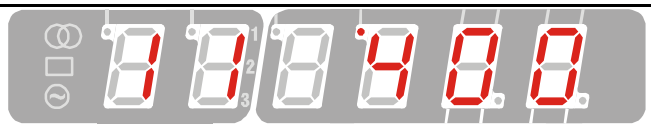
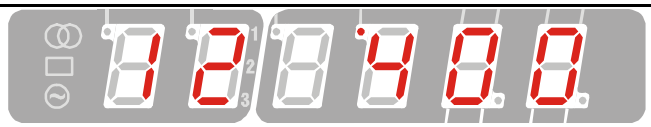
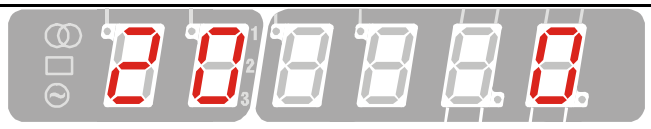
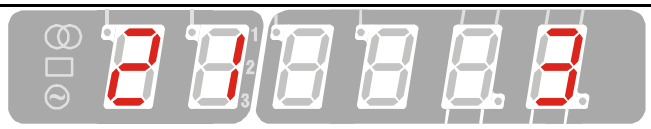
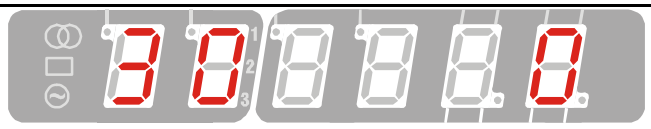
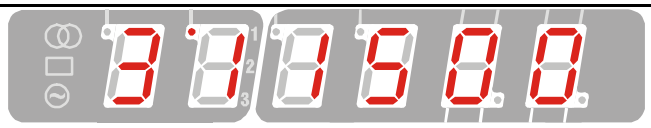
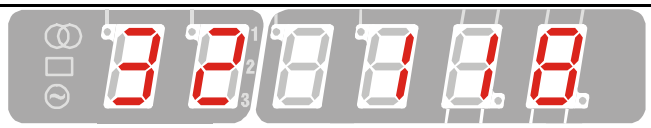
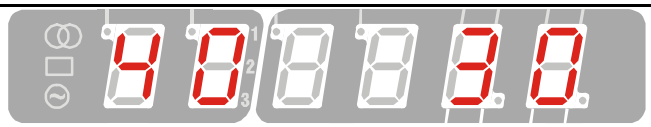
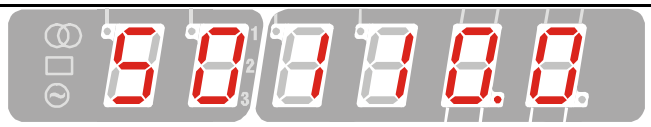
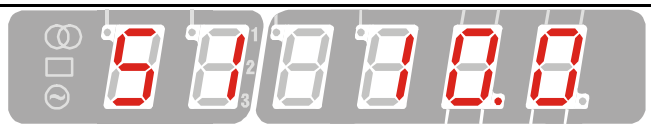
Table 7-4: Alarm messages

NOTE

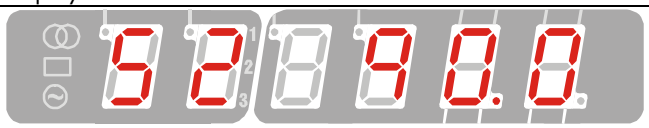
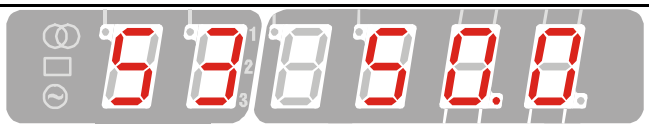
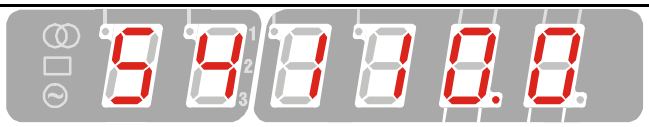
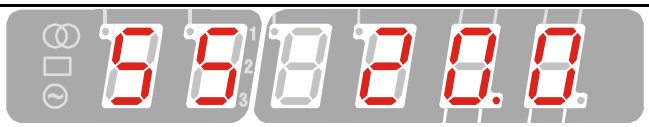
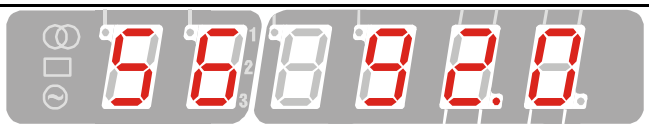
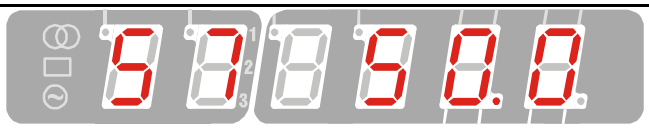
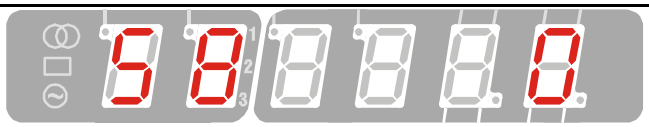
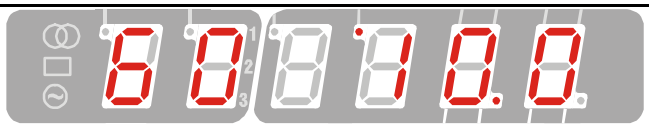
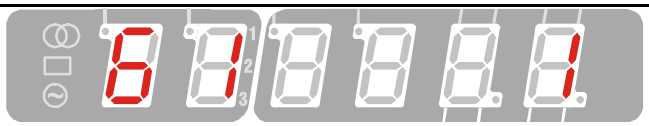
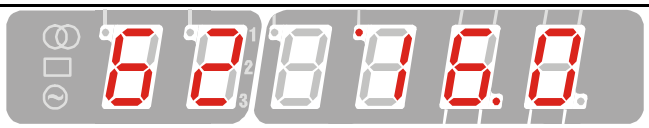
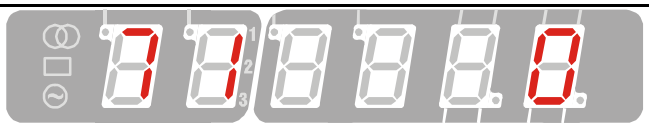
Discrete Inputs 4 & 5: If the parameter "Ignore Breaker Replies" (only changeable via FL-SOFT3) is set to "YES", the discrete inputs for 4 and 5 are no longer control inputs. These discrete inputs may now be used as freely configurable alarm inputs. All alarm classes may be configured for these discrete inputs.

7.1.9 Configuration Displays

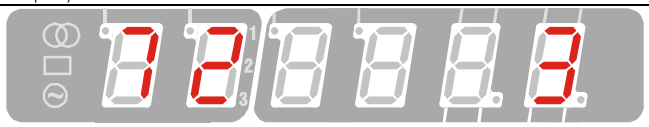
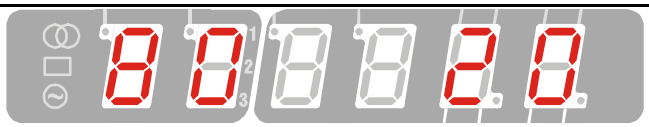
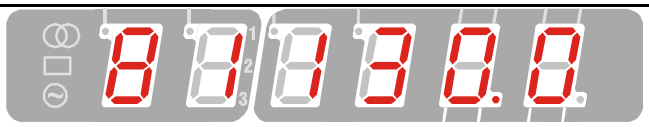
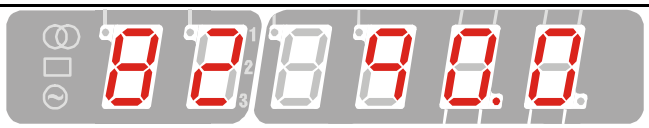
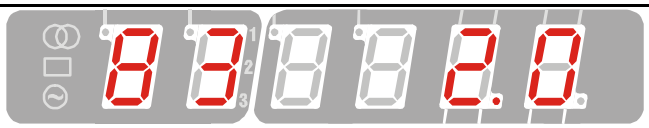
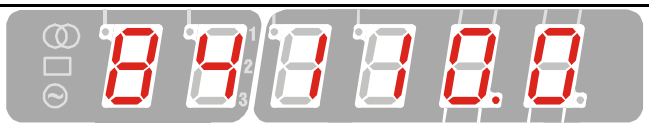
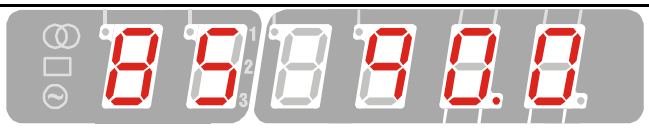
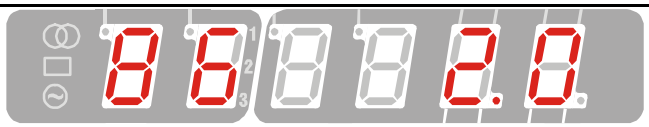
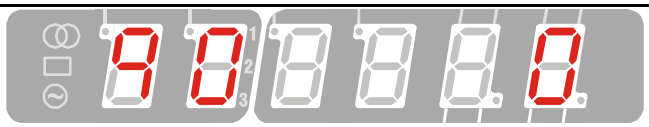
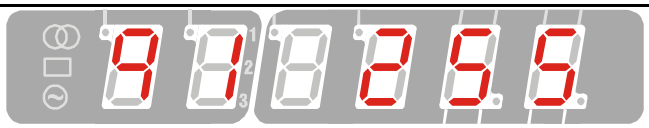
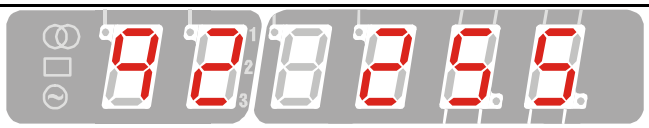
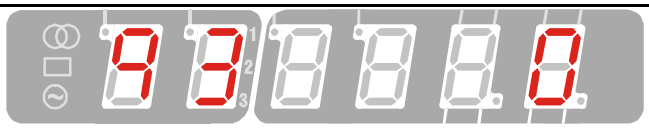
The following parameters can be configured as described under Configuring the on page 33:

Parameter		Range	Display	Applies to	
01 DL 1	Time until horn reset	0 to 1000 s [1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
10 DL 3	Rated frequency	50 Hz, 60 Hz		M-H M-L G-H G-L	✓ ✓ ✓ ✓
11 DL 3	Generator rated voltage	50 to 480 V [1 V interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
12 DL 3	Mains rated voltage	50 to 480 V [1 V interval]		M-H M-L G-H G-L	✓ ✓ - -
20 DL 3	Fuel relay (open/close)	0 = open to stop 1 = close to stop		M-H M-L G-H G-L	✓ ✓ ✓ ✓
21 DL 3	Preglow time	0 to 999 s [1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
30 DL 3	MPU (pickup) on/off	0 = off, 1 = on		M-H M-L G-H G-L	✓ - ✓ -
31 DL 3	Nominal speed	500 to 4000 rpm [1 rpm interval]		M-H M-L G-H G-L	✓ - ✓ -
32 DL 3	Number of teeth	2 to 260 teeth [1 tooth interval]		M-H M-L G-H G-L	✓ - ✓ -
40 DL 3	Cooldown time	0 to 999 s [1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
50 DL 3	Generator overfrequency threshold	50.0 to 130.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
51 DL 3	Generator overfrequency delay time	0.1 to 99.9 s [0.1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓

DL..Display Level (parameter 72)

Parameter		Range	Display	Applies to	
52 DL 3	Generator under-frequency thresh-old	50.0 to 130.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
53 DL 3	Generator under-frequency delay time	0.1 to 99.9 s [0.1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
54 DL 3	Generator over-voltage threshold	50.0 to 125.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
55 DL 3	Generator over-voltage delay time	0.1 to 99.9 s [0.1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
56 DL 3	Generator under-voltage threshold	50.0 to 125.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
57 DL 3	Generator under-voltage delay time	0.1 to 99.9 s [0.1 s interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
58 DL 3	Engine overspeed monitoring on/off	0 = off, 1 = on		M-H M-L G-H G-L	✓ - ✓ -
59 DL 3	Engine overspeed threshold	0 to 9999 rpm [1 rpm interval]		M-H M-L G-H G-L	✓ - ✓ -
60 DL 3	Battery undervolt-age threshold	8.0 to 42.0 V [0.1 V interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
61 DL 3	Battery charge failure monitoring on/off	0 = off, 1 = on		M-H M-L G-H G-L	✓ ✓ ✓ ✓
62 DL 3	Battery charge failure monitoring threshold	0.0 to 32.0 V [0.1 V interval]		M-H M-L G-H G-L	✓ ✓ ✓ ✓
71 DL 1	Reset maintenance hours	0 = no, 1 = yes		M-H M-L G-H G-L	✓ ✓ ✓ ✓

DL..Display Level (parameter 72)

Parameter		Range	Display	Applies to	
72 DL 1	Display level	1, 2, 3		M-H M-L G-H G-L	✓ ✓ ✓ ✓
80 DL 3	Mains settling time	0 to 9999 s [1 s interval]		M-H M-L G-H G-L	✓ ✓ - -
81 DL 3	Mains over-voltage threshold	50.0 to 130.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
82 DL 3	Mains under-voltage threshold	50.0 to 130.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
83 DL 3	Mains voltage hysteresis	0.0 to 50.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
84 DL 3	Mains overfrequency threshold	70.0 to 160.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
85 DL 3	Mains under-frequency threshold	70.0 to 160.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
86 DL 3	Mains frequency hysteresis	0.0 to 50.0 % [0.1 % interval]		M-H M-L G-H G-L	✓ ✓ - -
90 DL 3	J1939 Device Type	0 = Off 1 = J1939 2 = Scania S6 3 = Deutz EMR		M-H M-L G-H G-L	✓ - ✓ -
91 DL 3	Requested Send Address	0 to 255 [1 step interval]		M-H M-L G-H G-L	✓ - ✓ -
92 DL 3	Receive Device Number	0 to 255 [1 step interval]		M-H M-L G-H G-L	✓ - ✓ -
93 DL 3	J1939 Monitoring	0 = Off 1 = On		M-H M-L G-H G-L	✓ - ✓ -

DL..Display Level (parameter 72)

Table 7-5: Configuration displays

NOTE

The display automatically returns to generator voltage V_{12} being displayed if a button isn't pressed within 180 seconds.

8 Functional Description

8.1 Overview

	Application mode			
	{1 breaker open/close}		{2 breakers open/close }	
NAC1 Version	[G-L], [G-H], [M-L], [M-H]		[M-L], [M-H]	
Operation Mode	MAN	AUTO	MAN	AUTO
Operate the engine				
• Start engine by:				
the engine START - STOP push button	YES	–	YES	–
the discrete input DI3 (remote start)	–	YES	–	YES
emergency power (AMF)	–	–	–	YES
• Stop engine by:				
the STOP push button	YES	YES	YES	YES
the engine START - STOP push button	YES	–	YES	–
the discrete input DI3 (remote start)	–	YES	–	YES
emergency power (AMF)	–	–	–	YES
an alarm (i.e. overspeed)	YES	YES	YES	YES
Operate GCB				
• close GCB				
the BREAKER CONTROL push button (only if engine is running)	YES	–	YES	–
emergency power (AMF)	–	–	–	YES
• open GCB				
the STOP push button	YES	YES	YES	YES
the BREAKER CONTROL push button	YES	–	YES	–
emergency power (AMF)	–	–	–	YES
an alarm (i.e. overvoltage)	YES	YES	YES	YES
Operate MCB				
• open MCB				
the BREAKER CONTROL push button	–	–	YES	–
emergency power (AMF)	–	–	–	YES
• close MCB				
the STOP push button	–	–	YES	YES
the BREAKER CONTROL push button (only if mains are present)	–	–	YES	–
emergency power (AMF)	–	–	–	YES

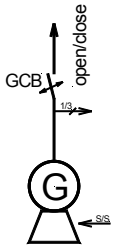
Table 8-1: Functional description - Overview

- Application Mode (page 45): depends on the application; defines the number/function of the breakers.
- *NAC1* Version (page 9): indicates, which *NAC1* versions permit this application mode.
- Operating Mode (page 46): depends on the application; differs between STOP, MANUAL and AUTOMATIC modes.

8.2 Application Modes

The most important features of the application modes are illustrated in the following. Please note that the 2 breaker application mode is only possible with the *NAC1* versions [M-L], and [M-H].

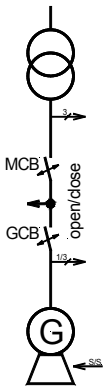
8.2.1 Application Mode {1 breaker open/close} – [G-L], [G-H], [M-L], [M-H]



This application mode provides the following functions:

- operation of the engine (start/stop)
- monitoring and display of generator and engine parameters
- monitoring of selected parameters and protection of the generator and the engine
- opening and closing the GCB
- dead bus monitoring and logic

8.2.2 Application Mode {2 breakers open/close} – [M-L], [M-H]



This application mode provides the following functions:

- operation of the engine (start/stop)
- monitoring and display of generator and engine parameters
- monitoring of selected parameters and protection of the generator and the engine
- opening and closing the GCB
- dead bus monitoring and logic
- operating the MCB (open/close)
- emergency power (AMF automatic mains failure) operation

8.3 Operating Modes

8.3.1 Operating Mode STOP

NOTE

Selecting the operating mode STOP is not the same as an EMERGENCY STOP. In some cases the *NAC1* will perform additional logic functions, such as an engine cool down period, before the engine is stopped. It is recommended that an EMERGENCY STOP discrete input is utilised and programmed as a class F alarm (only configurable via FL-SOFT3).

In the STOP operating mode neither the engine or the power circuit breakers can be operated. The following occurs if operating mode STOP has been selected while…

…the engine is not running

1. The GCB will not close
2. The fuel solenoid relay cannot be enabled
3. The discrete inputs "Oil pressure" and "Coolant Temperature" are ignored
4. The push buttons START - STOP and BREAKER CONTROL are disabled
5. The engine/generator monitoring remains de-activated (exception: all monitoring that is not delayed by the delayed engine speed monitoring)

…the engine is running

1. The GCB will open if it is closed
2. The MCB will close if the GCB is open and mains are present
3. An engine cool down will be performed
4. The fuel solenoid relay will be disabled
5. Selected engine/generator monitoring functions (this includes under-voltage, -frequency, -speed, oil pressure) will be de-activated (exception: all monitoring that is not delayed by the delayed engine speed monitoring)

8.3.2 Operating Mode MANUAL

NOTE

You find an overview about the buttons, LEDs and the seven-segment display under Operation and Navigation on page 31.

In the MANUAL operating mode (AUTO - MANUAL button 3) the engine and the power circuit breakers are operated via the BREAKER CONTROL button 4. The LED 16 in the upper right corner of the AUTO - MANUAL button 3 indicates the manual operating mode.

You can perform the following actions in the MANUAL operating mode depending on the application mode:

a.) Application Mode {2 breakers open/close} – [M-L], [M-H]

The START - STOP button 5
Start the engine (if the engine is stopped, LED 13 is not illuminated)
Stop the engine (if the engine is running, LED 13 is illuminated)

The BREAKER CONTROL button 4
Open the GCB and close the MCB (if the control unit is in generator operation (LEDs 11 and 12 are illuminated) and mains are present, LED 9 is illuminated)
Open the MCB and close the GCB (if the control unit is in mains operation (LEDs 9 and 10 are illuminated) and engine is running, LED 13 is illuminated)

Detailed operation with 2 CBs in manual mode (mains are present)

Preconditions:
- Generator is stopped – LED 12 is not illuminated
- MCB is closed – LED 10 is illuminated
- Mains are present – LED 9 is illuminated
- Unit is in manual mode – LED 16 is illuminated

Engine start sequence:

Action	*START*	Press the START - STOP button 5
Delay	*Preglow time*	The relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED 12 illuminates and LED 13 starts flashing when generator speed has been detected
Delay	*Engine delay time*	The engine monitoring is delayed until time configured in the engine parameters (page 69) expires – LED 13 changes to steady illumination after the time expires

GCB close sequence:

Action	*Breaker control*	Pressing the BREAKER CONTROL button 4
Operation	*Open MCB*	The MCB open relay (relay 1) energises to open the MCB – LED 10 goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED 11 illuminates

MCB close sequence:

Action	*Breaker control*	Press the BREAKER CONTROL button (4)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 2) de-energises to close the MCB – LED (10) illuminates

Stop sequence via START - STOP:

Action	*STOP*	Press the START - STOP button (5)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out
Action	*Breaker control*	Pressing the BREAKER CONTROL button (4)
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates

Stop sequence via STOP one time:

Action	*STOP*	Press the STOP button (6) once
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

Stop sequence via STOP two times:

Action	*STOP*	Press the STOP button (6) twice
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates
Operation	*Engine stop*	The engine stops immediately without a cool down period – LEDs (12) and (13) go out

Detailed operation with 2 CBs in manual mode (mains are not present) - [M-L], [M-H]

Preconditions:

- Generator is stopped – LED (12) is not illuminated
- MCB is closed – LED (10) is illuminated
- Mains are not present – LED (9) is not illuminated
- Unit is in manual mode – LED (16) is illuminated

Engine start sequence:

Action	*START*	Press the START - STOP button (5)
Delay	*Preglow time*	If diesel start logic is selected the relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED (12) illuminates and LED (13) starts flashing when generator speed has been detected
Delay	*Engine delay time*	The control unit waits for the engine monitoring delay time configured in the engine parameters (page 69) to expire – LED (13) changes to steady illumination after the time expires

GCB close sequence:

Action	*Breaker control*	Press the BREAKER CONTROL button (4)
Operation	*Open MCB*	The MCB open relay (relay 1) energises to open the MCB – LED (10) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED (11) illuminates

GCB open sequence:

Action	*Breaker control*	Press the BREAKER CONTROL button (4)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out

Note The MCB close command will not be issued unless the mains return

Stop sequence via START - STOP:

Action	*STOP*	Press the START - STOP button (5)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out
Action	*Breaker control*	Pressing the BREAKER CONTROL button (4)
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates

Stop sequence via STOP one time:

Action	*STOP*	Press the STOP button (6) once
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

Stop sequence via STOP two times:

Action	*STOP*	Press the STOP button (6) twice
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

b.) Application Mode {1 breaker open/close} – [G-L], [G-H], [M-L], [M-H]

The START - STOP button (5)
Starts the engine (if the engine is stopped, LED (13) is not illuminated)
Stops the engine (if the engine is running, LED (13) is illuminated)

The BREAKER CONTROL button (4)
Opens the GCB (if the GCB is closed LED (11) is illuminated)
Closes the GCB (if the GCB is open (LED (11) not illuminated) and the engine is running(LED (13) is illuminated))

Detailed operation with 1 CB in manual mode

Preconditions:		• Generator is stopped – LED (12) is not illuminated • Unit is in manual mode – LED (16) is illuminated
Engine start sequence:		
Action	*START*	Press the START - STOP button (5)
Delay	*Preglow time*	If diesel start logic is selected the relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED (12) illuminates and LED (13) starts flashing when generator speed has been detected
Delay	*Engine delay time*	The control unit waits for the engine monitoring delay time configured in the engine parameters (page 69) to expire – LED (13) changes to steady illumination after the time expires
GCB close sequence:		
Action	*Breaker control*	Press the BREAKER CONTROL button (4)
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED (11) illuminates
GCB open sequence:		
Action	*Breaker control*	Press the BREAKER CONTROL button (4)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Stop sequence via START - STOP:		
Action	*STOP*	Press the START - STOP button (5)
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out
Stop sequence via STOP one time:		
Action	*STOP*	Press the STOP button (6) once
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out
Stop sequence via STOP two times:		
Action	*STOP*	Press the STOP button (6) twice
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

Operating Mode AUTOMATIC

In the AUTOMATIC operating mode, all engine, GCB, and/or MCB functions are operated via the discrete inputs or automatically by the control unit (i.e. a mains failure). The function of the *NAC1* depends on the configuration of the unit and how the external signals are used. LED (15), in the upper left corner of the AUTO - MANUAL button (3), indicates the automatic operating mode.

c.) Detailed operation with 2 CBs in automatic mode (mains are present) - [M-L], [M-H]

Preconditions:

- Generator is stopped – LED (12) is not illuminated
- MCB is closed – LED (10) is illuminated
- Mains are present – LED (9) is illuminated
- Unit is in automatic mode – LED (15) is illuminated

Start sequence:

Action	*Remote start*	Discrete input DI3 (remote start) is activated (active HIGH signal) at terminal 18
Delay	*Preglow time*	If diesel start logic is selected the relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED (12) illuminates and LED (13) starts flashing when generator speed has been detected
Delay	*Engine delay time*	The control unit waits for the engine monitoring delay time configured in the engine parameters (page 69) to expire – LED (13) changes to steady illumination after the time expires
Operation	*Open MCB*	The MCB open relay (relay 1) energises to open the MCB – LED (10) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED (11) illuminates

Stop sequence:

Action	*Remote stop*	Discrete input DI3 (remote start) is deactivated (active LOW signal) at terminal 18
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close MCB*	The MCB open relay (relay 1) de-energises to close the MCB – LED (10) illuminates
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

d.) Detailed operation with 2 CBs in automatic mode (mains are <u>not</u> present) - [M-L], [M-H]

Preconditions:

- Generator is stopped – LED (12) is not illuminated
- MCB is closed – LED (10) is illuminated
- Mains are not present – LED (9) is not illuminated
- Unit is in automatic mode – LED (15) is illuminated

Start sequence:

Action	*Remote start*	Discrete input DI3 (remote start) is activated (active HIGH signal) at terminal 18
Delay	*Preglow time*	If diesel start logic is selected the relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED (12) illuminates and LED (13) starts flashing when generator speed has been detected
Delay	*Engine delay time*	The control unit waits for the engine monitoring delay time configured in the engine parameters (page 69) to expire – LED (13) changes to steady illumination after the time expires
Operation	*Open MCB*	The MCB open relay (relay 1) energises to open the MCB – LED (10) goes out
Delay	*Breaker delay*	The control unit waits for the breaker transfer time configured in the breaker parameters (page 70) to expire
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED (11) illuminates

Stop sequence:

Action	*Remote stop*	Discrete input DI3 (remote start) is deactivated (active LOW signal) at terminal 18
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

NOTE

The MCB described in the above text will only close if the mains return.

e.) AMF/Auto Mains Failure Operation - [M-L], [M-H]

The operation sequence for an AMF operation is similar to the above sequence with the difference that a remote start signal is not required for the engine start and the engine monitoring delay time is not considered, i.e. the CBs are operated immediately. For an AMF operation in automatic mode the parameter Emergency power monitoring (page 70) must be configured to ON, no class F alarms may be present, the engine must be ready for operation, and the configured mains fail delay time (page 70) must expire to start the engine.

Example for an AMF Operation:

Initial situation:

- Mains are present
- Mains circuit breaker is closed
- The generator controller is in the automatic operation mode and emergency stand-by

A mains failure occurs:

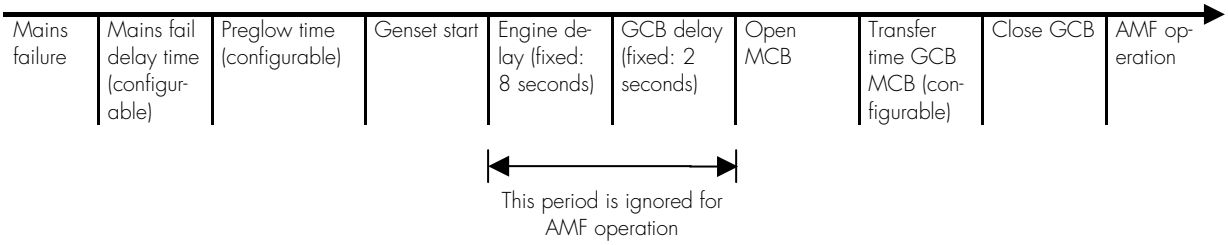
- Mains are not present

Reaction of the unit:

- The mains failure is detected by the unit
- The period configured in the parameter "Mains fail delay time" expires
- The period configured in the parameter "Preglow time" expires
- The generator will be started
- The mains circuit breaker will be opened
- The time configured in the parameter "Transfer time GCBMCB" expires
- The generator circuit breaker will be closed
- The unit is in auto emergency power operation now

The mains return:

- The return of the mains is detected by the unit
- The period configured in the parameter "Mains settling time" expires
- The generator circuit breaker will be opened
- The "Transfer time GCBMCB" and "Cool down time" timers start to run
- If the time configured in the parameter "Transfer time GCBMCB" expires, the MCB will be closed
- If the time configured in the parameter "Cool down time" expires, the generator/engine will be shut down
- The unit is back in emergency stand-by



f.) Detailed operation with 1 CB in Automatic mode

Preconditions:
- Generator is stopped – LED (12) is not illuminated
- Unit is in Automatic mode – LED (15) is illuminated

Start sequence:

Action	*Remote start*	Discrete input DI3 (remote start) is activated (active HIGH signal) at terminal 18
Delay	*Preglow time*	If diesel start logic is selected the relay will energise the glow plugs for the time configured in the engine parameters (page 68)
Operation	*Fuel relay*	The fuel relay (relay 5) is energised to enable the fuel solenoid
Operation	*Crank relay*	The crank relay (relay 6) is energised to engage the starter – LED (12) illuminates and LED (13) starts flashing when generator speed has been detected
Delay	*Engine delay time*	The control unit waits for the engine monitoring delay time configured in the engine parameters (page 69) to expire – LED (13) changes to steady illumination after the time expires
Operation	*Close GCB*	The GCB close relay (relay 2) energises to close the GCB – LED (11) illuminates

Stop sequence:

Action	*Remote stop*	Discrete input DI3 (remote start) is deactivated (active LOW signal) at terminal 18
Operation	*Open GCB*	The GCB close relay (relay 2) de-energises to open the GCB – LED (11) goes out
Delay	*Cool down time*	The control unit waits for the cool down time configured in the engine parameters (page 69) to expire
Operation	*Engine stop*	The engine stops – LEDs (12) and (13) go out

8.4 Breaker Closure Limits

8.4.1 Generator Circuit Breaker

The *NAC1* Series has fixed breaker closure limits which prevent the GCB closure if the generator voltage and/or frequency is/are not within these limits. These limits depend on the parameters rated system frequency and rated generator voltage (refer to „Measuring" on page 66) and cannot be changed. The limits are set as follows:

$f_{"generator"}$ must be within $f_{"rated system"}$ +/- 10 %
Examples:
If the rated system frequency is set to 50 Hz, the upper limit is at 55 Hz and the lower limit is at 45 Hz.
If the rated system frequency is set to 60 Hz, the upper limit is at 66 Hz and the lower limit is at 54 Hz.

$V_{"generator"}$ must be within $V_{"rated generator"}$ +/- 10 %
Examples:
If the rated generator voltage is set to 400 V, the upper limit is at 440 V and the lower limit is at 360 V.
If the rated generator voltage is set to 120 V, the upper limit is at 108 V and the lower limit is at 132 V.

If the generator voltage and/or frequency is/are not within these limits, the generator LED (12) is flashing and the GCB cannot be closed.
If the generator voltage and frequency are within these limits, the generator LED (12) is permanently on and the GCB may be closed.

8.4.2 Mains Circuit Breaker

The NAC1-M-L and M-H have flexible breaker closure limits which prevent the MCB closure if the mains voltage and/or frequency is/are not within the mains failure limits.
These limits depend on the parameters rated system frequency and rated mains voltage and can be freely configured (refer to „Monitoring: Mains Failure Limits" on page 75 for details).

The conditions for closing the MCB are specified as follows and all conditions must be fulfilled:

- The mains voltage is present.
- The mains settling time (refer to Emergency Power (AMF) on page 70) has expired.
- NONE of the following alarms is present:
  - Mains over/underfrequency
  - Mains over/undervoltage
  - Mains rotation field alarm

If the mains voltage is present, but the voltage and/or frequency is/are not within these limits, the mains LED (9) is flashing, and the MCB cannot be closed.

If the mains voltage and frequency are within these limits, and the mains settling time has expired, the mains LED (9) is illuminated permanently, and the MCB may be closed.

The mains LED (9) is off, if the phase-neutral measuring voltage is below 10V.

8.5 Functional Description of the Oil Pressure Input DI1

The *NAC1* Series is provided with an input for oil pressure. The function of this discrete input is described in the following.

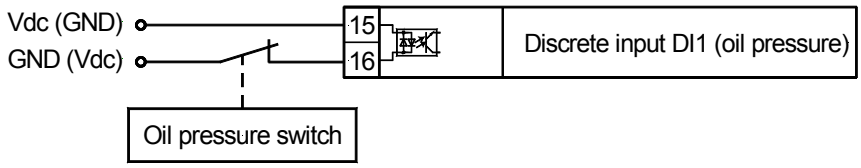


Figure 8-2: Discrete input DI1 - oil pressure

Terminal	Description	A_{max}
15	DI1 oil pressure common	2.5 mm²
16	DI1 oil pressure signal	2.5 mm²

Table 8-1: Discrete input DI1 - oil pressure

The oil pressure switch is connected to the terminals 15 (common) and 16 (DI1 signal) on the *NAC1*. The oil pressure switch (OPS) must be a N.C. contact. If the oil pressure is below the minimum required pressure, the contacts need to close. If the oil pressure is above the minimum required pressure, the contacts need to be open. The oil pressure is only monitored if the *NAC1* detects speed/frequency from the genset. If the genset is in a stand-by or stop mode, the oil pressure switch is disabled.

a.) Parameter "Crank termination by DI1"

If the parameter "Crank termination by DI1" is enabled, the oil pressure can be used to terminate the starting system for the engine. 2 seconds after oil pressure is detected, the crank relay will be disabled. The delay ensures that the crank relay is not disabled prior to the engine reaching firing speed.

b.) Parameter "Starter time"

In all other applications, the starter is active only for the time configured in the parameter "Starter time".

The following diagram shows the starting procedure as a function of time.

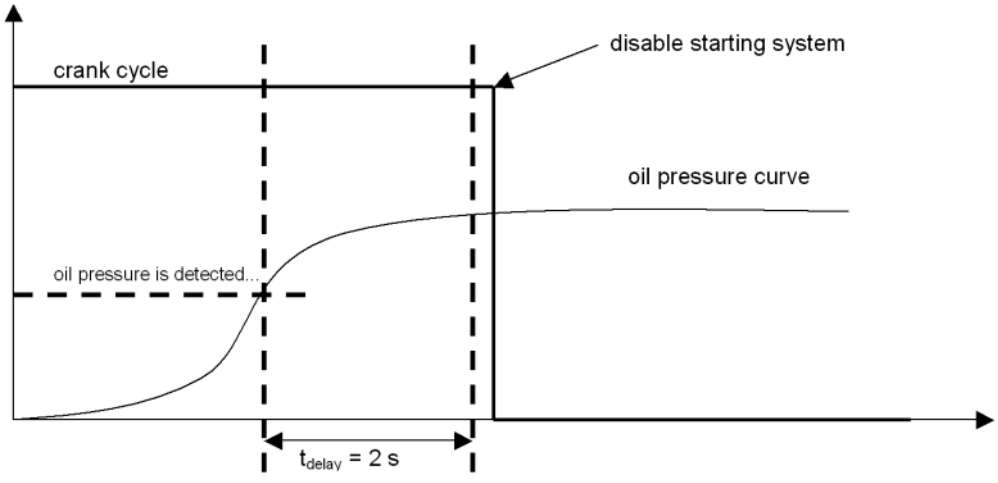


Figure 8-3: Starting procedure

8.6 Firing Speed Detection

The firing speed is used for crank termination if the parameter "Crank termination by DI1" is not enabled (refer to „Parameter "Crank termination by DI1"“ on page 56 if this parameter is enabled). When "Crank termination by DI1" is disabled, the firing speed is determined by the generator frequency or is calculated from the nominal speed and the rated system frequency. The control unit shows the following behavior:

Case 1:
Firing speed is reached if a minimum generator frequency of 15 Hz is detected. The *NAC1* versions [G-L] and [M-L] operate in this manner. It is possible for the *NAC1* versions [G-H] and [M-H] to also operate in this manner if the parameter "Speed pickup" is disabled.

Case 2:
Firing speed is reached if the calculated firing speed is detected via an MPU. The *NAC1* versions [G-H] and [M-H] must have the parameter "Speed pickup" enabled to operate in this manner.

The firing speed is calculated according to the following formula:

$$\text{Firing Speed} = \frac{\text{Nominal Speed}}{\text{Rated System Frequency}} * 15 \text{ Hz}$$

Example: If the nominal speed is 1,500 rpm and the rated system frequency is 50 Hz, the firing speed will be (1,500 rpm / 50Hz) * 15 Hz = 450 rpm. The crank will be terminated if the calculated speed exceeds 450 rpm.

8.7 Functional Description of the Charging Alternator Input/Output

The *NAC1* Series monitors the charging alternator operation with the following functionality.

If the engine is started, the internal switch is closed simultaneously with the crank relay output, and the battery voltage is applied to the exciter winding D+ through the internal switch contacts. This pre-excites the charging alternator so that voltage is generated. The internal switch will be opened when the engine has started properly and the crank relay output has been de-energised to terminate the crank cycle. If the engine is driving the charging alternator, the battery will be charged from the charging alternator. Terminal 3 (for 24V systems or terminal 4 for 12V systems) now acts as the charging alternator input for monitoring the charging voltage. Terminal 2 (battery voltage +) serves as the input for measuring the battery voltage of the unit at the same time.
Usually the alternator charges the battery while the engine is running. This ensures that the battery is charged and ready to energise the cranking circuit and other auxiliary components for the next start.
In some cases the alternator itself needs excitation from an auxiliary source for generating its own terminal voltages. In this case the battery will be connected into the alternator excitation windings during the engine start-up. This ensures that the alternator will be self-excited and provides voltage for charging the battery after the start-up sequence.

The *NAC1* provides two features:
1. Aux-excitation for the alternator
2. Continuous monitoring of the alternator terminal voltage

The D+ Terminals are internal connected to the crank-relay-contacts:
During engine-start up the battery will be connected across internal contacts and resistors to the D+ input of the alternator. The alternator will be excitated by the battery. Once the engine exceeds firing speed the internal switch opens and the D+ terminals will be disconnected from the alternator excitation windings.
While the engine is running the D+ terminals are still connected to the *NAC1* which will measure the terminal voltage of the alternator.
If the voltage drops below a limit the *NAC1* will initiate the fault "alternator charge failure".
Depending on the battery system the *NAC1* provides terminals for 12V and for 24V battery systems.
The internal resistors limit the charge current for each of the two systems.

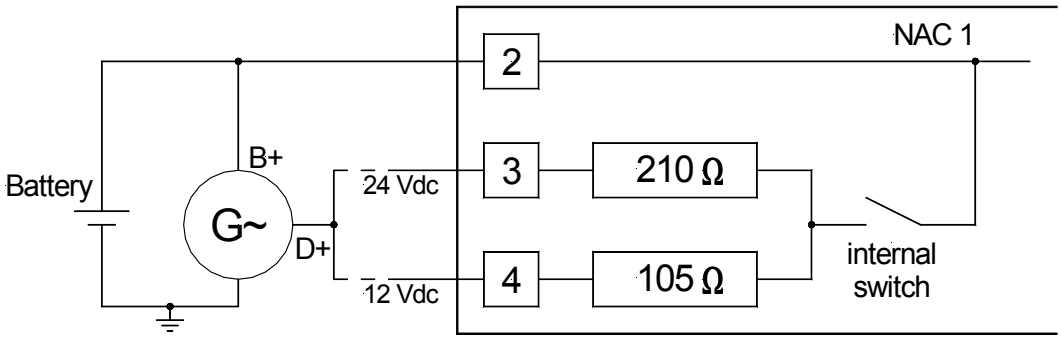


Figure 8-4: Charging alternator input/output

NOTE

The charging alternator D+ acts as an output for pre-exciting the charging alternator during engine start-up only. During regular operation, it acts as an input for monitoring the charging voltage.

8.8 Functional Description of the 2nd CB Close Delay Time

The *NAC1* Series provides Delayed close GCB and Delayed close MCB (only [M-L], [M-H]) signals in the list of configurable parameters (find more details about this under Relay Outputs on page 84) in order to meet the requirements of some special circuit breaker types which require an Enable CB Close signal before the actual CB close signal. The function of these signals is described in the following text.

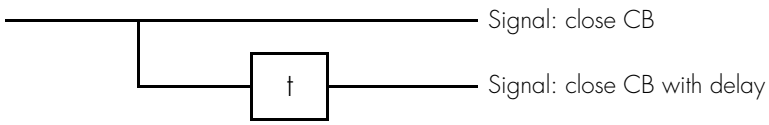
If those CBs are utilised, they require two Close CB signals with a time delay in between from two different relays. This can be achieved by selecting Delayed close GCB (MCB) from the list of configurable parameters for a freely configurable relay (relay 3 or 4). The delay time can be configured with the parameter 2nd GCB (MCB) Close Delay Time. If the user initiates the command Close GCB (MCB), the signal is immediately issued from the fixed relay (relay2 for GCB or relay 1 for MCB) assigned to give the close command. After the configured delay time has expired, the second Close GCB (MCB) signal is issued. The user configures the delay time for the second close command at the relay output.

Example for the functionality:

Assumption: The close GCB signal is to be issued parallel on a second relay with a delay. Relay 4 shall be used in this example for this. The parameter "Relay 4" has to be configured to "Delayed close GCB" from the list of configurable parameters (refer to Relay Outputs on page 84). The delay time may be configured with the parameter "2nd GCB close delay time"(refer to Application on page 67). A period of 2 seconds shall be configured for this example.

If the user triggers the command "Close GCB" now, the following sequence will be performed:

The signal "Close GCB" energises the relay firmly assigned to it (relay 2) immediately.
After the configured delay has expired, the signal "Close GCB" energises the relay assigned by the user (relay 4 in this example) with the configured delay.



The delay "t" corresponds with the values of the parameters "2nd GCB close delay time" and "2nd MCB close delay time".

If the respective circuit breaker is opened, both relays return to their initial state.

NOTE

This functionality can only be configured using FL-SOFT3.

8.9 Functional Description of the Engine Released Signal

The *NAC1* Series provides the engine released signal in the list of configurable parameters (find more details about this under Relay Outputs on page 84). It is possible to use this signal for some special applications. Its functionality is described in the following for an emergency power supply.

Emergency power supply systems often require that all external system components (i.e. governors, etc.) except the genset control be disconnected from the battery power supply and that the battery is not loaded unnecessarily during engine downtime. This means that the external components shall only be connected with battery power, if the engine is operating.
To achieve this, a genset control signal is required, which connects the external components to the battery, as soon as the engine is started. This can be accomplished using the engine released signal when configuring a relay (relay 3 [M-L], [M-H] or 4) to initiate this signal. The functionality is described in the following text with relay 4.

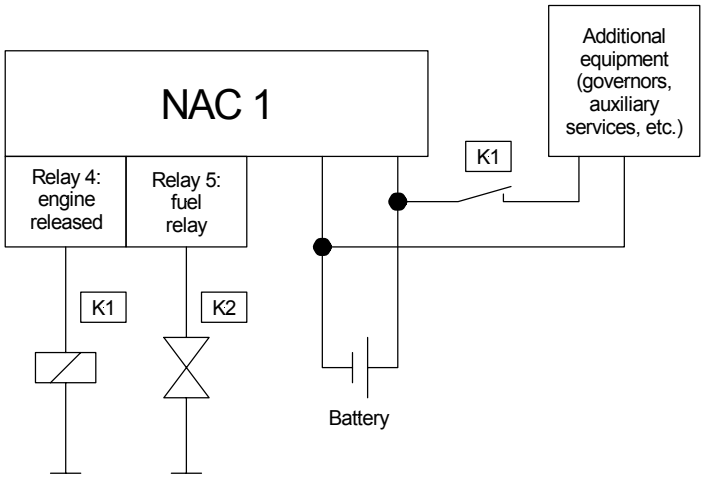


Figure 8-5: AMF application with engine released signal

The following functionality depends on the setting of the fuel relay (page .68.):

Fuel relay configured as operating solenoid:
The *NAC1* detects the mains loss and initiates the engine start. Relay 4 (configured to engine released) and relay 5 (fuel relay) are energised. The fuel relay provides the fuel supply to the engine. Relay 4 closes the contact K1 and connects the battery power to the external components that they are ready for operation. This ensures that these external components are not energised until they are needed.

Fuel relay configured as stop solenoid:
The *NAC1* detects the mains loss and initiates the engine start. Relay 4 (configured to engine released) is energised. Relay 4 closes the contact K1 and connects the battery power to the external components that are needed for operation. This ensures that these external components are not energised if they are not used. If the engine is stopped, relay 5 (fuel relay) will be energised, cutting off the fuel supply.

NOTE

It is not recommended to use the fuel relay signal for connecting the external equipment with the battery since this signal drops in amplitude with every possible start pause in contrast to the engine released signal.

9 Configuration

9.1 Restoring Default Values

The *NAC1* can be reset to factory settings easily. This may be comfortable for configuring the *NAC1* from a known state.

NOTE

The unit has to be in Operating Mode STOP (page 46) to load the default values.

9.1.1 Resetting Via the Front Panel

Preconditions for loading the default values:

- Unit must be in operation mode STOP – LED 17 is illuminated
- The engine must be stopped – LED 13 is not illuminated
- No generator voltage may be present – LED 12 is not illuminated

Press and hold the UP 7, ALARM 2, and STOP 6 buttons simultaneously for at least 10 seconds to reset the values. The factory default values have been restored when all the LEDs flash briefly,.

9.1.2 Resetting Via FL-SOFT3

Precondition for loading the default values:

- Unit has to be in operation mode STOP – LED 17 is illuminated

Connect the *NAC1* with your PC and start FL-SOFT3 as described in Configuration Using the PC on page 62.
Set the parameter Factory settings FL-CABLE-RS232 to YES.
Set the parameter Set default values to YES.
Now, the default values are loaded.

9.2 Configuration Via the Front Panel

Operating the control unit via the front panel is explained in Configuring the NAC1 on page 33. Familiarise yourself with the unit, the buttons' meaning/function, and the display monitoring using this section. The display of the parameters via the front panel and the display of the parameters via the computer program FL-SOFT3 will differ.

NOTE

Not all parameters may be accessed or changed when configuring the control unit via the front panel. To properly commission a control unit, FL-SOFT3 v3.1xxx or higher and a FL-CABLE-RS232 are required.

9.3 Configuration Using the PC

CAUTION

For the configuration of the unit via the PC please use the FL-SOFT3 software with the following software version:

FL-SOFT3 3.1 or higher

NOTE

Please note that configuration using the direct configuration cable FL-CABLE-RS232 is possible starting with revision B (first delivered July 2003). If you have an older model please contact our sales department.

For configuration of the unit via PC program please proceed as follows:

- Install the FL-SOFT3 program on your notebook/PC according to the provided user manual 37305. Consider the options that are given during the installation.
- Prior to the completion of the installation you will be prompted to select the language with which you want to start the PC program. The language of FL-SOFT3 may be changed at any time. The selection of the language refers only to language with which the menus and subprograms that FL-SOFT3 program works with. This setting will not change the configured language of the control unit.
- After the installation of FL-SOFT3 has been completed it is necessary to reboot your notebook/PC.
- Establish a connection between your notebook/PC and the control unit via the FL-CABLE-RS232. Insert the RJ45 plug into the RJ45 port on the control unit (see FL-CABLE-RS232 - Direct Configuration Cable on page 29 for details) and the serial cable to the COM1 port of your notebook/PC.
- You can now start the PC program as follows:
  - by "Start/Program/SEG FL/FL-SOFT3" (version 3.1 or higher) and opening the respective cfg file, or
  - by a double click on the respective file ending ".cfg" in the subdirectory "/FL-SOFT3".
  The cfg files differ in their language used. Use the file on the enclosed floppy disk with the language you want, i.e. US for US English or DE for German.
- After the FL-SOFT3 program has started, establish communication by pressing the F2 button or selecting Communication -> Connect from the menu. This will establish a data link between the control unit and the notebook/PC.
- Start the configuration routine pressing the F3 button or selecting Devices -> Parameterise from the menu and adjust the parameter of the unit to your application using this manual.

NOTE

You find detailed information about FL-SOFT3 and the utilisation of the software in the user manual 37305 belonging to it.

NOTE

The connection cables delivered with the FL-CABLE-RS232 must be used to connect it to ensure a proper function of the *NAC1*. An extension or utilisation of different cable types for the connection between *NAC1* and FL-CABLE-RS232 may result in a malfunction of the *NAC1*. This may further result in damage to components of the system. If an extension of the data connection line is required, only the serial cable between FL-CABLE-RS232 and notebook/PC may be extended.

NOTE

Unplug the FL-CABLE-RS232 after configuration to ensure a safe operation! If the FL-CABLE-RS232 remains plugged into the *NAC1* unit, a safe operation of the unit can not be guaranteed.

9.4 Editing the Configuration File

If you want to edit the configuration file in order to inhibit resetting the counters, you have to proceed as follows:

Open the configuration file in a text editor

In order to edit the configuration file, open the respective *.asm file in the "Tools" subdirectory of your FL-SOFT3 installation path with a text editor like Microsoft Notepad. An example of a name (depending on unit and software version) for a configuration file is:

8440-1746_NEW_pDirUS.asm

Delete the lines which are used to display the counter entries in the FL-SOFT3 configuration

The lines to be deleted in the *.asm file are:

```
 ;!K <b> <color=EE0000> –CONFIG.COUNTERS–</b>
%TAB 0,0,0,H'03;!z2550,"> Maintenance hours","0000h",1.0,0,9999
%TAB 0,0,0,H'03;!M2562,"> reset maintenance period h" ,H'FFFF,2,"No","Yes"
%TAB 0,0,0,H'03;!l2515,"> Counter value preset","00000000",1.0
%TAB 0,0,0,H'03;!M2554,"> Set operation hours" ,H'FFFF,2,"No","Yes"
%TAB 0,0,0,H'03;!z2540,"> Number of starts","00000",1.0,0,65535
```

Store the modified file

Store the modified configuration file back to the "Tools" subdirectory of your FL-SOFT3 installation path under the same file name.

If you load the modified file in FL-SOFT3 now, the deleted lines will not be displayed in the configuration menu anymore.

9.5 Configuring the Flags

The *NAC1* Series provides four configurable LED flags in the alphanumerical display to indicate alarms. One or more alarm messages can be assigned to each one of these flags (i.e. the respective flag will be illuminated if the configured alarm state(s) occur(s) in addition to the regular alarm indication). A detailed description of these flags can be found in the chapter Alarm Messages on page 37. The configuration parameter is described in detail under Flags on page 88. The flags may only be configured using FL-SOFT3.

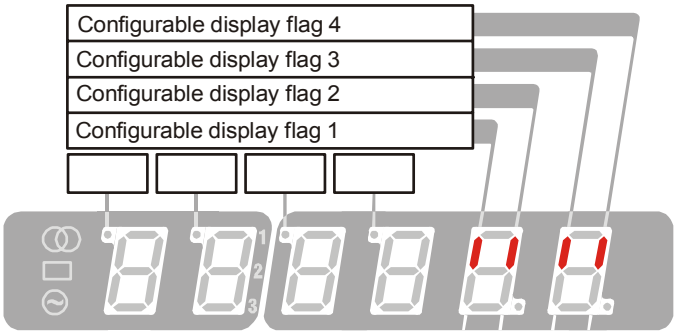


Figure 9-1: Configurable display flags

The flag parameters are displayed in FL-SOFT3 (refer to Configuration Using the PC on page 62 and the FL-SOFT3 user manual 37305 for more information) under System – Codes like shown in Figure 9-2 in default state (alarm "Start fail" is assigned to flag 1). The parameter with the name "Flag 1 Start fail" has the value "Yes", i.e. the alarm "Start fail" is assigned to flag 1.

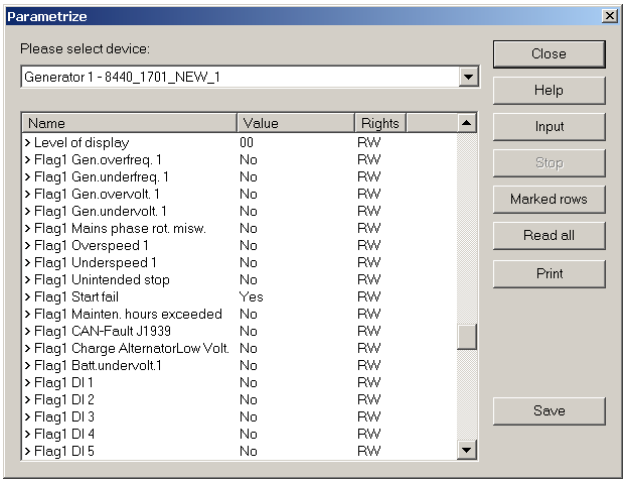


Figure 9-2: Flag configuration default

You may assign as many alarms as required to one flag using FL-SOFT3. Just mark the respective entry and press Input to configure the alarm assignment or double-click the entry for configuration. The example in Figure 9-3 shows that the alarms "Unintended stop" and "Start fail" are assigned to flag 1, i.e. the flag is illuminated (flashing) if at least one of these alarms is present.

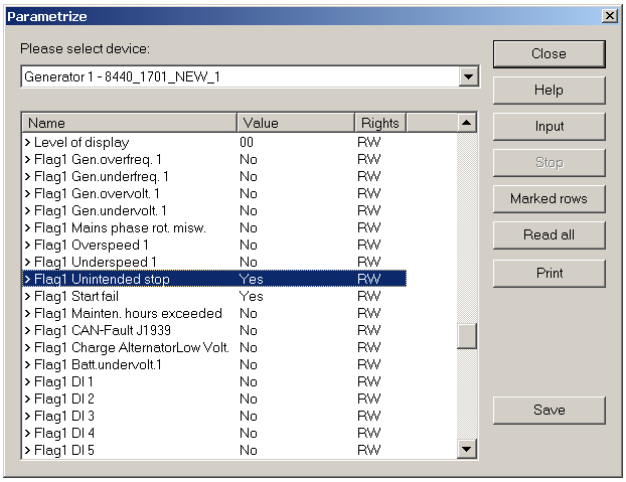
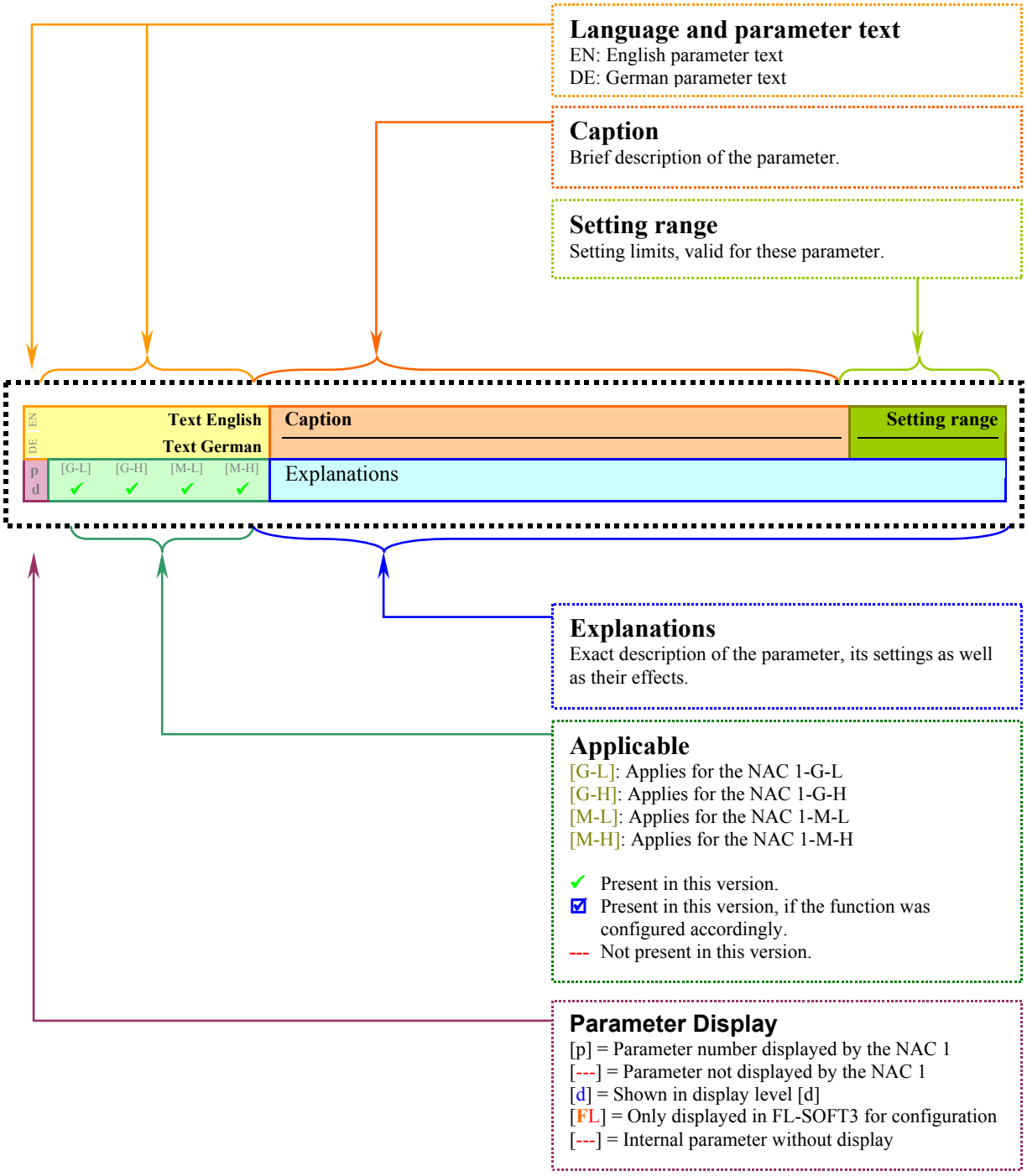


Figure 9-3: Flag configuration custom

10 Parameters

The following description of parameters is expanded to include all parameters that are accessible through FL-SOFT3. Not all parameters are accessible via the front panel.



10.1 Measuring

EN *Rated system frequency*
DE *Nennfrequenz im System*

	[G-L]	[G-H]	[M-L]	[M-H]
10				
3	✓	✓	✓	✓

Rated system frequency — 50/60 Hz

The rated frequency of the system has to be configured here.
The generator frequency monitoring as well as the mains failure limits refer to the value configured in this parameter.

EN *Rated voltage generator*
DE *Nennspannung Generator*

	[G-L]	[G-H]	[M-L]	[M-H]
11				
3	✓	✓	✓	✓

Rated generator voltage — 50 to 480 V

The rated voltage of the generator has to be configured here.
The generator voltage monitoring refers to the value configured in this parameter.

EN *Rated voltage mains*
DE *Nennspannung Netz*

	[G-L]	[G-H]	[M-L]	[M-H]
12				
3	–	–	✓	✓

Rated mains voltage — 50 to 480 V

The rated voltage of the mains has to be configured here.
The mains failure limits refer to the value configured in this parameter.

EN *Generator voltage measuring*
DE *Gen. Spannungsmessung*

	[G-L]	[G-H]	[M-L]	[M-H]

FL	✓	✓	✓	✓

Generator voltage measurement — 3Ph 4W/3Ph 3W/1Ph 2W/1Ph 3W

The method of voltage measurement for the generator. This parameter is set to 1Ph 2W and cannot be changed for the *NAC1* models [G-L] and [M-L].

A detailed description of the different measurement methods can be found in Voltage Measuring on page 19.

EN *Mains voltage measuring*
DE *Netz Spannungsmessung*

	[G-L]	[G-H]	[M-L]	[M-H]

FL	---	---	✓	✓

Mains voltage measurement — 3Ph 4W/3Ph 3W/1Ph 2W/1Ph 3W

The measurement principle for the mains. This parameter is set to 3Ph 4W and cannot be changed for [M-L].

A detailed description of the different measurement methods can be found in Voltage Measuring on page 19.

NOTE

The correct configuration of these parameters is essential for a proper operation of the control unit.

10.2 Application

EN *Ignore CB reply*
DE *Ignoriere Rückmeldung LS*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Ignore CB reply — YES/NO

This parameter controls the function of the discrete inputs DI4 and DI5.

YES.....The discrete inputs DI4 and DI5 are freely configurable. The parameters of the discrete inputs can be accessed and configured via FL-SOFT3.

NO.....The discrete inputs DI4 and DI5 operate as reply inputs for the mains (DI4) or generator (DI5) circuit breaker. The parameters of the discrete inputs can be accessed via FL-SOFT3 but cannot be changed.

CAUTION

The customer must ensure that a mechanical interlock for the circuit breakers exists for the case that the parameter "Ignore CB reply" is configured to "YES".

EN *2nd GCB close Delay time*
DE *Verz.Zeit zweiten GLS schließen*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

2nd GCB close delay time — 0.00 to 650.00 s

This parameter controls the delay for the 2nd GCB close signal. The application and behavior of this signal is described under Functional Description of the 2nd CB Close Delay Time on page 58.

EN *2nd MCB close Delay time*
DE *Ver. Zeit zweiten NLS schließen*

–	[G-L]	[G-H]	[M-L]	[M-H]
FL	---	---	✓	✓

2nd MCB close delay time — 0.00 to 650.00 s

This parameter controls the delay for the 2nd MCB close signal. The application and behavior of this signal is described under Functional Description of the 2nd CB Close Delay Time. on page 58.

10.3 Engine

10.3.1 Engine: Diesel

EN	*Fuel relay: close to stop*				
DE	*Kraftstoffmagnet: Stopmag.*				
20	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	✓	✓	✓	✓	

Fuel relay **close to stop/open to stop**

close to stop To stop the engine the stop solenoid is energised. Once speed is no longer detected, the stop solenoid remains closed for an additional 30 s.

open to stop Before the starting sequence is initiated, the operating solenoid is energised. To stop the engine the operating solenoid is de-energised.

EN	*Preglow time*				
DE	*Vorglühzeit*				
21	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	✓	✓	✓	✓	

Preglow time **0 to 300 s**

Before each starting the diesel engine is preglowed for this time (if a "0" has been configured here the engine will be started without preglow).

10.3.2 Engine: Pickup

EN	*Speed pickup*				
DE	*Pickup*				
30	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

Speed pick-up **ON/OFF**

ON..... Speed monitoring of the engine is performed using an MPU.
OFF..... Speed/frequency monitoring of the generator/engine is carried out by measuring the frequency of the generator. There is no MPU wired to this unit.

EN	*Nominal speed*				
DE	*Nenndrehzahl*				
31	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

Nominal speed **500 to 4,000 RPM**

Revolutions per minute of the engine at rated engine speed.

EN	*Number of gear teeth*				
DE	*Zähneanzahl*				
32	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

Number of gear teeth **5 to 260**

Number of pulses per revolution.

Note: If the number of gear teeth is not correct, the speed will not be calculated correctly and this will lead to a speed/frequency mismatch alarm.

10.3.3 Engine: Start/Stop Automatic

EN *Starter time*
DE *Einrückzeit Anlasser*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Starter time **1 to 10 *s***

The maximum time during which the crank relay remains enabled. The starter relay de-energises when the engine reaches ignition speed or the configured time expires.

EN *Start pause time*
DE *Startpausenzeit*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Start pause time **10 to 99 *s***

Time between the individual starting attempts. (This time is used to protect the starter relay.)

EN *Cool down time*
DE *Motor Nachlaufzeit*

40	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Cool down time **0 to 999 *s***

Regular stop: If the engine performs a normal stop or changed into the STOP operation mode, a cool down with an opened GCB is carried out. This time is adjustable.

Stop by an alarm of class F: If a class F alarm is detected, the GCB will open immediately and the engine will shutdown without a cool down.

EN *Crank termination by DI1*
DE *Anlasser ausspuren über DI1*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Crank termination by DI1 **YES/NO**

YES ..... The starting system is disengaged when the oil pressure monitoring input DI1 indicates that adequate oil pressure has been detected (refer to „Parameter "Crank termination by DI1"“ on page 56).

NO..... The crank termination will be performed if the firing speed is reached (refer to Firing Speed Detection on page 57) and the discrete input DI1 is only used for oil pressure monitoring.

EN *Engine monit. delay time*
DE *Motorverzögerung*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Engine monitoring delay time **0 to 99 *s***

The engine monitoring is delayed to prevent initiating an alarm while the generator set is starting. The *NAC1* does not monitor under-voltage and –frequency and low oil pressure alarms until the delay time has expired.

10.4 Breaker

EN	*Transfer time GCB/MCB*			
DE	*Pasuenzeit GLS/NLS*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
FL	**---**	**---**	✓	✓

Transfer time GCB/MCB — 0.10 to 99.99 s

Switching from generator supply to mains supply or from mains supply to generator supply occurs automatically depending on the operating conditions. The time between the reply "power circuit breaker is open" and a close-pulse is set by this parameter. This time applies for both directions. During this time the busbar is dead.

10.5 Emergency Power (AMF)

EN	*On/Off*			
DE	*Ein/Aus*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
FL	**---**	**---**	✓	✓

Emergency power monitoring On/Off — ON/OFF

ON..... If the unit is in operating mode AUTOMATIC and a mains fault according to the following parameters occurs, the engine is started and an automatic emergency operation is carried out.

OFF..... No emergency operation is carried out.

EN	*Mains fail delay time*			
DE	*Startverzögerung*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
FL	**---**	**---**	✓	✓

Mains fail delay time — 0.20 to 99.99 s

The minimum period of time that the monitored mains must be dead without interruption for the generator to start and carry out an emergency operation.

EN	*Mains settling time*			
DE	*Netzberuhigungszeit*			
80	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	**---**	**---**	✓	✓

Mains settling time — 0 to 9,999 s

The *NAC1* will recognise that the mains have returned and are stable after they have been detected within the rated limits without interruption for the time configured in this parameter. If the mains drop below or rise above the configured limits the timer will start over. The load transfer from generator back to mains will delayed by this parameter after a emergency power operation.

10.6 Monitoring

EN	*Time until horn reset*			
DE	*Zeit bis Hupenreset*			
01	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
1	✔	✔	✔	✔

Time until horn reset — 0 to 1,000 s

The alarm LED flashes and the centralised alarm (horn) is issued when a new B to F class alarm is detected. After the delay time configured in "Time until horn reset" has expired, the flashing alarm LED changes to steady illumination and the centralised alarm (horn) is reset. If this parameter is configured to 0 the horn will never be set.

10.6.1 Monitoring: Generator

EN	*Voltage monitoring generator*			
DE	*Spg. Überwachung Generator*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
---	✔	✔	✔	✔

Voltage monitoring generator — fixed to 4 phase

The line voltages are monitored for the setting 3Ph 3W. The star voltages are monitored for all other voltage systems.

10.6.2 Monitoring: Generator Overfrequency

EN	*Monitoring*			
DE	*Überwachung*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
---	✔	✔	✔	✔

Generator overfrequency monitoring — fixed to ON

The generator overfrequency monitoring is always enabled and cannot be disabled.

EN	*Limit*			
DE	*Limit*			
50	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	✔	✔	✔	✔

Generator overfrequency limit — 50.0 to 130.0 %

ⓘ This value refers to the Rated system frequency (see page 66).

The percentage threshold value that is to be monitored. If this value is reached or exceeded for at least the delay time, the action specified by the configured alarm class is initiated.

EN	*Delay*			
DE	*Verzögerung*			
51	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	✔	✔	✔	✔

Generator overfrequency delay — 0.1 to 99.9 s

If the monitored value exceeds the threshold value for the configured delay time, an alarm will be issued. If the monitored value falls below the threshold (minus the hysteresis) before the delay expires, the delay will be reset.

EN	*Alarm class*			
DE	*Alarmklasse*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
---	✔	✔	✔	✔

Generator overfrequency alarm class — fixed to F

The generator overfrequency alarm class is set to "F" and cannot be changed.

EN	*Self acknowledge*			
DE	*Selbstquittierend*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
---	✔	✔	✔	✔

Generator overfrequency self acknowledgement — fixed to NO

The generator overfrequency self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

10.6.3 Monitoring: Generator Underfrequency

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator underfrequency monitoring — fixed to ON

The generator underfrequency monitoring is always enabled and cannot be disabled.

EN *Limit*
DE *Limit*

52	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator underfrequency limit — 50.0 to 130.0 %

ⓘ This value refers to the „Rated system frequency" (see page 66).

The percentage threshold value that is to be monitored. If this value is reached or fallen below for at least the delay time, the action specified by the configured alarm class is initiated.

EN *Delay*
DE *Verzögerung*

53	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator underfrequency delay — 0.1 to 99.9 s

If the monitored value exceeds the threshold value for the configured delay time, an alarm will be issued. If the monitored value falls below the threshold (minus the hysteresis) before the delay expires, the delay will be reset.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator underfrequency alarm class — fixed to F

The generator underfrequency alarm class is set to "F" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator underfrequency self acknowledgement — fixed to NO

The generator underfrequency self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator underfrequency delayed by engine speed — fixed to YES

The generator underfrequency delay by engine speed is set to "YES" and cannot be changed. Monitoring is delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.4 Monitoring: Generator Overvoltage

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator overvoltage monitoring **fixed to ON**

The generator overvoltage monitoring is always enabled and cannot be disabled.

EN *Limit*
DE *Limit*

54	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator overvoltage limit **50.0 to 125.0 %**

ⓘ This value refers to the Rated generator voltage (see page 66.)

The percentage threshold value that is to be monitored. If this value is reached or exceeded for at least the delay time, the action specified by the configured alarm class is initiated.

EN *Delay*
DE *Verzögerung*

55	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator overvoltage delay **0.1 to 99.9 s**

If the monitored value exceeds the threshold value for the configured delay time, an alarm will be issued. If the monitored value falls below the threshold (minus the hysteresis) before the delay expires, the delay will be reset.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator overvoltage alarm class **fixed to F**

The generator overvoltage alarm class is set to "F" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator overvoltage self acknowledgement **fixed to NO**

The generator overvoltage self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator overvoltage delayed by engine speed **fixed to NO**

The generator overvoltage delay by engine speed is set to "NO" and cannot be changed. The monitoring is not delayed by the time configured in „Engine monitoring delay time“ on page „69“ after starting the engine.

10.6.5 Monitoring: Generator Undervoltage

EN Monitoring
DE Überwachung

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator undervoltage monitoring **fixed to ON**

The generator undervoltage monitoring is always enabled and cannot be disabled.

EN Limit
DE Limit

56	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator undervoltage limit **50.0 to 125.0 %**

ⓘ This value refers to the Rated generator voltage (see page 66.)

The percentage threshold value that is to be monitored. If this value is reached or fallen below for at least the delay time, the action specified by the configured alarm class is initiated.

EN Delay
DE Verzögerung

57	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Generator undervoltage delay **0.1 to 99.9 s**

If the monitored value exceeds the threshold value for the configured delay time, an alarm will be issued. If the monitored value falls below the threshold (minus the hysteresis) before the delay expires, the delay will be reset.

EN Alarm class
DE Alarmklasse

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator undervoltage alarm class **fixed to F**

The generator undervoltage alarm class is set to "F" and cannot be changed.

EN Self acknowledge
DE Selbstquittierend

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Generator undervoltage self acknowledgement **fixed to NO**

The generator undervoltage self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN Delayed by engine speed
DE Verzögert durch Motordrehz.

_	[G-L]	[G-H]	[M-L]	[M-H]
_	✓	✓	✓	✓

Generator undervoltage delayed by engine speed **fixed to YES**

The generator undervoltage delay by engine speed is set to "YES" and cannot be changed. The monitoring is delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.6 Monitoring: Mains

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	---	✓	✓

Mains phase rotation monitoring **fixed to ON**

The mains phase rotation monitoring is always enabled and cannot be disabled.

EN *Mains phase rotation*
DE *Netzdrehfeld*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	---	---	✓	✓

Mains phase rotation direction **CW/CC**

CW..... The three-phase measured mains voltage is rotating CW (clock-wise; that means the voltage rotates in direction A-B-C-Phase; default setting).
CCW ..... The three-phase measured mains voltage is rotating CCW (counter clock-wise; that means the voltage rotates in direction C-B-A-Phase).

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	---	✓	✓

Mains phase rotation alarm class **fixed to**

The mains phase rotation alarm class is set to "B" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	---	✓	✓

Mains phase rotation self acknowledgement **fixed to NO**

The mains phase rotation self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	---	✓	✓

Mains phase rotation delayed by engine speed **fixed to N**

The mains phase rotation delay by engine speed is set to "NO" and cannot be changed. The monitoring is not delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.7 Monitoring: Mains Failure Limits

EN *High voltage threshold*
DE *Obere Grenzspannung*

81	[G-L]	[G-H]	[M-L]	[M-H]
3	---	---	✓	✓

Emergency power: high voltage threshold **50.0 to 130.0 %**

ⓘ This value refers to the Rated mains voltage (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated.

EN *Low voltage threshold*
DE *Untere Grenzspannung*

82	[G-L]	[G-H]	[M-L]	[M-H]
3	---	---	✓	✓

Emergency power: low voltage threshold **50.0 to 130.0 %**

ⓘ This value refers to the Rated mains voltage (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated.

EN *Voltage hysteresis*
DE *Spannungshysterese*

83	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	---	---	✓	✓

Emergency power: voltage hysteresis — 0.0 to 50.0

ⓘ This value refers to the Rated mains voltage (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated. If the monitored value has passed a configured limit and returns but remains close to the limit, the hysteresis must be exceeded (on negative deviation monitoring) or fallen below (on exceeding monitoring) for the mains failure to be assessed as over. This must occur uninterrupted for the mains settling time (see parameter on page 70). If the monitored value returns to configured limits, the delay timer is reset to 0. See Figure 10-1.

EN *High frequency threshold*
DE *Obere Grenzfrequenz*

84	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	---	---	✓	✓

Emergency power: high frequency threshold — 70.0 to 160.0

ⓘ This value refers to the Rated system frequency (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated.

EN *Low frequency threshold*
DE *Untere Grenzfrequenz*

85	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	---	---	✓	✓

Emergency power: low frequency threshold — 70.0 to 160.0 %

ⓘ This value refers to the Rated system frequency (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated.

EN *Frequency hysteresis*
DE *Frequenzhysterese*

86	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
3	---	---	✓	✓

Emergency power: frequency hysteresis — 0.0 to 50.0 %

ⓘ This value refers to the .Rated system frequency. (see page 66).

This value is referred to for mains failure recognition and mains estimation. If the monitored value exceeds the adjusted limit, this is recognised as a mains failure and an emergency power operation is initiated. If the monitored value has passed a configured limit and returns but remains close to the limit, the hysteresis must be exceeded (on negative deviation monitoring) or fallen below (on exceeding monitoring) for the mains failure to be assessed as over. This must occur uninterrupted for the mains settling time (see parameter on page 70). If the monitored value returns to configured limits, the delay timer is reset to 0. See Figure 10-1.

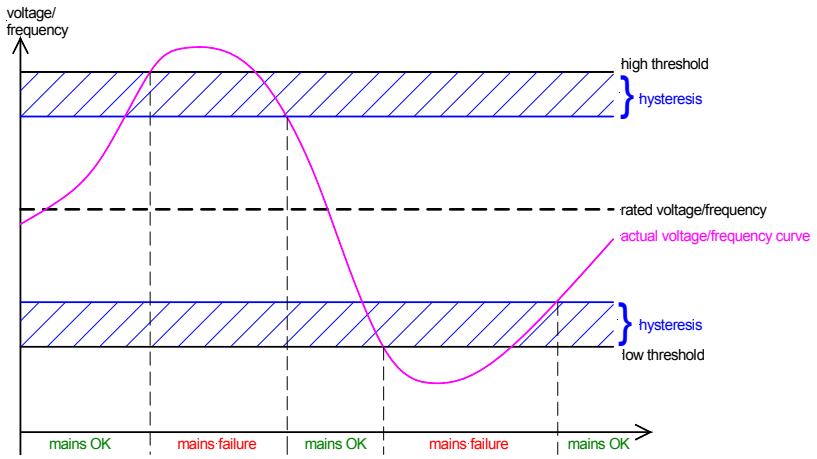


Figure 10-1: Voltage/frequency hysteresis

10.6.8 Monitoring: Engine Overspeed

EN *Monitoring*
DE *Überwachung*

58	[G-L]	[G-H]	[M-L]	[M-H]
3	---	✓	---	✓

Engine overspeed monitoring **ON/OFF**

ON ..... Overspeed monitoring of the engine speed is carried out according to the following parameters.
OFF..... No monitoring is carried out.

EN *Limit*
DE *Limit*

59	[G-L]	[G-H]	[M-L]	[M-H]
3	---	✓	---	✓

Engine overspeed limit **0 to 9,999 RPM**

The threshold value is set by this parameter. If this value is reached or exceeded for at least the delay time, the action specified by the configured alarm class is initiated.

EN *Delay*
DE *Verzögerung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine overspeed delay **fixed to 0.1 s**

If the monitored value exceeds the threshold value for the configured delay time, an alarm will be issued. If the monitored value falls below the threshold (minus the hysteresis) before the delay expires, the delay will be reset.
This value is fixed to 0.1 seconds and cannot be changed.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine overspeed alarm class **fixed to F**

The engine overspeed alarm class is set to "F" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine overspeed self acknowledgement **fixed to NO**

The engine overspeed self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine overspeed delayed by engine speed **fixed to NO**

The engine overspeed delay by engine speed is set to "NO" and cannot be changed. The monitoring is not delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.9 Monitoring: Engine Underspeed

EN	Monitoring
DE	Überwachung

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed monitoring **fixed to ON**

The engine underspeed monitoring is always enabled and cannot be disabled.

EN	Limit
DE	Limit

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed limit **fixed to 1,000 RPM**

The threshold value is fixed in this parameter. If this value is reached or fallen below for at least the delay time, the action specified by the configured alarm class is initiated.

EN	Delay
DE	Verzögerung

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed delay **fixed to 1.0 s**

If the monitored value falls below the threshold value for the configured delay time, an alarm will be issued
This value is fixed to 1.0 seconds and cannot be changed.

EN	Alarm class
DE	Alarmklasse

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed alarm class **fixed to F**

The engine underspeed alarm class is set to "F" and cannot be changed.

EN	Self acknowledge
DE	Selbstquittierend

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed self acknowledgement **fixed to NO**

The engine underspeed self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

EN	Delayed by engine speed
DE	Verzögert durch Motordrehz.

---	[G-L]	[G-H]	[M-L]	[M-H]
---	---	✓	---	✓

Engine underspeed delayed by engine speed **fixed to YES**

The engine underspeed delay by engine speed is set to "YES" and cannot be changed.
The monitoring is delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.10 Monitoring: Engine Start Fail

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine start fail monitoring **fixed to ON**

The engine start fail monitoring is always enabled and cannot be disabled.

EN *Number of start attempts*
DE *Anzahl Startversuche*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine number of start attempts **fixed to 3**

The control will attempt to start the engine with the configured number of start attempts. If the engine fails to start after the configured number of attempts an alarm will be initiated. An engine has been successfully started if the ignition speed has been achieved within the start delay time.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine start fail alarm class **fixed to F**

The engine start fail alarm class is set to "F" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine start fail self acknowledgement **fixed to NO**

The engine start fail undervoltage self-acknowledgement is set to "NO" and cannot be changed. The alarm will not automatically reset after the fault condition has cleared.

10.6.11 Monitoring: Engine Unintended Stop

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine unintended stop monitoring **fixed to ON**

The engine unintended stop monitoring is always enabled and cannot be disabled.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Engine unintended stop alarm class **fixed to F**

The engine unintended stop alarm class is set to "F" and cannot be changed.

10.6.12 Monitoring: Battery Undervoltage

EN *Monitoring*
DE *Überwachung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Battery undervoltage monitoring **fixed to ON**

The battery undervoltage monitoring is always enabled and cannot be disabled.

EN *Limit*
DE *Limit*

60	[G-L]	[G-H]	[M-L]	[M-H]
3	✓	✓	✓	✓

Battery undervoltage limit **8.0 to 42.0 V**

The threshold value is set by this parameter. If this value is reached or fallen below for at least the delay time, the action specified by the configured alarm class is initiated.

EN *Delay*
DE *Verzögerung*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Battery undervoltage delay **fixed to 60.0 s**

If the monitored value falls below the threshold value for the delay time, an alarm will be issued.
This value is fixed to 60.0 seconds and cannot be changed.

EN *Alarm class*
DE *Alarmklasse*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Battery undervoltage alarm class **fixed to B**

The battery undervoltage alarm class is set to "B" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Battery undervoltage self acknowledgement **fixed to NO**

The battery undervoltage self-acknowledgement is set to "NO" and cannot be changed.
The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
---	✓	✓	✓	✓

Battery undervoltage delayed by engine speed **fixed to NO**

The battery undervoltage delay by engine speed is set to "NO" and cannot be changed.
The monitoring is not delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.13 Monitoring: Battery Charge Voltage

EN *Monitoring*
DE *Überwachung*

	[G-L]	[G-H]	[M-L]	[M-H]
61				
3	✓	✓	✓	✓

Battery charge voltage monitoring **ON/OFF**

ON..... Battery charge voltage monitoring is carried out according to the following parameters.
OFF..... No monitoring is carried out.

EN *Limit*
DE *Limit*

	[G-L]	[G-H]	[M-L]	[M-H]
62				
3	✓	✓	✓	✓

Battery charge voltage limit **00.0 to 32.0 V**

The threshold value is set by this parameter. If this value is reached or fallen below for at least the delay time, the action specified by the configured alarm class is initiated.

EN *Delay*
DE *Verzögerung*

	[G-L]	[G-H]	[M-L]	[M-H]

---	✓	✓	✓	✓

Battery charge voltage delay **fixed to 10.0 s**

If the monitored value falls below the threshold value for the delay time, an alarm will be issued.
This value is fixed to 10.0 seconds and cannot be changed.

EN *Alarm class*
DE *Alarmklasse*

	[G-L]	[G-H]	[M-L]	[M-H]

---	✓	✓	✓	✓

Battery charge voltage alarm class **fixed to B**

The battery undervoltage alarm class is set to "B" and cannot be changed.

EN *Self acknowledge*
DE *Selbstquittierend*

	[G-L]	[G-H]	[M-L]	[M-H]

---	✓	✓	✓	✓

Battery charge voltage self acknowledgement **fixed to NO**

The battery undervoltage self-acknowledgement is set to "NO" and cannot be changed.
The alarm will not automatically reset after the fault condition has cleared.

EN *Delayed by engine speed*
DE *Verzögert durch Motordrehz.*

	[G-L]	[G-H]	[M-L]	[M-H]

---	✓	✓	✓	✓

Battery charge voltage delayed by engine speed **fixed to YES**

The battery undervoltage delay by engine speed is set to "YES" and cannot be changed.
The monitoring is delayed by the time configured in Engine monitoring delay time on page 69 after starting the engine.

10.6.14 Monitoring: Interface

EN	Monitoring				
DE	Überwachung				
93	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

J1939 interface monitoring **ON/OFF**

ON.....J1939 interface monitoring is carried out according to the following parameters.
OFF.....No monitoring is carried out.

EN	Delay				
DE	Verzögerung				
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
FL	**---**	✓	**---**	✓	

J1939 interface monitoring delay **0.1 to 650.0 s**

If a J1939 alarm is present for at least the delay time, an alarm will be issued.

EN	Alarm class				
DE	Alarmklasse				
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
FL	**---**	✓	**---**	✓	

J1939 interface monitoring alarm class **B/F**

An alarm class can be assigned to the J1939 monitoring. If fault condition is detected, the action specified by the alarm class is initiated. It may be possible to configure all classes of alarms in this parameter but only alarm classes B and F are implemented in the *NAC1* Series. Ensure that only class B or F is configured here.

EN	Self acknowledge				
DE	Selbstquittierend				
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
FL	**---**	✓	**---**	✓	

J1939 interface monitoring self acknowledgement **YES/NO**

YES.....The control will automatically clear the alarm if it is no longer valid.
NO.....An automatic reset of the alarm does not occur. Reset of the alarm must be performed manually by pressing the appropriate buttons, by enabling the appropriate discrete input, or via an interface.

EN	Delayed by engine speed				
DE	Verzögert durch Motordrehz.				
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
FL	**---**	✓	**---**	✓	

J1939 interface monitoring delayed by engine speed **YES/NO**

YES.....The J1939 monitoring is delayed by the engine. Therefore the conditions of the parameter "Engine monitoring delay time" on page 69 must be fulfilled.
NO.....The J1939 monitoring is not delayed by the engine.

10.7 Discrete Inputs

The *NAC1* Series has 5 discrete inputs (DI1 to DI5). The discrete inputs 1 & 2 are pre-defined as alarm inputs for oil pressure (DI1) and coolant temperature (DI2). The discrete input 3 is a control input for remote start. The functions of the discrete inputs 4 and 5 are dependent on the parameter Ignore CB reply (see page 67). If this parameter is set to NO, these discrete inputs are configured as reply inputs for MCB (DI4) and GCB (DI5). Any changes made to the settings of the discrete inputs DI4 and DI5 have no effect. If this parameter is set to YES, these inputs can be configured freely with the following parameters using FL-SOFT3.

EN *DI {x} operation*
DE *DI {x} Funktiont*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Discrete Input DI {x} operation — N.O./N.C.

The discrete input can be operated by a Normally Open contact or a Normally Closed contact. The Normally Closed contact input can be use to monitor for a broken wire. A positive or negative voltage potential can be applied.

N.O. ..... The discrete input is analysed as "present" by energising a voltage potential (N.O./operating current).

N.C. ..... The discrete input is analysed as "present" by de-energising a voltage potential (N.C./idle current).

EN *DI {x} delay*
DE *DI {x} Verzögerungt*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Discrete Input DI {x} delay — 0.02 to 650.00 s

A delay time in seconds may be assigned to each alarm input. The fault condition must be continuously present for the delay time at the input before tripping occurs.

EN *DI {x} alarm class*
DE *DI {x} Alarmklasset*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Discrete Input DI {x} alarm class — A/B/C/D/E/F/Control

ⓘ see chapter Alarm Classes on page 95.

An alarm class can be assigned to a discrete input. The alarm class is initiated when the discrete input receives a triggering signal. Only alarm classes B and F are implemented in the *NAC1*.

If "control" has been configured as the alarm class, the discrete input can be evaluated by the relay outputs if configured accordingly (see Relay Outputs on page 84 for more information).

EN *DI {x} delayed by eng. speed*
DE *DI {x} verzög. d. Motordrehz.*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Discrete Input DI {x} delayed by engine speed — YES/NO

YES ..... The input monitoring is delayed by the engine. Therefore the conditions of the parameter Engine monitoring delay time on page 69 must be fulfilled.

NO..... The input monitoring is not delayed by the engine. The input is analysed immediately.

EN *DI {x} self acknowledge*
DE *DI {x} Selbstquittierend*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Discrete Input DI {x} self acknowledge — YES/NO

YES ..... The control will automatically clear the alarm if the fault is no longer present.

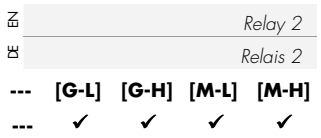
NO..... An automatic reset of the alarm does not occur. Reset of the alarm must be performed manually by pressing the appropriate buttons, by enabling the appropriate discrete input, or via an interface.

10.8 Relay Outputs

The *NAC1* Series has 6 (or 4 for [G-L] & [G-H]) relay outputs. The relay outputs 3 and 4 can be freely configured with one signal output from the list of configurable parameters in Table 10-1 (only [M-L] & [M-H]). If this signal is triggered, the relay will be operated.

Relay output 1 [M-L] & [M-H] **fixed to open MCB**

The relay output is preset to the command open MCB and cannot be changed.

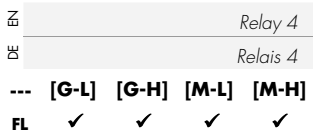


Relay output 2 **fixed to close GCB**

The relay output is preset to the command open GCB and cannot be changed.

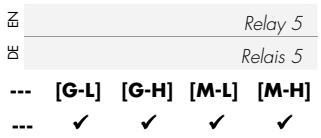
Relay output 3 [M-L] & [M-H] **one from configurable parameter list**

The relay output can be configured to one signal out of the configurable parameter list. The available signals are listed below.



Relay output 4 **one from configurable parameter list**

The relay output can be configured to one signal out of the configurable parameter list. The available signals are listed below.



Relay output 5 **fixed to fuel relay**

The relay output is preset to the fuel relay and cannot be changed.

Relay output 6 **fixed to starter**

The relay output is preset to the starter and cannot be changed.

The following output signals may be selected from the list of configurable parameters for the relay outputs 3 and 4. If a signal is selected for an *NAC1* version without this feature, the relay will not be triggered.

generator overfrequency	generator underfrequency	generator overvoltage
generator undervoltage	mains phase rotation mismatch [M-L], [M-H]	overspeed [G-H], [M-H]
underspeed [G-H], [M-H]	start fail	unintended stop
maintenance hours exceeded	battery undervoltage	charge alternator low voltage
discrete input 1	discrete input 2	discrete input 3
discrete input 4	discrete input 5	preglow
mode : automatic operation	all alarm classes	stopping alarm
engine released	horn	delayed close MCB [M-L], [M-H]
delayed close GCB		

Table 10-1: Relay outputs - list of configurable parameters

10.9 Counter

EN *Maintenance hours*
DE *Wartungsintervall Stunden*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Maintenance hours — 0 to 9,999 h

ⓘ To disable the maintenance counter "hours" configure "0".

This parameter defines the remaining hours until the next maintenance call occurs. Once the configured total time (calculated from days and hours) has been exceeded, a message is displayed.

If the parameter "Reset maintenance call" is configured to "YES" (see below) the maintenance counter is reset to the configured value.

EN *Reset maintenance period h*
DE *Wartungsstunden rücksetzen*

71	[G-L]	[G-H]	[M-L]	[M-H]
1	✓	✓	✓	✓

Reset maintenance period hours — YES/NO

If this parameter is configured to "YES" the maintenance counter 'Hours' is set/reset to the configured value. Once the counter has been set/reset, this parameter automatically changes back to "NO".

EN *Counter value preset*
DE *Zähler-Setzwert*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Counter value preset — 0 to 99,999.9

The operation hour counter is set to this value (the current value is overwritten). This counter may be used to count the operation hours.

EN *Set operation hours*
DE *Betriebsstunden setzen*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Set operation hours — YES/NO

If this parameter is configured to "YES" the operation hour counter is set/reset to the configured value. Once the counter has been set/reset, this parameter automatically changes back to "NO".

EN *Number of starts*
DE *Anzahl Starts*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Number of starts — 0 to 65,535

The start counter is set to this value (the current value is overwritten). This counter may be used to count the number of starts.

10.10 Interfaces

10.10.1 CAN Interface

EN					*Baudrate*
DE					*Baudrate*
	---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
FL		**---**	✓	**---**	✓

CAN baudrate **20/50/100/125/250/500/800/1000 kBd**

The CAN bus baudrate is configured here.

NOTE

The baud rate is the same for all devices connected to the CAN bus regardless of the selected protocol.

10.10.2 J1939

EN					*Device type*
DE					*Betriebsmodus*
90	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

J1939 device type **Off/Standard/S6 Scania/EMR**

Off ..... The J1939 visualisation is disabled. No values are displayed.
Standard .... The standard J1939 messages are displayed on the unit and in FL-SOFT3.
S6 Scania ... The standard J1939 messages are displayed on the unit and in FL-SOFT3, and the Scania S6 messages are displayed in FL-SOFT3 in addition. The Scania S6 messages do not appear on the unit.
EMR ..... The standard J1939 messages are displayed on the unit and in FL-SOFT3, and the Deutz EMR2 messages are displayed in FL-SOFT3 in addition. The Deutz EMR2 messages do not appear on the unit.

EN					*Request send address*
DE					*Request Sendeadresse*
91	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

J1939 request send address **0 to 255**

The J1939 protocol device number: This is necessary for requesting special parameter groups.
The acknowledgement command for passive alarms will also be sent with this participant address (Diagnostic Data Clear/Reset of Previously Active DTCs - DM3).

EN					*Receive device number*
DE					*Empf. Geräte Nummer*
92	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**	
3	**---**	✓	**---**	✓	

J1939 receive device number **0 to 255**

Indicates the number of the J1939 device, whose data shall be visualised.

You find detailed information about the J1939 protocol under J1939 Protocol Descriptions starting on page 96.

10.11 System

10.11.1 Factory Settings

EN	*Factory settings FL-CABLE-RS232*			
DE	*Werkseinstellung FL-CABLE-RS232*			
---	**[320]**	**[320X]**	**[350]**	**[350X]**
FL	✓	✓	✓	✓

Enable to reset to factory settings **ON/OFF**

OFF..... The parameters "Clear event log" and "Set default values" are disabled.
ON..... The parameters "Clear event log" and "Set default values" are enabled. The event log may be cleared and the default values may be restored.

EN	*Clear event log*			
DE	*Ereignisspeicher löschen*			
---	**[320]**	**[320X]**	**[350]**	**[350X]**
FL	✓	✓	✓	✓

Clear event log **ON/OFF**

OFF..... The event log will not be cleared.
ON..... All entries in the event logger will be cleared and this parameter will be reset to "OFF" automatically. The parameter "Factory settings" must be configured "ON" to clear the event log.

EN	*Set default values*			
DE	*Standardwerte*			
---	**[320]**	**[320X]**	**[350]**	**[350X]**
FL	✓	✓	✓	✓

Restore default values **ON/OFF**

OFF .....The default values will not be restored.
ON .....All parameters will be reset to their default values and this parameter will be reset to "OFF" automatically. The parameter "Factory settings" must be configured "ON" to restore the default values.

10.11.2 Parameter Access Level

EN	*Display level*			
DE	*Anzeigeebene*			
72	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
1	✓	✓	✓	✓

Display level **1 to 3**

The user may alter the number of configurable parameters that are displayed on the control unit front panel when the unit is in configuration mode. By selecting the highest level of access (level 3), all parameters will be displayed. The lower the access level selected, the fewer parameters are displayed.

10.11.3 Flags

The *NAC1* Series provides four configurable LED flags in the alphanumerical display to indicate alarms. One or more alarm messages can be assigned to each one of these flags (i.e. the respective flag will be illuminated if the configured alarm state(s) occur(s) in addition to the regular alarm indication). A detailed description of these flags can be found in the chapter Alarm Messages on page 37 and a configuration example can be found under Configuring the Flags on page 63.

EN	*Flag {x} {alarm y}*			
DE	*Flag {x} {Alarm y}*			
---	**[G-L]**	**[G-H]**	**[M-L]**	**[M-H]**
FL	✓	✓	✓	✓

Flag {x} {alarm y} **YES/NO**

YES ..... If the alarm {y} is present, the display flag {x} will be illuminated.
NO..... The display flag {x} ignores the alarm {y}.
{x}..... Display flags 1 to 4
{y}..... The following alarms may be indicated with the flags:
gen. overfrequency, gen. underfrequency, gen. overvoltage, gen. undervoltage, mains phase rotation mismatch, overspeed, underspeed, unintended stop, start fail, maintenance hours expired, CAN failure J1939, undervoltage auxiliary alternator, undervoltage battery, discrete input 1, discrete input 2, discrete input 3, discrete input 4, and/or discrete input 5

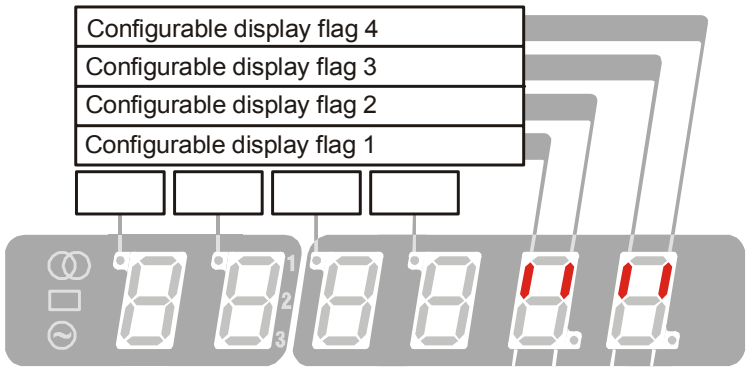


Figure 10-2: Configurable display flags

10.11.4 Versions

NOTE

The following parameters are not configurable. They may be viewed using FL-SOFT3 for information purposes only.

EN *Serial number*
DE *Seriennummer*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Serial number (S/N) **display only**

This is the serial number of the *NAC1* and identifies the control clearly.

EN *Boot item number*
DE *Boot Artikelnummer*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Boot item number (P/N) **display only**

This is the item number of the firmware, which is stored on the *NAC1*.

EN *Boot revision*
DE *Boot Revision*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Boot revision (REV) **display only**

This is the revision of the firmware, which is stored on the *NAC1*.

EN *Boot version*
DE *Boot Version*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Boot version **display only**

This is the version (Vx.xxxx) of the firmware, which is stored on the *NAC1*.

EN *Program item number*
DE *Programm Artikelnummer*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Program item number **display only**

This is the item number of the application software of the *NAC1*.

EN *Program revision*
DE *Programm Revision*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Program revision **display only**

This is the revision of the application software of the *NAC1*.

EN *Program version*
DE *Programm Version*

---	[G-L]	[G-H]	[M-L]	[M-H]
FL	✓	✓	✓	✓

Program version **display only**

This is the version (Vx.xxxx) of the application software of the *NAC1*.

11 Event Logger

The event logger is a FIFO (First In/First Out) memory for logging alarm events and operation states of the unit. The capacity of the event logger is 15 entries. Additional event messages overwrite the oldest messages. Since the *NAC1* units do not include a clock module, the operating hours are stored with each event logger entry as the timestamp.
The individual alarm messages, which are stored in the event history, are described in detail under Alarm Messages on page 37. The operation states, which are stored in the event history, are listed in Table 11-1 on page 91.

NOTE

The event logger cannot be read out directly from the front of the unit. It can only be read out using the program GetEventLog, which can either be used as a stand alone or within FL-SOFT3.

11.1 GetEventLog Software

11.1.1 Installing GetEventLog

GetEventLog can either be used as a stand alone or within FL-SOFT3. In order to call it up from FL-SOFT3, it must be installed into the FL-SOFT3 installation path.

To install GetEventLog, start GetEventLog_vxxxxx.exe from the GetEventLog directory on the CD delivered with the unit.
If you want to use GetEventLog from inside FL-SOFT3, it must be installed into the FL-SOFT3 installation directory.

11.1.2 Starting GetEventLog

Connect the *NAC1* to a free COM port on your computer using the FL-CABLE-RS232 as described under Configuration Using the PC on page 62.
Start GetEventLog directly or call it up by selecting GetEventLog from the menu Tools in FL-SOFT3.
After starting GetEventLog for the first time, you must configure the communication settings. To do this, select the Interface tab, configure the COM port according to the port, to which you have connected the FL-CABLE-RS232, and enter the other settings as represented in Figure 11-1 since these are the default settings of the *NAC1*.

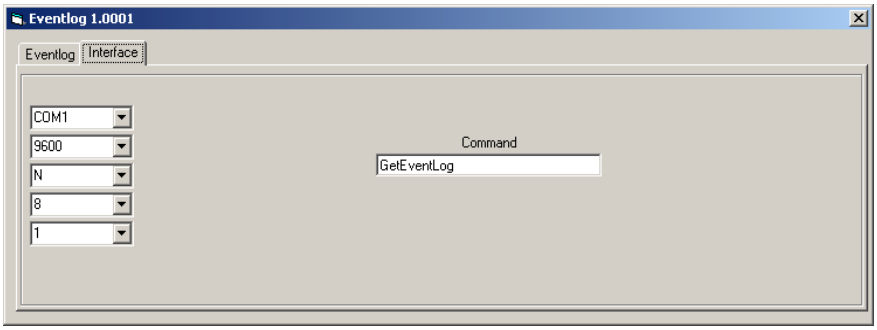


Figure 11-1: GetEventLog - interface configuration

a.) Reading Out GetEventLog

On the Eventlog tab of GetEventLog, click the Request Eventlog button to read out the content of the event logger memory. The content of the event logger is displayed as shown in Figure 11-2.

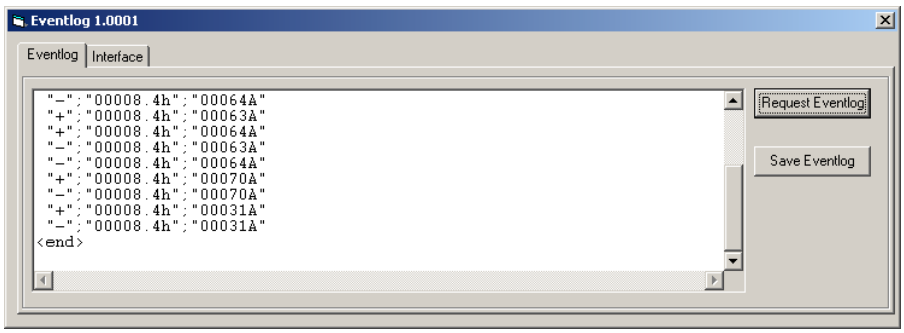


Figure 11-2: GetEventLog – event logger content

The 15 latest events are displayed in chronological order and each entry is composed like this:

"sign";"operating hour";"alarm/state"

whereas "sign""+" indicates the occurrence and "-" indicates the disappearance or acknowledgement of the alarm or state
"operating hour" serves as a timestamp and indicates the operating hour of the event occurred
"alarm/state" indicates the type of alarm or change of state that occurred

The alarm codes are the same as displayed on the unit and described under Alarm Messages on page 37. The codes for the operation states are indicated in Table 11-1 below.

Example: The entry "+";"00008.4h";"00031A" means that alarm 31A unintended stop "00031A" occurred "+" at operating hour 8.4 "00008.4h". The operating hours are indicated in decimals, i.e. 8.4 hours are 8 hours and 24 minutes.

Number	Operation state	[G-L]	[G-H]	[M-L]	[M-H]
70	Mode: Automatic	✓	✓	✓	✓
71	Mode: Stop	✓	✓	✓	✓
72	Mode: Manual	✓	✓	✓	✓
73	GCB closed	✓	✓	✓	✓
74	GCB opened	✓	✓	✓	✓
75	MCB closed	–	–	✓	✓
76	MCB opened	–	–	✓	✓
77	Mains not in range	–	–	✓	✓
78	Emergency mode active	–	–	✓	✓
79	Engine run	✓	✓	✓	✓

Table 11-1: Event logger - operation states

b.) Storing Event Logger Data

Using the Save Eventlog button on the Eventlog tab, you are able to save the content of the event logger in CSV format (comma separated values).

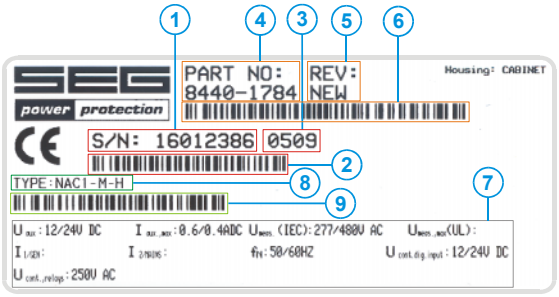
11.1.3 Resetting the Event Logger

The event logger can only be reset using FL-SOFT3. To do this, perform the following steps:

Connect the *NAC1* with your PC and start FL-SOFT3 as described in Configuration Using the PC on page 62.
Set the parameter Factory settings FL-CABLE-RS232 to YES.
Set the parameter Clear Even Log to YES. The event logger should be cleared.

12 Technical Data

Name plate



(Example for a typical name plate)

1	S/N	Serial number (numerical)
2	S/N	Serial number (barcode)
3	S/N	Date of production (YYMM)
4	P/N	Item number (numerical)
5	REV	Item revision number
6	P/N	Item number (barcode)
7	Details	Technical data
8	Type	Unit name
9	Type	Unit name (barcode)

Measuring values, voltages — ⅄/Δ

Measuring voltages — 480 Vac
- Rated value (Vn) ..... 277/480 Vac
- Maximum value (Vmax) ..... max. 346/600 Vac

- Measuring frequency — Generator ..... 15.0 to 85.0 Hz; Mains ..... 40.0 to 85.0 Hz
- Accuracy ..... Class 1
- Input resistance per path ..... 2.0 MΩ
- Maximum power consumption per path ..... < 0.15 W

Ambient variables

- Power supply ..... 12/24 Vdc (6.5 to 32.0 Vdc)
- Intrinsic consumption ..... max. 10 W
- Ambient temperature — Storage ..... -20 to +85°C/-4 to +185°F; Operation ..... -20 to +70°C/-4 to +158°F
- Ambient humidity ..... 95 %, non condensing

Discrete inputs — isolated

- Input range ($V_{Cont, digital input}$) ..... Rated voltage 12/24 Vdc (6.5 to 32.0 Vdc)
- Input resistance ..... approx. 6.7 kΩ

Relay outputs — potential free

- Contact material ..... AgCdO
- General purpose (GP) ($V_{Cont, relay output}$)
  - AC ..... 2.00 Aac@250 Vac
  - DC ..... 2.00 Adc@24 Vdc; 0.36 Adc@125 Vdc; 0.18 Adc@250 Vdc
- Pilot duty (PD) ($V_{Cont, relay output}$)
  - AC B300
  - DC ..... 1.00 Adc@24 Vdc; 0.22 Adc@125 Vdc; 0.10 Adc@250 Vdc

MPU Input — capacitive isolated

- Input impedance ..... min. approx. 17 kΩ
- Input voltage ..... 875 mV eff.

Pre-exciter current output D+

- Max. exciter current

12 Vdc (terminal 4) ..... 0.11 Adc
24 Vdc (terminal 3) ..... 0.11 Adc

Note: The charging alternator D+ acts as an output for pre-exciting the charging alternator during engine start-up only. During regular operation, it acts as an input for monitoring the charging voltage.

Interface

Service interface ..... non isolated
- Version RS-232
- Signal level 5V

Level conversion and insulation by using FI-CABLE-RS232

CAN bus interface ..... isolated
- Insulation voltage ..... 1,500 Vdc
- Version ..... CAN bus
- Internal line termination ..... Not available

Housing

- Dimensions (W × H × D) ..... 158 × 158 × 40 mm
- Front cutout (W × H) ..... 138 [+1.0] × 138 [+1.0] mm
- Connection ..... screw and plug terminals 2.5 mm²
- Recommended tightening torque

Connectors ..... 0.5 Nm
Housing clamps ..... 0.1 Nm
use only 60/75 °C copper leads
use only class 1 cables (or similar)

- Weight ..... approx. 450 g

Vibration

- Sinusoidal ..... 4 G, 5 Hz to 100 Hz
- Endurance ..... 4 G, 30 Hz, 1.5 h
- Random ..... 1.04 Grms, 10 Hz to 500 Hz, 2 h

Shock

- Shock ..... 40 G peak, 11 ms

Protection

- Protection system ..... IP54 from front for proper installation with gasket pending
- Front folio ..... insulating surface

- EMC test (CE) ..... tested according to applicable EN guidelines
- Listings ..... CE marking; UL listing for ordinary locations pending
- Type approval ..... UL/cUL, Ordinary Locations, File No.: 231544

Standards

- Shock ..... EN 60255-21-2
- Vibration ..... EN 60255-21-1; EN 60255-21-3
- Temperature ..... IEC 60068-2-30; IEC 60068-2-2; IEC 60068-2-1

13 Accuracy

Measuring value		Display	Accuracy	Notes
Frequency				
Generator	$f_{"L1N"}$, $f_{"L2N"}$, $f_{"L3N"}$	15.0 to 85.0 Hz	0.1 %	-
Mains	$f_{"L1N"}$, $f_{"L2N"}$, $f_{"L3N"}$	40.0 to 85.0 Hz	0.1 %	-
Voltage				
Generator	$V_{"L1N"}$, $V_{"L2N"}$, $V_{"L3N"}$,	0 to 600 V	1 %	Transformer ratio selectable
Mains	$V_{"L1N"}$, $V_{"L2N"}$, $V_{"L3N"}$,	0 to 600 V	1 %	Transformer ratio selectable
Miscellaneous				
Operating hours		0 to 99,999.9 h		-
Maintenance call		0 to 9,999 h		-
Start counter		0 to 65,535		-
Battery voltage		6.5 to 32 V	1 %	-
MPU speed		$f_{"n"}$ ± 40 %		-

Reference conditions (to measure the accuracy):

- Input voltage .....sinusoidal rated voltage
- Frequency.....rated frequency ± 2 %
- Power supply .....rated voltage ± 2 %
- Ambient temperature.....23 °C ± 2 K
- Warm-up period.....20 minutes

13.1 Alarm Classes

The *NAC1* Series provides only the alarm classes B & F:

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Close GCB" is de-energised	Shut-down engine	Engine blocked until ack. sequence has been passed
B	yes	yes	–	–	–
	Warning Alarm This alarm does not interrupt the operation. An output of the centralised alarm occurs: ⇨ Alarm text + flashing LED "Alarm" + Relay centralised alarm (horn).				
F	yes	yes	immediately	immediately	yes
	Responding Alarm With this alarm the GCB is opened immediately and the engine is stopped. ⇨ Alarm text + flashing LED "Alarm" + Relay centralised alarm (horn)+ GCB open + Engine stop.				

The alarm classes A, C, D, & E can be configured, but are intended for future software revisions and should not be used. The behavior of the unit is the following if configured for these alarm classes:

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Close GCB" is de-energised	Shut-down engine	Engine blocked until ack. sequence has been passed
A	yes	no	no	no	no
	Warning Alarm This alarm does not interrupt the unit operation. A message output without a centralised alarm occurs at the unit: ⇨ Alarm text.				
C	yes	yes	yes	after cool down	yes
	Responding Alarm With this alarm the GCB is opened and the engine is stopped. Coasting occurs. ⇨ Alarm text + flashing LED "Alarm" + Relay centralised alarm (horn) + Coasting + GCB open + Engine stop.				
D	yes	yes	yes	after cool down	yes
	Responding Alarm With this alarm the GCB is opened and the engine is stopped. Coasting occurs. ⇨ Alarm text + flashing LED "Alarm" + Relay centralised alarm (horn) + Coasting + GCB open + Engine stop.				
E	yes	yes	yes	immediately	yes
	Responding Alarm With this alarm the GCB is opened immediately and the engine is stopped. ⇨ Alarm text + flashing LED "Alarm" + Relay centralised alarm (horn)+ GCB open + Engine stop.				

NOTE

If the control unit is in MANUAL operation mode, a cool down phase is not performed regardless of the alarm class!

13.2 Conversion Factors

13.2.1 Conversion factors: Temperature

°C ⇨ °F	°F ⇨ °C
$1\ °F = \left([\text{Value}]\ °C \times 1.8\ °F/°C\right) + 32\ °F$	$1\ °C = \frac{\left([\text{Value}]\ °F - 32\ °F\right)}{1.8\ °F/°C}$

13.2.2 Conversion factors: Pressure

bar ⇨ psi	psi ⇨ bar
$1\ \text{psi} = [\text{Value}]\ \text{bar} \times 14.501$	$1\ \text{bar} = \frac{[\text{Value}]\ \text{psi}}{14.501}$

J1939 Protocol Descriptions

13.3 J1939 Measuring Values

These J1939 measuring values are received by the *NAC1* via CAN bus from the ECU and visualised in FL-SOFT3 using direct configuration. The PC/laptop running FL-SOFT3 must be connected to the *NAC1* via the FL-CABLE-RS232 (refer to page 29).

NOTE

The values are displayed on the unit with less accuracy. Refer to J1939 Visualisation [G-H], [M-H] on page 36 for more information.

13.3.1 J1939 Standard Measuring Values

Name			Unit	Value in FL-SOFT3 with defective sensor	Value in FL-SOFT3 with missing sensor value
SPN	PGN	Description in J1939 protocol			
190	61444	Engine speed	0.1 rpm	214748364.6rpm	214748364.7rpm
247	65253	Total engine hours	1 h	2147483646h	2147483647h
110	65262	Engine coolant temperature	°C	32766°C	32767°C
174	65262	Fuel temperature	1°C	32766°C	32767°C
175	65262	Engine oil temperature	0.01°C	21474836.46°C	21474836.47°C
100	65263	Engine oil pressure	1kPa	65534kPa	65535kPa
111	65263	Coolant level	0.1%	6553,4%	6553.5%
91	61443	Throttle position	0.1%	6553.4%	6553.5%
92	61443	Load at current speed	1%	65534%	65535%
513	61444	Actual engine torque	1%	32766%	32767%
98	65263	Engine oil level	0.1%	6553.4%	6553.5%
183	65266	Fuel rate	0.01 l/h	21474836.46 L/h	21474836.47 L/h
108	65269	Barometric pressure	0.1kPa	65534kPa	65535kPa
172	65269	Air inlet temperature	1°C	32766°C	32767°C
102	65270	Boost pressure	1kPa	65534kPa	65535kPa
105	65270	Intake manifold temp.	1°C	32766°C	32767°C
173	65270	Exhaust gas temperature	0.001°C	21474836.46°C	21474836.47°C

SPN = Suspect Parameter Number; PGN = Parameter Group Number

13.3.2 Special EMR messages

Type	Message acc. to EMR manual	Display in FL-SOFT3
0	Engine stop information	no stop
1	Engine safety	Type 1. Engine safety
2	CAN message engine stop request	Type 2: CAN message engine stop request
3	Low oil pressure	Type 3: low oil pressure
4	Low oil level	Type 4: low oil level
5	High coolant temp	Type 5: high coolant temp
6	Low coolant level	Type 6: low coolant level
7	Intake manifold temp	Type 7: intake manifold temp
8	Reserved (Stop via SAE-J1587)	Type 8: reserved (Stop via SAE-J1587)
9	Reserved (Stop via VP2)	Type 9: reserved (Stop via VP2)

NOTE

These parameters are only visible in FL-SOFT3 and are not displayed on the unit.

13.3.3 Special S6 messages

Suspect Parameter Number	Parameter Group Number	Description	Display in FL-SOFT3
DLN2-Proprietary	65409 (FF81h)	Assessed messages: Low engine oil level High engine oil level Low oil pressure High coolant temperature	NO Sensor defect YES

If DLN2 does not transmit, "missing" is displayed in FL-SOFT3.

NOTE

These parameters are only visible in FL-SOFT3 and are not displayed on the unit.

Front Customisation

The *NAC1* Series is designed language-independent, but can be customised to your demands using paper strips. The left paper strip is intended for customisation and may contain more detailed information about the display.

The right paper strip is divided in three parts. The lowest part serves for labelling the unit indicators (refer to Display of the Operating Values on page 33). You can customise the paper strip to reflect the unit of measure in your preferred language. The middle section serves for labelling the four configurable alarm flags (refer to Alarm Messages on page 37). You can customise the paper strip to reflect the alarm message assigned to the respective flag in your preferred language. The upper field is intended for customisation and may contain more detailed information about the display.

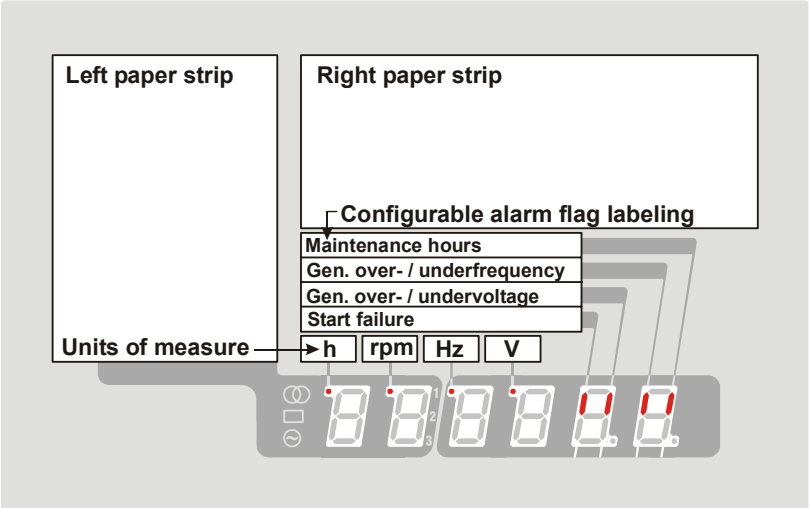


Figure 13-1: Paper strips

The unit is delivered with English paper strips, where the left paper strip contains the alarm messages and the right paper strip contains the units of measure in English, the default alarm messages for the alarm flags, and information about the configuration parameters in the upper section.

Templates for paper strips in different languages can be found in the "Paper Strips" directory on the CD delivered with the unit. The templates are in Microsoft Word format and can be customised to your demands. Please note that the paper strip geometry must not be modified in the templates. Just edit the text in the paper strips, print them out, cut out the paper strips where indicated, and insert them into the openings at the side of the unit.

Troubleshooting

In problems are encountered while commissioning or operating the *NAC1*, please refer to the troubleshooting table below and FL-SOFT3 prior to contacting SEG for technical assistance. The most common problems and their solutions are described in the troubleshooting table. If problems are encountered between the *NAC1* and its wiring and the engine or other devices, refer to the respective manuals for solving the problem.

Symptom	Possible cause	Possible solution	Verify
Unit does not power up.	Power supply outside operating range.	With power supply voltage connected to terminals 1(-) and 2(+) of the *NAC1*, measure the voltage at these terminals.	Voltage must be no less than 6.5 Volts and no greater than 32 Volts.
	Power supply polarity reversed.	With power supply voltage connected to terminals 1(-) and 2(+) of the NAC1, measure the voltage at these terminals.	Voltage measurement reads (+) polarity when meter is connected to terminal 1(-), and 2(+).
Alarm "60A - Oil pressure" occurs, after engine has fired.	Engine produces no oil pressure.	Check engine oil pressure.	Refer to chapter "Chapter 8 - Functional Description of the Oil Pressure Input DI1" for more information.
	Oil pressure sensor is miswired.	Check wiring of the oil pressure sensor.	A "Normally Closed" contact from the oil pressure sensor must be wired to terminals 16/15 on the *NAC1*. Refer to chapter "Chapter 8 - Functional Description of the Oil Pressure Input DI1" for more information.
	Incorrect oil pressure sensor is being used.	Verify the correct sensor is being used.	
	Oil pressure sensor is defective.	Check the oil pressure sensor.	Check oil pressure sensor for proper functionality and obstructions.
Alarm "61A – Coolant temperature" occurs after engine has fired.	Engine temperature is too high.	Check engine temperature.	Engine temperature must be within its specified range.
	Coolant temperature sensor is miswired.	Check wiring of the temperature sensor.	A "Normally Open" contact must be wired from the sensor to the *NAC1* (terminals 17/15).
	Coolant temperature sensor is defective.	Check coolant temperature sensor.	Check coolant temperature sensor for proper functionality.
Engine does not start by pressing the "Start" button.	Unit is in operating mode "Stop" and the "Stop" LED is lit.	Unit must be in operating mode "Manual".	Press the "Operating Mode" button twice for selecting manual mode.
Engine does not start by setting the "Remote-Start" signal (discrete input 3).	Unit is in operating mode "Stop".	Unit must be in operating mode "Auto" to be started via "Remote-Start" signal.	Press the "Operating Mode" button for selecting "Auto" mode.
	Unit is in operating mode "Manual".	Unit must be in operating mode "Auto" to be started via "Remote-Start" signal.	Press the "Operating Mode" button for selecting "Auto" mode.
	"Remote-Start" signal is miswired to the NAC1.	Measure the voltage between terminals 18/15.	If you set the "Remote Start" signal, you should measure a voltage between terminals 18/15. If a voltage is present at these terminals, everything is wired correctly.

Symptom	Possible cause	Possible solution	Verify
"Generator Circuit Breaker Closed" LED is not lit, although the Circuit Breaker is closed.	"Generator Circuit Breaker Closed" signal is miswired.	Measure the voltage between terminals 20 and 15 on the *NAC1*.	If the circuit breaker is closed, you should measure around 0 Volts between terminals 20 and 15. If around 0 Volts are measured, the "Generator Circuit Breaker Closed" LED should be lit. If the circuit breaker is open, you should measure a voltage similar to the battery voltage in your system between terminals 20 and 15. In this case the "Generator Circuit Breaker Closed" LED must not be lit. Check whether you are using an N.C. contact as breaker aux. contact.
	Wrong setting of Parameter "Ignore Breaker Replies".	Use the "FL-SOFT3" configuration software to check for correct setting of the Parameter "Ignore Breaker Replies".	Within the FL-SOFT3 configuration software, the parameter "Ignore Breaker Replies" must be set to "No" to enable the MCB reply state to be visualised on the "Generator Circuit Breaker Closed" LED. If the parameter "Ignore Breaker Replies" is set to "Yes", the state of the CB reply will not be recognised!
"Mains Circuit Breaker Closed" LED is not lit, although the Circuit Breaker is closed.	"Mains Circuit Breaker Closed" signal is miswired.	Measure the voltage between terminals 19 and 15 on the *NAC1*.	If the circuit breaker is closed, you should measure around 0 Volts between terminals 19 and 15. If around 0 Volts are measured, the "Mains Circuit Breaker Closed" LED should be lit. If the circuit breaker is open, you should measure a voltage similar to the battery voltage in your system between terminals 19 and 15. In this case the "Mains Circuit Breaker Closed" LED must not be lit. Check whether you are using an N.C. contact as breaker aux. contact.
	Wrong setting of Parameter "Ignore Breaker Replies".	Use the "FL-SOFT3" configuration software to check for correct setting of the Parameter "Ignore Breaker Replies".	Within the FL-SOFT3 configuration software, the parameter "Ignore Breaker Replies" must be set to "No" to enable the MCB reply state to be visualised on the "Mains Circuit Breaker Closed" LED. If the parameter "Ignore Breaker Replies" is set to "Yes", the state of the CB reply will not be recognised!

Symptom	Possible cause	Possible solution	Verify
Alarm "30A - Start fail" occurs.	Low fuel situation.	Check, if enough Fuel is present to run the engine.	Fuel level is above fuel pick-up and fuel system is properly primed
	Fuel line connection to the engine is not present.	Check whether the fuel line to engine is installed properly.	No leaks in fuel system and system is primed
	Generator produces no voltage.	Check, if the generator is excited properly.	While the crank is engaged the generator shall produce voltage.
	Fuel relay output of the *NAC1* is defective or miswired.	Measure the resistance between terminals 13 and 11 on the *NAC1*.	Case 1, Parameter "Fuel Relay Logic" is set to "Open to Stop": If engine is not started, the resistance between terminals 13 and 11 must be around infinitive Ohms. If the *NAC1* performs an start, the resistance between terminals 13 and 11 must be around 0 Ohms. Case 2, Parameter "Fuel Relay Logic" is set to "Close to Stop": If engine is not started, the resistance between terminals 13 and 11 must be around 0 Ohms. If the *NAC1* performs an start, the resistance between terminals 13 and 11 must be around infinitive Ohms.
	Crank Relay output of the *NAC1* is defective or miswired.	Measure the resistance between terminals 14 and 11 on the *NAC1*.	If engine is not started, the resistance between terminals 14 and 11 must be around infinitive Ohms. If the *NAC1* performs an start, the resistance between terminals 14 and 11 must be around 0 Ohms.
	Pickup Sensor is miswired to the *NAC1*.	Check whether the Pickup sensor is properly wired to terminals 37(GND) and 38(+) on the *NAC1*.	The *NAC1* requires 2 Vac for the MPU during cranking cycle. If this voltage is not achieved perhaps the gap between the pickup and the gear is too much.
	Parameter crank cutout speed is set too low	The crank cutout speed must be between the cranking speed and the normal operating speed of the engine	Measure engine speed when cranking engines, before ignition.
Starter is not engaged.	Starting relay output of the *NAC1* is defective or miswired.	Measure the resistance between terminals 14 and 11 on the *NAC1*.	If engine is not running, the resistance between terminals 14 and 11 should read infinite Ohms. If the *NAC1* performs a start, the resistance between terminals 14 and 11 must be around 0 Ohms.

Symptom	Possible cause	Possible solution	Verify
Alarm "21A - Underspeed" occurs, after engine has fired.	Pickup Sensor is miswired to the *NAC1*.	Check whether the pickup sensor is properly wired to terminals 37 (GND) and 38(+) on the *NAC1*.	The *NAC1* requires 2 Vac for the MPU during cranking cycle. If this voltage is not achieved perhaps the gap between the pickup and the gear is too much.
	Pickup Sensor is defective.	Check the pickup sensor for proper functionality.	The *NAC1* requires 2 Vac for the MPU during cranking cycle. If this voltage is not achieved perhaps the gap between the pickup and the gear is too much.
	Engine has stalled.	Check to see if engine fuel level is too low or fuel line is blocked or lost prime. Possible problem with engine air flow.	Troubleshoot engine fuel and air supply. Check air and fuel filters.
Alarm "13A - Generator undervoltage" occurs, after the engine has fired.	Generator voltages are not properly connected to the *NAC1*.	Check generator voltages if engine is started up.	Measure the generator voltages on the terminals 29/31/33/35 while the engine is running. (Please refer to the wiring diagram for your *NAC1* derivate, because the terminal assignment is different from derivate to derivate.)
	Wrong wiring selected for the generator voltage measurement.	Use the FL-SOFT3 configuration software to check for settings of parameter "Generator voltage measuring"	Check, which wiring you have to use, and then set the parameter "Generator voltage measuring" via FL-SOFT3 to one of the following selections : - 1Ph2W - 1Ph3W - 3Ph3W - 3Ph4W Note: These wirings are only selectable in the *NAC1*/X units! See "Chapter 6 - Connections - Voltage measurement Generator" for further details.
	Voltage regulator is not set correctly	Adjust voltage regulator rated voltage or remote voltage setting.	

Symptom	Possible cause	Possible solution	Verify
CAN/J1939 Communication does not work.	The parameter for enabling the J1939 Communication is configured "Off" in the *NAC1*.	Check for setting of Parameter 90 "J1939 Device Type" in the configuration menu of the *NAC1*.	Parameter 90 "J1939 Device Type" must be set to a value greater than "1" to enable a J1939/CAN communication. Refer to "Chapter 7 - Operation and Navigation - Configuration Displays" and "Parameters – Interfaces" for further information.
	Baud rate for CAN communication is set to a incorrect value.	Check that the correct baud rate is entered	The baud rate has to be the same for all devices connected to the CAN bus.
	Termination resistors are not correct.	Check whether the termination resistors are of the correct resistive value.	Refer to chapter "Connections - Interfaces" for further information on termination resistors.
	CAN connection is miswired.	Check whether the correct CAN lines are connected to terminals 39 (CAN-L) and 40 (CAN-H).	Refer to chapter "Connections - Interfaces" for further information on termination resistors.
	Wrong setting of parameter "Request send address".	Check whether you have selected the correct request send address.	Refer to chapter "Configuration Displays" and "Parameters – Interfaces" for further information.
	Wrong setting of parameter "Receive Device Number".	Check whether you have selected the correct receive device number.	Refer to chapter "Configuration Displays" and "Parameters – Interfaces" for further information.
Engine overspeeds on startup.	Engine governor is not set correctly.	Adjust governor settings for proper response.	Refer to governor manual.
	The Parameter for overspeed level is not set correctly.	Set the correct speed for overspeed.	
	The Parameter for Number of Pickup Teeth is not correct.	Check that this setting is correct for the engine.	Refer to engine specification.
Alarm 12 "Overvoltage" occurs on startup.	Voltage regulator is not set correctly	Adjust voltage regulator settings for proper response.	Refer to AVR manual.
Alarm "51A - Charge failure" occurs after the engine has fired, and the "Engine monitoring delay time" has expired.	Charge alternator is miswired to the *NAC1*.	If charge alternator with 24 Volts Volts are used, connect it to terminals 1 (-) and 3 (+). If charge alternator with 12 Volts are used, connect it to terminals 1 (-) and 4 (+).	Please Refer to "Chapter 8 - Functional Description of the Charging Alternator Input/Output" for further information.
	Charge alternator polarity reversed.	With charge alternator connected to terminals 1 (-) and 3 (+) [for 24 Volt charge alternators] or 1 (-) and 4 (+) [for 12 Volt charge alternators] of the *NAC1*, measure the voltage at these terminals.	Voltage measurement reads (+) polarity when meter is connected to terminal 1 (-), and 3 (+) or 1 (-) and 4 (+). Please Refer to "Chapter 8 - Functional Description of the Charging Alternator Input/Output" for further information.
	Charge alternator defective.	Check charge alternator output.	Ensure charge alternator output is within specifications.

List of Parameters

Unit number P/N _____ Rev _____

Version NAC 1 _____

Project _____

Serial number S/N _____ Date _____

	Parameter	Setting range	Default value	Customer setting	
MEASURING					
	Rated system frequency	50/60 Hz	50 Hz		
	Rated voltage generator	50 to 480 V	400 V		
[M-x]	Rated voltage mains	50 to 480 V	400 V		
[x-H]	Generator voltage measuring	3ph 4w 3ph 3w 1ph 2w 1ph 3w	3ph 4w	☐ 3ph 4w ☐ 3ph 3w ☐ 1ph 2w ☐ 1ph 3w	☐ 3ph 4w ☐ 3ph 3w ☐ 1ph 2w ☐ 1ph 3w
[x-L]	Generator voltage measuring	1ph 2w	1ph 2w	n/a	n/a
[M-H]	Mains voltage measuring	3ph 4w 3ph 3w 1ph 2w 1ph 3w	3ph 4w	☐ 3ph 4w ☐ 3ph 3w ☐ 1ph 2w ☐ 1ph 3w	☐ 3ph 4w ☐ 3ph 3w ☐ 1ph 2w ☐ 1ph 3w
[M-L]	Mains voltage measuring	3ph 4w	3ph 4w	n/a	n/a
APPLICATION					
	Ignore CB reply	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	2nd GCB Close Delay Time	0.00 to 650.00 s	0.20 s		
[M-x]	2nd MCB Close Delay Time	0.00 to 650.00 s	0.20 s		
ENGINE					
	Engine type: Diesel				
	Fuel relay	open to stop/close to stop	open to stop	☐ open ☐ close	☐ open ☐ close
[G-x]	Preglow time	0 to 300 s	0 s		
[M-x]	Preglow time	0 to 300 s	3 s		
	MPU (pickup)				
[x-H]	Speed Pickup	ON/OFF	ON	☐ 1 ☐ 0	☐ 1 ☐ 0
[x-H]	Nominal speed	500 to 4,000 RPM	1,500 RPM		
[x-H]	Number of gear teeth	5 to 260	118		
	Start/stop automatic				
	Starter time	1 to 10 s	8 s		
	Start pause time	10 to 99 s	10 s		
	Cool down time	0 to 999 s	30 s		
	Crank termination by DI1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Engine Monit. delay time	0 to 99 s	8 s		
BREAKER					
[M-x]	Transfer time GCB/MCB	0.10 to 99.99 s	0.10 s		
EMERGENCY POWER (AMF)					
[M-x]	On/Off	ON/OFF	ON	☐ 1 ☐ 0	☐ 1 ☐ 0
[M-x]	Mains fail delay time	0.20 to 99.99 s	3.00 s		
[M-x]	Mains settling time	0 to 9,999 s	20 s		

	Parameter	Setting range	Default value	Customer setting	
PROTECTION					
	Time until horn reset	0 to 1,000 s	180 s		
	Generator protection				
	Voltage monitoring generator	4 phase	4 phase	n/a	n/a
	Generator: Over frequency				
	Monitoring	ON	ON	n/a	n/a
	Limit	50.0 to 130.0 %	110.0 %		
	Delay	0.1 to 99.9 s	1.0 s		
	Alarm class	F	F	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Generator: Under frequency				
	Monitoring	ON	ON	n/a	n/a
	Limit	50.0 to 130.0 %	90.0 %		
	Delay	0.1 to 99.9 s	5.0 s		
	Alarm class	F	F	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Delayed by engine speed	YES	YES	n/a	n/a
	Generator: Over voltage				
	Monitoring	ON	ON	n/a	n/a
	Limit	50.0 to 125.0 %	110.0 %		
	Delay	0.1 to 99.9 s	2.0 s		
	Alarm class	F	F	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Delayed by engine speed	NO	NO	n/a	n/a
	Generator: Under voltage				
	Monitoring	ON	ON	n/a	n/a
	Limit	50.0 to 125.0 %	92.0 %		
	Delay	0.1 to 99.9 s	5.0 s		
	Alarm class	F	F	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Delayed by engine speed	YES	YES	n/a	n/a
	Mains protection				
[M-x]	Monitoring	ON	ON	n/a	n/a
[M-x]	Mains phase rotation	CW (+)/CCW (–)	CW	☐ + ☐ –	☐ + ☐ –
[M-x]	Alarm class	B	B	n/a	n/a
[M-x]	Self acknowledge	NO	NO	n/a	n/a
[M-x]	Delayed by engine speed	NO	NO	n/a	n/a
	Emergency power: Limits				
[M-x]	High voltage threshold	50.0 to 130.0 %	130.0 %		
[M-x]	Low voltage threshold	50.0 to 130.0 %	90.0 %		
[M-x]	Voltage hysteresis	0.0 to 50.0 %	2.0 %		
[M-x]	High frequency threshold	70.0 to 160.0 %	110.0 %		
[M-x]	Low frequency threshold	70.0 to 160.0 %	90.0 %		
[M-x]	Frequency hysteresis	0.0 to 50.0 %	2.0 %		
	Engine: Overspeed				
[x-H]	Monitoring	ON/OFF	ON	☐ 1 ☐ 0	☐ 1 ☐ 0
[x-H]	Limit	0 to 9,999 RPM	1,850 RPM		
[x-H]	Delay	0.1 s	0.1 s	n/a	n/a
[x-H]	Alarm class	F	F	n/a	n/a
[x-H]	Self acknowledge	NO	NO	n/a	n/a
[x-H]	Delayed by engine speed	NO	NO	n/a	n/a
	Engine: Underspeed				
[x-H]	Monitoring	ON	ON	n/a	n/a
[x-H]	Limit	1,000 RPM	1,000 RPM	n/a	n/a
[x-H]	Delay	1.0 s	1.0 s	n/a	n/a
[x-H]	Alarm class	F	F	n/a	n/a
[x-H]	Self acknowledge	NO	NO	n/a	n/a

MONITORING					
[x-H]	Delayed by engine speed	YES	YES	n/a	n/a
	Engine: Start fail				
	Monitoring	ON	ON	n/a	n/a
	Number of start attempts	3	3	n/a	n/a
	Alarm class	F	F	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Engine: Unintended stop				
	Monitoring	ON	ON	n/a	n/a
	Alarm class	F	F	n/a	n/a
	Battery: Undervoltage				
	Monitoring	ON	ON	n/a	n/a
	Limit	8.0 to 42.0 V	10.0 V		
	Delay	60.0 s	60.0 s	n/a	n/a
	Alarm class	B	B	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Delayed by engine speed	NO	NO	n/a	n/a
	Battery: charge voltage				
	Monitoring	ON/OFF	ON	☐ 1 ☐ 0	☐ 1 ☐ 0
..	Limit	0.0 to 32.0 V	16.0 V		
	Delay	10.0 s	10.0 s	n/a	n/a
	Alarm class	B	B	n/a	n/a
	Self acknowledge	NO	NO	n/a	n/a
	Delayed by engine speed	YES	YES	n/a	n/a
	Interface: J1939				
[x-H]	Monitoring	ON/OFF	OFF	☐ 1 ☐ 0	☐ 1 ☐ 0
[x-H]	Delay	0.1 to 650.0 s	20.0 s		
[x-H]	Alarm class	B/F	B		
[x-H]	Self acknowledge	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
[x-H]	Delayed by engine speed	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N

DISCRETE INPUTS				
Discrete input [DI1] oil pressure				
DI 1 operation	N.C.	N.C.	n/a	n/a
DI 1 delay	0.5 s	0.5 s	n/a	n/a
DI 1 alarm class	F	F	n/a	n/a
DI 1 delayed by eng. speed	YES	YES	n/a	n/a
DI 1 self acknowledge	NO	NO	n/a	n/a
Discrete input [DI2] coolant temperature				
DI 2 operation	N.C.	N.C.	n/a	n/a
DI 2 delay	1.0 s	1.0 s	n/a	n/a
DI 2 alarm class	F	F	n/a	n/a
DI 2 delayed by eng. speed	YES	YES	n/a	n/a
DI 2 self acknowledge	NO	NO	n/a	n/a
Discrete input [DI3] remote start				
DI 3 operation	N.C.	N.C.	n/a	n/a
DI 3 delay	0.02 s	0.02 s	n/a	n/a
DI 3 alarm class	Control	Control	n/a	n/a
DI 3 delayed by eng. speed	NO	NO	n/a	n/a
DI 3 self acknowledge	NO	NO	n/a	n/a
Discrete input [DI4] reply MCB or freely configurable If parameter "Ignore CB reply" is set to "YES", this input is freely configurable				
DI 4 operation	N.O./N.C.	N.C.	☐ N.O. ☐ N.C.	☐ N.O. ☐ N.C.
DI 4 delay	0.02 to 650.00 s	0.00 s		
DI 4 alarm class	A/B/C/D/E/F/Control	Control		
DI 4 delayed by eng. speed	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
DI 4 self acknowledge	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
Discrete input [DI5] reply GCB or freely configurable If parameter "Ignore CB reply" is set to "YES", this input is freely configurable				
DI 5 operation	N.O./N.C.	N.C.	☐ N.O. ☐ N.C.	☐ N.O. ☐ N.C.
DI 5 delay	0.02 to 650.00 s	0.00 s		
DI 5 alarm class	A/B/C/D/E/F/Control	Control		
DI 5 delayed by eng. speed	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
DI 5 self acknowledge	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N

DGITAL OUTPUTS					
[M-x]	Relay 1	Command: open MCB	open MCB	n/a	n/a
	Relay 2	Command: close GCB	close GCB	n/a	n/a
[M-x]	Relay 3	one from configurable parameter list (see end of table)	Preglow		
	Relay 4	one from configurable parameter list (see end of table)	stopping alarm		
	Relay 5	Fuel relay	Fuel relay	n/a	n/a
	Relay 6	Starter	Starter	n/a	n/a
	Relay 7	internal relay			

COUNTER					
	Maintenance hours	0 to 9,999 h	300 h		
	Reset maintenance period h	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Counter value preset	0 to 99,999.9 h	-		
	Set operation hours	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Number of starts	0 to 65,535	-		

COMM. INTERFACES					
[x-H]	CAN Interfaces				
	Baudrate	20/50/100/125/250/ 500/800/1000 kBd	125 kBd		
	J1939				
[x-H]	Device type	Off/Standard/S6 Scania/EMR	Standard		
[x-H]	Request send address	0 to 255	3		
[x-H]	Receive device number	0 to 255	0		

SYSTEM					
	Codes				
	Factory settings FL-CABLE-RS232	ON / OFF	OFF	☐ 1 ☐ 0	☐ 1 ☐ 0
	Clear event log	ON / OFF	OFF	☐ 1 ☐ 0	☐ 1 ☐ 0
	Set default values	ON / OFF	OFF	☐ 1 ☐ 0	☐ 1 ☐ 0
	Display level	1 to 3	1		
	Flag 1 gen. overfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 gen. underfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 gen. overvolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 gen. undervolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 mains rot. field alarm	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 overspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 underspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 unintended stop	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 start fail	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 maintenance hours exc.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 J1939 CAN Error	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 undervolt. aux. alt.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 undervolt. batt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 DI 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 DI 2	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 DI 3	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 DI 4	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 1 DI 5	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 gen. overfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 gen. underfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 gen. overvolt. 1	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 gen. undervolt. 1	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 mains rot. field alarm	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 overspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 underspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 unintended stop	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 start fail	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 maintenance hours exc.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 J1939 CAN Error	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 undervolt. aux. alt.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 undervolt. batt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 DI 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 DI 2	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 DI 3	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 DI 4	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 2 DI 5	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N

SYSTEM					
	Flag 3 gen. overfreq. 1	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 gen. underfreq. 1	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 gen. overvolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 gen. undervolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 mains rot. field alarm	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 overspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 underspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 unintended stop	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 start fail	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 maintenance hours exc.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 J1939 CAN Error	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 undervolt. aux. alt.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 undervolt. batt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 DI 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 DI 2	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 DI 3	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 DI 4	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 3 DI 5	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 gen. overfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 gen. underfreq. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 gen. overvolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 gen. undervolt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 mains rot. field alarm	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 overspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 underspeed 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 unintended stop	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 start fail	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 maintenance hours exc.	YES/NO	YES	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 J1939 CAN Error	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 undervolt. aux. alt.	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 undervolt. batt. 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 DI 1	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 DI 2	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 DI 3	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 DI 4	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Flag 4 DI 5	YES/NO	NO	☐ Y ☐ N	☐ Y ☐ N
	Versions				
	Serial number	Info	–		
	Boot item number	Info	–		
	Boot revision	Info	–		
	Boot version	Info	–		
	Program item number	Info	–		
	Program revision	Info	–		
	Program version	Info	–		

[x-H] applies only to NAC1-G-H and M-H
[G-x] applies only to NAC1-G-L and G-H
[M-L] applies only to NAC1-M-L
[x-L] applies only to NAC1-G-L and M-L
[M-x] applies only to NAC1-M-L and M-H
[M-H] applies only to NAC1-M-H

The output signals, which may be selected from the list of configurable parameters for the discrete inputs 1 and 4, are listed in Table 10-1 on page 84.

NOTE

All parameters shaded in gray colour are fixed parameters and cannot be configured by the operator. The "light gray" parameters for DI4 & DI 5 can be configured if the parameter "Ignore CB reply" is set to "YES".

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