DEIF

-power in control

CE

DESIGNER'S REFERENCE HANDBOOK

Engine Control Unit, ECU 100

- Functional description
- Additional functions
- Parameter list

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7. Parameter list

1. General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings

Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes

Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

1.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

1.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminal against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

1.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

1.2 About the Designer's Reference Handbook

1.2.1 General purpose

This Designer's Reference Handbook mainly includes functional descriptions, presentation of display unit and menu structure, information about the PID controller, the procedure for parameter setup and reference to parameter lists.

The general purpose of this document is to provide useful overall information about the functionality of the unit and its applications. This document also offers the user the information he needs in order to successfully set up the parameters needed in his specific application.

Please make sure to read this document before starting to work with the Multi-line 2 unit and the genset to be controlled. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

This Designer's Reference Handbook is mainly intended for the panel builder designer in charge. On the basis of this document, the panel builder designer will give the electrician the information he needs in order to install the Multi-line 2 unit, e.g. detailed electrical drawings. In some cases, the electrician may use these installation instructions himself.

1.2.3 Contents and overall structure

This document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page.

2. General product information

2.1 Introduction

2.1.1 Introduction

This chapter will deal with the unit in general and its place in the DEIF product range.

The ECU is part of the DEIF Multi-line 2 product family. Multi-line 2 is a complete range of multi-function generator protection and control products integrating all the functions you need into one compact and attractive solution.

The concept of the ECU is to offer a cost-effective solution to those who need a flexible protection unit for small single to medium and large genset applications. Being part of the Multi-line product family, the standard functions can be supplemented with a variety of optional functions.

2.2 Type of product

The Engine Control Unit is a micro-processor based control unit containing all necessary functions for protection and control of an engine.

All measured values and alarms are presented on the LCD display.

2.3 Variants and accessories

2.3.1 Variants

The ECU 100 family only consists of one variant, the ECU 110. Furthermore accessories are available.

A complete list of available variants and accessories is included in the data sheet. Please see www.deif.com

2.4 Setup of the controller

2.4.1 Setup of the controller

The parameter settings and M-Logic programming can easily be done via a PC Windows®-based utility software (USW). The software can be downloaded on www.deif.com. The USW is password-protected - for further information please read the help file in the USW editor.

To interface the ECU 100 from the PC, a USB to TTL cable is required which is available as an accessory. The cable is galvanically isolated and will protect your PC if it is connected during engine operation.

The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

2.5 PC utility software warning

2.5.1 PC utility software warning

It is possible to remote-control the engine from the PC utility software or by use of a modem. To avoid personal injury, make sure that it is safe to remote-control the engine.

2.6 UL applications

2.6.1 UL applications

These flat surface panel-mounted controllers are intended to be used in Listed Generator Assemblies, where the suitability of the combination has been determined by Underwriters Laboratories.
These devices have been evaluated for fire and shock only. They have no voltage-regulating function.

3. Functional descriptions

3.1 Standard functions

3.1.1 Standard functions

This chapter includes functional descriptions of standard functions as well as illustrations of the relevant application types. Flowcharts and single-line diagrams will be used in order to simplify the information.

Standard main functions and features are listed below

Engine control
Remote or Local control
Start/stop sequences
Run and stop coil
Test sequence

Engine protection
Overspeed
Multi-functional alarm inputs (digital, 4-20 mA or RMI)
Digital alarm inputs

Communication
CANbus engine communication, J1939
Modbus communication, RS485
TTL interface to PC
Additional Operator Panel, AOP-2

Display
Push-buttons for start and stop
Status texts
Info messages
Alarm indication
Alarm and Event LOG

M-Logic
Simple logic configuration tool
Selectable input events
Selectable output commands

Emulation software solution
Application test before installation

3.2 Terminal strip overview

3.2.1 Reference to Installation Instructions

Information about terminal strip overview and rear side controller view can be found in the "Installation Instructions", which is located on DEIF's homepage under documentation for ECU 100.

3.3 Operation modes and applications

3.3.1 Remote mode

Remote means that the engine can be operated from a distance by use of external signals given in one of the following ways.

1. Digital inputs
2. Modbus command at service port
3. Modbus RS485 terminal 49/50/51
4. Commands from Additional Operator Panel, AOP-2

3.3.2 Local mode

Local means that all commands must be done from the display, and the unit will not initiate any automatical sequences.

The following sequences can be activated in local mode:

Com-mand	Description	Comment
Start	The start sequence is initiated and continues until the engine starts or the maximum number of start attempts has been reached.	First start: include preheat Second start: cancel pre-heat
Stop	The engine will be stopped. After disappearance of the running signal, the stop sequence will continue to be active in the '"exten-ded stop time" period. The engine is stopped with cooling down time.	The cooling down time is cancelled if the stop button is activated twice.

3.3.3 Simple test

ECU 100 will go through the start sequence and run the engine for the time set in parameter 7042. This sequence is initiated by a digital input or the TEST push-button on the front. The test will run until the timer expires. When the timer runs out, the stop sequence including cooling down will be carried out.
If the timer in parameter 7042 is set to 0, the test is infinite. The test will be interrupted if the mode is changed to manual or auto.

If the timer is set to 0.0 min., the test sequence will be infinite. The test will be cancelled by pushing TEST again.

3.4 Flowcharts

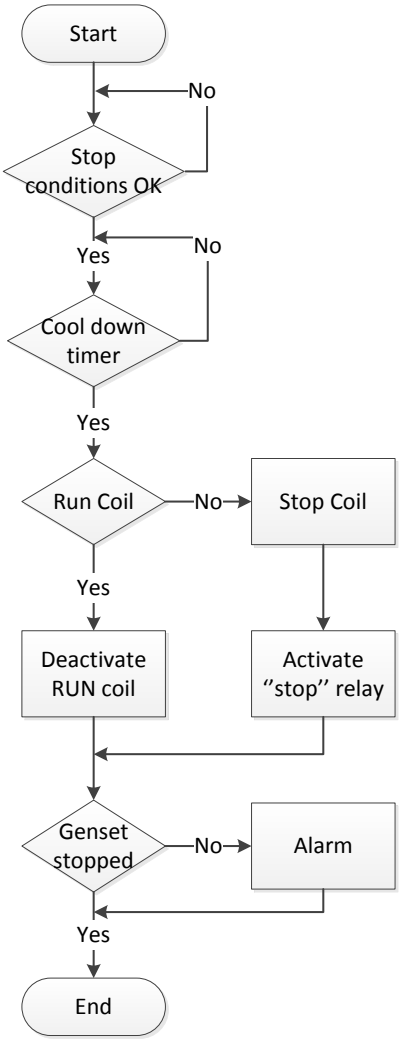
3.4.1 Flowcharts

Using flowcharts, the principles of the most important functions will be illustrated in the next sections. The functions included are:

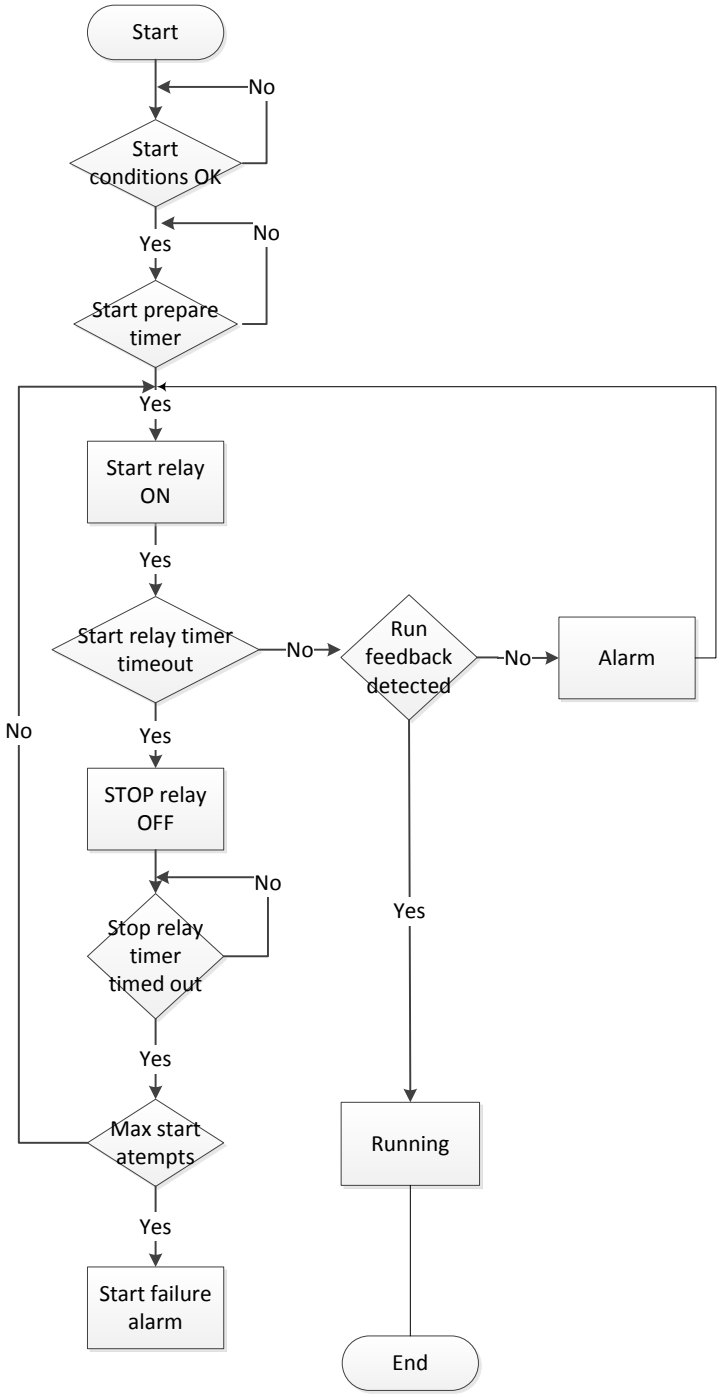
- Stop sequence
- Start sequence
- Test sequence

The flowcharts on the following pages are for guidance only. For illustrative purposes, the flowcharts are simplified in some extent.

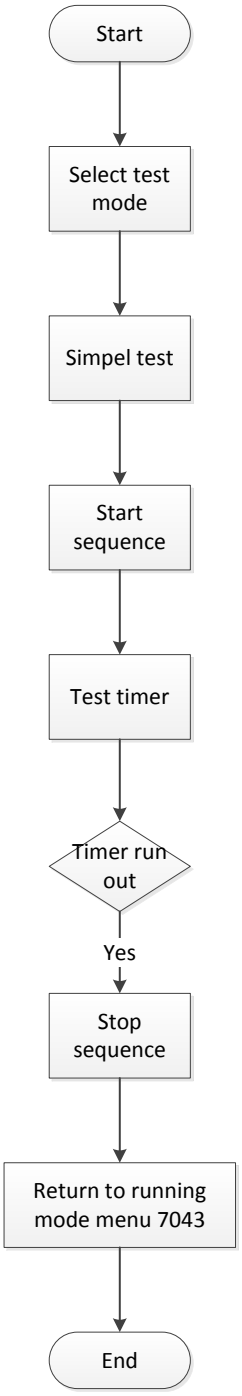
3.4.2 Stop sequence



3.4.3 Start sequence



3.4.4 Test sequence



3.5 Sequences

3.5.1 Sequences

The following contains information about the sequences of the engine. These sequences are automatically initiated if the auto mode is selected.

In manual, the selected sequence is the only sequence initiated (e.g. when the START push-button is pressed, the engine will start etc.).

The following sequences will be illustrated below:

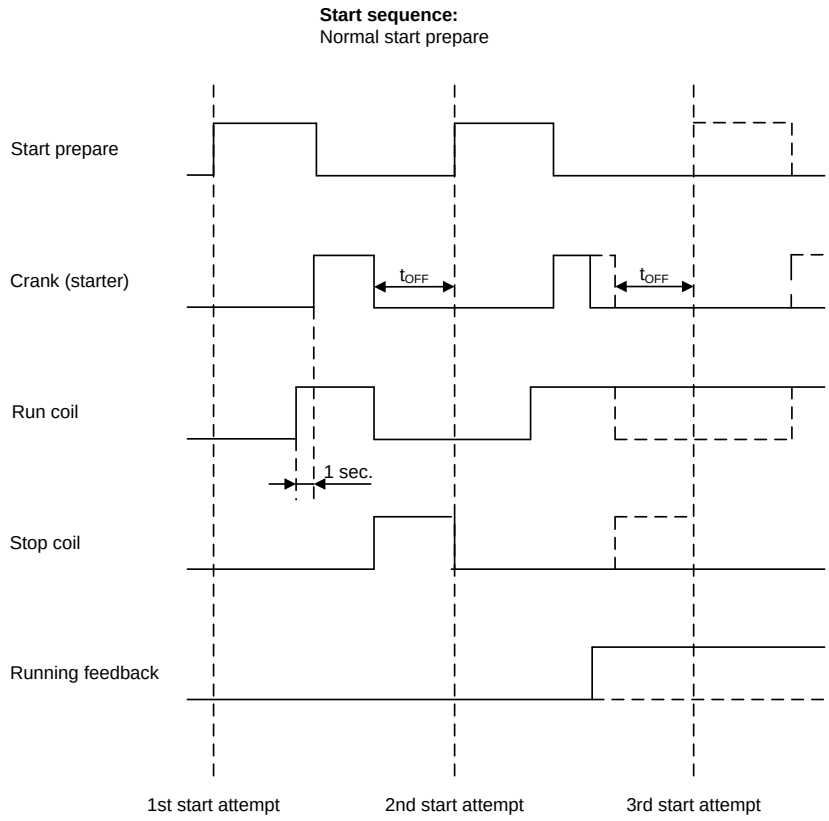
- START sequence
- STOP sequence

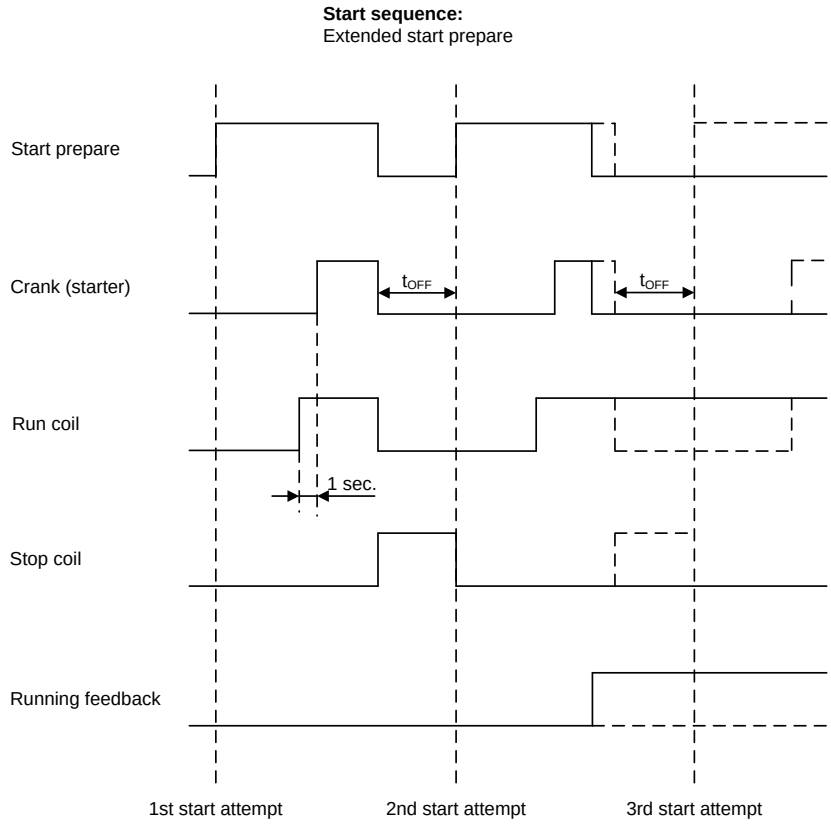
We recommend not using small relays for stop coil output. If small relays are used, a resistor must be mounted across the relay coil to prevent undesirable closing of the relay. This is caused by the wirebreak function.

3.5.2 Start sequence

The following drawings illustrate the start sequences of the engine with normal start prepare and extended start prepare.

No matter the choice of start prepare function, the running coil is activated 1 sec. before the start relay (starter).





Run coil can be activated from 1...600 sec. before crank (starter) will be executed. In the above example, the timer is set to 1 sec. (menu 6150).

3.5.3 Start sequence conditions

The start sequence initiation can be blocked by the following conditions:

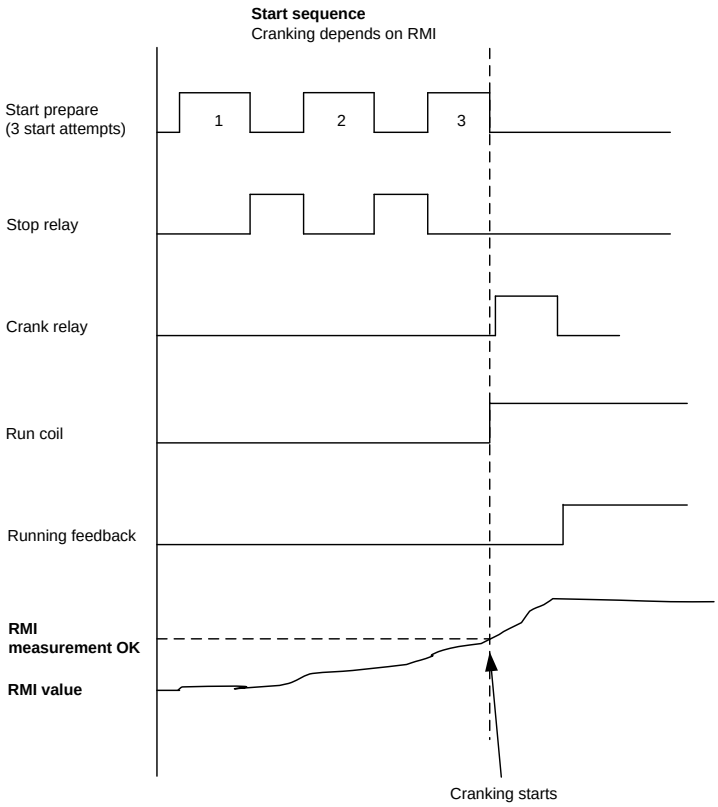
- RMI 6 (oil pressure)
- RMI 7 (water temperature)
- RMI 8 (fuel level)

This means that if e.g. the oil pressure is not reached sufficient pressure, then the crank relay will not engage the starter motor.

The selection is made in setting 6185. For each of the RMI settings, the rule is that the value (oil pressure, fuel level or water temperature) must exceed the setpoint of setting 6186 before starting is initiated.

If the value in 6186 is set to 0.0, the start sequence is initiated as soon as it is requested.

The diagram below shows an example where the RMI signal builds up slowly, and starting is initiated at the end of the third start attempt.



3.5.4 Running feedback

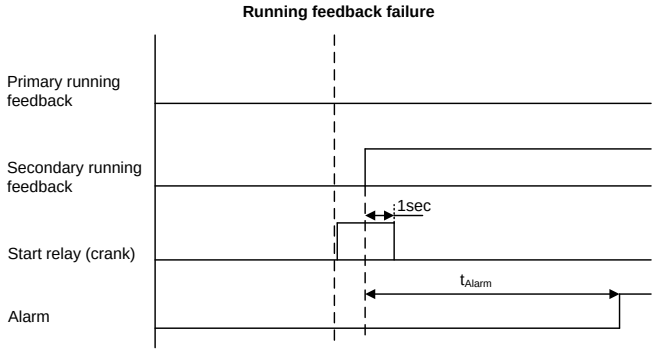
Different types of running feedback can be used to detect if the motor is running. Refer to menu 6170 for selection of the running feedback type.

Feedback type
Digital input
MPU input
EIC
Multi-input 6
Multi-input 7
Multi-input 8

The running detection is made with a built-in safety routine. The running feedback selected is the primary feedback. At all times, all the types of running feedback are used for running detection. If, for some reason, the primary choice is not detecting any running feedback, the starter relay will stay activated for 1 additional second. If a running feedback is detected based on one of the secondary choices, the engine will start. In this way, the engine will still be functional even though a tacho sensor is damaged or dirty.

As soon as the engine is running, no matter if the engine is started based on the primary or secondary feedback, the running detection will be made, based on all available types.

The sequence is shown in the diagram below.



The start sequence is interrupted in the following situations:

Event	Comment
Stop signal	
Start failure	
Remove starter feedback	Tacho setpoint.
Running feedback	Digital input.
Running feedback	Tacho setpoint.
Running feedback	W terminal
Running feedback	Oil pressure setpoint (menu 6175).
Running feedback	EIC (engine communication).
Emergency stop	
Alarm	Alarms with shutdown" or "trip and stop" fail class.
Stop push-button on display	Local mode.
RMI feedback	RMI input with shutdown
Modbus stop command	Local mode.
Digital stop input	Local mode.

If the MPU input is to be used to remove the starter, it has to be set up in menu 6174.

Setpoints related to the start sequence
- Crank failure alarm **(4530 Crank failure)**
If MPU is chosen as the primary running feedback, this alarm will be raised if the specified rpm is not reached before the delay has expired.

- Run feedback failure **(4540 Run feedb. fail)**
If running is detected on a secondary feedback, but the primary running feedback, e.g. digital input, has not detected running, then this alarm will be raised. The delay to be set is the time from the secondary running detection and until the alarm is raised.

- Start failure alarm **(4570 Start failure)**
The start failure alarm occurs, if the engine has not started after the number of start attempts set in menu 6190.

- Start prepare **(6180 Starter)**
Normal prepare: the start prepare timer can be used for start preparation purposes, e.g. prelubrication or pre-glowing. The start prepare relay is activated when the start sequence is initiated and deactivated when the start relay is activated. If the timer is set to 0.0 s, the start prepare function is deactivated.

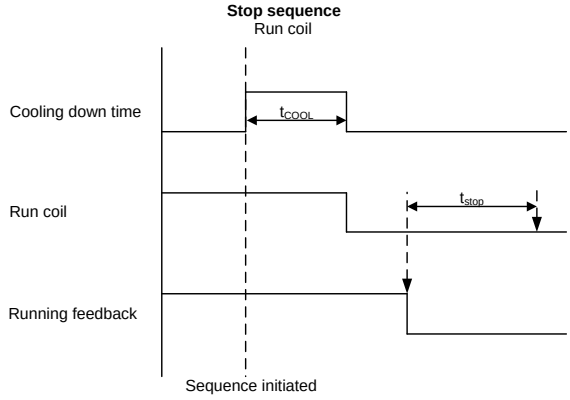
Extended prepare: the extended prepare will activate the start prepare relay when the start sequence is initiated and keep it activated when the start relay activates until the specified time has expired. If the extended prepare time exceeds the start ON time, the start prepare relay is deactivated. If the timer is set to 0.0 s, the extended prepare function is deactivated.

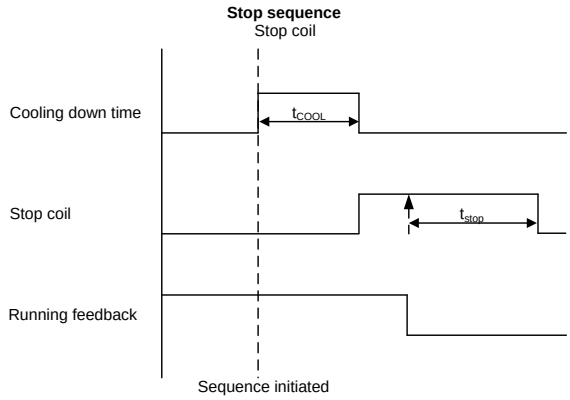
Start ON time: the starter will be activated during this period when cranking.

Start OFF time: the pause between two start attempts.

3.5.5 Stop sequence

The drawings illustrate the stop sequence.





The stop sequence will be activated if a stop command is given. The stop sequence includes the cooling down time if the stop is a normal or controlled stop.

Description	Cooling down	Stop	Comment
Trip and stop alarm	X	X	
Stop button on display	(X)	X	Manual stop. Cooling down is interrupted if the stop button is activated twice.
Emergency stop		X	Engine shuts down.

The stop sequence can only be interrupted during the cooling down period in these situations:

Event	Comment
Start button is pressed	Local mode: engine will run in idle speed
Digital start input	Remote mode

Setpoints related to the stop sequence

- Stop failure **(4580 Stop failure)**
A stop failure alarm will appear if the primary running feedback is still present after the delay in this menu has expired.

- Stop **(6210 Stop)**
Cooling-down:
The length of the cooling-down period can be defined.

Extended stop:
The delay after the running feedback has disappeared until a new start sequence is allowed. The extended stop sequence is activated any time the stop button is pressed.

Cool down controlled by engine temperature:
The engine temperature-controlled cool-down is to ensure that the engine is cooled down below the setpoint in menu 6214 "Cool down temperature" before the engine is stopped. This is particularly beneficial if the engine has been running for a short period of time and therefore not reached normal cooling water temperature, as the cool-down period will be very short or none at all. If the engine has been running for a long period, it has reached normal running temperature, and the cool-down period will be the exact time it takes to get the temperature below the temperature setpoint in menu 6214.

If, for some reason, the engine cannot get the temperature below the temperature setpoint in 6214 within the time limit in parameter 6211, the engine will be shut down by this timer. The reason for this could be high ambient temperature or too high exhaust temperatures etc.

If the cooling-down timer is set to 0.0 s, the cooling-down sequence will be infinite.

If the cooling-down temperature is set to 0 deg., the cooling-down sequence will be entirely controlled by the timer.

4. Display and menu structure

4.1 Password and parameter acccess

4.1.1 Passwords

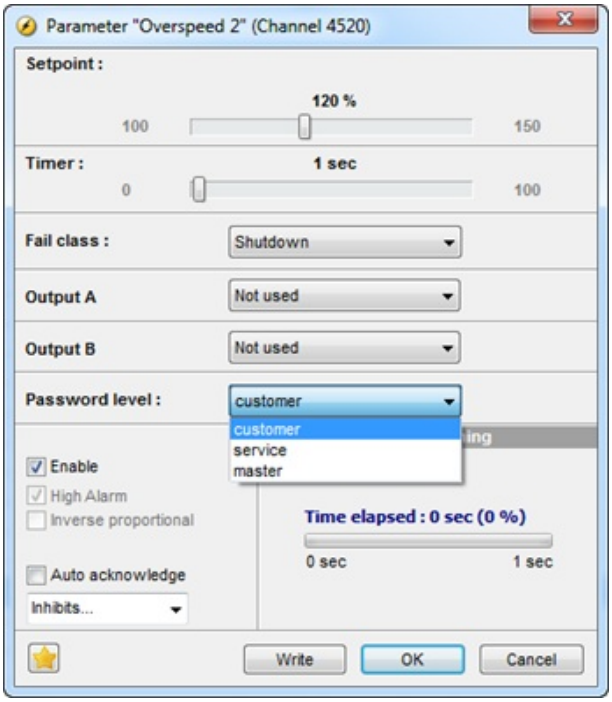
The unit includes three password levels. All levels can be adjusted in the PC software.

Available password levels:

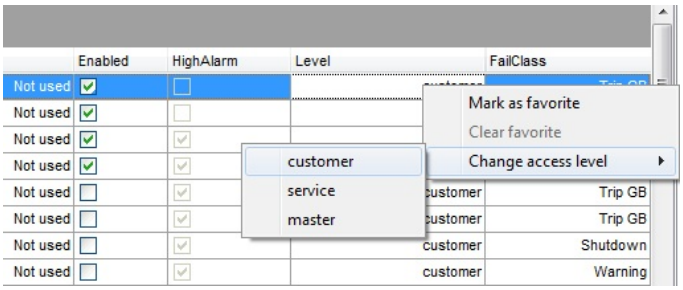
Password level	Factory setting	Access		
		Customer	Service	Master
Customer	2000	X		
Service	2001	X	X	
Master	2002	X	X	X

A parameter cannot be entered with a password that is ranking too low. But the settings can be displayed without password entry.

Each parameter can be protected by a specific password level. To do so, the PC utility software must be used. Enter the parameter to be configured and select the correct password level.

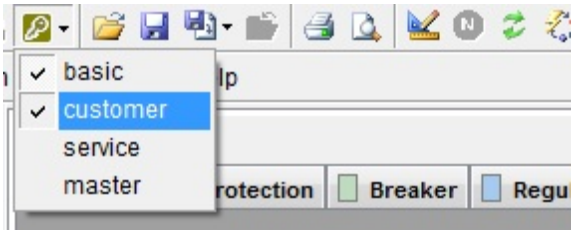


The password level can also be changed from the parameter view in the column "Level".



4.1.2 Parameter access

To gain access to adjust the parameters, the password level must be entered:



If the password level is not entered, it is not possible to enter the parameters.

The customer password can be changed in parameter 9111. The service password can be changed in parameter 9112. The master password can be changed in parameter 9113.

The factory passwords must be changed if the operator of the engine is not allowed to change the parameters.

It is not possible to change the password at a higher level than the password entered.

4.2 Reference to Operator's manual

Information about display and menu structure can be found in the "Operator's manual", which is located on DEIF's homepage under documentation for ECU 100.

5. Engine communication

5.1 Reference to engine communication manual

5.1.1 Engine communication

The ECU 100 is able to communicate with an engine controller through the CANbus (CAN A).

Information about engine communication can be found in the "Engine communication" manual, which is located on DEIF's homepage under documentation for ECU 100.

6. Additional functions

6.1 Start functions

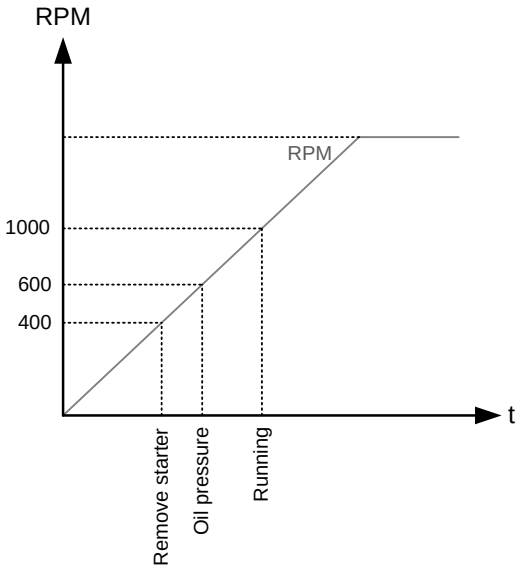
6.1.1 Start functions

The ECU will start the engine when the start command is given. The start relay is deactivated when the remove starter event occurs or when the running feedback is present.

The reason for having two possibilities to deactivate the start relay is to be able to delay the alarms with run status.

If it is not possible to activate the run status alarms at low revolutions, the remove starter function must be used.

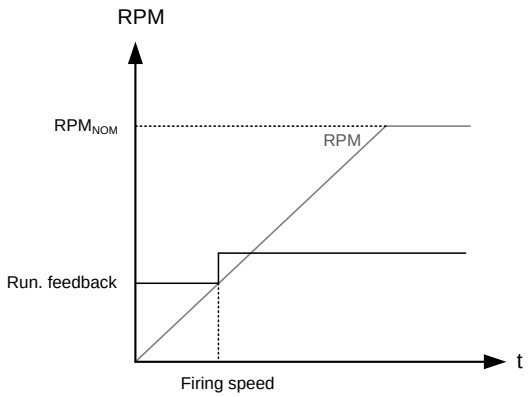
An example of a critical alarm is the oil pressure alarm. Normally, it is configured according to the shutdown fail class. But if the starter motor has to disengage at 400 RPM, and the oil pressure does not reach a level above the shutdown setpoint before 600 RPM, then the genset would shut down if the specific alarm was activated at the preset 400 RPM. In that case, the running feedback must be activated at a higher number of revolutions than 600 RPM.



6.1.2 Digital feedbacks

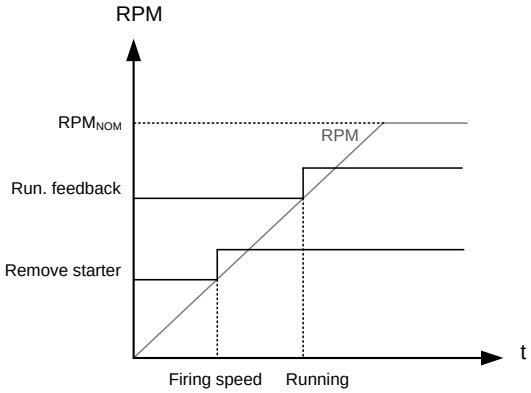
If an external running relay is installed, the digital control inputs for running detection or remove starter can be used.

Running feedback
When the digital running feedback is active, the start relay is deactivated, and the starter motor will be disengaged.



The diagram illustrates how the digital running feedback is activated when the engine has reached its firing speed.

Remove starter
When the digital remove starter input is present, the start relay is deactivated, and the starter motor will be disengaged.



The diagram illustrates how the remove starter input is activated when the engine has reached its firing speed. At the running speed, the digital running feedback is activated.

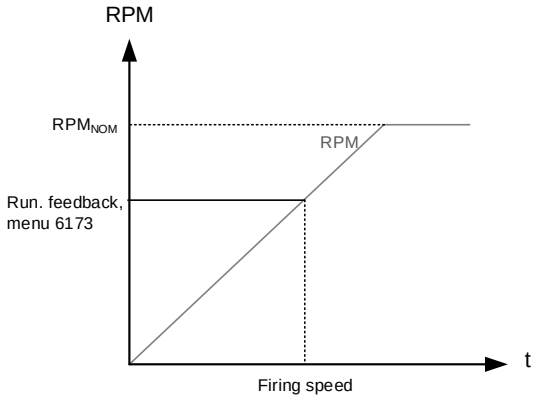
The remove starter input must be configured from a number of available digital inputs.

The running feedback is detected by either the digital input (see diagram above), frequency measurement (frequency level is adjustable in parameter 6165), RPM measured by magnetic pickup or EIC (engine communication).

6.1.3 Analogue feedback

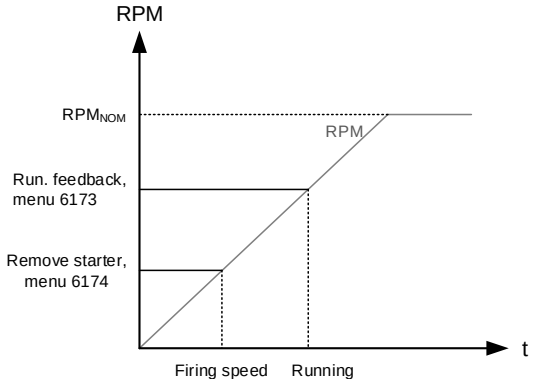
When a magnetic pick-up (MPU) is being used, the specific level of revolutions for deactivation of the start relay can be adjusted.

Running feedback
The diagram below shows how the running feedback is detected at the firing speed level. The factory setting is 1000 RPM **(6170 Running detect.).**



Notice that the factory setting of 1000 RPM is higher than the RPM level of starter motors of typical design. Adjust this value in 6170 to a lower value to avoid damage of the starter motor.

Remove starter input
The drawing below shows how the setpoint of the remove starter is detected at the firing speed level. The factory setting is 400 RPM **(6170 Running detect.).**



The number of teeth on the flywheel must be adjusted in menu 6170 when the MPU input is used.

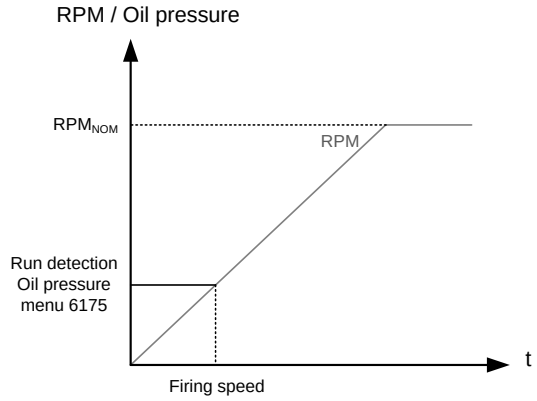
6.1.4 Oil pressure

The multi-inputs on terminals 6, 7 and 8 can be used for the detection of running feedback. The terminal in question must be configured as an RMI input for oil pressure measurement.

When the oil pressure increases above the adjusted value **(6175 Pressure level),** the running feedback is detected, and the start sequence is ended.

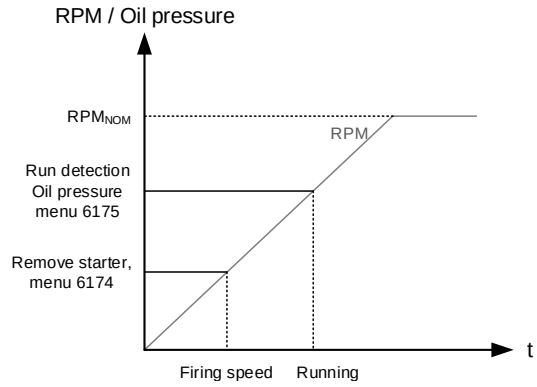
Running feedback

The diagram below shows how the running feedback is detected at the firing speed level. The factory setting is 1000 RPM (6170 Running detect.).



Remove starter input

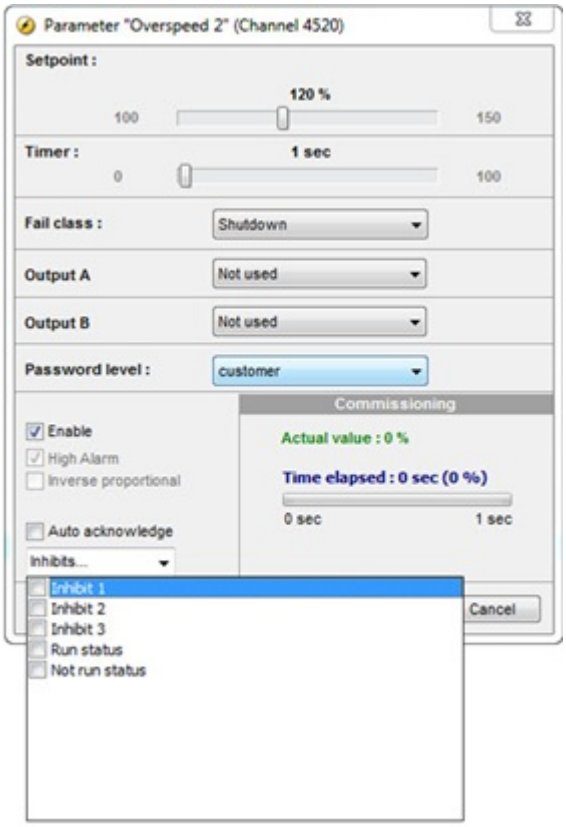
The drawing below shows how the setpoint of the "remove starter input" is detected at the firing speed level. The factory setting is 400 RPM **(6170 Running detect.).**



The remove starter function can use the MPU or a digital input.

6.2 Alarm inhibit

In order to select when the alarms are to be active, a configurable inhibit setting for each alarm has been made. The inhibit functionality is a way to make an alarm inactive when the events, chosen in the menu below, are active. The inhibit functionality is only available via the PC utility software. For each alarm, there is a drop-down window where it is possible to select which signals have to be present in order to inhibit the alarm.



Selections for alarm inhibit:

Function	Description
Inhibit 1	M-Logic outputs: Conditions are programmed in M-Logic
Inhibit 2	
Inhibit 3	
Run status	Running detected and the timer in menu 6160 expired
Not run status	Running not detected or the timer in menu 6160 not expired

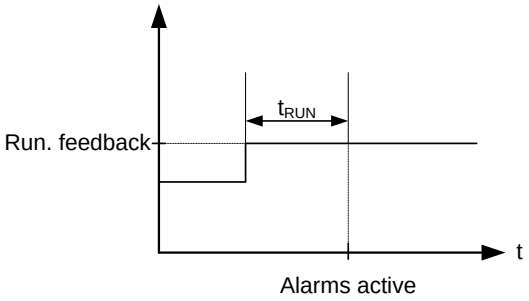
The timer in 6160 is not used if digital running feedback is used.

Inhibit of the alarm is active as long as one of the selected inhibit functions is active.

6.2.1 Run status (6160)

Alarms can be adjusted to activate only when the running feedback is active and a specific time delay has expired.

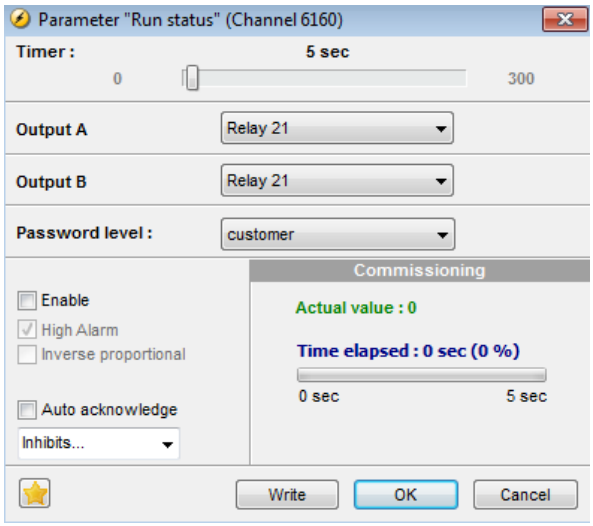
The diagram below illustrates that after activation of the running feedback, a run status delay will expire. When the delay expires, alarms with *Run status* will be activated.



The timer is ignored if digital running feedback is used.

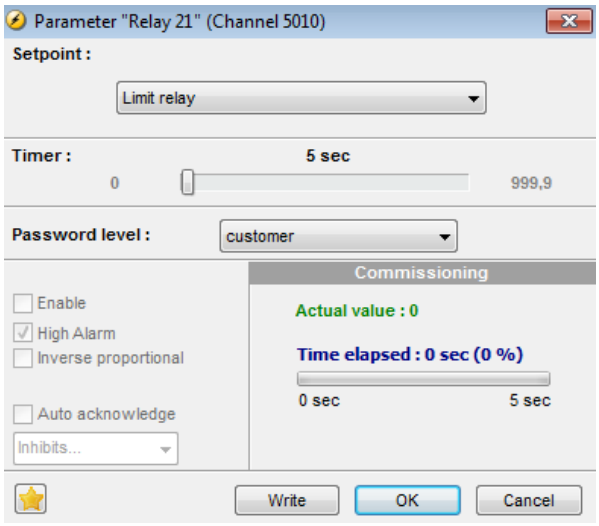
6.3 Running output

6160 Run status can be adjusted to give a digital output when the engine is running.



Select the correct relay number in output A and output B, enable the function and write to the controller.

Change the relay function to limit in the I/O menu. Then the relay will activate, but no alarm will appear.



If the relay function is not changed to "limit" function, an alarm will appear at every running situation.

6.4 Idle running

6.4.1 Idle running

The purpose of the idle run function is to change the start and stop sequences to allow the engine to operate under low temperature conditions.

It is possible to use the idle run function with or without timers. Two timers are available. One timer is used in the start sequence, and one timer is used in the stop sequence.

The main purpose of the function is to prevent the engine from stopping. The timers are available to make the function flexible.

The speed governor must be prepared for the idle run function if this function is to be used.

The function is typically used in installations where the engine is exposed to low temperatures which could generate starting problems or damage the engine.

6.4.2 Description

The function is enabled and configured in 6290 Idle running. It has to be noted that the governor itself must handle the idle speed based on a digital signal from the ECU (see the principle diagram below).

When the function is enabled, a digital input is used for control purposes. This input must be configured through the utility software:

No.	Input	Description
1	Low speed input	This input is used to change between idle speed and nominal speed. This input does not prevent the engine from stopping - it is only a selection between idle and nominal speed.

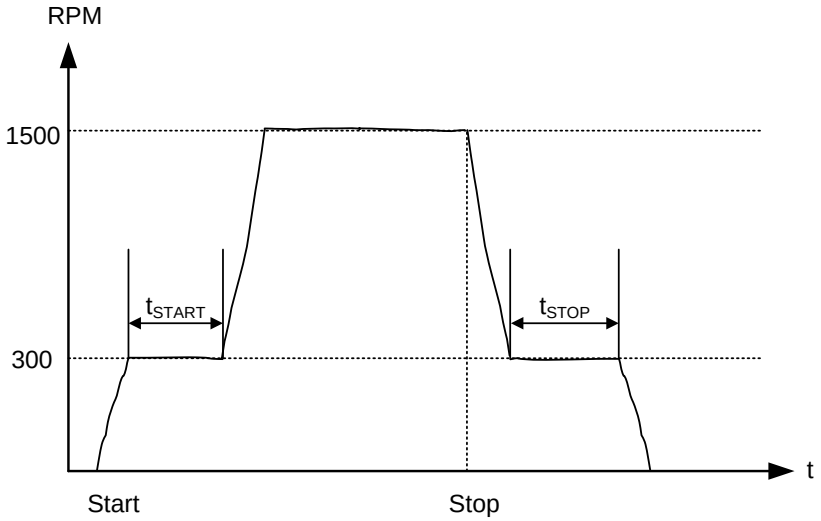
If the idle run function is selected by means of the timer, the low speed input is overruled.

Turbo chargers not originally prepared for operating in the low speed area can be damaged if the engine is running in "idle run" for too long.

6.4.3 Examples

Idle speed during starting and stopping
In this example both the start and the stop timers are activated.

The start and stop sequences are changed in order to let the engine stay at the idle level before speeding up. It also decreases the speed to the idle level for a specified delay time before stopping.



6.4.4 Inhibit

The alarms that are deactivated by the inhibit function are inhibited in the usual manner, except for the oil pressure alarms; RMI oil 6,7 and 8 which are active during "idle run" as well.

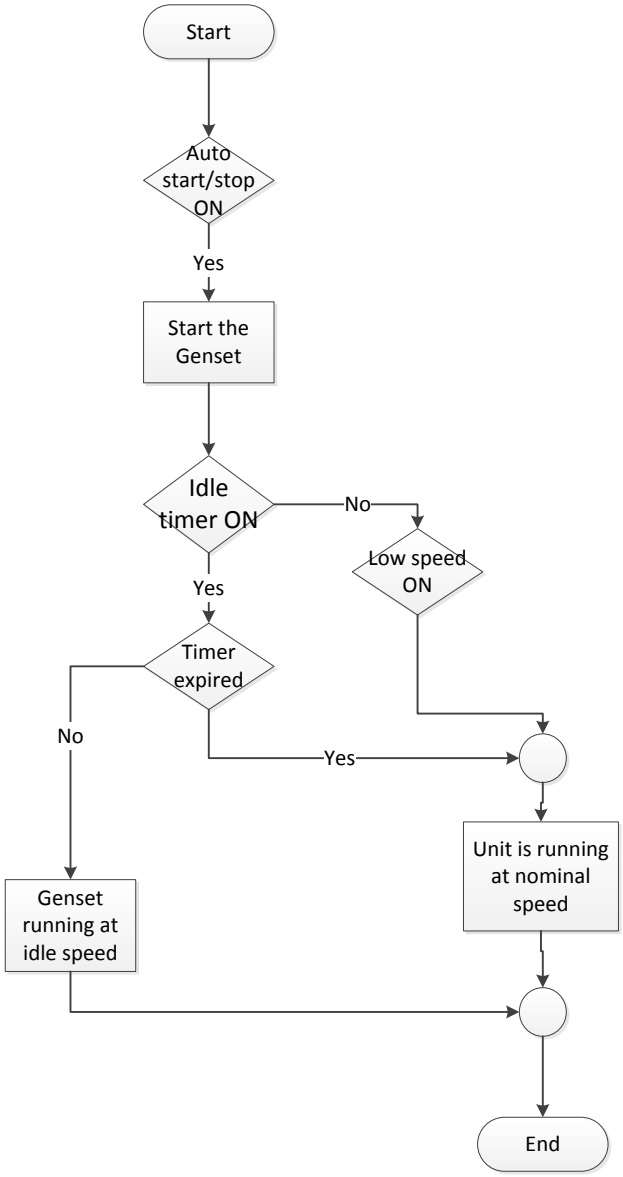
6.4.5 Running signal

The running feedback must be activated when the engine is running in idle mode.

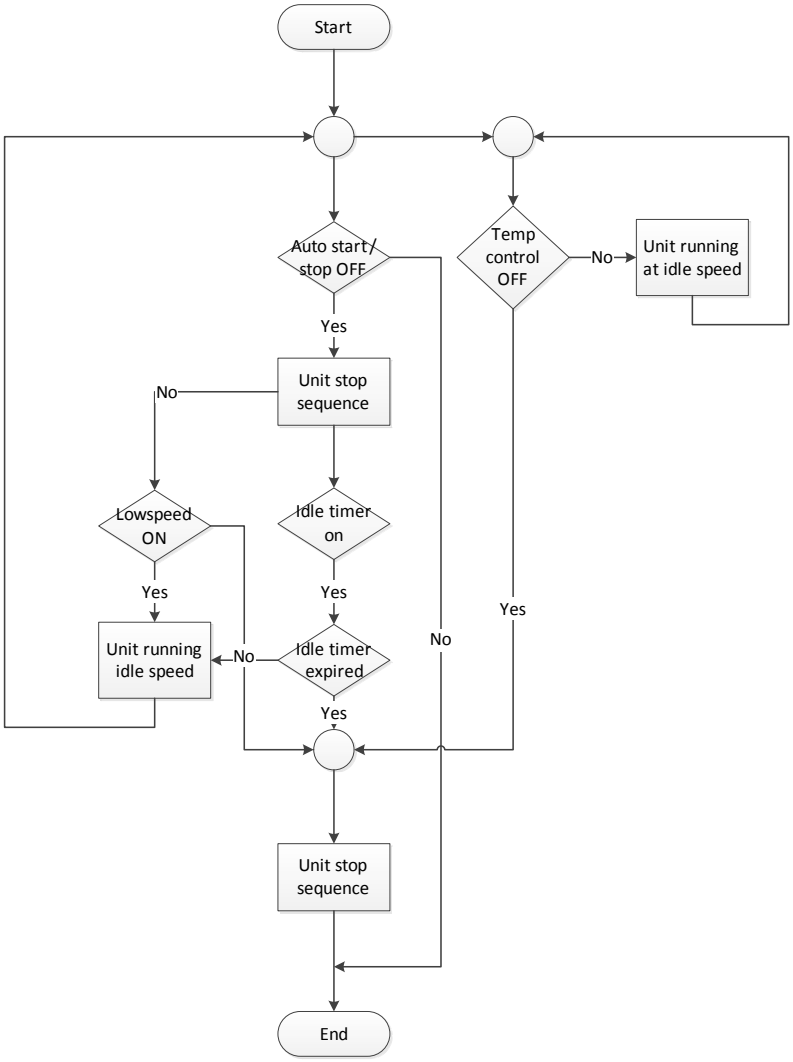
6.4.6 Idle speed flowcharts

The flowcharts illustrate the starting and stopping of the engine by use of the input "low speed".

6.4.7 Start


Start
Auto start/stop ON
Yes
Start the Genset
Idle timer ON
No
Low speed ON
Yes
Timer expired
No
Yes
Unit is running at nominal speed
Genset running at idle speed
End

6.4.8 Stop



6.5 Engine heater

This function is used to control the temperature of the engine. A sensor measuring the cooling water temperature is used to activate an external heating system to keep the engine at a minimum temperature.

The setpoints adjusted in menu 6320 are:

Setpoint: This setpoint +/- the hysteresis is the start and stop points for the engine heater.

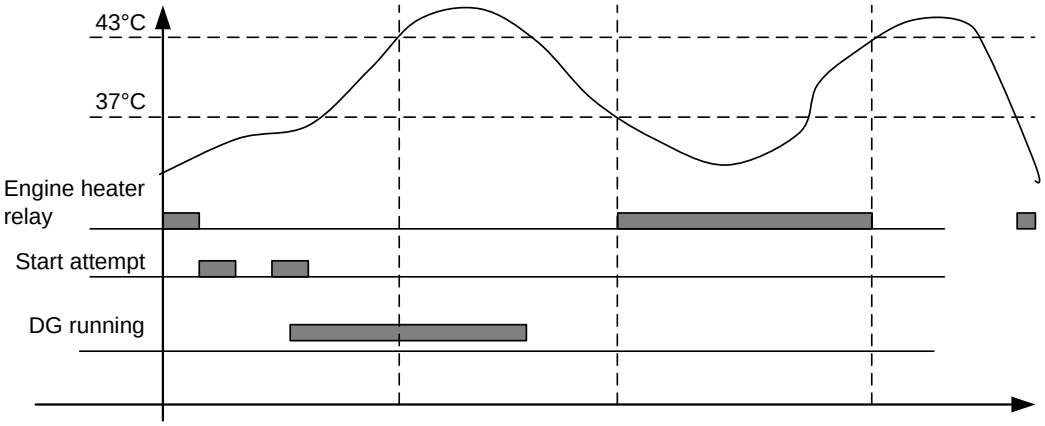
Output A: The relay output for the engine heater.

Type: Multi-input to be used for temperature measurement.

Hysteresis: This decides how big a deviation from the setpoint is needed to activate/deactivate the engine heater.

Enable: Enables the engine heater function.

Principle diagram:



The engine heater function is only active when the engine is stopped.

6.5.1 Engine heater alarm

If the temperature keeps dropping after the start setpoint has been exceeded, an alarm will be raised if configured in menu 6330.

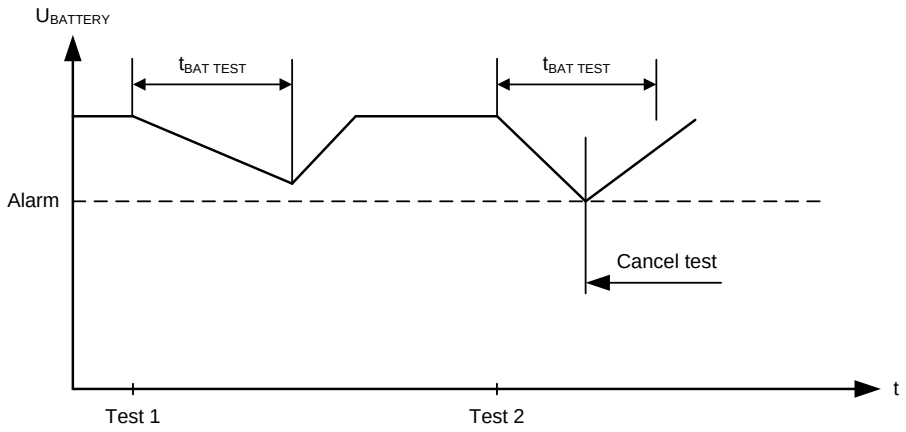
6.6 Battery test

6.6.1 Battery test

This function gives the possibility to test the condition of the battery. The battery test can be initiated with a digital input and is available when the engine is in auto mode.

If a busbar failure occurs during the battery test sequence, the test will automatically be interrupted, and the automatic busbar failure start up sequence will be activated.

During the test, the battery voltage will decrease, and an alarm will occur if it drops to the setpoint.

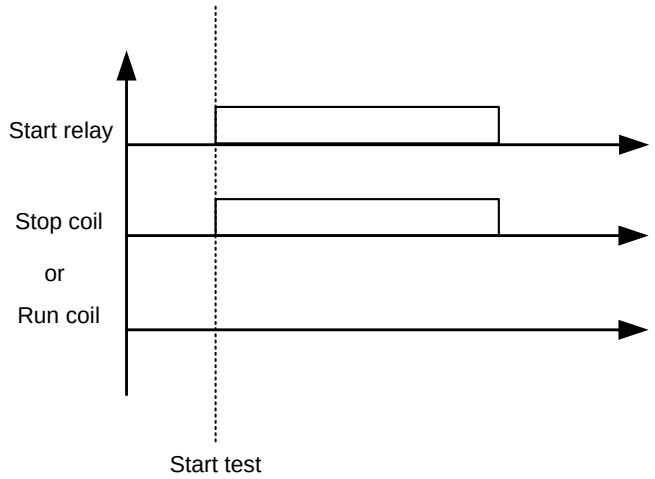


The drawing shows that test #1 is carried out without a large voltage drop of the battery voltage, whereas test #2 reaches the alarm setpoint as the voltage drop is too big.

As there is no reason to wear the battery down even more, the test stops when the battery test alarm occurs. The test is typically used at periodical intervals, e.g. once every week. The engine must be at a standstill when the test is started. Otherwise, the test command will be ignored. The stop relay will act depending on the coil type:

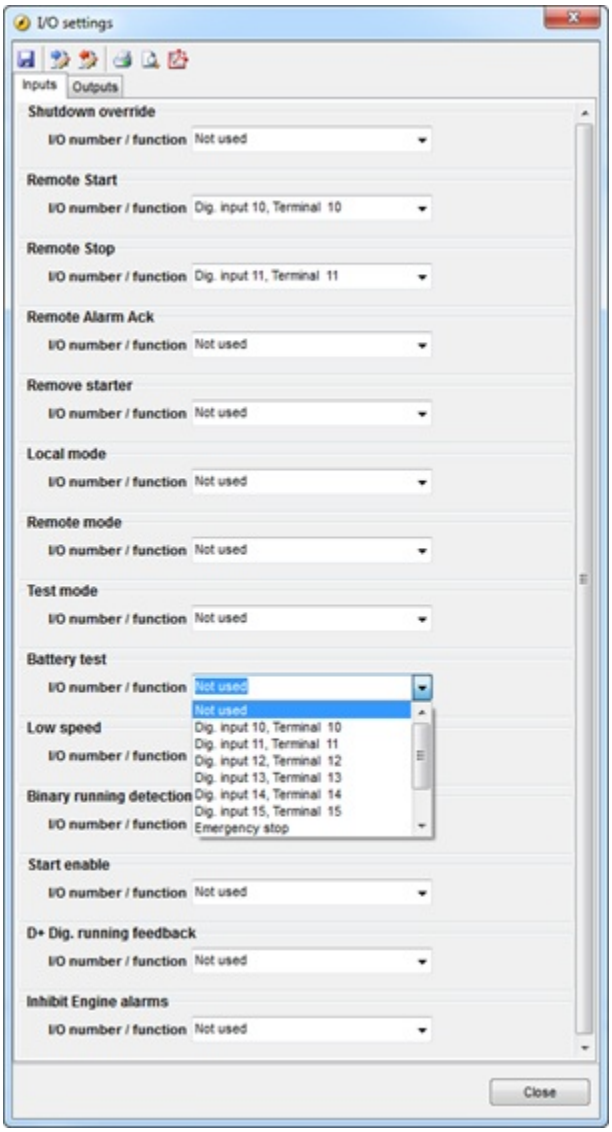
Stop coil: *The stop relay activates during the test.*
Run coil: *The stop relay stays deactivated during the test.*

The drawing below shows that when the test is started, the start relay activates what makes the engine turn.



6.6.2 Input configuration

If this function is to be used, it is necessary to configure a digital input that initiates the function. This is done in the dialogue box below:



6.7 Not in remote

6.7.1 Not in remote

This function can be used for indication or to raise an alarm in case the system is not in remote. The function is set up in menu 6540.

6.8 Fuel pump logic

The fuel pump logic is used to start and stop the fuel supply pump to maintain the fuel level in the service tank at predefined levels. The start and stop limits are detected from one of the three multi-inputs.

Setpoints available in menu 6550:

Pump start Start level.

Pump stop Stop level.

Timer: If the fuel level has not increased by 2% within this delay, a *Fuel fill alarm* will be raised.

Output A (OA): The relay to be used for control of the fuel pump. The selected relay activates below the start limit and deactivates above the stop level.

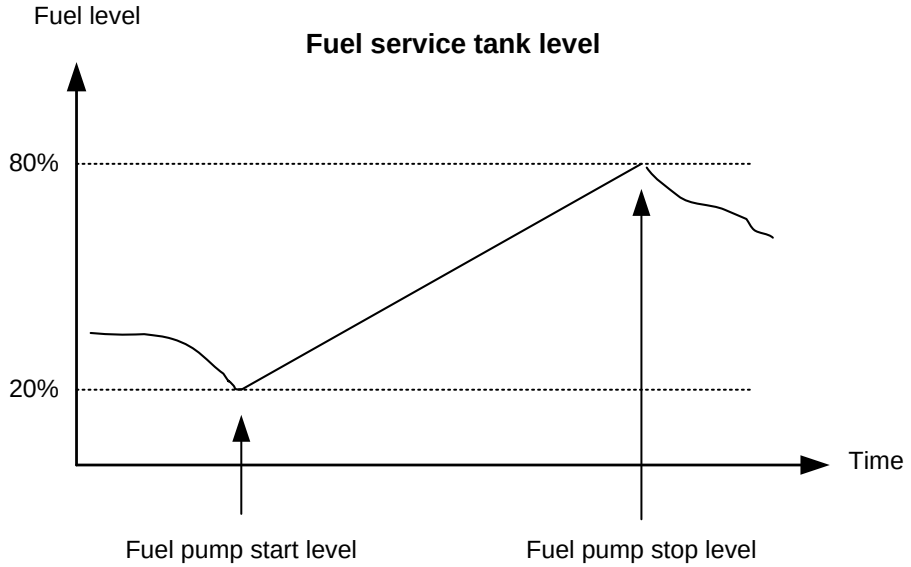
Type: The multi-input to be used for the fuel level sensor.

Fail class: The fail class of the *Fuel fill alarm*.

The fuel pump relay can be activated via M-logic.

The output relay should be configured as a limit relay, otherwise, an alarm will be raised whenever the output is activated.

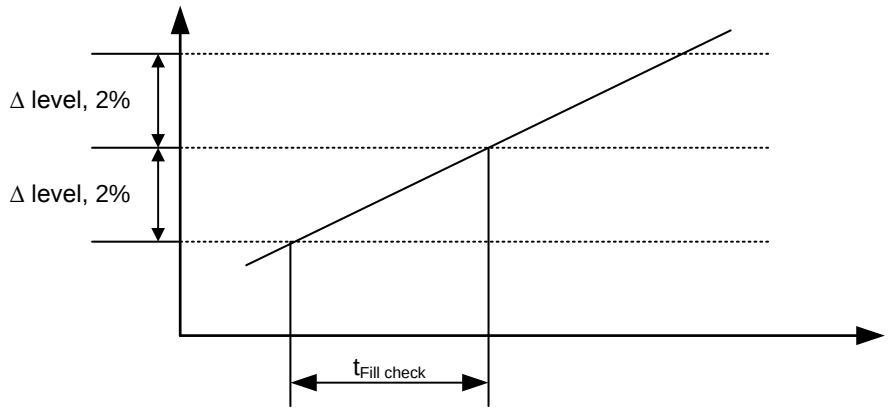
The below drawing shows how the fuel pump is activated when the level reaches 20% and stopped again when the level has reached 80%.



6.8.1 Fuel fill check

The fuel pump logic includes a **Fuel fill check** function.

When the fuel pump is running, the fuel level must increase by 2% within the **fuel fill check** timer set in menu 6553. If the fuel level does not increase by 2% within the adjusted delay time, then the fuel pump relay deactivates and a **Fuel fill alarm** occurs.



The level of increase is fixed at 2% and cannot be changed.

6.9 Fail class

6.9.1 Fail class

All activated alarms must be configured with a fail class. The fail classes define the category of the alarms and the subsequent alarm action.

Seven different fail classes can be used. The tables below illustrate the action of each fail class when the engine is running or stopped.

6.9.2 Engine running

Fail class	Action	Alarm horn relay	Alarm display	Cooling-down engine	Stop engine
1 Block		X	X		
2 Warning		X	X		
5 Shutdown		X	X		X

The table illustrates the action of the fail classes. If, for instance, an alarm has been configured with the "shutdown" fail class, the following actions occur.

- The alarm horn relay will activate
- The alarm will be displayed in the alarm info screen
- The engine is stopped instantly
- The engine cannot be started from the unit (see next table)

6.9.3 Engine stopped

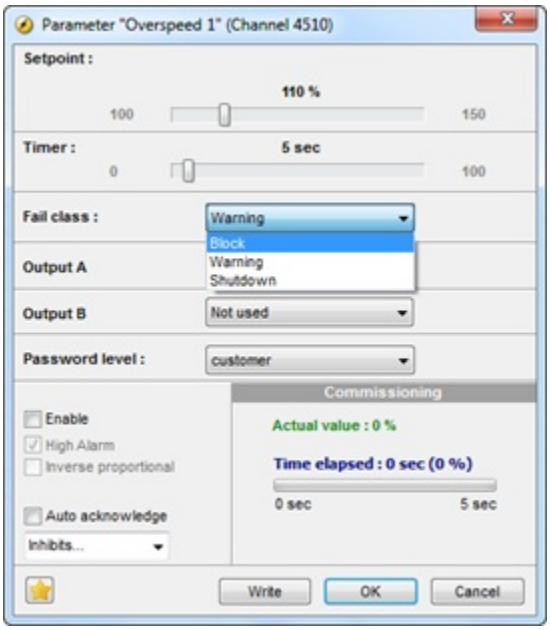
Fail class	Action	Block engine start
1 Block		X
2 Warning		
5 Shutdown		X

In addition to the actions defined by the fail classes, it is possible to activate one or two relay outputs if additional relays are available in the unit.

6.9.4 Fail class configuration

The fail class can be selected for each alarm function either via the display or the PC software.

To change the fail class via the PC software, the alarm function to be configured must be selected. Select the desired fail class in the fail class roll-down panel.



6.10 Service timers

The unit is able to monitor the maintenance intervals. Two service timers are available to cover different intervals. The service timers are set up in menus 6110 and 6120.

The function is based on running hours. When the adjusted time expires, the unit will display an alarm. The running hours is counting when the running feedback is present.

Setpoints available in menus 6110 and 6120:

Enable: Enable/disable the alarm function.

Hour's timer: The number of running hours to activate the alarm. The service timer alarm will be activated as soon as the running hours have been reached.

Days timer: The number of days to activate the alarm – if the running hours are not reached before this number of days, the alarm will still be activated. The service timer alarm will be activated at 8:00 AM on the day the alarm expires.

Fail class: The fail class of the alarm.

Output A: Relay to be activated when the alarm is activated.

Reset: Enabling this will reset the service timer to zero. This must be done when the alarm is activated.

6.11 Digital inputs

The unit has a number of digital inputs, some of which are configurable and some are not.

	Input function	Remote	Test	Local	Configurable	Input type
1	Shutdown override	X	X	X	Configurable	Constant
2	Remote start	X			Configurable	Pulse
3	Remote stop	X			Configurable	Pulse
4	Remote alarm acknowledge	X	X	X	Configurable	Constant
5	Remove starter			X	Configurable	Pulse
6	Local mode	X	X		Configurable	Pulse
7	Remote mode		X	X	Configurable	Pulse
8	Test mode	X		X	Configurable	Pulse
9	Battery test	X	X	X	Configurable	Constant
10	Low speed	X	X		Configurable	Constant
11	Digital running detection	X	X	X	Configurable	Constant
12	Start enable	X	X	X	Configurable	Constant
13	D+ (digital running feedback)	X	X	X	Configurable	Constant
14	Inhibit engine alarms	X	X	X	Configurable	Constant

6.11.1 Functional description

1. Shutdown override
This input deactivates all protections except the overspeed protection and the emergency stop input. The number of start attempts is three by default, but it can be configured in **6190 Start**. Also a special cool down timer is used in the stop sequence after an activation of this input.

2. Remote start
This input initiates the start sequence of the engine when manual mode is selected.

3. Remote stop
This input initiates the stop sequence of the engine when manual mode is selected. The engine will stop without cooling down.

4. Remote alarm acknowledge
Acknowledges all present alarms, and the alarm LED on the display stops flashing.

5. Remove starter
The start sequence is deactivated. This means the start relay deactivates, and the starter motor will disengage.

6. Local mode
Changes the present running mode to local.

7. Remote mode
Changes the present running mode to remote.

8. Test mode
Activates the test sequence.

9. Battery test
Activates the starter without starting the engine. If the battery is weak, the test will cause the battery voltage to drop more than acceptable, and an alarm will occur.

10. Low speed
Disables the regulators and keeps the engine running at a low RPM.

11. Digital running detection
The input is used as a running indication of the engine. When the input is activated, the start relay is deactivated.

12. Start enable
The input must be activated to be able to start the engine.

13. D+ (digital running feedback)
This input is used as a running indication of the engine. When the input is activated, the start relay is deactivated.

14. Inhibit Engine alarms
When this input is active, it will inhibit all engine interface alarms.

6.12 Outputs

The unit has a number of output functions which can be configured to any available relay.

	Output function	Remote	Test	Local	Configurable	Output type
1	Status OK	X	X	X	Configurable	Constant
2	Run coil	X	X	X	Configurable	Constant
3	Stop coil	X	X	X	Configurable	Constant
4	Prepare	X	X	X	Configurable	Constant
5	Starter (Crank)	X	X	X	Configurable	Constant
6	Horn	X	X	X	Configurable	Constant

6.12.1 Functional description

1. Status OK

2. Run Coil
The relay configured as run coil will close when the start prepare timer runs out and be closed the entire time the engine is running. The run coil timer can if used delay activation of the starter (crank) relay.

3. Stop Coil
This relay configured as stop coil will when activated close and stop the engine. When running feedback ends, stop coil will stay closed in the extended stop time (parameter 6212) and then open.

4. Prepare
This function (start prepare) will close the relay as the first thing in the start sequence. The relay will be closed for the time programmed in parameter 6181. This function is used for preheating the engine or for pre-lubrication.

5. Starter (Crank)
The relay configured to starter will be closed for the time selected in parameter 6184 in the start sequence.

6. Horn
The horn relay is an alarm output. This means that every time an alarm state appears, the horn relay will close for the time configured in the parameter 6130 Alarm horn regardless of fail class. If 6130 is set to 0 seconds, it will be on until the reset horn push-button is activated or the alarm(s) has (have) been acknowledged.

6.13 Multi-inputs

The ËCU unit has three multi-inputs which can be configured to be used as the following input types:
1. 4-20 mA
2. RMI oil
3. RMI water
4. RMI fuel
5. Digital

The function of the multi-inputs can only be configured in the PC utility software in 10980, 10990 and 11000.

For each input, two alarm levels are available, the menu numbers of the alarm settings for each multi-input is controlled by the configured input type as seen in the following table.

Input type	Multi-input 6	Multi-input 7	Multi-input 8
4-20 mA	4120/4130	4250/4260	4380/4390
RMI oil	4180/4190	4310/4320	4440/4450
RMI water	4200/4210	4330/4340	4460/4470
RMI fuel	4220/4230	4350/4360	4480/4490
Digital	3400	3410	3420

Only one alarm level is available for the digital input type.

6.13.1 4-20 mA

If one of the multi-inputs has been configured as 4-20 mA, the unit and range of the measured value corresponding to 4-20 mA can be changed in the PC utility software in order to get the correct reading in the display.

6.13.2 RMI inputs

The unit can contain up to three RMI (resistance measurement input). The inputs have different functions, as the hardware design allows for several RMI types.
RMI is a resistance measurement input which can be used together with a resistance dependant sensor.
These various types of RMI are available for all multi-inputs:

RMI oil: Oil pressure
RMI water: Cooling water temperature
RMI fuel: Fuel level sensor

For each type of RMI, it is possible to select between different characteristics including a configurable one.

6.13.3 RMI oil

This RMI input is used for measuring the lubricating oil pressure.

		RMI sensor type		
Pressure		**Type 1**	**Type 2**	**Type 3**
Bar	**psi**	**Ω**	**Ω**	**Ω**
0	0	10.0	10.0	
0.5	7	27.2		
1.0	15	44.9	31.3	
1.5	22	62.9		
2.0	29	81.0	51.5	
2.5	36	99.2		
3.0	44	117.1	71.0	
3.5	51	134.7		
4.0	58	151.9	89.6	
4.5	65	168.3		
5.0	73	184.0	107.3	
6.0	87		124.3	
7.0	102		140.4	
8.0	116		155.7	
9.0	131		170.2	
10.0	145		184.0	

The configurable type is configurable with eight points in the range 0-2500 Ω. The resistance as well as the pressure can be adjusted.

If the RMI input is used as a level switch, then be aware that no voltage must be connected to the input. If any voltage is applied to the RMI inputs, it will be damaged. Please refer to the Application Notes for further wiring information.

6.13.4 RMI water

This RMI input is used for measuring the cooling water temperature.

		RMI sensor type			
Temperature		**Type 1**	**Type 2**	**Type 3**	**Type 4**
°C	**°F**	**Ω**	**Ω**	**Ω**	**Ω**
40	104	291.5	480.7	69.3	
50	122	197.3	323.6		
60	140	134.0	222.5	36.0	
70	158	97.1	157.1		
80	176	70.1	113.2	19.8	
90	194	51.2	83.2		
100	212	38.5	62.4	11.7	
110	230	29.1	47.6		
120	248	22.4	36.8	7.4	
130	266		28.9		
140	284		22.8		
150	302		18.2		

The configurable type is configurable with eight points in the range 0-2500 Ω. The temperature as well as the resistance can be adjusted.

If the RMI input is used as a level switch, then be aware that no voltage must be connected to the input. If any voltage is applied to the RMI inputs, it will be damaged. Please refer to the Application Notes for further wiring information.

6.13.5 RMI fuel

This RMI input is used for the fuel level sensor.

	RMI sensor type
	Type 1
Value	**Resistance**
0%	78.8 Ω
100%	1.6 Ω

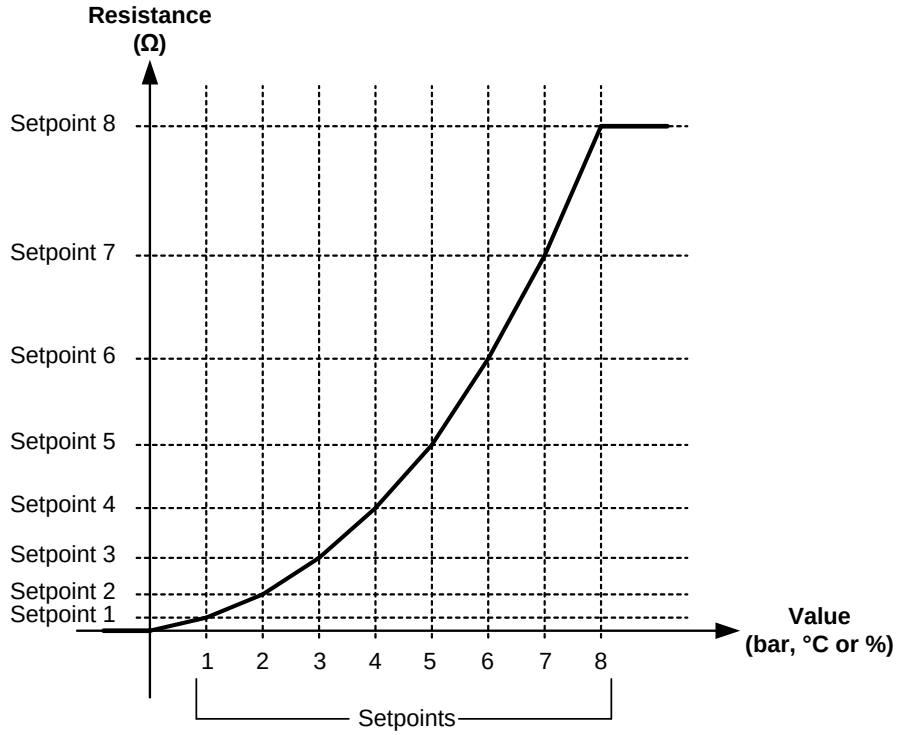
	RMI sensor type
	Type 2
Value	**Resistance**
0%	3 Ω
100%	180 Ω

If the RMI input is used as a level switch, then be aware that no voltage must be connected to the input. If any voltage is applied to the RMI inputs, it will be damaged. Please refer to the Application Notes for further wiring information.

	RMI sensor type
Value	**Type configurable**
%	**Resistance**
0	
10	
20	
30	
40	
50	
60	
70	
80	
90	
100	

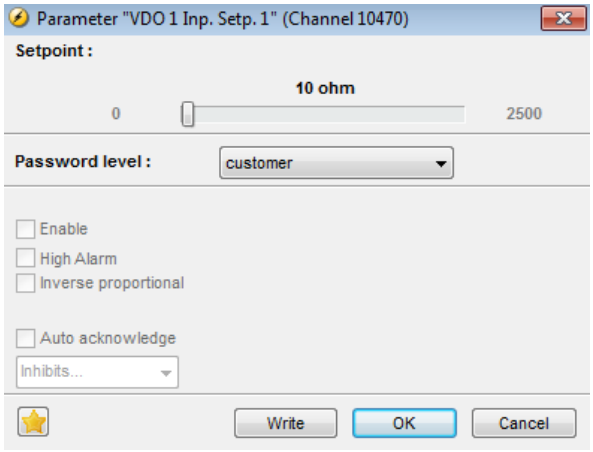
The configurable type is configurable with eight points in the range 0-2500 Ω. The value as well as the resistance can be adjusted.

6.13.6 Illustration of configurable inputs



6.13.7 Configuration

The eight curve settings for the configurable RMI inputs cannot be changed in the display, but **only** in the PC utility software. In the PC utility software the configurable inputs are adjusted in this dialogue box:



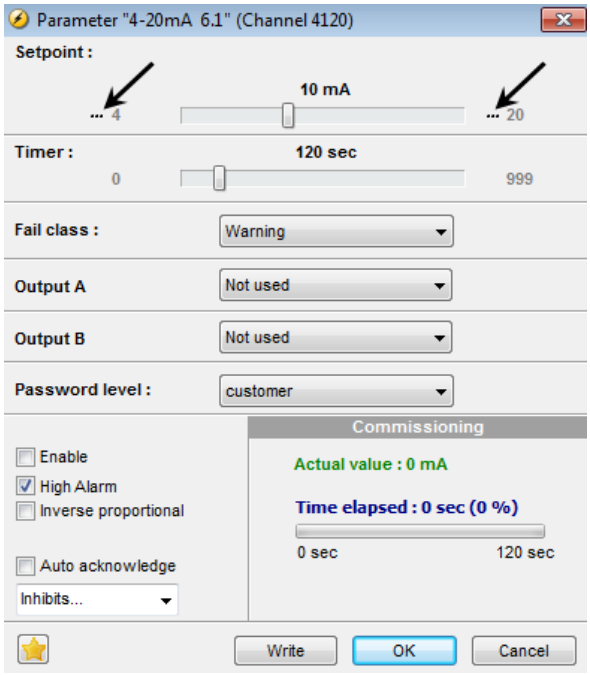
Adjust the resistance of the RMI sensor at the specific measuring value. In the example above the adjustment is 10 Ω at 0.0 bar.

6.13.8 Scaling of 4-20 mA inputs

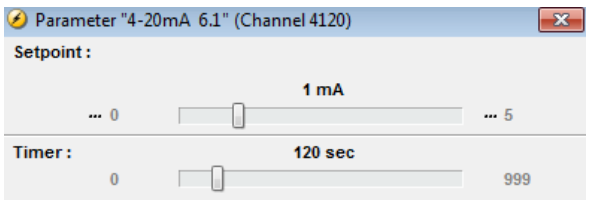
The scaling of the analogue inputs is made to ensure that the readout of the inputs is made with a resolution that fits the connected sensor. It is recommended to follow the guide below when changing the scaling of the analogue inputs.

Scaling example:

1. Use the utility software to configure a multi-input to be 4-20 mA, in this example multi-input 6 (parameter 10980)
2. Read the parameters from the device
3. After reading the parameters, the 4-20 mA alarm appears under the analogue fane in the USW. The example below shows how to adjust the analogue input alarm.
   The three dots to the left of the figures, marked with arrows, are buttons. Adjust the input as required, e.g. 0-5 bar:

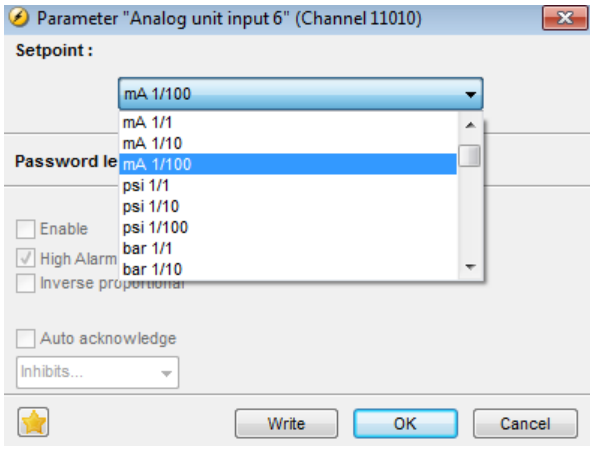


4. Adjust the input as required, e.g. 0-5 bar:

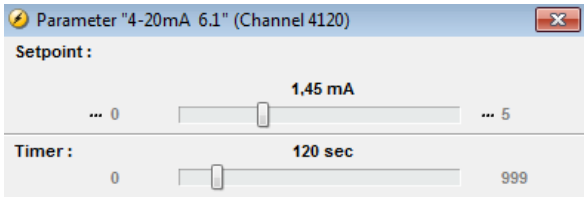


The display will then show 0 at 4 mA.

5. If needed, it is possible to scale the input to fit the sensor (Parameter 11010).



6. It is necessary to read the parameters from the device to the computer after changing the scale (1/1, 1/10 or 1/100) settings. This is in order to refresh the parameter list so the alarm settings present the correct value.
7. After reading the parameters, the alarm has been scaled so it needs to be adjusted (0-5 in this example), and this is also a scaling of the value on the display.



The display will now show the scaled value of multi-input 6.
In the example shown above, the value can be adjusted with two decimals. If the parameters were not refreshed, it would still only be possible to adjust the setpoint without decimals.

Save the parameter file:
After having set up the 4-20 mA inputs (HW as well as alarms), the parameter file should be uploaded from the device to the PC and then saved. In this way, the settings will not be modified again if the parameters are reloaded to the device.

6.13.9 Digital

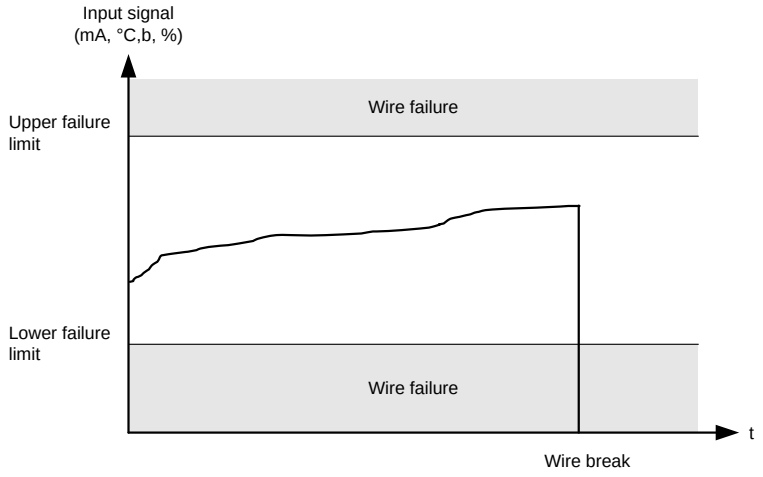
If the multi-inputs are configured to "Digital", they become available as digital inputs which means a switch function input.

6.14 Wire break fail detection

If it is necessary to supervise the sensors/wires connected to the multi-inputs and analogue inputs, then it is possible to enable the wire break function for each input. If the measured value on the input is outside the normal dynamic area of the input, it will be detected as if the wire has made a short-circuit or a break. An alarm with a configurable fail class will be activated.

Input	Wire failure area	Normal range	Wire failure area
4-20 mA	< 3 mA	4-20 mA	> 21 mA
RMI Oil, type 1	< 1.0 ohm	-	> 195.0 ohm
RMI Oil, type 2	< 1.0 ohm	-	> 195.0 ohm
RMI Temp, type 1	< 4.0 ohm	-	> 488.0 ohm
RMI Temp, type 2	< 4.0 ohm	-	> 488.0 ohm
RMI Temp, type 3	< 0.6 ohm	-	> 97.0 ohm
RMI Fuel, type 1	< 0.6 ohm	-	> 97.0 ohm
RMI Fuel, type 2	< 1.0 ohm	-	> 195.0 ohm
RMI configurable	< lowest resistance	-	> highest resistance
Level switch	Only active if the switch is open		

Principle
The illustration below shows that when the wire of the input breaks, the measured value will drop to zero, and the alarm will occur.

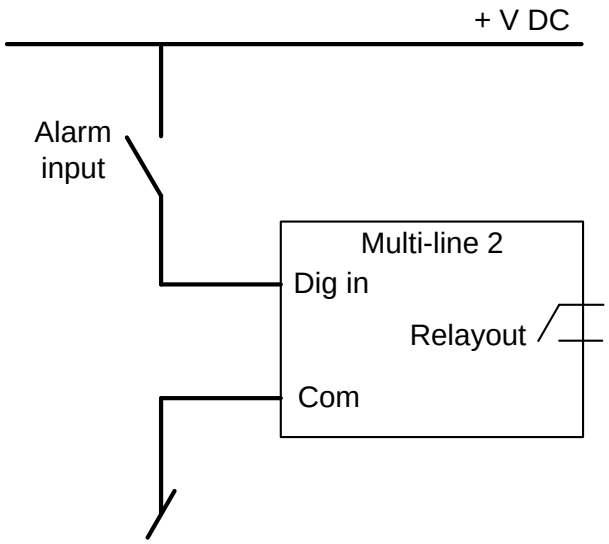


6.15 Input function selection

Digital input alarms can be configured with a possibility to select when the alarms are to be activated. The possible selections of the input function are normally open (NO) or normally closed (NC). Function selection can be done by use of USW or from display in menu 3000.

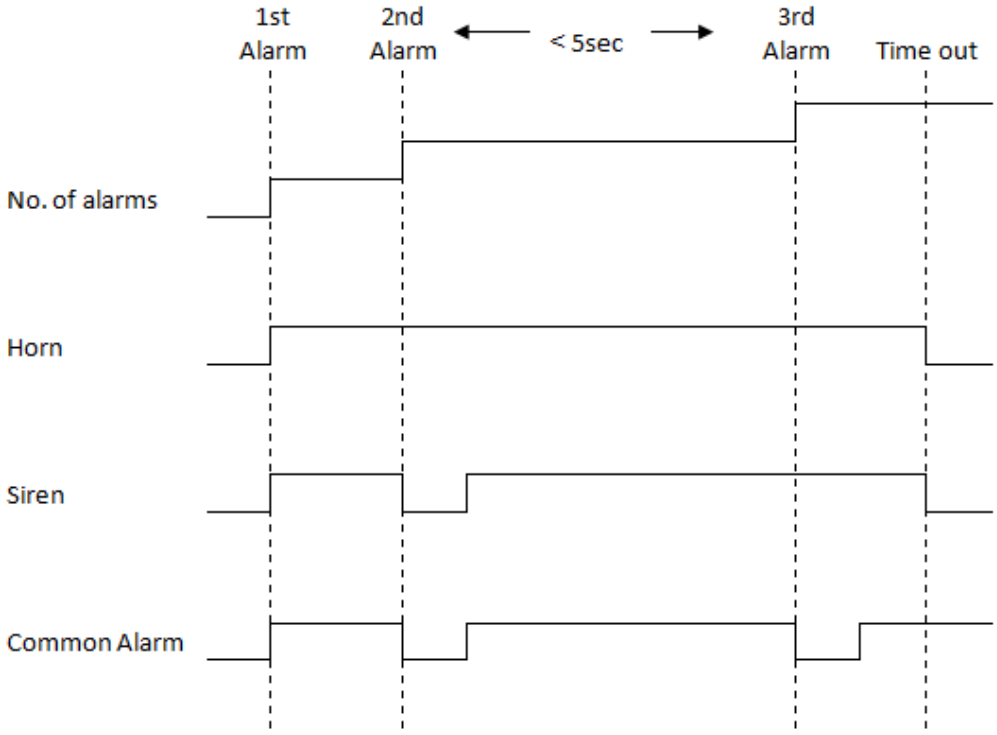
The drawing below illustrates a digital input used as an alarm input.

1. Digital input alarm configured to NC, normally closed
   This will initiate an alarm when the signal on the digital input disappears.
2. Digital input alarm configured to NO, normally open
   This will initiate an alarm when the signal on the digital input appears.


+ V DC
Alarm
input
Multi-line 2
Dig in
Relayout
Com

6.16 Relay function selection

Function	Description
Alarm relay NE	The relay is energised until the alarm occurs. From here, the relay stays deactivated until the alarm is acknowledged and gone. The relay will, based on the alarm, send out a signal, or not, depending on its physical setup (normally open or normally closed).
Limit relay	The relay will activate at the limit setpoint. No alarm will appear when both outputs (OA/OB) of the alarm are adjusted to the limit relay. After the condition activating this relay has returned to normal, the relay will deactivate when the "OFF delay" has expired. The OFF delay is adjustable.
Horn relay	The output activates on all alarms. For a detailed description, please refer to the chapter "Horn output".
Siren relay	The output activates on all alarms, like "Horn output". If the relay is ON, and another alarm is active, a short-time reset will be activated.
Alarm relay ND	The relay is deenergised until the alarm occurs. From here, the relay stays activated until the alarm is acknowledged and gone. The relay will, based on the alarm, send out a signal, or not, depending on its physical setup (normally open or normally closed).
Common alarm	The output activates all alarms, like "Horn output" If the relay is ON, and another alarm is active, a short-time reset will be activated. The common alarm output will be activated as long as there is an active alarm - also if the alarm is acknowledged.



The 1st alarm activates the relay chosen for the horn, siren or common alarm. The 2nd will deactivate the relay and subsequently activate again to tell that another alarm has occured, but only on the siren and the common alarm. The horn alarm will keep the relay activated from the 1st alarm, and until the timer in parameter 6130 runs out. Then the relay is deactivated.
The next alarms will in the same way always on the common alarm de- and activate the relay. On the siren, the time from the 2nd alarm to the next has to be more than 5 seconds; otherwise the relay will stay activated. When the timer runs out (parameter 6130), the siren deactivates the relay, but if a common alarm is chosen, it stays activated until the alarm is acknowledged and gone.

6.17 Language selection

The unit has the possibility to display different languages. It is delivered with one master language which is English. This is the default language, and it cannot be changed. In addition to the master language 11 different languages can be configured. This is done via the PC utility software.

The languages are selected in the system setup **menu 6080**. The language can be changed when connected to the PC utility software. It is not possible to make language configuration from the display, but the already configured languages can be selected.

6.18 Information and status texts

Information and status texts are displayed to ease operation and indicate the actual status of the unit/engine

Description of information and status texts can be found in the ECU operator's manual which is available at www.deif.com.

6.19 Counters

Counters for various values are included, and some of these can be adjusted if necessary, for instance if the unit is installed on an existing engine or a new circuit breaker has been installed.

The table shows the adjustable values and their function in menu 6100:

Description	Function	Comment
6101 Running time	Offset adjustment of the total running hours counter.	Counting when the running feedback is present.
6102 Running time	Offset adjustment of the total running thousand hours counter.	Counting when the running feedback is present.
6106 Start attempts	Offset adjustment of the number of start attempts.	Counting at each start attempt.

Additional counters for "Running hours" and "Energy" can be read out from the PC utility software.

6.20 M-Logic

The M-Logic functionality is included in the unit and is not an option-dependent function.

M-Logic is used to execute different commands at predefined conditions. M-Logic is not a PLC but substitutes one, if only very simple commands are needed.

M-Logic is a simple tool based on logic events. One or more input conditions are defined, and at the activation of those inputs, the defined output will occur. A great variety of inputs can be selected, such as digital inputs, alarm conditions and running conditions. A variety of the outputs can also be selected, such as relay outputs, change of engine modes and change of running modes.

The M-Logic is part of the PC utility software, and as such, it can only be configured in the PC utility software and not via the display.

The main purpose of M-Logic is to give the operator/designer more flexible possibilities of operating the generator control system.

Please refer to the "Help" function in the PC utility software for a full description of this configuration tool.

6.21 Buzzer

6.21.1 Buzzer

The ECU 100 has a built-in buzzer. The buzzer is configured in M-Logic. This means that if the buzzer is going to be used as a horn annunciator, the input must be set to "Horn" and the output must be set to "Buzzer". The buzzer will act concurrently to the horn output timer. If the delay timer in M-Logic is used, the buzzer will be active after this time delay.

If an AOP-2 is connected, the buzzer in the AOP-2 must be configured under the AOP-2 setup. But the configuration of the AOP-2 buzzer is similar to the description above.

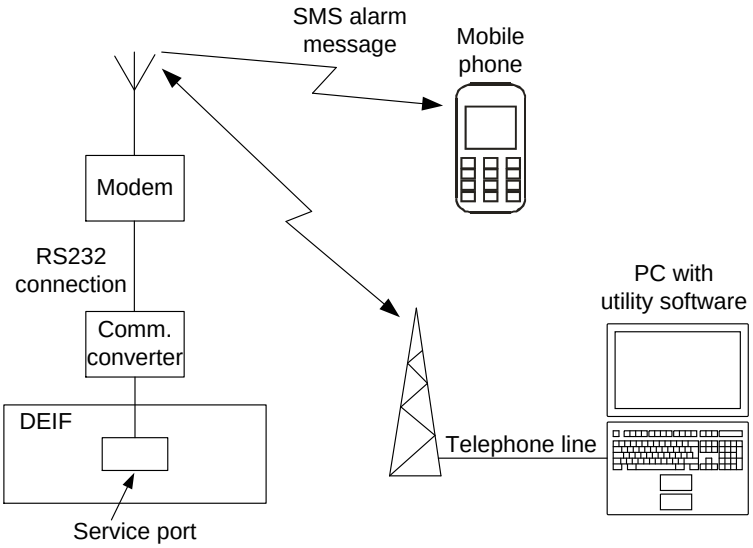
6.22 GSM communication

6.22.1 GSM and modem communication

GSM communication can be used for two purposes:

1. Sending SMS alarm messages to up to 5 different mobile phones. The messages will be clear text, representing the alarm in question (e.g. “Overspeed”) and an ID. The ID represents the total numbers of sent SMS.
2. Communicate with the PC utility software.

Connection



The connection is based on an RS232 connection to a GSM modem via the service port on the unit. Since the connection on the controller is a TTL communication, the interface box PI-1 (option J5) is needed to convert the signals to RS232. The PI-1 connects via a cable with SUB-D 9-pin female connector on the modem side (see illustration above).

Modem type

DEIF recommends using a Westermo GDW-11 modem, as the application has been tested with these terminals. The SIM card needed must support data transfer. Contact your GSM provider for details. The easiest way to set the PIN code in the modem itself is to mount the SIM card in a mobile phone and change the PIN code there. The SIM card will remember the PIN code when it is installed in the modem.

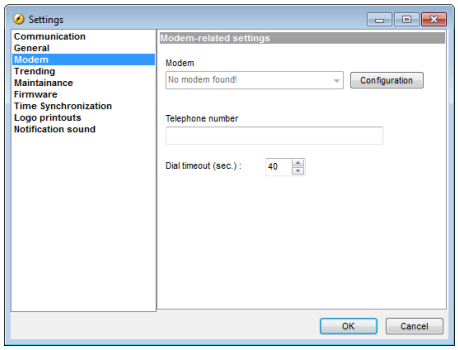
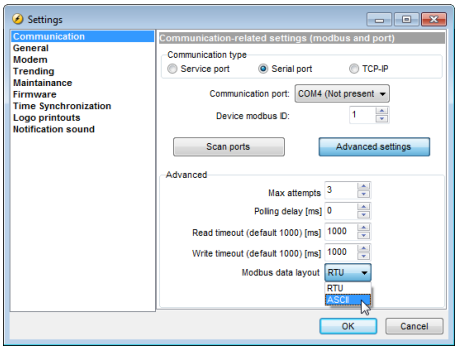
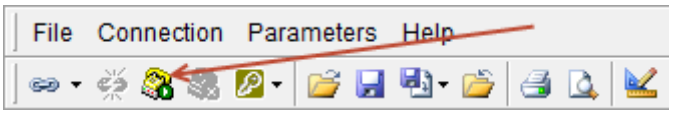
SMS alarm settings

Parameter no.	Name	Function	Set to
10320	GSM PIN code	Set PIN code for GSM modem*	None
10330	12345678901	GSM phone number 1	None
10340	12345678901	GSM phone number 2	None
10350	12345678901	GSM phone number 3	None
10360	12345678901	GSM phone number 4	None
10370	12345678901	GSM phone number 5	None

*After each auxiliary supply power up, the unit will send the required PIN code to the modem if this is necessary. The PIN code is adjusted in the PC utility software.
For calling a foreign number, type "+" and country code instead of "00", for example dial +45 99999999 for a Danish number.

Alarm during operation

Should an alarm occur during the interruption, the controller unit will re-transmit it when the modem starts again, so no messages are lost.

PC utility software communication via modem	
Locate the settings for modem communication in the utility software settings (F3).	Select modem and enter the telephone number of your GSM modem connected to the unit. When using modem dial-up, the PC utility software must also be set to run ASCII data communication.
	
After this, dial-up can be used. Click the this icon to start modem communication: 	

The modem communication is much slower than the normal direct connection, so please be patient. It is not recommended to download the entire setting list. Use single setting downloads.

If a PC utility software connection is required, then the SIM card must support data transfer. Contact your GSM provider for details.

PC utility software communication safety

If the communication fails, the controller will operate according to the received data. If e.g. only half of the parameter file has been downloaded when the communication is interrupted, the settings are going to be a mix.

6.23 Nominal settings

6.23.1 How to change the nominal settings

The ECU has two set of nominal values for the engine, and they are adjusted in menus 6000 to 6010 (Nominal settings 1 to 2).

Menu	Setting	Description
6005	Nom. RPM 1	Nominal engine revolution
6015	Nom. RPM 1	Nominal engine revolution

Activation

The switching between the nominal setpoints can be done in three ways; digital input, AOP or menu 6006.

Digital input
M-Logic is used when a digital input is needed for switching between the two sets of nominal settings. Select the required input among the input events, and select the nominal settings in the outputs.

Example:

Event A		Event B		Event C	Output
Dig. input no. 10	or	Not used	or	Not used	Set nom. parameter settings 1
Not Dig. input no. 10	or	Not used	or	Not used	Set nom. parameter settings 2

AOP
M-Logic is used when the AOP is used for switching between the two sets of nominal settings. Select the required AOP push-button among the input events, and select the nominal settings in the outputs.

Example:

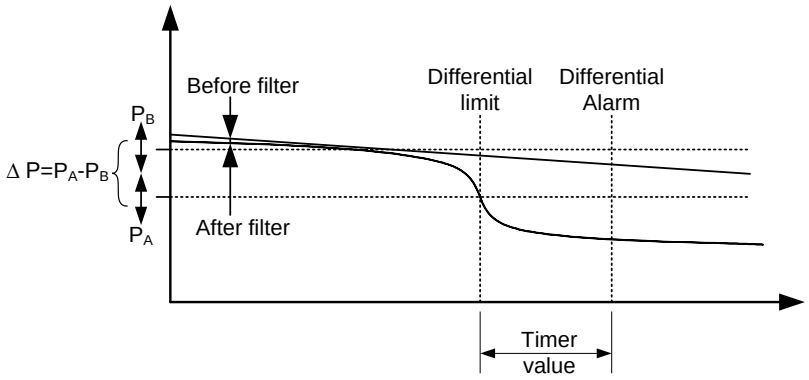
Event A		Event B		Event C	Output
Button07	or	Not used	or	Not used	Set nom. parameter settings 1
Button08	or	Not used	or	Not used	Set nom. parameter settings 2

Menu settings
In menu 6006, the switching is made between settings 1 to 2 simply by choosing the desired nominal setting.

6.24 Differential measurement

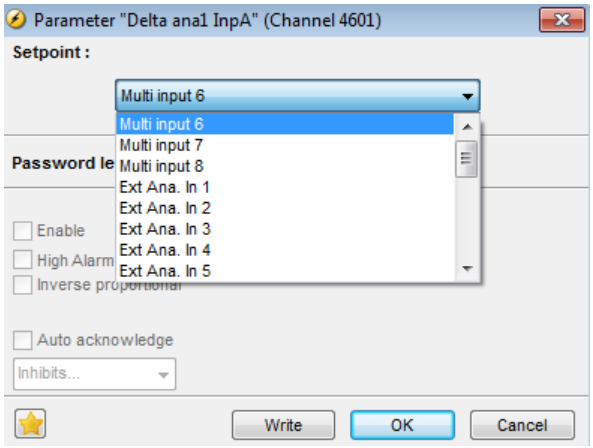
6.24.1 Differential measurement

With the differential measurement function, it is possible to compare two analogue inputs and trigger on the difference between the two values.
If the differential function is e.g. fuel filter check, the timer will be activated if the setpoint between PA (analogue A) and PB (analogue B) is exceeded. If the differential value drops below the setpoint value before the timer runs out, the timer will be stopped and reset.

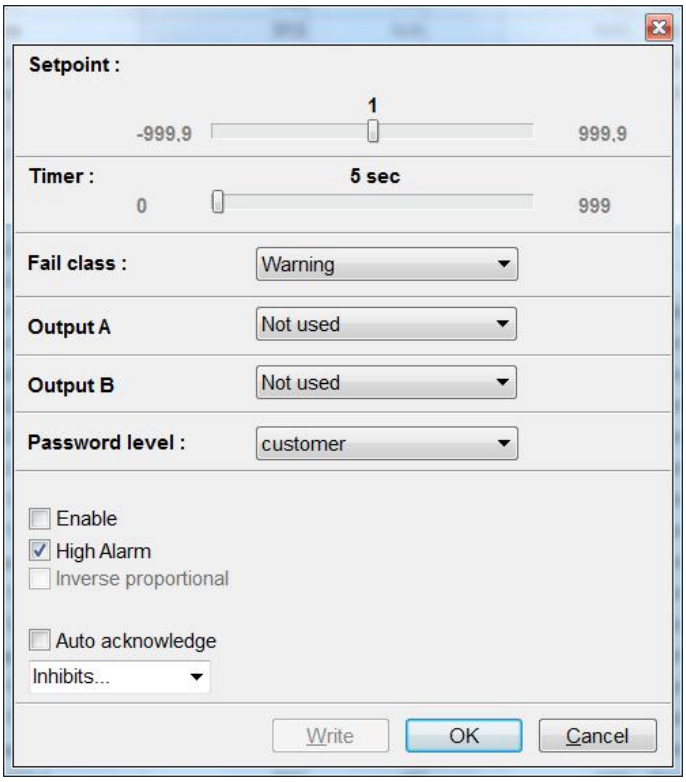


Six different differential measurements between two analogue input values can be configured.

Differential measurements between two sensors can be configured in menus 4600-4606 and 4670-4676. The sensors are selected from the input list as shown below, the list also contains various EIC measurements.



The relevant alarm setpoint is chosen in parameters 4610-4660 and 4680-4730



Each alarm can be configured in two alarm levels for each differential measurement between the analogue inputs A and B as follows. The configurations are done in menus 4610-4660 and 4680-4730.

Ain	4601	Delta ana1 InpA	1482	4	
Ain	4602	Delta ana1 InpB	1483	4	
Ain	4603	Delta ana2 InpA	1484	4	
Ain	4604	Delta ana2 InpB	1485	4	
Ain	4605	Delta ana3 InpA	1486	4	
Ain	4606	Delta ana3 InpB	1487	4	
Ain	4610	Delta ana1 1	1488	1	
Ain	4620	Delta ana1 2	1489	1	
Ain	4630	Delta ana2 1	1490	1	
Ain	4640	Delta ana2 2	1491	1	
Ain	4650	Delta ana3 1	1492	1	
Ain	4660	Delta ana3 2	1493	1	

7. Parameter list

7.1 Related parameters

7.1.1 Related parameters

For further information related to parameters, please see the installation instructions and the parameter list.