InteliNano^NT

InteliNano NT ® MRS

Modular Gen-set Controller

Compact Controller for Stand-by Operating Gen-sets
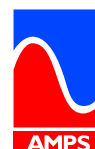
SW version 2.0.0.x, HW version 2.0, September 2015

Reference Guide

TABLE OF CONTENTS

1 Document information

DOCUMENT HISTORY

REVISION NUMBER	RELATED SW. VERSION	DATE
	1.3	29.11.2012
	1.4	5.3.2013
	1.4r1	11.3.2013
	1.5	20.9.2013
	1.6	1.9.2014
	2.0.0.x	24.9.2015

1.1 Clarification of notation

NOTE:
These boxes contain helpful tips, reminders, and other notes.

CAUTION!
These boxes call special attention to procedures or adjustments, which if done incorrectly can cause damage or equipment failure.

WARNING!
These boxes call special attention to important procedures or adjustments, which if done incorrectly could result in personal injury or death.

1.2 Conformity Declaration

	The following described machine complies with the appropriate basic safety and health requirement of the EC Low Voltage Directive No: 73/23 / EEC and EC Electromagnetic Compatibility Directive 89/336 / EEC based on its design and type, as brought into circulation by us.

1.3 Important

SAVE THESE INSTRUCTION - This manual contains important instructions for the **InteliNano^{NT}** controllers' family that shall be followed during installation and maintenance of the **InteliNano^{NT}** genset controllers.

This manual is intended for use by gen-set control panel builders and parties concerned with installation, operation, and maintenance of the gen-set.

This manual describes the **InteliNano^{NT} MRS** software, which is designed for single set, stand-by and island applications.

NOTE:
ComAp believes that all information provided herein is correct and reliable and reserves the right to update at any time. ComAp does not assume any responsibility for its use unless otherwise expressly undertaken.

NOTE:
SW and HW must be compatible otherwise some functions will be disabled.

NOTE:
Because of large variety of the **InteliNano^{NT}** parameters settings, it is not possible to describe all combinations. Some of the **InteliNano^{NT}**'s functions are subject of changes depend on SW version. The data in this manual only describes the product and is not intended as a warranty of performance or characteristics.

CAUTION!

Dangerous voltage
In no case touch the terminals for voltage measurement!
Always connect grounding terminals!

CAUTION!
All parameters are pre-set to initial values. But the setpoints in the "**Basic settings**" settings group **!!must!!** be adjusted before the first startup of the gen-set.

**!!! INCORRECT ADJUSTMENT OF BASIC PARAMETERS
CAN RESULT IN DAMAGE TO THE GEN-SET !!!**

The following instructions are for qualified personnel only. To avoid personal injury do not perform any action not specified in this User guide!!!

WARNING!

Remote control
The **InteliNano^{NT}** controller can be controlled remotely. When working on the gen-set, ensure that remote start is disabled.

This is done by:

Disconnect input REM START/STOP
or
Disconnect output *Starter* and outputs *GCB Close/Open*

1.4 Text

Stop   "Letters in the frame" buttons on the controller's front panel
Nominal Voltage Ph-N   ***"Italic"*** set points
Fuel Solenoid   *"Italic"* input/output function
T15   *"Italic"* controllers terminal
Manual Start   *"Italic"* event or ECU message
Generator CCW Rotation   *"Italic"* warning alarm
Start Fail   *"Italic"* shutdown alarm

2 System Overview

2.1 General description

The **InteliNano^NT MRS** is an **Manual Remote Start** controller for single generating sets. The **InteliNano^NT** supports electronic engines.
InteliNano^NT controllers are equipped with an intuitive graphic display, which together with extensive functionality, set the new standard in gen-set controls.
InteliNano^NT supports diesel and gasoline engines.
The key features of **InteliNano^NT** are easy installation and intuitive operation. Users may choose between predefined configurations for typical applications and user-defined configurations for special applications.

2.2 Configurability

One of the key features of the controller is high level of adaptability to the needs of every particular application. This customization is accomplished in the configuration.

NOTE:
Use **NanoEdit** PC software to the read configuration from the controller or disk, view it, modify it, and write the configuration to the controller or disk.

The firmware contains large number of binary inputs and outputs for all available. Configuration will be determined by application and hardware constraints. One of main tasks of the configuration is mapping of "logical" firmware inputs and outputs to the "physical" hardware input and output terminals.

A complete configuration consists of the following:

1. Mapping of logical ***binary and analog inputs*** (functions) to physical binary input terminals
2. Mapping of logical ***binary outputs*** (functions) to physical binary output terminals
3. Assigning sensor characteristics
4. Selecting of ECU type if an ECU is connected

The controller is delivered with a **default configuration, which should fit most standard applications**. The default configuration can be changed from controller's front panel or by using PC and **NanoEdit** software. See **NanoEdit** documentation for details.

NOTE:
For connection with PC use integrated USB module. The controller can be powered directly from USB communication port. . In this case the LCD backlight is turned off and all outputs are open
 Don't use USB hub for connection!

Once the configuration is modified (using PC) it can be stored in a file for reference or use with another controller. This configuration file is called the **archive** and has file extension ".ain". If the archive is saved while the PC is online with the controller, it will contain a full image (setpoints, measured values, and history log) of the controller at the moment of saving (except firmware).

The archive can then be used for the **cloning** of controllers, which means preparing controllers with identical configuration and settings.

3 Application Overview

3.1 MRS – Manual Remote Start

The **InteliNano^{NT} MRS** can be used with a generator circuit breaker – GCB (Figure **3.1**) or without a breaker (**Figure 3.2**).
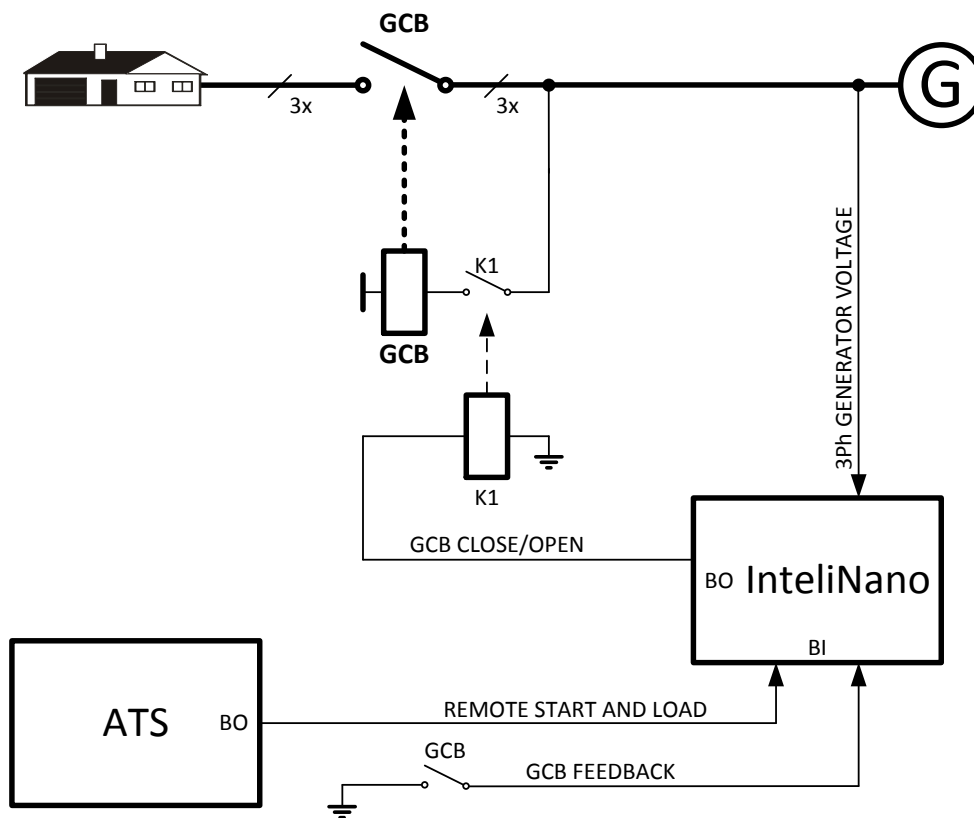

Figure 3.1
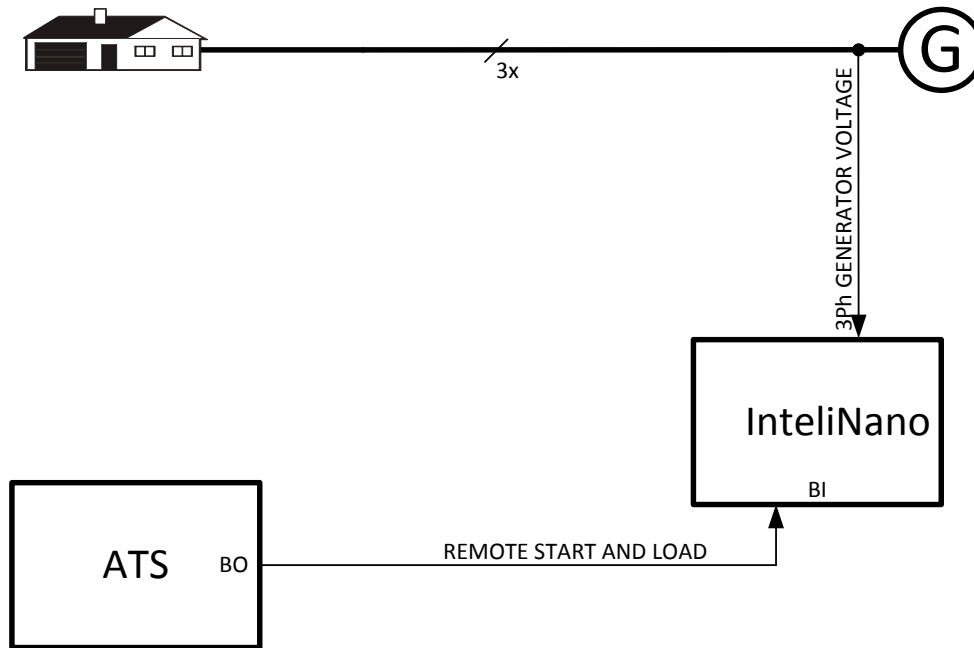MRS APPLICATION WITH GCB CONTROL

Figure 3.2
SIMPLE MRS APPLICATION

3.2 True RMS measurement

This controller measures AC values based on *True RMS* principle. This principle corresponds exactly to the physical definition of alternating voltage effective values. Under normal circumstances the generator voltage should have a pure sinusoidal waveform. However some nonlinear elements connected to the generator produce harmonic waveforms with frequencies of multiplies of the basic generator frequency and this may result in deformation of the voltage waveforms. The True RMS measurement **gives accurate readings** of effective values not only for pure sinusoidal waveforms, but also for deformed waveforms.

4 Installation and wiring

4.1 Mounting

The controller is to be mounted onto the switchboard or genset control panel door. Mounting cut-out size is 96x96mm. Use the screw holders included with the controller to mount the controller into the door as described on pictures below.
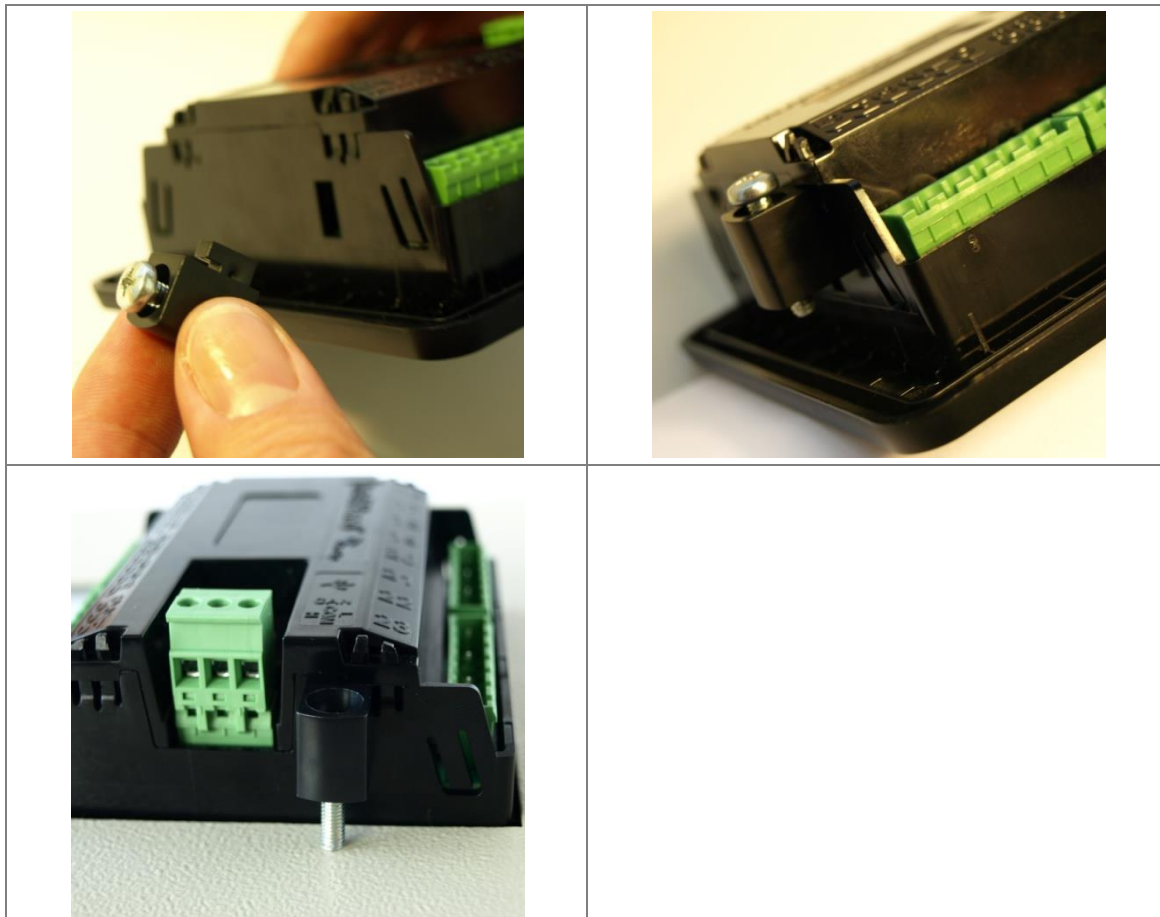

Figure 4.1
INTELINANO^NT'S CHASSIS MOUNTING

4.2 Package contents

Accessories	Description	Optional / Obligatory
InteliNano^{NT} MRS	**InteliNano^{NT} MRS** controller unit	Obligatory
Fast User Guide	Fast User Guide for the **InteliNano^{NT} MRS**	Obligatory
Gasket IN-NT	Gasket under the **InteliNano^{NT}** controller	Optional
Fixing clips	Two controller holders	Obligatory

4.3 Terminal diagram

GENERATOR VOLTAGE MEASUREMENT
T20 = Neutral
T21 = Phase 1
T22 = Phase 2
T23 = Phase 3

USB interface

CAN INTERFACE
L
COM
H

POWER SUPPLY, D+
T01 = BATT -
T02 = D+
T03 = BATT +

INTPUT TERMINALS
T10 = COM for analog inputs
T11 = binary input
T12 = binary input
T13 = binary/analog input – Low Fuel Level
T14 = binary/analog input – Coolan Temperature
T15 = binary/analog input – Oil Pressure

OUTPUT TERMINALS
T04 = binary output – Starter (6A)
T05 = binary output - Fuel Solenoid (6A)
T06 = binary output (500 mA)
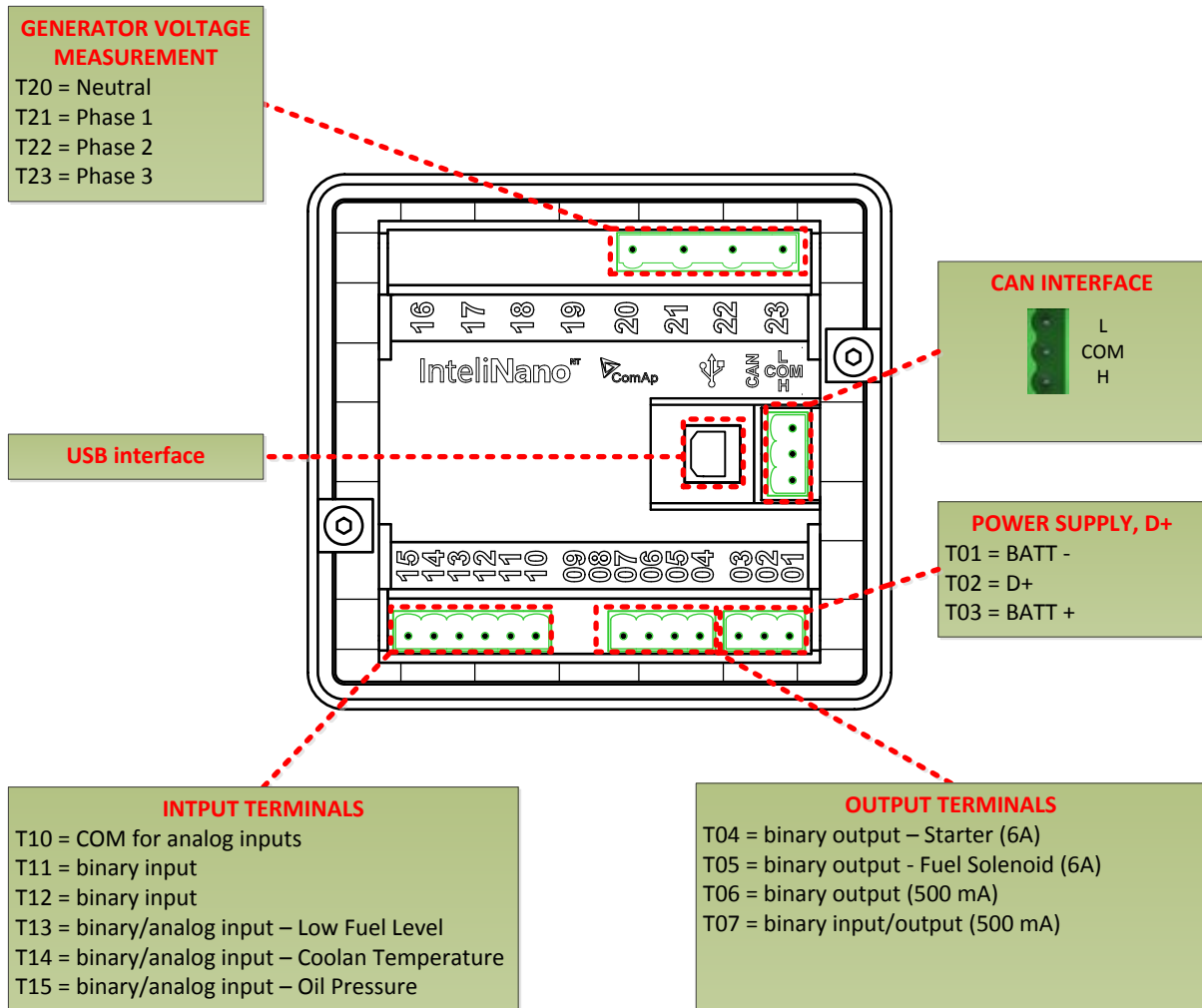T07 = binary input/output (500 mA)

Figure 4.2
INTELINANO^{NT} MRS TERMINALS DESCRIPTION

4.4 Power supply

To ensure proper function:
It is strictly recommended to use power supply cable 2,5mm^2!

Maximum continuous DC power supply voltage is 36 VDC. The **InteliNano^{NT}**'s power supply terminals are protected against large pulse power disturbances. When there is a potential risk of the controller being subjected to conditions outside its capabilities, an outside protection devise should be used.

For the connections with 12VDC power supply, the **InteliNano^{NT}** includes internal capacitors that allow the controller to continue operation during cranking if the battery voltage dip occurs. If the voltage before drop is 10V, after 100ms the voltage recovers to 5 V, the controller continues operating.
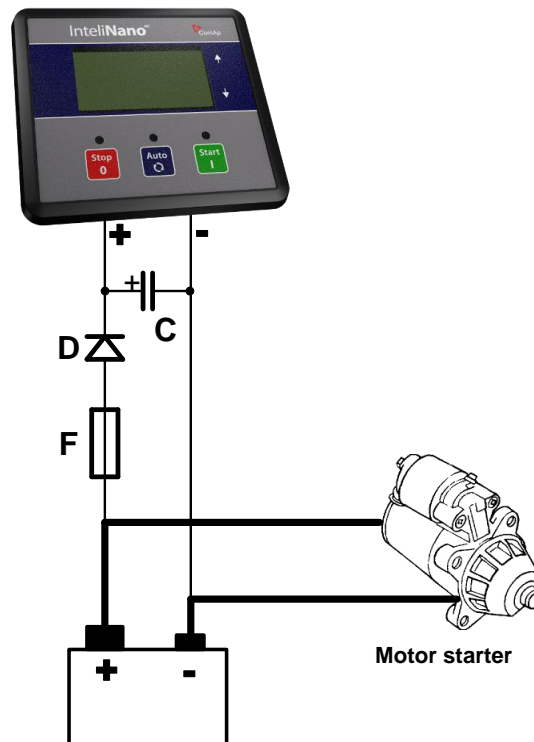

Figure 4.3
RECOMMENDED POWER SUPPLY WIRING

The capacitor size should be 5 000 μF to withstand 150ms voltage dip under following conditions: Voltage before the drop is 12V, after 150ms the voltage recovers to min. allowed voltage, i.e. 8V.

4.4.1 Power supply fusing

A 15-amp fuse should be connected in-line with the battery positive terminal to the controller and modules. The controller should never be connected directly to the starting battery.
Fuse value and type depends on number of connected devices and wire length.
Recommended fuse (not fast) type - T15A. Not fast due to internal capacitors charging during power up.
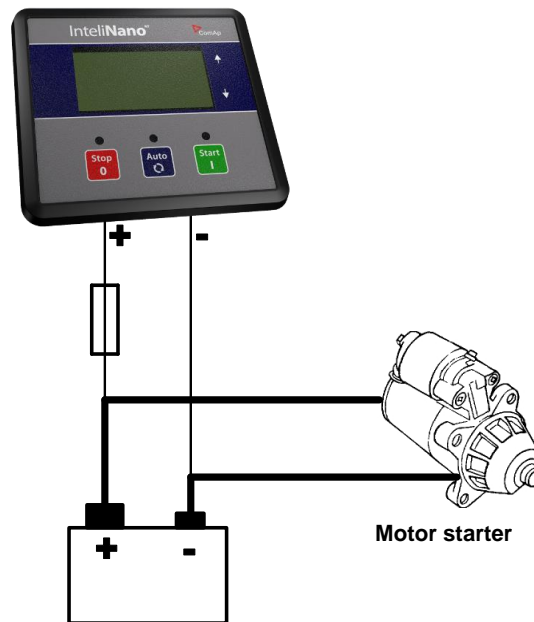

Figure 4.4
INTELINANO^{NT} **MRS** POWER SUPPLY FUSING

4.5 D+

Charging alternator D+ output is on terminal **T02**.
D+ current is 100mA and is switched off after 5s when starter is disconnected.

WARNING!
IF THE D+ FEATURE IS NOT USED, CONNECT THIS TERMINAL TO BATTERY POSITIVE!

In case of charging alternator malfunction the warning *Low Battery (Charge Fail)* will appear in event log.

4.6 Voltage measurement and generator connection types

WARNING!
Risk of personal injury due to electric shock when manipulating the voltage terminals under voltage! Be sure the terminals are not energized before beginning work.

Use **1.5 mm^2** cables for voltage measurement connection.

There are 4 voltage measurement connection types (setpoint *B04 Connection Type [3Ph4Wire / 3Ph3Wire / Split Ph / Mono Ph]*) Each matches a corresponding generator connection type.

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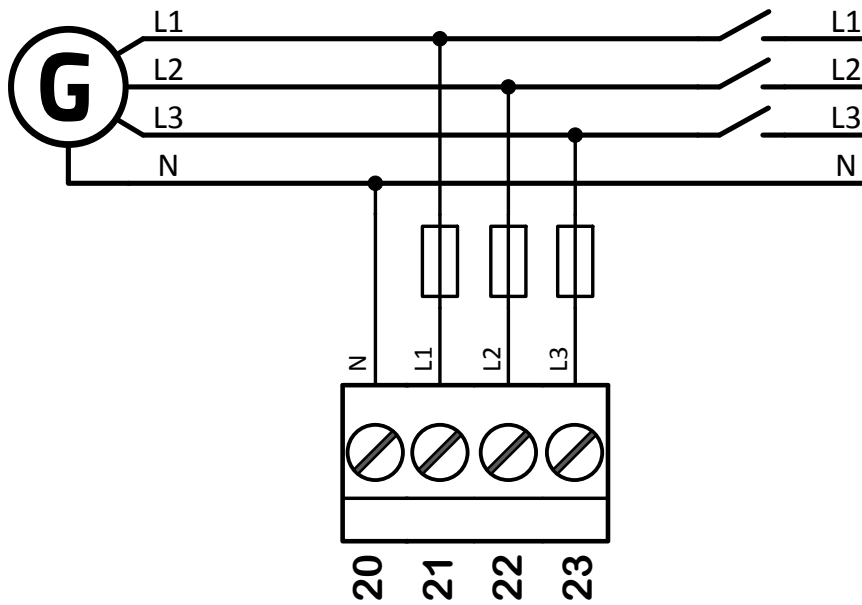## 4.6.1 Connection Type: 3 Phase 4 Wires

Figure 4.5
INTELINANO^{NT} MRS 3 PHASES AND 4 WIRES TERMINALS CONNECTION
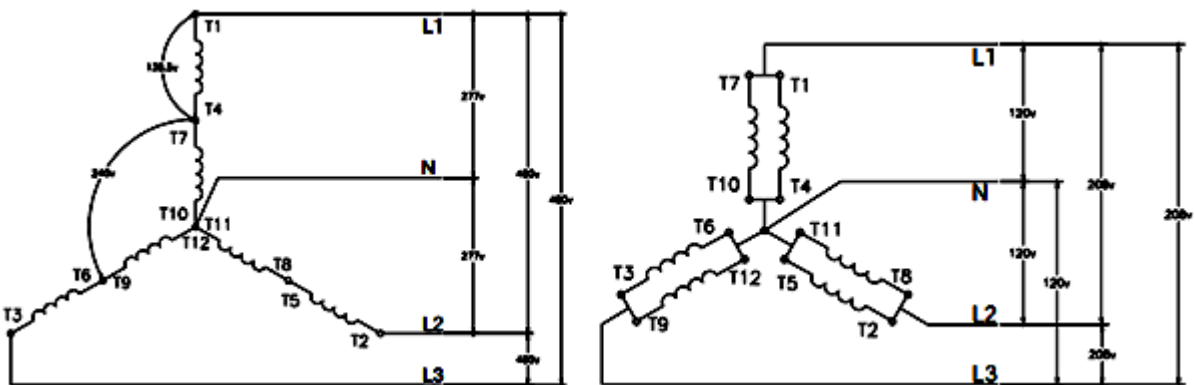
Three phase "wye" measurement – 3PY

Figure 4.6
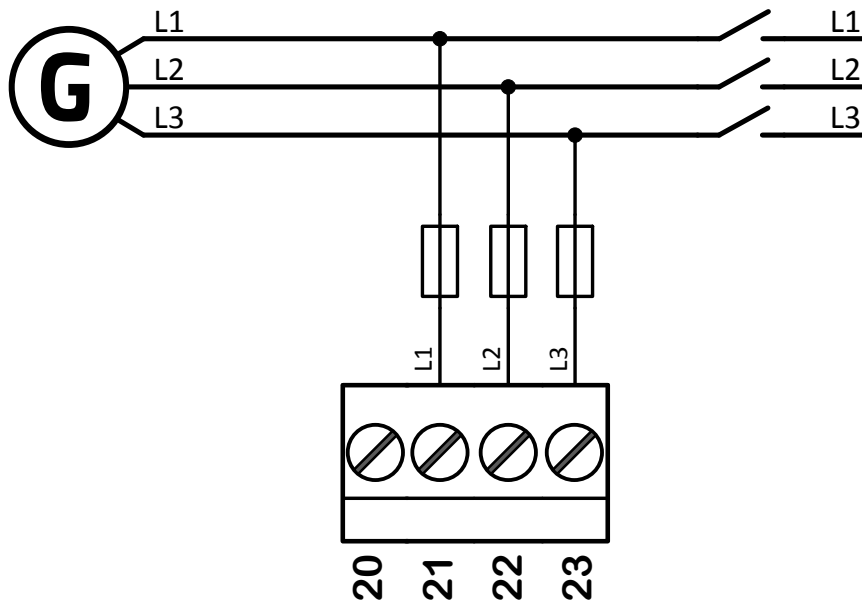STAR CONNECTION

4.6.2 Connection Type: 3 Phase 3 Wires

Figure 4.7
INTELINANO^{NT} MRS 3 PHASES AND 3 WIRES TERMINALS CONNECTION
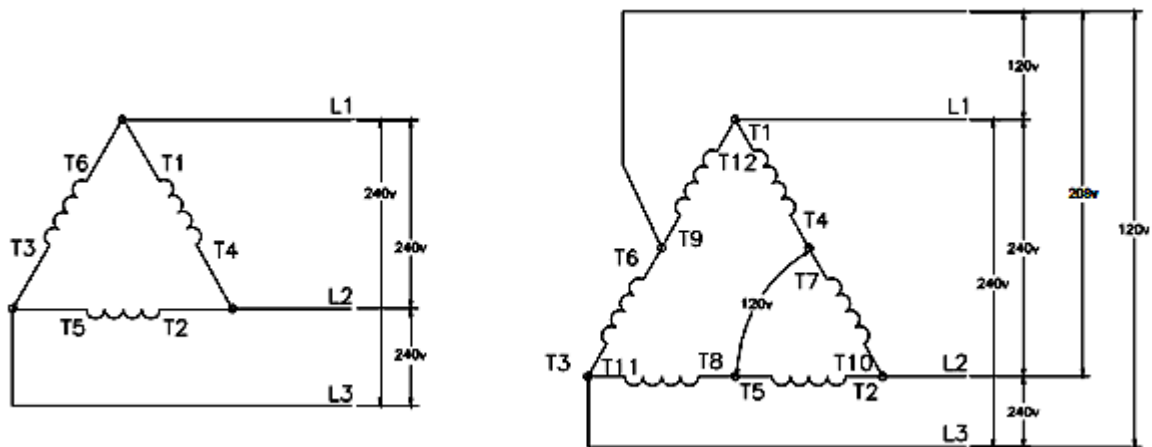
Three phase "delta" measurement – 3PD

Figure 4.8
DELTA CONNECTION (LEFT), HIGH-LEG DELTA CONNECTION (RIGHT)

NOTE:
In case of HIGH-LEG DELTA connection, the N (neutral) wire (in the diagram connected between T6 and T9) has to be connected!
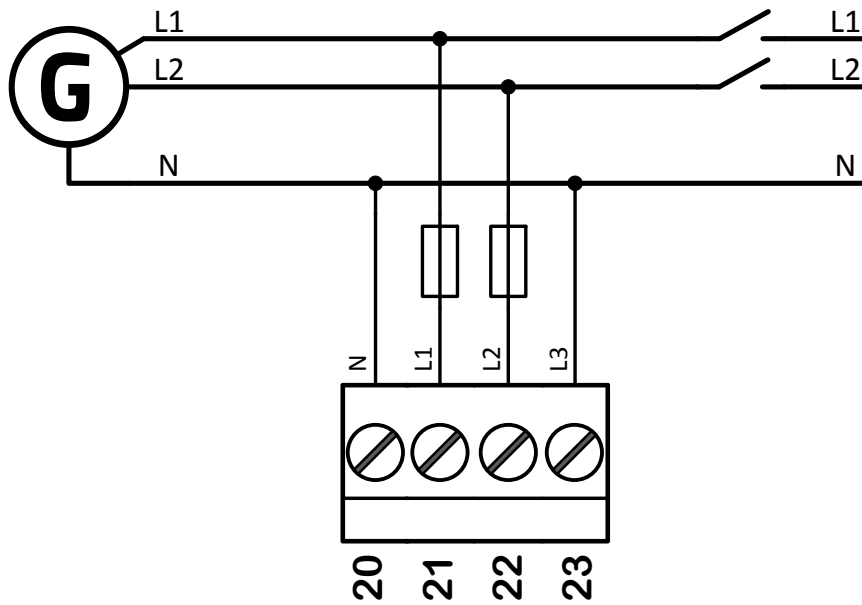
4.6.3 Connection Type: Split Phase

Figure 4.9
INTELINANONT MRS SPLIT PHASE TERMINALS CONNECTION
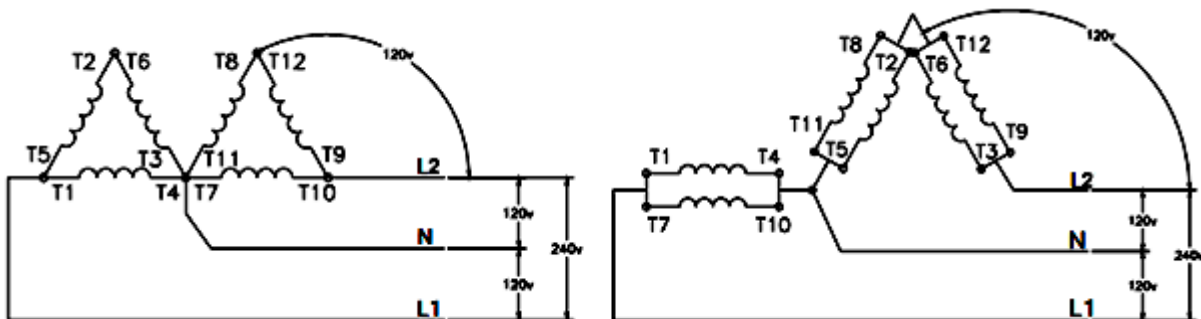
Split-phase measurement – 1PH

Figure 4.10
DOUBLE DELTA CONNECTION (LEFT), ZIG ZAG(DOG LEG) CONNECTION (RIGHT)

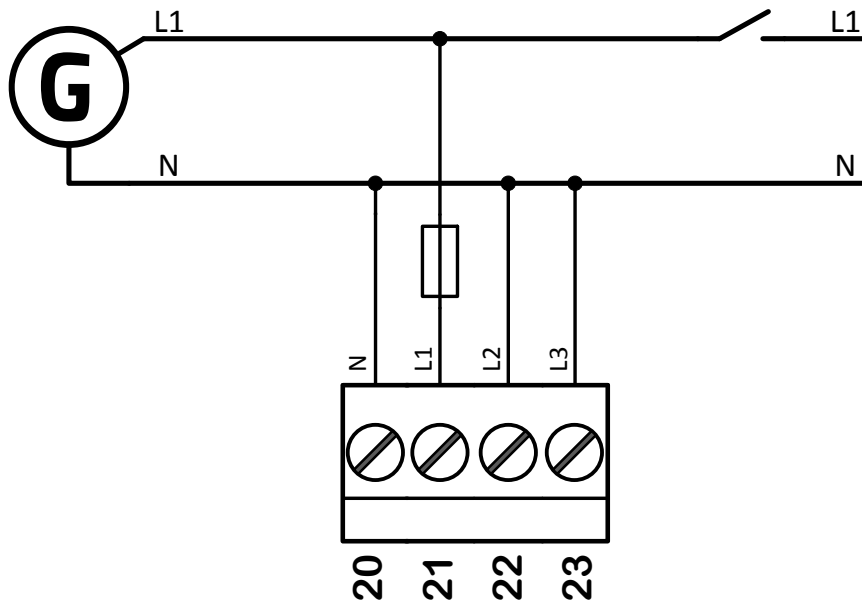## 4.6.4 Connection Type: Mono Phase

Figure 4.11
INTELINANO^{NT} **MRS** MONO PHASE TERMINALS CONNECTION
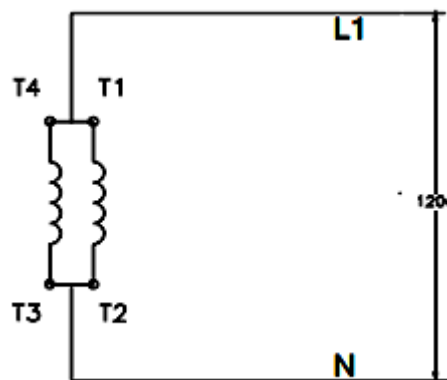
Single-phase measurement – 1PH

Figure 4.12
MONOPHASE CONNECTION

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4.7 Binary inputs

Use minimally **1 mm^2** cables for wiring of standard binary inputs.

NOTE:
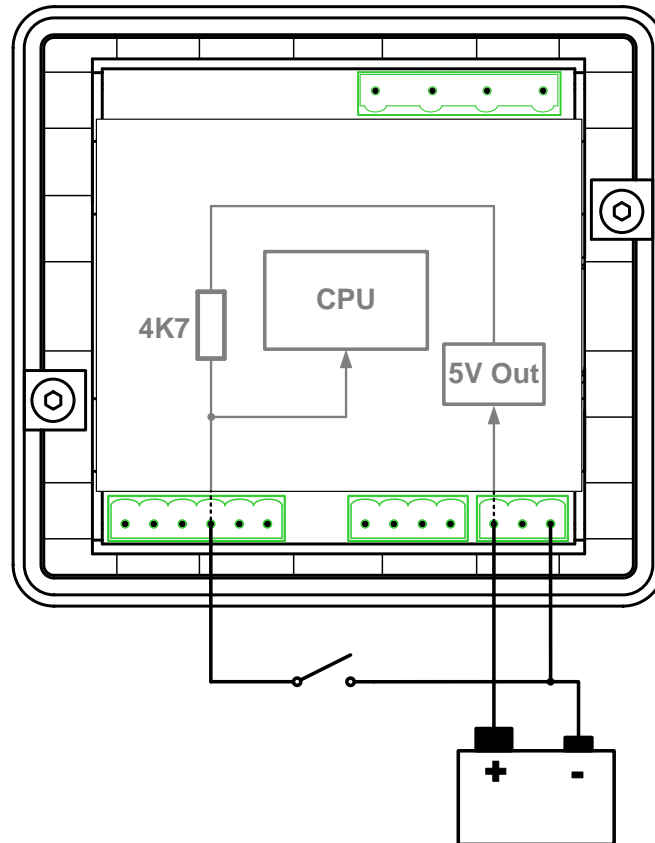Logical binary functions for each binary input have to be assigned during the configuration.

Figure 4.13
RECOMMENDED BINARY INPUTS WIRING

4.8 Binary outputs

Use minimal **1 mm^2** cables for wiring of binary outputs *T06*, *T07*. **2,5 mm^2** cables are required for high current outputs *T04* and *T05*. For more technical detail see chapter *13.5 Binary outputs.*

WARNING!
Controller outputs switch high side! Never connect any analog sensor to this output to avoid sensor damage. All outputs are short circuit protected.

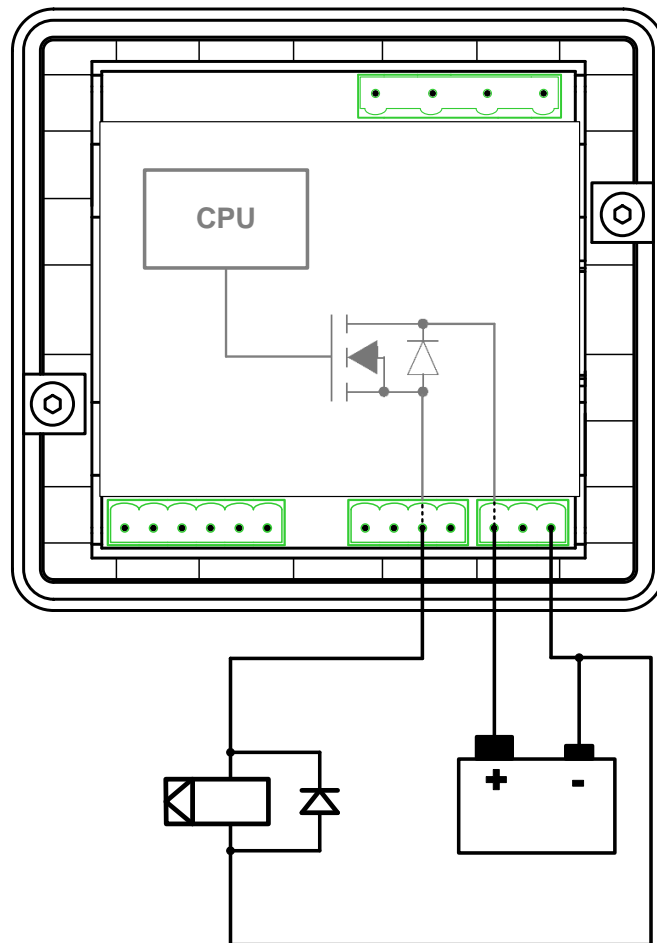Use suppression diodes on all relays and other inductive loads!

Figure 4.14
RECOMMENDED BINARY OUTPUT WIRING

4.9 Analog inputs

The analog inputs are designed for resistive automotive type sensors like VDO or DATCON. The sensors are connected either by one wire (the second pole is sensor body) or by two wires.

CAUTION!
In case of grounded sensors connect the terminal *T10* to the engine body as near the sensor as possible!

CAUTION!
In case of isolated sensors connect the terminal *T10* to the negative power supply terminal of the controller as well as the opposite poles of the sensors!

NOTE:
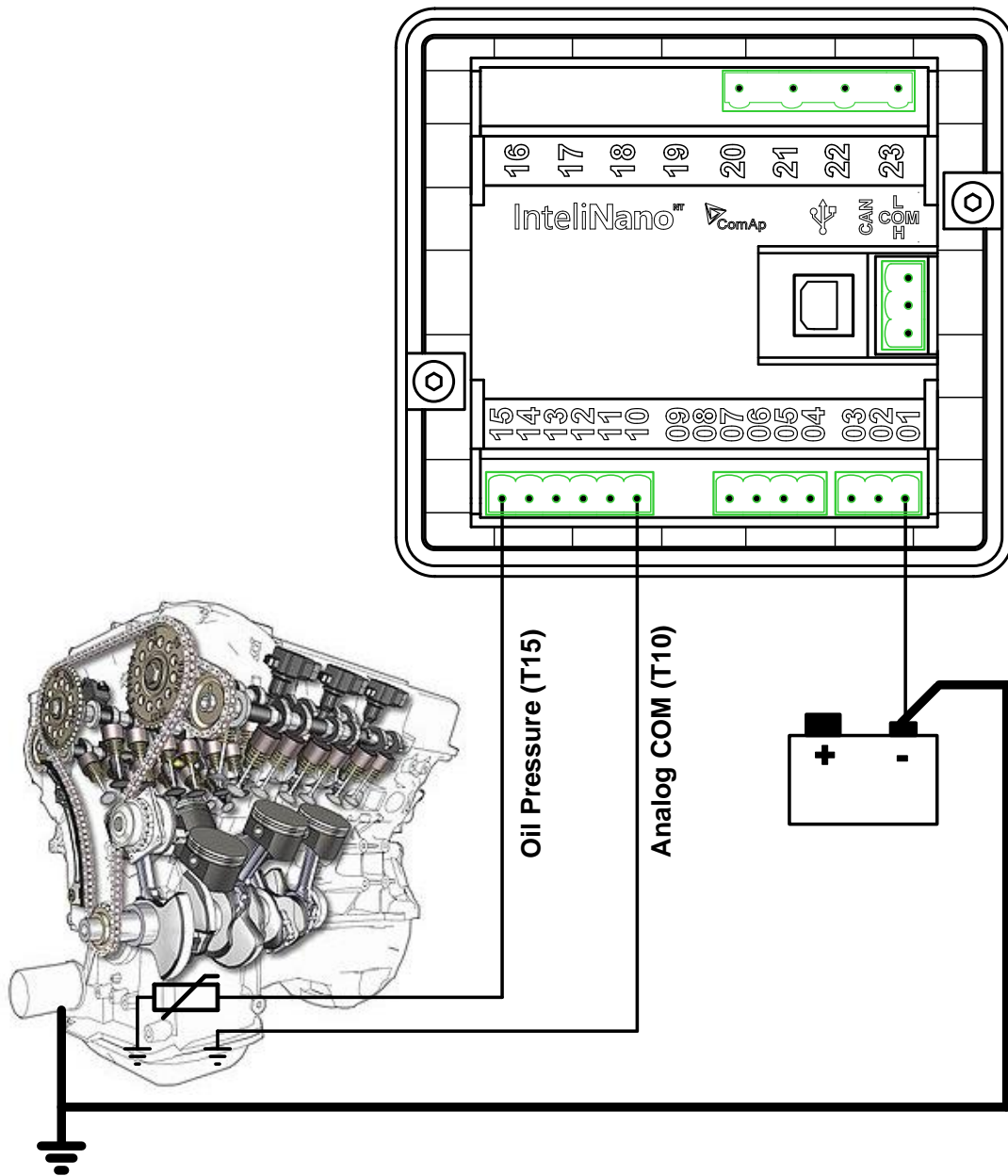Value #### is displayed when measured value is out of range or sensor's wire is broken.
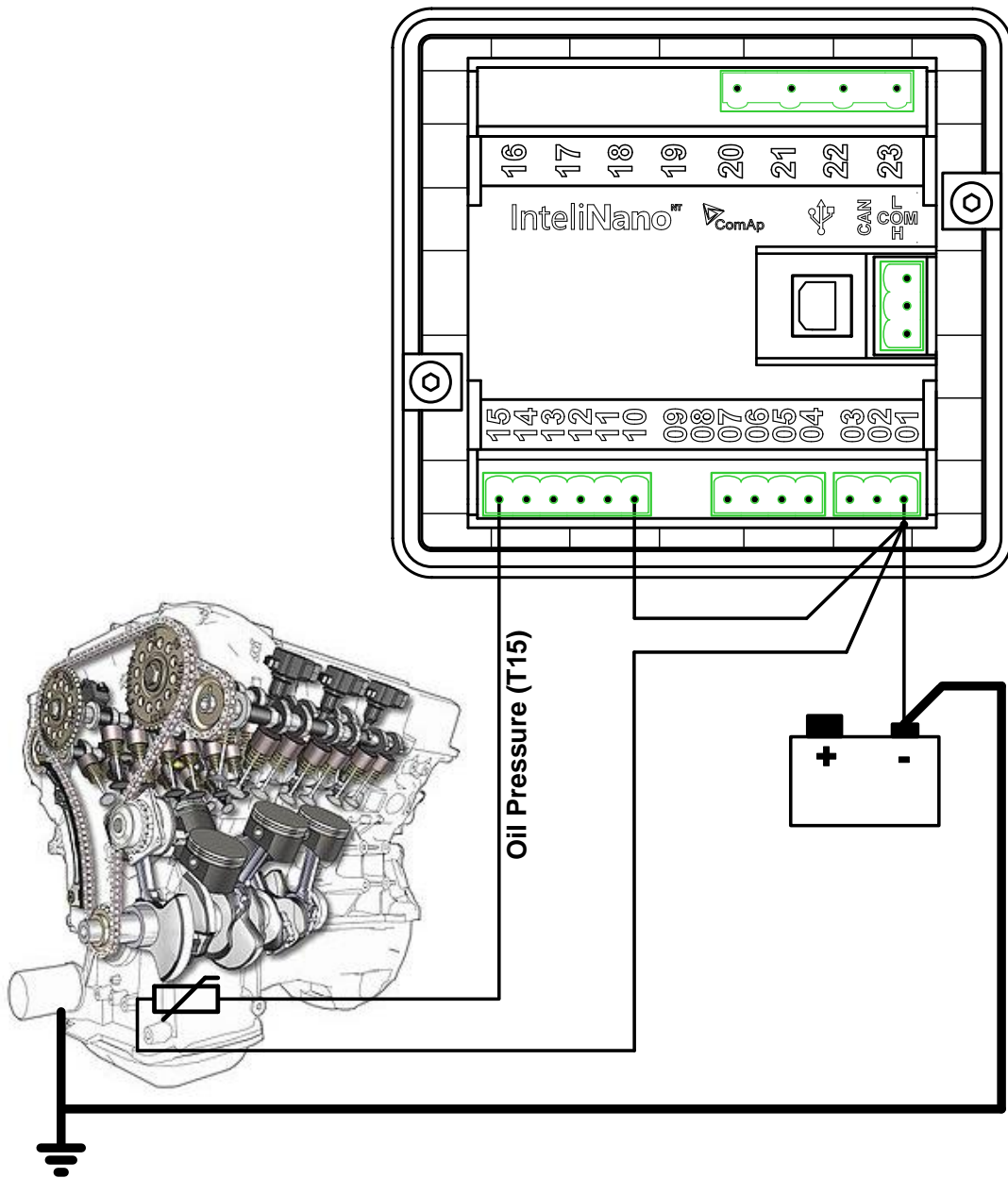
Figure 4.15
WIRING OF ANALOG INPUTS - GROUNDED SENSORS

Figure 4.16
WIRING OF ANALOG INPUTS - ISOLATED SENSORS

5 Recommended Wiring

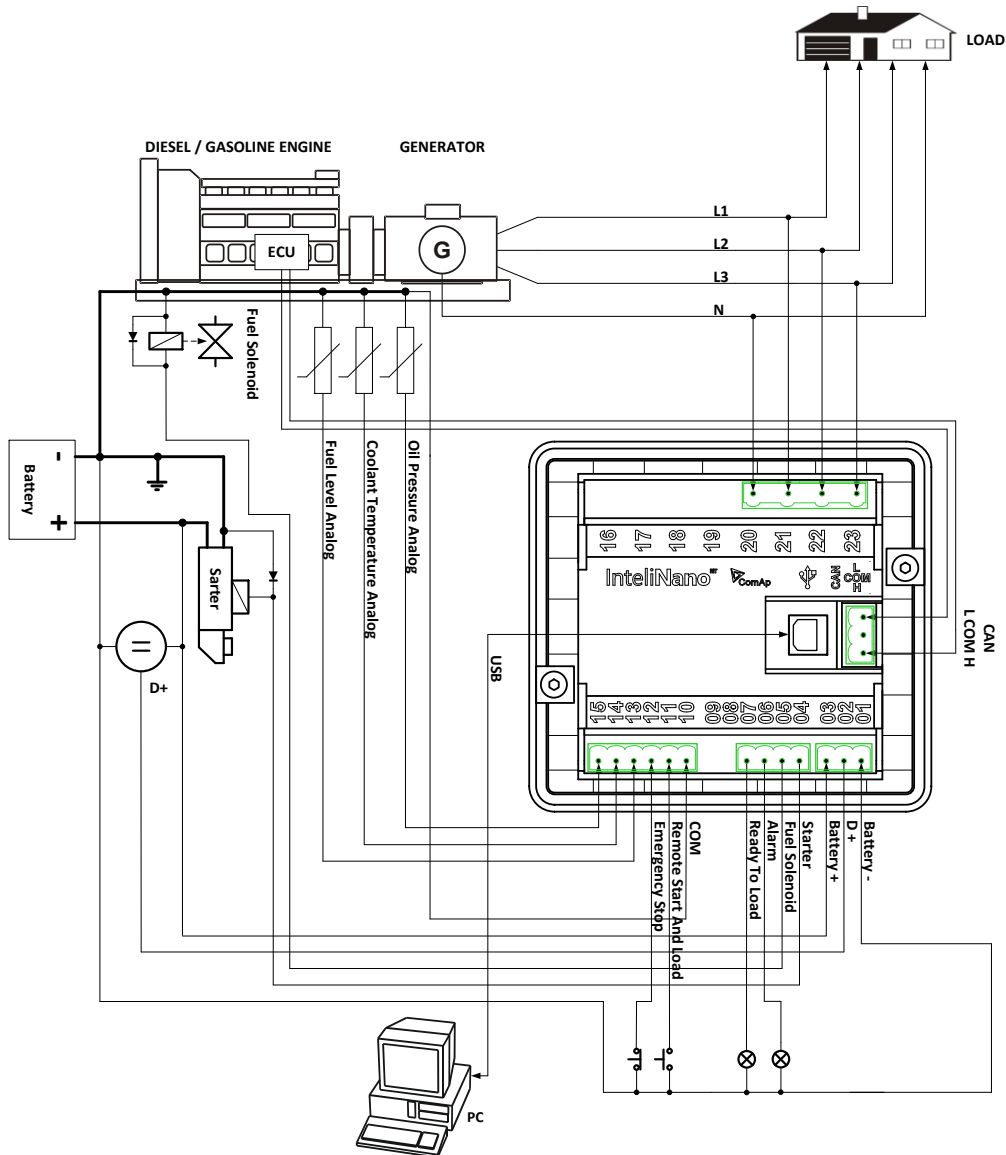## 5.1 InteliNano^{NT} MRS – Wiring Diagram

Figure 5.1
TYPICAL WIRING DIAGRAM OF MRS APPLICATION

6 Controller Settings

6.1 Setup mode

CAUTION!
Controller must be in manual mode before you can enter the controller's setup mode. Use button Auto for switching between **Auto** and **Manual** mode. Green LED above button Auto is turned off when the controller is in Manual mode.

If you have not configured custom initialization (init) screen then press and hold Stop button, then briefly press ▲ button then Auto (**Figure 6.1).**
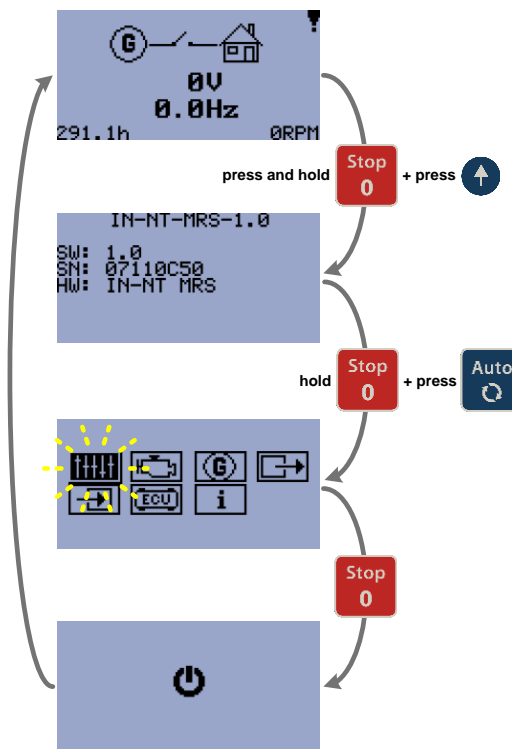

Figure 6.1
ENTRY TO SETUP MODE (WITHOUT CUSTOM SCREEN)

If you have already created your own init screen then press and hold Stop button and then press briefly press ▲, the custom init screen will appear, keep holding the Stop button. Then press ▼ to switch LCD to default init screen and then press Auto (**Figure 6.2**).
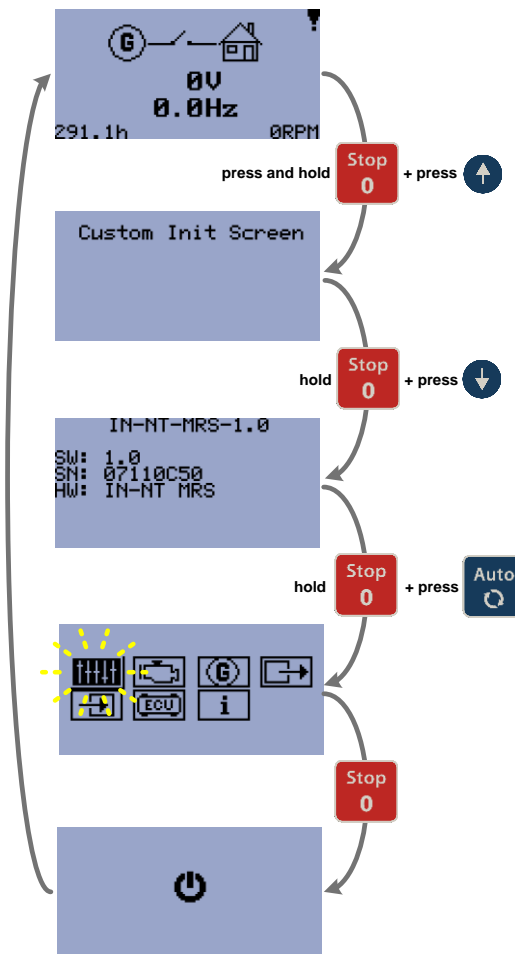
Figure 6.2
ENTRY TO SETUP MODE (WITH CUSTOM SCREEN)

NOTE:
The controller will automatically switch to Setup mode when there is a problem with the CRC or there is an incompatibility between firmware and archive version. This situation can occur when you upgrade a firmware. If this occurs, verify that all setpoints are properly configured.

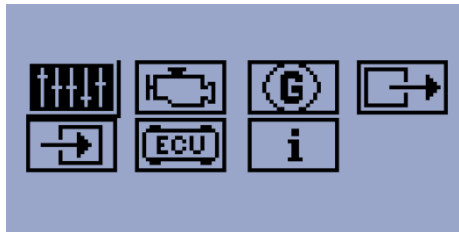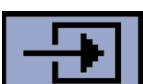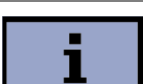**Figure 6.3**
SETUP SCREEN

	Basic settings
	Engine parameters and protections
	Generator protections
	Outputs settings
	Inputs settings
	ECU setting
	Info

To move up and down in the setup menu use ▲ and ▼ buttons. Press **Start** button to select or **Stop** button for exit (**Figure 6.4**).

Figure 6.4
SETUP MENU ORGANIZATION

To apply all changes return to the main setup menu and restart the controller by pressing the **Stop** button.

7 Inputs and Outputs

In the table below you can see which logical function can be assigned to physical binary or analog input or binary output. Each logical input or output function has unique code. Input code's firs letter is **"I"** output code's letter is **"O"**. Summary of all logical input function is in chapter **_Logical binary and analog inputs_**, summary of logical output function is in **_Logical binary outputs_**.

Each logical binary input and output can be configured as **_Normally Open_** (NO) or **_Normally Close_** (NC)

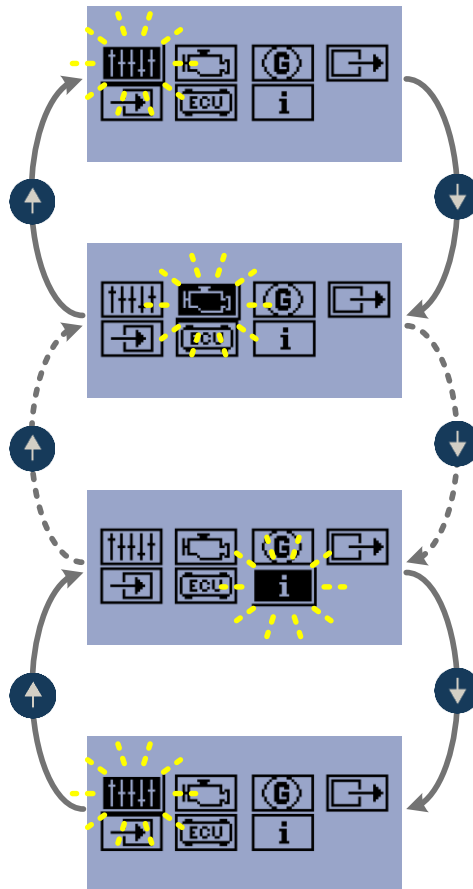| Inputs			
Terminal	**Type**	**Direction**	**Input function assignment**
_T07_	binary	input/output	_I00, I01, I04,, I07, I10, I11, I12, I13, I14, I15, I20, I22, I24, I29_
_T11_	binary	input	_I00, I01, I02, I03, I04, I07, I10, I11, I12, I13, I14, I15, I20, I22, I24, I29_
_T12_	binary	input	_I00, I01, I04, I07, I10, I11, I12, I13, I14, I15, I20, I22, I24, I29_
_T13_	binary/analog	input	_I00, I01, I04, I07, I10, I11, I12, I13, I14, I15, I20, I21, I22, I23, I24, I25, I29_
_T14_	binary/analog	input	_I00, I01, I04, I07, I10, I11, I12, I13, I14, I15, I20, I21, I22, I23, I24, I25, I29_
_T15_	binary/analog	input	_I00, I01, I04, I07, I10, I11, I12, I13, I14, I15, I20, I21, I22, I23, I24, I25, I29_

Outputs			
Terminal	**Type**	**Direction**	**Input function assignment**
_T04_	binary	output	_O00, O01, O02, O03, O04, O05, O06, O07, O08, O09, O10, O11_
_T05_	binary	output	_O00, O02, O03, O04, O05, O06, O07, O08, O09, O10, O11_
_T06_	binary	output	_O00, O02, O03, O04, O05, O06, O07, O08, O09, O10, O11_
_T07_	binary	input/output	_O00, O02, O03, O04, O05, O06, O07, O08, O09, O10, O11_

NOTE:
All inputs except for **_Fuel Level Analog_**, **_Coolant Temperature Analog_** and **_Oil Pressure Analog_** can be configured to the **InteliNano^NT** controller terminal number **_T11_**, **_T12_**, **_T13_**, **_T14_**, **_T15_** and shared input/output terminal **_T07_**. All outputs except **_Starter_** can be configured to terminal **_T04_**, **_T05_**, **_T06_**, **_T07_**. Binary output **_Starter_** can be configured only to high current output terminal **_T04_**.

7.1 Normally Open Contact

Normally Open Contact represents a standard opened contact – no voltage on output terminal and no passing current from/to binary input terminal. When the contact is opened the controller reads logical 0 (L) on the binary input. When contact is closed the controller reads a logical 1 (H).

In this case 0V on the binary output represents a logical 0 (L) Battery positive voltage on the output represents a logical 1 (H).

	Normally Open Contact – output
	Normally Open Contact – input button

7.2 Normally Closed Contact

Normally Closed Contact (inverted) represents a closed contact – positive voltage on output terminal or passing current from/to binary input terminal. When the contact is opened the controller reads logical 1 (H) on the binary input. When the contact is closed the controller reads a logical 0 (L).
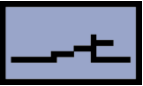
In this case 0V on binary output represents a logical 1 (H). Battery positive voltage on the output represents a logical 0 (L).

	Normally Closed Contact – output
	Normally Closed Contact – input button

8 Outputs settings

8.1 Binary outputs InteliNano^{NT} MRS - default

T04 *Starter*

T05 *Fuel Solenoid*

T06 *Alarm*

T07 *Ready To Load*

8.2 Logical binary outputs

Output code	Output name	Type	Terminal assignment
O00	*Not Used*	binary	*T04* , *T05*, *T06*, *T07*
O01	*Starter*	binary	*T04*
O02	*Fuel Solenoid*	binary	*T04* , *T05*, *T06*, *T07*
O03	*Stop Solenoid*	binary	*T04* , *T05*, *T06*, *T07*
O04	*Alarm*	binary	*T04* , *T05*, *T06*, *T07*
O05	*GCB Close/Open*	binary	*T04* , *T05*, *T06*, *T07*
O07	*Ready To Load*	binary	*T04* , *T05*, *T06*, *T07*
O08	*Prestart*	binary	*T04* , *T05*, *T06*, *T07*
O09	*ECU Power Relay*	binary	*T04* , *T05*, *T06*, *T07*
O10	*Choke*	binary	*T04* , *T05*, *T06*, *T07*
O11	*Glow Plugs*	binary	*T04* , *T05*, *T06*, *T07*

For the configuration of outputs use the PC software, **NanoEdit,** or switch controller to setup mode.
Figure 8.1 is an example of how to configure a binary output via the controller's screen. First select an output terminal. Then use ▲ and ▼ buttons to select a function. Then press Start button to confirm the selection. Lastly press Stop button to return. Then choose a logical function (*O00* - *O11*) and select contact type (*Normally Open contact* or *Normally Closed contact*) and confirm the change.

Figure 8.1
BINARY OUTPUT SETTING EXAMPLE

InteliNano-NT, SW version 2.0.0.x, HW version 2.0, ©ComAp – September 2015
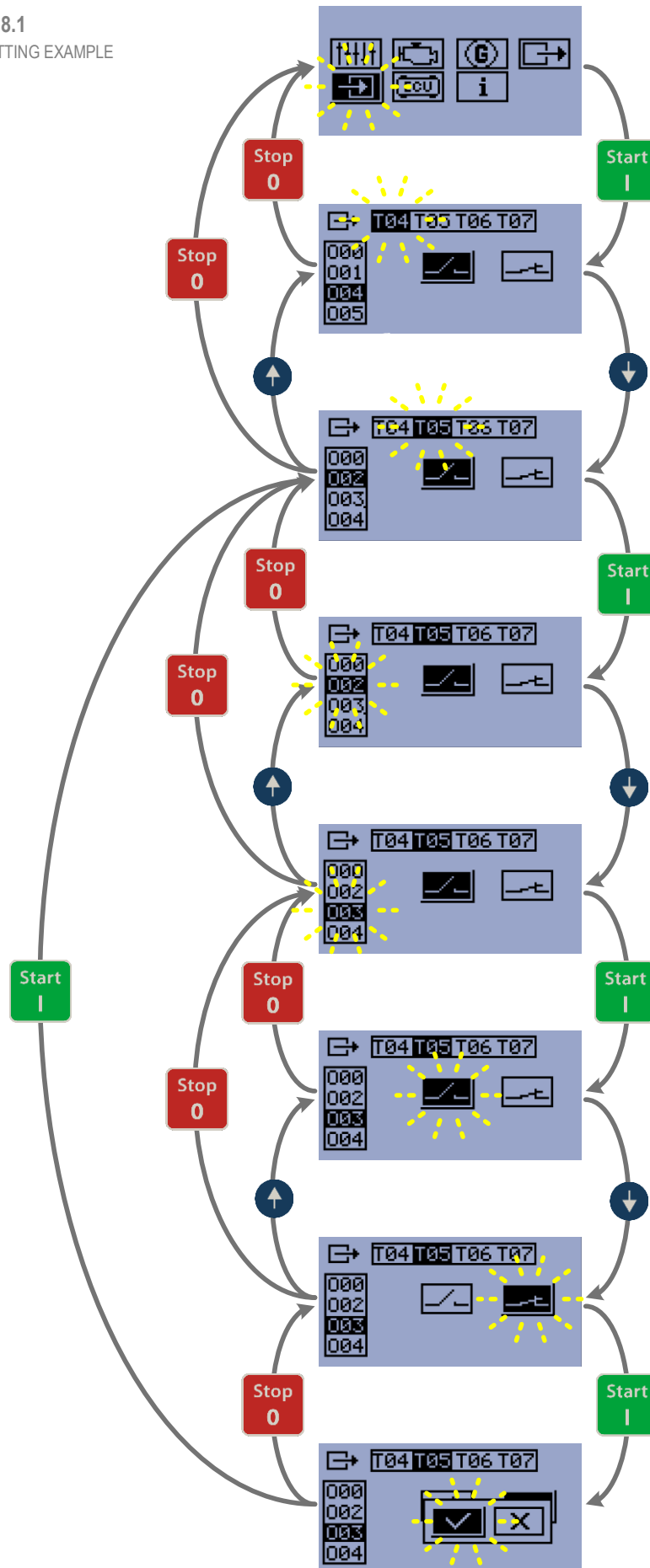
O00   Not Used

Output has no function. Use this configuration when output is not connected.

O01   Starter
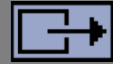
This output is dedicated for starter motor control. The number of cranking attempts is 6.
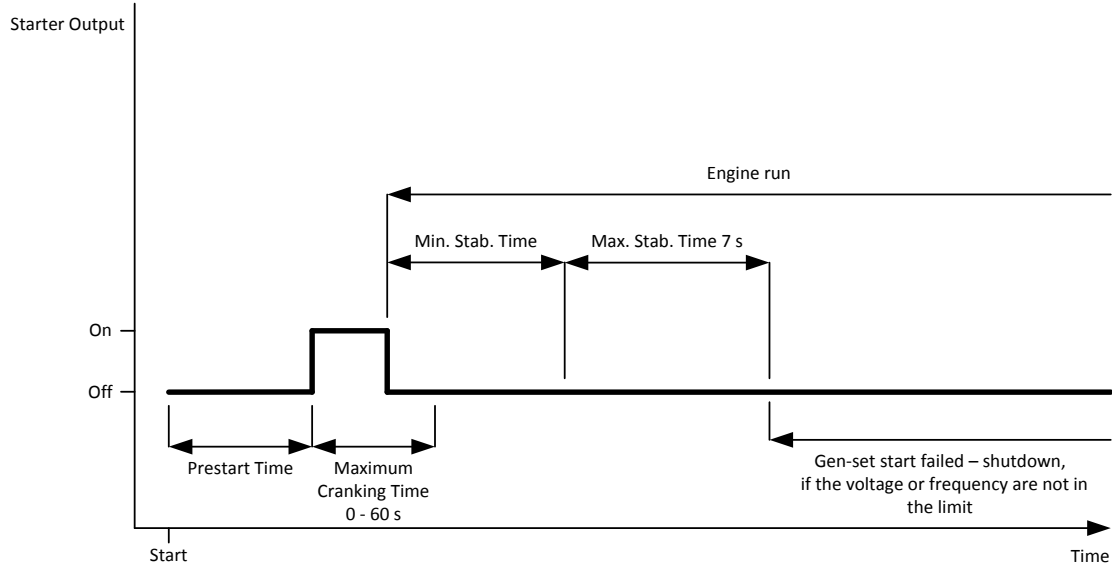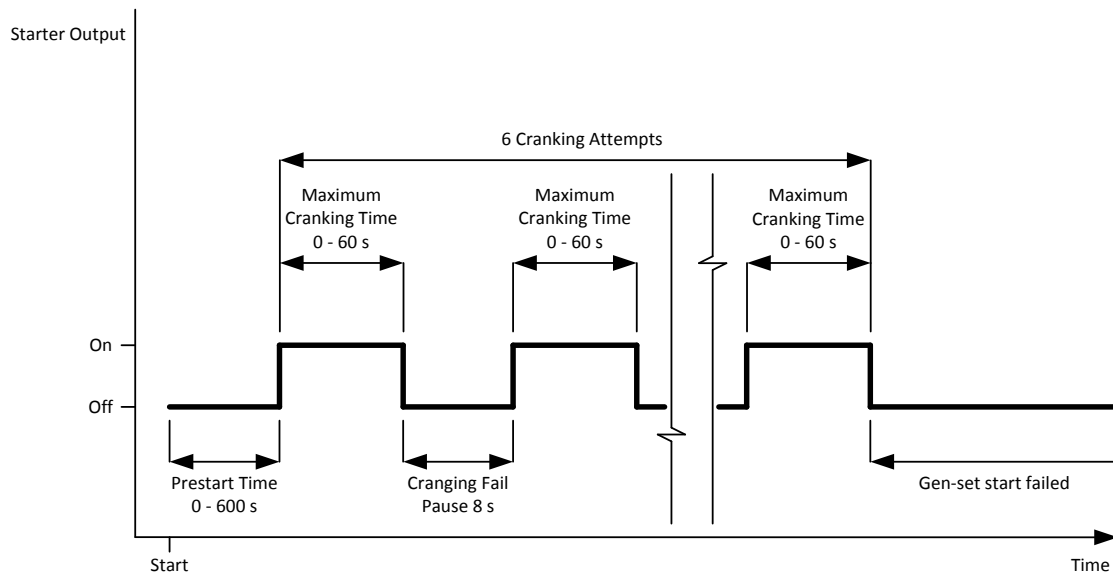
The starter output become inactive when one of following conditions is reach or exceeded.

RPM ≥ 25% of nominal RPM (1500RPM=50Hz; 1800RPM=60Hz)
or
Oil Pressure Analog ≥ 3 bar (43 PSI), only when *Oil Pressure Starter Disengagement* is enabled
or
Low Oil Pressure input is opened, only when *Oil Pressure Starter Disengagement* is enabled
or
voltage on D+ terminal ≥ 80% of battery voltage for 1 s or longer

O02   Fuel Solenoid

This output is dedicated to control the fuel solenoid (valve). The output is closed in the same time as **Starter** output and remains closed while the engine is running.

Diagram 1 (top):

Starter Output

Maximum Cranking Time 0 - 60 s (three instances)

On / Off

Prestart Time 0 - 600 s

Cranging Fail Pause 8 s

Gen-set start failed

Start — Time

Fuel Solenoid is opened

Diagram 2 (bottom):

Starter Output

Engine run

Min. Stab. Time

Max. Stab. Time 7 s

On / Off

Prestart Time

Maximum Cranking Time 0 - 60 s

Start — Stop — Time

Fuel Solenoid is opened
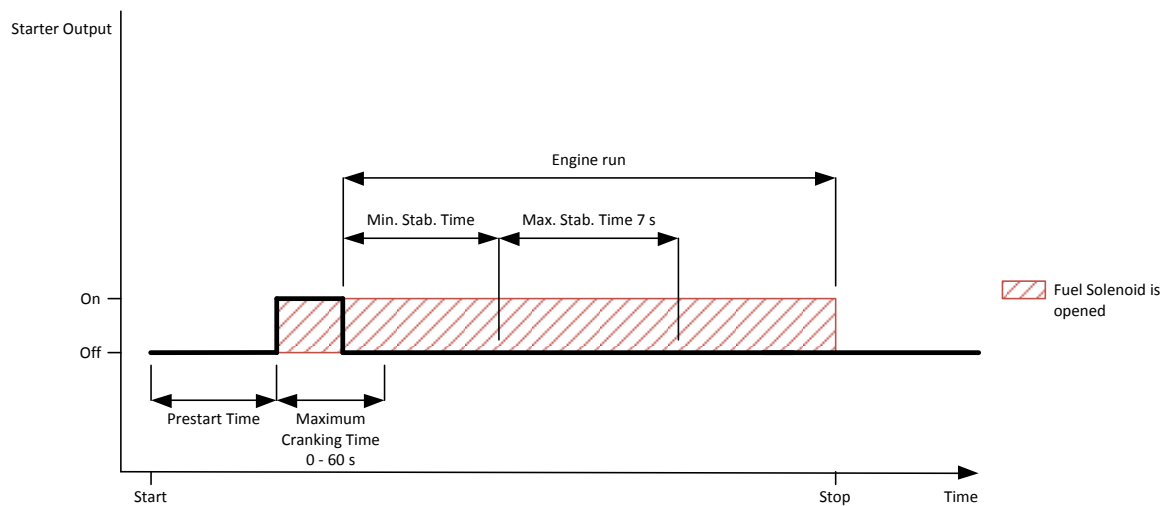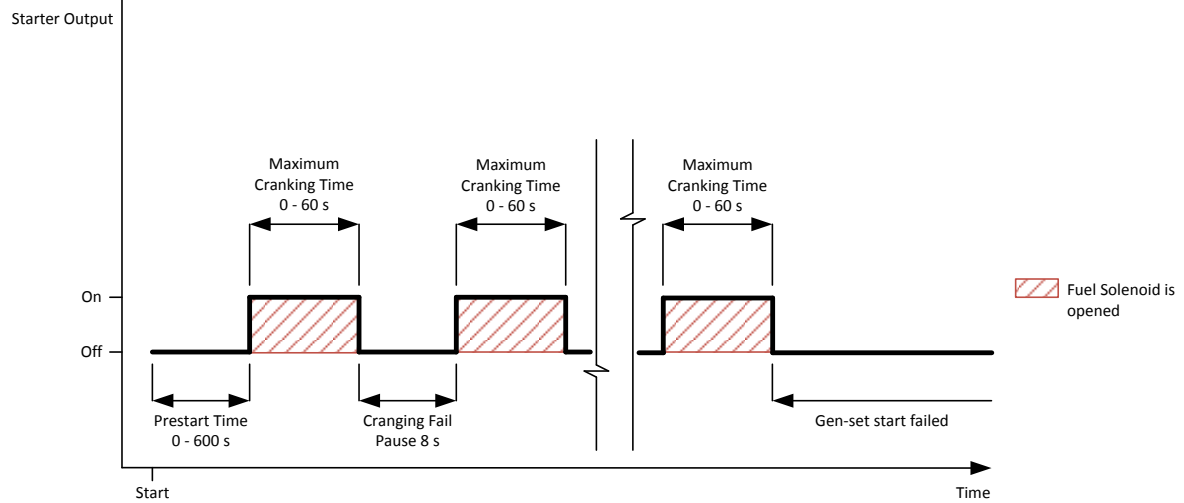
O03   Stop Solenoid

This output is dedicated to control the stop solenoid (valve). The output closes when an engine stop command is received and remains active until the gen-set is stopped.

The engine is stopped if:

- **RPM < 2**
  and
- **Generator voltage < 10V**
  and
- **Oil pressure < 3 Bar. (43 PSI)**
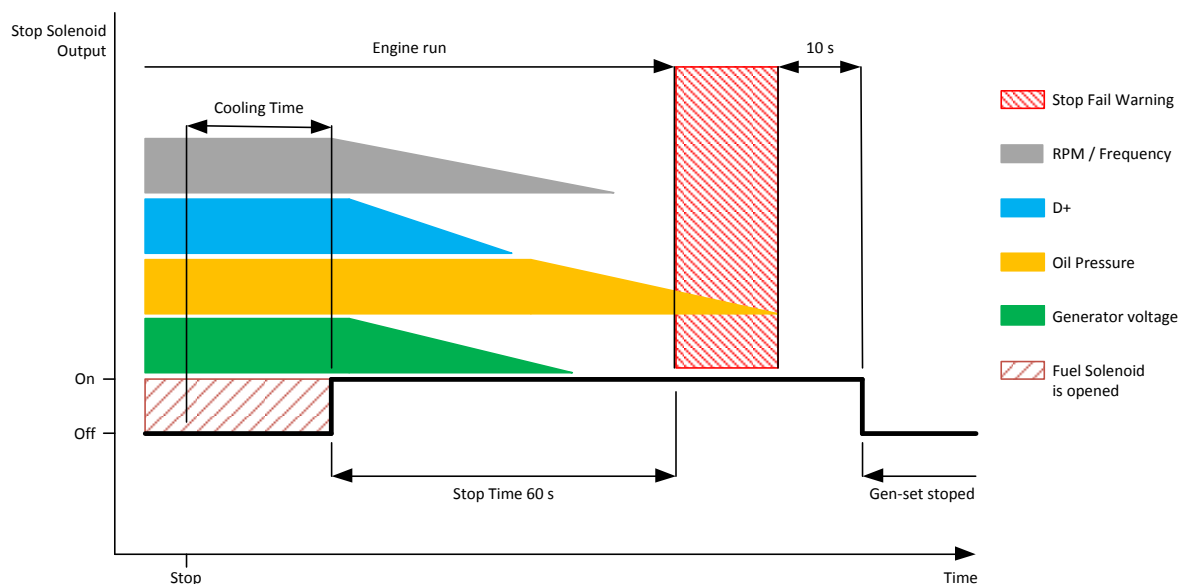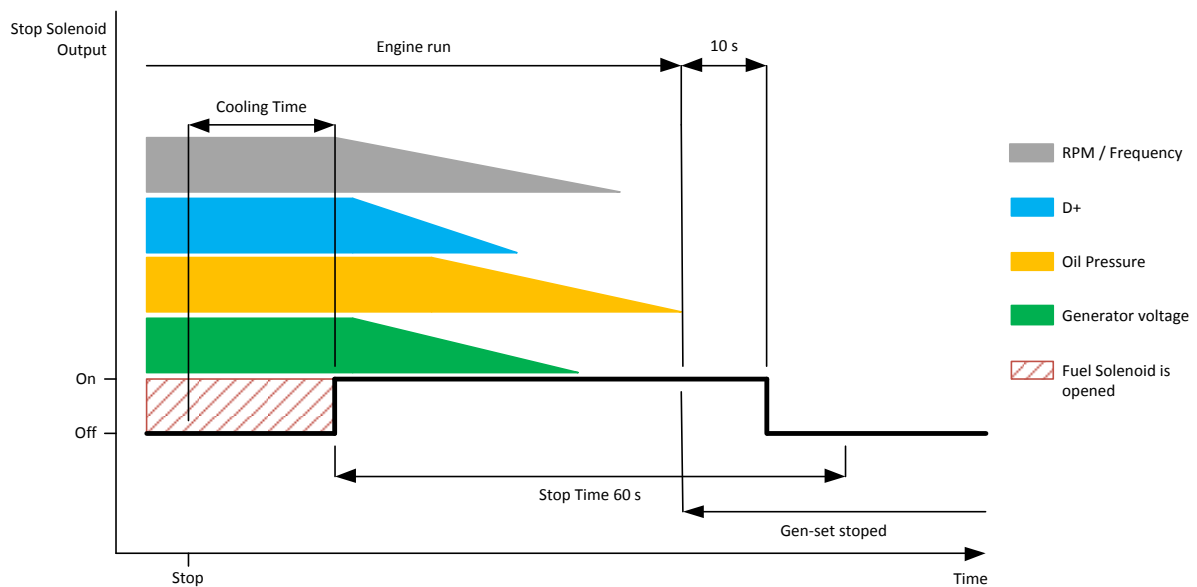
O04   Alarm

The output is to be used for external alarm indication. The output is active when at least one unconfirmed and active alarm is present in the event log.

O05   GCB Close/Open

This output is to be used for a contactor control in case a contactor is used in the GCB position.
GCB position is indicated on the mains screen when feedback is configured.
Wrong breaker / contactor position is indicated on mains screen also.
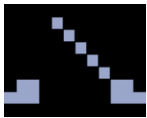
 GCB is opened but has to be close.

 GCB is closed but has to be open.

O07   Ready To Load
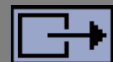
The output is activated when gen-set is running and all electrical values are in limits and no shutdown alarms are active - it is possible to close GCB or it is already closed. The output opens during cooling state or when emergency stop or any shutdown is active.

O08   Prestart
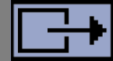
The output is activated while engine is cranking, but prior to the engine start. It is deactivated when 25% of Nominal RPM speed is reached. This output is typically used for pre-heat or pre-lubrication.
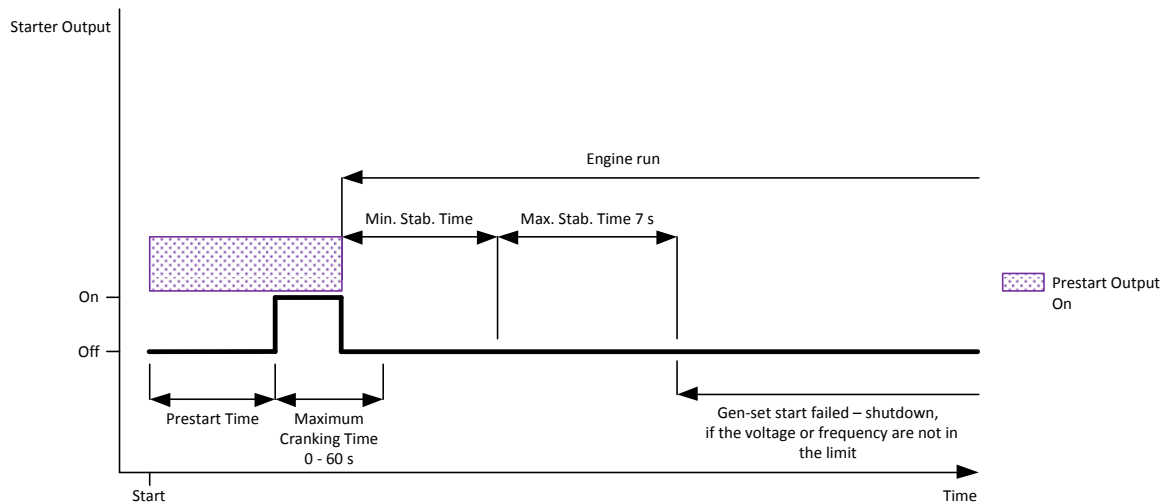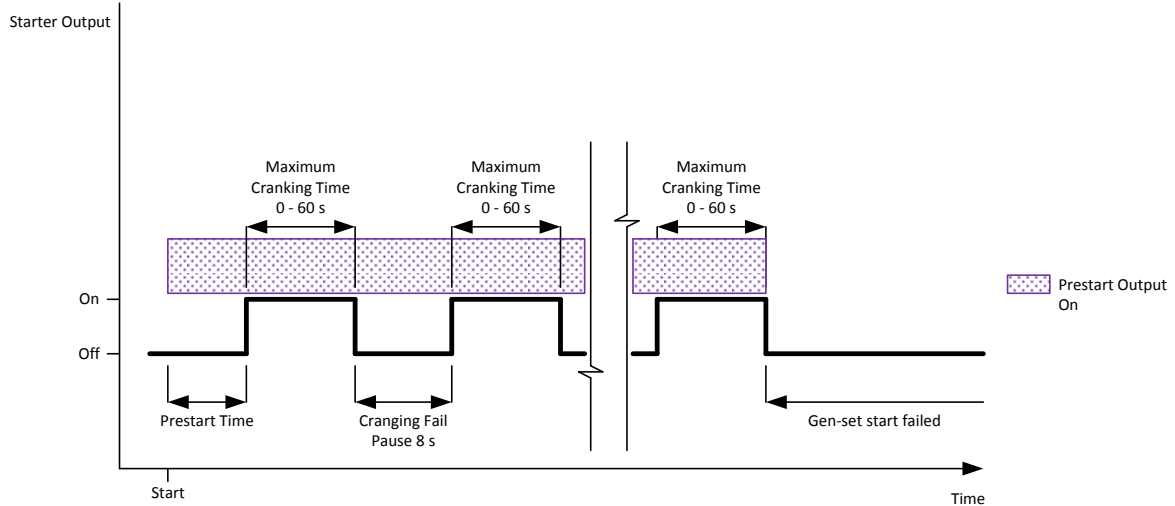
O09   ECU Power Relay
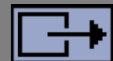
This output is to be used for "keyswitch" input to the ECU. If the particular ECU does not have keyswitch or similar input, it can be used for control of DC power for the ECU.
The output closes together with *O08* *Prestart* and remains closed while the engine is running. It is opened when a stop command is received. (i.e. together with the *O02* *Fuel Solenoid*).

NOTE:
The controller does not evaluate the communication failure alarm during the period when this output is not active.

O10   Choke

The output is activated while engine is cranking and between cranking attempts. Choke Time (timer) will start on engine rune. The Choke output will close when Choke Time elapsed.
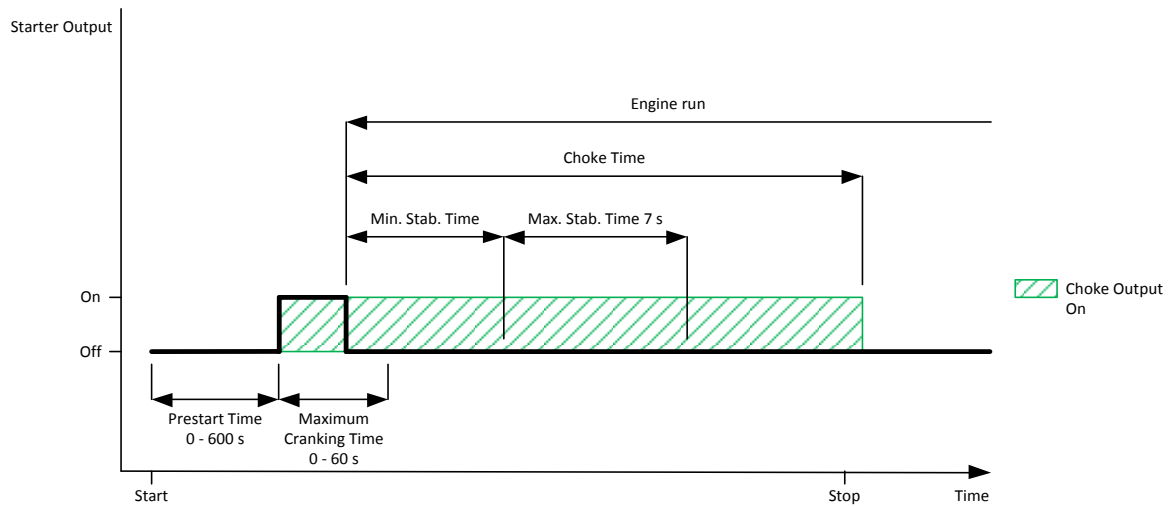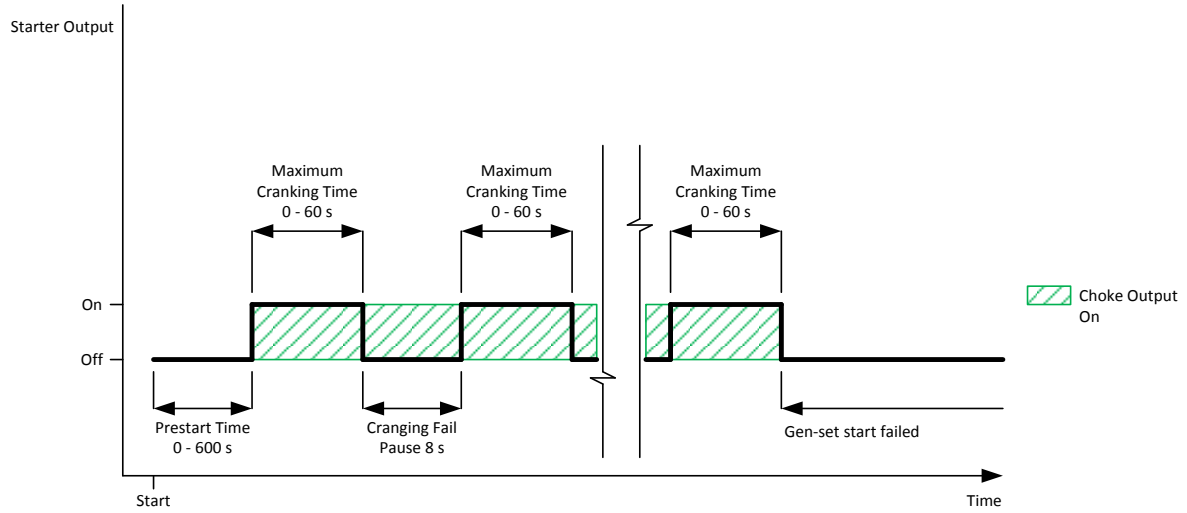
This output is activated before each cranking procedure for Prestart Time but maximally for 8s!
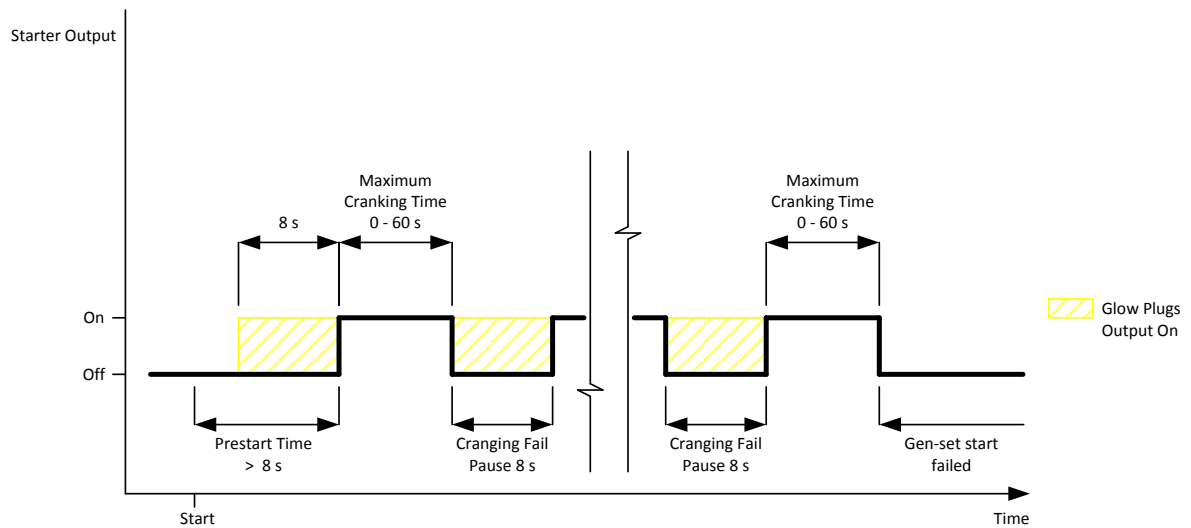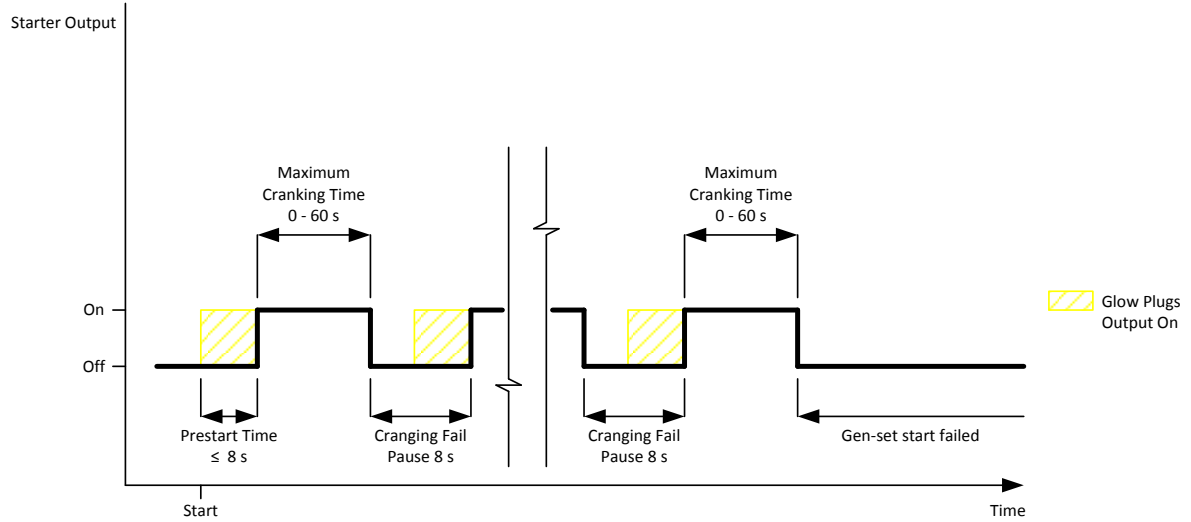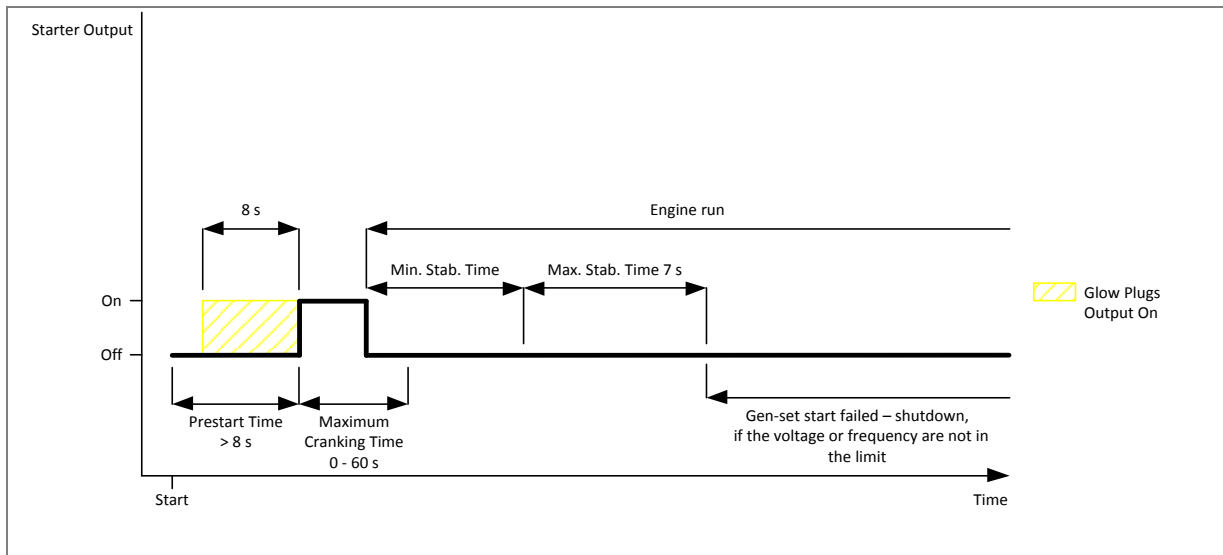
9 Inputs settings

9.1 Binary and analog inputs InteliNano^{NT} MRS - default

T07   **Not Used** (**I00**) – terminal is configured as output

T11   **Remote Start/Stop** (**I03**) – **Normally Open contact**

T12   **Emergency Stop** (**I01**) – **Normally Close contact**

T13   **Fuel Level Analog** (**I21**) – **VDO Level %**

T14   **Coolant Temperature Analog** (**I25**) – **VDO 40-120 °C**

T15   **Oil Pressure Analog** (**I23**) – **VDO 10 bar**

9.2 Logical binary and analog inputs

| Input code	Input name	Type	Terminal assignment
I00	Not Used	binary	T07, T11, T12, T13, T14, T15
I01	Emergency Stop	binary	T07, T11, T12, T13, T14, T15
I02	Remote Start/Stop	binary	T11
I03	Remote Start And Load	binary	T11
I04	Access Lock	binary	T07, T11, T12, T13, T14, T15
I07	GCB Feedback	binary	T07, T11, T12, T13, T14, T15
I10	External Warning 1	binary	T07, T11, T12, T13, T14, T15
I11	External Warning 2	binary	T07, T11, T12, T13, T14, T15
I12	External Warning 3	binary	T07, T11, T12, T13, T14, T15
I13	External Shutdown 1	binary	T07, T11, T12, T13,T14, T15
I14	External Shutdown 2	binary	T07, T11, T12, T13, T14, T15
I15	External Shutdown 3	binary	T07, T11, T12, T13, T14, T15
I20	Low Fuel Level	binary	T07, T11, T12, T13, T14, T15
I21	Fuel Level Analog	analog	T13, T14, T15
I22	Low Oil Pressure	binary	T07, T11, T12, T13, T14, T15
I23	Oil Pressure Analog	analog	T13, T14, T15
I24	High Coolant Temperature	binary	T07, T11, T12, T13, T14, T15
I25	Coolant Temperature Analog	analog	T13, T14, T15
I29	Fuel Level SD	Binary	T07, T11, T12, T13, T14, T15

For the configuration of inputs use the PC software, **NanoEdit,** or switch the controller to setup mode. is an example of how to configure a binary input via the controller's screen. First select an input terminal. Then use ▲ and ▼ buttons to select a function. Then press Start button to confirm the selection. Lastly press Stop button to return. Then choose a logical function (I00-I20, **I22** and **I24**) and select contact type (**Normally Open contact** or **Normally Closed contact**) and confirm change. **Figure 9.2** is an example of how to configure a binary input as analog.

Figure 9.1
BINARY INPUT SETTING EXAMPLE
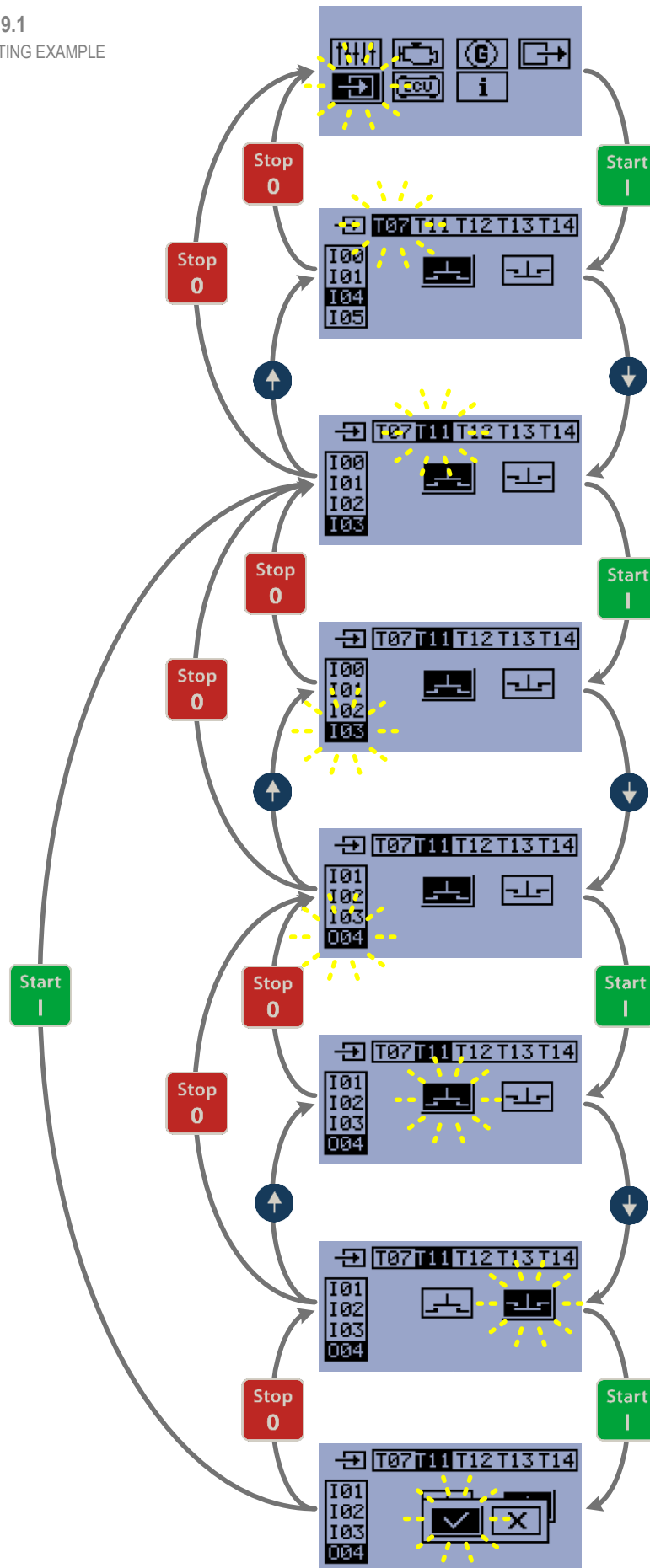
Figure 9.2
ANALOG INPUT SETTING EXAMPLE
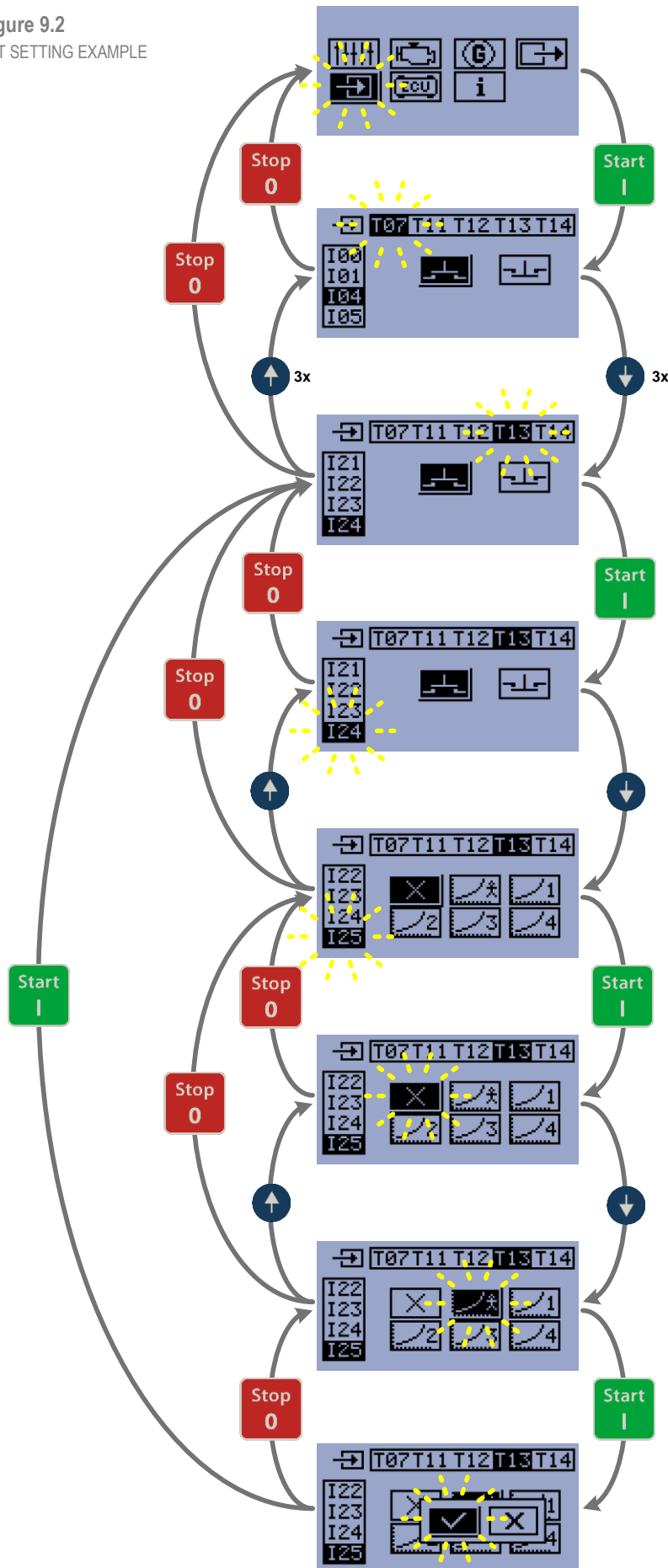
I00   Not Used

Input has no function. Use this configuration when binary or analog input is not connected.

Hint:
T07 *T07* is input-output terminal. Primarily it is configured as an output. To configure as an input, assign the function *O00* *Not Used* in the output configuration.

I01   Emergency Stop

This input will activate the built-in *Emergency Stop* alarm. It is recommended to use a *Normally Close* button for this input.

If this binary input is activated, the left red LED above **Stop** button will blink, the general shutdown symbol will be displayed on LCD's upper right corner, *Emergenc Stop* symbol will be displayed on event log with running hours stamp and shut down procedure will occur. For more details see Shutdown procedure in chapter *12 Alarm, Events and History Management.*

CAUTION!
This is a software function only.

I02   Remote Start/Stop

This input is an external request for engine to run and stop. It is active in **Auto** mode only.
When this input is activated, controller starts the engine and keeps the GCB open.
When this input is deactivated, controller stops the engine.

NOTE:
The *Remote Start/stop* can be configured only on terminal *T11* This is also used for waking the controller from "Zero Power" mode.

I03   Remote Start And Load

The *Remote Start And Load* input can be used only when the controller is in **Auto** mode.

This input starts engine and closes the GCB (only when is configured) after all engines and generator parameters are within tolerance. When this input is deactivated the controller will open the breaker (only when is configured) and stop the engine.

NOTE:
The *Remote Start And Load* can be configured only on terminal *T11*. This is also used for waking the controller from "Zero Power" mode.

I04   Access Lock

When this input is closed, no setpoints can be adjusted from controller's front panel and gen-set mode (**Manual** - **Auto**) cannot be changed.
Access Lock does not protect setpoints and mode changing from **NanoEdit**. Also history is accessible.
Access Lock is also functionless in case that the controller is in setup mode.

I07   GCB Feedback

This is an input from the generator circuit breaker. If the input is active, the controller will consider the GCB as closed and vice versa. If the GCB is not in expected position, the alarm *GCB Fail* will occur. For more details see *Shutdown* procedure in chapter *12 Alarm, Events and History Management.*

NOTE:
The feedback time limit is 5s.

GCB position is indicated on the mains screen when feedback is configured.
Wrong breaker / contactor position is indicated on mains screen also.

     GCB is opened but has to be close.

     GCB is closed but has to be open.

I10   External Warning 1

If this binary input is activated the red LED above **Stop** button will blink, general warning symbol will be displayed on LCD's upper right corner and *External Warning 1* symbol will be displayed on event log with running hours stamp. This alarm is only warning. For more details see *Warning* procedure in chapter *12 Alarm, Events and History Management.*

I11   External Warning 2

If this binary input is activated the red LED above **Stop** button will blink, general warning symbol will be displayed on LCD's upper right corner and *External Warning 2* symbol will be displayed on event log with running hours stamp. This alarm is only warning. For more details see *Warning* procedure in chapter *12 Alarm, Events and History Management.*

I12   External Warning 3

If this binary input is activated left red LED above **Stop** button will blink, general warning symbol will be displayed on LCD's upper right corner and *External Warning 3* symbol will be displayed on event log with running hours stamp. This alarm is only warning. For more details see *Warning* procedure in chapter *12 Alarm, Events and History Management.*

I13   External Shutdown 1

When this binary input is activated the red LED above **Stop** button will blink, general shutdown symbol will be displayed on LCD's upper right corner, *External Shutdown 1* symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see *Shutdown* procedure in chapter *12 Alarm, Events and History Management.*

CAUTION!
This is a software function only.

I14   External Shutdown 2

When this binary input is activated the red LED above **Stop** button will blink, general shutdown symbol will be displayed on LCD's upper right corner, *External Shutdown 2* symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see *Shutdown* procedure in chapter *12 Alarm, Events and History Management.*

CAUTION!
This is a software function only.

I15   External Shutdown 3

When this binary input is activated the red LED above **Stop** button will blink, general shutdown symbol will be displayed on LCD's upper right corner, *External Shutdown 3* symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see *Shutdown* procedure in chapter *12 Alarm, Events and History Management.*

CAUTION!
This is a software function only.

I20   Low Fuel Level

When this binary input is activated the red LED above **Stop** button will blink, the general warning symbol will be displayed on LCD's upper right corner, and *Low Fuel Level* symbol will be displayed on event log with running hours stamp. This alarm is only warning. For more details see *Warning* procedure in chapter *12 Alarm, Events and History Management.*

NOTE:
Input has 10s delay.

I21   Fuel Level Analog

Analog input for fuel level measurement. When measured value exceeds the preset threshold, the left red LED above **Stop** button will blink, the general warning symbol will be displayed on LCD's upper right corner, and fuel level symbol will be displayed on event log with running hours stamp . This alarm is only warning. For more details see ***Warning*** procedure in chapter ***12 Alarm, Events and History Management.***
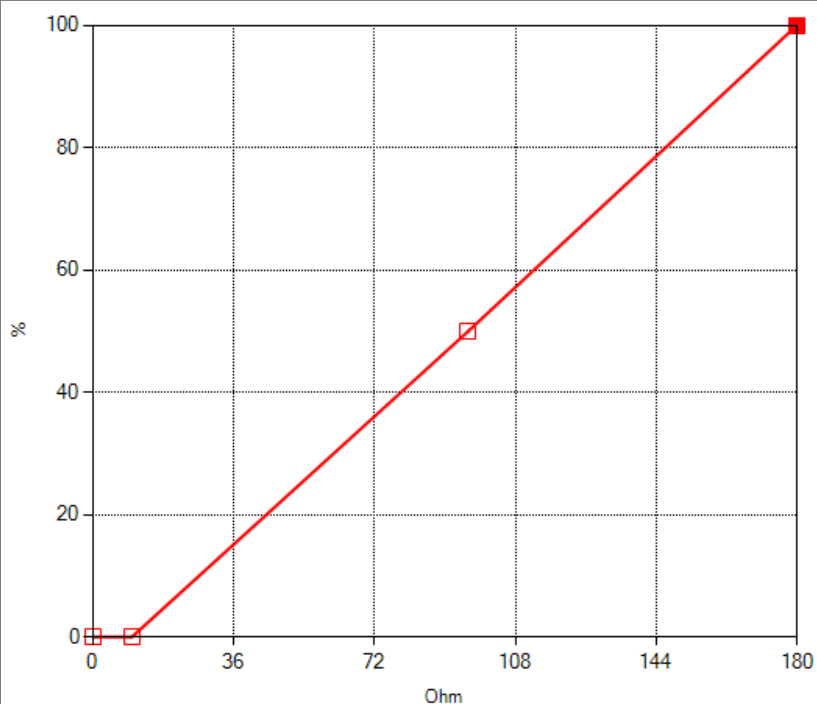
Alarm threshold is 20% of measurement range. You can choose one from two preset resistive sensors (VDO, Datcon) or you can create your own sensor curve.
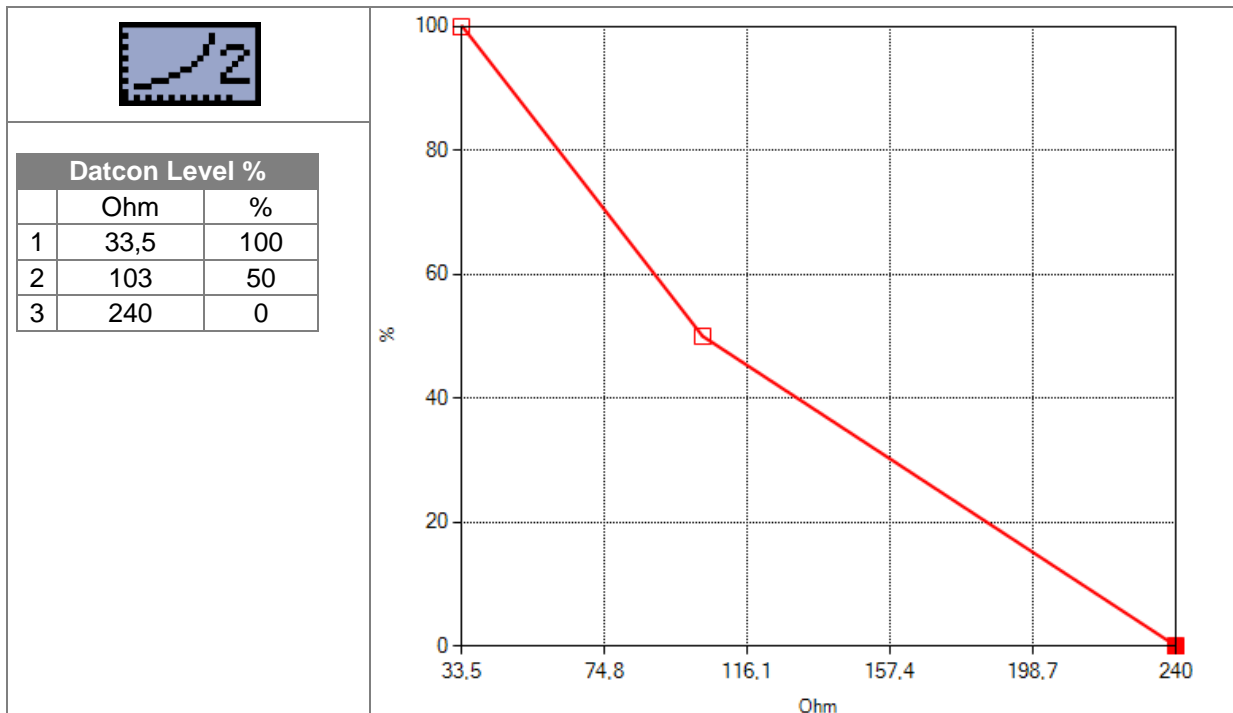
NOTE:
Input has 10s delay.

VDO Level %		
	Ohm	%
1	0	0
2	10	0
3	96	50
4	180	100

Datcon Level %		
	Ohm	%
1	33,5	100
2	103	50
3	240	0

I22   Low Oil Pressure

When this binary input is activated the red LED above **Stop** button will blink, the general shutdown symbol will be displayed on LCD's upper right corner, the oil pressure symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see *Shutdown* procedure in chapter *12 Alarm, Events and History Management.*

Evaluation of the protection is delayed for 1s.

I29   Fuel Level SD

When this binary input is activated the red LED above **Stop** button will blink, the general warning symbol will be displayed on LCD's upper right corner. Fuel Level SD symbol will be displayed on event log with running hours stamp and shutdown procedure will occur.

Input has 10s delay.

I23   Oil Pressure Analog

Analog input for oil pressure measurement. When the measured value exceeds the preset threshold the red LED above **Stop** button will blink, the general shutdown symbol will be displayed on LCD's upper right corner, the oil pressure symbol will be displayed on event log with running hours stamp and the shut down procedure will occur. For more details see **_Shutdown_** procedure in chapter **_12 Alarm, Events and History Management._**

Default threshold is 1 Bar of measurement range. You can choice one from five default resistive sensors (VDO, Datcon) or you can create your own sensor curve.

You can setup shutdown threshold (**_E04 Oil Pressure Shutdown_**) in Engine parameters and protection group.

NOTE:
Input has 3s delay.

VDO 5 Bar		
	Ohm	Bar
1	10	0
2	50	1
3	85	2
4	119	3
5	152	4
6	180	5

VDO 10 Bar		
	Ohm	Bar
1	10	0
2	50	2
3	85	4
4	119	6
5	152	8
6	180	10

Datcon 5 Bar		
	Ohm	Bar
1	33,5	5,5
2	153	1,4
3	240	0
4	350	0

Datcon 7 Bar		
	Ohm	Bar
1	33,5	6,9
2	153	1,7
3	240	0
4	350	0

Datcon 10 Bar		
	Ohm	Bar
1	33,5	10,3
2	153	2,6
3	240	0
4	350	0
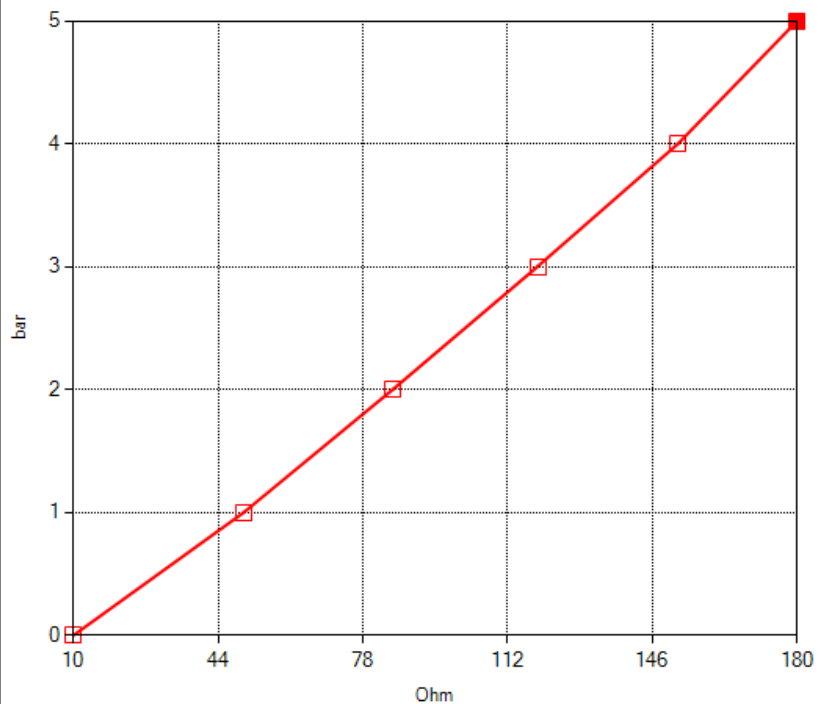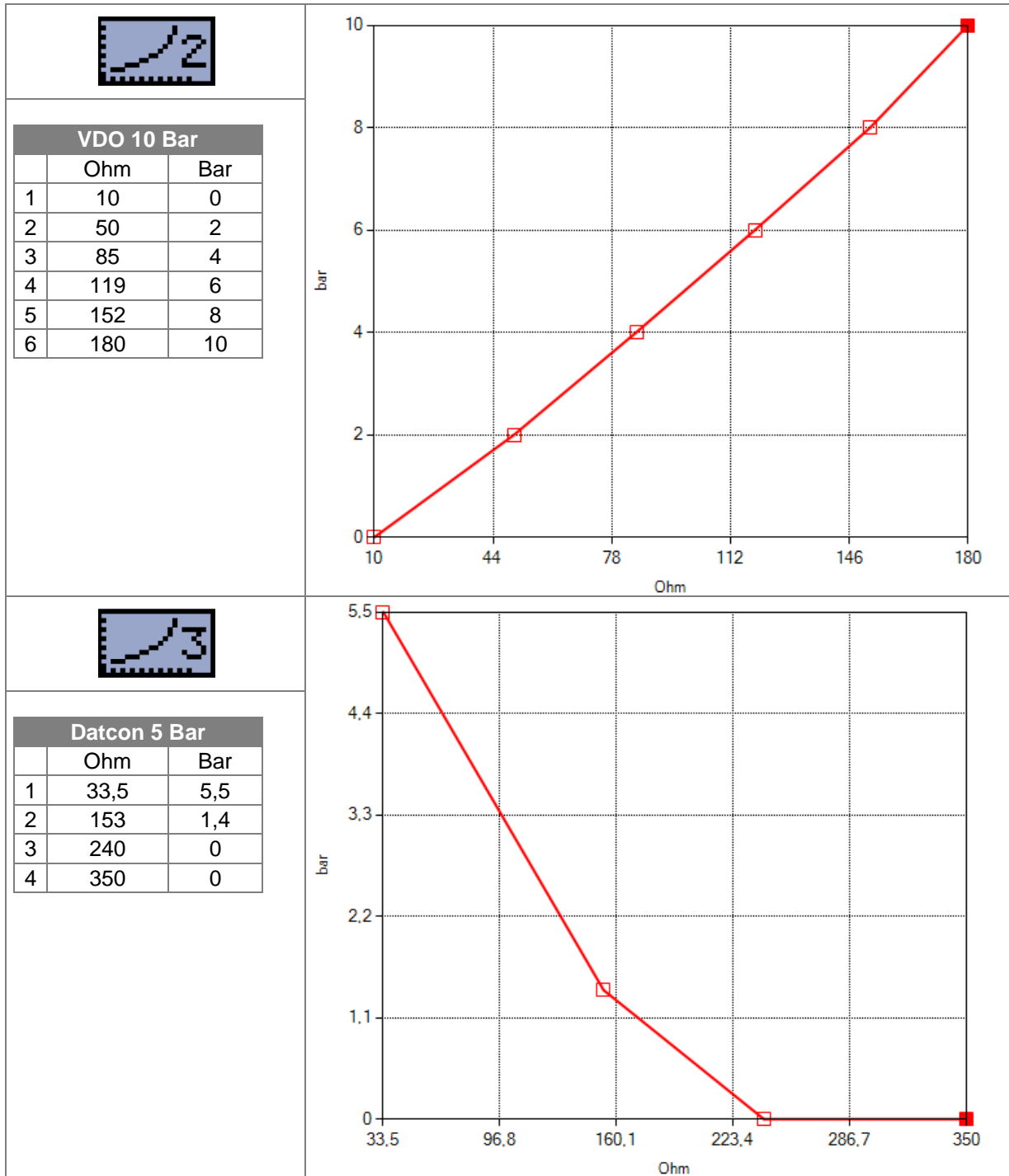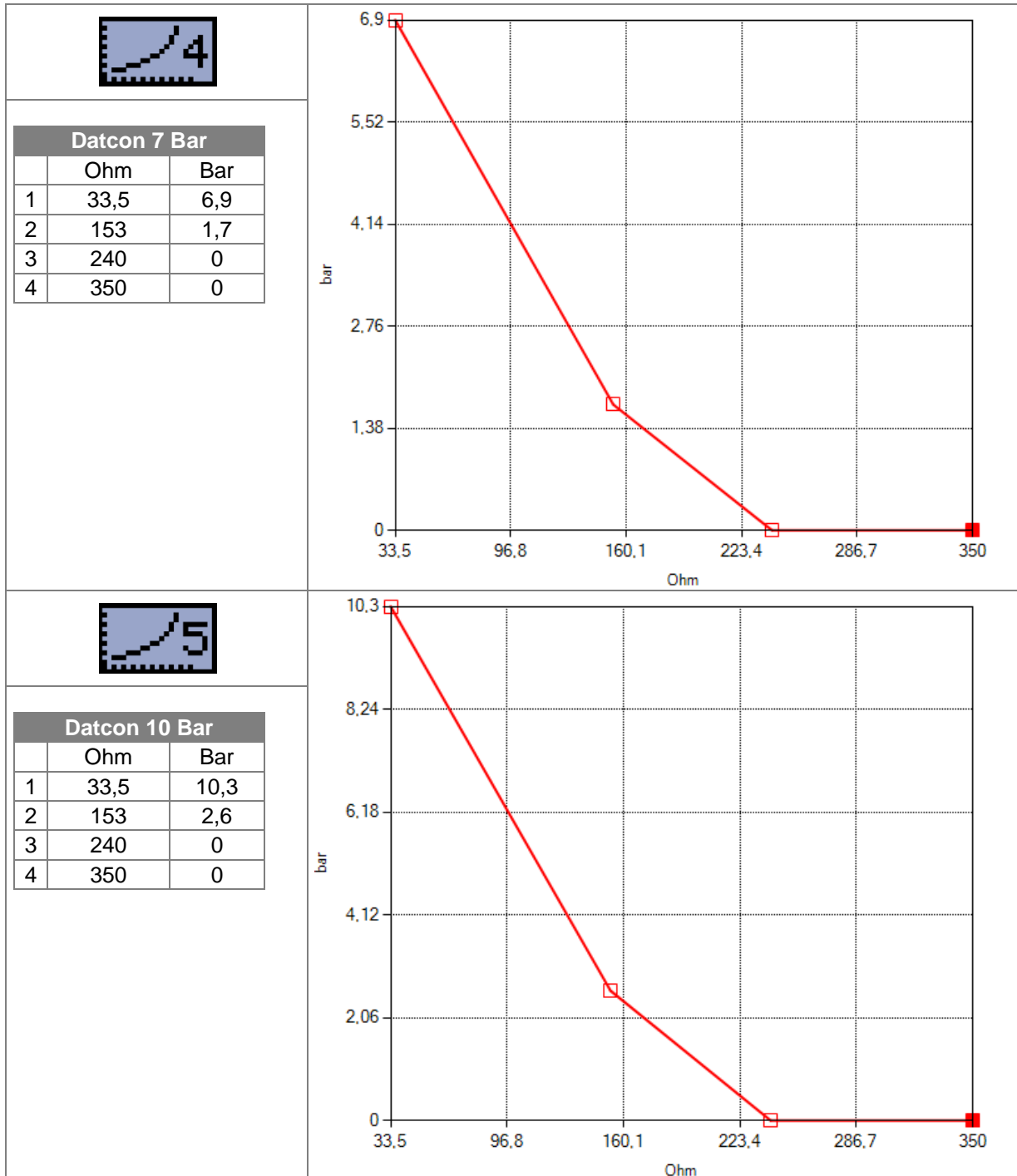
I24   High Coolant Temperature

When this external binary input is activated the red LED above **Stop** button will blink, the general shutdown symbol will be displayed on LCD's upper right corner, the Coolant Temperature symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see **_Shutdown_** procedure in chapter **_12 Alarm, Events and History Management._**

I25   Coolant Temperature Analog

Analog input for coolant temperature measurement. When the measured value exceeds the preset threshold, the red LED above **Stop** button will blink, the general shutdown symbol will be displayed on the LCD's upper right corner, the coolant temperature symbol will be displayed on event log with running hours stamp, and the shut down procedure will occur. For more details see **_Shutdown_** procedure in chapter **_12 Alarm, Events and History Management._**

Default threshold is 90°C. You can choose one from four default resistive sensors (VDO, Datcon) or you can create your own sensor curve.

You can setup shutdown threshold (**_E05 Coolant Temperature Shutdown_**) in Engine parameters and protection group.
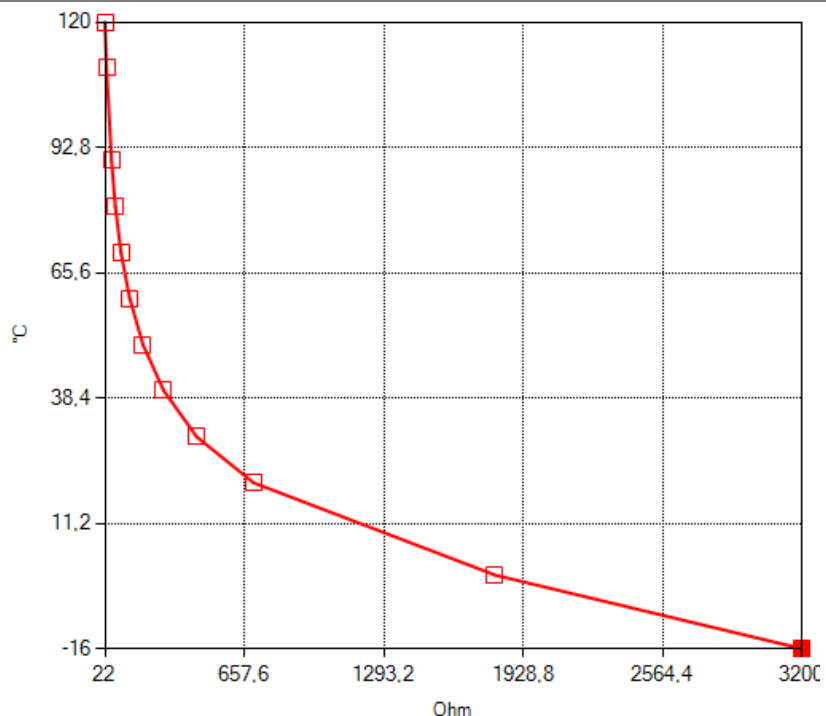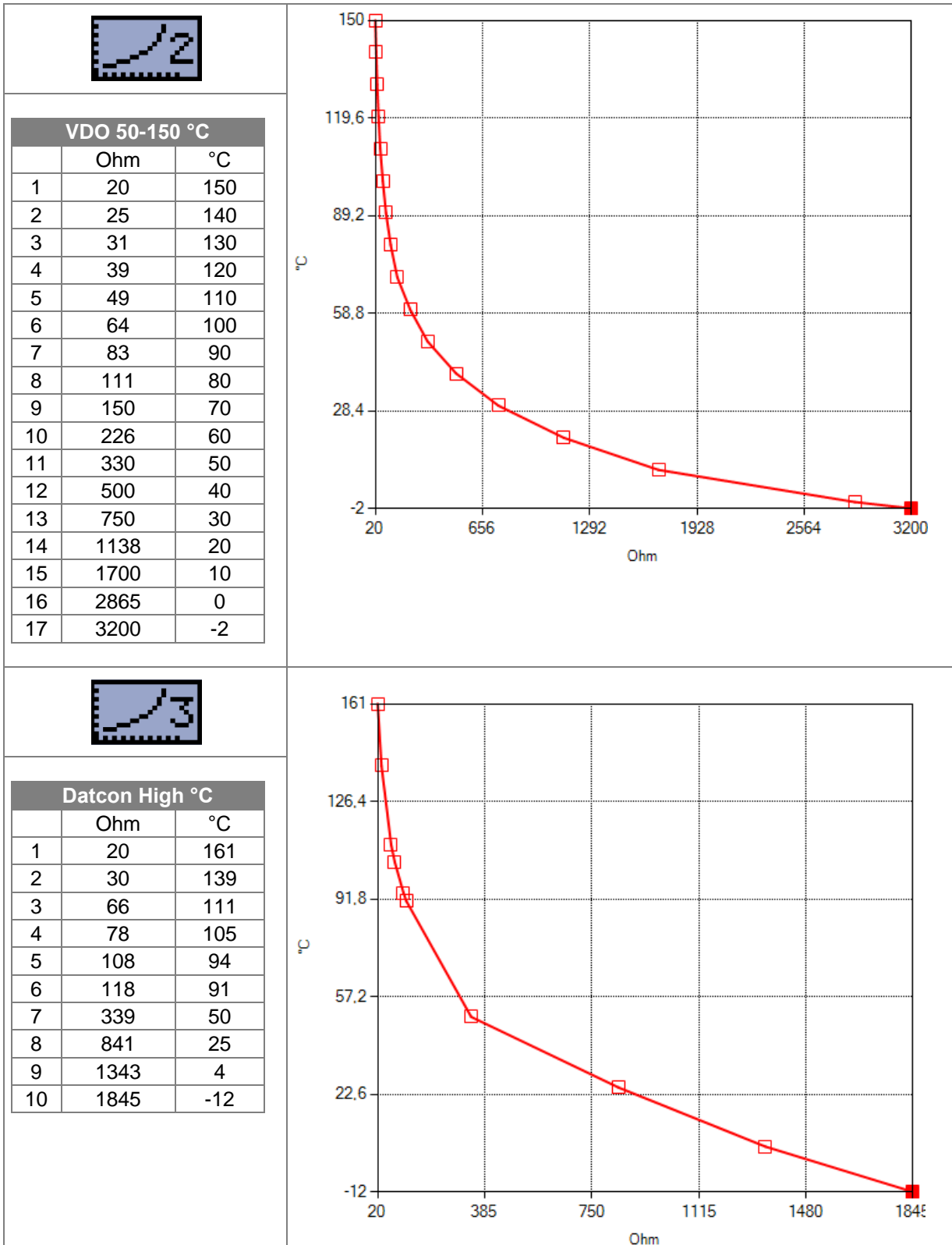
NOTE:
Input has 5s delay.

| VDO 40-120 °C		
	Ohm	°C
1	22	120
2	29	110
3	52	90
4	69	80
5	95	70
6	135	60
7	195	50
8	290	40
9	440	30
10	700	20
11	1800	0
12	3200	-16

VDO 50-150 °C		
	Ohm	°C
1	20	150
2	25	140
3	31	130
4	39	120
5	49	110
6	64	100
7	83	90
8	111	80
9	150	70
10	226	60
11	330	50
12	500	40
13	750	30
14	1138	20
15	1700	10
16	2865	0
17	3200	-2

Datcon High °C		
	Ohm	°C
1	20	161
2	30	139
3	66	111
4	78	105
5	108	94
6	118	91
7	339	50
8	841	25
9	1343	4
10	1845	-12

Datcon Low °C		
	Ohm	°C
1	6	150
2	8	140
3	11	130
4	15	120
5	21	110
6	30	100
7	43	90
8	63	80
9	95	70
10	113	66
11	146	60
12	229	50
13	372	40
14	624	30
15	819	25
16	1014	20
17	1209	15
18	1404	10
19	1599	5
20	1794	0
21	1989	-5
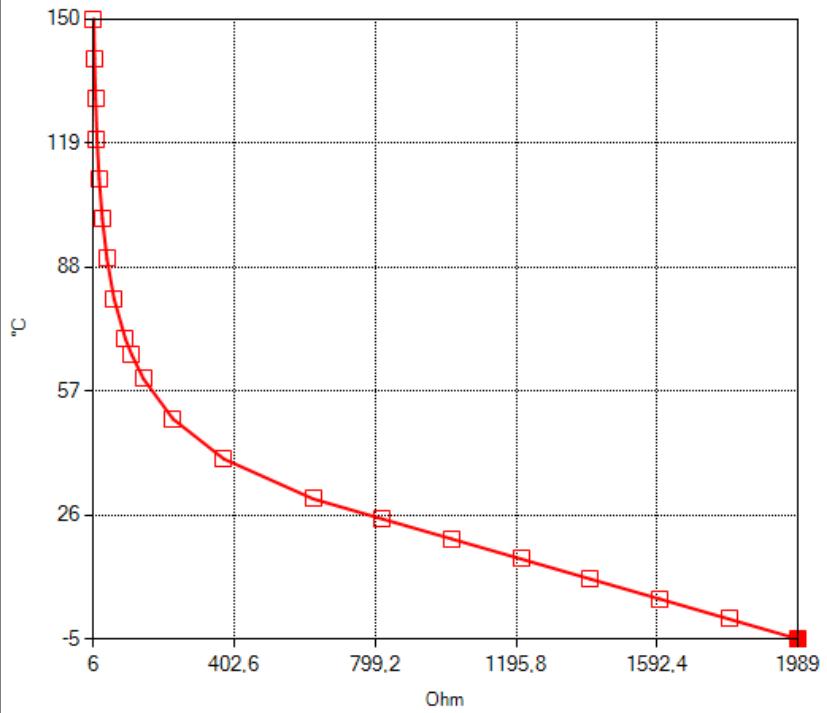
10 Setpoints

Setpoints are analog, binary, or special data objects that are used for adjusting the controller to the specific environment or application. Setpoints are separated into groups according to their function. Setpoints can be adjusted from the controller's front panel or from a PC. **Figure 10.1** is an example of how to change the Nominal Frequency from 50Hz to 60Hz via controller's front panel.
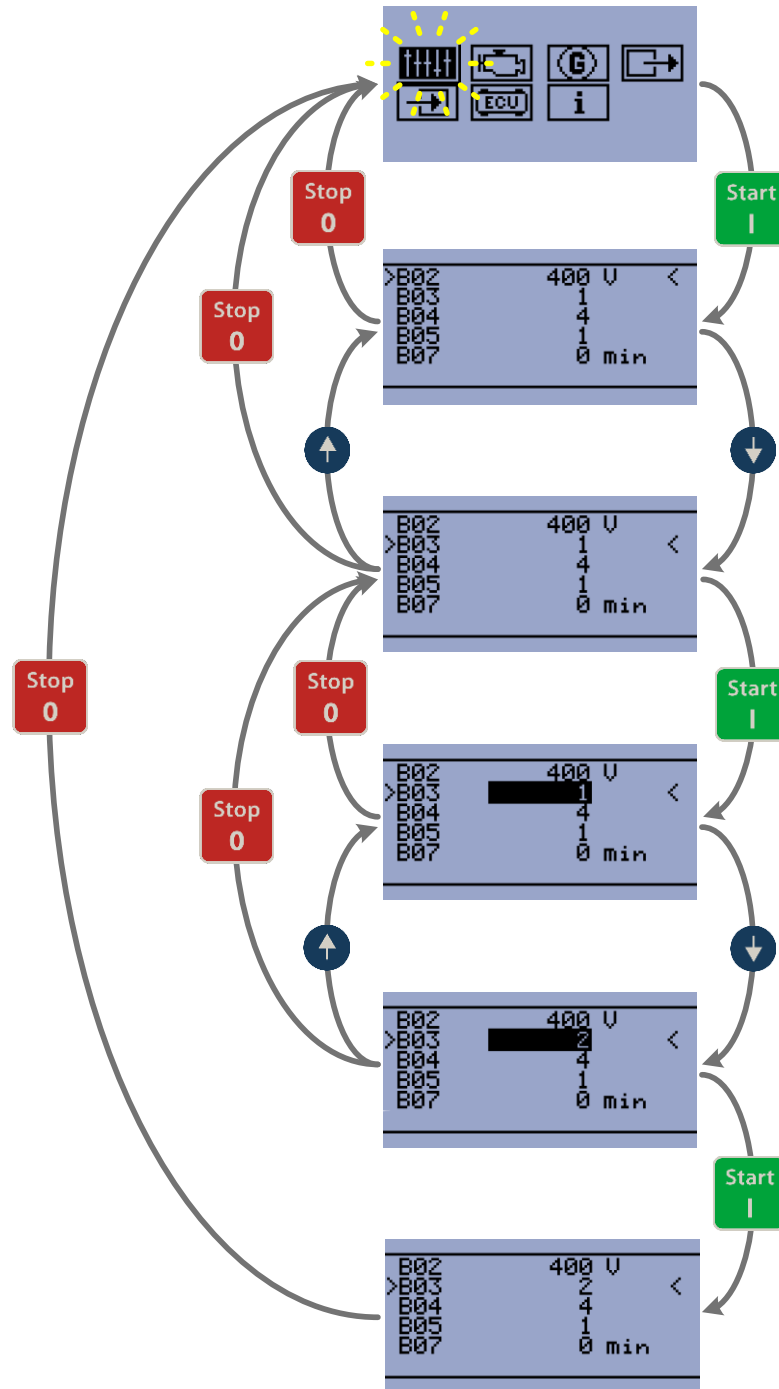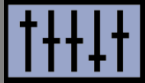

Figure 10.1
NOMINAL FREQUENCY SETUP EXAMPLE

	Basic settings

Setpoint code	Setpoint name
B01	Nominal Voltage Ph-N
B02	Nominal Voltage Ph-Ph
B03	Nominal Frequency
B04	Connection Type
B05	Units Format
B07	Zero Power Mode Delay
B08	Light Tower Mode
B09	Nominal RPM

	Engine parameters and protections

Setpoint code	Setpoint name
E01	Prestart Time
E02	Maximum Cranking Time
E03	Cooling Time
E04	Oil Pressure Shutdown
E05	Coolant Temperature Shutdown
E15	Fuel Level Shutdown
E06	Battery Undervoltage
E07	Warning Maintenance
E08	Oil Pressure Starter Disengagement
E09	Choke Time
E10	Minimal Stabilization Time
E11	Starting RPM

	Generator protections

Setpoint code	Setpoint name
G01	Generator Overvoltage Shutdown
G02	Generator Undervoltage Shutdown
G03	Generator Overfrequency Shutdown
G04	Generator Underfrequency Shutdown

10.1 B - Basic settings

B01 Nominal Voltage Ph-N †††↓†

Units:	Volts [V]
Step:	1V
Range:	80 – 480 V
Default value:	230V

Nominal system voltage (phase to neutral). This setpoint can be hidden depending on the connection type (setpoint *B04 Connection Type*). You can setup this value only if you will choose the connection type as Mono phase - *B04 Connection Type* (1).

B02 Nominal Voltage Ph-Ph †††↓†

Units:	Volts [V]
Step:	1V
Range:	80 – 600 V
Default value:	400V

Nominal system voltage (phase to phase). This setpoint can be hidden depending on the connection type (setpoint *B04 Connection Type*).You can setup this value only if you will choose the connection type as Split phase, 3Ph3Wire or 3Ph4Wire - *B04 Connection Type* (2;3;4).

B03 Nominal Frequency †††↓†

Units:	
Step:	
Range:	1,2
Default value:	1

Nominal system frequency.

Setpoint code	Value	Meaning
B03	1	50Hz
B03	2	60Hz

B04   Connection Type

Units:	
Step:	
Range:	1,2,3,4,5
Default value:	4

Generator winding connection.

Setpoint code	Value	Meaning
B04	1	Mono Phase
B04	2	Split Phase
B04	3	3Ph3Wire
B04	4	3Ph4Wire
B04	5	Autodetect

Mono Phase: MONOPHASE,
                 Single-phase measurement – 1PH

Split Phase: DOUBLE DELTA Connection, Split Phase,
                 Single-phase measurement – 1PH

3Ph3Wire: DELTA Connection, 3 Phase without neutral - 3 Wires,
                 Three phase "delta" measurement – 3PD

3Ph4Wire: STAR Connection, 3 phases and neutral - 4 wires,
                 Three phase "wye" measurement – 3PY

Autodetect:

	3Ph3Wire (High-Leg Delta)	L1 >=100V; L1 <=140V
		L2 >=140V
or		L3 >=100V; L3 <=140V
	3Ph4Wire	L1 >=100V
		L2 >=100V
or		L3 >=100V
	Split Phase	L1 >=100V
		L2 >=100V
or		L3 <= 20V
	Mono Phase	L1 >=100V
		L2 <= 20V
or		L3 <= 20V

Voltage Autodetect shutdown

B05   Units Format

Units:	
Step:	
Range:	1,2
Default value:	1

This setpoint is affecting unit format for pressure and temperature.

Setpoint code	Value	Meaning	Pressure	Temperature
B05	1	Metric unit format	bar	°C
B05	2	US unit format	PSI	°F

When you change this setpoint all values will be automatically recalculated including user definable sensor curve for analog input

B07   Zero Power Mode Delay

Units:	minutes [min]
Step:	1 minute
Range:	0-360 minutes
Default value:	0

The controller is switched to Zero Power Mode when there is no user interaction with the controller for the preset time. Value 0 also disables this function. For the controller wake up press button **Start** or activate input *T11*. The controller will not switch to Zero Power Mode if any alarm is active.

B08   Light Tower Mode

|	
Units:	
Step:	
Range:	1,2
Default value:	1

When this setpoint is enabled, the controller is switched to special operation mode. First screen was changed and generator voltage measurement is hides in this operation mode.

Setpoint code	Value	Meaning
E08	1	Disable
E08	2	Enable

First main screen shows battery voltage, running hours and engine status (stop, starting/stopping, run) via symbol in light tower reflector (upper left corner).

Second screen shows all analog values which are available. (Oil Pressure, Coolant Temperature; Fuel Level and Battery Voltage)
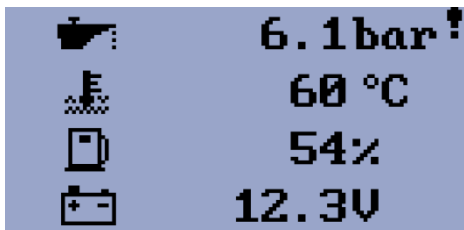
Last screen is event log.

B09 Nominal RPM	
Units:	RPM
Step:	1
Range:	100-4000
Default value:	1500
Nominal engine speed.	

10.2 E - Engine parameters and protections

E01   Prestart Time

Units:	seconds [s]
Step:	1s
Range:	0-600s
Default value:	2

Time of closing of the **O08 Prestart** output prior to the engine start.
Set to zero if you want to leave the output **O08 Prestart** open.

E02   Maximum Cranking Time

Units:	seconds [s]
Step:	1s
Range:	0-60s
Default value:	5

Maximum duration when the starter motor is energized.

E03   Cooling Time

Units:	seconds [s]
Step:	1s
Range:	0-3600s
Default value:	30

Runtime of the unloaded gen-set to cool the engine before stop.

E04   Oil Pressure Shutdown

Units:	Bar [Bar]
Step:	0,1 Bar
Range:	0-10 Bar
Default value:	1 Bar
Delay:	3 s

Shutdown threshold level for **I23 Oil Pressure Analog** input.

E05   Coolant Temperature Shutdown

Units:	degree Celsius [°C]
Step:	1 °C
Range:	0 -150 °C
Default value:	90 °C
Delay:	5 s

Shutdown threshold level for **I25 Coolant Temperature Analog** input.

E15   Fuel Level Shutdown

Units:	%
Step:	1
Range:	0 - 20
Default value:	10

When this protection is activated the red LED above **Stop** button will blink, the general shutdown symbol will be displayed on LCD's upper right corner. Fuel Level SD symbol will be displayed on event log with running hours stamp and the shutdown procedure will occur.

Input has 10s delay.

E06   Battery Undervoltage

Units:	Volts [V]
Step:	0,1 V
Range:	8 – 40 V
Default value:	11,5 V
Delay:	30 s

Warning threshold for **Low Battery** voltage.

E07   Warning Maintenance

Units:	hours [h]
Step:	1 h
Range:	0 – 10000 h
Default value:	9999 h

Counts down when the engine is running. When the counter reaches zero, an alarm will appear. When the value 10000 is set, than the Maintenance function is disabled and counter will not count. Counter value will not appear in the controller's statistics. Maximum value for running countdown is 9999. **Warning Maintenance** will appear when counter time has elapsed.

E08   Oil Pressure Starter Disengagement

Units:	
Step:	
Range:	1,2
Default value:	1

When this setpoint is enabled, the controller will use *Low Oil Pressure* or *Oil Pressure Analog* signal for starter disengagement. Starter will disengaged when oil pressure reach starting oil pressure or binary input *Low Oil Pressure* will be opened (*Normally Open* contact) or closed (*Normally Close* contact).
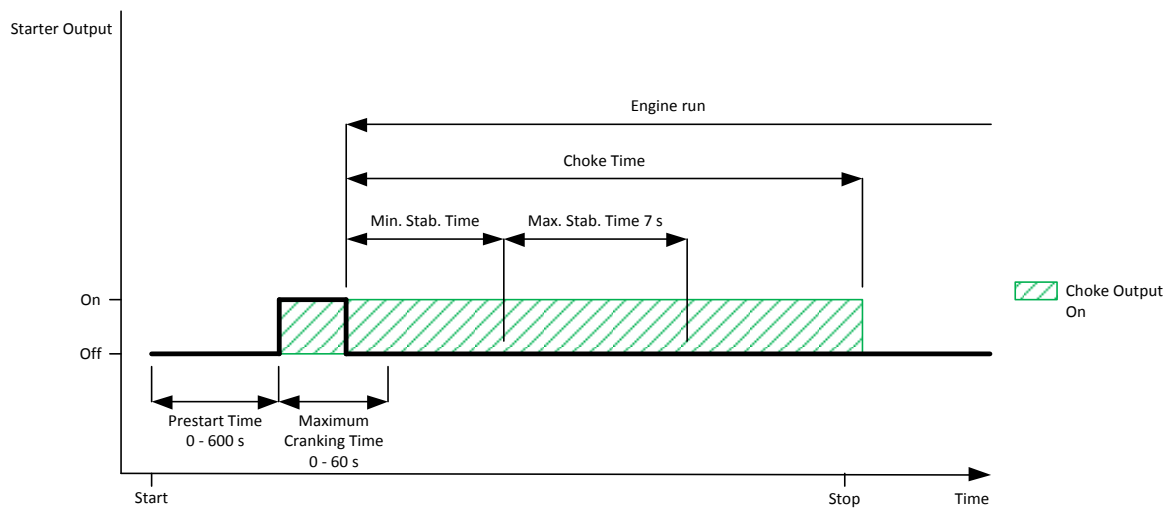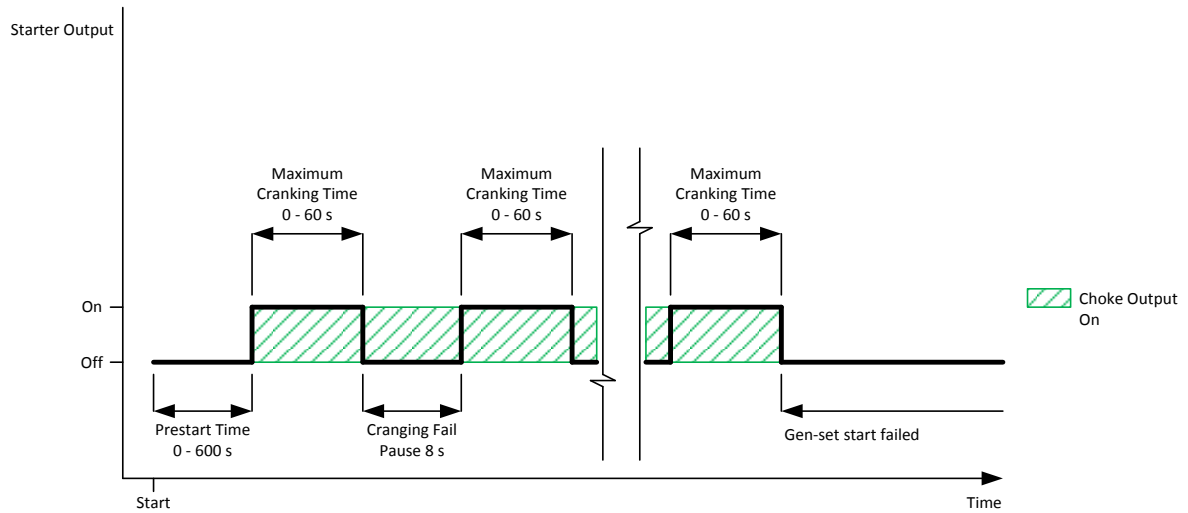When is disabled then only RPM (frequency), generator voltage or D+ will be used for starter disengagement.

Setpoint code	Value	Meaning
E08	1	Disable
E08	2	Enable

InteliNano-NT, SW version 2.0.0.x, HW version 2.0, ©ComAp – September 2015

E09   Choke Time

Units:	seconds [s]
Step:	1 s
Range:	0 – 3600 s
Default value:	0 s

Choke output timer. The timer is started on engine run.

E10 Minimal Stabilization Time

Units:	seconds [s]
Step:	1 s
Range:	1 – 300 s
Default value:	3 s
Delay:	

Minimum time after reaching of defined level of RPM to the closing GCB.
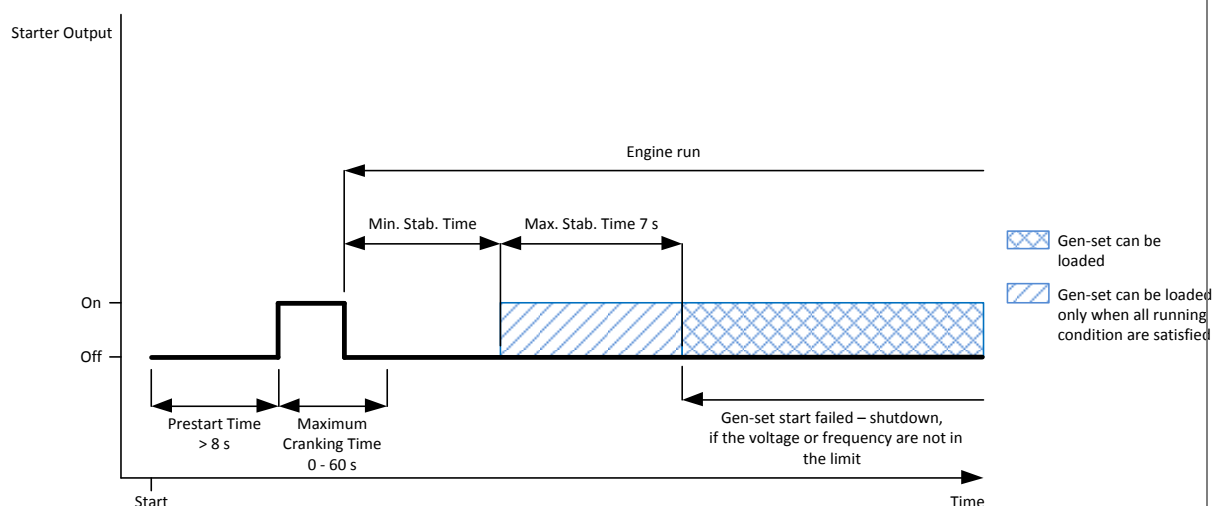
E11 Starting RPM

Units:	%
Step:	1
Range:	5 – 60
Default value:	25

When Starting RPM are reached controller stops cranking. (Starter is disengaged.)

10.3 G - Generator protections

G01 Generator Overvoltage Shutdown

Units:	percentage [%]
Step:	1 %
Range:	*G02 Generator Undervoltage Shutdown* – 200 %
Default value:	110 %
Delay:	3 s

Threshold for generator overvoltage. All three phases are evaluated. Maximum value is used. **Generator Overvoltage** alarm will appear when output voltage exceed preset threshold and shutdown procedure will start.

G02 Generator Undervoltage Shutdown

Units:	percentage [%]
Step:	1 %
Range:	0 - *G01 Generator Overvoltage Shutdown* %
Default value:	70 %
Delay:	3 s

Threshold for generator undervolatge. All three phases are evaluated. Minimum value is used. **Generator Undervoltage** alarm will appear when output voltage exceed preset threshold and shutdown procedure will start.

G03 Generator Overfrequency Shutdown

Units:	percentage [%]
Step:	0,1 %
Range:	*G04 Generator Underfrequency Shutdown* – 130 %
Default value:	110 %
Delay:	3 s

Threshold for **Generator Overfrequency** alarm, relative to the nominal frequency (setpoint *B03 Nominal Frequency*).

G04 Generator Underfrequency Shutdown

Units:	percentage [%]
Step:	0,1 %
Range:	0 – *G03 Generator Overfrequency Shutdown* %
Default value:	85 %
Delay:	3 s

Threshold for **Generator Underfrequency** alarm, relative to the nominal frequency (setpoint *B03 Nominal Frequency*).

11 ECU

For ECU configuration you have to use PC software NanoEdit. It is impossible to configure ECU via controller's front fascia.

If ECU is configured simultaneously with analog inputs (*Fuel Level Analog*, *Oil Pressure Analog*, *Coolant Temperature Analog*) value from analog measurement will be displayed and used for protection.

If ECU is configured simultaneously with binary inputs (*Low Fuel Level*, *Low Oil Pressure*, *High Coolant Temperature*) value from ECU will be displayed. For protections is used value from ECU and binary input signal. For more detail see example.

ECU configured	Analog input	Binary input	Protections from	Displayed value from
yes	no	no	ECU	ECU
yes	yes	no	analog input	analog input
yes	no	yes	ECU or binary input	ECU
yes	yes	yes	analog or binary input	analog input
no	no	yes	binary input	binary input status

11.1 CAN bus wiring

The wiring of CAN bus communication should be provided so that following rules are kept:

- Maximal length of the CAN bus depends on the communication speed. For the speed of 250kbps, which is used on the CAN for communication with ECU the maximal length is 200m.
- The bus must be wired in linear form with termination resistors at both ends. No nodes except on the controller terminals are allowed.
- Use cable with following parameters:

Cable type	Shielded twisted pair
Impedance	120Ω
Propagation velocity	>= 75% (delay <= 4.4 ns/m)
Wire crosscut	>= 0.25mm^2
Attenuation (@1MHz)	<= 2dB/100m

12 Alarms, Events and History Management

Following alarms and records are available:

- ***Event***
- ***Warnings***
- ***Shutdowns***
- ***ECU Messages***

Four records can be displayed simultaneously on the LCD screen. Total capacity is 10 records. The **Figure 12.1** is an example of how the history is organized. The last screen in this example is showing the four latest events.

To view further history records press ▼ button see **Figure 12.1**.For alarm (shutdown) confirmation press **Stop** button.
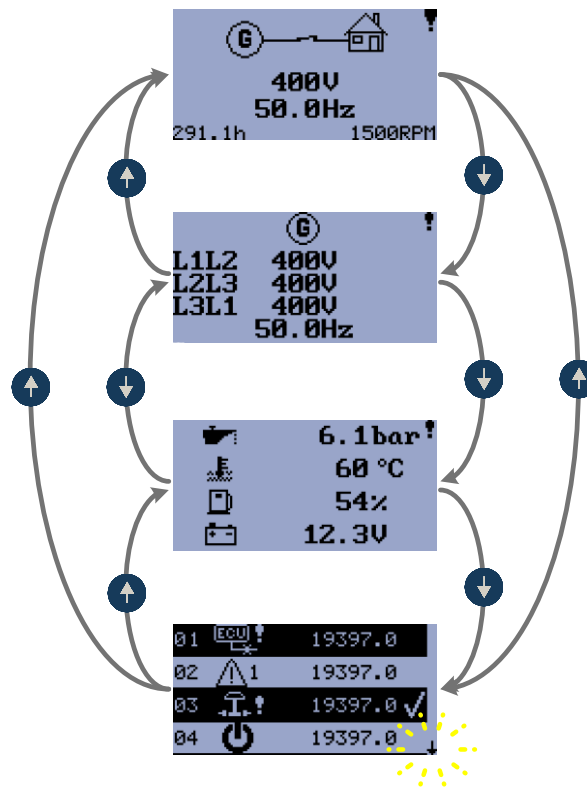
Figure 12.1
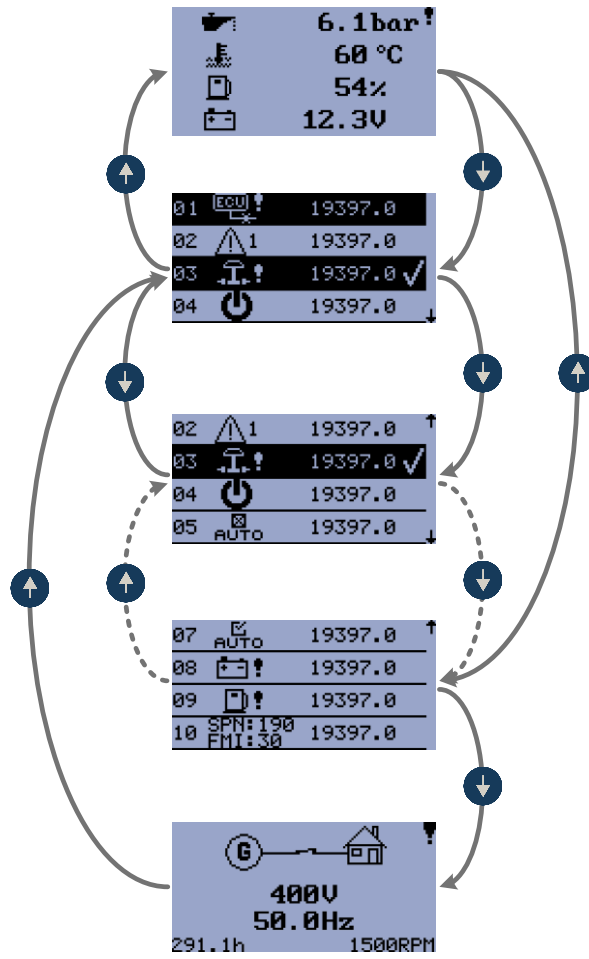
Figure 12.2

12.1 Events

Every event listed in table below is saved in history with running hours stamp see **Figure 12.3**.

Figure 12.3
EVENT – POWER ON

Possible Events

	### *Manual Start* Engine was manually started by pressing button **Start** in **Manual** mode.

	### *Remote Start* Engine was remotely started via input terminal's function *I02 Remote Start/Stop* or *I03 Remote Start And Load*. The controller is in **Auto** mode.

	### *Manual Stop* Engine was manually stopped by pressing button **Stop** in **Manual** mode.

	### *Remote Stop* Engine was remotely stopped via input terminal's function *I02 Remote Start/Stop* or *I03 Remote Start And Load*. The controller is in **Auto** mode.

	### *Auto On* Auto mode is active.

	### **Auto Off** Auto mode is inactive

	### **Power On** The controller is turned on.

12.2 Warnings

12.2.1   Active warning

When a warning occurs, *O04* *Alarm* output will close and the red LED above **Stop** button will blink. Warning symbol will blink in the upper-right corner of the LCD and the proper warning symbol will be displayed in the history with running hours stamp. Active warning can't be confirmed. See list of *Possible warnings*.

Figure 12.4
ACTIVE WARNING – LOW BATTERY

12.2.2   Inactive warning

When a warning becomes inactive, *O04* *Alarm* output will open, the red LED above **Stop** button will stop blinking, and the warning symbol on main screen will go out.

Figure 12.5
INACTIVE WARNING – LOW BATTERY

12.2.3   Possible warnings

	Warning Maintenance
	The service interval is determined by the setpoint *E07* *Warning Maintenance*.The protection becomes active when the engine running hours reach this value.

	Low Battery (Charging Fail)
	This warning comes up if the battery voltage is lower than preset Battery Undervoltage limit for longer than 30s. This warning also comes up when charging alternator fail.

	Low Fuel Level
	This warning occur when analog input Fuel Level is below 20% or binary input Fuel Level is closed longer than 10s.

	External Warning 1
	This warning occurs when external warning 1 input is activated.

	External Warning 2 This warning occurs when external warning 2 input is activated.
	External Warning 3 This warning occurs when external warning 3 input is activated.

	ECU Communication Error This warning is activated when the ECU (if configured) is not communicating and all values from ECU show #####.

12.3 Shutdowns

12.3.1   Shutdown procedure

The **InteliNano^NT** controller opens outputs *O05 GCB Close/Open*, *O01 Starter*, *O08 Prestart* and *O02 Fuel Solenoid* and closes *O03 Stop Solenoid* to stop the engine immediately. *O04 Alarm* output is closed. Active or not confirmed protection disables start.

12.3.2   Active unconfirmed shutdown

When a shutdown occurs, the *Shutdown procedure* will start, the red LED above Stop button blinks, the shutdown symbol ▼ will blink in the upper right corner of LCD, and the proper shutdown symbol is displayed in history with running hours stamp. The record in history is negative, see **Figure 12.6**. See list of *Possible shutdown alarms*. For shutdown alarm confirmation press Stop button.

Figure 12.6
ACTIVE UNCONFIRMED SHUTDOWN – EMERGENCY STOP

12.3.3   Active confirmed shutdown

When an active shutdown is confirmed the red LED above the Stop button stops blinking. The record in history stays negative with confirmation symbol at the end. *O04 Alarm* output is open.

Figure 12.7
ACTIVE CONFIRMED SHUTDOWN – EMERGENCY STOP

12.3.4   Inactive unconfirmed shutdown

O04 Alarm output is closed, red LED above Stop button blinks. Shutdown symbol ▼ is displayed in upper-right corner of the LCD, and proper warning symbol is displayed in history with running hours stamp. See **Figure 12.8**.. See list of *Possible shutdown alarms*. For shutdown alarm confirmation press Stop button

Figure 12.8
INACTIVE UNCONFIRMED SHUTDOWN – EMERGENCY STOP

12.3.5 Inactive confirmed shutdown

O04 *Alarm* output is opened. It is possible to start engine when all shutdowns are inactive and confirmed.

Figure 12.9
INACTIVE CONFIRMED SHUTDOWN – EMERGENCY STOP

12.3.6 Possible shutdown alarms

	### *Emergency Stop* The binary input *Emergency Stop* was activated.

	### *Overspeed* The protection comes active if the speed is greater than 115% of nominal engine RPM, which is derived from generator frequency.

	### *Underspeed* Low engine RPM. This alarm will be issued when the gen-set is running and then stops by itself, i.e. the RPM drops under the nominal engine RPM. The underspeed alarm starts to be evaluated 5 sec after successful gen-set start and is being evaluated all the time the *Fuel Solenoid* is on.

	### *Low Oil Pressure* Engine will stop when oil pressure declined to or less than 1 bar or binary input *I22 Low Oil Pressure* is active.

	### *High Coolant temperature* Engine will stop when temperature of coolant exceed *Coolant Temperature Shutdown* threshold.

	### *External Shutdown 1*

	### *External Shutdown 2*

	External Shutdown 3

	GCB Fail Failure of generator circuit breaker.

	Generator Overvoltage Generator will stop when output voltage exceeds the preset threshold *G01 Generator Overvoltage Shutdown*.

	Generator Undervoltage Generator will stop when output voltage drops below the preset threshold *G02 Generator Undervoltage Shutdown*.

	Generator Overfrequency The generator frequency is out of limits given by setpoints *G03 Generator Overfrequency Shutdown* and *G04 Generator Underfrequency Shutdown* .

	Generator Underfrequency The generator frequency is out of limits given by setpoints *G03 Generator Overfrequency Shutdown* and *G04 Generator Underfrequency Shutdown* .

	Generator CCW Rotation orrect generator phase sequence.

	Start Fail Gen-set start failed.

	Stop Fail Gen-set stop failed.

	Battery Flat If the controller loses power during starting sequence due to bad battery condition, it will not try to start again and will activate this protection.

VA!	### Voltage Autodetect If generator voltage measured doesn't correspond with predefined values for particular connection type when Autodetect value for **B04** **Connection Type** is used.

(icon)	### Fuel Level SD This shutdown occur when analog input Fuel Level is below shutdown level or binary input Fuel Level SD is closed longer than 10s.

12.4 ECU Messages

```
10  SPN:190   19397.0
    FMI:30
```

Figure 12.10
ECU MESAAGE

	ECU Message
	Diagnostic messages are read and displayed in the history behind the ECU Warning symbol. For Standard J1939 SPN (Suspect Parameter Number) and FMI (Failure Mode Identifier) are shown. Detail SPN/FMI code specification see in: • SAE Truck and Bus Control and Communications Network Standards Manual, SAE HS-1939 Publication • Or refer to corresponding engine manufacturer's ECU error codes list. Complete list of text diagnostic messages for each ECU can be found in ComAp Electronic Engines Support manual.

13 Technical data

13.1 Power supply

Power supply range	6 – 36 VDC		
Power supply drop-out immunity	100ms		
Power consumption	**Supply voltage (V)**	**Power consumption (mA)**		
		+25°C	**-30°C**	**+70°C**
	36	35	37	37
	30	39	41	41
	24	45	48	47
	18	57	57	59
	12	84	80	85
	10	100	103	101
	8	126	121	128
	6	202	199	204
	4	295	288	319
	Low voltage detection	6,66 / 7,33	6,74 / 7,39	6,73 / 7,45
	Minimal operating supply voltage	2,3	2,5	2,4
Zero Power Mode consumption	**Supply voltage (V)**	**Power consumption (µA)**		
		+25°C	**-30°C**	**+70°C**
	36	344	354	555
	30	208	195	374
	24	153	143	292
	18	115	107	222
	12	78	72	72
	8	52	48	48

13.2 Operating conditions

Operating temperature	-20 ... 70°C
Operating humidity	95 % non-condensing (IEC/EN 60068-2-30)
Protection degree (front panel)	IP65 – with GASKET 4x405 only IP50 – without gasket
Storage temperature	-30 ... 80°C

13.3 Physical dimensions

Dimensions	118×108×40mm (W×H×D)
Weight	
Mounting cutout size	96×96mm (W×H)
Recommended torque for holders	15 – 20 cN*m

13.4 Binary inputs

Number of binary inputs	up to 6
Galvanic insulation	Not insulated
Closed contact voltage	< 2V
Open contact voltage	> 3,5V
Input resistance	1,5 kΩ

13.5 Binary outputs

Total number of binary outputs	up to 4*
Number of low current binary outputs	2
Number of high current binary outputs	2
Galvanic insulation	Not insulated
Type	Transistor, switching to positive supply terminal
Operating voltage	8 – 36 VDC
Switching current of low current binary output	500 mA (suppresion diodes required for inductive loads)
Switching current of high current binary output	6A – long term 10A – short term
Total output current	10A – long term 15A – short term

NOTE:
One low current(500mA) binary output – *T07* can be configured as binary input .

13.6 Analog inputs

Number of analog inputs	up to 3
Galvanic insulation	Not insulated
Electrical range	0 – 2500 Ω
Resolution	0,1 Ω
Supported sensor types	Predefined: VDO 10 Bar, VDO Temperature, VDO Fuel level User defined: 10 points non-linear sensors can be defined by the user
Precision	2 % ± 3 Ω

13.7 Generator measurements

Measurement inputs	3ph generator voltage
Measurement type	True RMS
Voltage range	480 V Ph-Ph (277 V Ph-N)
Max. measured voltage	340 V Ph-N
Voltage accuracy	1 %
Frequency range	40 – 70 Hz, measured from L1
Frequency accuracy	1 %

13.8 Charging alternator preexcitation circuit

Excitation current	100 mA
Charging fail threshold	80 % of U_{supply}

13.9 Communication interface

USB (device)	On the board

13.10 CAN interface

Type	CAN bus
Galvanic insulation	No
Baud rate	250 kbps
Bus length	max. 200 m
Termination resistor	120 Ω, built-in, jumper activated

13.10.1   Recommended CAN cables

- Belden 3082A DeviceBus for Allen-Bradley DeviceNet
- Belden 3083A DeviceBus for Allen-Bradley DeviceNet
- Belden 3084A DeviceBus for Allen-Bradley DeviceNet
- Belden 3085A DeviceBus for Allen-Bradley DeviceNet
- Belden 3086A DeviceBus for Honneywell SDS

- Belden 3087A DeviceBus for Honneywell SDS
- Lapp Cable Unitronic Bus DeviceNet Trunk Cable
- Lapp Cable Unitronic Bus DeviceNet Drop Cable
- Lapp Cable Unitronic Bus CAN
- Lapp Cable Unitronic-FD Bus P CAN UL/CSA