AGC 150 Engine drive

4189341308D

Designer's handbook

DEIF Improve Tomorrow

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1. Introduction

1.1 About the AGC 150 Engine drive

The AGC 150 Engine drive is a single controller for one engine. The controller has all the functions needed to protect and control an engine. All the values and alarms are shown on the LCD display screen, which is sunlight-readable.

The controller is simple to mount and the graphical display unit makes it easy to use. The parameters can easily be configured on the display unit or with the use of a PC and the utility software.

Key features

- Protect and monitor the engine
- Engine start and stop sequences
- Automatic and manual control of engine speed
- Tier 4F/Stage V
- Configurable inputs and outputs, including
  - CAN bus ports
  - Ethernet port
- Alarm and event log
- 3-level password protection
- Easy configuration with the utility software
- Pump function with fixed and variable speed

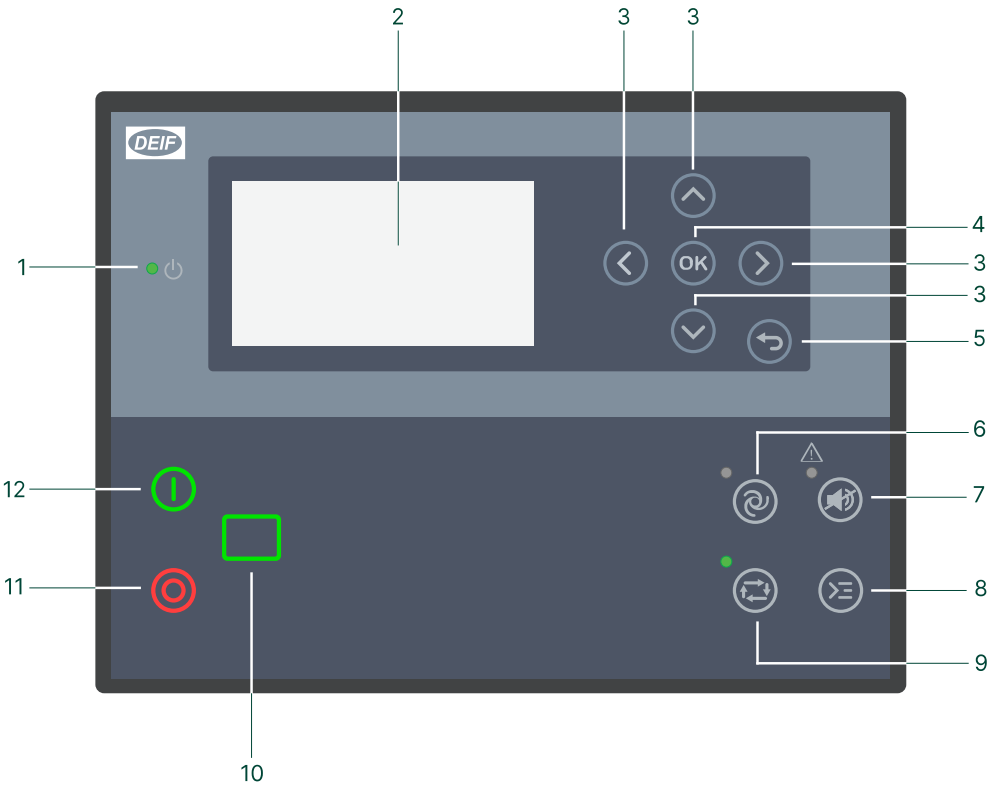
Standard functions

- Engine control:
  - Start/stop sequences
  - Run and stop coil
  - Analogue and ECU governor control

- Display:
  - Prepared for remote mounting
  - Buttons for start and stop
  - Status text
  - Measurement readings
  - ECU data
  - Alarms

- M-Logic:
  - Simple logic configuration tool
  - Configurable input events
  - Configurable output commands

1.1.1 Display, buttons and LEDs



No.	Name	Function
1	Power	Green: The controller power is ON. OFF: The controller power is OFF.
2	Display screen	Resolution: 240 x 128 px. Viewing area: 88.50 x 51.40 mm. Six lines, each with 25 characters.
3	Navigation	Move the selector up, down, left and right on the screen.
4	OK	Go to the menu system. Confirm the selection on the screen.
5	Back	Go to the previous page.
6	AUTO mode	The controller automatically starts and stops the engine. No operator actions are needed.
7	Silence horn	Stops an alarm horn (if configured) and enters the alarm menu.
8	Shortcut menu	Access jump to parameter, running mode, test and lamp test.
9	SEMI-AUTO mode	The controller cannot automatically start and stop the engine. The operator can start and stop the engine manually from the display.
10	Engine	Green: There is running feedback or an external signal. Green flashing: The engine is getting ready. Red: The engine is not running, or there is no running feedback.
11	Stop	Stops the engine if SEMI-AUTO or manual mode is selected.
12	Start	Starts the engine if SEMI-AUTO or manual is selected.

1.1.2 Controller types

Parameter	Setting	Controller type	Minimum software
9101	DG unit	Generator controller	S2
	DG unit	Generator Stand-alone controller	S1
	Mains unit	Mains controller	S2
	BTB unit	BTB controller	S2
	DG HYBRID unit	Genset-Solar hybrid controller	S2
	ENGINE DRIVE unit	Engine drive controller	S1
	Remote unit	Remote display	None
	ENGINE DRIVE MARINE unit	Engine drive controller for marine use	S1
	DG MARINE unit	Stand-alone genset controller for marine use	S1
	ASC 150 Storage*	Battery storage controller	S3
	ASC 150 Solar*	Solar controller	S3
	ATS unit	Automatic transfer switch (open transition)	S1
	ATS unit	Automatic transfer switch (closed transition)	S2
	DG PMS LITE	PMS lite controller	S2

Software packages and controller types

The controller software package determines which functions the controller can use.

- S1 = Stand-alone
  - You can change the controller type to any other controller that uses S1 software.
- S2 = Core
- S3 = Extended
  - You can change the controller type to any other controller type*.
    - * To change to an ASC 150, the controller must have the sustainability option (S10).
- S4 = Premium
  - You can change the controller type to any other controller type*.
    - * To change to an ASC 150, the controller must have the sustainability option (S10).
  - All functions are supported.

You can select the controller type under `Basic settings > Controller settings > Type`.

1.2 About the Designer's handbook

General purpose

This document gives information about the controller's functionality and its applications, and for configuring the controller.

CAUTION

Installation errors

Read this document before working with the controller. Failure to do this may result in human injury or damage to the equipment.

Intended users of the Designer's handbook

This Designer's handbook is for the person who installs and configures the AGC 150 Engine drive controller.

The Designer's handbook can also be used during commissioning to check the parameters, and operators may find it useful for understanding the system and for troubleshooting.

List of technical documentation

Document	Contents
Product sheet	• Short description • Controller applications • Main features and functions • Technical data • Protections • Dimensions
Data sheet	• General description • Functions and features • Controller applications • Controller types and variants • Protections • Inputs and outputs • Technical specifications
Designer's handbook	• Principles • General controller sequences, functions and protections • Protections and alarms • Regulation • Hardware characteristics • Communication
Installation instructions	• Tools and materials • Mounting • Minimum wiring for the controller • Wiring information and examples
Operator's manual	• Controller equipment (buttons and LEDs) • Operating the system • Alarms and log
Modbus tables	• Modbus address list ◦ PLC addresses ◦ Corresponding controller functions • Descriptions for function codes, function groups

1.2.1 Software version

This document is based on the AGC 150 software version 1.20.

1.3 Warnings and safety

1.3.1 Symbols for hazard statements

DANGER!

This shows dangerous situations.

If the guidelines are not followed, these situations will result in death, serious personal injury, and equipment damage or destruction.

WARNING

This shows potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This shows low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

NOTICE

This shows an important notice

Make sure to read this information.

1.3.2 Symbols for general notes

NOTE This shows general information.

More information
This shows where you can find more information.

Example

This shows an example.

How to ...
This shows a link to a video for help and guidance.

Safety during installation and operation

Installing and operating the controller may require work with currents and voltages. The installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

Factory settings

The controller is delivered pre-programmed from the factory with a set of default settings. These settings are based on typical values and may not be correct for your system. You must therefore check all parameters before using the controller.

Electrostatic discharge

Electrostatic discharge can damage the controller terminals. You must protect the terminals from electrostatic discharge during the installation. When the controller is installed and connected, these precautions are no longer necessary.

Data security

To minimise the risk of data security breaches:

- As far as possible, avoid exposing controllers and controller networks to public networks and the Internet.
- Use additional security layers like a VPN for remote access, and install firewall mechanisms.
- Restrict access to authorised persons.

1.4 Legal information

Third party equipment

DEIF takes no responsibility for the installation or operation of any third party equipment, including the **engine**. Contact the **engine company** if you have any doubt about how to install or operate the engine.

Warranty

NOTICE
 **Warranty** The controller 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.

Copyright

2. Utility Software

2.1 Download the utility software

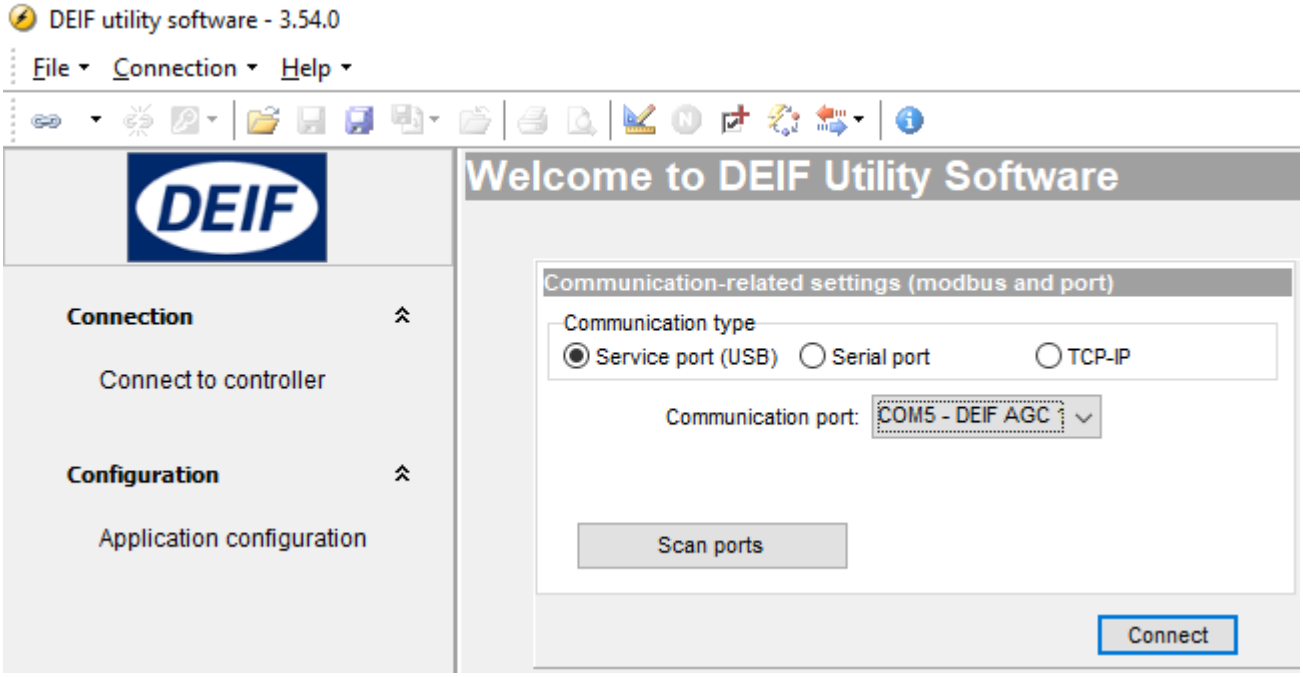
The **Multi-line 2 Utility Software v.3.x** is the software interface between a PC and the controller. The software is free of charge. Download it from www.deif.com

2.2 Connection

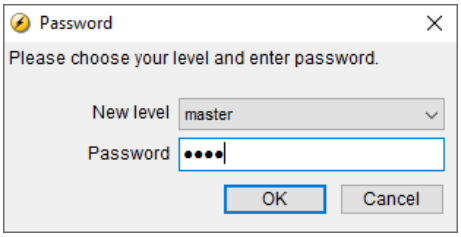
2.2.1 USB connection

You need a USB cable (USB A to B) to connect the controller to a PC.

1. Install the utility software on a PC.
2. Use the USB cable to connect the controller service port to the PC.
3. Start the utility software.



4. Select a service port option.
5. When prompted, select the access level, enter the password, and select OK.



More information
See **General functions, Password** for the default passwords.

2.2.2 TCP connection

You can use TCP/IP communication to connect to the controller. This requires an Ethernet cable, or a connection to the network that includes the controller.

Default controller network address

- IP: 192.168.2.2
- Gateway: 192.168.2.1
- Subnet mask: 255.255.255.0

Configuring the controller IP address using the display unit or a USB connection

When connecting to a controller using TCP/IP, you must know the controller's IP address. Find the IP address on the display under: `Communication > Ethernet setup`.

You can use the display to change the controller's IP address.

Alternatively, you can use a USB connection or an Ethernet connection and the utility software to change the controller IP address.

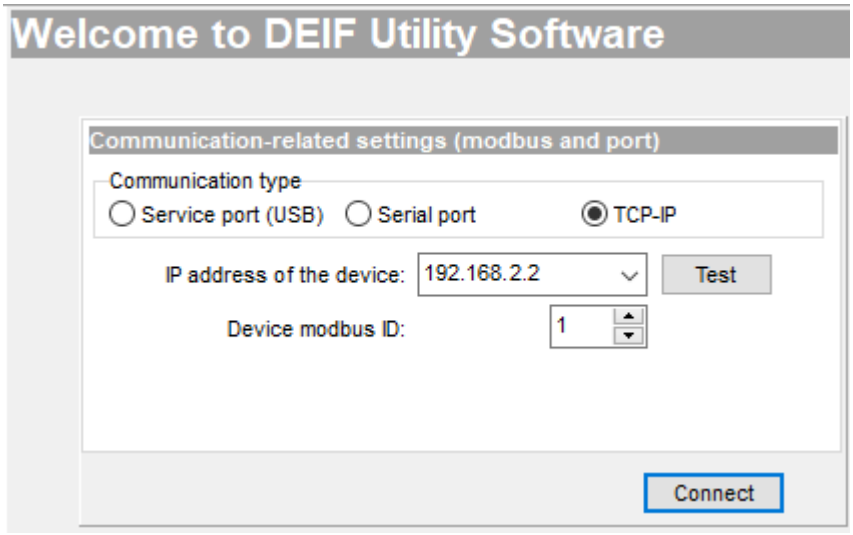
Point-to-point Ethernet connection to the controller

If you do not want to use the display unit or a USB connection to change the IP address, you can use a point-to-point Ethernet connection. The PC must have a static IP address. For the default controller network address, the PC static IP address must be 192.168.2.xxx, where xxx is a free IP-address in the network (note: xxx cannot be 2 (the controller IP address) or 1 (the gateway)).

If you change the controller address (for example, from 192.168.**2**.yyy to 192.168.**47**.yyy) the connection is lost. A new static IP for the PC is needed. In this case, 192.168.47.zzz, where zzz is a free IP-address in the network. The PC address, IP address, and gateway must be in the same subnet.

When the PC has the correct static IP address:

1. Use an Ethernet cable to connect the PC to the controller.
2. Start the utility software.
3. Select *TCP-IP*, and enter the controller IP address.

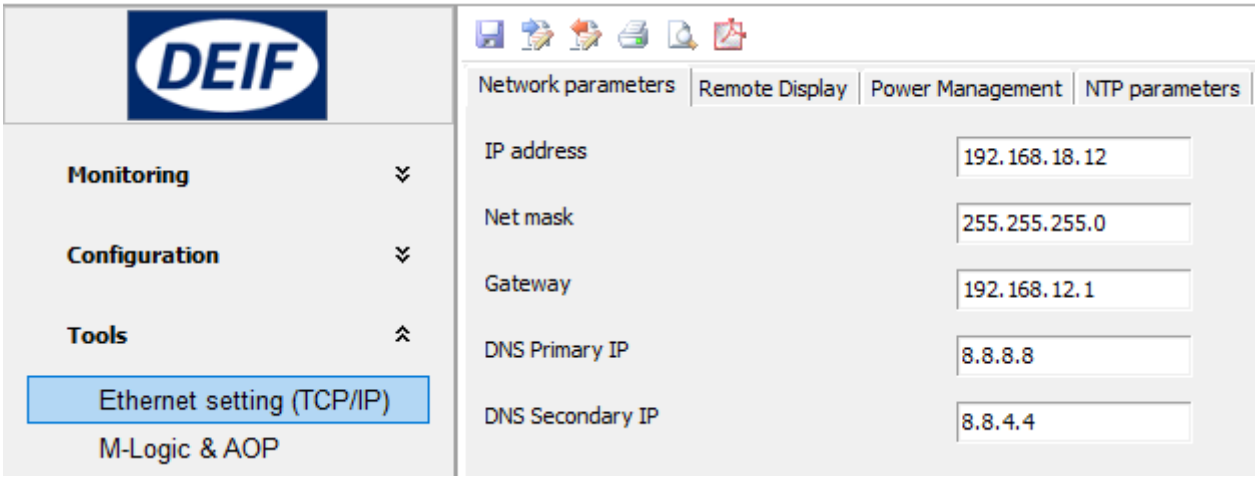


4. You can use the *Test* button to check if the connection is successful.
5. Select *Connect* to connect to the controller using TCP-IP.

Configuring the controller IP address using the utility software

1. Select *Connect* to connect to the controller using TCP-IP.
2. Select *Ethernet setting (TCP/IP)*.

The *Network Parameters* window opens:



When the controller network parameters have been changed, press the *Write to device* button.

The controller receives the new network parameters and reboots the network hardware.

To connect to the controller again, use the new controller IP address (and a correct PC static IP address).

Using a switch

For a system with multiple controllers, all controllers can be connected to a switch. Create a unique IP address for each controller in the network before connecting the controllers to a switch.

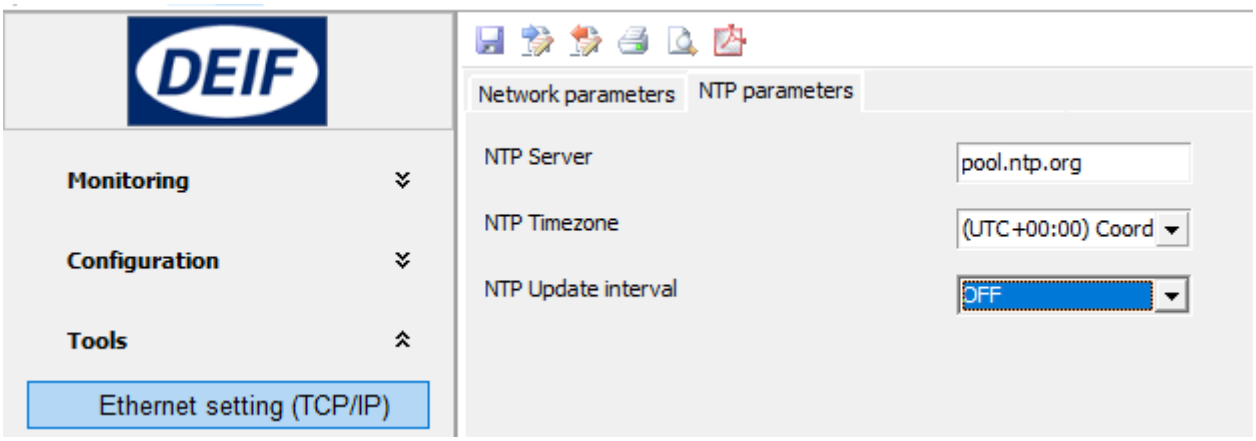
The PC can then be connected to the switch, and the Ethernet cable can be in the same port of the switch at all times. You can enter the controller IP address in the utility software.

The TCP-IP connection is faster than other connections. It also allows the user to shift between controllers in the application supervision window in the utility software.

2.3 Using NTP

To ensure that the controller always has the right time, you can use the network time protocol (NTP) function.

Select *Ethernet setting (TCP/IP)* in the Utility software, then select the *NTP parameters* tab in the *Network Parameters* window:



You can select an NTP server, a time zone and an update interval. Write the changes to the controller to activate the NTP function.

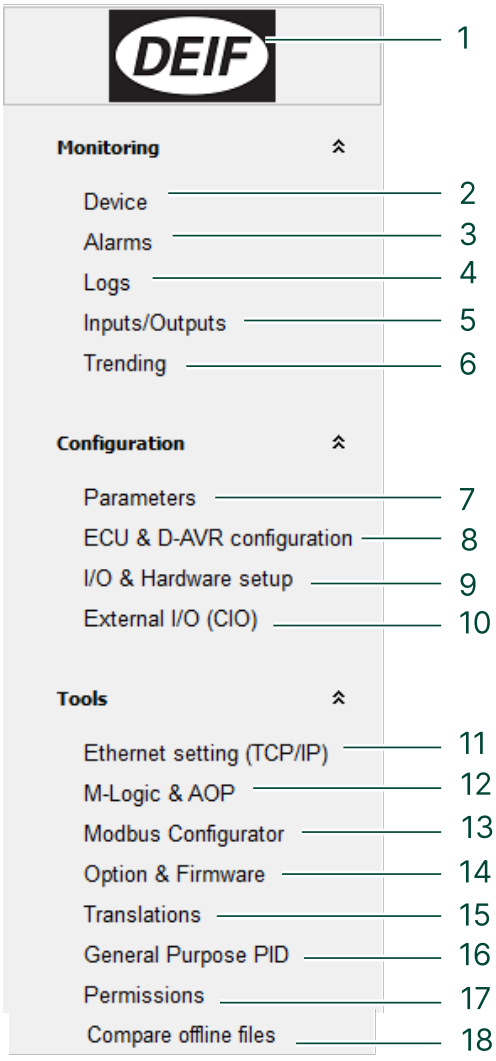
NOTE The selected NTP server must be available in the network.

2.4 Utility software interface

2.4.1 Top toolbar

1. Connect to a controller.
2. Disconnect from a controller.
3. Permission level.
4. Application settings.
5. Enter an upgrade code (received from DEIF support).
6. Add options (create an option code and send it to support@deif.com).
7. Update the controller firmware.
8. Configure the display views.
9. Not used for AGC 150.
10. Configure the AOP-2 buttons and LEDs (Additional Operator Panel).
11. Read the controller counters.
12. Information on the controller and the software.
13. Read, write, backup and restore the device.
14. Data tracing (shows the max./min. of a value, as long as the data tracer window is open).
15. Configure the controller I/O settings.
16. Synchronise the controller clock with the connected PC.

2.4.2 Left menu



1. A direct link to deif.com.
2. Device
   - Gives an overview of the connected controller.
3. Alarms
   - Gives an overview of the active alarms.
   - Shows the alarm history (only alarms that have been present during the connection time).
4. Logs
   - See the events logs from the controller.
5. Inputs/Outputs
   - The controller input and output status.
6. Trending
   - See real-time operation.
   - Trending is possible when a PC is connected, and the trending window is open. The controller cannot save trending.
7. Parameters
   - Configure and view the parameters
   - You can view the parameters as a list or as a tree structure.
8. ECU & D-AVR configuration
   - EIC general configuration, for example Engine I/F and EIC start/stop.
   - ECU alarms
   - ECU regeneration
   - SPN ignore list
   - DAVR configuration
   - DAVR alarms
9. I/O & Hardware setup
   - Configure the inputs and outputs.
10. External I/O (CIO)
    - Detect and configure the external inputs and outputs.
11. Ethernet settings
    - Configure Ethernet settings and communication.
12. M-Logic & AOP
    - Configure M-Logic and additional operator panels.
13. Modbus Configurator
    - Configure the configurable Modbus addresses.
14. Option & Firmware
    - See the available options.
15. Translations
    - Customise or translate the text in the controller
16. General Purpose PID
    - Configure the general purpose PIDs.
17. Permissions
    - See and change the user permissions.
18. Compare offline files
    - Compare files.

3. Engine functions

3.1 Engine sequences

The engine START and STOP sequences are started automatically if:

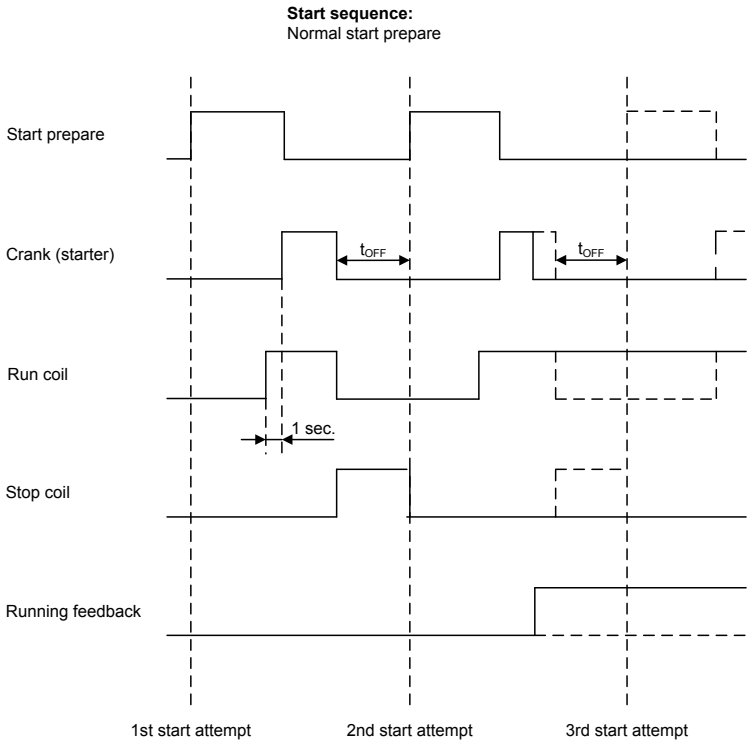
- AUTO mode is selected.
- SEMI-AUTO mode: The command is selected.
  - Only the selected sequence is started. For example, when the *START* button is pressed, the engine starts.

3.2 Start functions

3.2.1 Start sequence

Normal start prepare or extended start prepare are the possible start sequences for the engine. In both cases, the running coil is activated 1 s before the start relay (starter).

Normal start prepare sequence



The run coil opens between the start attempts, because the run coil type is set to pulse. When the engine receives running feedback, the run coil is closed until the stop sequence is started. If the run coil type is set to continuous, the run coil is closed between the start attempts until start failure, or the stop sequence opens it.

`Engine > Start sequence > Before crank > Run coil`

Parameter	Text	Range	Default
6151	Run coil timer	0.0 to 600.0 s	1.0 s
6152	Run coil type	Pulse Continuous	Pulse

Engine > Start sequence > Before crank > Start prepare

Parameter	Text	Range	Default
6181	Start prepare	0.0 to 600.0 s	5.0 s
6182	Ext. prepare	0.0 to 600.0 s	0.0 s

Double starter

In some emergency installations, the prime mover is equipped with an extra start motor. Dependent on the configuration, the double starter function can toggle between the two starters or try several attempts with the standard starter before switching to the *double starter*. The function is set up in parameters 6191 and 6192, and a relay for cranking with the alternative starter is chosen in the *I/O & Hardware setup*.

Engine > Start sequence > Crank > Start attempts

Parameter	Text	Range	Default
6191	Single starter attempts	1 to 100	3
6192	Double starter attempts	0 to 10	0

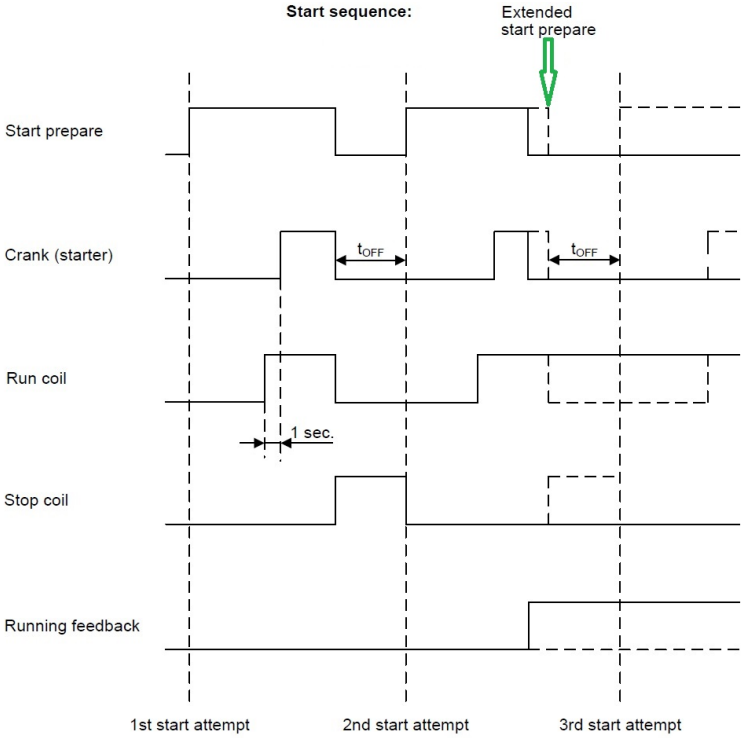
Choose a value that is more than zero in parameter 6192. This value determines the amount of attempts on each starter before switching to the next. The standard starter has first priority. When the maximum allowed number of attempts is reached, the start attempts stop and the alarm Start failure appears. Select the maximum number of attempts with parameter 6191.

- A value of 1 in parameter 6192 results in a toggle function with 1 attempt on each starter between toggling.
- A value of 2 in parameter 6192 results in a toggle function with 2 attempt on each starter between toggling.

Engine > Start sequence > Crank > Crank timers

Parameter	Text	Range	Default
6183	Start ON time	1.0 to 600.0 s	5.0 s
6184	Start OFF time	1.0 to 99.0 s	5.0 s

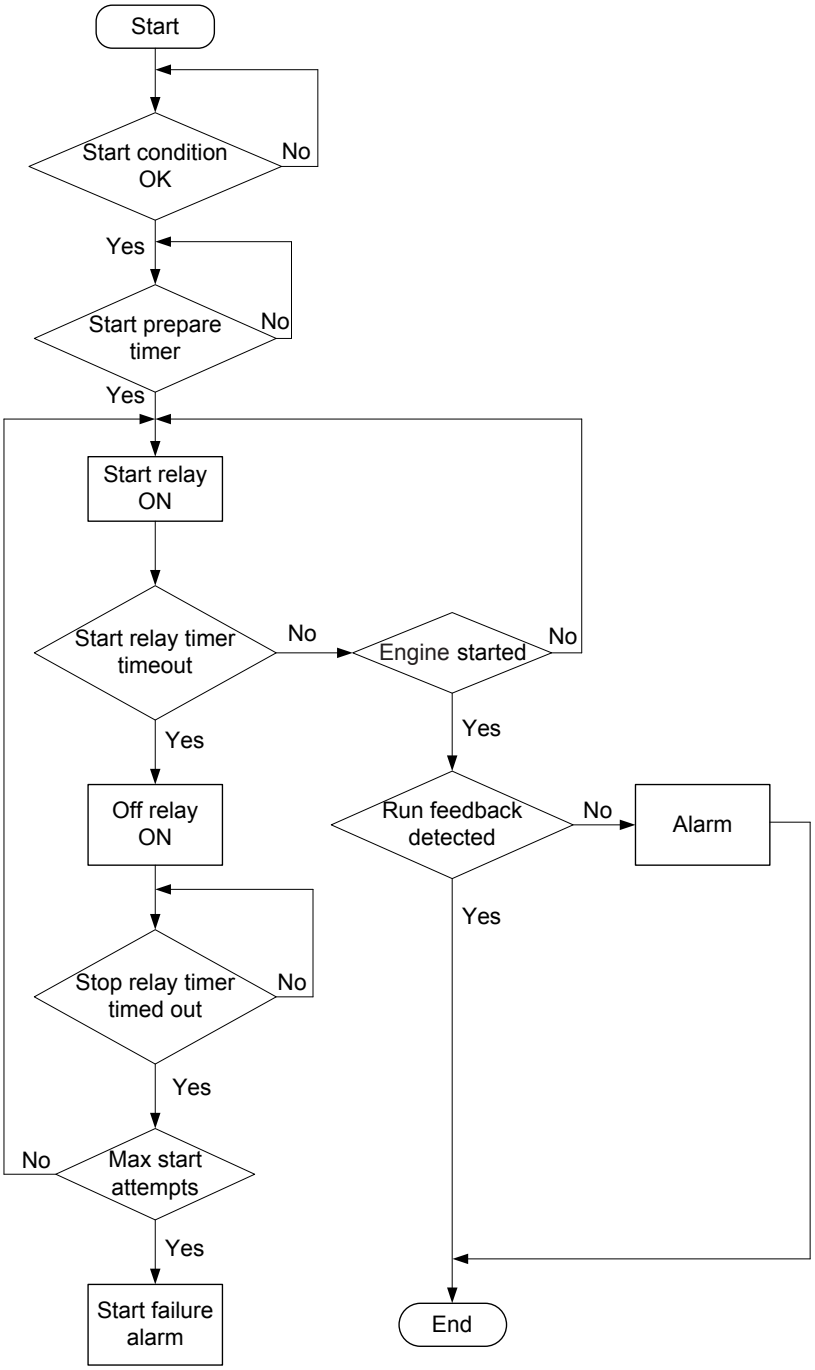
Extended start prepare sequence



You can activate the run coil 0 to 600 s before crank (starter) is executed. In this example, the timer is set to 1.0 s.

The extended start prepare function keeps the start prepare relay closed until remove starter or running detection is reached. This function is helpful if booster pumps for start fuel are used, because they are kept on until the engine is running.

Start sequence flowchart



3.2.2 Start sequence conditions

The start sequence initiation is controlled by these multi-input conditions:

- RMI oil pressure
- RMI water temperature
- RMI fuel level
- RMI Custom
- Binary input

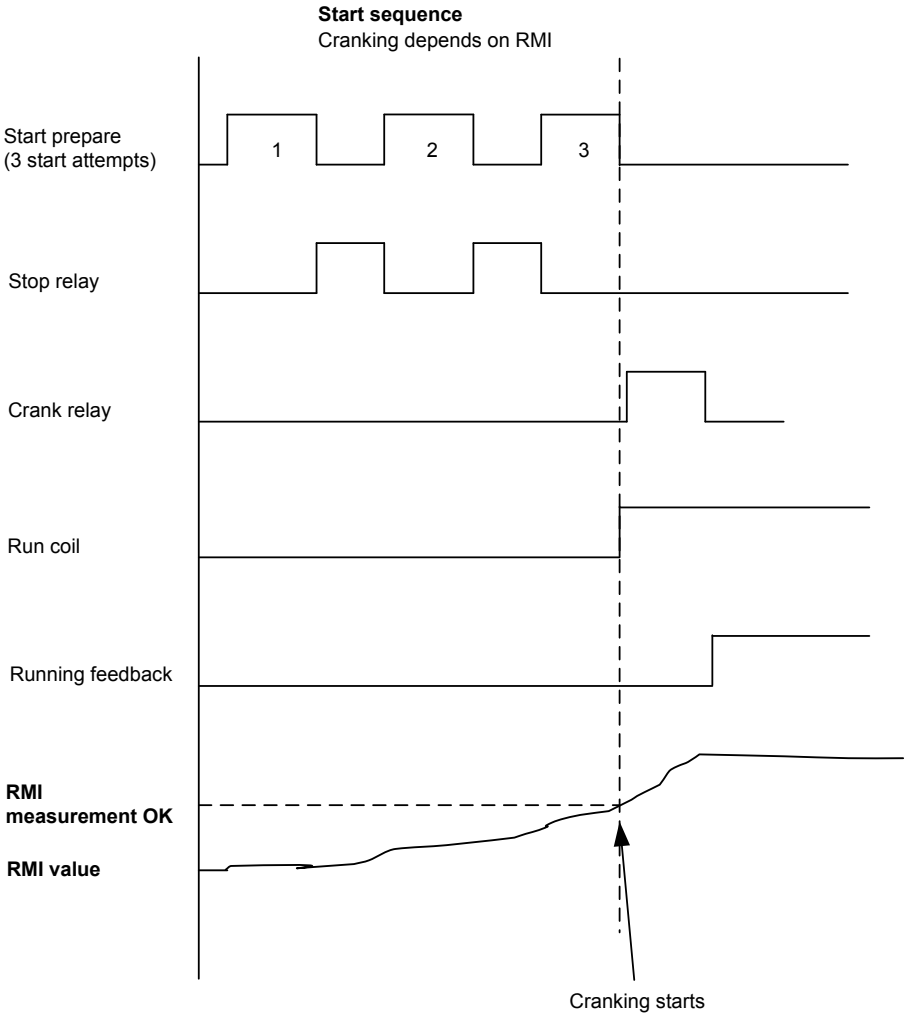
This means that if, for example, the oil pressure is not primed to the sufficient value, the crank relay will not engage the starter motor.

You can only configure these multi-input conditions with the utility software.

More information
See Inputs and outputs for how to configure the inputs.

If the binary start threshold is used, the input is chosen from the I/O list in the utility software.

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



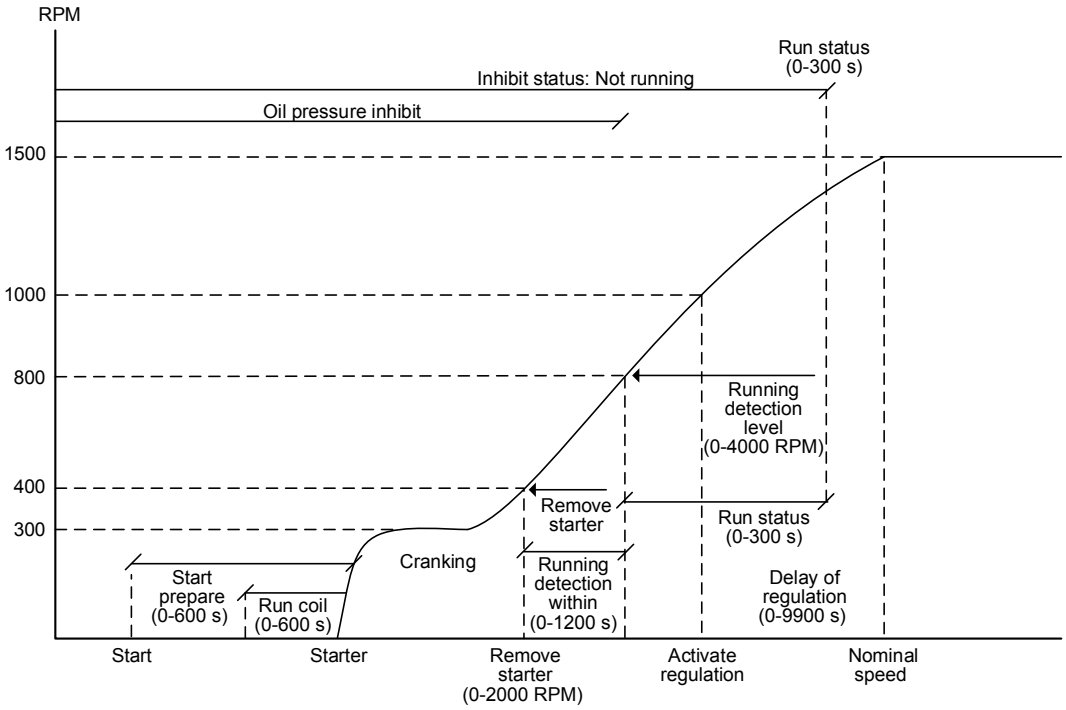
The start is initiated as soon as the start threshold limit is reached. By default, the controller waits until the start prepare timer is over and the start threshold conditions are correct before the crank relay/start is initiated. You can configure this in parameter 6185. You can change the start prepare type to interrupt start prepare, which means the controller is permitted to interrupt the start prepare and initiate the start when the start threshold conditions are correct.

`Engine > Start sequence > Before crank > Start threshold`

Parameter	Text	Range	Default
6185	Start threshold input type	Multi-input 20 Multi-input 21 Multi-input 22 Multi-input 23	Multi-input 20
6186	Start threshold set point	0.0 to 300.0	0.0

3.2.3 Start-up overview

Start-up overview



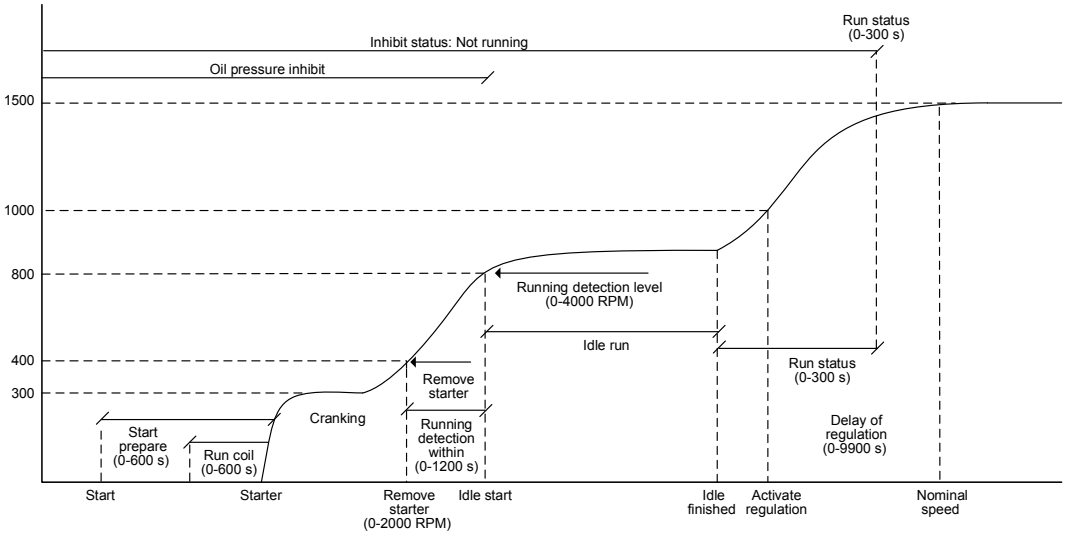
Set points related to the start sequence

Parameter	Text	Description
6181	Start prepare	Start prepare is used for start preparation, for example pre-lubrication 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.
6182	Extended prepare	Extended prepare will activate the start prepare relay when the start sequence is initiated. The relay is activated until the specified time has expired. If the extended prepare time exceeds the start ON time, the start prepare relay is deactivated when the start relay deactivates. If the timer is set to 0.0 s, the extended prepare function is deactivated.
6183	Start ON time	The starter will be activated for this period when cranking.
6184	Start OFF time	The pause between two start attempts.
6151	Run coil timer	The timer for the run coil is a set point for how long the run coil will be activated before cranking the engine. This gives the ECU time to start up before cranking.
6174	Remove starter	The starter is removed, when the RPM set point is reached. (only when the running detection type is configured as either MPU or EIC).
6173	Running detection RPM level	The set point defines the running detection level in RPM (only when the running detection type is configured as either MPU or EIC).
6351	Run detection	This timer will make sure that the engine goes from the RPM level set in remove starter and running detection level. The timer is only active when the running detection type is configured as MPU or EIC. If the timer is exceeded, and the level is not reached, the start sequence will start again and will have used a start attempt. If all the start attempts are used, the start failure will occur.
6161	Run status timer	The timer starts when the running detection level is reached. When the timer is exceeded, the inhibit status not running is deactivated, and the running alarms and failures are enabled.

Alarms related to the start sequence

Parameter	Text	Description
4530	Crank failure alarm	This alarm is activated, if MPU is configured as the primary running feedback and the specified RPM is not reached before the delay is completed.
4540	Run feedback failure alarm	This alarm is activated, if there is a failure on the primary running feedback. For example, if the primary running feedback is configured to digital input without running detection, and an active secondary running feedback detects the engine to be running. The delay to be set is the time from the secondary running detection until the alarm is raised.
6352	Engine externally stopped	This alarm is activated, if the running sequence is active and the engine is below running detection level without receiving a command from the controller.

Start-up overview with idle run



The set points and alarms are the same as above, except for the idle run function.

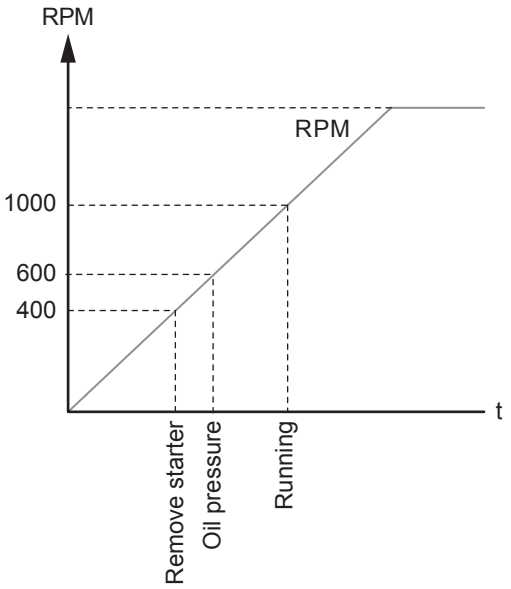
3.2.4 Start functions

The controller starts the engine when the start command is given. The start sequence 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. However, if the starter motor has to disengage at 400 RPM, and the oil pressure does not reach a level above the shutdown set point before 600 RPM, then the engine shuts down if the specific alarm is activated at the preset 400 RPM. In that case, the running feedback must be activated at a higher number of revolutions than 600 RPM.

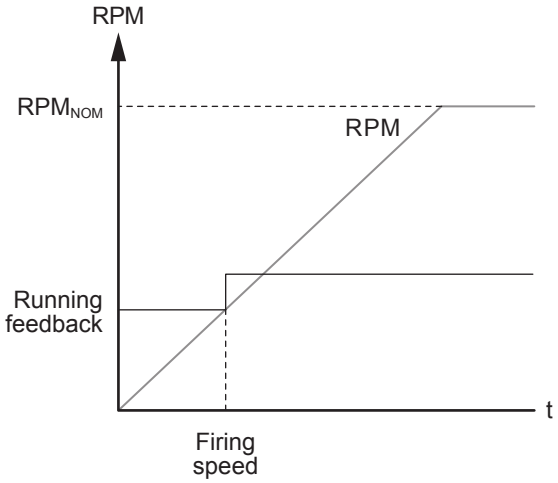


3.2.5 Digital feedbacks

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

Running feedback

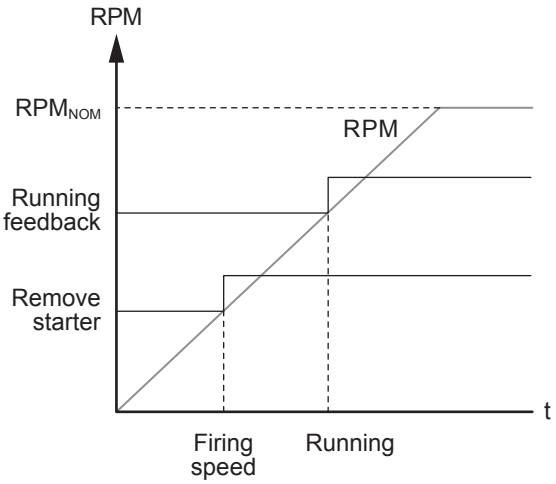
When the digital running feedback is active, the start relay is deactivated and the starter motor will be disengaged.



The diagram shows 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 shows 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.

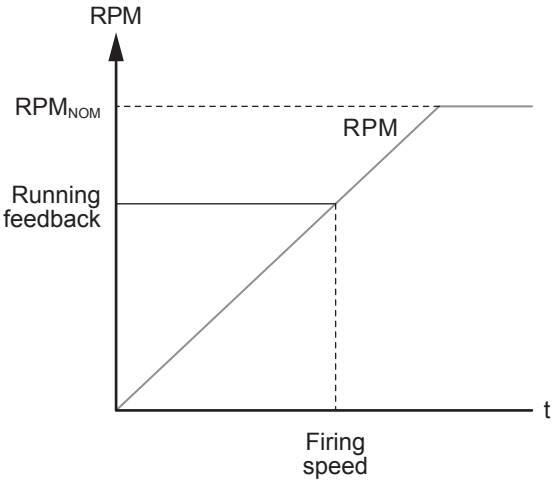
NOTE The remove starter input must be configured from a number of available digital inputs.

3.2.6 Analogue tacho feedback

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

Running feedback

The diagram shows how the running feedback is detected at the firing speed level. The factory setting is 1000 RPM.



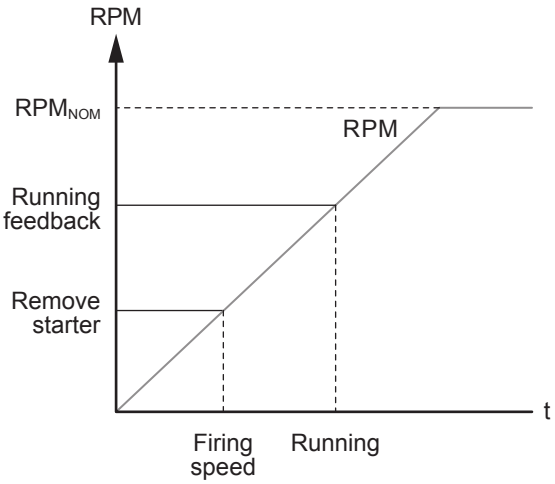
CAUTION

Caution

The factory setting of 1000 RPM is higher than the RPM level of typical starter motors. Adjust the setting to a lower value to avoid damage of the starter motor.

Remove starter input

The diagram shows how the set point of the remove starter is detected at the firing speed level. The factory setting is 400 RPM.



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

`Settings > Engine > Start sequence > After crank > Remove starter`

Parameter	Text	Range	Default
6174	Remove start	1 to 2000 RPM	400 RPM

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

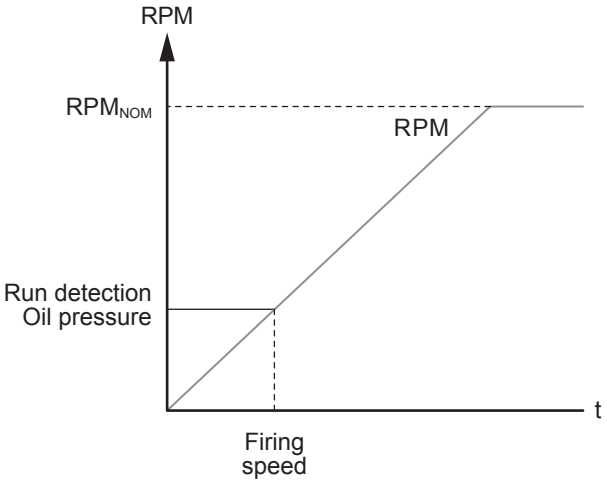
3.2.7 Oil pressure

The multi-inputs on terminals 20, 21, 22 and 23 can be used for the detection of running feedback. The terminal in question must be configured as an RMI input for oil pressure measurement. This is done with the utility software:

1. Select *I/O & Hardware setup* tab.
2. Select the relevant multi-input tab.
3. For *Input type*, select *RMI oil pressure*.

When the oil pressure increases above the adjusted value, running is detected, and the start sequence is ended.

Running feedback



More information
See **Running feedback** for how to configure the parameters.

3.3 Running feedback

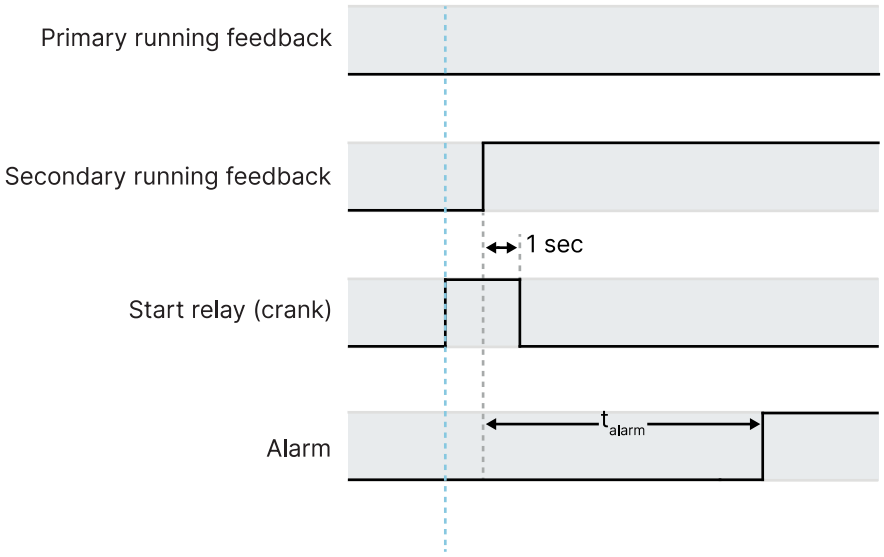
The controller uses running feedback to detect whether the engine is running:

- A digital input

- RPM, measured by magnetic pick-up (set point 0 to 4000 RPM)
- EIC

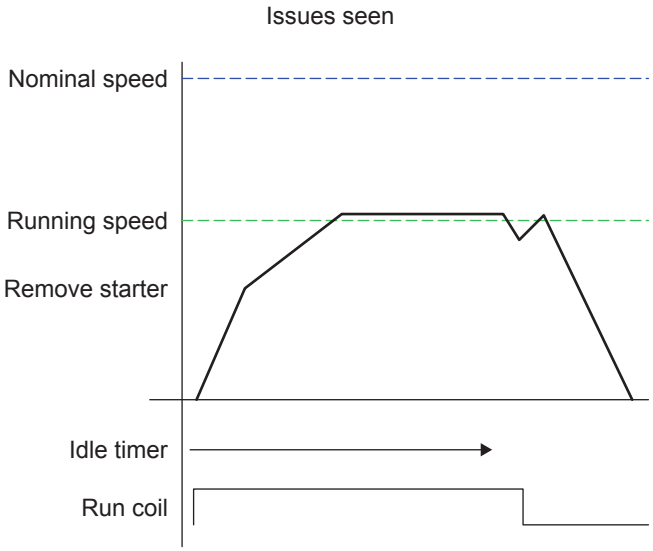
The selected running feedback is the primary feedback. However, all available running feedback is used for running detection. If the primary running feedback does not detect any running feedback, the starter relay stays activated for one additional second.

3.3.1 Start sequence running feedback



- If a running feedback is detected based on one of the secondary choices, the engine will start.
- If no running feedback is detected, the start sequence is interrupted.
- In parameter 6176 you can configure a delay time, before the start sequence is stopped.

3.3.2 Not running delay time



The engine will still be functional, even though a tacho sensor is damaged or dirty.

As soon as the engine is running, the running detection will be based on all available types.

3.3.3 Interruption of the start sequence

The start sequence is interrupted in the following situations:

Event	Notes
Stop signal	
Start failure	
Remove starter feedback	Tacho set point.
Running feedback	Digital input.
Running feedback	Tacho set point.
Running feedback	Oil pressure set point.
Running feedback	EIC (engine communication).
Emergency stop	
Alarm	Alarms with Shutdown or Trip and stop fail class.
Stop button on the display	Only in SEMI-AUTO or Manual mode.
Modbus stop command	SEMI-AUTO or Manual mode.
Digital stop input	SEMI-AUTO or Manual mode.
Deactivate the Auto start/stop	
Running mode	It is not possible to change the running mode to Block mode when the engine is running.

`Settings > Engine > Running detection`

Parameter	Text	Range	Default
6171	Number of teeth for MPU running detection	0 to 500 teeth	0 teeth*
6172	Primary running detection type	Digital input MPU input EIC Multi-input 20 to 23	MPU input
6173	Running detection	0 to 4000 RPM	1000 RPM
6175	Oil pressure	0.0 to 150.0 bar	0.0 bar
6176	Not running delay	0.0 to 5.0 s	0.0 s

NOTE * If there is no MPU (that is, parameter 6171 is 0), the controller calculates the genset speed from the frequency. This value is used for the remove starter function, and the overspeed and underspeed protections.

3.3.4 MPU wire break

The MPU wire break function is only active when the engine is not running. In this case, an alarm is activated if the wire connection between the controller and the MPU breaks. The MPU wire alarm is activated, when there is more than 400 kΩ.

`Engine > Running detection > MPU wirebreak`

Parameter	Text	Range	Default
4551	Tacho sensor	Tacho sensor Hall sensor*	Tacho sensor
4552	Output A	Relays and M-Logic	Not used
4553	Output B	Relays and M-Logic	Not used
4554	Enable	OFF ON	OFF
4555	Fail class	Fail classes	Warning

NOTE * There is no wire break on a Hall sensor.

3.3.5 D+ (Charger generator fail)

When the D+ function is enabled, the start relay is deactivated. The D+ turns off when the start disengages. The alarm is activated if there is no D+ feedback from the charging alternator after the delay time runs out.

`Engine > Running detection > Charger Gen fail`

Parameter	Text	Range	Default
4991	Set point	5.50 to 30.00 V	6.00 V
4992	Timer	0.0 to 999.0 s	10.0 s
4993	Output A	Relays and M-Logic	Not used
4994	Output B	Relays and M-Logic	Not used
4995	Enable	OFF ON	OFF
4996	Fail class	Fail classes	Warning

`Engine > Start sequence > After crank > Remove starter`

Parameter	Text	Range	Default
6174	Remove start	1 to 2000 RPM	400 RPM

3.3.6 Running output

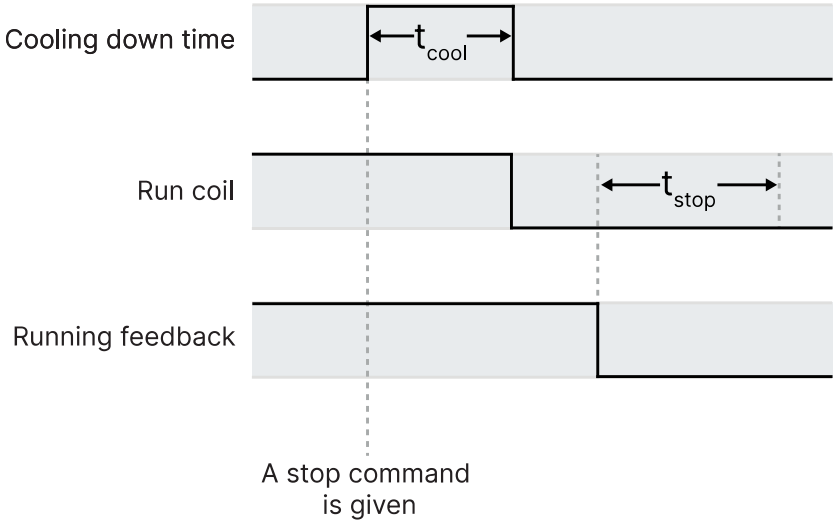
The run status timer can be configured to activate a digital output when the engine is running.

Configure the run status under `Functions > Run status` (parameter 6160). Configure the timer for the time that running detection must be present before *Run status* is activated. If the timer for run status is changed, it also affects the alarm inhibit for *Not run status*.

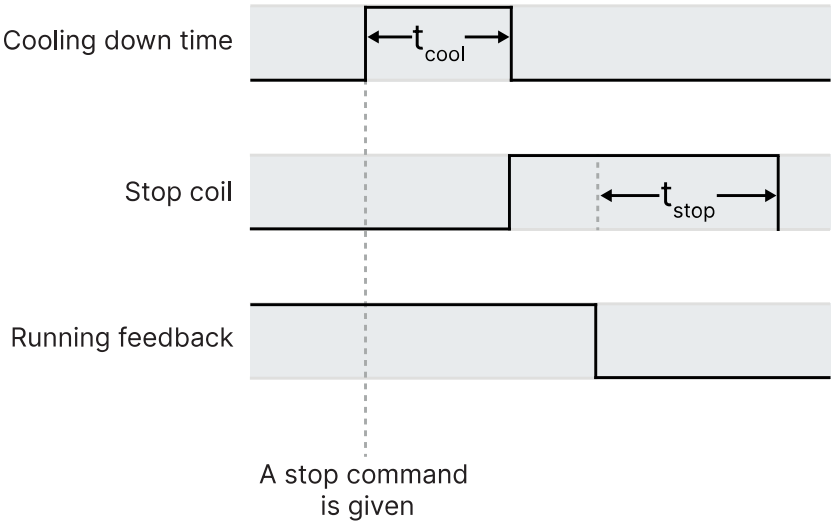
3.4 Stop functions

3.4.1 Stop sequence

Stop sequence: Run coil



Stop sequence: Stop coil



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

`Engine > Stop sequence > Cooldown`

Parameter	Text	Range	Default
6211	Cooldown time	0 to 9900 s	240 s

3.4.2 Stop sequence commands for the engine

Description	Cooling down	Stop	Notes
AUTO mode stop	●	●	
Trip and stop alarm	●	●	
Stop button on the display	(●)	●	SEMI-AUTO or Manual mode. Cooling down is interrupted if the *Stop* button is activated twice.
Remove Auto start/stop	●	●	
Emergency stop		●	The engine shuts down.

Interruption of the stop sequence can only occur during the cooling down period. If the status of the engine is engine stopping, then starting a new start sequence is only possible when the engine is stopped.

Interruption of the cool down period can occur if the start button is pushed or a remote command is given. In SEMI-AUTO mode the engine will run in idle or at nominal speed.

NOTE When the engine is stopped, the analogue speed control output is reset to the offset value.

3.4.3 Set points related to the stop sequence

`Engine > Stop sequence > Stop failure`

Parameter	Text	Range	Default
4581	Stop failure timer	10.0 to 120.0 s	30.0 s
4582	Stop failure, Output A	Relays and M-Logic	Not used
4583	Stop failure, Output B	Relays and M-Logic	Not used
4584	Activation of the stop failure alarm	OFF ON	ON
4585	Stop failure alarm fail class	Fail classes	Shutdown

`Engine > Stop sequence > Extended stop`

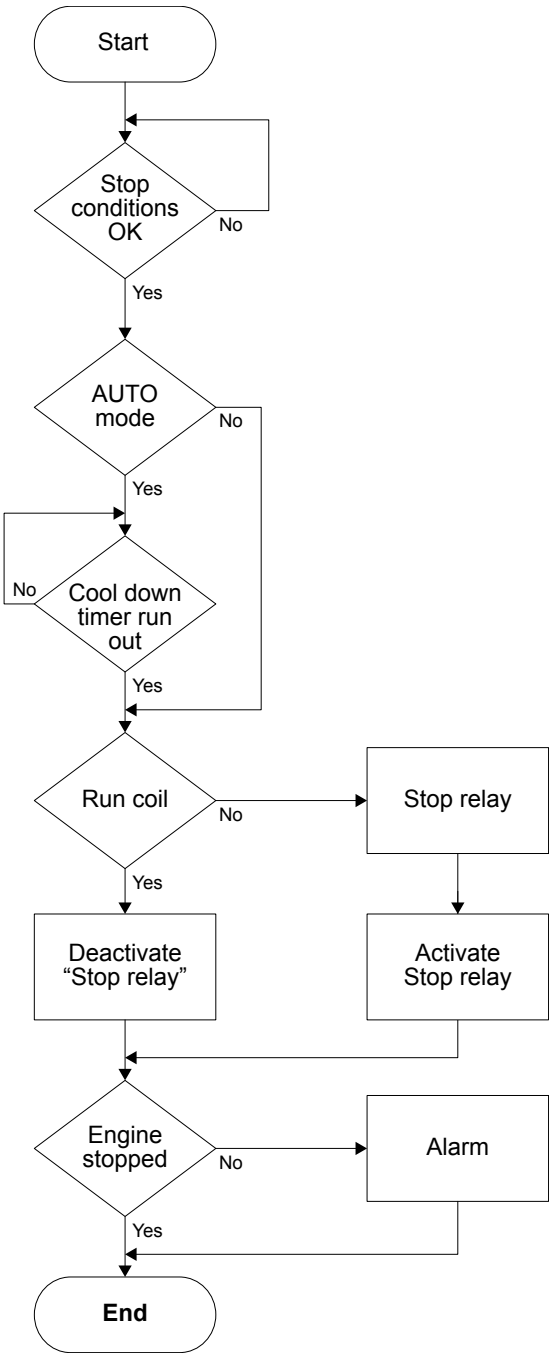
Parameter	Text	Range	Default
6212	Extended stop timer	0 to 300.0 s	5.0 s

`Engine > Stop sequence > Stop threshold`

Parameter	Text	Range	Default
6213	Input type	Multi input 20 to 23 M-Logic EIC temp. inputs	Multi input 20
6214	Threshold value/set point	0 to 482 °	0 °

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

3.4.4 Stop sequence flowchart



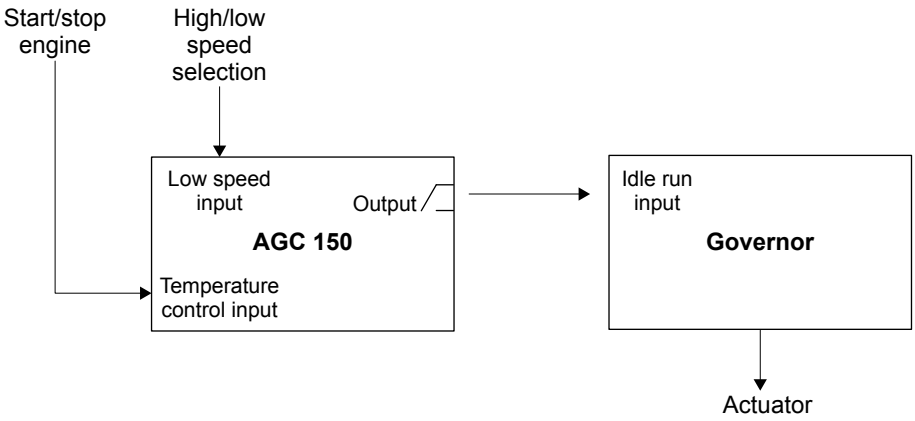
3.5 Idle running

Idle running changes the start and stop sequences so the engine can run at low temperature conditions.

The function is typically used in installations where the engine has to operate at low temperatures. This can cause starting problems or damage the engine. You can also use the function when the engine has to run at low RPM until a specified temperature is reached.

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 timers make the function flexible.

You must prepare the speed governor for the idle run function using a digital signal from the controller.



When the function is enabled, two digital inputs are used for control purposes:

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.
2. Temperature control input. When this input is activated, the engine starts. It is not able to stop as long as this input is activated.

You can use the low speed input together with a timer to select the idle run function. If an input and a timer are used at the same time, the digital input is prioritised. For example, if the idle run function is activated with the low speed input and the start timer is enabled, the idle run function is still active if the timer expires before the digital input is deactivated.

NOTE 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.

It is possible to interrupt the idle run sequence in SEMI-AUTO mode with parameter 6297 enabled. If you push the *START* button, the engine regulates to nominal values, and if you push the *STOP* button, the engine is stopped.

`Engine > Start sequence > Idle run`

Parameter	Text	Range	Default
6291	Idle start timer	0.0 to 999.0 min	300.0 min
6292	Idle start enable	OFF ON	OFF
6295	Output A	Relays and M-Logic	Not used
6296	Enable idle run	OFF ON	OFF
6297	Idle interrupt	OFF ON	OFF

`Engine > Stop sequence > Idle stop`

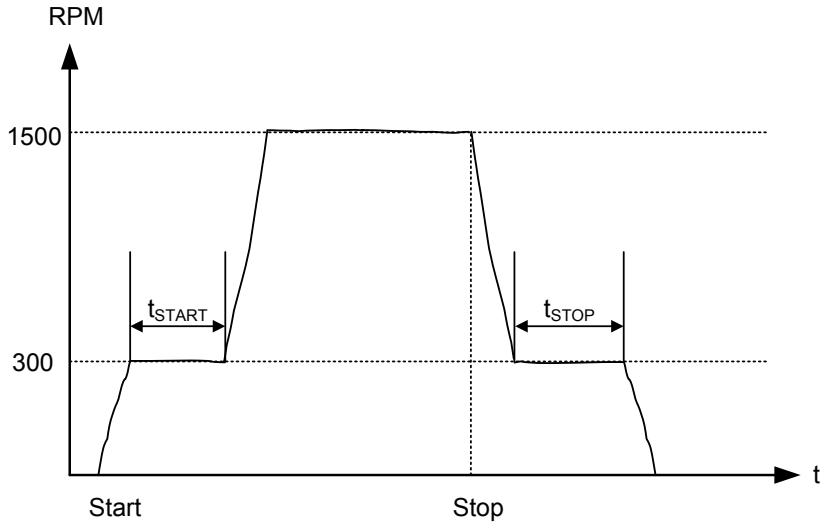
Parameter	Text	Range	Default
6293	Stop timer	0.0 to 999.0 min	300.0 min
6294	Enable stop	OFF ON	OFF

Examples

Idle speed during starting and stopping

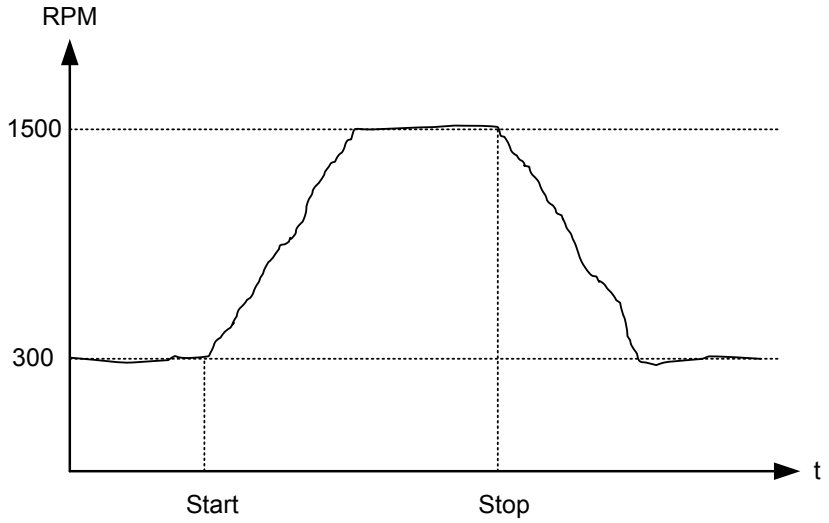
- Both the start and the stop timers are activated.
- The start and stop sequences are changed to let the engine stay at the idle level before speeding up.

- It also decreases the speed to the idle level for a specified delay time before stopping.



Idle speed with a digital input configured to low speed

- The idle speed with low speed activated runs in idle speed until the low speed input is deactivated, and then the engine regulates to nominal values.
- To prevent the engine from stopping, then the digital input *Temp control* must be left ON at all times. The engine speed-time curve then looks like this:



NOTE The oil pressure alarm (RMI oil) is enabled during idle run if set to ON.

3.5.1 Temperature-dependent idle start-up

This is an example of a system that will start up in idle run, if the coolant temperature is below a specified value. When the temperature exceeds the specified value, the engine will ramp up to nominal values.

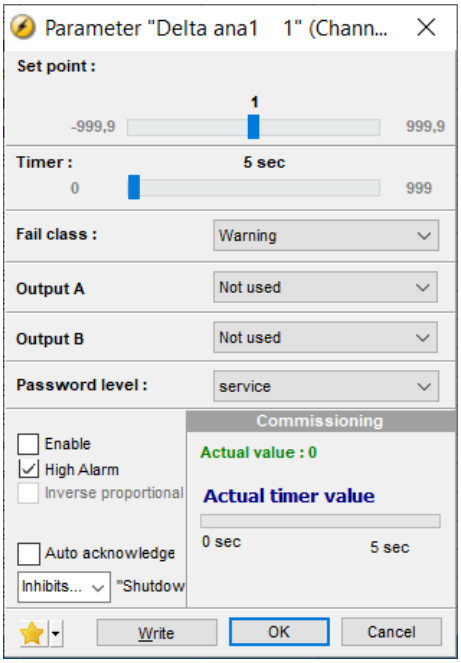
For this function to work, you must turn idle running ON and configure the digital output.

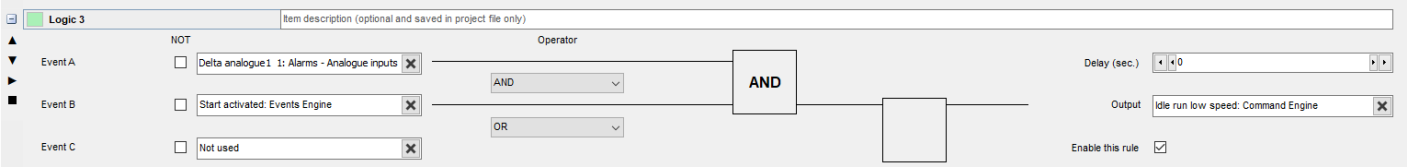
`Engine > Start sequence > Idle run`

Parameter	Text	Range	Set value to
6296	Idle running	OFF ON	ON

Example

The function uses delta analogue 1 (parameters 4601, 4602 and 4610) and one M-Logic line. After starting, when the coolant temperature is below 110 °C, the controller idles. Once the temperature reaches 110 °C, the controller automatically ramps up to full speed.





3.5.2 Inhibit

The alarms that are deactivated by the inhibit function are inhibited in the usual manner, except for the oil pressure alarms, RMI oil 20, 21, 22 and 23. These alarms are active during Idle run as well.

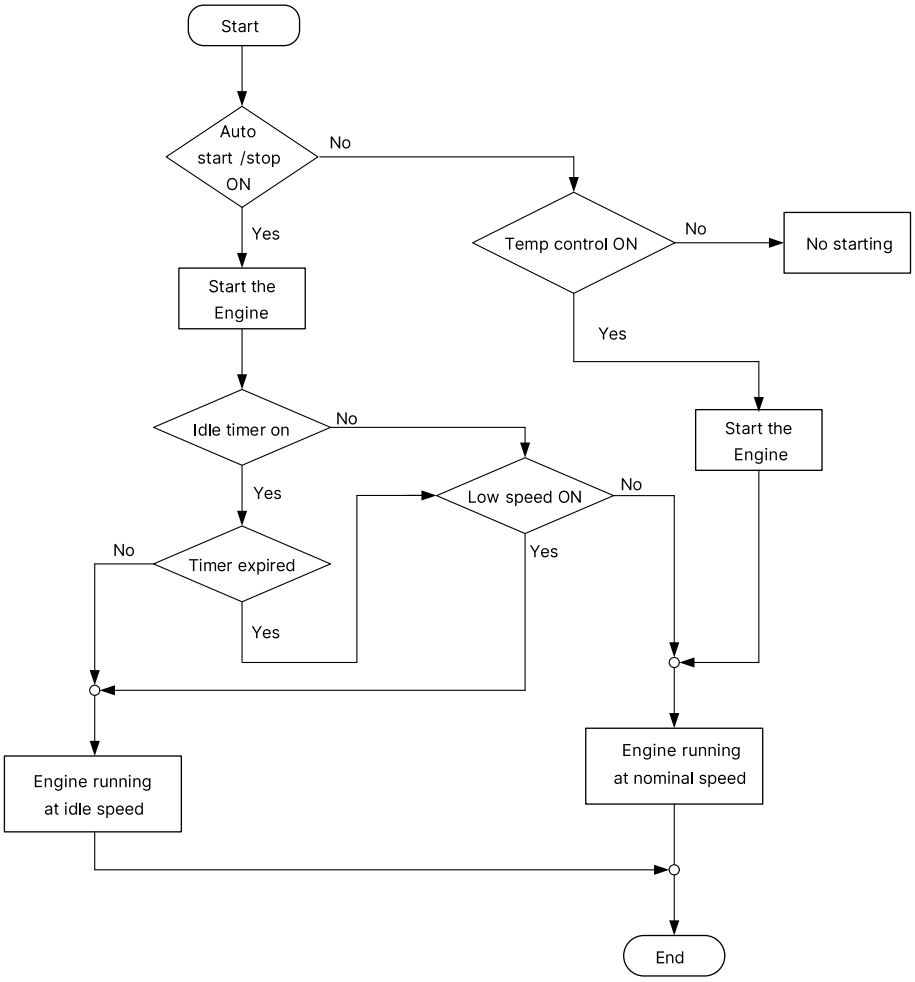
3.5.3 Running signal

You must activate the running feedback when the engine is running in idle mode.

3.5.4 Idle speed flowcharts

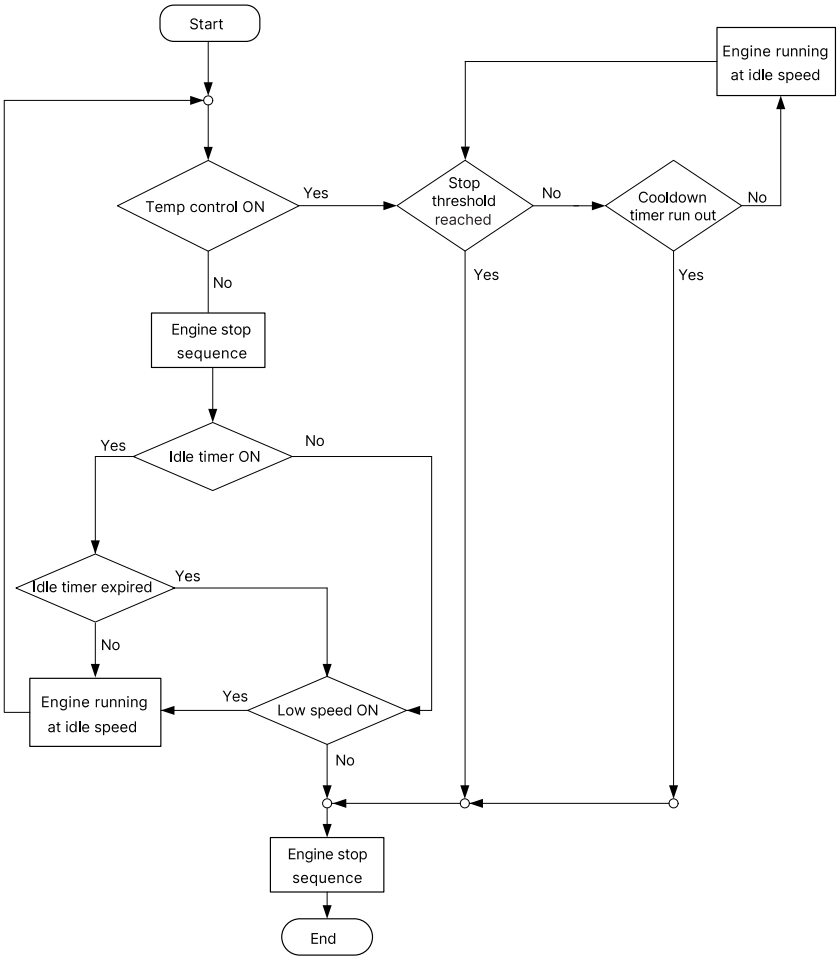
The flowcharts show the start and stop of the engine by the inputs *Temp control* and *Low speed*.

Start flowchart



NOTE The AGC 150 Engine drive marine controller does not support the auto start/stop function.

Stop flowchart



NOTE The AGC 150 Engine drive marine controller does not support the auto start/stop function.

3.6 Engine communication

The AGC supports J1939 and can communicate with any engine that uses generic J1939. In addition, the AGC can communicate with a wide range of ECUs and engines.

More information
See **Engine communication AGC 150** for a full list of supported ECUs and engines, along with detailed information for each protocol.

Exhaust after-treatment (Tier 4/Stage V)

AGC 150 supports Tier 4 (Final)/Stage V requirements. It provides monitoring and control of the exhaust after-treatment system, as required by the standard.

More information
See the **Operator's manual** for a description of the exhaust after-treatment.

3.7 Regulation

Regulation of the AGC 150 Engine drive is mainly done with the general purpose PIDs or with M-Logic. Some settings are also available from the controller.

More information
See **General purpose PID** for the PID settings.

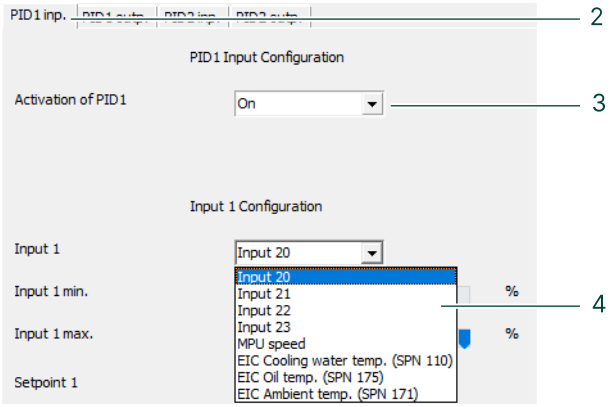
PID regulation is active when the controller is in AUTO mode. The engine speed can be configured in PID1 when the controller is in AUTO mode.

3.8 Engine speed control

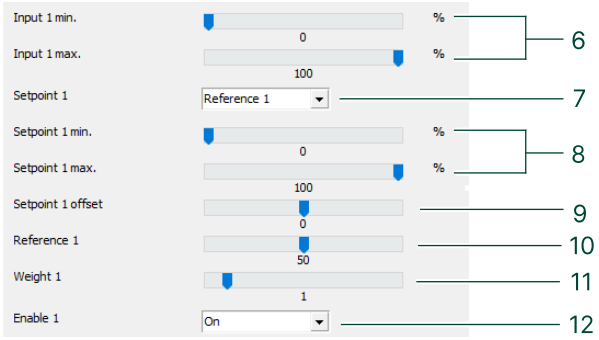
The engine speed control is configured with PID1.

PID1 input configuration

1. In the utility software, select the *General Purpose PID* tab from the vertical menu.
2. Select the *PID1 inp.* tab.
3. In the drop-down list, select *ON* to activate PID1.
4. In the drop-down list, select the source of this input here. Options include multi-input, MPU speed or EIC speed.



5. If a multi-input is selected:
   - Select the *I/O & Hardware setup* tab to configure the multi-input.
   - The configured scaling value is shown without decimals in the PID settings (1.00 = 100).



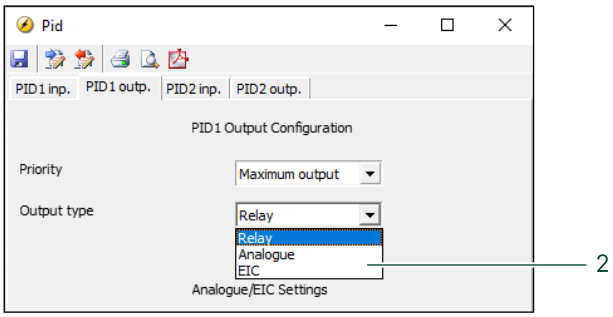
6. Define the input range with *Input min* and *Input max*.
7. Select *Reference 1* to define the set point in this box. Alternatively, select a set point source (from the same options as for *Input 1*).
8. Define the set point range with *Setpoint 1 min* and *Setpoint 1 max*.
9. Select the offset for set point 1.
10. Select the general purpose PID set point. *Reference 1* must be chosen for *Setpoint 1* for this input.
11. The input value is multiplied by the weight factor.
    - A weight factor of 1 means that the real input value is used in the calculations.
    - A weight factor of 3 means that the input value is three times as big in the calculations.
12. Enable the PID1.

Settings > Engine > Speed control > Basic speed settings

Parameter	Text	Range	Default
2831	Min. speed	100 to 4000 RPM	1000 RPM
2832	Max. speed	100 to 4000 RPM	2000 RPM

PID1 output configuration

1. In the *General Purpose PID* tab, select the *PID1 outp.* tab.
2. In the *Output type* drop-down window, select relay, analogue or EIC:



3. Configure the output settings with the sliders.
   - Analogue Kp: Proportional gain value, increase to get a more aggressive reaction.
   - Analogue Ti: The integral output, increase to get a less aggressive integral action.
   - Analogue Td: The derivative output, increase to get a more aggressive derivative action.
4. Select an analogue output from the drop-down list. The controller's analogue outputs are listed here.
5. Enable the *Analogue output inverse* to inverse the output function.
6. Select *ON* to enable the engine speed.

7. Configure the offset settings with the sliders.
   - Analogue offset: Determines the output starting point, when the controller is in SEMI-AUTO mode.
   - See **Manual control of the engine speed** in this document for information about the manual settings.

3.9 Engine speed ramp

To use the ramp function the PID1 engine speed must be ON. The ramp function is active in AUTO, SEMI-AUTO and manual mode at start up and cooldown.

Settings > Engine > Speed control > Basic speed settings

Parameter	Text	Range	Default
2833	Ramp up	0.01 to 100.00 %/s	2.00 %/s
2834	Ramp down	0.01 to 100.00 %/s	2.00 %/s

3.10 Manual control of the engine speed

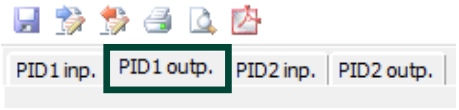
You can manually control the engine speed in MANUAL and SEMI-AUTO mode with digital inputs, AOP buttons or on the controller. This function gives the commissioning engineer a helpful tool for adjustment of the regulation.

The engine speed settings are configured with the utility software. To use this function with the digital inputs or the AOP buttons, you need to configure the events with M-Logic & AOP.

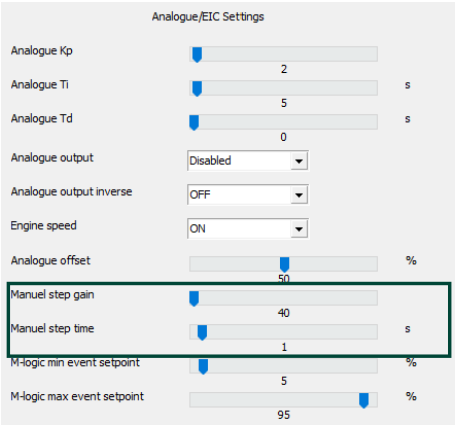
Configuration of the manual speed settings

The manual settings for the engine speed are configured with the utility software:

1. Select the *General Purpose PID* tab from the vertical toolbar.
2. Select the *PID1 outp.* tab:



3. Configure the *Manual set gain* and the *Manual step time*:

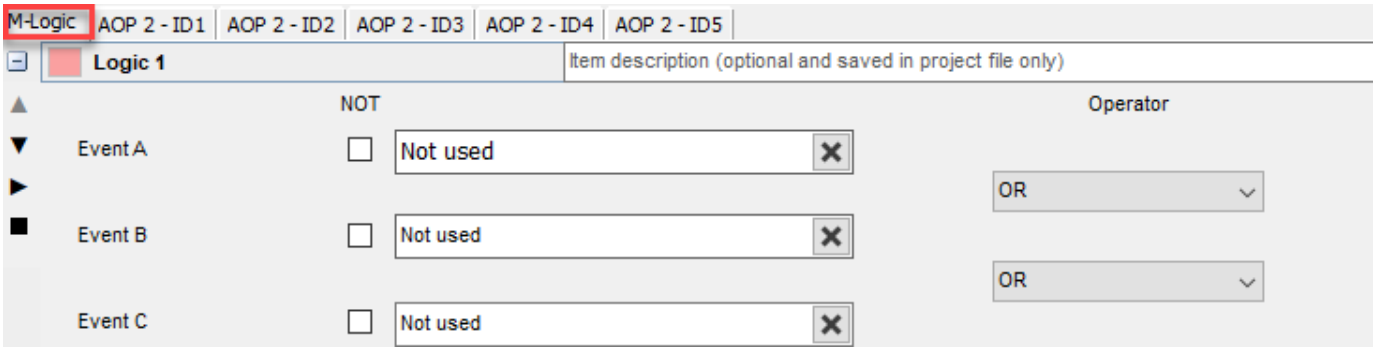


4. Select the *Write to the device* button to send the settings to the controller.

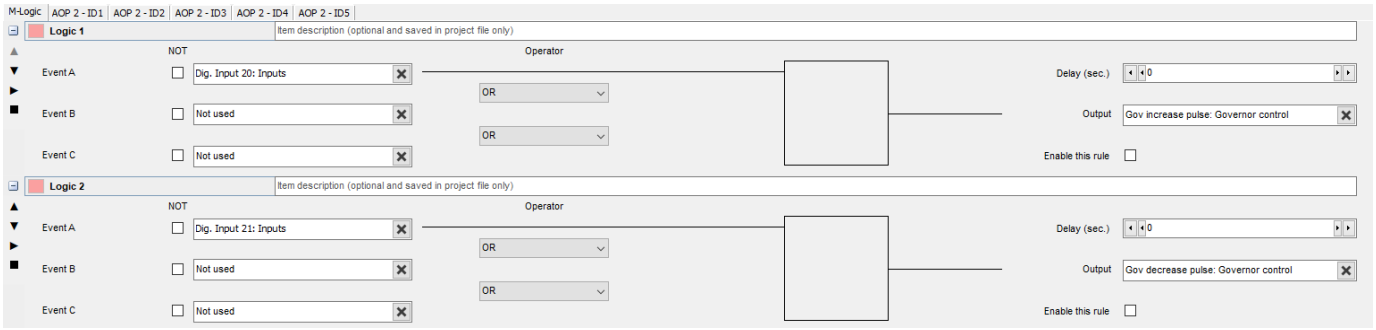
Configuration of digital inputs and AOP buttons with M-logic

The digital inputs and AOP buttons need to be configured with M-logic to control the engine speed manually.

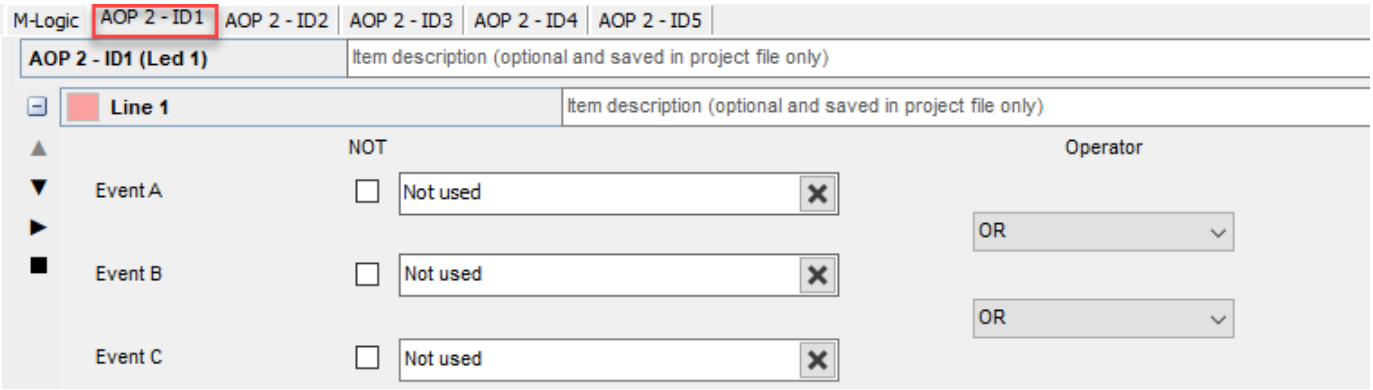
1. Select the *M-Logic & AOP* tab from the vertical toolbar.
2. For the digital inputs, select the *M-Logic* tab:



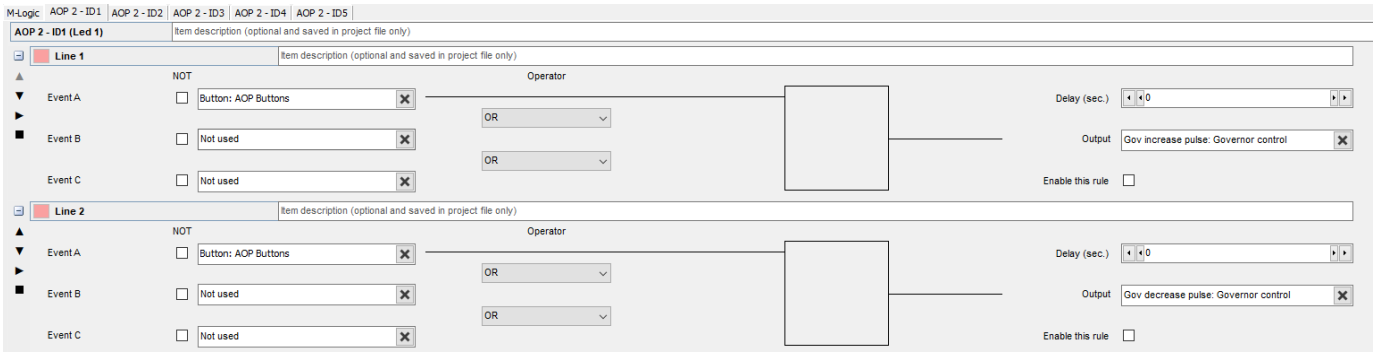
3. Select the digital input in the *Input* section in the *Events* tab on the right.
4. Select the output in the *Governor control* section in the *Output* tab on the right:



5. For the AOP buttons, go to the AOP tab:

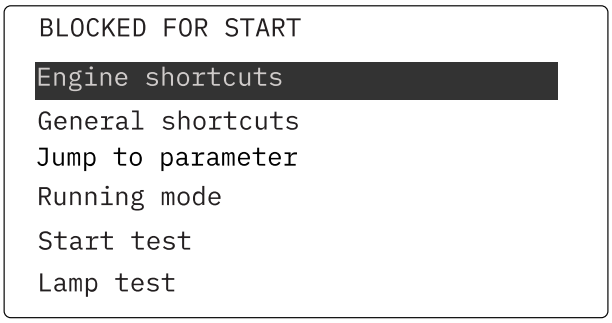


6. Select the AOP button in the *AOP button* section in the *Events* tab on the left.
7. Select the output in the *Governor control* section in the *Output* tab:

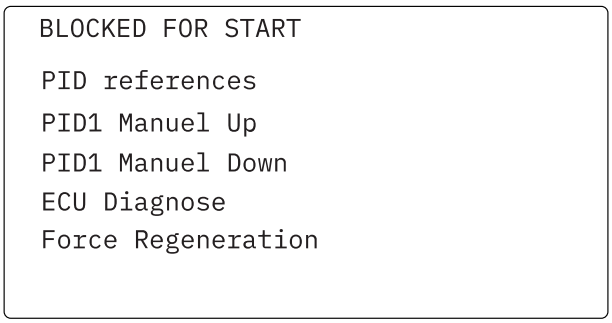


On the controller

1. From the view menu, push the *Shortcut* button to see the menu.



2. Use the *Up* and *Down* buttons to see the *Engine shortcuts* menu, and push the OK button.



3. Use the *PID1 Manuel Up* and the *PID1 Manuel Down* to manually control the speed.

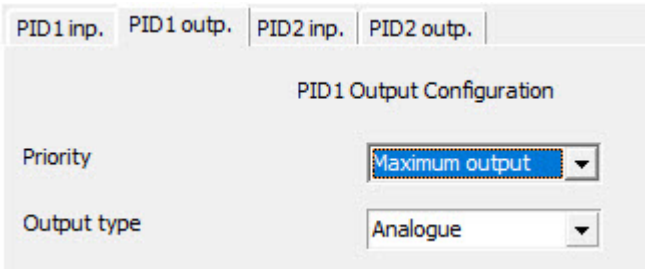
NOTE You cannot use the *PID1 Manuel Up* and the *PID1 Manuel Down* during ramp up and ramp down (start/stop).

3.11 Pulse-width modulation (PWM) output

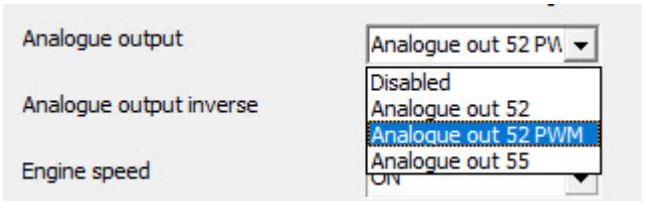
The PWM output is configured with the PID1 output.

Configuration of the PID1 output

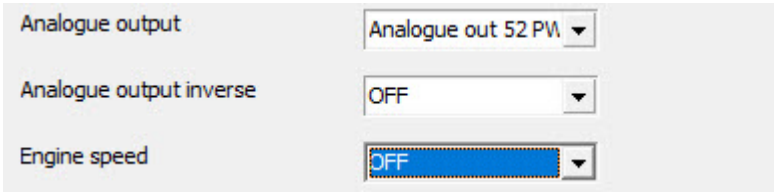
1. In the utility software, go to the *General Purpose PID* tab.
2. Select the *PID1 outp.* tab.
3. In the *Output type* drop-down list, select analogue:



4. Configure the output settings with the sliders.
5. In the *Analogue output* drop-down list, select *Analogue out 52 PWM*:



6. Set the *Analogue output inverse* to OFF.
7. If PID1 is used to control the engine speed, set the *Engine speed* to *ON*. If PID1 is not used to control the engine speed, set the *Engine speed* to *OFF*.



8. Configure the offset settings with the sliders.
   - The analogue offset determines the output starting point, when the controller is in SEMI-AUTO mode.
   - The manual settings are for manual control of the engine speed. See **Manual control of the engine speed** in this document.

More information
See **Analogue outputs** for how to configure the PWM parameters.

The configuration of the PID1 input depends on what you use the PID1 for. See **General purpose PID** in this document for how to configure the PID input.

3.12 Running output

The run status timer can be configured to activate a digital output when the engine is running.

Configure the run status under `Functions > Run status` (parameter 6160). Configure the timer for the time that running detection must be present before *Run status* is activated. If the timer for run status is changed, it also affects the alarm inhibit for *Not run status*.

3.13 Engine protections

3.13.1 Protections in general

All protection settings are stated in percent of the nominal values.

Most of the protections are of the definite time type (a set point and time is selected). When the timer runs out, the output is activated. The operate time will be the delay setting + the reaction time.

When setting up the AGC 150, the measuring class of the controller and an adequate safety margin has to be taken into consideration, for example:

General parameter ranges

For all protections, the following parameters are to be set within the ranges mentioned:

Parameter text	Range
Output A	Not used 12 relays: 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 External I/O: 3 × 8 relays (CIO 208) Limits
Output B	
Enable	OFF ON
Fail class	Block Warning Shutdown

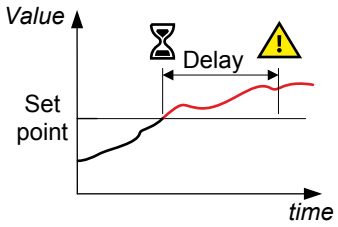
3.13.2 Engine protections

Protection	IEC symbol (IEC 60617)	ANSI (IEEE C37.2)	Operate time	Alarms
Over-speed	-	12	-	2
Under-speed	-	14	-	1

3.13.3 Overspeed

These alarms alerts the operator that the engine is running too fast.

The alarm response is based on the engine speed as a percentage of the nominal speed. If the engine speed rises above the set point for the delay time, the alarm is activated.



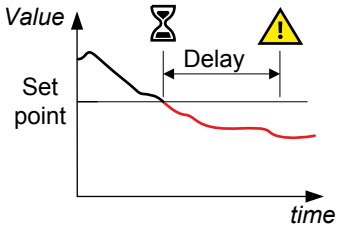
Engine > Protections > RPM-based protections > Overspeed > Overspeed [1 or 2]

Parameter	Text	Range	Overspeed 1	Overspeed 2
4511 or 4521	Set point	100 to 150 %	110 %	120 %
4512 or 4522	Timer	0 to 3200 s	5 s	1 s
4513 or 4523	Output A	Relays and M-Logic	Not used	Not used
4514 or 4524	Output B	Relays and M-Logic	Not used	Not used
4515 or 4525	Enable	OFF ON	OFF	OFF
4516 or 4526	Fail class	Fail classes	Warning	Shutdown

3.13.4 Underspeed

This alarm alerts the operator that the engine is running too slowly.

The alarm response is based on the engine speed as a percentage of the nominal speed. If the engine speed drops below the set point for the delay time, the alarm is activated.



Engine > Protections > RPM-based protections > Underspeed > Underspeed

Parameter	Text	Range	Default
4591	Set point	50 to 100 %	90 %
4592	Timer	0 to 3200 s	5 s
4593	Output A	Relays and M-Logic	Not used
4594	Output B	Relays and M-Logic	Not used
4595	Enable	OFF ON	OFF
4596	Fail class	Fail classes	Warning

3.13.5 Alarms for over- and underspeed

You can set up alarms for overspeed and underspeed:

- Settings for the overspeed alarm relate to the maximum speed setting (parameter 2832).
- Settings for the underspeed alarm relate to the minimum speed setting (parameter 2831).

Configure the alarm for EIC overspeed in `Engine > Protections > EIC - based protections > Overspeed > EIC Overspeed`.

Parameter	Text	Range	Default
7601	Set point	100.0 to 150.0 %	110.0 %
7602	Timer	0.0 to 3200 s	5.0 s
7603	Output A	Relays and M-Logic	Not used
7604	Output B	Relays and M-Logic	Not used
7605	Enable	OFF ON	OFF
7606	Fail class	Fail classes	Warning

Configure the alarm for MPU overspeed in `Engine > Protections > RPM - based protections > Overspeed > Overspeed #`, where # is 1 or 2.

Parameter	Text	Range	Overspeed 1	Overspeed 2
4511 or 4521	Set point	100.0 to 150.0 %	110.0 %	120.0 %
4512 or 4522	Timer	0.0 to 3200 s	5.0 s	1.0 s
4513 or 4523	Output A	Relays and M-Logic	Not used	Not used
4514 or 4524	Output B	Relays and M-Logic	Not used	Not used
4515 or 4525	Enable	OFF ON	OFF	OFF
4516 or 4526	Fail class	Fail classes	Warning	Shutdown

Configure the alarm for MPU underspeed in `Engine > Protections > RPM - based protections > Underspeed > Underspeed`.

Parameter	Text	Range	Underspeed
4591	Set point	50.0 to 100.0 %	90.0 %
4592	Timer	0.0 to 3200 s	5.0 s
4593	Output A	Relays and M-Logic	Not used
4594	Output B	Relays and M-Logic	Not used
4595	Enable	OFF ON	OFF
4596	Fail class	Fail classes	Warning

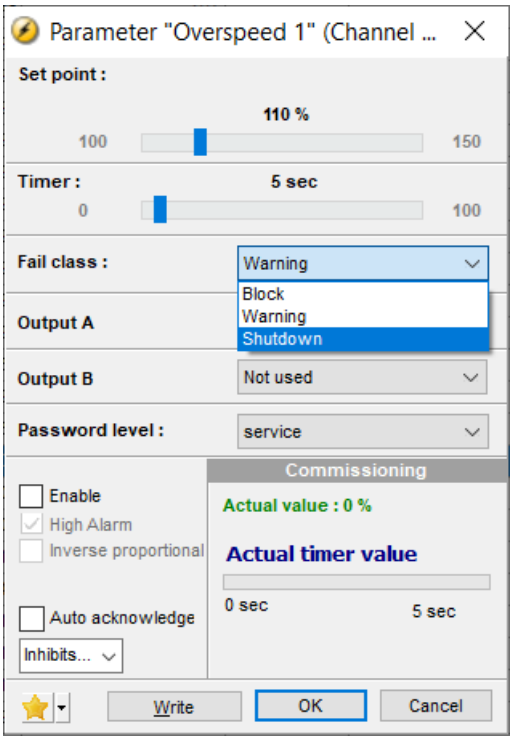
3.13.6 Fail classes

All activated alarms must have a fail class configured. The fail classes define the alarm category and the alarm action. You can use three different fail classes.

You can configure the fail class for each alarm function on the controller or with the utility software.

With the utility software

1. Select the alarm function you need to configure
2. Select the applicable fail class in the drop-down list:

3. 

On the controller

Alarm actions for a running engine

Fail class/Action	Alarm horn relay	Alarm display	Stop engine
Block	●	●	
Warning	●	●	
Shutdown	●	●	●

The table shows the action of the fail classes. For example, if an alarm is configured with the shutdown fail class, this happens:

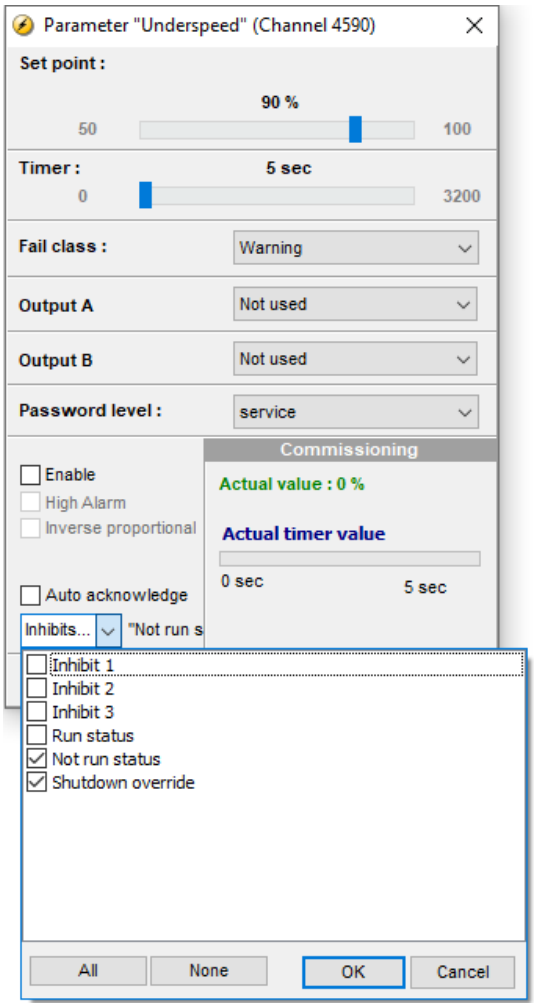
- The alarm horn relay is activated
- The alarm is displayed on the alarm info screen
- The engine is immediately stopped
- You cannot start the engine from the controller (see next table)

Alarm actions for a stopped engine

Fail class/Action	Block engine start
Block	●
Warning	
Shutdown	●

3.13.7 Alarm inhibit

You can configure inhibits for each alarm with the utility software. When configuring the parameters for an alarm, inhibits can be selected in a drop-down window.

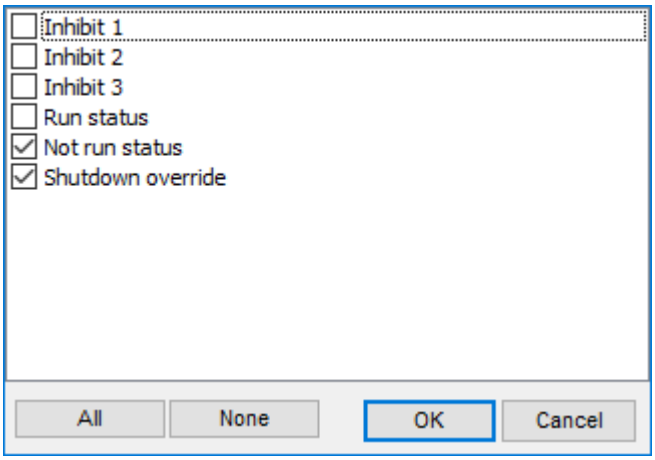


Alarm inhibits

Function	Notes
Inhibit 1	
Inhibit 2	M-Logic outputs: Conditions are programmed in M-Logic.
Inhibit 3	
Run status	Running detected and the timer has expired*.
Not run status	Running not detected or the timer has not expired*.
Shutdown override	Shutdown override is activated.

NOTE * The run status timer is configured in `Functions > Run status > Timer`. With binary running feedback the timer is not used.

The alarm inhibit is active as long as one of the selected inhibits are active.



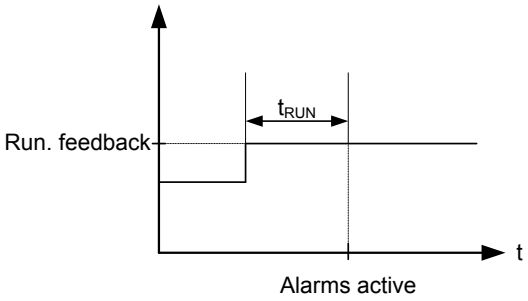
In this example, inhibit is set to *Not run status* and *Shutdown override*. The alarm is activated when the engine is started.

Only alarm inputs can be inhibited. Function inputs such as running feedback, remote start or access lock are never inhibited.

Run status

Alarms can be configured 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.



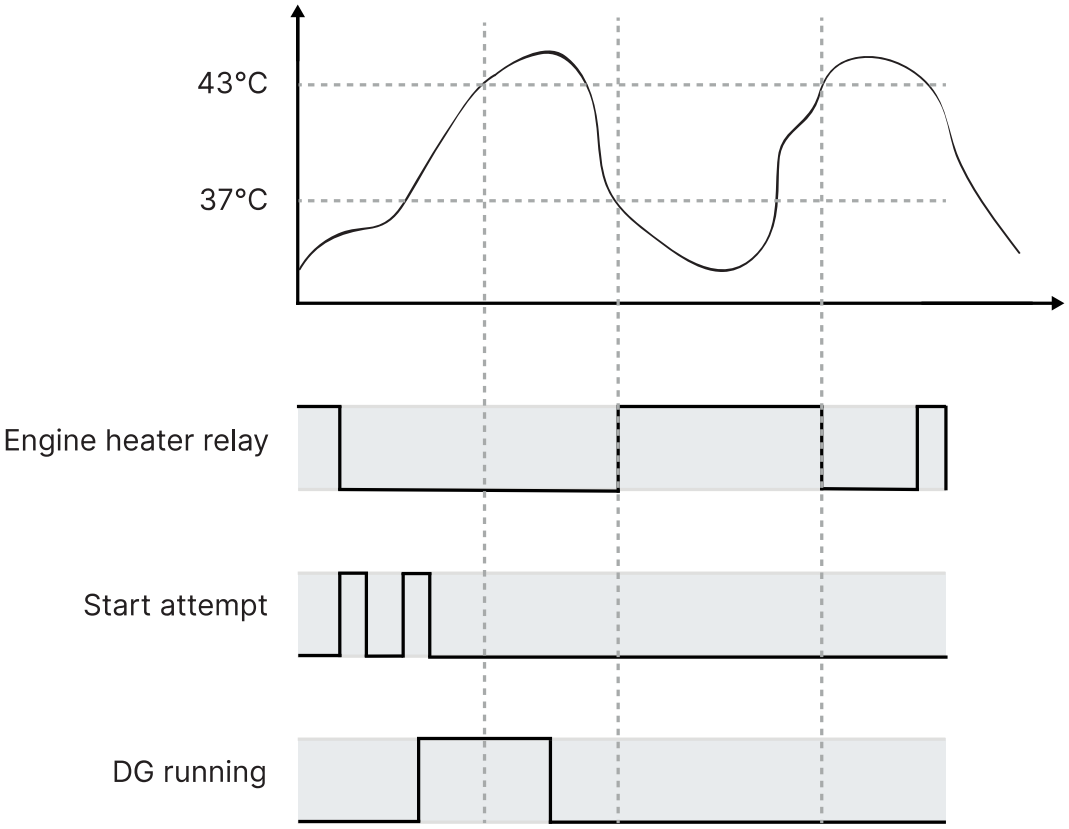
`Functions > Run status`

Parameter	Text	Range	Default
6161	Run status delay timer	0.0 to 300.0 s	5.0 s
6162	Output A	Relays and M-Logic	Not used
6163	Output B	Relays and M-Logic	Not used
6164	Enable	OFF ON	OFF

3.13.8 Engine pre-heater

This function is used to control the temperature of the engine. A temperature sensor is used to activate an external heating system to keep the engine at a minimum temperature. This function is only active when the engine is stopped.

Example: Engine pre-heater sequence



The function includes a set point and a hysteresis. In the example, the set point is 40 °C with a hysteresis of 3 °C. The controller opens the engine heater relay when the engine has reached 43 °C, and closes when the engine temperature is 37 °C.

A relay must be chosen for the engine heater. If a slave relay of the chosen relay is wanted, this can be programmed in M-Logic.

If the engine heater is active, and the manual control command has been activated, the engine heater relay is opened. When the command is activated again, the heater relay closes if the temperature is below the set point.

`Functions > Engine heater`

Parameter	Text	Range	Default
6321	Set point	20 to 250 °C	40 °C
6322	Output A	Relays and M-Logic	Not used
6323	Input type	Multi-input 20 to 23 EIC temp. inputs	Multi-input 20
6324	Hysteresis	1 to 70 °C	3 °C

Engine heater alarm

The engine heater alarm has a temperature set point and a timer. If the temperature gets below the set point, and the engine heater relay is closed, the timer starts. If the timer expires, and the temperature is below the set point, the alarm is activated.

Functions > Engine heater > Engine heater 1

Parameter	Text	Range	Default
6331	Set point	10 to 250 °C	30 °C
6332	Timer	1.0 to 300.0 s	10.0 s
6333	Output A	Relays and M-Logic	Not used
6334	Output B	Relays and M-Logic	Not used
6335	Enable	OFF ON	OFF
6336	Fail class	Fail classes	Warning

3.14 Ventilation

The ventilation function is used to control the cooling of the engine. The purpose is to use a multi-input for measuring the cooling water temperature. This way an external ventilation is activated to keep the engine below a maximum temperature.

Select the type of input to use in parameter 6323 *Engine heater*.

Functions > Fan > Single fan start/stop > Fan configuration > Max ventilation

Parameter	Text	Range	Default
6461	Set point	20 to 250 °C	90 °C
6462	Output A	Relays and limits	Not used
6463	Hysteresis	1 to 70 °C	5 °C
6464	Enable	ON OFF	OFF

3.14.1 Max. ventilation alarms

There are two ventilation alarms.

Functions > Fan > Single fan start/stop > Fan Alarms

Parameter	Text	Range	Default
6471	Set point	20 to 250 °C	95 °C
6472	Timer	0 to 60 s	1 s
6473	Output A	Relays and limits	Not used
6474	Output B	Relays and limits	Not used
6475	Enable	ON OFF	OFF
6476	Fail class	Fail classes	Warning

3.15 Pump logic

3.15.1 Fuel pump logic

The fuel pump logic is used to start and stop the fuel supply pump to keep the fuel in the service tank at the required level. The fuel level is detected from one of the three multi-inputs.

Parameters

Parameter	Name	Range	Default	Details
6551	Fuel pump log. start	0 to 100 % 1 to 10 s	20 % 1 s	Fuel transfer pump start point.
6552	Fuel pump log. stop	0 to 100 %	80 %	Fuel transfer pump stop point.
6553	Fuel fill check	0.1 to 999.9 s Fail classes	60 s Warning	Fuel transfer pump alarm timer and fail class. The alarm is activated if the fuel pump relay is activated, but the fuel level does not increase by 2 % within the delay time.
6554	Fuel pump log. input	Multi input [102/105/108], Ext. Ana. In [1 to 8], Auto detection	Auto detection	The multi-input or external analogue input for the fuel level sensor. Configure the input in the utility software under *I/O & Hardware setup*. Select the multi-input if 4-20 mA is used. Select *Auto detection* if a multi input with RMI fuel level is used.
6557	Fuel fill slope	1 to 10%	2%	The fuel fill slope percentage.

Relay output

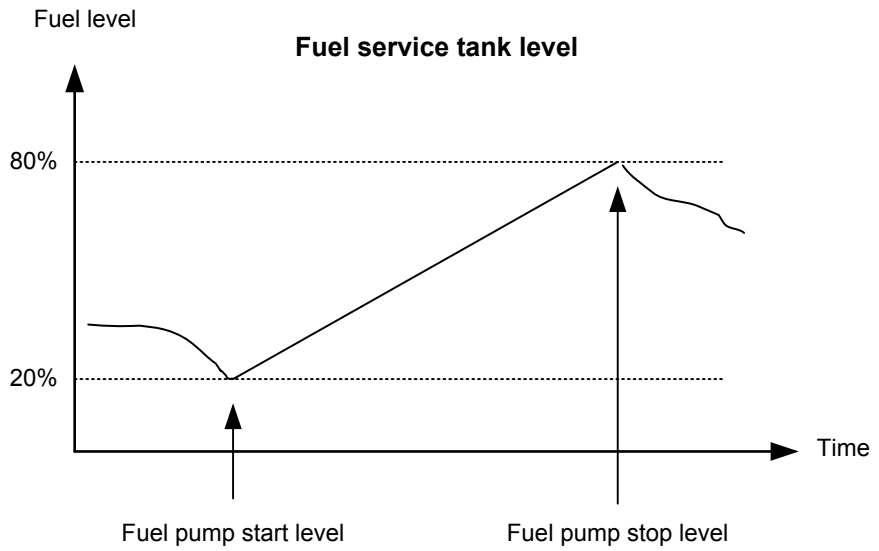
In the utility software under *I/O & Hardware setup*, select the output relay to control the fuel pump, as shown in the following example. If you do not want an alarm whenever the output is activated, configure the output relay as a limit relay.

The controller activates the relay when the fuel level is below the start limit. The controller deactivates the relay when the fuel level is above the stop limit.

NOTE The fuel pump relay can be activated using M-Logic (`Output > Command > Activate Fuel Pump`).

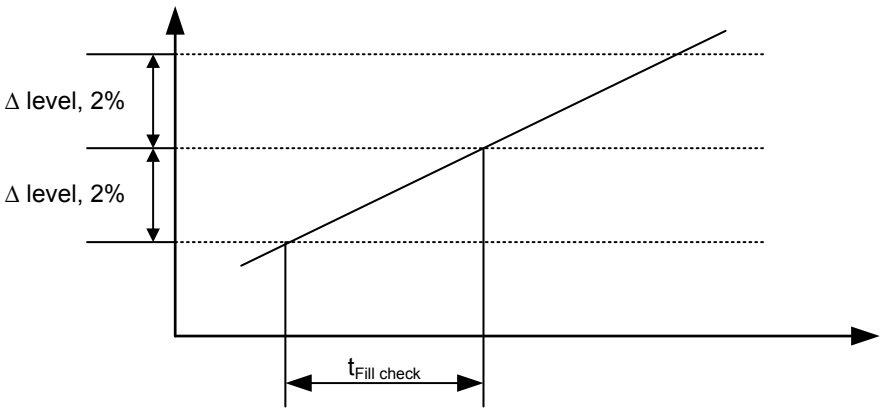
How it works

The diagram below shows how the fuel pump is started when the fuel level is 20 % and stopped again when the level is 80 %.



Fuel fill check

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 %, the controller deactivates the fuel pump relay and activates a **Fuel fill alarm**.



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

Fuel tank level and volume

You can set the capacity of the day tank in parameter 6911. The controller uses this value and the fuel level to calculate the fuel volume.

3.15.2 DEF pump logic

The DEF pump logic can start and stop the DEF pump to keep the DEF at the required level. For this function, engine interface communication (EIC) must provide the DEF level. If the EIC cannot provide the DEF level, you can use the generic fluid pump logic instead.

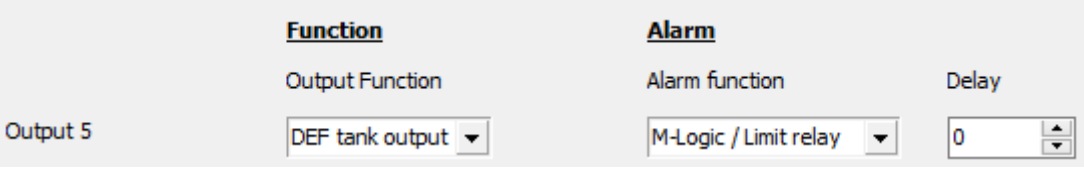
Parameters

Parameter	Name	Range	Default	Details
6721	DEF pump log. start	0 to 100 % 1 to 10 s	20 % 1 s	DEF transfer pump start point.
6722	DEF pump log. stop	0 to 100 %	80 %	DEF transfer pump stop point.
6723	DEF fill check	0.1 to 999.9 s Fail classes	60 s Warning	DEF transfer pump alarm timer and fail class. The alarm is activated if the DEF pump relay is activated, but the DEF level

Parameter	Name	Range	Default	Details
				does not increase by the DEF fill slope (see 6724) within the delay time.
6724	DEF fill slope	1 to 10 %	2 %	When the DEF pump relay is activated, this is the amount by which the DEF level must increase in the time defined in 6723.

Relay output

In the utility software under *I/O & Hardware setup*, select the output relay to control the DEF pump, as shown in the following example. If you do not want an alarm whenever the output is activated, configure the output relay as a limit relay.



The controller activates the relay when the DEF level is below the start limit. The controller deactivates the relay when the DEF level is above the stop limit.

NOTE The DEF pump relay can be activated using M-Logic (`Output > Command > Activate DEF Pump`).

3.15.3 Generic pump logic

The fluid pump logic can start and stop a pump to keep any fluid at the required level.

Parameters

Parameter	Name	Range	Default	Details
6731	Fluid pump start	0 to 100 % 1 to 10 s	20 % 1 s	Fluid transfer pump start point.
6732	Fluid pump stop	0 to 100 %	80 %	Fluid transfer pump stop point.
6733	Fluid check	0.1 to 999.9 s Fail classes	60 s Warning	Fluid transfer pump alarm timer and fail class. The alarm is activated if the fluid pump relay is activated, but the fluid level does not increase by the fluid fill slope (see 6735) within the delay time.
6734	Fluid pump log.	Multi input [102/105/108], Ext. Ana. In [1 to 8]	Multi input 102	Select the analogue input for the fluid level. Configure the input in the utility software under *I/O & Hardware setup*.
6735	Fluid fill slope	1 to 10 %	2 %	When the fluid pump relay is activated, this is the amount by which the fluid level must increase in the time defined in 6733.

Relay output

In the utility software under *I/O & Hardware setup*, select the output relay to control the fluid pump, as shown in the following example. If you do not want an alarm whenever the output is activated, configure the output relay as a limit relay.

The controller activates the relay when the fluid level is below the start limit. The controller deactivates the relay when the fluid level is above the stop limit.

NOTE The fluid pump relay can be activated using M-Logic (`Output > Command > Activate Generic Pump`).

3.16 SDU 104 integration

The SDU 104 is a parallel redundancy shutdown unit used for the protection of marine engines. You can use the SDU 104 together with the AGC 150 Engine drive marine and AGC 150 Generator marine.

How to configure AGC 150 Marine controllers for use with the SDU 104

1. Go to the *I/O & Hardware setup* tab.
2. Select the *DI 39-40-41* tab.
3. Configure the digital inputs:
   - Digital input 39: SDU comm error
   - Digital input 40: SDU status OK
   - Digital input 41: SDU warning
4. Go to the *DO 5 - 18* tab.
5. Configure *Output 13* and *Output 14*:
   - Output 13: SDU watchdog
   - Output 14: SDU fault reset
6. Go to the *Parameters* tab to configure SDU parameters 18000, 18010, and 18020. These parameters are the alarms for the digital inputs.

By default, digital output 11 is configured as *Status OK*. This output must be configured for the SDU watchdog output to work.

More information
See the **SDU 104 Installation instructions** for how to connect the SDU 104 to the AGC 150 Marine controller. You can also see how to configure the SDU 104.

3.17 Other functions

3.17.1 Unsupported application

The AGC 150 Engine drive controller has configuration limitations. If a configuration rule is broken, the controller activates the *Unsupported application* alarm. The alarm value shows which rule was broken. You can see the alarm value in the alarm log in the utility software.

3.17.2 Service timers

The controller has two service timers to monitor maintenance intervals. Click the Σ icon in the utility software to see the service timers.

The timer function is based on running hours. When the adjusted time expires, the controller displays an alarm. The running hours are counted when there is running feedback. An alarm occurs when the running hours or days expires.

The controller remembers the last reset on each service timer.

`Engine > Maintenance > Service timer [1 to 2]`

Parameter	Text	Range	Default
6111 or 6121	Enable	OFF	OFF

Parameter	Text	Range	Default
		ON	
6112 or 6122	Running hours	0 to 9000 hours	500 hours
6113 or 6123	Days	1 to 1000 days	365 days
6114 or 6124	Fail class	Fail classes	Warning
6115 or 6125	Output A	Relays and M-Logic	Not used
6116 or 6126	Reset	OFF ON	OFF

3.17.3 Diagnostics timer

Diagnostics mode is activated when the diagnostics timer expires. Use diagnostics to read ECU data without starting the engine. To configure the timer and enable diagnostics, go to *Parameters* in the utility software, and select parameter 6701.

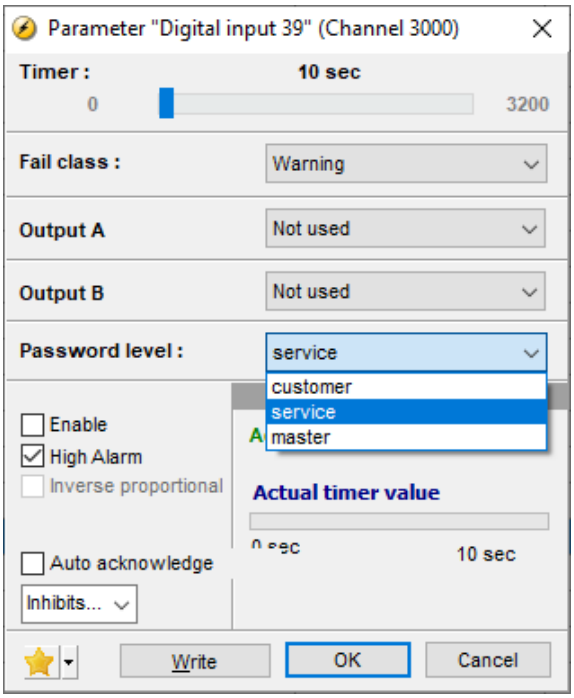
4. General functions

4.1 Password

The controller has three password levels that can be configured on the controller or from the utility software. Parameter settings cannot be changed with a lower ranking password, but are shown on the display.

Password level	Default password	Customer access	Service access	Master access
Customer	2000	●		
Service	2001	●	●	
Master	2002	●	●	●

With the utility software it is possible to protect each parameter with a specific password level. Enter the parameter and select the correct password level.



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

1. Right-click the appropriate field in the Level column.
2. Select *Change access level*.
3. Select the required access level.
   - *Customer*
   - *Service*
   - *Master*

You can see and edit permissions in the utility software on the *Tools* > *Permissions* page.

4.2 Parameter access

To adjust the parameters, the password level must be entered. If the operator is not allowed to change the parameters, the default password must be changed. It is not possible to change the password at a higher level than the password entered.

Configure the password in Service View > Password.

Parameter	Text	Range	Default
9111	Customer password	0 to 32000	2000
9112	Service password	0 to 32000	2001
9113	Master password	0 to 32000	2002

4.3 Running modes

The controller has three different running modes, a block mode and a test mode. Push the *Shortcut* button and select *Running Modes* to see the running modes and block mode. To select the test mode, push the *Shortcut* button and select *Start Test*.

Mode	Description
AUTO	The controller automatically starts and stops the engine.
SEMI-AUTO	The controller cannot automatically start and stop the engine. The operator can start these sequences using the buttons on the controller, Modbus commands or the digital inputs.
MANUAL	The operator can use the digital increase/decrease inputs (if they are configured) and the *Start* and *Stop* buttons. When the engine starts in manual mode, it will start without subsequent regulation.
BLOCK	The controller cannot start a sequence, for example the start sequence. Select the block mode when you do maintenance work on the engine.
Test	The test sequence will start when you select the test mode.

NOTE The engine will shut down if you select the block mode while the engine is operating.

4.3.1 SEMI-AUTO mode

You can operate the controller in SEMI-AUTO mode. SEMI-AUTO mode means that the controller will not start a sequence automatically as it does in AUTO mode. It will only start sequences, if external signals are given.

An external signal can be given in three ways:

1. The push-buttons on the display are used
2. The digital inputs are used
3. Modbus command

NOTE The AGC 150 is only equipped with a limited number of digital inputs. Please refer to **Digital inputs, DI** in this document for additional information about availability.

When the engine is running in SEMI-AUTO mode, the controller will control the engine speed.

SEMI-AUTO mode commands

Command	Description	Notes
Start	The start sequence is started and continues until the engine starts or the maximum number of start attempts is reached.	
Stop	The engine is stopped. Without the running signal, the stop sequence continues to be active in the extended stop time period. The engine is stopped with cooling down time.	The cooling down time is cancelled if the *Stop* button is activated twice.

Command	Description	Notes
PID1 Manual Up	The regulator is deactivated and the speed control output is activated as long as the PID1 input is ON.	
PID1 Manual Down	The regulator is deactivated and the speed control output is activated as long as the PID1 input is ON.	

4.3.2 Test mode

The test mode is activated by select the test mode on the controller or by activating a digital input.

Configuration of test parameters on the controller

1. Push the *Shortcut* button on the controller.
2. Select *Jump to parameter*.
3. Type in the menu number *7440* to configure the test parameters.

Parameter	Text	Range	Default
7041	Set point	1 to 100	80
7042	Timer	0.0 to 999.0 min	0.0 min
7043	Return mode	SEMI-AUTO mode AUTO mode No mode change MANUAL	No mode change
7044	Type	Simple test	Simple test

NOTE If the timer is set to 0.0 min., the test sequence will be infinite.

Simple test

The simple test will start the engine and run it at nominal speed. The test will run until the timer expires.

4.3.3 Manual mode

In the manual mode you can controller the engine from the controller and with digital inputs.

Table 4.1 Manual mode commands

Command	Description	Notes
Start	The start sequence is initiated and continues until the engine starts or the maximum number of start attempts are reached.	No regulation
Stop	The engine is stopped. Without the running signal, the stop sequence continues to be active in the extended stop time period. The engine is stopped with cooling down time.	
PID1 Manual Up	The controller gives signal to increase the engine speed.	
PID1 Manual Down	The controller gives signal to decrease the engine speed.	

4.3.4 Block mode

When the block mode is selected, the controller is locked for certain actions. This means that the controller cannot start the engine. You will need a password to change the running mode from the display. It is not possible to select the block mode when running feedback is present.

If digital inputs are used to change the mode, it is important that the input configured to block mode is a constant signal:

- When the signal is ON, the controller is blocked.
- When the signal is OFF, the controller returns to the mode selected before block mode.

You can only change the block mode on the display or with digital inputs. If the block mode is selected using the display after a digital block input is activated, the controller will stay in block mode after the block input is deactivated with the digital input. If you need to change the block mode now, it must be on the display. Alarms are not influenced by block mode selection.

CAUTION

Caution

Before the running mode is change, it is important to check that persons are clear of the engine and that the engine is ready for operation. You can start the engine from the local engine control panel, if such is installed. Therefore, DEIF recommends avoiding local cranking and starting of the engine.The engine will shut down if block mode is selected while the engine is running.

4.3.5 Not in AUTO mode

This function activates an alarm if the system is not in AUTO mode.

`Functions > Not in Auto`

Parameter	Text	Range	Default
6541	Timer	10.0 to 900.0 s	300.0 s
6544	Enable	OFF ON	OFF
6545	Fail class	Fail classes	Warning

4.4 M-Logic

The main purpose of M-Logic is to give the operator/designer more flexibility.

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 modes.

You can configure M-Logic in the utility software.

4.4.1 General shortcuts

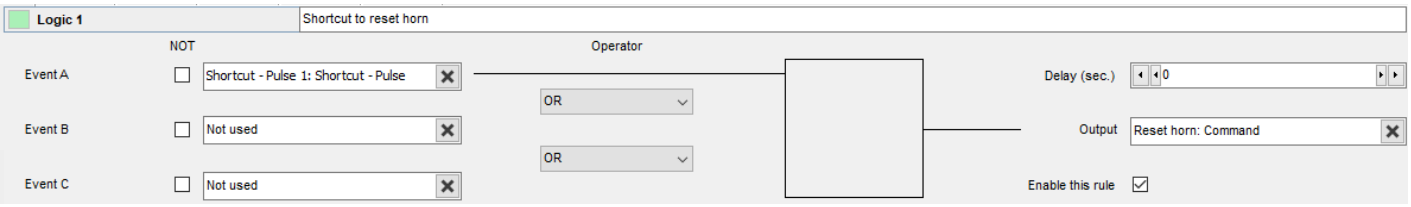
You can configure your own shortcuts with M-Logic in the utility software. You can see the configured shortcuts when you push the *Shortcut* button and select *General shortcuts*. If you have not configured a shortcut, then the *General shortcuts* menu is empty.

For a pulse shortcut, the command is sent each time you select the shortcut and press OK in the display menu.

For a switch shortcut, the switch is toggled (on/off) each time you select the shortcut.

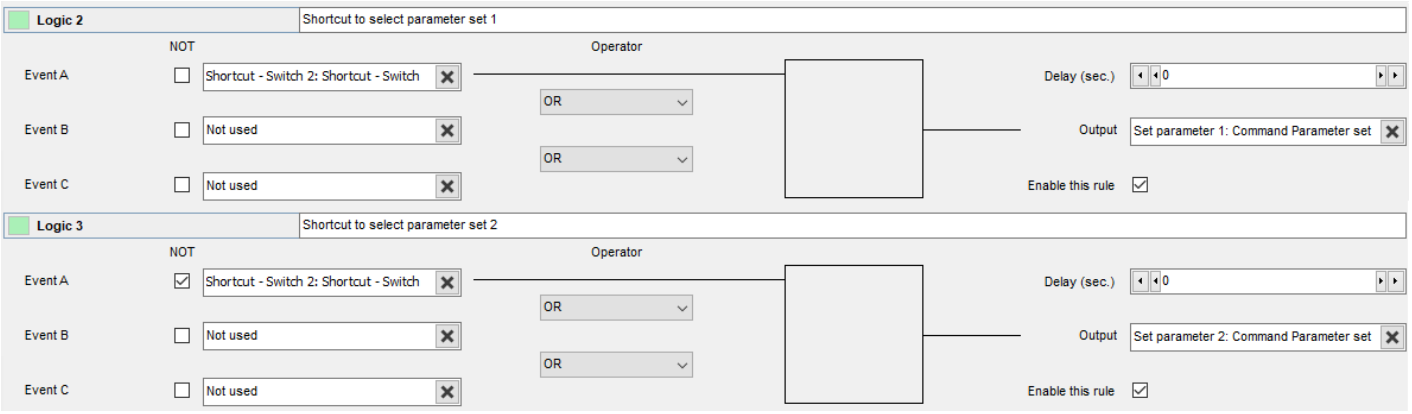
Use the *Translations* interface to rename the shortcut.

Example of shortcut pulse



Rename *SC Pulse 1* to *Reset horn*.

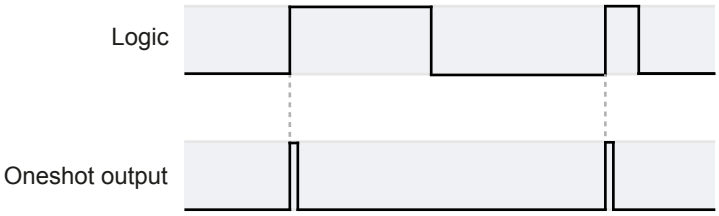
Example of shortcut switch



Rename *SC Switch 2 on* to *Use parameter set 1*. Rename *SC Switch 2 off* to *Use parameter set 2*.

4.4.2 Oneshots

Description	Notes
Oneshot set [1-16]	The oneshot is activated for a short time (about 100 ms) when the logic is true. If the logic remains true, the oneshot is not activated again. When the logic is false, the function is reset.

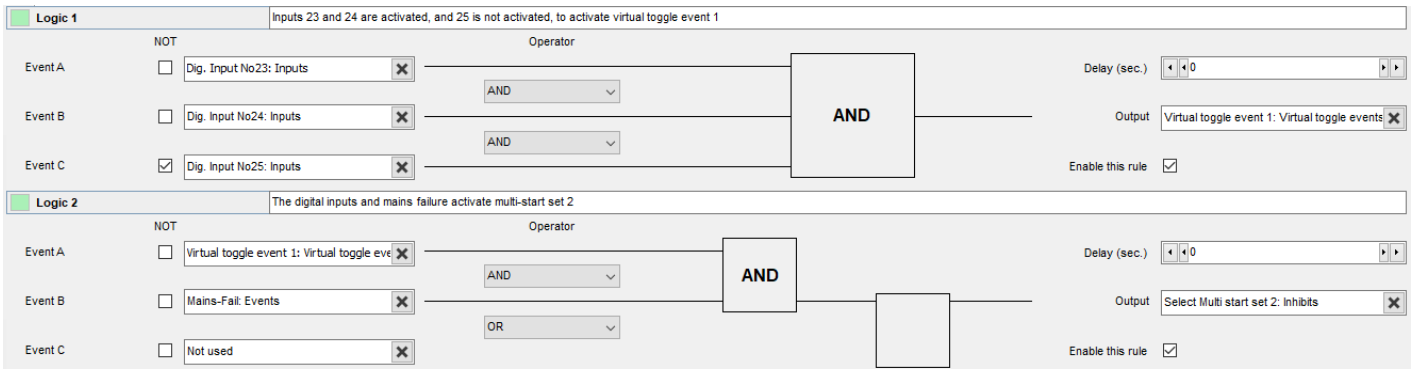


Oneshots

Description	Notes
Oneshot output [1-16]	The event is active when the oneshot output is activated.

4.4.3 Virtual toggle events

Virtual toggle events are used to expand the number of events in a logic sequence. For example, the output of Logic 1 can be used to continue the sequence in Logic 2.



- The *Logic 1* output is set to *Virtual toggle event 1*.
- *Event A* in *Logic 2* is *Virtual toggle event 1*.

Up to five events that can be used in this logic sequence (A + B + C in Logic 1 and B + C in Logic 2).

Virtual toggle events

Description	Notes
Virtual toggle event [1-96]*	Virtual toggle events 1 to 96 can be activated by Modbus. They can also be used in multiple lines of logic to increase the number of events possible in one sequence.

NOTE * Previously *Virtual event [1-96]*.

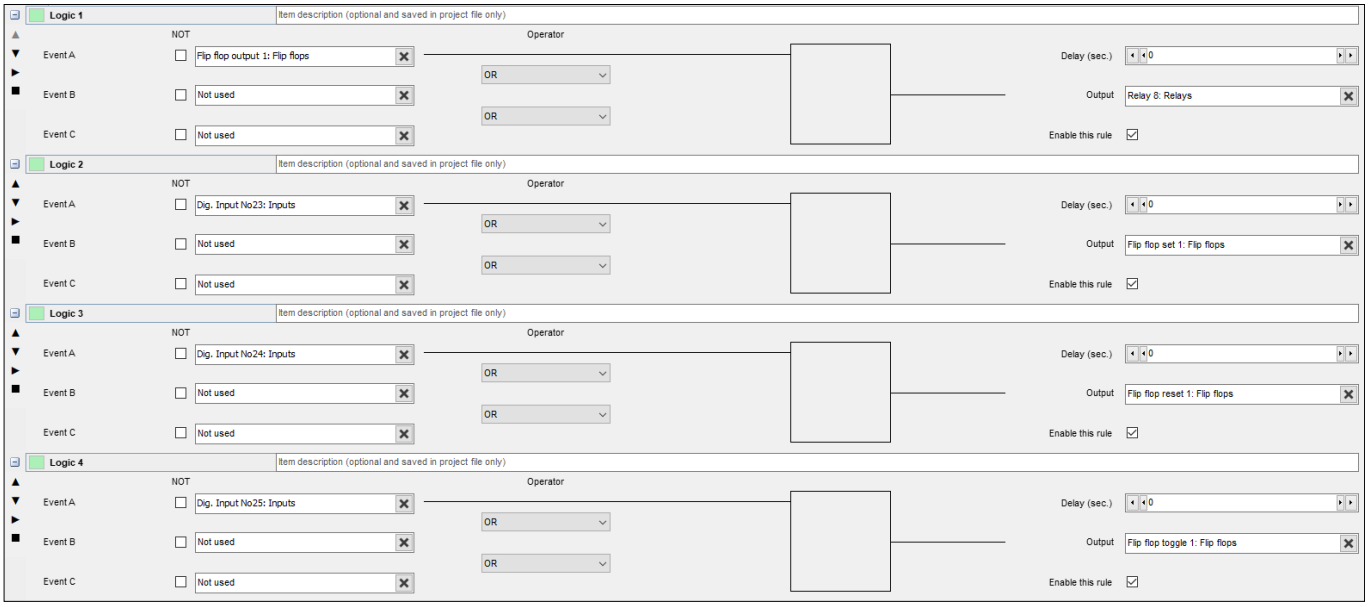
4.4.4 Flip flop function

The flip flop function makes it easy for a pulse input to latch an output, for example a relay.

The Event selects a flip flop output [1-16], and the Output selects the output function:

- Flip flop set [1-16] = Change the flip flop output state to High.
- Flip flop reset [1-16] = Change the flip flop output state to Low.
- Flip flop toggle [1-16] = Shift the flip flop output state from Low to High or from High to Low.

Example



The example shows how flip flop set 1 could be configured to set relay 8:

- Logic 1: Flip flop output 1 is selected to set the relay output.

- Logic 2: Digital input 23 is used to trigger flip flop set 1 and thus sets the relay output active.
- Logic 3: Digital input 24 is used to deactivate the relay output by triggering flip flop reset 1.
- Logic 4: Digital input 25 is used to toggle the flip flop output state.
- Relay 8 must be set to *M-Logic / Limit relay*.

If reset and set are active at the same time, the flip flop will prioritise the reset command. The set or reset function may not be active when the toggle function is used.

The flip flops are also accessible from Modbus.

4.4.5 Virtual switch events

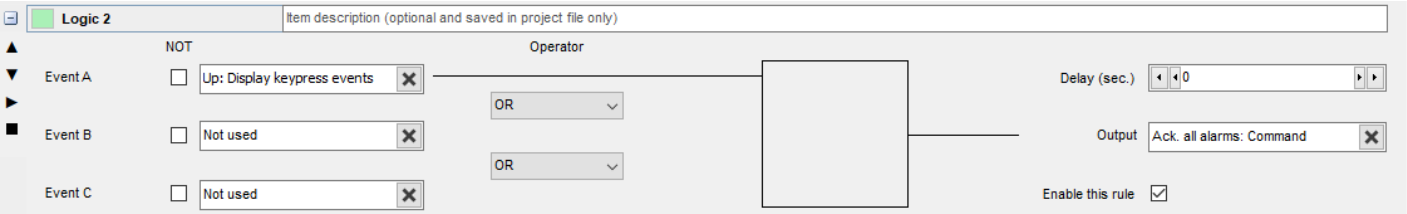
Description	Notes
Virtual switch event [1-32]	Virtual switch events 1 to 32 can be activated by Modbus. They can also be used in multiple lines of logic to increase the number of events possible in one sequence.

4.4.6 M-Logic event counters

Description	Notes
M-logic event counter limit [1-8]	The event counter has reached the limit selected in the *Counters > M-logic event counter* window.
M-logic event reset counter [1-8]	The event counter has been reset. The reset conditions are in the *Counters > M-logic event counter* window.

4.4.7 Display keypress events

Use the display keypress events to activate an output with the display buttons. For example, you can configure the *UP* button to acknowledge all alarms when you push it.



The function can also be used to detect when a button is pushed.

4.5 Timers and counters

4.5.1 Command timers

Command timers are used to execute a command at a specific time.

Up to four command timers can be configured with M-Logic. Each command timer can be set for the following time periods:

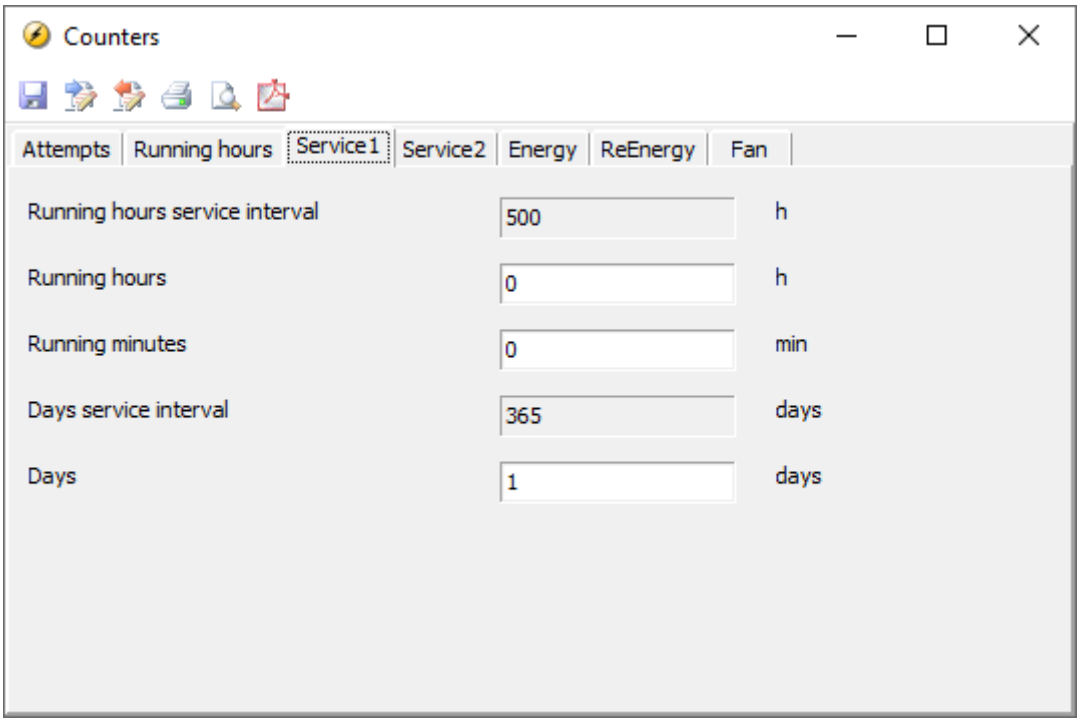
- Individual days (MO, TU, WE, TH, FR, SA, SU)
- MO, TU, WE, TH
- MO, TU, WE, TH, FR
- MO, TU, WE, TH, FR, SA, SU
- SA, SU

The time-dependent commands are flags that are raised when the command timer is in the active period.

4.5.2 USW counters

You can view and adjust a number of counters using the USW. Click the **Σ** icon to open the counters window.

AGC counters example

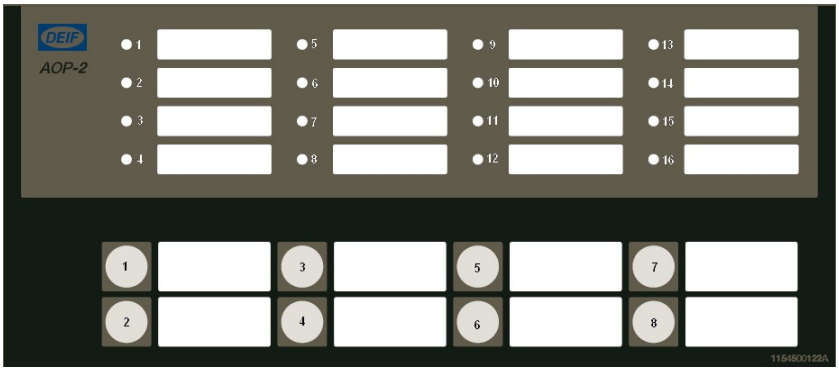


Counters	Details
Attempts	Engine start attempts
Running hours	Running hours
Service 1	Service timer to monitor the maintenance intervals
Service 2	Service timer to monitor the maintenance intervals
Fan	Running hours for the engine fan

4.6 Interfaces

4.6.1 Additional operator panel, AOP-2

The AOP-2 is an additional operator panel that can be connected to the controller using a CAN bus communication port. It can be used as an interface to the controller for indication of status and alarms together, and with buttons for, for example, alarm acknowledge and mode selection.



The configurable LEDs are named 1 to 16, and the buttons are named 1 to 8.

CAN Node ID configuration

The CAN Node ID for the AOP-2 can be set to 1-9:

1. Press buttons 7 and 8 simultaneously to activate the CAN ID change menu. The LED for the present CAN ID number is ON, and LED 16 is flashing.
2. Use button 7 (increase) and button 8 (decrease) to change the CAN ID according to the table below.
3. Press button 6 to save the CAN ID and return to normal operation.

CAN ID	Indication of CAN ID selection
0	LED 16 flashes (CAN bus OFF)
1	LED 1 ON. LED 16 flashes (default value).
2	LED 2 ON. LED 16 flashes.
3	LED 3 ON. LED 16 flashes.
4	LED 4 ON. LED 16 flashes.
5	LED 5 ON. LED 16 flashes.

Programming

Use the utility software to program the AOP-2. See the **Help** in the utility software.

4.6.2 Access lock

With the access lock on, the operator cannot change controller parameters or running modes. The input to be used for the access lock function is defined in the utility software.

Access lock is typically activated from a key switch installed behind the door of the switchboard cabinet. As soon as access lock is activated, changes from the display cannot be made.

Access lock only locks the display and does not lock any AOP or digital input. AOP can be locked by using M-Logic. It is still possible to read all parameters, timers and the state of inputs in the service menu.

You can read alarms, but not acknowledge them when access lock is activated. Nothing can be changed from the display.

This function is ideal for rental or critical equipment. The operator cannot change anything. If there is an AOP-2, the operator is still able to change up to 8 different predefined things.

NOTE The *Stop* button is not active in SEMI-AUTO mode when the access lock is activated. For safety reasons, an emergency stop switch is recommended.

4.6.3 Language selection

The controller can show several languages. The default master language is English, which cannot be changed. Different languages can be configured with the utility software.

`Basic settings > Controller settings > Language`

Parameter	Text	Range	Default
6081	Language selection	English	English

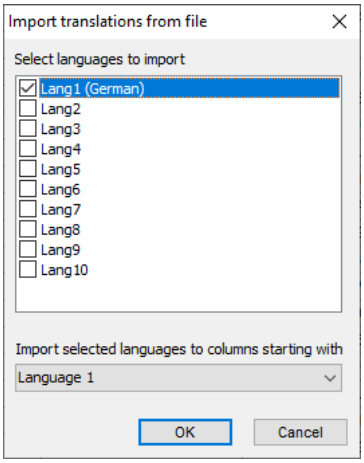
Parameter	Text	Range	Default
		Language [1 to 11]	

4.6.4 Translations

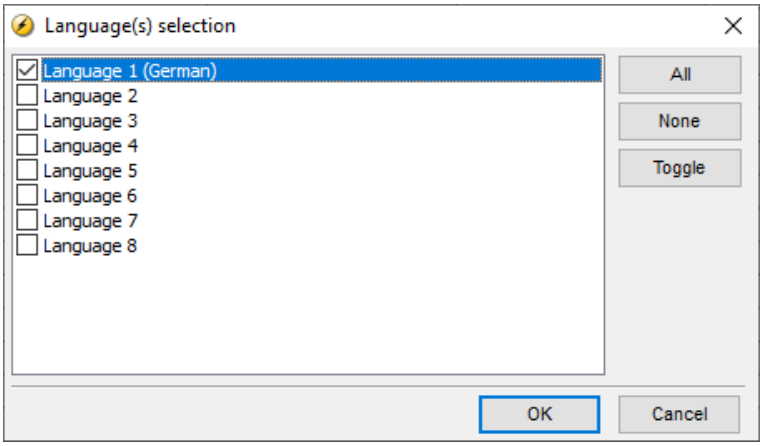
You can translate and customise the text in the controller with the utility software.

Translate the text in the controller

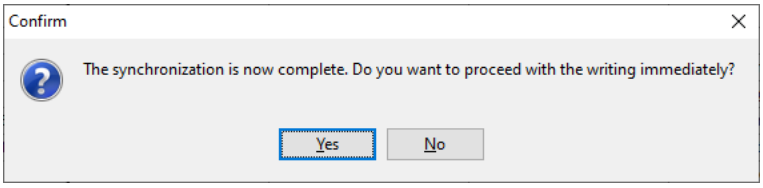
1. Go to the *Translations* tab in the left toolbar.
2. Click the *Import translations from file* icon.
3. From the pop-up window, select the language file you want to import.
4. Select the language to import (lang1), and select the column to import the translations to.



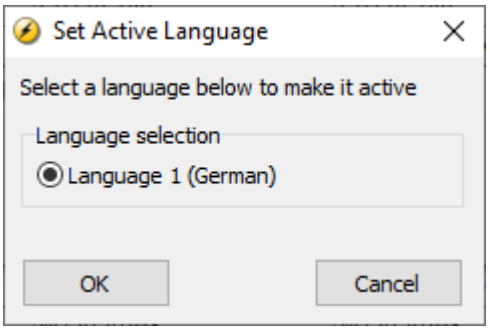
5. Once the translations are imported, you might get a warning stating that *Some translations were not imported*. Click *OK*.
6. To write the imported translations to the controller, click the *Write to controller* icon.
7. In the pop-up window, select the language you want to write to the controller.



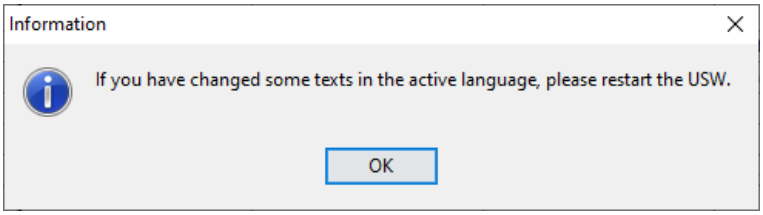
8. Click *OK*.
9. Select *Yes* to confirm you want to continue the writing procedure.



10. In the pop-up window, select the language you want to activate and click *OK*.



11. Click the *OK* button on the information message and if necessary, restart the utility software.



12. The text in the controller is now updated.

Customise the translations

To customise the translations, click on the cell with the text you want to edit. You can now edit the text. The text is automatically saved when you have finished editing.

You can also double-click on the phrase or word you want to edit in the *Master language* column. In the pop-up window, you can edit that particular phrase for all the language columns.

Change the placement of the translations

1. Select the *Edit language sequence* icon.
2. From the list on the left, select the language you want as the first in the sequence (after the master language), and click the > button to move the selected language.
3. Repeat step 2 for the remaining languages in the current sequence.
4. To change the position of a language in the new sequence, click on the language you want to move, and use the *Up* and *Down* buttons to move the language.
5. Click *OK* when you have finished.

NOTE You cannot edit the Master language.

4.7 Alarm list monitoring

Alarm list monitoring allows you to view all active alarms using Modbus, which is useful for remote monitoring and touch screen devices, for example AGI and SCADA/BMS systems. The alarms are in Modbus addresses 28000 to 28099 and these are not listed in the *Input register (04)*.

The Modbus address for an active alarm corresponds to the address value in the utility software. For example, Modbus address 309 is equal to parameter 4530 Crank failure as the address in the utility for this parameter is 309.

All groups | Regulation | Digital In | Analogue In | Outputs | General | Engine test | Communication | Jump | USW

Drag a column header here to group by that column

Category	Channel	Text	Address	Value	Unit	Timer
Analogue In	4510	Overspeed 1	307	110	%	
Analogue In	4520	Overspeed 2	308	120	%	
Analogue In	4530	Crank failure	309	50	RPM	

5. General purpose PID

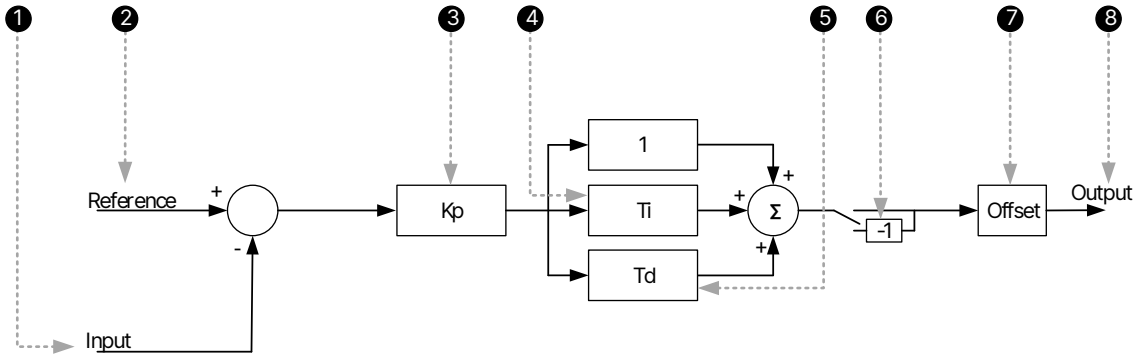
5.1 Introduction

The general purpose PID controllers are principally similar to the PID controllers for regulation. They consist of a proportional, an integral and a differential part, and the integral and differential parts are dependent on the proportional gain.

The general purpose PIDs are slightly less responsive. They are meant to control temperature, fans and so on. Configuration of the general purpose PIDs is documented by describing the possibilities of the general purpose PID interface, and with examples of configuration for different purposes.

5.1.1 General purpose PID analogue loop

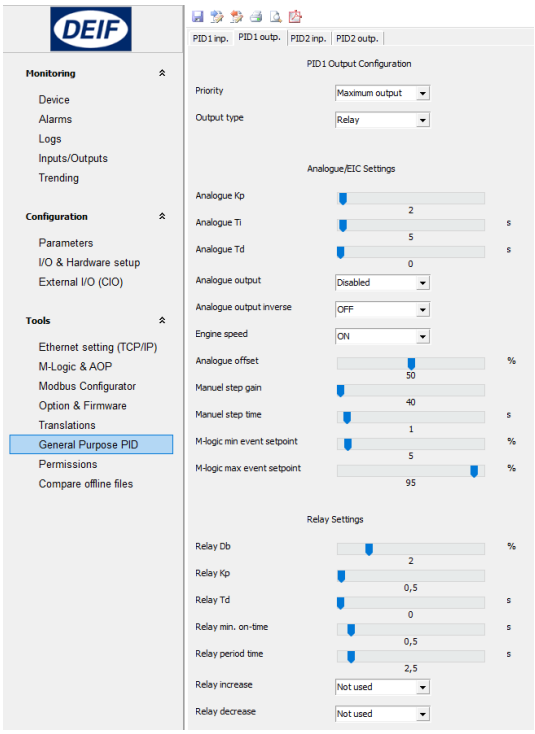
The analogue regulation in the general purpose PIDs is handled by a PID loop. The diagram below shows which elements the PID loop consists of.



1. **Input:** This is the analogue input that measures the process the controller is trying to regulate.
2. **Reference:** This is the set point that the controller is trying to bring the input to match.
3. **Kp:** The proportional gain of the PID loop.
4. **Ti:** The integral gain of the PID loop.
5. **Td:** The derivative gain of the PID loop.
6. **Inverse:** Enabling inverse will give the output a negative sign.
7. **Offset:** The offset is added on the function and displaces the regulation range.
8. **Output:** This is the final output from the PID, controlling the transducer.

5.1.2 General purpose PID interface in the utility software

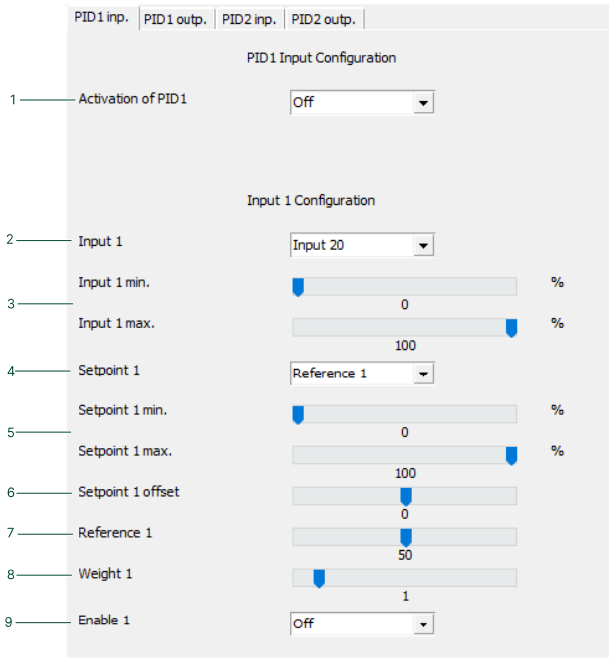
Configuration of the general purpose PID's input and output settings is done with the PID interface in the utility software. It cannot be done from the controller.



5.2 Inputs

Each output can have up to three inputs. Only one input at a time is used for calculation of the output signal.

Explanation of general purpose PID settings



1. **Activation drop-down**: Enables the PID or allows it to be enabled from M-Logic.
2. **Top drop-down**: The source of this input is chosen here.
3. **Input 1 min.** and **Input 1 max.**: Defines the scale of the input value evaluated.
4. **Setpoint 1**: Set point used for regulation. Select *Reference 1* to define the set point in this box. Alternatively, select a set point source.
5. **Setpoint 1 min.** and **Setpoint 1 max.**: The minimum and maximum value for set point 1.
6. **Setpoint 1 offset**: The offset for set point 1.
7. **Reference 1**: Select the general purpose PID set point for this input. *Reference 1* must be selected for **Setpoint 1**.
8. **Weight 1**: The weight factor is multiplied by the input value.
   - A weight factor of 1 means that the real input value is used in calculations.
   - A weight factor of 3 means that the input value is considered three times as big in calculations.
9. **Enable 1**:
   - On: This input will be evaluated.
   - Off: This input will not be evaluated.

5.2.1 Dynamic input selection

Each general purpose PID can have up to three active inputs. All activated inputs are evaluated constantly, and the input causing the greatest or smallest output is selected. Priority of great or small output is selected in the output settings.

Example: Dynamic input selection Ventilation of a container fitted with an engine inside is a good example for use of the dynamic input selection. The following two variables depend on the ventilation, and it therefore makes sense to let them share the output.

- The container is fitted with a temperature sensor for internal container temperature. Due to the lifetime of electronics inside the container, the maximum maintained temperature needs to be 30 °C. (Input 1).
- The engine air intake is located inside the container, hence turbo compressor inlet temperature depends on the air temperature in the container. Maximum maintained intake air temperature is 32 °C. (Input 2).

This is the data that is used to configure the inputs in the screenshot in the previous paragraph (Inputs). The two inputs are configured with both full range of measurement (0 to 100 %) and a weight factor of 1. The common output to the ventilator speed drive is configured to prioritise maximum output as explained in the next chapter, “Output”. This configuration makes sure that none of the input set points are continuously exceeded, unless maximum ventilation is reached.

An example of operation is the controller has been using input 1, and a temperature of 30 °C is maintained in the container. At one point, the air filter housing is heated by radiation from the engine, causing input 2 to rise more above 32 °C than input1 is above 30 °C. This means that input 2 now has the greatest positive deviation. All inputs are configured with a weight factor of 1 and maximum output is prioritised, hence the greatest positive deviation results in maximum output, or, to put it in another way, input 2 is now the one selected.

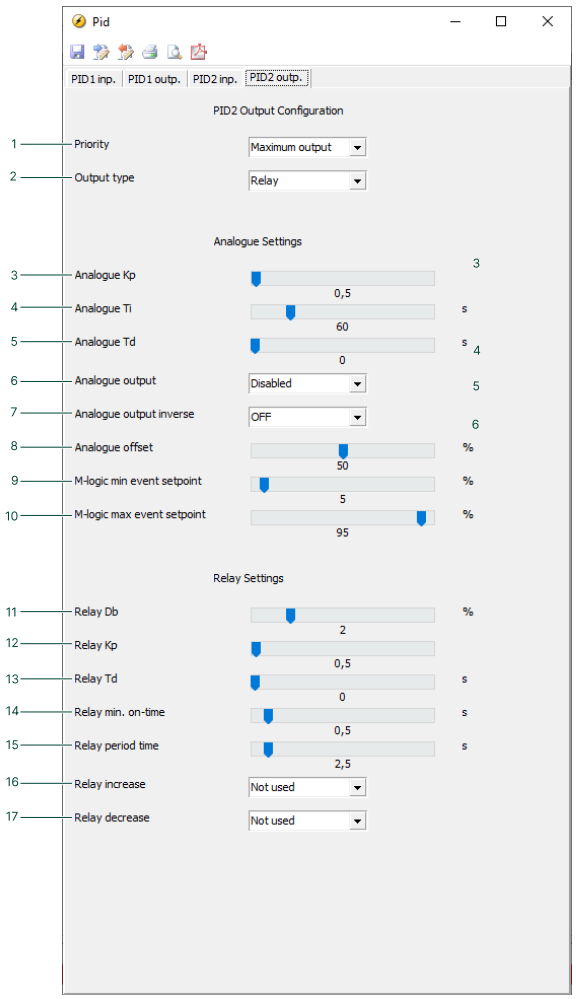
In case of high ambient temperatures, the ventilation might not be able to influence the temperature enough, and the temperatures start to rise above set point. The output will stay at 100 % as long as any of the inputs are continuously above their set points.

Weight factor applies to dynamic input selection as well. In the event that different weight factors have been configured for any of the three inputs, maximum deviation cannot be equated to maximum output. If two inputs with similar deviation to their respective set points are configured with weight factors of 1 and 2 respectively, the latter will result in twice the output as the first.

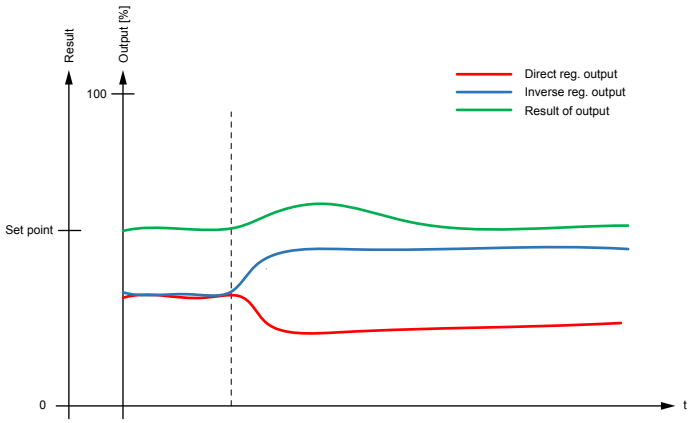
5.3 Outputs

5.3.1 Explanation of output settings

Explanation of general purpose PID settings

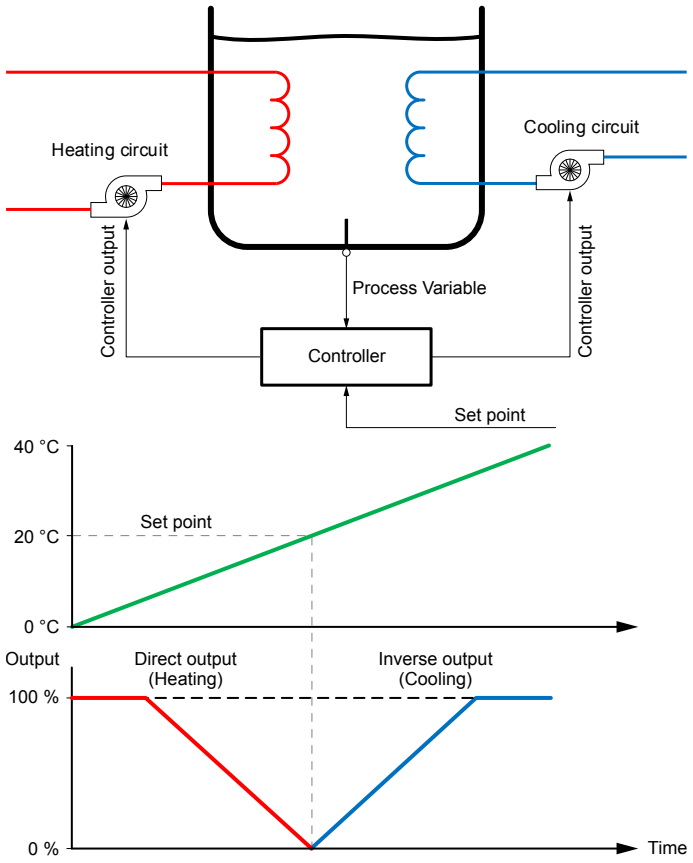


1. **Priority**: This setting determines whether it is min. or max. output that is prioritised. This setting is used for the dynamic input selection feature. Maximum output results in selection of the input that gives the greatest output. Minimum output results in selection of the input that gives the smallest output.
2. **Output type**: Choose between relay or analogue output. For PID1 EIC is also an option. The following parameters marked “analogue” only apply to the use of analogue regulation, in the same way as parameters marked “relay” only apply to relay regulation.
3. **Analogue Kp**: This is the proportional gain value. Increasing this value gives a more aggressive reaction. Adjusting this value also affects the integral and derivative output. If Kp needs adjustment without affecting the Ti or Td part, adjust these accordingly.
4. **Analogue Ti**: Increasing the Ti results in less aggressive integral action.
5. **Analogue Td**: Increasing the Td gives more aggressive derivative action.
6. **Analogue output**: Choose the physical internal or external output.
7. **Analogue output inverse**:Enabling this inverses the output function.



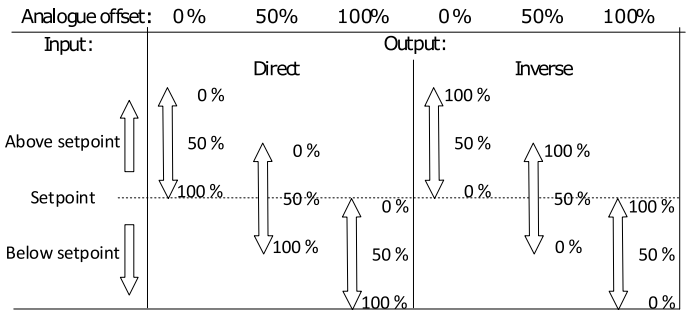
Direct error = SP - PV
Inverse error = PV - SP
Direct output is used in applications where a rise in analogue output increases the process variable.
Inverse output is used in applications where a rise in analogue output decreases the process variable.

Example explaining direct and indirect regulation



Typically, heating applications use direct output and cooling applications use inverse output. Imagine a container of water, which must be kept at a set point of 20 °C at all times. The container can be exposed to temperatures between 0 and 40 °C, hence it is fitted with both a heating coil and a cooling coil. See the illustrations of this below here. For this application, two controllers must be configured: one with direct output for the heating pump and one with inverse output for the cooling pump. To achieve the illustrated inverse output, an offset of 100 % is needed. See the sections about “Analogue offset” and “Example of inverse output with 100 % offset” for more information regarding offset. Temperatures below 20 °C then result in a positive output for the heating pump, in the same way as temperatures above 20 °C result in a positive output for the cooling pump, and the temperature is maintained around the set point.

8. **Analogue offset**: Determines the output starting point. The full range of output can be seen as values in the range between 0 and 100 %. The offset displaces this range. 50 % offset centres the range of output at the set point. 0 and 100 % offset result in having the full range of output above or below the set point. See the table below for illustration of how the output behaves according to the input and with different offsets.



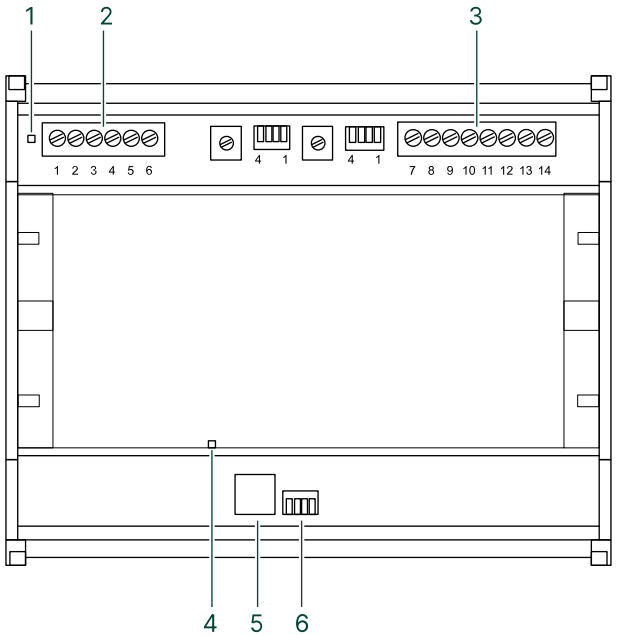
100 % offset is commonly used with inverse output, like in the previous cooling example.

9. **M-Logic min event set point**: Determines the output of M-Logic function PID1 force min. Outp.
10. **M-Logic max event set point**: Determines the output of M-Logic function PID1 force max. Outp.
11. **Relay Db**: Deadband setting for relay control.
12. **Relay Kp**: Proportional gain value for relay control.
13. **Relay Td**: Derivative output for relay control.
14. **Relay min on-time**: Minimum output time for relay control. Set this to the minimum time that is able to activate the controlled actuator.
15. **Relay period time**: Total time for a relay activation period. When the regulation output is above this period time, the relay output is constantly activated.
16. **Relay increase**: Choose the terminal for the relay used for positive activation.
17. **Relay decrease**: Choose the terminal for the relay used for negative activation.

5.3.2 Additional analogue outputs with IOM 230

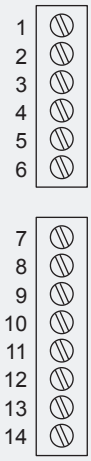
The controller has two built-in analogue outputs. The controller also supports up to two IOM 230 analogue interface modules, which provides four additional analogue outputs.

Table 5.1 IOM 230 overview



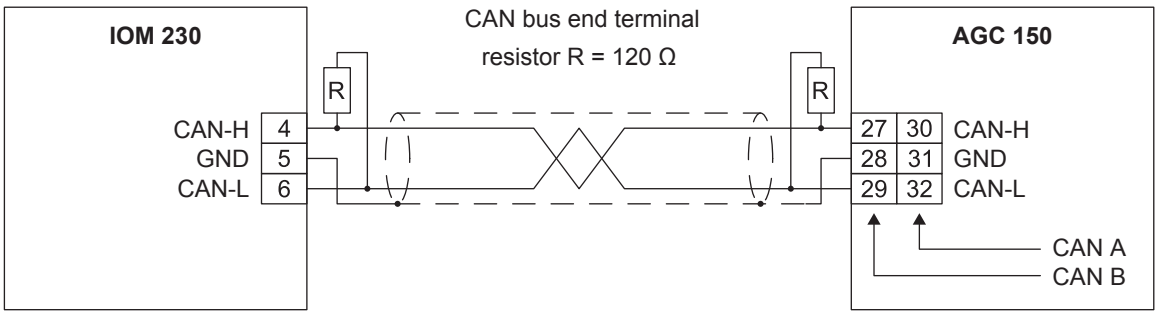
1. IOM 230 status LED (green = system OK, red = system failure)
2. Terminals 1 to 6
3. Terminal 7 to 14
4. CAN status LED (green = system OK, red = system failure)
5. PC port
6. IOM 230 CAN ID selector

Table 5.2 IOM 230 Terminals

	Terminal	Description	Comment
	1	+12/24V DC	Power supply
	2	0V DC	
	3	Not used	-
	4	CAN-H	CAN bus interface
	5	CAN-GND	
	6	CAN-L	
	7		
	8		
	9		
	10		
	11	Not used	-
	12	VAr share out	Load sharing lines
	13	Common	
	14	P share out	

CAN bus connections

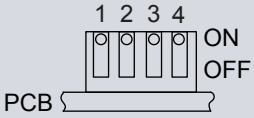
Figure 5.1 Example of CAN bus connections



The cable shield must not be connected to ground, only to the GND terminals.

Use different CAN addresses for the different IDs. Only ID0 participate in the load share functionality

IOM 230 CAN ID selector settings

	IOM ID	Switch 1	Switch 2	Switch 3	Switch 4
	ID0	OFF	OFF	OFF	OFF
	ID1*	ON	OFF	OFF	OFF
	ID2	OFF	ON	OFF	OFF

All other combinations = ID0.

NOTE *ID1 is used for PID1 and PID2.

More information
See **IOM 200 analogue interface for AGC 200 Application notes** for more information about IOM 230.

5.4 M-Logic

All functions of the general purpose PIDs can be activated and deactivated using M-Logic. In the following, events and commands regarding the general purpose PIDs are described.

Events

- **PID active**: This event is active when the related PID is activated.
- **PID at min output**: This event is active when the output is below the output parameter M-Logic min event set point.
- **PID at max output**: This event is active when the output is above the output parameter M-Logic max event set point.
- **PID using input 1**: This event is active when dynamic input selection has selected input 1 for output calculation.
- **PID using input 2**: This event is active when dynamic input selection has selected input 2 for output calculation.
- **PID using input 3**: This event is active when dynamic input selection has selected input 3 for output calculation.
- **PID Modbus control**: This event is active when remote Modbus control of this PID is requested.

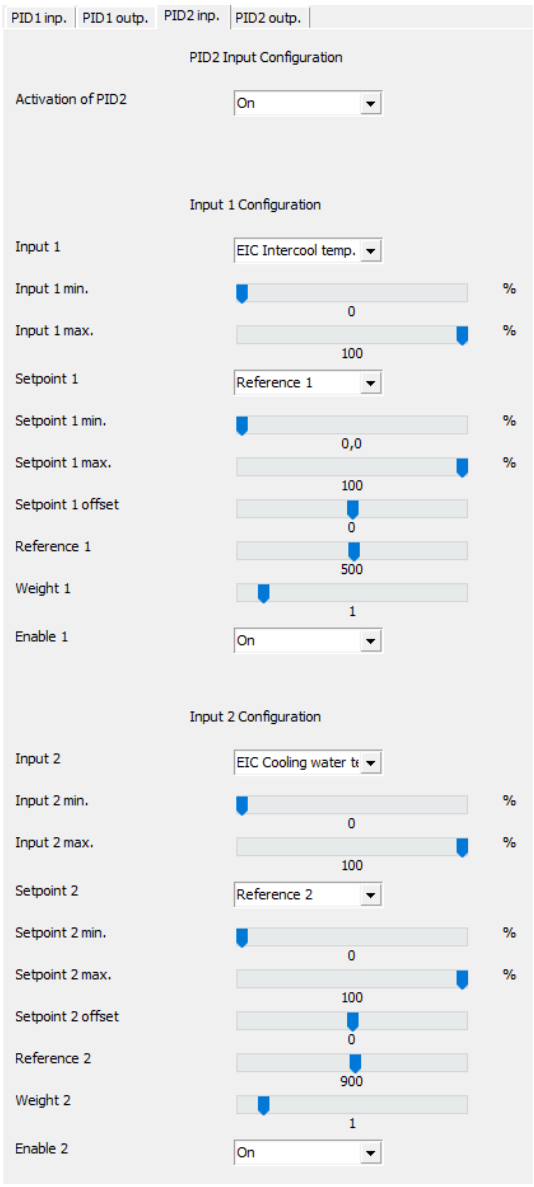
Commands

- **PID activate**: This command activates the PID controller.
- **PID force min. outp.**: This command forces the output to the value set in the output parameter Analogue min outp.
- **PID force max. outp.**: This command forces the output to the value set in the output parameter Analogue max outp. (for example, for post-cooling purposes).
- **PID reset**: This command forces the output to the value set in the output parameter Analogue offset.
- **PID Freeze**: This command freezes the output at the current value.

5.5 Example: Use of a general purpose PID

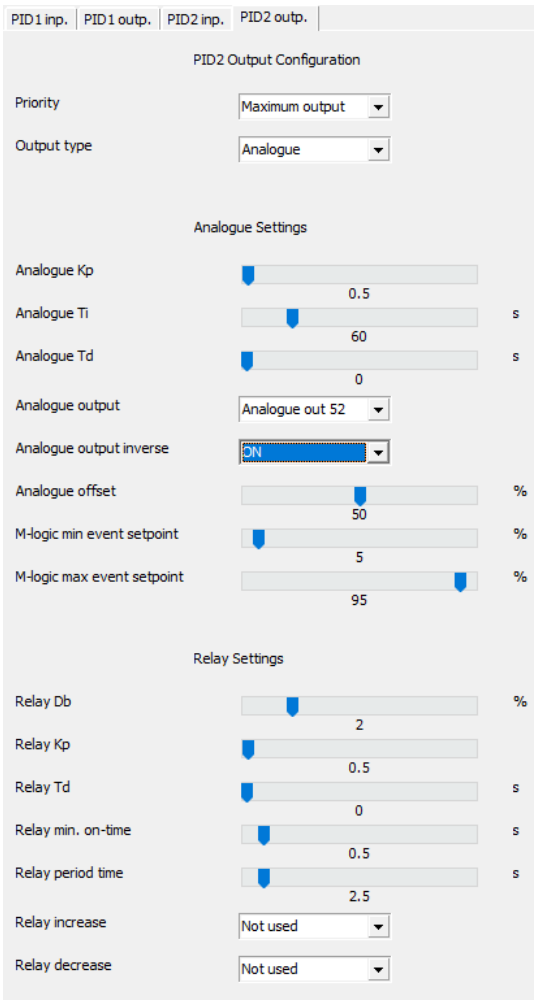
In this example a general purpose PID is used for analogue fan control.

The fan is mounted on a radiator “sandwich” construction. The fan drags air through two radiators, one for cooling of the intercooler coolant and one for cooling of the jacket water. As these two systems have different temperature set points, the dynamic set point selection is used. PID2 is used in this example, and the following image shows an example of input settings.



The ECM (Engine Control Module) measures both the intercooler coolant temperature as well as the jacket cooling water temperature. The engine controller receives these values by an EIC option (Engine Interface Communication).

EIC Intercool temp. is selected as input 1, and EIC Cooling water temp. as input 2. Min. and max. values are configured for full range. The input 1 reference set point is set at 500 to achieve a temperature set point of 50.0 °C for intercooler coolant. Input 2 has a reference set point set at 900 to achieve a set point of 90.0 °C jacket water coolant. To achieve equal weighting of the inputs when calculating the output, both weight factors are set to a value of 1. Input 1 and 2 are activated.



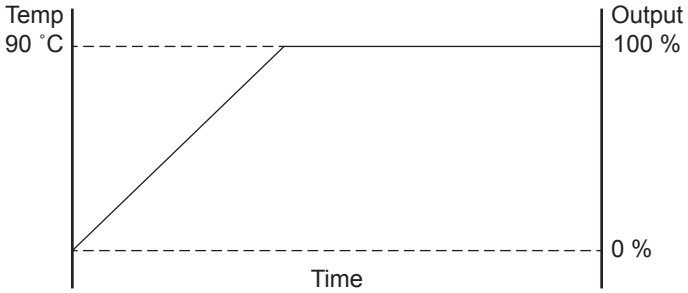
In this application, none of the temperatures must permanently exceed their set points. To make sure that this does not happen the maximum output is selected as priority for the dynamic input selection:

- Analogue is selected as output type, and Analogue output 52 is selected as the analogue output.
- Inverse output is activated to obtain a rise in analogue output to the fan when the temperature rises.
- An offset of 100 % is chosen to achieve 100 % output at the set point.
- Full range of output is selected. As this is output for a fan, it may be preferred to use a minimum output.
- Standard settings are used for M-Logic min./max. events.
- No relay settings are configured, as this is an analogue function.

Below is an example of M-Logic lines for this application. Logic 1 makes sure that the regulation is active and the output is calculated as long as the engine is running. Logic 2 forces the fan to maximum speed during cool-down to ensure efficient cool-down.

When the engine is started and operating, the regulation is activated and an output is calculated. When either the intercooler or jacket water coolant exceeds their set point, the output starts to increase from 0 %. The input that results in calculation of the greatest output is prioritised at all times, making sure that both systems are supplied with adequate cooling. During the stop sequence, the fan is forced to max. output, ensuring most possible cooling. The output remains at 0 % until the engine is started again.

This is an example that uses inverse output combined with 0 % offset. The application is an engine with electric thermostat control. During engine start-up, it is preferred to start the output before the set point is reached, to help avoid overshooting the set point too much. This is obtained by using inverse output with no offset. The diagram below illustrates this function if the controller is configured as straight proportional without integral or derivative action. With these settings, the output is 100 % when the set point is reached, and the beginning of the output is determined by the proportional gain.


Temp
90 °C
Output
100 %
0 %
Time

6. Inputs and outputs

6.1 Digital inputs

6.1.1 Standard digital inputs

The controller has as standard 12 digital inputs, located on terminals 39 to 50. All inputs are configurable.

Digital inputs

Input	Text	Function	Technical data
39	In	Auto start/stop *	Negative switching only, < 100 Ω
40	In	Configurable	Negative switching only, < 100 Ω
41	In	Configurable	Negative switching only, < 100 Ω
42	In	Configurable	Negative switching only, < 100 Ω
43	In	Configurable	Negative switching only, < 100 Ω
44	In	Configurable	Negative switching only, < 100 Ω
45	In	Configurable	Negative switching only, < 100 Ω
46	In	Configurable	Negative switching only, < 100 Ω
47	In	Configurable	Negative switching only, < 100 Ω
48	In	Configurable	Negative switching only, < 100 Ω
49	In	Configurable	Negative switching only, < 100 Ω
50	In	Configurable	Negative switching only, < 100 Ω

NOTE * The AGC 150 Engine drive marine controller does not support the auto start/stop function.

6.1.2 Configuring digital inputs

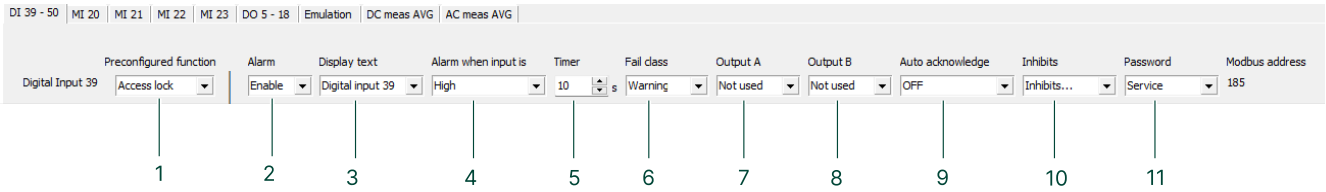
The digital inputs can be configured from the controller or with the utility software (some parameters can only be accessed with the utility software).

`I/O settings > Inputs > Digital input > Digital input [39 to 50]`

Parameter	Text	Range	Default
3001, 3011, 3021, 3031, 3041, 3051, 3061, 3071, 3081, 3091, 3101 or 3111	Delay	0.0 to 3200 s	10.0 s
3002, 3012, 3022, 3032, 3042, 3052, 3062, 3072, 3082, 3092, 3102 or 3112	Output A	Relays and M-Logic	Not used
3003, 3013, 3023, 3033, 3043, 3053, 3063, 3073, 3083, 3093, 3103 or 3113	Output B	Relays and M-Logic	Not used
3004, 3014, 3024, 3034, 3044, 3054, 3064, 3074, 3084, 3094, 3104 or 3114	Alarm	Disable Enable	Disable
3005, 3015, 3025, 3035, 3045, 3055, 3065, 3075, 3085, 3095, 3105 or 3115	Fail class	Fail classes	Warning
3006, 3016, 3026, 3036, 3046, 3056, 3066, 3076, 3086, 3096, 3106 or 3116	Type	High Low	High

Configure a digital input with the utility software

In the utility software, in *I/O & Hardware setup*, select the digital input to configure.



No.	Text	Description
1	Preconfigured function	Select a function for the digital input.
2	Alarm	Activates or deactivates the alarm function.
3	Display text	Select the display text. This is also shown on the display.
4	High alarm	The alarm is activated when the signal is high.
5	Timer	The timer setting is the time from the alarm level is reached until the alarm occurs.
6	Fail class	Select the required fail class from the list. When the alarm occurs, the controller reacts according to the selected fail class.
7	Output A	Select the terminal (or the limit option) to be activated by an alarm. Limit makes the alarm useable as an input event in M-Logic.
8	Output B	Select the terminal (or the limit option) to be activated by an alarm. Limit makes the alarm useable as an input event in M-Logic.
9	Auto acknowledge	If this option is set, the alarm is automatically acknowledged if the signal related to the alarm disappears.
10	Inhibits	Select the exceptions to when an alarm must be activated. To select when the alarms are to be active, each alarm has a configurable inhibit setting.
11	Password level	Select the password level that is needed to modify this parameter (cannot be edited by a user with lower privileges).

Click on the *Write to device* button to write the settings to the controller.

6.1.3 Digital input functions

The controller has a number of digital input functions, as shown in the following tables.

Digital inputs for the Engine drive controller

Function	Details	AUTO mode	SEMI-AUTO mode	Test mode	Man. mode	Block mode	Type[1]
Start enable	This input must be activated to be able to start the engine. When the engine is operating, the input can be removed.	●	●	●	●		C
Auto start/ stop	The engine will start when this input is activated. The engine will stop if the input is deactivated. The input can be used when auto mode is selected.	●					C
Remote start	This input starts the start sequence for the engine when SEMI-AUTO or Manual mode is selected.		●		●		C
Remote stop	This input starts the stop sequence of the engine when SEMI-AUTO or Manual mode is selected. The engine will stop without cooling down.		●		●		C
Alternative start		●	●	●	●	●	C

Function	Details	AUTO mode	SEMI-AUTO mode	Test mode	Man. mode	Block mode	Type[1]
Remove starter	The start sequence is deactivated. This means the start relay deactivates, and the starter motor will disengage.	●	●	●	●		C
Low speed	Disables the regulators and keeps the engine operating at a low RPM. The governor must be prepared for this function.	●	●	●	●		C
Binary running detection	The input is used as a running indication of the engine. When the input is activated, the start relay is deactivated.	●	●	●	●	●	C
Oil pressure alarm	The oil pressure alarm is activated if the oil pressure exceeds the set point. The function automatically sets *Not run status* as the inhibit, the alarm input as *Low*, and *Shutdown* as the fail class.	●	●	●	●	●	C
Water temperature alarm	The water temperature alarm is activated if the water temperature exceeds the set point. The function automatically sets *Shutdown override* as the inhibit, the alarm input as *Low*, and *Shutdown* as the fail class.	●	●	●	●	●	C
SEMI-AUTO mode	Changes the running mode to SEMI-AUTO.	●		●	●	●	P
AUTO mode	Changes the running mode to AUTO.		●	●	●	●	P
Manual mode	Changes the running mode to Manual.		●	●		●	P
Block mode	Changes the running mode to Block.	●	●	●	●		C
Man. PID1 up [2]	If manual mode is selected, then the speed control output will be increased.				●		C
Man. PID1 down [2]	If manual mode is selected, then the speed control output will be decreased.				●		C
Access lock	Activating the access lock input deactivates the control display buttons. It will only be possible to view measurements, alarms and the log.	●	●	●	●	●	C
Remote alarm ack.	Acknowledges all present alarms, and the alarm LED on the display stops flashing.	●	●	●	●	●	C
Shutdown override	This input deactivates all protections except the over-speed protections, the emergency stop input, the fast over-current protection, and the EIC over-speed protection. A special cool down timer is used in the stop sequence after activation of this input. Active alarms for deactivated protections are still shown in the alarm list and log, but the failclass is still inhibited.	●	●	●	●		C
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.	●	●				P
Switchboard error	The input will stop or block the engine, depending on running status.	●	●	●	●	●	C
Allow safe regeneration	See the **CAN bus engine communication manual** for details.	●	●	●	●		P
Simulate start button push	This input is used to simulate the start button being pushed.		●	●	●		P

Function	Details	AUTO mode	SEMI-AUTO mode	Test mode	Man. mode	Block mode	Type[1]
Simulate stop button push	This input is used to simulate the stop button being pushed.		●	●	●		P
Simulate AUTO mode button push	This input is used to simulate the AUTO mode button being pushed.		●	●	●		P
Simulate MANUAL mode button push	This input is used to simulate the MANUAL mode button being pushed.		●	●	●		P
Simulate alarm list button push	This input is used to simulate the alarms button being pushed.		●	●	●		P

Note [1] C = Continuous, P = Pulse.

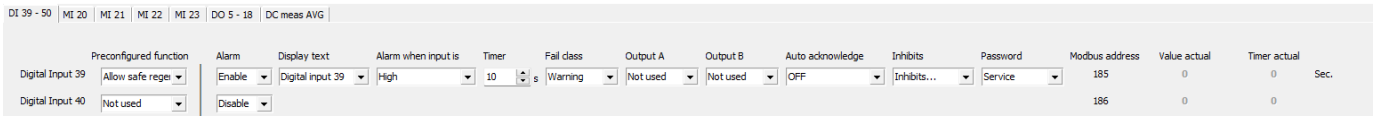
[2] Can only be used in manual mode.

6.1.4 Custom alarms

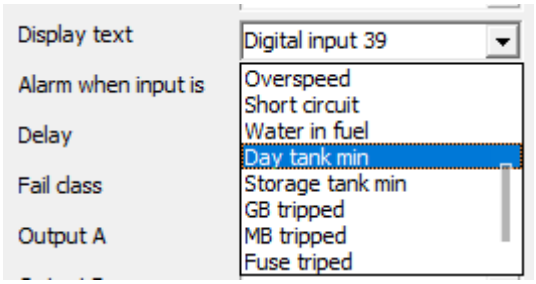
You can configure custom alarms for the digital inputs using the utility software or on the controller.

In the utility software

1. Select the *I/O & Hardware setup* tab.
2. Select one of the digital input tabs.
3. You can configure custom alarms for each active digital input. You must select *Enable* from the *Alarm* drop-down menu to see the alarm options.

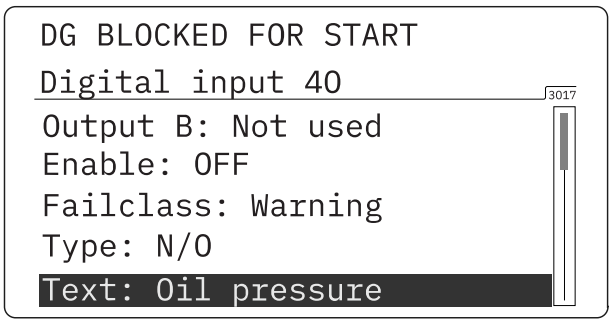


4. Pre-defined display text options are available for the custom alarms:



On the controller

Go to `Parameters > I/O settings > Inputs > Digital inputs > Digital input XX > Text`. Select from a range of pre-defined text options.



6.2 DC relay outputs

The controller has 12 DC relay outputs as standard. The outputs are put into two groups with different electrical characteristics.

All outputs are configurable, unless otherwise stated.

Relay outputs, group 1

Electrical characteristics

- Voltage: 0 to 36 V DC
- Current: 15 A DC inrush, 3 A DC continuous

Relay	Default
Relay 05	Run coil
Relay 06	Crank

Relay outputs, group 2

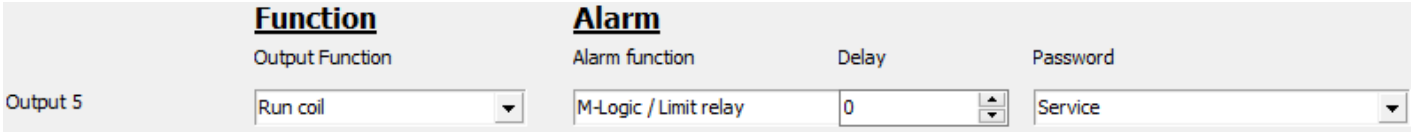
Electrical characteristics

- Voltage: 4.5 to 36 V DC
- Current: 2 A DC inrush, 0.5 A DC continuous

Relay	Default
Relay 09	Start prepare
Relay 10	Stop coil
Relay 11	Status OK
Relay 12	Horn
Relay 13	No default
Relay 14	No default
Relay 15	No default
Relay 16	No default
Relay 17	No default
Relay 18	No default

6.2.1 Configure a relay output

Use the utility software, under *I/O & Hardware setup, DO 5 - 18* to configure the relay outputs.



Setting	Description
Output function	Select an output function.
Alarm function	Alarm relay NE M-Logic / Limit relay Alarm relay ND
Delay	The alarm timer.
Password	Select the password level to modify this configuration (cannot be edited by a user with lower privileges).

6.2.2 Digital output functions

AGC 150 has a number of digital output functions, as shown in the following table.

Function	Activated when
Not used	The digital output is not used.
Status ok	The controller status is okay.
Horn	An alarm is activated and not silenced.
Start prepare	The start sequence activates the start prepare.
Starter (Crank)	The start sequence activates the crank.
Run coil	The start sequence activates the run coil.
Stop coil	The stop sequence activates the stop coil.
Double starter	The start sequence activates the double starter.
Siren	An alarm is activated and not silenced.
DEF tank output	This output controls the DEF pump. The controller activates the relay when the DEF level is below the start limit.
Generic fluid output	This output controls the fluid pump. The controller activates the relay when the fluid level is below the start limit.
Fuel tank output	This relay controls the fuel pump. The controller activates the relay when the fuel level is below the start limit.
Any alarm present	The controller activates the output when there is an active alarm.

NOTE The AGC 150 Engine drive controller does not have a keyswitch function.

6.3 Analogue inputs

6.3.1 Introduction

The controller has four analogue inputs (also known as multi-inputs): Multi-input 20, multi-input 21, multi-input 22, and multi-input 23. Terminal 19 is the common ground for the multi-inputs.

The multi-inputs can be configured as:

- 4-20 mA
- 0-10 V DC

- Pt100
- RMI oil pressure
- RMI water temperature
- RMI fuel level
- RMI Custom
- Binary/digital input

The function of the multi-inputs can only be configured with the utility software.

Wiring

The wiring depends on the measurement type (current, voltage, or resistance).

More information
See **Wiring** in the **Installation instructions** for examples of wiring.

6.3.2 Application description

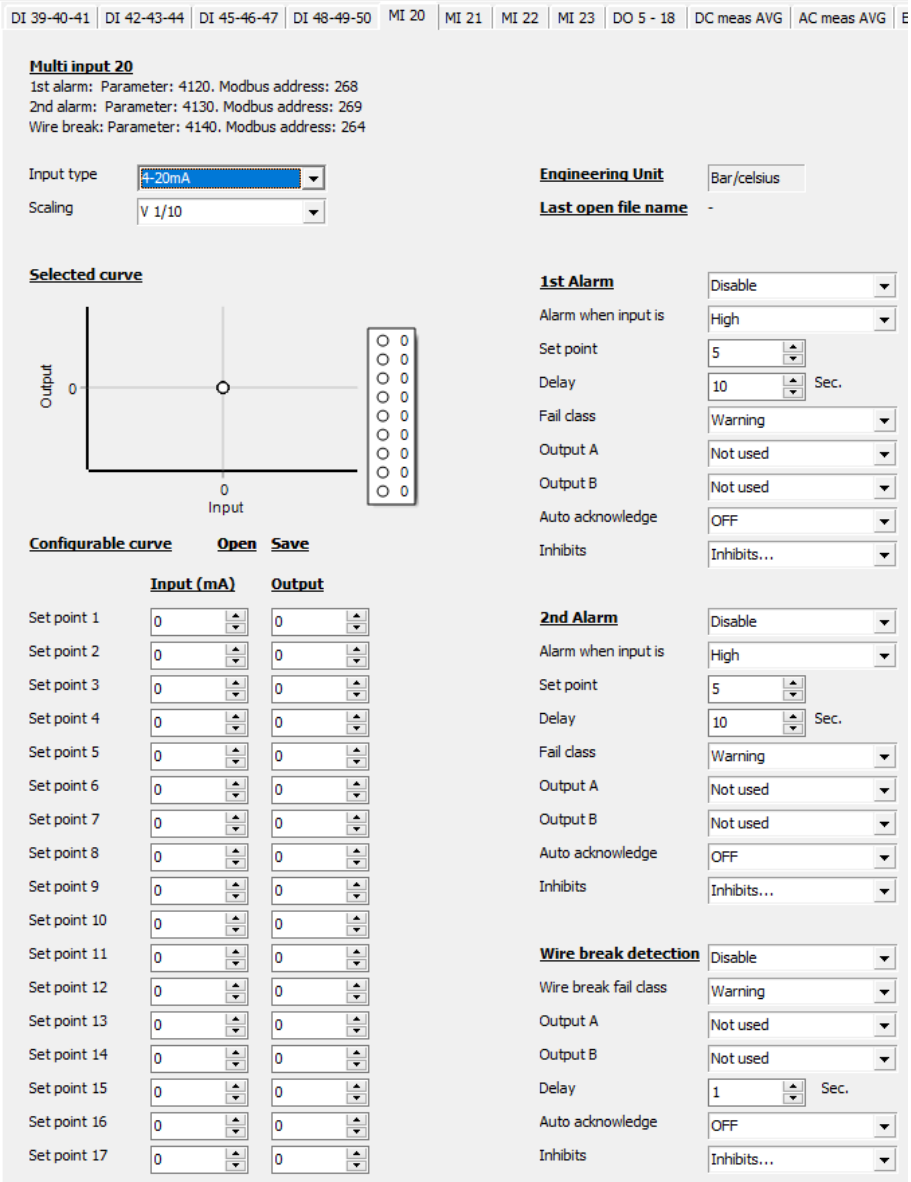
The multi-inputs can be used in different applications, for example:

- Temperature sensor. Pt100 resistors are often used to measure temperature. In the Utility Software, you can choose whether the temperature should be shown as Celsius or Fahrenheit.
- RMI inputs. The AGC has four RMI types: oil, water, fuel, and custom. It is possible to choose different types within each RMI type. There is also a configurable type.
- An extra button. If the input is configured as digital, it works like an extra digital input.

6.3.3 Configuring multi-inputs

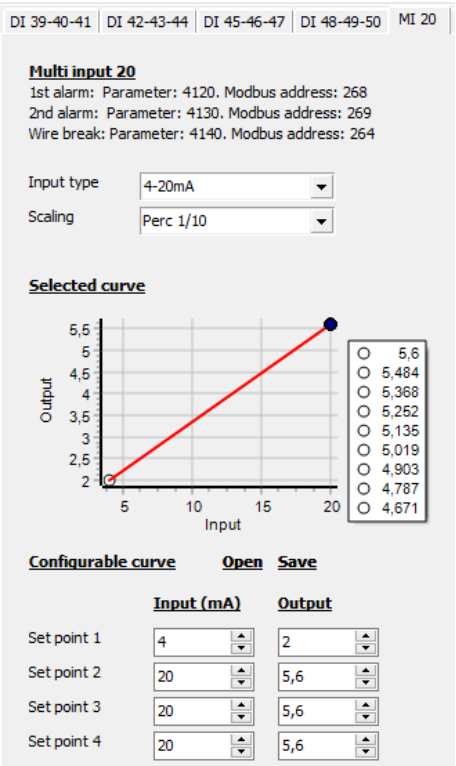
Configure each multi-input to match the connected sensor.

1. In the utility software, select *I/O & Hardware setup*, then select *MI 20 / 21 / 22 / 23*.

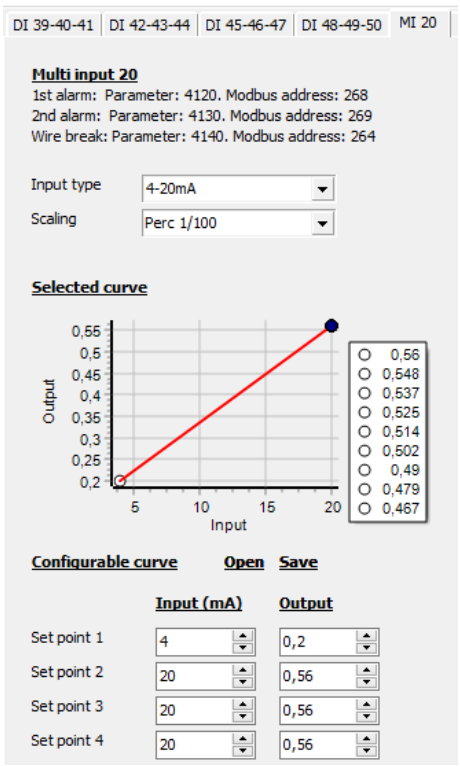


2. Select the appropriate *Scaling*.

Examples



Scaling 1/10

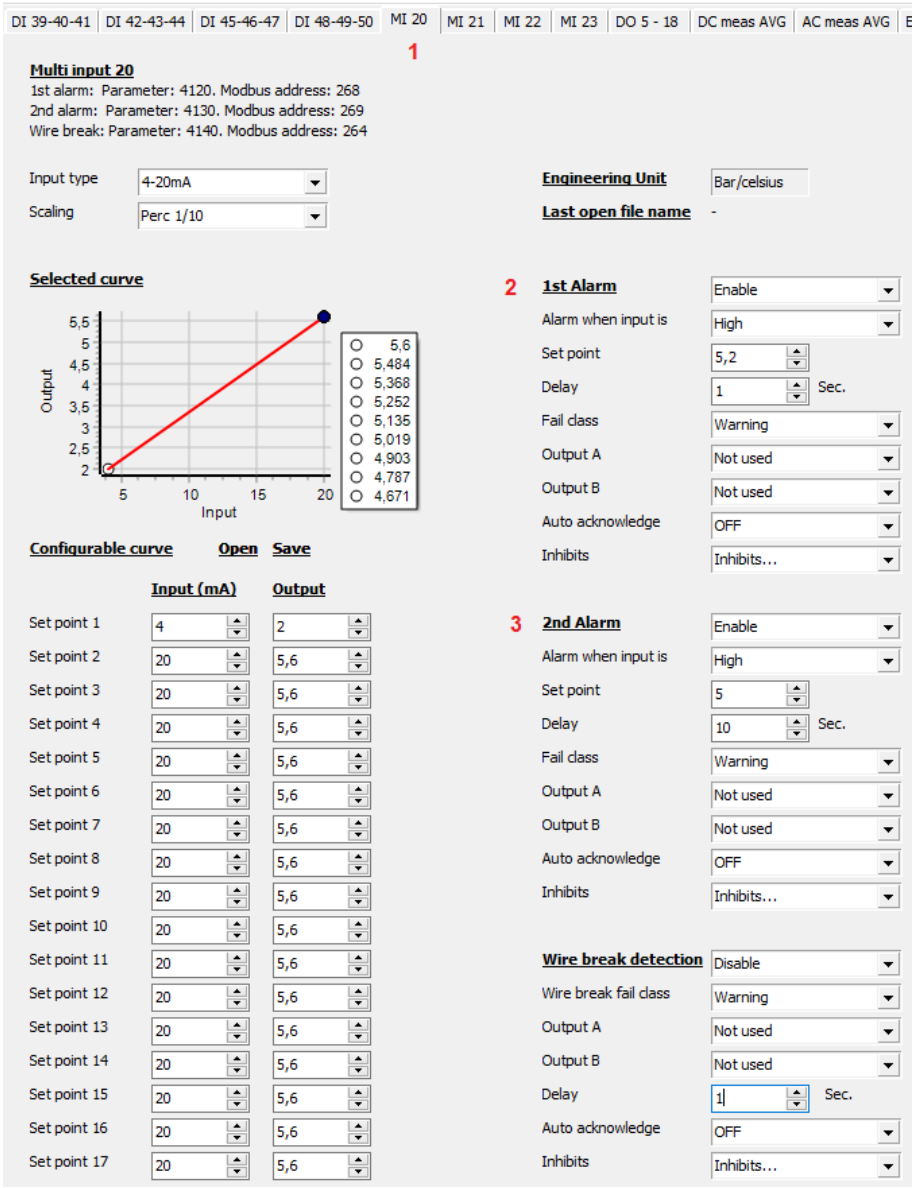


Scaling 1/100

6.3.4 Alarms

For each multi-input, two alarm levels are available. With two alarms it is possible to have the first alarm reacting slow, while the second alarm can react faster. For example, if the sensor measures generator current as protection against overload, a small overload is acceptable for a shorter period, but in case of a large overload, the alarm should activate quickly.

Use the utility software to configure the multi-input alarms. Select *I/O & Hardware setup*, then select *MI 20 / 21 / 22 /23*.



1. Select the desired multi-input tab.
2. Configure the parameters for 1st alarm.
3. Configure the parameters for 2nd alarm.

Sensors with max. output less than 20 mA

If a sensor has a maximum output less than 20 mA, it is necessary to calculate what a 20 mA signal would indicate.

Example: A pressure sensor gives 4 mA at 0 bars and 12 mA at 5 bar.

- (12 - 4) mA = 8 mA = 5 bar
- 1 mA = 5 bar/8 = 0.625 bar
- 20 - 4 mA = 16 × 0.625 bar = 10 bar

Configuring multi-input alarms from the display

Alternatively, you can use the display to configure the multi-input alarms: `I/O settings > Inputs > Multi input > Multi input [20 to 23].1 / 2`

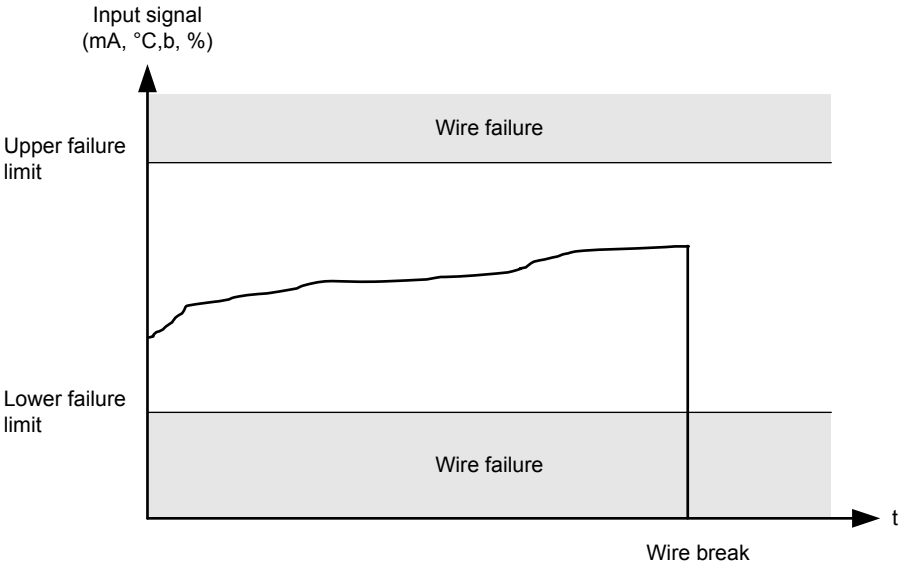
6.3.5 Wire break

To supervise the sensors/wires connected to the multi-inputs and analogue inputs, you can 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 is detected as a short circuit or a break. An alarm with a configurable fail class is activated.

Input	Wire failure area	Normal range	Wire failure area
4-20 mA	<3 mA	4-20 mA	>21 mA
0-10 V DC	≤0 V DC	-	N/A
RMI Oil, type 1	<10.0 Ω	-	>184.0 Ω
RMI Oil, type 2	<10.0 Ω	-	>184.0 Ω
RMI Oil, type 4	<33.0 Ω	-	240.0 Ω
RMI Temp, type 1	<10.0 Ω	-	>1350.0 Ω
RMI Temp, type 2	<18.2 Ω	-	>2400.0 Ω
RMI Temp, type 3	<3.6 Ω	-	>250.0 Ω
RMI Temp, type 4	<32.0 Ω	-	>2500.0 Ω
RMI Fuel, Type 1	<1.6 Ω	-	>78.8 Ω
RMI Fuel, Type 2	<3.0 Ω	-	>180.0 Ω
RMI Fuel, type 4	<33.0 Ω	-	>240.0 Ω
RMI configurable	<lowest resistance	-	>highest resistance
RMI Custom	<lowest resistance	-	>highest resistance
Pt100	<82.3 Ω	-	>194.1 Ω
Level switch	Only active if the switch is open		

Principle

The diagram shows that when the wire of the input breaks, the measured value drops to zero, and the alarm is activated.



Configuring wire break alarms from the utility software or display

You can use the utility software to configure wire break alarms. Alternatively, you can use the display to configure wire break alarms: `I/O settings > Inputs > Multi input > Wire fail [20 to 23]`

6.3.6 RMI sensor types

The multi-inputs can be configured as RMI inputs.

The available RMI input types are:

- RMI oil pressure

- RMI water temperature
- RMI fuel level
- RMI Custom

For each RMI input type, you can select different curves, including a configurable curve. The configurable curve has up to 20 set points. The resistance and the pressure can be adjusted.

NOTE The sensor range is 0 to 2500 Ω.

NOTE If the RMI input is used as a level switch, then no voltage must be connected to the input. If any voltage is applied to the RMI inputs, it will be damaged.

6.3.7 Differential measurement

Differential measurement can be used to compare two measurements, and activate an alarm or trip if the difference between two measurements become too large or too small. Remove the check mark from "High Alarm" in the alarm configuration to activate the alarm when the difference between the two inputs are lower than the alarm's set point.

It is possible to have up to six comparisons, and two alarms can be configured to each comparison.

`Functions > Delta alarms > Set #`

Parameter	Text	Range	Default
4601	Input A for comparison set 1	Multi-input 20 to 23 EIC Oil pressure EIC Water temperature EIC Oil temperature EIC Ambient temperature EIC Intercooler temperature EIC Fuel temperature EIC Fuel deliv. pressure EIC Air f1 diff. pressure EIC Air f2 diff. pressure EIC Fuel pump pressure EIC Fuel f diff. s pressure EIC Oil f diff. pressure EIC Exhaust left temperature EIC Exhaust right temperature EIC Fuel f diff. pressure EIC T. Winding Highest EIC T. Winding Lowest EIC T Winding 1 to 3 EIC DEF Level EIC DEF Temp EIC Speed MPU Speed KWG ISO5 insulation resistance EIC Estimated Percent Fan Speed EIC Fan speed RPM EIC Engine Percent Load at Current Speed EIC Driver's Demand Engine - Percent Torque EIC Actual Engine - Percent Torque	Multi-input 20
4602	Input B for comparison set 1		
4603	Input A for comparison set 2		
4604	Input B for comparison set 2		
4605	Input A for comparison set 3		
4606	Input B for comparison set 3		
4671	Input A for comparison set 4		
4672	Input B for comparison set 4		
4673	Input A for comparison set 5		
4674	Input B for comparison set 5		
4675	Input A for comparison set 6		
4676	Input B for comparison set 6		

Functions > Delta alarms > Set # > Delta ana# 1 or 2

Parameter	Text	Range	Default
4611, 4631, 4651, 4681, 4701 or 4721	Set point 1	-999.9 to 999.9	1.0
4621, 4641, 4661, 4691, 4711 or 4731	Set point 2	-999.9 to 999.9	1.0
4612, 4632, 4652, 4682, 4702 or 4722	Timer 1	0.0 to 999.0 s	5.0 s
4622, 4642, 4662, 4692, 4712 or 4732	Timer 2	0.0 to 999.0 s	5.0 s
4613, 4633, 4653, 4683, 4703 or 4723	Output A set 1	Relays and M-Logic	-
4623, 4643, 4663, 4693, 4713 or 4733	Output A set 2		
4614, 4634, 4654, 4684, 4704 or 4724	Output B set 1		
4624, 4644, 4664, 4694, 4714 or 4734	Output B set 2		
4615, 4635, 4655, 4685, 4705 or 4725	Enable set 1	OFF ON	OFF
4625, 4645, 4665, 4695, 4715 or 4735	Enable set 2		
4616, 4636, 4656, 4686, 4706 or 4726	Fail class set 1	Fail classes	Warning
4626, 4646, 4666, 4696, 4716 or 4736	Fail class set 2		

6.4 Analogue outputs

AGC 150 has two analogue outputs that are active and galvanically separated. No external supply can be connected.

Function	ANSI no.
Selectable ±10 V DC or relay output for speed control (governor)	77
PWM speed control output for CAT® engines	77

Duty cycle

The PWM signal has a frequency of 500 Hz ±50 Hz. The resolution of the duty cycle is 10,000 steps. The output is an open collector output with a 1 kΩ pull-up resistor. Frequency and amplitude are configurable.

`Engine > Speed control > Analogue configuration > Analogue output > PWM 52 setup`

Parameter	Text	Range	Default
5721	PWM 52 Limits (minimum)	0 to 50 %	10 %
5722	PWM 52 Limits (maximum)	50 to 100 %	90 %
5724	PWM amplitude	1.0 to 10.5 V	5.0 V
5725	PWM frequency	1 to 2500 Hz	500 Hz

Figure 6.1 Duty cycle (min. level 0 to 0.05 V, max. level 5.7 to 6.0 V)

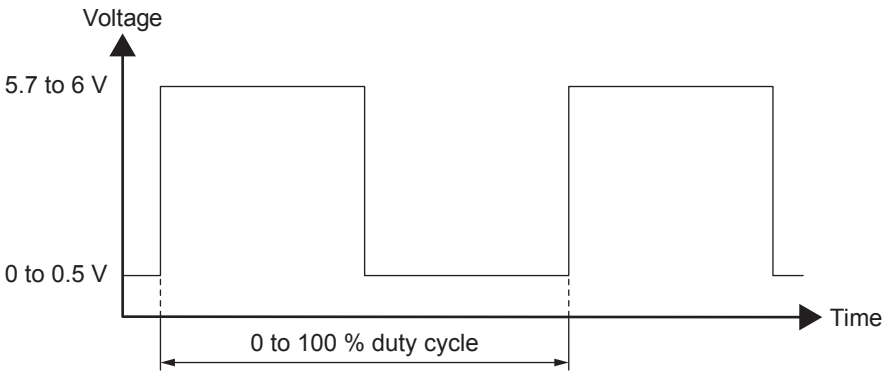


Figure 6.2 Example: 10 % duty cycle

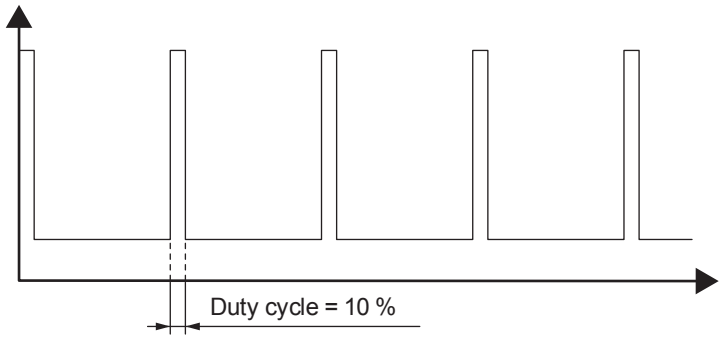
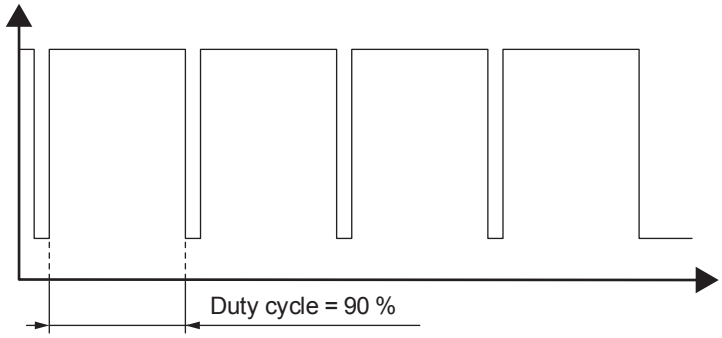


Figure 6.3 Example: 90 % duty cycle



6.5 Additional inputs and outputs

If more inputs and/or outputs (IOs) are needed, you can use CIO modules with the AGC 150. When the CIOs are installed and the IOs are configured, the CIO IOs act like IOs on the AGC 150.

To use CIOs, in *CIO Enable* (parameter 7891) select *ON*.

More information
See the **CIO 116 Installation and Commissioning guide** under www.deif.com/products/cio-116.

See the **CIO 208 Installation and Commissioning guide** under www.deif.com/products/cio-208.

See the **CIO 308 Installation and Commissioning guide** under www.deif.com/products/cio-308.