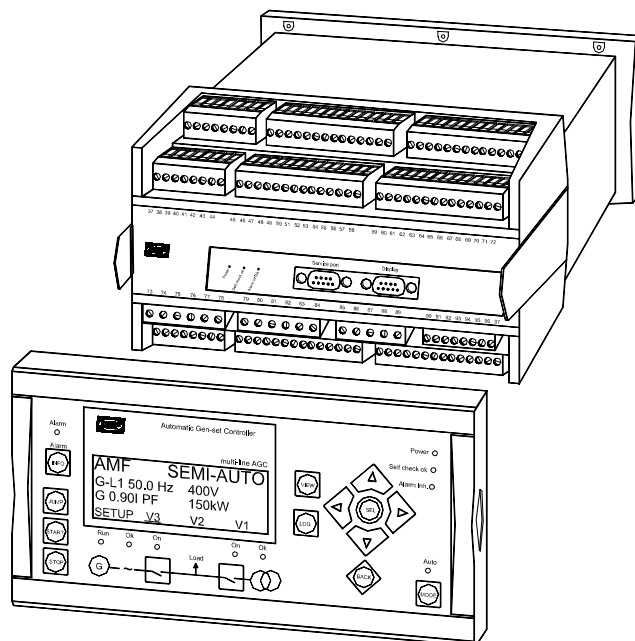# M-logic Handbook

M-logic
Automatic Gen-set Controller

4189340339F
SW version 2.32.X

- *General description*

- *Programming*

- *Configuration*

- *Examples*

- *Relay configuration*

Table of contents

1. About this document

General purpose

This document is the M-logic Handbook for DEIF's Automatic Gen-set Controller, the AGC. The document mainly includes a general description, information about programming, overall configuration and relay configuration.

The general purpose of this handbook is to inform the intended users about programming and configuration of the M-logic tool.

Intended users

The handbook is mainly intended for the person responsible for the unit setup. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the handbook.

> **Please make sure to read this handbook before working with the multi-line 2 controller and the gen-set to be controlled. Failure to do this could result in damage to the equipment or human injury.**

Overall structure

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

2. Warnings and legal information

Legal information and responsibility

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

> **The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.**

Electrostatic discharge awareness

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

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorized personnel who understand the risks involved in working with live electrical equipment.

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

Notes

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

Notes

> **The notes provide general information which will be helpful for the reader to bear in mind.**

Warning

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

3. General description

Introduction

The standard M-logic tool is included in all AGC units. So, as such, this functionality is not option dependent but can be developed further by selecting additional options.

M-logic can be used to program the AGC to execute different commands at predefined conditions. M-logic is not a PLC, but it can substitute one, if only very simple commands are needed.

If DEIF's Additional Operator Panel is used, then the M-logic is also used for the configuration of that specific display.

(i)   The AOP can only be used with software versions 2.10 and forward.

Type of product

M-logic is a simple tool based on logic events. One or more input conditions are defined, and activating those inputs results in the predefined output. 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 gen-set/plant mode and change of running modes.

The M-logic is part of the PC utility software, and it can only be configured via this software and **not** via the display.
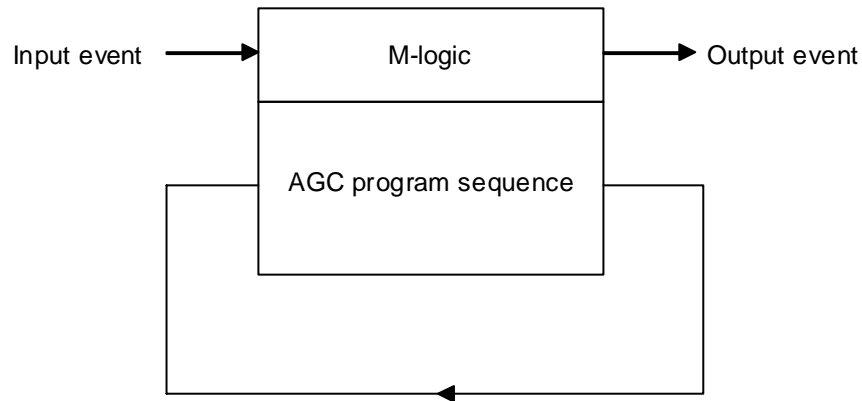
The main purpose of the M-logic is to give the user/designer more flexible possibilities of operating the generator control system.

Principle

The drawing below illustrates the M-logic principle.

AGC program sequence
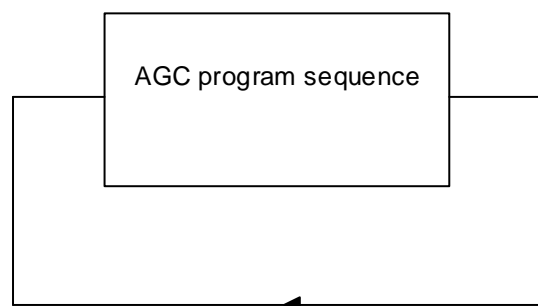
The program sequence without the M-logic function enabled.

The drawing illustrates the program sequence with the M-logic enabled. M-logic is part of the program sequence.

The input and output events are described on page 12 and page 16.

Software requirements

The M-logic can be used when the AGC has software version 1.51.0 or later. To check the unit's software version, place the cursor under setup in the view menu system:

```
ML2-AGC          V. 1.51.0
2003-07-21        10:42:50
SETUP MENU
SETUP    V3      V2      V1
```

PC utility software requirements

M-logic functionality requires PC utility software version 1.40.19 or later. This is indicated in the help menu:
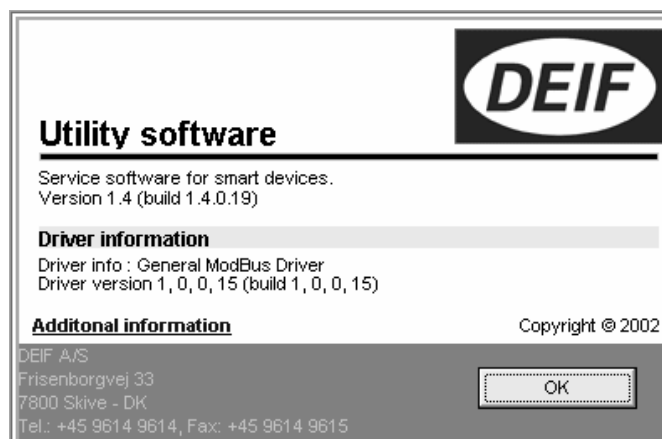
The AOP can only be programmed with utility software version 1.40.48 and later.

4. Programming

Principle

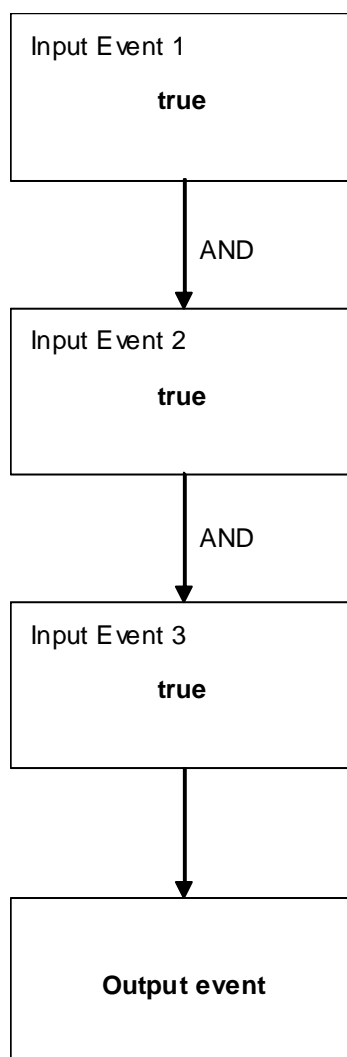Programming is done via the PC utility software following the instructions in this chapter. The general idea of programming M-logic is to make one or more simple equations which have to be in the TRUE state to execute the output command. If the input events are in the FALSE state, then the output command will not be executed.
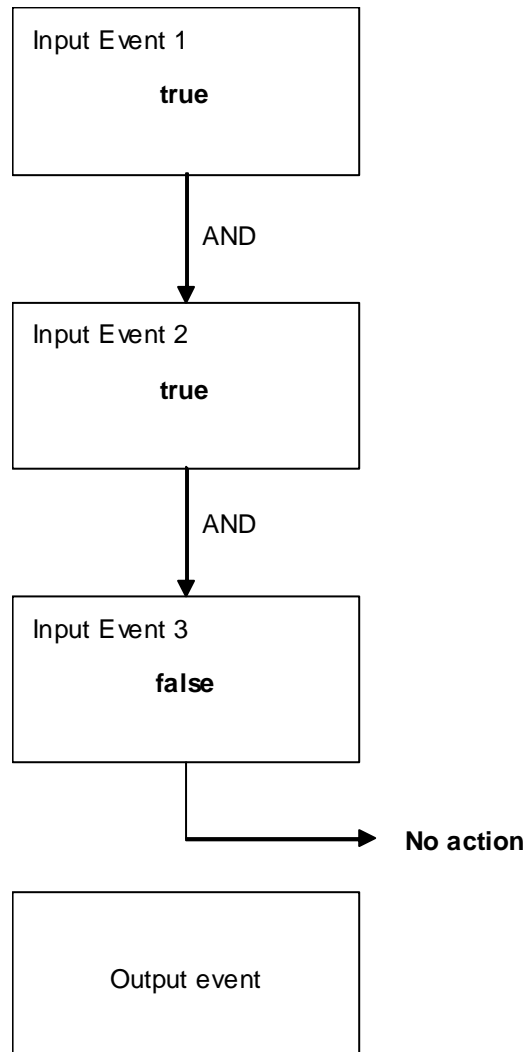
Example 1:

In this example the number of input events is 3. As it appears, all input events are in the TRUE state, and the output event is therefore executed.

```
┌─────────────────────────┐
│ Input Event 1           │
│           true          │
└─────────────────────────┘
             │
             │  AND
             ▼
┌─────────────────────────┐
│ Input Event 2           │
│           true          │
└─────────────────────────┘
             │
             │  AND
             ▼
┌─────────────────────────┐
│ Input Event 3           │
│           true          │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│                         │
│      Output event       │
│                         │
└─────────────────────────┘
```

Example 2:

In this example the number of input events is 3. As it appears, input 1 and input 2 are in the TRUE state, and input 3 is in the FALSE state. Therefore, the output event will not be executed, and the result is NO ACTION.

```
┌─────────────────────┐
│ Input Event 1       │
│                     │
│        true         │
│                     │
│                     │
└──────────┬──────────┘
           │ AND
           ▼
┌─────────────────────┐
│ Input Event 2       │
│                     │
│        true         │
│                     │
│                     │
└──────────┬──────────┘
           │ AND
           ▼
┌─────────────────────┐
│ Input Event 3       │
│                     │
│        false        │
│                     │
│                     │
└──────────┬──────────┘
           └──────────────► No action

┌─────────────────────┐
│                     │
│                     │
│   Output event      │
│                     │
│                     │
└─────────────────────┘
```

Definitions

The TRUE and FALSE states are explained below.

A TRUE state of an input event will be detected, if the condition defined in the input event is met.

Examples given:
Digital input is TRUE when activated (12/24V DC applied)
Alarm condition is TRUE when the alarm is present
Mode condition is TRUE when the mode is selected

A FALSE state of an input event will be detected, if the condition defined in the input event is NOT met.

Examples given:
Digital input is FALSE when deactivated (12/24V DC not applied)
Alarm condition is FALSE when the alarm is not present
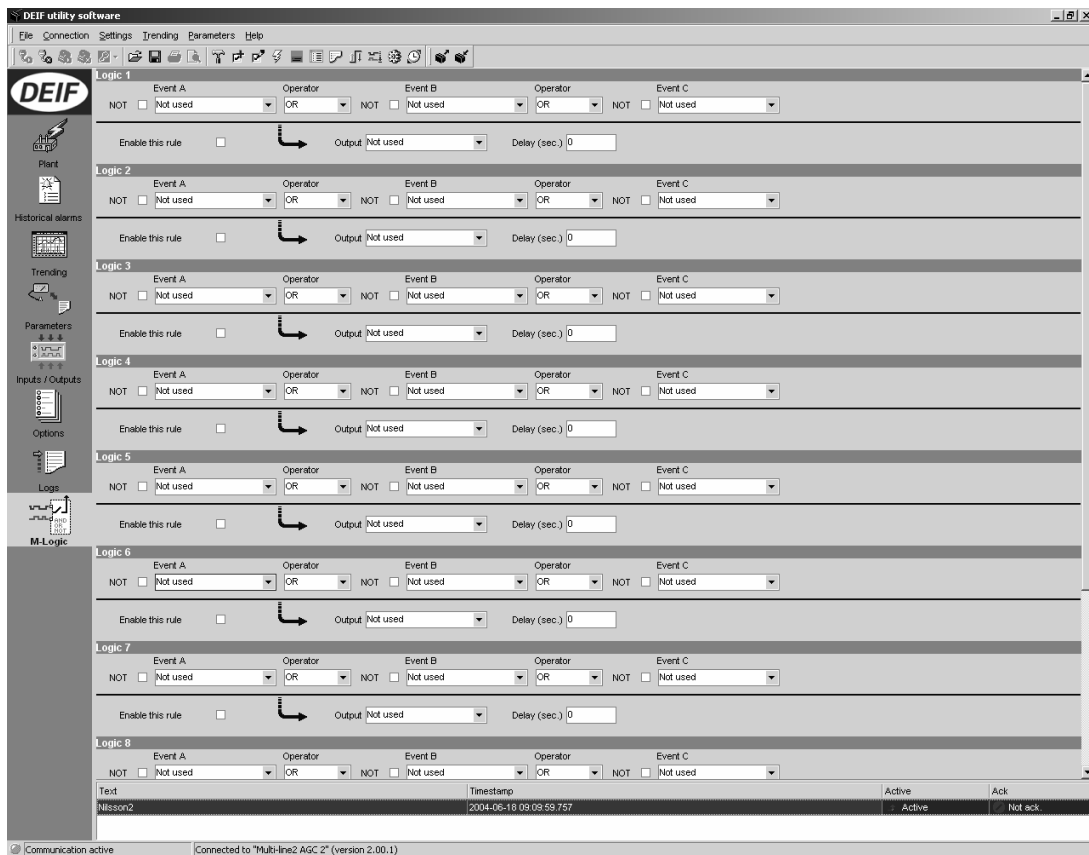*Mode condition is FALSE when the mode is not selected*

5. Configuration

(i) **To activate the 'M-logic' icon in the PC utility software 'Alt + F1' must be activated.**

Connection

A part of the PC utility software is used for the M-logic configuration, and when connected to the unit, the M-logic can be selected. The following screen will be displayed:

The screen will show the present M-logic configuration. In the example above the M-logic is NOT used.

M-logic modules

40 logic modules are available. They are referred to as logic 1, logic 2, logic 3 etc. Below logic 2 is shown.
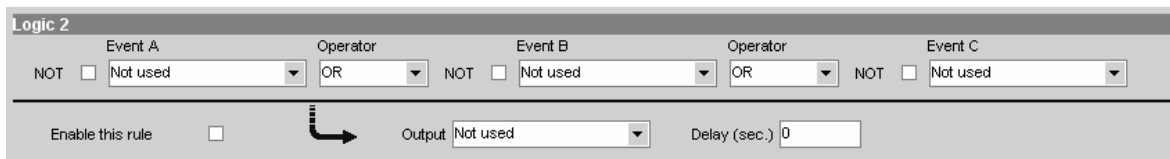

Explanation of the M-logic modules:

Name	Explanation
Event A, event B, event C	Selection of the event which influences the activation of the output.
Not	Inverts the selected event. E.g. a digital input will be TRUE when the input is deactivated.
Operator	Selection between AND and OR.
Enable this rule	The rule must be enabled, before it is downloaded to the unit. Only enabled rules will be functional.
Output	Selection of the output event which has to be executed when the logic configuration is TRUE.
Delay (sec.)	Delay time which delays the output for the adjusted time when the logic configuration is TRUE.

Configuration tools

When the M-logic screen is shown, two buttons are used to load the settings to and from the unit, and two buttons are used to open and save logics files.
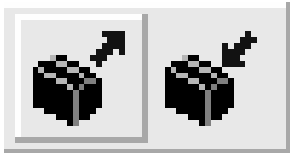
Read M-logic settings from the unit
Activating this button will upload all M-logic settings from the unit to the PC utility software.

Write M-logic settings to the unit
Activating this button will download the M-logic settings from the PC utility software to the unit.

Save
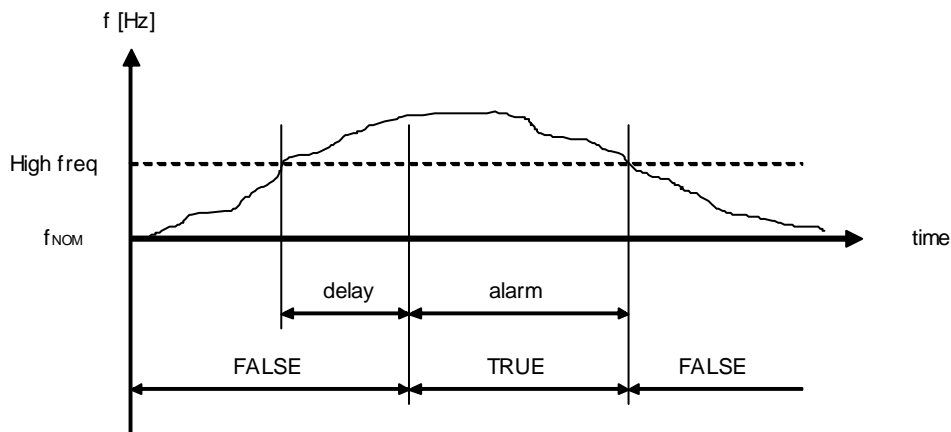*Activating this button makes it possible to save the logics file for future use.*

Open
Activating this button makes it possible to open a previously saved logics file.

Input events

Definitions

The alarm input events are TRUE when the alarm is active, i.e. the alarm limit has been exceeded, and the delay times have expired.

Alarm table

Alarm inputs	Comment	
Unacknowledged alarm	Alarm LED flashing, unacknowledged alarm is present.	
Bus high-voltage 1	1180	
Bus high-voltage 2	1190	
Bus low-voltage 1	1200	
Bus low-voltage 2	1210	
Bus high-freq. 1	1220	
Bus high-freq. 2	1230	
Bus low-freq. 1	1240	
Bus low-freq. 2	1250	
Overcurrent 1	1020	
Overcurrent 2	1030	
Overload 1	1260	
Overload 2	1270	TRUE condition when alarm is active.
Unbalanced current	1280	
Unbalanced voltage	1290	
df/dt (ROCOF)	1350	
Vector jump	1360	
Gen. high-voltage 1	1100	
Gen. high-voltage 2	1110	
Gen. low-voltage 1	1120	
Gen. low-voltage 2	1130	
Gen. high-freq. 1	1140	
Gen. high-freq. 2	1150	
Gen. low-freq. 1	1160	
Gen. low-freq. 2	1170	
Overspeed	4320	
GB open failure	2093	

Alarm inputs	Comment	
GB close failure	2094	
GB position failure	No menu	
GB sync. failure	2070	
MB open failure	2091	
MB close failure	2092	
MB position failure	No menu	
MB sync. failure	2070	
Phase seq. error	No menu	

> ⓘ **If relay A and relay B are configured in the protection menu to a 'Limit' relay, the 'Alarm' table will not be active in M-logic.**

Event table

Events	Comment
Mains failure	Refer to mains failure settings (menus 6590 and 6600).
GB synchronising	TRUE when the GB ON sequence is activated, and the unit synchronises the generator breaker.
MB synchronising	TRUE when the MB ON sequence is activated, and the unit synchronises the mains breaker.
Peak shaving started	True when the gen-set is starting (menu 6520), running (run. feedback) (menu 3310) or stopping (menu 6530).
DG volt./freq. OK	Refer to the settings 2040 for limits and 6190 for timer.
GB direct In	TRUE when the generator breaker has closed to a black bus.
Engine running	Running feedback present.
Engine fail.	External engine failure alarm activated.
Alarm inhibit	Inhibit input activated.
Access lock	TRUE if display is locked.
Emergency stop	TRUE when emergency stop is activated.
Ready to auto start	TRUE if the unit is in auto, and no alarms are active.
Cranking	TRUE when the gen-set is cranking the starter.
Start activated	TRUE when a start signal is activated.
Lamp test	Turns on the LEDs for 3 seconds.
GB black close request	TRUE when ready to close to a black bus.

Logic table

Logic	Comment
TRUE	Fixed TRUE condition.
FALSE	Fixed FALSE condition.

Input table

Input	Comment
MB closed	TRUE at selected breaker feedback.
MB open	
GB closed	
GB open	
Config. dig. input no. 43	TRUE when activated with a digital signal.
Config. dig. input no. 44	
Config. dig. input no. 45	
Config. dig. input no. 46	
Config. dig. input no. 47	
Config. dig. input no. 48	
Config. dig. input no. 49	
Config. dig. input no. 50	
Config. dig. input no. 51	
Config. dig. input no. 52	
Config. dig. input no. 53	
Config. dig. input no. 54	
Config. dig. input no. 55	
Config. dig. input no. 91	
Config. dig. input no. 92	
Config. dig. input no. 93	
Config. dig. input no. 94	
Config. dig. input no. 95	
Config. dig. input no. 96	
Config. dig. input no. 97	
Config. dig. input no. 110	
Config. dig. input no. 111	
Config. dig. input no. 112	
Config. dig. input no. 113	
Config. dig. input no. 118	

Mode table

Mode	Comment
Island	TRUE when the gen-set mode is selected.
AMF	
Peak shaving	
Fixed power	
Mains power export	
Load take over	
Semi-auto mode	TRUE when the running mode is selected.
Test mode	
Auto mode	
DI semi-auto mode used	If configurable input is selected.
DI test mode used	If configurable input is selected.
DI auto mode used	If configurable input is selected.
DI manual mode used	If configurable input is selected.
DI block mode used	If configurable input is selected.
Stop mode	Active if stop mode is selected.
Mode shift or AMF active	If AMF is selected internally.

Relays table

Relays	Comment
Relay no. 1	TRUE when relay is activated.
Relay no. 2	
Relay no. 3	
Relay no. 4	
Relay no. 5	
Relay no. 6	
Relay no. 7	
Relay no. 8	
Relay no. 9	
Relay no. 10	
Relay no. 11	
Relay no. 12	
Relay no. 13	

Virtual event table

Virtual event	Comment
Virtual event no. 1	TRUE if the output command *virtual event* is activated.
Virtual event no. 2	
Virtual event no. 3	
Virtual event no. 4	
Virtual event no. 5	
Virtual event no. 6	
Virtual event no. 7	
Virtual event no. 8	
Virtual event no. 9	
Virtual event no. 10	

AOP buttons table

AOP buttons	Comment
Button 01	TRUE when AOP button is pushed.
Button 02	
Button 03	
Button 04	
Button 05	
Button 06	
Button 07	
Button 08	

The numbering of the buttons is made as indicated below.
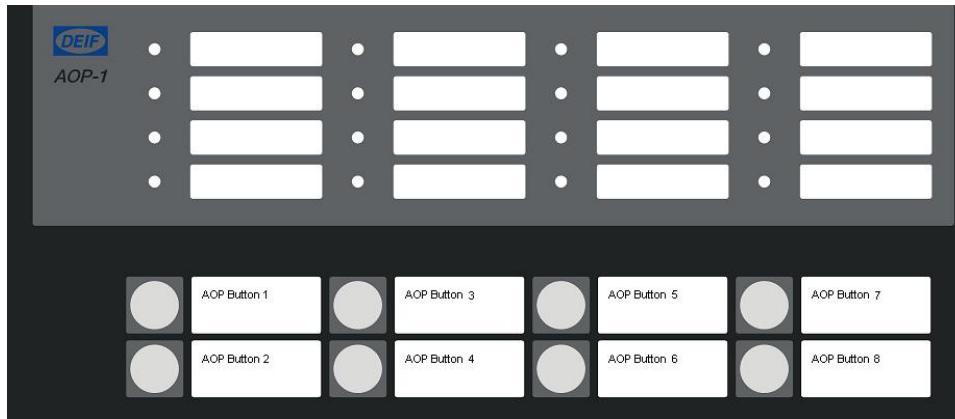
Fail class table

Fail classes	Comment
Alarm	TRUE when an alarm with the specific fail class is active.
Warning	
Trip GB	
Trip GB + stop	
Shutdown	
Trip MB	

Power management table

Power management	Comment
Specified number of GBs closed	TRUE if the number of GBs is the same or higher than the number specified in menu 7532.
Variable multi start enabled	TRUE if menu 7534 is enabled.
All GBs off	
Any GBs on	
MB on	

Output events

Relays table

Relays	Comment
Relay no. 1	TRUE when relay is activated.
Relay no. 2	
Relay no. 3	
Relay no. 4	
Relay no. 5	
Relay no. 6	
Relay no. 7	
Relay no. 8	
Relay no. 9	
Relay no. 10	
Relay no. 11	
Relay no. 12	
Relay no. 13	

Commands table

Mode	Comment
Island	TRUE when the gen-set mode is selected.
AMF	
Peak shaving	
Fixed power	
Mains power export	
Load take over	
Semi-auto mode	TRUE when the running mode is selected.
Test mode	
Auto mode	
Manual mode	
Block mode	
Lamp test	TRUE if activated from configurable input or M-logic module. The lamp test will be activated one time only.
Ack. all alarms	The alarm will be activated one time only.
Force unit in quarantine	When TRUE the gen-set will be forced to be last priority gen-set in a power management application. The command is only usable in the priority routine 'fuel optimisation'.
Set nom. parameter settings 1	Changes the selection of set point to the settings 1
Set nom. parameter settings 2	Changes the selection of set point to the settings 2

Virtual events table

Virtual event	Comment
Virtual event no. 1	TRUE if the output command *virtual event* is activated.
Virtual event no. 2	
Virtual event no. 3	
Virtual event no. 4	
Virtual event no. 5	
Virtual event no. 6	
Virtual event no. 7	
Virtual event no. 8	
Virtual event no. 9	
Virtual event no. 10	

AOP LED table

AOP LED 01-16	Comment
Red + flash	1. priority
Red	2. priority
Yellow + flash	3. priority
Yellow	4. priority
Green + flash	5. priority
Green	6. priority

The numbering of the LEDs is made as indicated below.
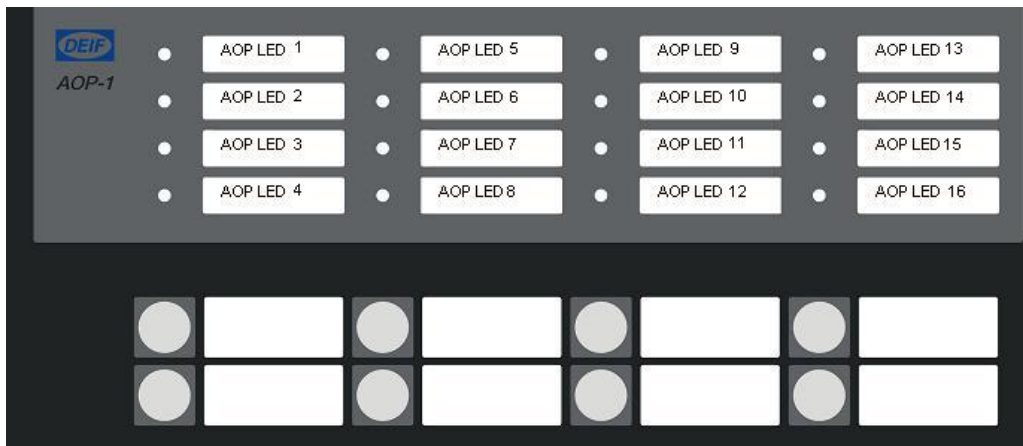
Description of priority

The LEDs can be used as output commands in one or several M-logic modules. If a LED is used in more than one M-logic module, then the LED will act according to the priority listed above when the M-logic modules in question are true.

If e.g. the output from M-logic module 1 is configured to be red + flashing, and the output from M-logic module 2 is configured to be yellow, then the LED will be flashing red when both M-logic modules are true.

Inhibits table

Inhibit event	Comment
Activate load dependent stop used	Select load dependent stop to be fully controlled by the unit or manually by the event below named 'activate load dependent stop'.
Activate load dependent stop	If manual load dependent stop is selected above, this event controls whether the load dependent stop is inhibited or not. The automatic load dependent stop is disabled, if this output is low and enabled if the output is high.
Deactivate mode button	When this output is high, the mode push-button on the display is inhibited.
Activate back sync.	When TRUE the possibility to synchronise the MB available in menu 6613 is enabled.
Activate GB sync. to mains	When TRUE the possibility to synchronise the GB available in menu 6614 is enabled.
Deactivate back sync.	When TRUE the possibility to synchronise the MB available in menu 6613 is disabled.
Deactivate GB sync. to mains	When TRUE the possibility to synchronise the GB available in menu 6613 is disabled.
Deactivate deload error	Deactivate the alarm function for deload error.
Inhibit analogue load share	When the option G3 is available in the AGC and this condition is TRUE, the load share regulation is deactivated.
Inh. alarm ack. in AUTO	When TRUE it is not possible to acknowledge any alarms with the fail class 'Shutdown' or 'Trip and stop'.

Inhibit event	Comment
Inhibit external comm.	When TRUE it is not possible to send commands from any external communication to the AGC.
Inhibit safety stop	When TRUE the added 'Safety stop' functionality in the fail class 'Trip and stop' is disabled when used in power management option G5.

Manual GOV/AVR regulation

Inhibit event	Comment
Increase GOV for 5 s	Increases the regulation output to the speed governor for 5 seconds.
Decrease GOV for 5 s	Decreases the regulation output to the speed governor for 5 seconds.
Increase AVR for 5 s	Increases the regulation output to the AVR for 5 seconds.
Decrease AVR for 5 s	Decreases the regulation output to the AVR for 5 seconds.

Each output can only be selected once. If more than one logic line must activate an output command by use of the virtual relays, refer to example 5 on page 20.

Delay

It is possible to add a delay to the output event. In the example below relay 5 will activate 10 seconds after the gen-set starts (running signal present). The delay is an ON delay.

6. Examples

The examples given below are not full descriptions of all possibilities; they are just basic examples to show some of the possibilities of M-logic.

Single event command

Example 1, TRUE command example
If only a single input event is needed to activate the output, then just leave the two additional events blank.

In this example relay 5 must activate when the engine is running. This is the only condition.

Example 2, NOT command example
If an output command must activate when a condition is not met, then a check mark can be added in the NOT field.

In this example relay 5 must activate when the unit is NOT in auto mode, i.e. in block, manual, semi-auto or test mode.

Multiple event command

Example 3, three command events
If three events are needed to activate the output, then one logic module is enough.

In this example relay 5 must activate when these conditions are met:

1. *No unacknowledged alarms*
2. *Not in auto mode*
3. *Digital input no. 43*

Example 4, five command events

If more than three events are needed, it is necessary to use two or more logic modules. In this example five events are required.

In this example the unit automatically goes to auto mode when these conditions are met:

1. Mains failure present
2. Semi-auto mode selected
3. Engine is running
4. MB is open
5. *Digital input terminal 43 is activated*

This is possible because the *virtual event 1* is selected as the output command in logic 1, and one of the input events in logic 2 is selected to be *virtual event 1*.

Both rules have to be enabled.

Example 5, same output used:

In this example two logic modules must activate the same output.

7. Relay configuration

This chapter describes how to set up the relays to be used in M-logic. Be aware that only a limited number of relays can be used in the unit.

Unit and options	Relays available
Standard unit (not option D, not option E)	Relay 9, 10
Option M12	Relay 5, 6, 7, 8
Option M14	Relay 1, 2, 3, 4

When the parameter list is uploaded to the PC utility software, then the desired relay can be configured. To be able to use the relay as an output in M-logic, the relay must be configured to be a 'Limit' relay.
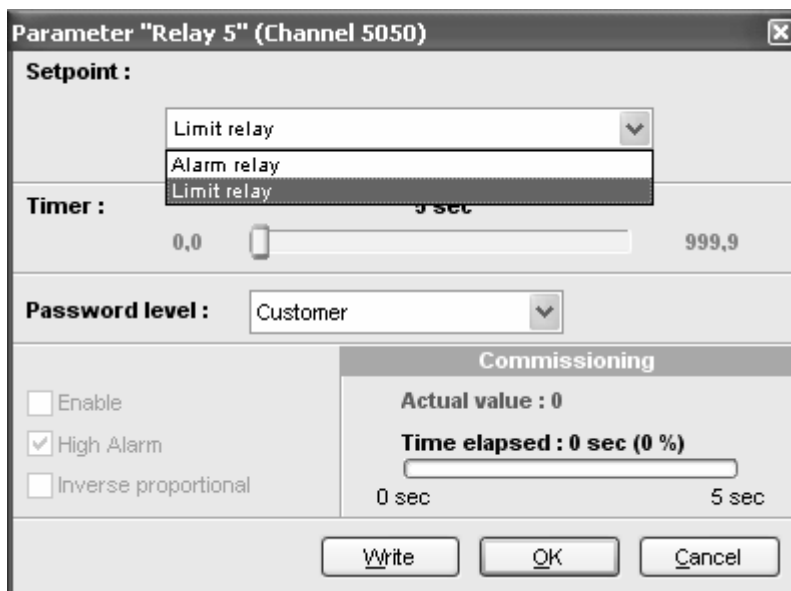
DEIF A/S reserves the right to change any of the above