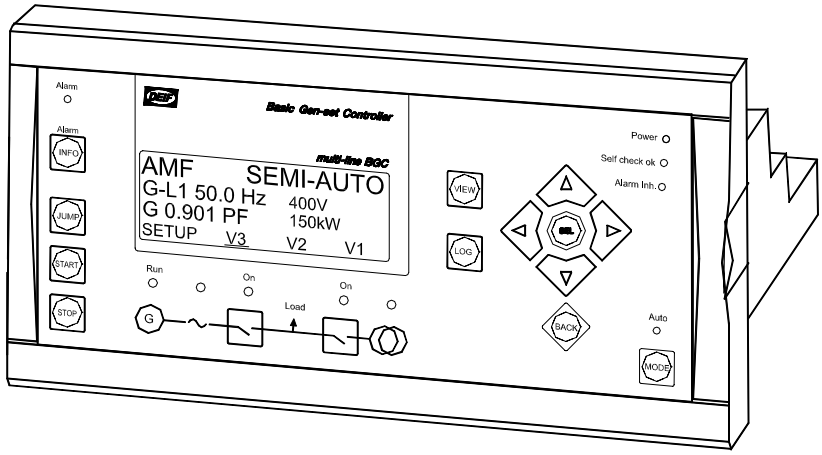
DEIF A/S

M-logic Handbook

M-logic
Basic Gen-set Controller

4189340379C
SW version 2.3X.X



- *General description*
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Table of contents

1. About this document

General purpose

This document is the M-logic Handbook for DEIF's basic gen-set controller, the BGC. 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 BGC unit, the company responsible for the installation or the operation of the set must be contacted.

The BGC 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 authorised personnel who understand the risks involved in working with live electrical equipment.

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

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 BGC units from SW version 2.00.0. 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 BGC 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.

Type of product

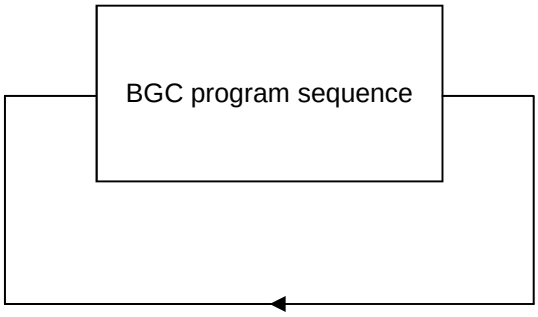
M-logic is a simple tool based on logic events. One or more input conditions are defined, and activating those inputs results in the predefined output. A great variety of inputs can be selected, such as digital inputs, alarm conditions and running conditions. A variety of the outputs can also be selected, such as relay outputs, change of gen-set 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.

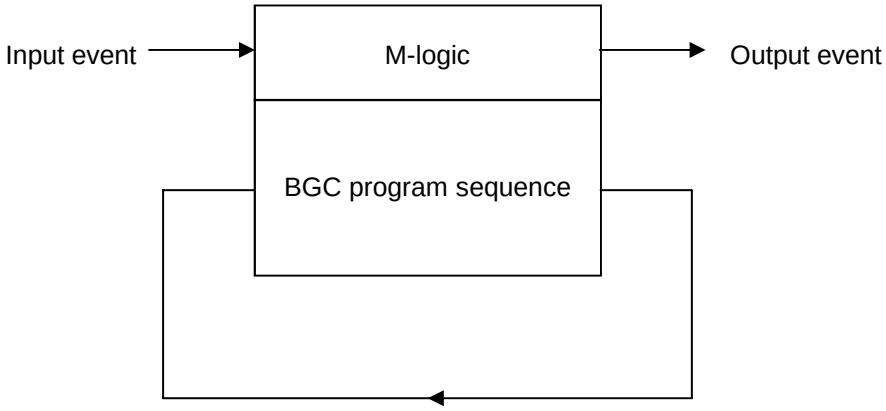
The main purpose of the M-logic is to give the user/designer more flexible possibilities of operating the generator control system.

Principle

The drawing below illustrates the M-logic principle.



The program sequence without the M-logic function enabled.

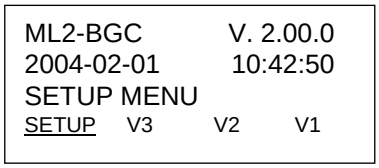


The drawing illustrates the program sequence with the M-logic enabled. M-logic is part of the program sequence.

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

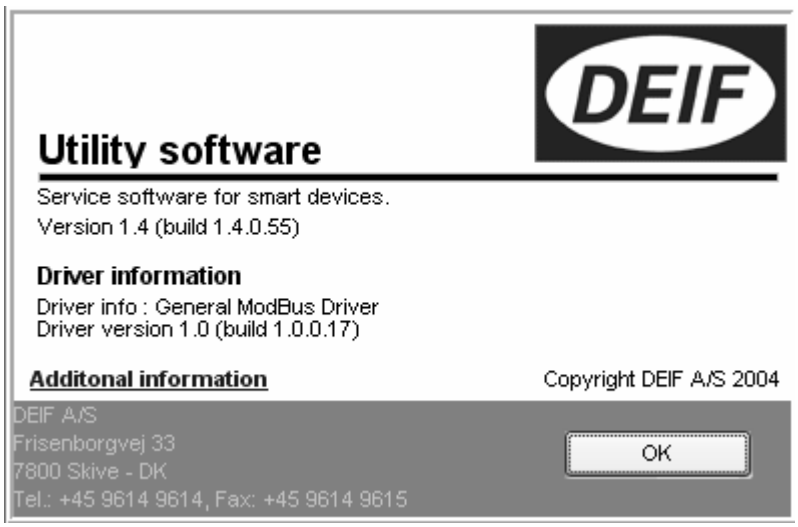
Software requirements

The M-logic can be used when the BGC has software version 2.00.0 or later. To check the unit's software version, place the cursor under setup in the view menu system:



PC utility software requirements

The M-logic functionality requires PC utility software version 1.40.55 or later. This is indicated in the help menu:



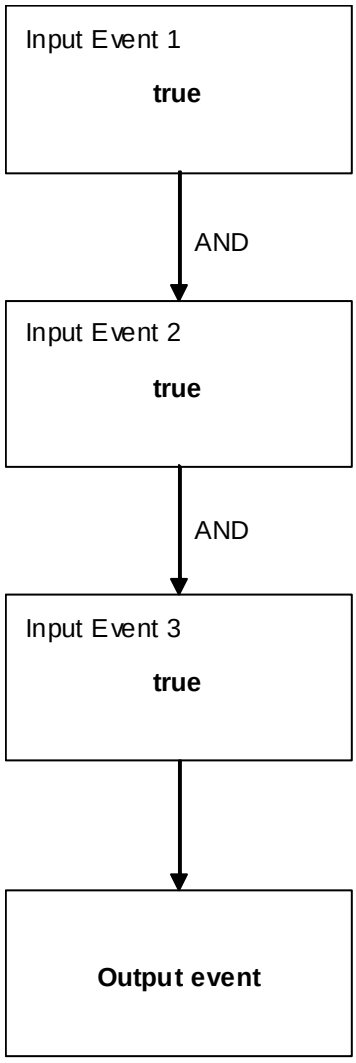
4. Programming

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.

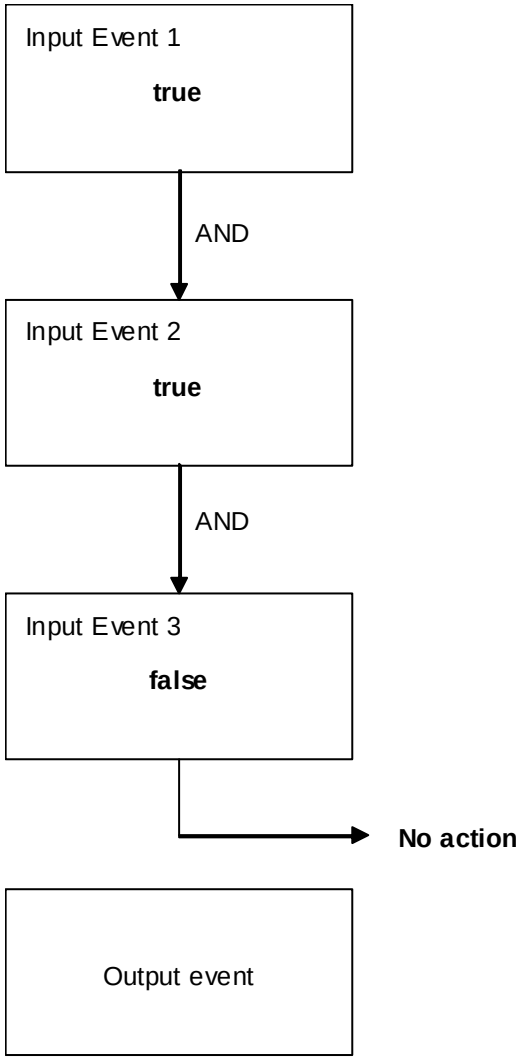
Example 1:

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.



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.



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

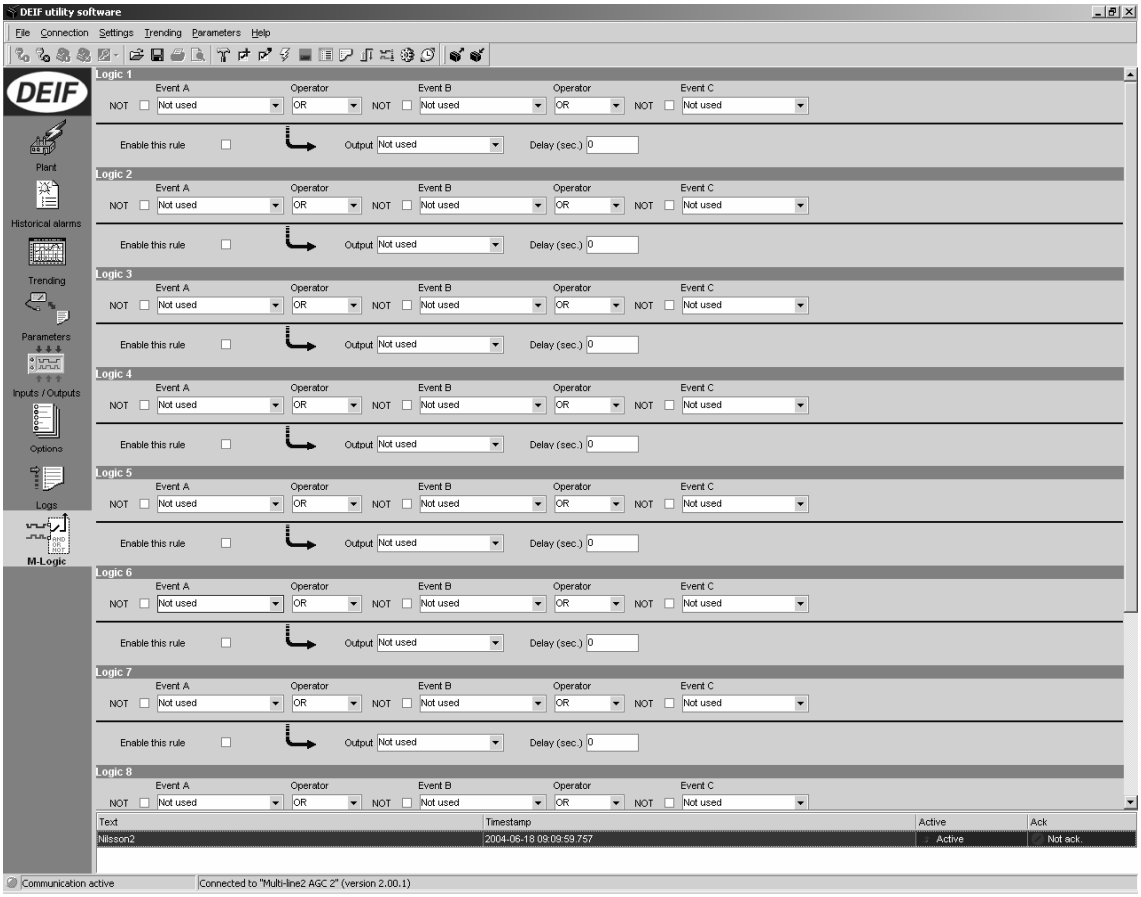
A FALSE state of an input event will be detected, if the condition defined in the input event is **not** met.

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

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; press Alt + F1 to activate. 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

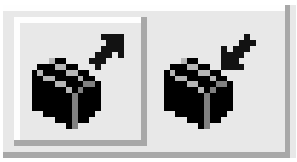
40 logic modules are available. They are referred to as logic 1, logic 2, logic 3 etc. Below logic 2 is shown.

Explanation of the M-logic modules:

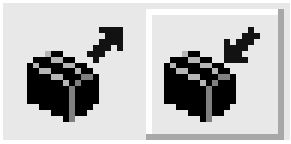
Name	Explanation
Event A, event B, event C	Selection of the event which influences the activation of the output.
Not	Inverts the selected event. E.g. a digital input will be TRUE when the input is deactivated.
Operator	Selection between AND and OR.
Enable this rule	The rule must be enabled, before it 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

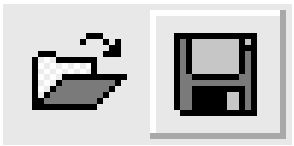
When the M-logic screen is shown, two buttons are used to load the settings to and from the unit, and two buttons are used to open and save logics files.



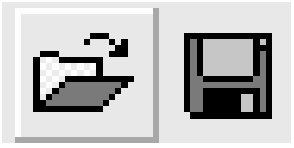
Read M-logic settings from the unit
Activating this button will upload all M-logic settings from the unit to the PC utility software.



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.

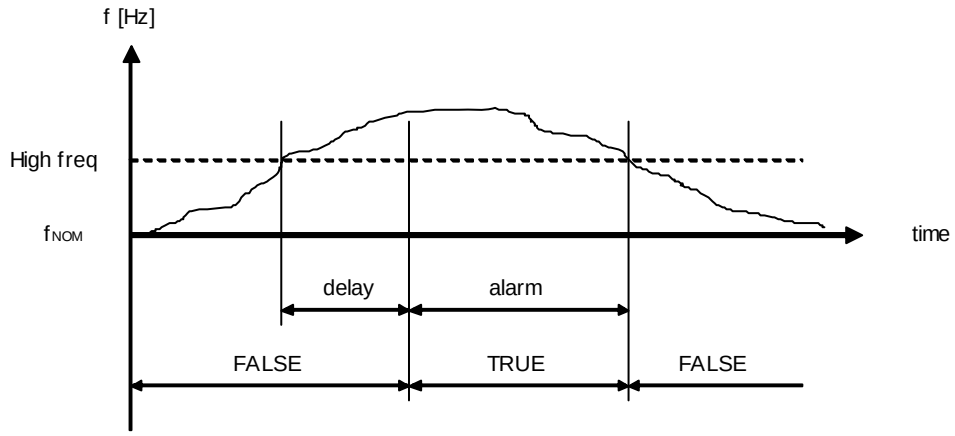


Open
Activating this button makes it possible to open a previously saved logics file.

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	1010	TRUE condition when alarm is active.
Bus high-voltage 2	1020	
Bus low-voltage 1	1030	
Bus low-voltage 2	1040	
Bus high-freq. 1	1050	
Bus high-freq. 2	1060	
Bus low-freq. 1	1070	
Bus low-freq. 2	1080	
Overcurrent 1	1100	
Overcurrent 2	1110	
Overload 1	1120	
Overload 2	1130	
Unbalanced current	1140	
Unbalanced voltage	1150	
df/dt (ROCOF)	1180	
Vector jump	1190	
Gen. high-voltage 1	1210	
Gen. high-voltage 2	1220	
Gen. low-voltage 1	1230	
Gen. low-voltage 2	1240	
Gen. high-freq. 1	1250	
Gen. high-freq. 2	1260	
Gen. low-freq. 1	1270	
Gen. low-freq. 2	1280	
Overspeed	1420	
No alarm	No alarms present.	

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 4420 and 4430).
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 3030), running (run. feedback) or stopping (menu 3040).
DG volt./freq. OK	Refer to the settings 2050 for limits and 4380 for timer.
GB direct In	TRUE when the generator breaker has closed to a black bus.
Engine running	Running feedback present.
Alarm inhibit	TRUE when the alarm inhibit input is active, and when the run status timer has not expired.
VI Access lock	TRUE if display is locked (VI = virtual input).
VI Emergency stop	TRUE when emergency stop is activated (VI = virtual input).
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.
Black busbar	TRUE when the voltage measure-ments on the busbar/mains inputs are below the dead bus limit. (30% of the nominal voltage).
GB close preventive faults	TRUE when the gen-set is blocked from starting caused by the following fail classes and alarms when fire pump is not activated: Alarms with the following fail classes: ALARM, GBTRIP, GBTRIPSTOP, SHUTDOWN, GB sync. fail, GB position fail, Phase sequence error, Start attempt error, GB-on failure.
MB close preventive faults	TRUE when the MB close operation is blocked by the following alarms: df/dt, Vector jump, MB-on failure, MB sync. Failure, MB-off failure.
EI communication error	TRUE upon EI communication error.

Events	Comment
Alarm horn	TRUE upon every alarm (regardless of fail class). If no rule is enabled with this event, the alarm relay is at the default horn relay at term. 33.
External alarm reset	TRUE when the Alarm button is pressed for 2 seconds. Is on in 3 seconds.
Command timer 1	TRUE when command timer 1 is adjusted to be on. Is true in one minute.
Command timer 2	TRUE when command timer 2 is adjusted to be on. Is true in one minute.
Command timer 3	TRUE when command timer 3 is adjusted to be on. Is true in one minute.
Command timer 4	TRUE when command timer 4 is adjusted to be on. Is true in one minute.
Command timer 5	TRUE when command timer 5 is adjusted to be on. Is true in one minute.
Command timer 6	TRUE when command timer 6 is adjusted to be on. Is true in one minute.
Command timer 7	TRUE when command timer 7 is adjusted to be on. Is true in one minute.
Command timer 8	TRUE when command timer 8 is adjusted to be on. Is true in one minute.

Logic table

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

Input table

Input	Comment
Config. dig. input no. 24	TRUE when activated with a digital signal.
Config. dig. input no. 25	
Config. dig. input no. 26	
Config. dig. input no. 27	
Config. dig. input no. 28	
Config. dig. input no. 37	
Config. dig. input no. 38	
Config. dig. input no. 39	
Config. dig. input no. 40	
Config. dig. input no. 71	
Config. dig. input no. 72	
Config. dig. input no. 73	
Config. dig. input no. 74	

Mode table

Mode	Comment
Island	TRUE when the gen-set mode is selected.
AMF	
Peak shaving	
Fixed power	
Load take over	
Semi auto mode	TRUE when the running mode is selected.
Test mode	
Auto mode	

Relays table

Relays	Comment
Relay no. 0	TRUE when relay is activated.
Relay no. 1	
LS relay no. 4	
LS relay no. 5	
Horn relay (term. 33)	TRUE when the relay at term. 33 is active.

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	

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	

Output events

Relays table

Relays	Comment
Relay no. 0	Active when an enabled rule with this output event is true. Relays 2 and 3 are only selectable when breaker type is set to Continues.
Relay no. 1	
Relay no. 2	
Relay no. 3	
LS relay no. 4	
LS relay no. 5	
Horn relay	Active when an enabled rule with this output event is true. The horn relay output is only available for M-logic configuration if an input event is configured with the 'Horn active' event. See chapter 6.
Crank relay	Active when an enabled rule with this output event is true. The crank relay (term. 32) can be used for other purposes, if the option H5 is used to send the command. (Volvo Penta 2 and Scania 2).
Start prepare relay	Active when an enabled rule with this output event is true. The start prepare relay (term. 31) can be used for other purposes, if the option H5 is used to send the command. (Volvo Penta 2 and Scania 2).
Run/stop coil relay	Active when an enabled rule with this output event is true. The run/stop coil relay (term. 44) can be used for other purposes, if the option H5 is used to send the command. (Volvo Penta 2 and Scania 2).

Commands table

Mode	Comment
Island	Active when an enabled rule with this output event is true.
AMF	
Peak shaving	
Fixed power	
Load take over	
Semi auto mode	Active when an enabled rule with this output event is true.
Test mode	
Auto mode	
Lamp test	Active when an enabled rule with this output event is true. The lamp test will be activated one time only.
Ack. all alarms	The alarm will be activated one time only.

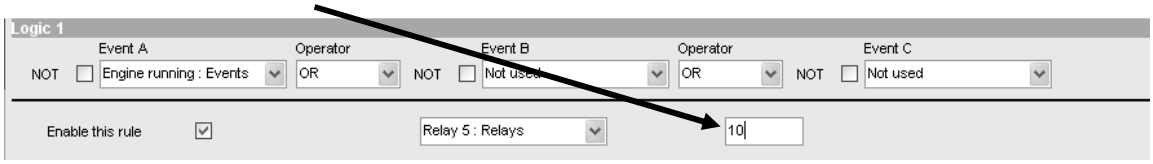
Mode	Comment
Test with LTO/ mode FULL	Active when an enabled rule with this output event is true. A test using load take over mode will be initiated.
Short time parallel	Active when an enabled rule with this output event is true. The function short time parallel will be active.
Test mode parallel	Active when an enabled rule with this output event is true. A parallel test will be initiated.
Test mode simple	Active when an enabled rule with this output event is true. A simple test will be initiated.

Virtual events table

Virtual event	Comment
Virtual event no. 1	Active when an enabled rule with this output event is true.
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	

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. The delay must be between 0 and 3600 seconds.



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

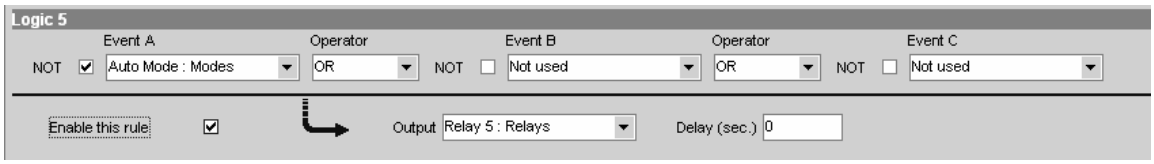
Example 1, TRUE command example

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.

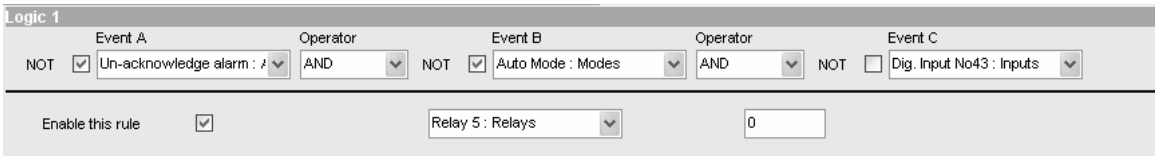


In this example relay 5 must activate when the unit is NOT in auto mode, i.e. in block, manual, semi auto or test mode.

Multiple event command

Example 3, three command events

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

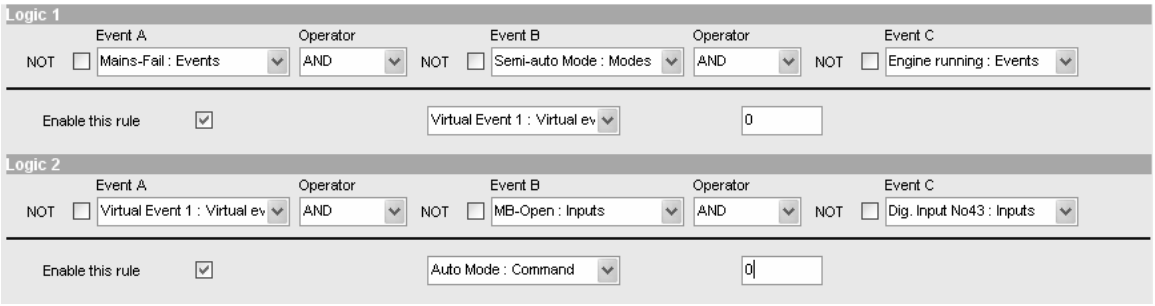


In this example relay 5 must activate when these conditions are met:

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:

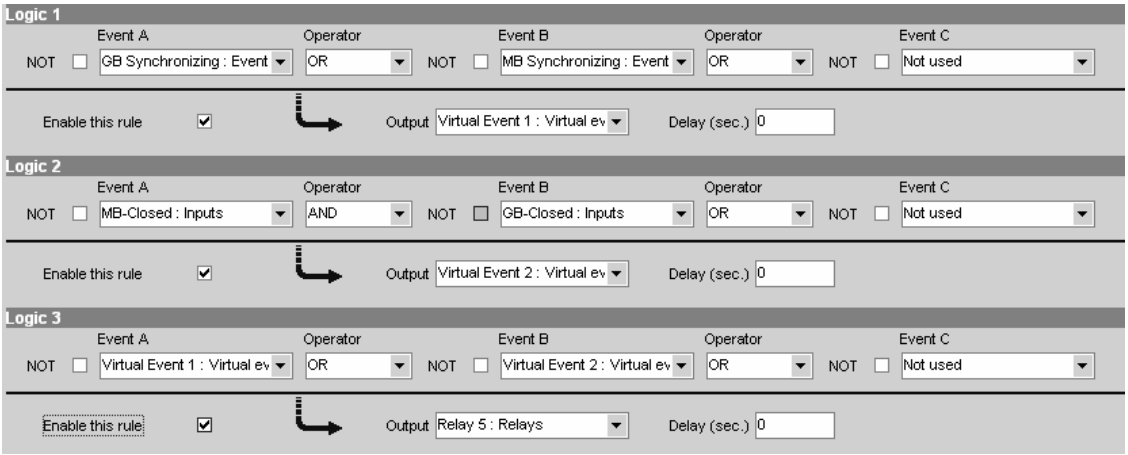
1. *Mains failure present*
2. *Semi auto mode selected*
3. *Engine is running*
4. *MB is open*
5. *Digital input terminal 43 is activated*

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.

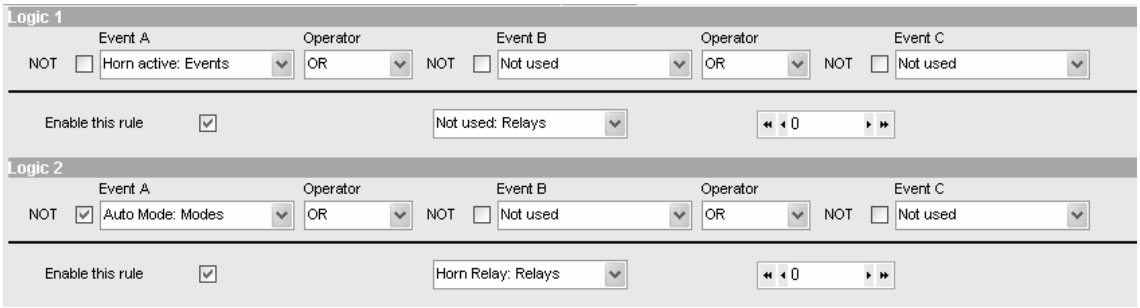


Example 6, horn relay functionality:

In this example the functionality of the horn relay is modified so the horn relay is only activated when there is an alarm with the fail class *Shutdown*.

Example 7, horn relay functionality:

In this example the horn relay is not used as a horn relay. It is used as an output for indicating that the BGC is not in AUTO mode. It is seen that an input event is configured with *Horn active*.



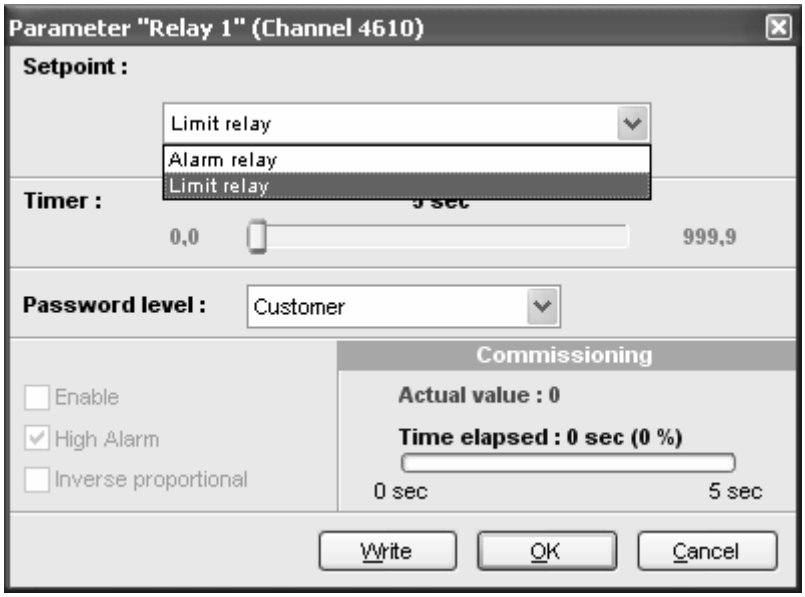
The 'Horn relay' is not used as an alarm horn relay in example 7.

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 Breaker signal = Continuous	Relay 1, 2, 3
Standard unit Breaker signal = Pulse	Relay 1
Synchronising option G2	Relay 4, 5
Load share option G3	Relay 4, 5

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.



The horn relay does not need to be adjusted to 'Limit' relay in order to use it in M-logic.