DEIF

-power in control

CE

MULTI-LINE 2
APPLICATION NOTES



M-Logic, Internal Logic Controller
ECU 100/GCU 100

- Description of M-Logic
- Functional description
- List of possible selections for logics

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

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1. Delimitation

1.1 Scope of Application Notes, M-Logic

1.1.1 ECU 100 and GCU 100

This document covers the following products:

ECU 100	SW version 1.0x.x
GCU 100	SW version 1.0x.x

2. General information

2.1 Warnings, legal information and safety

2.1.1 Warnings and notes

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

Warnings

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

Notes

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

2.1.2 Legal information and disclaimer

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

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

Disclaimer

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

2.1.3 Safety issues

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

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

2.1.4 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.

2.1.5 Factory settings

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

2.2 About the Application Notes

2.2.1 General purpose

This document includes application notes for DEIF's Multi-line 2 unit. It mainly includes examples of different applications suitable for the unit.

For functional descriptions, the procedure for parameter setup, parameter lists etc., please see the Designer's Reference Handbook.

The general purpose of the application notes is to offer the designer information about suitable applications for the Multi-line 2 unit.

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

2.2.2 Intended users

The Application Notes are mainly intended for the person responsible for designing Multi-line 2 systems. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in this document.

2.2.3 Contents and overall structure

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

3. General description

3.1 Introduction

3.1.1 Introduction to M-Logic

The M-Logic is a small logic controller incorporated in the Multi-line 2 unit. Even though it is a logic controller, it must not be confused with a PLC. The M-Logic can be compared with a PLC limited in functionality and can only be used for uncomplicated tasks.

The M-Logic can carry out binary control functions only; there are no possibilities for analogue reading and/or control functions.

The M-Logic can be programmed from the free PC tool called DEIF Utility Software (USW version 3). The USW can be downloaded from: www.deif.com/download_centre/software_download.aspx.

M-Logic setting is done in command lines. There are 40 lines, and each line contains 3 events, 2 operators and one output with a possibility to make a time delay.

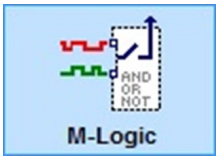
If 3 operators are not enough, a number of virtual events can be used to pass the control on to another line and carry on there. This makes it possible to build larger eventbased controls.

4. Configuration

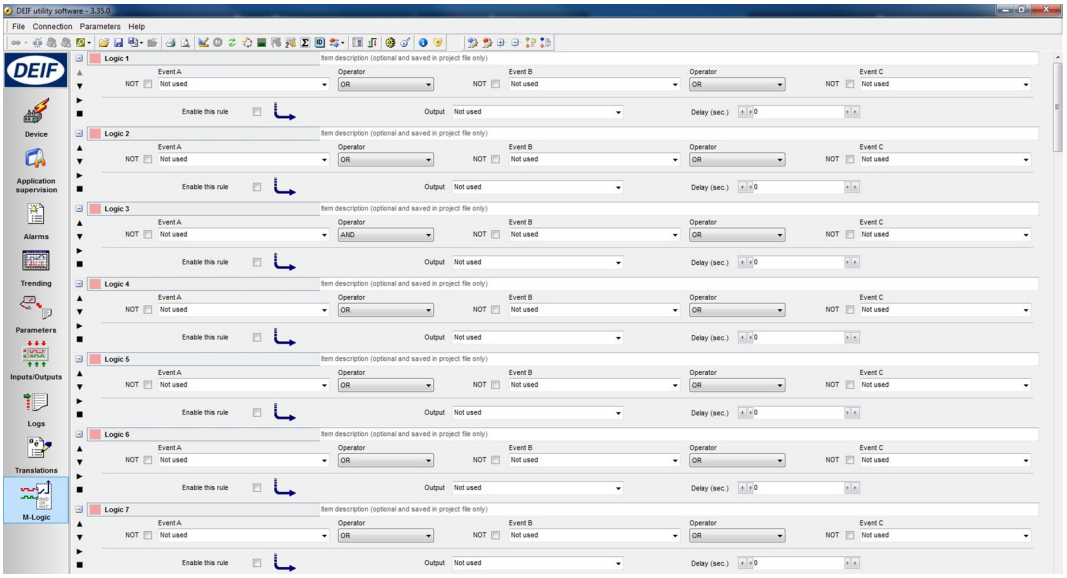
4.1 Starting

4.1.1 Starting the M-Logic

Once the USW has been started, there will be an icon on the lower left-hand side to activate M-Logic



Click the icon and the icon for read M-Logic settings  from the unit, and the following screen appears:



4.2 Read/write

When the M-Logic screen is shown, the M-Logic toolbar appears at the top of the screen. The toolbar has two buttons which are used to write and read the M-Logic configuration to and from the unit.

The M-Logic configuration can also be saved/opened to/from a file using the default save/open buttons.

Read M-Logic settings from the unit
Activating this button will read all M-Logic settings from the unit to the USW.

Write M-Logic settings to the unit
Activating this button will write the M-Logic settings from the USW to the unit.

4.3 Save/open

Save
Activating this button makes it possible to save the M-Logic configuration to file (part of the general Multi-line 2 configuration file ".USW").

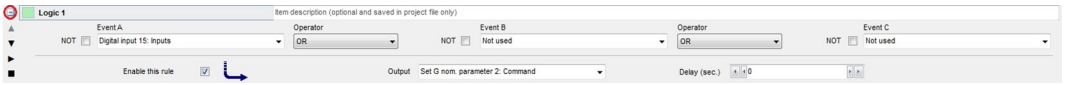
Open
Activating this button makes it possible to open a previously saved logics file.

4.4 Basic functions

4.4.1 Basic functions

The M-Logic consists of a number of "lines", Logic 1, Logic 2 and so on. Each of these lines have three **event** settings, two **operator** settings, one **enable** tick box and one **output** setting.

The Logic line can be collapsed or expanded using this button. The free text will still be shown.

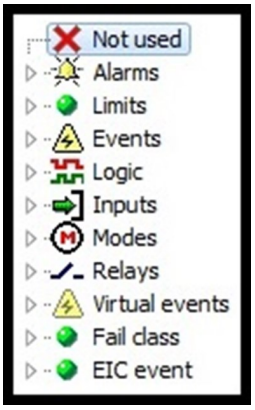


The free text is stored in the .usw file, but not in the product itself.

4.4.2 Events A, B and C

These are used to trigger the logic.

Note that for each event, the function "NOT" can be selected to get an inverted function.



When opening the roll-down window of the events, this window appears:

Alarms: Use an alarm to activate.

Limits: Same as alarms, only with no time delay on binary inputs.

Events: Events that are not alarms, e.g. "Engine running".

Logic: Can be TRUE or FALSE. TRUE means always, FALSE means never.

Inputs: Direct activation of a binary input. The availability of binary inputs is option-dependent.

Modes: Running modes and plant modes, e.g. "AUTO/Remote".

Relays: Activation when a relay activates. The availability of relay outputs is option-dependent.

Virtual events: A number of internal (virtual) events that can be activated from another logic line. By using these virtual events, the number of activating (triggering) events can be expanded from the three available in each logic line to, in theory, an unlimited number of events.

Fail class: The event activates upon activation of any alarm with the chosen fail class, e.g. "Shut-down".

EIC events: Events that are related to engine communication.

The contents of the roll-down window vary slightly between ECU and GCU versions.

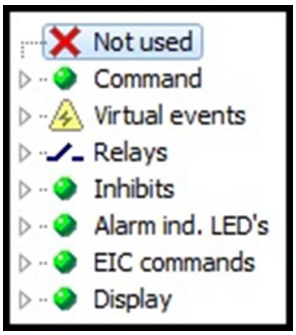
4.4.3 Operators

Two operators are available, and they can be:
“OR” (any operator activates the function output),
“AND” (all activated operators must have status ON to activate the function output).

4.4.4 Enable the rule

If this tick box is not ticked, the logic in question will not operate.

4.4.5 Output



This is the selection of the reaction of the system upon activation of the function. Note that the output has a delay function. If set to 0 s (default), there is no delay.

Command: Command to the Multi-line unit, e.g. select AUTO running mode.

Virtual events: A number of internal (virtual) events that can be activated and used in another logic line. By using these virtual events, the number of activating (triggering) events can be expanded from the three available in each logic line to, in theory, an unlimited number of events.
Virtual events can also be trigged from Modbus.

Relays: Selection of a relay output. The selection of these is option-dependent.

Inhibits: A selection of inhibit functions for the alarms.

Alarm ind. LEDs: The availability of the alarm LEDs is dependent on the module in question.

EIC commands: Commands that are related to engine communication.

Display: View of actual display from 1-20.

If a relay output is chosen, the relay in question must be set up to "Limit relay" output. This is done in the parameter list under "OUTPUTS".

4.5 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

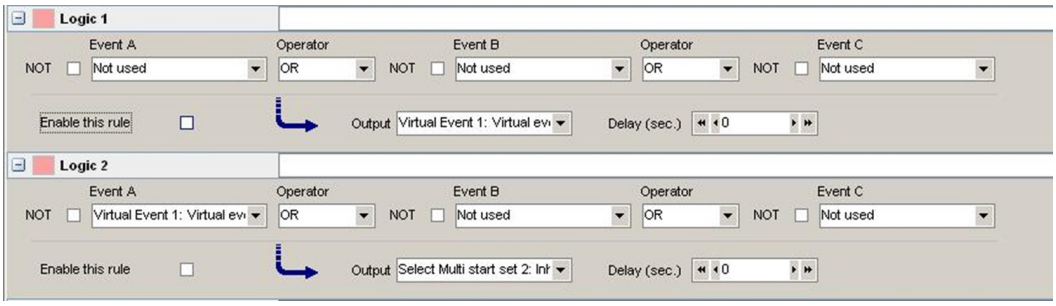
4.6 Examples

By using the events, rules can be made for the use of the M-Logic.

4.6.1 Virtual events

Virtual events are used to expand the number of events in a logic sequence.

The following shows how the output of Logic 1 is used to continue the sequence in Logic 2.



The Logic 1 output is set to Virtual Event 1.
The Event A in Logic 2 is Virtual Event 1.

This gives a total of five events that can be used in this logic sequence (A + B + C in Logic 1 and B + C in Logic 2).

4.6.2 Set/reset function

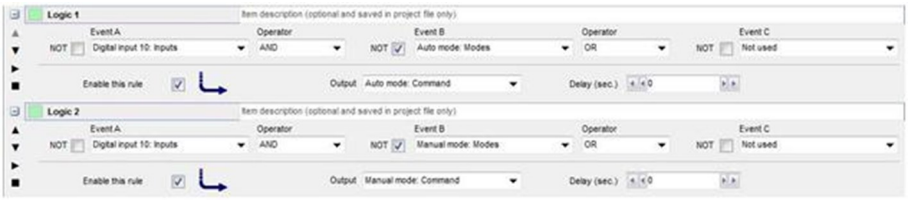
If you use a single binary input for e.g. selection of AUTO/Remote or MANUAL/Local, you need a SET/RESET function, since two digital inputs are normally required for this.

In the following example, digital input no. 10 is used to switch between Remote (input ON) and Local (input OFF).

First line: If input 10 = ON and Remote = OFF (NOT Remote operation mode), then set Remote mode command.

Second line: If input 10 = OFF and Local = OFF (NOT Local operation), then set Local mode command.

In M-Logic, it looks like this:



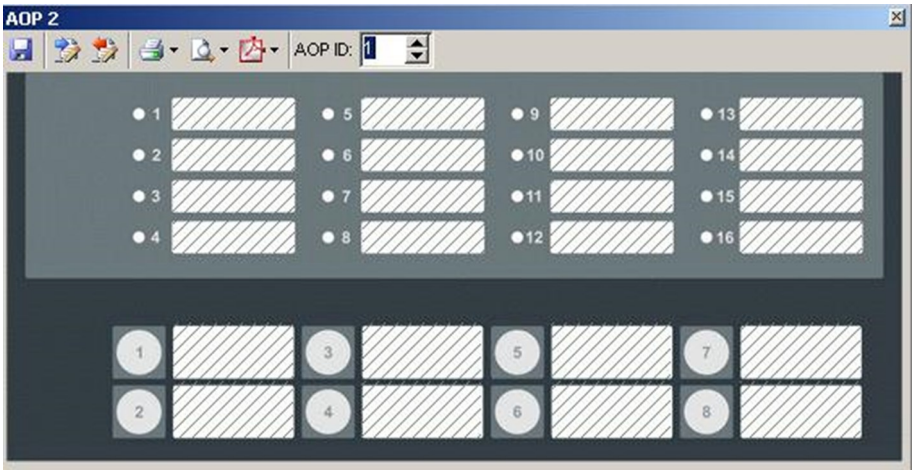
4.6.3 Controlling a relay output with one single AOP button

In this example, the relay can be replaced by any other output, and the AOP button can be replaced by e.g. a digital input.

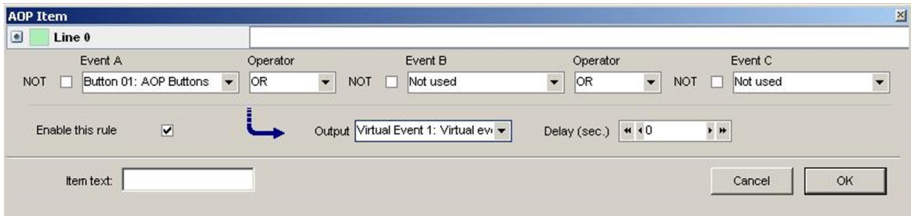
AOP-2 configurator

Press  and the window below appears

Read the present setting by clicking this button 



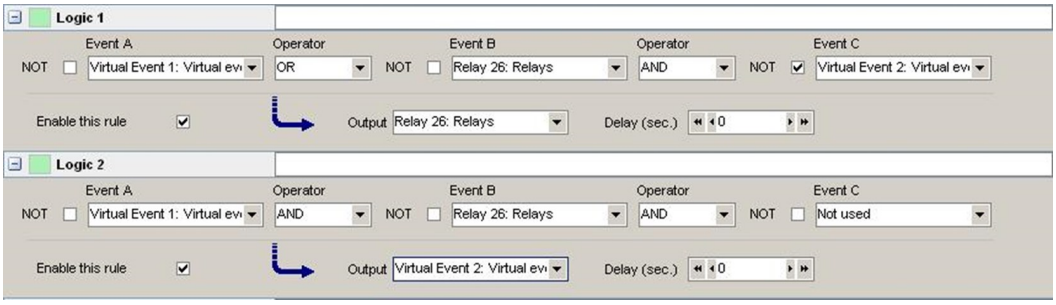
Click button 1 and you select this:



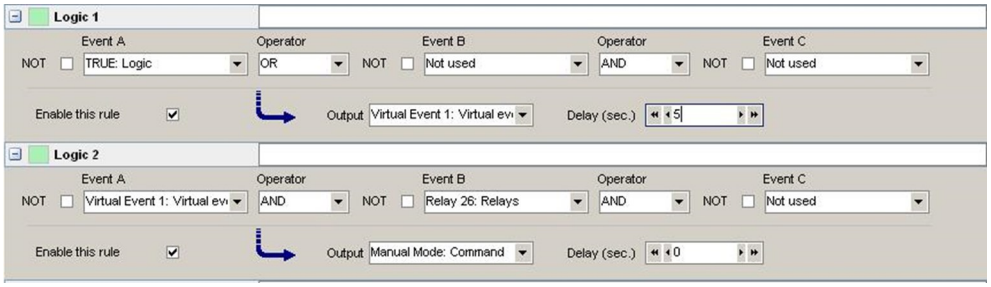
The item text can be written freely and printed, so it can be put in the AOP-2 front pockets.

Click OK. Remember to save the AOP-2 setting, and close the AOP-2 window.

The result is that the relay changes position every time the AOP 1 button is activated.



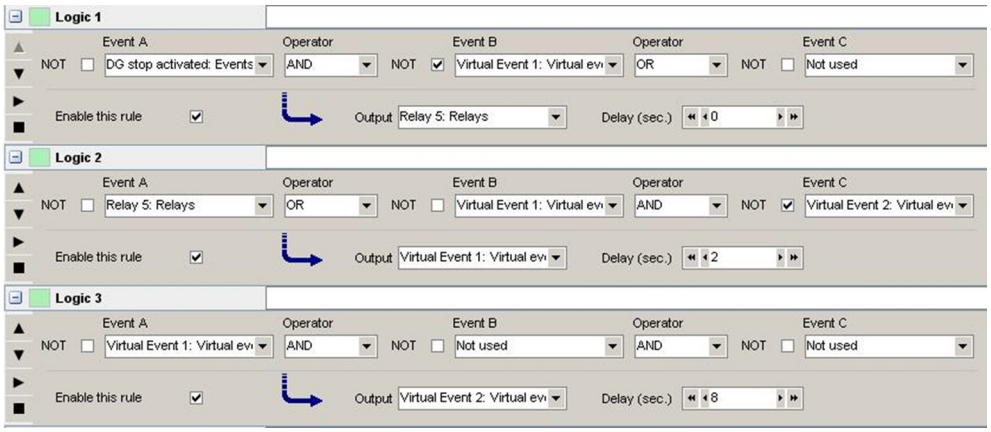
4.6.4 Power up in a specific mode



In the above example, the unit will always power up in manual mode. The timer in Logic 1 sets the output for 5 s, and this is used to set manual mode in event 2. When the timer expires, you can freely select any mode since the virtual event 1 turns ON and the Logic 2 says NOT virtual event 1.

4.6.5 Flip-flop function

If a flip-flop (periodical relay output ON/OFF) function is required, the following example can be used:



The example shows how to configure relay 5 as an output for a flashing light (or similar) during engine stopping sequence.

The event "DG Stop activated" triggers the function.

Logic 1: DG stop activated event triggers the function. The relay output resets if the virtual event (VE) 1 is active.

Logic-2: Relay 5 triggers VE 1 or VE 1 holds itself ON provided VE 2 is NOT active. The time delay of VE 1 is the relay 5 ON time.

Logic 3: VE 1 triggers VE 2. The time delay of VE 2 is the relay 5 OFF time. This time has to be longer than the time delay of VE 1.

The relay 5 (parameter) has to be set to "Limit".

5. List of events and commands

5.1 References

5.1.1 References to DRH and description of options

The terms used in the lists are those used in the Designer's Reference Handbook and the description of options. Please refer to these documents for detailed explanations.

If there are no references to the function in question, the reference can be found in the Designer's Reference Handbook.

In the following section, the X refers to the CANbus addresses. These are divided into: DG (diesel generator unit): Address 1-16.

5.2 ECU 100 and GCU 100

5.2.1 Events

Event	ECU 100	GCU 100	Description	Notes
Alarms	X	X	All alarms are available as events in the alarm category. Note that the list will show all alarms, also those that are not available in the present configuration of basic unit and options.	
Limits	X	X	All limits are available as events in the limit category. Note that the list will show all limits, also those that are not available in the present configuration of basic unit and options.	If the outputs A and B of the alarm in question (e.g. BB < are set to "limit", the alarm message will not appear, but the function will still trigger in the M-Logic limits section.
Events		X	Blackout	Blackout handling. Applies to GCU 113.
		X	TB closed	Tie breaker (single generator set). Applies to GCU 113.
		X	TB opened	
		X	GB opened	Generator breaker (generator set). Applies to GCU 112, GCU 113.
		X	GB closed	
		X	G volt/freq OK delay expired	Diesel generator V/Hz OK (generator set). Applies to GCU 111, GCU 112, GCU 113.
	X	X	Running	Engine is running (generator set).
	X	X	Emergency stop	Emergency stop activated.
	X	X	Engine cranking	Crank output activated.
	X	X	Start active	Start sequence activated.
	X	X	Lamp test active	Lamp test in progress.
	X	X	Battery test active	Battery test in progress.
	X	X	Cool down active	Cool down sequence in progress.
		X	Trip external TB	TB tripped. Applies to GCU 113.
	X	X	Engine heater in manual control	Force/release block of engine heater (toggle function)
		X	Alternative start activated	Alternative start is a full AMF sequence test of the plant. Applies to GCU 111, GCU 112, GCU 113.

Event	ECU 100	GCU 100	Description	Notes
	X	X	G nom. parameter set 1 used	The parameter sets can be selected internally or with digital input.
	X	X	G nom. parameter set 2 used	The parameter sets can be selected internally or with digital input.
		X	G volt/freq OK	Generator frequency and voltage are within range.
	X		Ack. all alarms active	Acknowledge all active alarms.
		X	Three-phase system	AC configuration. Applies to GCU 111, GCU 112, GCU 113.
Logic		X	Split L1L3-phase system	Applies to GCU 111, GCU 112, GCU 113.
		X	Split L1L2-phase system	
		X	Single phase system	
	X	X	Emulation selected with output cmd enabled	Emulation active with output cmd enabled.
	X	X	Emulation selected with output cmd enabled	Emulation active with output cmd disabled.
		X	BB nom parameter set 1 used	Nominal busbar settings 1 and 2. Applies to GCU 111, GCU 112, GCU 113.
		X	BB nom parameter set 2 used	
	X	X	Not used	
	X	X	TRUE	"Always"
	X	X	FALSE	"Never"
Inputs	X	X	Digital input activated (digital input or external I/O)	The number of digital inputs selectable is hardware option-dependent. The number indicates the terminal number for the input in question.
	X	X	Emergency stop	Emergency stop input activated (note that all this is normal state for emer.)
Modes	X	X	Remote mode	
	X	X	Test mode	
	X	X	Local mode	
	X	X	DI remote mode	DI = Digital Input.
	X	X	DI test mode	
Relays	X	X	DI local mode	
	X	X	Relay output activated	The number of relays available is option-dependent. The number relates to the lowest terminal number of the output.

Event	ECU 100	GCU 100	Description	Notes
Virtual events	X	X	Virtual event 1-32	These are used as interconnection between multiple logics to enhance the possible number of events in one sequence.
Fail class	X	X	Block	Start blocking
	X	X	Warning	Warning
		X	Trip GB	Trip genset breaker. Applies to GCU 112 and GCU 113.
		X	Trip + stop	Trip breaker, cool down and stop. Applies to GCU 112 and GCU 113.
	X	X	Shutdown	Trip genset breaker and stop engine.
		X	Trip TB	Trip tie breaker. Applies to GCU 113.
		X	Trip TB + GB	Trip tie breaker and genset breaker. Applies to GCU 113.

All EIC events are present in ECU 110, GCU 111, GCU 112, GCU 113.

Event	ECU 100	GCU 100	Description	Notes
EIC event	X	X	DPF lamp OFF	Particulate filter is OK
	X	X	DPF lamp ON (solid)	Indicates
	X	X	DPF lamp ON (flash)	Regeneration is necessary (after generation, the lamp turns OFF).
	X	X	DPF active Regeneration not activated (status)	Regeneration status.
	X	X	DPF active Regeneration activated (status)	Regeneration status.
	X	X	DPF active Regeneration needed (status)	Regeneration status.
	X	X	DPF Regen not needed (status)	Level of needed regeneration.
	X	X	DPF Regen needed - lowest level (status)	Level of needed regeneration.
	X	X	DPF Regen needed - highest level (status)	Level of needed regeneration.
	X	X	DPF Regen not inhibited (lamp)	Regeneration switch is disabled.
	X	X	DPF Regen inhibited (lamp)	Regeneration disable switch is active. Automatic and manual regeneration cannot occur.
	X	X	High Exh Syst Temp OFF (lamp)	Exhaust temp. below.
	X	X	High Exh Syst Temp ON (lamp)	Exhaust temp. above.

5.2.2 Operators

Operator	Description	Notes
OR	Using OR between 2 events means that the output will activate when one of these activates.	
AND	Using AND between 2 operators means that the output will only activate if both events are activated.	

5.2.3 Outputs, ECU 100 and GCU 100

Output	ECU 100	GCU 100	Description	Notes
Command	X	X	Manual mode	
	X	X	Auto mode	Function modes
	X	X	Test mode	
	X	X	Lamp test	Activate lamp test (LEDs on display)
	X	X	Ack. all alarms	Acknowledge all alarms
	X	X	Battery test	Activate battery test
	X	X	Engine heater manual ctrl.	Engine heater in manual
	X	X	Set G nom parameter 1	Choose a parameter set (nominal settings)
	X	X	Set G nom parameter 2	Choose a parameter set (nominal settings)
	X	X	Select test type to simple	Test sequence selection. Applies to all variants.
		X	Select test type to full	Test sequence selection. Applies to GCU 113.
		X	GB close inhibit	Inhibit the closing of GB. Applies to GCU 112, GCU 113.
		X	Open GB	Reacts in manual mode only. Applies to GCU 112, GCU 113.
		X	Close GB	Reacts in manual mode only. Applies to GCU 112, GCU 113.
		X	Open TB	Reacts in manual mode only. Applies to GCU 113.
		X	Close TB	Reacts in manual mode only. Applies to GCU 113.
	X	X	Remote start	Reacts in manual mode only.
	X	X	Remote stop	Reacts in manual mode only.
		X	DG start + GB on	Applies to GCU 112 and GCU 113.
		X	DG start + GB on	Applies to GCU 112 and GCU 113.
		X	Select three-phase system	Selects expected to measure AC voltage on a 3-phase system. Applies to GCU 111, GCU 112, GCU 113.
		X	Select split L1L3-phase system	Selects expected to measure AC voltage on a 2-phase system. Applies to GCU 111, GCU 112, GCU 113.

Output	ECU 100	GCU 100	Description	Notes
		X	Select split L1L2-phase system	Selects expected to measure AC voltage on a 2-phase system. Applies to GCU 111, GCU 112, GCU 113.
		X	Select single phase system	Selects expected to measure AC voltage on a 1-phase system. Applies to GCU 111, GCU 112, GCU 113.
	X	X	Idle run low speed	Idle speed constant low speed.
	X	X	Cool down threshold	Interrupts cool down sequence.
	X	X	Activate all AOP-2 buzzers	All AOP-2 buzzers. All AOP-2 relays.
	X	X	Activate all AOP-2 relays	
	X	X	Activate relay on AOP-2 ID1	Single AOP-2 relays.
	X	X	Activate relay on AOP-2 ID2	Single AOP-2 relays.
	X	X	Activate relay on AOP-2 ID3	Single AOP-2 relays.
	X	X	Activate relay on AOP-2 ID4	Single AOP-2 relays.
	X	X	Activate relay on AOP-2 ID5	Single AOP-2 relays.
	X	X	Activate buzzer on AOP-2 ID1	Single AOP-2 relays.
	X	X	Activate buzzer on AOP-2 ID2	Single AOP-2 relays.
	X	X	Activate buzzer on AOP-2 ID3	Single AOP-2 relays.
	X	X	Activate buzzer on AOP-2 ID4	Single AOP-2 relays.
	X	X	Activate buzzer on AOP-2 ID5	Single AOP-2 relays
		X	TB close inhibit	Inhibits the closing of TB. Applies to GCU 113.
	X	X	Reset horn	Resets the horn relay.
	X	X	Activate buzzer on controller	Activates the controller's internal buzzer.
	X	X	Deactivate buzzer on controller	Deactivates the controller's internal buzzer.
		X	Set BB parameter 1	Select between parameter set 1 and 2 for BB (busbar) nominal settings. Applies to GCU 111, GCU 112, GCU 113.

Output	ECU 100	GCU 100	Description	Notes
		X	Set BB parameter 2	
	X	X	M-Logic alarm 1	These are virtual alarms that can be used to trigger M-Logic events. The alarms can also be set in the digital inputs.
	X	X	M-Logic alarm 2	
	X	X	M-Logic alarm 3	
	X	X	M-Logic alarm 4	
	X	X	M-Logic alarm 5	
	X	X	Shutdown override	Activates shutdown override
Virtual events	X	X	Virtual event 1-32	These are used as inter-connection between multiple logics to enhance the possible number of events in one sequence.
Relays	X	X	Selectable no. of relays	The list will show all relays.
Inhibits	X	X	Not used	-
	X	X	Deactivate mode button	Mode button on display front.
	X	X	Inh. acknowledge in remote	If in remote, the alarm acknowledge is not possible.
	X	X	Inh. Modbus commands	Modbus commands are ignored.
		X	Inhibit 1	Alarm inhibits.
	X	X	Inhibit 2	
	X	X	Inhibit 3	
	X	X	Inh. start button	-
	X	X	Inh. stop button	-
	X	X	Inh. GB button	Applies to GCU 112 and GCU 113.
	X	X	Inh. TB button	Applies to GCU 113.
	X	X	Inhibit engine start	
Alarm ind. LEDs	X	X	LED X red + flash	X = ID number (01-04).
	X	X	LED X red	
	X	X	LED X yellow + flash	
	X	X	LED X yellow	
	X	X	LED X green + flash	
	X	X	LED X green	
EIC commands	X	X	EIC droop	Activates ECU droop.
	X	X	EIC droop emulation	Activates droop in the ML-2 (reference setpoint still nominal frequency/power but regulation loop is with added droop for stability).
	X	X	EIC reset trip fuel	Resets fuel counter in the ECU.

Output	ECU 100	GCU 100	Description	Notes
	X	X	EIC enable cylinder cutout	Allows cylinder cutout.
	X	X	EIC engine overspeed test	Initiates overspeed test.
	X	X	EIC intermittent oil priming	Activates oil priming pump.
	X	X	EIC engine or mode command	Sets the operating mode of the engine.
	X	X	EIC engine speed gov param command	Selects default or variant 1 governor parameter setting.
	X	X	EIC DPF regeneration inhibit	The regeneration disabled (inhibit) switch disallows any automatic or manual (non-mission) regeneration of the diesel particulate filter.This may be used by the operator to prevent regeneration when the machine is operating in a hazardous environment and the OEM is concerned about high temperature.
	X	X	EIC DPF regeneration force	The regeneration initiate switch initiates a manual (non-mission) regeneration of the particulate filter when the machine is in non-mission condition and DPF soot levels are high enough to allow regeneration. This switch is for use in forcing a regeneration event to occur to trouble- shoot the system. During a non-mission regeneration the engine speed will in- crease to an optimum speed for regeneration
	X	X	Inh EUC alarms	Inhibit of EIC alarms; red/yellow/protection/ malfunction.
	X	X	EIC select Cummins	Enables speed control for PCC 1301.
	X	X	EIC start/stop enable	Switches ON/OFF the start and stop.
	X	X	EIC speed control inhibit	Disables the EIC speed control.
Display	X	X	Act. view X on display	Act. view 1-20 on display.