



MULTI-LINE 2



Converting GPU-2 to GPU-3

- Parameter conversion
 - Wiring
 - Options
 - I/O list



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1. General information

1.1 Warnings, legal information and safety

1.1.1 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



DANGER!

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

Notes



INFO

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

1.1.2 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.



DANGER!

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.

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.

1.1.3 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.



DANGER!

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

1.1.4 Electrostatic discharge awareness

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

1.1.5 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.

1.2 About the Application Notes

1.2.1 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.



INFO

For functional descriptions, the procedure for parameter setup, parameter lists, and so on, 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.



DANGER!

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

1.2.2 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.

1.2.3 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.

2. Application and installation

2.1 About the application

2.1.1 General description

This document mainly includes general information (in point form) on how to upgrade a standard GPU-2 to a GPU-3 system, including mounting instructions and wiring descriptions, parameter and general standard conversions.



CAUTION

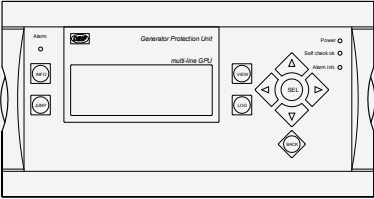
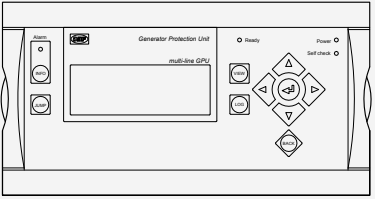
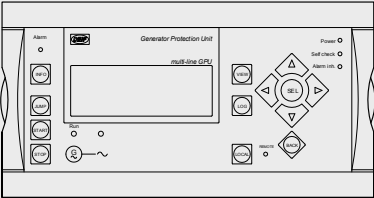
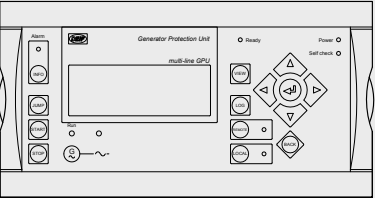
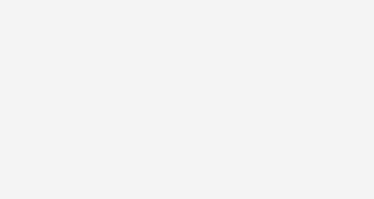
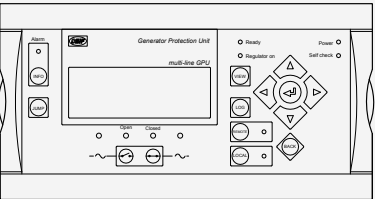
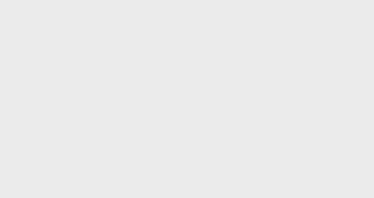
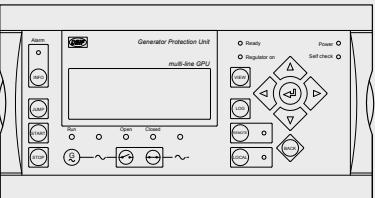
This document only cover GPU-2 standard software version 2.xx.x.

The general purpose of this document is to help the user with the first steps of upgrading a standard generator protection unit (GPU) system.

DEIF A/S always recommends to create a full backup parameter file before the old unit is powered down.

2.1.2 Converting the display

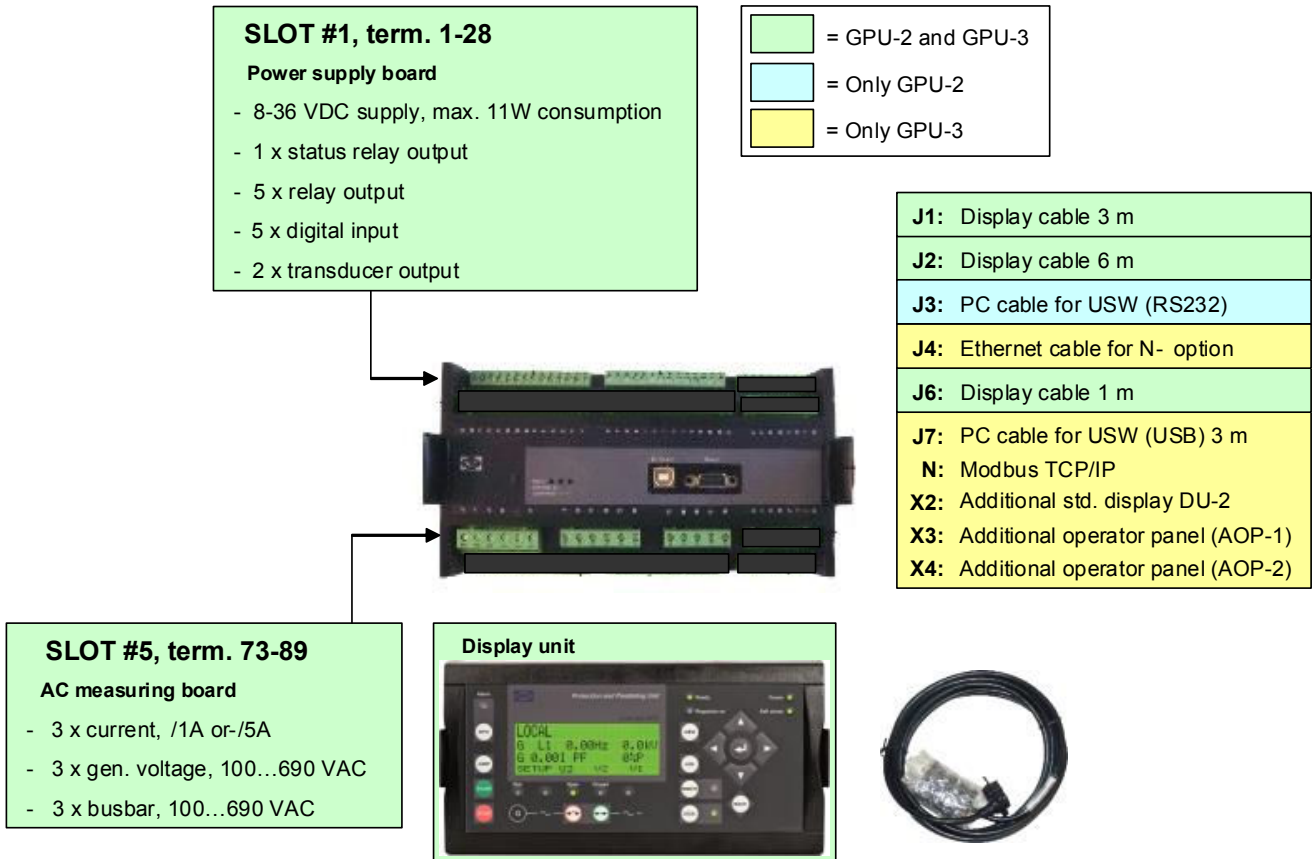
The table below shows an overview of standard displays and the options of converting the displays.

GPU-2	GPU-3	Note
		Standard
		Engine control (option Y7)
		Breaker control (option Y5)
		Engine and breaker control (Y1)

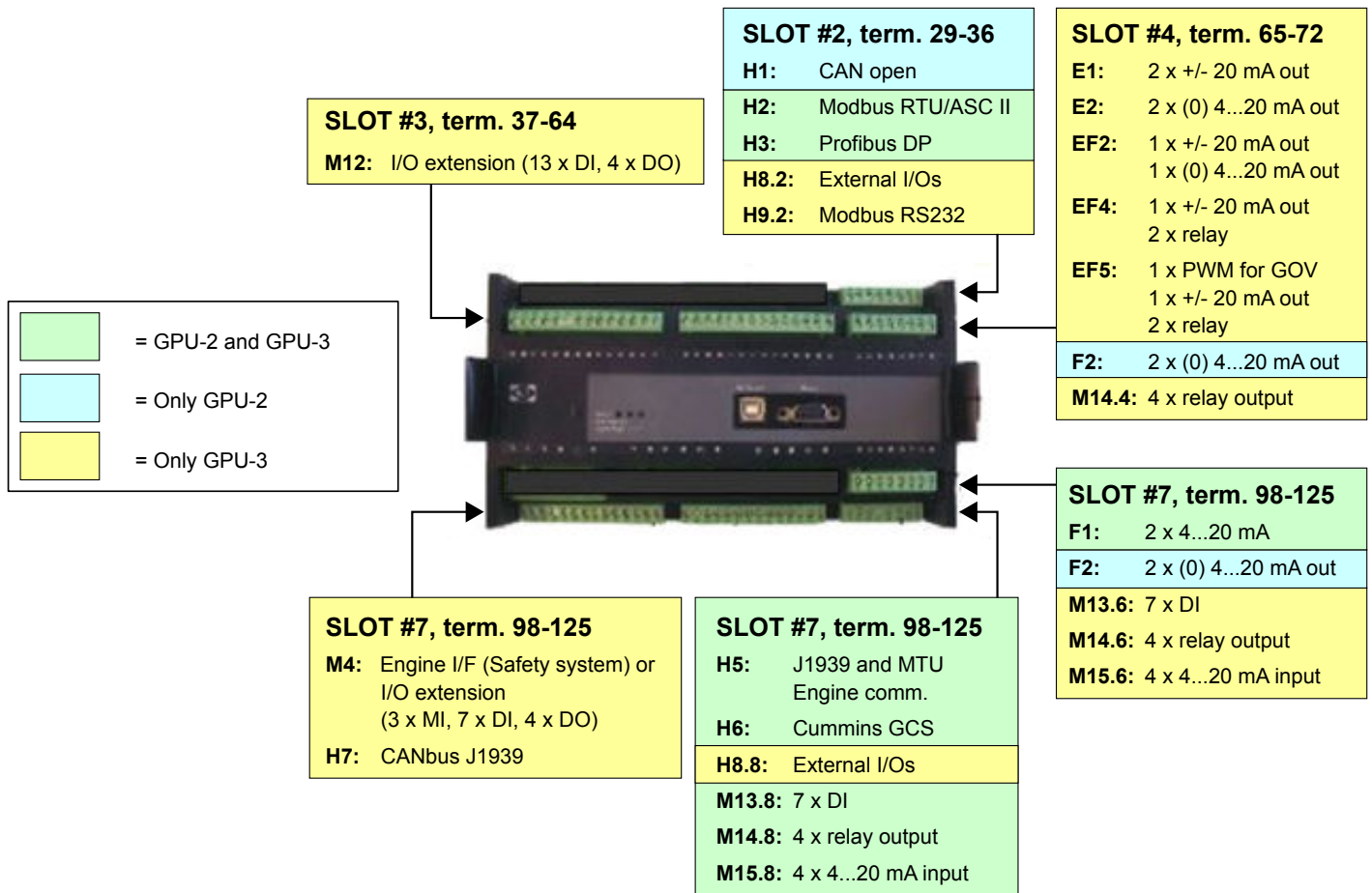
2.1.3 Description of options

The unit housing is divided into board slot positions. This means that the unit consists of a number of printed circuit boards (PCBs) mounted in numbered slots - #1-8. Some of these board slots are standard and some are intended for options. The board slot positions are arranged as illustrated below.

Figure 2.1 Standard PCB's in GPU-2/GPU-3



The illustration below shows the location of the various options.



The table below provides an overview and description of the GPU-2 options and shows which options that can be converted to GPU-3. GPU-2 options B1 and C1 are implemented as standard software in GPU-3.

GPU-2	Description	GPU-3	Option type
Option A1	Vector jump and df/dt (ROCOF) Over-/under-voltage (generator and busbar) Over-/under-frequency (generator and busbar) Time-dependent under-voltage Reactive power-dependent under-voltage	Option A1	Software
Option A2	Df/dt (ROCOF) Over-/under-voltage (generator and busbar) Over-/under-frequency (generator and busbar)	Option A1	Software
Option A3	Vector jump Over-/under-voltage (generator and busbar) Over-/under-frequency (generator and busbar)	Option A1	Software
N/A	Positive sequence voltage low	Option A4	
N/A	Directional over-current	Option A5	
Option B1	Over-/under-voltage (generator and busbar) Over-/under-frequency (generator and busbar)	Standard	Software
Option C1	Over-/under-voltage (generator) Over-/under-frequency (generator) Overload Fast over-current (<42 ms, 350 %, 2 levels) Current/voltage unbalance Reactive power import (excitation loss) Reactive power export (over-excitation)	Standard	Software

GPU-2	Description	GPU-3	Option type
Option C2	Negative seq. voltage/current Zero Seq. voltage/current Power-dependent reactive power import/export Inverse time over-current	Option C2	Software
Option D1	Fixed U/Q/PF Q load sharing Voltage droop GPU: voltage matching (requires option G2)	Option D1	Software
Option E1	+/-20 mA for speed governor +/-20 mA for AVR	Option E1	Hardware
N/A	0(4)...20 mA for speed governor or transducer 0(4)...20 mA for AVR or transducer	Option E2	Hardware
Option EF2	+/-20 mA for speed governor 1 x 0(4) 20 mA transducer output	Option EF2	Hardware
Option EF3	1 x PWM (Pulse Width Modulated) output for CAT speed governor 1 x PWM (Pulse Width Modulated) output for droop +/-20 mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Option EF5	Hardware
Option EF4	+/-20 mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Option EF4	Hardware
N/A	1 x PWM (Pulse Width Modulated) output for CAT speed governor +/-20 mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Option EF5	Hardware
Option F1	2 x 0(4) to 20 mA transducer out	Option F1	Hardware
Option F2	4 x 0(4) to 20 mA transducer out	Option E2 + F1	Hardware
Option G1	Start/stop of next DG outputs	Standard	
Option G2	Synchronisation with relay outputs	Option G2	SW and HW option
Option H1	CANopen	N/A	Hardware
Option H2 and H3	Modbus and Profibus DP	Option H2 and H3	Hardware
Option H4	CAT CCM	Option H7	Hardware
N/A	Reading of J1939 values Full J1939 engine	Option H5	Hardware
N/A	Cummins GCS	Option H6	Hardware
N/A	Engine communication - CAN bus J1939	Option H7	Hardware
N/A	CAN bus interface for external I/O modules (Beckhoff) in slot #2 or slot #8	Option H8.x	Hardware
N/A	Modbus RTU/ASCII (RS-232) and GSM modem connection	Option H9.2	Hardware
Option J1	Display cable, 3 m	Standard	Hardware
Option J2	Display cable, 6 m	Option J2	Hardware
Option J3	PC cable for utility software (RS-232)	N/A	Hardware
N/A	PC cable for opiton N-programming	Option J4	Hardware
N/A	Display cable, 1 m	Option J6	Hardware
N/A	PC cable for utility software (USB), 1 m	Option J7	Hardware
Option M1 or M2	Engine control and protection	Option M4	Hardware

GPU-2	Description	GPU-3	Option type
	Configurable I/O's. 13 inputs, 4 outputs.	Option M12	Hardware
Option M13	7 digital inputs in slot #8	Option M13.x	Hardware
Option M14	4 relay outputs in slot #8	Option M14.x	Hardware
Option M15	4 analogue inputs in slot #8	Option M15.x	Hardware
Option M20	Front folio with engine control	Option Y7 (GPU)	Hardware
N/A	Modbus TCP/IP and alarms via SMS or email	Option N	Hardware
N/A	Verified class 0.5	Option Q1	Hardware
N/A	Additional standard display on CAN bus	Option X2	Hardware
N/A	Additional Operator Panel (AOP-1)	Option X3	Hardware
N/A	Additional Operator Panel (AOP-2)	Option X4	Hardware
N/A	Front folio with engine and GB control	Option Y1	Hardware
N/A	Front folio with GB control	Option Y5 (GPU)	Hardware
Option Z1	PNOM >20 MW		

2.2 Installation and parameter setup

2.2.1 Wiring installation

The table below shows an overview of the terminals on a standard GPU-2 and GPU-3 without options.

General description	Terminal GPU-2	Terminal description GPU-2	Terminal GPU-3	Terminal description GPU-3
Power supply	1	24 V DC (+)	1	24 V DC (+)
Power supply	2	0 V DC (-)	2	0 V DC (-)
Relay (NO)	3 + 4	Status relay	3 + 4	Status relay
Relay (NO + NC)	5 + 6 + 7	Relay 1	5 + 6 + 7	Relay 5
Relay (NO + NC)	8 + 9 + 10	Relay 2	8 + 9 + 10	Relay 8
Relay (NO + NC)	11 + 12 + 13	Relay 3	11 + 12 + 13	Relay 11
Relay (NO + NC)	14 + 15 + 16	Relay 4	14 + 15 + 16	Open GB
Relay (NO + NC).		Not used	17 + 18 + 19	Relay 17
Transistor output	20	Open collector 1	20	Open collector 1
Transistor output	21	Open collector 2	21	Open collector 2
Transistor output	22	Common for terminals 20 and 22	22	Common for terminals 20 and 22
Digital input	23	Alarm inhibit	23	Alarm inhibit group 1
Digital input	24	Remote alarm acknowledge	24	Remote alarm acknowledge
Digital input	25	Configurable	25	Configurable
Digital input	26	Configurable	26	Configurable
Digital input	27	Configurable	27	Configurable
Common	28	Common for terminals 23-27	28	Common for terminals 23-27

General description	Terminal GPU-2	Terminal description GPU-2	Terminal GPU-3	Terminal description GPU-3
I1	73 + 74	Current meas.	73 + 74	Current meas.
I2	75 + 76	Current meas.	75 + 76	Current meas.
I3	77 + 78	Current meas.	77 + 78	Current meas.
U1	79	Volt. meas. Gen	79	Volt. meas. Gen
U2	81	Volt. meas. Gen	81	Volt. meas. Gen
U3	83	Volt. meas. Gen	83	Volt. meas. Gen
U1	85	Volt. meas. BB	85	Volt. meas. BB
U2	87	Volt. meas. BB	87	Volt. meas. BB
U3	89	Volt. meas. BB	89	Volt. meas. BB



INFO

Further wiring terminals (if having options added) and wire mounting differences for both units can be seen in manuals *Installation Instructions* and *Description of options* for both GPU-2 and GPU-3 at www.deif.com.

2.2.2 Parameter settings - system setup

The PC utility software is a software program used for configuring the Multi-line 2 product. There are two versions, 1.x for GPU-2 and 3.x. for GPU-3.

The utility software can be downloaded at www.deif.com.

Procedure for retrofitting a GPU-2 to a GPU-3 is, besides the physical replacement, in general to retrieve all settings from the GPU-2 and manually setup same parameters in the GPU-3 through the USW. See what settings and how to retrieve them from GPU-2 in the manual *ML-2 application notes Getting started 1x 4189340866* which can be downloaded at www.deif.com.



CAUTION

It's very important to take out these GPU-2 parameters before powering down the unit as there are a certain risk (due to unit age) of resetting all parameters back to factory setup.

The table below shows a direct conversion of the parameters that include nominal settings.

Nominal settings

Parameter GPU-2	Description	Unit	Parameter GPU-3	Description	Unit
4011	Nom. frequency	Hz	6001	Nom. f (1)	Hz
4012	Nom. power	kW	6002	Nom. P (1)	kW
4013	Nom. current	A	6003	Nom. I (1)	A
4014	Nom. voltage	V	6004	Nom. U (1)	V
N/A			6005	Nom. RPM (1)	RPM
4021	Volt. prim. GEN	V	6041	G primary U	V
4022	Volt. sec. GEN	V	6042	G secondary U	V
4023	Current prim.	A	6043	G primary I	A
4024	Current sec.	A	6044	G secondary I	A
4031	Volt. prim. BUS	V	6051	BB primary U1	V
4032	Volt. sec. BUS	V	6052	BB secondary U1	V

Parameter GPU-2	Description	Unit	Parameter GPU-3	Description	Unit
4033	Nom. volt. BUS	V	6053	BB nominal U1	V
4121	Running time	Hours	6101	Running hours (0-999)	Hours
			6102	Running hours (1.000-999.000)	Hours
4122	CB operations		6103	GB operations	

2.2.3 Protection setup

These adjustment points are available in GPU-2:

- Set points
- Delay timer
- Output A
- Output B.

The protection has a commissioning window where live status is shown.

In GPU-3, the same adjustment points are available, but "Fail class" is added. Here it is possible to set an alarm action to for example *Trip of GB, Warning, shutdown*, and so on.

Inhibits are also added in the protection parameter window, where one or several conditions can be set to inhibit the specific protection.

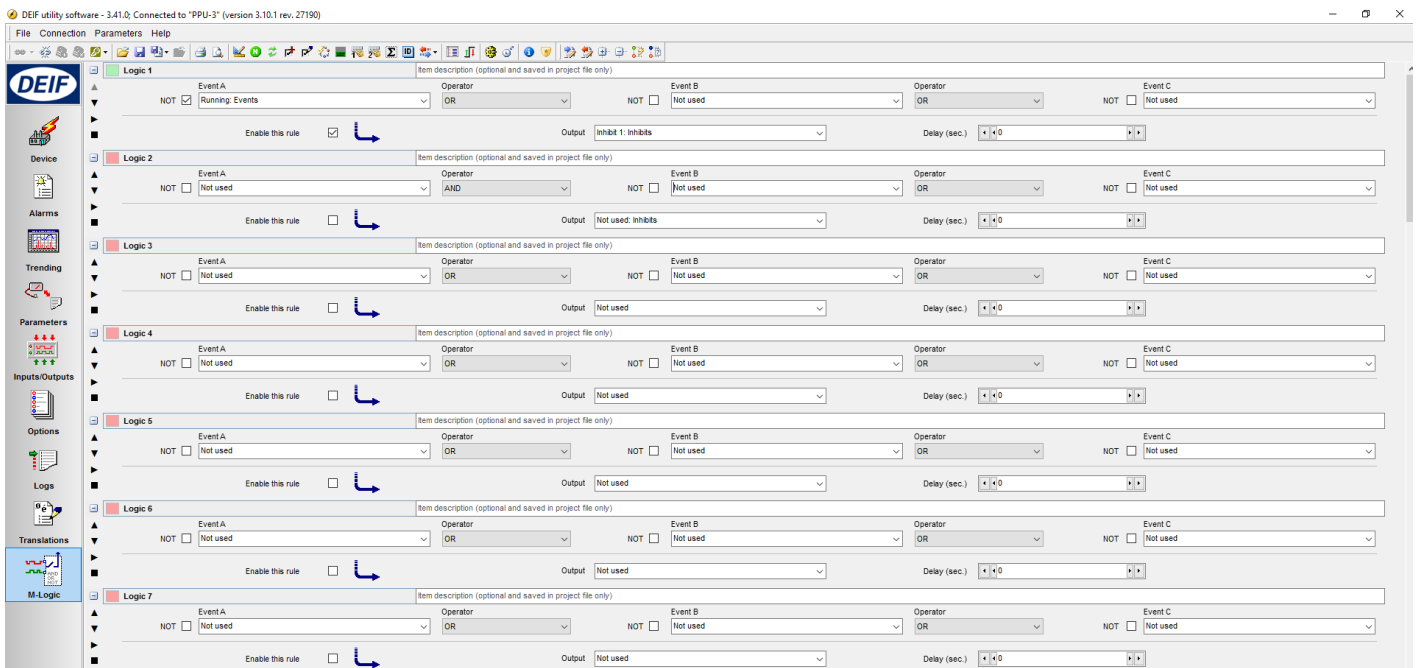
It is also possible to attach the protection to an inhibit group, which can be activated from M-Logic. In M-Logic further general inhibits can be set up.

2.2.4 M-Logic in GPU-3

The M-Logic functionality is included in the GPU-3 unit and is not an option-dependent function.

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, controller commands, inhibitions etc.



2.2.5 External communication - Modbus

The functions and readings on Modbus/Profibus are not placed on same addresses on a GPU-2 and a GPU-3 controller.

Parameter 7514 allows to enable GPU-2 Modbus protocol in a GPU-3 controller and has three different settings:

1. Standard: Normal GPU/PPU-3 register layout.
2. GPU/PPU-2: GPU/PPU-2 register layout. Only GPU/PPU-2 registers will respond, requests to any other register will result in "ILLEGAL DATA ADDRESS".
3. MIX: GPU/PPU-2 register layout. Requests to GPU/PPU-3 registers that are not occupied by GPU/PPU-2 will respond as in "Standard" mode.

This only applies to the external communication board (options H2 and H3) located in slot #2. The USB service port and Ethernet port (option N) still use the GPU-3 Modbus address list.

Contact DEIF Support for a complete list of available parameters.



INFO

The protocol converter is only usable from software version 2.x.x and forward. On units with software below version 2.x.x, alarm bits are not set on same Modbus addresses. In this situation the system communicating with GPU-2 will have to be reprogrammed.