DEIF

-power in control

CE

MULTI-LINE 2
APPLICATION NOTES

Converting PPU-2 to PPU-3

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

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

Document no.: 4189341126C
SW version:

1. General information

1.1. Warnings, legal information and safety ... 3
1.1.1. Warnings and notes ... 3
1.1.2. Legal information and disclaimer ... 3
1.1.3. Safety issues ... 3
1.1.4. Electrostatic discharge awareness ... 3
1.1.5. Factory settings ... 4
1.2. About the Application Notes ... 4
1.2.1. General purpose ... 4
1.2.2. Intended users ... 4
1.2.3. Contents and overall structure ... 4

2. Application and installation

2.1. About the application ... 5
2.1.1. General description ... 5
2.1.2. Converting the display ... 5
2.1.3. Description of options ... 6
2.2. Installation and parameter setup ... 11
2.2.1. Wiring installation ... 11
2.2.2. Parameter settings - system setup ... 13
2.2.3. Parameter setup regulator governor ... 15
2.2.4. Parameter setup relay or analogue governor ... 15
2.2.5. Parameter setup governor relay ... 15
2.2.6. Synchronisation setup ... 16
2.2.7. Protection setup ... 16
2.2.8. Mode selection ... 18
2.2.9. External communication - Modbus ... 18
2.2.10. M-Logic in PPU-3 ... 19

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

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.

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.

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.

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.

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.

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 PPU-2 to a PPU-3 system, including mounting instructions and wiring descriptions, parameter and general standard conversions. Upgrading of a GPU-2 to a GPU-3 is a similar setup. Contact DEIF support for more details.

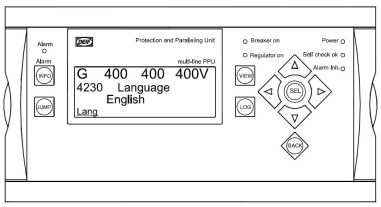
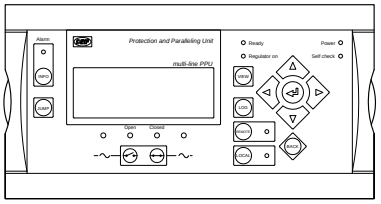
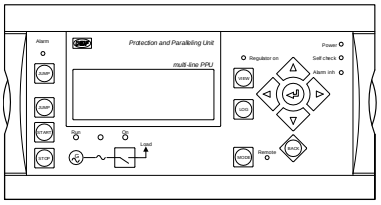
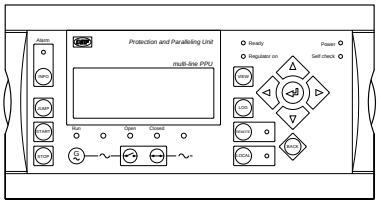
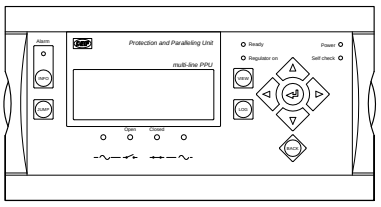
This document only cover GPU/PPU-2 standard software version 2.xx.x

The general purpose of this document is to help the user with the first steps of upgrading a standard paralleling and protection unit system.

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

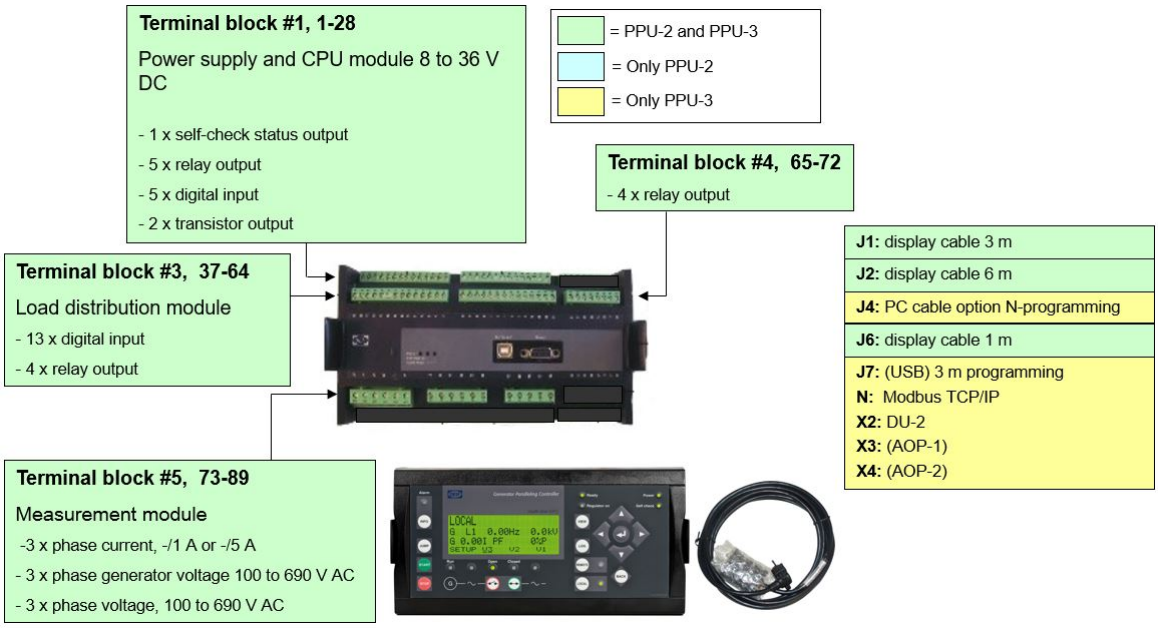
2.1.2 Converting the display

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

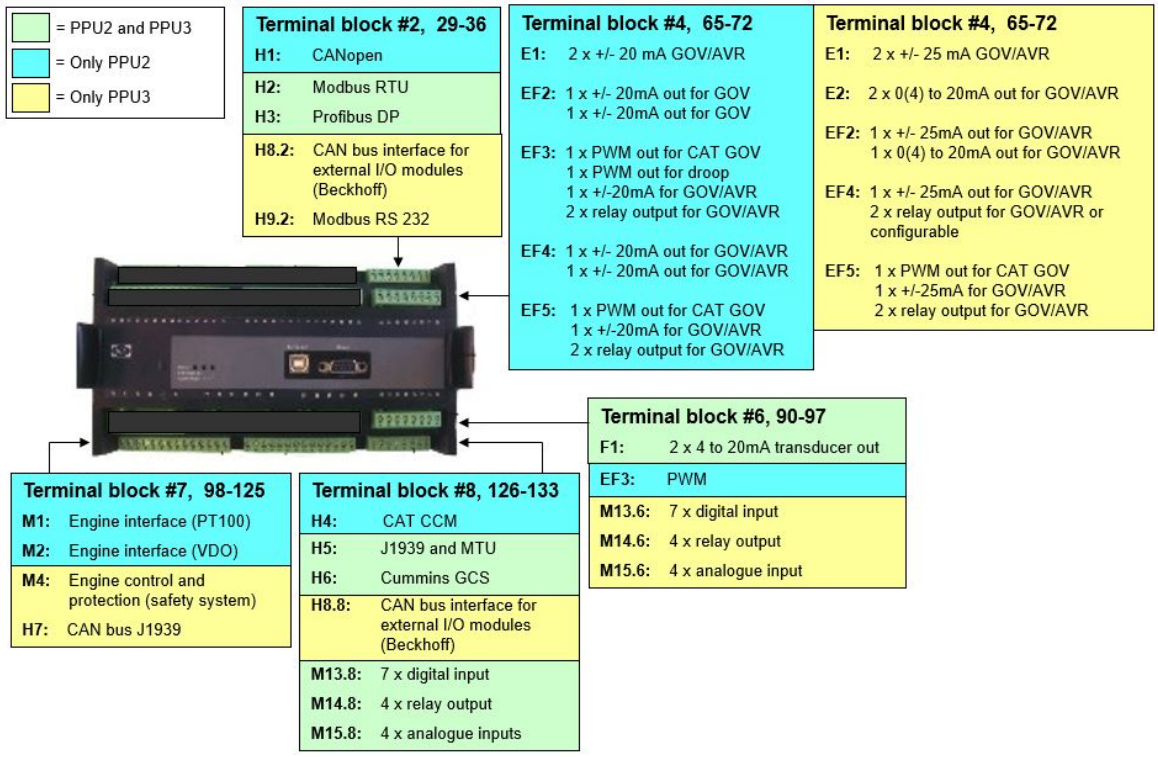
PPU-2	PPU-3	Note
		Standard
		Engine control (option Y1)
		No control buttons (option Y11)

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, 3, 4 and 5. Some of these board slots are standard and some are intended for options. The board slot positions are arranged as illustrated below.



The illustration below shows the location of the various options related to slots #2, 4, 6, 7 and 8.



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

PPU-2	Description	PPU-3	Option type
Option A1	Vector jump and df/dt (ROCOF)	Option A1	Software
	Over-/under-voltage (generator and busbar) Over-/under-frequency (generator and busbar)		
	Time-dependent under-voltage Reactive power-dependent under-voltage		
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
Option C2	Negative seq. voltage/current Zero Seq. voltage/current	Option C2	Software
	Power-dependent reactive power import/export Inverse time over-current		
Option D1 (GPU/PPU)	Fixed U/Q/PF Q load sharing	Option D1	Software
	Voltage droop GPU: voltage matching (requires option G2)		
Option E1	+/-20 mA for speed governor +/-20 mA for AVR	Option E1	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

PPU-2	Description	PPU-3	Option type
Option EF5	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 (GPU)	4 x 0(4) to 20 mA transducer out	N/A	Hardware
Option G1	Start/stop of next DG outputs	Standard	
Option G2 (GPU)	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
Option H5	Reading of J1939 values	Option H5	Hardware
	Full J1939 engine		
Option H6	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 (Beckh-off) 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
Option J6	Display cable, 1 m	Option J6	Hardware
N/A	PC cable for utility software (USB), 1 m	Option J7	Hardware
Option K1 and K2	Documentation	Option K1 and K2	Hardware
Option M1 and M2	Engine control and protection	Option M4	
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

PPU-2	Description	PPU-3	Option type
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

Terminals for NEL and GB feedback have been changed. The table below shows an overview of the terminals on PPU-2 and PPU-3.

General description	Terminal PPU-2	Terminal description	Terminal PPU-3	Terminal description	Note
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 (open breaker)	14 + 15 + 16	Open GB	
Relay (NO + NC)	17 + 18 + 19	Sync relay	17 + 18 + 19	Close GB	
Alarm ack.	24	Digital input	24	Digital input	
Start sync/ control	25	Digital input	25	Digital input	
Common for terminals 23-27	28	Common	28	Common	
Modbus RTU RS-485	29 30 31	DATA + DATA GND DATA -	29 30 31	DATA + DATA GND DATA -	
Load sharing	37 38 39	Active load sharing Common Reactive load sharing	37 38 39	Active load sharing Common Reactive load sharing	
External f/P set point	40 41	f/P set point Common	40 41	f/P set point Common	
De-load	43	Digital input	43	Digital input	
Man. GOV control up	44	Digital input	44	Digital input	
Man. GOV control down	45	Digital input	45	Digital input	
Mode 1	48	Digital input	48	Digital input	Fixed frequency/configurable

General description	Terminal PPU-2	Terminal description	Terminal PPU-3	Terminal description	Note
Mode 2	49	Digital input	49	Digital input	P load sharing/ configurable
Mode 3	50	Digital input	50	Digital input	Ext. GOV set point/configurable
Mode 4	51	Digital input	51	Digital input	Fixed voltage/ configurable
Mode 5	52	Digital input	52	Digital input	Q load sharing/ configurable
Mode 6	53	Digital input	53	Digital input	Ext. AVR set point/configurable
Breaker open	54	Digital input	26	Digital input	Difference between the terminals
Breaker closed	55	Digital input	27	Digital input	Difference between the terminals
Common for terminals 43-55	56	Common	56	Common	
Load-dep. start next DG	57 + 58	Relay 5 (NO)	57 + 58	Relay 57 (NO)	
Load-dep. stop next DG	59 + 60	Relay 6 (NO)	59 + 60	Relay 59 (NO)	
Analogue GOV output +/-20 mA	66 67	+ 0	66 67	+ 0	
Analogue transducer output 4-20 mA	70 71	+ 0	70 71	+ 0	
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	

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

2.2.2 Parameter settings - system setup

The PC utility software is a software program that can be used for configuration of the Multi-line 2 products. There are two versions, 1.x for PPU-2 and 3.x. for PPU-3.
The utility software can be downloaded at www.deif.com.

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

It's very important to take out these PPU-2 parameters before powering down the unit as there is 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 PPU-2	Description	Address	Value	Parameter PPU-3	Description	Address	Value
4011	Nom. frequency	182	Hz	6001	Nom. f (1)	407	Hz
4012	Nom. power	183	kW	6002	Nom. P (1)	408	kW
4013	Nom. current	184	A	6003	Nom. I (1)	409	A
4014	Nom. voltage	185	V	6004	Nom. U (1)	410	V
N/A				6005	Nom. RPM (1)	411	RPM
4021	Volt. prim. GEN	186	V	6041	G primary U	428	V
4022	Volt. sec. GEN	187	V	6042	G secondary U	429	V
4023	Current prim.	188	A	6043	G primary I	430	A
4024	Current sec.	189	A	6044	G secondary I	431	A
4031	Volt. prim. BUS	190	V	6051	BB primary U1	432	V
4032	Volt. sec. BUS	191	V	6052	BB secondary U1	433	V
4033	Nom. volt. BUS	421	V	6053	BB nominal U1	1326	V

2.2.3 Parameter setup regulator governor

The table below illustrates the differences in the regulator parameter setup. In PPU-3, the possibility to adjust the differential band in the regulator has been added.

Parameter setup regulator governor

Parameter PPU-2	Description	Address	Parameter PPU-3	Description	Address
2122	Freq. control Kp	92	2511	f Kp	122
2123	Freq. control Ki	93	2512	f Ti	123
			2513	f Td	124
2132	Power control Kp	15	2531	P Kp	126
2133	Power control Ki	50	2532	P Ti	127
			2533	P Td	128

2.2.4 Parameter setup relay or analogue governor

In PPU-3, it is possible to change between relay and analogue governor setup, see the table below.

Parameter setup relay or analogue governor

Controller	Parameter	Description	Address	Set point
PPU-2	N/A	N/A	N/A	N/A
PPU-3	2781	Reg. output GOV	183	Relay or analogue

2.2.5 Parameter setup governor relay

The PPU-2 standard unit controls the governor on relay output terminals 65-68, slot #4, these are not configurable. The PPU-3 standard unit has four configurable relay outputs, placed in slot #4, terminals 65-72. The table below shows the differences in the standard parameter settings.

Parameter setup governor relay

Controller	Parameter	Description	Address	Value	Output A	Output B
PPU-2	2252	GOV period time	122	ms	N/A	N/A
PPU-3	2602	GOV period time	144	ms	Terminal 65	Terminal 67

2.2.6 Synchronisation setup

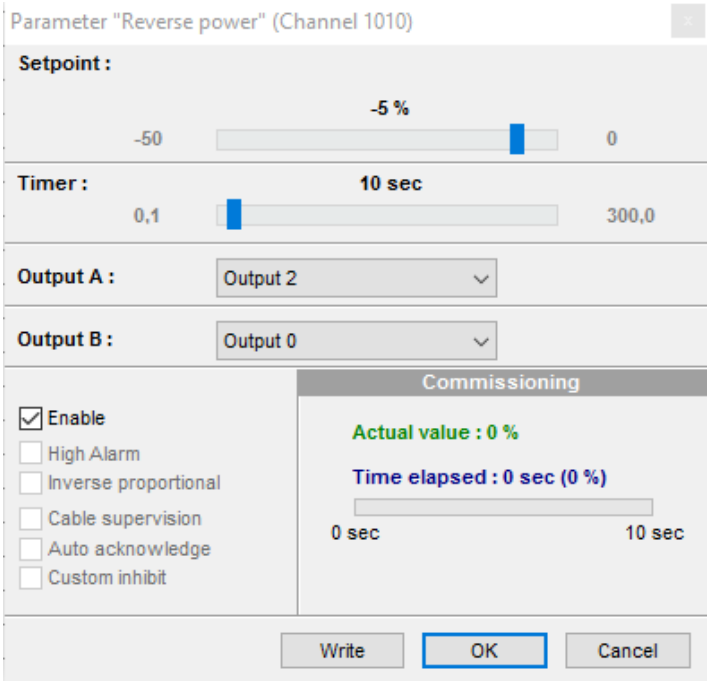
The table below shows which parameters that are to be configured when setting the synchronisation.

Synchronisation setup

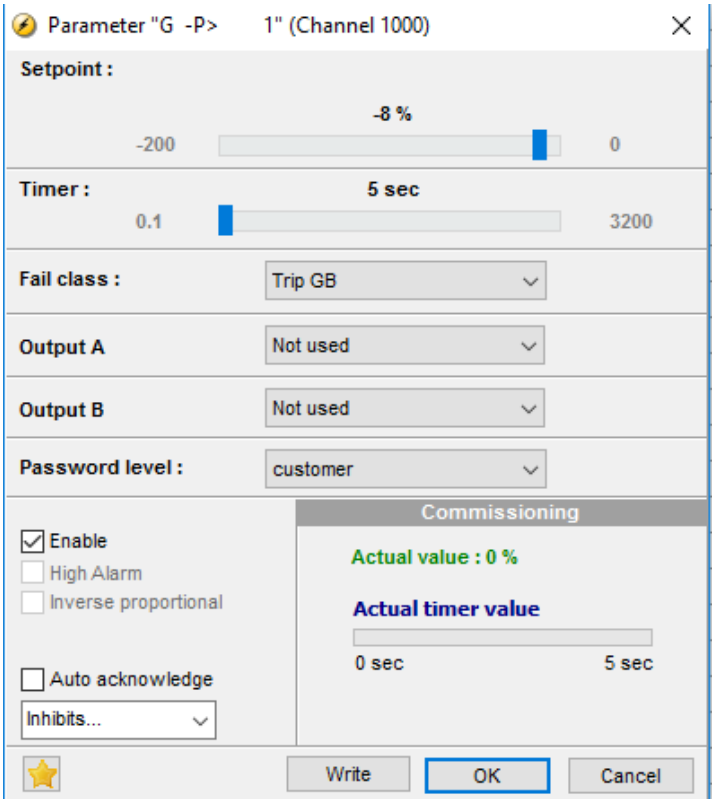
Parameter PPU-2	Description	Address	Parameter PPU-3	Description	Address
2021	Sync. dfMax	71	2021	Sync. dfMax	65
2022	Sync. dfMin	72	2022	Sync. dfMin	66
2023	Sync. duMax	73	2023	Sync. duMax	67
2024	Sync. t CB	74	2024	Sync. t GB	68
2041	Blackout dfMax	80	2111	Blackout dfMax	94
2042	Blackout duMax	81	2112	Blackout duMax	95
2043	Blackout ena-ble	82	2113	Sync. blackout enable	96

2.2.7 Protection setup

The following adjustment points are available in PPU-2: Set points, delay timer, output A or B. The protection has a commissioning window where live status is shown.



In PPU-3, the same adjustment points are present, but "Fail class" is added. Here it is possible to set an alarm to for example Trip of GB, Warning shutdown, and so on. Inhibits are also added in the protection parameter.



2.2.8 Mode selection

The setup for regulation mode has been changed and works differently in PPU-3. In the PPU-2 system, the selection of running modes is a combination of digital inputs, see the table below. In the PPU-3 system, the four different modes can be configured in the utility software - I/O settings.

PPU-2		**Description**	**PPU-3**
Digital input (48)	Digital input (49)	Active mode	Input
OFF	OFF	Fixed frequency	Digital input (configurable)
ON	OFF	Fixed power	Digital input (configurable)
OFF	ON	Droop	Digital input (configurable)
ON	ON	Load sharing	Digital input (configurable)
Mode 4 (51)	Mode 5 (52)	AVR mode	Input
OFF	OFF	Fixed voltage	ON
ON	OFF	Fixed Q	ON
OFF	ON	Fixed PF	ON
ON	ON	Q load sharing	ON
		Voltage droop	ON

For description of the complete mode setup, refer to the Designer's Reference Handbook.

2.2.9 External communication - Modbus

The functions and readings on Modbus addresses are not the same from a PPU-2 and a PPU-3 controller.

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

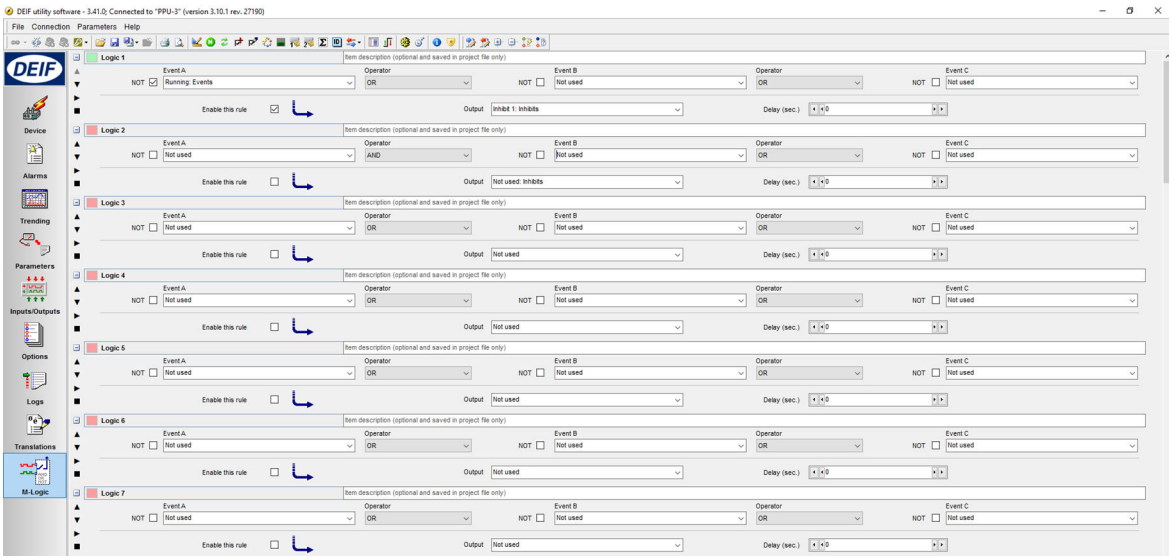
1. Standard: Normal PPU-3 register layout.
2. GPU/PPU-2: GPU/PPU-2 register layout. Only GPU/PPU-2 registers will respond, requests to any other register will result in "ILLEGAL DATA ADDRESS".
3. MIX: GPU/PPU-2 register layout. Requests to GPU/PPU-3 registers that are not occupied by GPU/PPU-2 will respond 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 PPU-3 Modbus address list.
Contact DEIF Support for a complete list of available parameters.

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 the same Modbus addresses. In this situation, the system communicating with PPU-2 will have to be reprogrammed.

2.2.10 M-Logic in PPU-3

The M-Logic functionality is included in the PPU-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, change of genset modes and change of running modes.