PUMP GENIUS
Multipump
CFW-11

Application Manual

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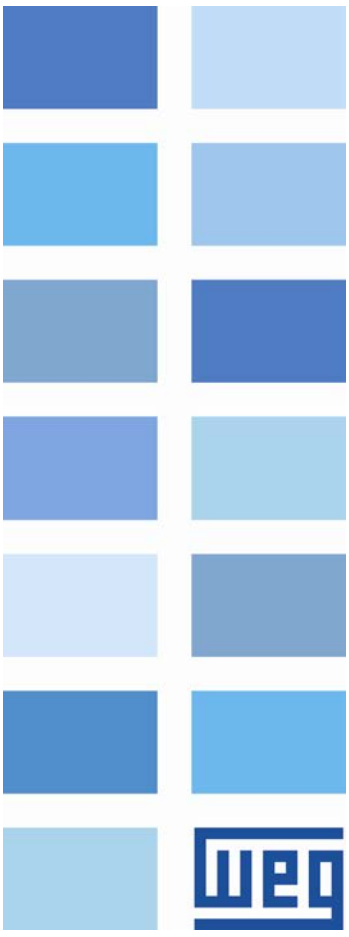

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CONTENTS

ABOUT THE MANUAL

This manual provides the necessary information for the configuration of a Pump Genius Multipump application developed with the CFW-11 inverter SoftPLC function. This application manual must be used together with the CFW-11 user's manual, the SoftPLC function manual and the WLP software manual.

ABBREVIATIONS AND DEFINITIONS

PLC	Programmable Logic Controller
CRC	Cycling Redundancy Check
RAM	Random Access Memory
USB	Universal Serial Bus
WLP	Ladder Language Programming Software

NUMERICAL REPRESENTATION

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter 'h' after the number.

QUICK PARAMETER REFERENCE, FAULTS AND ALARMS

Parameter	Description	Adjustable Range	Factory Setting	User Setting	Properties	Groups	Page
P1010	Pump Genius Multipump Application Version	0.00 to 10.00			ro	50	67
P1011	Control Setpoint	-32768 to 32767 [Eng. Un.1]	200		rw	50	45
P1012	Control Setpoint 1	-32768 to 32767 [Eng. Un.1]	200			50	46
P1013	Control Setpoint 2	-32768 to 32767 [Eng. Un.1]	230			50	46
P1014	Control Setpoint 3	-32768 to 32767 [Eng. Un.1]	180			50	46
P1015	Control Setpoint 4	-32768 to 32767 [Eng. Un.1]	160			50	46
P1016	Control Process Variable	-32768 to 32767 [Eng. Un.1]			ro	50	67
P1017	Operation Time of the Pump Driven by the CFW-11	0 to 32767 h			rw	50	67
P1018	Operation Time for Forcing Rotation of Pumps	0 to 32767 h			rw	50	67
P1019	Time Interval for Forcing Rotation of Pumps	0 to 32767 h	72 h			50	62
P1020	Pump Motor Speed for Forcing Rotation of Pumps	0 to 18000 rpm	0			50	62
P1021	Pump Control and Activation Mode Configuration	0 = Fixed Control with Pumps activated in a Sequence 1 = Fixed Control with Pumps Rotation 2 = Floating Control with Pumps activated in a Sequence 3 = Floating Control with Pumps Rotation	1			50	34
P1022	Control Setpoint Source Selection	1 = Control Setpoint via Analog Input AI1 2 = Control Setpoint via Analog Input AI2 3 = Control Setpoint via HMI or Communication Networks (P1011) 4 = Two Setpoints via Digital Input DI9 (P1012 and P1013) 5 = Three Setpoints via Digital Inputs DI9 and DI10 (P1012, P1013 and P1014) 6 = Four Setpoints via Digital inputs DI9 and DI10 (P1012, P1013, P1014 and P1015)	3			50	46
P1023	Control Process Variable Selection Source	1 = Control Process Variable via Analog Input AI1 2 = Control Process Variable via Analog Input AI2 3 = Control Process Variable via difference between Analog Input AI1 and AI2 (AI1 – AI2)	1			50	42
P1024	Control Process Variable Sensor Minimum Level	-32768 to 32767 [Eng. Un.1]	0			50	44
P1025	Control Process Variable Sensor Maximum Level	-32768 to 32767 [Eng. Un.1]	400			50	45
P1026	Value for Low Level Alarm for the Control Process Variable	-32768 to 32767 [Eng. Un.1]	100			50	63
P1027	Time Delay for Low Level Fault for the Control Process Variable (F771)	0 to 32767 s	0 s			50	63
P1028	Value for High Level Alarm for the Control Process Variable	-32768 to 32767 [Eng. Un.1]	350			50	63
P1029	Time Delay for High Level Fault for the Control Process Variable (F773)	0 to 32767 s	0 s			50	64
P1030	Control Action of the PID Controller	1 = Direct 2 = Reverse	0			50	47
P1031	PID Proportional Gain	0.000 to 32.000	1.000			50	48
P1032	PID Integral Gain	0.000 to 32.000	25.000			50	48
P1033	PID Derivative Gain	0.000 to 32.000	0.000			50	48
P1034	Control Process Variable Deviation for Pump Genius to Wake Up	-32768 to 32767 [Eng. Un.1]	30			50	49
P1035	Control Process Variable Level to Starting the Pump Genius	-32768 to 32767 [Eng. Un.1]	180			50	49

Parameter	Description	Adjustable Range	Factory Setting	User Setting	Properties	Groups	Page
P1036	Time Delay for Pump Genius to Wake up or Starting by Level	0 to 32767 s	5 s			50	49
P1037	Pump Motor Speed below which Pump Genius goes to Sleep Mode	0 to 18000 rpm	1250 rpm			50	50
P1038	Time Delay for Pump Genius goes to Sleep Mode	0 to 32767 s	10 s			50	50
P1039	Sleep Boost Offset	-32768 to 32767 [Eng. Un. 1]	0			50	50
P1040	Sleep Boost Maximum Time	0 to 32767 s	15 s			50	51
P1041	Pipe Charging Time	0 to 32767 s	30 s			50	55
P1042	Motor Speed for Dry Pump	0 to 18000 rpm	1650 rpm			50	64
P1043	Motor Torque for Dry Pump	0.0 to 100.0 %	20.0 %			50	64
P1044	Time Delay for Dry Pump Fault (F781)	0 to 32767 s	0 s			50	64
P1045	Time Delay for Pump Protection via External Sensor (F783)	0 to 32767 s	2 s			50	66
P1047	Operation Time of Pump 1	0 to 32767 h			rw	50	68
P1048	Operation Time of Pump 2	0 to 32767 h			rw	50	68
P1049	Operation Time of Pump 3	0 to 32767 h			rw	50	68
P1050	Operation Time of Pump 4	0 to 32767 h			rw	50	68
P1051	Operation Time of Pump 5	0 to 32767 h			rw	50	68
P1052	Pump Motor Speed for Starting an additional Pump in Parallel	0 to 18000 rpm	1700 rpm			50	57
P1053	Control Process Variable Deviation for Starting an additional Pump in Parallel	-32768 to 32767 [Eng. Un.1]	10			50	57
P1054	Time Delay for Starting an additional Pump in Parallel	0 to 32767 s	2 s			50	57
P1055	Delay in the Deceleration of the CFW-11 Pump when Starting a Pump in Parallel	0.00 to 100.00 s	0.01s			50	58
P1056	Pump Motor Speed for Stopping one Pump in Parallel	0 to 18000 rpm	1300 rpm			50	59
P1057	Control Process Variable Deviation for Stopping one Pump in Parallel	-32768 to 32767 [Eng. Un.1]	20			50	59
P1058	Time Delay for Stopping one Pump in Parallel	0 to 32767 s	2 s			50	60
P1059	Delay in the Acceleration of the CFW-11 Pump when Stopping a Pump in Parallel	0.00 to 100.00 s	0.01s			50	60

Fault / Alarm	Description	Possible Causes
A750: Sleep Mode Active	It indicates that the Pump Genius is in the sleep mode	Value of the pump motor speed is below the threshold programmed in P1037 during the time programmed in P1038, and only one pump is started in the Pump Genius
A752: Pipe Charging	It indicates that the process of pipe charging is being executed	The command for enable Pump Genius via digital input DI1 with the pipe charging enabled
A754: Forcing Rotation of Pumps	It indicates to the user that the Pump Genius is forcing the rotation of pumps	The Pump Genius is operating with only one pump running for a longer time than the value set in P1019 and the speed value of this pump is lower than the value set in P1020
A756: Sleep Boost Active	It indicates that the sleep boost is in execution	Motor speed was below the value set in P1037 during the time set in P1038, but before going into sleep mode applies a boost in the control setpoint to increase the process variable
A760: Pump 1 Disabled	It indicates that pump 1 was disabled while it was on	Digital input DI2 went to logic level “0” while pump 1 was on
A762: Pump 2 Disabled	It indicates that pump 2 was disabled while it was on	Digital input DI3 went to logic level “0” while pump 2 was on
A764: Pump 3 Disabled	It indicates that pump 3 was disabled while it was on	Digital input DI4 went to logic level “0” while pump 3 was on
A766: Pump 4 Disabled	It indicates that pump 4 was disabled while it was on	Digital input DI5 went to logic level “0” while pump 4 was on
A768: Pump 5 Disabled	It indicates that pump 5 was disabled while it was on	Digital input DI6 went to logic level “0” while pump 5 was on
A770: Low Level of the Control Process Variable	It indicates that the control process variable (P1016) is in low level	The control process variable (P1016) is lower than the value programmed in P1026
F771: Low Level of the Control Process Variable	It indicates that the Pump Genius was stopped due to low level of the control process variable	The control process variable (P1016) remained for a time (P1027) at a value lower than the threshold programmed in P1026
A772: High Level of the Control Process Variable	It indicates that the control process variable (P1016) is in high level	The control process variable (P1016) is higher than the value programmed in P1028
F773: High Level of the Control Process Variable	It indicates that the Pump Genius was stopped due to high level of the control process variable	The control process variable (P1016) remained for a time (P1029) at a value higher than the threshold programmed in P1028
A780: Dry Pump	It indicates that the dry pump condition was detected	Value of the pump motor speed is above of the threshold programmed in P1042 and motor torque is below the threshold programmed in P1043
F781: Dry Pump	It indicates that the pump was stopped due to dry pump protection	During a time (P1044) the value of the pump motor speed remains above of the threshold programmed in P1042 and motor torque remains below the threshold programmed in P1043
A782: External Sensor Protection	It indicates that protection via external sensor (DI11) is actuated	Pump in operation and digital input DI11 is at logic level “0”
F783: External Sensor Protection	It indicates that the pump was stopped due to protection via external sensor (DI11)	Pump in operation and digital input DI11 remained at logic level “0” for a time (P1045)
F799: Incompatible Software Version	It indicates that the software version of CFW-11 (P0023) in not compatible with the version used in the development of the Pump Genius Multipump application	The software version of the CFW-11 inverter was not updated for the special version Ve5.3x

1. INTRODUCTION TO THE PUMP GENIUS MULTIPUMP APPLICATION

The Pump Genius Multipump application developed for the CFW-11 inverter SoftPLC function provides the user with flexibility in the operation and configuration. Tools, already developed for the WLP programming software, are being used together with configuration wizards and monitoring dialogs boxes.

1.1 PUMPS

Pumps are hydraulic operating machines that transfer energy to the fluid for the purpose of transporting it from one point to another. They receive energy from a motor source and transfer part of it to the fluid in the form of pressure energy, kinetic energy, or both, i.e., increase the fluid's pressure or speed, or both quantities.

Commonly used ways to drive pumps are:

- Electric motors;
- Internal combustion motors;
- Turbines.

Pumps can be classified into two wide categories:

- Centrifugal pumps or turbo pumps;
- Volumetric pumps or positive displacement pumps.

1.1.1 Centrifugal Pumps

The operating based on the principle of transferring kinetic energy to the fluid to be pumped; this kinetic energy is transformed into potential energy (pressure). The rotational movement of a rotor inserted into a casing is the functional part responsible for this transformation.

Depending on the types and shapes of rotors, centrifugal pumps can be classified as follows:

- Radial or pure, when the direction of the pumped fluid is perpendicular to the rotating axle;
- Mixed flow or semi-axial, when the direction of the pumped fluid is inclined in relation to the rotating axle;
- Axial flow, when the direction of the pumped fluid is parallel in relation to the rotating axle.

1.1.2 Positive Displacement Pumps

The operating principle of this type of pump is based on the direct transfer of mechanical work (of a motor shaft rotation against a load torque) into potential energy (pressure energy). This transfer is obtained by the movement of a mechanical apparatus of the pump (piston, diaphragm, gears, screws, etc.), which forces the fluid to execute the same movement.

The liquid cyclical fills and then is ejected from a given volume of space inside the pump, a process which is responsible for the name "Volumetric Pump".

Variations of these mechanical apparatuses permit the classification of volumetric or positive displacement pumps:

- Piston or alternative pumps, when the apparatus which produces the movement of the fluid is a piston which moves in alternating directions and expels the pumped fluid;
- Rotary pumps, when the apparatus which produces the movement of the fluid is driven by rotational movement, like a screw, gear, flakes, lobes, etc.

1.2 CRITERIA FOR ASSOCIATION OF PUMPS IN PARALLEL

It is useful to analyze some data in order to designing a pumping system to determine whether it shall be composed of a single pump or through association of pumps in parallel:

- Determine whether a single pump can alone meet the flow required by the pumping system;
- Determine if over the long term there is potential for a change in the needed flow rate, for example, due to a population increase;
- Note the range of consumption which needs to be supported by the pumping system during the day.

1.2.1 Advantages in the Association of Pumps in Parallel

A pumping system with association of pumps in parallel has the following advantages compared to a single pump system:

- Greater flexibility of the pumping system, both in operation and in implementation;
- Energy saving;
- Increased life span of the pumping system;
- It facilitates uninterrupted operation;
- It provides the necessary flow according to the pumping system demand;
- It simplifies a pumping system fault diagnosis;
- Pump operation time equalization, thus assuring uniform wear.

1.2.2 Disadvantages in the Association of Pumps in Parallel

A pumping system with association of pumps in parallel has the following disadvantages compared to a single pump system:

- More units (pumps, sensors, piping, etc.) to be maintained;
- Larger space of plant, increasing construction costs;
- The greater the number of pumps associated in parallel, the lower the flow of each individual pump. For example, if we have only one pump at maximum flow rate of 150 l/s, by associate a second pump in parallel, we will have a maximum flow of 260 l/s, i.e., each pump will have maximum flow of 130l/s.

1.3 GENERAL CHARACTERISTICS OF THE PUMP GENIUS MULTIPUMP APPLICATION

The main characteristic of the Pump Genius Multipump application developed for the CFW-11 inverter SoftPLC function is the control of two or more pumps in parallel using only one frequency inverter; and it will control the speed of only one pump.

Each is notable for the following characteristics:

- Fixed Control: control of up to 6 (six) pumps associated in parallel;
- Floating Control: control of up to 5 (five) pumps associated in parallel;
- Fixed and Floating Control: control of the activation mode of the pumps (sequence or rotation);
- Fixed and Floating Control: logic for rotation of the pumps according to the operation time;
- Floating Control: rotate (change) of the pump driven by the frequency inverter;
- Floating Control: possibility of forcing the rotation pumps, i.e. if the Pump Genius operate for a long time with only one pump (Pump Genius does not enter in sleep mode), the Pump Genius is disabled, then another pump is turned on (as operating time) for controlling the pumping;
- Acceleration and deceleration ramps for the pump driven by inverter;
- Maximum and minimum speed limits for the pump driven by inverter;
- Selection of the pumping control setpoint via analog inputs, CFW-11 HMI or logical combination of the digital inputs DI9 and DI10 (maximum of 4 setpoints);
- Selection of the pumping control process variable via analog inputs or the difference between analog input AI1 and AI2 (AI1 – AI2);
- Selection of the engineering unit and range of the control process variable sensor via CFW-11 parameters;
- Gain, offset and filter adjustments for the control signals via analog inputs;
- PID controller gain setting of the pumping control via HMI parameters;
- Control action of the PID controller configured for direct or reverse mode;
- Enabling of the Pump Genius through digital input DI1;
- Enable or not of the Sleep mode;
- Wake up mode or start level mode for starting the 1st pump in the Pump Genius;
- Enable or not of the sleep boost before to going into sleep mode;
- Initiate the pumping with pipe charging through the pump driven by inverter;
- Low level protection for the control process variable (pipe breaking);
- High level protection for the control process variable (pipe obstruction);
- Indication of the low or high level alarm protection for the control process variable via digital output DO9;
- Dry pump protection through evaluation of motor torque and pump speed;
- Pump protection via external sensor through digital input DI11;
- Possibility of running the pump driven by inverter via HMI (local mode);
- Possibility of implementation or modification of the application by the user through the WLP software.

2 CONTROL MODES

Two distinct ways of control (fixed control and floating control) and several possibilities of use or configuration were implemented in the Pump Genius Multipump application developed for the CFW-11 frequency inverter SoftPLC function: associating pumps in parallel with fixed control, associating pumps in parallel with floating control, defining the setpoint via analog inputs, or via HMI / communication networks or via logic combination of digital inputs, etc. Below are details about the two control modes and examples of some other type of configuration.

NOTE!
The digital outputs of the accessory module can be relay or transistor. If the transistor will be necessary to add an external relay or auxiliary contactor at 24Vdc for command of the pump. Refer to the installation guide of the accessory module used for more information.

2.1 FIXED CONTROL

The system is composed of the association of two or more pumps in parallel, and the frequency inverter always controls the speed of the same pump. The other pumps of the system are commanded by the digital outputs of the CFW-11 frequency inverter and operate at the rated speed. Thus, the users can use the start mode that best suits their needs: direct on line, star delta, softstater, etc.

The user can configure the Pump Genius Multipump application with fixed control for up to six pumps associated in parallel, one always driven by the frequency inverter and the others commanded to the digital outputs of the frequency inverter so that it controls the moment to start or stop of the system. It also allows the following settings: setpoint via analog inputs, via HMI and setpoint via logic combination of digital inputs.

The figure 2.1 presents a typical system with six pumps in parallel and control setpoint via HMI basically composed of:

- 01 CFW-11 frequency inverter (D);
- 06 Motor + pump (P1, P2, P3, P4, P5 and PD);
- 01 Sensor with analog output signal to measure the control process variable (A0);
- Command to enable Pump Genius (S0);
- Command to enable the use of the pump 1, 2, 3, 4, and 5 (S1, S2, S3, S4 and S5);
- Status light for the pumps 1, 2, 3, 4 and 5 are running (H1, H2, H3, H4 and H5).

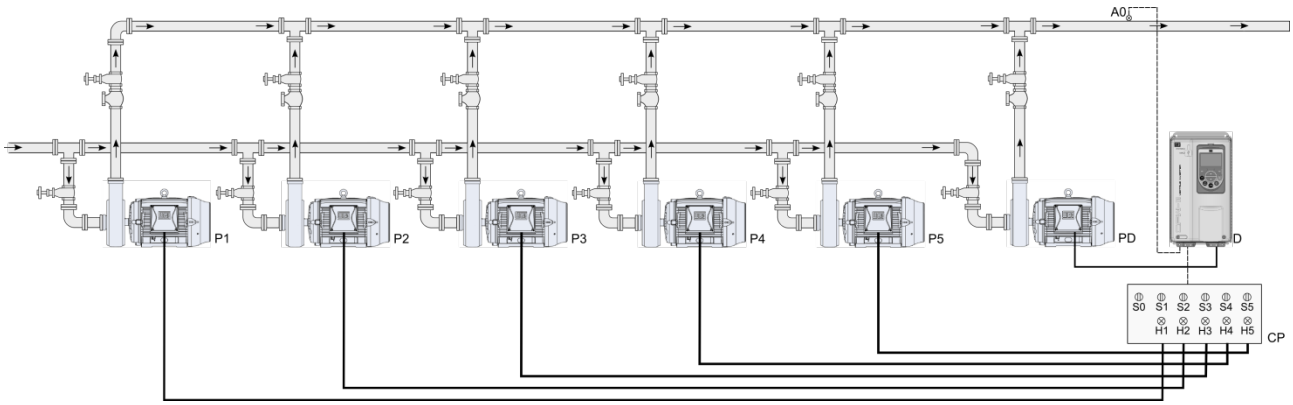


Figure 2.1 – Pump Genius Multipump application with fixed control and six pumps in parallel

NOTE!
Use the Fixed Control configuration wizard to configure the Pump Genius Multipump application with fixed control, six pumps in parallel and control setpoint via HMI. See section 5.1 for more details on the configuration wizard for fixed control.

NOTE!
The pumps 1 to 5 can be driven by contactors (direct on line or star delta start), softstater, intelligent relays, etc. The signals H1, H2, H3, H4 and H5 are not necessary for the operation of the Pump Genius Multipump with fixed control, 6 pumps in parallel and control setpoint via HMI, because they only serve to indicate the operating condition of the pumps on the command panel (CP). In the figure 2.1, the signals H1, H2, H3, H4 and H5 come from auxiliary contacts of contactors K1, K2, K3, K4 and K5 which start the pumps 1, 2, 3, 4 and 5.

2.1.1 Power Connections

The figure 2.2 presents the power connection diagram for a system with six pumps in parallel with fixed control.

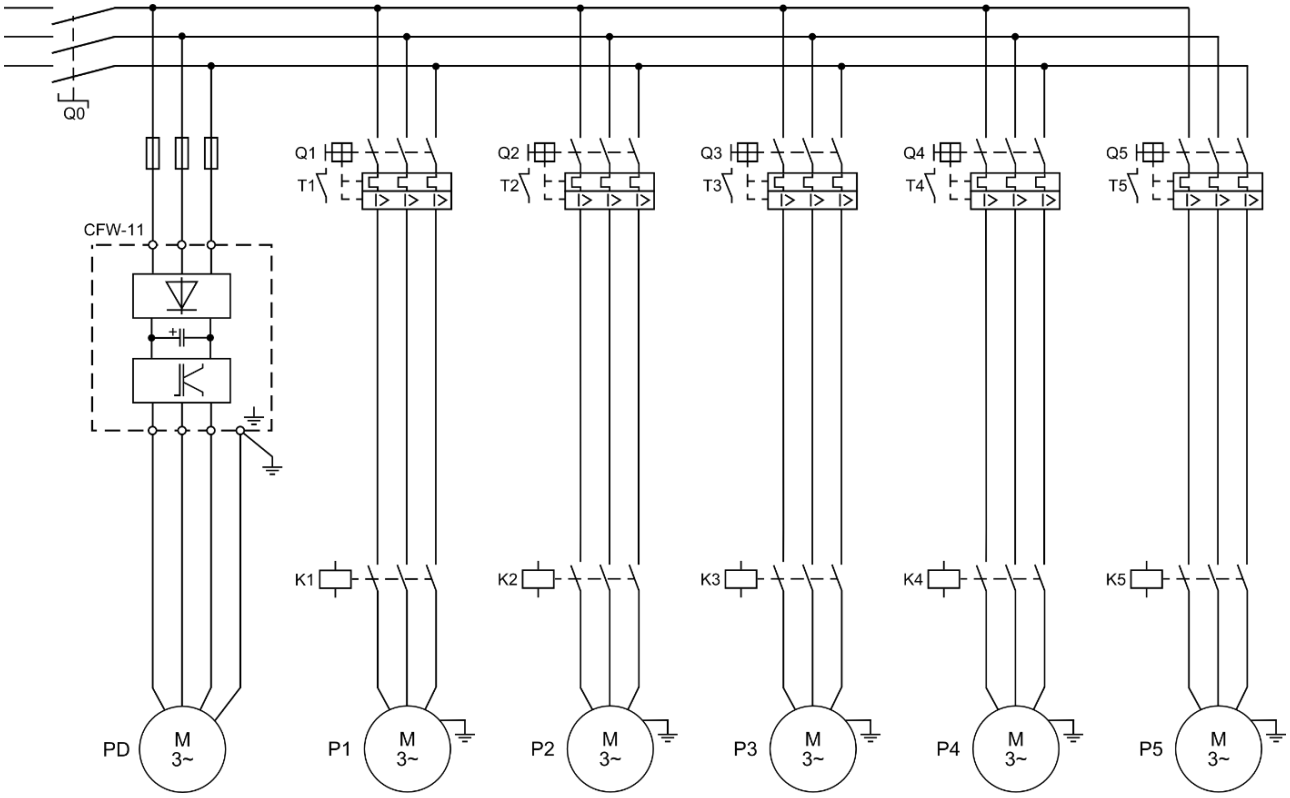


Figure 2.2 – Power connections of the Pump Genius Multipump application with fixed control and six pumps in parallel

Where:

- Q0: Protection circuit breaker for the system power supply;
- Q1, Q2, Q3, Q4 and Q5: Motor circuit breaker for the protection of the pumps;
- K1, K2, K3, K4 and K5: Contactors for starting the pumps;
- P1, P2, P3, P4, P5 and PD: System pump motors;
- The protection of CFW-11 inverter is done with fuses.

NOTE!
It is recommended the protection of the inverter so as to avoid damages.

2.1.2 Command Connections

The figure 2.3 presents the command connection diagram for fixed control and six pumps in parallel.

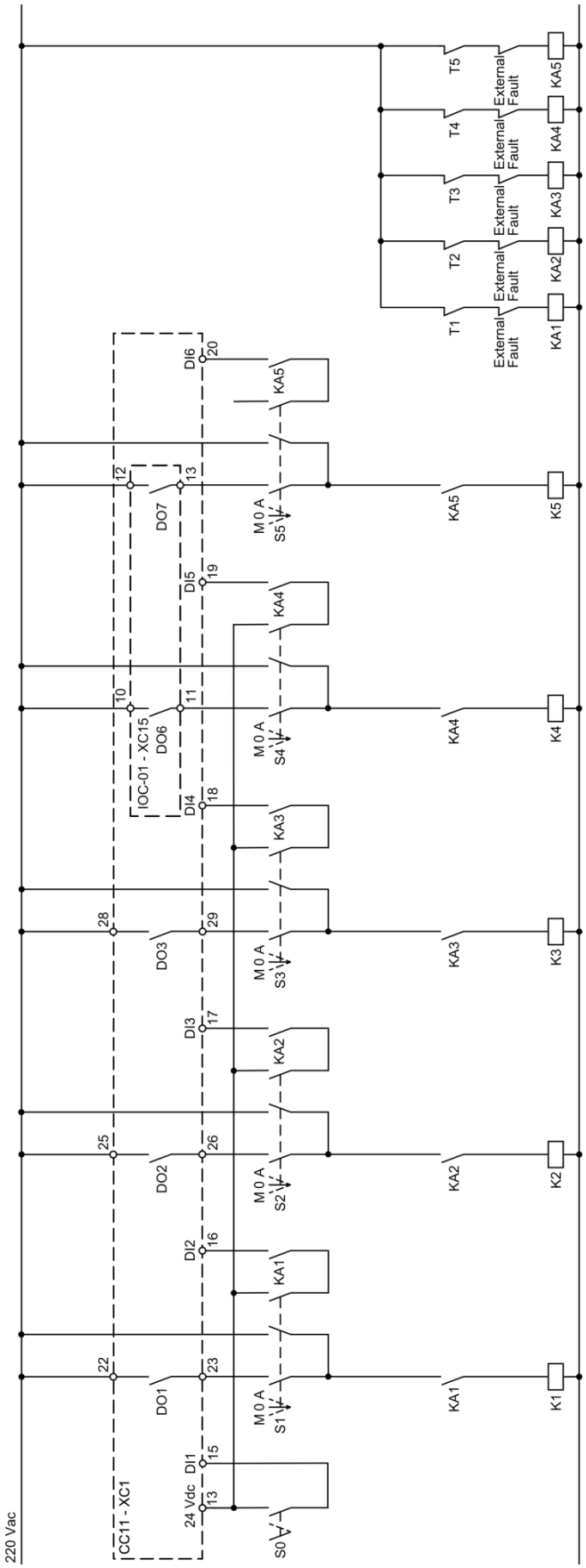


Figure 2.3 – Command connections of the Pump Genius Multipump application with fixed control and six pumps in parallel

Where:

■ S0: Start/Stop switch. The “Start” position issues the command for enabling the Pump Genius operation. The “Stop” position disables the Pump Genius operation, that is, it stops all the pumps of the system;

■ S1, S2, S3, S4 and S5: Manual / 0 / Automatic commutation switches (optional). The “Manual” position issues the command for starting the pump independent of the Pump Genius. The “0” position switches off the pump and disables it from the Pump Genius. The “Automatic” position enables the pump to be used in the Pump Genius;

■ K1, K2, K3, K4 and K5: Contactors for starting the pumps;

■ KA1, KA2, KA3, KA4 and KA5: Auxiliary contactors for the pump protection logics;

■ T1, T2, T3, T4 and T5: Contact of the pump motors protection thermal;

■ External Fault: A sensor, such as a pressure switch, can be used for the protection of the pumps;

■ DO1, DO2 and DO3: Relay digital outputs of the CFW-11 frequency to command pumps 1, 2 and 3;

■ DO6 and DO7: Relay digital outputs of the IOC-01 accessory module of the CFW-11 frequency inverter to command pumps 4 and 5;

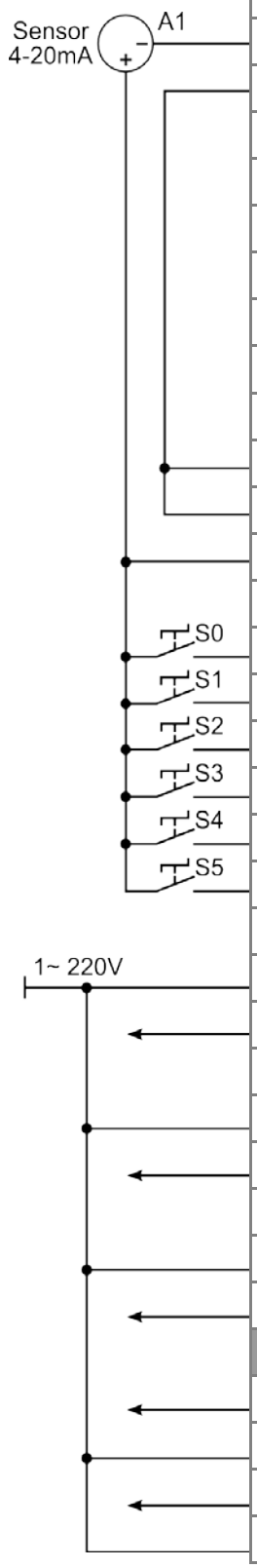
■ DI1: Digital input of the CFW-11 frequency inverter to enable the Pump Genius operation;

■ DI2, DI3, DI4, DI5 and DI6: Digital inputs of the CFW-11 frequency inverter indicating that the pumps are enabled for the Pump Genius.

NOTE!
The connections of the command shown in figure 2.3 are relative to the IOC-01 accessory module. If you use another accessory module, please refer to the appropriate installation guide.

2.1.3 Control Connections

The figure 2.4 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector XC1 terminal strip and IOC-01 accessory module of the CFW-11 frequency inverter for the Pump Genius Multipump configured for fixed control, six pumps in parallel and setpoint via HMI.



XC1 Terminal Strip		Function for Fixed Control, six pumps in parallel and Setpoint via HMI
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): No function
6	AI2-	
7	AO1	Analog output 1: Motor speed
8	AGND	
9	AO2	Analog output 2: Motor current
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: Enable pump 1 via DO1
17	DI3	Digital input 3: Enable pump 2 via DO2
18	DI4	Digital input 4: Enable pump 3 via DO3
19	DI5	Digital input 5: Enable pump 4 via DO6
20	DI6	Digital input 6: Enable pump 5 via DO7
21	NC1	Digital output 1 DO1: Start pump 1
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: Start pump 2
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: Start pump 3
28	C3	
29	NO3	
XC15 Terminal Strip		
10	NO6	Digital output 6 DO6: Start pump 4
11	C6	
12	NO7	Digital output 7 DO7: Start pump 5
13	C7	

Figure 2.4 – Signals on connector XC1 and XC15 of terminal strip for fixed control, six pumps and setpoint via HMI

NOTE!
Refer to the CFW-11 frequency inverter manual and the IOC-01 installation guide for further details about connections.

2.1.4 Operation Description

The figure 2.5 presents the operation scheme of the Pump Genius configured for fixed control, six pumps in parallel and setpoint via HMI. The pumps will be starting in the "In a Sequence" activation mode in order to simplify the understanding of their drive. For the “Pump Rotation” activation mode, the operation time for the start or stop of the pumps is taken into account.

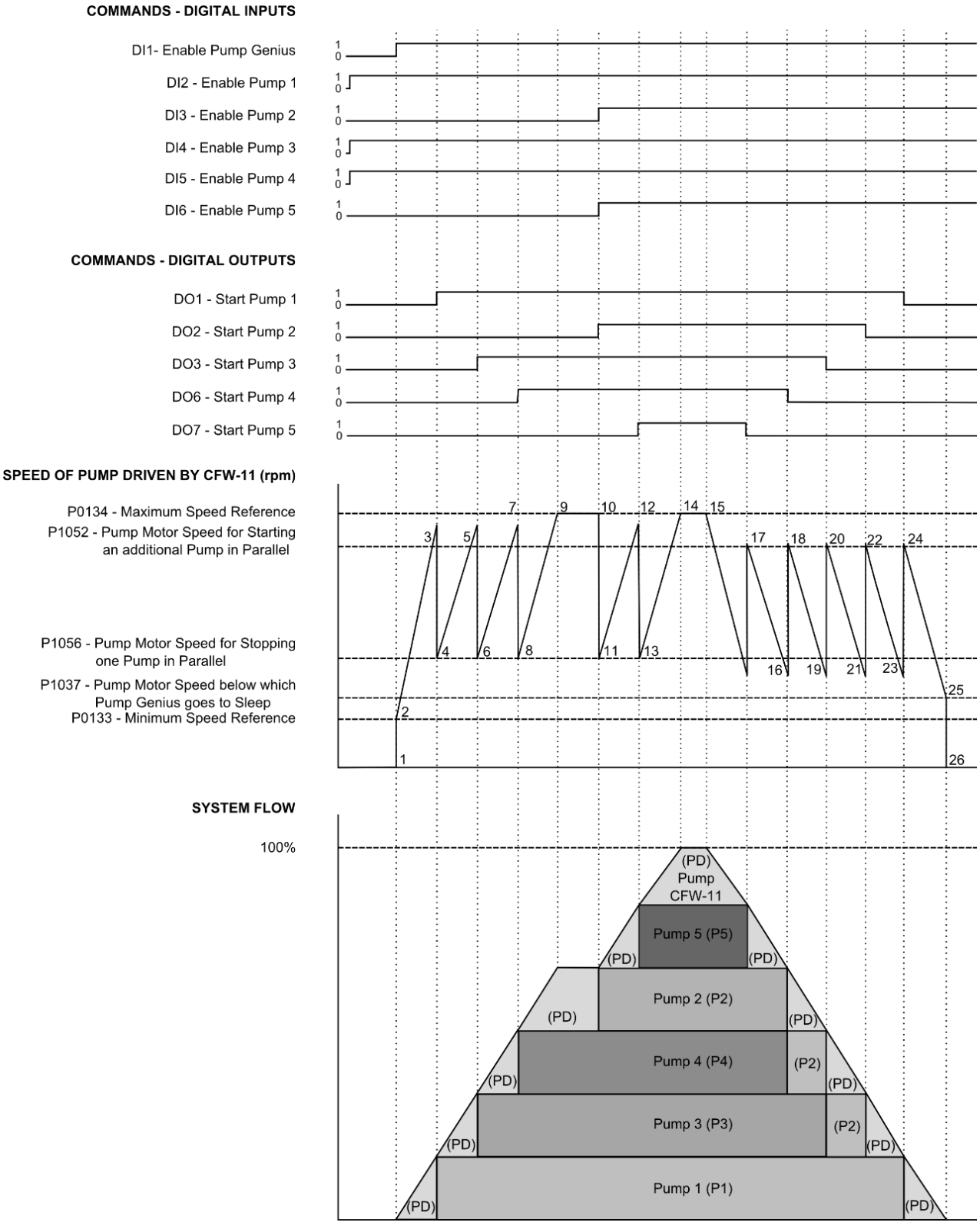


Figure 2.5 – Operation description of the Pump Genius configured for fixed control

The graph of the figure 2.5 shows the digital inputs for the command and enabling of the pumps, the digital outputs for the start of the pumps, the motor speed behavior of the pump driven by the CFW-11 frequency

inverter as the pumps are started and stopped in order to maintain the control process variable according to the setpoint of the required control. The analysis below of the behavior according to the identified moments:

1 – The digital input DI1 is activated in order to enable the Pump Genius. It is verified if the Pump Genius will remain in the sleep mode or in the wake up mode. The wake up mode is activated (the first time the Pump Genius is enabled, the time (P1036) is discarded) and the pump driven by the CFW-11 frequency inverter is started;

2 – The pump driven by the CFW-11 inverter (PD) accelerated to the minimum speed (P0133) and then the PID controller is enabled. If the pipe charging process is enabled, a period of time (P1041) is awaited to enable the PID controller;

3 – According to the control setpoint and the control process variable, the PID controller responds and accelerates the pump driven by the CFW-11 inverter (PD). At this moment the pump motor speed exceeds the threshold value programmed for starting an additional pump (P1052) and the deviation from the control setpoint exceeds the threshold programmed for starting an additional pump (P1053), initiating the time count P1054 and it is awaited and the command to start one more pump in parallel is issued. It is verified which pump will enter the system. In this case, since the activation mode is "In a Sequence", and pump 1 (P1) is enabled for operation, the command is issued to start pump 1 (P1) via digital output DO1, which, according to the wiring diagram, commands contactor K1;

4 – After pump 1 (P1) is started, the speed of the pump driven by the CFW-11 inverter (PD) is reduced to the value of the motor speed programmed to stop a pump in parallel (P1057). This is done to minimize oscillations in the system. After that, the Pump Genius takes back the speed control of the pump driven by the CFW-11 inverter (PD) and it accelerates again;

5 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1) is already running, in the sequence pump 2 (P2) should be started, but it is disabled via digital input DI3; therefore, since pump 3 (P3) is enabled to operate, the command to start pump 3 (P3) is issued via digital output DO3, which, according to the wiring diagram, commands contactor K3;

6 – After pump 3 (P3) is started, the analysis at instant “4” follows;

7 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1) and pump 3 (P3) are already running, in the sequence pump 2 (P2) should be started, but it is disabled via digital input DI3; therefore, since pump 4 (P4) is enabled to operate, the command to start pump 4 (P4) is issued via digital output DO6, which, according to the wiring diagram, commands contactor K4;

8 – After pump 4 (P4) is started, the analysis at instant “4” follows;

9 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1), pump 3 (P3) and pump 4 (P4) are already running, in the sequence pump 2 (P2) or pump 5 (P5) should be started, but they are disabled via digital input DI3 and DI6; therefore, the system remains as it is and the pump driven by the CFW-11 inverter (PD) reaches the maximum programmed speed;

10 – Because the system needs another pump in parallel, when pump 2 (P2) is enabled via digital input DI3 and pump 5 (P5) is enabled via digital input DI6, the command to start the pump 2 (P2) is immediately issued via digital output DO2, which, according to the wiring diagram, commands contactor K2;

11 – After pump 2 (P2) is started, the analysis at instant “4” follows;

12 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1), pump 2 (P2), pump 3 (P3) and pump 4 (P4) are already running, in the sequence pump 5 (P5) should be started, the command is issued to start pump 5 (P5) via digital output DO7, which, according to the wiring diagram, commands contactor K5;

13 – After pump 5 (P5) is started, the analysis at instant “4” follows;

14 – With all pumps of the system are running, the pump driven by the CFW-11 inverter (PD) reaches the maximum programmed speed and continues to control the system;

15 – The system begins to feel an increase in the process variable and starts to decrease the speed of the pump driven by CFW-11 inverter (PD);

16 – When the value of motor speed programmed to stop one pump in parallel (P1056) is reached and there is a certain difference (deviation) between the control setpoint and the process variable (P1057), a period of time is awaited (P1058) and the command to stop one pump in parallel is issued. It is checked which pump will be removed from system. In this case, since the activation mode is "In a Sequence", the pump 5 (P5) must be stopped. The command to stop pump 5 (P5) is issued via digital output DO7, which, according to the wiring diagram, commands contactor K5;

17 – After stopping pump 5 (P5), the speed of the pump driven by the CFW-11 inverter (PD) is increased to the value of motor speed to start one more pump in parallel (P1052). This is done so as to minimize oscillations in the system. After that, the Pump Genius takes back the speed control of the pump driven by CFW-11 inverter (PD) and it decelerates again;

18 – Following the analysis done at moment “16”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5) is already stopped, the next pump to be stopped is pump 4 (P4). The command to stop pump 4 (P4) is issued via digital output DO6, which, according to the wiring diagram, commands contactor K4;

19 – After stopping pump 4 (P4), the analysis done at moment “14” follows;

20 – Following the analysis done at moment “16”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5) and pump 4 (P4) are already stopped, the next pump to be stopped is pump 3 (P3). The command to stop pump 3 (P3) is issued via digital output DO3, which, according to the wiring diagram, commands contactor K3;

21 – After stopping pump 3 (P3), the analysis done at moment “14” follows;

22 – Following the analysis done at moment “16”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5), pump 4 (P4) and pump 3 (P3) are already stopped, the next pump to be stopped is pump 2 (P2). The command to stop pump 2 (P2) is issued via digital output DO2, which, according to the wiring diagram, commands contactor K2;

23 – After stopping pump 2 (P2), the analysis done at moment “14” follows;

24 – Following the analysis done at moment “16”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5), pump 4 (P4), pump 3 (P3) and pump 2 (P2) are already stopped, the next pump to be stopped is pump 1 (P1). The command to stop pump 1 (P1) is issued via digital output DO1, which, according to the wiring diagram, commands contactor K1;

25 – When the motor speed programmed to sleep (P1037) is reached, a period of time is awaited (P1038) and, since the pump driven by the CFW-11 inverter (PD) remains with speed below the value programmed to sleep, the sleep mode is activated;

26 – With the sleep mode active, the pump driven by the CFW-11 inverter (PD) is stopped, but the Pump Genius remains enabled, and the control process variable is monitored. If the value falls below the deviation of the process variable to wake up (P1034) for a period of time (P1036), the wake up mode is activated and the control begins to start and stop the pumps again according to the requirements of the control setpoint.

NOTE!
Refer the chapter 3 for further details on the parameters.

2.2 FLOATING CONTROL

The system is composed of the association of two or more pumps in parallel, and the frequency inverter can be connected (via inverter output contactor commanded by a digital output) and control the speed of any of the pumps. The other pumps of the system are commanded by the digital outputs of the CFW-11 frequency inverter that drive the contactors directly connected to the mains power and operate at the rated speed. That is, with the control turned off, the first pump to be started is connected to the inverter via the digital output command and the other pumps will be connected directly to the mains power via the command of other outputs subsequently activated. At another moment, according to the setting, another pump can be driven by CFW-11 inverter; by doing that, all pumps in the system are used in a uniform way. The interlock that prevents two or more pumps are connected to the inverter is done as electric as figure 2.8.

The user can configure the Pump Genius Multipump application with floating control to have up to five pumps associated in parallel, being the first pump to be started connected to the CFW-11 inverter and the others commanded via digital outputs of the CFW-11 inverter so that it controls the moment to start them or stop them in the system. It also allows the following settings: setpoint via analog inputs, via HMI and setpoint via logic combination of digital inputs.

The figure 2.6 presents a typical system with five pumps and control setpoint via HMI basically composed of:

- 01 CFW-11 frequency inverter (D);
- 05 Motor + pump (P1, P2, P3, P4 and P5);
- 01 Sensor with analog output signal to measure the control process variable (A0);
- Command to enable the Pump Genius (S0);
- Command to enable the use of the pump 1, 2, 3, 4 and 5 (S1, S2, S3, S4 and S5);
- Status light for the pumps 1, 2, 3, 4 and 5 are running (H1, H2, H3, H4 and H5).

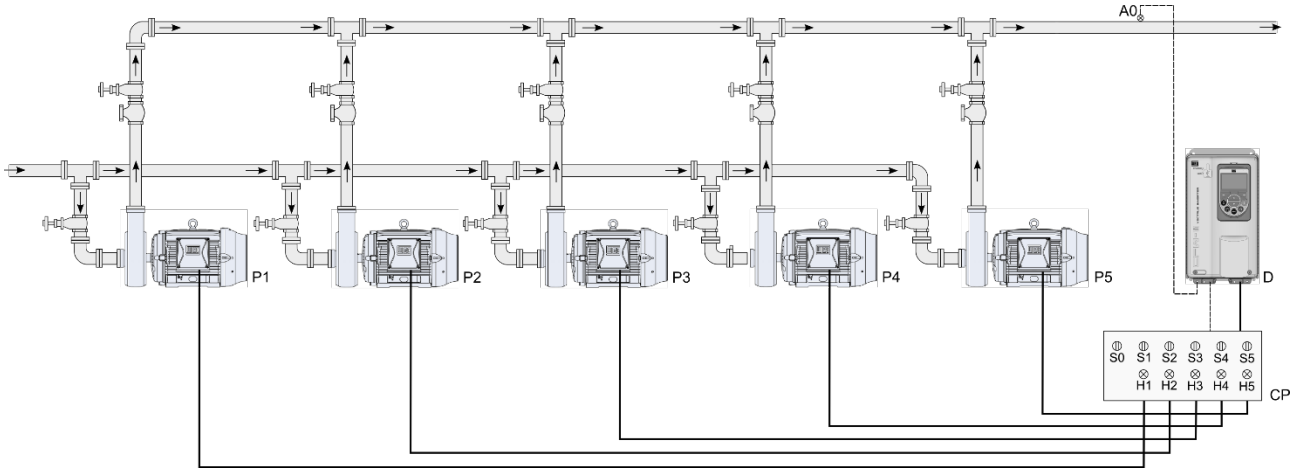


Figure 2.6 – Pump Genius Multipump application with floating control and five pumps in parallel

NOTE!
Use the Floating Control configuration wizard to configure the Pump Genius Multipump application with floating control, five pumps in parallel and control setpoint via HMI. See section 5.2 for more details on the configuration wizard for floating control.

NOTE!
The signals H1, H2, H3, H4 and H5 are not necessary for the operation of the Pump Genius Multipump with floating control, five pumps in parallel and control setpoint via HMI, because they only serve to indicate the operating condition of the pumps on the command panel (CP). In the figure 2.6, the signals H1, H2, H3, H4 and H5 come from auxiliary contacts of contactors K1, K1.1, K2, K2.1, K3, K3.1, K4, K4.1, K5 and K5.1 which start the pumps 1, 2, 3, 4 and 5.

2.2.1 Power Connections

The figure 2.7 presents the power connection diagram for a system with five pumps in parallel with floating control.

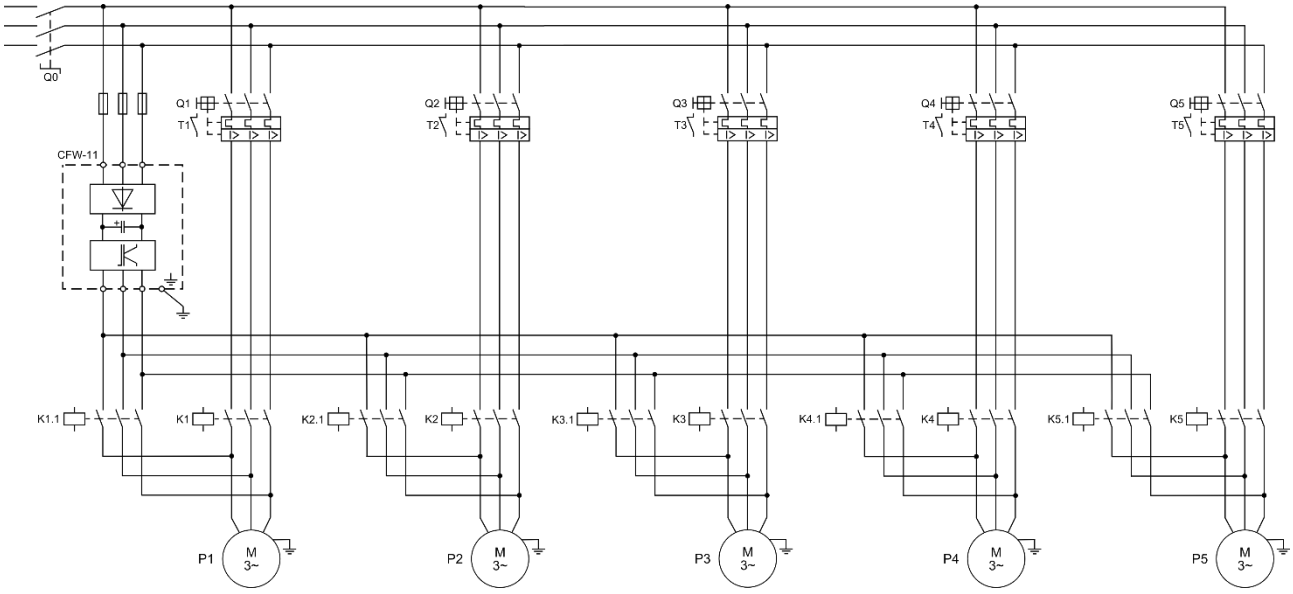


Figure 2.7 – Power connections of the Pump Genius Multipump application with floating control and five pumps in parallel

Where:

- Q0: Protection circuit breaker for the system power supply;
- Q1, Q2, Q3, Q4 and Q5: Motor circuit breaker for the protection of the pumps;
- K1, K2, K3, K4 and K5: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the CFW-11 inverter;
- K1.1, K2.1, K3.1, K4.1 and K5.1: Contactors to start the pump with the CFW-11 inverter;
- P1, P2, P3, P4 and P5: System pump motors;
- The protection of CFW-11 inverter is done with fuses.

NOTE!
It is recommended the protection of the inverter so as to avoid damages.

2.2.2 Command Connections

The figure 2.8 presents the command connection diagram for five pumps in parallel and floating control.

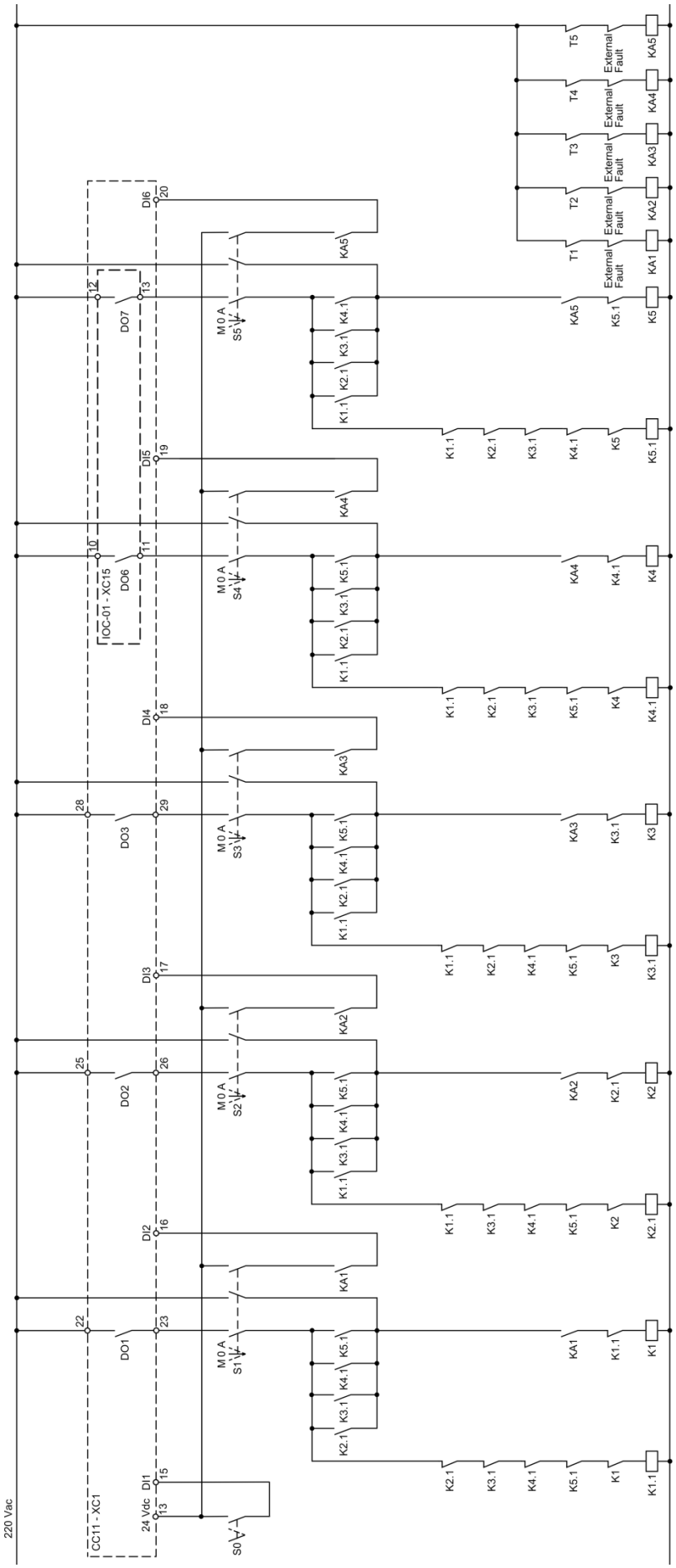


Figure 2.8– Command connections of the Pump Genius Multipump application with floating control and five pumps in parallel

Where:

■ S0: Start/Stop switch. The “Start” position issues the command for enabling the Pump Genius operation. The “Stop” position disables the Pump Genius operation, that is, it stops all the pumps of the system;

■ S1, S2, S3, S4 and S5: Manual / 0 / Automatic commutation switches (optional). The “Manual” position issues the command for starting the pump independent of the Pump Genius. The “0” position switches off the pump and disables it from the Pump Genius. The “Automatic” position enables the pump to be used in the Pump Genius;

■ K1, K2, K3, K4 and K5: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the frequency inverter;

■K1.1, K2.1, K3.1, K4.1 and K5.1: Contactors to start the pump with the CFW-11 inverter;

■ KA1, KA2, KA3, KA4 and KA5: Auxiliary contactors for the pump protection logics;

■ T1, T2, T3, T4 and T5: Contact of the pump motors protection thermal;

■ External Fault: A sensor, such as a pressure switch, can be used for the protection of the pumps;

■ DO1, DO2 and DO3: Relay digital outputs of the CFW-11 inverter to command pumps 1, 2 and 3;

■ DO6 and DO7: Relay digital outputs of the IOC-01 accessory module of the CFW-11 inverter to command pumps 4 and 5;

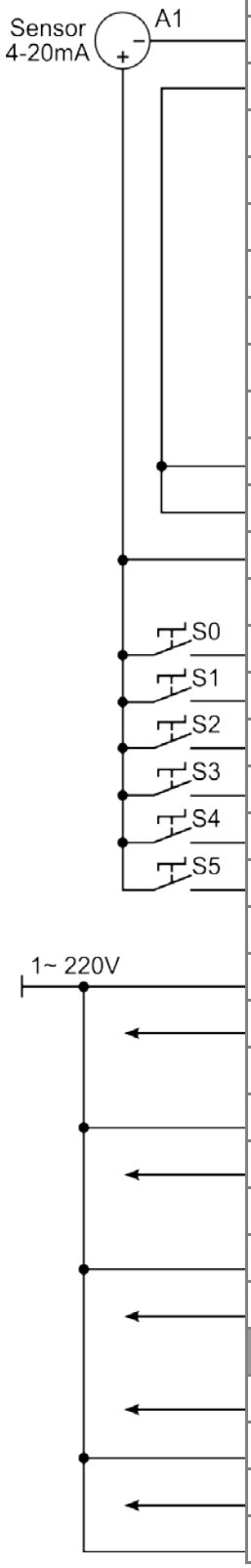
■ DI1: Digital input of the CFW-11 inverter to enable the Pump Genius operation;

■ DI2, DI3, DI4, DI5 and DI6: Digital inputs of the CFW-11 inverter indicating that the pumps are enabled for the Pump Genius.

NOTE!
The connections of the command shown in figure 2.8 are relative to the IOC-01 accessory module. If you use another accessory module, please refer to the appropriate installation guide.

2.2.3 Control Connections

The figure 2.9 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector XC1 terminal strip and IOC-01 accessory module of the CFW-11 frequency inverter for the Pump Genius Multipump configured for floating control, five pumps in parallel and setpoint via HMI.



XC1 Terminal Strip		Function for Floating Control, five pumps in parallel and Setpoint via HMI
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): No function
6	AI2-	
7	AO1	Analog output 1: Motor speed
8	AGND	
9	AO2	Analog output 2: Motor current
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: Enable pump 1 via DO1
17	DI3	Digital input 3: Enable pump 2 via DO2
18	DI4	Digital input 4: Enable pump 3 via DO3
19	DI5	Digital input 5: Enable pump 4 via DO6
20	DI6	Digital input 6: Enable pump 5 via DO7
21	NC1	Digital output 1 DO1: Start pump 1
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: Start pump 2
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: Start pump 3
28	C3	
29	NO3	
XC15 Terminal Strip		
10	NO6	Digital output 6 DO6: Start pump 4
11	C6	
12	NO7	Digital output 7 DO7: Start pump 5
13	C7	

Figure 2.9 – Signals on connector XC1 and XC15 of terminal strip for floating control and setpoint via HMI

NOTE!
Refer to the CFW-11 frequency inverter manual and the IOC-01 installation guide for further details about connections.

2.2.4 Operation Description

The figure 2.10 presents the operation scheme of the Pump Genius configured for floating control, five pumps in parallel and setpoint via HMI. The pumps will be starting in the "In a Sequence" activation mode in order to simplify the understanding of their drive. For the “Pump Rotation” activation mode, the operation time for the start or stop of the pumps is taken into account.

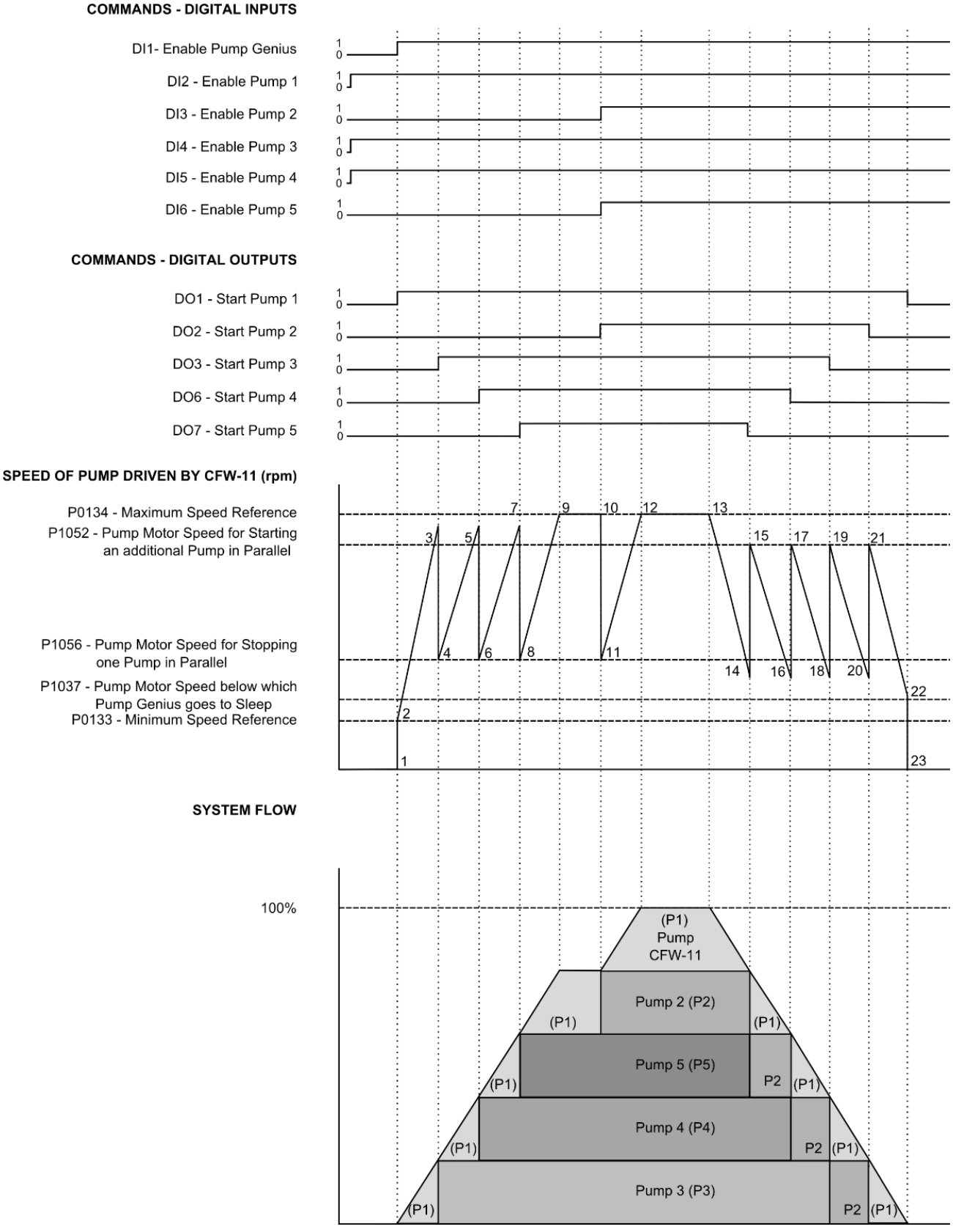


Figure 2.10 – Operation description of the Pump Genius configured for floating control

The graph of the figure 2.10 shows the digital inputs for the command and enabling of the pumps, the digital outputs for the start of the pumps, the motor speed behavior of the pump driven by the CFW-11 frequency inverter as the pumps are started and stopped in order to maintain the control process variable according to the setpoint of the required control. The analysis below of the behavior according to the identified moments:

1 – The digital input DI1 is activated in order to enable the Pump Genius. It is verified if the Pump Genius will remain in the sleep mode or in the wake up mode. The wake up mode is activated (the first time the Pump Genius is enabled the time (P1036) is disregarded). It is verified which pump must enter the system and be driven by the inverter. In this case, as the activation mode is “In a Sequence” and pump 1 (P1) is enabled for operation, the command for starting pump 1 (P1) is issued via digital output DO1, which, according to the wiring diagram, commands the K1.1 contactor so that the motor is driven by the inverter. Then a period of time of 500ms is awaited (a fixed time value for this application) until the acceleration of pump 1 (P1) begins up to the minimum programmed speed;

2 – The pump driven by the CFW-11 inverter accelerated to the minimum speed (P0133) and then the PID controller is enabled. If the pipe charging process is enabled, a period of time (P1041) is awaited to enable the PID controller;

3 – According to the control setpoint and the control process variable, the PID controller responds and accelerates the pump driven by the CFW-11 inverter. At this moment, the pump motor speed exceeds the threshold value programmed for starting an additional pump (P1052) and the deviation from the control setpoint exceeds the threshold programmed for starting an additional pump (P1053), initiating the time count P1054 and it is awaited and the command to start one more pump in parallel is issued. It is verified which pump will enter the system. In this case, since pump 1 (P1) is already started and being driven by the inverter, in the sequence pump 2 (P2) must be started, but it is disabled via digital input DI3; therefore, since pump 3 (P3) is enabled to operate, the command to start pump 3 (P3) is issued via digital output DO3, which, according to the wiring diagram, commands contactor K3;

4 – After pump 3 (P3) is started, the speed of the pump 1 (P1) driven by the inverter is reduced to the value of the motor speed programmed to stop a pump in parallel (P1057). This is done to minimize oscillations in the system. After that, the Pump Genius takes back the speed control of the pump 1 (P1) driven by the inverter and it accelerates again;

5 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1) and pump 3 (P3) are already running, in the sequence pump 2 (P2) should be started, but it is disabled via digital input DI3; therefore, since pump 4 (P4) is enabled to operate, the command to start pump 4 (P4) is issued via digital output DO6, which, according to the wiring diagram, commands contactor K4;

6 – After pump 4 (P4) is started, the analysis at instant “4” follows;

7 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1), pump 3 (P3) and pump 4 (P4) are already running, in the sequence pump 2 (P2) should be started, but it is disabled via digital input DI3; therefore, since pump 5 (P5) is enabled to operate, the command to start pump 5 (P5) is issued via digital output DO7, which, according to the wiring diagram, commands contactor K5;

8 – After pump 5 (P5) is started, the analysis at instant “4” follows;

9 – Following the analysis at instant "3", the command is issued to start one more pump in parallel and it is checked which pump must enter the system. In this case, as the pump 1 (P1), pump 3 (P3), pump 4 (P4) and pump 5 (P5) are already running, in the sequence pump 2 (P2) should be started, but it is disabled via digital input DI3; therefore, the system remains as it is and the pump 1 (P1) reaches the maximum programmed speed;

10 – Because the system needs another pump in parallel, when pump 2 (P2) is enabled via digital input DI3, the command to start the pump 2 (P2) is immediately issued via digital output DO2, which, according to the wiring diagram, commands contactor K2;

11 – After pump 2 (P2) is started, the analysis at instant “4” follows;

12 – With all pumps of the system are running, the pump 1 (P1) driven by CFW-11 inverter reaches the maximum programmed speed and continues to control the system;

13 – The system begins to feel an increase in the process variable and starts to decrease the speed of the pump 1 (P1) driven by CFW-11 inverter;

14 – When the value of motor speed programmed to stop one pump in parallel (P1056) is reached and there is a certain difference (deviation) between the control setpoint and the process variable (P1057), a period of time is awaited (P1058) and the command to stop one pump in parallel is issued. It is checked which pump will be removed from system. In this case, since the activation mode is "In a Sequence", the pump 5 (P5) must be stopped. The command to stop pump 5 (P5) is issued via digital output DO7, which, according to the wiring diagram, commands contactor K5;

15 – After stopping pump 5 (P5), the speed of the pump 1 (P1) driven by CFW-11 inverter is increased to the value of motor speed to start one more pump in parallel (P1052). This is done so as to minimize oscillations in the system. After that, the Pump Genius takes back the speed control of the pump 1 (P1) driven by CFW-11 inverter and it decelerates again;

16 – Following the analysis done at moment “14”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5) is already stopped, the next pump to be stopped is pump 4 (P4). The command to stop pump 4 (P4) is issued via digital output DO6, which, according to the wiring diagram, commands contactor K4;

17 – After stopping pump 4 (P4), the analysis at instant “15” follows;

18 – Following the analysis done at moment “14”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5) and pump 4 (P4) are already stopped, the next pump to be stopped is pump 3 (P3). The command to stop pump 3 (P3) is issued via digital output DO3, which, according to the wiring diagram, commands contactor K3;

19 – After stopping pump 3 (P3), the analysis at instant “15” follows;

20 – Following the analysis done at moment “16”, the command for stopping another pump in parallel is issued, and it is checked which pump must be removed from the system. In this case, since pump 5 (P5), pump 4 (P4) and pump 3 (P3) are already stopped, the next pump to be stopped is pump 2 (P2). The command to stop pump 2 (P2) is issued via digital output DO2, which, according to the wiring diagram, commands contactor K2;

21 – After stopping pump 2 (P2), the analysis done at moment “15” follows;

22 - When the motor speed programmed to sleep (P1037) is reached, a period of time is awaited (P1038) and, since the pump 1 (P1) driven by CFW-11 inverter remains with speed below the value programmed to sleep, the sleep mode is activated;

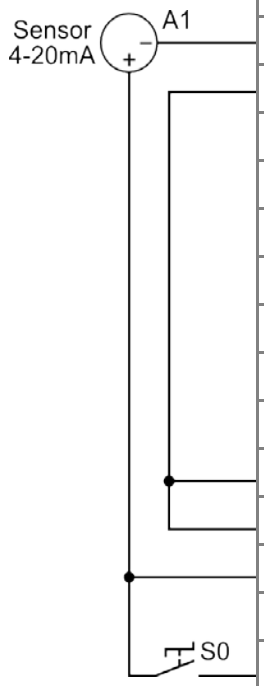
23 – With the sleep mode active, pump 1 (P1), which is being driven by CFW-11 inverter, is stopped. After 500ms (fixed time for this application) the command to stop digital output DO1 is issued, which, according wiring diagram, commands contactor K1.1. But the Pump Genius remains enabled, monitoring the control process variable. If the value falls below the deviation of the process variable to wake up (P1034) for a period of time (P1035), the wake up mode is activated and the control begins to start and stop the pumps again according to the requirements of the control setpoint.

NOTE!
Refer the chapter 3 for further details on the parameters.

2.3 OTHER CONFIGURATIONS

2.3.1 Control Setpoint via HMI or Communication Networks

The user can configure the Pump Genius Multipump application so as to have the control setpoint adjusted via HMI of the CFW-11 inverter (or Communication Networks). The figure 2.11 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector XC1 terminal strip of the CFW-11 inverter to use the control setpoint via HMI or communication networks.



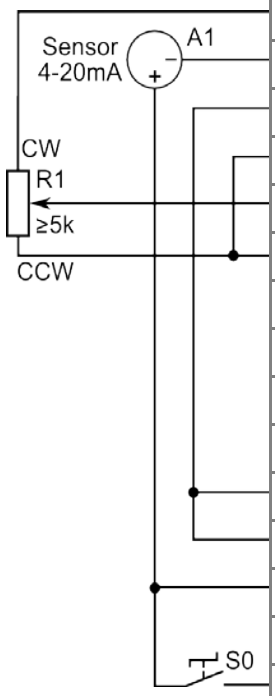
XC1 Terminal Strip		Function for Control Setpoint via HMI or Communication Networks
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): No function
6	AI2-	
7	AO1	Analog output 1: No function
8	AGND	
9	AO2	Analog output 2: No function
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: No function
17	DI3	Digital input 3: No function
18	DI4	Digital input 4: No function
19	DI5	Digital input 5: No function
20	DI6	Digital input 6: No function
21	NC1	Digital output 1 DO1: No function
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: No function
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: No function
28	C3	
29	NO3	

Figure 2.11– Terminal strip XC1 for control setpoint via HMI or Communication Networks

NOTE!
Refer to the CFW-11 inverter manual for more information on the connections.

2.3.2 Control Setpoint via Analog Input

The user can configure the Pump Genius Multipump application so as to have the control setpoint adjusted via one analog input of the CFW-11 inverter. The figure 2.12 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector XC1 terminal strip of the CFW-11 frequency inverter to use the control setpoint via analog input.



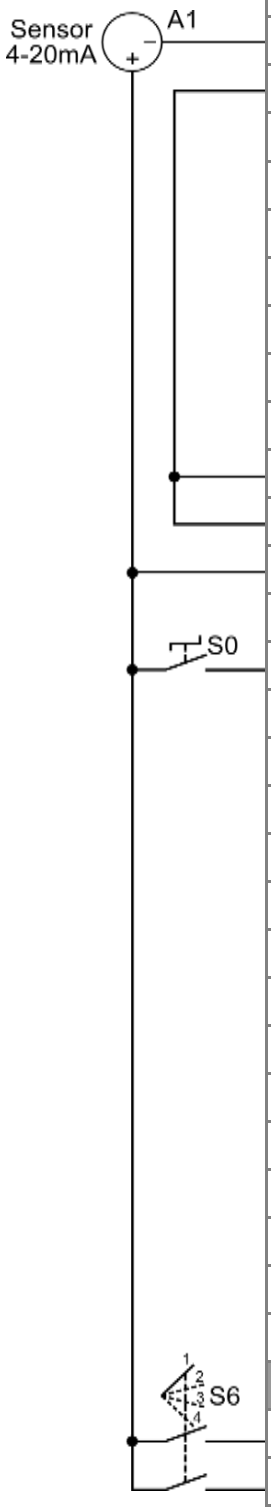
XC1 Terminal Strip		Function for Control Setpoint via Analog Input
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): Control setpoint
6	AI2-	
7	AO1	Analog output 1: Motor speed
8	AGND	
9	AO2	Analog output 2: Motor current
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: No function
17	DI3	Digital input 3: No function
18	DI4	Digital input 4: No function
19	DI5	Digital input 5: No function
20	DI6	Digital input 6: No function
21	NC1	Digital output 1 DO1: No function
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: No function
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: No function
28	C3	
29	NO3	

Figure 2.12– Terminal strip XC1 for control setpoint via analog input AI2

2.3.3 Control Setpoint via Logical Combination of Digital Inputs

The user can configure the Pump Genius Multipump application so as to have two, three or four values for control setpoint adjusted via logical combination of digital inputs DI9 and DI10. The figure 2.13 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector

XC1 terminal strip of the CFW-11 frequency inverter and IOC-01 accessory module to use the control setpoint via logical combination of digital inputs DI9 and DI10.



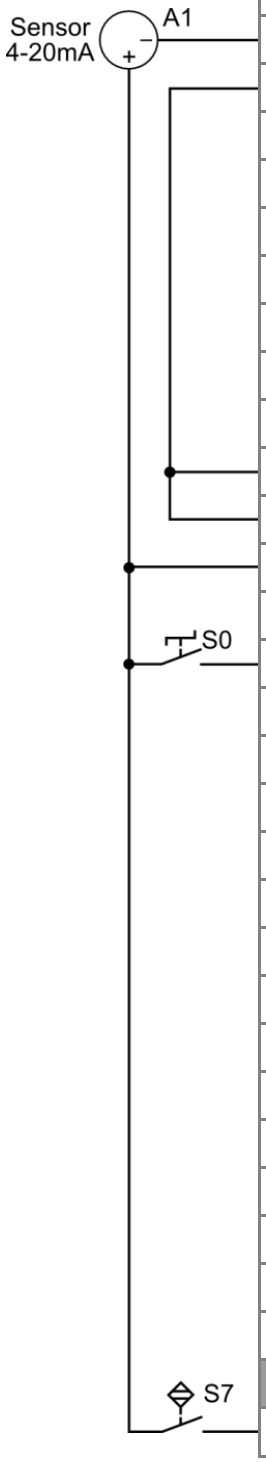
XC1 Terminal Strip		Function for Control Setpoint via Logical Combination of DI's
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): No function
6	AI2-	
7	AO1	Analog output 1: Motor speed
8	AGND	
9	AO2	Analog output 2: Motor current
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: No function
17	DI3	Digital input 3: No function
18	DI4	Digital input 4: No function
19	DI5	Digital input 5: No function
20	DI6	Digital input 6: No function
21	NC1	Digital output 1 DO1: No function
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: No function
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: No function
28	C3	
29	NO3	
XC15 Terminal Strip		
1	DI9	Digital input 9: 1st DI for selection of the control setpoint
2	DI10	Digital input 10: 2nd DI for selection of the control setpoint

Figure 2.13 – Terminal strip XC1 and XC15 for control setpoint via logic combination of DI9 and DI10

NOTE!
Refer to the CFW-11 inverter manual and the installation guide of the IOC-01 accessory module for more information on the connections.

2.3.4 Pump Protection via External Sensor

The user can configure the Pump Genius Multipump application so as to have the external sensor installed on the digital input DI11 for pump protection. The figure 2.14 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made to connector XC1 terminal strip of the CFW-11 frequency inverter and IOC-01 accessory module to use the external sensor for pump protection.



XC1 Terminal Strip		Default Function for Pump Protection via External Sensor
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (4-20 mA): Control process variable
3	AI1-	
4	REF-	Negative reference for potentiometer
5	AI2+	Analog input 2 (0-10 V): No function
6	AI2-	
7	AO1	Analog output 1: Motor speed
8	AGND	
9	AO2	Analog output 2: Motor current
10	AGND	
11	DGND	Reference (0 V) for the 24 VDC power supply
12	COM	Common point of the digital inputs
13	24VDC	24 VDC power supply
14	COM	Common point of the digital inputs
15	DI1	Digital input 1: Enable Pump Genius
16	DI2	Digital input 2: No function
17	DI3	Digital input 3: No function
18	DI4	Digital input 4: No function
19	DI5	Digital input 5: No function
20	DI6	Digital input 6: No function
21	NC1	Digital output 1 DO1: No function
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2: No function
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3: No function
28	C3	
29	NO3	
XC15 Terminal Strip		
3	DI11	Digital input 11: External Sensor

Figure 2.14 – Terminal strip XC1 and XC15 for pump protection via external sensor in the DI11 digital input

NOTE!
Refer to the CFW-11 inverter manual and the installation guide of the IOC-01 accessory module for more information on the connections.

3 PARAMETERS DESCRIPTION

The CFW-11 inverter parameters (P0000 to P0999) and the SoftPLC function parameters (P1000 to P1099) for the Pump Genius Multipump application will be presented next.

NOTE!
The Pump Genius Multipump application only works on CFW-11 inverter with special firmware version Ve.5.3x. So upgrading the CFW-11 inverter firmware to the working of this application is required.

NOTE!
The adjustable range of the CFW-11 parameters has been customized for the Pump Genius Multipump application. Refer to the CFW-11 programming manual for more details on the parameters.

Symbols for property description:

CFG Configuration parameter, value can be programmed only with motor stopped
RO Read-only parameter
RW Read and write parameter

3.1 PUMP CONTROL AND ACTIVATION MODE

This group of parameters allows the user to configure the control mode that the CFW-11 frequency inverter will use to activate the pumps.

P1021 – Pump Control and Activation Mode Configuration

Adjustable Range:	0 = Fixed Control with Pumps activated in a Sequence 1 = Fixed Control with Pumps Rotation 2 = Floating Control with Pumps activated in a Sequence 3 = Floating Control with Pumps Rotation	**Factory Setting:**	1
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS └ 50 SoftPLC		

Description:
This parameter defines the control mode that the CFW-11 frequency inverter will apply to control the pump(s) connected to it and how the command to start and stop the pump(s) will be done.

Table 3.1 – Description of the control and activation mode of the Pump Genius Multipump

P1021	Description
0	Defines the system will be controlled by the speed variation of a pump (always the same pump), and it may be associated to up to other five pumps in parallel operating at fixed speed. The activation mode (start and stop) of the pumps will be in a sequence: - To Start: Start CFW11 Pump → Pump 1 → Pump 2 → Pump 3→ Pump 4 → Pump 5; - To Stop: Stop Pump 5 → Pump 4 → Pump 3 → Pump 2 → Pump 1 → CFW-11 Pump.
1	Defines the system will be controlled by the speed variation of a pump (always the same pump), and it may be associated to up to other five pumps in parallel operating at fixed speed. The activation mode (start and stop) of the pumps will be with rotation: - To Start: Starts the CFW-11 pump and after the pump that has the shortest operating time; - To Stop: Stops the pump that has the longest operating time and at last the CFW-11 pump.
2	Defines the system will be controlled by the speed variation of any of the pumps (but only one of them), and it may be associated to up to other four pumps in parallel operating at fixed speed. The activation mode (start and stop) of the pumps will be in a sequence: - To Start: Start Pump 1 → Pump 2 → Pump 3→ Pump 4 → Pump 5; - To Stop: Stop Pump 5 → Pump 4 → Pump 3 → Pump 2 → Pump 1.
3	Defines the system will be controlled by the speed variation of any of the pumps (but only one of them), and it may be associated to up to other four pumps in parallel operating at fixed speed. The activation mode (start and stop) of the pumps will be with rotation: - To Start: Starts the pump that has the shortest operating time; - To Stop: Stops the pump that has the longest operating time.

3.2 ORIGIN OF COMMANDS

This group of parameters allows the user to configure the origin of the CFW-11 inverter commands. For this application inverter control in the LOCAL situation is performed through the HMI, and in the REMOTE situation via the SoftPLC function, i.e., by the logical of Pump Genius.

LOCAL Situation:
It allows the user to command the respective pump driven by the CFW-11 inverter, while disregarding the control logic of the Pump Genius. The command is issued via HMI or digital input and is accepted only if the pump is not running.

NOTE!
The parameter P0205 (Reading Parameter Selection 1) is automatic changed for "1-Speed Reference #" when the CFW-11 inverter operates in LOCAL situation.

REMOTE Situation:
It enables the Pump Genius logic, according to the programming performed by the user.

P0220 – LOCAL/REMOTE Selection Source

P0221 – Speed Reference Selection – LOCAL Situation

P0222 – Speed Reference Selection – REMOTE Situation

P0223 – FORWARD/REVERSE Selection - LOCAL Situation

P0226 – FORWARD/REVERSE Selection - REMOTE Situation

P0224 – Run/Stop Selection – LOCAL Situation

P0227 – Run/Stop Selection – REMOTE Situation

P0225 – JOG Selection – LOCAL Situation

P0228 – JOG Selection – REMOTE Situation

NOTE!
Refer to the CFW-11 programming manual for more information on the command origin parameters. Some parameter options have been removed from the configuration wizard.

3.3 RAMPS

This group of parameters allows the user to adjust the inverter ramps, so that the motor can be accelerated or decelerated at a faster or slower rate.

P0100 – Acceleration Time

Adjustable Range:	0.0 to 999.0 s	**Factory Setting:**	5.0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 20 Ramps		

Description:
This parameter determines the time of linear acceleration between zero and maximum speed (defined in P0134).

P0101 – Deceleration Time

Adjustable Range:	0.0 to 999.0 s	**Factory Setting:**	5.0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 20 Ramps		

Description:
This parameter determines the time of linear deceleration between the maximum speed (defined in P0134) and zero.

NOTE!
Refer to the CFW-11 programming manual for more information on the ramp parameters.

3.4 SPEED LIMITS

This group of parameters allows the user to configure the motor speed limits.

P0133 – Minimum Speed Reference Limit

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1200 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 22 Speed Limits		

Description:
This parameter defines the minimum value for the motor speed reference when the inverter is enabled.

P0134 – Maximum Speed Reference Limit

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1800 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 22 Speed Limits		

Description:
This parameter defines the maximum value for the motor speed reference when the inverter is enabled.

NOTE!
Refer to the CFW-11 programming manual for more information on the speed limit parameters. With the CFW-11 inverter programmed to scalar (V/f) mode, the motor slip is disregarded.

3.5 DIGITAL INPUTS

This group of parameters allows the user to configure the command function of each digital input in the Pump Genius Multipump application.

P0263 – DI1 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump Genius (PLC Use)		**Factory Setting:**	21
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs	

Description:
This parameter configures the function of the digital input DI1 in the application ladder as enable the Pump Genius for operation.

Logic level “0” the Pump Genius is disabled for operation.

Logic level “1” the Pump Genius is enabled for operation.

P0264 – DI2 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump 1 via DO1 (PLC Use)		**Factory Setting:**	21
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs	

Description:
This parameter defines that the digital input DI2 function will be to enable the use of the pump 1 (commanded by the digital output DO1) on the Pump Genius. According to section 2.1 and 2.2, a selector switch, sensors for the motor or pump protection, etc. can be inserted in this command.

At logic level “0”, it indicates that pump 1 operation is disabled on the Pump Genius.

At logic level “1”, it indicates that pump 1 operation is enabled on the Pump Genius, and can be started or stopped according to use requirements.

P0265 – DI3 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump via DO2 (PLC Use)		**Factory Setting:**	21
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs	

Description:
This parameter defines that the digital input DI3 function will be to enable the use of the pump 2 (commanded by the digital output DO2) on the Pump Genius. According to section 2.1 and 2.2, a selector switch, sensors for the motor or pump protection, etc. can be inserted in this command.

At logic level “0”, it indicates that pump 2 operation is disabled on the Pump Genius.

At logic level “1”, it indicates that pump 2 operation is enabled on the Pump Genius, and can be started or stopped according to use requirements.

P0266 – DI4 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump via DO3 (PLC Use)		**Factory Setting:**	0
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs	

Description:
This parameter defines that the digital input DI4 function will be to enable the use of the pump 3 (commanded by the digital output DO3) on the Pump Genius. According to section 2.1 and 2.2, a selector switch, sensors for the motor or pump protection, etc. can be inserted in this command.

At logic level “0”, it indicates that pump 3 operation is disabled on the Pump Genius.

At logic level “1”, it indicates that pump 3 operation is enabled on the Pump Genius, and can be started or stopped according to use requirements.

P0267 – DI5 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump 4 via DO6 (PLC Use)	**Factory Setting:**	0
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs

Description:
This parameter defines that the digital input DI5 function will be to enable the use of the pump 4 (commanded by the digital output DO6) on the Pump Genius. According to section 2.1 and 2.2, a selector switch, sensors for the motor or pump protection, etc. can be inserted in this command.

At logic level “0”, it indicates that pump 4 operation is disabled on the Pump Genius.

At logic level “1”, it indicates that pump 4 operation is enabled on the Pump Genius, and can be started or stopped according to use requirements.

P0268 – DI6 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump 5 via DO7 (PLC Use)	**Factory Setting:**	0
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 40 Digital Inputs	or	07 I/O CONFIGURATION ∟ 40 Digital Inputs

Description:
This parameter defines that the digital input DI6 function will be to enable the use of the pump 5 (commanded by the digital output DO7) on the Pump Genius. According to section 2.1 and 2.2, a selector switch, sensors for the motor or pump protection, etc. can be inserted in this command.

At logic level “0”, it indicates that pump 5 operation is disabled on the Pump Genius.

At logic level “1”, it indicates that pump 5 operation is enabled on the Pump Genius, and can be started or stopped according to use requirements.

DI9 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1022 = 4 or 5 or 6, it defines that the digital input DI9 in the application ladder as the 1st digital input of the logical combination which defines the control setpoint of the Pump Genius.

DI10 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1022 = 5 or 6, it defines that the digital input DI10 in the application ladder as the 2nd digital input of the logical combination which defines the control setpoint of the Pump Genius.

NOTE!
Refer to the section 3.9 for more information on the control setpoint of the pumping control via logical combination of the digital inputs DI9 and DI10.

DI11 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1045 ≠ 0, it defines that the digital input DI11 in the application ladder as enabling the pump protection via an external sensor.

Logic level “0” indicates that the external sensor for pump protection is actuated. When the pump is running, the alarm “A782: External Sensor for Pump Protection actuated” will be generated. After the programmed time in P1045 elapses, the fault “F783: External Sensor for Pump Protection actuated” will be generated, and the pump will be disabled.

Logic level “1” indicates that the condition for pump protection was not detected.

NOTE!
Refer to the section 3.19 for more information on the pump protection via external sensor.

NOTE!
Refer to the CFW-11 programming manual for more information on the digital inputs parameters. Some parameter options have been removed from the configuration wizard.

3.6 DIGITAL OUTPUTS

This group of parameters allows the user to configure the command function of each digital output in the Pump Genius Multipump application.

P0275 – DO1 Function (RL1)

Adjustable Range:	0 to 36 / 28 = Start Pump 1 (SoftPLC)		**Factory Setting:**	28
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 41 Digital Outputs	or	07 I/O CONFIGURATION ∟ 41 Digital Outputs	

Description:
This parameters define the function of the digital outputs DO1. If you selected the "28 = Start Pump 1 (SoftPLC)”, the output assumes the function of starting pump 1, according the pumping control. According to section 2.1 and 2.2, the NO contact of the digital output DO1 relay must be used.

P0276 – DO2 Function (RL2)

Adjustable Range:	0 to 36 / 28 = Start Pump 2 (SoftPLC)		**Factory Setting:**	28
Properties:	CFG			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 41 Digital Outputs	or	07 I/O CONFIGURATION ∟ 41 Digital Outputs	

Description:
This parameters define the function of the digital outputs DO2. If you selected the "28 = Start Pump 2 (SoftPLC)”, the output assumes the function of starting pump 2, according the pumping control. According to section 2.1 and 2.2, the NO contact of the digital output DO2 relay must be used.

P0275 – DO3 Function (RL3)

Adjustable Range:	0 to 36 / 28 = Start Pump 3 (SoftPLC)	**Factory Setting:**	0
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 41 Digital Outputs	or	07 I/O CONFIGURATION ∟ 41 Digital Outputs

Description:
This parameters define the function of the digital outputs DO3. If you selected the "28 = Start Pump 3 (SoftPLC)", the output assumes the function of starting pump 3, according the pumping control. According to section 2.1 and 2.2, the NO contact of the digital output DO3 relay must be used.

DO6 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P0267 = 21 it defines that the digital output DO6 assumes the function of starting pump 4, according the pumping control.

DO7 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P0268 = 21 it defines that the digital output DO7 assumes the function of starting pump 5, according the pumping control.

DO8 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

This parameter assumes the function of indicating an existence of alarm and/or a fault.

DO9 Function

Description:
It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

This parameter assumes the function of indicating that the alarm “A770: Low Level Alarm for the Control Process Variable” or “A772: High Level Alarm for the Control Process Variable” or “F771: Low Level Fault for the Control Process Variable” or “F773: High Level Fault for the Control Process Variable” is active.

NOTE!
Refer to the CFW-11 programming manual for more information on the digital outputs parameters.

3.7 ANALOG INPUTS

This group of parameters allows the user to configure the function of each analog input in the Pump Genius Multipump application.

P0231 – AI1 Signal Function

P0236 – AI2 Signal Function

Adjustable Range:	0 to 7 / 7 = Control Setpoint (PLC Use) (P1022 = 1 to 2) 0 to 7 / 7 = Control Process Variable (PLC Use) (P1023 = 1 to 3)	**Factory Setting:**	P0231 = 7 P0236 = 0
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 38 Analog Inputs	or	07 I/O CONFIGURATION ∟ 38 Analog Inputs

Description:
These parameters configure the function of the analog inputs AI1 and AI2 in the Pump Genius Multipump application as reading of the control setpoint (P1022=1 to 2) or as control process variable (P1023=1 to 3).

P0233 – AI1 Signal Type

P0238 – AI2 Signal Type

Adjustable Range:	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA	**Factory Setting:**	1
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 38 Analog Inputs	or	07 I/O CONFIGURATION ∟ 38 Analog Inputs

Description:
These parameters configure the type of signal (voltage or current) that will be read at each analog input, as well as its range. According to the selected option adjust the DIP switch S1.4 (AI1) and S1.3 (AI2) of the CFW-11 control board.

P0232 – AI1 Gain

P0237 – AI2 Gain

Adjustable Range:	0.000 to 9.999	**Factory Setting:**	1.000
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 38 Analog Inputs	or	07 I/O CONFIGURATION ∟ 38 Analog Inputs

Description:
These parameters apply a gain to the value read at the analog inputs AI1 and AI2, i.e., the value obtained at the analog input is multiplied by the gain, thus allowing adjustments in the measured variable

P0234 – AI1 Offset

P0239 – AI2 Offset

Adjustable Range:	-100.00 to +100.00 %	**Factory Setting:**	0.00 %
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 38 Analog Inputs	or	07 I/O CONFIGURATION ∟ 38 Analog Inputs

Description:
These parameters add to the measured quantity a value, in percentage, in order to adjust the read variable.

P0235 – AI1 Filter

P0240 – AI2 Filter

Adjustable Range:	0.00 to 16.00 s	**Factory Setting:**	0.25 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 38 Analog Inputs	or	07 I/O CONFIGURATION ∟ 38 Analog Inputs

Description:
These parameters configure the 1st order filter time constant that will be applied to the analog inputs AI1 and AI2.

NOTE!
Refer to the CFW-11 programming manual for more information on the analog inputs parameters. Some parameter options have been removed from the configuration wizard.

3.8 CONTROL PROCESS VARIABLE

This group of parameters allows the user to configure the control process variable of the Pump Genius Multipump application.

P1023 – Control Process Variable Selection Source

Adjustable Range:	1 = Control Process Variable via Analog Input AI1 2 = Control Process Variable via Analog Input AI2 3 = Control Process Variable via difference between Analog Input AI1 and AI2 (AI1 – AI2)	**Factory Setting:**	1
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the source of the Pump Genius process variable.

Table 3.2 – Description of the control process variable source

P1023	Description
1	It defines that the source of the control process variable of the Pump Genius is the value read by the analog input AI1. The value is converted according to engineering unit 1 and displayed in parameter P1016.
2	It defines that the source of the control process variable of the Pump Genius is the value read by the analog input AI2. The value is converted according to engineering unit 1 and displayed in parameter P1016.
3	It defines that the source of the control process variable of the Pump Genius is the value read by the analog input AI1 subtracted from the value read by the analog input AI2. The value of AI1 – AI2 is converted according to engineering unit 1 and displayed in parameter P1016.

3.8.1 Engineering Unit Configuration

This group of parameters allows the user to configure the engineering unit of the Pump Genius control process variable.

P0510 – Engineering Unit 1

Adjustable Range:

0 = None
1 = V
2 = A
3 = rpm
4 = s
5 = ms
6 = N
7 = m
8 = Nm
9 = mA
10 = %
11 = °C
12 = CV
13 = Hz
14 = HP
15 = h
16 = W
17 = kW
18 = kWh
19 = H
20 = min
21 = °F
22 = bar
23 = mbar
24 = psi
25 = Pa
26 = kPa
27 = MPa
28 = mwc (meter of water column)
29 = mca (metro de coluna d'agua)
30 = gal
31 = l (litro)
32 = in
33 = ft
34 = m^3
35 = ft^3
36 = gal/s
37 = GPM (= gal/min)
38 = gal/h
39 = l/s
40 = l/min
41 = l/h
42 = m/s
43 = m/min
44 = m/h
45 = ft/s
46 = ft/min
47 = ft/h
48 = m^3/s
49 = m^3/min
50 = m^3/h
51 = ft^3/s
52 = CFM (= ft^3/min)
53 = ft^3/h
54 = kgf
55 = kgfm
56 = lbf
57 = lbfft
58 = ohm
59 = rpm/s

Factory Setting: 24

60 = mH
61 = ppr
62 = °
63 = rot

Properties:
Access groups via HMI: 01 PARAMETER GROUPS
∟ 30 HMI

Description:
This parameter selects the engineering unit that will be displayed in the SoftPLC user parameter that is associated with it. I.e., any SoftPLC user parameter that is associated with the engineering unit 1 will be displayed in this format on the CFW-11 inverter HMI.

NOTE!
The parameters P1011, P1012, P1013, P1014, P1015, P1016, P1024, P1025, P1026, P1028, P1034, P1035, P1039, P1053 and P1057 are associated with the engineering unit 1.

P0511 – Decimal Point of Engineering Unit 1

Adjustable Range: 0 = xywz; 1 = xyw.z; 2 = xy.wz; 3 = x.ywz **Factory Setting:** 1

Properties:
Access groups via HMI: 01 PARAMETER GROUPS
∟ 30 HMI

Description:
This parameter selects the decimal point that will be displayed in the SoftPLC user parameter that is associated with it. I.e., any SoftPLC user parameter that is associated with the decimal point of engineering unit 1 will be displayed in this format on the CFW-11 inverter HMI.

NOTE!
The parameters P1011, P1012, P1013, P1014, P1015, P1016, P1024, P1025, P1026, P1028, P1034, P1035, P1039, P1053 and P1057 are associated with the decimal point of engineering unit 1.

3.8.2 Sensor Scale Configuration

This group of parameters allows the user to configure the scaling of the control process variable.

P1024 – Control Process Variable Sensor Minimum Level

Adjustable Range: -32768 to 32767 [Eng. Un. 1] **Factory Setting:** 0

Properties:
Access groups via HMI: 01 PARAMETER GROUPS
∟ 50 SoftPLC

Description:
This parameter defines the minimum level of the Pump Genius control process variable sensor according to its engineering unit.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1025 – Control Process Variable Sensor Maximum Level

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	400
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the maximum level of the Pump Genius control process variable sensor according to its engineering unit.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

Through the minimum and maximum level of control process variable sensor and the value of analog input AIx, we have the line equation for conversion of the Pump Genius control process variable:

$$P1016 = (P1025 - P1024) \times AIx + P1024$$

Where,

P1016 = Control process variable;
P1024 = Minimum level of control process variable sensor;
P1025 = Maximum level of control process variable sensor;
AIx = Value of analog input AI1, AI2 or difference between AI1 and AI2 (AI1 – AI2) in %.

3.9 CONTROL SETPOINT

This group of parameters allows the user to configure the control setpoint of the Pump Genius Multipump application.

P1011 – Control Setpoint

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	200
Properties:	RW		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value of the control setpoint of the Pump Genius in engineering units when the control setpoint source was programmed to be via HMI or communication networks (P1022=3). When the control setpoint source was programmed to be another source (P1022≠3), it is indicates the actual control setpoint of the Pump Genius.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1012 – Control Setpoint 1

P1013 – Control Setpoint 2

P1014 – Control Setpoint 3

P1015 – Control Setpoint 4

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	P1012 = 200 P1013 = 230 P1014 = 180 P1015 = 160
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
These parameters define the value of the control setpoint of the Pump Genius in engineering units when the control setpoint source was programmed to be via logical combination of digital inputs DI9 and DI10 (P1022=4, 5 or 6) according the table 3.3.

NOTE!
These parameters are displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1022 – Control Setpoint Selection Source

Adjustable Range:	1 = Control Setpoint via Analog Input AI1 2 = Control Setpoint via Analog Input AI2 3 = Control Setpoint via HMI or Communication Networks (P1011) 4 = Two Setpoints via Digital Input DI4 (P1012 and P1013) 5 = Three Setpoints via Digital Inputs DI9 and DI10 (P1012, P1013 and P1014) 6 = Four Setpoints via Digital Inputs DI9 and DI10 (P1012, P1013, P1014 and P1015)	**Factory Setting:**	3
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the source of the Pump Genius control setpoint.

Table 3.2 – Description of the control setpoint source

P1022	Description
1	It defines that the source of the control setpoint of the Pump Genius is the value read by the analog input AI1. The value is converted according to engineering unit 1 and displayed in parameter P1011.
2	It defines that the source of the control setpoint of the Pump Genius is the value read by the analog input AI2. The value is converted according to engineering unit 1 and displayed in parameter P1011.
3	It defines that the source of the control setpoint of the Pump Genius is the value programmed in the parameter P1011 of the CFW-11 inverter HMI or the value written via communication networks.
4	It defines that there are two setpoints for the Pump Genius selected via logical combination of the digital input DI9. The setpoint value selected is displayed in parameter P1011.
5	It defines that there are three setpoints for the Pump Genius selected via logical combination of the digital inputs DI9 and DI10. The setpoint value selected is displayed in parameter P1011.
6	It defines that there are four setpoints for the Pump Genius selected via logical combination of the digital inputs DI9 and DI10. The setpoint value selected is displayed in parameter P1011.

When the control setpoint is via logical combination of the digital inputs DI9 and DI10, the following truth table should be applied for obtaining the control setpoint of the Pump Genius:

Table 3.3 – Truth table for control setpoint via logical combination of the digital inputs DI9 and DI10

	P1012 – Control Setpoint 1	P1013 – Control Setpoint 2	P1014 – Control Setpoint 3	P1015 – Control Setpoint 4
Digital Input DI9	0	1	0	1
Digital Input DI10	0	0	1	1

3.10 PID CONTROLLER

This group of parameters allows the user to adjust the operating conditions of the PID controller for controlling the pumping.

The PID controller can control the motor (pump) speed driven by CFW-11 inverter through the comparison of the control process variable (feedback) with the control setpoint.

The PID controller will be set up to operate from 0.0 to 100.0 %, where 0.0 % equates to minimum speed programmed in P0133 and 100.0 % equates to maximum speed programmed in P0134.

The control process variable is read via an analog input, which requires the chosen input to be appropriately configured for the purpose.

The "Academic" structure has been adopted as algorithm for the PID controller. It obeys the following equation:

$$u(k) = i(k-1) + Kp \cdot [(1 + Ki \cdot Ts + (Kd/Ts)) \cdot e(k) - (Kd/Ts) \cdot e(k-1)]$$

Where,

u(k) = PID controller output
i(k-1) = integral part in the previous sampling instant
Kp = proportional gain
Ki = integral gain
Kd = derivative gain
Ts = cyclic sampling time (fixed at 50ms)
e(k) = error in the present sampling instant (setpoint – process variable (direct), or process variable – setpoint (reverse))
e(k-1) = error in the previous sampling instant

P1030 – Control Action of the PID Controller

Adjustable Range:	1 = Direct Mode 2 = Reverse Mode	**Factory Setting:** 1
Properties:	CFG	
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC	

Description:
This parameter configures the control action of the Pump Genius's PID controller, by defining the effect of the error polarity.

Table 3.5 – Description of the control action of the PID controller

P1030	Description
1	It defines that the control or regulation action of the PID controller will be in direct mode. I.e., the error is the control setpoint value (P1011) minus the control process variable value (P1016).
2	It defines that the control or regulation action of the PID controller will be in reverse mode. I.e., the error is the control process variable value (P1016) minus the control setpoint value (P1011).

NOTE!
The PID control action should be set to direct mode, when, in order to increase the control process variable value, it is necessary to increase the PID output. Ex: Pump driven by the inverter is filling a reservoir. Raising the reservoir level (control process variable), requires a higher flow rate, which is achieved by increasing the motor speed.
The PID control action should be selected to reverse mode, when, in order to increase the control process variable value, it is necessary to reduce the PID output. Ex: Pump driven by the inverter is removing fluid from a reservoir. In order to increase the fluid level in the reservoir (control process variable), it is necessary to reduce the pump speed by reducing the motor speed.

P1031 – PID Proportional Gain

Adjustable Range:	0.000 to 32.000	**Factory Setting:**	1.000
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the proportional gain value of the PID controller for the Pump Genius.

P1032 – PID Integral Gain

Adjustable Range:	0.000 to 32.000	**Factory Setting:**	25.000
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the integral gain value of the PID controller for the Pump Genius.

P1033 – PID Derivative Gain

Adjustable Range:	0.000 to 32.000	**Factory Setting:**	0.000
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the derivative gain value of the PID controller for the Pump Genius.

NOTE!
The PID controller of the standard Pump Genius Multipump application is of the academic type. Should a different structure be adopted for the PID controller (through WLP), then the controller gains must be re-optimized by the user. PID block input arguments can only be changed in the ladder application developed with the WLP. Refer to the WLP programming software help topics for more information on the PID block.

3.11 PUMP GENIUS STARTUP MODES

This group of parameters allows the user to set the conditions to startup the Pump Genius, and it may be:

3.11.1 Wake up and Start Level Mode

■ Wake up Mode: Configures the Pump Genius to start the 1st pump and resume control of the pumping when the deviation between the control process variable and the control setpoint reaches a programmed threshold;
■ Start Level Mode: Configures the Pump Genius to start the 1st pump and resume control of the pumping when the control process variable reaches a programmed threshold.

P1034 – Control Process Variable Deviation for Pump Genius to Wake up

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	30
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value to be reduced (direct PID) or increased (reverse PID) to the control setpoint for resuming control of the pumping. Becoming this value is compared with the control process variable and, if the value of the control process variable is less (direct PID) or greater (reverse PID) than this value, the condition to wake up is enabled.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1035 – Control Process Variable Level to Starting the Pump Genius

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	180
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the control process variable level for starting the 1st pump and resuming control of the pumping. With a Direct Mode PID controller, the pumping control will be enabling to start when the control process variable drops lower than P1035. With a Reverse Mode PID controller it will be enabling to start when the process variable rises above P1035.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1036 – Time Delay for Pump Genius to Wake up or Starting by Level

Adjustable Range:	0 to 32767 s	**Factory Setting:**	5 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time after the condition for wake up mode or start level mode becomes true, as follows:

- Wake up Mode: The Wake up condition, as defined in P1034, must remain TRUE continuously for the time programmed in P1036, in order for the 1st pump to start and pumping control to resume. The P1036 waiting time restarts from zero, if the Wake up condition momentarily becomes FALSE.
- Start Level Mode: The control process variable Start Level condition as defined in P1035, must remain TRUE continuously for the time programmed in P1036, in order for the 1st pump to start and pumping control to resume. The P1036 waiting time restarts from zero, if the Start Level condition momentarily becomes FALSE.

3.11.2 Sleep Mode and Sleep Boost

This group of parameters allows the user to set the conditions to stop the pump, and it may be:

■ Sleep Mode: Configures the Pump Genius to stop the last running pump in the pumping control when the pump motor speed drops below a programmed threshold (low control demand). Even though apparently the system is off, the control process variable is still monitored for wake up or start level conditions.
■ Sleep Boost: Configures the Pump Genius so before stop the pump when the pump motor speed drops below a programmed threshold (low demand control), i.e., enable the sleep mode, to be added to the control setpoint a value to increase the control process variable with the purpose of the pump will remain in sleep mode longer.

P1037 – Pump Motor Speed below which Pump Genius goes to Sleep Mode

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1250 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value of the pump motor speed below which the sleep mode can be active when only one pump is running.

NOTE!
A setting of “0 rpm” disables the Sleep Mode, and the Pump Genius will be enabled according to the command “Enable Pump Genius” via digital input DI1.

P1038 – Time Delay for Pump Genius goes to Sleep Mode

Adjustable Range:	0 to 32767 s	**Factory Setting:**	10 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time with the value of the pump motor speed should remain below the value set in P1037 in order for sleep mode to be activated and the last running pump in the Pump Genius to be stopped.

P1039 – Sleep Boost Offset

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	0
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value to be added to the control setpoint in automatic mode to increase the control process variable before the Pump Genius go into sleep mode. When the control process variable reach the control setpoint value added to the sleep boost offset, the Pump Genius will go into sleep mode.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511). A setting of “0” disable the sleep boost. This function is only enabled to use for control action of the PID controller in direct mode (P1030=1).

NOTE!
The alarm message “A756: Sleep Boost Active” will be generated on the HMI of the CFW-11 inverter to alert that the Pump Genius is executing the sleep boost.

P1040 – Sleep Boost Maximum Time

Adjustable Range:	0 to 32767 s	**Factory Setting:**	15 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the maximum time that the control process variable has to reach the control setpoint value added to the sleep boost offset, i.e., the maximum time that the sleep boost will be active. If the control process variable does not reach the control setpoint value added to the sleep boost offset during this time, the Pump Genius will go into sleep mode.

The figure 3.1 presents a timing analysis of the Pump Genius operation with a Direct Mode PID controller when it is configured for Wake up Mode, Sleep Mode and the Sleep Boost function disabled:

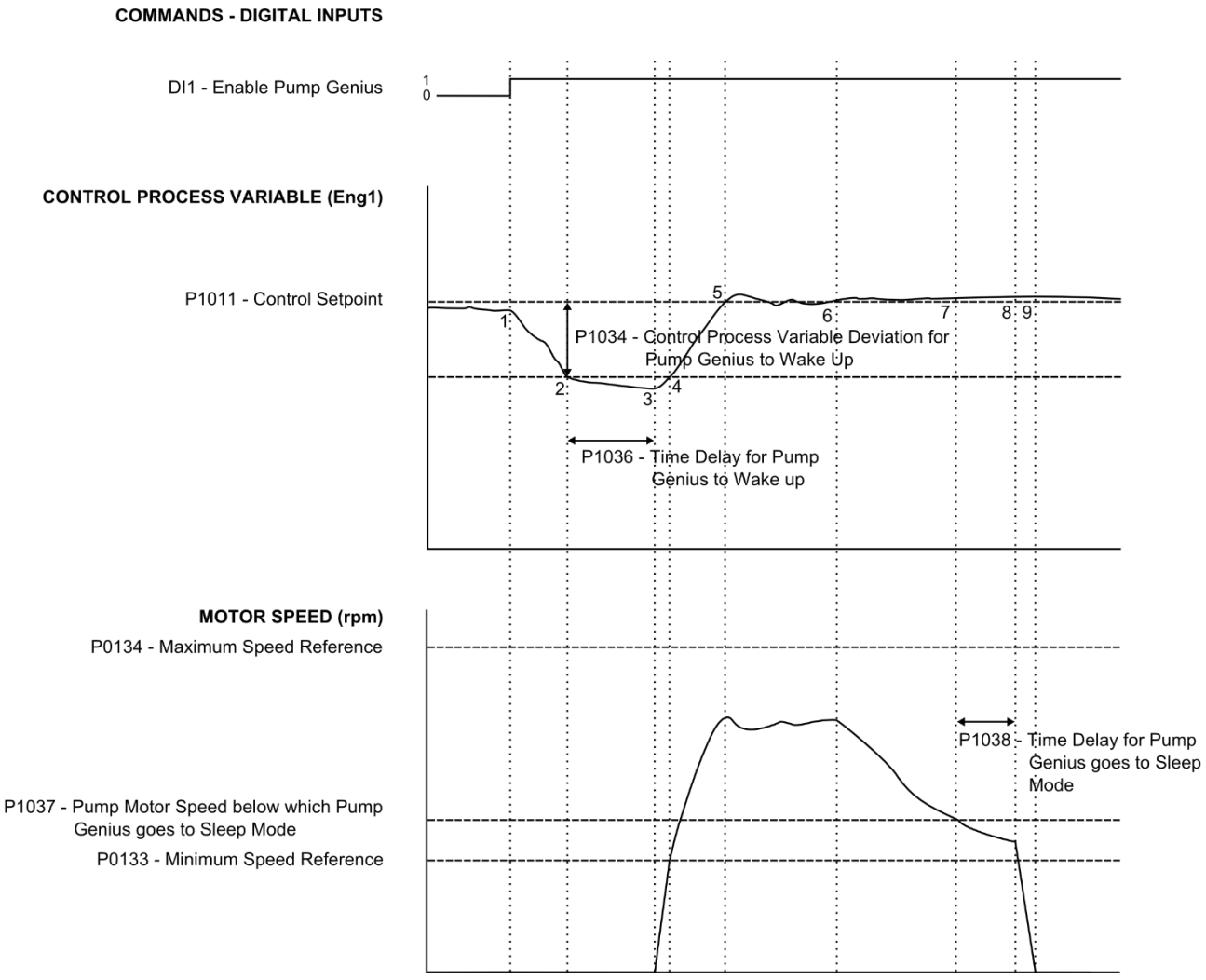


Figure 3.1 – Operation of the Pump Genius for wake up mode and sleep mode

1 – The Pump Genius is enabled for operation via digital input DI1. Since the condition to wake up was not detected, the pumping control remains in the sleep mode;

2 – The control process variable begins to decrease and is lower than the control process variable deviation programmed for Pump Genius to wake up (P1034); in this moment the time count to wake up (P1036) is initiated;

3 – The control process variable remains smaller than the control process deviation for Pump Genius to wake up (P1034) and the time delay to wake up (P1036) is elapsed; at this moment the control issues the command to start the 1st pump and resumes controlling the pumping with variable speed;

4 – The inverter accelerates the pump up to the minimum speed. After that, the PID controller is enabled and starts controlling the pump speed;

5 – The resumed Pump Genius allows the value of the control process variable to catch up with the control setpoint required by the user. The PID controller output increases during the catch-up phase, raising the pumping speed. A stabile phase with constant pumping speed may follow;

6 – The value of the control process variable continues above the setpoint due to a decrease in demand and pump speed begins to decrease;

7 – The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (P1037); the time count for Pump Genius goes to sleep mode (P1038) is initiated;

8 – The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (P1037) and the time delay for Pump Genius goes to sleep mode (P1038) is elapsed; at this moment the control issues the command to stop pumping action, and the last operating pump decelerates;

9 – The inverter driven pump reaches "zero" speed, and remains stopped; at this moment the Pump Genius goes into sleep mode.

The figure 3.2 presents a timing analysis of the Pump Genius operation with a Direct Mode PID controller when it is configured for Start Level Mode, Sleep Mode and the Sleep Boost function disabled:

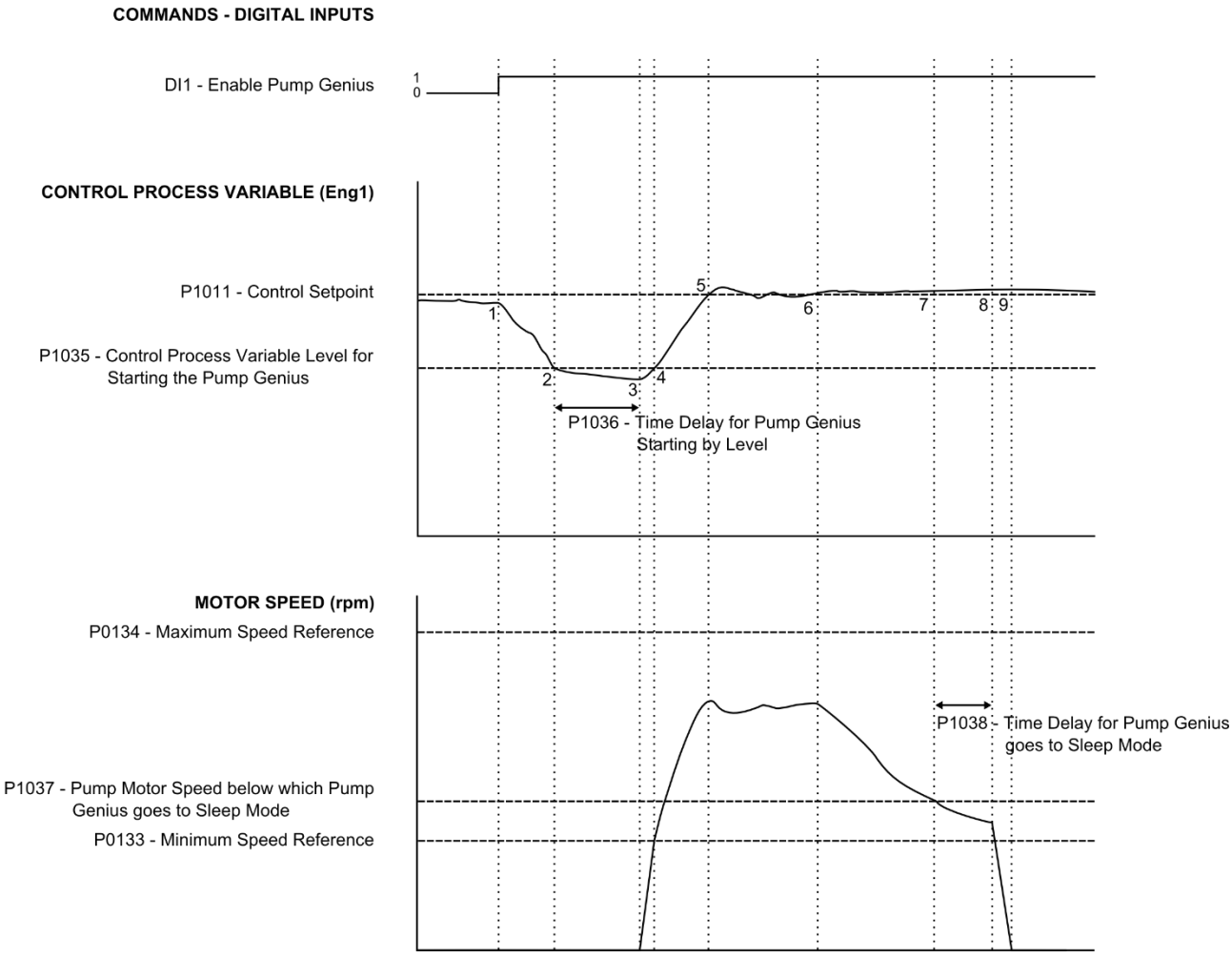


Figure 3.2 – Operation of the Pump Genius for start level mode and sleep mode

1 – The Pump Genius is enabled for operation via digital input DI1. As the control process variable level condition to start the Pump Genius was not detected, the Pump Genius remains in the sleep mode;

2 – The control process variable begins to decrease and is lower than the control process variable threshold programmed starting the Pump Genius (P1035); in this moment the time count for Pump Genius starting by level (P1036) is initiated;

3 – The control process variable remains smaller than the threshold for starting the Pump Genius (P1035) and the time delay for Pump Genius starting by level (P1036) is elapsed; at this moment the control issues the command to start the 1st pump and resumes controlling the pumping with variable speed;

4 – The inverter accelerates the pump up to the minimum speed. After that, the PID controller is enabled and starts controlling the pump speed;

5 – The resumed Pump Genius allows the value of the control process variable to catch up with the control setpoint required by the user. The PID controller output increases during the catch-up phase, raising the pumping speed. A stabile phase with constant pumping speed may follow;

6 – The value of the control process variable continues above the setpoint due to a decrease in demand and pump speed begins to decrease;

7 – The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (P1037); the time count for Pump Genius goes to sleep mode (P1038) is initiated;

8 – The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (P1037) and the time delay for Pump Genius goes to sleep mode (P1038) is elapsed; at this moment the control issues the command to stop pumping action, and the last operating pump decelerates;

9 – The inverter driven pump reaches "zero" speed, and remains stopped; at this moment, the Pump Genius goes into sleep mode.

The figure 3.3 presents a timing analysis of the Pump Genius operation with a Direct Mode PID controller when it is configured for Wake up Mode and Sleep Mode with Sleep Boost enabled:

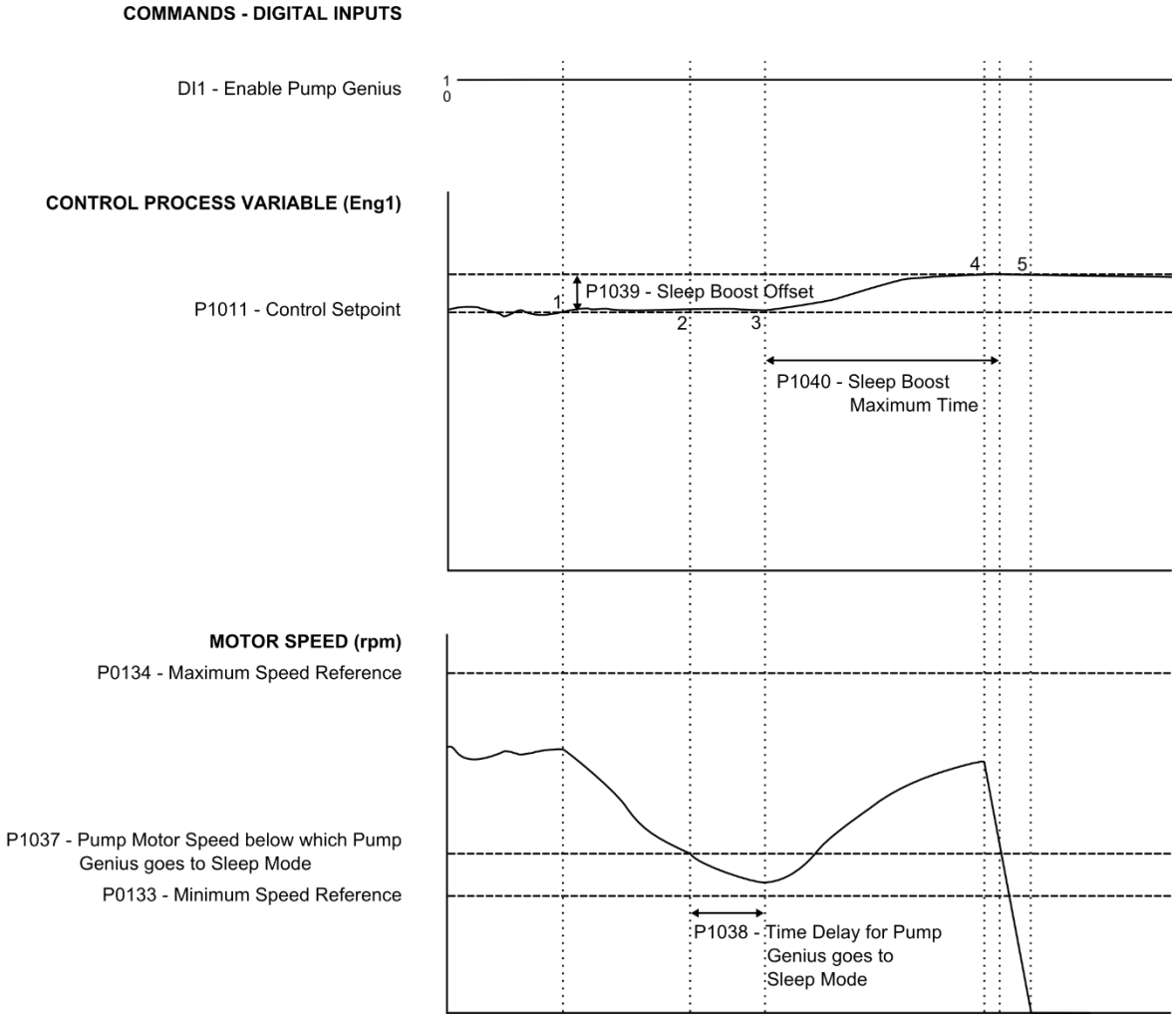


Figure 3.3 – Operation of the Pump Genius for sleep mode with sleep boost enabled

1 – The Pump Genius is keeping the system controlled as the control setpoint required by the user. At this moment the value of the control process variable begins to increase and the speed motor begins to decrease;

2 – The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (P1037); the time count for the Pump Genius go to sleep mode (P1038) is initiated;

3 – The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (P1037) and the time delay for Pump Genius goes to sleep mode (P1038) is elapsed; at this moment, as the sleep boost is enabled will not be made the command to stop the pump. It will be added the sleep boost offset (P1039) to the control setpoint for increase the control process variable; at this moment the count of the sleep boost maximum time (P1040) is initiated;

4 – The inverter accelerates the pump again as the action of the PID controller and the control process variable reaches the control setpoint value added to the sleep boost active; at this moment the control issues the command to stop the pump before the count of the sleep boost maximum time be elapsed;

5 – The inverter driven pump reaches "zero" speed, and remains stopped; at this moment the Pump Genius goes into sleep mode.

3.12 PIPE CHARGING

This group of parameters allows the user to configure the Pump Genius to execute the pipe charging sequence using the 1st pump to be started in the Pump Genius.

The Pipe Charging assures that the pumping pipe is charged gradually, thus avoiding the "water hammer" pressure shock at the instant the pipe is filled with fluid. It is executed every time the Pump Genius receives a new enable, either via enable Pump Genius command or an exit from a disabled by fault state. If the control process variable in the newly enabled Pump Genius is already at a certain value, and it enters into sleep mode, the pipe charging sequence is not executed.

P0105 – Enable Pipe Charging (Selection 1st/2nd Ramp)

Adjustable Range:	0 = Disable (1st Ramp) 6 = Enable (SoftPLC)	**Factory Setting:**	6
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 20 Ramps		

Description:
This parameter allows enabling of the pipe charging sequence (assigns to the SoftPLC function the ramp selection command) using the 1st pump to be started in the Pump Genius.

NOTE!
The alarm message "A752: Pipe Charging" will be generated in the HMI of the CFW-11 inverter providing an alert that the Pump Genius is in the pipe charging sequence.

P0102 – Acceleration Time 2

Adjustable Range:	0.0 to 999.0 s	**Factory Setting:**	10.0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 20 Ramps		

Description:
This parameter defines a second acceleration time for the inverter driven pump for the purpose of pipe charging.

NOTE!
Refer to the CFW-11 inverter programming manual for more information about the ramp parameters.

P1041 – Pipe Charging Time

Adjustable Range:	0 to 32767 s	**Factory Setting:**	30 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the elapsed time for pipe charging.

The figure 3.4 presents a timing analysis of the Pump Genius operation when is configured for execution of the pipe charging sequence (the PID controller shown in this example is Direct Mode, which is, however, irrelevant for the pipe charging sequence):

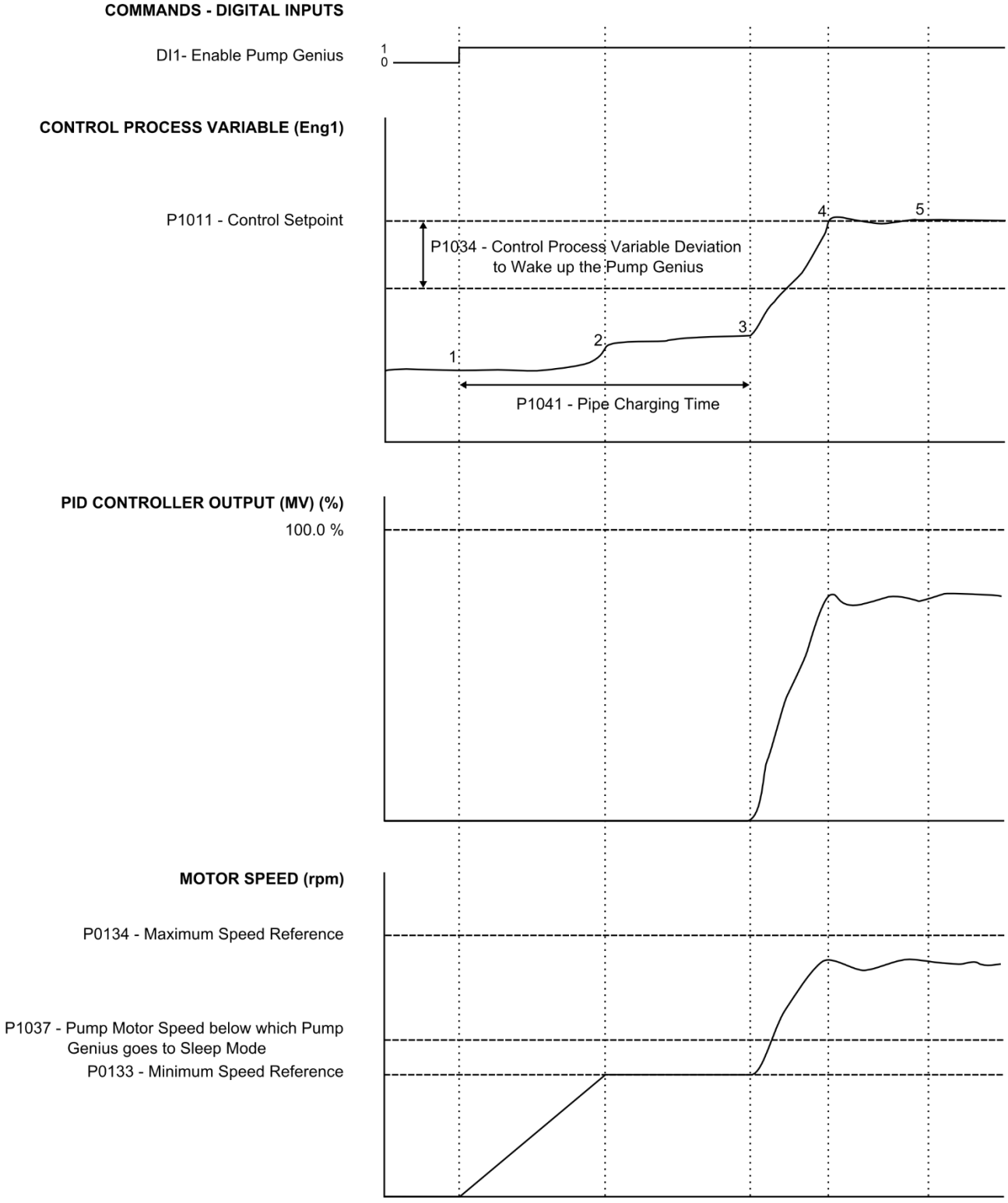


Figure 3.4 – Operation of the Pump Genius with pipe charging

1 – The Pump Genius is enabled for operation via digital input DI1. As the control process variable is lower than the control process deviation for Pump Genius to wake up (P1034), the time delay to wake up (P1036) is not awaited and the command run is issued. As pipe charging is enabled (P0105), the time count (P1041) is initiated, while the PID controller remains disabled. The pump is accelerated to the minimum speed (P0133) with a slower ramp in order to avoid the "water hammer;

2 – The pump speed reaches the value programmed for minimum speed (P0133) and continues at this speed during the course of time for pipe charging (P1041). During this time the PID controller is disabled.

3 – The time for pipe charging (P1041) is elapsed; at this moment the PID controller is enabled and begins to increase the pump speed in order for the control process variable to catch up with the control setpoint required by the user;

4 – With increasing the pump speed, the control process variable reaches the control setpoint value;

5 – A short time later the control process variable stabilizes and pumping continues at steady speed.

3.13 STARTING AN ADDITIONAL PUMP IN PARALLEL

This group of parameters allows the user to adjust the operating conditions for starting an additional pump in parallel in the Pump Genius.

P1052 – Pump Motor Speed for Starting an additional Pump in Parallel

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1700 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the pump motor speed above which starting an additional pump in parallel in the Pump Genius is enabled in order to maintain control according to the required setpoint.

P1053 – Control Process Variable Deviation for Starting an additional Pump in Parallel

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	10
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the maximum deviation of the control process variable from the control setpoint (a negative value for a Direct Mode PID, or a positive value for a Reverse Mode PID), which, if exceeded, enables starting an additional pump in the Pump Genius.

NOTE!
A setting of "0" disables the P1053 condition of the logic for starting an additional pump in parallel.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1054 – Time Delay for Starting an additional Pump in Parallel

Adjustable Range:	0 to 32767 s	**Factory Setting:**	2 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines a time delay during which both, the conditions of P1052 and P1053 must remain satisfied, before an additional pump is started in parallel in the Pump Genius.

P1055 – Delay in the Deceleration of the CFW-11 Pump when Starting a Pump in Parallel

Adjustable Range:	0.00 to 100.00 s	**Factory Setting:**	0.01 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines a delay for the beginning of the deceleration of the pump driven by the CFW-11 frequency inverter when a new pump is started in parallel.

NOTE!
Value of the parameter in 100.00 will not apply the deceleration of the pump driven by the CFW-11 frequency inverter, i.e., the pump remains at the same speed it was before a new pump is started.

The figure 3.5 presents a timing analysis of the Pump Genius operation with Direct Mode PID controller, when the need to start an additional pump in parallel is detected:

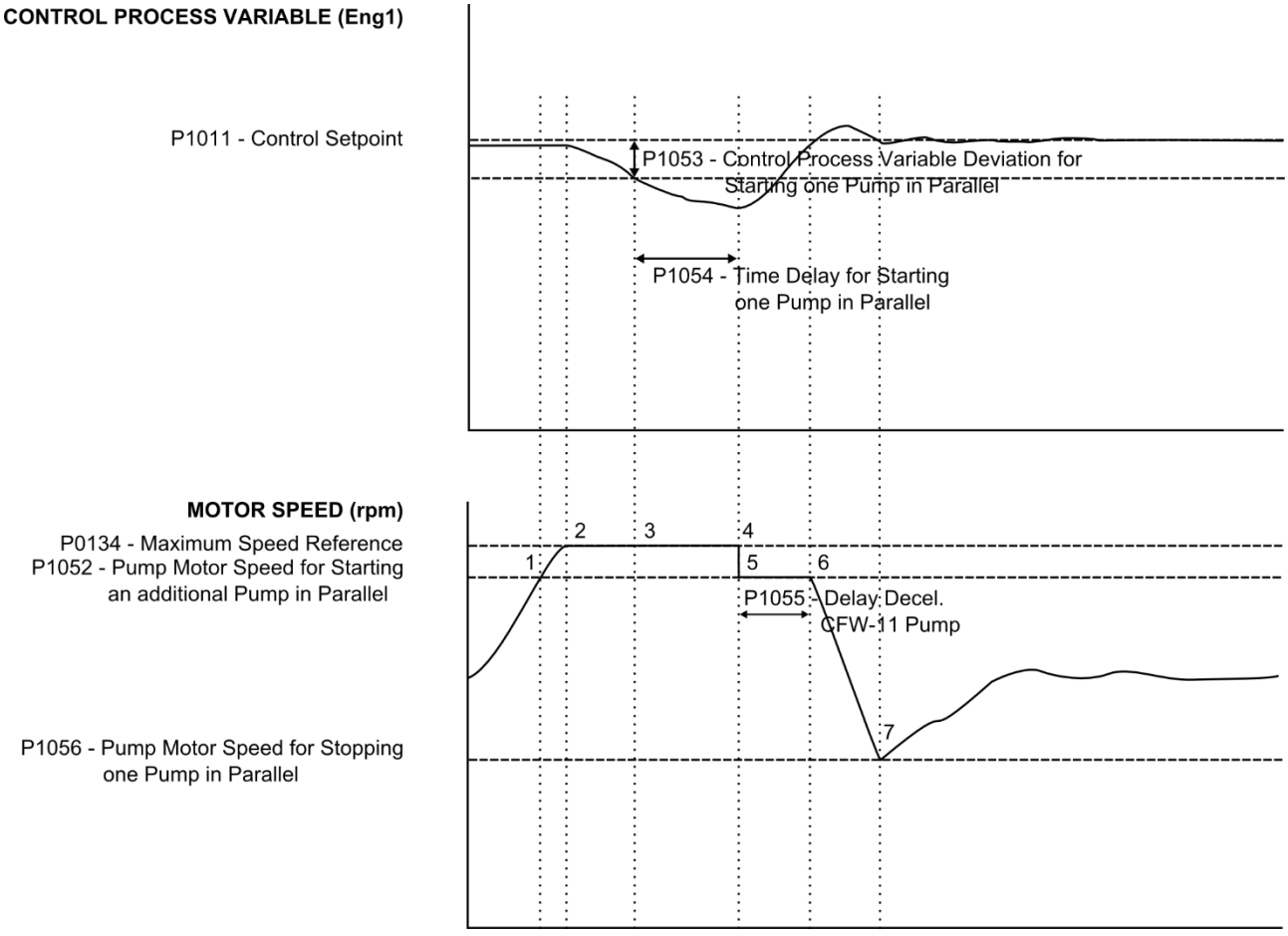


Figure 3.5 – Pump Genius operation for starting an additional pump in parallel

1 – The Pump Genius is operating with one pump running and it is increasing its speed to keep the pumping control according to the required setpoint. At this moment, it is detected that the PID controller output is above the value set to start one more pump (P1052), but the difference between the setpoint and the control process variable remains below the deviation set to start one more pump (P1053); therefore, it is not still necessary to start one more pump in parallel;

2 – The motor speed reaches the maximum speed programmed for the pump (P0134) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable continues lower than the deviation set to start one more pump (P1053);

3 – The motor speed still at the maximum speed programmed for the pump (P0134) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable is still above the deviation set to start one more pump (P1053) and the time to start one more pump in parallel on the pumping control (P1054) initiates;

4 – The motor speed still at the maximum speed programmed for the pump (P0134) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable is still above the deviation set to start one more pump (P1053) and the time to start one more pump in parallel on the pumping control (P1054) elapses; at this moment, a command is issued (via digital output) to start one more pump in parallel on the pumping control. The pump to be started will be the one with the shortest operation time among those which are enabled for operation;

5 – One pump is started; at this moment, the PID controller goes into the manual control mode and the speed of the pump driven by the inverter goes to the value set in P1052. Then the time count of the delay to start the deceleration of the pump driven by the inverter (P1055) begins;

6 – The time count of the delay to start the deceleration of the pump driven by the inverter (P1055) elapses; the PID controller remains in the manual control mode and the speed reference of the pump driven by the inverter goes to the value set in P1056;

7 – The motor decelerates down to the value set to stop one pump (P1056) and the PID controller goes to the automatic control mode. Then the PID controller begins to control the system again to stabilize the pumping control according to the setpoint required by the user, but now with one more pump in parallel.

3.14 STOPPING ONE PUMP IN PARALLEL

This group of parameters allows the user to adjust the operating conditions for stopping one of the activated pumps in parallel in the Pump Genius.

P1056 – Pump Motor Speed for Stopping one Pump in Parallel

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1300 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value of the pump motor speed below which stopping one pump in parallel in the Pump Genius becomes enabled.

P1057 – Control Process Variable Deviation for Stopping one Pump in Parallel

Adjustable Range:	-35768 to 32767 [Eng. Un. 1]	**Factory Setting:**	20
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the maximum deviation of the control process variable from the control setpoint (a positive value for a Direct Mode PID, or a negative value for an Inverse Mode PID), which, if exceeded, enables stopping one pump in parallel in the Pump Genius.

NOTE!
A setting of “0” disables the P1057 condition of the logic for stopping one pump in parallel.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1058 – Time Delay for Stopping one Pump in Parallel

Adjustable Range:	0 to 32767 s	**Factory Setting:**	2 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines a time delay during which both conditions of P1056 and P1057 must remain satisfied before stopping one of the pumps in parallel in the Pump Genius.

P1059 - Delay in the Acceleration of the CFW-11 Pump when Stopping a Pump in Parallel

Adjustable Range:	0.00 to 100.00 s	**Factory Setting:**	0.01 s
Properties:			
Groups of access via HMI:	SPLC		

Description:
This parameter defines a delay for the beginning of the acceleration of the pump driven by the CFW-11 frequency inverter when a pump in parallel is stopped.

NOTE!
Value of the parameter in 100.00 will not apply the acceleration of the pump driven by the CFW-11 frequency inverter, i.e., the pump remains at the same speed it was before a pump is stopped.

The figure 3.6 presents a timing analysis of the Pump Genius operation with Direct Mode PID controller, when the need to stop one pump in parallel is detected:

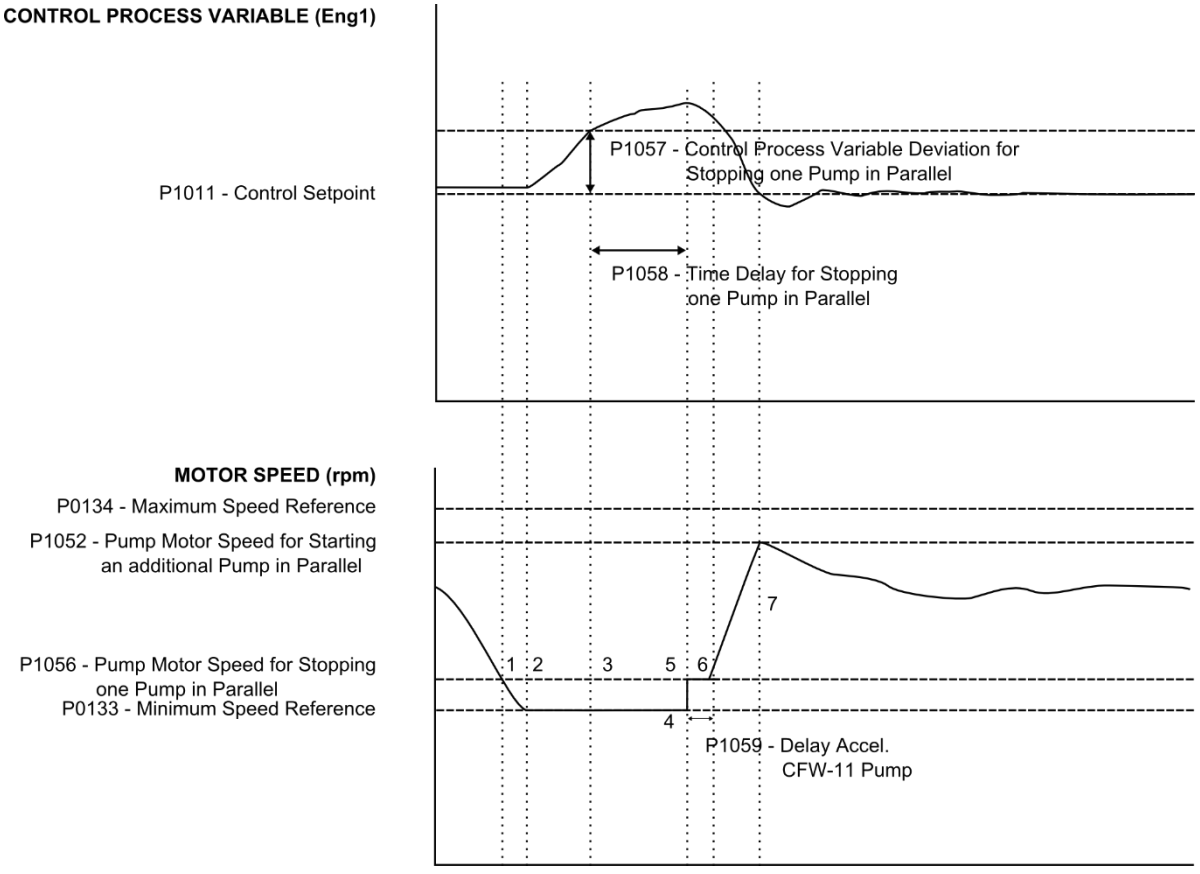


Figure 3.6 – Pump Genius operation for stop one pump in parallel

1 – The Pump Genius is operating with more than one pump activated and is decreasing its speed to control the process variable. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1056), but the control process variable deviation from the control setpoint remains lower than the threshold programmed for stopping one pump (P1057); it is thus not necessary to stop one pump in parallel;

2 – The pumps motor speed reaches its minimum value, i.e., the pumps are operating at their minimum speed defined by P0133 and the value of the control process variable begins to increase. However, its deviation from the control setpoint remains lower than the threshold programmed for stopping one pump in parallel (P1057); it is thus not yet necessary to stop one pump.

3 – The pumps motor speed continues at minimum speed (P0133), as the value of the control process variable continues to increase. At this moment its deviation from the control setpoint exceeds the threshold programmed for stopping one pump in parallel (P1057), and the time count (P1058) is initiated;

4 – The pumps motor speed continues at minimum speed (P0133), the value of the control process variable keeps increasing, the difference between the setpoint and the control process variable is still above the deviation set to stop one pump (P1057) and the time to start one pump in parallel on the pumping control (P1058) elapses; at this moment, a command is issued (via digital output) to stop one pump in parallel on the pumping control. The pump to be stopped will be the one with the longest operation time among those which are enabled for operation;

5 – One pump is stopped; at this moment, the PID controller goes into the manual control mode and the speed of the pump driven by the inverter goes to the value set in P1056. Then the time count of the delay to start the acceleration of the pump driven by the inverter (P1059) begins;

6 – The time count of the delay to start the acceleration of the pump driven by the inverter (P1059) elapses; the PID controller remains in the manual control mode and the speed reference of the pump driven by the inverter goes to the value set in P1056;

7 – The motor accelerates up to the value set to start a pump (P1052) and the PID controller goes to the automatic control mode. Then the PID controller begins to control the system again to stabilize the pumping control according to the setpoint required by the user, but now with least one pump in parallel.

3.15 FORCING ROTATION OF PUMPS

This group of parameters allows the user to adjust the operating conditions for forcing rotation of pumps in the Pump Genius in case it operates for an uninterrupted period of time. I.e., if the Pump Genius remains with only one pump operating for a certain period of time (the control does not go into sleep mode), a command is executed to turn off the pump is running; at this moment the Pump Genius verify which pump have the lower operation time; then the pump driven by the inverter is rotated and resumes controlling the pumping with variable speed. With this, the rotation of pumps still done even without the sleep mode is active.

NOTE!
Forcing rotation of pumps is valid only when one pump is running in the Pump Genius.

NOTE!
The operation time for forcing rotation of pumps is displayed in P1018.

P1019 – Time Interval for Forcing Rotation of Pumps

Adjustable Range:	0 to 32767 h	**Factory Setting:**	72 h
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the maximum time interval the Pump Genius can run uninterruptedly with only one pump started. After this time, it is checked the condition set in P1020 for the Pump Genius to be shut down and a new pump to be started and resumes controlling the pumping with variable speed.

NOTE!
A setting of "0 h" enables the test mode, in which at every 60 seconds the logic for forcing rotation of pumps is enabled.

P1020 – Pump Motor Speed for Forcing Rotation of Pumps

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	0 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value of pump motor speed below which forcing rotation of pumps becomes enabled.

NOTE!
A setting of "0 rpm" disables the forcing rotation of pumps.

3.16 LOW LEVEL PROTECTION FOR THE CONTROL PROCESS VARIABLE (PIPE BREAKING)

This group of parameters allows the user to configure the conditions for alarm and failure to detect low level for the control process variable of the Pump Genius. This allows detecting non-ideal conditions of the pumping operation, for example, a pipe breaking.

P1026 – Value for Low Level Alarm for the Control Process Variable

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	100
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value below which a low level alarm will be generated for the control process variable of the pumping control (A770).

NOTE!
A setting of "0" disables the low level alarm and fault for the control process variable.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1027 – Time Delay for Low Level Fault for the Control Process Variable (F771)

Adjustable Range:	0 to 32767 s	**Factory Setting:**	0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time with the low level alarm (A770) for the control process variable active, before the fault “F771: Low Level Fault for the Control Process Variable” is generated.

NOTE!
A setting of “0 s” disables the low level fault for the control process variable.

3.17 HIGH LEVEL PROTECTION FOR THE CONTROL PROCESS VARIABLE (PIPE OBSTRUCTION)

This group of parameters allows the user to configure the conditions for alarm and failure to detect high level for the control process variable for the Pump Genius. This allows detecting non-ideal conditions of the pumping operation, for example, a pipe obstruction.

P1028 – Value for High Level Alarm for the Control Process Variable

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:**	350
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the value above which a high level alarm will be generated for the control process variable of the Pump Genius (A772).

NOTE!
A setting of “0” disables the high level alarm and fault for the control process variable.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1029 – Time Delay for High Level Fault for the Control Process Variable (F773)

Adjustable Range:	0 to 32767 s	**Factory Setting:**	0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time with the high level alarm (A772) for the control process variable active, before the fault “F773: High Level Fault for the Control Process Variable” is generated.

NOTE!
A setting of “0 s” disables the high level fault for the control process variable.

3.18 DRY PUMP PROTECTION

This group of parameters allows the user to configure dry pump detection, to protect the inverter driven pump.

P1042 – Motor Speed for Dry Pump

Adjustable Range:	0 to 18000 rpm	**Factory Setting:**	1650 rpm
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the pump motor speed threshold value, above which evaluation of actual motor torque to detect the dry pump condition (P1043) is enabled.

P1043 – Motor Torque for Dry Pump

Adjustable Range:	0.0 to 100.0 %	**Factory Setting:**	20.0 %
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the pump motor torque threshold value, below which the dry pump condition is detected, resulting in the alarm message “A780: Dry Pump”.

P1044 – Time Delay for Dry Pump Fault (F781)

Adjustable Range:	0 to 32767 s	**Factory Setting:**	0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time with the dry pump condition (A780) active, before the dry pump fault “F781: Dry Pump” is generated.

NOTE!
A setting of “0 s” disables the dry pump fault.

The figure 3.7 presents a timing analysis of the Pump Genius operation when a Dry Pump Fault is detected:

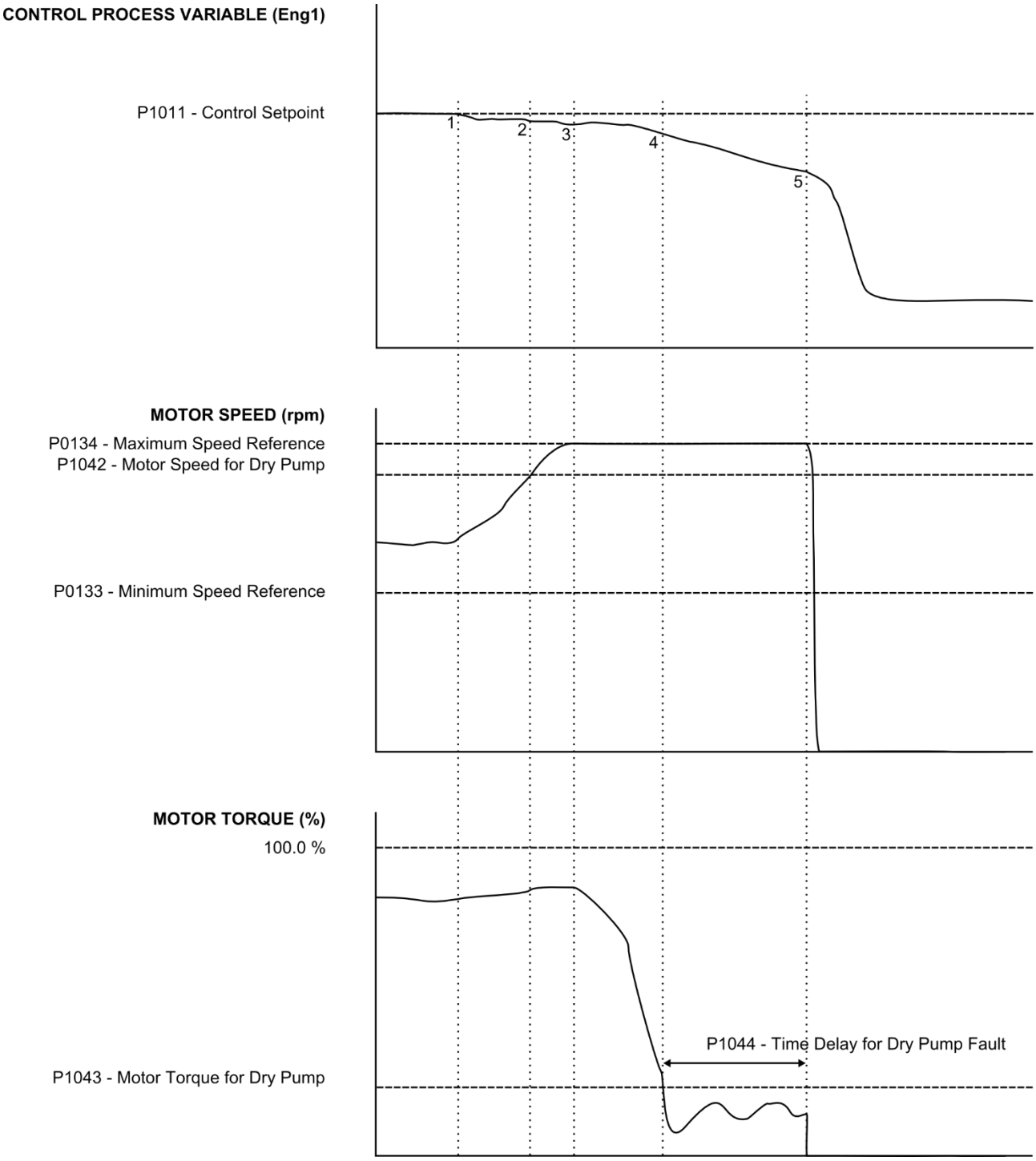


Figure 3.7 – Operation of the Pump Genius for dry pump protection

1 – The Pump Genius is running at a speed satisfying the control setpoint required by the user. At this moment the value of the control process variable begins to decrease and pump speed begins to increase;

2 – The pump speed continues to increase and becomes greater than the threshold programmed for detecting dry pump (P1042);

3 – The pump speed continues to increase and reaches the maximum speed programmed for the pump (P0134), but as the pump motor torque is still greater than the threshold programmed to detect dry pump (P1043), pumping continues while the value of the control process variable continues to decrease;

4 – As the pump continues to operate at maximum speed, and the process variable continues to decrease, the pump motor torque drops below the threshold programmed to detect dry pump (P1043). At this moment the time count to generate Dry Pump Fault (P1044) is initiated and the alarm message "A780: Dry Pump" is

generated to alert the user, that the protection for dry pump is about to act and disable the inverter driven pump;

5 – The pump continues to operate at maximum speed, and the control process variable continues to decrease, while the pump motor torque remains below the threshold programmed to detect Dry Pump (P1043). At this moment the time delay to generate Dry Pump Fault (P1044) is elapsed, and the fault "F781: Dry Pump" is generated, disabling the inverter driven pump.

3.19 PUMP PROTECTION VIA EXTERNAL SENSOR

This group of parameters allows the user to configure an external sensor (pressure switch, level sensor, etc.) to protect the inverter driven pump. The sensor can be wired to the digital input DI11.

P1045 – Time Delay for Pump Protection via External Sensor (F783)

Adjustable Range:	0 to 32767 s	**Factory Setting:**	2 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter defines the waiting time with the condition of sensor (DI11) at logic level “0” while the pump is running, before the external sensor fault “F783: External Sensor Protection” is generated.

NOTE!
A setting of “0 s” disables the pump protection faults via external sensor (DI11).

3.20 HMI MONITORING

This parameter group allows the user to configure which parameters will be shown on the HMI display in the monitoring mode.

P0205 – Reading Parameter Selection 1

P0206 – Reading Parameter Selection 2

P0207 – Reading Parameter Selection 3

NOTE!
Refer to the CFW-11 programming manual for more information about the HMI parameters. Some parameter options have been removed from the configuration wizard.

3.21 READING PARAMETERS

P1010 – Pump Genius Multipump Application Version

Adjustable Range:	0.00 to 10.00	**Factory Setting:**	-
Properties:	RO		
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC		

Description:
This parameter indicates the version of the Pump Genius Multipump application.

P1016 – Control Process Variable

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	**Factory Setting:** -
Properties:	RO	
Access groups via HMI:	01 PARAMETER GROUPS	
	∟ 50 SoftPLC	

Description:
This parameter indicates the value of the Pump Genius process variable according to the source of the control process variable selected by P1023.

NOTE!
This parameter is displayed according to the selection of the engineering unit 1 parameters (P0510 and P0511).

P1017 – Operation Time of the Pump Driven by the CFW-11

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Access groups via HMI:	01 PARAMETER GROUPS	
	∟ 50 SoftPLC	

Description:
This parameter indicates the value of the operation time of the pump driven by the CFW-11 inverter.

NOTE!
This parameter is displayed according to the selection of the engineering unit 2 parameters (P0512 and P0513).

P1018 – Operation Time for Forcing Rotation of Pumps

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Access groups via HMI:	01 PARAMETER GROUPS	
	∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of the Pump Genius operating with only one pump started. It times is used in the logic of force rotation of the pumps.

NOTE!
The value of hours is reset every time the pump driven by the CFW-11 frequency inverter is stopped.

NOTE!
It is possible to change the operation time of the pump since the motor is stopped.

P1047 – Operation Time of Pump 1

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Access groups via HMI:	01 PARAMETER GROUPS	
	∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of pump 1. It is used to define which pump will be started or stopped on the Pump Genius.

P1048 – Operation Time of Pump 2

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of pump 2. It is used to define which pump will be started or stopped on the Pump Genius.

P1049 – Operation Time of Pump 3

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Groups of access via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of pump 3. It is used to define which pump will be started or stopped on the Pump Genius.

P1050 – Operation Time of Pump 4

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Access groups via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of pump 4. It is used to define which pump will be started or stopped on the Pump Genius.

P1051 – Operation Time of Pump 5

Adjustable Range:	0 to 32767 h	**Factory Setting:** -
Properties:	RW	
Groups of access via HMI:	01 PARAMETER GROUPS ∟ 50 SoftPLC	

Description:
This parameter indicates the operation time of pump 5. It is used to define which pump will be started or stopped on the Pump Genius.

NOTE!
It is possible to change the operation time of the pump since the motor is stopped.

4 CREATION AND DOWNLOAD THE APPLICATION

In order to configure the CFW-11 inverter for Pump Genius Multipump application, it is necessary to create the ladder application on the WLP and then download it to the SoftPLC function of the CFW-11 inverter, as well as the parameter values configured on the configuration wizard.

The following steps show how to create and configure the Pump Genius Multipump application in the WLP and how to transfer it to the CFW-11 inverter.

NOTE!
The Pump Genius Multipump application only works on CFW-11 inverter with **special firmware version Ve.5.3x**. So upgrading the CFW-11 inverter firmware to the working of this application is required.

1st Step: Create a new project on the WLP based on the Pump Genius Multipump ladder standard application. For this, select Tools, Application, CFW-11, Create, Pump Genius and finally click Multipump;

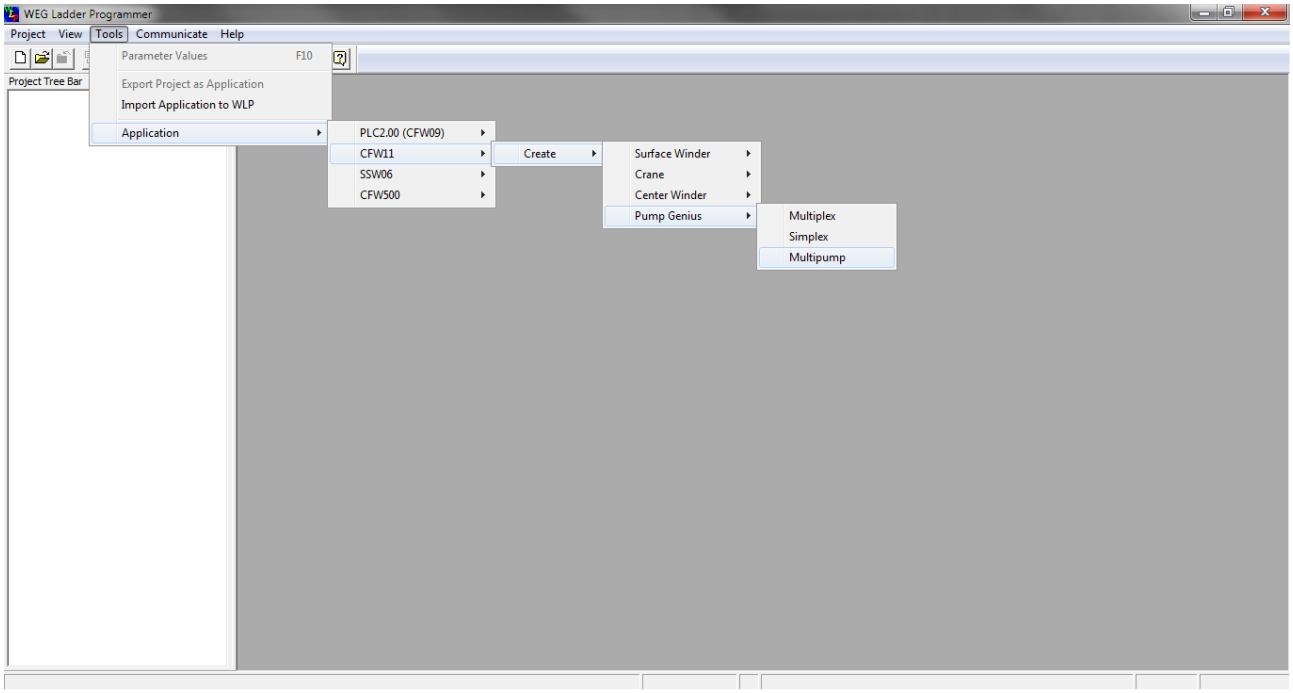


Figure 4.1 – Create the Pump Genius Multipump application in the WLP

2nd Step: Name the new project created;

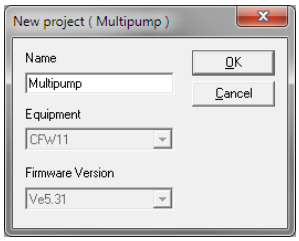


Figure 4.2 – Dialog to name the new project

3rd Step: Adjust the configuration of the WLP communication interface with the equipment, can be via USB or serial port (COM1..COM8). For this, select Communicate and then click Configuration (Shift + F8);

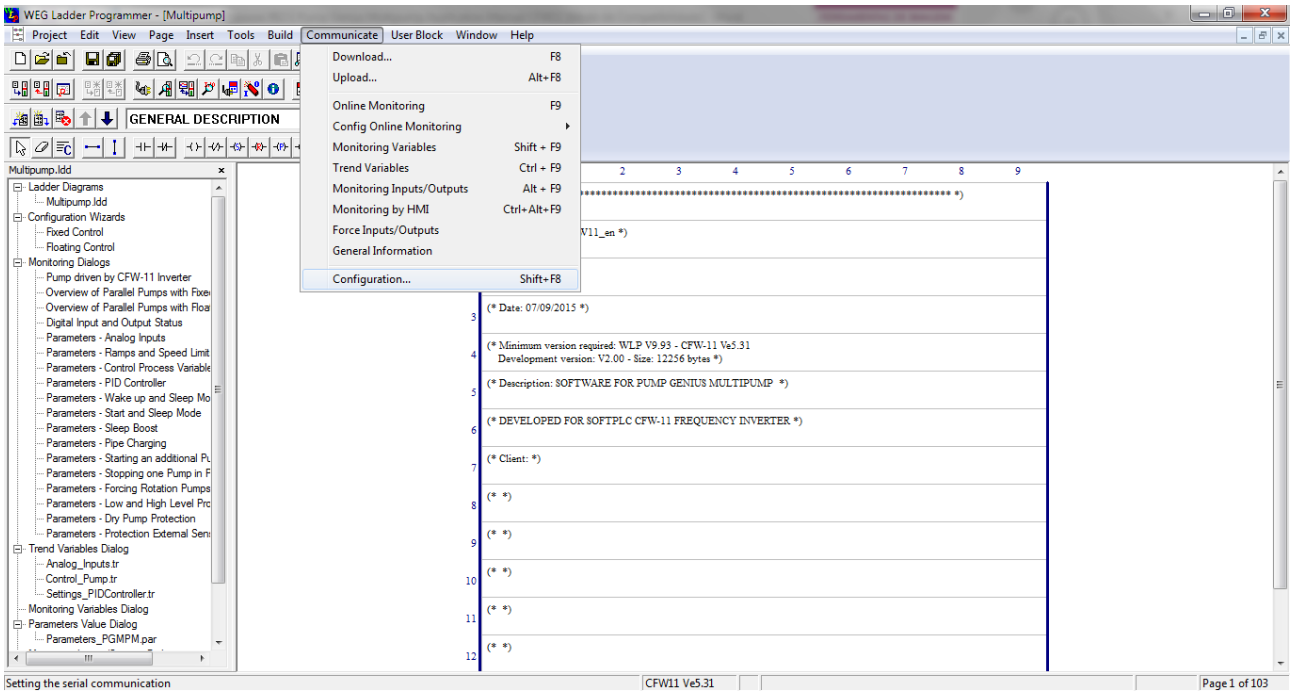


Figure 4.3 – Adjust the communication interface in the new project

4th Step: Download the ladder application and user's parameter. For this, select Communicate and then click Download (F8);

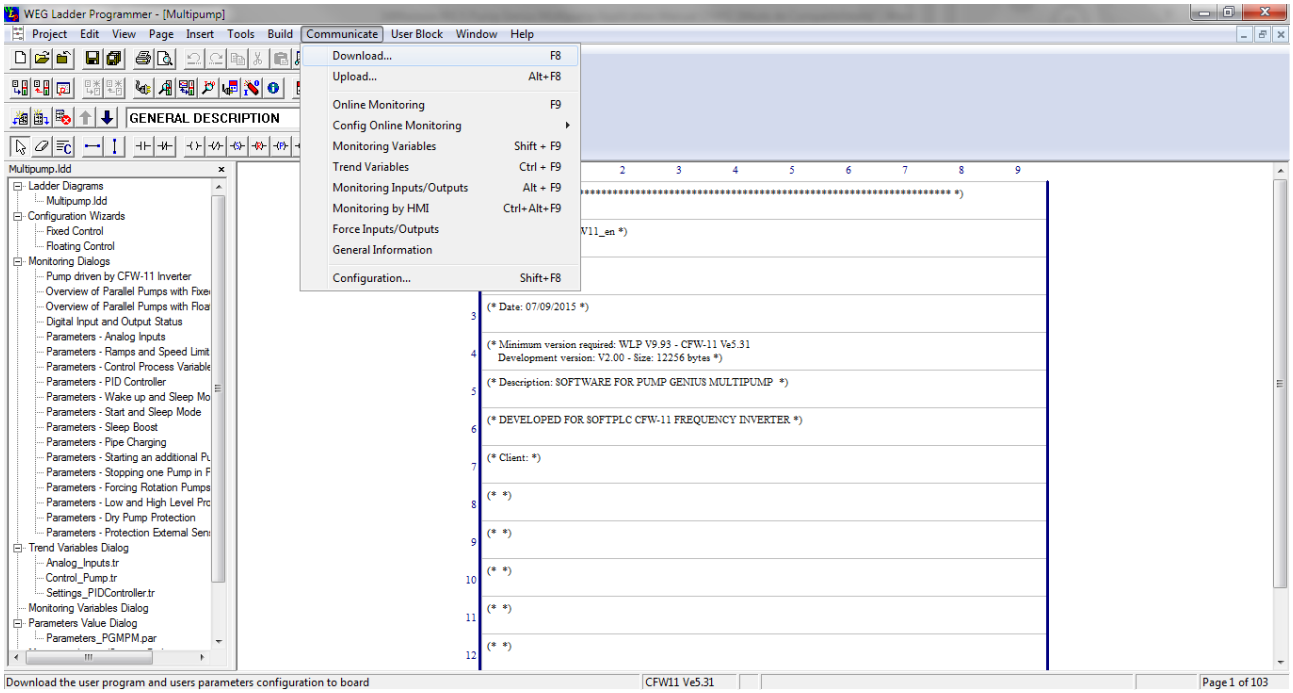


Figure 4.4 – Download the new project

5th Step: Select “User Program” and “Users Parameters Configuration” in the download dialog. Then click “Ok” to start the transfer to the CFW-11 inverter;

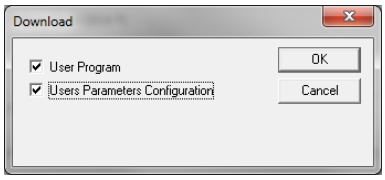


Figure 4.5 – Ladder application download dialog

6th Step: Download the ladder application to the CFW-11 inverter. For this, after the project is compiled and the CFW-11 inverter is identified, click "Yes" to start the download;

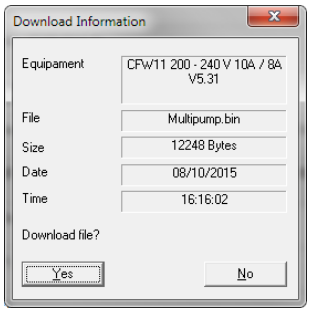


Figure 4.6 – User program download dialog

7th Step: Enable the execution of the SoftPLC user program after the download of the ladder application to the CFW-11 inverter. Click "Yes" to enable the execution of the SoftPLC user program.

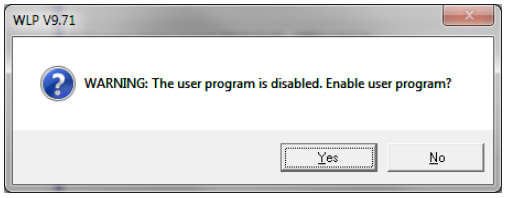


Figure 4.7 – Enabling dialog of the SoftPLC user’s program

8th Step: Download the user’s parameters configuration of the ladder application to the CFW-11 inverter. For this, click “Download” in the user parameters configuration dialog; and then, click "Yes" to start the download;

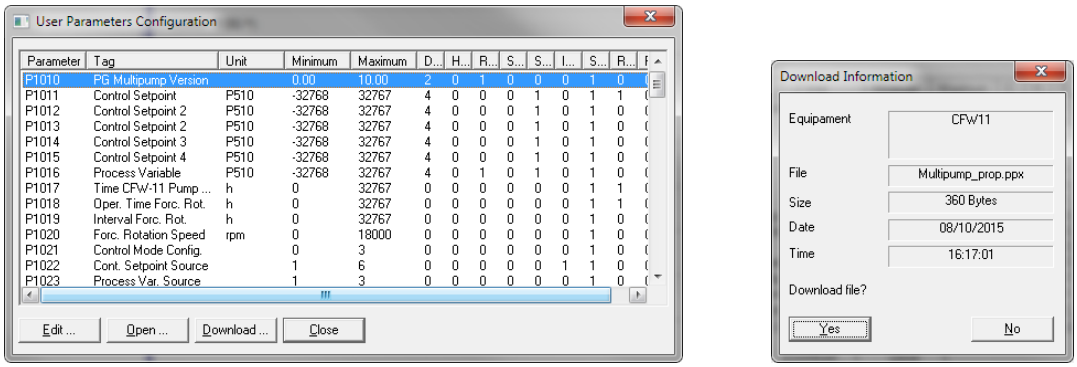


Figure 4.8 – User parameters download dialogs

9th Step: Start the configuration wizard setup for Pump Genius Multipump application. For this, click the Configuration Wizard “Fixed Control” or “Floating Control” in the project tree bar according to the pump operation mode for and follow the steps described in chapter 5;

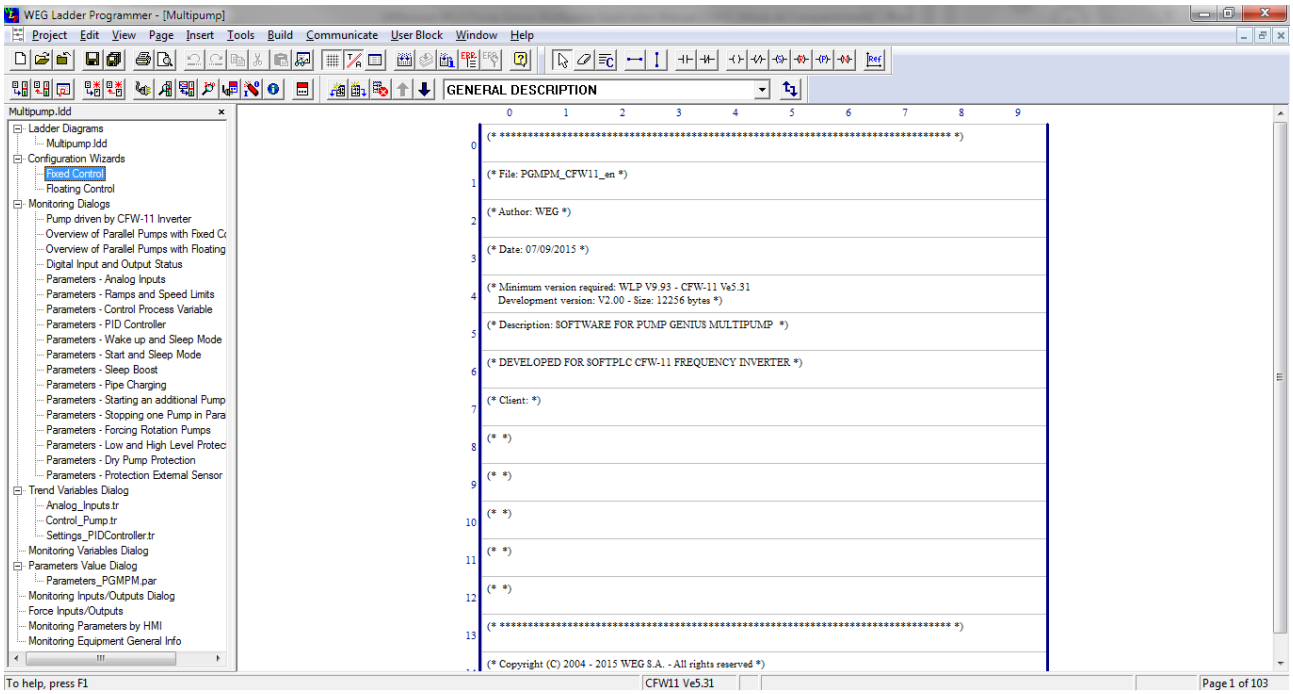


Figure 4.9 – Select the configuration wizard for Pump Genius Multipump

10th Step: Click "Finish" in the summary of Pump Genius Multipump configuration;

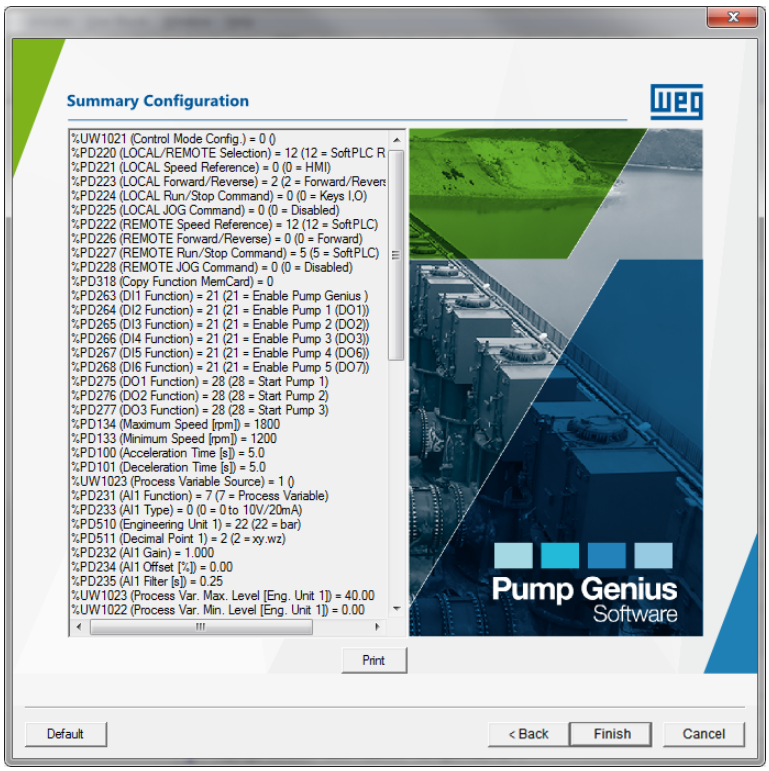


Figure 4.10 – Summary of Pump Genius Multipump configuration

11th Step: Send the values of the parameters configured in the configuration wizard of Pump Genius Multipump for the CFW-11 inverter. For this, click "Yes" to start sending the values.

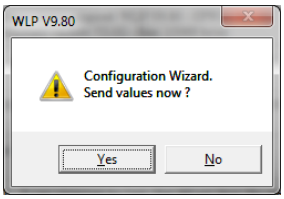


Figure 4.11 – Dialog for download the values of configuration wizard

NOTE!
After performing these steps, the CFW-11 inverter is configured for Pump Genius Multipump application.

5 APPLICATION CONFIGURATION WIZARD

The Pump Genius Multipump application can be configured with the WLP (WEG Ladder Programmer) software. Altogether two configuration wizards are implemented, as follows:

- **Multipump Fixed Control:** Configures the Pump Genius Multipump application to operate with association of up to six pumps in parallel, and the frequency inverter always controls the speed of the same pump;
- **Multipump Floating Control:** Configures the Pump Genius Multipump application to operate with the association of up to five pumps in parallel and the frequency inverter can control the speed of any pump according to the rotation requirements.

5.1 FIXED CONTROL

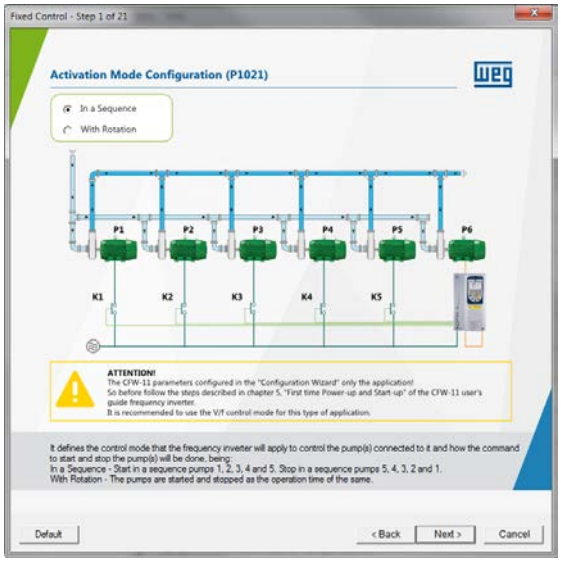
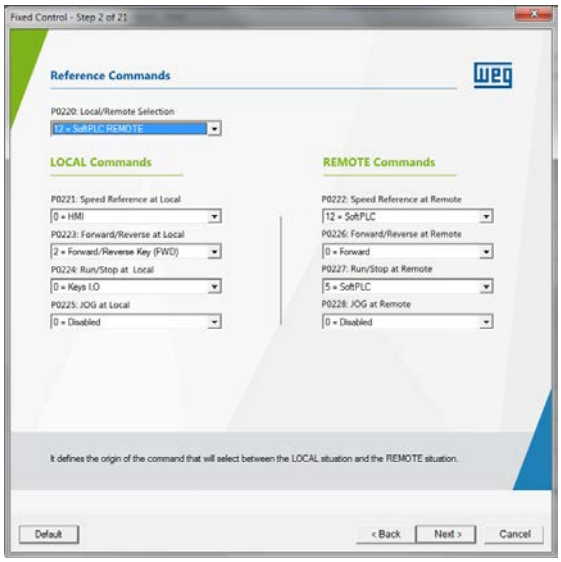
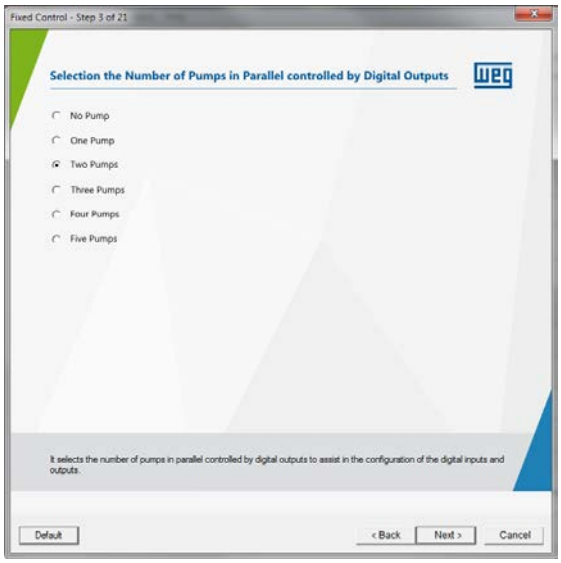
The configuration of the ladder application for Pump Genius Multipump with fixed control, and up to six pumps in parallel is done using the “Fixed Control” configuration wizard, which consists of an oriented sequence for the configuration of the relevant parameters for this application.

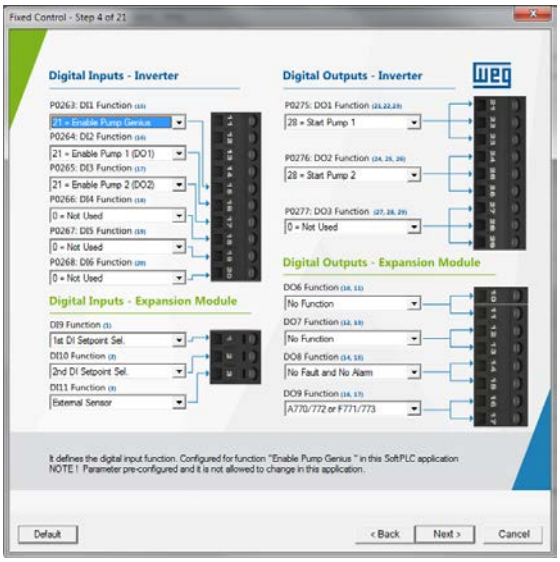
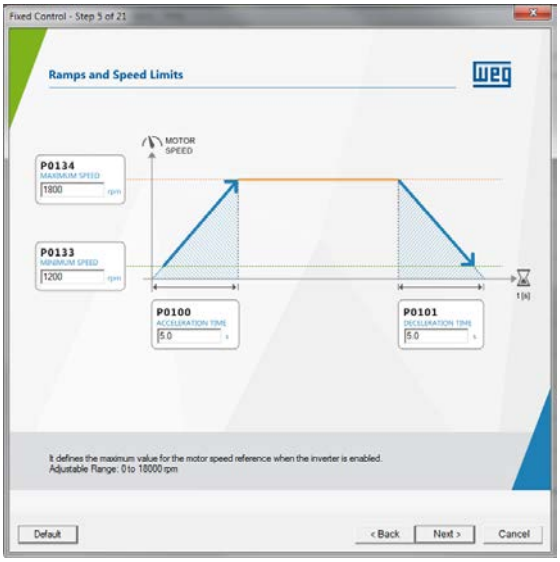
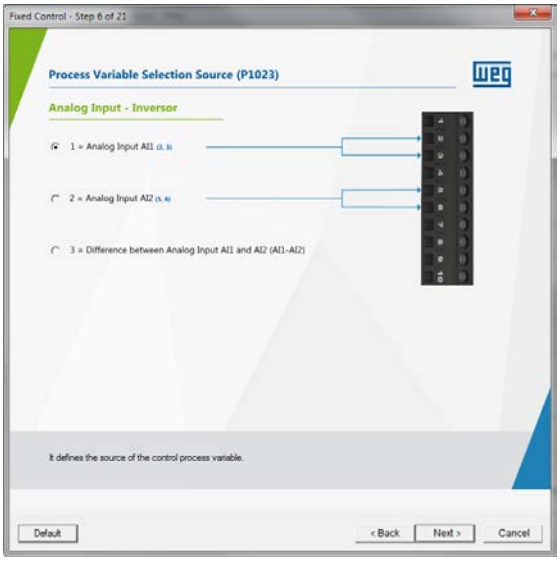
NOTE!
When powering up the inverter for the first time follow the steps described in the chapter 5 “First time Power-up and Start-up” of the CFW-11 user´s guide inverter.
It is recommended to use the V/f control mode for this type of application!

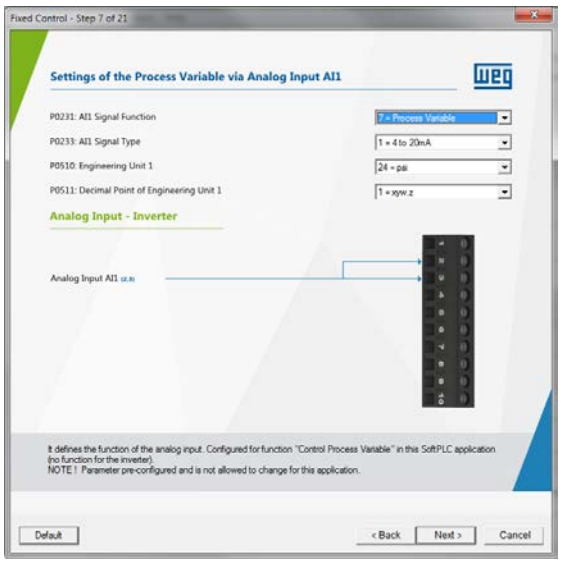
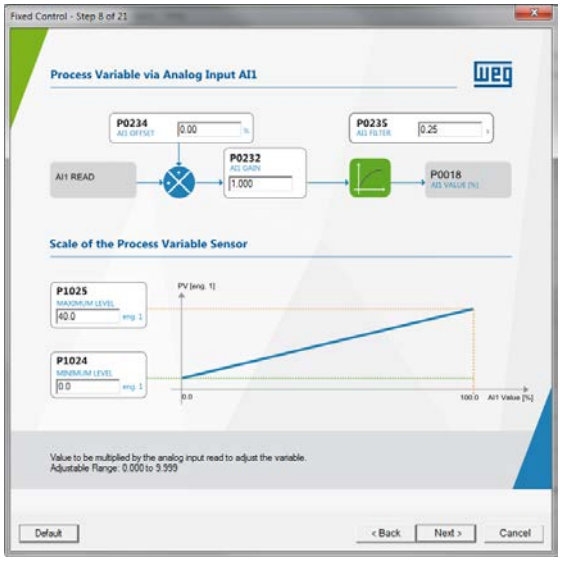
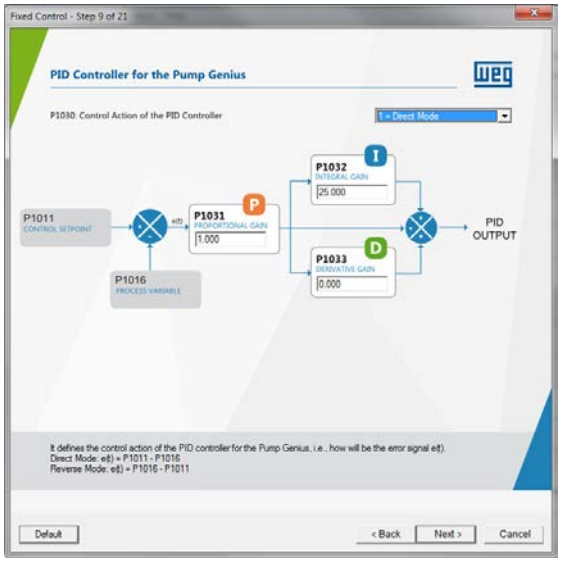
Table 5.1 – Configuration wizard for fixed control

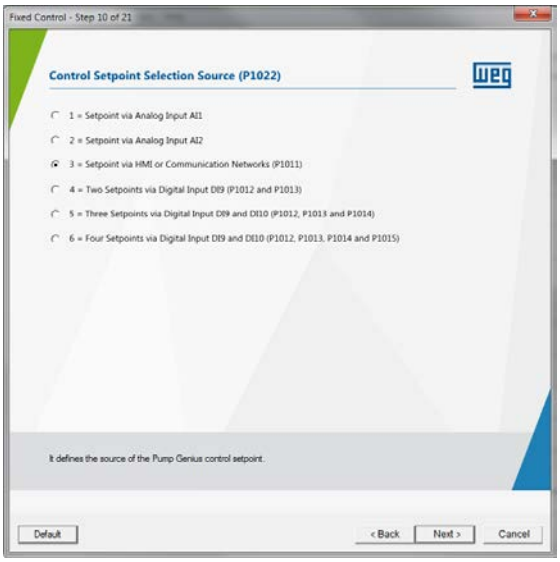
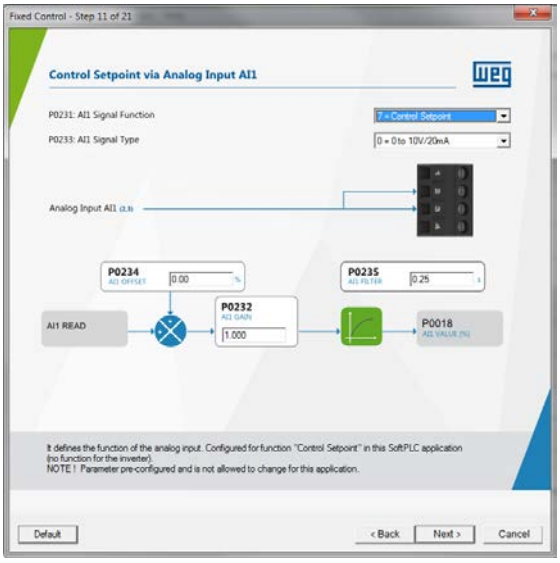
Fixed control

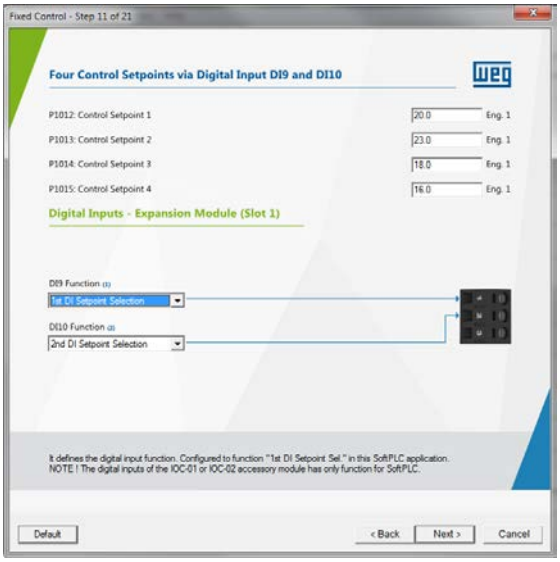
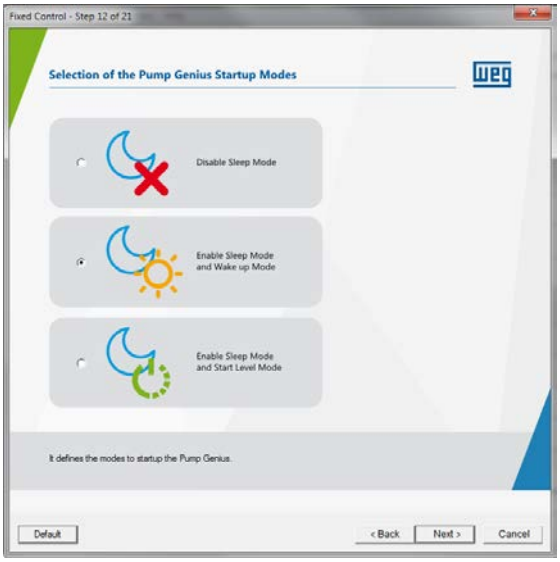
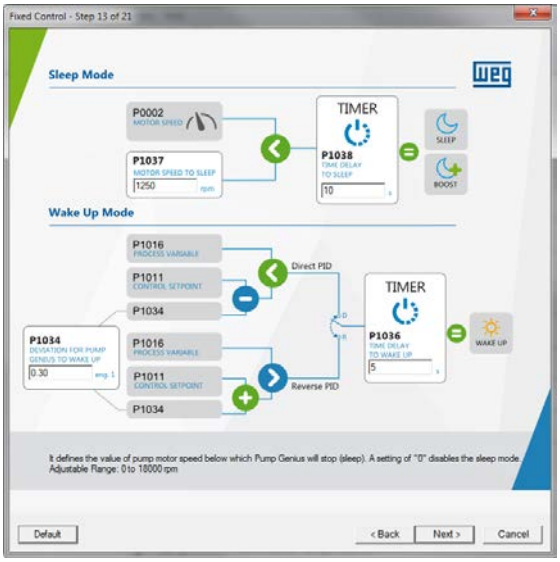
Step	Description	WLP Configuration Wizard
	General presentation of the application Pump Genius Multipump configuration wizard for Fixed Control.	

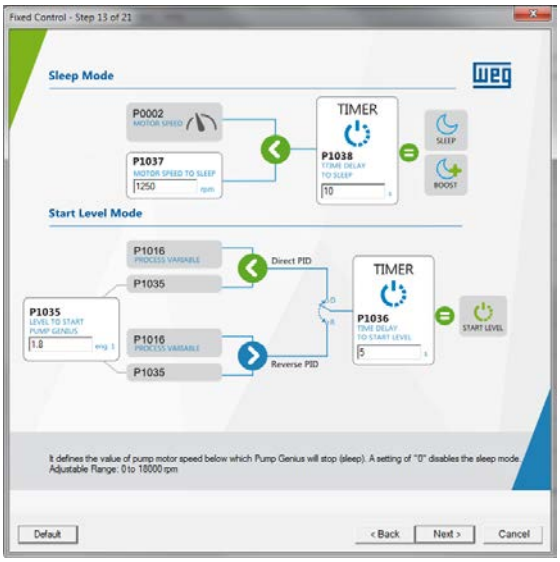
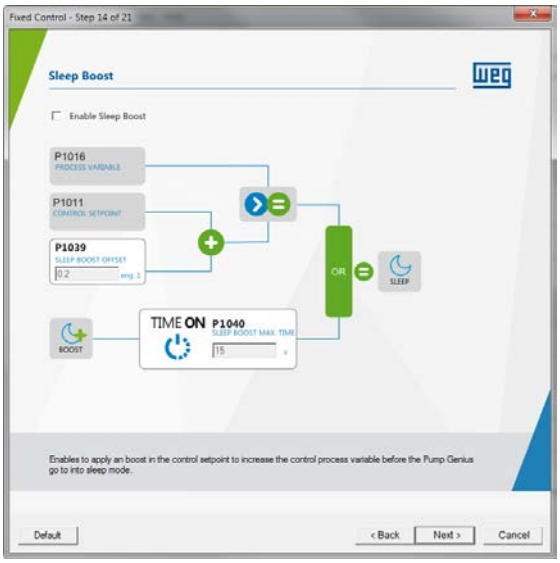
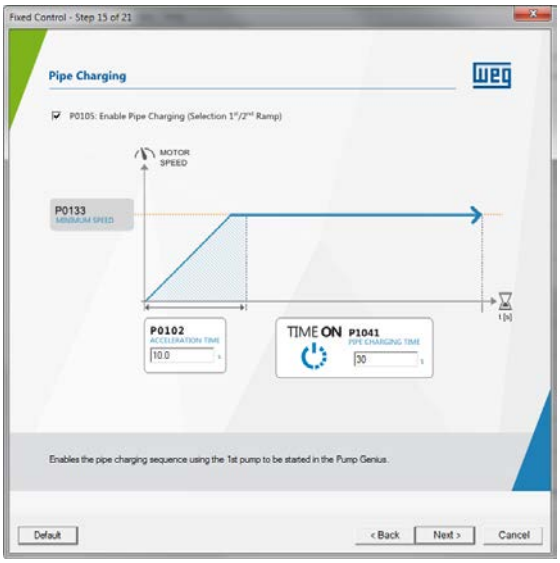
1	It presents the parameter for the configuration of the activation mode of the multipump fixed control. P1021: Pump Control and Activation Mode Configuration	
2	It presents the parameters for configuration of the reference commands : P0220: Local/Remote Selection Source P0221: Speed Reference Selection - Local Situation P0222: Speed Reference Selection - Remote Situation P0223: Forward/Reverse Selection - Local Situation P0224: Run/Stop Selection - Local Situation P0225: JOG Selection - Local Situation P0226: Forward/Reverse Selection - Remote Situation P0227: Run/Stop Selection - Remote Situation P0228: JOG Selection - Remote Situation	
3	It presents the options to define the number of pumps in parallel of the fixed control multipump controlled by digital outputs.	

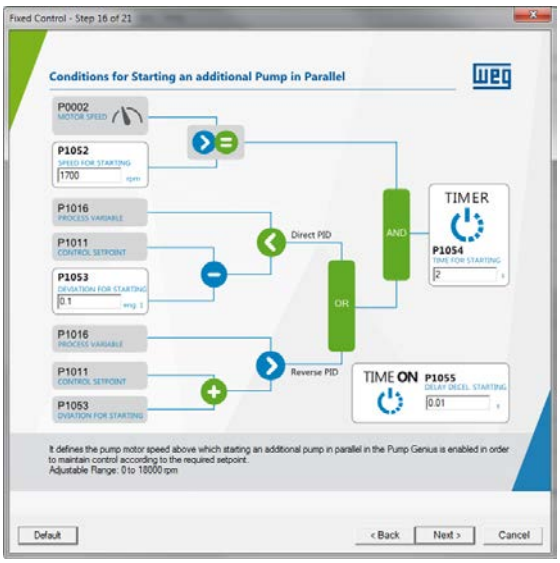
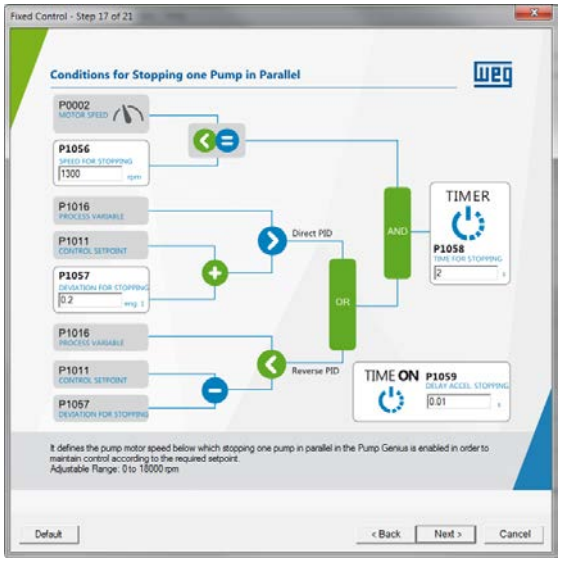
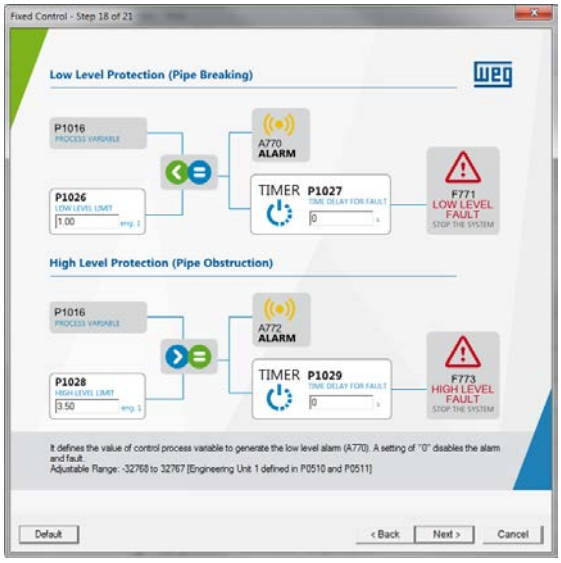
4	It presents the parameters for the configuration of the functions of the CFW-11 digital inputs and outputs: P0263: DI1 Function P0264: DI2 Function P0265: DI3 Function P0266: DI4 Function P0267: DI5 Function P0268: DI6 Function DI9 Function DI10 Function DI11 Function P0275: DO1 Function (RL1) P0276: DO2 Function (RL2) P0277: DO3 Function (RL3) DO6 Function DO7 Function DO8 Function DO9 Function	
5	It presents the parameters for the configuration of the CFW-11 ramps limits and speed: P0100: Acceleration Time P0101: Deceleration Time P0133: Minimum Speed Reference Limit P0134: Maximum Speed Reference Limit	
6	It presents the parameter for the source selection of the control process variable: P1023: Control Process Variable Selection Source	

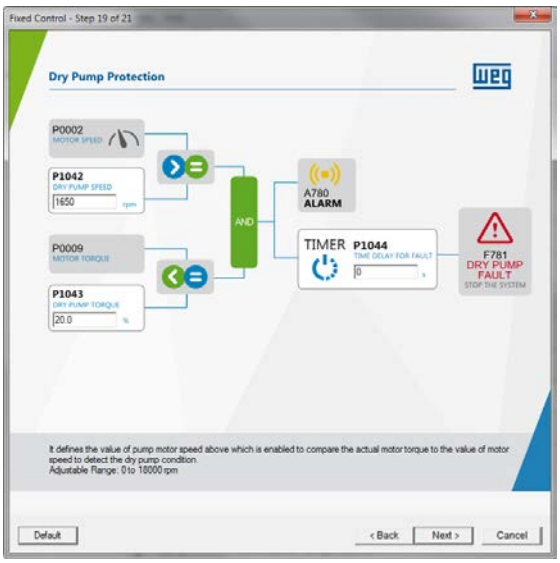
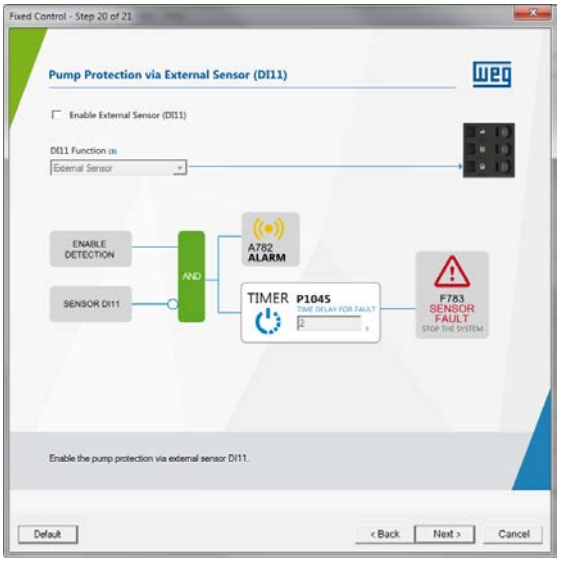
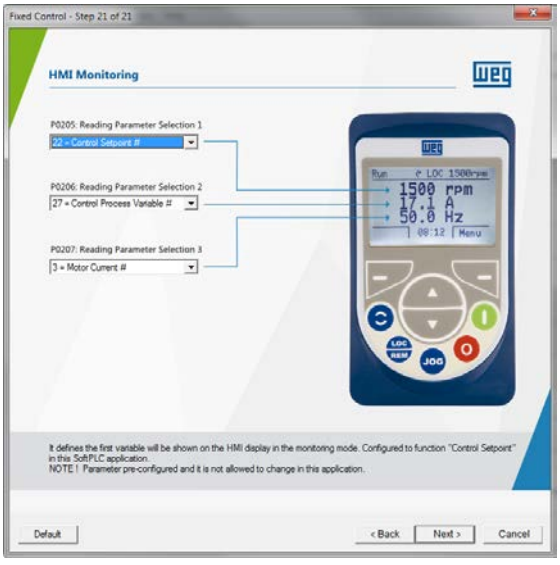
7 – 1 to 7 – 3	It presents the parameters for the configuration of the control process variable via analog input AI1 or AI2 and the engineering unit of the control process variable: P0231 and P0236: AI1 and AI2 Signal Function P0233 and P0238: Signal Type AI1 and AI2 P0510: Engineering Unit 1 P0511: Decimal Point of Engineering Unit 1	
8 – 1 to 8 – 3	It presents the parameters for the configuration of the control process variable via analog input AI1 or AI2, and of the scale of the control process variable sensor: P0234 and P0239: AI1 and AI2 Offset P0232 and P0237: AI1 and AI2 Gain P0235 and P0240: AI1 and AI2 Filter P1024: Control Process Variable Sensor Minimum Level P1025: Control Process Variable Sensor Maximum Level	
9	It presents the parameters for the configuration of the PID controller for the Pump Genius: P1030: Control Action of the PID Controller P1031: PID Proportional Gain P1032: PID Integral Gain P1033: PID Derivative Gain	

10	It presents the parameter for the source selection of the Pump Genius control setpoint: P1022: Control Setpoint Selection Source	
11 – 1 to 11 – 2	It presents the parameters for the configuration of the Pump Genius control setpoint via analog input AI1 or AI2: P0231 and P0236: AI1 and AI2 Signal Function P0232 and P0237: AI1 and AI2 Gain P0233 and P0238: AI1 and AI2 Signal Type P0234 and P0239: AI1 and AI2 Offset P0235 and P0240: AI1 and AI2 Filter	
11 – 3	It presents the parameter for the configuration of the control setpoint via HMI or Communication Networks: P1011: Control Setpoint	

11 – 4 to 11 – 6	It presents the parameters for the configuration of the Pump Genius control setpoint via logical combination of digital inputs DI9 and DI10: DI9 Function DI10 Function P1012: Control Setpoint 1 P1013: Control Setpoint 2 P1014: Control Setpoint 3 P1015: Control Setpoint 4	
12	It presents the modes or conditions to startup the Pump Genius.	
13 – 1	It presents the parameters for the configuration of the sleep mode and wake up mode: P1034: Control Process Variable Deviation for Pump Genius to Wake up P1036: Time Delay for Pump Genius to Wake up P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode P1038: Time Delay for Pump Genius goes to Sleep Mode	

13 – 2	It presents the parameters for the configuration of the sleep mode and start level mode: P1035: Control Process Variable Level for Starting the Pump Genius P1036: Time Delay for Pump Genius Starting by Level P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode P1038: Time Delay for Pump Genius goes to Sleep Mode	
14	It presents the parameters for configuration of the sleep boost: P1039: Sleep Boost Offset P1040: Sleep Boost Maximum Time	
15	It presents the parameters for the configuration of pipe charging using the 1st pump to be started in the Pump Genius: P0102: Acceleration Time 2 P0105: Enable Pipe Charging (1st / 2nd Ramp Selection) P1041: Pipe Charging Time	

16	It presents the parameters for the configuration of the conditions for starting an additional pump in parallel in the Pump Genius: P1052: Pump Motor Speed for Starting an additional Pump in Parallel P1053: Control Process Variable Deviation for Starting an additional Pump in Parallel P1054: Time Delay for Starting an additional Pump in Parallel P1055: Delay in the Deceleration of the CFW-11 Pump when Starting a Pump	
17	It presents the parameters for the configuration of the conditions for stopping one pump in parallel in the Pump Genius: P1056: Pump Motor Speed for Stopping one Pump in Parallel P1057: Control Process Variable Deviation for Stopping one Pump in Parallel P1058: Time Delay for Stopping one Pump in Parallel P1059: Delay in the Acceleration of the CFW-11 Pump when Stopping a Pump	
18	It presents the parameters for the configuration of the low level protection for the control process variable (pipe breaking) and high level protection for process variable (pipe obstruction): P1026: Value for Low Level Alarm for the Control Process Variable P1027: Time Delay for Low Level Fault for the Control Process Variable (F771) P1028: Value for High Level Alarm for the Control Process Variable P1029: Time for High Level Fault for the Control Process Variable (F773)	

19	It presents the parameters for the configuration of the dry pump protection: P1042: Motor Speed for Dry Pump P1043: Motor Torque for Dry Pump P1044: Time Delay for Dry Pump Fault (F781)	
20	It presents the parameter for the configuration of the pump protection via external sensor (DI11): DI11 Function P1045: Time Delay for Pump Protection via External Sensor Fault (F783)	
21	It presents the parameters that define which variables will be shown on the HMI display in the monitoring mode: P0205: Reading Parameter Selection 1 P0206: Reading Parameter Selection 2 P0207: Reading Parameter Selection 3	

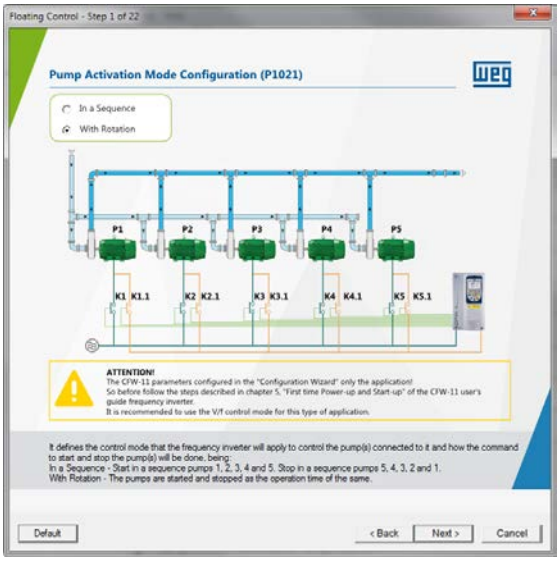
	It presents a summary with all the parameters configured of Pump Genius Multipump application by the Fixed Control configuration wizard.	

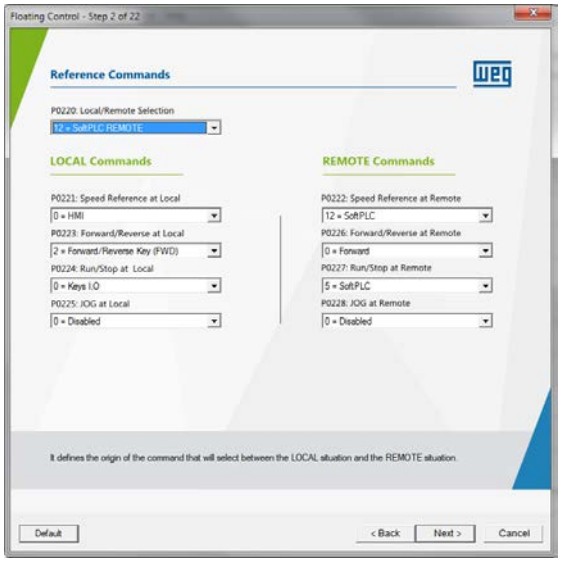
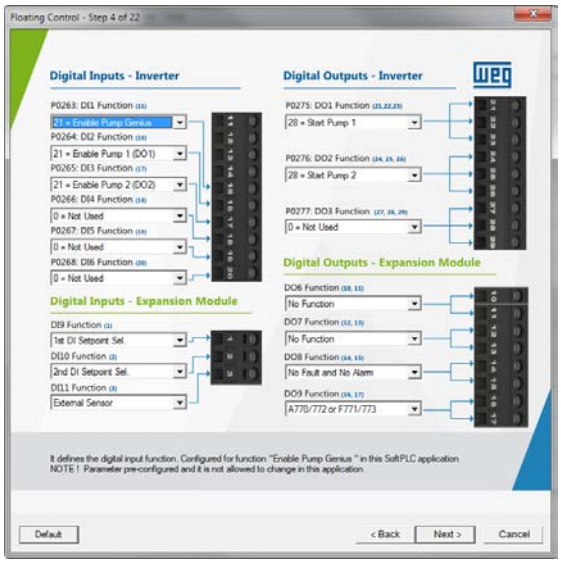
5.2 FLOATING CONTROL

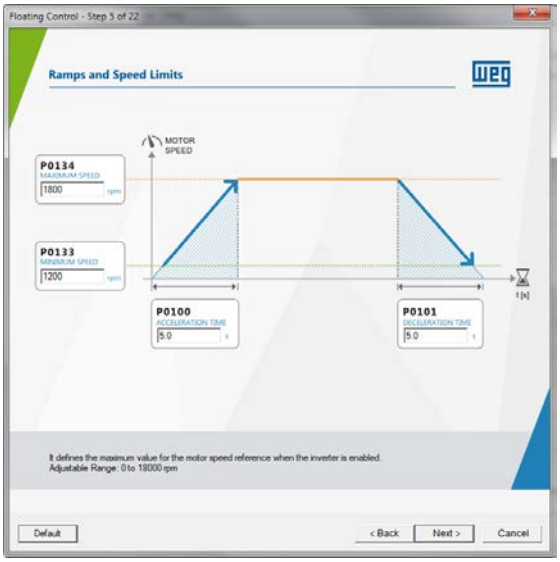
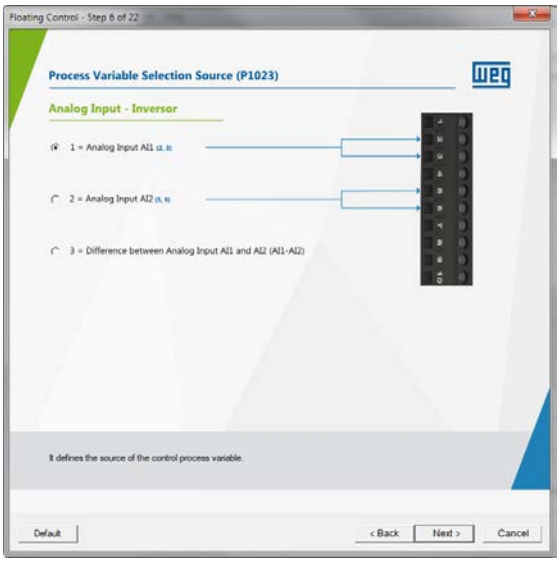
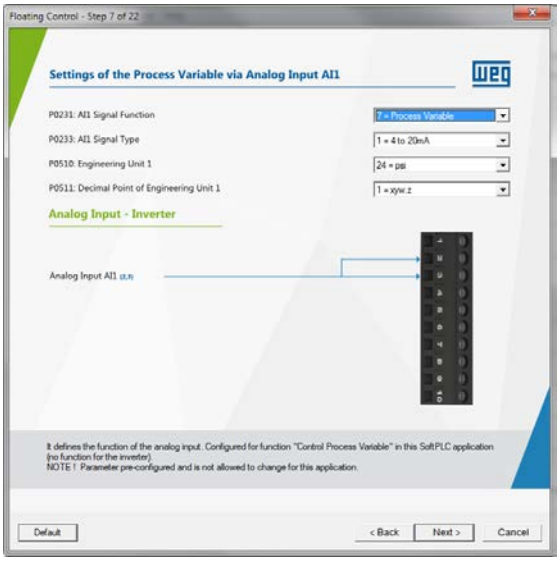
The configuration of the ladder application for Pump Genius Multipump with floating control, and up to five pumps in parallel is done using the “Multipump Floating Control” configuration wizard, which consists of an oriented sequence for the configuration of the relevant parameters for this application.

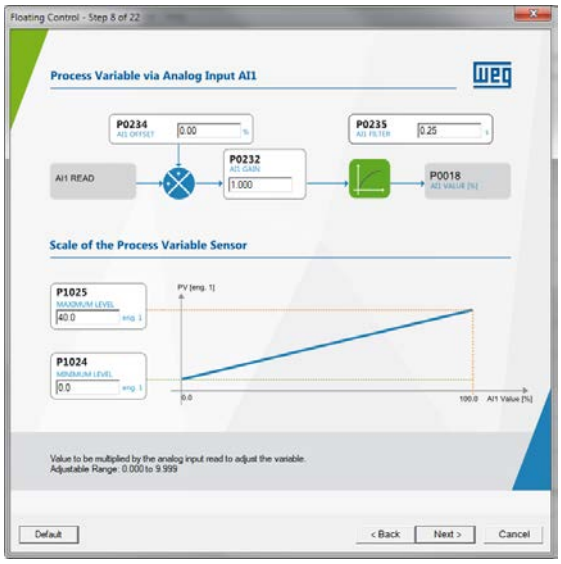
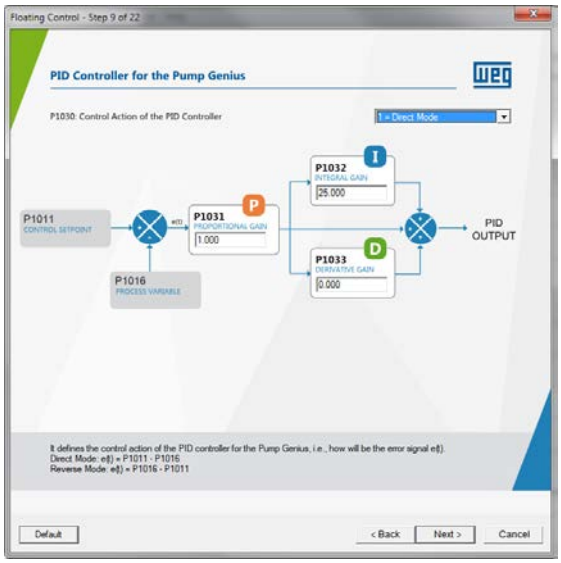
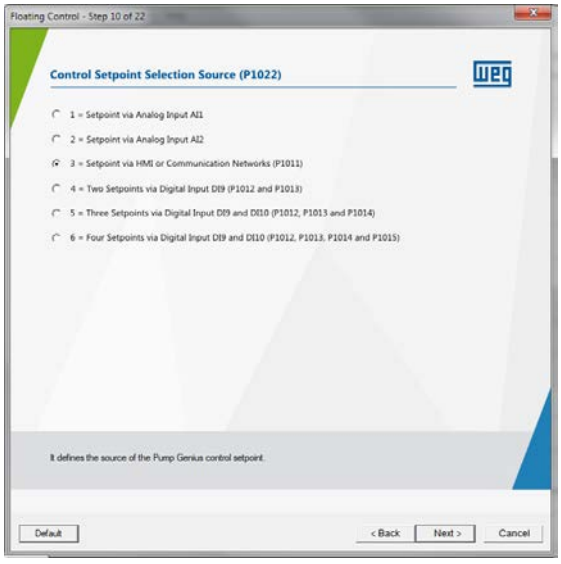
NOTE!
When powering up the inverter for the first time follow the steps described in the chapter 5 “First time Power-up and Start-up” of the CFW-11 user´s guide inverter.
It is recommended to use the V/f control mode for this type of application!

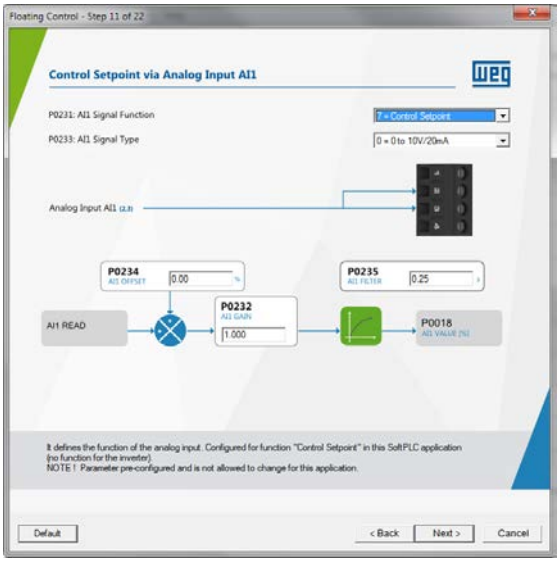
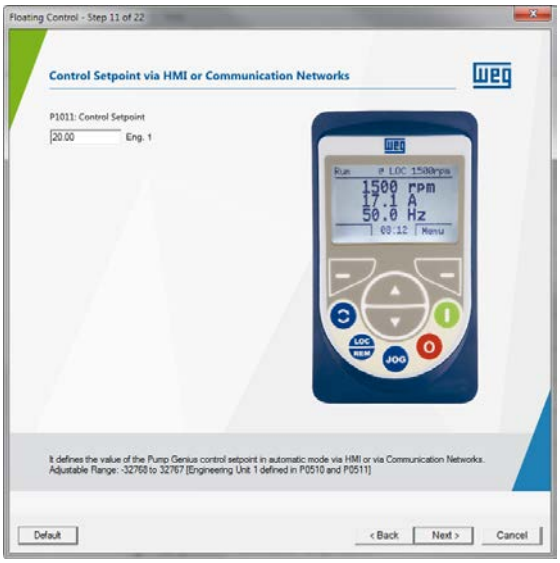
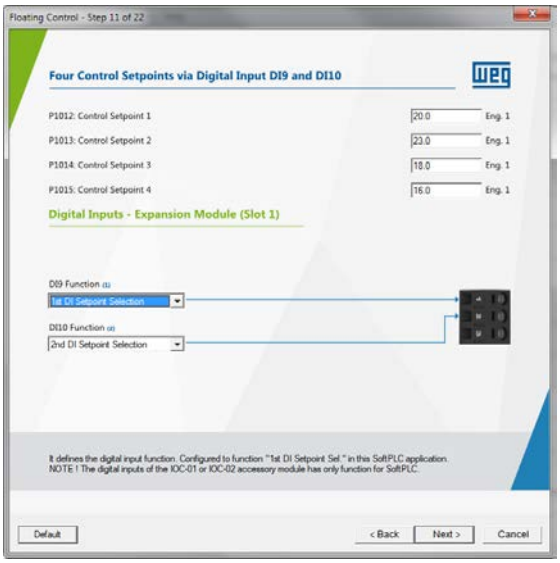
Table 5.2 – Configuration wizard for floating control

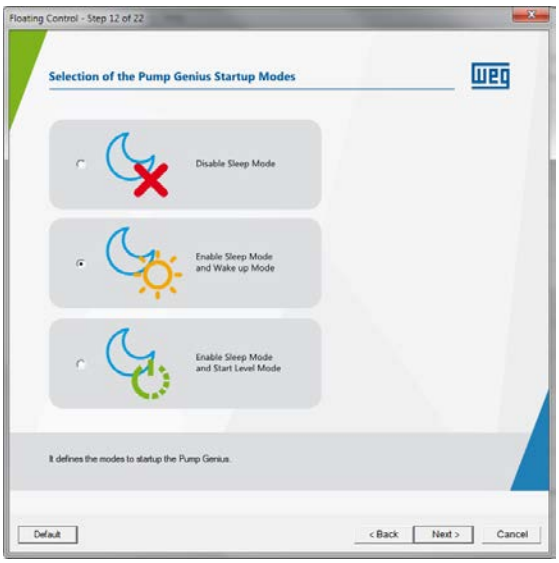
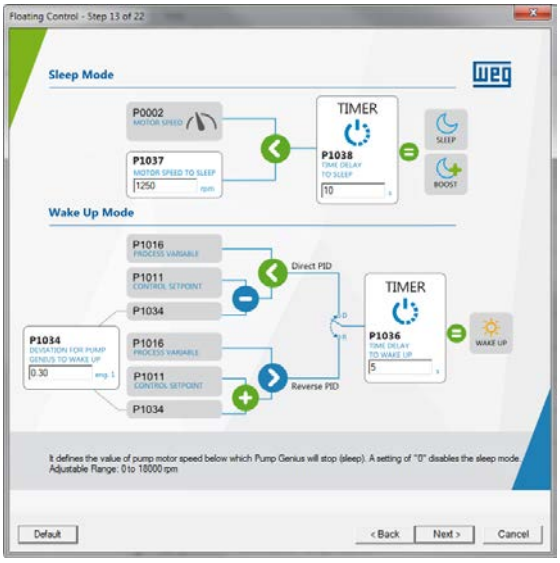
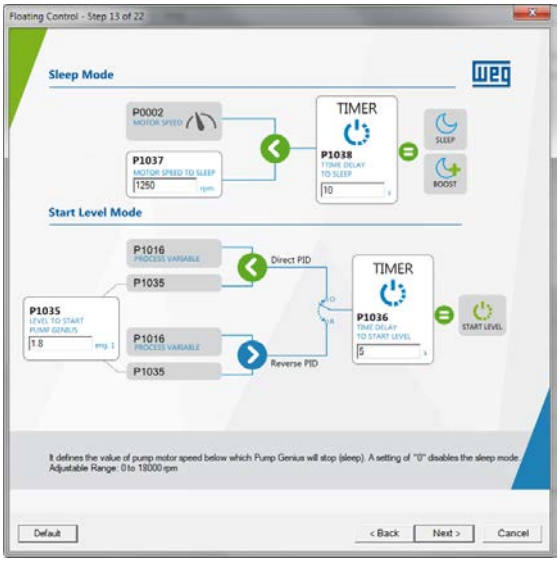
Step	Description	WLP Configuration Wizard
	General presentation of the application Pump Genius Multipump configuration wizard for Floating Control.	
1	It presents the parameter for the configuration of the activation mode of the multipump floating control. P1021: Pump Control and Activation Mode Configuration	

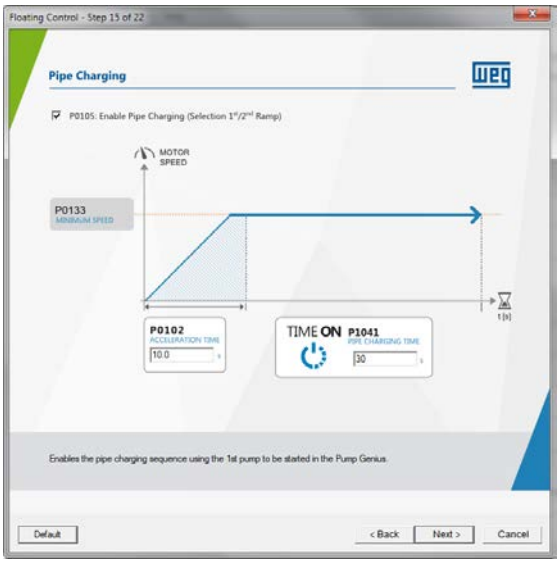
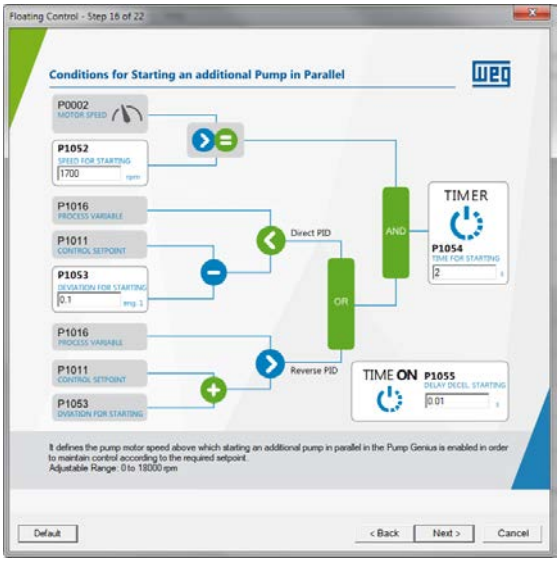
2	It presents the parameters for configuration of the reference commands : P0220: Local/Remote Selection Source P0221: Speed Reference Selection - Local Situation P0222: Speed Reference Selection - Remote Situation P0223: Forward/Reverse Selection - Local Situation P0224: Run/Stop Selection - Local Situation P0225: JOG Selection - Local Situation P0226: Forward/Reverse Selection - Remote Situation P0227: Run/Stop Selection - Remote Situation P0228: JOG Selection - Remote Situation	
3	It presents the options to define the number of pumps in parallel of the floating control multipump controlled by digital outputs.	
4	It presents the parameters for the configuration of the functions of the CFW-11 digital inputs and outputs: P0263: DI1 Function P0264: DI2 Function P0265: DI3 Function P0266: DI4 Function P0267: DI5 Function P0268: DI6 Function DI9 Function DI10 Function DI11 Function P0275: DO1 Function (RL1) P0276: DO2 Function (RL2) P0277: DO3 Function (RL3) DO6 Function DO7 Function DO8 Function DO9 Function	

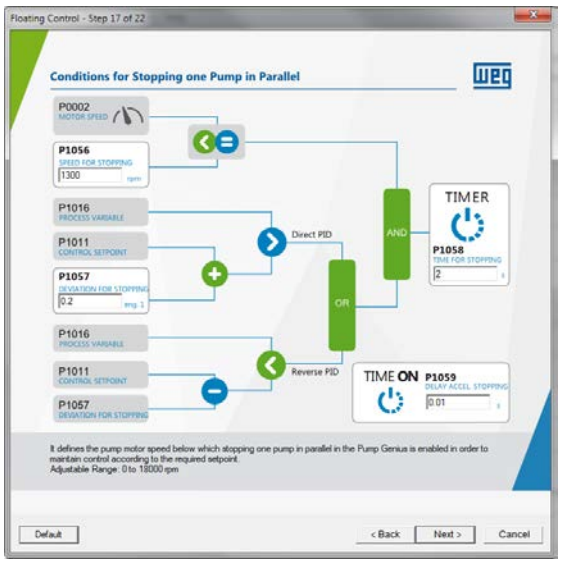
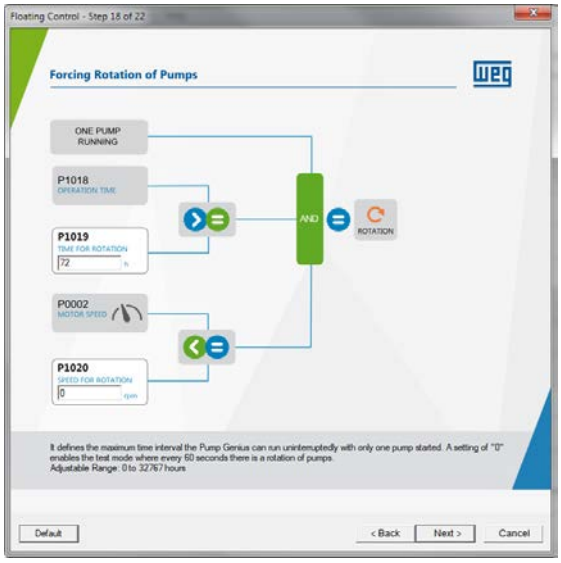
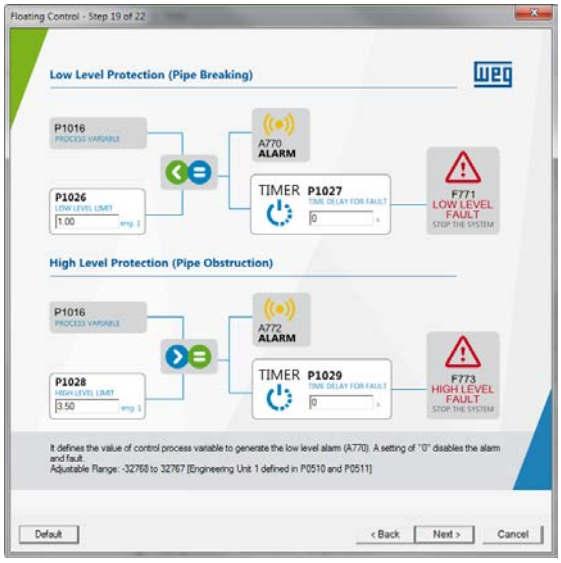
5	It presents the parameters for the configuration of the CFW-11 ramps limits and speed: P0100: Acceleration Time P0101: Deceleration Time P0133: Minimum Speed Reference Limit P0134: Maximum Speed Reference Limit	
6	It presents the parameter for the source selection of the control process variable: P1023: Control Process Variable Selection Source	
7	It presents the parameters for the configuration of the control process variable via analog input AI1 or AI2 and the engineering unit of the control process variable: P0231 and P0236: AI1 and AI2 Signal Function P0233 and P0238: Signal Type AI1 and AI2 P0510: Engineering Unit 1 P0511: Decimal Point of Engineering Unit 1	

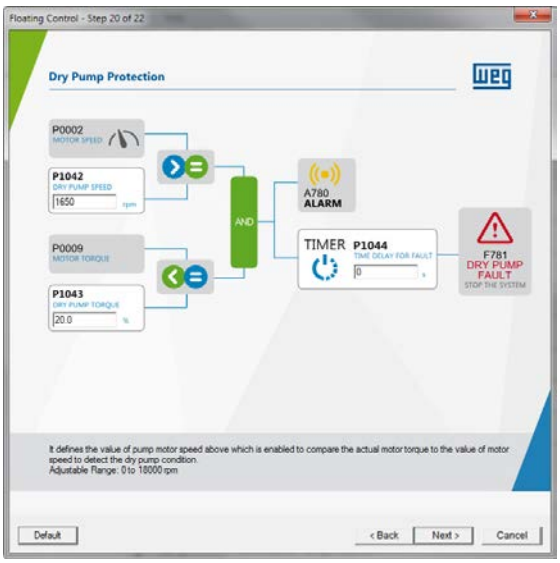
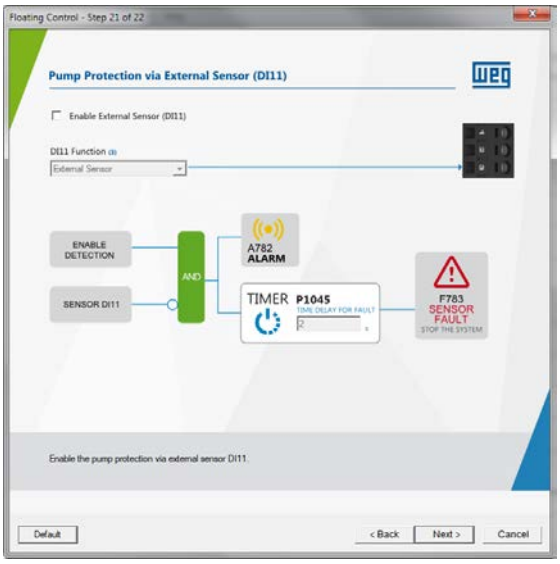
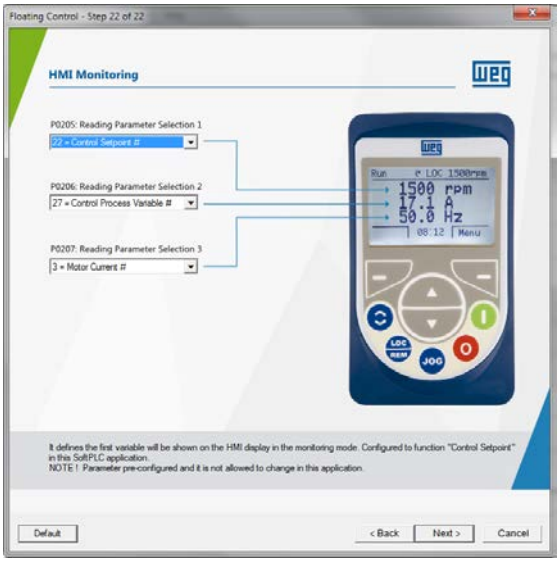
8	It presents the parameters for the configuration of the control process variable via analog input AI1 or AI2, and of the scale of the control process variable sensor: P0234 and P0239: AI1 and AI2 Offset P0232 and P0237: AI1 and AI2 Gain P0235 and P0240: AI1 and AI2 Filter P1024: Control Process Variable Sensor Minimum Level P1025: Control Process Variable Sensor Maximum Level	
9	It presents the parameters for the configuration of the PID controller for the Pump Genius: P1030: Control Action of the PID Controller P1031: PID Proportional Gain P1032: PID Integral Gain P1033: PID Derivative Gain	
10	It presents the parameter for the source selection of the Pump Genius control setpoint: P1022: Control Setpoint Selection Source	

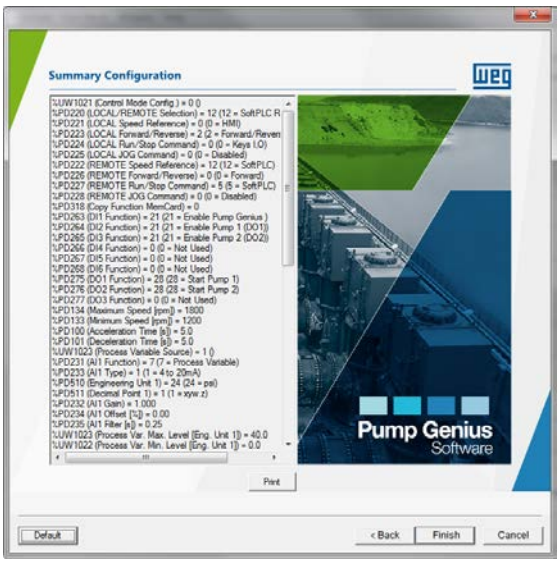
11 – 1 to 11 – 2	It presents the parameters for the configuration of the Pump Genius control setpoint via analog input AI1 or AI2: P0231 and P0236: AI1 and AI2 Signal Function P0232 and P0237: AI1 and AI2 Gain P0233 and P0238: AI1 and AI2 Signal Type P0234 and P0239: AI1 and AI2 Offset P0235 and P0240: AI1 and AI2 Filter	
11 – 3	It presents the parameter for the configuration of the control setpoint via HMI or Communication Networks: P1011: Control Setpoint	
11 – 4 to 11 – 6	It presents the parameters for the configuration of the Pump Genius control setpoint via logical combination of digital inputs DI9 and DI10: DI9 Function DI10 Function P1012: Control Setpoint 1 P1013: Control Setpoint 2 P1014: Control Setpoint 3 P1015: Control Setpoint 4	

12	It presents the modes or conditions to startup the Pump Genius.	
13 – 1	It presents the parameters for the configuration of the sleep mode and wake up mode: P1034: Control Process Variable Deviation for Pump Genius to Wake up P1036: Time Delay for Pump Genius to Wake up P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode P1038: Time Delay for Pump Genius goes to Sleep Mode	
13 – 2	It presents the parameters for the configuration of the sleep mode and start level mode: P1035: Control Process Variable Level for Starting the Pump Genius P1036: Time Delay for Pump Genius Starting by Level P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode P1038: Time Delay for Pump Genius goes to Sleep Mode	

14	It presents the parameters for configuration of the sleep boost: P1039: Sleep Boost Offset P1040: Sleep Boost Maximum Time	
15	It presents the parameters for the configuration of pipe charging using the 1st pump to be started in the Pump Genius: P0102: Acceleration Time 2 P0105: Enable Pipe Charging (1st / 2nd Ramp Selection) P1041: Pipe Charging Time	
16	It presents the parameters for the configuration of the conditions for starting an additional pump in parallel in the Pump Genius: P1052: Pump Motor Speed for Starting an additional Pump in Parallel P1053: Control Process Variable Deviation for Starting an additional Pump in Parallel P1054: Time Delay for Starting an additional Pump in Parallel P1055: Delay in the Deceleration of the CFW-11 Pump when Starting a Pump	

17	It presents the parameters for the configuration of the conditions for stopping one pump in parallel in the Pump Genius: P1056: Pump Motor Speed for Stopping one Pump in Parallel P1057: Control Process Variable Deviation for Stopping one Pump in Parallel P1058: Time Delay for Stopping one Pump in Parallel P1059: Delay in the Acceleration of the CFW-11 Pump when Stopping a Pump	
18	It presents the parameters for the configuration of the forcing rotation of pumps in the Pump Genius: P1019: Time Interval for Forcing Rotation of Pumps P1020: Pump Motor Speed for Forcing Rotation of Pumps	
19	It presents the parameters for the configuration of the low level protection for the control process variable (pipe breaking) and high level protection for process variable (pipe obstruction): P1026: Value for Low Level Alarm for the Control Process Variable P1027: Time Delay for Low Level Fault for the Control Process Variable (F771) P1028: Value for High Level Alarm for the Control Process Variable P1029: Time for High Level Fault for the Control Process Variable (F773)	

20	It presents the parameters for the configuration of the dry pump protection: P1042: Motor Speed for Dry Pump P1043: Motor Torque for Dry Pump P1044: Time Delay for Dry Pump Fault (F781)	
21	It presents the parameter for the configuration of the pump protection via external sensor (DI11): DI11 Function P1045: Time Delay for Pump Protection via External Sensor Fault (F783)	
22	It presents the parameters that define which variables will be shown on the HMI display in the monitoring mode: P0205: Reading Parameter Selection 1 P0206: Reading Parameter Selection 2 P0207: Reading Parameter Selection 3	

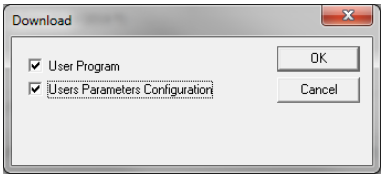
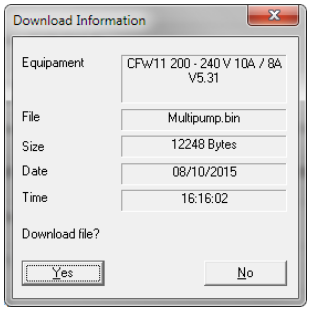
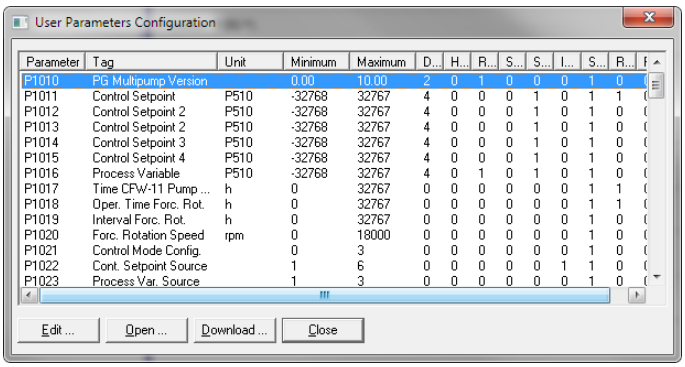
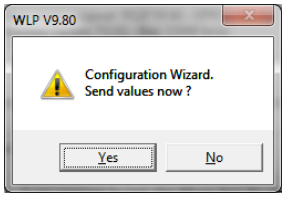
	It presents a summary with all the parameters configured of Pump Genius Multipump application by the Floating Control configuration wizard.	

6 DOWNLOAD DIALOG BOXES

Through the WLP it is possible to download the user´s ladder program, the configuration of user´s parameters and the values configured in the configuration wizard. Below is a presentation of the main download dialogs to the CFW-11 inverter.

NOTE!
Refer to the help topics in the WLP programming software for more details on the download.

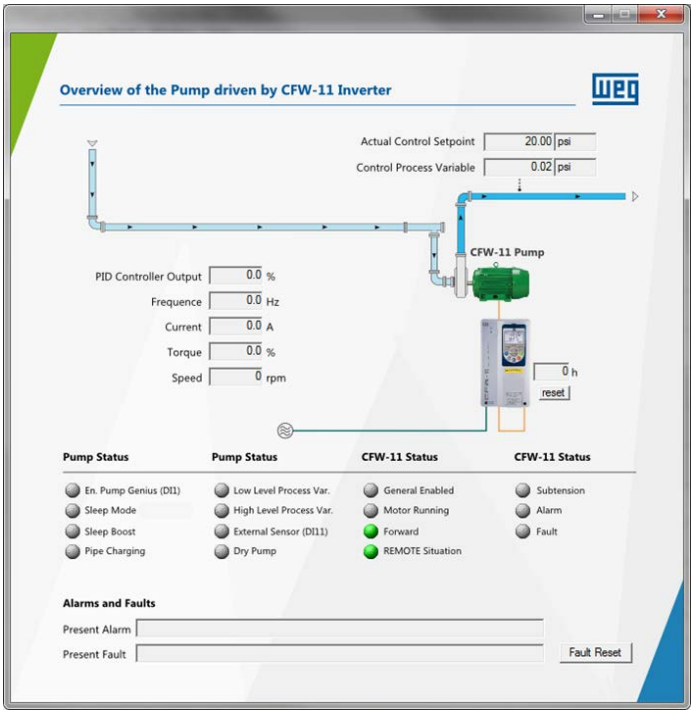
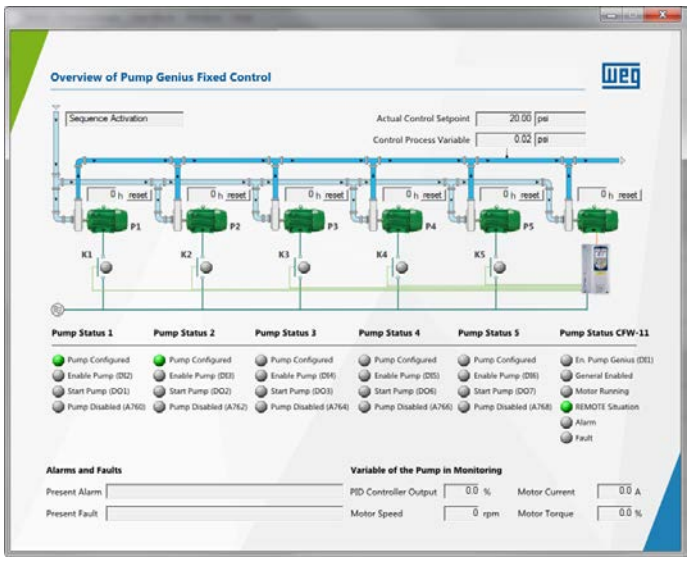
Table 6.1 – Download dialog box for the Pump Genius Multipump application

Description	WLP Download Dialog Box
Download dialog box of the application developed with the WLP containing the following options: ■ User Program; ■ Configuration of the User's Parameters.	
User program download dialog box containing: ■ Characteristics of the connected equipment; ■ Name of the file to be downloaded; ■ Size of the application to be downloaded; ■ File compilation date; ■ File compilation hour; ■ Command to transfer or not the compiled application.	
Configuration of the user parameters dialog box containing: ■ Parameter number; ■ Name assigned to the parameter by the user; ■ Unit assigned to the parameter by the user; ■ Minimum and maximum values; ■ Number of decimal positions; ■ Options for visualization in hexadecimal format, with sign, ignoring the password, visualization on the HMI, retentive and for change confirmation; ■ Commands for opening, editing, performing the download and for closing the dialog box of the user parameters.	
Dialog box for the download of the values configured with the fixed control or floating control configuration wizard.	

7 MONITORING DIALOG BOXES

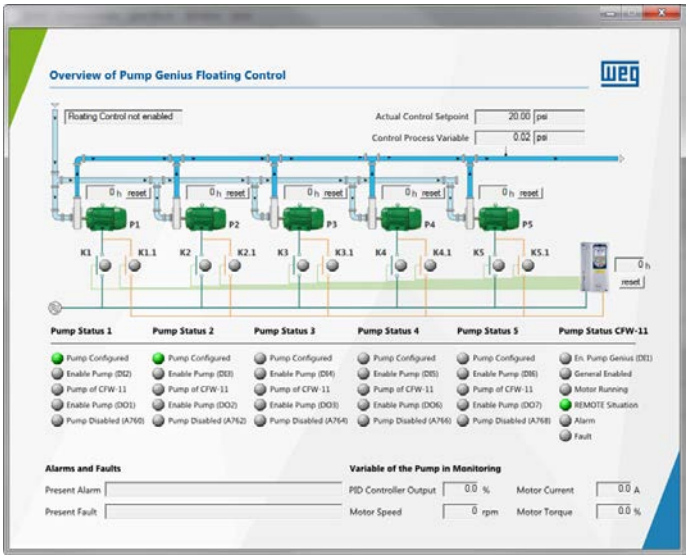
It is possible to monitor and change the parameters of the Pump Genius Multipump application through the WLP.

Table 7.1 – Monitoring dialogs of the Pump Genius Multipump application

Description	WLP Monitoring Dialog
Monitoring of the pump driven by CFW-11 inverter. It permits visualization of the following variables: ■ Actual control setpoint and control process variable displayed as engineering unit 1; ■ Operation time, frequency, current, torque and speed of pump driven by CFW-11 inverter; ■ PID controller output; ■ Status of the pump status indicating: command for enable Pump Genius via DI1, sleep mode active, sleep boost active, pipe charging active, low level and high level of control process variable, dry pump condition, and status of external sensor (DI11); ■ Status of CFW-11 inverter indicating: general enabled, motor running, forward, remote situation, subtension, alarm active and fault active; ■ Present alarm and fault; ■ Command for reset of faults.	
Monitoring of the status of the pumps associated in parallel of the Pump Genius Multipump application with fixed control. It shows the following variables: ■ Present control setpoint and control process variable according to engineering unit 1; ■ Operation time of the pumps; ■ Command to reset the operation time of the pumps; ■ Status of pumps 1 to 6 indicating: pump configured on the Pump Genius, command to enable the use, command for digital output to start the pump and disabled pump running alarm; ■ Status of the pump driven by the inverter indicating: command to enable the Pump Genius via DI1, general enabling, motor running, remote situation, active alarm and active fault; ■ Present alarm and fault; ■ Command to reset the drive fault; ■ Control reference, current, torque and speed of the pump driven by the CFW-11 inverter.	

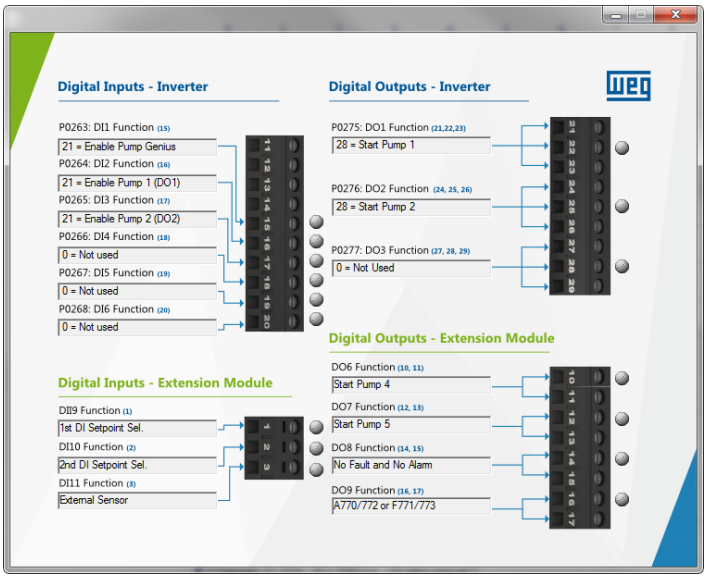
Monitoring of the status of the pumps associated in parallel of the Pump Genius Multipump application with floating control. It shows the following variables:

- Present control setpoint and control process variable according to engineering unit 1;
- Operation time of the pumps;
- Command to reset the operation time of the pumps;
- Status of pumps 1 to 6 indicating: pump configured on the Pump Genius, command to enable the use of pump driven by the CFW-11 inverter, command for digital output to start the pump and disabled pump running alarm;
- Status of the pump driven by the inverter indicating: command to enable the Pump Genius via DI1, general enabling, motor running, remote situation, active alarm and active fault;
- Present alarm and fault;
- Command to reset the drive fault;
- Control reference, current, torque and speed of the pump driven by the CFW-11 inverter.



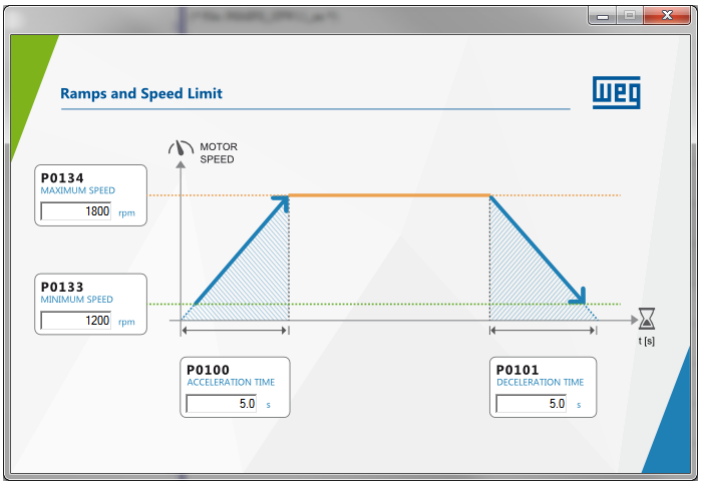
Monitoring of the status of commands made at the pump driven by CFW-11 inverter. It permits the visualization of the following variables:

- Present status of CFW-11 digital inputs;
- Function of digital inputs for Pump Genius;
- Present status of CFW-11 digital outputs;
- Function of digital outputs for Pump Genius



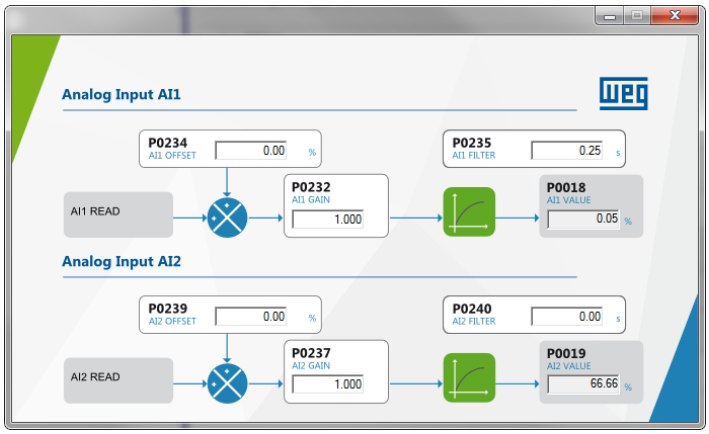
It shows the ramp and speed limit parameters of the CFW-11 inverter, configured for the pump of the Pump Genius. It permits the modification of the following variables:

- P0100: Acceleration Time;
- P0101: Deceleration Time;
- P0133: Minimum Speed Reference Limit;
- P0134: Maximum Speed Reference Limit.



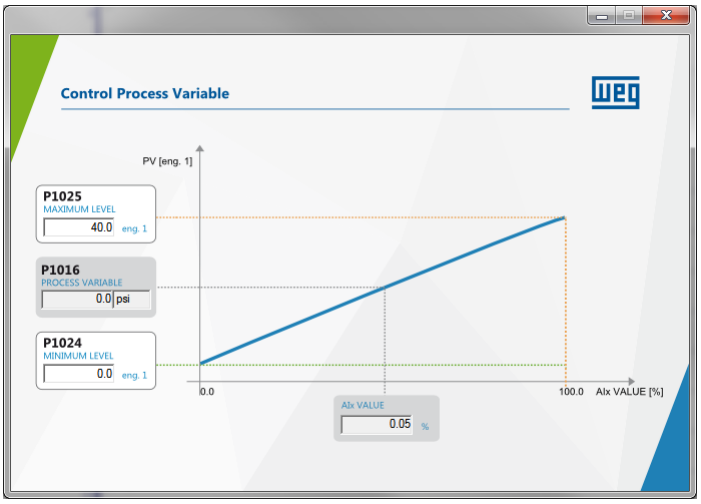
It shows the parameters for reading the Pump Genius signals via the CFW-11 analog inputs. It permits the modification and visualization of the following variables:

- P0018: AI1 Value;
- P0019: AI2 Value;
- P0029: AI3 Value;
- P0021: AI4 Value;
- P0232: AI1 Gain;
- P0234: AI1 Offset;
- P0235: AI1 Filter;
- P0237: AI2 Gain;
- P0239: AI2 Offset;
- P0240: AI2 Filter;



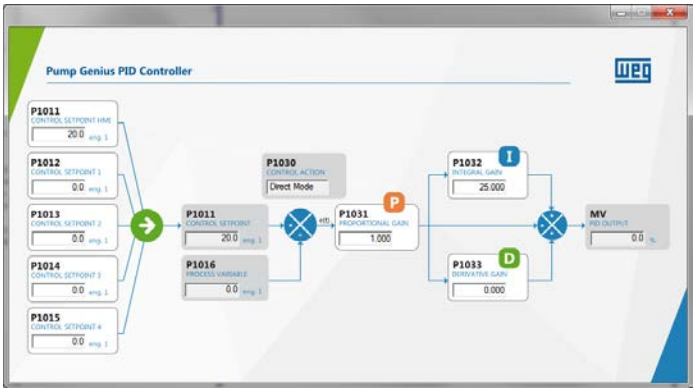
It shows the setting parameters of the control process variable. It permits the change and visualization of the following variables:

- P1024: Control Process Variable Sensor Minimum Level;
- P1025: Control Process Variable Sensor Maximum Level;
- Value of control process variable (P1016) displayed as engineering unit 1;
- Value of analog input selected for control process variable in %.



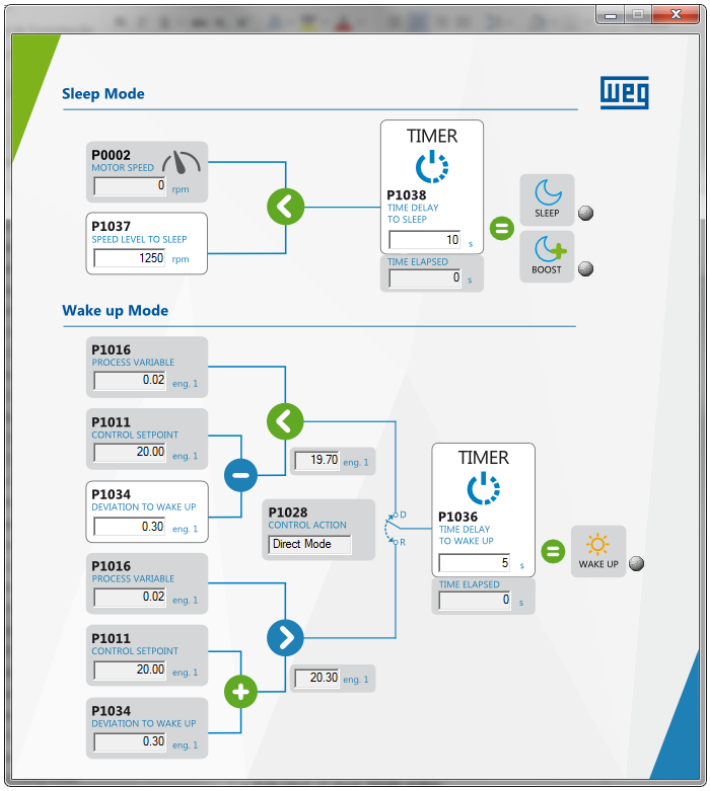
It shows the Pump Genius academic PID controller adjustment and operation parameters. It permits the modification and visualization of the following variables:

- P1011: Control Setpoint (read and write);
- P1012: Control Setpoint 1;
- P1013: Control Setpoint 2;
- P1014: Control Setpoint 3;
- P1015: Control Setpoint 4;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1031: PID Proportional Gain;
- P1032: PID Integral Gain;
- P1033: PID Derivative Gain;
- Output (MV) of academic PID controller in %.



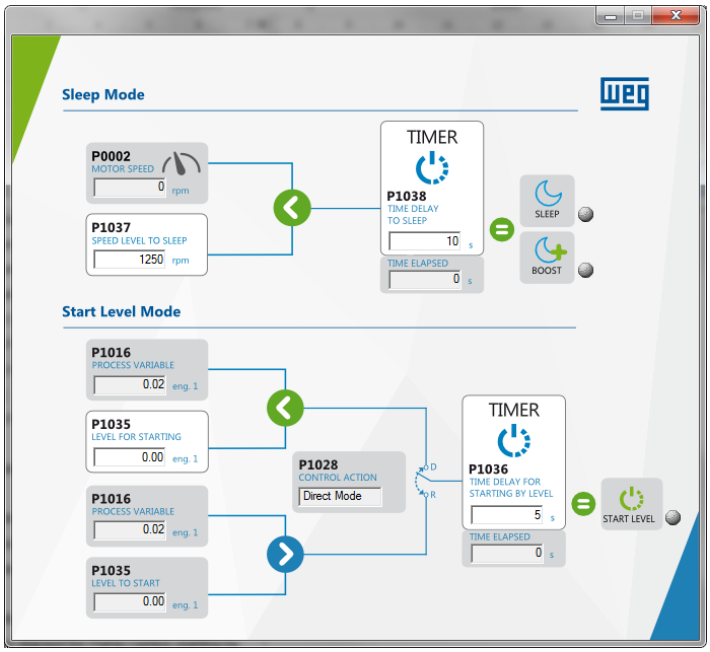
It shows the operation parameters for executing the start and stops the Pump Genius with Wake up Mode configuration. It permits the modification and visualization of the following variables:

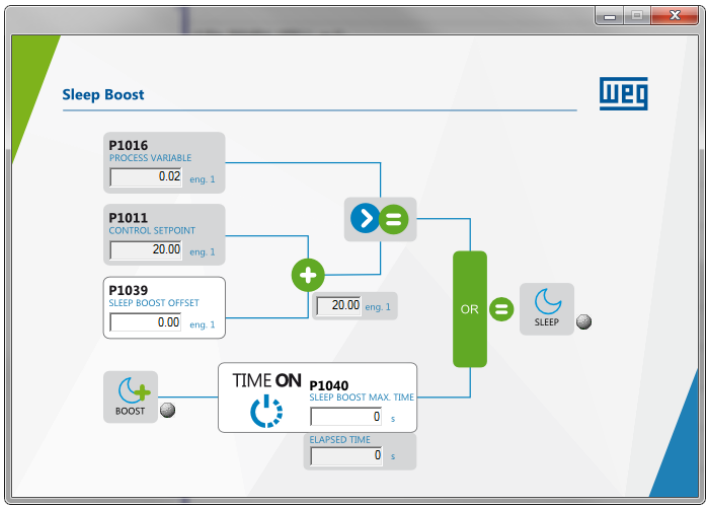
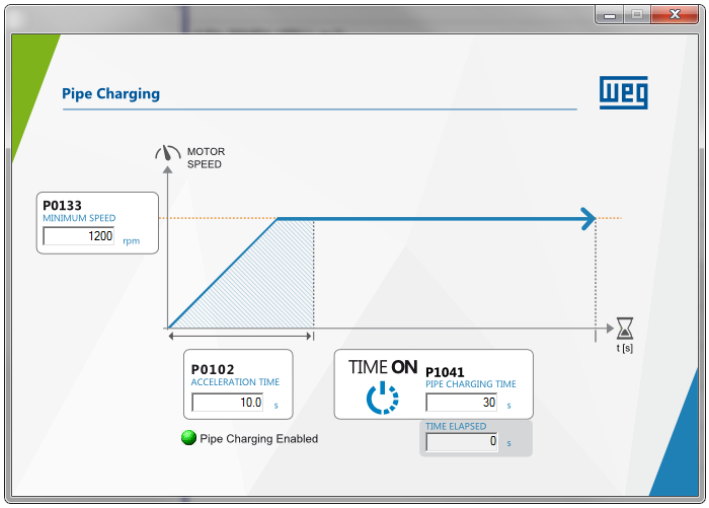
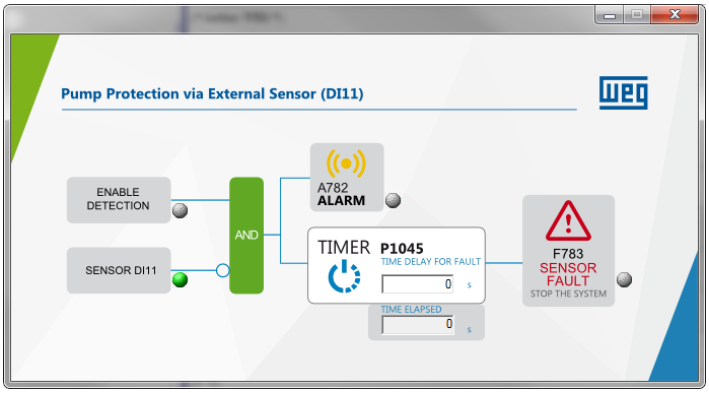
- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1034: Control Process Variable Deviation for Pump Genius to Wake up;
- P1036: Time Delay for Pump Genius to Wake Up;
- P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode;
- P1038: Time Delay for Pump Genius goes to Sleep Mode;
- Motor speed reference in rpm;
- Value of the time elapsed for Pump Genius to wake up;
- Value of the time elapsed for Pump Genius goes to sleep mode;
- Indication of wake up mode active;
- Indication of sleep mode active or sleep boost.



It shows the operation parameters for executing the start and stops the Pump Genius with Start Level Mode configuration. It permits the modification and visualization of the following variables:

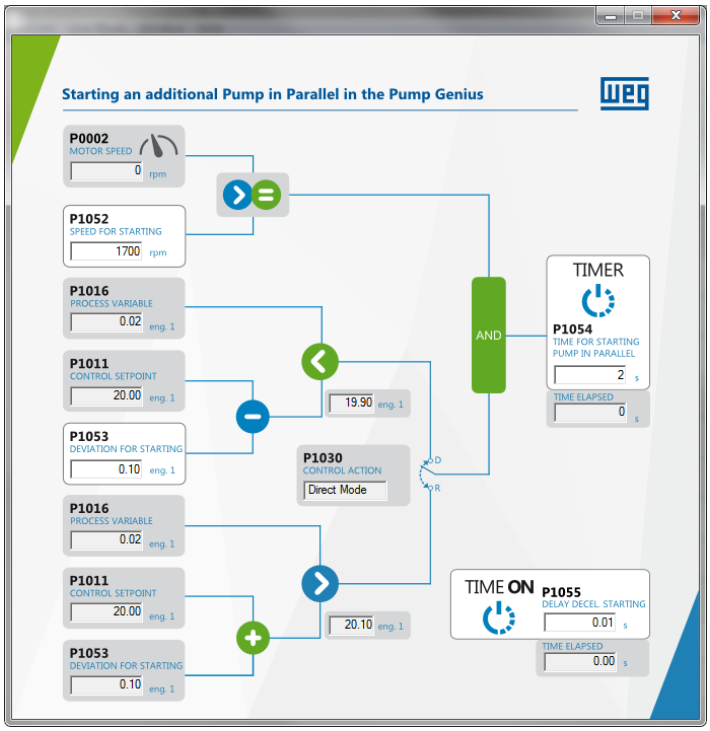
- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1035: Control Process Variable Level for Starting the Pump Genius;
- P1036: Time Delay for Pump Genius to Starting by Level;
- P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode;
- P1038: Time Delay for Pump Genius goes to Sleep Mode;
- Motor speed reference in rpm;
- Value of the time elapsed for Pump Genius starting by level;
- Value of the time elapsed for Pump Genius goes to sleep mode;
- Indication of start level mode active;
- Indication of sleep mode active or sleep boost.



It shows the operation parameters of sleep boost function. It permits the modification and visualization of the following variables: ■ P1011: Control Setpoint; ■ P1016: Control Process Variable; ■ P1039: Sleep Boost Offset ; ■ P1040: Sleep Boost Maximum time; ■ Maximum time value elapsed of sleep boost; ■ Indication of the sleep mode and sleep boost active.	
It shows the operation parameters for pipe charging using the 1st pump to be started in the Pump Genius. It permits the modification and visualization of the following variables: ■ P0102: Acceleration Time 2; ■ P0133: Minimum Speed Reference Limit; ■ P1041: Pipe Charging Time; ■ Value of the time elapsed of the pipe charging; ■ Indication of pipe charging enabled.	
It shows the adjustment parameters for pump protection via external sensor in DI11 digital input. It permits the change and visualization of the following variables: ■ P1045: Time Delay for Pump Protection via External Sensor Fault (F783); ■ Value of the time elapsed for generate the fault F783; ■ Indication of sensor (DI11) enabled; ■ Indication of status of sensor installed in digital input DI11; ■ Indication of active alarm and fault.	

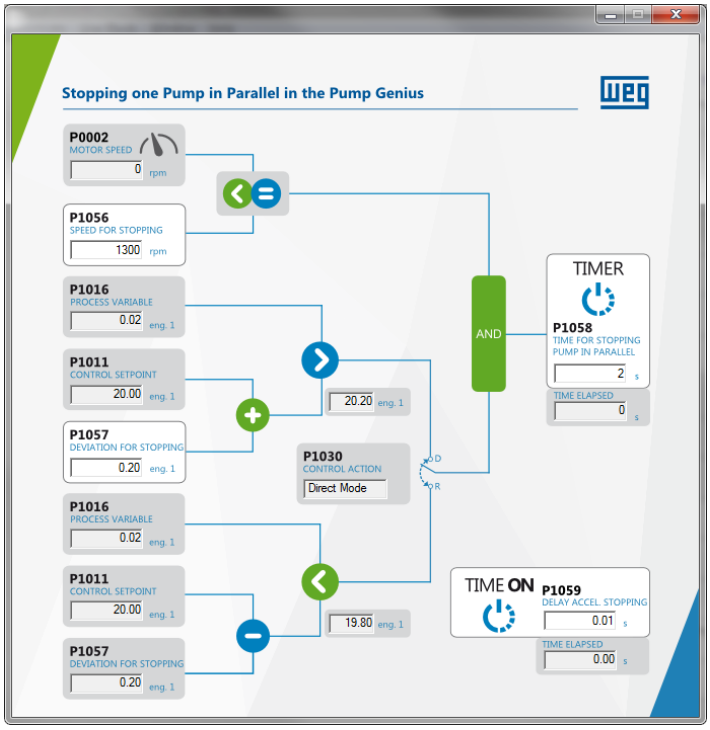
It shows the parameters for starting an additional pump in parallel in the Pump Genius. It permits the change and visualization of the following variables:

- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1052: Pump Motor Speed for Starting an additional Pump in Parallel;
- P1053: Control Process Variable Deviation for Starting an additional Pump in Parallel;
- P1054: Time Delay for Starting an additional Pump in Parallel;
- P1055: Delay in the Deceleration of the Pump of the CFW-11 when Starting a Pump in Parallel;
- Motor speed reference in rpm;
- Value of the time elapsed for starting an additional pump in parallel.



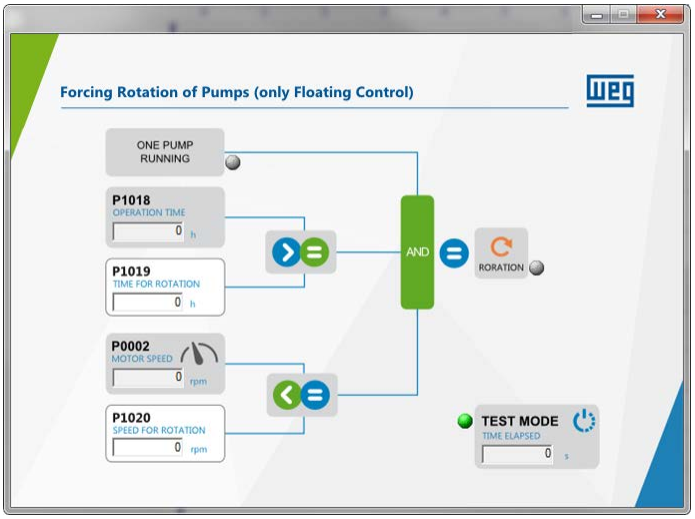
It shows the parameters for stopping one pump in parallel in the Pump Genius. It permits the change and visualization of the following variables:

- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1056: Pump Motor Speed for Stopping one Pump in Parallel;
- P1057: Control Process Variable Deviation for Stopping one Pump in Parallel;
- P1058: Time Delay for Stopping one Pump in Parallel;
- P1059: Delay in the Acceleration of the Pump of the CFW-11 when Stopping a Pump in Parallel;
- Motor speed reference in rpm;
- Value of the time elapsed for stopping one pump in parallel.



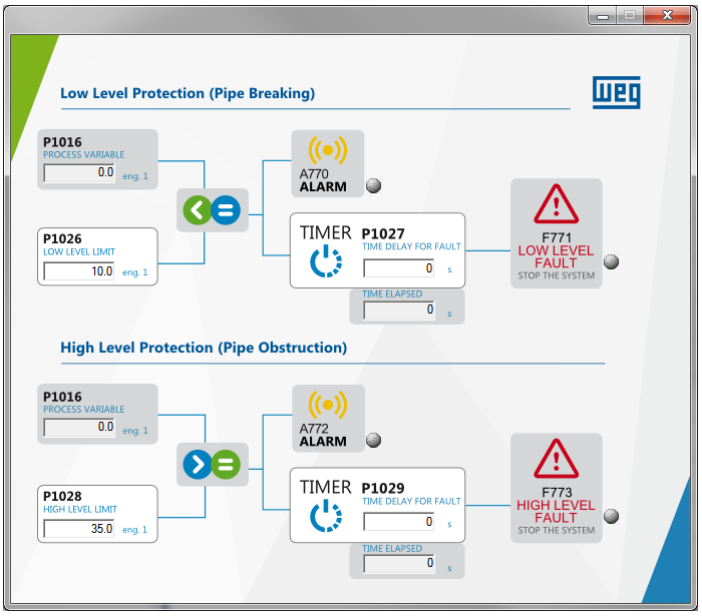
It shows the parameters for forcing rotation of pumps in the Pump Genius. It permits the change and visualization of the following variables:

- P1018: Forcing Rotation of Pumps Operation Time;
- P1019: Time Interval for Forcing Rotation of Pumps;
- P1020: Pump Motor Speed for Forcing Rotation of Pumps;
- Motor speed reference in rpm;
- Value of the time elapsed, when in test mode, for forcing rotation of pumps;
- Indication of only one pump running;
- Indication of forcing rotation of pumps in test mode;
- Indication of command to forcing rotation of pumps in the Pump Genius.



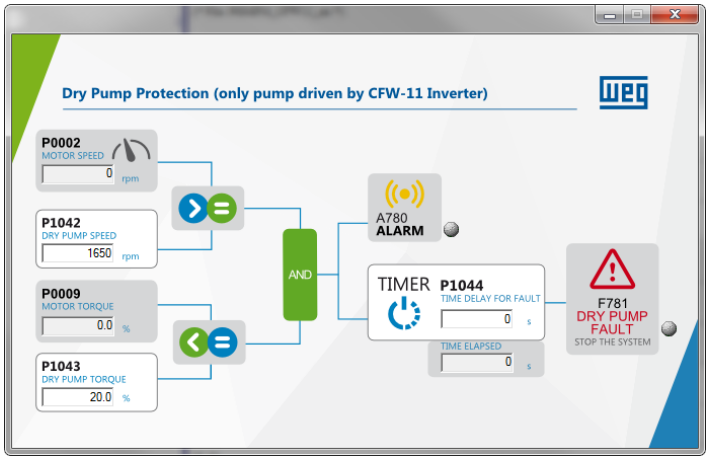
It shows the adjustment parameters of the low and high level protection for the control process variable. It permits the change and visualization of the following variables:

- P1016: Control Process Variable;
- P1026: Value for Low Level Alarm for the Control Process Variable;
- P1027: Time Delay for Low Level Fault for the Control Process Variable (F771);
- P1028: Value for High Level Alarm for the Control Process Variable;
- P1029: Time Delay for High Level Fault for the Control Process Variable (F773);
- Value of the time elapsed to generate the low level and high level fault for the control process variable;
- Indication of active alarms and faults.



It shows the adjustment parameters for dry pump protection. It permits the change and visualization of the following variables:

- P0002: Actual Motor Speed in rpm;
- P0009: Actual Motor Torque in %;
- P1042: Motor Speed for Dry Pump;
- P1043: Motor Torque for Dry Pump;
- P1044: Time Delay for Dry Pump Fault (F781);
- Value of the time elapsed for generate the dry pump fault (F781);
- Indication of active alarm and fault.



8 TREND VARIABLES DIALOG BOXES

It is possible to monitor variables of the Pump Genius Multipump application through the WLP.

Analog Inputs:
It permits the visualization of the analog input values for an analysis of the response throughout the operation time.

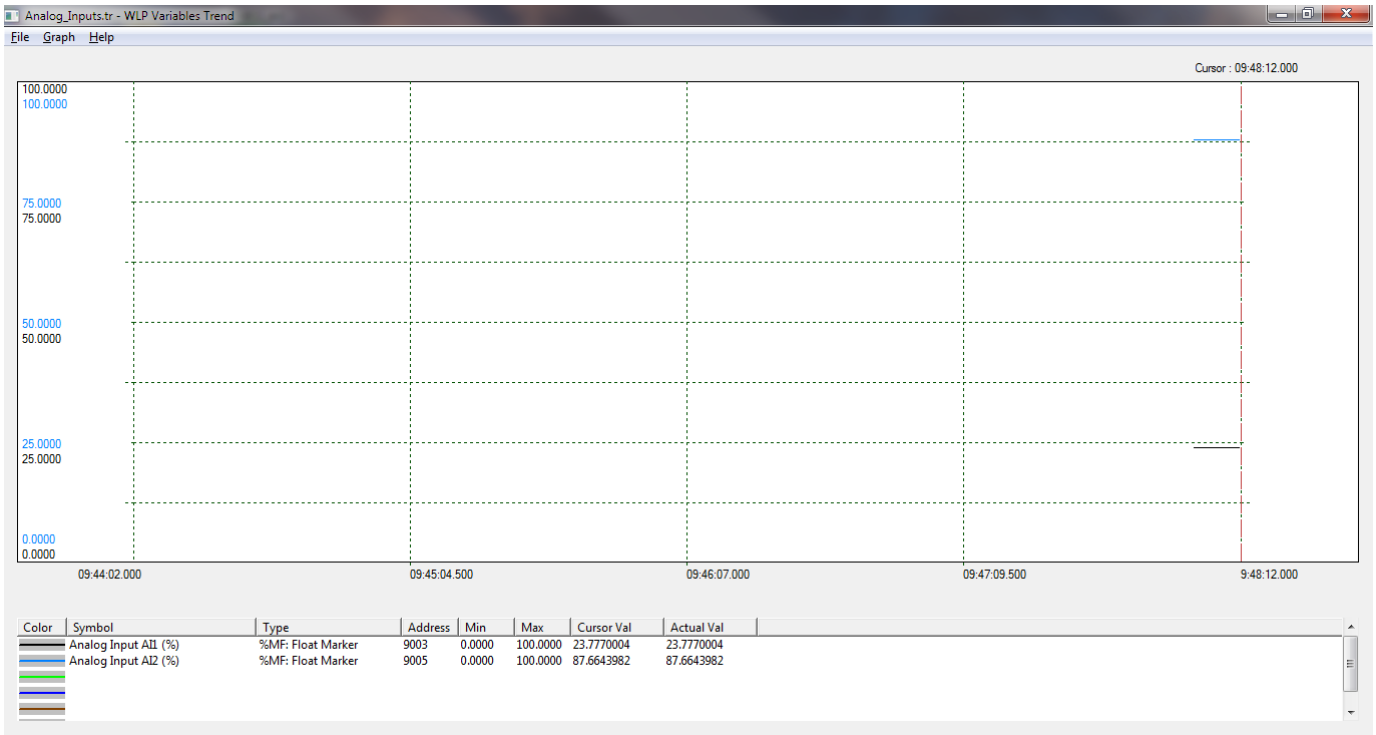


Figure 8.1 – Trend variable dialog for analog inputs

Control of the Pump driven by CFW-11 Inverter:
It permits the visualization of control values of the pump driven by CFW-11 inverter.

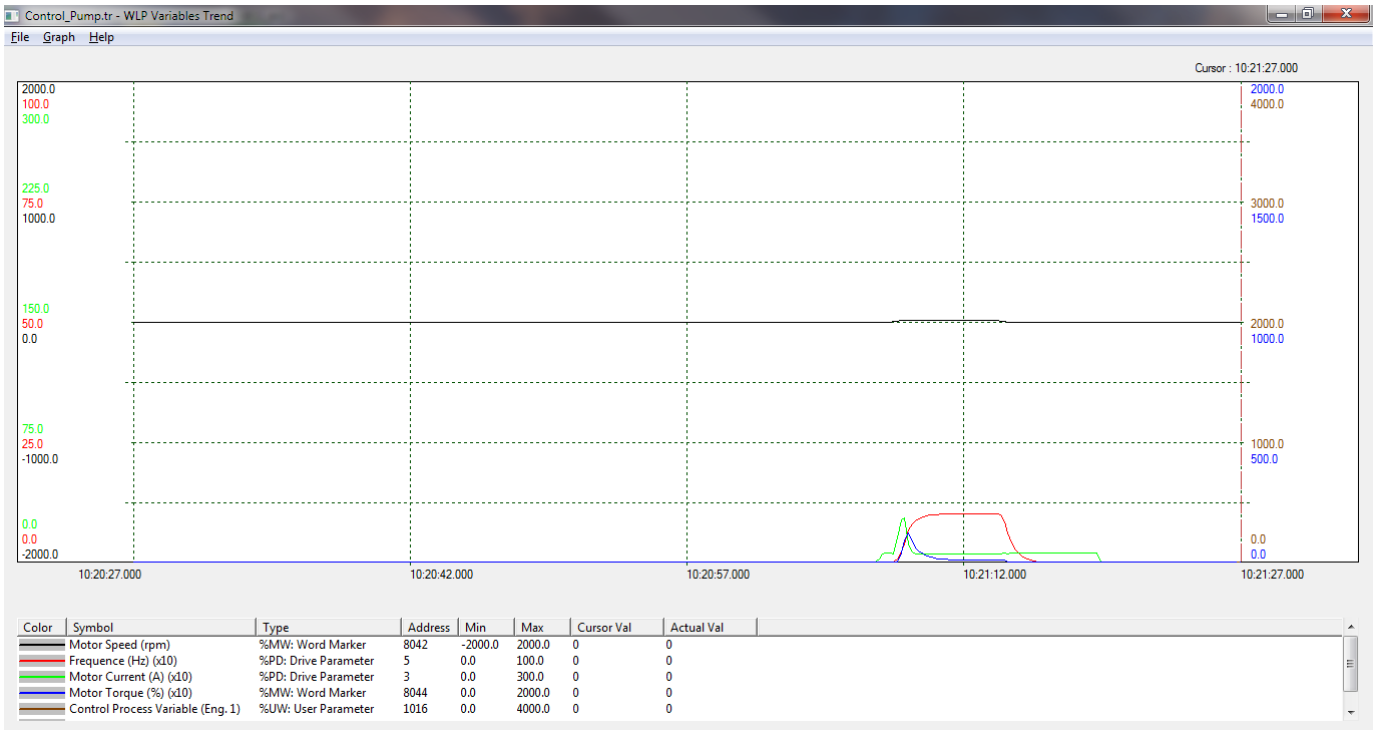


Figure 8.2 – Trend variable dialog for control values of the pump

PID Controller Settings:

It permits the visualization of the values for the Pump Genius's PID controller settings.

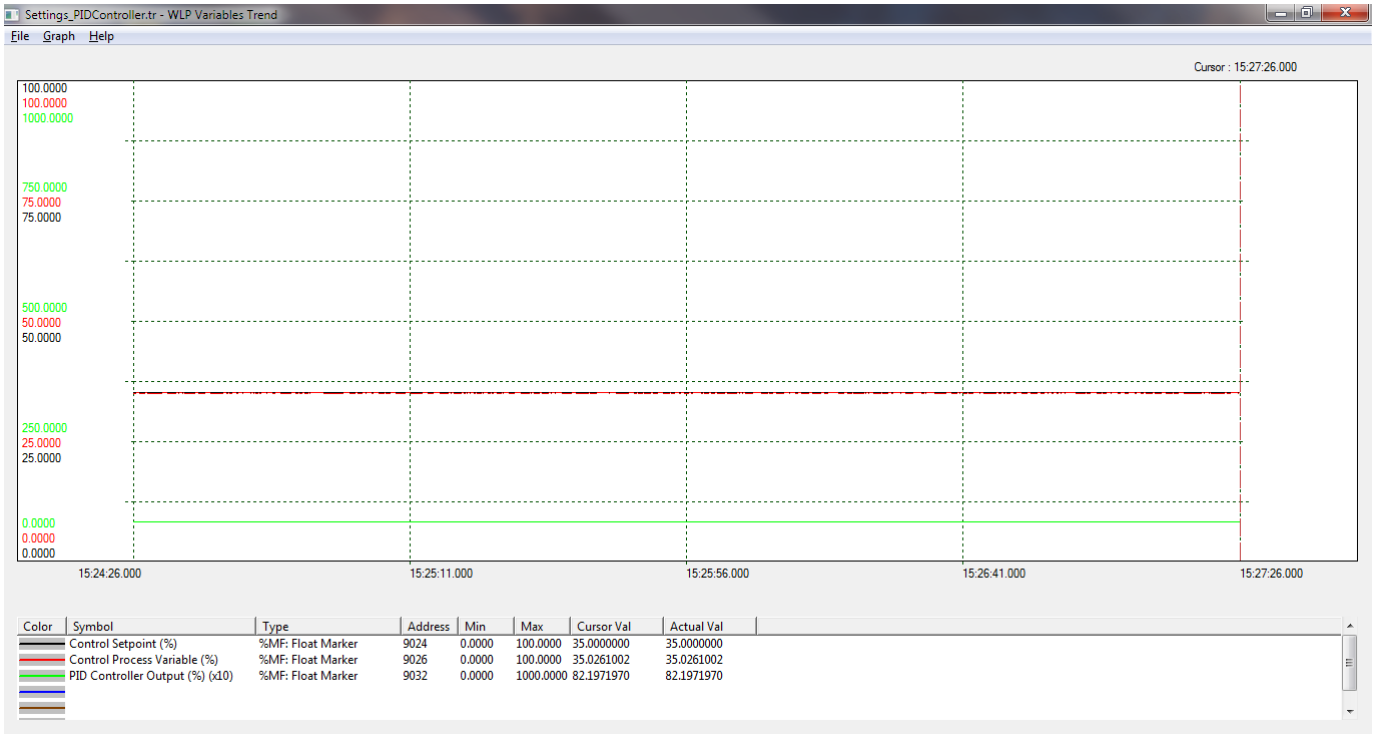


Figure 8.3 – Trend variable dialog for PID controller settings

NOTE!

Refer to the WLP programming software help topics for more information on the use of the trend variables.

9 PARAMETER VALUE DIALOG

It is possible to save the parameters of the each pump configured in the Pump Genius Multipump application through the WLP.

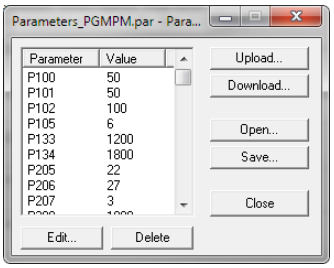


Figure 9.1 – Parameter value dialog

NOTE!
Refer to the WLP programming software help topics for more information on the use of the parameter value dialog box.