

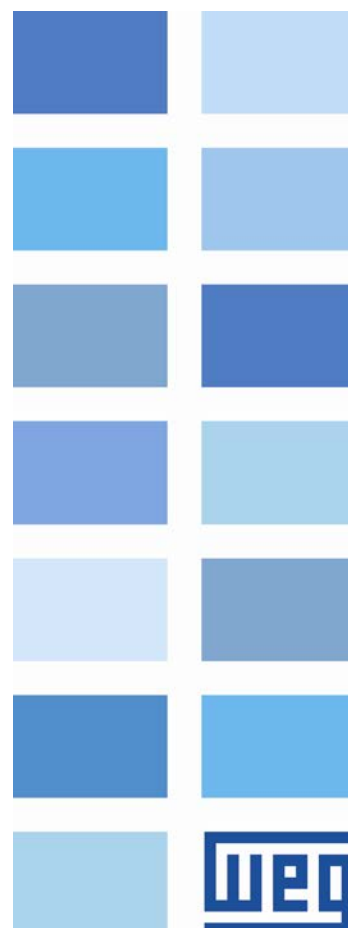
PUMP GENIUS

Multiplex

CFW-11

Application Manual

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ABOUT THE MANUAL

This manual provides the necessary information for the configuration of a Pump Genius Multiplex application developed with the CFW-11 inverter SoftPLC function. This application manual must be used together with the CFW-11 user's manual, the SymbiNet communication 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 Multiplex Application Version	0.00 to 10.00			ro	50	93
P1011	Control Setpoint	-32768 to 32767 [Eng. Un.1]	200		rw	50	64
P1012	Control Setpoint 1	-32768 to 32767 [Eng. Un.1]	200			50	64
P1013	Control Setpoint 2	-32768 to 32767 [Eng. Un.1]	230			50	64
P1014	Control Setpoint 3	-32768 to 32767 [Eng. Un.1]	180			50	64
P1015	Control Setpoint 4	-32768 to 32767 [Eng. Un.1]	160		ro	50	64
P1016	Control Process Variable	-32768 to 32767 [Eng. Un.1]			ro	50	93
P1017	Control Auxiliary Variable	-32768 to 32767 [Eng. Un.2]			ro	50	93
P1018	Pump Operation Time	0 to 32767 h			rw	50	94
P1019	Status of Pump Operation Mode	0 = Master Pump 1 = Slave Pump			ro	50	94
P1020	Configuration of Pump Operation Mode	0 = Master/Slave Pump 1 = Slave Pump	0			50	48
P1021	Automatic Master Pump Change Over Time in the event of Master Fails	0 to 32767 s	2 s			50	56
P1022	Control Setpoint Source Selection	0 = Without Source for Control Setpoint (Slave Pump) 1 = Control Setpoint via Analog Input AI1 2 = Control Setpoint via Analog Input AI2 3 = Control Setpoint via Analog Input AI3 4 = Control Setpoint via Analog Input AI4 5 = Control Setpoint via HMI (P1011) 6 = Two Setpoints via Digital Input DI4 (P1012 and P1013) 7 = Three Setpoints via Digital Inputs DI4 and DI5 (P1012, P1013 and P1014) 8 = Four Setpoints via Digital inputs DI4 and DI5 (P1012, P1013, P1014 and P1015)	5			50	64
P1023	Control Process Variable Selection Source	0 = Without Source for Process Variable (Slave Pump) 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) 4 = Control Process Variable via Analog Input AI3 5 = Control Process Variable via Analog Input AI4	1			50	65
P1024	Control Process Variable Sensor Minimum Level	-32768 to 32767 [Eng. Un.1]	0			50	68
P1025	Control Process Variable Sensor Maximum Level	-32768 to 32767 [Eng. Un.1]	400			50	68
P1026	Value for Low Level Alarm for the Control Process Variable	-32768 to 32767 [Eng. Un.1]	100			50	84
P1027	Time Delay for Low Level Fault for the Control Process Variable (F771)	0 to 32767 s	0 s			50	84
P1028	Value for High Level Alarm for the Control Process Variable	-32768 to 32767 [Eng. Un.1]	350			50	84
P1029	Time Delay for High Level Fault for the Control Process Variable (F773)	0 to 32767 s	0 s			50	85
P1030	Control Action of the PID Controller	0 = Direct 1 = Reverse	0			50	69
P1031	PID Proportional Gain	0.00 to 320.00	1.00			50	69
P1032	PID Integral Gain	0.00 to 320.00	25.00			50	70
P1033	PID Derivative Gain	0.00 to 320.00	0.00			50	70

Parameter	Description	Adjustable Range	Factory Setting	User Setting	Properties	Groups	Page
P1034	Control Process Variable Deviation for Pump Genius to Wake Up	-32768 to 32767 [Eng. Un.1]	30			50	70
P1035	Control Process Variable Level to Starting the Pump Genius	-32768 to 32767 [Eng. Un.1]	180			50	71
P1036	Time Delay for Pump Genius to Wake up or Starting by Level	0 to 32767 s	5 s			50	71
P1037	Pump Motor Speed below which Pump Genius goes to Sleep Mode	0 to 18000 [Eng. Un. 3]	1250 rpm 42.0 Hz			50	71
P1038	Time Delay for Pump Genius goes to Sleep Mode	0 to 32767 s	10 s			50	72
P1039	Sleep Boost Offset	-32768 to 32767 [Eng. Un. 1]	0			50	72
P1040	Sleep Boost Maximum Time	0 to 32767 s	15 s			50	72
P1041	Pipe Charging Time	0 to 32767 s	30 s			50	77
P1042	Motor Speed for Dry Pump	0 to 18000 [Eng. Un. 3]	1620 rpm 54.0 Hz			50	85
P1043	Motor Torque for Dry Pump	0.0 to 100.0 %	20.0 %			50	85
P1044	Time Delay for Dry Pump Fault (F781)	0 to 32767 s	0 s			50	85
P1045	Time Delay for Pump Protection via External Sensor (F783)	0 to 32767 s	2 s			50	87
P1046	Control Auxiliary Variable Selection Source for Pump Protection	0 = Without Protection via Control Auxiliary Variable 1 = Control Auxiliary Variable via Analog Input AI1 2 = Control Auxiliary Variable via Analog Input AI2 3 = Control Auxiliary Variable via Analog Input AI3 4 = Control Auxiliary Variable via Analog Input AI14	0			50	88
P1047	Control Auxiliary Variable Sensor Minimum Level	-32768 to 32767 [Eng. Un.2]	0			50	90
P1048	Control Auxiliary Variable Sensor Maximum Level	-32768 to 32767 [Eng. Un.2]	1000			50	90
P1049	Value to detect Low Level of Control Auxiliary Variable	-32768 to 32767 [Eng. Un.2]	250			50	91
P1050	Control Setpoint in Low Level	-32768 to 32767 [Eng. Un.1]	160			50	91
P1051	Hysteresis to reactivate the Control Setpoint	-32768 to 32767 [Eng. Un.2]	100			50	92
P1052	Pump Motor Speed for Starting an additional Pump in Parallel	0 to 18000 [Eng. Un. 3]	1700 rpm 57.0 Hz			50	79
P1053	Control Process Variable Deviation for Starting an additional Pump in Parallel	-32768 to 32767 [Eng. Un.1]	10			50	79
P1054	Time Delay for Starting an additional Pump in Parallel	0 to 32767 s	2 s			50	80
P1055	Pump Motor Speed for Stopping one Pump in Parallel	0 to 18000 [Eng. Un. 3]	1300 rpm 43.0 Hz			50	81
P1056	Control Process Variable Deviation for Stopping one Pump in Parallel	-32768 to 32767 [Eng. Un.1]	0			50	81
P1057	Time Delay for Stopping one Pump in Parallel	0 to 32767 s	2 s			50	81
P1058	Operation Time for Forcing Rotation of Pumps	0 to 32767 h			rw	50	94
P1059	Time Interval for Forcing Rotation of Pumps	0 to 32767 h	72 h			50	83
P1060	Pump Motor Speed Forcing Rotation of Pumps	0 to 18000 [Eng. Un. 3]	0 rpm 0.0 Hz			50	83

Quick Parameter Reference, Faults and Alarms



Fault / Alarm	Description	Possible Causes
A750: Sleep Mode Active	It indicates 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 P1059 and the speed value of this pump is lower than the value set in P1060
A755: 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
A756: Pump Disabled via DI2	It indicates that the pump was disabled from operation in the Pump Genius	Digital input DI2 was set to logic level "0", issuing the command to disable the pump
A758: Change Master Pump? I (yes) O (no)	It indicates the loss of communication with the pump that was master of the Pump Genius. Waiting for user command to execute (I=yes) or not execute (O=no) the manual change-over of the master pump of the Pump Genius	Loss of communication with the pump that had assumed the master function of the Pump Genius
F759: Two or more Master Active	It indicates that the two or more master/slave pumps assumed the master function of the Pump Genius. Setting of P1021=0 enables the fault	The user programmed two or more pumps for master/slave (P1020 = 0) and after a fault or rebooting of CFW-11 inverter, two or more CFW-11 inverters assumed the master function of the Pump Genius at the same time
A760: Master Pump Configuration Error	It indicates that the master/slave pump was not properly configured, i.e., is unable to control the pumping with the PID controller	The source of control setpoint was not defined (P1022 = 0) or the source of control process variable was not defined (P1023 = 0)
F761: Master Pump Configuration Error	It indicates that the master/slave pump was not properly configured, i.e., is unable to control the pumping with the PID controller	The command for enable the Pump Genius via DI1, or to enable use of the pump via DI2 was executed with the alarm A760 active
A762: Loss of the Master	It indicates that the slave pump (P1020=1) detected a loss of communication with the master pump of the Pump Genius	Loss of the communication with the master pump
A764: Acknowledging SymbiNet Network	It indicates that the CFW-11 inverter is in the process of acknowledging the SymbiNet network	CFW-11 inverter was energized and waiting its turn for up to 3 seconds to acknowledge the SymbiNet network
A766: SymbiNet is not Active	It indicates that the SymbiNet protocol is not configured or there is an error in RS485 or CAN interface	The user not programmed P0312 = 5 (RS485) or P0700 = 3 (CAN). If the user has programmed correctly the interface, it may be in error as the diagnostic showed by P0316 (RS485) or P0705 (CAN).
F767: SymbiNet Configuration Error	It indicates that the SymbiNet protocol was configured in both, RS485, and CAN interfaces	The user programmed at the same time P0312 = 5 and P0700 = 3
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

Quick Parameter Reference, Faults and Alarms



Fault / Alarm	Description	Possible Causes
A774: Low Level of Control Auxiliary Variable	It indicates that the control auxiliary variable (P1017) is in low level and the control setpoint was changed to the value of P1050	The control auxiliary variable (P1017) is lower than the value programmed in P1049
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 Activated	It indicates that protection via external sensor (DI6) is activated	Pump in operation and digital input DI6 is at logic level "0"
A784: External Sensor Pump Protection	It indicates that the pump was stopped due to protection via external sensor (DI6)	Pump in operation and digital input DI6 remained at logic level "0" for a time (P1045)
F799: Incompatible Software Version	It indicates that the software version of CFW-11 (P0023) is not compatible with the version used in the application development	The software version of the CFW-11 inverter was not updated for the special version Ve5.3x

1. INTRODUCTION TO THE PUMP GENIUS MULTIPLEX APPLICATION

The Pump Genius Multiplex 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, flukes, lobes, etc.

Introduction to the Pump Genius Multiplex Application

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.

Introduction to the Pump Genius Multiplex Application

1.3 GENERAL CHARACTERISTICS OF THE PUMP GENIUS MULTIPLEX APPLICATION

The main characteristic of the Pump Genius Multiplex application developed for the CFW-11 inverter SoftPLC function is the control of two or more pumps in parallel with each pump being driven by its respective CFW-11 inverter.

Each is notable for the following characteristics:

- Control of up to 5 (five) associated pumps in parallel with each pump driven by their respective CFW-11 inverter;
- Communication (data exchange) between the associated pumps through the SymbiNet network protocol via RS485 or CAN interface;
- Configuration of each pump to function as either master/slave pump or slave pump; this configuration determines how the respective pump will take appropriate actions to control the pumping;
- Logic to equalize pump operation time, by rotating active pumps in and out of the pumping control;
- In case of communication loss with the actual master pump, another master/slave pump can assume the pumping (becoming master). This change can be done automatically or manually via a command in the CFW-11 HMI;
- Executes the change of master pump if the broken cable of the control process variable sensor is detected when the analog input is 4-20mA;
- Acceleration and deceleration ramps for each inverter driven pump;
- Maximum and minimum speed limits for each inverter driven pump;
- Selection of the pumping control setpoint via analog inputs, CFW-11 HMI or logical combination of the digital inputs DI4 and DI5 (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;
- Enable or not of the sleep boost before to going into sleep mode;
- Wake up mode or start level mode for starting the 1st pump in the Pump Genius;
- Initiate the pumping with pipe charging through inverter driven pump;
- Low level protection for the control process variable (pipe breaking);
- High level protection for the control process variable (pipe obstruction);
- Indication of the sleep mode active via digital output DO1;
- Indication of the master pump active via digital output DO2;
- Indication of the low or high level alarm protection for the control process variable via digital output DO3;
- Dry pump protection through evaluation of motor torque and pump speed;
- Pump protection via external sensor through digital input DI6;
- Selection of an analog input as a control auxiliary variable for pump protection;
- Pump cavitation protection via low level limitation for the control auxiliary variable;
- Pump protection via high level limitation for the control auxiliary variable;
- Possibility to forcing the rotation of pumps, i.e., if the Pump Genius be operating for a long time with only one pump (Pump Genius does not go into sleep mode), the Pump Genius will be disabled and then, the other pump is started (as the operation time) for controlling the pumping;
- Possibility of enabling an individual pump to work within the Pump Genius through digital input DI2;
- Possibility of running the inverter driven pump via HMI (local mode);
- Possibility of implementation or modification of the application by the user through the WLP software.

2 PUMP GENIUS MULTIPLEX CONFIGURATION

In the Pump Genius Multiplex application developed for the CFW-11 SoftPLC function several possibilities of use or configuration were implemented: associated pumps in parallel defining whether it will operate as a master/slave or slave, the possibility of having more than one process variable sensor allowing the exchange of the master/slave pump, protect the pump using an analog variable or a digital sensor, etc. Below are details about some association types of pumps in parallel and examples of some other configurations.



NOTE!

The Pump Genius Multiplex 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.

2.1 ONE MASTER/SLAVE PUMP WITH ONE SLAVE PUMP

The user can configure the Pump Genius Multiplex application to having two pumps in parallel, each pump being driven by its respective CFW-11 inverter. One pump will be a master/slave pump (one that performs the actions for pumping control) and the other pump will be a slave pump (receives commands from the master/slave pump). The communication between the pumps is accomplished via RS485 or CAN interface, using the SymbiNet network protocol.

The pumping system to be presented in the sequence contains one master/slave pump, one slave pump and communication done via RS485 interface, which basically comprises:

- 02 CFW-11 inverters + RS485 communication interface (D1 and D2);
- 02 Electric motors and pumps (P1 and P2);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Command for enabling the Pump Genius (S1);
- Command for enabling the use of the pump driven by CFW-11 inverter (S2.1 and S2.2);
- Status light for inverter fault (H1.1 and H1.2);
- Status light for motor running (H2.1 and H2.2);
- Status light for low or high level protection for the control process variable (H3).

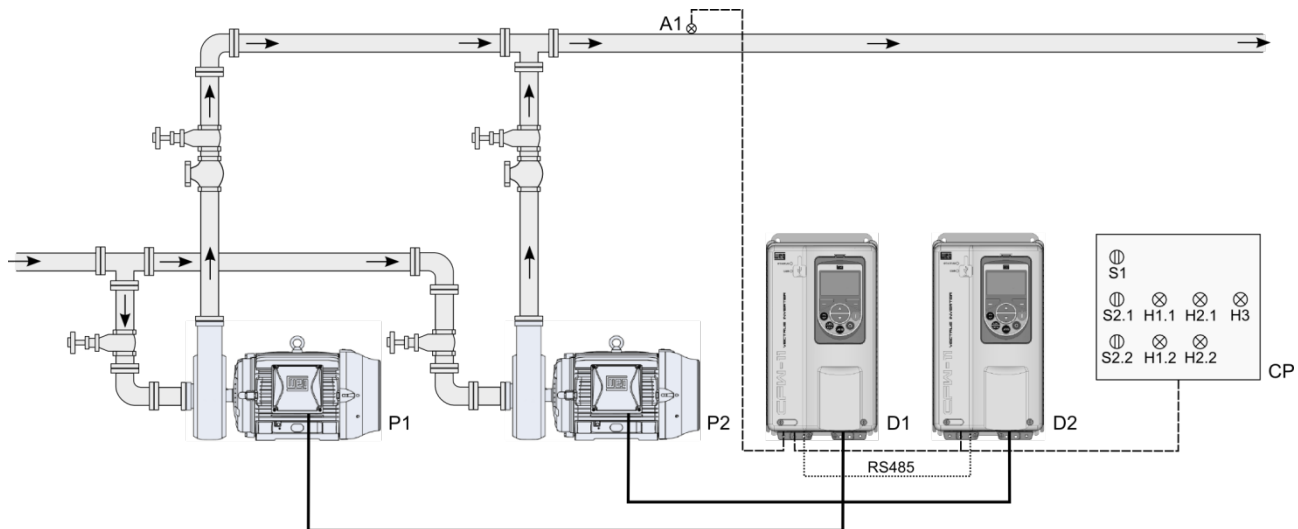


Figure 2.1 – Pump Genius Multiplex application with two pumps in parallel and RS485 communication interface



NOTE!

Using the **Master/Slave Pump** configuration wizard to configure the pump 1 and the **Slave Pump** configuration wizard to configure the pump 2 in this pumping system with two pumps in parallel and RS485 communication interface. See chapter 5 for more details on the configuration wizard.



NOTE!

The indicating lights H1.1, H1.2, H2.1, H2.2 and H3 are not necessary for the operation of the Pump Genius with two pumps in parallel and RS485 communication interface. They only indicate the condition of the pumps' operation at the command panel (CP).

2.1.1 Power Connections

The figure 2.2 presents the power connection diagram for a Pump Genius Multiplex application with two pumps in parallel.

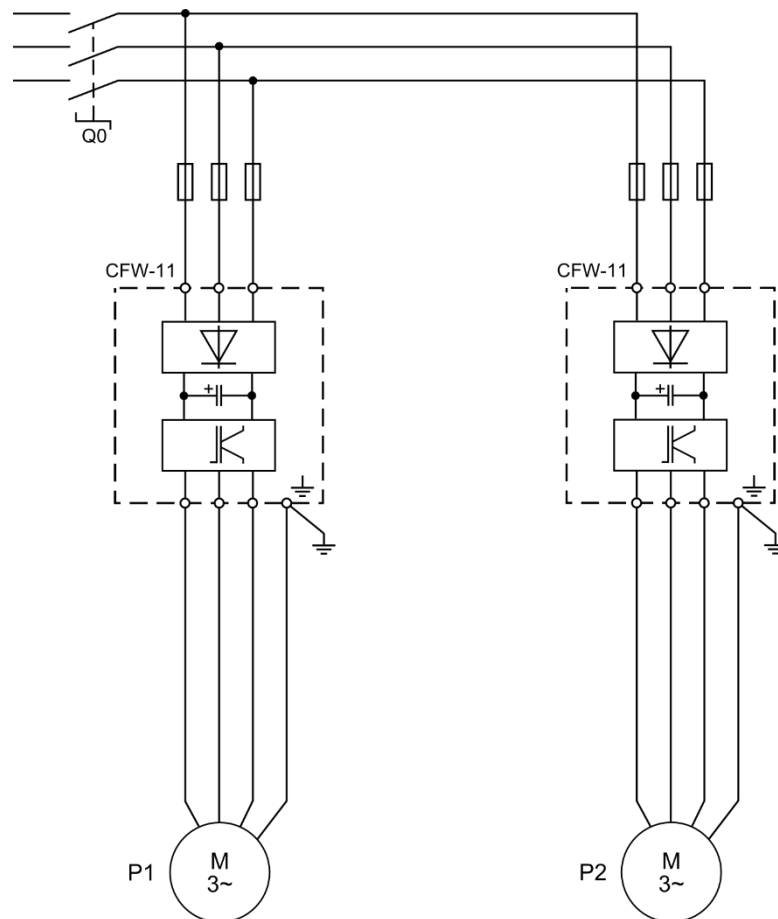


Figure 2.2– Power connections of the Pump Genius Multiplex application with two pumps in parallel

Where:

- Q0: Protection circuit breaker for the system power supply;
- P1 and P2: 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 Control Connections

The figure 2.3 and 2.4 presents the control connections (analog inputs/outputs, digital inputs/outputs), must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pump (Pump 1) and the slave pump (Pump 2); communication connections (SymbiNet network) at the RS485 interface accessory module terminal strip XC7 of the master/slave pump (Pump 1) and the slave pump (Pump 2).

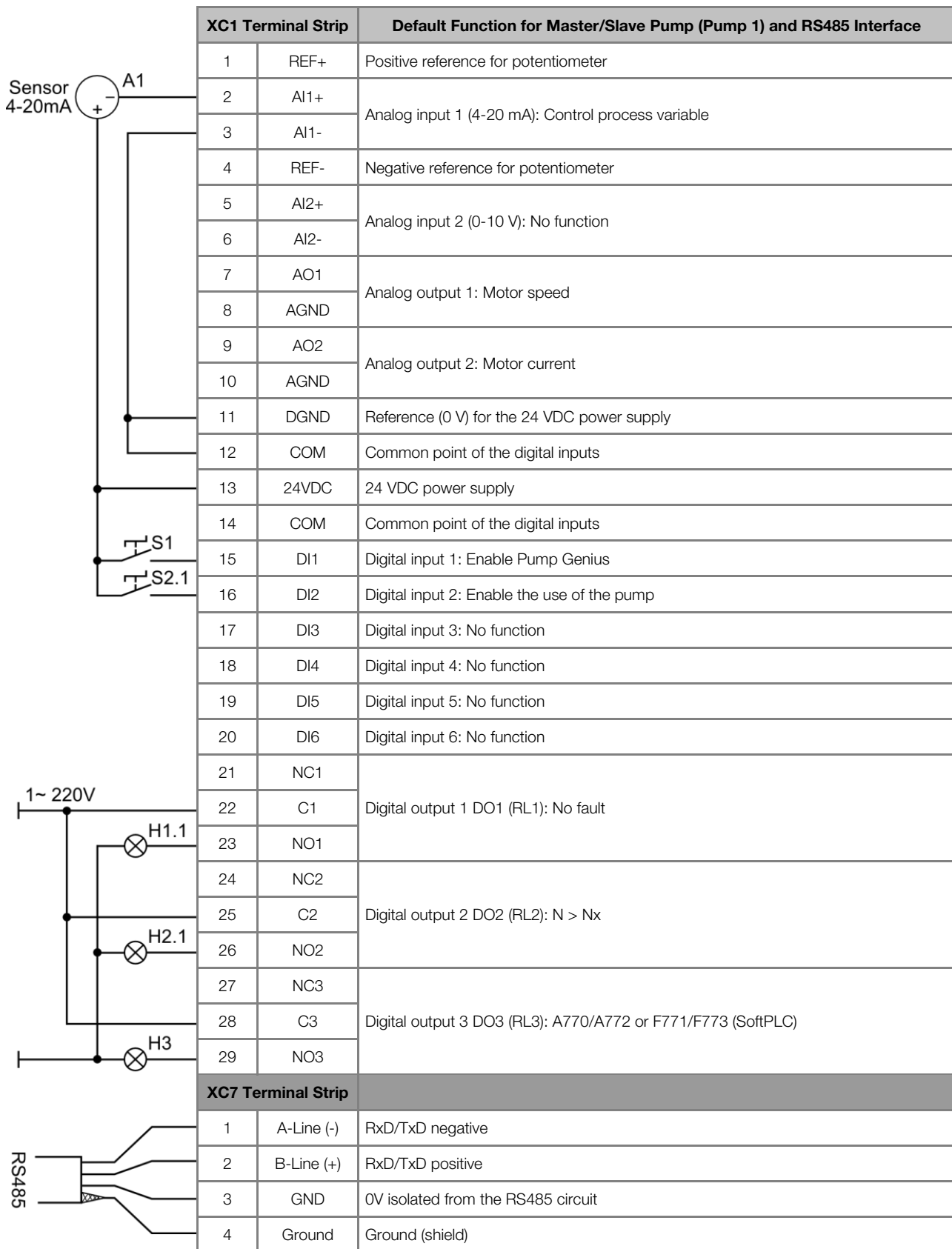


Figure 2.3 – Terminal strip XC1 and XC7 for master/slave pump (Pump 1) and RS485 interface

XC1 Terminal Strip		Default Function for Slave Pump (Pump 2) and RS485 Interface
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (0-10 V): No function
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: No function
16	DI2	Digital input 2: Enable the use of the pump
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 (RL1): No fault
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2 (RL2): N > Nx
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3 (RL3): No function
28	C3	
29	NO3	
XC7 Terminal Strip		
1	A-Line (-)	RxD/TxD negative
2	B-Line (+)	RxD/TxD positive
3	GND	0V isolated from the RS485 circuit
4	Ground	Ground (shield)

Figure 2.4 – Terminal strip XC1 and XC7 for slave pump (Pump 2) and RS485 interface



NOTE!

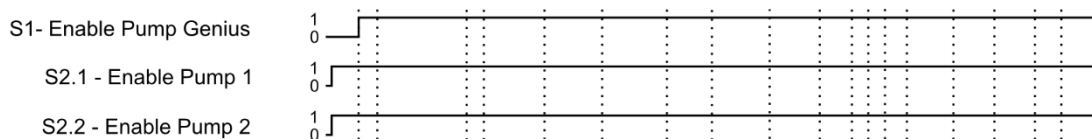
Refer to the CFW-11 inverter manual for more information on the connections.

Pump Genius Multiplex Configuration

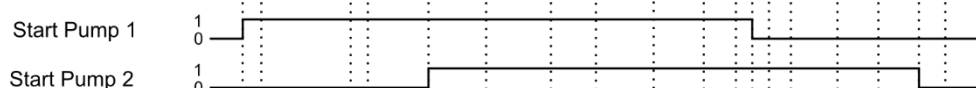
2.1.3 Operation Description

The figure 2.5 presents a timing analysis of the Pump Genius configured with two pumps in parallel being one master/slave pump (Pump 1) and one slave pump (Pump 2).

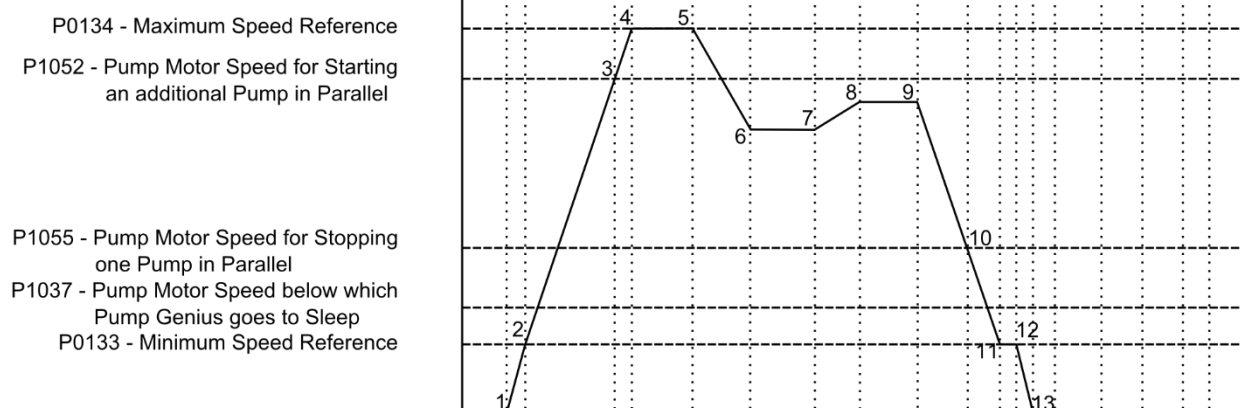
COMMANDS - DIGITAL INPUTS



COMMANDS - SYMBINET NETWORK



SPEED OF PUMP 1 (rpm)



SPEED OF PUMP 2 (rpm)

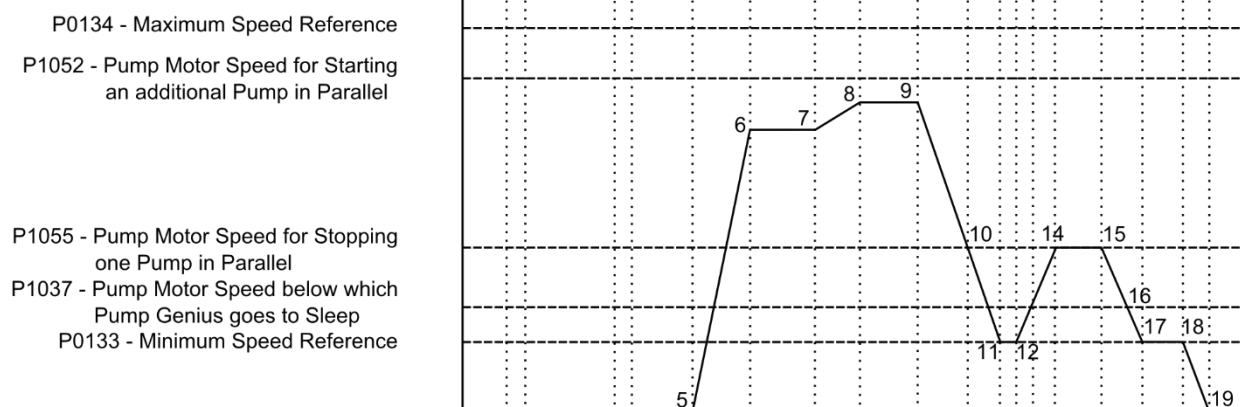


Figure 2.5 – Operation description of the Pump Genius Multiplex with two pumps in parallel

Pump Genius Multiplex Configuration

- 1 – The digital input DI1 is activated in order to enable the Pump Genius. It is verified if the control 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 control (pump 1 – master/slave) verify which pump have the lower operation time. Then, as the operation time of the pump 1 and pump 2 are equal, the pump 1 (highest priority) is started;
- 2 – The pump 1 is 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 1. 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;
- 4 – The pump 1 is accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;
- 5 – All processes continue as at time point 4, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, is done the command via SymbiNet network to start the pump 2;
- 6 – The pump 2 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 1 until the moment that both pumps operate at the same speed;
- 7 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;
- 8 – The PID controller increases the reference speed for the pump 1 and pump 2 and the two pumps are accelerated until the control process variable value becomes equal to the setpoint control required;
- 9 – Eventually, through the continued action of the PID controller, the pumping control achieves stabile operation at the control setpoint as required by the user.
- 10 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 1 and pump 2. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 11 – The pump 1 and pump 2 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;
- 12 – All processes continue as at time point 11, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 1 is running more time, is done the command via SymbiNet network to stop the pump 1;
- 13 – The pump 1 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 2;
- 14 – The PID controller increases the reference speed for the pump 2 until the control process variable value becomes equal to the setpoint control required;
- 15 – The PID controller can control the pumping, then the process variable begins to increase and is necessary to decrease the speed of the pump 2 to keep pumping controlled;
- 16 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 2. At this moment the pump motor speed exceeds the threshold value programmed to sleep (P1037), initiating the time count P1038;

Pump Genius Multiplex Configuration

17 – The pump 2 is decelerated to the minimum speed (P0133), the conditions to sleep remain active and the time (P1038) is awaited;

18 – All processes continue as at time point 17, until the time count (P1038) is elapsed. Then, the sleep mode is activated and it is done the command via SymbiNet network to stop the pump 2;

19 – The pump 2 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled; but the Pump Genius remains enabled, and the control process variable is monitored. If the value falls below the deviation of the control 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.

Pump Genius Multiplex Configuration

2.2 ONE MASTER/SLAVE PUMP WITH SLAVE PUMPS

The user can configure the Pump Genius Multiplex application to having up to five pumps in parallel, each pump being driven by its respective CFW-11 inverter. One pump will be a master/slave pump (one that performs the actions for pumping control) and the others pumps will be a slave pumps (receives commands from the master pump). The communication between the pumps is accomplished via RS485 or CAN interface, using the SymbiNet network protocol.

The pumping system to be presented in the sequence contains one master/slave pump, two slave pumps and communication done via RS485 interface, which basically comprises:

- 03 CFW-11 inverters + RS485 communication interface (D1, D2 and D3);
- 03 Electric motors and pumps (P1, P2 and P3);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Command for enabling the Pump Genius (S1);
- Command for enabling the use of the pump driven by CFW-11 inverter (S2.1, S2.2 and S2.3);
- Status light for inverter fault (H1.1, H1.2 and H1.3);
- Status light for motor running (H2.1, H2.2 and H2.3);
- Status light for low or high level protection for the control process variable (H3).

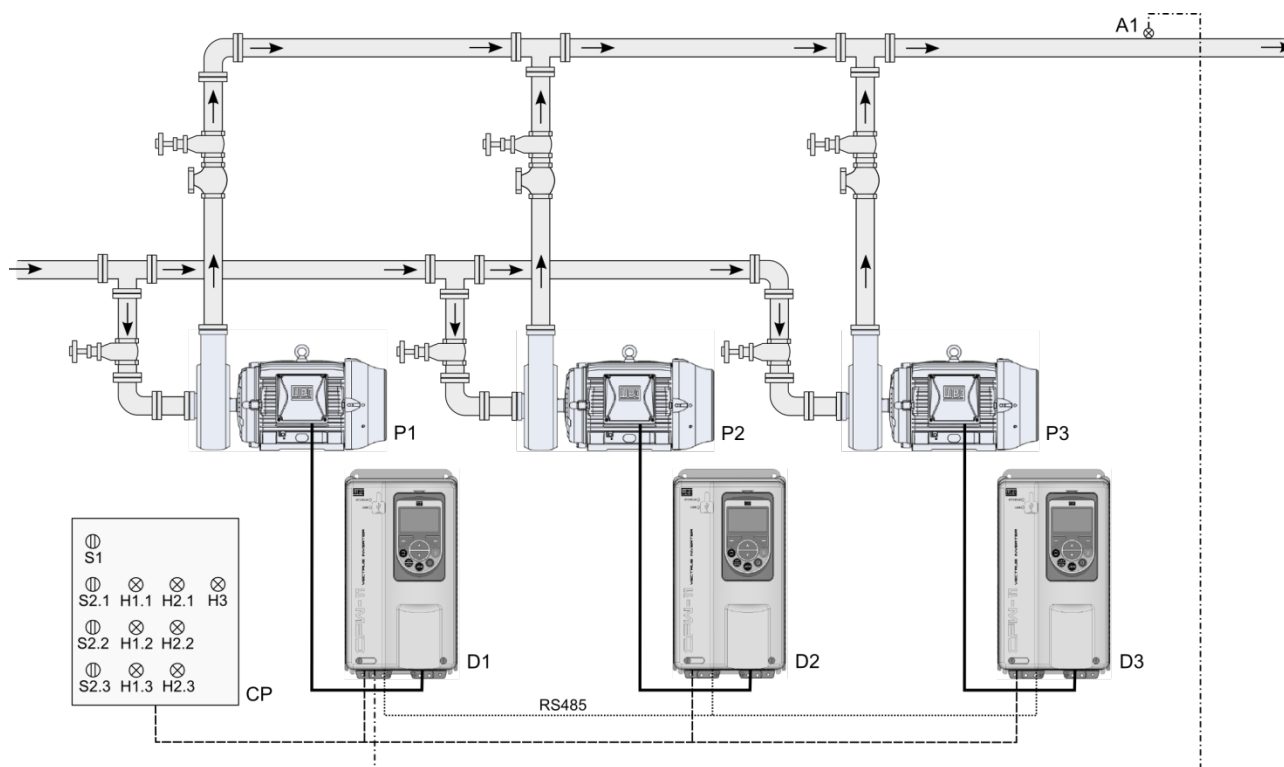


Figure 2.6 – Pump Genius Multiplex application with three pumps in parallel and RS485 communication interface



NOTE!

Using the **Master/Slave Pump** configuration wizard to configure the pump 1 and the **Slave Pump** configuration wizard to configure the pump 2 and pump 3 in this pumping system with three pumps in parallel and RS485 communication interface. See chapter 5 for more details on the configuration wizard.



NOTE!

The indicating lights H1.1, H1.2, H1.3, H2.1, H2.2, H2.3 and H3 are not necessary for the operation of the Pump Genius with three pumps in parallel and RS485 communication interface. They only indicate the condition of the pumps' operation at the command panel (CP).

2.2.1 Power Connections

The figure 2.7 presents the power connection diagram for a Pump Genius Multiplex application with three pumps in parallel.

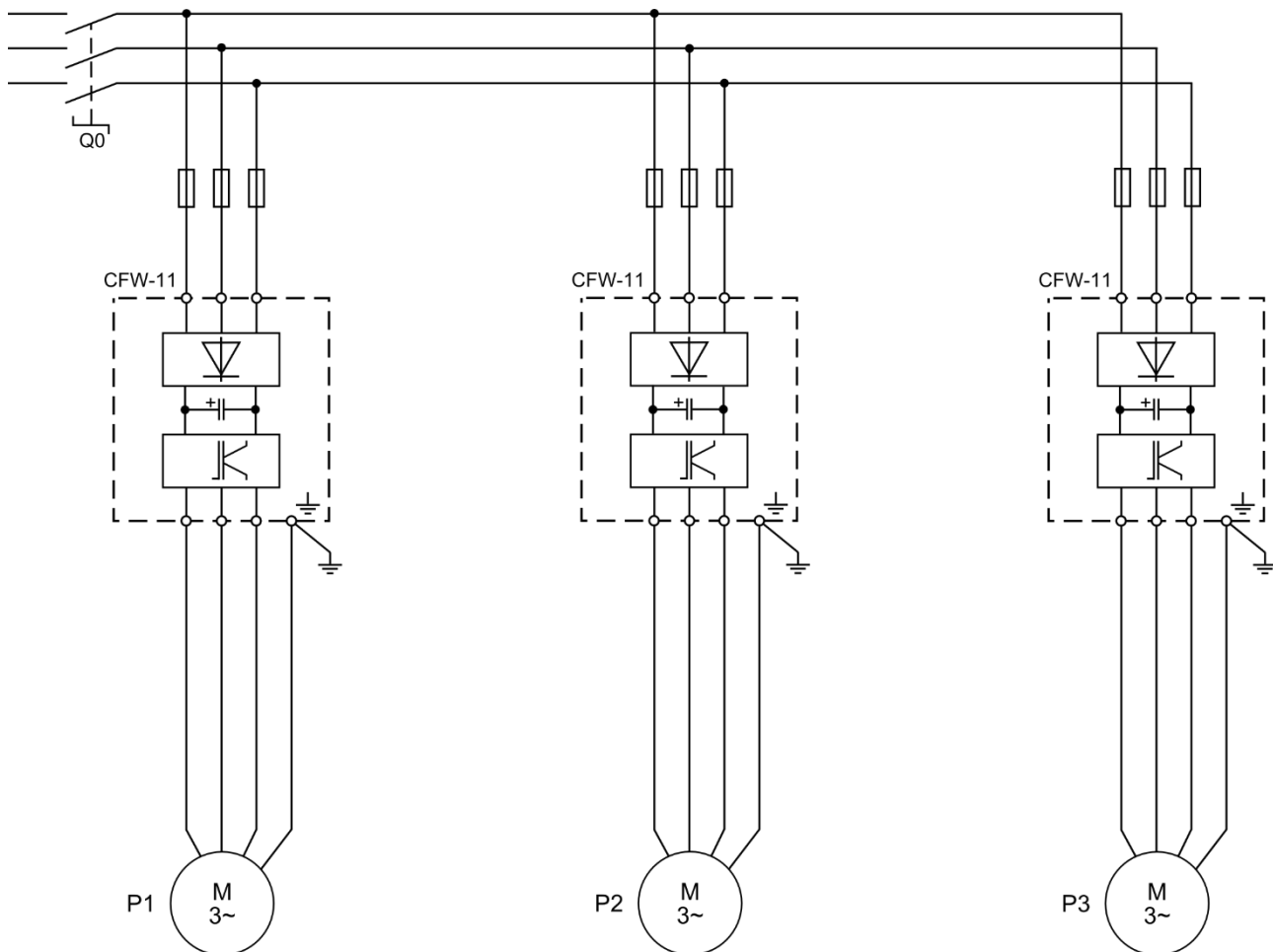


Figure 2.7– Power connections of the Pump Genius Multiplex application with three pumps in parallel

Where:

- Q0: Protection circuit breaker for the system power supply;
- P1, P2 and P3: 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 Control Connections

The figure 2.8, 2.9 and 2.10 presents the control connections (analog inputs/outputs, digital inputs/outputs), must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pump (Pump 1) and the slave pumps (Pump 2 and Pump 3); communication connections (SymbiNet network) at the RS485 interface accessory module terminal strip XC7 of the master/slave pump (Pump 1) and the slave pumps (Pump 2 and Pump 3).

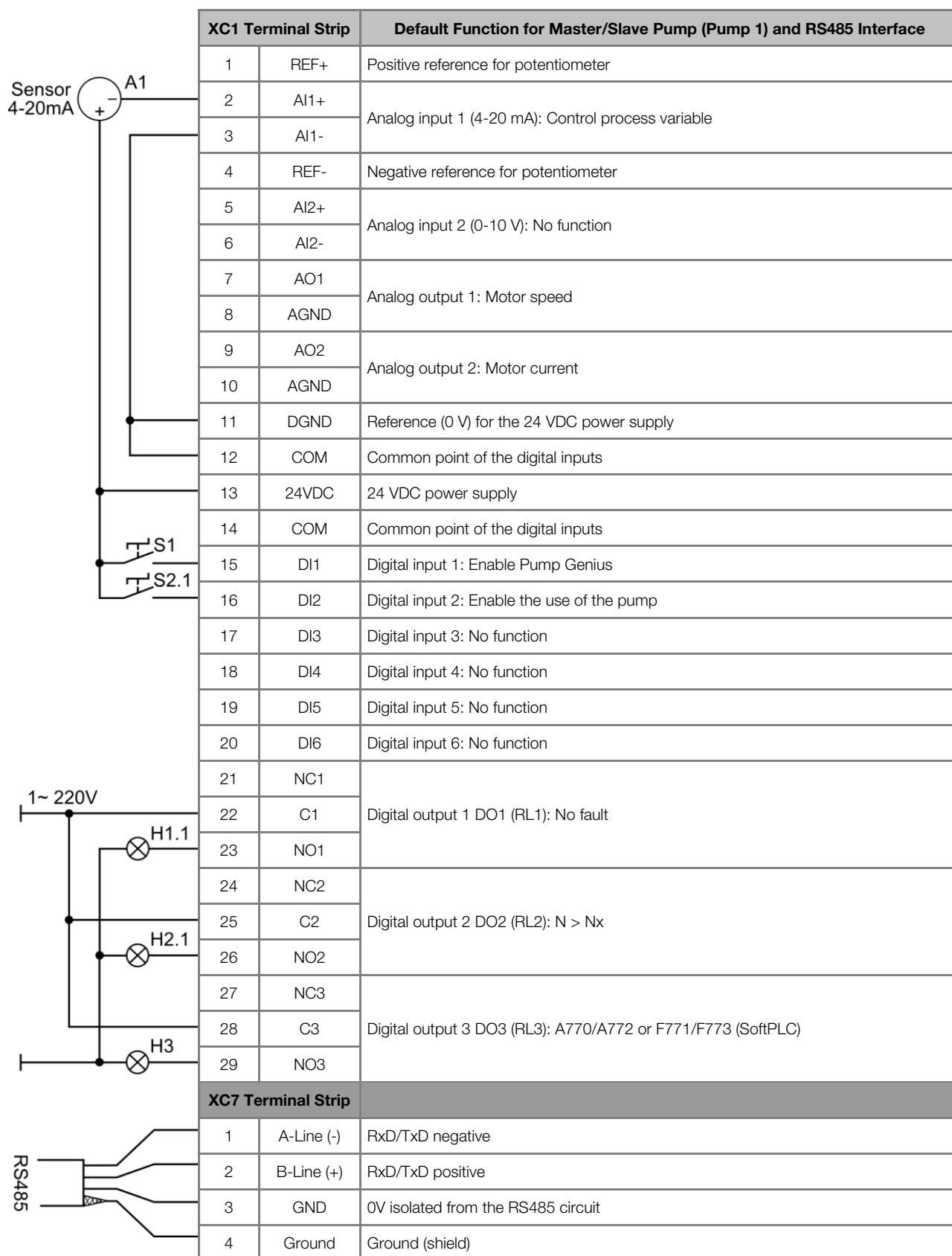


Figure 2.8 – Terminal strip XC1 and XC7 for master/slave pump (Pump 1) and RS485 interface

XC1 Terminal Strip		Default Function for Slave Pump (Pump 2) and RS485 Interface
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (0-10 V): No function
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: No function
16	DI2	Digital input 2: Enable the use of the pump
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 (RL1): No fault
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2 (RL2): N > Nx
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3 (RL3): No function
28	C3	
29	NO3	
XC7 Terminal Strip		
1	A-Line (-)	RxD/TxD negative
2	B-Line (+)	RxD/TxD positive
3	GND	0V isolated from the RS485 circuit
4	Ground	Ground (shield)

Figure 2.9 – Terminal strip XC1 and XC7 for slave pump (Pump 2) and RS485 interface

XC1 Terminal Strip		Default Function for Slave Pump (Pump 3) and RS485 Interface
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (0-10 V): No function
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: No function
16	DI2	Digital input 2: Enable the use of the pump
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 (RL1): No fault
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2 (RL2): N > Nx
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3 (RL3): No function
28	C3	
29	NO3	
XC7 Terminal Strip		
1	A-Line (-)	RxD/TxD negative
2	B-Line (+)	RxD/TxD positive
3	GND	0V isolated from the RS485 circuit
4	Ground	Ground (shield)

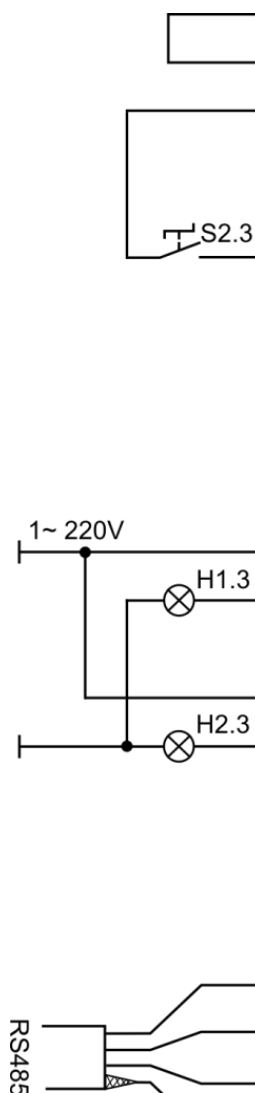


Figure 2.10 – Terminal strip XC1 and XC7 for slave pump (Pump 3) and RS485 interface



NOTE!

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

Pump Genius Multiplex Configuration

2.2.3 Operation Description

2.2.3.1 Starting the Pumps

The figure 2.11 presents the a timing analysis of the Pump Genius configured with three pumps in parallel being one master/slave (Pump 1) and two slaves (Pump 2 and Pump 3) in the process of starting the pumps.

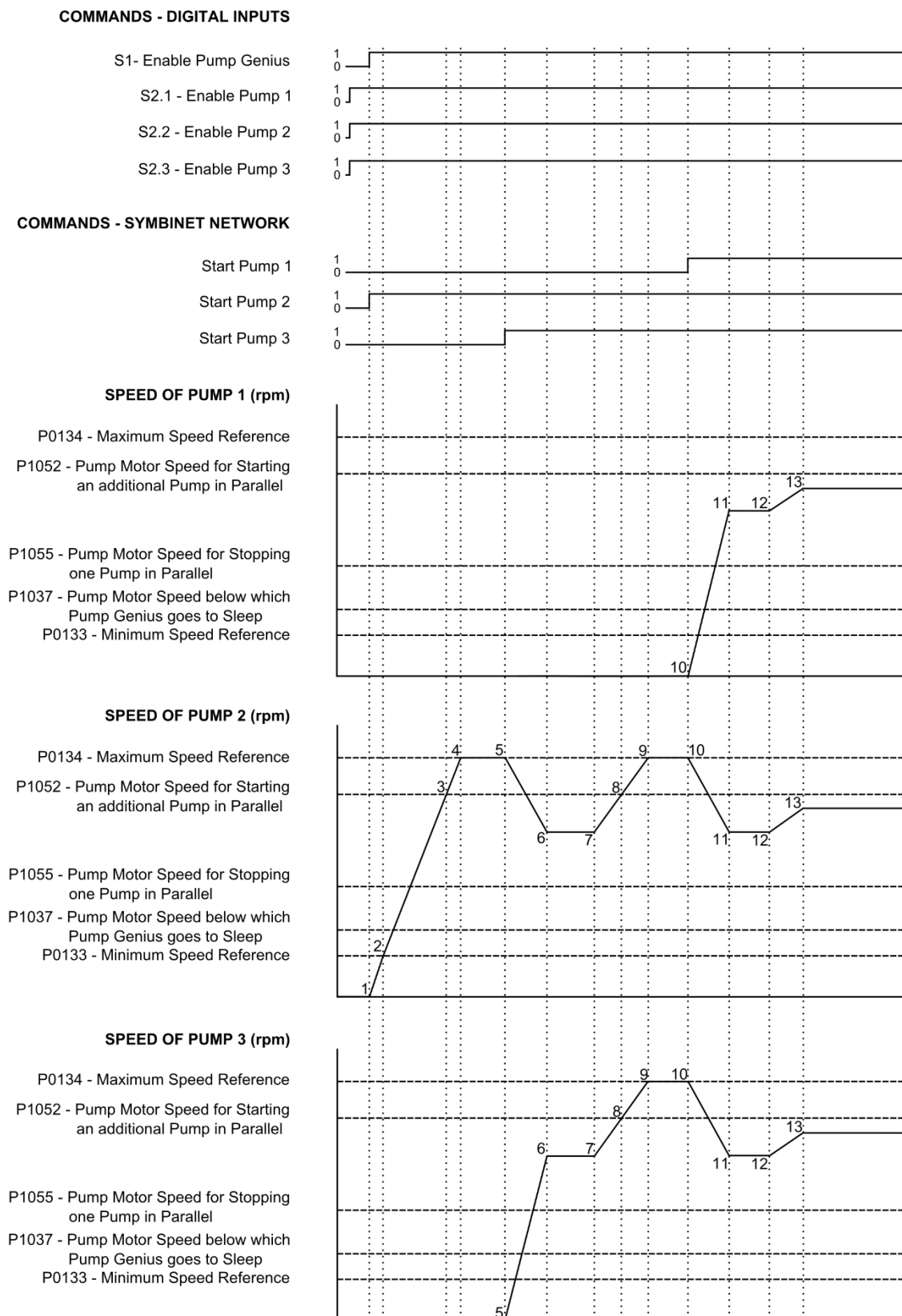


Figure 2.11 – Operation description of the Pump Genius Multiplex with three pumps in parallel

Pump Genius Multiplex Configuration

- 1 – The digital input DI1 is activated in order to enable the Pump Genius. It is verified if the control 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 control (pump 1 – master/slave) verify which pump have the lower operation time. Then, as the operation time of the pump 2 is lower than pump 1 and pump 3, the pump 2 is started;
- 2 – The pump 2 is 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 2. 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;
- 4 – The pump 2 is accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;
- 5 – All processes continue as at time point 4, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, as the operation time of the pump 3 is lower than pump 1, it is done the command via SymbiNet network to start the pump 3;
- 6 – The pump 3 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 2 until the moment that both pumps operate at the same speed;
- 7 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;
- 8 – At this moment the pumps 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;
- 9 – The pump 2 and pump 3 are accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;
- 10 – All processes continue as at time point 9, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, as the pump 2 and pump 3 are in running, it is done the command via SymbiNet network to start the pump 1;
- 11 – The pump 1 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 2 and pump 3 until the moment that both pumps operate at the same speed;
- 12 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;
- 13 – The PID controller increases the reference speed for the pump 1, pump 2 and pump 3 and the three pumps are accelerated until the control process variable value becomes equal to the setpoint control required.



NOTE!

Refer the chapter 3 for further details on the parameters.

Pump Genius Multiplex Configuration

2.2.3.2 Stopping the Pumps

The figure 2.12 presents the a timing analysis of the Pump Genius configured with three pumps in parallel being one master/slave (Pump 1) and two slaves (Pump 2 and Pump 3) in the process of stopping the pumps.

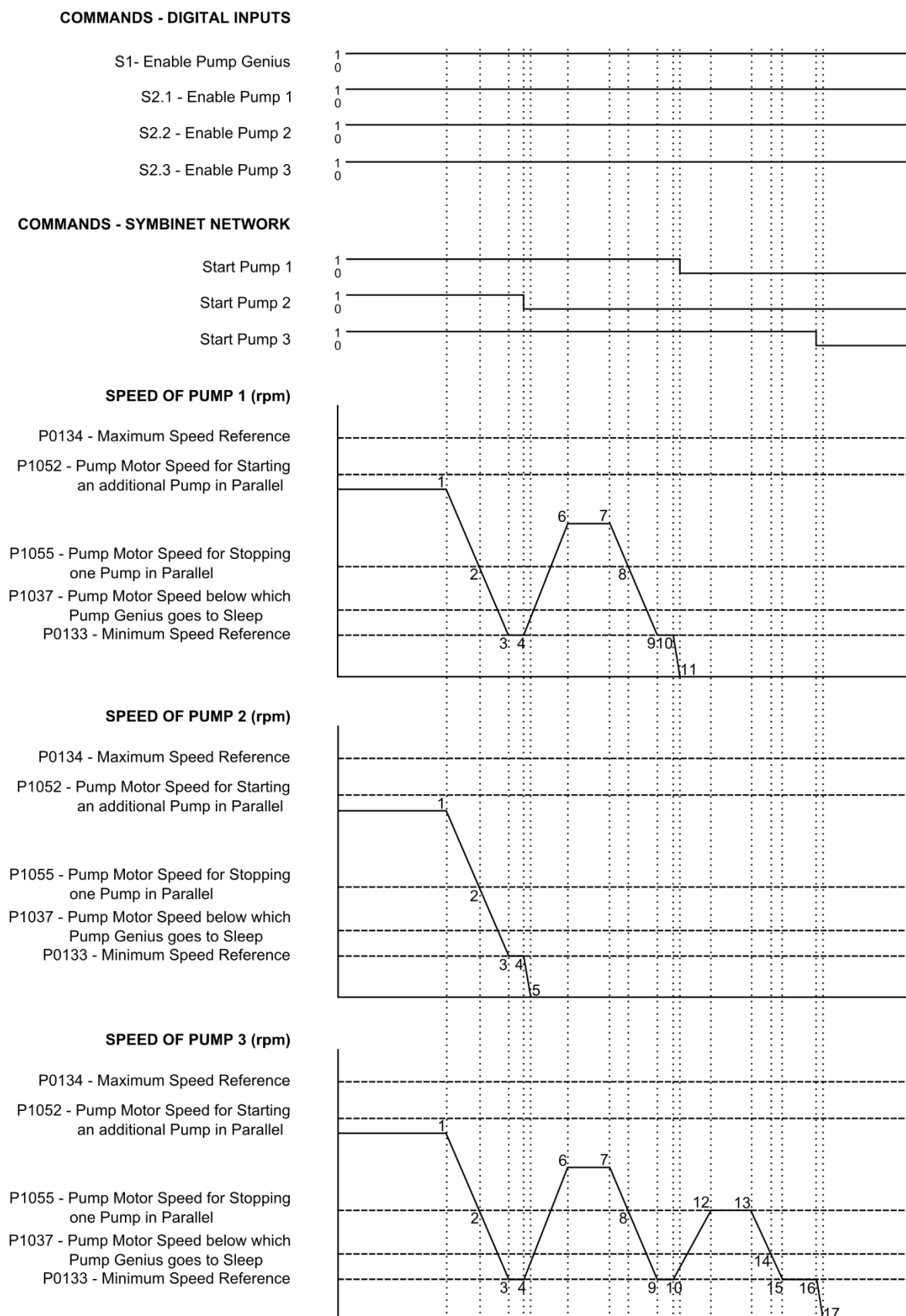


Figure 2.12 – Operation description of the Pump Genius Multiplex with three pumps in parallel

Pump Genius Multiplex Configuration

- 1 – The PID controller is controlling the pumping using the pump 1, pump 2 and pump 3. Then, the control process variable begins to increase and is necessary to decrease the speed of the pumps to keep pumping controlled;
- 2 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 1, pump 2 and pump 3. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 3 –The pump 1, pump 2 and pump 3 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;
- 4 – All processes continue as at time point 3, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 2 is running more time, is done the command via SymbiNet network to stop the pump 2;
- 5 – The pump 2 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 1 and pump 3;
- 6 – Eventually, with the continued action of the PID controller, the pumping control achieves stabile operation at the control setpoint as required by the user.
- 7 – The PID controller is controlling the pumping using the pump 1 and pump 3. Then, the control process variable begins to increase and is necessary to decrease the speed of the pumps to keep pumping controlled;
- 8 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 1 and pump 3. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 9 –The pump 1 and pump 3 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;
- 10 – All processes continue as at time point 9, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 1 is running more time, is done the command via SymbiNet network to stop the pump 1;
- 11 – The pump 1 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 3;
- 12 – The PID controller increases the reference speed for the pump 3 until the control process variable value becomes equal to the setpoint control required;
- 13 – The PID controller can control the pumping, then the control process variable begins to increase and is necessary to decrease the speed of the pump 3 to keep pumping controlled;
- 14 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 3. At this moment the pump motor speed exceeds the threshold value programmed to sleep (P1037), initiating the time count P1038;
- 15 – The pump 3 is decelerated to the minimum speed (P0133), the conditions to sleep remain active and the time (P1038) is awaited;
- 16 – All processes continue as at time point 15, until the time count (P1038) is elapsed. Then, the sleep mode is activated and it is done the command via SymbiNet network to stop the pump 3;

Pump Genius Multiplex Configuration

17 – The pump 3 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled; but the pumping control remains enabled, and the control process variable is monitored. If the value falls below the deviation of the control 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.

Pump Genius Multiplex Configuration

2.3 MASTER/SLAVE PUMPS WITH SLAVE PUMPS

The user can configure the Pump Genius Multiplex application to having up to five pumps in parallel, each pump being driven by its respective CFW-11 inverter. Some pumps will be master/slave pumps (one that performs the actions for pumping control) and the others pumps will be a slave pumps (receives commands from the master/slave pump). The communication between the pumps is accomplished via RS485 or CAN interface, using the SymbiNet network protocol.

The pumping system to be presented in the sequence contains two master/slave pumps, two slave pumps and communication done via CAN interface, which basically comprises:

- 04 CFW-11 inverters + CAN communication interface (D1, D2, D3 and D4);
- 04 Electric motors and pumps (P1, P2, P3 and P4);
- 02 Sensor with analog output signal for measurement of the control process variable (A1.1 and A1.3);
- Command for enabling the Pump Genius (S1);
- Command for enabling the use of the pump driven by CFW-11 inverter (S2.1, S2.2, S2.3 and S2.4);
- Status light for inverter fault (H1.1, H1.2, H1.3 and H1.4);
- Status light for motor running (H2.1, H2.2, H2.3 and H2.4);
- Status light for low or high level protection for the control process variable (H3.1 and H3.3).

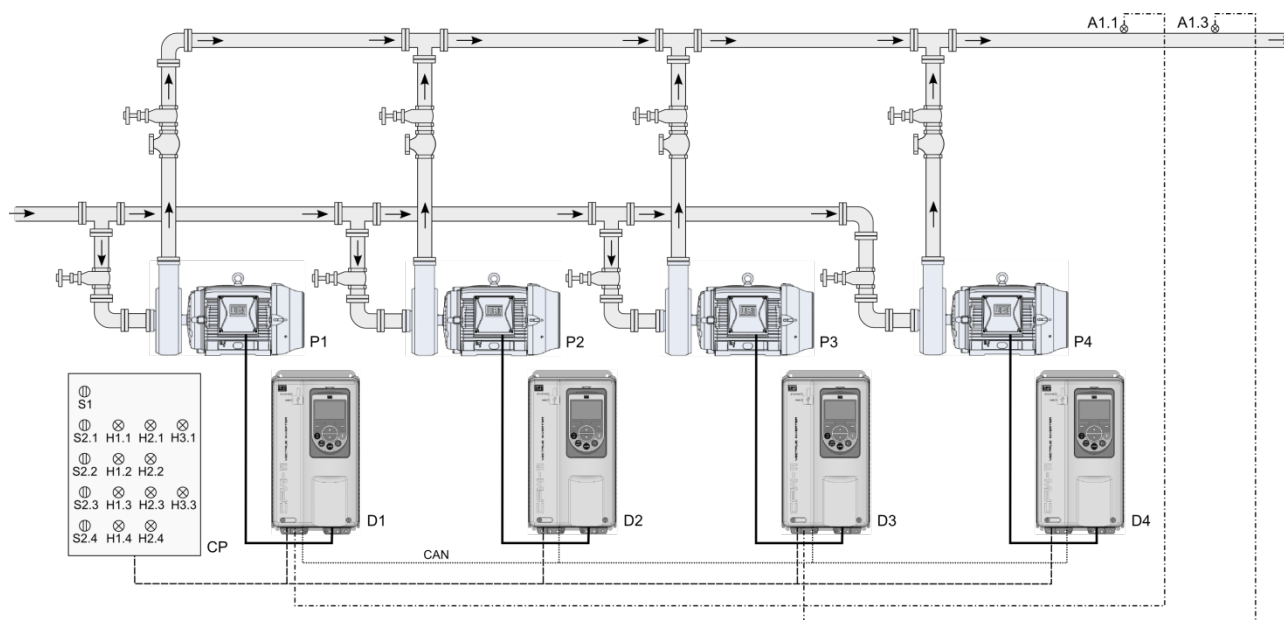


Figure 2.13 – Pump Genius Multiplex application with four pumps in parallel and CAN communication interface



NOTE!

Using the **Master/Slave Pump** configuration wizard to configure the pump 1 and pump 3, and the **Slave Pump** configuration wizard to configure the pump 2 and pump 4 in this pumping system with four pumps in parallel and CAN communication interface. See chapter 5 for more details on the configuration wizard.



NOTE!

The indicating lights H1.1, H1.2, H1.3, H1.4, H2.1, H2.2, H2.3, H2.4, H3.1 and H3.3 are not necessary for the operation of the Pump Genius Multiplex with four pumps in parallel and CAN communication interface. They only indicate the condition of the pumps' operation at the command panel (CP).

2.3.1 Power Connections

The figure 2.14 presents the power connection diagram for a Pump Genius Multiplex application with four pumps in parallel.

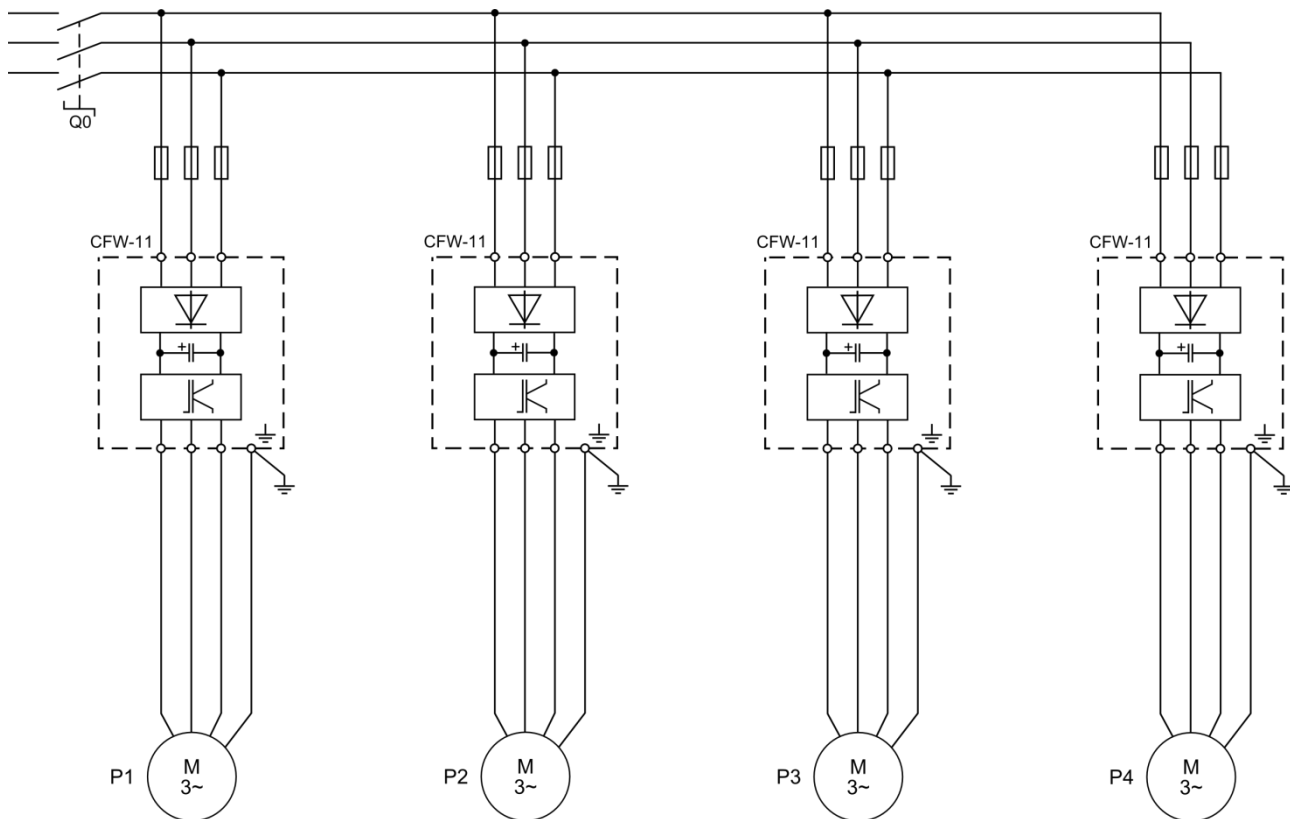


Figure 2.14– Power connections of the Pump Genius Multiplex application with four pumps in parallel

Where:

- Q0: Protection circuit breaker for the system power supply;
- P1, P2, P3 and P4: 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.

2.3.2 Control Connections

The figure 2.15, 2.16, 2.17 and 2.18 presents the control connections (analog inputs/outputs, digital inputs/outputs), must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pumps (Pump 1 and Pump 3) and the slave pumps (Pump 2 and Pump 4); communication connections (SymbiNet network) at the CAN interface accessory module terminal strip XC5 of the master/slave pumps (Pump 1 and Pump 3) and the slave pumps (Pump 2 and Pump 4).

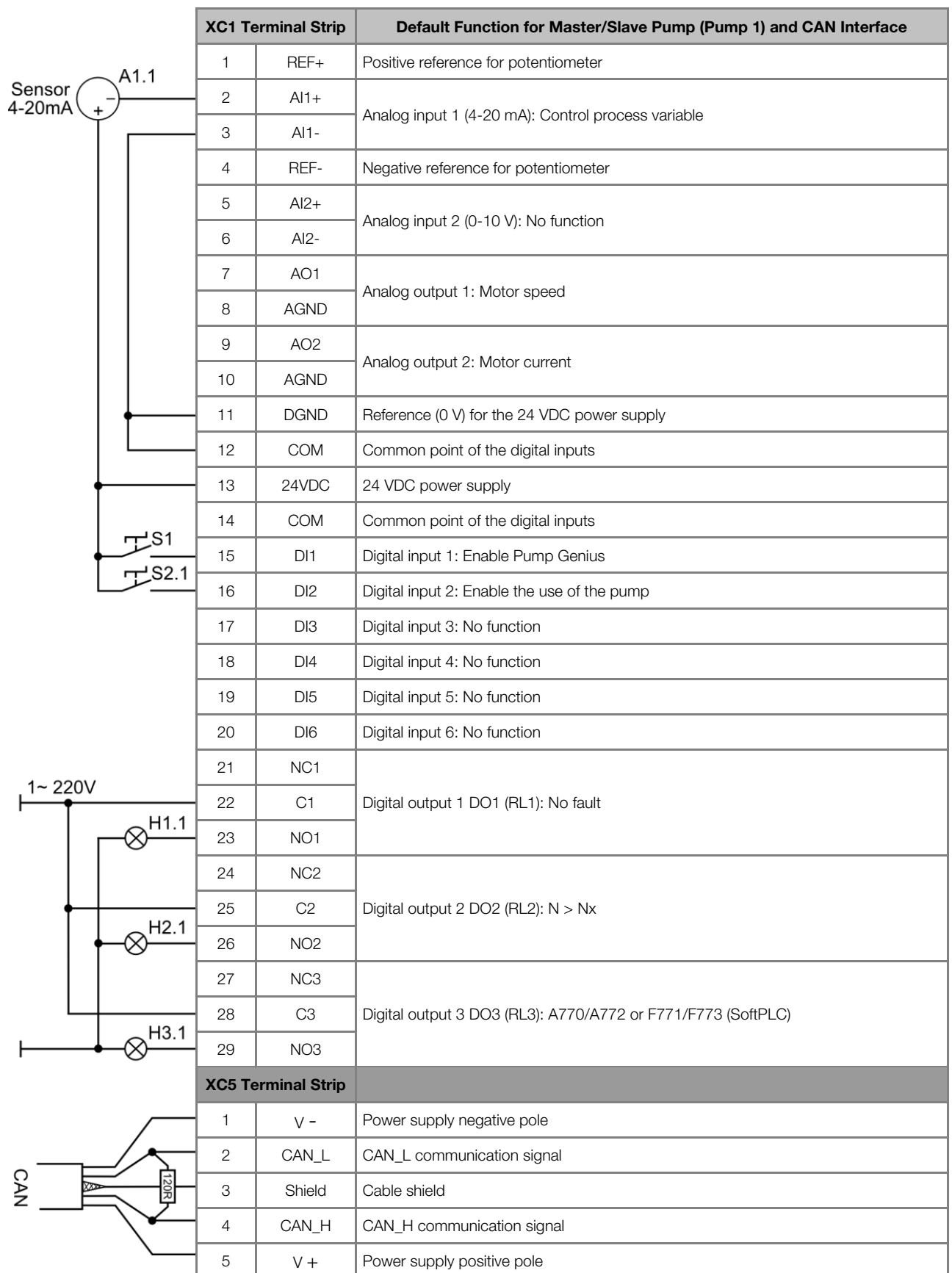


Figure 2.15 – Terminal strip XC1 and XC5 for master/slave pump (Pump 1) and CAN interface

XC1 Terminal Strip		Default Function for Slave Pump (Pump 2) and CAN Interface
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (0-10 V): No function
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: No function
16	DI2	Digital input 2: Enable the use of the pump
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 (RL1): No fault
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2 (RL2): N > Nx
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3 (RL3): No function
28	C3	
29	NO3	
XC5 Terminal Strip		
1	V -	Power supply negative pole
2	CAN_L	CAN_L communication signal
3	Shield	Cable shield
4	CAN_H	CAN_H communication signal
5	V +	Power supply positive pole

Figure 2.16 – Terminal strip XC1 and XC5 for slave pump (Pump 2) and CAN interface

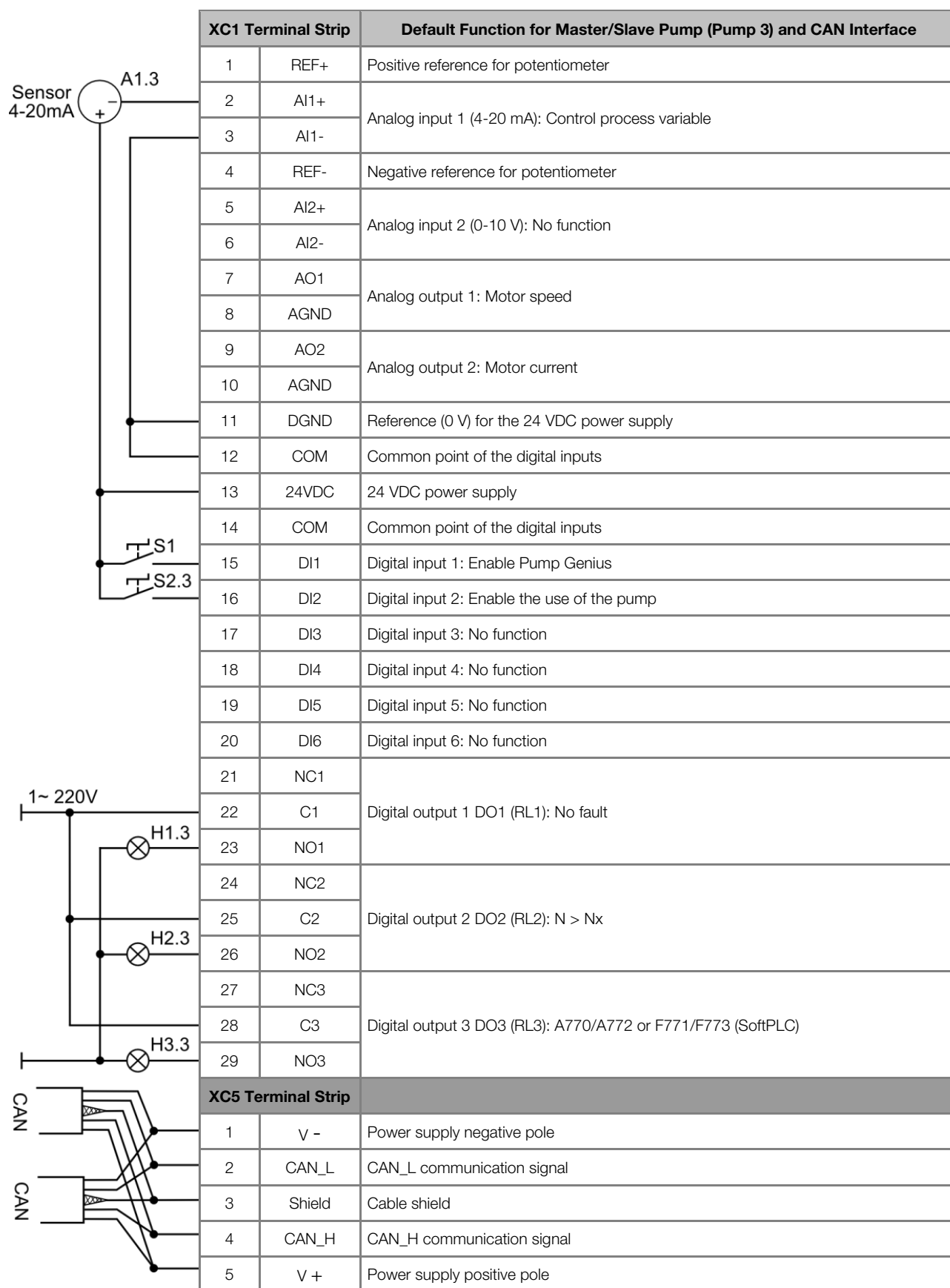


Figure 2.17 – Terminal strip XC1 and XC5 for master/slave pump (Pump 3) and CAN interface

XC1 Terminal Strip		Default Function for Slave Pump (Pump 4) and CAN Interface
1	REF+	Positive reference for potentiometer
2	AI1+	Analog input 1 (0-10 V): No function
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: No function
16	DI2	Digital input 2: Enable the use of the pump
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 (RL1): No fault
22	C1	
23	NO1	
24	NC2	Digital output 2 DO2 (RL2): N > Nx
25	C2	
26	NO2	
27	NC3	Digital output 3 DO3 (RL3): No function
28	C3	
29	NO3	
XC5 Terminal Strip		
1	V -	Power supply negative pole
2	CAN_L	CAN_L communication signal
3	Shield	Cable shield
4	CAN_H	CAN_H communication signal
5	V +	Power supply positive pole

Figure 2.18 – Terminal strip XC1 and XC5 for slave pump (Pump 4) and CAN interface



NOTE!

Please pay attention to ground the 0V of the 24V power supply and the shield of the CAN network cable for the proper functioning of the communication between the CFW-11 inverters. Refer to the CFW-11 inverter manual for more information on the connections.

2.3.3 Operation Description

2.3.3.1 Starting the Pumps

The figure 2.19 presents the a timing analysis of the Pump Genius configured with four pumps in parallel being two master/slave (Pump 1 and Pump 3) and two slaves (Pump 2 and Pump 4) in the process of starting the pumps.

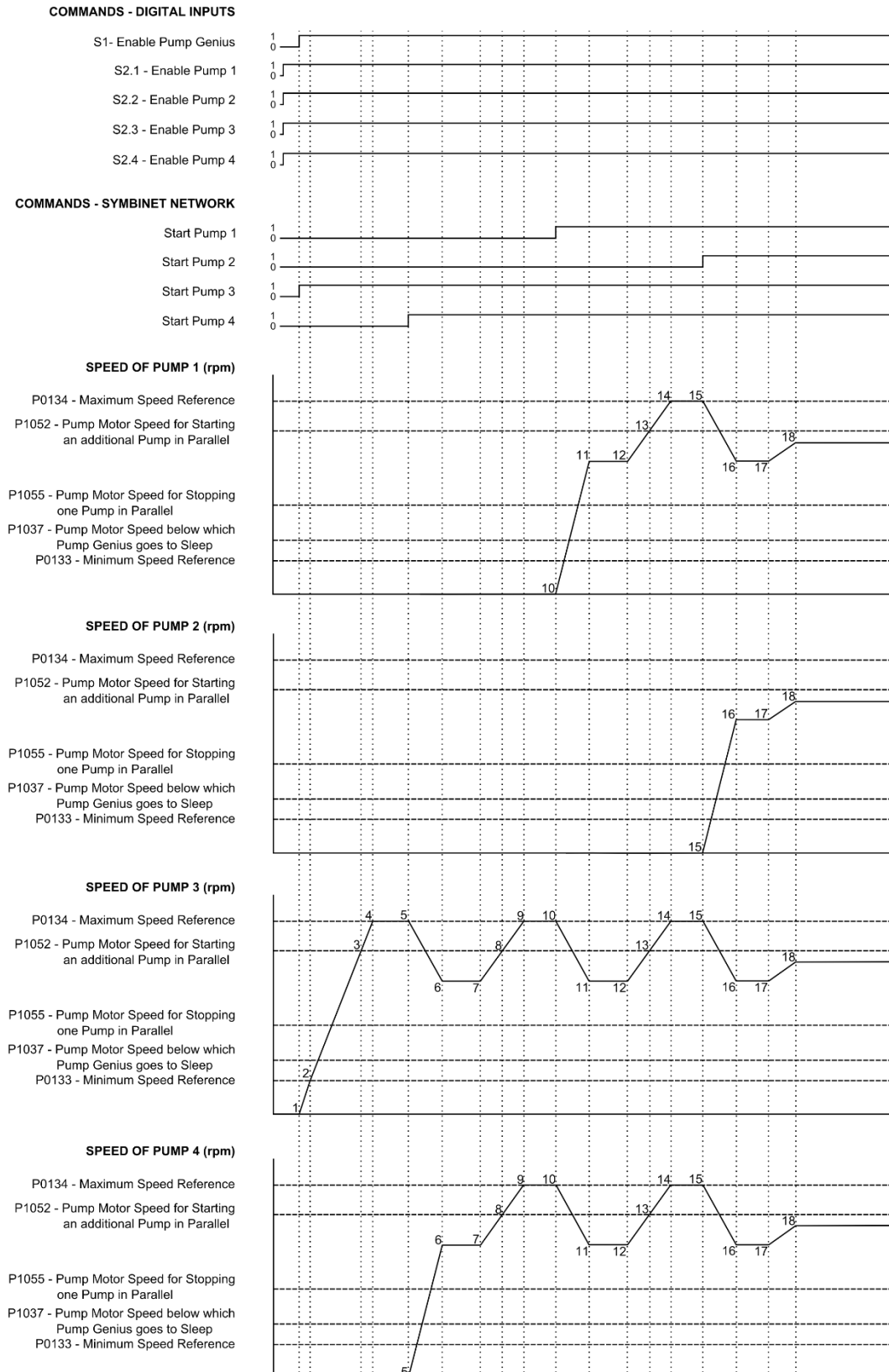


Figure 2.19 – Operation description of the Pump Genius with four pumps in parallel

Pump Genius Multiplex Configuration

1 – Because of having two master/slave pumps, first it is necessary that one of the two pumps (Pump 1 or Pump 3) assume the master function of the Pump Genius. This is done in the power-on of the CFW-11 inverter, and assuming that all inverters are energized at the same time, the pump 1 will assume the master function due to having higher priority. The digital input DI1 is activated in order to enable the Pump Genius. It is verified (by pump 1) if the control 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 control (pump 1 – master/slave) verify which pump have the lower operation time. Then, as the operation time of the pump 3 is lower than pump 1, pump 2 and pump 4, the pump 3 is started;

2 – The pump 3 is 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 3. 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;

4 – The pump 3 is accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;

5 – All processes continue as at time point 4, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, as the operation time of the pump 4 is lower than pump 1 and pump 2, it is done the command via SymbiNet network to start the pump 4;

6 – The pump 4 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 3 until the moment that both pumps operate at the same speed;

7 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;

8 – At this moment the pumps 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;

9 – The pump 3 and pump 4 are accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;

10 – All processes continue as at time point 9, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, as the operation time of the pump 1 is lower than pump 2, it is done the command via SymbiNet network to start the pump 1;

11 – The pump 1 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 3 and pump 4 until the moment that both pumps operate at the same speed;

12 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;

13 – At this moment the pumps 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;

14 – The pump 1, pump 3 and pump 4 are accelerated to the maximum speed (P0134), the conditions for starting an additional pump in parallel (P1052 and P1053) remain actives and the time (P1054) is awaited;

Pump Genius Multiplex Configuration

15 – All processes continue as at time point 14, until the time count (P1054) has elapsed. At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network. Then, as the pump 1, pump 3 and pump 4 are in running, it is done the command via SymbiNet network to start the pump 2;

16 – The pump 2 is accelerated to the speed reference from the PID controller as the acceleration ramp set in the P0100 parameter. Then, the control process variable begins to increase due to the addition of another pump; the PID controller begins to decrease the speed reference for the pump 1, pump 3 and pump 4 until the moment that both pumps operate at the same speed;

17 – The PID controller can control the pumping, then the control process variable begins to decrease and is necessary to increase the speed of the pumps to keep pumping controlled;

18 – The PID controller increases the reference speed for the pump 1, pump 2, pump 3 and pump 4 and the four pumps are accelerated until the control process variable value becomes equal to the setpoint control required.



NOTE!

Refer the chapter 3 for further details on the parameters.

Pump Genius Multiplex Configuration

2.3.3.2 Stopping the Pumps

The figure 2.20 presents the a timing analysis of the Pump Genius configured with four pumps in parallel being two master/slave (Pump 1 and Pump 3) and two slaves (Pump 2 and Pump 4) in the process of stopping the pumps.

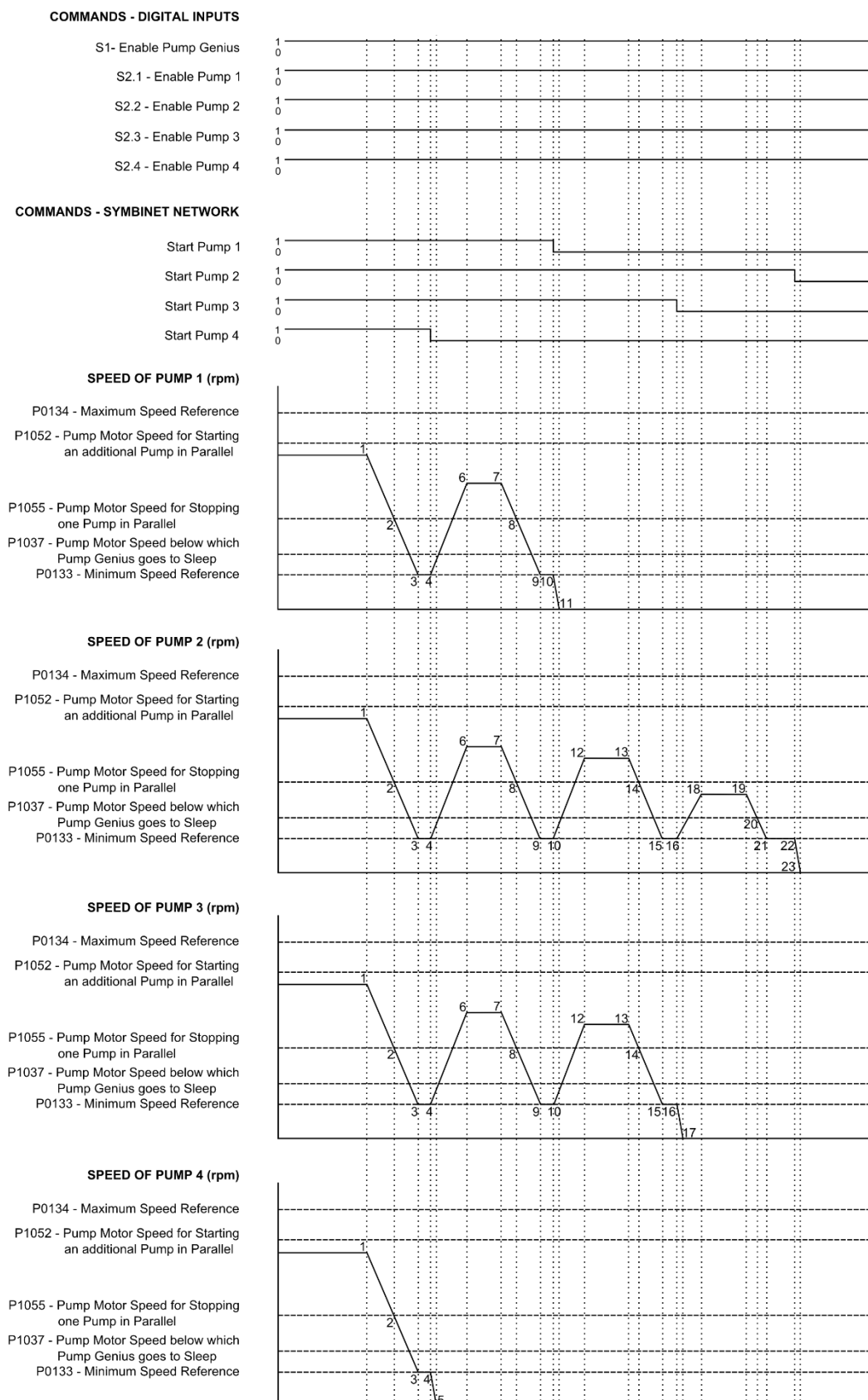


Figure 2.20 – Operation description of the Pump Genius Multiplex with four pumps in parallel

Pump Genius Multiplex Configuration

- 1 – The PID controller is controlling the pumping using the pump 1, pump 2, pump 3 and pump 4. Then, the control process variable begins to increase and is necessary to decrease the speed of the pumps to keep pumping controlled;
- 2 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 1, pump 2, pump 3 and pump 4. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 3 –The pump 1, pump 2, pump 3 and pump 4 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;
- 4 – All processes continue as at time point 3, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 4 is running more time, is done the command via SymbiNet network to stop the pump 4;
- 5 – The pump 4 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 1, pump 2 and pump 3;
- 6 – Eventually, with the continued action of the PID controller, the pumping control achieves stabile operation at the control setpoint as required by the user.
- 7 – The PID controller is controlling the pumping using the pump 1, pump 2 and pump 3. Then, the control process variable begins to increase and is necessary to decrease the speed of the pumps to keep pumping controlled;
- 8 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 1, pump 2 and pump 3. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 9 –The pump 1, pump 2 and pump 3 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;
- 10 – All processes continue as at time point 9, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 1 is running more time, is done the command via SymbiNet network to stop the pump 1;
- 11 – The pump 1 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 2 and pump 3;
- 12 – Eventually, with the continued action of the PID controller, the pumping control achieves stabile operation at the control setpoint as required by the user.
- 13 – The PID controller is controlling the pumping using the pump 2 and pump 3. Then, the control process variable begins to increase and is necessary to decrease the speed of the pumps to keep pumping controlled;
- 14 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 2 and pump 3. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (P1055) and the deviation from the control setpoint exceeds the threshold programmed for stopping one pump (P1056), initiating the time count P1057;
- 15 –The pump 2 and pump 3 are decelerated to the minimum speed (P0133), the conditions for stopping one pump in parallel (P1055 and P1056) remain actives and the time (P1057) is awaited;

Pump Genius Multiplex Configuration

16 – All processes continue as at time point 15, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped. As the pump 3 is running more time, is done the command via SymbiNet network to stop the pump 3;

17 – The pump 3 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled, i.e., one of the parallel pumps was successfully stopped. At this moment the control process variable reaches the control setpoint required by the user and the PID controller responds and accelerates the pump 2;

18 – The PID controller increases the reference speed for the pump 2 until the control process variable value becomes equal to the setpoint control required;

19 – The PID controller can control the pumping, then the control process variable begins to increase and is necessary to decrease the speed of the pump 2 to keep pumping controlled;

20 – According to the control setpoint and the control process variable, the PID controller responds and decelerates the pump 2. At this moment the pump motor speed exceeds the threshold value programmed to sleep (P1037), initiating the time count P1038;

21 – The pump 2 is decelerated to the minimum speed (P0133), the conditions to sleep remain active and the time (P1038) is awaited;

22 – All processes continue as at time point 21, until the time count (P1038) is elapsed. Then, the sleep mode is activated and it is done the command via SymbiNet network to stop the pump 2;

23 – The pump 2 is decelerated to the zero speed as the deceleration ramp set in the P0101 parameter and then is disabled; but the pumping control remains enabled, and the control process variable is monitored. If the value falls below the deviation of the control 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.

2.4 OTHER CONFIGURATIONS

2.4.1 Control Setpoint via HMI

The user can configure the Pump Genius Multiplex application so as to have the control setpoint adjusted via HMI of the CFW-11 inverter. The figure 2.21 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pumps in order to use the control setpoint via HMI.

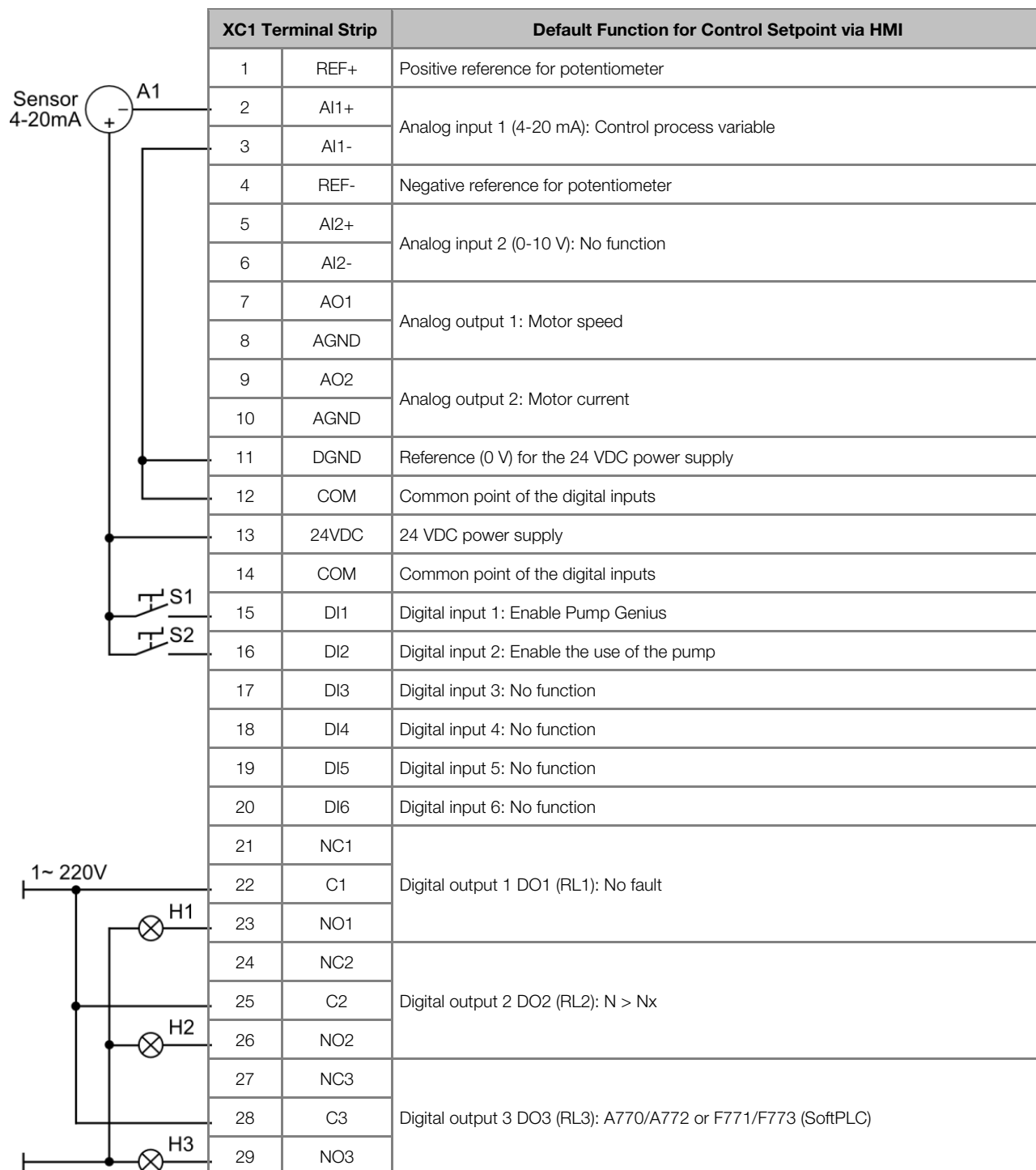


Figure 2.21 – Terminal strip XC1 for control setpoint via HMI



NOTE!

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

2.4.2 Control Setpoint via Logical Combination of Digital Inputs

The user can configure the Pump Genius Multiplex application so as to have the control setpoint adjusted via logical combination of digital inputs DI4 and DI5. The figure 2.22 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pumps in order to use the control setpoint via logical combination of digital inputs DI4 and DI5.

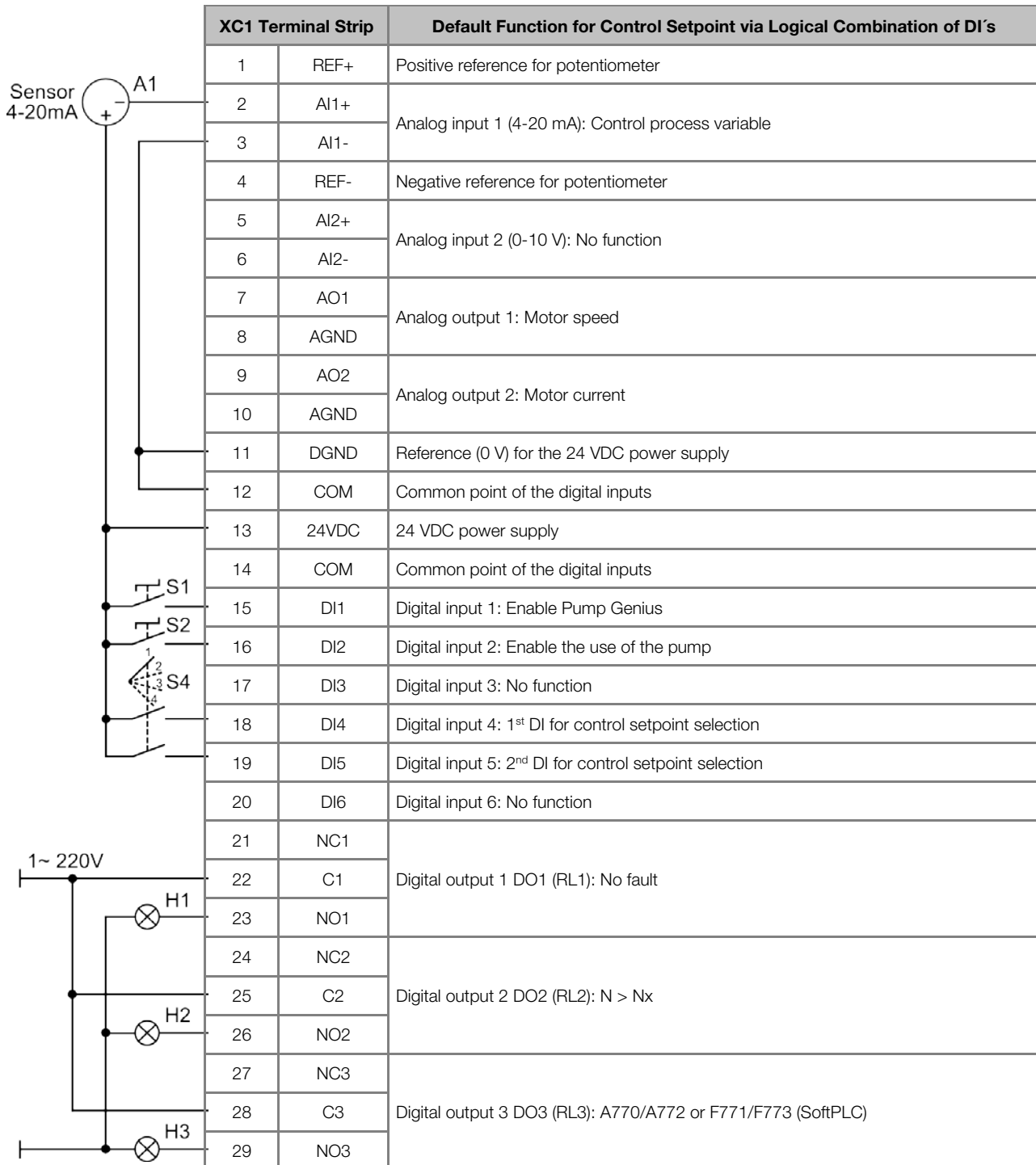


Figure 2.22 – Terminal strip XC1 for control setpoint via logical combination of digital inputs



NOTE!

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

2.4.3 Control Setpoint via Analog Input

The user can configure the Pump Genius Multiplex application so as to have the control setpoint adjusted via one analog input of the CFW-11 inverter. The figure 2.23 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pumps in order to use the control setpoint via analog input.

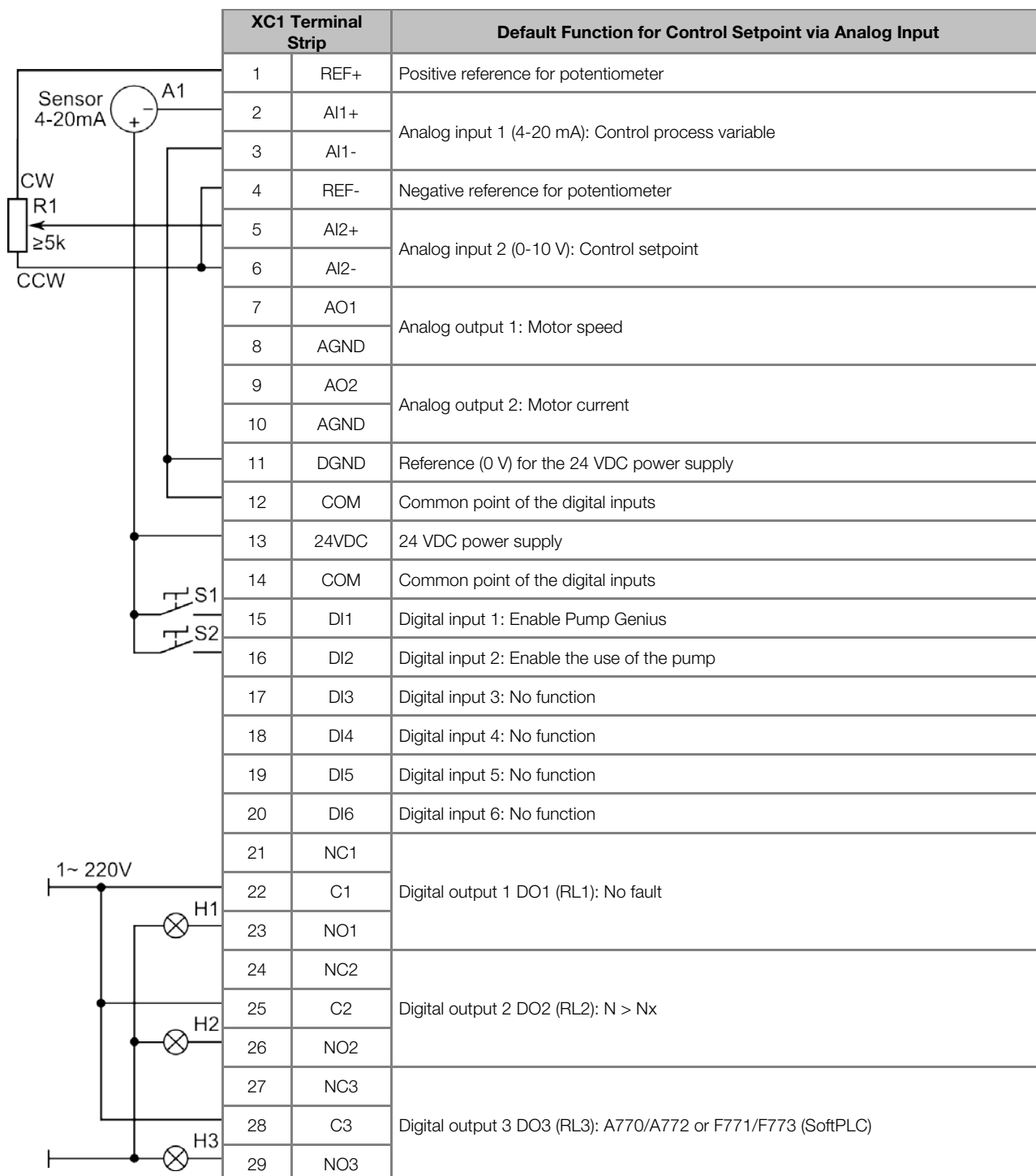


Figure 2.23 – Terminal strip XC1 for control setpoint via analog input



NOTE!

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

Pump Genius Multiplex Configuration

2.4.4 Pump Protection via External Sensor

The user can configure the Pump Genius Multiplex application so as to have the external sensor installed on the digital input DI6 for pump protection. The figure 2.24 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave or slave pumps in order to use the external sensor for pump protection.

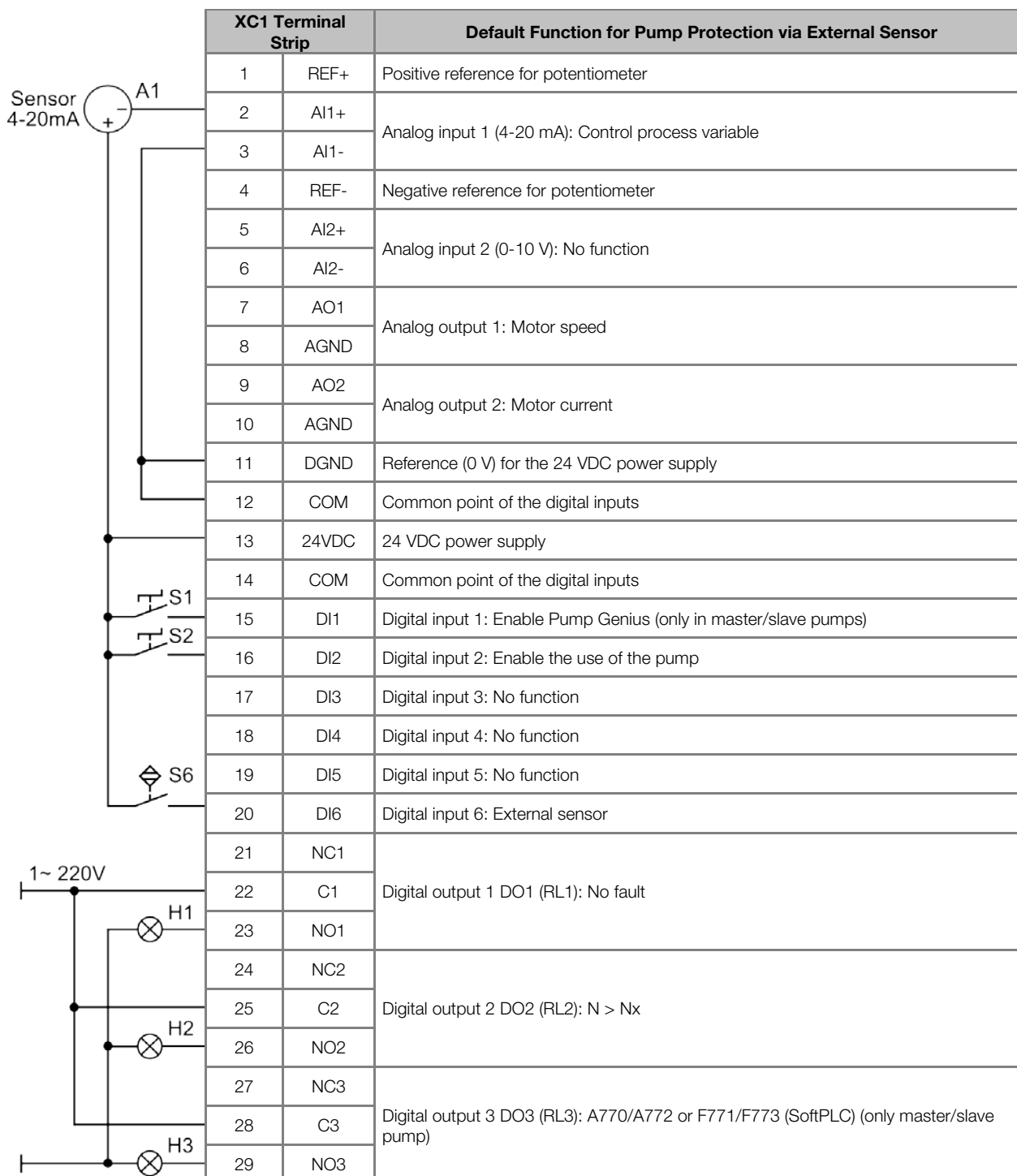


Figure 2.24 – Terminal strip XC1 for pump protection via external sensor



NOTE!

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

Pump Genius Multiplex Configuration

2.4.5 Pump Protection via Control Auxiliary Variable

The user can configure the Pump Genius Multiplex application so as to have an auxiliary sensor with analog output signal for measure the control auxiliary variable for pump protection. The figure 2.25 presents the minimum control connections (analog inputs/outputs, digital inputs/outputs) that must be made at the CC11 control boards terminal strip XC1 of the CFW-11 inverters of the master/slave pumps in order to use the control auxiliary variable for pump protection.

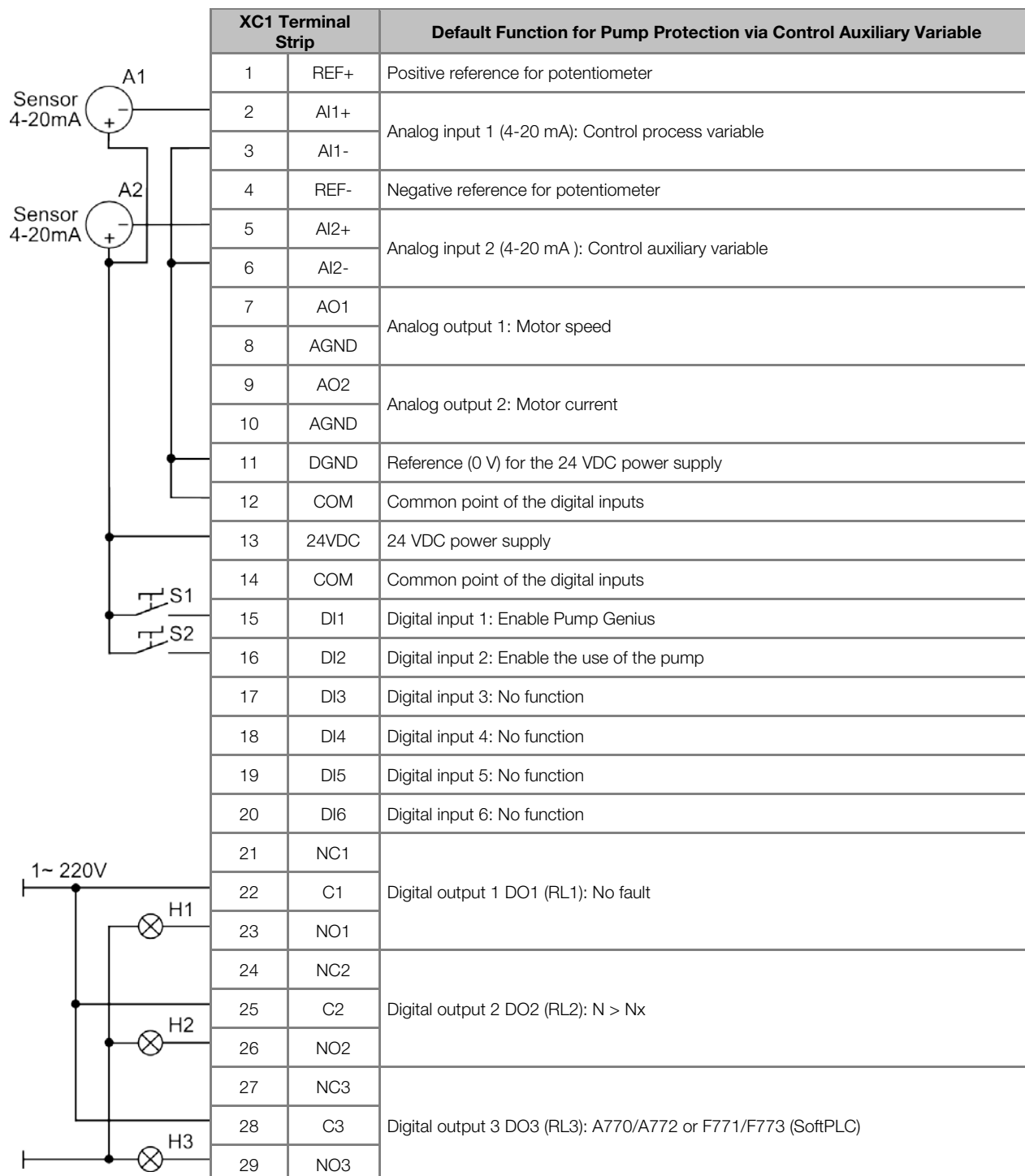


Figure 2.25 – Terminal strip XC1 for pump protection via control auxiliary variable



NOTE!

Refer to the CFW-11 inverter manual 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 Multiplex application will be presented next.



NOTE!

The Pump Genius Multiplex 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 Multiplex application. Refer to the CFW-11 programming manual for more details on the parameters.

Symbols for property description:

CAN	Parameter visible on the HMI if the inverter has CAN interface installed
CFG	Configuration parameter, value can be programmed only with motor stopped
Net	Parameter visible on the HMI if the inverter has any network interface installed - RS232, RS485, CAN, Anybus-CC, Profibus – or if USB interface was connected
RO	Read-only parameter
RW	Read and write parameter
Serial	Parameter visible on the HMI if the inverter has RS232 or RS485 interface installed
Snet	Parameter visible on the HMI if the inverter has RS485 or CAN interface configured for SymbiNet protocol

3.1 CONFIGURATION OF PUMP OPERATION

This group of parameters allows the user to configure the pump operation mode in the Pump Genius Multiplex application.

P1020 – Configuration of Pump Operation Mode

Adjustable	0 = Master/Slave Pump	Factory Setting:	0
Range:	1 = Slave Pump		
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Description:

This parameter defines the pump operation mode in the Pump Genius.

Table 3.1 – Description of the pump operation mode in the Pump Genius

P1020	Description
0	Indicates that this pump can be master or slave depending on its priority (Pump 1 > Pump 2 > Pump 3 > Pump 4 > Pump 5), i.e., this pump can control the pumping, defining speed reference through the PID controller and the need for starting or stopping other pumps. You must configure the SymbiNet communication network for data exchange between the pumps (CFW-11 inverter).
1	Indicates that this pump will always be a slave, i.e., this pump will receive from the master/slave pump the speed reference and the Start/Stop command. You must configure the SymbiNet communication network for data exchange between the pumps (CFW-11 inverter).



NOTE!

For a pump to assume the master function of the Pump Genius, besides configuring its operation as master/slave (P1020 = 0), the source of the control setpoint (P1022 ≠ 0) and the source of the control process variable (P1023 ≠ 0) must also be configured.

Parameters Description



NOTE!

When a pump is configured as master/slave ($P1020 = 0$) it may assume the function of master pump in the following circumstances:

- 1) Loss of the SymbiNet communication network; this transition can be performed automatically ($P1021 \neq 0$), or manually via a command in the CFW-11 HMI;
- 2) Detection of broken cable of the control process variable sensor, when the analog input is 4 - 20mA; in this case, the transition will take place automatically.

Any change of the master in a Pump Genius leads to a shutdown of all pumps. Another pump will have to assume the master function of the Pump Genius and restart in this new configuration.

3.2 CONFIGURATION OF THE SYMBINET PROTOCOL

This group of parameters allows the user to adjust the SymbiNet protocol for communication between CFW-11 inverters; it is through this network that the data exchange between the parallel pumps of the Pump Genius Multiplex application is executed.

3.2.1 General Characteristics of SymbiNet

SymbiNet is a protocol to allow several WEG devices to send and receive operational data among them. It is totally configured using parameters, without the need of a network master or a configuration tool.

Every device on the network must have a different network address, independent of the communication interface. The data exchange is programmed based on the list of Modbus registers available for the several devices. For each device, the user must program which Modbus registers it should utilize, i.e., which Modbus registers should be transmitted by the other devices on the network to be used locally. With all devices programmed, the protocol automatically manages data transmission, sending and receiving telegrams with Modbus registers, and indicating the communication status.

The SymbiNet protocol was implemented for two communications interfaces – RS485 and CAN. The user must select one or the other and the selection is done in the own selection protocol parameter for the desired interface.



NOTE!

If the selection protocol is changed, the new interface selected will be valid only after rebooting the CFW-11 inverter.

The network address configuration of the SymbiNet protocol depends on the interface used. Each interface has a different parameter to program the network address, which must be used for this purpose. Valid values for these addresses are 1 to 63; values out of this range disable the protocol. For communication performance optimization, it is recommended to program the device addresses sequentially, starting from address 1.

For programming which registers should be utilized locally, there are groups of 4 parameters each, through which it is possible to program who should transmit, which registers should be transmitted and where the received values should be stored.



NOTE!

Refer to the SymbiNet protocol programming manual for more details about its operation and configuration.

3.2.2 RS485 Communication Interface

This group of parameters allows the user to configure the RS485 communication interface for operation of the SymbiNet protocol, required to perform the communication between the CFW-11 inverters present in the Pump Genius Multiplex application.

Parameters Description

P0308 – Serial Address

Adjustable	1 to 63	Factory Setting:	1
Range:			
Properties:	CFG and Serial		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 113 Serial RS232 / 485</div>		

Description:

This parameter defines the inverter address used for serial communication. It is necessary that each device of the SymbiNet network has a distinct address.

P0310 – Serial Communication Rate

Adjustable	0 = 9600 bits/s	Factory Setting:	3
Range:	1 = 19200 bits/s		
	2 = 38400 bits/s		
	3 = 57600 bits/s		
Properties:	CFG and Serial		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 49 Communication		
	L 113 Serial RS232 / 485		

Description:

This parameter defines the desired baud rate for the serial interface, in bits per second. This rate must be the same for all the devices connected to the SymbiNet network

P0311 – Serial Interface Byte Configuration

Adjustable	0 = 8 data bits, no parity, 1 stop bit	Factory Setting:	0
Range:	1 = 8 data bits, parity even, 1 stop bit		
	2 = 8 data bits, parity odd, 1 stop bit		
	3 = 8 data bits, no parity, 2 stop bits		
	4 = 8 data bits, parity even, 2 stop bits		
	5 = 8 data bits, parity odd, 2 stop bits		
Properties:	CFG and Serial		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 113 Serial RS232 / 485</div>		

Description:

This parameter defines the number of data bits, parity and stop bits of the serial interface bytes. This configuration must be identical for all the devices connected to the SymbiNet network.

P0312 – Serial Protocol

Adjustable	1 = TP	Factory Setting:	5
Range:	2 = Modbus-RTU		
	3 = BacNet		
	4 = Reserved		
	5 = SymbiNet		
Properties:	CFG and Serial		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 113 Serial RS232 / 485</div>		

Description:

This parameter defines the desired protocol for the serial interface.

Parameters Description



NOTE!

The SymbiNet protocol is the protocol that must be used in the Pump Genius Multiplex application.

P0313 – Communication Error Action

Adjustable Range:	0 = Inactive 1 = Disable via Start/Stop 2 = Disable via General Enable 3 = Change to Local 4 = Change to Local keeping the commands and the reference 5 = Fault trip	Factory Setting: 0
Properties:	CFG and Serial	
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 111 Status / Comands	

Description:

This parameter defines the action to be executed by the inverter when a communication error is detected.

P0314 – Serial Watchdog

Adjustable Range:	0.0 to 999.0 s	Factory Setting: 0.0 s
Properties:	CFG and Serial	
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 113 Serial RS232 / 485	

Description:

This parameter defines a time limit for the detection of a serial interface communication error.



NOTE!

A setting of "0.0 s" disables this function.

P0316 – Serial Interface Status

Adjustable Range:	0 = Inactive 1 = Active 2 = Watchdog Error	Factory Setting: -
Properties:	RO	
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 113 Serial RS232 / 485	

Description:

It allows identifying if the RS232 or RS485 serial interface board is properly installed and if the serial communication presents errors.



NOTE!

Refer to the RS232 / RS485 serial communication manual for more information on the parameters. Some parameter options have been removed from the configuration wizard.

Parameters Description

3.2.3 CAN Communication Interface

This group of parameters allows the user to configure the CAN communication interface for operation of the SymbiNet protocol required to perform the communication between the CFW-11 inverters present in the Pump Genius Multiplex application.

P0700 – CAN Protocol

Adjustable	1 = CANopen	Factory Setting:	3
Range:	2 = DeviceNet 3 = SymbiNet		
Properties:	CFG and CAN		
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 112 CANopen / DeviceNet		

Description:

This parameter defines the desired protocol for the CAN interface.



NOTE!

The SymbiNet protocol is the protocol that must be used in the Pump Genius Multiplex application.

P0701 – CAN Address

Adjustable	1 to 63	Factory Setting:	1
Range:			
Properties:	CFG and CAN		
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 112 CANopen / DeviceNet		

Description:

This parameter defines the inverter address used for the CAN communication. It is necessary that each device of the SymbiNet network has a distinct address.

P0702 – CAN Baud Rate

Adjustable	0 = 1 Mbps / Auto	Factory Setting:	0
Range:	1 = Reserved / Auto 2 = 500 Kbps 3 = 250 Kbps 4 = 125 Kbps 5 = 100 Kbps 6 = 50 Kbps 7 = 20 Kbps 8 = 10 Kbps		
Properties:	CFG and CAN		
Access groups via HMI:	01 PARAMETER GROUPS L 49 Communication L 112 CANopen / DeviceNet		

Description:

This parameter defines the desired baud rate for the CAN interface, in bits per second. This rate must be the same for all the devices connected to the SymbiNet network.

Parameters Description

P0703 – CAN Reset Bus Off

Adjustable	0 = Manual	Factory Setting:	1
Range:	1 = Automatic		
Properties:	CFG and CAN		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 112 CANopen / DeviceNet</div>		

Description:

This parameter defines the inverter behavior when detecting a “bus off” error at the CAN interface.

P0313 – Communication Error Action

Adjustable	0 = Inactive	Factory Setting:	0
Range:	1 = Disable via Start/Stop 2 = Disable via general enable 3 = Change to Local 4 = Change to Local keeping the commands and the reference 5 = Fault trip		
Properties:	CFG and Serial		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 111 Status / Comands</div>		

Description:

This parameter defines the action to be executed by the inverter when a communication error is detected.

P0705 – CAN Controller Status

Adjustable	0 = Disabled	Factory Setting:	-
Range:	1 = Auto-baud 2 = CAN enabled 3 = Warning 4 = Error Passive 5 = Bus Off 6 = No Bus Power		
Properties:	RO		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 112 CANopen / DeviceNet</div>		

Description:

It allows identifying if the CAN interface board is properly installed and if the communication presents errors



NOTE!

Refer to the CANopen communication manual for more information on these parameters. Some parameter options have been removed from the configuration wizard.

3.2.4 SymbiNet Protocol Configuration

This group of parameters allows the user to configure the SymbiNet protocol to perform the communication between the CFW-11 inverters present in the Pump Genius Multiplex application.

Parameters Description

P0768 – Enable Pump 1 Address (Group 1 Source Address)

Adjustable Range:	0 to 63	Factory Setting:	1
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the address of the pump that will send registers. In the Pump Genius, it is defined that group 1 is the pump 1.



NOTE!

The address setting “0” disables the transmission of data by the respective pump. For example, if there are only pumps 1, 2 and 3, it is not necessary to send the data request of the pumps 4 and 5. This optimizes the transmission of data over the network SymbiNet.

P0772 – Enable Pump 2 Address (Group 2 Source Address)

Adjustable Range:	0 to 63	Factory Setting:	2
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the address of the pump that will send registers. In the Pump Genius application, it is defined that group 2 is the pump 2.



NOTE!

The address setting “0” disables the transmission of data by the respective pump. For example, if there are only pumps 1, 2 and 3, it is not necessary to send the data request of the pumps 4 and 5. This optimizes the transmission of data over the network SymbiNet.

P0776 – Enable Pump 3 Address (Group 3 Source Address)

Adjustable Range:	0 to 63	Factory Setting:	3
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the address of the pump that will send registers. In the Pump Genius application, it is defined that group 3 is the pump 3.



NOTE!

The address setting “0” disables the transmission of data by the respective pump. For example, if there are only pumps 1, 2 and 3, it is not necessary to send the data request of the pumps 4 and 5. This optimizes the transmission of data over the network SymbiNet.

Parameters Description

P0780 – Enable Pump 4 Address (Group 4 Source Address)

Adjustable Range:	0 to 63	Factory Setting:	4
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the address of the pump that will send registers. In the Pump Genius application, it is defined that group 4 is the pump 4.



NOTE!

The address setting “0” disables the transmission of data by the respective pump. For example, if there are only pumps 1, 2 and 3, it is not necessary to send the data request of the pumps 4 and 5. This optimizes the transmission of data over the network SymbiNet.

P0784 – Enable Pump 5 Address (Group 5 Source Address)

Adjustable Range:	0 to 63	Factory Setting:	5
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the address of the pump that will send registers. In the Pump Genius application, it is defined that group 5 is the pump 5.



NOTE!

The address setting “0” disables the transmission of data by the respective pump. For example, if there are only pumps 1, 2 and 3, it is not necessary to send the data request of the pumps 4 and 5. This optimizes the transmission of data over the network SymbiNet.

P0796 – Highest Allowed Address (RS485 Interface)

Adjustable Range:	0 to 63	Factory Setting:	5
Properties:	CFG and Snet		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 49 Communication</div> <div>L 116 SymbiNet</div>		

Description:

This parameter defines the highest or last one address used for the communication on the SymbiNet network. It is displayed only when using the RS485 interface.



NOTE!

If there are only pumps 1, 2, 3 and 4, this parameter should be programmed to 4. This optimizes the transmission of data over the network SymbiNet.



NOTE!

Refer to the SymbiNet protocol manual for more information on these parameters. Some parameter options have been removed from the configuration wizard.

Parameters Description

P1021 – Automatic Master Pump Change Over Time in the event of Master Fails

Adjustable Range:	0 to 32767 s	Factory Setting:	2 s
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

Description:

This parameter defines the time delay for the master/slave pump assuming the master function in the Pump Genius after the communication with the original master/slave pump was lost (A758). This loss of communication will be detected by the pumps that are configured as Master/Slave.

If the set time delay elapses without the reception of a valid telegram from the original master, a command to all pumps will be generated, to recognize a new master/slave pump as master for Pump Genius. Only pumps programmed with the function master/slave (P1020 = 0), which have an analog input programmed to read the control process variable, may assume the master function of the Pump Genius.



NOTE!

A setting of "0 s" disables the automatic change of the master pump and enables the fault "Two or more masters active (F759)". The change can also be performed manually through the HMI of the CFW-11 inverter in the presence of alarm A758.

3.3 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.



NOTE!

The parameter P0205 (Reading Parameter Selection 1) is automatically changed to "22 – P1011 Control Setpoint #" when the CFW-11 inverter operates in REMOTE mode.

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.

3.4 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:	<div>01 PARAMETER GROUPS</div> <div>L 20 Ramps</div>		

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:	<div>01 PARAMETER GROUPS</div> <div>L 20 Ramps</div>		

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.

3.5 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:	<div>01 PARAMETER GROUPS</div> <div>L 22 Speed Limits</div>		

Description:

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

Parameters Description

P0134 – Maximum Speed Reference Limit

Adjustable	0 to 18000 rpm	Factory Setting:	1800 rpm
Range:			
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 22 Speed Limits</div>		

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.

3.5.1 Engineering Unit Configuration of Speed

This group of parameters allows the user to configure the engineering unit of the Pump Genius speed.

P0514 – Engineering Unit 3

Adjustable	3 = rpm	Factory Setting:	13
Range:	13 = Hz		
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 30 HMI</div>		

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 3 will be displayed in this format on the CFW-11 inverter HMI.



NOTE!

The parameters P1037, P1042, P1052, P1055 and P1060 are associated with the engineering unit 3.

P0515 – Decimal Point of Engineering Unit 3

Adjustable	0 = xyzw	Factory Setting:	1
Range:	1 = xyz.w		
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 30 HMI</div>		

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 3 will be displayed in this format on the CFW-11 inverter HMI.



NOTE!

The parameters P1037, P1042, P1052, P1055 and P1060 are associated with the engineering unit 3.

3.6 DIGITAL INPUTS

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

Parameters Description

P0263 – DI1 Function

Adjustable Range:	0 to 31 / 21 = Enable Pump Genius (PLC Use)	Factory Setting:	P1020 = 0: 21 P1020 = 1: 0
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 use of Pump in the P. G. (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 DI2 in the application ladder as enabling the use of the pump in the Pump Genius. I.e., when the Pump Genius is enabled for operation (DI1 at the logic level “1”), this pump can be started to execute its control function. Additional switching elements can be inserted into the wiring of this digital input in order to perform protection functions, such as: a protection sensor for pump or motor, etc.

Logic level “0” indicates that the pump driven by CFW-11 inverter is disabled for the operation in the Pump Genius.

Logic level “1” indicates that the pump driven by CFW-11 inverter is enabled for the operation in the Pump Genius.



NOTE!

If the digital input DI2 has not been programmed to “Enable use of the Pump in the Pump Genius”, the pump driven by CFW-11 inverter will always be enabled for use in the Pump Genius.



NOTE!

If the digital input DI2 has been programmed to “Run/Stop”, the pump driven by CFW-11 inverter will be enabled for use in the Pump Genius in REMOTE mode and will be started by digital input when in LOCAL mode.

P0265 – DI3 Function

Adjustable Range:	0 to 31	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 configures the function of digital input DI3. It has no specific function in the Pump Genius Multiplex application.

Parameters Description

P0266 – DI4 Function

Adjustable Range: 0 to 31 / 21 = 1st DI for Control Setpoint Selection (PLC Use) **Factory Setting:** 0

Properties: CFG

Access groups via HMI: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
L 40 Digital Inputs L 40 Digital Inputs

Description:

This parameter configures the function of the digital input DI4 in the application ladder as the 1st digital input of the logical combination which defines the control setpoint of the Pump Genius.

P0267 – DI5 Function

Adjustable Range: 0 to 31 / 21 = 2nd DI for Control Setpoint Selection (PLC Use) **Factory Setting:** 0

Properties: CFG

Access groups via HMI: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
L 40 Digital Inputs L 40 Digital Inputs

Description:

This parameter configures the function of the digital input DI5 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 DI4 and DI5.

P0268 – DI6 Function

Adjustable Range: 0 to 31 / 21 = External Sensor (PLC Use) **Factory Setting:** 0

Range:

Properties: CFG

Access groups via HMI: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
L 40 Digital Inputs L 40 Digital Inputs

Description:

This parameter configures the function of the digital input DI6 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 alarm “A784: External Sensor for Pump Protection” 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 3.20 for more information on the pump protection via an external sensor.

P0269 – DI7 Function

P0270 – DI8 Function

Adjustable Range: 0 to 31 **Factory Setting:** P0269 = 0

Range: P0270 = 0

Properties: CFG

Access groups via HMI: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
L 40 Digital Inputs L 40 Digital Inputs

Parameters Description

Description:

These parameters configure the function of digital input DI7 and DI8. It has no specific function in the Pump Genius Multiplex application. It is necessary to install the IOB-01 accessory module in order to get access to these digital inputs.



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.

3.7 DIGITAL OUTPUTS

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

P0275 – DO1 Function (RL1)

Adjustable	0 to 36 / 28 = Sleep Mode active (SoftPLC)	Factory Setting:	13
Range:			
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS or 07 I/O CONFIGURATION		
	L 41 Digital Outputs	L 41 Digital Outputs	

Description:

These parameters define the function of the digital output DO1. If you selected the "28 = Sleep Mode active (SoftPLC)", the output assumes the function of indicating that the Pump Genius is in Sleep Mode.

P0276 – DO2 Function (RL2)

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

Description:

This parameter defines the function of the digital output DO2. If you selected the "28 = Master Pump active (SoftPLC)", the output assumes the function of indicating that this pump is a master pump of the Pump Genius Multiplex application.

P0277 – DO3 Function (RL3)

Adjustable	0 to 36 / 28 = A770/A772 or F771/F773 active (SoftPLC)	Factory Setting:	28
Range:			
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS or 07 I/O CONFIGURATION		
	L 41 Digital Outputs	L 41 Digital Outputs	

Description:

This parameter defines the function of the digital output DO3. If you selected the "28 = Alarm A770/A772 or Fault F771/F773 active (SoftPLC)", the output 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. According to the chapter 2, a NO contact of the relay digital output must be used.

Parameters Description

P0278 – DO4 Function

P0279 – DO5 Function

Adjustable Range:	0 to 36	Factory Setting:	P0278 = 0 P0279 = 0
Properties:	CFG		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 41 Digital Outputs</div>	or	<div>07 I/O CONFIGURATION</div> <div>└ 41 Digital Outputs</div>

Description:

These parameters define the function of the digital outputs DO4 and DO5. It has no specific function in the Pump Genius Multiplex application. It is necessary to install the IOB-01 accessory module to get access to the digital outputs DO4 and DO5.



NOTE!

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

3.8 ANALOG INPUTS

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

P0231 – AI1 Signal Function

P0236 – AI2 Signal Function

P0241 – AI3 Signal Function

P0246 – AI4 Signal Function

Adjustable Range:	0 to 7 / 7 = Control Setpoint (PLC Use) (P1022 = 1 to 4) 0 to 7 / 7 = Control Process Variable (PLC Use) (P1023 = 1 to 5) 0 to 7 / 7 = Control Auxiliary Variable (PLC Use) (P1046 = 1 to 4)	Factory Setting:	P0231 = 7 P0236 = 0 P0241 = 0 P0246 = 0
Properties:	CFG		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 38 Analog Inputs</div>	or	<div>07 I/O CONFIGURATION</div> <div>└ 38 Analog Inputs</div>

Description:

These parameters configure the function of the analog inputs AI1, AI2, AI3 and AI4 in the Pump Genius Multiplex application as reading of the control setpoint (P1022=1 to 4), or as control process variable (P1023=1 to 5) or as control auxiliary variable (P1046=1 to 4).

P0233 – AI1 Signal Type

P0238 – AI2 Signal Type

P0243 – AI3 Signal Type

P0248 – AI4 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:	<div>01 PARAMETER GROUPS</div> <div>└ 38 Analog Inputs</div>	or	<div>07 I/O CONFIGURATION</div> <div>└ 38 Analog Inputs</div>

Parameters Description

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, and the DIP switch S3.1 (AI3) and S3.2 (AI4) of the IOB-01 accessory module.

P0232 – AI1 Gain

P0237 – AI2 Gain

P0242 – AI3 Gain

P0247 – AI4 Gain

Adjustable 0.000 to 9.999 **Factory Setting:** 1.000

Range:

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

or

07 I/O CONFIGURATION

L 38 Analog Inputs

L 38 Analog Inputs

Description:

These parameters apply a gain to the value read at the analog inputs AI1, AI2, AI3 and AI4, 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

P0244 – AI3 Offset

P0249 – AI4 Offset

Adjustable -100.00 to +100.00 % **Factory Setting:** 0.00 %

Range:

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

or

07 I/O CONFIGURATION

L 38 Analog Inputs

L 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

P0245 – AI3 Filter

P0250 – AI4 Filter

Adjustable 0.00 to 16.00 s **Factory Setting:** 0.25 s

Range:

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

or

07 I/O CONFIGURATION

L 38 Analog Inputs

L 38 Analog Inputs

Description:

These parameters configure the 1st order filter time constant that will be applied to the analog inputs AI1, AI2, AI3 and AI4.



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.

Parameters Description

3.9 CONTROL SETPOINT

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

P1011 – Control Setpoint

Adjustable Range:	-32768 to 32767 [Eng. Unit 1]	Factory Setting:	200
Properties:	RW		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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 (P1022=5). When the control setpoint source was programmed to be another source (P1022≠5), it 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. Unit 1]	Factory Setting:	P1012 = 200 P1013 = 230 P1014 = 180 P1015 = 160
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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 DI4 and DI5 (P1022=6, 7 or 8) 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:	0 = Without Source for Control Setpoint (Slave Pump) 1 = Control Setpoint via Analog Input AI1 2 = Control Setpoint via Analog Input AI2 3 = Control Setpoint via Analog Input AI3 4 = Control Setpoint via Analog Input AI4 5 = Control Setpoint via HMI (P1011) 6 = Two Setpoints via Digital Input DI4 (P1012 and P1013) 7 = Three Setpoints via Digital Inputs DI4 and DI5 (P1012, P1013 and P1014) 8 = Four Setpoints via Digital Inputs DI4 and DI5 (P1012, P1013, P1014 and P1015)	Factory Setting:	P1020 = 0: 5 P1020 = 1: 0
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Parameters Description

Description:

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

Table 3.2 – Description of the control setpoint source

P1022	Description
0	It defines that there is no source for the control setpoint of the Pump Genius. This option is valid when the pump operation is defined as slave (P1020 = 1), because as such, it can never provide the setpoint for controlling the pumping.
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 read by the analog input AI3. The value is converted according to engineering unit 1 and displayed in parameter P1011.
4	It defines that the source of the control setpoint of the Pump Genius is the value read by the analog input AI4. The value is converted according to engineering unit 1 and displayed in parameter P1011.
5	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.
6	It defines that there are two setpoints for the Pump Genius selected via logical combination of the digital input DI4. The setpoint value selected is displayed in parameter P1011.
7	It defines that there are three setpoints for the Pump Genius selected via logical combination of the digital inputs DI4 and DI5. The setpoint value selected is displayed in parameter P1011.
8	It defines that there are four setpoints for the Pump Genius selected via logical combination of the digital inputs DI4 and DI5. The setpoint value selected is displayed in parameter P1011.

When the control setpoint is via logical combination of the digital inputs DI4 and DI5, 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 DI4 and DI5

	P1012 – Control Setpoint 1	P1013 – Control Setpoint 2	P1014 – Control Setpoint 3	P1015 – Control Setpoint 4
Digital Input DI4	0	1	0	1
Digital Input DI5	0	0	1	1

3.10 CONTROL PROCESS VARIABLE

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

P1023 – Control Process Variable Selection Source

Adjustable Range: 0 = Without Source for Process Variable (Slave Pump) **Factory Setting:** P1020 = 0: 1
 1 = Control Process Variable via Analog Input AI1 P1020 = 1: 0
 2 = Control Process Variable via Analog Input AI2
 3 = Control Process Variable via difference between Analog Input AI1 and AI2 (AI1 – AI2)
 4 = Control Process Variable via Analog Input AI3
 5 = Control Process Variable via Analog Input AI4

Properties:

Access groups via HMI: 01 PARAMETER GROUPS

L 50 SoftPLC

Description:

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

Parameters Description

Table 3.4 – Description of the control process variable source

P1023	Description
0	It defines that there is no source for the control process variable of the Pump Genius. This option is valid when the pump function is defined as slave (P1020 = 1), because as such, it can never provide the control process variable for controlling the pumping.
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.
4	It defines that the source of the control process variable of the Pump Genius is the value read by the analog input AI3. The value is converted according to engineering unit 1 and displayed in parameter P1016.
5	It defines that the source of the control process variable of the Pump Genius is the value read by the analog input AI4. The value is converted according to engineering unit 1 and displayed in parameter P1016.

3.10.1 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 columna 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	Factory Setting: 24
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Parameters Description

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 = m³/s
 49 = m³/min
 50 = m³/h
 51 = ft³/s
 52 = CFM (= ft³/min)
 53 = ft³/h
 54 = kgf
 55 = kgfm
 56 = lbf
 57 = lbfft
 58 = ohm
 59 = rpm/s
 60 = mH
 61 = ppr
 62 = °
 63 = rot

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

L 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, P1050, P1050, P1053 and P1056 are associated with the engineering unit 1.

P0511 – Decimal Point of Engineering Unit 1

Adjustable

0 = xyzw

Factory Setting: 1

Range:

1 = xyz.w

2 = xy.wz

3 = x.ywz

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

L 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, P1050, P1050, P1053 and P1056 are associated with the engineering unit 1.

Parameters Description

3.10.2 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. Unit 1]	Factory Setting:	0
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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. Unit 1]	Factory Setting:	400
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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 AI_x , we have the line equation for conversion of the Pump Genius control process variable:

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

Where,

P1016 = Control process variable;

P1024 = Minimum level of control process variable sensor;

P1025 = Maximum level of control process variable sensor;

AI_x = Value of analog input AI1, AI2, AI3, AI4 or difference between AI1 and AI2 ($AI1 - AI2$) in %.

3.11 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.

Parameters Description

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:

$$u(k) = i(k-1) + K_p \cdot [(1 + K_i \cdot T_s + (K_d/T_s)) \cdot e(k) - (K_d/T_s) \cdot e(k-1)]$$

Where,

$u(k)$ = PID controller output

$i(k-1)$ = integral part in the previous sampling instant

K_p = proportional gain

K_i = integral gain

K_d = derivative gain

T_s = 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	1 = Direct Mode	Factory Setting:	1
Range:	2 = Reverse Mode		
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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	0.00 to 320.00	Factory Setting:	1.00
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Description:

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

Parameters Description

P1032 – PID Integral Gain

Adjustable 0.00 to 320.00 **Factory Setting:** 25.00

Range:

Properties:

Access groups via HMI: 01 PARAMETER GROUPS

L 50 SoftPLC

Description:

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

P1033 – PID Derivative Gain

Adjustable 0.00 to 320.00 **Factory Setting:** 0.00

Range:

Properties:

Access groups via HMI: 01 PARAMETER GROUPS

L 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 Multiplex 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.

3.12 PUMP GENIUS STARTUP MODES

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

3.12.1 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 -32768 to 32767 [Eng. Un. 1] **Factory Setting:** 30

Range:

Properties:

Access groups via HMI: 01 PARAMETER GROUPS

L 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).

Parameters Description

P1035 – Control Process Variable Level to Starting the Pump Genius

Adjustable	-32768 to 32767 [Eng. Un. 1]	Factory Setting:	180
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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	0 to 32767 s	Factory Setting:	5 s
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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.

3.12.2 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 last running 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	0 to 18000 [Eng. Un. 3]	Factory Setting:	1250 rpm 42.0 Hz
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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.

Parameters Description



NOTE!

A setting of "0" 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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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.



NOTE!

The alarm message "A750: Sleep Mode Active (M)" will be generated on the HMI of the CFW-11 inverter is functioning as the master of the Pump Genius, and the alarm message "A750: Sleep Mode Active (E)" will be displayed on the HMI of the CFW-11 inverters that are function are slaves in the Pump Genius, to alert that the Pump Genius is in sleep mode.

P1039 – Sleep Boost Offset

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	Factory Setting:	0
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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 "A755: 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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:

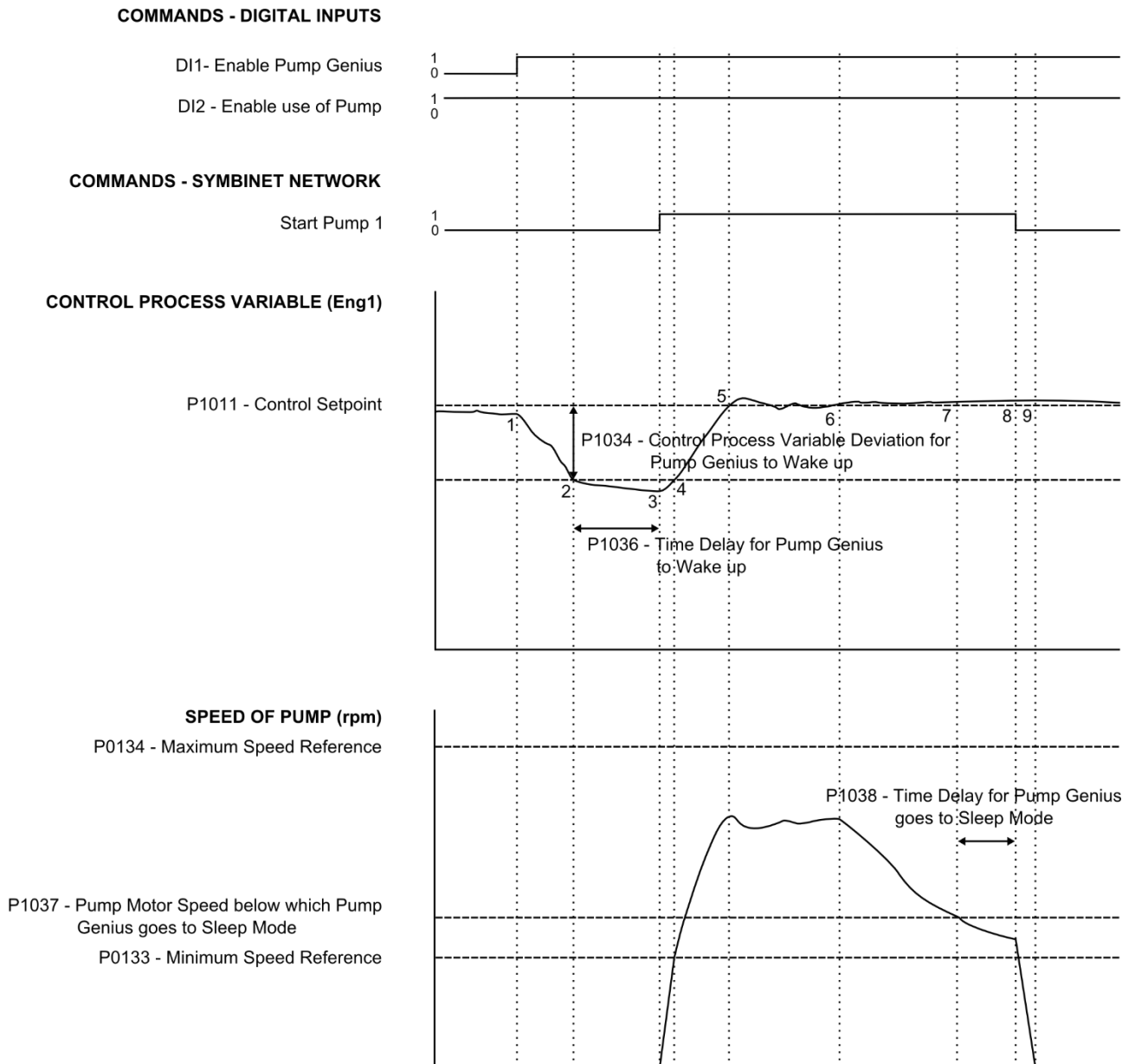


Figure 3.1 – Operation of the Pump Genius for wake up mode and sleep mode

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 (master pump) verify

Parameters Description

which pump have the lower operation time; then the command run is issued via SymbiNet network to the first 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 stable 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 (master pump) 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:

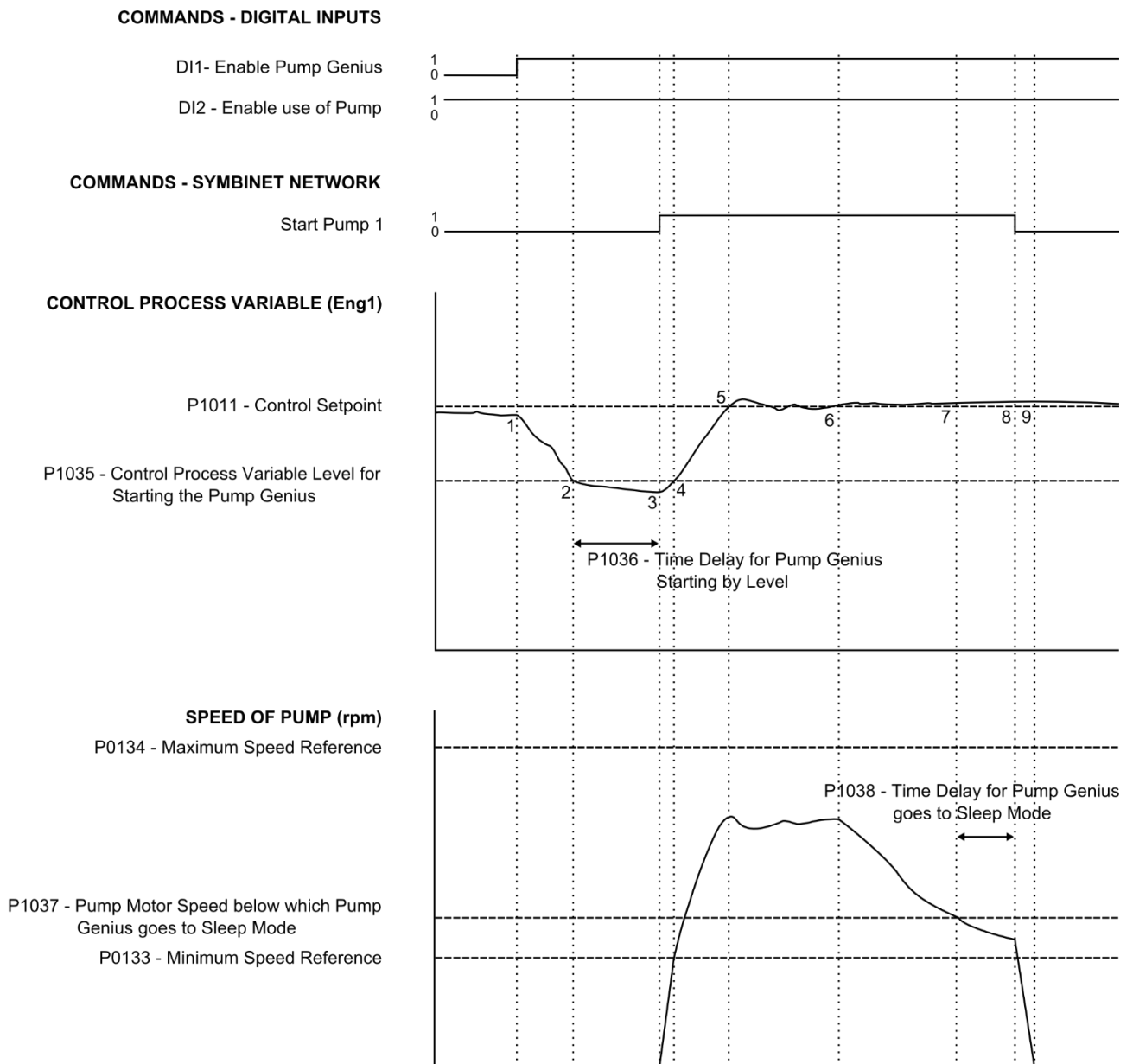


Figure 3.2 – Operation of the Pump Genius for start level mode and sleep mode

- 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 (master pump) verify which pump have the lower operation time; then the command run is issued via SymbiNet network to the first 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;

Parameters Description

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 (master pump) 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:

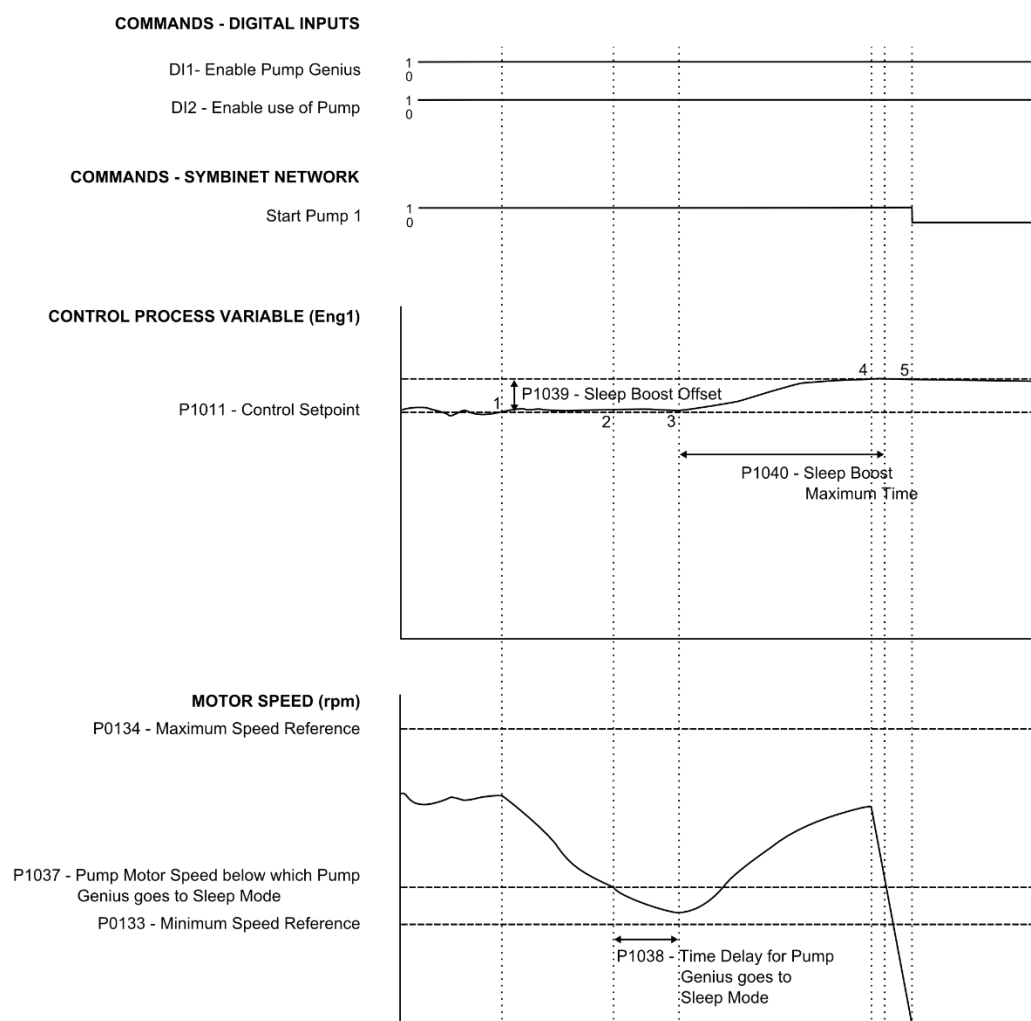


Figure 3.3 – Operation of the Pump Genius for sleep mode with sleep boost enabled

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

Parameters Description

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 (master pump) issues the command to stop pumping action 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.

3.13 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	0 = Disable (1 st Ramp)	Factory Setting:	0
Range:	6 = Enable (SoftPLC)		
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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	0.0 to 999.0 s	Factory Setting:	10.0 s
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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	0 to 32767 s	Factory Setting:	P1020 = 0: 30 s
Range:			P1020 = 1: 0 s
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Parameters Description

Description:

This parameter defines the elapsed time for pipe charging.

**NOTE!**

This parameter has no function when the pump is configured as a slave pump ($P1020 = 1$).

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):

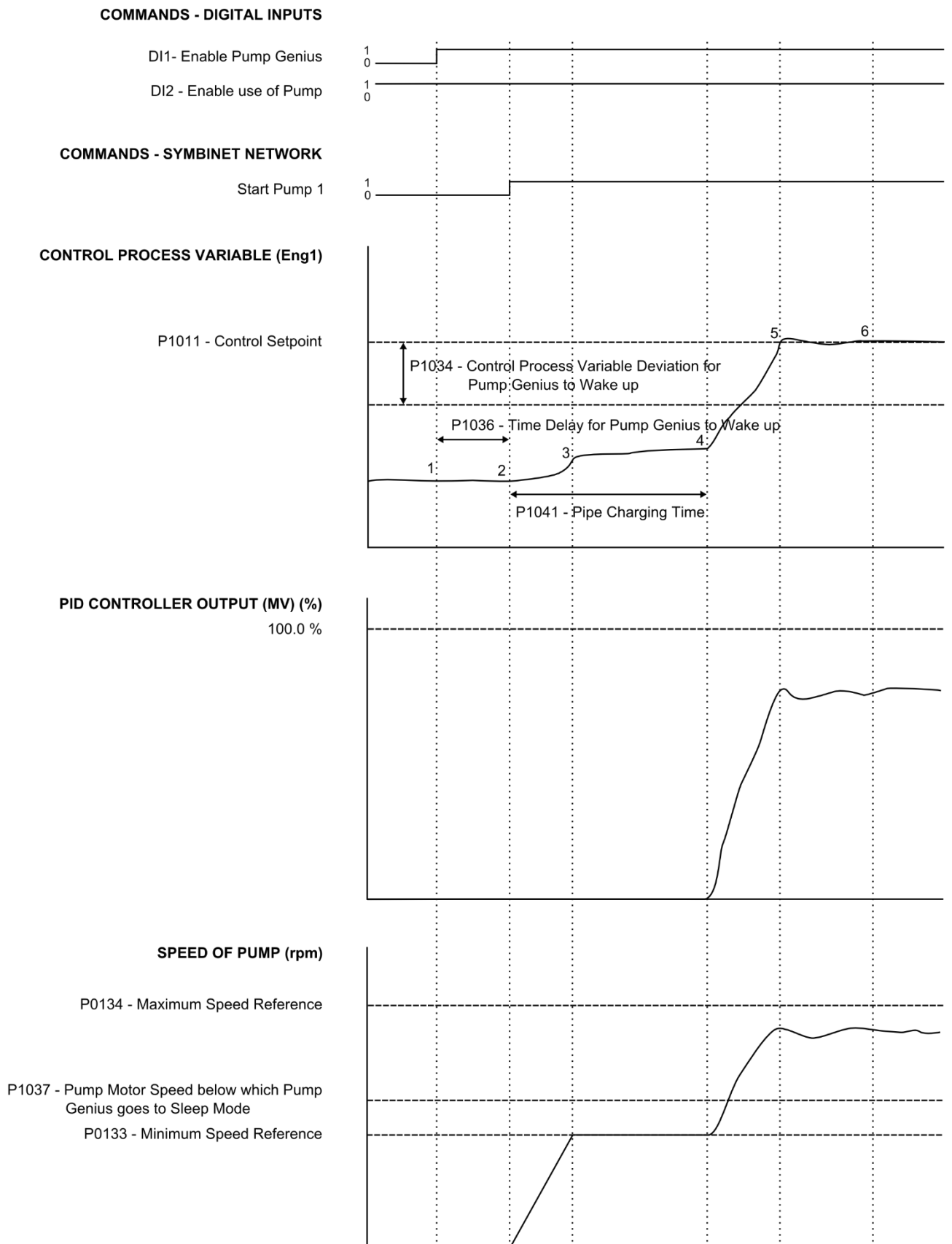


Figure 3.4 – Operation of the Pump Genius with pipe charging

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 initiated;

Parameters Description

2 – 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 (master pump) verify which pump have the lower operation time; then the command run is issued via SymbiNet network to the first pump. As pipe charging is enabled (P0105), the time count (P1041) is initiated, while the PID controller remains disabled. The first pump is accelerated to the minimum speed (P0133) with a slower ramp in order to avoid the “water hammer”;

3 – 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 remains disabled;

4 – 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;

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

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

3.14 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 [Eng. Un. 3]	Factory Setting:	1700 rpm 57.0 Hz
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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 0 to 32767 s

Factory Setting: 2 s

Range:**Properties:**

Access groups via HMI:

01 PARAMETER GROUPS

L 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.

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:

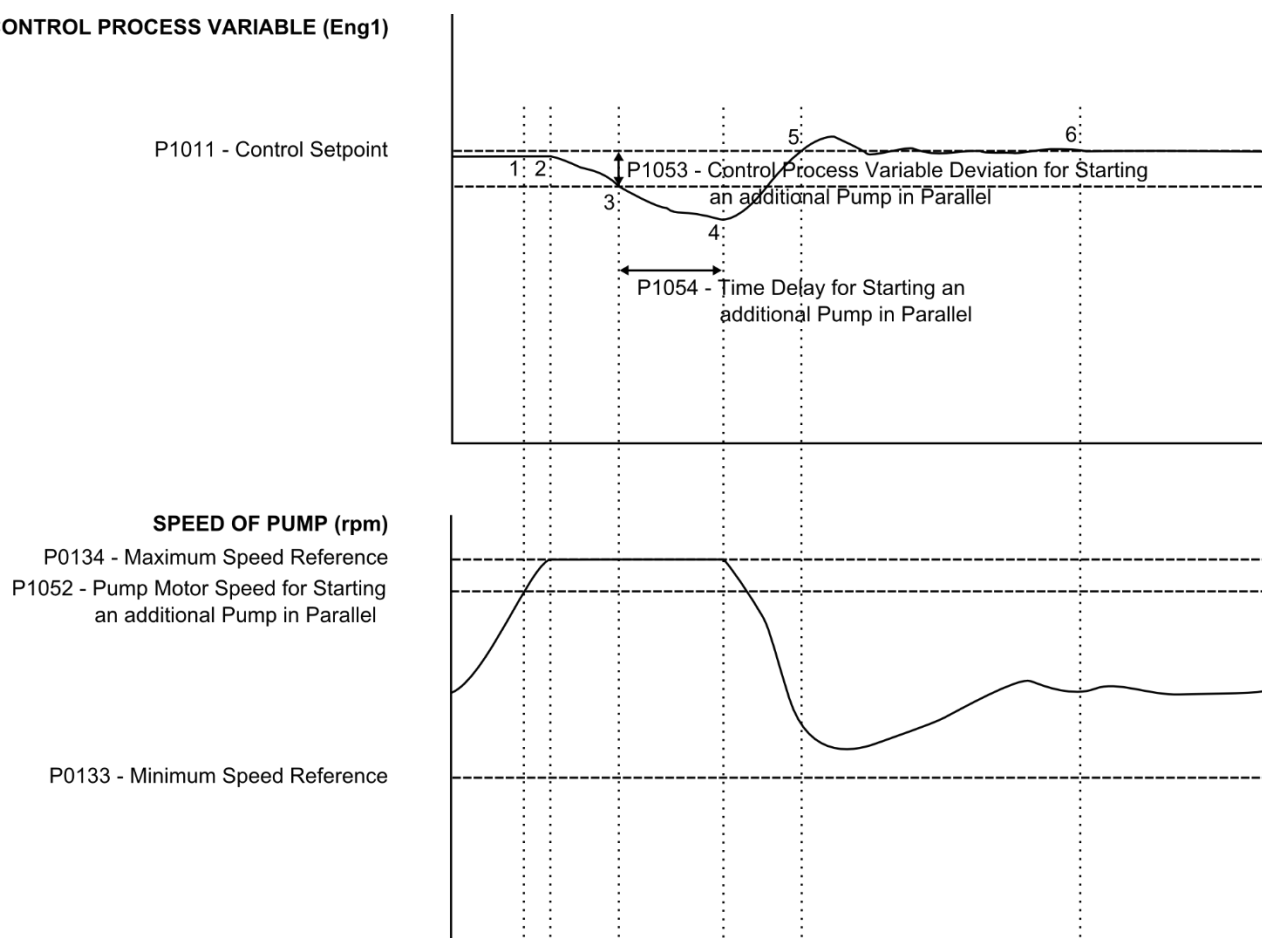
CONTROL PROCESS VARIABLE (Eng1)

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

1 – The Pump Genius is operating with one pump running and is increasing its speed according to PID control, to keep up with demand. At this moment, the pump motor speed exceeds the threshold value programmed for starting an additional pump (P1052). However, the difference between the control setpoint and control process variable remains lower than the deviation programmed for starting an additional pump (P1053); it is thus not yet necessary to start an additional pump;

2 – The pump motor speed reaches its maximum value (P0134) and the value of the control process variable begins to decrease, but its deviation from the control setpoint remains lower than the threshold programmed for starting an additional pump (P1053); it is thus not yet necessary to start an additional pump;

3 – The pump motor speed remains saturated at maximum value (P0134), as the value of the control process variable continues to decrease. At this point, however, its deviation from the control setpoint exceeds the threshold programmed for starting an additional pump (P1053), initiating the time count P1054;

Parameters Description

4 – All processes continue as at time point 3, until the time count (P1054) has elapsed; At this moment among the enabled pumps, the one with the lowest accumulated operating time receives the command to start via SymbiNet network;

5 – An additional pump was successfully started, all activated inverter driven pumps receiving the same speed reference from the PID controller of the master pump; With the added pumping capacity, the control process variable catches up with the control setpoint required by the user, but the Pump Genius is not yet stabilized;

6 – Eventually, through the continued action of the PID controller, the Pump Genius achieves stable operation at the control setpoint as required by the user.

3.15 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.

P1055 – Pump Motor Speed for Stopping one Pump in Parallel

Adjustable Range:	0 to 18000 [Eng. Un. 3]	Factory Setting:	1300 rpm 43.0 Hz
Properties:			
Access groups via HMI:			
	01 PARAMETER GROUPS		
	L 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.

P1056 – Control Process Variable Deviation for Stopping one Pump in Parallel

Adjustable Range:	-35768 to 32767 [Eng. Un. 1]	Factory Setting:	0
Properties:			
Access groups via HMI:			
	01 PARAMETER GROUPS		
	L 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 P1056 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).

P1057 – 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		
	L 50 SoftPLC		

Description:

This parameter defines a time delay during which both conditions of P1055 and P1056 must remain satisfied before stopping one of the pumps in parallel in the Pump Genius.

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:

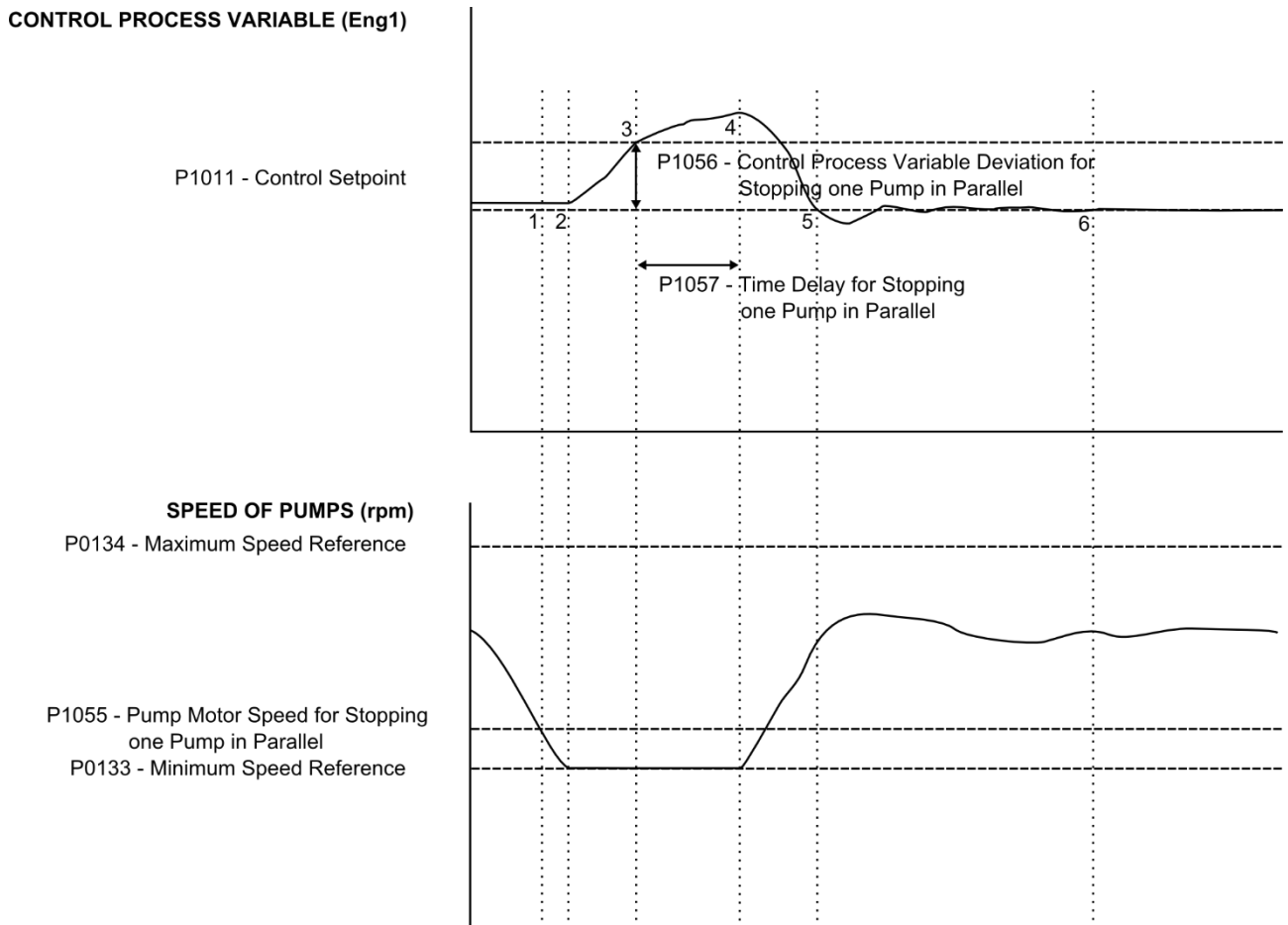


Figure 3.6 – Pump Genius operation for stop one pump in parallel

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 (P1055), but the control process variable deviation from the control setpoint remains lower than the threshold programmed for stopping one pump in parallel (P1056); 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 (P1056); 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 (P1056), and the time count (P1057) is initiated;

4 – All processes continue as at time point 3, until the time count (P1057) is elapsed. At this moment the command for stopping one pump in parallel is issued via SymbiNet network. From among the activated pumps, the one with the largest accumulated operating time will be stopped;

5 – One of the parallel pumps was successfully stopped; at this moment the control process variable reaches the control setpoint required by the user, but the Pump Genius is not yet stabilized;

6 – Eventually, with the continued action of the PID controller, the Pump Genius achieves stable operation at the control setpoint as required by the user.

Parameters Description

3.16 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 control (master pump) verify which pump have the lower operation time; then the command run is issued via SymbiNet network to the first pump 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 P1058.

P1059 – Time Interval for Forcing Rotation of Pumps

Adjustable Range:	0 to 32767 h	Factory Setting:	72 h
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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 P1060 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.

P1060 – Pump Motor Speed for Forcing Rotation of Pumps

Adjustable Range:	0 to 18000 [Eng. Un. 3]	Factory Setting:	0 rpm 0.0 Hz
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

Description:

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



NOTE!

A setting of “0” disables the forcing rotation of pumps.

3.17 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.

Parameters Description

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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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.

3.18 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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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.

Parameters Description



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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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.

3.19 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 [Eng. Un. 3]	Factory Setting:	1620 rpm 54.0 Hz
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

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:

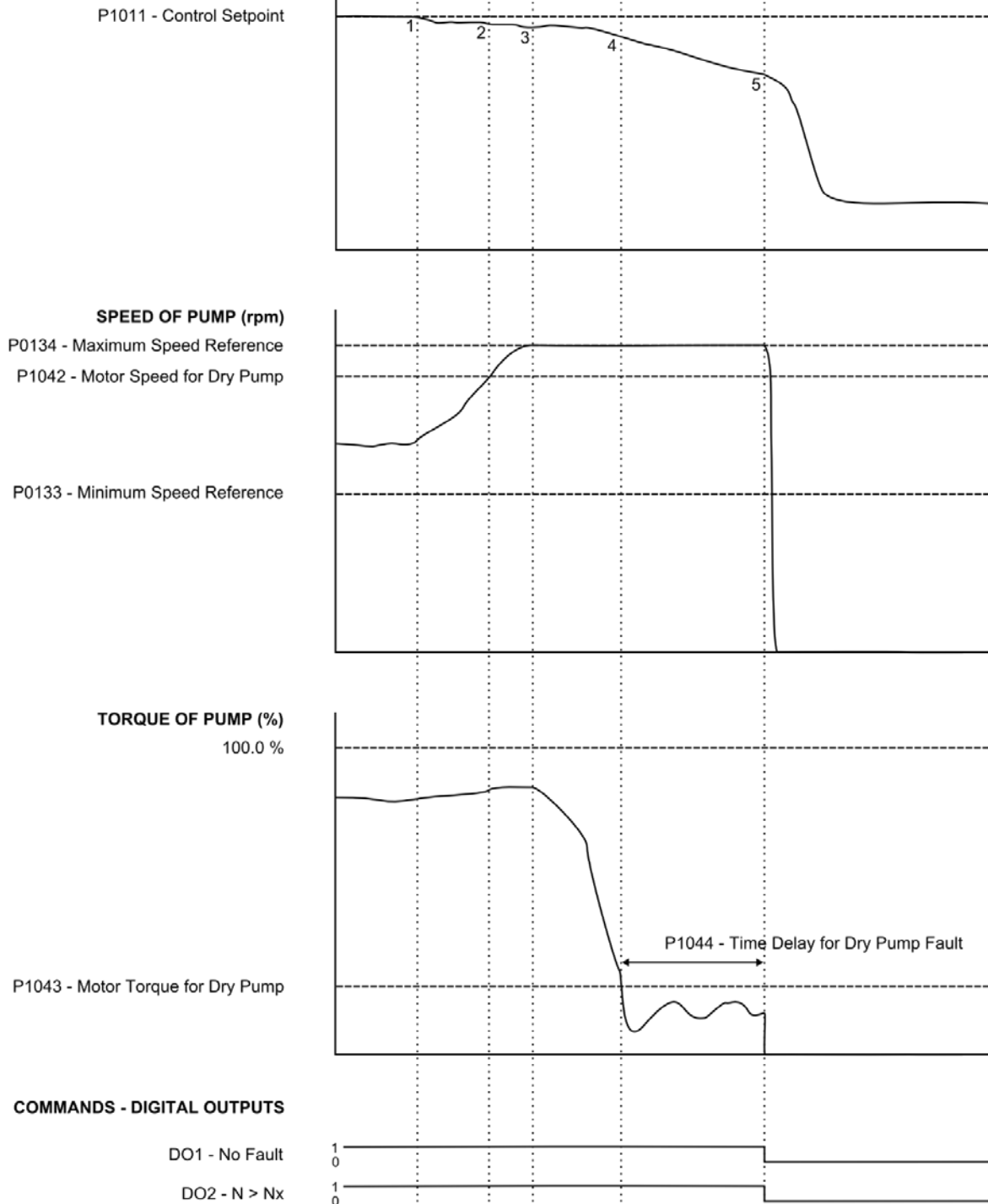
CONTROL PROCESS VARIABLE (Eng1)

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;

Parameters Description

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.

3.20 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 DI6.



NOTE!

Enabling the use of an external sensor for pump protection is accomplished by programming the digital input DI6, as described in section 3.6.

P1045 – Time Delay for Pump Protection via External Sensor (A784)

Adjustable Range:	0 to 32767 s	Factory Setting:	2 s
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

Description:

This parameter defines the waiting time with the condition of sensor (DI6) at logic level "0" while the pump is running, before the external sensor alarm "A784: External Sensor Pump Protection" is generated, and the pump is stopped.



NOTE!

A setting of "0 s" disables the pump protection via external sensor (DI6).

3.21 CONTROL AUXILIARY VARIABLE FOR PUMPS PROTECTION

This group of parameters allows the user to configure a control auxiliary variable for the protection of pumps of the Pump Genius. This protection is accomplished by reading a sensor installed on an analog input, and comparing its value with low level condition. The low level condition is directly associated with pump cavitation protection.

Cavitation is a phenomenon that occurs in a pump when the pressure at the inlet side of the rotor drops below the vapor pressure of the pumped liquid, resulting in evaporation with the formation of small vapor bubbles (cavities) in the liquid part. When these cavities, formed in the low pressure region of the rotor, reach the high pressure region at the outlet side of the rotor, they immediately collapse, returning to the liquid phase. The rapid implosion of the cavities results in violent shock waves and momentary huge temperature gradients between the bubble surface and the surrounding liquid (10000°C have been measured). If, prior to their collapse, these bubbles adhere to rotor surfaces, their implosion produces microjets, which impact the surface with sufficient energy to remove microscopic amounts of material. Immediate negative consequences of cavitation and its cumulative effects over extended periods of time are as follows:

Parameters Description

- Operation with high level of noise and vibration;
- Impairment of performance, changing the pump characteristics;
- Premature wear of the rotor by removal of metal particles.

Occurrence of pump cavitation can be prevented by avoiding operation with insufficient liquid at the inlet of the pump. Installing an external sensor in the suction part, for example a level sensor, which measures the inlet reservoir fluid level, can help detect conditions that lead to cavitation. When this level is below a certain threshold, the control setpoint is changed to a value that reduces pump suction, thus lowering the pressure difference between the inlet and outlet of the pump.

P1046 – Control Auxiliary Variable Selection Source for Pumps Protection

Adjustable Range:	0 = Without Protection via Control Auxiliary Variable 1 = Control Auxiliary Variable via Analog Input AI1 2 = Control Auxiliary Variable via Analog Input AI2 3 = Control Auxiliary Variable via Analog Input AI3 4 = Control Auxiliary Variable via Analog Input AI4	Factory Setting: 0
Properties:		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>	

Description:

This parameter defines the source of the control auxiliary variable for pump protection.

Table 3.6 – Description of control auxiliary variable source for pump protection

P1046	Description
0	It defines that there is no pump protection via control auxiliary variable.
1	It defines that the source of the control auxiliary variable for pump protection is the value read by the analog input AI1. The value is converted according to engineering unit 2 and displayed in parameter P1017.
2	It defines that the source of the control auxiliary variable for pump protection is the value read by the analog input AI2. The value is converted according to engineering unit 2 and displayed in parameter P1017.
3	It defines that the source of the control auxiliary variable for pump protection is the value read by the analog input AI3. The value is converted according to engineering unit 2 and displayed in parameter P1017.
4	It defines that the source of the control auxiliary variable for pump protection is the value read by the analog input AI4. The value is converted according to engineering unit 2 and displayed in parameter P1017.

3.21.1 Engineering Unit Configuration

This group of parameters allows the user to configure the engineering unit of the control auxiliary variable for pump protection.

P0512 – Engineering Unit 2

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	Factory Setting: 10
--------------------------	---	----------------------------

Parameters Description

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 columna d'agua)
 30 = gal
 31 = l (litro)
 32 = in
 33 = ft
 34 = m³
 35 = ft³
 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 = m³/s
 49 = m³/min
 50 = m³/h
 51 = ft³/s
 52 = CFM (= ft³/min)
 53 = ft³/h
 54 = kgf
 55 = kgfm
 56 = lbf
 57 = lbfft
 58 = ohm
 59 = rpm/s
 60 = mH
 61 = ppr
 62 = °
 63 = rot

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

L 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 2 will be displayed in this format on the CFW-11 inverter HMI.



NOTE!

The parameters P1017, P1047, P1048, P1049, P1049 and P1051 are associated with engineering unit 2.

Parameters Description

P0513 – Decimal Point of Engineering Unit 2

Adjustable	0 = xyzwz	Factory Setting:	1
Range:	1 = xyzw.z		
	2 = xy.wz		
	3 = x.ywz		
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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 2 will be displayed in this format on the CFW-11 inverter HMI.



NOTE!

The parameters P1017, P1047, P1048, P1049, P1049 and P1051 are associated with engineering unit 2.

3.21.2 Sensor Scale Configuration

This group of parameters allows the user to configure the scale of the control auxiliary variable.

P1047 – Control Auxiliary Variable Sensor Minimum Level

Adjustable	-32768 to 32767 [Eng. Unit 2]	Factory Setting:	0
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Description:

This parameter defines the minimum level of the control auxiliary variable sensor for pump protection according to its engineering unit.



NOTE!

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

P1048 – Control Auxiliary Variable Sensor Maximum Level

Adjustable	-32768 to 32767 [Eng. Unit 2]	Factory Setting:	1000
Range:			
Properties:			
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Description:

This parameter defines the maximum level of the control auxiliary variable sensor for pump protection according to its engineering unit.



NOTE!

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

Parameters Description

The relationship between the analog input, AI_x , configured for control auxiliary variable sensor, and the display value, P1017, in engineering units, is as follows:

$$P1017 = (P1048 - P1047) \times AI_x + P1047$$

Where,

P1017 = Control auxiliary variable;

P1047 = Minimum level of the control auxiliary variable sensor;

P1048 = Maximum level of the control auxiliary variable sensor;

AI_x = Value of analog input AI_1 , AI_2 , AI_3 or AI_4 in %.

3.21.3 Pump Protection via Control Auxiliary Variable

This group of parameters allows the user to configure the protection of pump(s) of the Pump Genius Multiplex.

P1049 – Value to detect Low Level of Control Auxiliary Variable

Adjustable Range:	-32768 to 32767 [Eng. Unit 2]	Factory Setting:	250
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

Description:

This parameter defines the control auxiliary variable threshold below which the control setpoint will be changed to the value programmed in P1050. I. e., when low level is detected, the control setpoint can be changed to a different value (lower), thus assuring a decrease in consumption of the pump, preventing it to operate in cavitation for example.



NOTE!

The alarm message "A774: Low Level of Control Auxiliary Variable" will be generated in the HMI of the CFW-11 inverter, to alert that the control auxiliary variable is in low level.



NOTE!

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

P1050 – Control Setpoint in Low Level

Adjustable Range:	-32768 to 32767 [Eng. Unit 1]	Factory Setting:	160
Properties:			
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div>		

Description:

This parameter defines the value of the Pump Genius setpoint, when a low level of the control auxiliary variable is detected.



NOTE!

The control setpoint should be adjusted to an appropriate value that reduces the consumption of the pump to prevent the cavitation.



NOTE!

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

P1051 – Hysteresis to reactivate the Control Setpoint

Adjustable -32768 to 32767 [Eng. Unit 2]

Factory Setting: 100

Range:

Properties:

Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

Description:

This parameter defines the value of control auxiliary variable hysteresis to be applied for the reset of its low or high level condition, after which the Pump Genius returns to operate with the control setpoint required by the user.



NOTE!

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

The figure 3.8 presents a timing analysis of the Pump Genius operation when low level of the control auxiliary variable is detected:

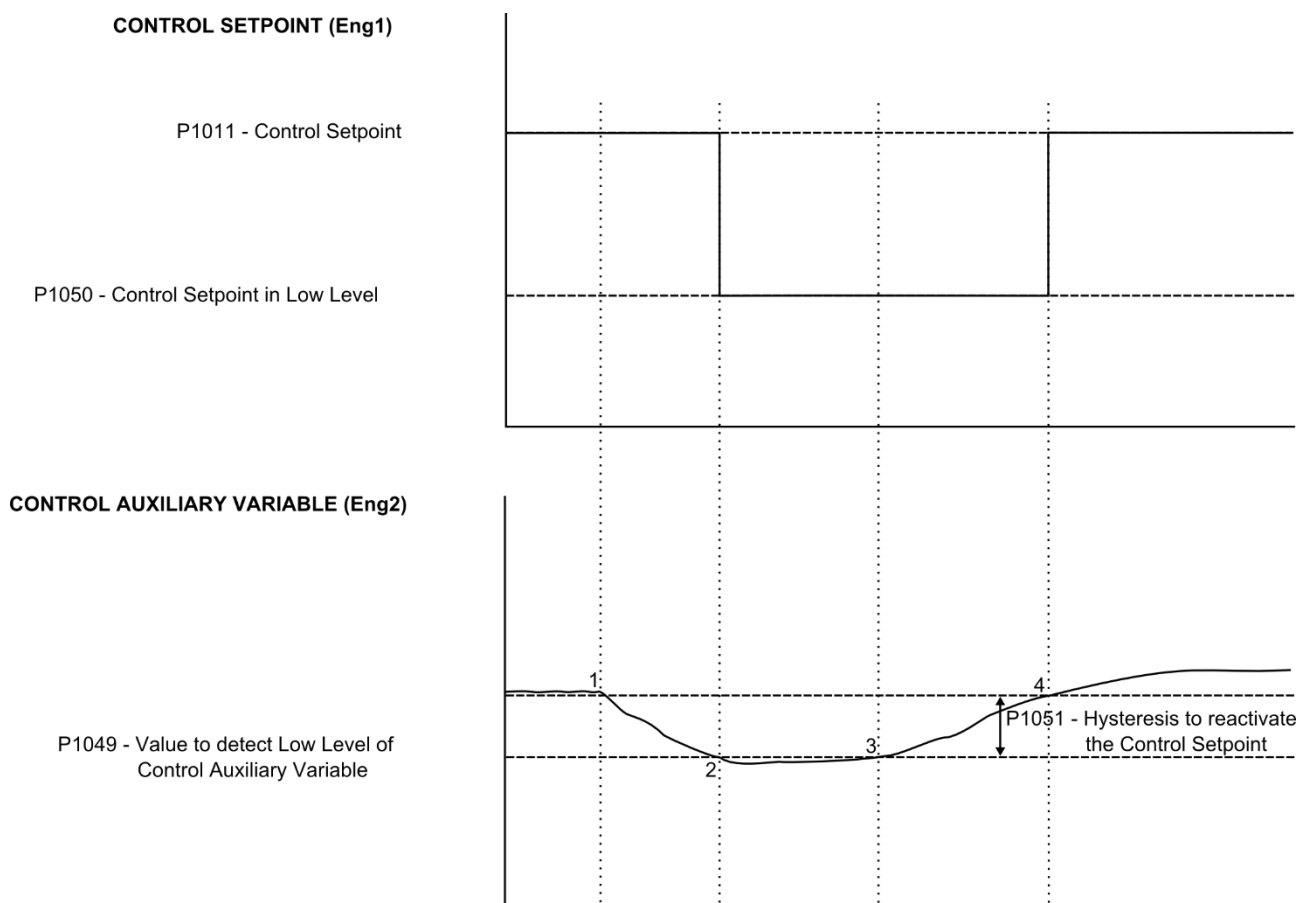


Figure 3.8 – Pump Genius operation with pump protection via control auxiliary variable

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

2 – The control auxiliary variable drops below the threshold programmed to detect low level of the control auxiliary variable (P1049). At this moment, the value of the control setpoint is changed to the value programmed as control setpoint in low level (P1050);

Parameters Description

3 – The change of control setpoint results in an increase of the control auxiliary variable and the same reaches the value programmed to detect low level of control auxiliary variable (P1049), but to reactivate the control setpoint is necessary to be greater than the value set in hysteresis to reactivate the control setpoint (P1051);

4 – At this moment, its value exceeds the programmed hysteresis threshold (P1051), and the control setpoint is reset back to the value required by the user, according to the value programmed in P1011.

3.22 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.

3.23 READING PARAMETERS

P1010 – Pump Genius Multiplex Application Version

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

Description:

This parameter indicates the version of the Pump Genius Multiplex application.

P1016 – Control Process Variable

Adjustable Range:	-32768 to 32767 [Eng. Un. 1]	Factory Setting:	-
Properties:	RO		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 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 – Control Auxiliary Variable

Adjustable Range:	-32768 to 32767 [Eng. Un. 2]	Factory Setting:	-
Properties:	RO		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Parameters Description

Description:

This parameter indicates the value of the Pump Genius auxiliary variable according to the source of the control auxiliary variable selected by P1046.



NOTE!

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

P1018 – Pump Operation Time

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

Description:

This parameter displays the operation time of the pump driven by CFW-11 inverter.

It determines which pump will be started or stopped in parallel in the Pump Genius, when all appropriate conditions are met.



NOTE!

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

P1019 – Status of Pump Operation Mode

Adjustable	0 = Master Pump	Factory Setting:	-
Range:	1 = Slave Pump		
Properties:	RO		
Access groups via HMI:	01 PARAMETER GROUPS		
	L 50 SoftPLC		

Description:

This parameter displays the pump operation mode in the Pump Genius Multiplex application.

Table 3.7 – Description of the pump operation mode in the Pump Genius Multiplex application

P1019	Description
0	Indicates that this pump is the master of the Pump Genius, i.e., this pump is control the pumping, defining speed reference through the PID controller and the need for starting or stopping other pumps.
1	Indicates that this pump is the slave, i.e., this pump is receive from the master pump the speed reference and the Start/Stop command.

P1058 – Operation Time for Forcing Rotation of Pumps

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

Description:

This parameter displays the operation time of the Pump Genius operating with only one pump running for logic to forcing rotation of pumps driven by CFW-11 inverter.



NOTE!

This operation time will only work on the master pump and can be changed by the user at any time.

4 CREATION AND DOWNLOAD THE APPLICATION

In order to configure the CFW-11 inverter for Pump Genius Multiplex 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 Multiplex application in the WLP and how to transfer it to the CFW-11 inverter.



NOTE!

The Pump Genius Multiplex 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 Multiplex ladder standard application. For this, select Tools, Application, CFW-11, Create, Pump Genius and finally click Multiplex;

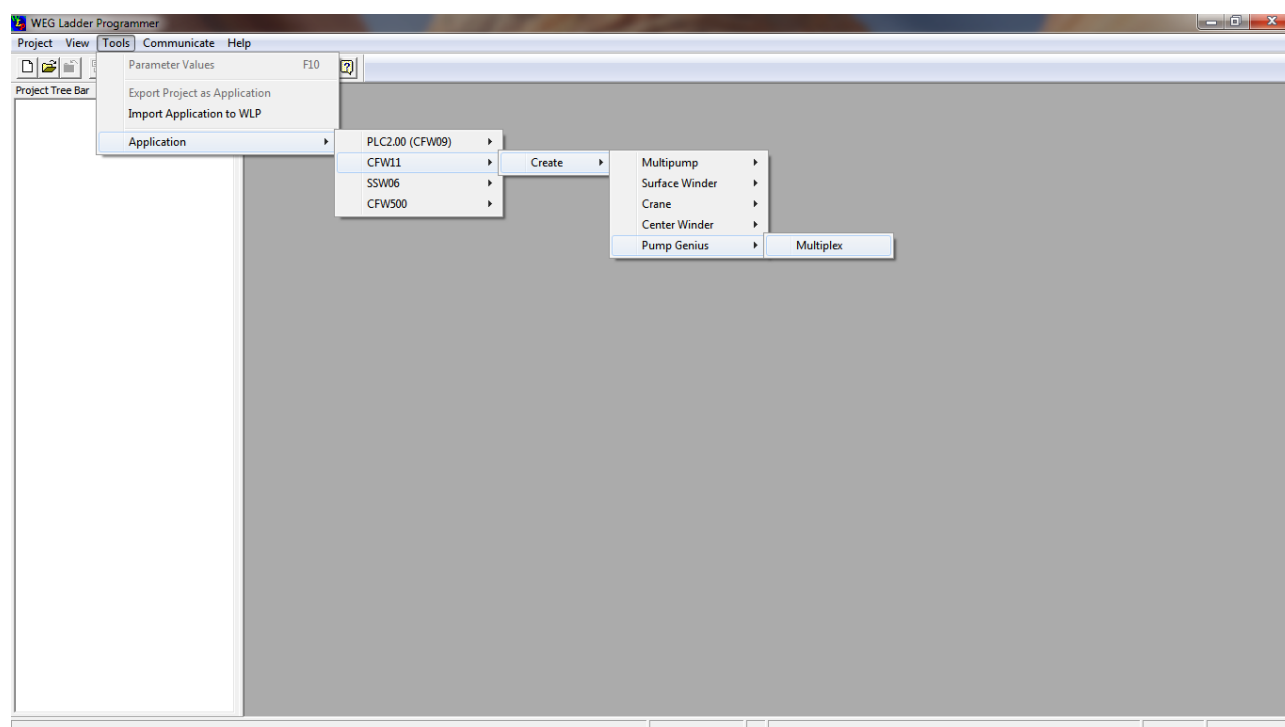


Figure 4.1 – Create the Pump Genius Multiplex application in the WLP

2nd Step: Name the new project created;

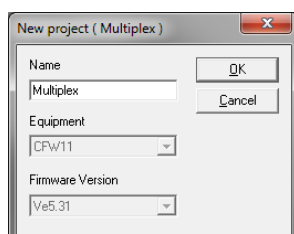


Figure 4.2 – Dialog to name the new project

Creation and Download the Application

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);

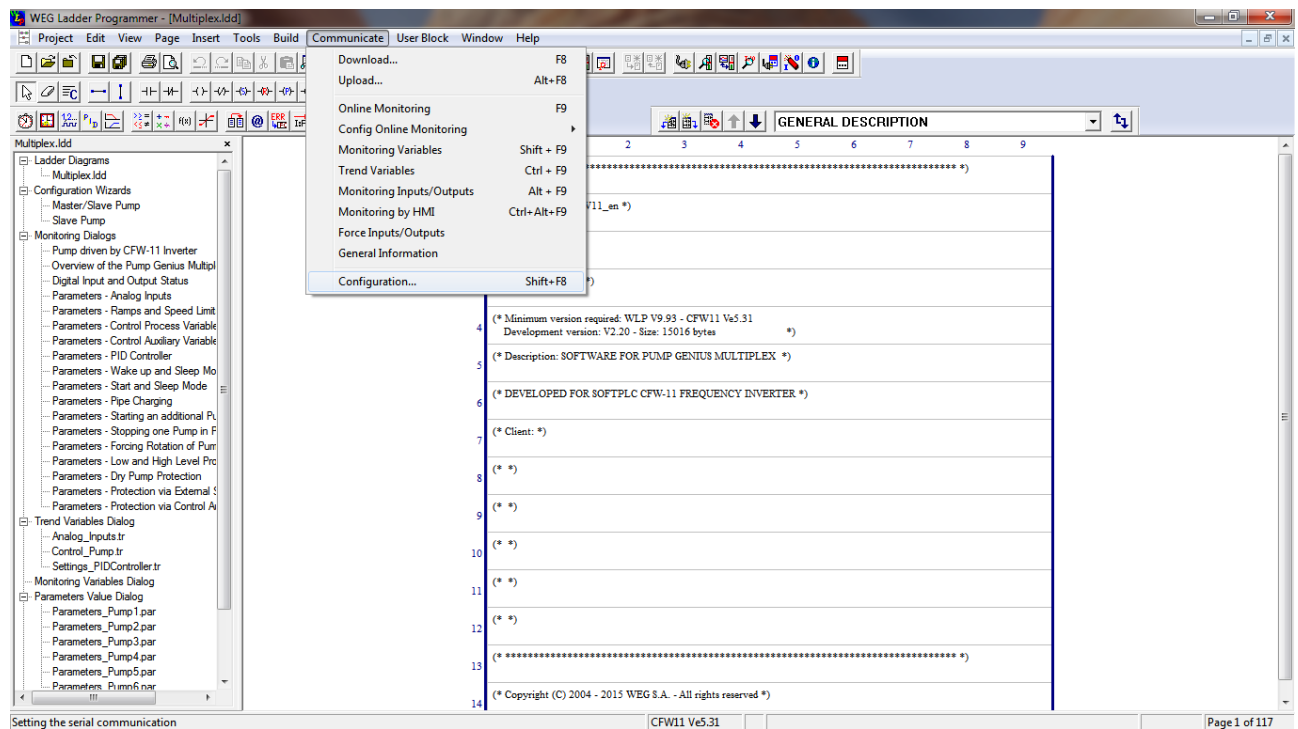


Figure 4.3 – Adjust the communication interface in the new project

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

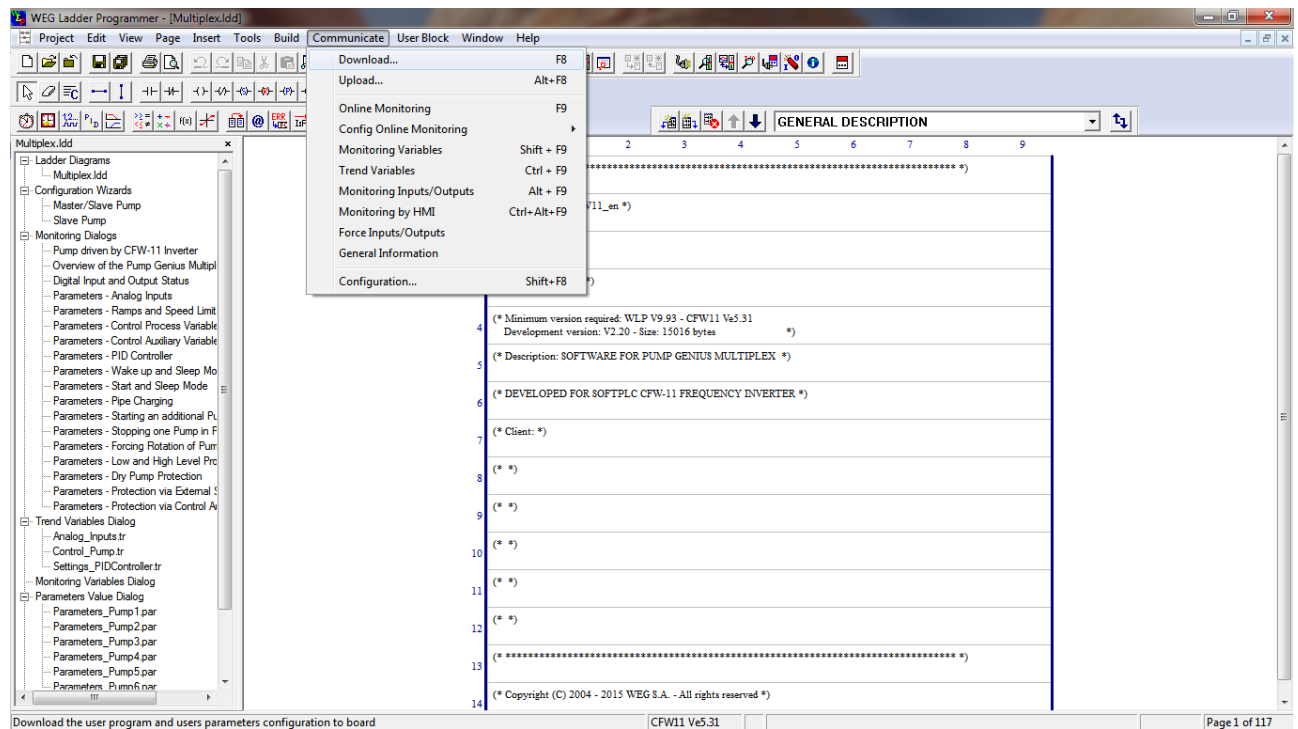


Figure 4.4 – Download the new project

Creation and Download the Application

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;

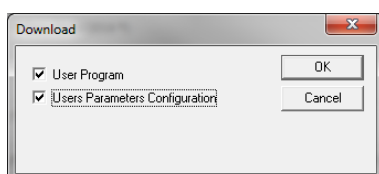


Figure 4.5 – Ladder application download dialog

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;

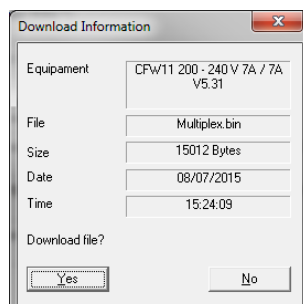


Figure 4.6 – User program download dialog

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.

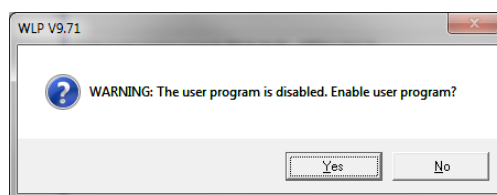


Figure 4.7 – Enabling dialog of the SoftPLC user's program

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;

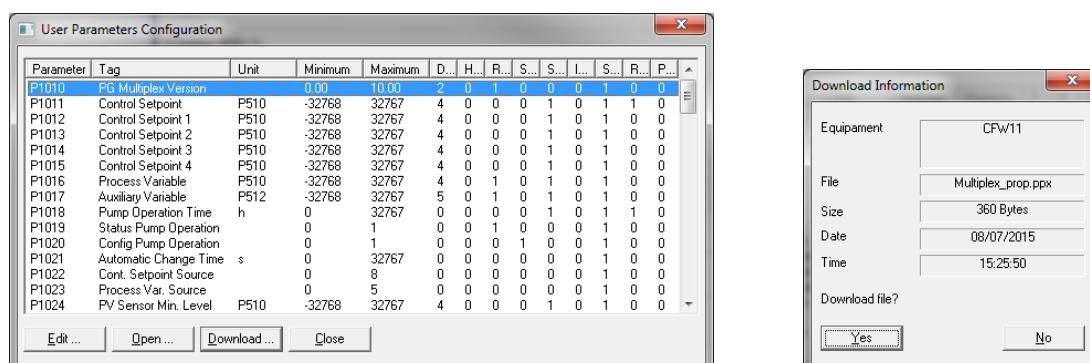


Figure 4.8 – User parameters download dialogs

Creation and Download the Application

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

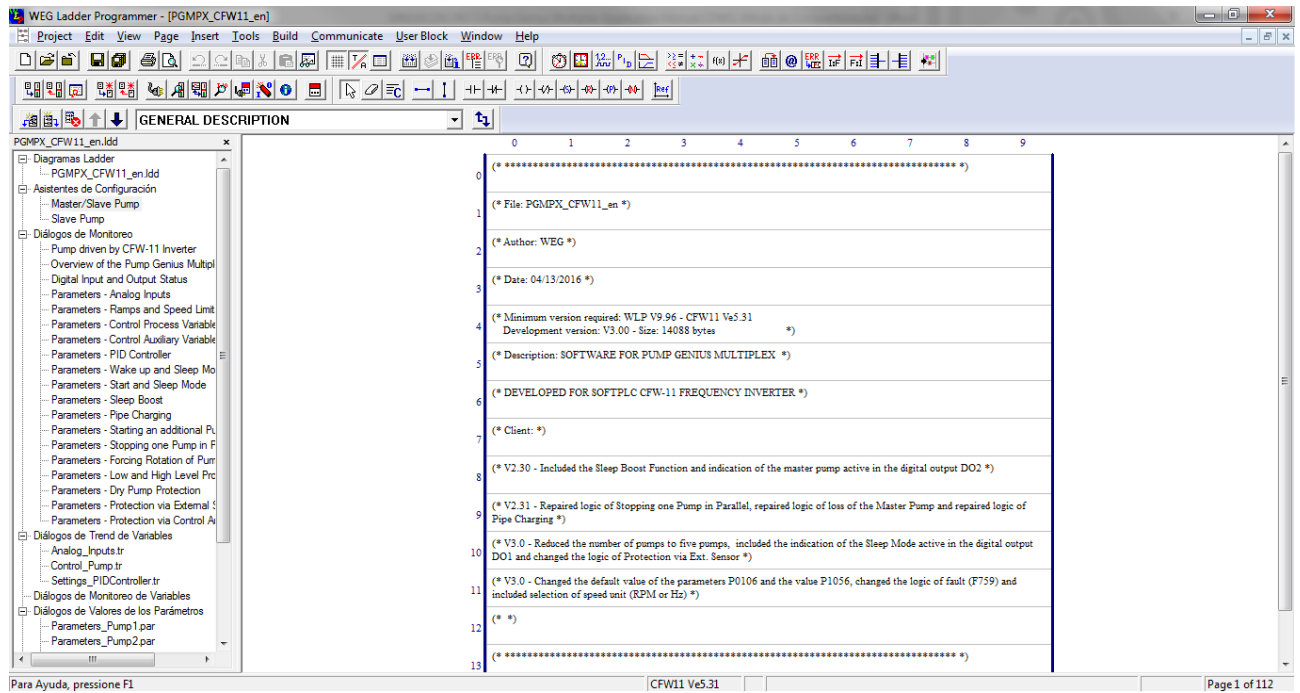


Figure 4.9 – Select the configuration wizard for Pump Genius Multiplex

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

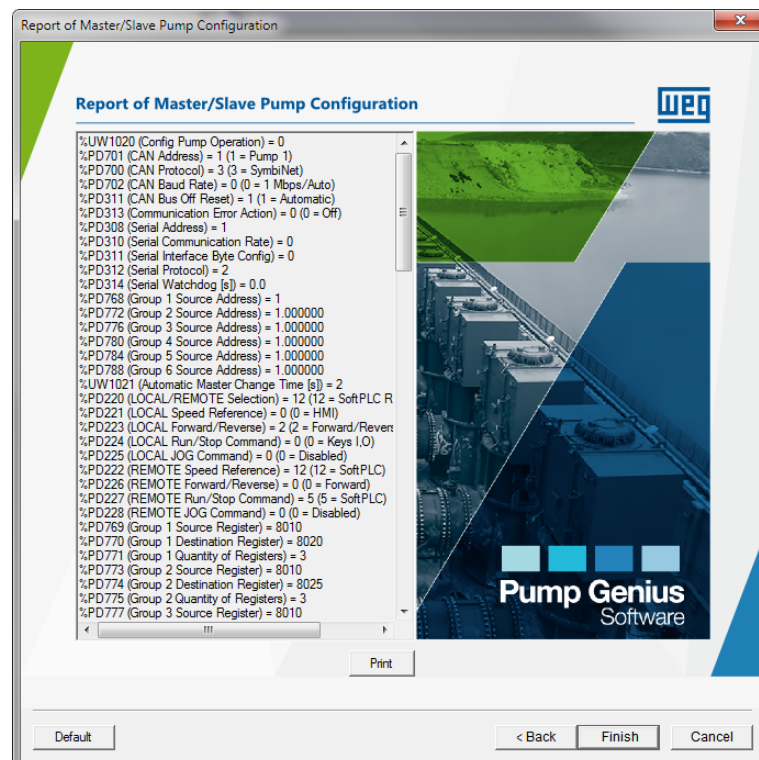


Figure 4.10 – Summary of Pump Genius Multiplex configuration

Creation and Download the Application

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

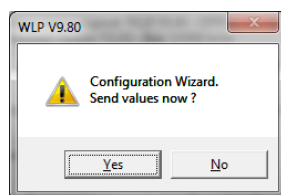


Figure 4.11 – Dialog for download the values of configuration wizard



NOTE!

After performing these steps, the CFW-11 inverter is configured for Pump Genius Multiplex application. You need to repeat these steps for the next pump in parallel defining another network address for it (the address of pump 1 is 1, the address of pump 2 is 2, and so on until the pump 5).



5 APPLICATION CONFIGURATION WIZARD

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

- **Master/Slave Pump:** This configuration wizard should be used to configure all pumps will operate as master/slave in the Pump Genius Multiplex;
- **Slave Pump:** This configuration wizard should be used to configure all pumps will operate as (always) slave in the Pump Genius Multiplex.



NOTE!
Basically after executing a configuration wizard to master/slave or slave pump, you must change the address of another master/slave or slave pump that data exchange occurs via SymbiNet network (the address of pump 1 is 1, the address of pump 2 is 2, and so on until the pump 5).

5.1 MASTER/SLAVE PUMP

The configuration of the master/slave pump in the Pump Genius Multiplex is done with the “Master/Slave Pump” configuration wizard, which consists of an oriented step by step guide for the configuration of the parameters regarding the application considering the pump network address.



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!

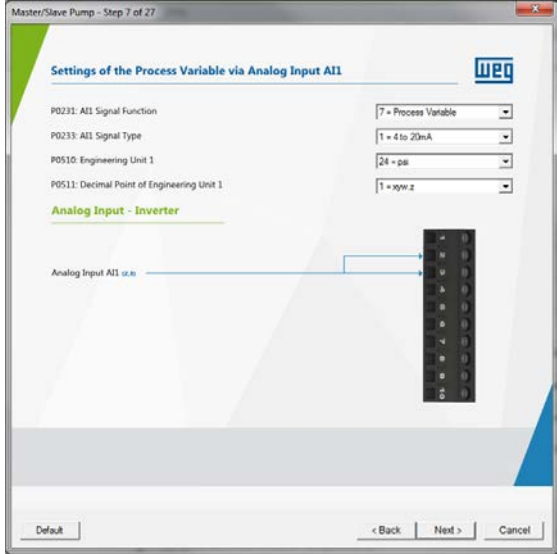
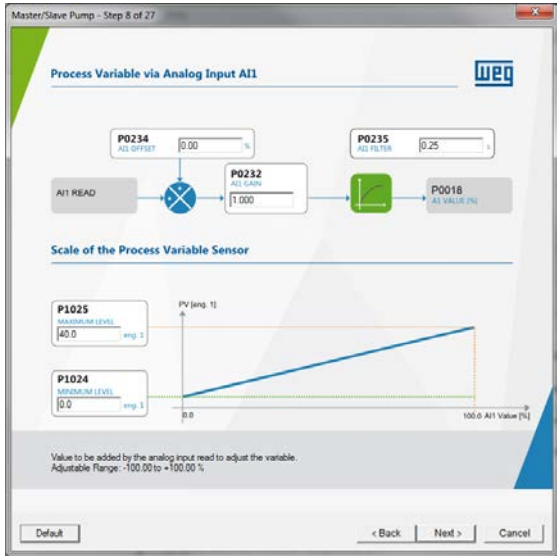
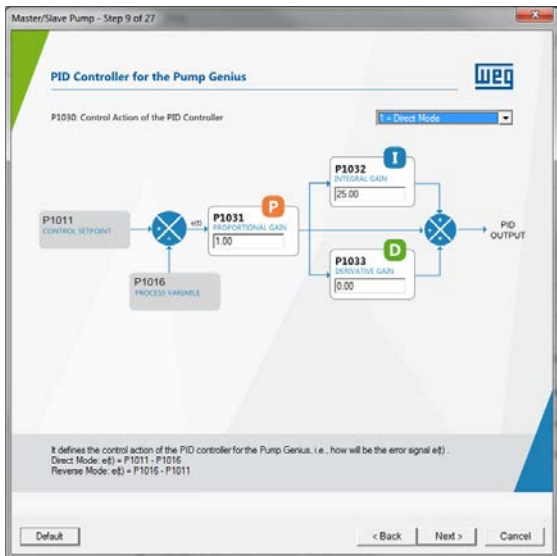
Table 5.1 – Configuration wizard for master/slave pump

Step	Description	WLP Configuration Wizard
	General presentation of the application Pump Genius Multiplex configuration wizard for Master/Slave Pump.	

1	<p>It presents the options to define the communication interface of the SymbiNet network.</p>	
2 - 1	<p>It presents the parameters for configuration of the RS485 communication interface:</p> <p>P0308: Serial Address</p> <p>P0310: Serial Communication Rate</p> <p>P0311: Serial Interface Byte Configuration</p> <p>P0312: Serial Protocol</p> <p>P0313: Communication Error Action</p> <p>P0314: Serial Watchdog</p>	
2 - 2	<p>It presents the parameters for configuration of the CAN communication interface:</p> <p>P0313: Communication Error Action</p> <p>P0700: CAN Protocol</p> <p>P0701: CAN Address</p> <p>P0702: CAN Baud Rate</p> <p>P0703: CAN Bus Off Reset</p> <p>P0703: CAN Bus Off Reset</p>	

<p>3 - 1</p>	<p>It presents the parameters for configuration of the reference commands and the SymbiNet protocol via RS485 communication interface:</p> <p>P0220: Local/Remote Selection Source</p> <p>P0221: Speed Reference Selection - Local Situation</p> <p>P0222: Speed Reference Selection - Remote Situation</p> <p>P0223: Forward/Reverse Selection - Local Situation</p> <p>P0224: Run/Stop Selection - Local Situation</p> <p>P0225: JOG Selection - Local Situation</p> <p>P0226: Forward/Reverse Selection - Remote Situation</p> <p>P0227: Run/Stop Selection - Remote Situation</p> <p>P0228: JOG Selection - Remote Situation</p> <p>P0768: Enable Pump 1 Address</p> <p>P0772: Enable Pump 2 Address</p> <p>P0776: Enable Pump 3 Address</p> <p>P0780: Enable Pump 4 Address</p> <p>P0784: Enable Pump 5 Address</p> <p>P0796: Highest Allowed Address</p> <p>P1021: Automatic Master Pump Change Over Time in the event of Master Fails</p>	
<p>3 - 2</p>	<p>It presents the parameters for configuration of the reference commands the SymbiNet protocol via CAN communication interface:</p> <p>P0220: Local/Remote Selection Source</p> <p>P0221: Speed Reference Selection - Local Situation</p> <p>P0222: Speed Reference Selection - Remote Situation</p> <p>P0223: Forward/Reverse Selection - Local Situation</p> <p>P0224: Run/Stop Selection - Local Situation</p> <p>P0225: JOG Selection - Local Situation</p> <p>P0226: Forward/Reverse Selection - Remote Situation</p> <p>P0227: Run/Stop Selection - Remote Situation</p> <p>P0228: JOG Selection - Remote Situation</p> <p>P0768: Enable Pump 1 Address</p> <p>P0772: Enable Pump 2 Address</p> <p>P0776: Enable Pump 3 Address</p> <p>P0780: Enable Pump 4 Address</p> <p>P0784: Enable Pump 5 Address</p> <p>P1021: Automatic Master Pump Change Over Time in the event of Master Fails</p>	

4	<p>It presents the parameters for the configuration of the CFW-11 ramps limits and speed:</p> <p>P0100: Acceleration Time</p> <p>P0101: Deceleration Time</p> <p>P0133: Minimum Speed Reference Limit</p> <p>P0134: Maximum Speed Reference Limit</p>	
5	<p>It presents the parameters for the configuration of the functions of the CFW-11 digital inputs and outputs:</p> <p>P0263: DI1 Function</p> <p>P0264: DI2 Function</p> <p>P0265: DI3 Function</p> <p>P0266: DI4 Function</p> <p>P0267: DI5 Function</p> <p>P0268: DI6 Function</p> <p>P0269: DI7 Function</p> <p>P0270: DI8 Function</p> <p>P0275: DO1 Function (RL1)</p> <p>P0276: DO2 Function (RL2)</p> <p>P0277: DO3 Function (RL3)</p> <p>P0278: DO4 Function</p> <p>P0279: DO5 Function</p>	
6	<p>It presents the parameter for the source selection of the control process variable:</p> <p>P1023: Control Process Variable Selection Source</p>	

<p>7 - 1 to 7 - 5</p>	<p>It presents the parameters for the configuration of the control process variable via analog input AI1, AI2, AI3 or AI4 and the engineering unit of the control process variable:</p> <p>P0231, P0236, P0241 and P0246: AI1, AI2, AI3 and AI4 Signal Function</p> <p>P0233, P0238, P0243 and P0248: Signal Type AI1, AI2, AI3 and AI4</p> <p>P0510: Engineering Unit 1</p> <p>P0511: Decimal Point of Engineering Unit 1</p>	
<p>8 - 1 to 8 - 5</p>	<p>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:</p> <p>P0234, P0239, P0244 and P0249: AI1, AI2, AI3 and AI4 Offset</p> <p>P0232, P0237, P0242 and P0247: AI1, AI2, AI3 and AI4 Gain</p> <p>P0235, P0240, P0245 and P0250: AI1, AI2, AI3 and AI4 Filter</p> <p>P1024: Control Process Variable Sensor Minimum Level</p> <p>P1025: Control Process Variable Sensor Maximum Level</p>	
<p>9</p>	<p>It presents the parameters for the configuration of the PID controller for the Pump Genius:</p> <p>P1030: Control Action of the PID Controller</p> <p>P1031: PID Proportional Gain</p> <p>P1032: PID Integral Gain</p> <p>P1033: PID Derivative Gain</p>	

10	<p>It presents the parameter for the source selection of the Pump Genius control setpoint: P1022: Control Setpoint Selection Source</p>	
11 - 1 to 11 - 4	<p>It presents the parameters for the configuration of the Pump Genius control setpoint via analog input AI1, AI2, AI3 or AI4:</p> <p>P0231, P0236, P0241 and P0246: AI1, AI2, AI3 and AI4 Signal Function</p> <p>P0232, P0237, P0242 and P0247: AI1, AI2, AI3 and AI4 Gain</p> <p>P0233, P0238, P0243 and P0248: AI1, AI2, AI3 and AI4 Signal Type</p> <p>P0234, P0239, P0244 and P0249: AI1, AI2, AI3 and AI4 Offset</p> <p>P0235, P0240, P0245 and P0250: AI1, AI2, AI3 and AI4 Filter</p>	
11 - 5	<p>It presents the parameters for the configuration of the Pump Genius control setpoint via HMI of CFW-11:</p> <p>P1011: Control Setpoint</p>	

<p>11 - 6 to 11 - 8</p>	<p>It presents the parameters for the configuration of the Pump Genius control setpoint via logical combination of digital inputs DI4 and DI5:</p> <p>P0266: DI4 Function P0267: DI5 Function P1012: Control Setpoint 1 P1013: Control Setpoint 2 P1014: Control Setpoint 3 P1015: Control Setpoint 4</p>	
<p>12</p>	<p>It presents the parameter for the source selection of the Speed Engineering Unit.</p>	
<p>13</p>	<p>It presents the modes or conditions to startup the Pump Genius.</p>	

Application Configuration Wizard

<p>14 - 1</p>	<p>It presents the parameters for the configuration of the sleep mode and wake up mode:</p> <p>P1034: Control Process Variable Deviation for Pump Genius to Wake up</p> <p>P1036: Time Delay for Pump Genius to Wake up</p> <p>P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode</p> <p>P1038: Time Delay for Pump Genius goes to Sleep Mode</p>	
<p>14 - 2</p>	<p>It presents the parameters for the configuration of the sleep mode and start level mode:</p> <p>P1035: Control Process Variable Level for Starting the Pump Genius</p> <p>P1036: Time Delay for Pump Genius Starting by Level</p> <p>P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode</p> <p>P1038: Time Delay for Pump Genius goes to Sleep Mode</p>	
<p>15</p>	<p>It presents the parameters for configuration of the sleep boost:</p> <p>P1039: Sleep Boost Offset</p> <p>P1040: Sleep Boost Maximum Time</p>	

<p>16</p>	<p>It presents the parameters for the configuration of pipe charging using the 1st pump to be started in the Pump Genius:</p> <p>P0102: Acceleration Time 2</p> <p>P0105: Enable Pipe Charging (1st / 2nd Ramp Selection)</p> <p>P1041: Pipe Charging Time</p>	
<p>17</p>	<p>It presents the parameters for the configuration of the conditions for starting an additional pump in parallel in the Pump Genius:</p> <p>P1052: Pump Motor Speed for Starting an additional Pump in Parallel</p> <p>P1053: Control Process Variable Deviation for Starting an additional Pump in Parallel</p> <p>P1054: Time Delay for Starting an additional Pump in Parallel</p>	
<p>18</p>	<p>It presents the parameters for the configuration of the conditions for stopping one pump in parallel in the Pump Genius:</p> <p>P1055: Pump Motor Speed for Stopping one Pump in Parallel</p> <p>P1056: Control Process Variable Deviation for Stopping one Pump in Parallel</p> <p>P1057: Time Delay for Stopping one Pump in Parallel</p>	

Application Configuration Wizard

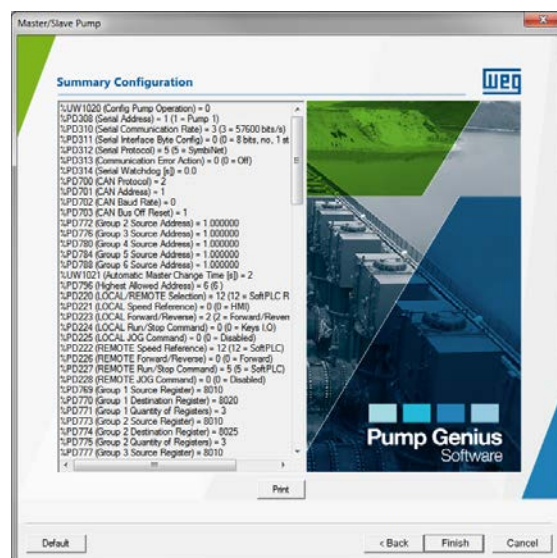


19	<p>It presents the parameters for the configuration of the forcing rotation of pumps in the Pump Genius:</p> <p>P1059: Time Interval for Forcing Rotation of Pumps</p> <p>P1060: Pump Motor Speed for Forcing Rotation of Pumps</p>	
20	<p>It presents the parameters for the configuration of the low level protection for the control process variable (pipe breaking) and high level protection for process variable (pipe obstruction):</p> <p>P1026: Value for Low Level Alarm for the Control Process Variable</p> <p>P1027: Time Delay for Low Level Fault for the Control Process Variable (F771)</p> <p>P1028: Value for High Level Alarm for the Control Process Variable</p> <p>P1029: Time for High Level Fault for the Control Process Variable (F773)</p>	
21	<p>It presents the parameters for the configuration of the dry pump protection:</p> <p>P1042: Motor Speed for Dry Pump</p> <p>P1043: Motor Torque for Dry Pump</p> <p>P1044: Time Delay for Dry Pump Fault (F781)</p>	

22	<p>It presents the parameter for the configuration of the pump protection via external sensor (DI6):</p> <p>P0268: DI6 Function</p> <p>P1045: Time Delay for Pump Protection via External Sensor (A784)</p>	
23	<p>It presents the parameter for the source selection of the control auxiliary variable for pump protection:</p> <p>P1046: Control Auxiliary Variable Selection Source for Pump Protection</p>	
24 - 1 to 24 - 4	<p>It presents the parameters for the configuration of the control auxiliary variable for pump protection via analog input AI1, AI2, AI3 or AI4, and the engineering unit of the control auxiliary variable:</p> <p>P0231, P0236, P0241 and P0246: AI1, AI2, AI3 and AI4 Signal Function</p> <p>P0233, P0238, P0243 and P0248: AI1, AI2, AI3 and AI4 Signal Type</p> <p>P0512: Engineering Unit 2</p> <p>P0513: Decimal Point of Engineering Unit 2</p>	

<p>25 - 1 to 25 - 4</p>	<p>It presents the parameters for the configuration of the control auxiliary variable for pump protection via analog input AI1, AI2, AI3 or AI4, and the scale of the control auxiliary variable sensor for pump protection:</p> <p>P0232, P0237, P0242 and P0247: AI1, AI2, AI3 and AI4 Gain</p> <p>P0234, P0239, P0244 and P0249: AI1, AI2, AI3 and AI4 Offset</p> <p>P0235, P0240, P0245 and P0250: AI1, AI2, AI3 and AI4 Filter</p> <p>P1047: Control Auxiliary Variable Sensor Minimum Level</p> <p>P1048: Control Auxiliary Variable Sensor Maximum Level</p>	
<p>26</p>	<p>It presents the parameters for the configuration of the pump protection via control auxiliary variable:</p> <p>P1049: Value to detect Low Level of Control Auxiliary Variable</p> <p>P1050: Control Setpoint in Low Level</p> <p>P1051: Hysteresis to reactivate the Control Setpoint</p>	
<p>27</p>	<p>It presents the parameters that define which variables will be shown on the HMI display in the monitoring mode:</p> <p>P0205: Reading Parameter Selection 1</p> <p>P0206: Reading Parameter Selection 2</p> <p>P0207: Reading Parameter Selection 3</p>	

It presents a summary with all the parameters configured of Pump Genius Multiplex application by the Master/Slave Pump configuration wizard.



5.2 SLAVE PUMP

The configuration of the slave pump in the Pump Genius Multiplex is done with the “Slave Pump” configuration wizard, which consists of an oriented step by step guide for the configuration of the parameters regarding the application considering the pump network address.



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 slave pump

Step	Description	WLP Configuration Wizard
	General presentation of the application Pump Genius Multiplex configuration wizard for Slave Pump.	
1	It presents the options to define the communication interface of the SymbiNet network.	

<p>2 - 1</p>	<p>It presents the parameters for configuration of the RS485 communication interface:</p> <p>P0308: Serial Address</p> <p>P0310: Serial Communication Rate</p> <p>P0311: Serial Interface Byte Configuration</p> <p>P0312: Serial Protocol</p> <p>P0313: Communication Error Action</p> <p>P0314: Serial Watchdog</p>	
<p>2 - 2</p>	<p>It presents the parameters for configuration of the CAN communication interface:</p> <p>P0313: Communication Error Action</p> <p>P0700: CAN Protocol</p> <p>P0701: CAN Address</p> <p>P0702: CAN Baud Rate</p> <p>P0703: CAN Bus Off Reset</p>	
<p>3 - 1</p>	<p>It presents the parameters for configuration of the reference commands and the SymbiNet protocol via RS485 communication interface:</p> <p>P0220: Local/Remote Selection Source</p> <p>P0221: Speed Reference Selection - Local Situation</p> <p>P0222: Speed Reference Selection - Remote Situation</p> <p>P0223: Forward/Reverse Selection - Local Situation</p> <p>P0224: Run/Stop Selection - Local Situation</p> <p>P0225: JOG Selection - Local Situation</p> <p>P0226: Forward/Reverse Selection - Remote Situation</p> <p>P0227: Run/Stop Selection - Remote Situation</p> <p>P0228: JOG Selection - Remote Situation</p> <p>P0768: Enable Pump 1 Address</p> <p>P0772: Enable Pump 2 Address</p> <p>P0776: Enable Pump 3 Address</p> <p>P0780: Enable Pump 4 Address</p> <p>P0784: Enable Pump 5 Address</p> <p>P0796: Highest Allowed Address</p>	

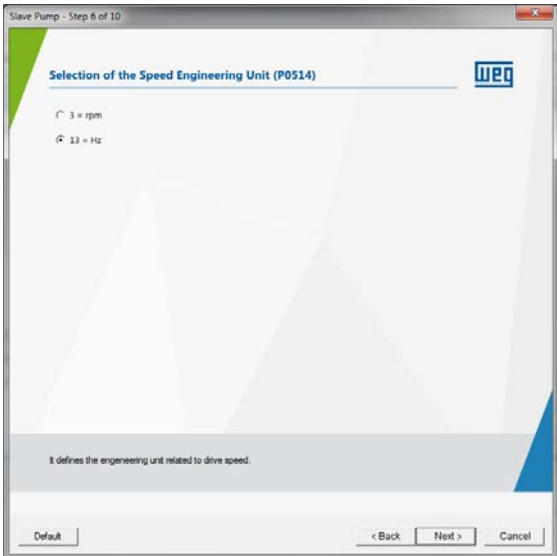
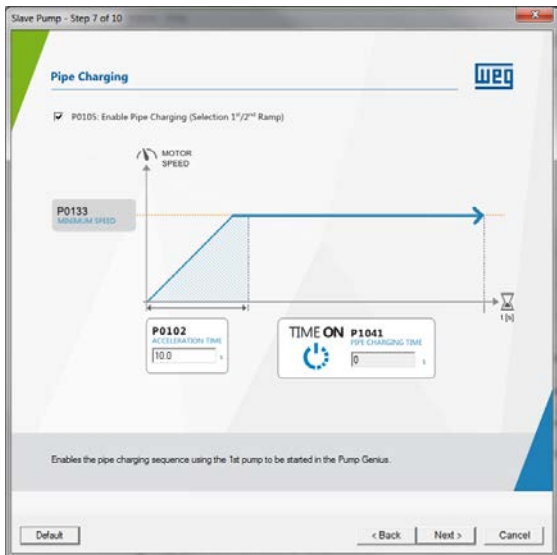
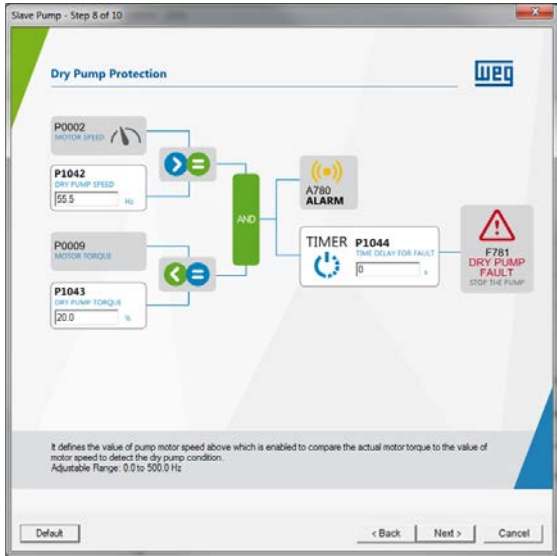
Application Configuration Wizard



<p>3 - 2</p>	<p>It presents the parameters for configuration of the reference commands and the SymbiNet protocol via CAN communication interface:</p> <p>P0220: Local/Remote Selection Source</p> <p>P0221: Speed Reference Selection - Local Situation</p> <p>P0222: Speed Reference Selection - Remote Situation</p> <p>P0223: Forward/Reverse Selection - Local Situation</p> <p>P0224: Run/Stop Selection - Local Situation</p> <p>P0225: JOG Selection - Local Situation</p> <p>P0226: Forward/Reverse Selection - Remote Situation</p> <p>P0227: Run/Stop Selection - Remote Situation</p> <p>P0228: JOG Selection - Remote Situation</p> <p>P0768: Enable Pump 1 Address</p> <p>P0772: Enable Pump 2 Address</p> <p>P0776: Enable Pump 3 Address</p> <p>P0780: Enable Pump 4 Address</p> <p>P0784: Enable Pump 5 Address</p>	
<p>4</p>	<p>It presents the parameters for the configuration of the CFW-11 ramps and speed limits:</p> <p>P0100: Acceleration Time</p> <p>P0101: Deceleration Time</p> <p>P0133: Minimum Speed Reference Limit</p> <p>P0134: Maximum Speed Reference Limit</p>	
<p>5</p>	<p>It presents the parameters for the configuration of the functions of the CFW-11 digital inputs and outputs:</p> <p>P0263: DI1 Function</p> <p>P0264: DI2 Function</p> <p>P0265: DI3 Function</p> <p>P0266: DI4 Function</p> <p>P0267: DI5 Function</p> <p>P0268: DI6 Function</p> <p>P0269: DI7 Function</p> <p>P0270: DI8 Function</p> <p>P0275: DO1 Function (RL1)</p> <p>P0276: DO2 Function (RL2)</p> <p>P0277: DO3 Function (RL3)</p> <p>P0278: DO4 Function</p> <p>P0279: DO5 Function</p>	

Application Configuration Wizard



6	<p>It presents the parameter for the source selection of the Speed Engineering Unit</p>	
7	<p>It presents the parameters for the configuration of pipe charging using the 1st pump to be started in the Pump Genius:</p> <p>P0102: Acceleration Time 2</p> <p>P0105: Enable Pipe Charging (1st / 2nd Ramp Selection)</p> <p>P1041: Pipe Charging Time</p>	
8	<p>It presents the parameters for the configuration of the dry pump protection:</p> <p>P1042: Motor Speed for Dry Pump</p> <p>P1043: Motor Torque for Dry Pump</p> <p>P1044: Time Delay for Dry Pump Fault (F781)</p>	

<p>9</p>	<p>It presents the parameter for the configuration of the pump protection via external sensor (DI6):</p> <p>P0268: DI6 Function</p> <p>P1045: Time Delay for Pump Protection via External Sensor (A784)</p>	
<p>10</p>	<p>It presents the parameters that define which variables will be shown on the HMI display in the monitoring mode:</p> <p>P0205: Reading Parameter Selection 1</p> <p>P0206: Reading Parameter Selection 2</p> <p>P0207: Reading Parameter Selection 3</p>	
	<p>It presents a summary with all the parameters configured of Pump Genius Multiplex application by the Slave Pump configuration wizard.</p>	

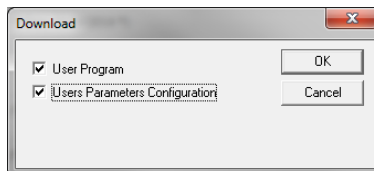
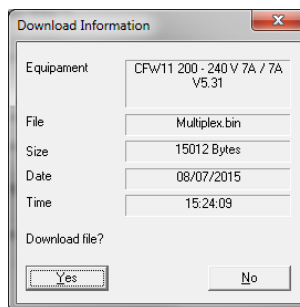
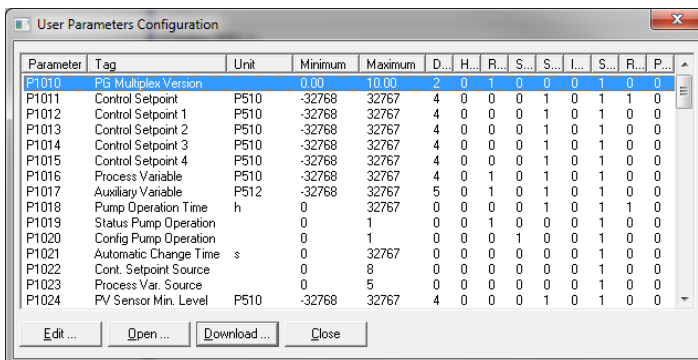
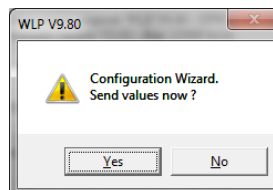
6 DOWNLOAD DIALOG BOXES

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 Multiplex application

Description	WLP Download Dialog Box
Download dialog box of the application developed with the WLP containing the following options: <ul style="list-style-type: none"> User Program; Configuration of the User's Parameters. 	
User program download dialog box containing: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 master/slave pump or slave pump configuration wizard.	

7 MONITORING DIALOG BOXES

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

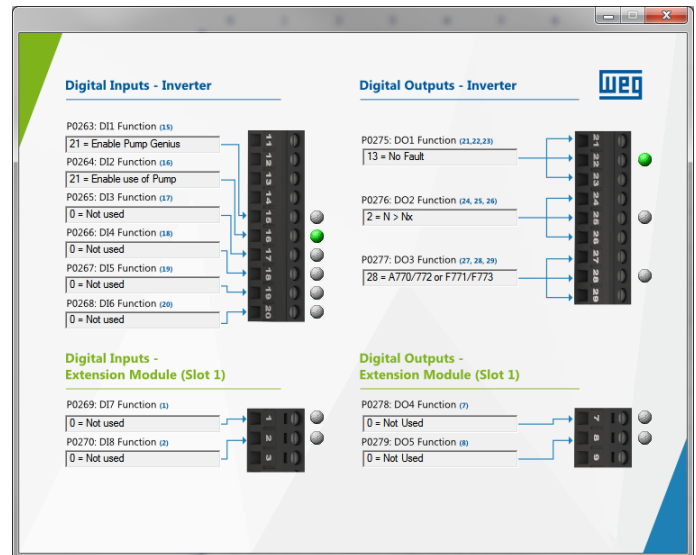
Table 7.1 – Monitoring dialogs of the Pump Genius Multiplex application

Description	WLP Monitoring Dialog
<p>Monitoring of the pump driven by CFW-11 inverter. It permits visualization of the following variables:</p> <ul style="list-style-type: none"> ■ Actual control setpoint and control process variable displayed as engineering unit 1; ■ Control Auxiliary variable as engineering unit 2; ■ Configuration of pump in the SymbiNet network; ■ Configuration of pump operation; ■ 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, command for enabling use of pump via DI2, status of sleep mode, sleep boost, pipe charging, forcing rotation of pumps, low level and high level of control process variable, low level and high level of control auxiliary variable, dry pump condition, and status of external sensor (DI6); ■ Status of SymbiNet network configuration indicating: network configured, pump with the master function, error of master pump configuration, loss of the master identified by slave and acknowledging SymbiNet network; ■ 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. 	
<p>Monitoring of the status of Pump Genius Multiplex. It permits the visualization of the following variables:</p> <ul style="list-style-type: none"> ■ Indication that the pump is being monitored; ■ Actual control setpoint and control process variable displayed as engineering unit 1; ■ Operation time of pumps 1, 2, 3, 4 and 5; ■ General status of pumps 1, 2, 3, 4 and 5 indicating: SymbiNet network configured, pump with the master function, command for enable Pump Genius via DI1, command for enable use of the pump via DI2, pump running, pump in remote situation and pump in fault; ■ Present alarm and fault of the pump in monitoring; ■ PID controller output, motor speed, motor current and motor torque of the pump in monitoring. 	

Monitoring Dialog Boxes

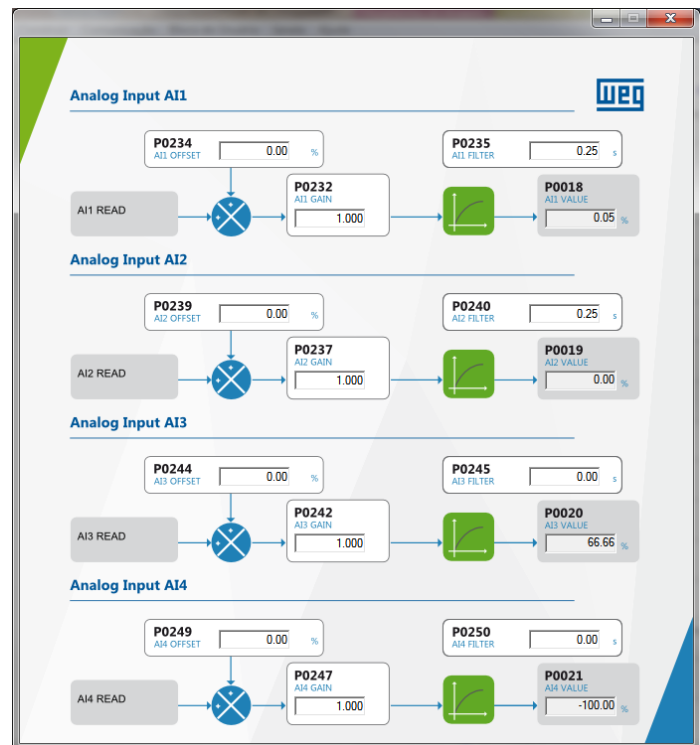
Monitoring of the status of commands made at the pump driven by CFW-11 inverter. It permits the visualization of the following variables:

- 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



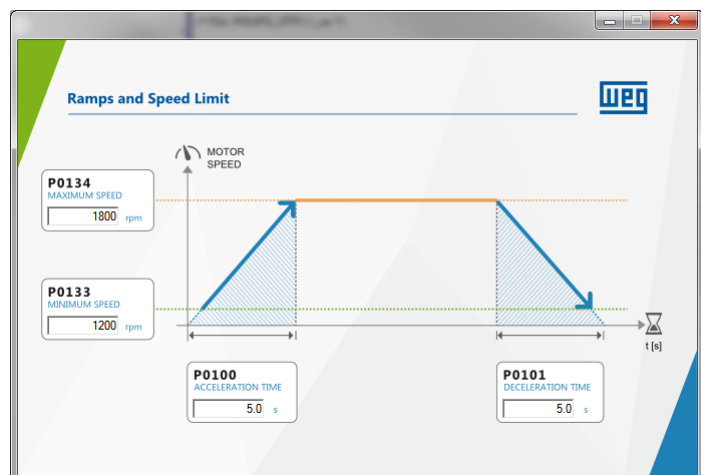
It shows the parameters for reading the Pump Genius signals via the CFW-11 analog inputs. It permits the modification and visualization of the following variables:

- 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;
- P0242: AI3 Gain;
- P0244: AI3 Offset;
- P0245: AI3 Filter;
- P0247: AI4 Gain;
- P0249: AI4 Offset;
- P0250: AI4 Filter.



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:

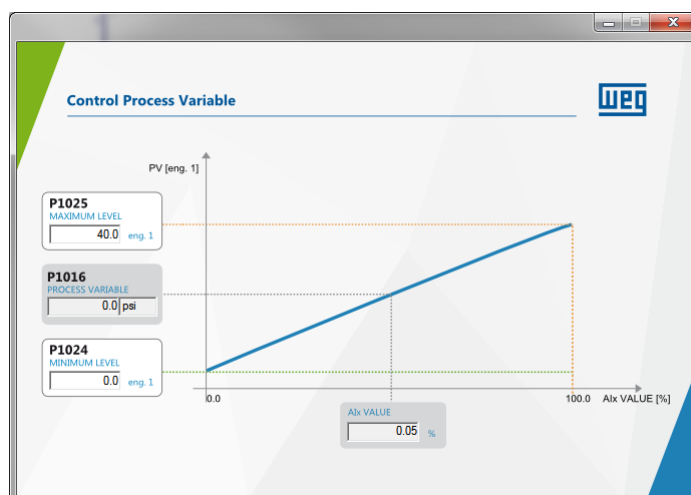
- P0100: Acceleration Time;
- P0101: Deceleration Time;
- P0133: Minimum Speed Reference Limit;
- P0134: Maximum Speed Reference Limit.



Monitoring Dialog Boxes

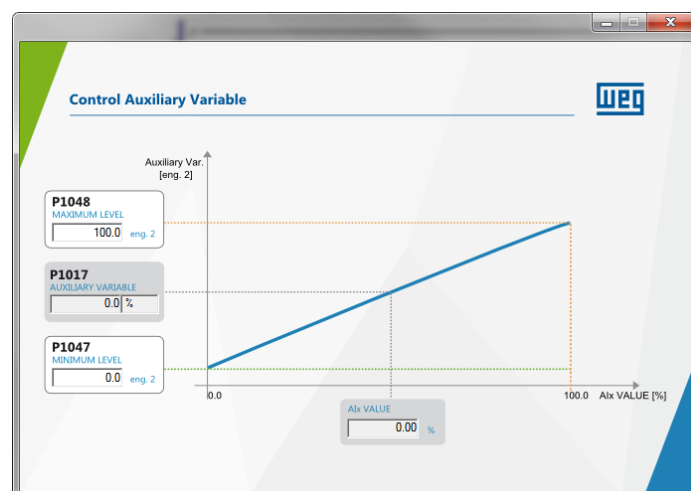
It shows the setting parameters of the control process variable. It permits the change and visualization of the following variables:

- 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 %.



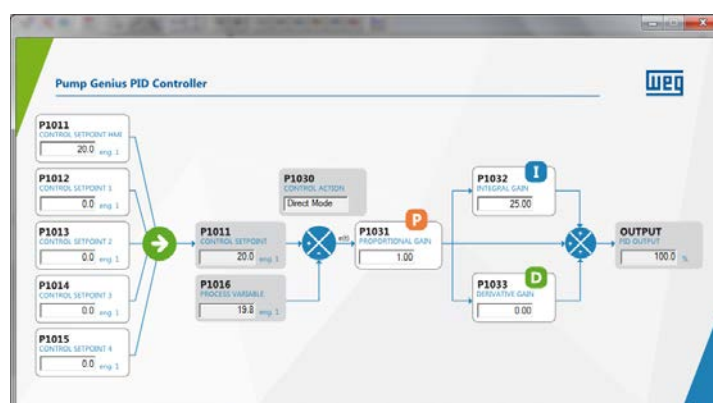
It shows the setting parameters of the control auxiliary variable. It permits the change and visualization of the following variables:

- P1047: Control Auxiliary Variable Sensor Minimum Level;
- P1048: Control Auxiliary Variable Sensor Maximum Level;
- Value of control auxiliary variable (P1017) displayed as engineering unit 2;
- Value of analog input selected for control auxiliary variable in %.



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

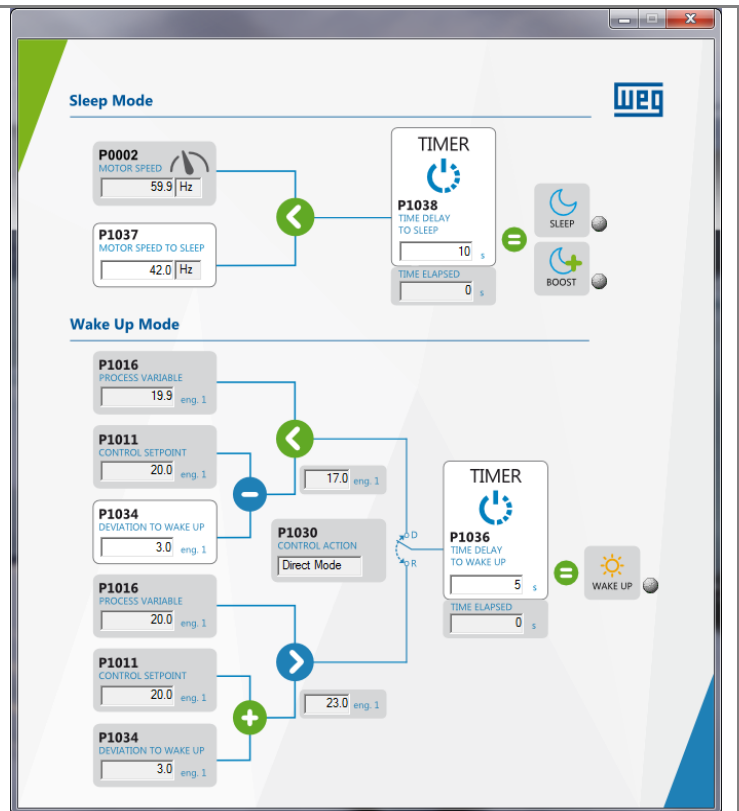
- P1011: Control Setpoint (read and write);
- P1012: Control Setpoint 1;
- P1013: Control Setpoint 2;
- P1014: Control Setpoint 3;
- P1015: Control Setpoint 4;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1031: PID Proportional Gain;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



Monitoring Dialog Boxes

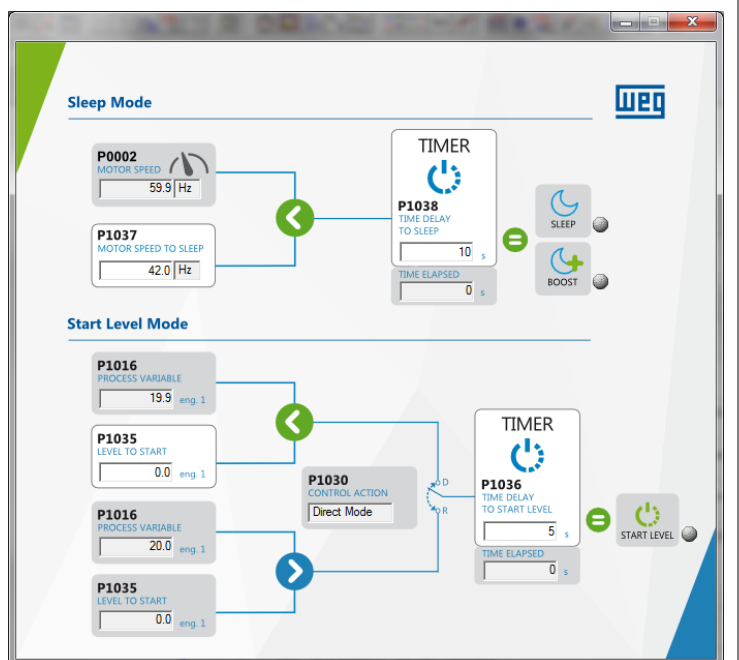
It shows the operation parameters for executing the start and stops the Pump Genius with Wake up Mode configuration. It permits the modification and visualization of the following variables:

- 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 Eng. Unit 3;
- 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.



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:

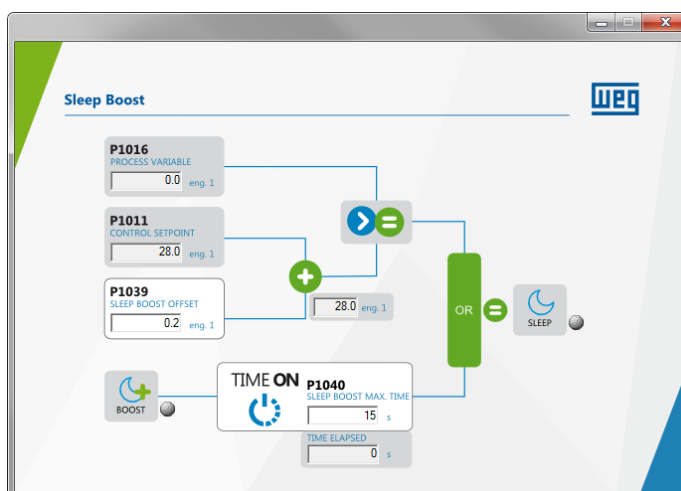
- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1035: Control Process Variable Level for Starting the Pump Genius;
- P1036: Time Delay for Pump Genius to Starting by Level;
- P1037: Pump Motor Speed below which Pump Genius goes to Sleep Mode;
- P1038: Time Delay for Pump Genius goes to Sleep Mode;
- Motor speed reference in Eng. Unit 3;
- 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.



Monitoring Dialog Boxes

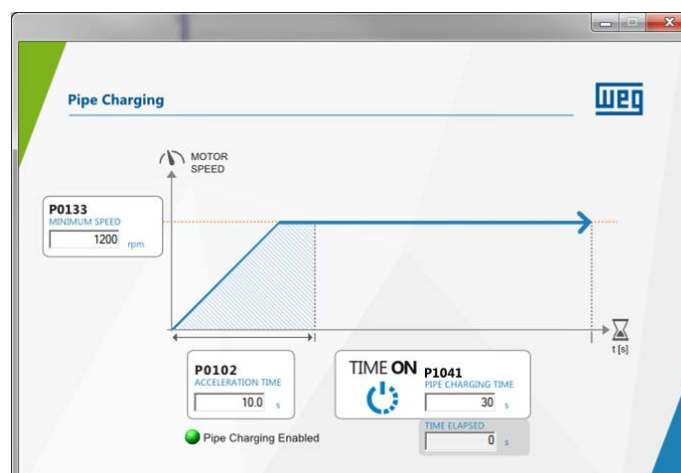
It shows the operation parameters of sleep boost function. It permits the modification and visualization of the following variables:

- 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:

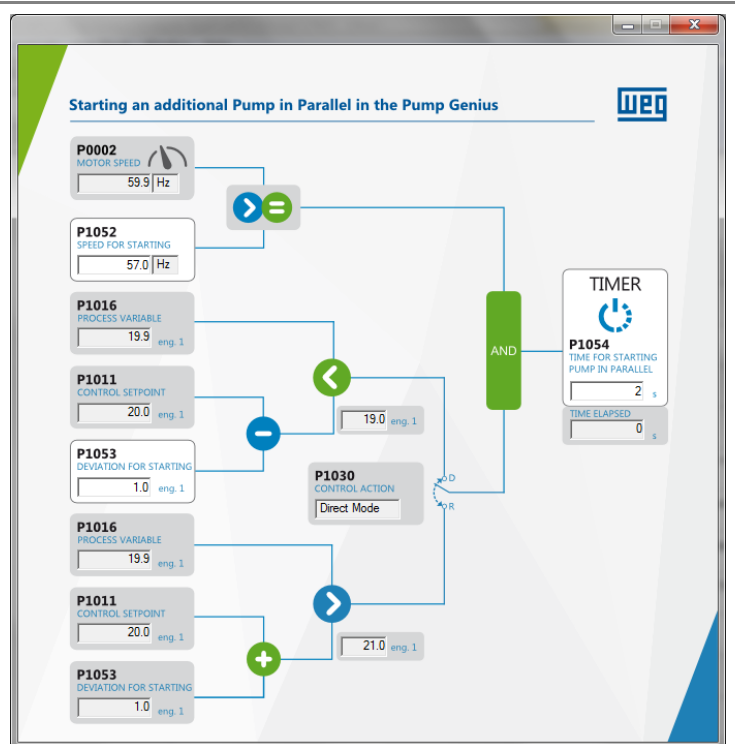
- P0102: Acceleration Time 2;
- P0133: Minimum Speed Reference Limit;
- P1041: Pipe Charging Time;
- Value of the time elapsed of the pipe charging;
- Indication of pipe charging enabled.



Monitoring Dialog Boxes

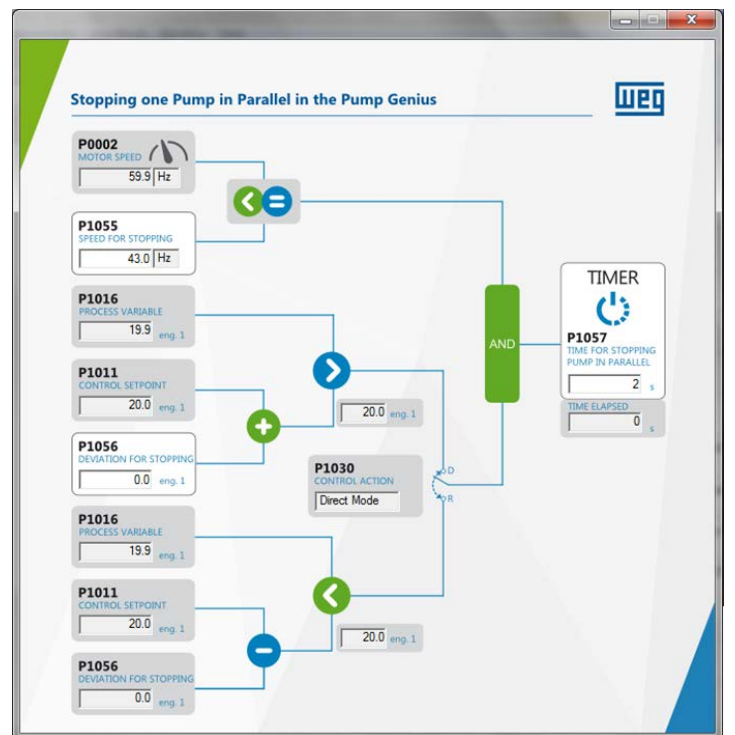
It shows the parameters for starting an additional pump in parallel in the Pump Genius. It permits the change and visualization of the following variables:

- 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;
- Motor speed reference in Eng. Unit 3;
- 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:

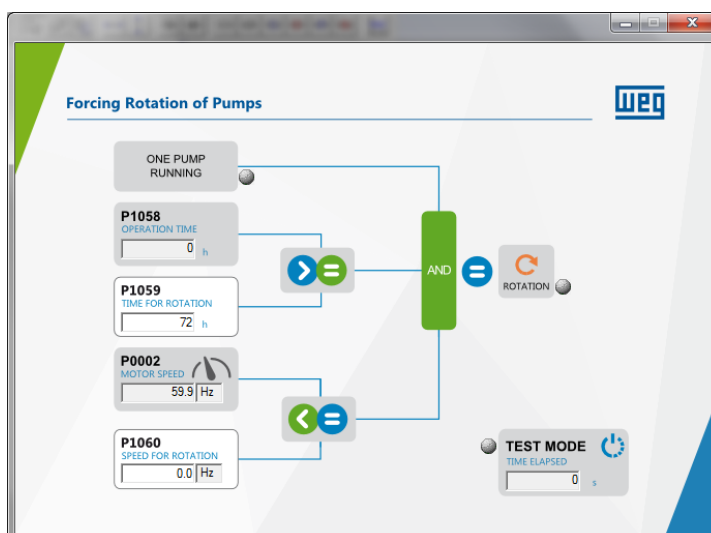
- P1011: Control Setpoint;
- P1016: Control Process Variable;
- P1030: Control Action of the PID Controller (direct mode or reverse mode);
- P1055: Pump Motor Speed for Stopping one Pump in Parallel;
- P1056: Control Process Variable Deviation for Stopping one Pump in Parallel;
- P1057: Time Delay for Stopping one Pump in Parallel;
- Motor speed reference in Eng. Unit 3;
- Value of the time elapsed for stopping one pump in parallel.



Monitoring Dialog Boxes

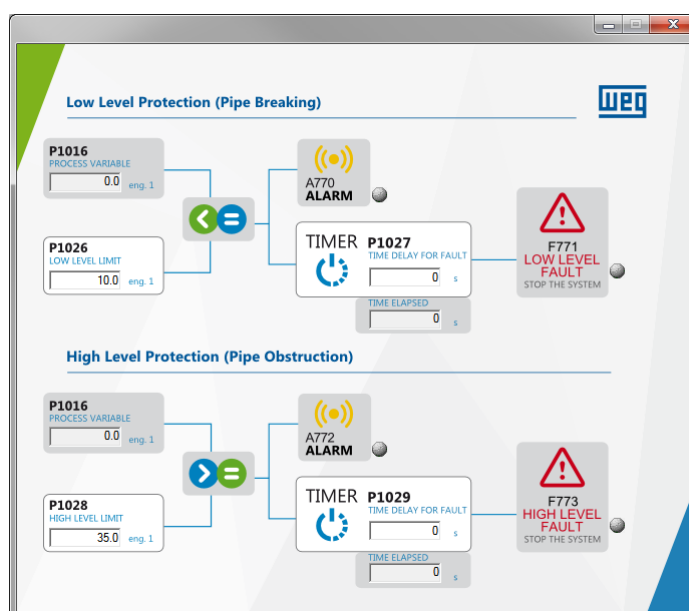
It shows the parameters for forcing rotation of pumps in the Pump Genius. It permits the change and visualization of the following variables:

- P1058: Forcing Rotation of Pumps Operation Time;
- P1059: Time Interval for Forcing Rotation of Pumps;
- P1060: Pump Motor Speed for Forcing Rotation of Pumps;
- Motor speed reference in Eng. Unit 3;
- 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.



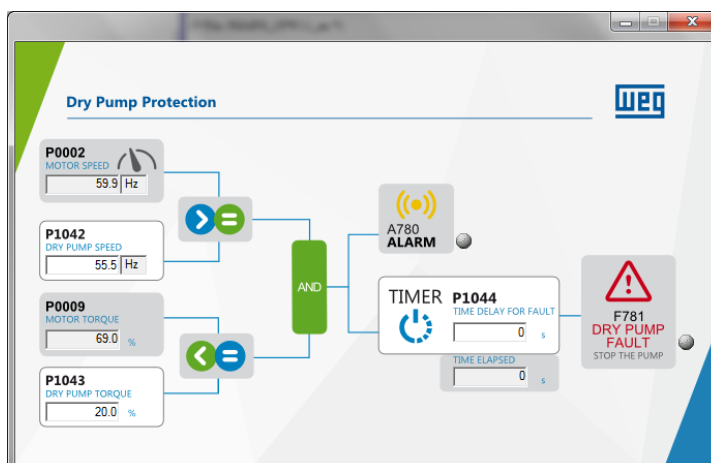
It shows the adjustment parameters of the low and high level protection for the control process variable. It permits the change and visualization of the following variables:

- 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:

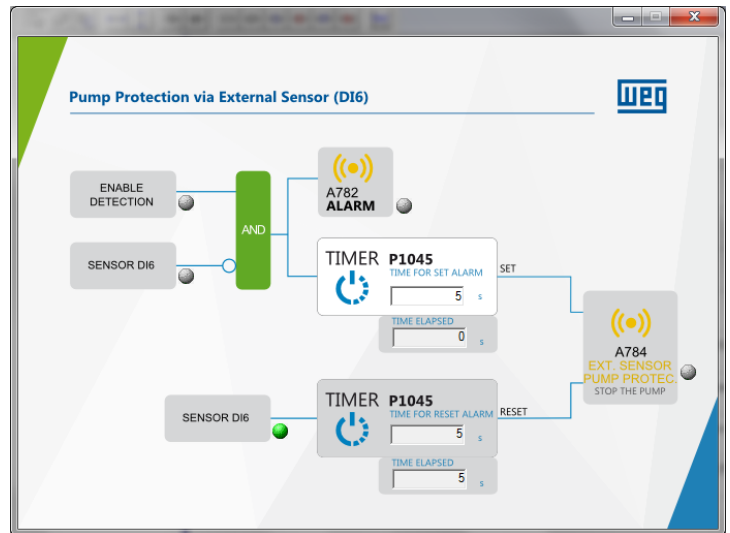
- P0002: Actual Motor Speed in Eng. Unit 3;
- P0009: Actual Motor Torque in %;
- P1042: Motor Speed for Dry Pump;
- P1043: Motor Torque for Dry Pump;
- P1044: Time Delay for Dry Pump Fault (F781);
- Value of the time elapsed for generate the dry pump fault (F781);
- Indication of active alarm and fault.



Monitoring Dialog Boxes

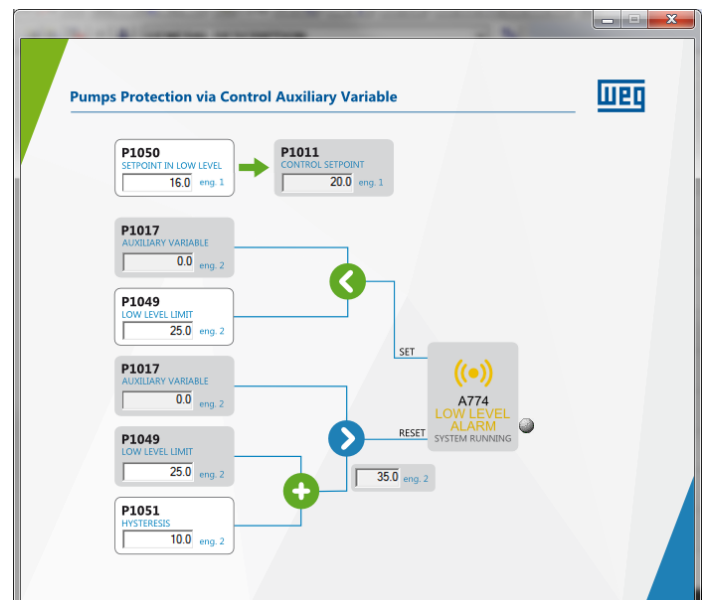
It shows the adjustment parameters for pump protection via external sensor in DI6 digital input. It permits the change and visualization of the following variables:

- P1045: Time Delay for Pump Protection via External Sensor Fault (F783);
- Value of the time elapsed for generate the alar F784;
- Indication of sensor (DI6) enabled;
- Indication of status of sensor installed in digital input DI6;
- Indication of active alarms.



It shows the adjustment parameters for pump protection via control auxiliary variable. It permits the change and visualization of the following variables:

- P1011: Control Setpoint;
- P1017: Control Auxiliary Variable;
- P1049: Value to detect Low Level of Control Auxiliary Variable;
- P1050: Control Setpoint in Low Level;
- P1051: Hysteresis to reactivate the Control Setpoint;
- Indication of active alarms.



8 TREND VARIABLES DIALOG BOXES

It is possible to monitor variables of the Pump Genius Multiplex 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.

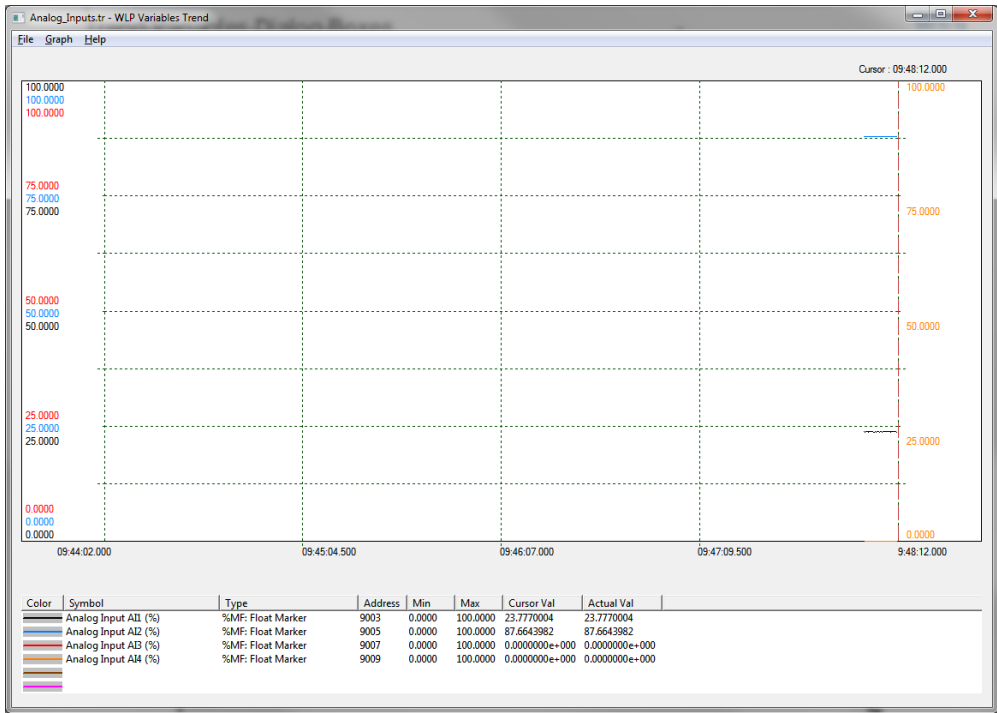


Figure 8.1 – Trend variable dialog for analog inputs

Control of the Pump driven by CFW-11 Inverter:

It permits the visualization of control values of the pump driven by CFW-11 inverter.

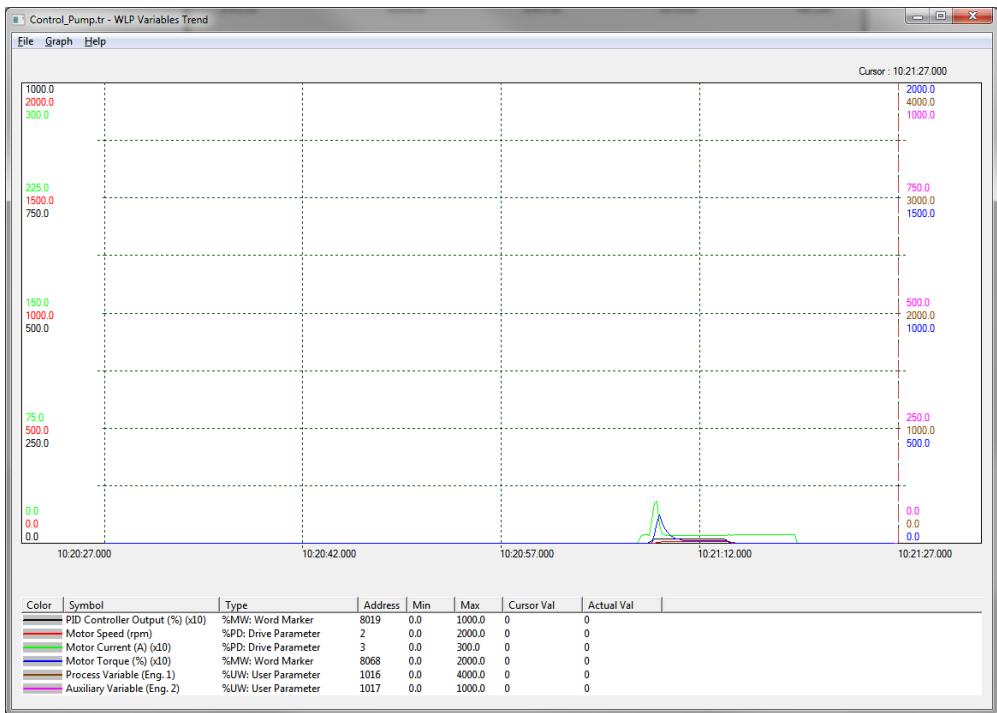


Figure 8.2 – Trend variable dialog for control values of the pump



PID Controller Settings:

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

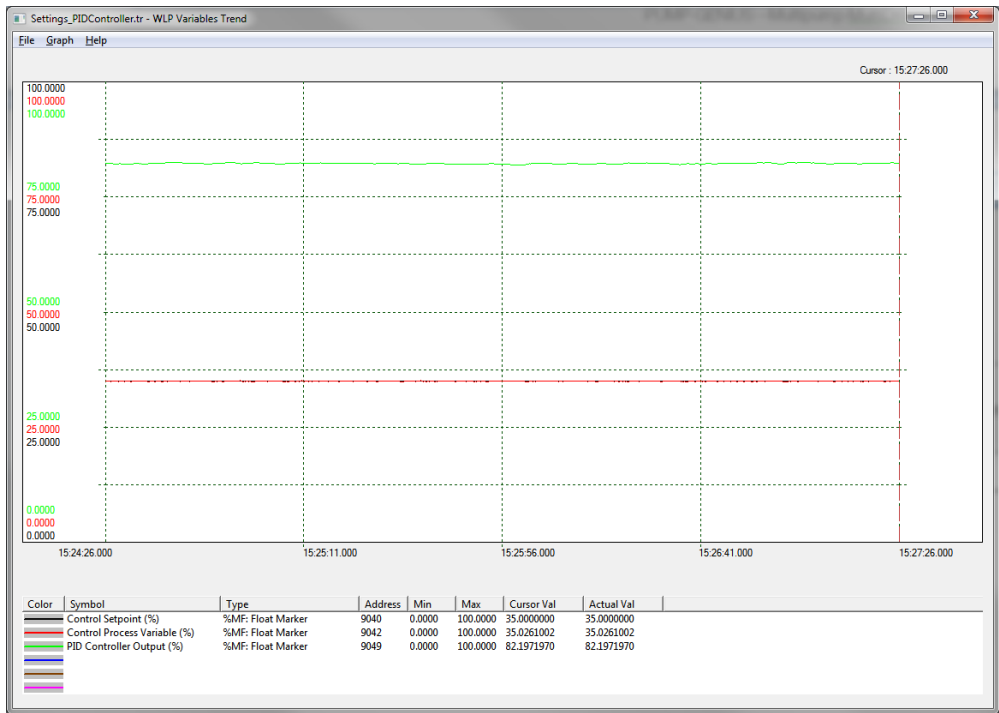


Figure 8.3 – Trend variable dialog for PID controller settings



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 Multiplex application through the WLP.

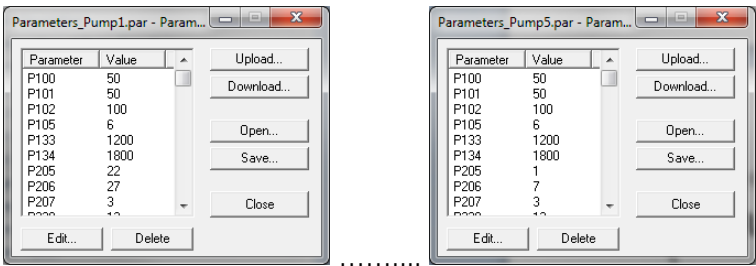


Figure 9.1 – Parameter value dialog of pump 1 to pump 5



NOTE!

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