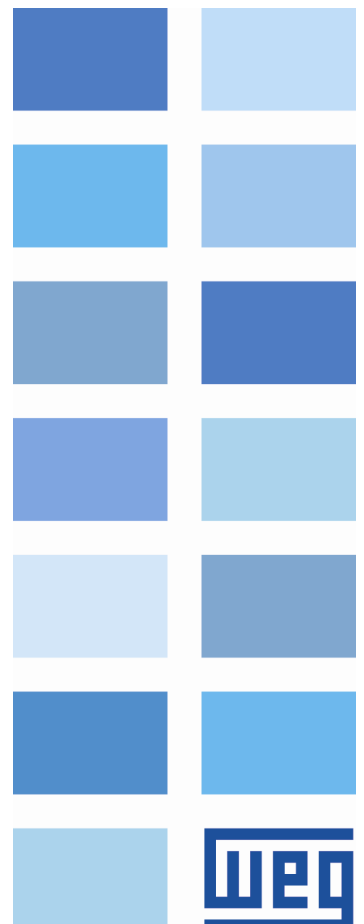


# Floating Control Multipump System

## CFW-11

### Application Manual

Language: English  
Document: 10000123460 / 01





# **Floating Control Multipump System Application Manual**

Series: CFW-11

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Publication Date: 02/2010

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## About the Manual

This manual provides the necessary description for configuration the floating control multipump system application developed of the CFW-11 frequency inverter SoftPLC function. This manual must be used together with the CFW-11 user manual, the SoftPLC manual and the WLP software manual.

## Abbreviations and Definitions

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

## Numerical Representation

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

# 1 Introduction to Multipump Systems

The multipump system applications developed for the CFW-11 SoftPLC provide to the user flexibility in the system use and configuration. It uses the tools already developed for the WLP programming software, together with configuration wizards and monitoring dialog boxes.

## 1.1 What is a Multipump System?

Multipump or multiple pumps pumping system refers to control of more than one pump using only one frequency inverter to control the pump speed. The inverter selects which pumps will operate in order to keep/control the output pressure of the pumping system. An alternation between their activation is also performed, making it possible an equal use of the pumps.

In order to control the system output pressure a PID controller is used, together with the star/stop logics of the pumps.

The system can be controlled in two manners:

- **Fixed Control**, where the pump driven by the inverter is always the same one;
- **Floating Control**, where the pump driven by the inverter is changed according to the alternating need.

## 1.2 General Characteristics of a Multipump System

The multipump system developed for the CFW-11 with SoftPLC presents the following characteristics:

- Control of up to 5 pumps in fixed control mode;
- Control of up to 4 pumps in floating control mode;
- Pump activation control mode;
- Control of the inverter driven pump change (floating control);
- Acceleration and deceleration ramp for the inverter driven pump;
- Minimum and maximum speed limits for the inverter driven pump;
- System pressure setpoint setting via parameter or via analog input;
- Selection via digital input, of up to two pressure setpoint values;
- Selection whether or not the pump is enabled via digital input;
- Gain, offset and filter adjustment for the analog input control signals;
- System in sleep mode or wake up mode;
- Pipe charging before to enable the pressure control;
- Fault and alarm for minimum output pressure (pipe breaking);
- Fault and alarm for maximum output pressure (pipe obstruction);
- Alternation of pumps according to their operation time;
- Possibility of running the inverter pump via HMI (local mode);
- Possibility of implementation or modification of the applicative by the user through the WLP software.

## 1.3 Advantages of a Multipump System

A multiple pump pumping system presents the following advantages compared to a system with only one pump:

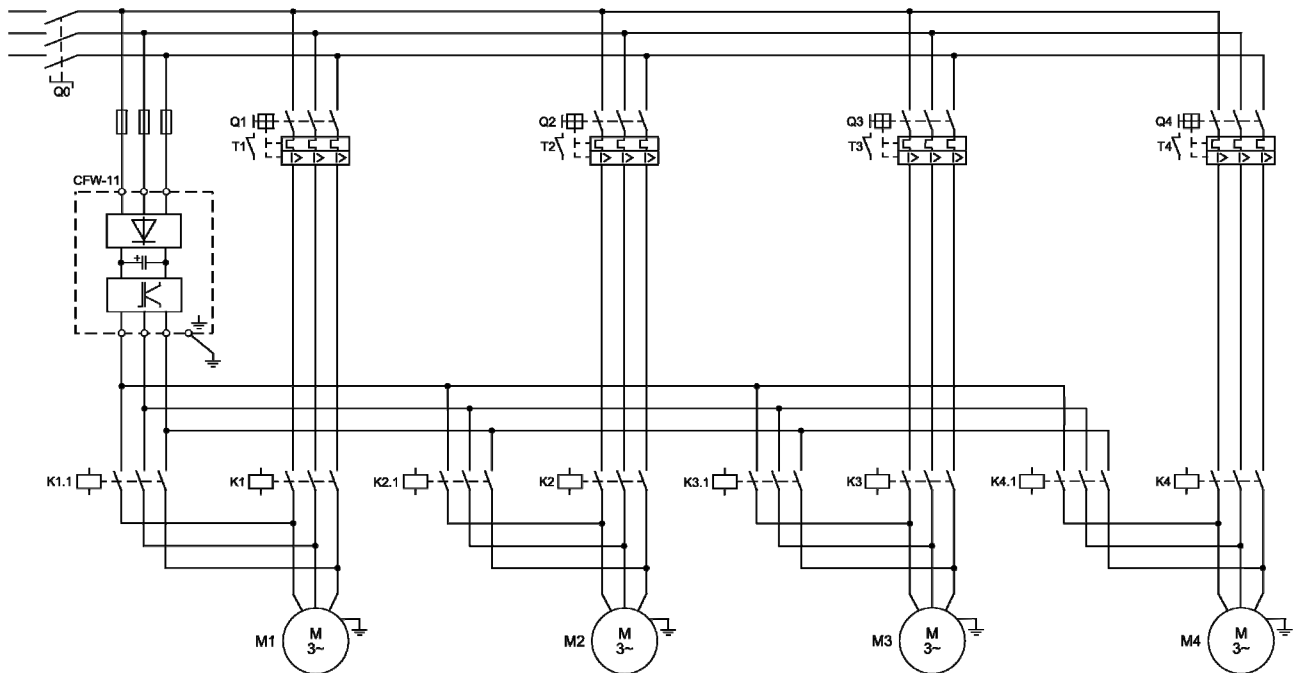
- Energy savings;
- Increased life span of the pumping system;
- It makes maintenance without operation interruption easier;
- It keeps a constant line pressure;
- It provides the necessary flow according to the system demand;
- It allows system fault diagnosis;
- Pump operation time equalization, allowing thus the uniform wearing of them.

## 2 Floating Control Multipump System

It is characterized by the fact that the inverter can be connected to any pump of the system. At this moment the other pumps of the system assume the function of auxiliary pumps and are activated by the CFW-11 digital outputs. In other words, with the whole system off, the first pump to be activated is connected to the inverter and the other pumps are activated via direct on line starts. In another moment, according to the programming, another pump can be driven by the inverter; therefore, an equal use of all the system pumps is obtained.

### 2.1 Power Connections

The power section connection schematic for a floating control multipump system with four pumps is presented below.



#### Note:

- ☑ Q0: Multipump system line protection circuit breaker;
- ☑ Q1, Q2, Q3 and Q4: Motor circuit breaker for the protection of the pumps;
- ☑ K1, K2, K3 and K4: Contactors for starting the pumps directly on line when they have the function of auxiliary pumps;
- ☑ K1.1, K2.1, K3.1 and K4.1: Contactors for driving the pump with the inverter;
- ☑ M1, M2, M3 and M4: Multipump system pump motors;
- ☑ The CFW-11 protection is done with fuses.

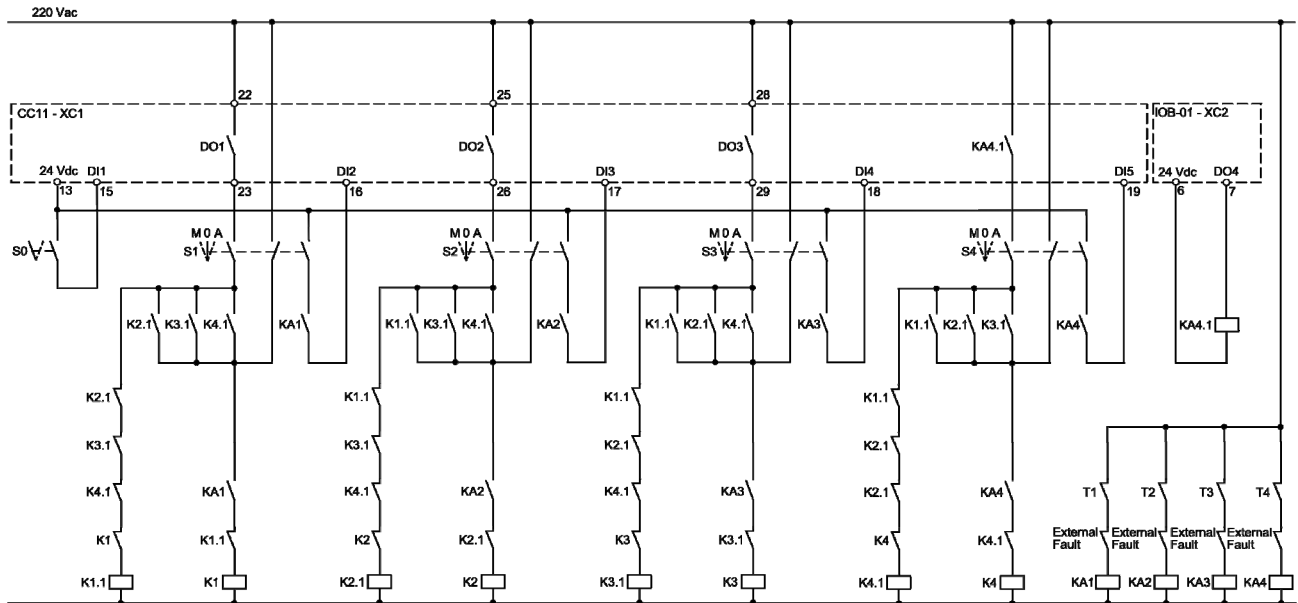


#### NOTE!

It is recommended to protect the auxiliary pump motors and the inverter in order to avoid damaging them.

## 2.2 Command Connections

The command connection schematic for a floating control multipump system with four auxiliary pumps is presented below.

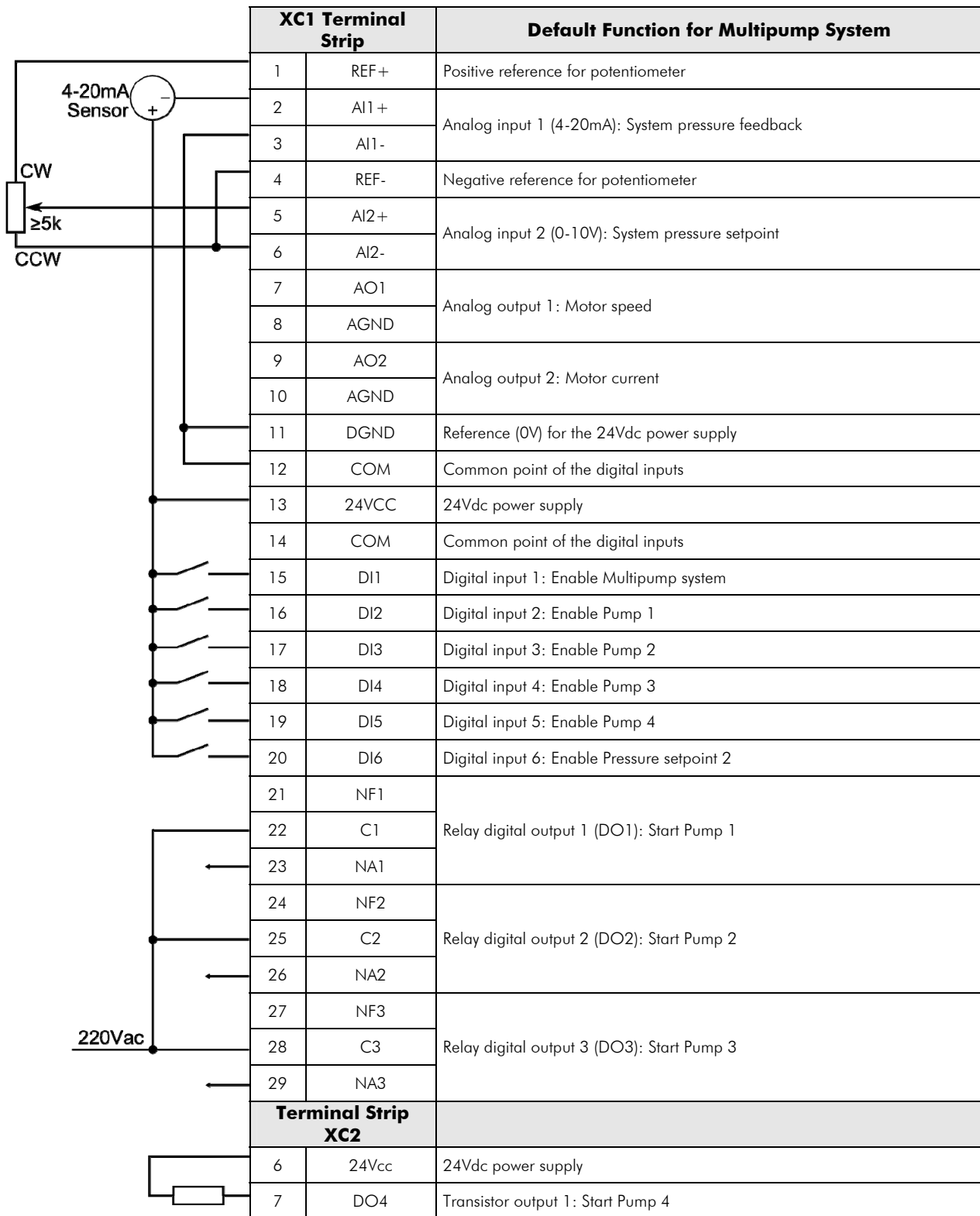


### Note:

- ☑ S0: Start / Stop switch. The “Start” position issues the command for enabling the multipump system control. The “Stop” position switch disables the multipump system;
- ☑ S1, S2, S3 and S4: Manual / 0 / Automatic switches (optional). The “Manual” position issues the command for starting the pump without the multipump system control. The “0” position switches off the pump and disables it from the multipump system. The “Automatic” position enables the pump to be used in the multipump system;
- ☑ K1, K2, K3 and K4: Contactors for starting the pumps directly when they have the function of auxiliary pumps;
- ☑ K1.1, K2.1, K3.1 and K4.1: Contactors for driving the pump with the inverter;
- ☑ KA1, KA2, KA3 and KA4: Auxiliary contactors for the protection logics of the pumps;
- ☑ KA4.1: Auxiliary 24 Vdc contactor, necessary because the DO4 IOB-01 expansion module is a transistor digital output;
- ☑ T1, T2, T3 and T4: Contacts of the pump motor protection thermal relays;
- ☑ External Fault: A sensor, as a pressostat for instance, can be used for the protection of pumps;
- ☑ DO1, DO2 and DO3: CFW-11 inverter digital outputs, for the command of the pumps;
- ☑ DO4: CFW-11 inverter expansion module transistor digital output, for the command of one pump;
- ☑ DI1: CFW-11 digital input, command for enabling the multipump system control;
- ☑ DI2, DI3, DI4 and DI5: CFW-11 digital inputs, indicating that the pumps are enabled for the multipump system.

## 2.3 Control Connections

The control connections (analog and digital inputs and outputs) made at the CFW-11 control board CC11 XC1 terminal strip and at the IOB-01 expansion module XC2 terminal strip for a multipump system with four pumps is presented next.



### NOTE!

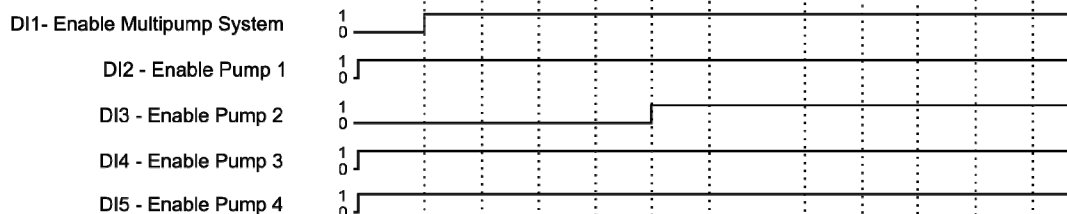
It is necessary to set the DIP-switch S1.4 in ON in order to enable the 4-20mA current reading at the analog input AI1. Refer to CFW-11 frequency inverter manual for further information on connections.



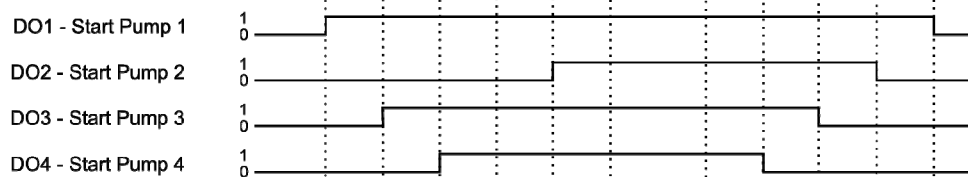
## 2.4 Functional Description

See below the operation diagram of the pumps in a floating control multipump system with four pumps. The graph below presents the "in a sequence" control mode for the pump activations in order to facilitate the comprehension of the motor activations. For the "with rotation" control mode the operation time is taken into account for the activation of the pumps, as well as for the selection of which pump will be driven by the inverter.

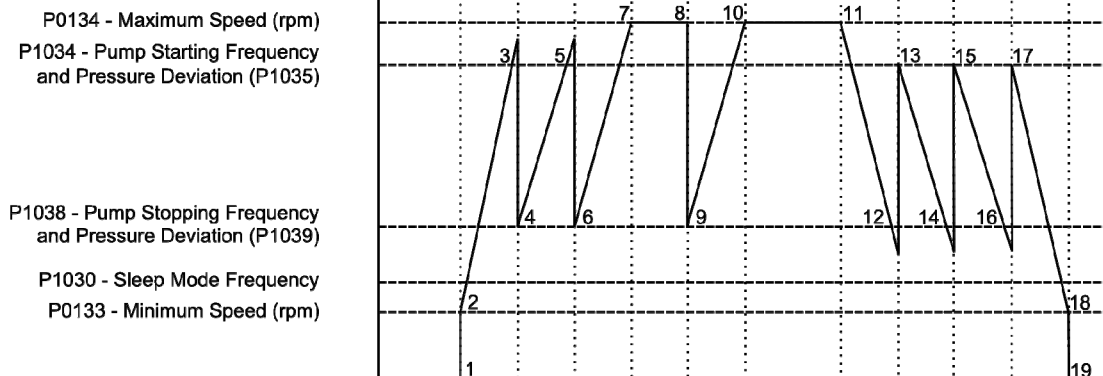
### COMMAND - DIGITAL INPUTS



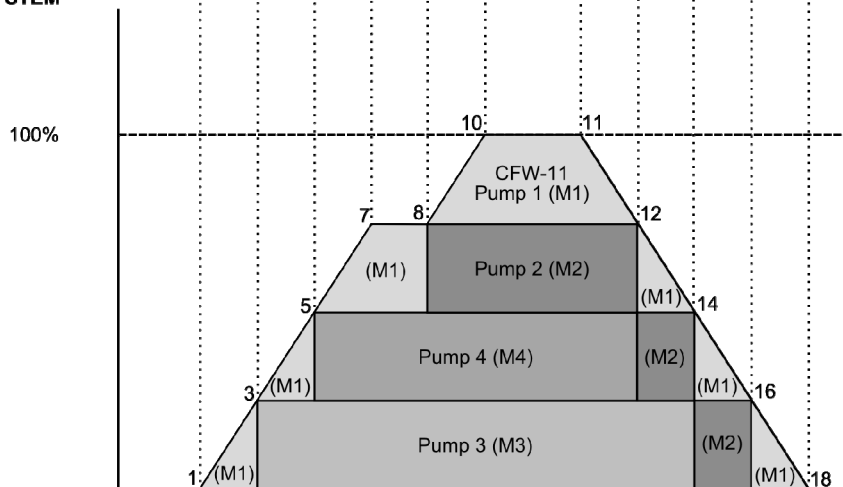
### COMMAND - DIGITAL OUTPUTS



### CFW-11 PUMP FREQUENCY (Hz)



### MULTIPUMP FLOW SYSTEM



## Floating Control Multipump System

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The graph shows the digital inputs used for command and for pump enabling, the digital outputs for the activation of the pumps, the behavior of the CFW-11 driven pump speed as the pumps are activated and deactivated due to the system flow and pressure requirements. The analysis of the system behavior in the given moments is listed below.

- 1** – The digital input DI1 is activated in order to enable the system. It is verified if the system will remain in sleep mode or in wake up mode. The wake up mode is activated (the first time the system is enabled the P1033 time is disregarded). It is verified which pump must enter the system being driven by the inverter. In this case, as the control mode is “In a Sequence” and the pump 1 (M1) is enabled for operation. A command for starting the pump 1 (M1) is given via DO1 digital output, which according to the electric diagram commands the K1.1 contactor, so that the motor is driven by the inverter. Then a 500ms time is awaited (a fixed time value for this application) before the acceleration of the pump 1 (M1) up to the minimum programmed speed is started.
- 2** – According to the adjusted pressure setpoint, the PID controller responds and accelerates the pump controlled by the inverter (M1). If the pipe charging is enabled, it is necessary wait a time (P1047) for enable the PID controller.
- 3** – When the frequency programmed for activation of a pump (P1034) is reached and there is a certain deviation of the system pressure from the pressure setpoint (P1035), then after some time (P1036) a command for starting a pump is issued. It is verified which pump must enter the system. In this case, since the pump 1 (M1) is already working and being driven by the inverter, in a sequence the pump 2 (M2) should be activated; but since it is disabled via the digital input DI3 and the pump 3 (M3) is enabled for operation, then the command to start the pump 3 (M3) is given via the digital output DO3, which according to the command schematic controls the contractor K3.
- 4** – After the pump 3 (M3) is started, the pump 1 (M1) speed is reduced to the value programmed as the pump stopping frequency (P1038). This is done in order to attenuate oscillations in the pressure control system. After this, the PID controller takes back the speed control of the pump 1 (M1) and accelerates it again.
- 5** – Following the same analysis of the moment “3”, the command for starting another pump is issued, and it is verified which pump must enter the system. In this case, since the pump 1 (M1) is already working driven by the inverter and the pump 3 (M3) is already on, in a sequence the pump 2 (M2) should be activated; but since it is disabled via the digital input DI3 and the pump 4 (M4) is enabled for operation, then the command to start the pump 4 (M4) is given via the digital output DO4, which according to the command schematic controls the contractor K4.
- 6** – After the pump 4 (M4) is started, the same analysis of the moment “4” applies.
- 7** – Following the same analysis of the moment “3”, the command for starting another pump is issued, and it is verified which pump must enter the system. In this case, since the pump 1 (M1) is already working driven by the inverter and the pumps 3 (M3) and 4 (M4) are already on, the pump 2 (M2) should be activated; but since it is disabled via the digital input DI3, the system remains as it is, and the pump 1 (M1), which is being driven by the inverter, reaches the maximum programmed speed.
- 8** – Since the system is already needing one more pump, when the pump 2 (M2) is enabled via digital input DI3, then the pump 2 (M2) starting command is given immediately via digital output DO2, which according to the command schematic controls the contactor K2.
- 9** – After starting the pump 2 (M2), the same analysis of the moment “4” applies.
- 10** – With all the system pumps on, the pump 1 (M1) is accelerated up to the maximum programmed speed and continues to control the system pressure.
- 11** – The system senses a reduction in the flow and in order to keep the system pressure constant it starts reducing the speed of the pump 1 (M1) that is being driven by the inverter.
- 12** – When the frequency programmed for deactivation of a pump (P1038) is reached and there is a certain deviation of the system pressure from the pressure setpoint (P1039), then after some time (P1040) a command for stopping a pump is issued. It is verified which pump must be removed from the system. In this case, since the pump activation mode is “in a sequence”, the pump 4 (M4) must be stopped. The command to stop the pump 4 (M4) is given via the digital output DO4, which according to the command schematic controls the contractor K4.
- 13** – After stopping the auxiliary pump 4 (M4), the pump 1 (M1) speed is increased to the value programmed as the pump starting frequency (P1036). This is done in order to attenuate oscillations in the pressure control system. After this, the PID controller takes back the speed control of the pump 1 (M1) and decelerates it again.

## Floating Control Multipump System

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**14 –** Following the same analysis of the moment “12”, the command for stopping another pump is issued, and it is verified which pump must be removed from the system. In this case, since the pump 4 (M4) is already off, the next pump to be switched off will be the pump 3 (M3). The command to stop the auxiliary pump 3 (M3) is given via the digital output DO3, which according to the command schematic controls the contactor K3.

**15 –** After stopping the pump 3 (M3), the same analysis of the moment “13” applies.

**16 –** Following the same analysis of the moment “12”, the command for stopping another pump is issued, and it is verified which pump must be removed from the system. In this case, since the pump 4 (M4) and the pump 3 (M3) are already off, the next one to be switched off will be the pump 2 (M2). The command to stop the auxiliary pump 2 (M2) is given via the digital output DO2, which according to the command schematic controls the contactor K2.

**17 –** After stopping the pump 2 (M2), the same analysis of the moment “13” applies.

**18 –** When the frequency programmed for the sleep mode is reached (P1030), and if after some time (P1031) the speed of the pump 1 (M1), which is being driven by the inverter, remains below the sleep mode activation frequency, then the sleep mode will be activated.

**19 –** With the sleep mode active the pump 1 (M1), which is being driven by the inverter, is switched off, and after 500ms (fixed time value for this application) a command is issued for switching off the digital output DO1, which according to the command schematic controls the contactor K1. But the system remains enabled and its pressure being supervised. If the pressure stays below the deviation limit (P1032) longer than a certain time (P1033), the wake up mode is activated and the multipump control starts switching the pumps ON and OFF again, according to the needs of the system pressure.



### **NOTE!**

Refer to chapter 5 for further details on the parameters.

### 3 WLP Applicative Configuration

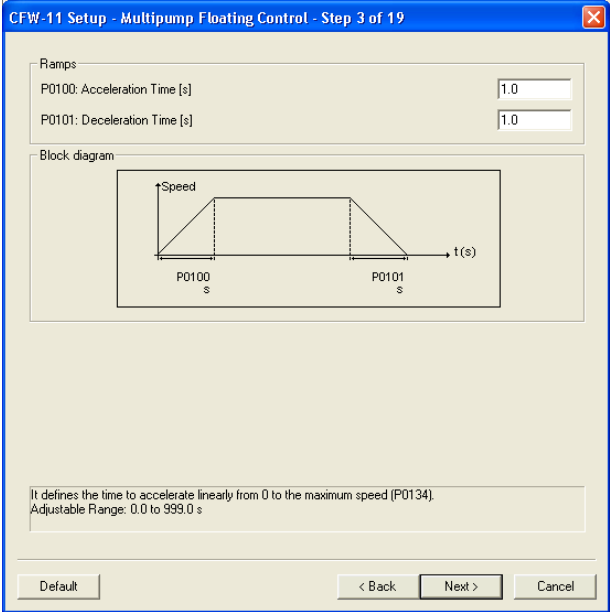
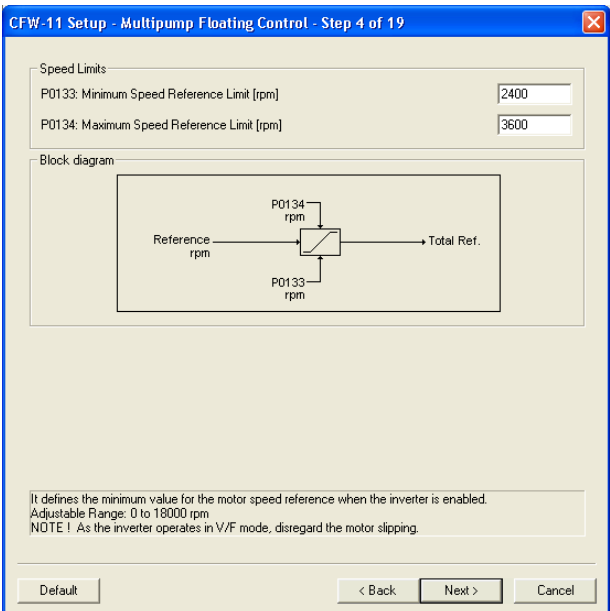
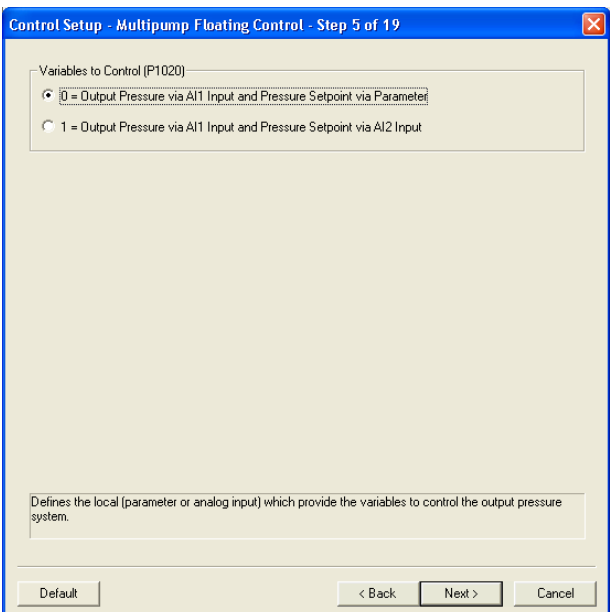
Through the WLP it is possible to create and to configure the applicative for the floating control multipump system. Refer to help topics in the WLP programming software for further details on creating an applicative. The configuration of the applicative is done through a configuration wizard, which consists of a step by step guide for the adjustment of the parameters pertinent to the application.

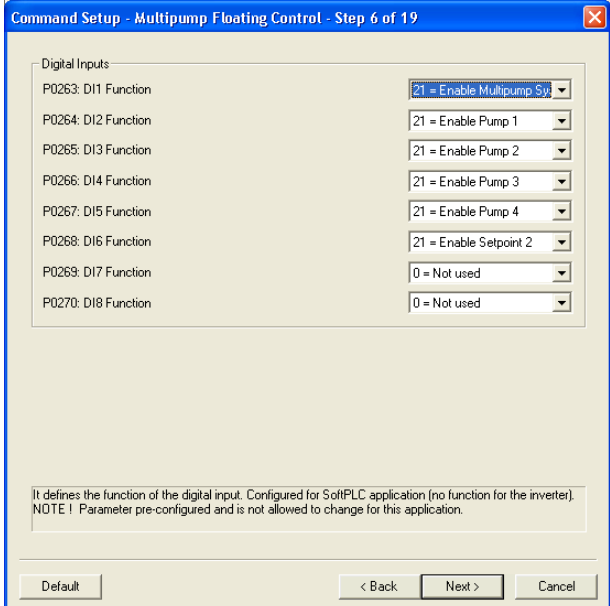
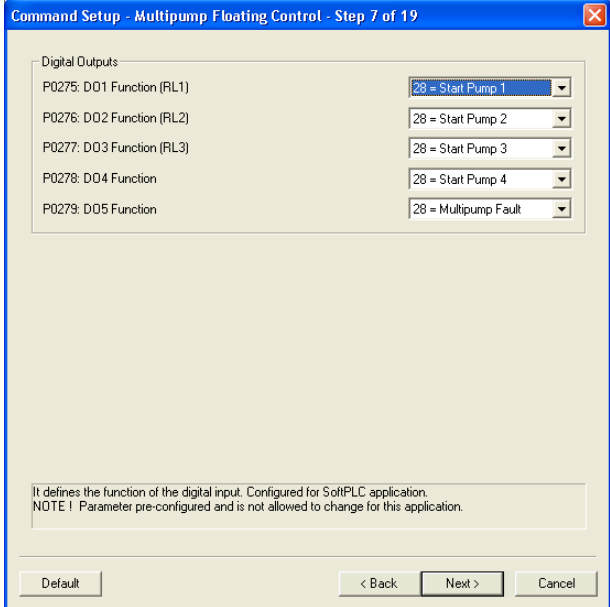
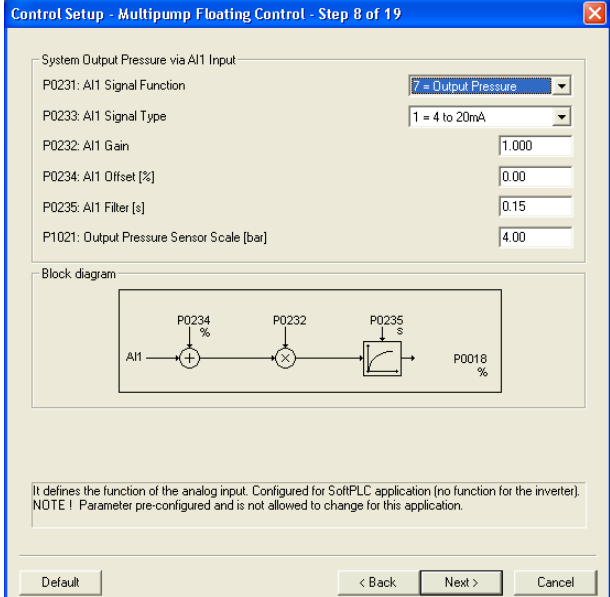


#### NOTE!

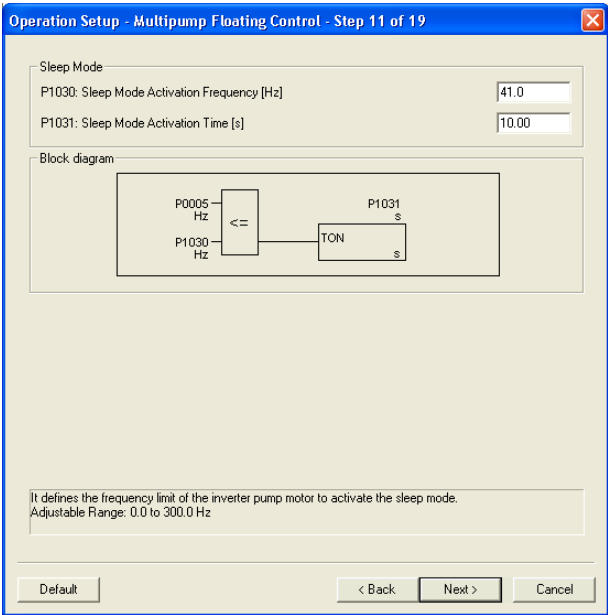
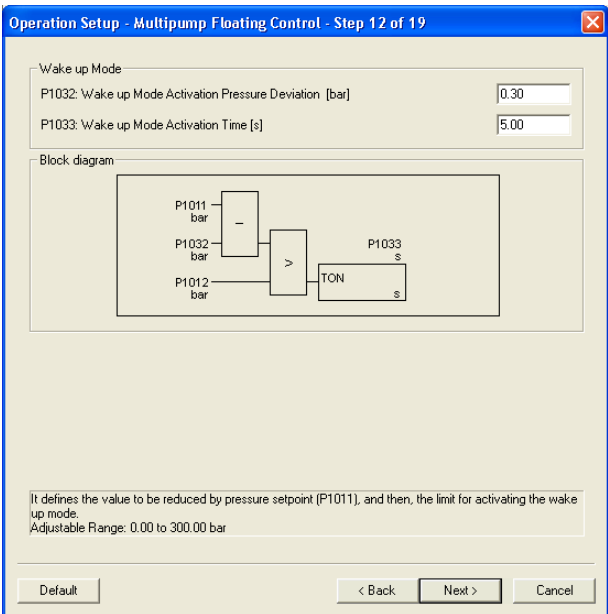
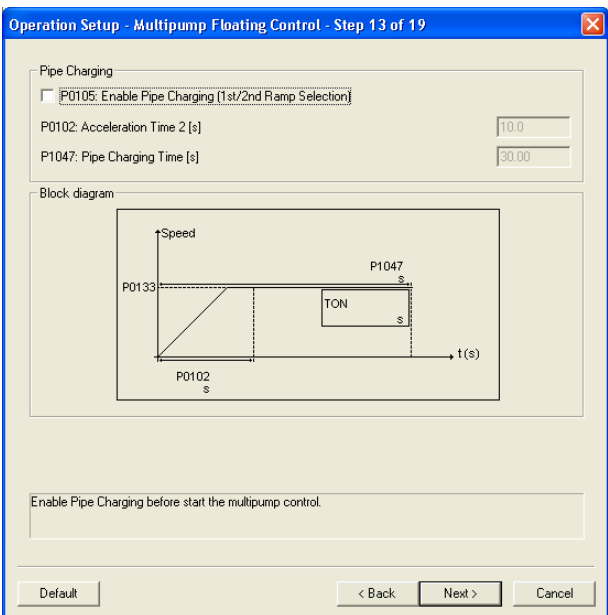
When powering up the inverter for the first time, follow all the steps described in the chapter 5 "First Time Power-Up and Start-Up" of the CFW-11 frequency inverter manual.

Step	Description	WLP Configuration Wizard
1	<p>It presents the parameters for the general configuration of the floating control multipump system:</p> <p>P1018: Number of Pumps</p> <p>P1019: Pump Activation Control Mode</p>	
2	<p>It presents the parameters for the configuration the origin of the commands:</p> <p>P0220: Local/Remote Selection Source</p> <p>P0221: Speed Reference Selection – Local 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>P0222: Speed Reference Selection – Remote 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>	

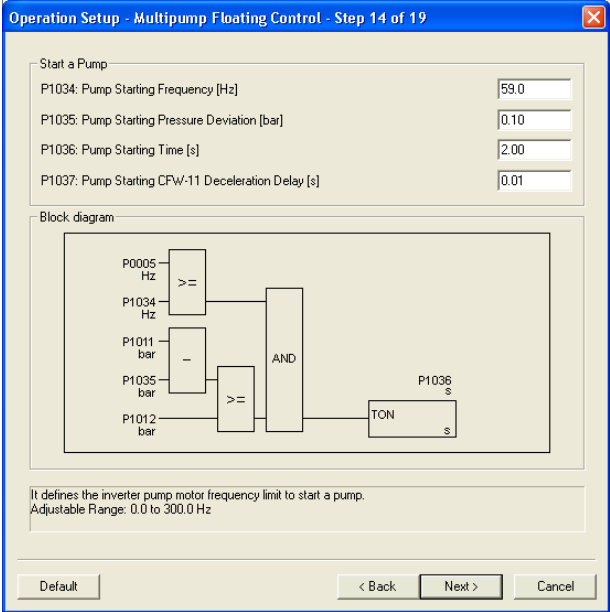
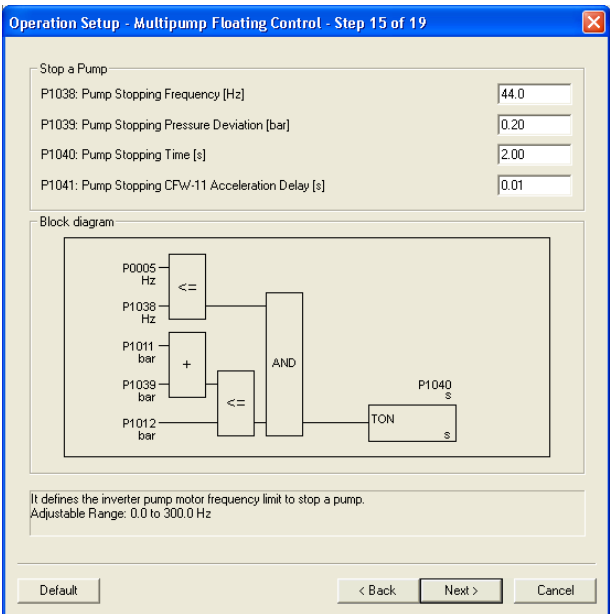
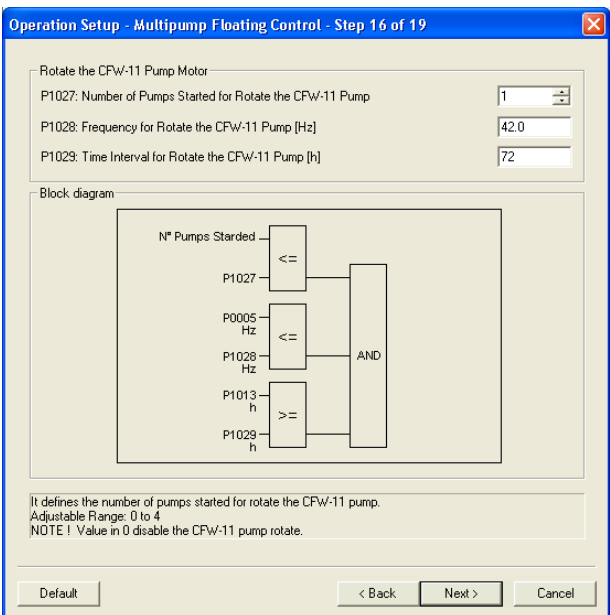
3	<p>It presents the parameters for the configuration of the CFW-11 ramp times:</p> <p>P0100: Acceleration Time</p> <p>P0101: Deceleration Time</p>	
4	<p>It presents the parameters for the configuration of the CFW-11 speed limits:</p> <p>P0133: Minimum Speed Reference Limit</p> <p>P0134: Maximum Speed Reference Limit</p>	
5	<p>It presents the parameter for the selection of the origin of the system control variables:</p> <p>P1020: Variables to Control</p>	

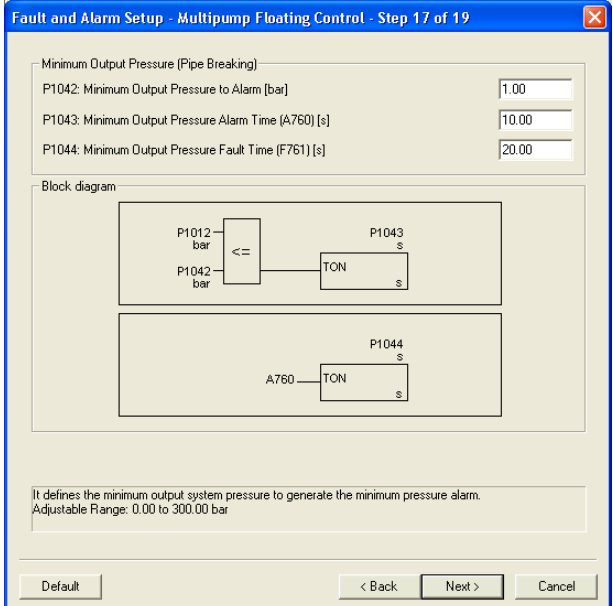
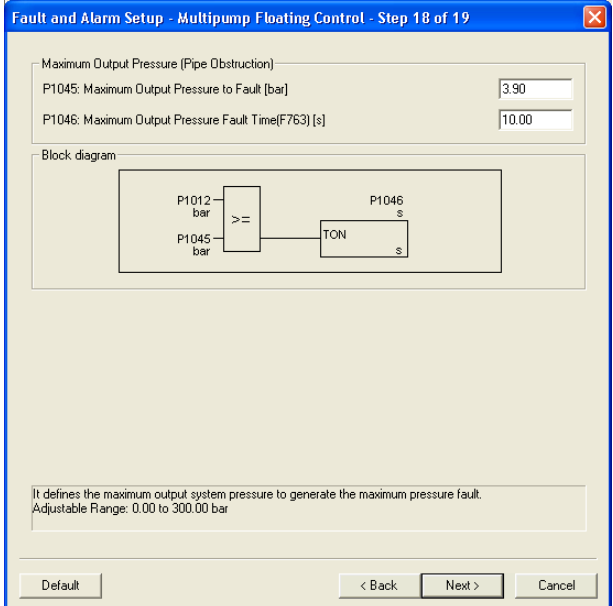
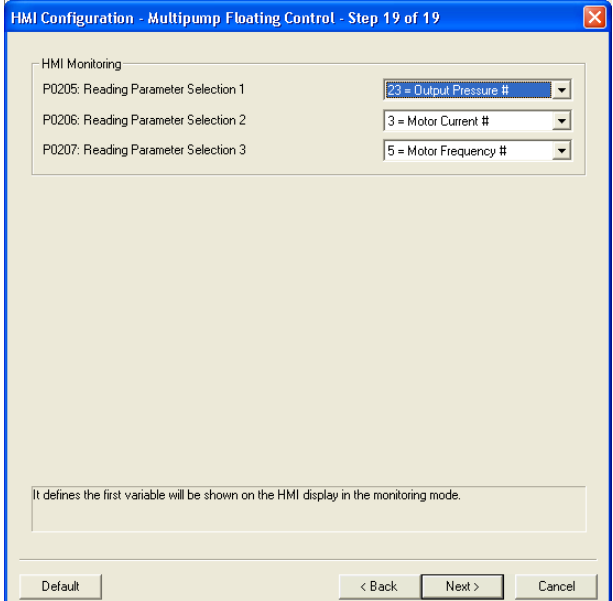
6	<p>It presents the parameters for the configuration of the CFW-11 digital input functions:</p> <p>P0263: DI1 Function  P0264: DI2 Function  P0265: DI3 Function  P0266: DI4 Function  P0267: DI5 Function  P0268: DI6 Function  P0269: DI7 Function  P0270: DI8 Function</p>	
7	<p>It presents the parameters for the configuration of the CFW-11 digital output functions:</p> <p>P0275: DO1 Function (RL1)  P0276: DO2 Function (RL2)  P0277: DO3 Function (RL3)  P0278: DO4 Function  P0279: DO5 Function</p>	
8	<p>It presents the parameters for the configuration of the system output pressure feedback reading via the analog input AI1:</p> <p>P0231: AI1 Signal Function  P0233: AI1 Signal Type  P0232: AI1 Gain  P0234: AI1 Offset  P0235: AI1 Filter  P1021: Output Pressure Sensor Scale</p>	

<p>9 - 0</p>	<p>It presents the parameters for the configuration of the system output pressure setpoint via parameter:</p> <p>P1022: System Pressure Setpoint 1</p> <p>P1023: System Pressure Setpoint 2</p>	
<p>9 - 1</p>	<p>It presents the parameters for the configuration of the output pressure setpoint reading via the analog input AI2:</p> <p>P0236: AI2 Signal Function</p> <p>P0238: AI2 Signal Type</p> <p>P0237: AI2 Gain</p> <p>P0239: AI2 Offset</p> <p>P0240: AI2 Filter</p>	
<p>10</p>	<p>It presents the parameters for the adjustment of the system output pressure PID controller:</p> <p>P1024: Proportional Gain</p> <p>P1025: Integral Gain</p> <p>P1026: Derivative Gain</p>	

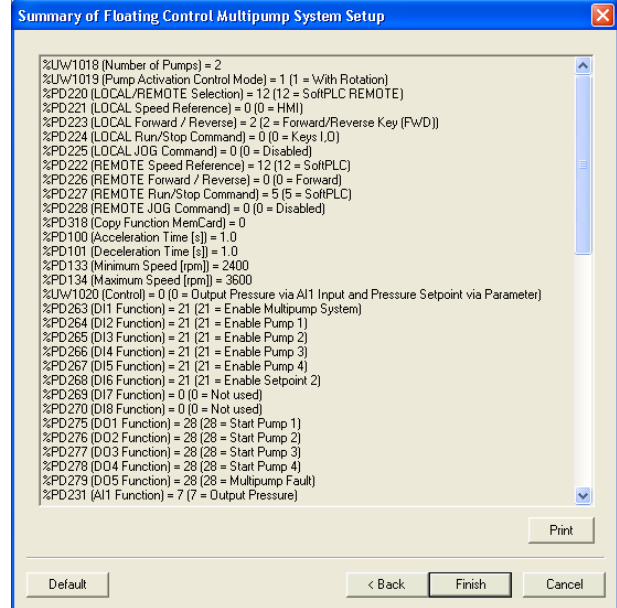
11	<p>It presents the system operation parameters for the sleep mode:</p> <p>P1030: Sleep Mode Activation Frequency</p> <p>P1031: Sleep Mode Activation Time</p>	
12	<p>It presents the system operation parameters for the wake up mode:</p> <p>P1032: Wake up Mode Activation Pressure Deviation</p> <p>P1033: Wake up Mode Activation Time</p>	
13	<p>It presents the system operation parameters for the pipe charging:</p> <p>P0105: Enable Pipe Charging (1st/2nd Ramp Selection)</p> <p>P0102: Acceleration Time 2</p> <p>P1047: Pipe Charging Time</p>	



14	<p>It presents the system operation parameters for starting a pump:</p> <p>P1034: Pump Starting Frequency</p> <p>P1035: Pump Starting Pressure Deviation</p> <p>P1036: Pump Starting Time</p> <p>P1037: Pump Starting CFW-11 Deceleration Delay</p>	
15	<p>It presents the system operation parameters for stopping a pump:</p> <p>P1038: Pump Stopping Frequency</p> <p>P1039: Pump Stopping Pressure Deviation</p> <p>P1040: Pump Stopping time</p> <p>P1041: Pump Stopping CFW-11 Acceleration Delay</p>	
16	<p>It presents the system operation parameters for rotate the CFW-11 pump motor:</p> <p>P1027: Number of Pumps Started for Rotate the CFW-11 Pump</p> <p>P1028: Frequency for Rotate the CFW-11 Pump</p> <p>P1029: Time Interval for Rotate the CFW-11 Pump</p>	

17	<p>It presents the parameters for the configuration of the minimum output pressure alarm and fault generation (pipe breaking):</p> <p>P1042: Minimum Output Pressure to Alarm</p> <p>P1043: Minimum Output Pressure Alarm Time (A760)</p> <p>P1044: Minimum Output Pressure Fault Time (F761)</p>	
18	<p>It presents the parameters for the configuration of the maximum output pressure alarm and fault generation (pipe obstruction):</p> <p>P1045: Maximum Output Pressure to Fault</p> <p>P1046: Maximum Output Pressure Fault Time (F763)</p>	
19	<p>It presents the parameters that define which variables are showed on the HMI display in 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 of all the parameters that were adjusted with the floating control multipump system setup.



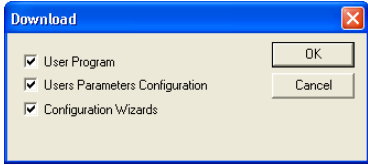
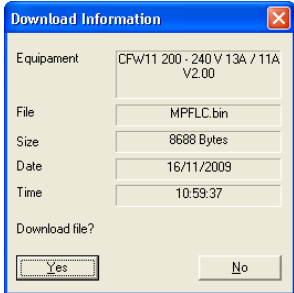
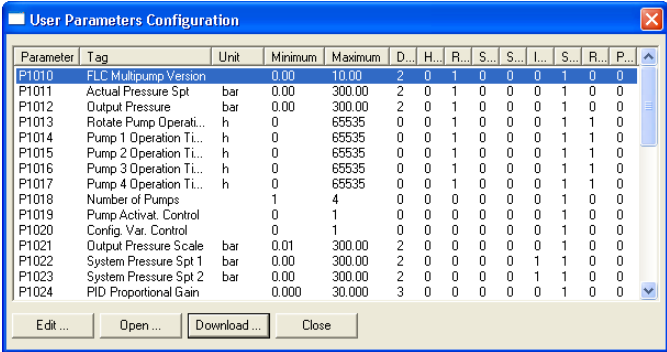

## 4 WLP Applicative Download

Together with the conclusion of the floating control multipump system applicative configuration, it will be necessary to perform the applicative download to the CFW-11 frequency inverter SoftPLC. Therefore, after finishing the configuration wizard the download dialog box will be presented, as showed below.



### NOTE!

Refer to help topics in the WLP programming software for further details on the download.

Description	WLP Download Dialog Box
<p>Download dialog box of the WLP developed applicative containing the following options:</p> <ul style="list-style-type: none"> <li>- User Program;</li> <li>- User Parameter Configuration;</li> <li>- Configuration wizards.</li> </ul>	
<p>User Program Download dialog box containing:</p> <ul style="list-style-type: none"> <li>- Characteristics of the connected equipment;</li> <li>- Name of the file to be downloaded;</li> <li>- Size of the applicative to be downloaded;</li> <li>- File compilation date;</li> <li>- File compilation hour.</li> <li>- Command to transfer or not to transfer the compiled applicative.</li> </ul>	
<p>User Parameter Configuration Dialog containing:</p> <ul style="list-style-type: none"> <li>- Parameter number;</li> <li>- Parameter name given by the user;</li> <li>- Parameter unit defined by the user;</li> <li>- Minimum and maximum values;</li> <li>- Number of decimal places;</li> <li>- Hexadecimal format option, has signal, ignore password, read only, show in HMI, retentive and modify confirmation;</li> <li>- Command for editing, opening, downloading and closing the user parameter dialog box.</li> </ul>	
<p>Dialog box for the download of the values configured with the Floating Control Multipump System wizard.</p>	

## 5 Parameter Descriptions

The CFW-11 as well as the SoftPLC parameters for the floating control multipump system application will be presented next.



### NOTE!

The adjustable range of the CFW-11 parameters has been customized for the multipump system application. Refer to CFW-11 programming manual for further details on the parameters.

### Symbols for the Parameter Proprieties Description:

RO	Read-only parameters.
CFG	Parameter that can be changed only with a stopped motor.
Net	Parameter visible through the HMI if the inverter has a network interface installed – RS232, RS484, CAN, Anybus-CC – or if the USB interface is connected.
Serial	Parameter visible through the HMI if the inverter has the RS232 or the RS485 interface installed.
USB	Parameter visible through the HMI if the inverter USB interface is connected.

### 5.1 General Configuration

This group of parameters allows the user to configure the number of pumps the system will use and how their activation control will be done.

#### P1018 – Number of Pumps

<b>Adjustable Range:</b>	1 to 4	<b>Factory Setting:</b>	2
--------------------------	--------	-------------------------	---

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS
L 50 SoftPLC

#### Description:

This parameter defines the number of pumps that the multipump control will use for the system output pressure regulation.

#### P1019 – Pump Activation Control Mode

<b>Adjustable Range:</b>	0 = In a Sequence 1 = With Rotation	<b>Factory Setting:</b>	1
--------------------------	--	-------------------------	---

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS
L 50 SoftPLC

#### Description:

This parameter defines how the control for starting and stopping the pumps configured in the system will be done.

With P1019 = 0 (In a Sequence), the auxiliary pumps will be started and stopped in a sequence, regardless of their operation time. According to the sequence below, the first selected pump is the one driven by the inverter. The control will be done in the following order:

Starting a Pump	Pump 1 → Pump 2 → Pump 3 → Pump 4
Stopping a Pump	Pump 4 → Pump 3 → Pump 2 → Pump 1

## Parameter Descriptions

With P1019 = 1 (With Rotation), the pumps will be started and stopped according to their operation time, where through the rotation of the pumps a similar operation time among them is achieved, producing an uniform wearing of them. The control will be done in the following order:

Starting a Pump	The pump configured in the system, and with the shortest operation time is started.
Stopping a Pump	The pump configured in the system, and with the longest operation time is started.

## 5.2 Origin of the Commands

This group of parameters allows the user to configure the origin of the CFW-11 inverter commands. For this application the control of the inverter in LOCAL situation is done by the HMI, and in REMOTE situation it is done via SoftPLC.

### LOCAL Situation:

It allows the user to command the pump driven by the CFW-11 ignoring the multipump system control logics. The command is done via HMI and it is only possible with the system disabled, i.e., with the digital input DI1 with logic level "0" and with only one of the digital inputs DI2, DI3, DI4 or DI5 with logic level "1".

### REMOTE Situation:

It enables the multipump system control logics according to the programming done by the user.

#### P0220 – LOCAL/REMOTE Selection Source

#### P0221 – Speed Reference Selection – LOCAL Situation

#### P0222 – Speed Reference Selection – REMOTE Situation

#### P0223 – FORWARD/REVERSE Selection - LOCAL Situation

#### P0226 – FORWARD/REVERSE Selection - REMOTE Situation

#### P0224 – Run/Stop Selection – LOCAL Situation

#### P0227 – Run/Stop Selection – REMOTE Situation

#### P0225 – JOG Selection – LOCAL Situation

#### P0228 – JOG Selection – REMOTE Situation



### NOTE!

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

## 5.3 Ramps

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

#### P0100 – Acceleration Time

#### P0101 – Deceleration Time



### NOTE!

Refer to CFW-11 programming manual for further information on the ramp parameters.

## 5.4 Speed Limits

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

### P0133 – Minimum Speed Reference Limit

### P0134 – Maximum Speed Reference Limit



#### NOTE!

Refer to CFW-11 programming manual for further information on the speed limit parameters. When the CFW-11 frequency inverter is programmed in scalar (V/f) mode, the motor slip must be disregarded.

## 5.5 Variables to Control

### P1020 – Variables to Control

**Adjustable** 0 = Output Pressure via AI1 Input and Pressure Setpoint via Parameter  
**Range:** 1 = Output Pressure via AI1 Input and Pressure Setpoint via AI2 Input **Factory Setting:** 0

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the origin of the signals for the system output pressure control, i.e., the setpoint and the measured variable (feedback).

P1020	Description
0	It defines that the system output pressure, which is the measured variable (feedback), will be read through the AI1 analog input; the setpoint for the pressure control will be read via parameter.
1	It defines that the system output pressure, which is the measured variable (feedback), will be read through the AI1 analog input; the setpoint for the pressure control will be read through the AI2 analog input.

## 5.6 Digital Inputs

This group of parameters allows the user to configure the command function of each digital input in the floating control multipump system applicative.

### P0263 – DI1 Function

**Adjustable** 21 = Enable Multipump System (PLC use) **Factory Setting:** 21

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

#### Description:

This parameter defines that the digital input DI1 function will be to enable the operation of the floating control multipump system.

## Parameter Descriptions

With the input in logic level "0", the floating control multipump system stays disabled, but if the command is in LOCAL situation, it allows the pump driven by the inverter to be operated by means of the CFW-11 HMI.

With the input in logic level "1", the floating control multipump system is enabled for the pumping system output pressure control.

### P0264 – DI2 Function

**Adjustable Range:** 21 = Enable Pump 1 (PLC use)

**Factory Setting:** 21

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

#### Description:

This parameter defines that the digital input DI2 function will be to enable the pump 1 in the floating control multipump system. It is necessary that the multipump system be previously configured to have at least one auxiliary pump ( $P1018 \geq 1$ ).

With the input in logic level "0", it indicates that the pump 1 must not be started by the multipump system. According to the section 2.2, selection switches, sensors for motor protection, etc., can be inserted in this command.

With the input in logic level "1", it indicates that the pump 1 is enabled for operation, being able to be started or stopped according to the multipump system needs.

### P0265 – DI3 Function

**Adjustable Range:** 21 = Enable Pump 2 (PLC use)

**Factory Setting:** 21

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

#### Description:

This parameter defines that the digital input DI3 function will be to enable the pump 2 in the floating control multipump system. It is necessary that the multipump system be previously configured to have at least two pumps ( $P1018 \geq 2$ ).

With the input in logic level "0", it indicates that the pump 2 must not be started by the multipump system. According to the section 2.2, selection switches, sensors for motor protection, etc., can be inserted in this command.

With the input in logic level "1", it indicates that the pump 2 is enabled for operation, being able to be started or stopped according to the multipump system needs.



## P0266 – DI4 Function

**Adjustable Range:** 21 = Enable Pump 3 (PLC use)

**Factory Setting:** 21

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

### Description:

This parameter defines that the digital input DI4 function will be to enable the pump 3 in the floating control multipump system. It is necessary that the multipump system be previously configured to have at least three pumps ( $P1018 \geq 3$ ).

With the input in logic level "0", it indicates that the pump 3 must not be started by the multipump system. According to the section 2.2, selection switches, sensors for motor protection, etc., can be inserted in this command.

With the input in logic level "1", it indicates that the pump 3 is enabled for operation, being able to be started or stopped according to the multipump system needs.

## P0267 – DI5 Function

**Adjustable Range:** 21 = Enable Pump 4 (PLC use)

**Factory Setting:** 21

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

### Description:

This parameter defines that the digital input DI5 function will be to enable the pump 4 in the floating control multipump system. It is necessary that the multipump system be previously configured to have four pumps ( $P1018 = 4$ ).

With the input in logic level "0", it indicates that the pump 4 must not be started by the multipump system. According to the section 2.2, selection switches, sensors for motor protection, etc., can be inserted in this command.

With the input in logic level "1", it indicates that the pump 4 is enabled for operation, being able to be started or stopped according to the multipump system needs.

## P0268 – DI6 Function

**Adjustable Range:** 21 = Enable Pressure setpoint 2 (PLC use)

**Factory Setting:** 21

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

### Description:

This parameter defines that the digital input DI6 function will be to enable another setpoint for the pressure control (P1023) of the floating control multipump system, in case the system is configured for pressure setpoint via parameter.

With the input in logic level “0”, the value for the pressure control setpoint corresponds to the content of the parameter P1022 (System Pressure Setpoint 1).

With the input in logic level “1”, the value for the pressure control setpoint corresponds to the content of the parameter P1023 (System Pressure Setpoint 2).

## P0269 – DI7 Function

## P0270 – DI8 Function

**Adjustable Range:** 0 to 31

**Factory Setting:** 0

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 40 Digital Inputs

or

07 I/O CONFIGURATION

L 40 Digital Inputs

### Description:

These parameters define the function of the digital inputs DI7 and DI8. It is necessary to install the IOB-01 expansion module in order to get access to these digital inputs.



### NOTE!

Refer to CFW-11 programming manual for further information on the digital input parameters. Some parameter options have been removed from the configuration wizard.

## 5.7 Digital Outputs

This group of parameters allows the user to configure the command function of each digital output in the floating control multipump system applicative.

### P0275 – DO1 Function (RL1)

**Adjustable Range:** 28 = Start Pump 1 (SoftPLC)

**Factory Setting:** 28

**Proprieties:**

**Access groups via HMI:**

01 PARAMETER GROUPS

L 41 Digital Outputs

or

07 I/O CONFIGURATION

L 41 Digital Outputs

**Description:**

This parameter defines that the DO1 digital output function will be to start the pump 1 according to the floating control multipump system command. According to the section 2.3, the NO contact of the digital output DO1 relay must be used.

### P0276 – DO2 Function (RL2)

**Adjustable Range:** 28 = Start Pump 2 (SoftPLC)

**Factory Setting:** 28

**Proprieties:**

**Access groups via HMI:**

01 PARAMETER GROUPS

L 41 Digital Outputs

or

07 I/O CONFIGURATION

L 41 Digital Outputs

**Description:**

This parameter defines that the DO2 digital output function will be to start the pump 2 according to the floating control multipump system command. According to the section 2.3, the NO contact of the digital output DO2 relay must be used.

### P0277 – DO3 Function (RL3)

**Adjustable Range:** 28 = Start Pump 3 (SoftPLC)

**Factory Setting:** 28

**Proprieties:**

**Access groups via HMI:**

01 PARAMETER GROUPS

L 41 Digital Outputs

or

07 I/O CONFIGURATION

L 41 Digital Outputs

**Description:**

This parameter defines that the DO3 digital output function will be to start the pump 3 according to the floating control multipump system command. According to the section 2.3, the NO contact of the digital output DO3 relay must be used.

## P0278 – DO4 Function

**Adjustable Range:** 28 = Start Pump 4 (SoftPLC)

**Factory Setting:** 28

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 41 Digital Outputs

or

07 I/O CONFIGURATION

L 41 Digital Outputs

### Description:

This parameter defines that the DO4 digital output function will be to start the pump 4 according to the floating control multipump system command. According to the section 2.3, it is necessary to use a 24Vdc contactor, because the digital output 4 is of the transistor type. In order to get access to this digital output it is necessary to install the IOB-01 expansion module.

## P0279 – DO5 Function

**Adjustable Range:** 28 = Multipump Fault

**Factory Setting:** 28

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 41 Digital Outputs

or

07 I/O CONFIGURATION

L 41 Digital Outputs

### Description:

This parameter defines that the DO5 digital output function will be to indicate the fault occurrence in the multipump system. In order to get access to this digital output it is necessary to install the IOB-01 expansion module.



### NOTE!

Refer to CFW-11 programming manual for further information on the digital output parameters. Some parameter options have been removed from the configuration wizard.

## 5.8 System Pressure Feedback

This parameter group allows the user to configure the measured variable (feedback), i.e., the system output pressure.

## P0231 – AI1 Signal Function

**Adjustable Range:** 7 = Output Pressure (PLC use)

**Factory Setting:** 7

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter defines that the AI1 analog input function will be the reading of the output pressure for the control of the system pressure.

### P0233 – AI1 Signal Type

**Adjustable Range:** 0 = 0 to 10V/20mA  
1 = 4 to 20mA

**Factory Setting:** 1

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter configures the type of signal (voltage or current) that will be read by the analog input. Adjust the CFW-11 control board S1.4 switch according to the selected type of signal.



### NOTE!

The 4-20mA signal has an alarm to detect cable breaking (Break Detect AI1 (A163)). When it is active, the multipump system will be disabled.

### P0232 – AI1 Gain

**Adjustable Range:** 0.000 to 9.999

**Factory Setting:** 1.000

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter applies a gain to the value read by the AI1 analog input, i.e., the value read by the analog input is multiplied by the gain, allowing thus adjustments in this variable.

### P0234 – AI1 Offset

**Adjustable Range:** -100.00% to +100.00%

**Factory Setting:** 0.00%

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter adds an offset in percentage to the value read at the input, for adjustments of the variable.

## P0235 – AI1 Filter

**Adjustable Range:** 0.00 to 16.00 s

**Factory Setting:** 0.15 s

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter configures the time constant of a first-order filter that will be applied to the AI1 analog input.



### NOTE!

Refer to CFW-11 programming manual for further information on the analog input parameters. Some parameter options have been removed from the configuration wizard.

## P1021 – Output Pressure Sensor Scale

**Adjustable Range:** 0.01 to 300.00 bar

**Factory Setting:** 4.00 bar

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter configures the range of the output pressure sensor connected at the CFW-11 AI1 analog input, i.e., the maximum value in bars measured by the pressure sensor that corresponds to the analog input maximum value (10V or 20mA).

## 5.9 System Output Pressure Setpoint

This group of parameters allows the user to configure the setpoint for the system output pressure control.



### NOTE!

The output pressure control setpoint can be obtained via the AI2 analog input reading or via parameter, as programmed in P1020.

## P0236 – AI2 Signal Function

**Adjustable Range:** 7 = Pressure Setpoint (PLC use)

**Factory Setting:** 7

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter defines that the AI2 analog input function will be the setpoint for the control of the system pressure.

## P0238 – AI2 Signal Type

**Adjustable Range:** 0 = 0 to 10V/20mA  
1 = 4 to 20mA

**Factory Setting:** 0

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs  
or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter configures the type of signal (voltage or current) that will be read by the analog input. Adjust the CFW-11 control board S1.3 switch according to the selected type of signal.



### NOTE!

The 4-20mA signal has an alarm to detect cable breaking (Break Detect AI2 (A164)). When it is active, the multipump system will be disabled.

## P0237 – AI2 Gain

**Adjustable Range:** 0.000 to 9.999

**Factory Setting:** 1.000

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs  
or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter applies a gain to the value read by the AI2 analog input, i.e., the value read by the analog input is multiplied by the gain, allowing thus adjustments in this variable.

## P0239 – AI2 Offset

**Adjustable Range:** -100.00% to +100.00%

**Factory Setting:** 0.00%

### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs  
or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter adds an offset in percentage to the value read at the input, for adjustments of the variable.

## P0240 – AI2 Filter

**Adjustable Range:** 0.00 to 16.00 s

**Factory Setting:** 0.15 s

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 38 Analog Inputs

or

07 I/O CONFIGURATION

L 38 Analog Inputs

### Description:

This parameter configures the time constant of a first-order filter that will be applied to the AI2 analog input.



### NOTE!

Refer to CFW-11 programming manual for further information on the analog input parameters. Some parameter options have been removed from the configuration wizard.

## P1022 – System Pressure Setpoint 1

**Adjustable Range:** 0.00 to 300.00 bar

**Factory Setting:** 2.00 bar

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the setpoint value for the control of the system output pressure. It is active when the logic level "0" is applied to the DI6 digital input.

## P1023 – System Pressure Setpoint 2

**Adjustable Range:** 0.00 to 300.00 bar

**Factory Setting:** 1.50 bar

### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the setpoint value for the control of the system output pressure. It is active when the logic level "1" is applied to the DI6 digital input.



### NOTE!

The actual system pressure setpoint is indicated at the read-only parameter P1011.

## 5.10 PID Controller

This parameter group allows the user to adjust the system output pressure PID controller gains.



### NOTE!

The standard applicative PID for the floating control multipump system is of the academic type. The modification of the type will result in changes in the values of the gains that must be adjusted by the user.



**P1024 – Proportional Gain****Adjustable Range:** 0.000 to 30.000**Factory Setting:** 2.500**Proprieties:****Access groups via HMI:**

01 PARAMETER GROUPS

L 50 SoftPLC

**Description:**

This parameter defines the value of the system output pressure control PID proportional gain.

**P1025 – Integral Gain****Adjustable Range:** 00.00 to 300.00**Factory Setting:** 35.00**Proprieties:****Access groups via HMI:**

01 PARAMETER GROUPS

L 50 SoftPLC

**Description:**

This parameter defines the value of the system output pressure control PID integral gain.

**P1026 – Derivative Gain****Adjustable Range:** 0.000 to 30.000**Factory Setting:** 0.000**Proprieties:****Access groups via HMI:**

01 PARAMETER GROUPS

L 50 SoftPLC

**Description:**

This parameter defines the value of the system output pressure control PID derivative gain.

**NOTE!**

The PID block minimum and maximum value limits correspond to the speeds programmed at P0133 and P0134, respectively. The other input arguments of the PID block can be changed only by the Ladder applicative developed with the WLP. Refer to help topics in the WLP programming software for further information on the PID block.

**5.11 Sleep Mode**

This parameter group allows the user to program the sleep mode activation conditions.

**Sleep Mode** is a multipump system state where the flow request is null or almost null, and all the pumps are stopped. The system, however, remains monitoring the output pressure and verifying the conditions to activate the wake up mode.

**P1030 – Sleep Mode Activation Frequency****Adjustable Range:** 0.0 to 300.0 Hz**Factory Setting:** 41.0 Hz**Proprieties:****Access groups via HMI:**

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the frequency of the motor driven by the CFW-11, which is the limit for the multipump system to activate the sleep mode. This condition is valid when only the pump driven by the inverter is operating and the frequency stays below the programmed value. At the moment the sleep mode is activated, first a command for disabling the inverter is issued, and then 500ms later the command for deactivating the correspondent digital output.

### P1031 – Sleep Mode Activation Time

<b>Adjustable Range:</b>	0.01 to 650.00 s	<b>Factory Setting:</b>	10.00 s
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### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines waiting time with the P1030 condition fulfilled, in order to activate the sleep mode.

## 5.12 Wake up Mode

This parameter group allows the user to adjust the conditions for the activation of the wake up mode.

**Wake up Mode** is when the multipump system controls the output pressure again, switching the pumps on and off according to the flow requirements.

### P1032 – Wake up Mode Activation Pressure Deviation

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b>	0.30 bar
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### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the value to be subtracted from the pressure setpoint, becoming this difference the pressure limit for activating the system control again, i.e., entering the wake up mode. This condition is valid when the system is in sleep mode and the pressure stays below the programmed limit. At the moment the wake up mode is initiated, first a command for activating the correspondent digital output is issued, and then 500ms later the inverter is enabled.

### P1033 – Wake up Mode Activation Time

<b>Adjustable Range:</b>	0.01 to 650.00 s	<b>Factory Setting:</b>	5.00 s
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### Proprieties:

### Access groups via HMI:

01 PARAMETER GROUPS

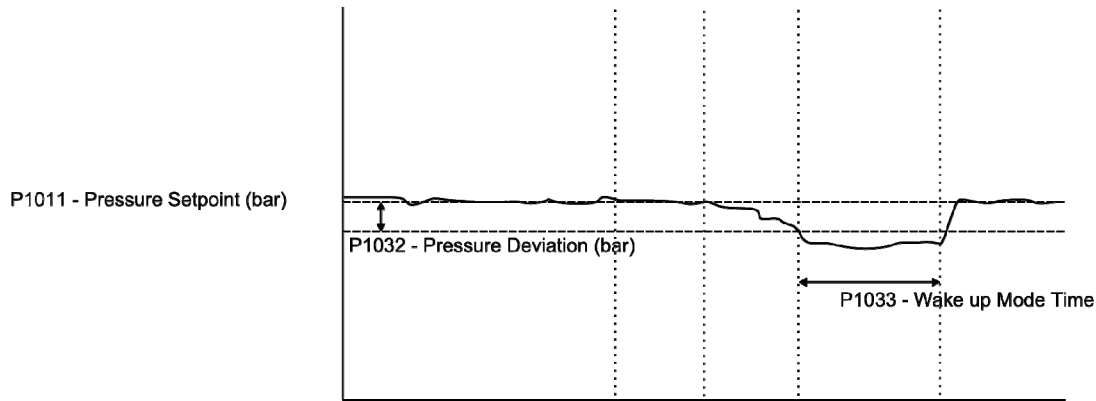
L 50 SoftPLC

### Description:

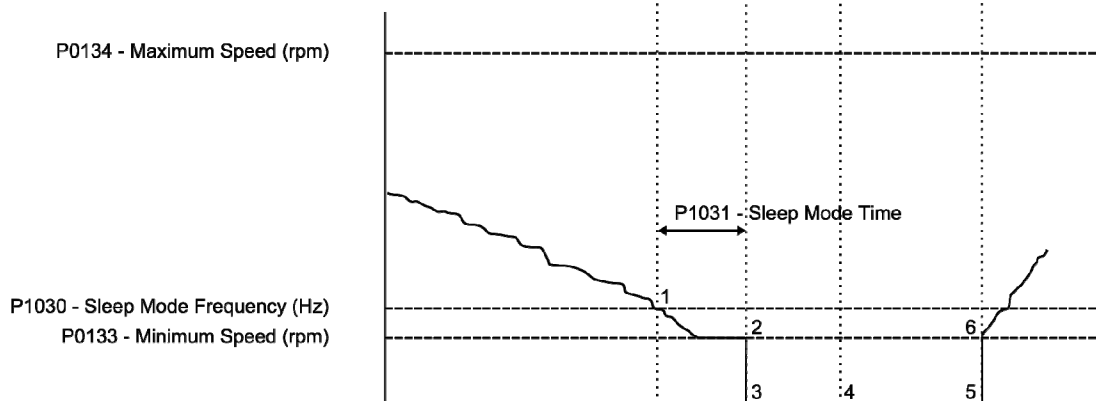
This parameter defines a waiting time with the P1032 condition fulfilled, in order to activate the wake up mode. This time is disregarded the first time the system is enabled.

See below the operation diagram of the pump driven by the CFW-11 for the sleep and wake up modes operation.

### OUTPUT PRESSURE SYSTEM (bar)



### CFW-11 PUMP FREQUENCY (Hz)



The analysis of the identified moments follows below:

- 1** – The frequency of the pump motor driven by the inverter is lower than the value to activate the sleep mode (P1030) and the timing for the activation of the sleep mode (P1031) begins.
- 2** – The motor stays with the frequency lower than the programmed (P1030) and the sleep mode activation time elapses. The sleep mode is then activated.
- 3** – The command for the CFW-11 inverter to stop the motor is given, and 500ms later the command for opening the pump contactor. The system remains enabled and keeps monitoring the output pressure.
- 4** – The output pressure reaches the value programmed for activating the wake up mode (P1011 – P1032) and the timing for the activation of the wake up mode (P1033) begins.
- 5** – The pressure remains lower than the programmed (P1011 – P1032) and the wake up time elapses. The wake up mode is then activated.
- 6** – The command to close the contactor of the pump to be driven by the inverter is given, and 500ms later the inverter is enabled. Then the system controls the pressure again according to the control logic.

## 5.13 Pipe Charging

This parameter group allows the user to adjust the conditions for the pipe charging.

**Pipe Charging** allows the pipe is charged slowly during the time, thus avoid the water hammer. The pipe charging is started when the multipump system is enabled, by a new command or by a failure that has previously disabled. If in the new enabled of the system, a certain pressure is detected, the pipe charging is not executed.

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

<b>Adjustable</b>	0 = Disable (1st Ramp)	<b>Factory</b>	0
<b>Range:</b>	6 = Enable (SoftPLC)	<b>Setting:</b>	

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 20 Ramps

#### Description:

This parameter enabled pipe charging (SoftPLC will select the ramp).

### P0102 – Acceleration Time 2

<b>Adjustable</b>	0.0 to 999.0 s	<b>Factory</b>	10.0 s
<b>Range:</b>		<b>Setting:</b>	

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 20 Ramps

#### Description:

This parameter defines another ramp value to accelerate the CFW11 pump in pipe charging.



#### NOTE!

Refer to CFW-11 programming manual for further information on the ramp parameters.

### P1047 – Pipe Charging Time

<b>Adjustable</b>	0.00 to 650.00 s	<b>Factory</b>	30.0 s
<b>Range:</b>		<b>Setting:</b>	

#### Proprieties:

#### Access groups via HMI:

01 GRUPOS PARÂMETROS

L 50 SoftPLC

#### Description:

This parameter defines the elapsed time for pipe charging.



#### NOTE!

The value 0.00 in this parameter disables the pipe charging.

## 5.14 Starting the Pumps

This parameter group allows the user to adjust the operation conditions for starting the system pumps.

### P1034 – Pump Starting Frequency

<b>Adjustable</b>	0.0 to 300.0 Hz	<b>Factory</b>	59.0 Hz
<b>Range:</b>		<b>Setting:</b>	

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the frequency of the motor driven by the CFW-11 in the multipump system, which is the limit for starting a pump. This condition is valid when the inverter frequency stays above the programmed value.

### P1035 – Pump Starting Pressure Deviation

**Adjustable Range:** 0.00 to 300.00 bar

**Factory Setting:** 0.10 bar

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines the value to be subtracted from the pressure setpoint, becoming this difference (P1011 – P1035) the pressure limit for the multipump system to activate a pump. This condition is valid when the system pressure stays below the programmed limit.

### P1036 – Pump Starting Time

**Adjustable Range:** 0.01 to 650.00 s

**Factory Setting:** 2.00 s

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines a time delay with P1034 and P1035 conditions fulfilled, so that the multipump system activates a pump.

### P1037 – Pump Starting CFW-11 Deceleration Delay

**Adjustable Range:** 0.01 to 100.00 s

**Factory Setting:** 0.01 s

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines a time delay before initiating the deceleration of the inverter driven pump when a pump is activated.



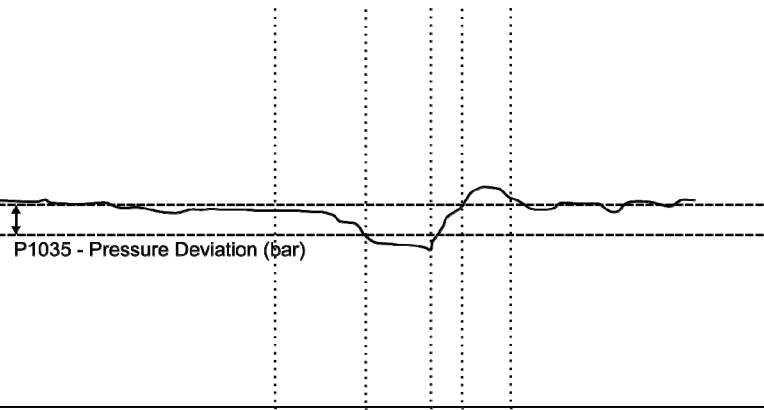
### NOTE!

By setting the parameter value in 100.00, the deceleration of the pump driven by the inverter does not take place, i.e., the pump remains at the same speed it was before a pump starting.

See below the operation diagram of the pump driven by the CFW-11 when the system needs to start a pump.

## OUTPUT PRESSURE SYSTEM (bar)

P1011 - Pressure Setpoint (bar)



## CFW-11 PUMP FREQUENCY (Hz)

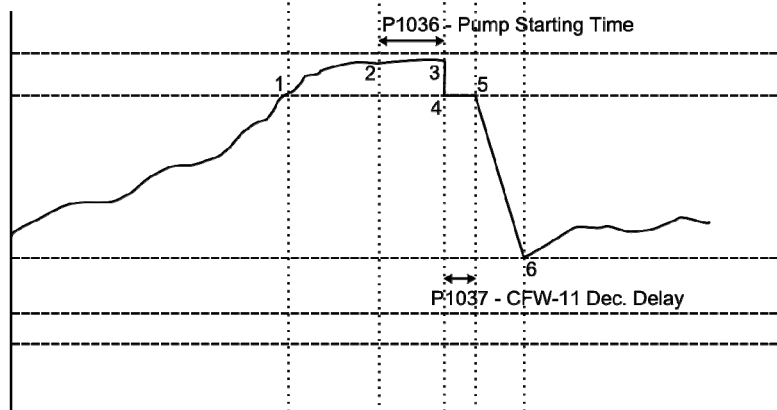
P0134 - Maximum Speed (rpm)

P1034 - Pump Starting Frequency (Hz)

P1038 - Pump Stopping Frequency (Hz)

P1030 - Sleep Mode Activation Frequency (Hz)

P0133 - Minimum Speed (rpm)



The analysis of the identified moments follows below:

- 1** – The frequency of the motor driven by the inverter is higher than the frequency for starting a pump (P1034).
- 2** – The motor stays with the frequency higher than the programmed value (P1034) and the system pressure diminishes, becoming lower than the programmed for starting an auxiliary pump (P1011 – P1035) and the timing for starting a pump (P1036) begins.
- 3** – The time for starting a pump (P1036) elapses and the command for starting it is given.
- 4** – A pump is started. At this moment the PID controller changes to the manual control mode and the frequency of the pump driven by the inverter goes to the value programmed in P1034. The timing to initiate the deceleration of the inverter driven pump (P1037) begins.
- 5** – The time to initiate the deceleration of the inverter driven pump (P1037) elapses. The PID controller remains in the manual control mode and the frequency of the inverter driven pump is decelerated to the value programmed in P1038.
- 6** – The motor decelerates down to the value programmed to stop an auxiliary pump (P1038) and the PID controller changes to the automatic mode. The system controls the output pressure again, but now with one more pump.

## 5.15 Stopping the Pumps

This parameter group allows the user to adjust the operation conditions for stopping the system pumps.

### P1038 – Pump Stopping Frequency

<b>Adjustable Range:</b>	0.0 to 300.0 Hz	<b>Factory Setting:</b>	44.0 Hz
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the frequency of the motor driven by the CFW-11 in the multipump system, which is the limit for stopping a pump. This condition is valid when the inverter frequency stays below the programmed frequency limit.

### P1039 – Pump Stopping Pressure Deviation

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b>	0.20 bar
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the value to be added from the pressure setpoint, becoming this result (P1011 + P1039) the pressure limit for the multipump system to deactivate a pump. This condition is valid when the system pressure stays above the programmed limit.

### P1040 – Pump Stopping time

<b>Adjustable Range:</b>	0.01 to 650.00 s	<b>Factory Setting:</b>	2.00 s
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines a time delay with P1038 and P1039 conditions fulfilled, so that the multipump system deactivates a pump.

### P1041 – Pump Stopping CFW-11 Acceleration Delay

<b>Adjustable Range:</b>	0.01 to 100.00 s	<b>Factory Setting:</b>	0.01 s
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines a time delay before initiating the acceleration of the CFW-11 inverter driven pump when a pump is deactivated.

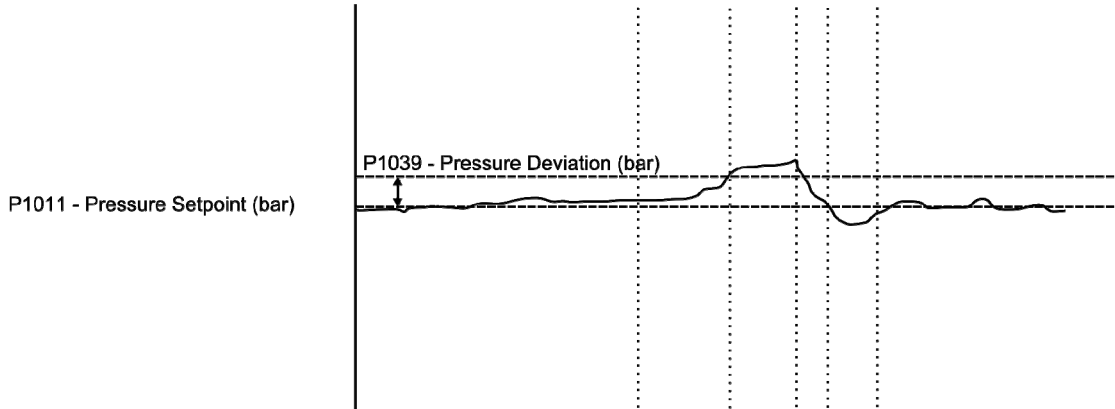


### NOTE!

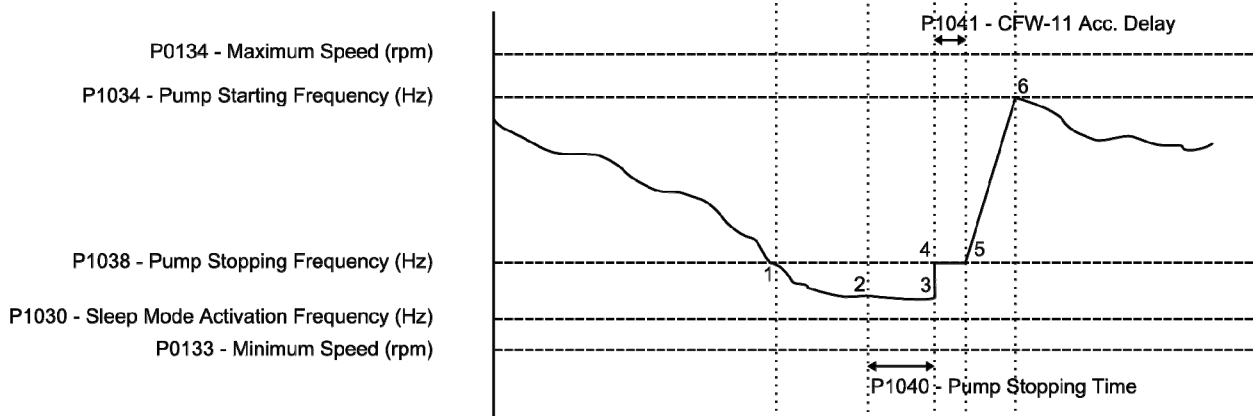
By setting the parameter value in 100.00, the acceleration of the pump driven by the inverter does not take place, i.e., the pump remains at the same speed it was before the pump stopping.

See below the operation diagram of the pump driven by the CFW-11 when the system needs to stop a pump.

#### OUTPUT PRESSURE SYSTEM (bar)



#### CFW-11 PUMP FREQUENCY (Hz)



The analysis of the identified moments follows below:

- 1** – The frequency of the motor driven by the inverter is lower than the frequency for stopping a pump (P1038).
- 2** – The motor stays with the frequency lower than the programmed value (P1038) and the system pressure increases, becoming higher than the programmed for stopping an auxiliary pump (P1011 + P1039) and the timing for stopping an auxiliary pump (P1040) begins.
- 3** – The time for stopping a pump (P1040) elapses and the command for stopping it is given.
- 4** – An auxiliary pump is stopped. At this moment the PID controller changes to the manual control mode and the frequency of the pump driven by the inverter goes to the value programmed in P1038. The timing to initiate the acceleration of the inverter driven pump (P1041) begins.
- 5** – The time to initiate the acceleration of the inverter driven pump (P1041) elapses. The PID controller remains in the manual control mode and the frequency of the inverter driven pump is accelerated to the value programmed in P1034.
- 6** – The motor accelerates up to the value programmed to start an auxiliary pump (P1034) and the PID controller changes to the automatic mode. The system controls the output pressure again, but now with one pump less.



## 5.16 Rotate of the Pump Driven by the Inverter

This parameter group allows the user to adjust the operation conditions for rotate the pump driven by the CFW11 in case it remains operating uninterruptedly for a period, i.e., the inverter driven pump remains on during a certain period of time. Then the rotate of the pump driven by the inverter is performed according to the contents of the configuration parameters.

### P1027 – Number of Pumps Started for Rotate the CFW-11 Pump

<b>Adjustable Range:</b>	1 to 4	<b>Factory Setting:</b>	1
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the number of pumps that may be on, so that the system is able to rotate the pump driven by the inverter. This condition is valid when the number of pumps in operation is less or equal to the programmed number.



#### NOTE!

With 0 programmed at this parameter the rotation of pumps according to their operation time is disabled.

### P1028 – Frequency for Rotate the CFW-11 Pump

<b>Adjustable Range:</b>	0.0 to 300.0 Hz	<b>Factory Setting:</b>	42.0 Hz
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the frequency of the pump motor driven by the inverter in the multipump system, which is the limit for rotate the inverter driven pump. This condition is valid when the inverter frequency stays below the programmed frequency limit.

### P1029 – Time Interval for Rotate the CFW-11 Pump

<b>Adjustable Range:</b>	0 to 65000 hours	<b>Factory Setting:</b>	72 h
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the maximum time period that the pump driven by the inverter can operate uninterruptedly. After this time has elapsed, the condition programmed in P1028 is verified so that the system be switched off and a new pump be driven by the inverter.



#### NOTE!

The value "0" at this parameter enables the test mode, where at every 60 seconds the logic for rotate the pump driven by the inverter, is enabled.

### 5.17 Minimum Output Pressure (Pipe Breaking)

This parameter group allows the user to adjust the conditions to generate fault and alarm because of minimum output pressure (pipe breaking).

#### P1042 – Minimum Output Pressure to Alarm

**Adjustable Range:** 0.00 to 300.00 bar

**Factory Setting:** 1.00 bar

##### Proprieties:

##### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

##### Description:

This parameter defines the minimum system pressure value, so that an alarm message is generated in the system. This condition is valid when the system output pressure is lower than the programmed pressure.

#### P1043 – Minimum Output Pressure Alarm Time (A760)

**Adjustable Range:** 0.00 to 650.00 s

**Factory Setting:** 10.00 s

##### Proprieties:

##### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

##### Description:

This parameter defines the time period that the minimum pressure condition must be kept with the pump driven by the inverter on, so that the alarm message "A760: Minimum Pressure" be generated.



##### NOTE!

The value 0.00 in this parameter disables the alarm.

#### P1044 – Minimum Output Pressure Fault Time (F761)

**Adjustable Range:** 0.00 to 650.00 s

**Factory Setting:** 20.00 s

##### Proprieties:

##### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

##### Description:

This parameter defines the time period that the minimum pressure condition must be kept with all the system pumps on, so that the fault message "F761: Minimum Pressure" be generated.



##### NOTE!

The multipump system is switched off if this fault message is generated.  
The value 0.00 in this parameter disables the fault.

## 5.18 Maximum Output Pressure (Pipe Obstruction)

This parameter group allows the user to adjust the conditions to generate a fault because of Maximum output pressure (pipe obstruction).

### P1045 – Maximum Output Pressure to Fault

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b>	3.90 bar
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the maximum system pressure value, so that a fault message is generated in the system. This condition is valid when the system output pressure is higher than the programmed pressure.

### P1046 – Maximum Output Pressure Fault Time (F763)

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	10.00 s
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines the time period that the maximum pressure condition must be kept with only the inverter driven pump on, so that the fault message “F763: Maximum Pressure” be generated.



#### NOTE!

The multipump system is switched off if this fault message is generated.  
The value 0.00 in this parameter disables the fault.

## 5.19 HMI Monitoring

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

### P0205 – Reading Parameter Selection 1

### P0206 – Reading Parameter Selection 2

### P0207 – Reading Parameter Selection 3



#### NOTE!

Refer to CFW-11 programming manual for further information on the HMI parameters. Some parameter options have been removed from the configuration wizard.

## 5.20 Reset Command of the Pump Operation Time

### P1049 – Operation Time Reset

<b>Adjustable Range:</b>	0 = No reset is executed 1 = Enables the pump 1 operation time reset 2 = Enables the pump 2 operation time reset 3 = Enables the pump 3 operation time reset 4 = Enables the pump 4 operation time reset 5 = Enables the reset of the time for rotate the CFW-11 pump	<b>Factory Setting:</b> 0
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#### Proprieties:



#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter defines which pump of the system will be enabled to receive the reset command of the operation hours (i.e., the value of the operation time counter is reset).

The reset command is executed by CFW-11 the HMI  key. E.g., in order to reset the operation hours of the pump 1, change the value of the parameter P1049 to 1 and press the CFW-11 the HMI  key.

## 5.21 Reading Parameters

### P1010 – FLC Multipump Version

<b>Adjustable Range:</b>	0.00 to 10.00	<b>Factory Setting:</b> -
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**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter indicates the software version of the applicative developed for the floating control multipump system.

### P1011 – Actual System Pressure Setpoint

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b> -
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**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

#### Description:

This parameter indicates the actual setpoint for the floating control multipump system output pressure regulation, regardless if it is via parameter or via analog input.

### P1012 – Output Pressure

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b> -
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**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter indicates the system output pressure value read through the analog input.

### P1013 – Operation Time for Rotate the CFW-11 Pump

**Adjustable Range:** 0 to 65535 hours

**Factory Setting:** -

**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter indicates the time for rotate the pump driven by the CFW-11 value. It is the parameter used to store the uninterrupted operation time of the pump driven by the CFW-11, in order that the rotate of the driven pump be executed.

### P1014 – Pump 1 Operation Time

**Adjustable Range:** 0 to 65535 hours

**Factory Setting:** -

**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter indicates the pump 1 operation time value. This value is used to define which pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

### P1015 – Pump 2 Operation Time

**Adjustable Range:** 0 to 65535 hours

**Factory Setting:** -

**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter indicates the pump 2 operation time value. This value is used to define which pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

### P1016 – Pump 3 Operation Time

**Adjustable Range:** 0 to 65535 hours

**Factory Setting:** -

**Proprieties:** RO

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter indicates the pump 3 operation time value. This value is used to define which pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

P1017 – Pump 4 Operation Time		
Adjustable Range:	0 to 65535 hours	Factory Setting: -
Proprieties:	RO	
Access groups via HMI:		
01 PARAMETER GROUPS		
L	50 SoftPLC	

**Description:**  
This parameter indicates the pump 4 operation time value. This value is used to define which pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

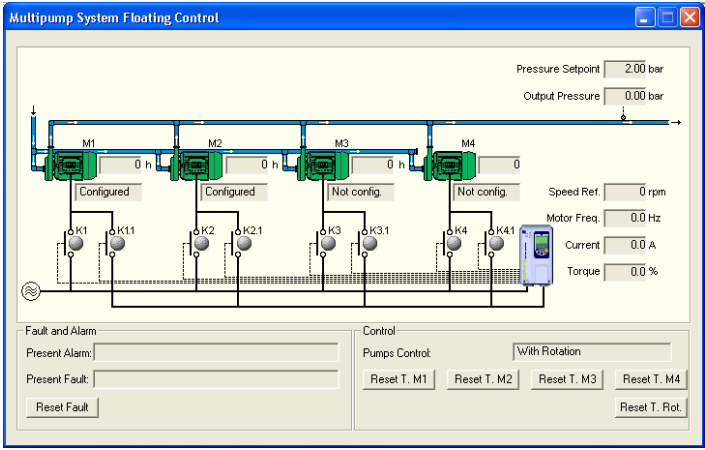
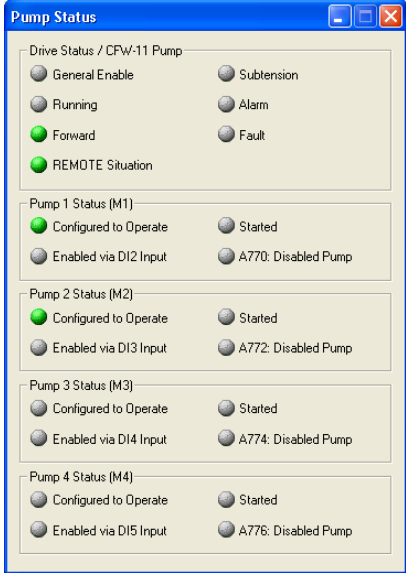
### 6 Fault and Alarm Messages

The floating control multipump system applicative generates the following fault and alarm messages:

Fault / Alarm	Description	Probable Causes
A750: Sleep Mode Active	It indicates to the user that the multipump system is in the sleep mode	The motor speed remained lower than the P1030 value longer than the P1031 time
A752: Pipe Charging	It indicates that pipe charging is running.	New enabling of the multipump system.
A754: Rotate Mode Active	It indicates to the user that the multipump system is performing the rotate of the CFW-11 driven pump.	The operation time of the pump driven by the CFW-11 (P1014) exceeded the value programmed for rotate the CFW-11 driven pump (P1029).
A760: Minimum Pressure	It indicates that the system output pressure is low.	The output pressure remained lower than the P1042 value longer than the P1043 time.
F761: Minimum Pressure	It indicates that the output pressure remained low during the time for the pipe burst detection.	Active A760 alarm, all the system pumps on and the waiting time (P1044) has elapsed.
F763: Maximum Pressure	It indicates that the system output pressure is high.	The output pressure is higher than P1045, only the inverter driven pump on, and the waiting time (P1046 ) has elapsed.
A770: Disabled Pump 1	It indicates that the pump 1 has been disabled while it was on	The digital input DI2 went to logic level "0" with the pump 1 on.
A772: Disabled Pump 2	It indicates that the pump 2 has been disabled while it was on	The digital input DI3 went to logic level "0" with the pump 2 on.
A774: Disabled Pump 3	It indicates that the pump 3 has been disabled while it was on	The digital input DI4 went to logic level "0" with the pump 3 on.
A776: Disabled Pump 4	It indicates that the pump 4 has been disabled while it was on	The digital input DI5 went to logic level "0" with the pump 4 on.

## 7 Monitoring Dialogs

Through the WLP it is possible to monitor and change the applicative parameters of the floating control multipump system.

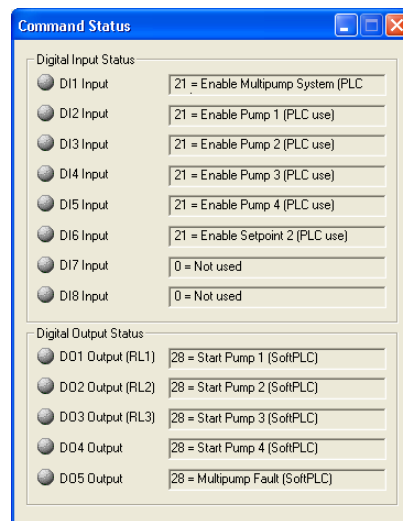
Description	WLP Monitoring Dialog Box
<p>Floating control multipump system operation monitoring.</p> <p>It shows the following variables:</p> <ul style="list-style-type: none"> <li>- Operating time of the pumps;</li> <li>- Whether or not the pump is configured for operation;</li> <li>- Pump in operation;</li> <li>- System pressure setpoint and output pressure;</li> <li>- Frequency, current, torque and speed reference of the pump driven by the CFW-11 inverter;</li> <li>- Present fault and alarm;</li> <li>- Reset command for system faults;</li> <li>- Control mode for the pumps activation</li> <li>- Reset command of the pump operation times.</li> </ul>	
<p>Multipump system pump status monitoring. It shows the following variables:</p> <ul style="list-style-type: none"> <li>- General enable, motor running, FORWARD speed direction, REMOTE situation, subtension, alarm and fault for the pump driven by the CFW-11 inverter;</li> <li>- Configured in the system status, enabled via DI2 input, pump on and disabled pump alarm (A770) for the pump 1;</li> <li>- Configured in the system status, enabled via DI3 input, pump on and disabled pump alarm (A772) for the pump 2;</li> <li>- Configured in the system status, enabled via DI4 input, pump on and disabled pump alarm (A774) for the pump 3;</li> <li>- Configured in the system status, enabled via DI5 input, pump on and disabled pump alarm (A776) for the pump 4.</li> </ul>	



## Monitoring Dialogs

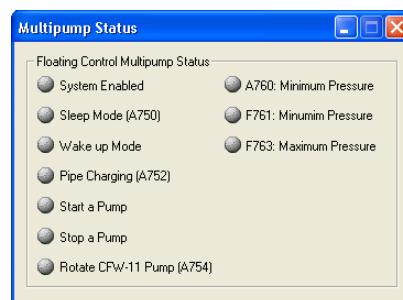
Status monitoring of the commands produced in the multipump system. It shows the following variables:

- Actual status of the CFW-11 digital inputs;
- Function of the digital inputs in the multipump system;
- Actual status of the CFW-11 digital outputs;
- Function of the digital outputs in the multipump system.



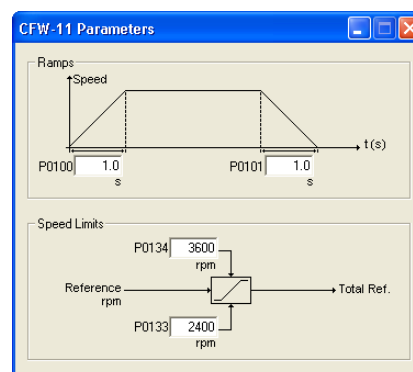
Monitoring of the multipump system operational status. It shows the following variables:

- Enabled system status;
- Active sleep mode (A750);
- Active wake up mode;
- Active pipe charging (A752);
- Condition for starting a pump in the system;
- Condition for stopping a pump of the system;
- Condition to rotate the CFW-11 driven pump (A754);
- Minimum pressure alarm (A760);
- Minimum pressure fault (F761);
- Maximum pressure fault (F763).



It lists CFW-11 parameters for ramps and speed limits configured in the multipump system. It makes possible the modification of the following variables:

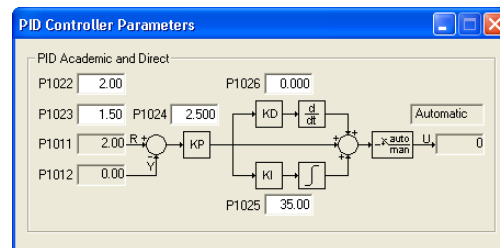
- P0100: Acceleration time;
- P0010: Deceleration time;
- P0133: Minimum speed reference limit;
- P0134: Maximum speed reference limit.



## Monitoring Dialogs

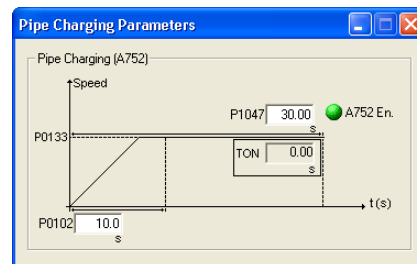
It lists the adjustment and operation parameters of the PID controller for the output pressure regulation of the multipump system. It makes possible the modification and visualization of the following variables:

- P1011: Actual system pressure setpoint ;
- P1012: Output pressure;
- P1022: System pressure setpoint 1;
- P1023: System pressure setpoint 2;
- P1024: PID proportional gain;
- P1025: PID integral gain;
- P1026: PID derivative gain;
- Whether the PID controller is in automatic or manual mode;
- Output (U) of the PID controller (speed reference, in RPM, for the inverter driven pump).



It lists the operation parameters for the control logic of the pipe charging. It makes possible the modification and visualization of the following variables:

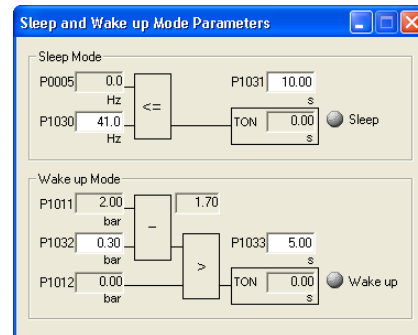
- P0102: Acceleration time 2;
- P1047: Pipe charging time;
- Pipe charging elapsed time value;
- Indication of enabled pipe charging.



## Monitoring Dialogs

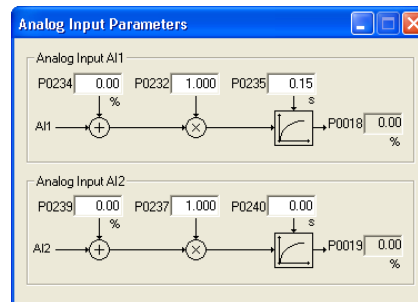
It lists the operation parameters for the control logic of the sleep and wake up modes. It makes possible the modification and visualization of the following variables:

- P0005: Motor frequency;
- P1011: Actual system pressure setpoint ;
- P1012: Output pressure;
- P1030: Sleep mode activation frequency;
- P1031: Sleep mode activation time;
- P1032: Wake up mode activation pressure deviation;
- P1033: Wake up mode activation time;
- The time elapsed for the sleep mode activation;
- The time elapsed for the wake up mode activation;
- Active sleep mode indication;
- Active wake up mode indication.



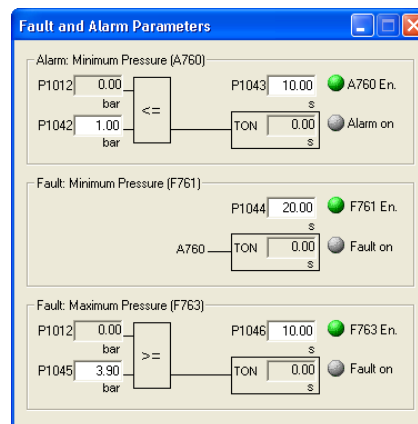
It lists the parameters for the reading of the multipump system control signals via the CFW-11 analog inputs. It makes possible the modification and visualization of the following variables:

- P0018: AI1 value;
- P0019: AI2 value;
- P0232: AI1 gain;
- P0234: AI1 offset;
- P0235: AI1 filter;
- P0237: AI2 gain;
- P0239: AI2 offset;
- P0240: AI2 filter.



It lists the operation parameters of the control logic to generate faults and alarms. It makes possible the modification and visualization of the following variables:

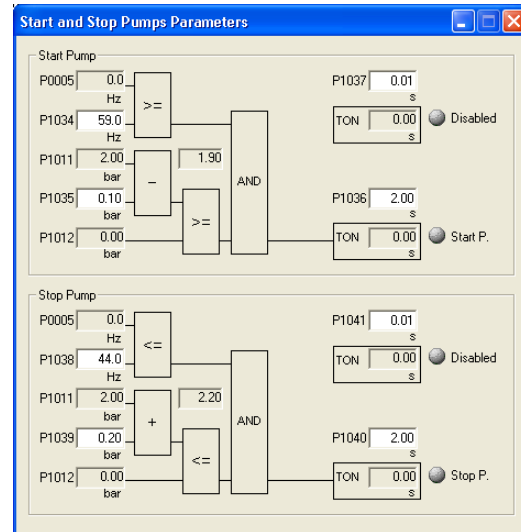
- P1012: Output pressure;
- P1042: Minimum output pressure to alarm;
- P1043: Minimum output pressure alarm time;
- P1044: Minimum output pressure fault time;
- P1045: Maximum output pressure to fault;
- P1046: Maximum output pressure fault time;
- Value of the elapsed time to generate faults and alarms;
- Indication of active faults and alarms;
- Indication of enabled faults and alarms.



## Monitoring Dialogs

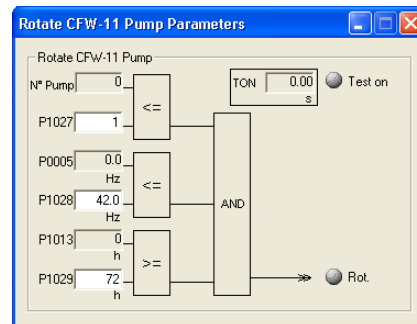
It lists the operation parameters for the control logic to start and stop pumps. It makes possible the modification and visualization of the following variables:

- P0005: Motor frequency;
- P1011: Actual system pressure setpoint ;
- P1012: Output pressure;
- P1034: Pump starting frequency;
- P1035: Pump starting pressure deviation;
- P1036: Pump starting time;
- P1037: Pump starting CFW-11 deceleration delay;
- P1038: Pump stopping frequency;
- P1039: Pump stopping pressure deviation;
- P1040: Pump stopping time;
- P1041: Pump stopping CFW-11 acceleration delay;
- Value of the elapsed time to start and stop pumps;
- Value of the elapsed time of the acceleration or deceleration delay by starting or stopping pumps;
- Indication of the command to start or stop a pump;
- Indication of the disabled time delay.



It lists the operation parameters for the control logic to rotate the CFW-11 driven pump. It makes possible the modification and visualization of the following variables:

- P0005: Motor frequency;
- P1013: Operation time for rotate the CFW-11 pump;
- P1027: Number of pumps started for rotate the CFW-11 pump;
- P1028: Frequency for rotate the CFW-11 pump;
- P1029: Time interval for rotate the CFW-11 pump;
- Number of pumps running in the system;
- Value of the elapsed time, when in test mode, for rotate the CFW-11 pump;
- Indication of the rotate in test mode;
- Indication of the command to rotate the CFW-11 driven pump.

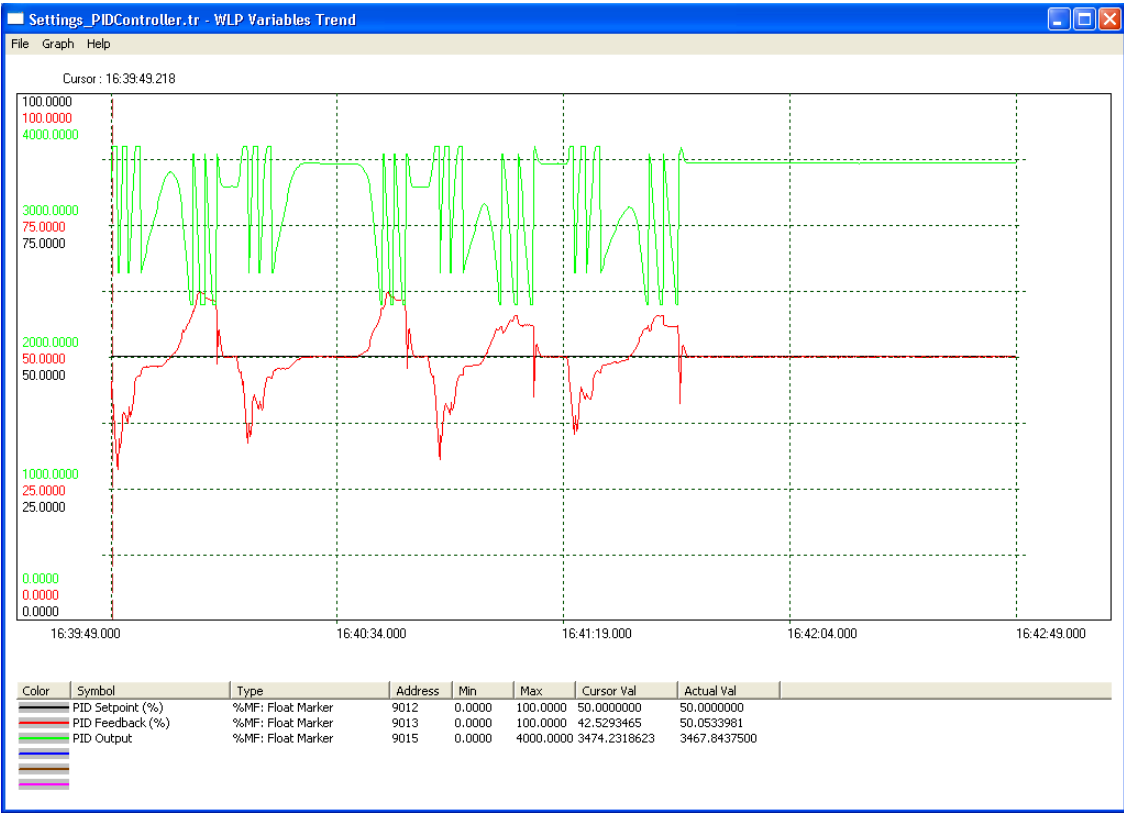


## 8 Trend Variables Dialogs

It is possible to monitor variables of the floating control multipump system applicative through the WLP.

### PID Controller Settings:

It makes possible the visualization of the output pressure control system PID controller settings values.

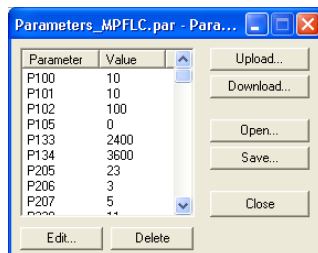


### NOTE!

Refer to help topics in the WLP programming software for further information on the use of the trend variable dialogs.

## 9 Parameter Value Dialogs

It is possible to save the parameters of the floating control multipump system applicative through the WLP.



### NOTE!

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