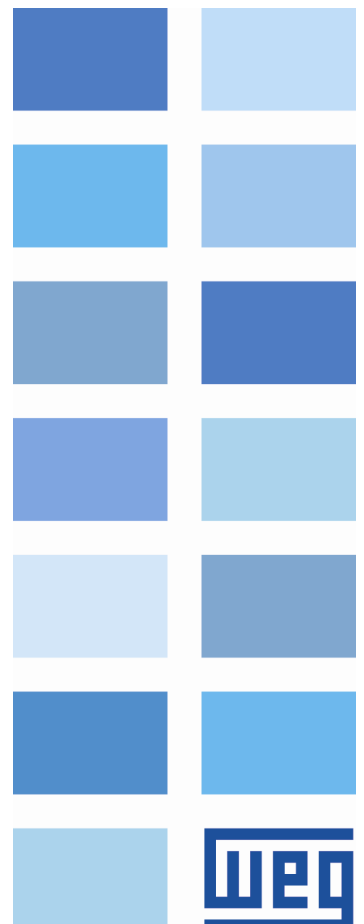


# Fixed Control Multipump System

## CFW-11

### Application Manual

Language: English  
Document: 10000123067 / 01





# **Fixed Control Multipump System Application Manual**

Series: CFW-11

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## About the Manual

This manual provides the necessary description for configuration the fixed 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:

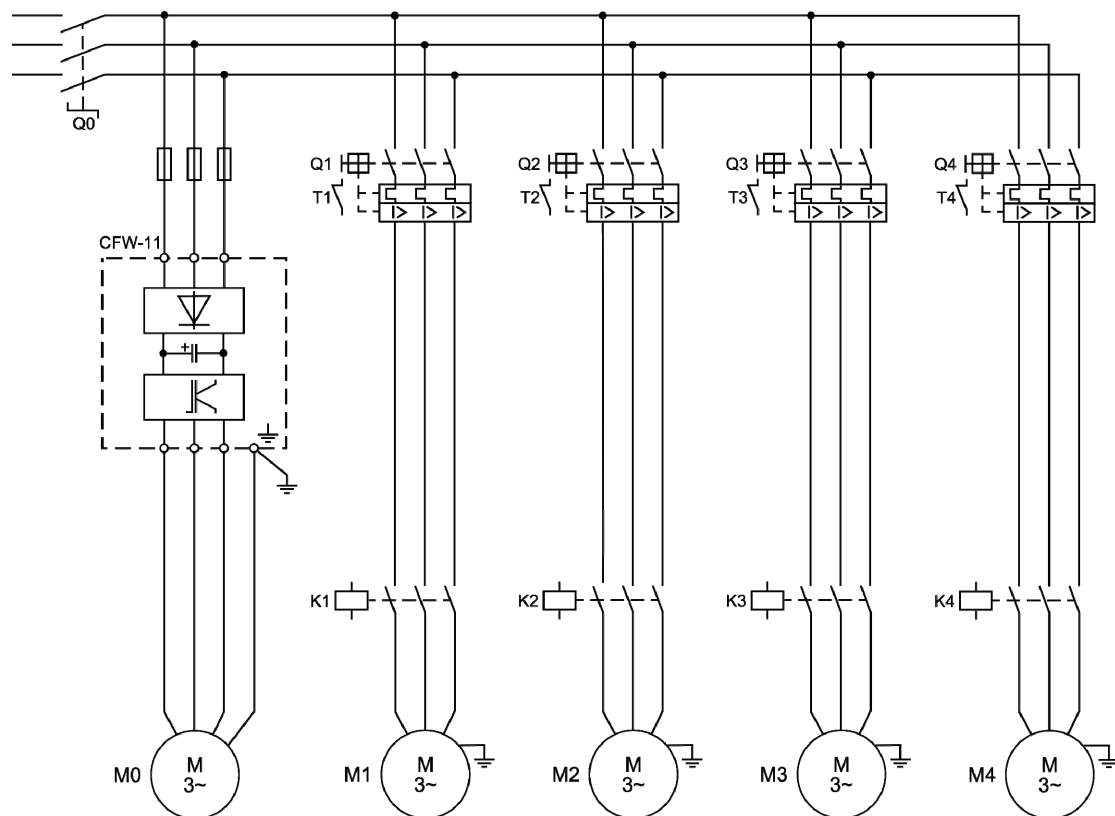
- Energy savings;
- Increased life span of the pumping system;
- It makes maintenance without operation interruption easier;
- It keeps a constant line pressure;
- It provides the necessary flow according to the system demand;
- It allows system fault diagnosis;
- Pump operation time equalization, allowing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

## 2 Fixed Control Multipump System

It is characterized by the fact that the inverter always controls the speed of the same pump. The other pumps of the system are called auxiliary pumps and are activated by the CFW-11 digital outputs. In that way, the more suitable starting technique can be chosen by the user, direct on line, star-delta, soft-starter, etc.

### 2.1 Power Connections

The power section connection schematic for a fixed control multipump system with four auxiliary 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 auxiliary pumps;
- ☑ K1, K2, K3 and K4: Contactors for starting the auxiliary pumps;
- ☑ M0, M1, M2, M3 and M4: Multipump system pump motors;
- ☑ The CFW-11 protection is done with fuses.

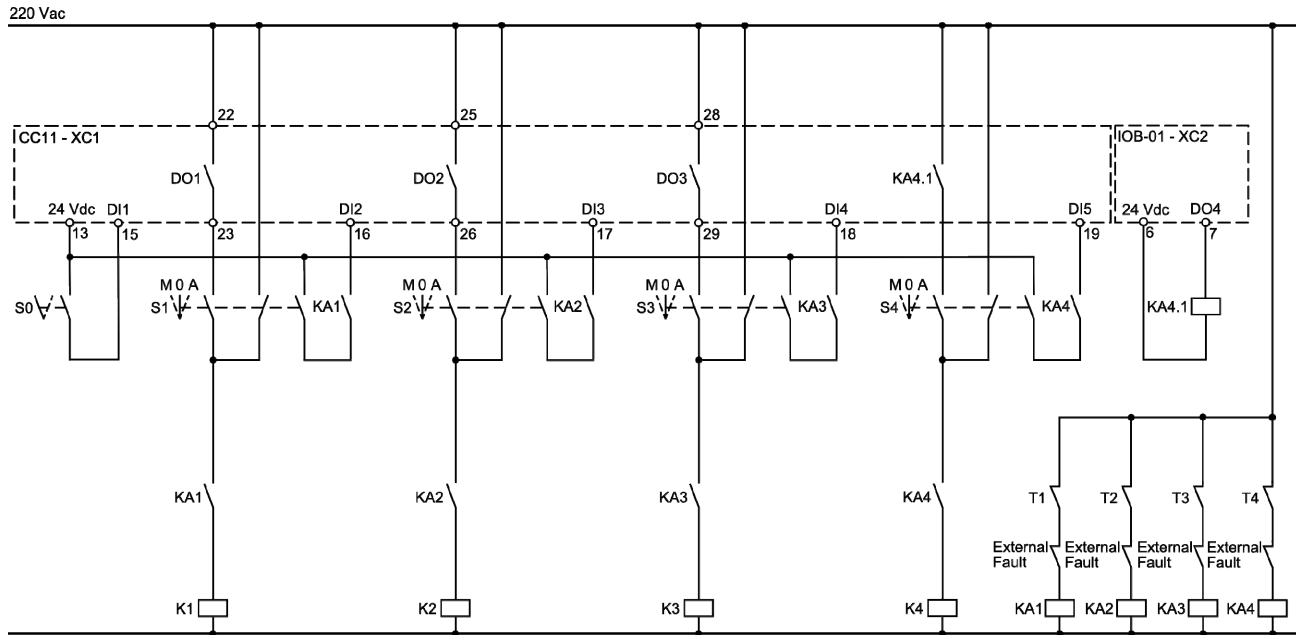


**NOTE!**

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 fixed control multipump system with four auxiliary pumps is presented below.

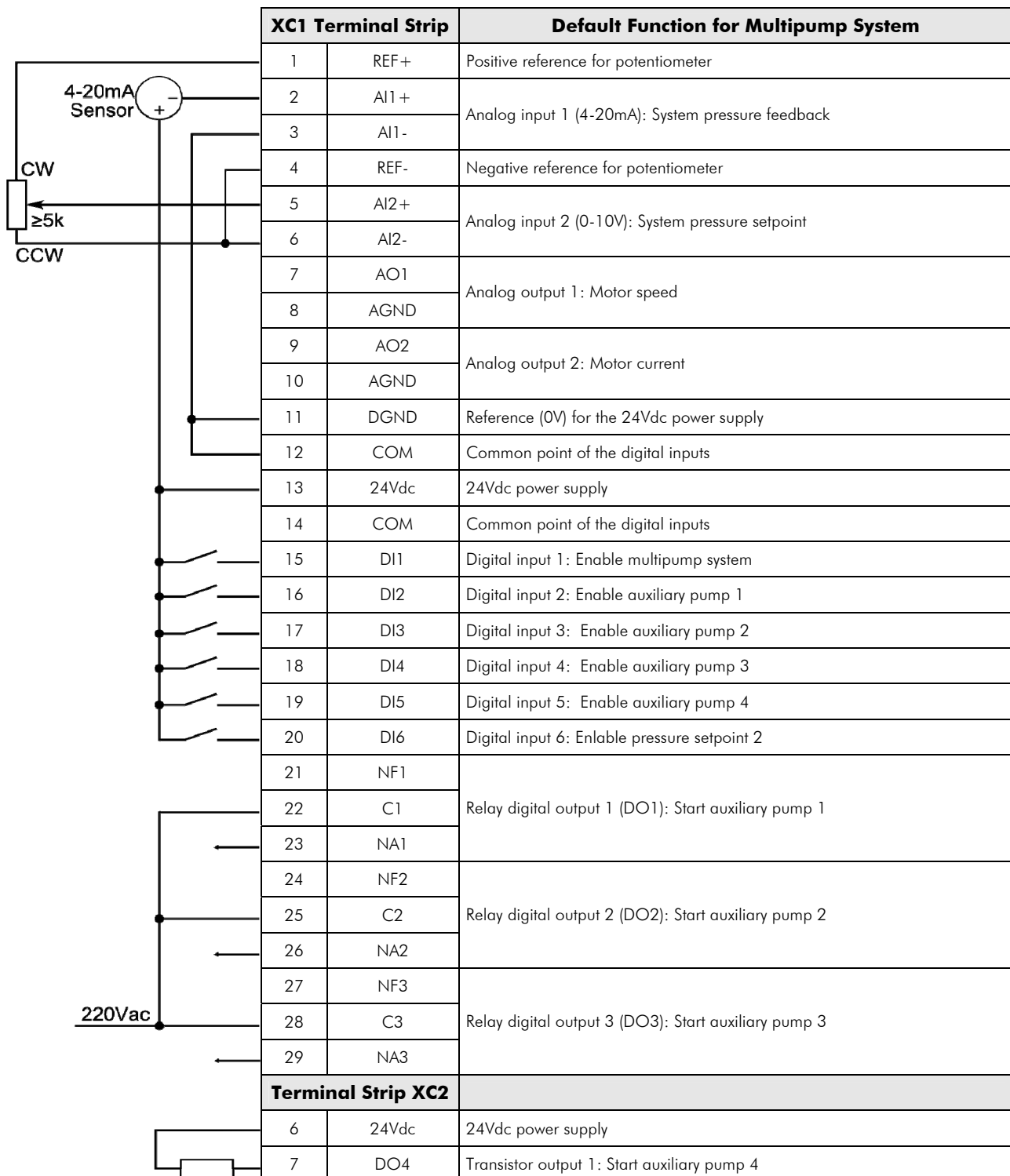


### Note:

- ☑ 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 auxiliary 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 auxiliary pump to be used in the multipump system;
- ☑ K1, K2, K3 and K4: Contactors for starting the auxiliary pumps;
- ☑ KA1, KA2, KA3 and KA4: Auxiliary contactors for the protection logics of the auxiliary 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 auxiliary pump motor protection thermal relays;
- ☑ External Fault: A sensor, as a pressostat for instance, can be used for the protection of auxiliary pumps;
- ☑ DO1, DO2 and DO3: CFW-11 inverter digital outputs, for the command of auxiliary pumps;
- ☑ DO4: CFW-11 inverter expansion module transistor digital output, for the command of one auxiliary 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 auxiliary 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 CC11control board XC1 terminal strip and at the IOB-01 expansion module XC2 terminal strip for a multipump system with four auxiliary 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.

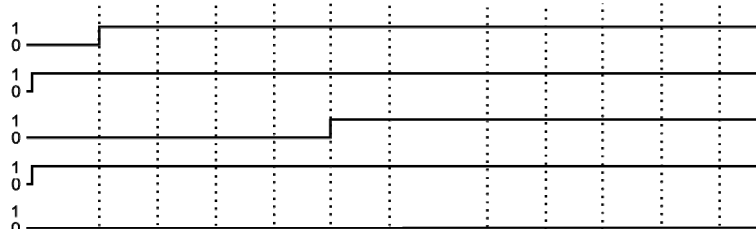


## 2.4 Functional Description

See below the operation diagram of the pump driven by the CFW-11 and of the auxiliary pumps in a fixed control multipump system with four auxiliary pumps. The graph below presents the "in a sequence" control mode for the auxiliary 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 auxiliary pumps.

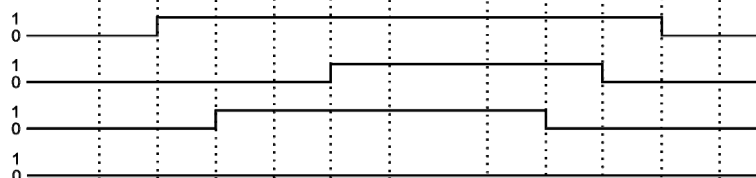
### COMMAND - DIGITAL INPUTS

DI1- Enable Multipump System  
DI2 - Enable Auxiliary Pump 1  
DI3 - Enable Auxiliary Pump 2  
DI4 - Enable Auxiliary Pump 3  
DI5 - Enable Auxiliary Pump 4



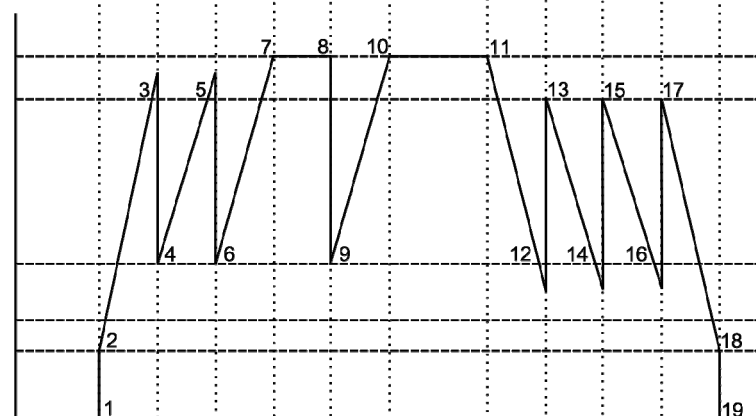
### COMMAND - DIGITAL OUTPUTS

DO1 - Start Auxiliary Pump 1  
DO2 - Start Auxiliary Pump 2  
DO3 - Start Auxiliary Pump 3  
DO4 - Start Auxiliary Pump 4



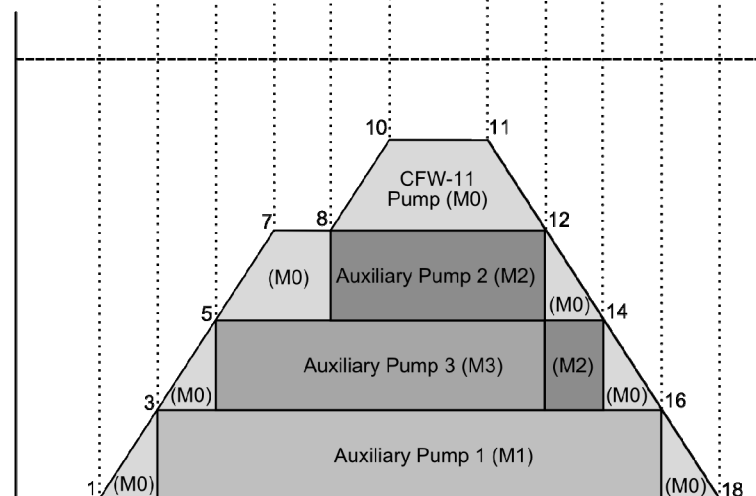
### CFW-11 PUMP FREQUENCY (Hz)

P0134 - Maximum Speed (rpm)  
P1034 - Auxiliary Pump Starting Frequency and Pressure Deviation (P1035)  
P1038 - Auxiliary Pump Stopping Frequency and Pressure Deviation (P1039)  
P1030 - Sleep Mode Frequency  
P0133 - Minimum Speed (rpm)



### MULTIPUMP FLOW SYSTEM

100%



## Fixed Control Multipump System

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The graph shows the digital inputs used for the pump command and enabling, the digital outputs for the activation of the auxiliary pumps, the behavior of the CFW-11 driven pump speed as the auxiliary 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) and the pump driven by the inverter (M0) is accelerated up to the programmed minimum speed.
- 2** – According to the adjusted pressure setpoint, the PID controller responds and accelerates the pump controlled by the inverter (M0). 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 an auxiliary 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 an auxiliary pump is issued. It is verified which auxiliary pump must enter the system. In this case, the pump activation mode is “in a sequence”, and the auxiliary pump 1 (M1) is enabled for operation. The command to start the auxiliary pump 1 (M1) is given via the digital output DO1, which according to the command schematic controls the contactor K1.
- 4** – After the auxiliary pump 1 (M1) is started, the speed of the motor controlled by the inverter (M0) is reduced to the value programmed as the auxiliary 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 driven by the inverter (M0) and accelerates it again.
- 5** – Following the same analysis of the moment “3”, the command for starting another auxiliary pump is issued, and it is verified which auxiliary pump must enter the system. In this case, since the auxiliary pump 1 (M1) is already working, the auxiliary pump 2 (M2) should enter the system; however it is disabled via the digital input DI3 and the auxiliary pump 3 (M3) is enabled for operation. The command to start the auxiliary pump 3 (M3) is given via the digital output DO3, which according to the command schematic controls the contactor K3.
- 6** – After the auxiliary pump 3 (M3) is started, the same analysis of the moment “4” applies.
- 7** – Following the same analysis of the moment “3”, the command for starting another auxiliary pump is issued, and it is verified which auxiliary pump must enter the system. In this case, since the auxiliary pump 1 (M1) and the auxiliary pump 3 (M3) are already working, the auxiliary pump 2 (M2) should enter the system; however it is disabled via the digital input DI3 and the auxiliary pump 4 (M4) is also disabled via digital input DI5. The system remains as it is and the inverter controlled pump (M0) reaches the maximum programmed speed.
- 8** – Since the system is already needing one more auxiliary pump, when the auxiliary pump 2 (M2) is enabled via digital input DI3, then the command for starting the auxiliary pump 2 (M2) is given immediately via the digital output DO2, which according to the command schematic controls the contactor K2.
- 9** – After starting the auxiliary pump 2 (M2), the same analysis of the moment “4” applies.
- 10** – Following the same analysis of the moment “3”, the command for starting another auxiliary pump is issued, and it is verified which auxiliary pump must enter the system. In this case, since the auxiliary pump 1 (M1), the auxiliary pump 2 (M2) and the auxiliary pump 3 (M3) are already working, the auxiliary pump 4 (M4) should be started; but since it is disabled via digital input DI5, the pump controlled by the inverter (M0) reaches the maximum programmed speed and continues controlling 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 controlled by the inverter (M0).
- 12** – When the frequency programmed for deactivation of an auxiliary 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 an auxiliary pump is issued. It is verified which auxiliary pump must be removed from the system. In this case, since the pump activation mode is “in a sequence”, and the auxiliary pump 4 (M4) is disabled, the auxiliary pump 3 (M3) must be stopped. 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.
- 13** – After stopping the auxiliary pump 3 (M3), the speed of the motor controlled by the inverter (M0) is increased to the value programmed as the auxiliary 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 driven by the inverter (M0) and decelerates it again.

**14 –** Following the same analysis of the moment “12”, the command for stopping another auxiliary pump is issued, and it is verified which auxiliary pump must be removed from the system. In this case, since the auxiliary pump 4 (M4) and the auxiliary pump 3 (M3) are already off, the next one to be switched off will be the auxiliary 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.

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

**16 –** Following the same analysis of the moment “12”, the command for stopping another auxiliary pump is issued, and it is verified which auxiliary pump must be removed from the system. In this case, since the auxiliary pump 4 (M4), the auxiliary pump 3 (M3) and the auxiliary pump 2 (M2) are already off, the next one to be switched off will be the auxiliary pump 1 (M1). The command to stop the auxiliary pump 1 (M1) is given via the digital output DO1, which according to the command schematic controls the contactor K1.

**17 –** After stopping the auxiliary pump 1 (M1), 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 controlled pump (M0) remains below the sleep mode activation frequency, then the sleep mode will be activated.

**19 –** When the sleep mode is active the pump driven by the inverter (M0) is switched off, 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.

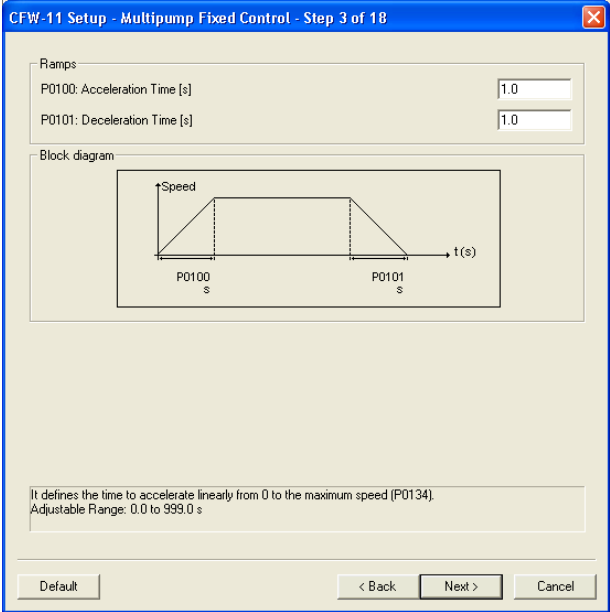
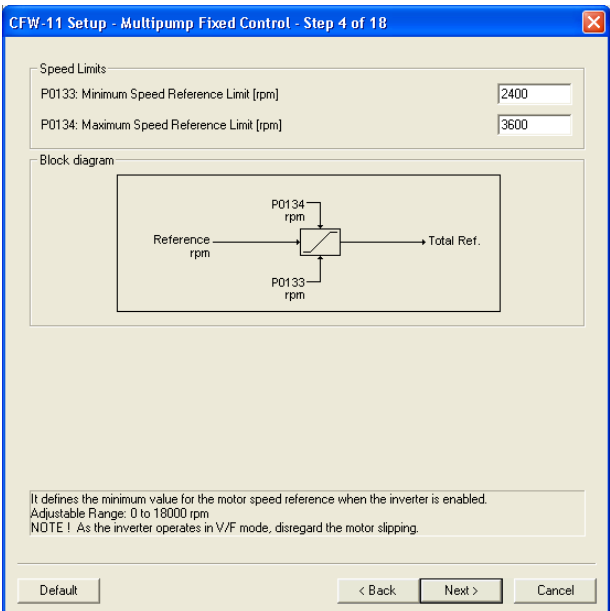
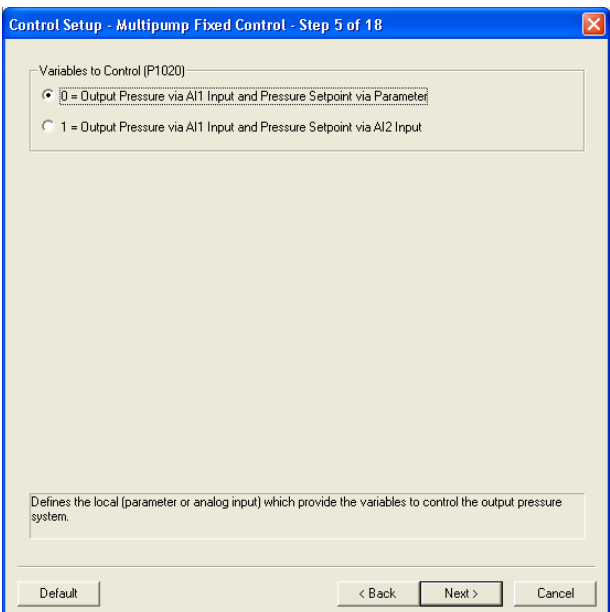
### 3 WLP Applicative Configuration

Through the WLP it is possible to create and to configure the applicative for the fixed 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 the fixed control multipump configuration wizard, which consists of a step by step guide for the adjustment of the parameters pertinent to the application.


**NOTE!**

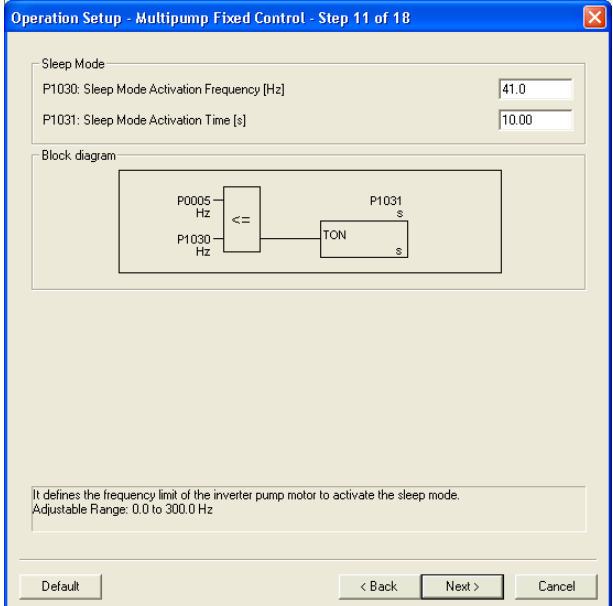
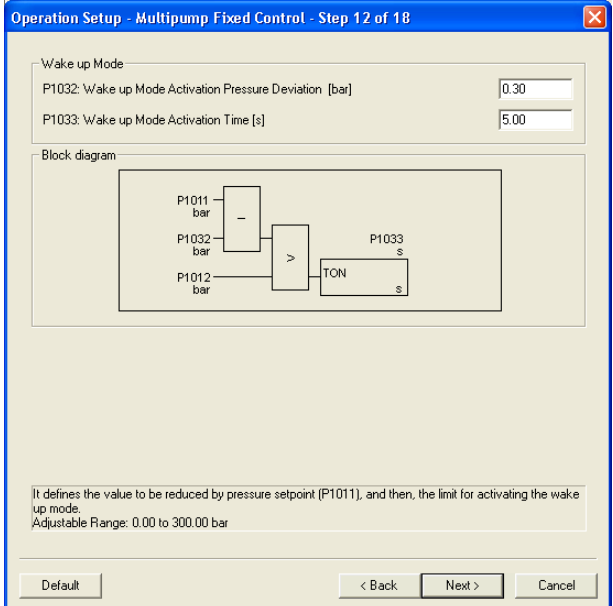
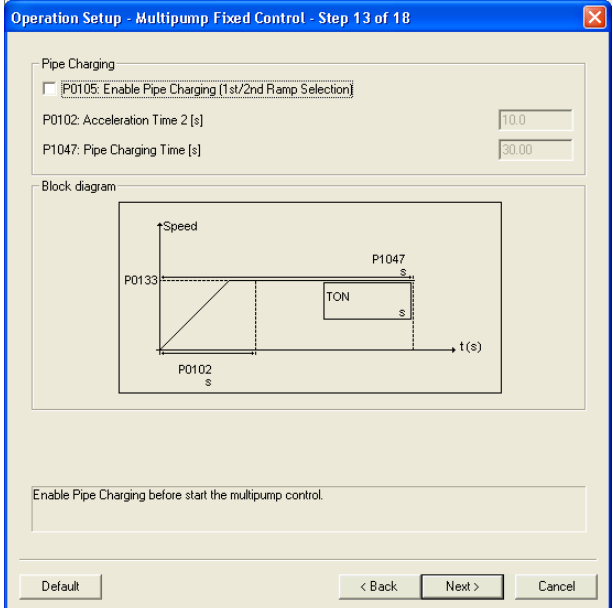
When powering up the inverter for the first time, follow all the steps described in the chapter 5 "First Time Power-Up and Start-Up" of the CFW-11 frequency inverter manual.

Step	Description	WLP Configuration Wizard
1	<p>It presents the parameters for the general configuration of the fixed control multipump system:</p> <p>P1018: Number of Auxiliary Pumps</p> <p>P1019: Auxiliary Pump Activation Control Mode</p>	
2	<p>It presents the parameters for the configuration of the command origin in the CFW-11:</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>	

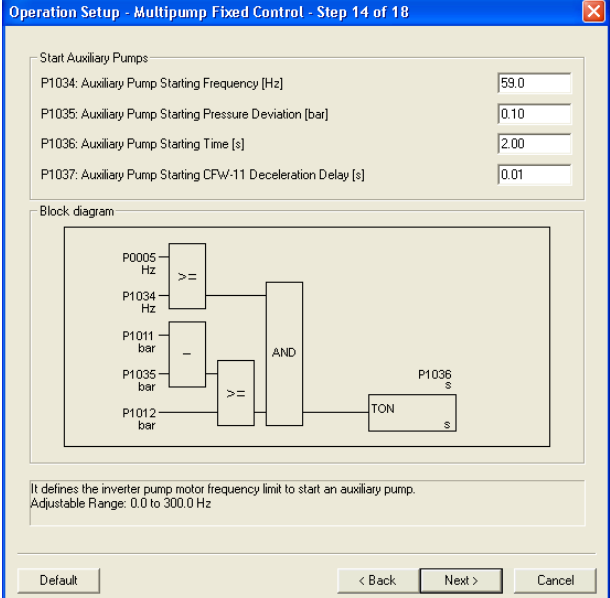
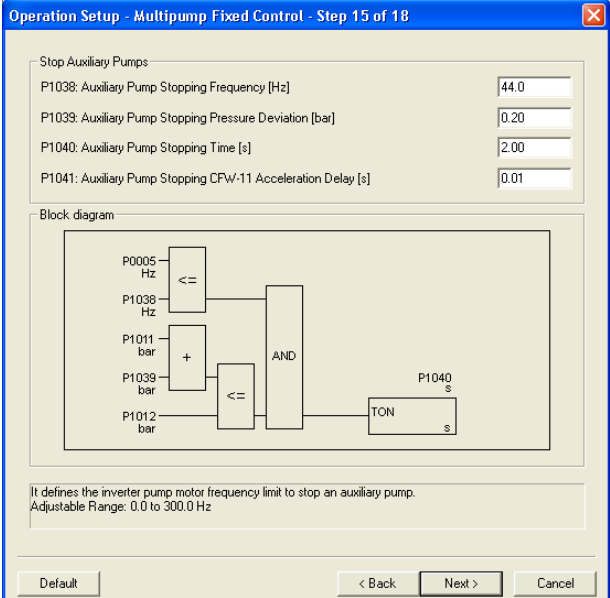
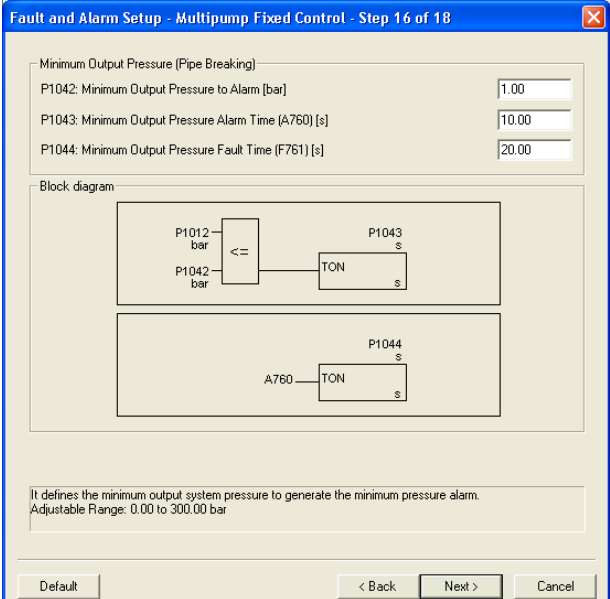
3	<p>It presents the parameters for the configuration of the CFW-11 ramp times:</p> <p>P0100: Acceleration Time</p> <p>P0101: Deceleration Time</p>	
4	<p>It presents the parameters for the configuration of the CFW-11 speed limits:</p> <p>P0133: Minimum Speed Reference Limit</p> <p>P0134: Maximum Speed 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>	

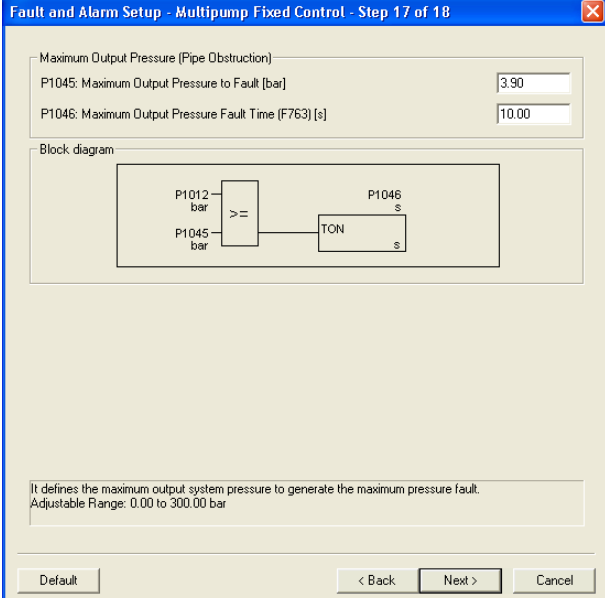
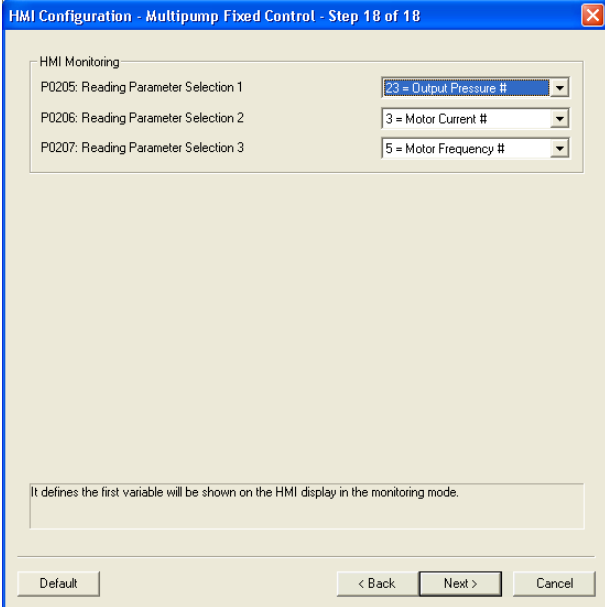
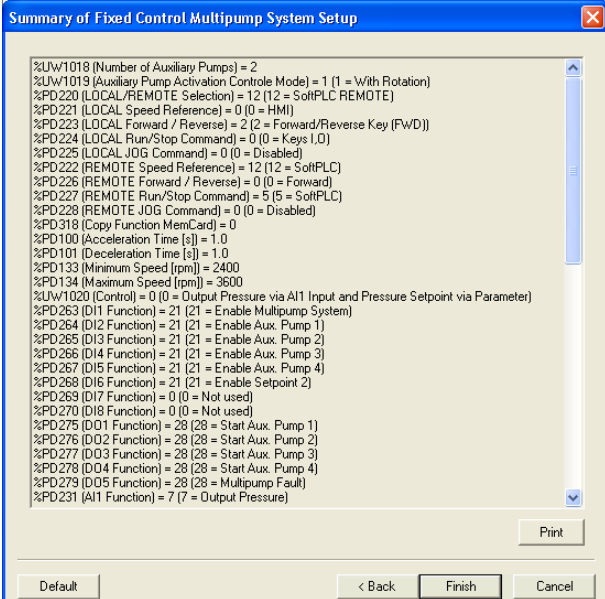
6	<p>It presents the parameters for the configuration of the CFW-11 digital input functions:</p> <p>P0263: DI1 Function  P0264: DI2 Function  P0265: DI3 Function  P0266: DI4 Function  P0267: DI5 Function  P0268: DI6 Function  P0269: DI7 Function  P0270: DI8 Function</p>	
7	<p>It presents the parameters 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 system 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 control gains:</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 auxiliary pumps:</p> <p>P1034: Auxiliary Pump Starting Frequency</p> <p>P1035: Auxiliary Pump Starting Pressure Deviation</p> <p>P1036: Auxiliary Pump Starting Time</p> <p>P1037: Auxiliary Pump Starting CFW-11 Deceleration Delay</p>	
15	<p>It presents the system operation parameters for stopping auxiliary pumps:</p> <p>P1038: Auxiliary Pump Stopping Frequency</p> <p>P1039: Auxiliary Pump Stopping Pressure Deviation</p> <p>P1040: Auxiliary Pump Stopping time</p> <p>P1041: Auxiliary Pump Stopping CFW-11 Acceleration Delay</p>	
16	<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>	

17	<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>	
18	<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>	
	<p>It presents a summary of all the parameters that were adjusted with the fixed control multipump system setup.</p>	

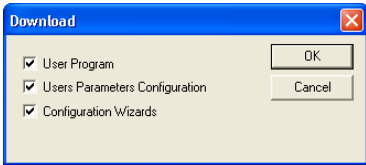
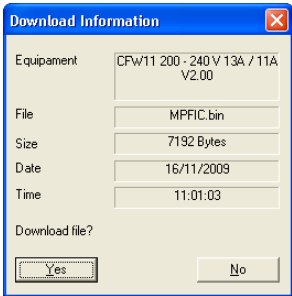
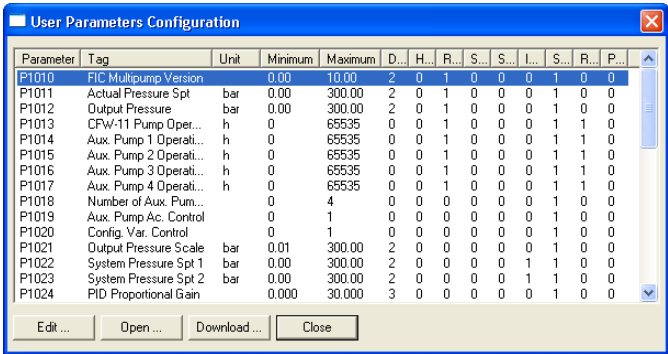
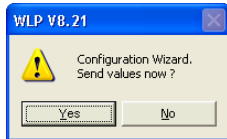
## 4 WLP Applicative Download

Together with the conclusion of the fixed 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>- Users Parameters 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 Fixed Control Multipump System wizard.</p>	

## 5 Parameter Descriptions

The CFW-11 as well as the SoftPLC parameters for the fixed 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:

<b>RO</b>	Read-only parameters.
<b>CFG</b>	Parameter that can be changed only with a stopped motor.
<b>Net</b>	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.
<b>Serial</b>	Parameter visible through the HMI if the inverter has the RS232 or the RS485 interface installed.
<b>USB</b>	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 auxiliary pumps the system will use and how their activation control will be done.

#### P1018 – Number of Auxiliary Pumps

<b>Adjustable Range:</b>	0 to 4	<b>Factory Setting:</b>	2
--------------------------	--------	-------------------------	---

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

└ 50 SoftPLC

#### Description:

This parameter defines the number of auxiliary pumps that the multipump control will use for the system output pressure regulation. The value "0" configures the system to operate without auxiliary pumps.

#### P1019 – Auxiliary 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

└ 50 SoftPLC

#### Description:

This parameter defines how the control for starting and stopping the auxiliary 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. The control will be done in the following order:

Starting Auxiliary Pumps	Auxiliary Pump 1 → Auxiliary Pump 2 → Auxiliary Pump 3 → Auxiliary Pump 4
Stopping Auxiliary Pumps	Auxiliary Pump 4 → Auxiliary Pump 3 → Auxiliary Pump 2 → Auxiliary Pump 1

With P1019 = 1 (With Rotation), the auxiliary pumps will be started and stopped according to their operation time, where through the rotation of the auxiliary 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 Auxiliary Pumps	The auxiliary pump configured in the system, and with the shortest operation time is started.
Stopping Auxiliary Pumps	The auxiliary 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".

### 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

└ 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 fixed control multipump system applicative.

### P0263 – DI1 Function

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

**Factory Setting:** 21

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

└ 40 Digital Inputs

or

07 I/O CONFIGURATION

└ 40 Digital Inputs

#### Description:

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

With the input in logic level “0”, the fixed 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 fixed control multipump system is enabled for the pumping system output pressure control.

## P0264 – DI2 Function

**Adjustable Range:** 21 = Enable Auxiliary 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 DI2 digital input function will be to enable the auxiliary pump 1 in the fixed 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 auxiliary 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 auxiliary 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 Auxiliary 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 DI3 digital input function will be to enable the auxiliary pump 2 in the fixed control multipump system. It is necessary that the multipump system be previously configured to have at least two auxiliary pumps ( $P1018 \geq 2$ ).

With the input in logic level "0", it indicates that the auxiliary 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 auxiliary 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 Auxiliary 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 auxiliary pump 3 in the fixed control multipump system. It is necessary that the multipump system be previously configured to have at least three auxiliary pumps ( $P1018 \geq 3$ ).

With the input in logic level "0", it indicates that the auxiliary 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 auxiliary 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 Auxiliary 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 auxiliary pump 4 in the fixed control multipump system. It is necessary that the multipump system be previously configured to have four auxiliary pumps ( $P1018 = 4$ ).

With the input in logic level "0", it indicates that the auxiliary 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 auxiliary 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 fixed 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 fixed control multipump system applicative.

## P0275 – DO1 Function (RL1)

<b>Adjustable Range:</b>	28 = Start Auxiliary Pump 1 (SoftPLC)	<b>Factory Setting:</b> 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 auxiliary pump 1 according to the fixed 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)

<b>Adjustable Range:</b>	28 = Start Auxiliary Pump 2 (SoftPLC)	<b>Factory Setting:</b> 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 auxiliary pump 2 according to the fixed 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)

<b>Adjustable Range:</b>	28 = Start Auxiliary Pump 3 (SoftPLC)	<b>Factory Setting:</b> 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 auxiliary pump 3 according to the fixed 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 Auxiliary 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 auxiliary pump 4 according to the fixed 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 (scale) 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 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 fixed 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

└ 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

└ 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** 0.000**Proprieties:****Access groups via HMI:**

01 PARAMETER GROUPS

└ 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

└ 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 all the auxiliary pumps are off and the frequency stays below the programmed value.

### 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
--------------------------	--------------------	-------------------------	----------

### 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.

### 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

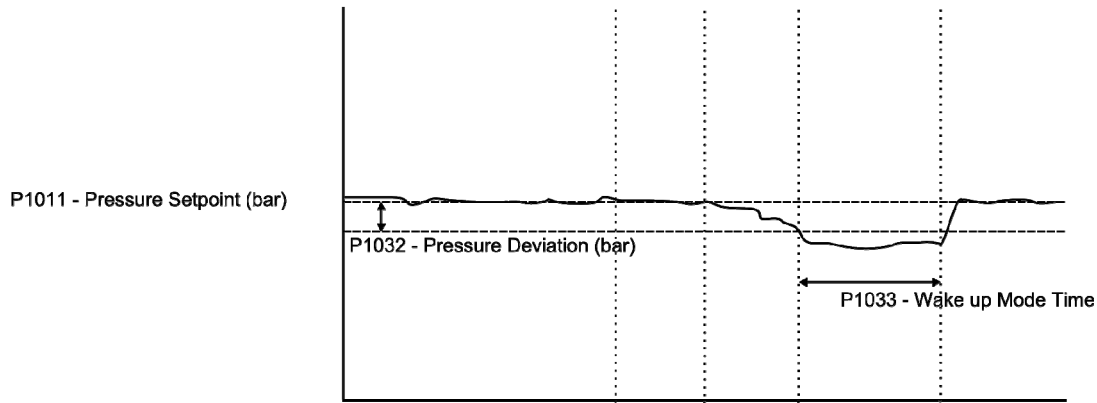
L 50 SoftPLC

### Description:

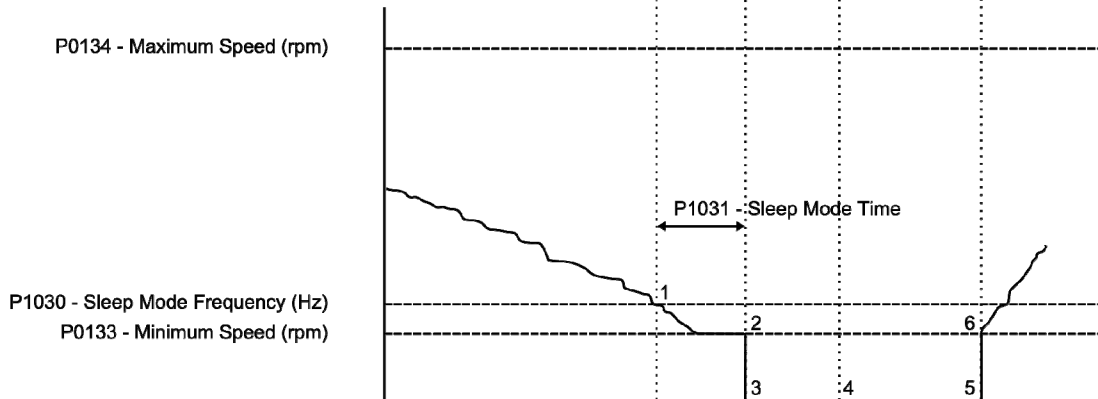
This parameter defines a waiting time with the P1032 condition fulfilled, in order to activate the wake up mode. This time is disregarded the first time the system is enabled.

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 (P1031) elapses. The sleep mode is then activated.
- 3** – The command for stopping the motor is issued. 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 run the motor is given, and 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 Range:</b>	0 = Disable (1st Ramp) 6 = Enable (SoftPLC)	<b>Factory Setting:</b> 0
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#### 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 Range:</b>	0.0 to 999.0 s	<b>Factory Setting:</b> 10.0 s
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#### 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 Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b> 30.0 s
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#### 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 Auxiliary Pumps

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

### P1034 – Auxiliary Pump Starting Frequency

<b>Adjustable Range:</b>	0.0 to 300.0 Hz	<b>Factory Setting:</b> 59.0 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 in the multipump system, which is the limit for starting an auxiliary pump. This condition is valid when the inverter frequency stays above the programmed value.

### P1035 – Auxiliary 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 an auxiliary pump. This condition is valid when the system pressure stays below the programmed limit.

### P1036 – Auxiliary 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 an auxiliary pump.

### P1037 – Auxiliary 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 an auxiliary pump is activated.



### NOTE!

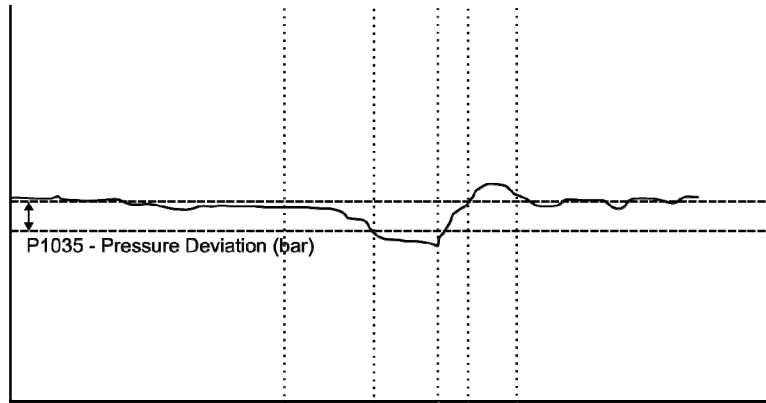
By setting the parameter value in 100.00, the deceleration of the pump driven by the inverter does not take place, i.e., the pump remains at the same speed it was before the auxiliary pump starting.

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

## OUTPUT PRESSURE SYSTEM (bar)

P1011 - Pressure Setpoint (bar)

P1035 - Pressure Deviation (bar)



## CFW-11 PUMP FREQUENCY (Hz)

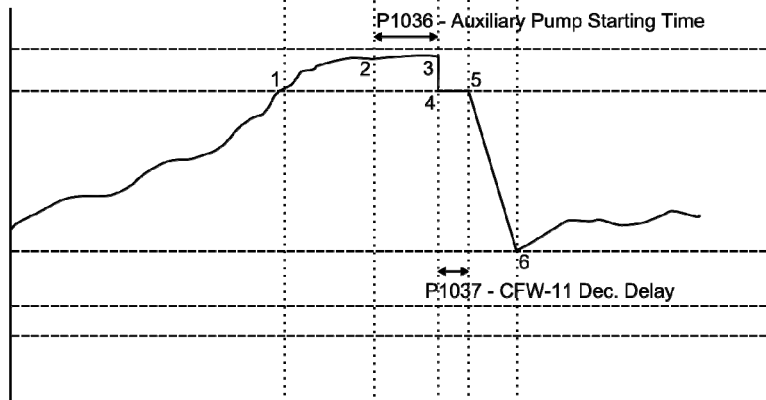
P0134 - Maximum Speed (rpm)

P1034 - Auxiliary Pump Starting Frequency (Hz)

P1038 - Auxiliary 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 an auxiliary 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 an auxiliary pump (P1036) begins.
- 3** – The time for starting an auxiliary pump (P1036) elapses and the command for starting it is given.
- 4** – An auxiliary 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 auxiliary pump.

## 5.15 Stopping Auxiliary Pumps

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

### P1038 – Auxiliary 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
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L 50 SoftPLC
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#### Description:

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

### P1039 – Auxiliary 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
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L 50 SoftPLC
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#### 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 an auxiliary pump. This condition is valid when the system pressure stays above the programmed limit.

### P1040 – Auxiliary 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
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L 50 SoftPLC
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#### Description:

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

### P1041 – Auxiliary 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
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L 50 SoftPLC
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#### Description:

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

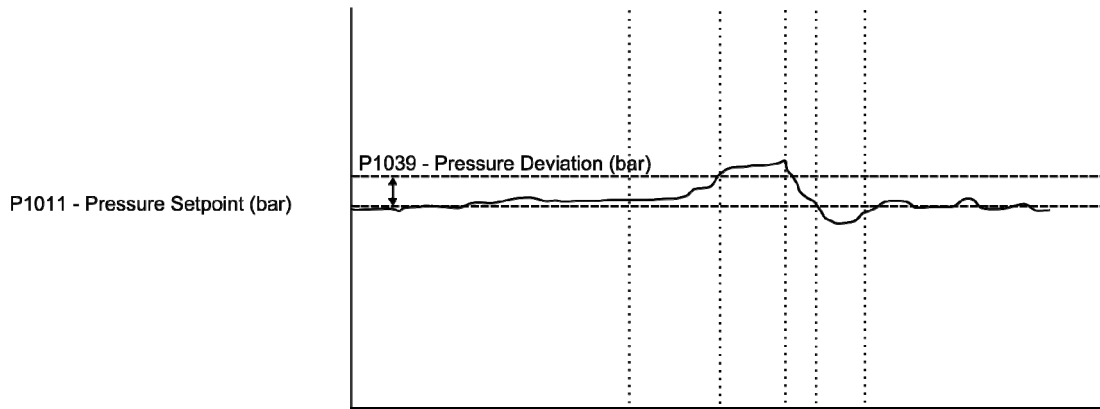


### NOTE!

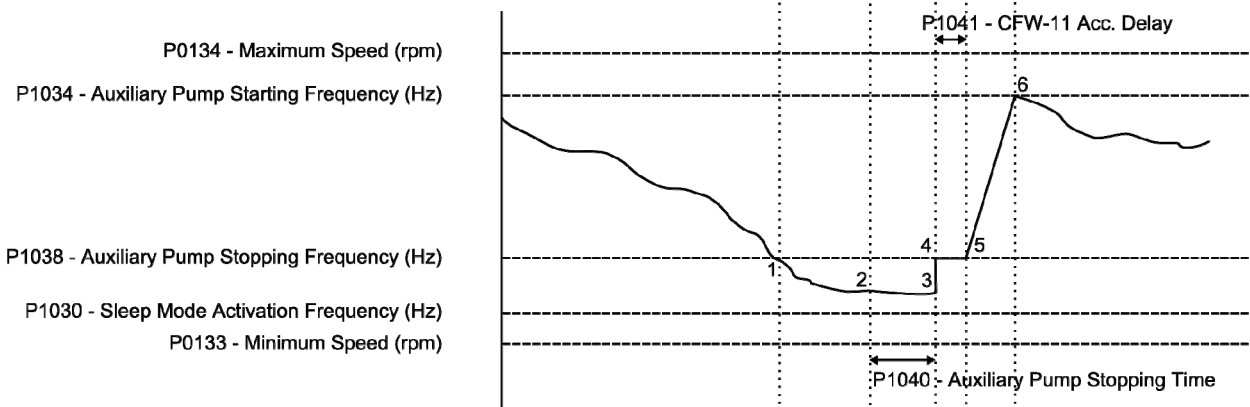
By setting the parameter value in 100.00, the acceleration of the pump driven by the inverter does not take place, i.e., the pump remains at the same speed it was before the auxiliary pump stopping.

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

## 5.16 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

<b>Adjustable Range:</b>	0.00 to 300.00 bar	<b>Factory Setting:</b>	1.00 bar
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS
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L 50 SoftPLC
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#### 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)

<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
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L 50 SoftPLC
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#### 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)

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	20.00 s
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#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS
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L 50 SoftPLC
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#### 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.

## 5.17 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 all the auxiliary pumps of the system off, 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.

## 5.18 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

## 5.19 Reset Command of the Pump Operation Time

### P1049 – Operation Time Reset

<b>Adjustable Range:</b>	0 = No reset is executed 1 = Enables the auxiliary pump 1 operation time reset 2 = Enables the auxiliary pump 2 operation time reset 3 = Enables the auxiliary pump 3 operation time reset 4 = Enables the auxiliary pump 4 operation time reset 5 = Enables the CFW-11 driven pump operation time reset	<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 auxiliary pump 1, change the value of the parameter P1049 to 1 and press the CFW-11 the HMI  key.

## 5.20 Reading Parameters

### P1010 – FIC 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 fixed 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 fixed 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 – CFW-11 Driven Pump 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 CFW-11 driven pump operation time value.

### P1014 – Auxiliary 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 auxiliary pump 1 operation time value. This value is used to define which auxiliary pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

### P1015 – Auxiliary 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 auxiliary pump 2 operation time value. This value is used to define which auxiliary pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

### P1016 – Auxiliary 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 auxiliary pump 3 operation time value. This value is used to define which auxiliary pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

## P1017 – Auxiliary 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 auxiliary pump 4 operation time value. This value is used to define which auxiliary pump will be started or stopped when the system is configured for control with rotation (P1019 = 1).

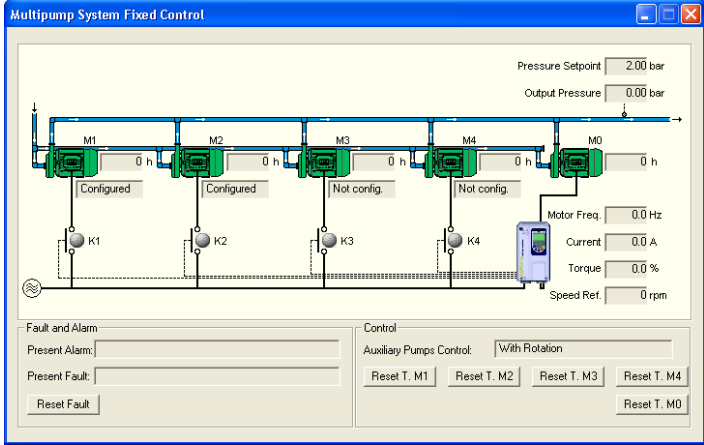
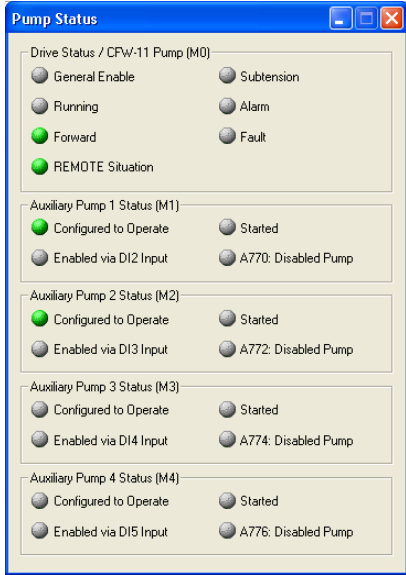
## 6 Fault and Alarm Messages

The fixed 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.
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, all the auxiliary pumps are off and the waiting time (P1046 ) has elapsed.
A770: Disabled Auxiliary Pump 1	It indicates that the auxiliary pump 1 has been disabled while it was on.	The digital input DI2 went to logic level "0" with the auxiliary pump 1 on.
A772: Disabled Auxiliary Pump 2	It indicates that the auxiliary pump 2 has been disabled while it was on.	The digital input DI3 went to logic level "0" with the auxiliary pump 2 on.
A774: Disabled Auxiliary Pump 3	It indicates that the auxiliary pump 3 has been disabled while it was on.	The digital input DI4 went to logic level "0" with the auxiliary pump 3 on.
A776: Disabled Auxiliary Pump 4	It indicates that the auxiliary pump 4 has been disabled while it was on.	The digital input DI5 went to logic level "0" with the auxiliary pump 4 on.

## 7 Monitoring Dialogs

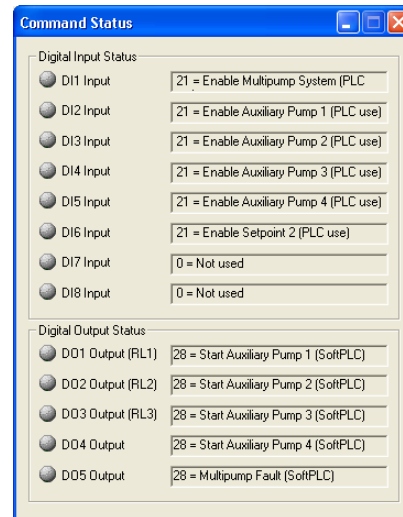
Through the WLP it is possible to monitor and change the applicative parameters of the fixed control multipump system.

Description	WLP Monitoring Dialog Box
<p>Fixed 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 auxiliary 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 enabling, 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 auxiliary pump 1;</li> <li>- Configured in the system status, enabled via DI3 input, pump on and disabled pump alarm (A772) for the auxiliary pump 2;</li> <li>- Configured in the system status, enabled via DI4 input, pump on and disabled pump alarm (A774) for the auxiliary pump 3;</li> <li>- Configured in the system status, enabled via DI5 input, pump on and disabled pump alarm (A776) for the auxiliary pump 4.</li> </ul>	

## Monitoring Dialogs

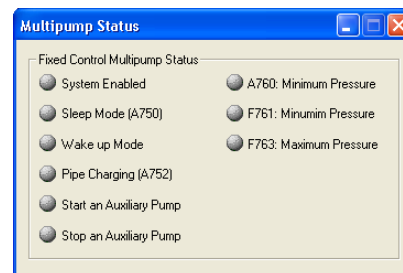
Status monitoring of the commands produced in the multipump system. It shows the following variables:

- 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.



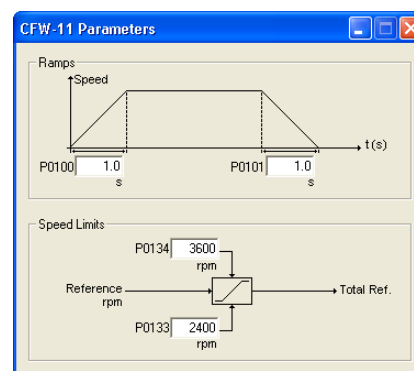
Monitoring of the multipump system operational status. It shows the following variables:

- Enabled system status;
- Active sleep mode (A750);
- Active wake up mode;
- Active pipe charging (A752);
- Condition for starting an auxiliary pump in the system;
- Condition for stopping an auxiliary pump of the system;
- 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:

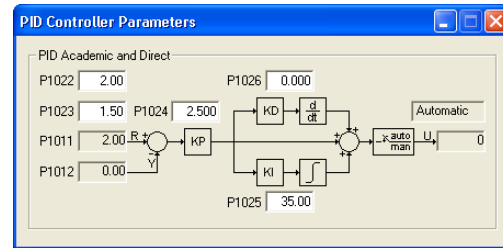
- P0100: Acceleration time;
- P0010: Deceleration time;
- P0133: Minimum speed reference limit;
- P0134: Maximum speed reference limit.



## Monitoring Dialogs

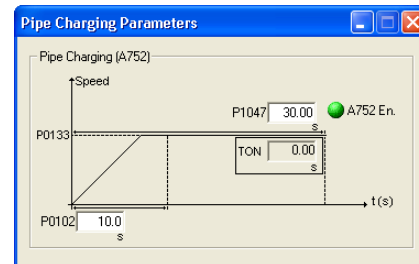
It lists the adjustment and operation parameters of the PID controller for the output pressure regulation of the multipump system. It makes possible the modification and visualization of the following variables:

- 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;
- The PID controller is in automatic or manual mode;
- Output (U) of the PID controller (speed reference, in RPM, for the inverter driven pump).



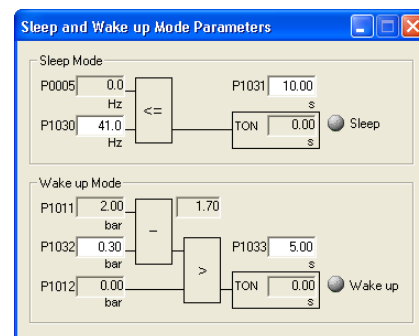
It lists the operation parameters for the control logic of the pipe charging. It makes possible the modification and visualization of the following variables:

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



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.

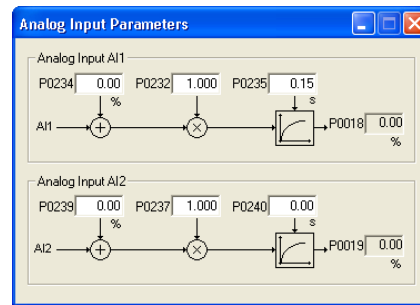




## Monitoring Dialogs

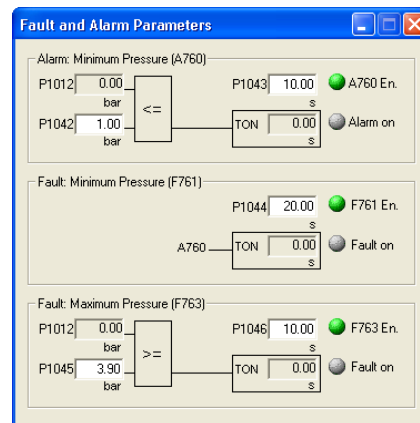
It lists the parameters for the reading of the multipump system control signals via the CFW-11 analog inputs. It makes possible the modification and visualization of the following variables:

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



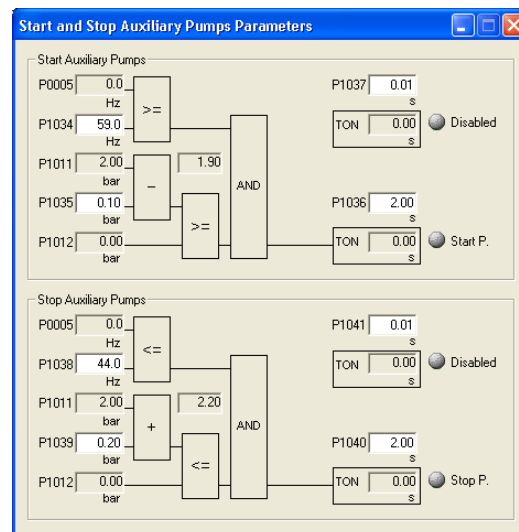
It lists the operation parameters of the control logic to generate faults and alarms. It makes possible the modification and visualization of the following variables:

- 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.



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

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

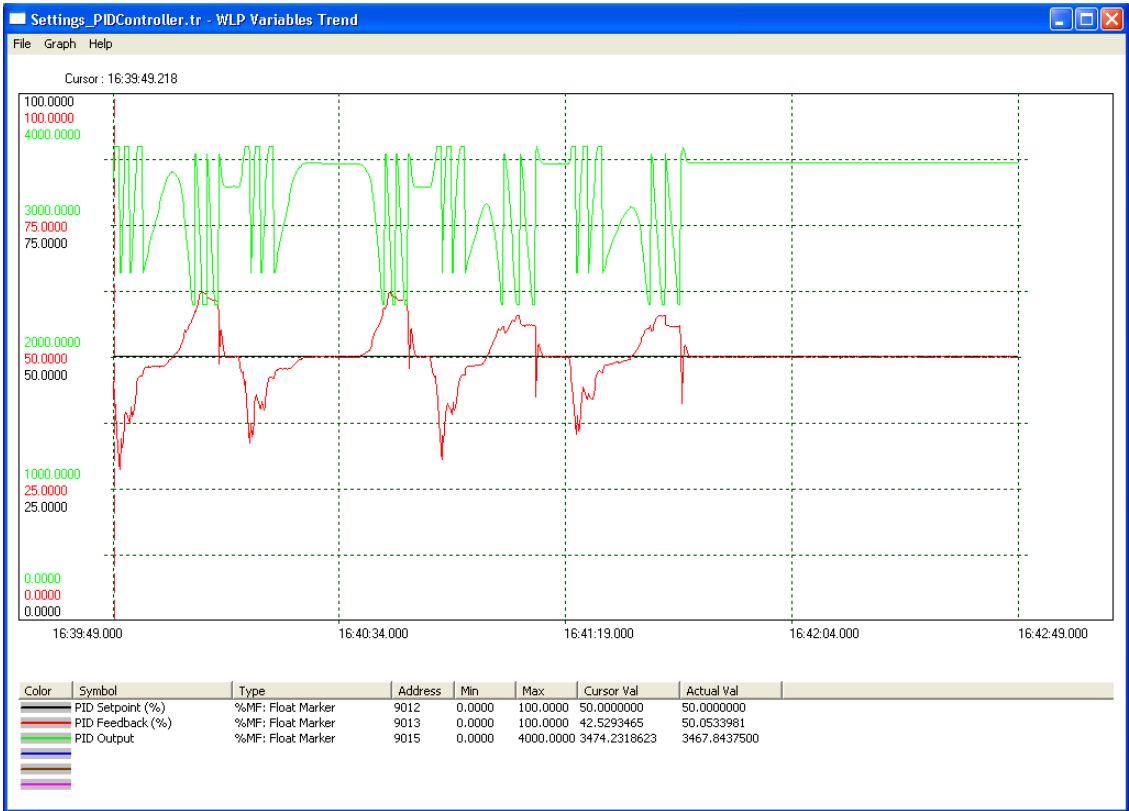


## 8 Trend Variables Dialogs

It is possible to monitor variables of the fixed 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.

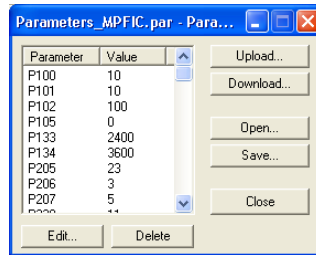


### NOTE!

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

## 9 Parameter Value Dialogs

It is possible to save the parameters of the fixed 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.