Pump Genius

CFW900 V1.57

Application Manual

Application Manual

CFW900

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SUMMARY OF REVISIONS

The information below describes the reviews made in this manual.

Version	Revision	Description	Date
V1.0X	R00	First Edition.	29/11/2024

1 GENERAL INFORMATION

This manual provides the necessary information for the configuration of Pump Genius Simplex, Multipump and Multiplex application developed for CFW900 inverter. This application manual must be used together with the CFW900 user's manual, the CFW900 programming manual and the WPS software manual.

1.1 SAFETY NOTICES IN THE MANUAL

The following safety notices are used in this manual:

DANGER!
The procedures recommended in this warning have the purpose of protecting the user against death, serious injuries and considerable material damage.

ATTENTION!
The procedures recommended in this warning have the purpose of avoiding material damage.

NOTE!
The information mentioned in this warning is important for the proper understanding and good operation of the product.

1.2 TERMINOLOGY AND DEFINITIONS

1.2.1 Terms and Definitions Used

Amp, A: Ampère.

AIP: analog input via potenciometer.

AIx: analog input "x".

AOx: analog output "x".

° **C**: Celsius degrees.

CA: alternate current.

DC: direct current.

Pre-Charge Circuit: charges the capacitors of the DC link with limited current, avoiding current peaks in the inverter power-up.

CO/DN/PB/ETH: Interface CANopen, DeviceNet, ProfibusDP or Ethernet.

CV: cavalo-vapor = 736 Watts (Brazilian unit of measurement of power, normally used to indicate mechanical power of electric motors).

Heatsink: metal part designed to dissipate the heat produced by power semiconductors.

DIx: digital input "x".

DOx: digital output "x".

Switching Frequency: switching frequency of the IGBTs of the inverter bridge, normally expressed in kHz.

Run/Stop: inverter function which, when activated (run), accelerates the motor by acceleration ramp up to the reference frequency and, when deactivated (stop), decelerates the motor by deceleration ramp. It may be controlled by digital input set for this function, via serial or via SoftPLC.

h: hour; time unit.

General Enable: when activated, it accelerates the motor by acceleration ramp and Run/Stop = Run. When disabled, the PWM pulses will be immediately blocked. It may be controlled by digital input set for this function, via serial or via SoftPLC.

HMI: human-machine interface; device which allows controlling the motor, viewing and changing the inverter parameters. It features keys to control the motor, navigation keys and graphic LCD display.

hp: horse power = 746 Watts (power unit, normally used to indicate mechanical power of electric motors).

Hz: hertz; frequency unit.

IGBT: insulated gate bipolar transistor - basic component part of the output inverter bridge. It works as an electronic switch in the saturated (closed switch) and cut-off (open switch) modes.

$\mathbf{I}_{nom}$: inverter rated current by P295.

kHz: quilohertz = 1000 Hertz; frequency unit.

200 V Line: Models powered from 110 to 127 Vac, 200 to 240 Vac or 280 to 340 Vdc, for more information refer to the inverter user manual.

400 V Line: Models powered from 380 to 480 Vac or 537 to 680 Vdc, for more information refer to the inverter user manual.

DC Link: intermediary circuit of the inverter; voltage in direct current obtained by rectifying the power supply alternate voltage or external supply; it supplies the output inverter bridge with IGBTs.

mA: miliampère = 0.001 Ampère.

min: minute; time unit.

ms: milisecond = 0.001 second.

Nm: Newton meter; torque unit.

NTC: resistor whose resistance value in ohms decreases proportionally to the increase of the temperature; it is used as a temperature sensor in power packs.

PE: Protective Earth.

PTC: resistor whose resistance value in ohms increases proportionally to the temperature; it is used as a temperature sensor in motors.

PWM: pulse width modulation - modulation by pulse width; pulsed voltage that supplies the motor.

Rectifier: input circuit of the inverters that transforms the input AC voltage into DC. It is formed by high-power diodes.

RMS: root mean square; effective value.

rpm: revolutions per minute; rotation unit.

s: second; time unit.

V: volts; electric voltage unit.

WPS: Programming Software “WEG Programming Suite”.

Ω: ohms; electric resistance unit.

1.2.2 Symbols to Describe Parameter Properties

ro: read only parameter.
cfg: parameter that can be changed only with a stopped motor.
V/f: parameter available in the V/f mode.
VVW: parameter available in the VVW mode.

2 INTRODUCTION TO THE PUMP GENIUS APPLICATION

The Pump Genius application developed for the CFW900 inverter provides the user flexibility in the operation and configuration. It uses the tools already developed for the WPS programming software with configuration and monitoring wizards. For the CFW900 frequency inverter, the Pump Genius application functions were implemented in three different control strategies: Simplex, Multipump and Multiplex.

2.1 PUMPS

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

Commonly used ways to drive pumps are:

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

Pumps can be classified into two wide categories:

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

2.1.1 Centrifugal Pumps

This kind of pump has as its operating principle the transfer of mechanical energy to the fluid to be pumped in the form of kinetic energy. This kinetic energy is transformed into potential energy (pressure energy), which is its main characteristic. The rotational movement of a rotor inserted in a casing (pump body) is the functional part responsible for this transformation.

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

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

2.1.2 Positive Displacement Pumps

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

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

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

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

2.2 CRITERIA FOR ASSOCIATION OF PUMPS IN PARALLEL

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

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

2.2.1 Advantages in the Association of Pumps in Parallel

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

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

2.2.2 Disadvantages in the Association of Pumps in Parallel

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

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

2.3 GENERAL CHARACTERISTICS OF THE PUMP GENIUS

2.3.1 Pump Genius Simplex

The main characteristic of the Pump Genius Simplex application developed for the CFW900 inverter is the control of one pump using for this a frequency inverter that will control your speed as required by the user demand.

Each is notable for the following characteristics:

- Control of only one pump driven by CFW900 frequency inverter;
- Acceleration and deceleration ramps for the pump driven by inverter;
- Enable or disable the check valve function during deceleration, where the deceleration ramp is modified to prevent valve malfunctions in the system;
- Maximum and minimum speed limits for the pump driven by inverter;

- Selection of the control setpoint via analog input, or HMI of the CFW900 frequency inverter, or communication networks, or logical combination of two digital inputs (maximum 4 setpoints), or via electronic potentiometer (EP) via two digital inputs, or scheduling;
- Enable or disable the setpoint compensation for friction losses;
- Election of the control process variable (PID 1) via analog input, or via the difference between analog input AI1 and AI2 (AI1–AI2), or via frequency input; it is also possible to disable the measurement;
- Election of the control auxiliary variable (PID 2) via analog input or via frequency input; it is also possible to disable the measurement;
- Election of the flow variable (PID 3) via analog input or via frequency input; it is also possible to disable the measurement;
- Selection of engineering units and range of sensors for process control variables, control auxiliary, and flow via CFW900 frequency inverter parameters.
- Gain, offset and filter adjustments for the control signals via analog inputs;
- PID controller gains setting of the pumping control (PID 1, PID 2 and PID 3) via HMI parameters;
- Control action of the PID controller 1 configured for direct mode or reverse mode, or can be disabled;
- Selection of operation mode of the PID controller 1 in Manual or Automatic, and may be selecting via digital input DIx or via parameter;
- Enable or disable the sleep mode;
- Enable or disable the boost function before entering sleep mode;
- Wake up mode or start level mode for starting the pump with the PID controller enabled;
- Initiate the pumping with smooth pipe charging through the pump driven by inverter;
- Enable or disable the use of an auxiliary pump, which can be of the jockey or priming type;
- Adjustment of the motor current limitation during the pipe charging process;
- Low level protection of the control process variable (pipe breaking);
- High level protection of the control process variable (pipe obstruction);
- Low level protection of the control auxiliary variable (suction);
- High level protection of the control auxiliary variable (suction);
- Low level protection of the flow variable;
- High level protection of the flow variable;
- Pump protection via external sensor through up to four digital inputs DIx;
- Dry pump protection through evaluation of motor current and pump speed;
- Pump leakage protection curve through evaluation of motor current and pump speed;
- Pump cavitation protection via low-level adjustment of the control auxiliary variable and PID (PID 2) in cascade with PID 1;
- Flow limitation protection via high-level adjustment of the flow variable and PID (PID 3) in cascade with PID 1;
- Detection of pump clogging driven by the inverter via high current in the motor;
- Execution of deragging of the pump via a command to start the pump, or a command in the digital input DIx, or Network Command, or when the clogging of the pump is detected;
- Possibility of enabling the pump driven by the frequency inverter via HMI (local mode);
- Possibility of implementation or modification (customization) of the application by the user through the WPS software.

2.3.2 Pump Genius Multipump

The Pump Genius Multipump application developed for the CFW900 frequency inverter has the main characteristic of controlling two or more pumps in parallel using only one CFW900 frequency inverter, and it will control the speed of just one pump.

Presents the main features:

- Fixed Control: control of up to 9 (nine) pumps associated in parallel, one pump (always the same) driven by the CFW900 frequency inverter, and the others by some other starting method (Contactor, Soft Starter, etc);
- Floating Control: control of up to 8 (eight) pumps associated in parallel where the first pump to be connected is connected to the CFW900 frequency inverter, and the other pumps are switched on and off via contactors;
- Cascade Control: control of up to 8 (eight) pumps associated in parallel where the last pump turned on is connected to the CFW900 frequency inverter, and the other pumps are switched on and off via contactors;
- Floating control and cascade control: allows the exchange of the pump driven by the CFW900 frequency inverter;
- Floating control and cascade control: possibility of forcing the alternation of pumps, i.e., if the Pump Genius operates for a long time with only one pump (Pump Genius does not enter in sleep mode), the Pump Genius is disabled, then another pump is turned on (as operating time) for controlling the pumping;
- Selection of the criteria of start/stop pumps in parallel (sequential mode or operating time);
- Acceleration and deceleration ramps for the pump driven by inverter;
- Enable or disable the check valve function during deceleration, where the deceleration ramp is modified to prevent valve malfunctions in the system;
- Maximum and minimum speed limits for the pump driven by inverter;
- Selection of the control setpoint via analog input, or HMI of the CFW900 frequency inverter, or communication networks, or logical combination of two digital inputs (maximum 4 setpoints), or via electronic potentiometer (EP) via two digital inputs, or scheduling;
- Enable or disable the setpoint compensation for friction losses;
- Election of the control process variable (PID 1) via analog input, or via the difference between analog input AI1 and AI2 (AI1–AI2), or via frequency input; it is also possible to disable the measurement;
- Election of the control auxiliary variable (PID 2) via analog input or via frequency input; it is also possible to disable the measurement;
- Election of the flow variable (PID 3) via analog input or via frequency input; it is also possible to disable the measurement;
- Selection of engineering units and range of sensors for process control variables, control auxiliary, and flow via CFW900 frequency inverter parameters.
- Gain, offset and filter adjustments for the control signals via analog inputs;
- PID controller gains setting of the pumping control (PID1, PID2 and PID3) via HMI parameters;
- Control action of the PID controller 1 configured for direct mode or reverse mode, or can be disabled;
- Selection of operation mode of the PID controller 1 in Manual or Automatic, and may be selecting via digital input DIx or via parameter;
- Enable or disable the sleep mode;
- Enable or disable the boost function before entering sleep mode;
- Wake up mode or start level mode for starting the pump with the PID controller enabled;
- Initiate the pumping with smooth pipe charging through the pump driven by inverter;

- Enable or disable the use of an auxiliary pump, which can be of the jockey or priming type;
- Adjustment of the motor current limitation during the pipe charging process;
- Low level protection of the control process variable (pipe breaking);
- High level protection of the control process variable (pipe obstruction);
- Low level protection of the control auxiliary variable (suction);
- High level protection of the control auxiliary variable (suction);
- Low level protection of the flow variable;
- High level protection of the flow variable;
- Pump protection via external sensor through up to four digital inputs DIx;
- Dry pump protection through evaluation of motor current and pump speed;
- Pump leakage protection curve through evaluation of motor current and pump speed;
- Pump cavitation protection via low-level adjustment of the control auxiliary variable and PID (PID 2) in cascade with PID 1;
- Flow limitation protection via high-level adjustment of the flow variable and PID (PID 3) in cascade with PID 1;
- Detection of pump clogging driven by the inverter via high current in the motor;
- Execution of deragging of the pump via a command in the digital input DIx or via network command;
- Possibility of enabling the pump driven by the frequency inverter via HMI (local mode);
- Possibility of implementation or modification (customization) of the application by the user through the WPS software.

2.3.3 Pump Genius Multiplex

The main characteristic of the Pump Genius Multiplex application developed for the CFW900 inverter is the control of two or more pumps in parallel with each pump being driven by its respective CFW900 inverter.

Each is notable for the following characteristics:

- Control of up to 8 (eight) associated pumps in parallel with each pump driven by their respective CFW900 inverter;
- Communication (data exchange) between associated pumps in parallel via Symbinet communication protocol (over Ethernet port);
- Configuration of each pump to function as either master pump or follower pump; this configuration determines how the respective pump will take appropriate actions to control the pumping;
- Logic to equalize the operating time of the pumps by alternating the active pump;
- In case of communication loss with the actual master pump, another master/slave pump can assume the master pump function. This change can be done automatically or manually via a command in the CFW900 HMI;
- Executes the change of the master pump if the control process variable sensor cable breaks when analog input is 4-20mA;
- Acceleration and deceleration ramps for each inverter driven pump;
- Maximum and minimum speed limits for each inverter driven pump;

- Selection of the control setpoint via analog input, or HMI of the CFW900 frequency inverter, or communication networks, or logical combination of two digital inputs (maximum 4 setpoints), or via electronic potentiometer (EP) via two digital inputs, or scheduling;
- Enable or disable the setpoint compensation for friction losses;
- Election of the control process variable (PID 1) via analog input, or via the difference between analog input AI1 and AI2 (AI1–AI2), or via frequency input; it is also possible to disable the measurement;
- Election of the control auxiliary variable (PID 2) via analog input or via frequency input; it is also possible to disable the measurement;
- Election of the flow variable (PID 3) via analog input or via frequency input; it is also possible to disable the measurement;
- Selection of engineering units and range of sensors for process control variables, control auxiliary, and flow via CFW900 frequency inverter parameters.
- Gain, offset and filter adjustments for the control signals via analog inputs;
- PID controller gains setting of the pumping control (PID1, PID2 and PID3) via HMI parameters;
- Control action of the PID controller 1 configured for direct mode or reverse mode, or can be disabled;
- Selection of operation mode of the PID controller 1 in Manual or Automatic, and may be selecting via digital input DIx or via parameter;
- Enable or disable the sleep mode;
- Enable or disable the boost function before entering sleep mode;
- Wake up mode or start level mode for starting the pump with the PID controller enabled;
- Initiate the pumping with smooth pipe charging through the pump driven by inverter;
- Enable or disable the use of an auxiliary pump, which can be of the jockey or priming type;
- Adjustment of the motor current limitation during the pipe charging process;
- Low level protection of the control process variable (pipe breaking);
- High level protection of the control process variable (pipe obstruction);
- Low level protection of the control auxiliary variable (suction);
- High level protection of the control auxiliary variable (suction);
- Low level protection of the flow variable;
- High level protection of the flow variable;
- Pump protection via external sensor through up to four digital inputs DIx;
- Dry pump protection through evaluation of motor current and pump speed;
- Pump leakage protection curve through evaluation of motor current and pump speed;
- Pump cavitation protection via low-level adjustment of the control auxiliary variable and PID (PID 2) in cascade with PID 1;
- Flow limitation protection via high-level adjustment of the flow variable and PID (PID 3) in cascade with PID 1;
- Detection of pump clogging driven by the inverter via high current in the motor;
- Execution of deragging of the pump via a command to start the pump, or a command in the digital input DIx, or via network command, or when the clogging of the pump is detected;
- Possibility of enabling the pump driven by the frequency inverter via HMI (local mode);
- Possibility of implementation or modification (customization) of the application by the user through the WPS software.

2.4 PUMP GENIUS CONNECTIONS

The Pump Genius application developed for the SoftPLC function of the CFW900 frequency inverter has some restrictions on the possibilities of accessories to be installed.

It has the following compatibility:

- **SLOT X:** IOS;
- **SLOT A:** REL-01;
- **SLOT B:** IOD-01 or IOAI-01;
- **SLOT C:** REL-01 or IOAI-01;
- **SLOT D:** REL-01;

2.4.1 Suggestion of Accessories for Pump Genius

The Table 2.1 on page 2-7 presents the suggested use of accessories in Pump Genius.

Pump Genius	Pumps Number		Slot X	Slot A	Slot B	Slot C	Slot D
Simplex	1		CFW900-IOS	REL-01	IOAI-01(1)		
			2 AI 6 DI 2 DO	3 RO	3 AI		
Multipump	up to 3		CFW900-IOS	REL-01	IOAI-01(1)		
			2 AI 6 DI 2 DO	3 RO	3 AI		
	up to 5	Relay	CFW900-IOS	REL-01	IOAI-01(1)	REL-01	
			2 AI 6 DI 2 DO	3 RO	3 AI	3 RO	
		Transistor	CFW900-IOS	REL-01	IOD-01	IOAI-01(1)	
			2 AI 6 DI 2 DO	3 RO	8 DI 8 DO	3 AI	
	up to 8	Transistor	CFW900-IOS	REL-01	IOD-01	IOAI-01(1)	
			2 AI 6 DI 2 DO	3 RO	8 DI 8 DO	3 AI	
		Relay	CFW900-IOS	REL-01	IOD-01	REL-01	REL-01
			2 AI 6 DI 2 DO	3 RO	8 DI 8 DO	3 RO	3 RO
Multiplex	up to 8		CFW900-IOS	REL-01	IOAI-01(1)		
			2 AI 6 DI 2 DO	3 RO	3 AI		

Table 2.1: *Suggested accessories on Pump Genius*

(1) Optional modules if the two analog inputs of the CFW900-IOS are not sufficient.
(2) Other combinations are also possible, mixing the transistor outputs available on the CFW900-IOS module and the relay outputs available on the REL-01 modules. It is up to the user to evaluate which solution best meets their needs.

3 CONTROL CONNECTIONS

The Pump Genius application (Simplex, Multipump and Multiplex) developed for the CFW900 frequency inverter includes several features for pumping control, several of which impact specific connections on the control card and accessories. Following will be presented schematic suggestive as each functionality.

NOTE!
The Pump Genius application (Simplex, Multipump and Multiplex) only works on the CFW900 frequency inverter with **firmware version V1.57.**

NOTE!
Refer to the CFW900 User Manual for more details on installing and connecting the inverter.

3.1 CONTROL SETPOINT

3.1.1 HMI or Communication Networks or Scheduling

The user can configure the Pump Genius application (Simplex, Multipump and Multiplex) with the control setpoint defined in a parameter that can be changed via the HMI of the CFW900 frequency inverter (or communication networks or scheduling). It can be composed as follows:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Enable Pump Genius command (S1);
- Status light for motor running (H1).

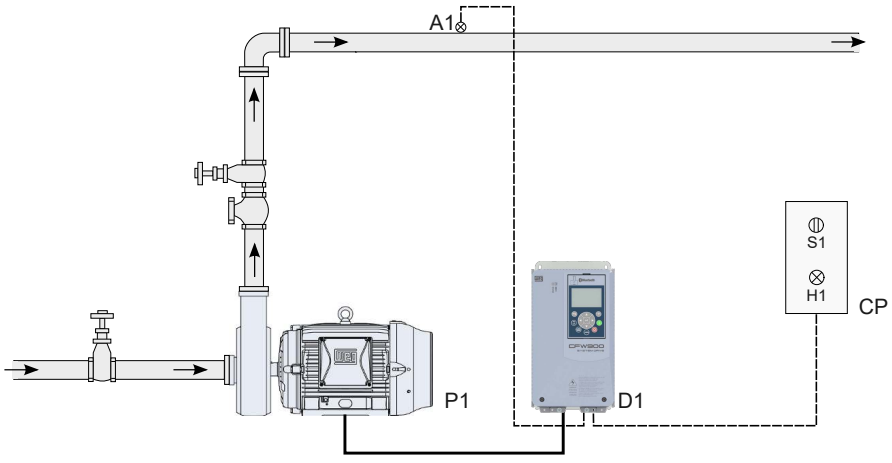
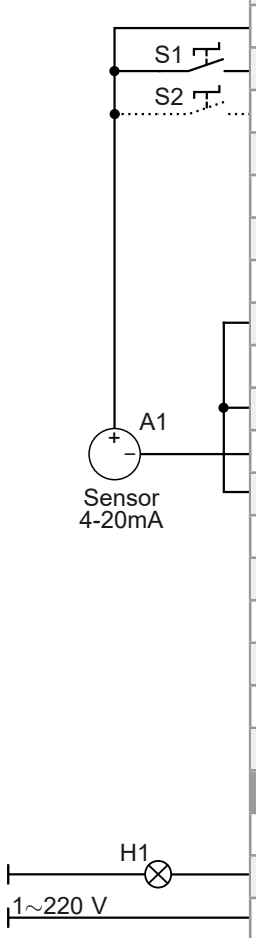


Figure 3.1: *Pump Genius application with control setpoint via HMI or communication networks or scheduling*

NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with control setpoint via HMI or communication networks or scheduling.

NOTE!
The indicating light H1 is not necessary for the operation of the Pump Genius with control setpoint via HMI or communication networks or scheduling. It only indicates the condition of the pump operation at the command panel (CP).

The Figure 3.2 on page 3-2 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter to have the control setpoint adjusted via HMI or communication networks or scheduling.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1 (Opcional)
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.2: *Signals on connectors of the IO modules for setpoint via HMI or communication networks or scheduling.*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.1.2 Analog Input

The user can configure the Pump Genius application (Simplex, Multipump e Multiplex) to allow control the setpoint via one analog input of the CFW900 inverter, which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- 01 Potentiometer for adjusting the control setpoint via input analog (R1);
- Enable Pump Genius Command (S1);
- Status light for motor running (H1);
- Status light for inverter no alarm (H2);
- Status light for inverter no fault (H3).

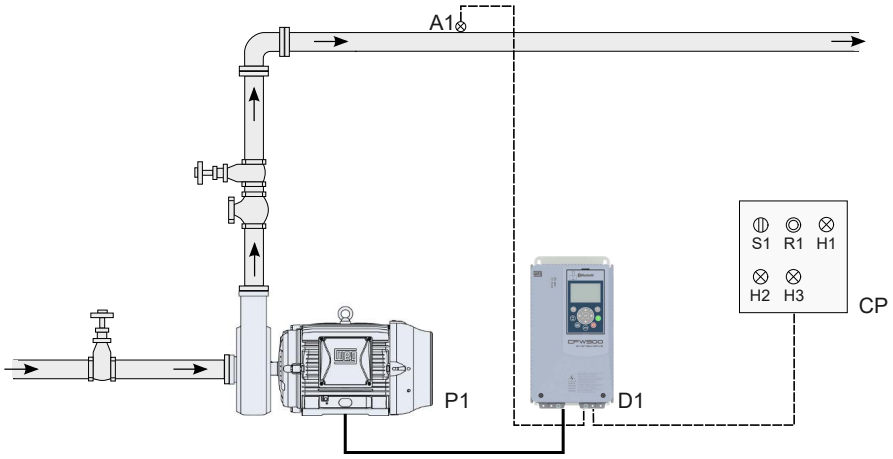
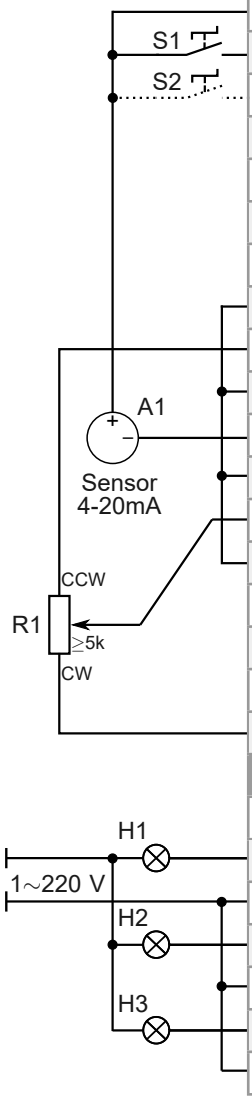


Figure 3.3: *Pump Genius Simplex application and control setpoint via analog input*

NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with control setpoint via analog input.

NOTE!
The indicating lights H1, H2 and H3 are not necessary for the operation of the Pump Genius with control setpoint via analog input. They only indicate the condition of the pump operation at the command panel (CP).

The Figure 3.4 on page 3-5 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter to have the control setpoint adjusted via analog input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1 (Opcional)
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: Control setpoint
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No alarm
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No fault
7	C3	Common of relay output 3n

Figure 3.4: *Signals on connectors of the IO modules for setpoint via analog input*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.1.3 Electronic Potentiometer (EP)

The user can configure the Pump Genius application (Simplex, Multipump and Multiplex) to have the control setpoint increased or decreased through commands on digital inputs, which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Enable Pump Genius Command (S1);
- Command Increment Setpoint (S3);
- Command Decrement Setpoint (S4);
- Status light for motor running (H1).

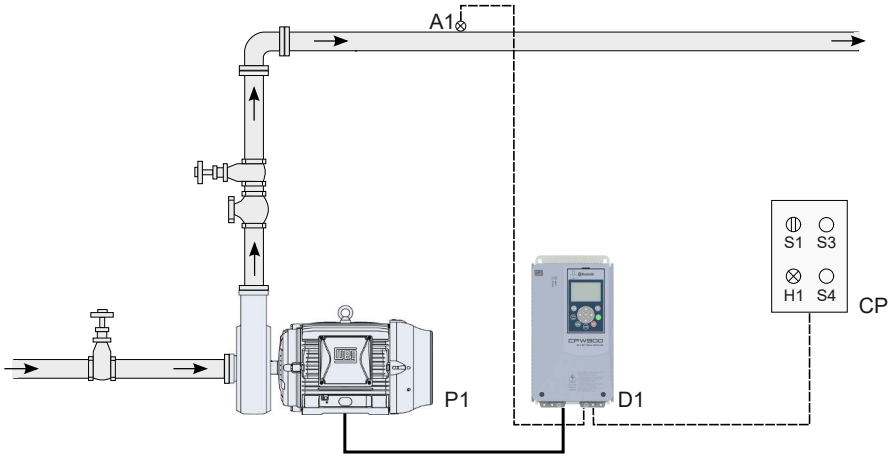
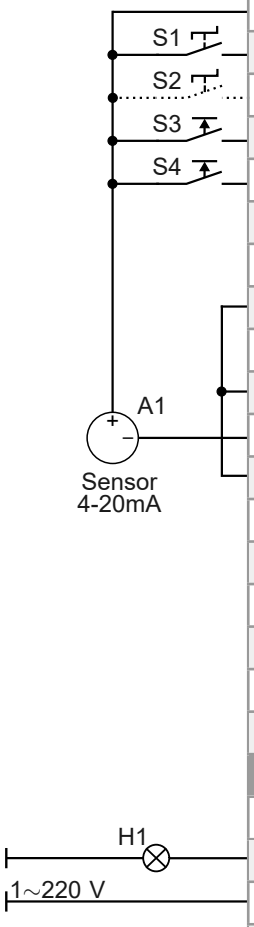


Figure 3.5: *Pump Genius application with control setpoint via electronic potentiometer (EP)*

NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with control setpoint via electronic potentiometer (EP).

NOTE!
The indicating light H1 is not necessary for the operation of the Pump Genius with control setpoint via electronic potentiometer (EP). It only indicates the condition of the pump operation at the command panel (CP).

The Figure 3.6 on page 3-7 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter to have the control setpoint adjusted via electronic potentiometer (EP).



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1 (Opcional)
12	DI3	Digital Input 3: Command increase control setpoint
13	DI4	Digital Input 4: Command decrease control setpoint
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.6: *Signals on connectors of the IO modules for control setpoint via electronic potentiometer (EP)*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.1.4 Logic combination of the Digital Inputs

The user can configure the Pump Genius (Simplex, Multipump and Multiplex) application to have two, three or four setpoint values for control via logic combination of digital inputs, which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Enable Pump Genius Command (S1);
- Switch of “n” positions for selection of the control setpoint (S4);
- Status light for motor running (H1).

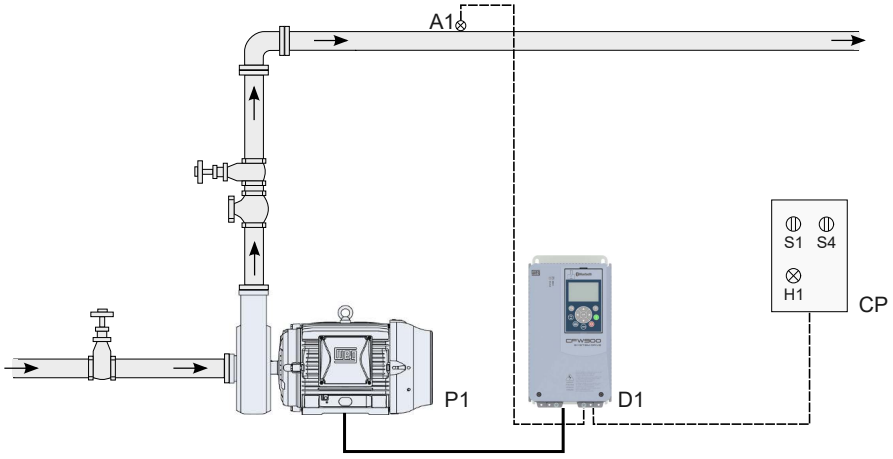
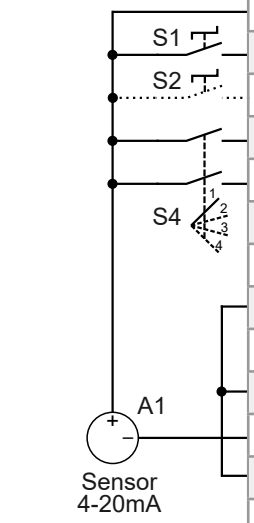


Figure 3.7: *Pump Genius application and control setpoint via combination of the digital inputs*

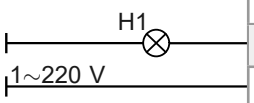
NOTE!
Use the Pump Genius configuration wizard in WPS software to configure the pump driven by CFW900 inverter with control setpoint via logical combination of the digital inputs.

NOTE!
The indicating light H1 is not necessary for the operation of the Pump Genius with control setpoint via logic combination of digital inputs. It only indicates the condition of the pump operation at the command panel (CP).

The Figure 3.8 on page 3-9 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter to have the control setpoint adjusted via via logic combination of digital inputs.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1 (Opcional)
12	DI3	Digital Input 3: 1st DI to select the control setpoint
13	DI4	Digital Input 4: 2nd DI to select the control setpoint
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.8: *Signals on connectors of the IO modules for control setpoint via logical combination of digital inputs*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.1.5 PID Controller in Manual or Automatic mode via Digital Input

The user can configure the Pump Genius application (Simplex, Multipump and Multiplex) to have the PID controller operating mode defined according to the state of a digital input, where (0) indicates manual mode and (1) indicates automatic mode, which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Enable Pump Genius Command (S1);
- Manual (0)/ Automatic (1) commutation switch to select the operation mode of the PID controller (S5);
- Status light for motor running (H1).

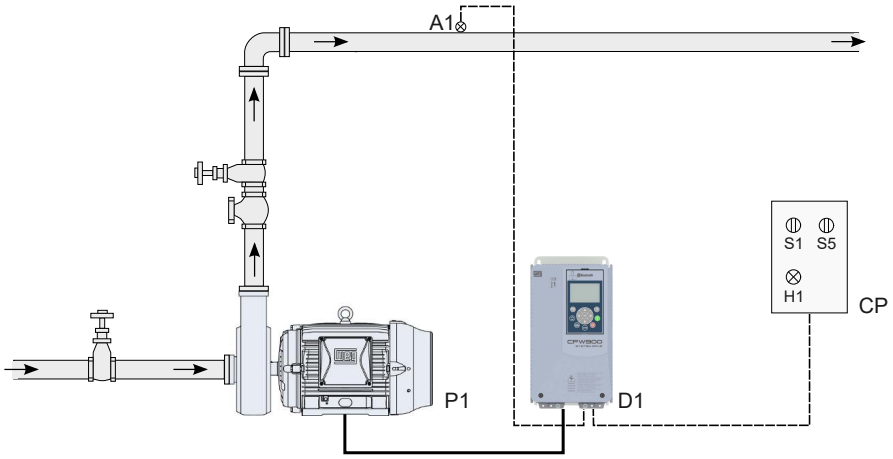
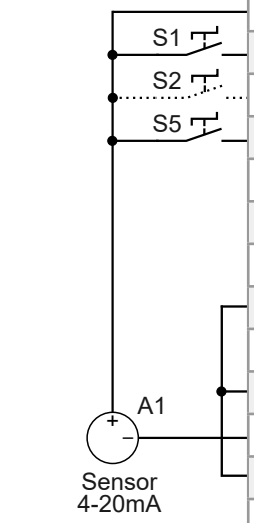


Figure 3.9: *Pump Genius application with selection of PID controller in manual or automatic via digital input*

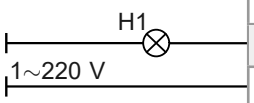
NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with selection of PID controller in manual or automatic via digital input.

NOTE!
The indicating light H1 is not necessary for the operation of the Pump Genius with selection of PID controller in manual or automatic via digital input. It only indicates the condition of the pump operation at the command panel (CP).

The Figure 3.10 on page 3-11 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter with selection of PID controller in manual or automatic via digital input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1 (Opcional)
12	DI3	Digital Input 3: PID controller selection: Manual (0); Automatic (1)
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.10: *Signals on connectors of the IO modules with selection of PID controller in manual or automatic via digital input*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.2 ASSOCIATION OF PUMPS IN PARALLEL

The Pump Genius application basically contemplates two distinct methods for controlling pumping when the system has two or more pumps associated in parallel. The Multipump method uses only one CFW900 frequency inverter to vary the speed of the pump driven by it and drives the other pumps in parallel through commands via digital outputs. The Multiplex method uses a CFW900 frequency inverter for each pump in parallel with data exchange between them (SymbiNet Protocol over Ethernet port), thus allowing the speed variation of all pumps in parallel in the system.

3.2.1 Multipump Fixed Control

It is characterized by the fact that the system consists of the association of two to nine (one fixed on inverter output) pumps in parallel and the CFW900 frequency inverter always controls the speed of the same pump. The other pumps in the system are controlled by the digital outputs of the same frequency inverter and operate at the rated speed. Thus, the user can use the start mode that best suits his needs: direct on line, star delta, softstater, etc.

The Figure 3.11 on page 3-12 presents a typical system with three pumps in parallel and control setpoint via HMI, basically composed of:

- 01 CFW900 frequency inverter (D1);
- 03 Electric motor + pump (P1, P2 and PD);
- 01 Sensor with analog output signal to measure the control process variable (A1);
- Command to enable Pump Genius (S0);
- Command to enable the use of the pump 1, and 2 (S1 and S2);
- Status light of the pump driven by the connected frequency inverter (PD) or for motor running (H0);
- Status light of the pumps 1 and 2 are running (H1 and H2).

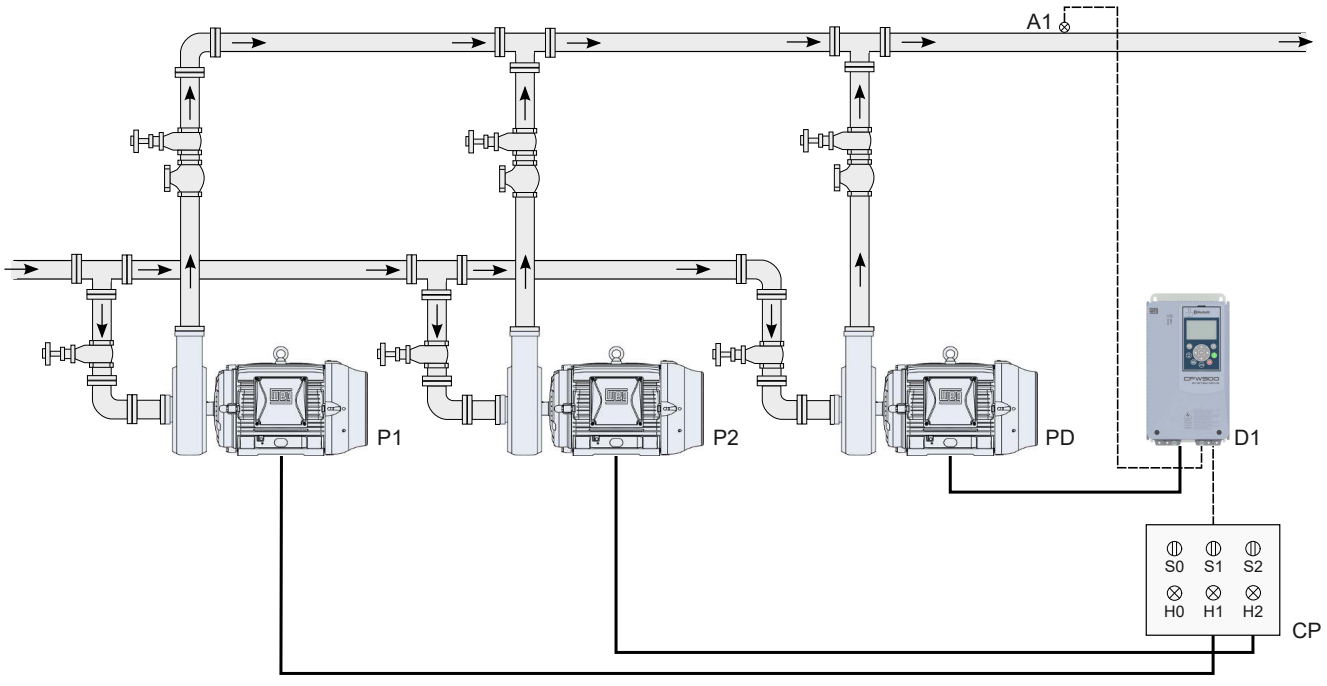
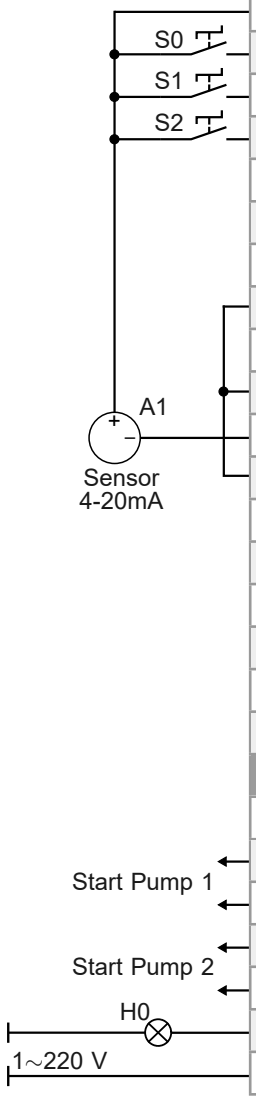


Figure 3.11: *Pump Genius Multipump application with fixed control and control setpoint via HMI*

NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the CFW900 frequency inverter to control the associated pumps in parallel with fixed control configuration and control setpoint via HMI.

NOTE!
Pumps 1 and 2 can be driven by contactors (direct on line or star delta), static starters (softstater), smart relays, etc. The H0, H1 and H2 signals are not necessary for the operation of the Pump Genius Multipump with fixed control, as they are used to indicate the operating condition of the pumps in the control panel (CP). In Figure 3.11 on page 3-12, the H1 and H2 signals come from auxiliary contacts of contactors K1 and K2 that drive pumps 1 and 2 as shown in Figure 3.14 on page 3-16.

The Figure 3.12 on page 3-14 presents the control connections (analog inputs/outputs, digital inputs/outputs) that must be made to the connectors of the IO modules of the CFW900 frequency inverter for a pumping system with three pumps in parallel with fixed control.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1
12	DI3	Digital Input 3: Enable Pump 2
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Start Pump 1
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: Start Pump 2
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: Run
7	C3	Common of relay output 3n

Figure 3.12: *Signals on connectors of the IO modules for a pumping system with three pumps in parallel with fixed control*

NOTE!
Refer to the CFW900 frequency inverter and the REL-01 accessory module manuals for more information on connections.

3.2.1.1 Power Connections

The Figure 3.13 on page 3-15 presents the power connection diagram for a system with three pumps in parallel with fixed control.

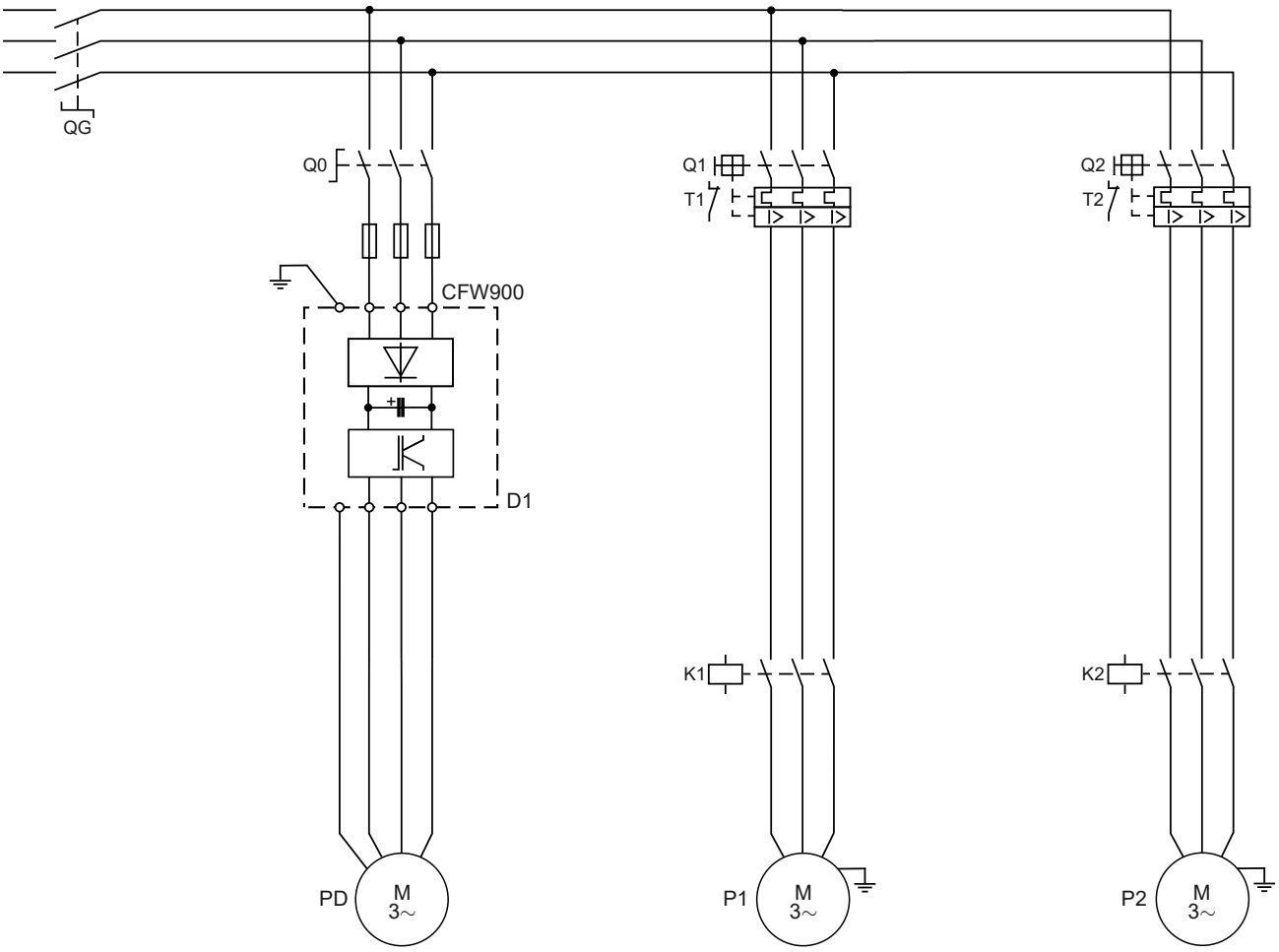


Figure 3.13: *Power connections of the Pump Genius Multipump application with fixed control and three pumps in parallel*

Where:

- QG: Protection circuit breaker for the system power supply;
- Q0: Device for disconnecting the CFW900 frequency inverter supply;
- Q1 and Q2: Motor circuit breaker for the protection of the pumps;
- K1 and K2: Contactors for starting the pumps;
- P1, P2 and PD: System pump motors;
- The protection of CFW900 inverter is done with fuses.

NOTE!
It is recommended to install the protection devices of the pump motors and the CFW900 frequency inverter to prevent damage to them.

3.2.1.2 Command Connections

The Figure 3.14 on page 3-16 presents the command connection diagram for fixed control and three pumps in parallel.

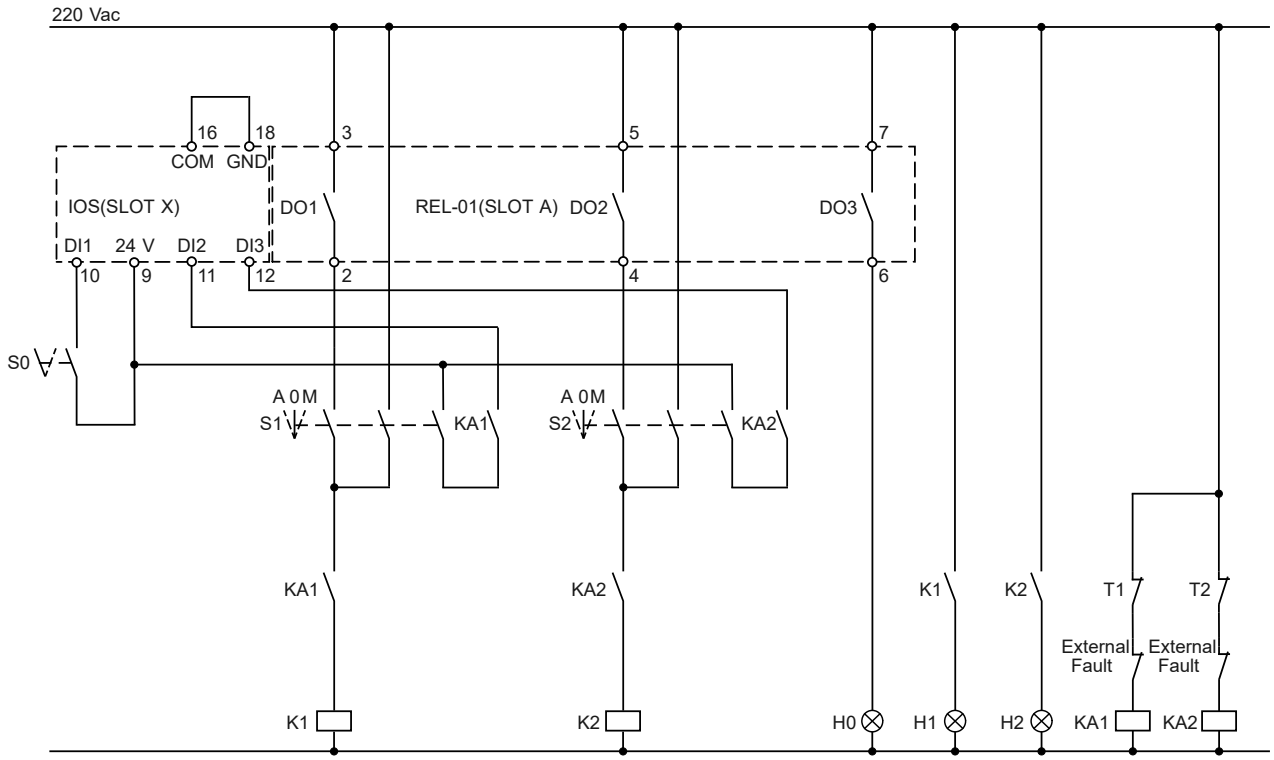


Figure 3.14: *Command connections of the Pump Genius Multipump application with fixed control and three pumps in parallel*

Where:

- S0: Start/Stop switch. The “Start” position perform the command for enabling the Pump Genius operation. The “Stop” position disables the Pump Genius operation, that is, it stops all the pumps of the system;
- S1 and S2: Manual/0/Automatic commutation switches (optional). The “Manual” position perform the command for starting the pump independent of the Pump Genius. The “0” position switches off the pump and disables it from the Pump Genius. The “Automatic” position enables the pump to be used in the Pump Genius;
- K1 and K2: Contactors for starting the pumps;
- KA1 and KA2: Auxiliary contactors for the pump protection logics;
- T1 and T2: Contacts of the thermal relays for protection of the pumps;
- External Fault: A sensor, such as a pressure switch, can be used for the protection of the pumps;
- DO1 and DO2: Relay digital outputs of the REL-01 accessory module to command pumps 1 and 2;
- DO3: Relay digital output of the REL-01 accessory module for running pump indication;
- DI1: Digital input of the CFW900-IOS accessory module of the CFW900 frequency inverter to enable the pumping control operation;
- DI2 and DI3: Digital inputs of the CFW900-IOS accessory module of the CFW900 frequency inverter indicating that the pumps are enabled for the pumping control;
- H0: Status light of the pump driven by the connected frequency inverter (DP) or for motor running;
- H1 and H2: Status light of the pumps 1 and 2 are running.

3.2.2 Multipump Floating Control

The system is composed of the association of two to eight pumps in parallel, and the CFW900 frequency inverter can be connected (via inverter output contactor commanded by a digital output) and control the speed of any of the pumps, but always the first started. With the control enabled and all the pumps turned off, the first pump to be started is connected to the inverter via the digital output command and the other pumps will be connected directly to the main power via the command of other outputs subsequently activated. After stopping the system, depending on the configuration, availability and/or operating time, another pump can be driven by CFW900 inverter; by doing that, all pumps in the system are used in a uniform way. The interlock that prevents two or more pumps to be connected to the inverter is electrically done as Figure 3.18 on page 3-22.

The Figure 3.15 on page 3-18 presents a typical system with three pumps and control setpoint via HMI, basically composed of:

- 01 CFW900 frequency inverter (D1);
- 03 Electric motor + pump (P1, P2 and P3);
- 01 Sensor with analog output signal to measure the control process variable (A1);
- Command to enable Pump Genius (S0);
- Command to enable the use of the pump 1, 2 and 3 (S1, S2 and S3);
- Status light of inverter fault (H0) and motor running (Run) (H1);
- Status light of the pumps 1, 2 and 3 are running (H2, H3 and H4).

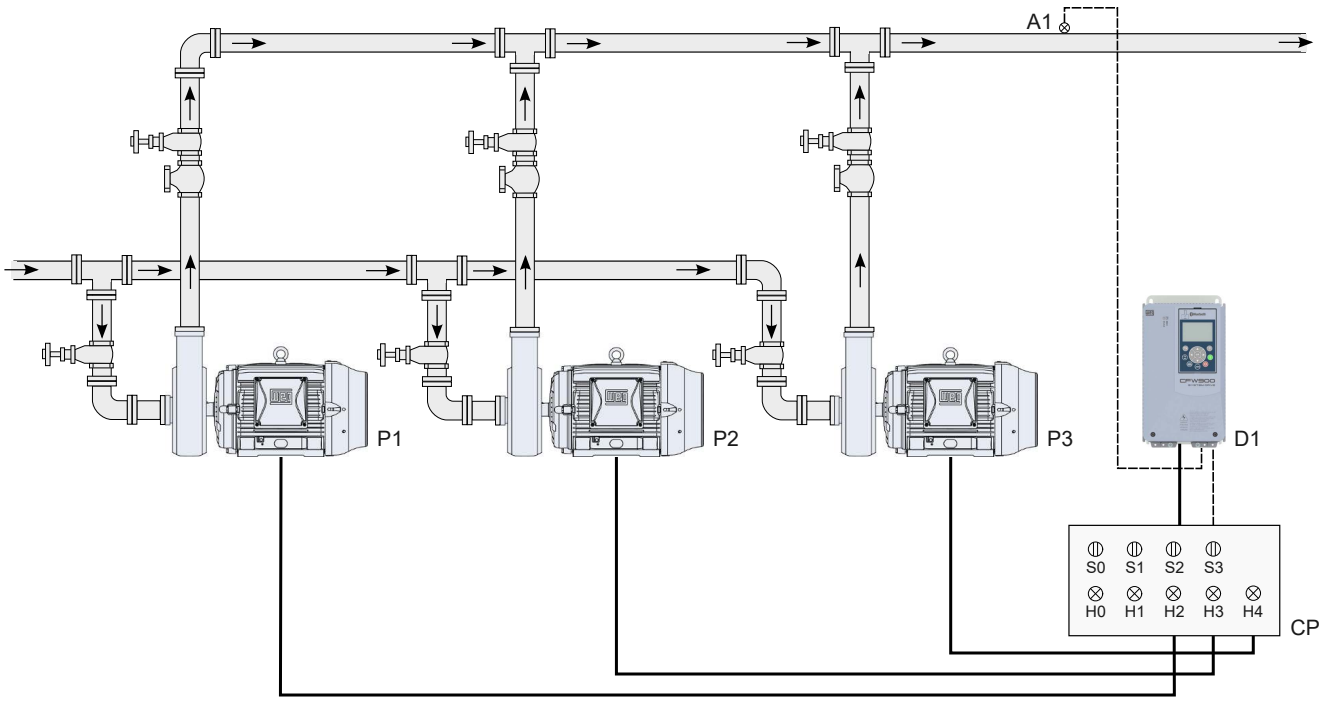
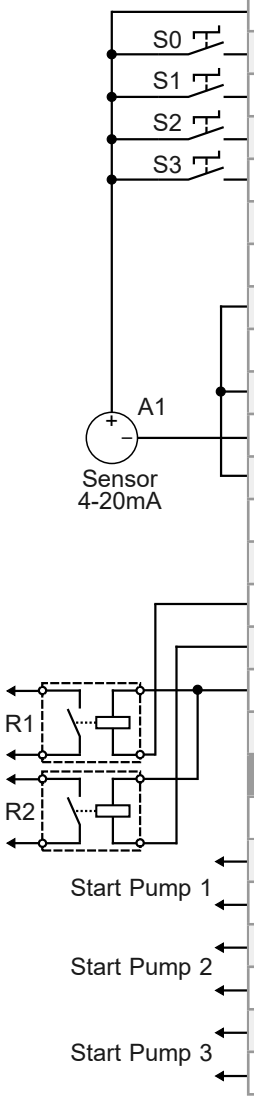


Figure 3.15: *Pump Genius Multipump application with floating control and control setpoint via HMI*

NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the CFW900 frequency inverter to control the associated pumps in parallel with floating control configuration and control setpoint via HMI.

NOTE!
The signals H0, H1, H2 and H3 are not necessary for the operation of the Pump Genius Multipump with floating control, because they are used to indicate the operating condition of the pumps on the command panel (CP). In Figure 3.15 on page 3-18, the signals H1, H2, H3 and H4 come from auxiliary contacts of contactors K1, K1.1, K2, K2.1, K3 and K3.1 which start the pumps 1, 2 and 3 as presented in Figure 3.18 on page 3-22.

The Figure 3.16 on page 3-19 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter for a pumping system with three pumps in parallel with floating control.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1
12	DI3	Digital Input 3: Enable Pump 2
13	DI4	Digital Input 4: Enable Pump 3
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No Fault
24	DO2	Digital output 2: Run
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Start Pump 1
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: Start Pump 2
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: Start Pump 3
7	C3	Common of relay output 3n

Figure 3.16: *Signals on connectors of the IO modules for a pumping system with three pumps in parallel with floating control*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.2.2.1 Power Connections

The Figure 3.17 on page 3-20 presents the power connection diagram for a system with three pumps in parallel with floating control.

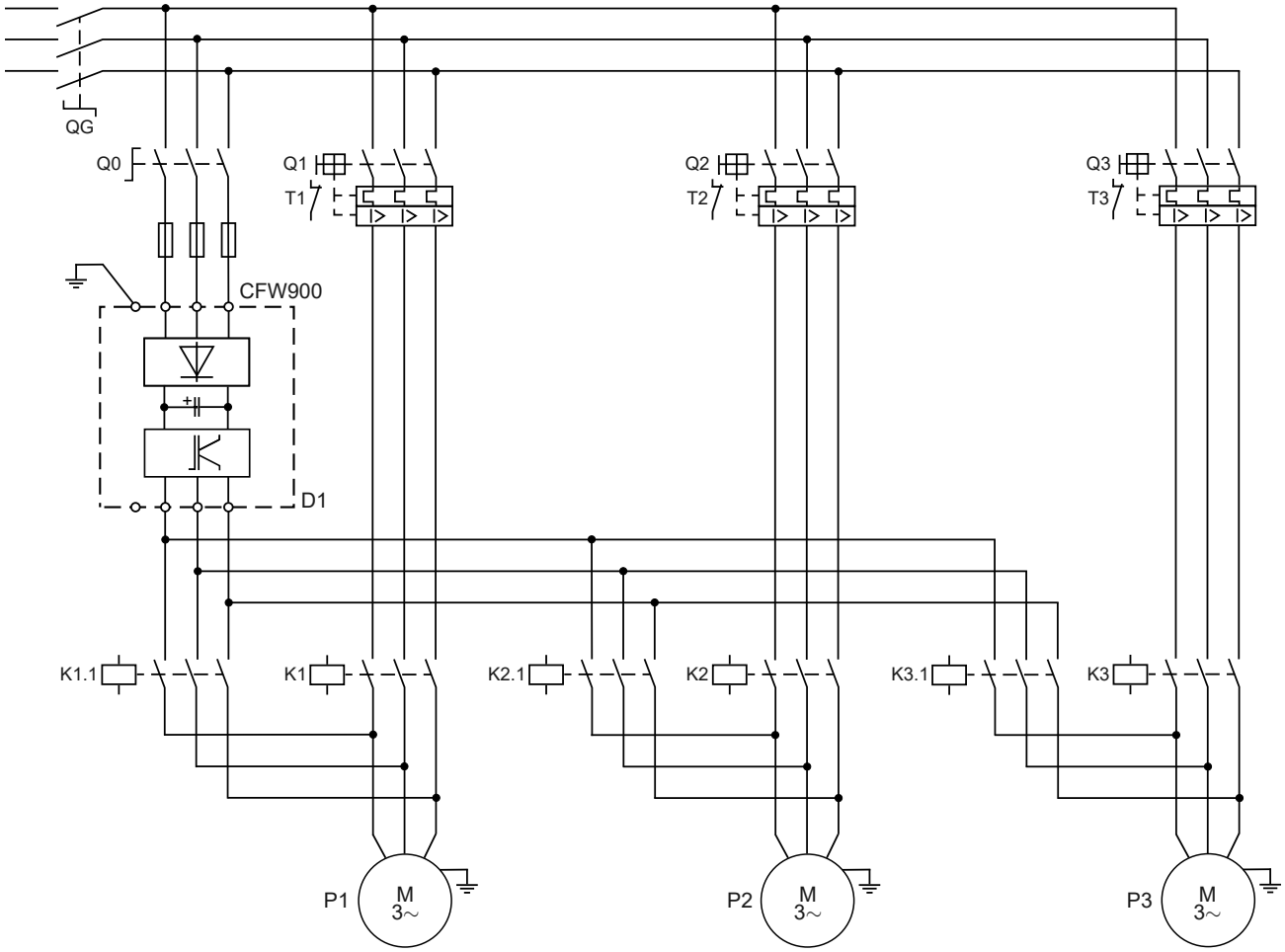


Figure 3.17: *Power connections of the Pump Genius Multipump application with floating control and three pumps in parallel*

Where:

- QG: Protection circuit breaker for the system power supply;
- Q0: Device for disconnecting the CFW900 frequency inverter supply;
- Q1, Q2 and Q3: Motor circuit breaker for the protection of the pumps;
- K1, K2 and K3: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the CFW900 inverter;
- K1.1, K2.1 and K3.1: Contactors to start the pump with the CFW900 inverter;
- P1, P2 and P3: System pump motors;
- The protection of CFW900 inverter is done with fuses.

NOTE!
It is recommended to install the protection devices of the pump motors and the CFW900 frequency inverter to prevent damage to them.

3.2.2.2 Command Connections

The Figure 3.18 on page 3-22 presents the command connection diagram for three pumps in parallel and floating control.

Where:

- S0: Start/Stop switch. The “Start” position issues the command for enabling Pump Genius operation. The “Stop” position disables the Pump Genius operation, that is, it stops all the pumps of the system;
- S1, S2 and S3: Manual / 0 / Automatic commutation switches (optional). The “Manual” position issues the command for starting the pump independent of the pumping control. The “0” position switches off the pump and disables it from the pumping control. The “Automatic” position enables the pump to be used in the Pump Genius;
- K1, K2 and K3: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the CFW900 inverter;
- K1.1, K2.1 and K3.1: Contactors to start the pump with the frequency inverter;
- KA1, KA2 and KA3: Auxiliary contactors for the pump protection logics;
- T1, T2 and T3: Contact of the pump motors thermal protection;
- External Fault: A sensor, such as a pressure switch, can be used for the protection of the pumps;
- DO1, DO2 and DO3: Relay digital output of the REL-01 accessory module to command pumps 1, 2 and 3;
- R1 e R2: Relays connected to the digital transistor outputs of the I/O accessory CFW900-IOS for indication of inverter without fault and motor running (Run);
- DI1: Digital input of the CFW900-IOS accessory module of the CFW900 frequency inverter to enable the Pump Genius operation;
- DI2, DI3 and DI4: Digital inputs of the CFW900-IOS accessory module of the CFW900 frequency inverter indicating that the pumps are enabled for the Pump Genius;
- H0 e H1: Status light of inverter fault and motor running (Run);
- H2, H3 and H4: Status light of the pumps 1, 2 and 3 are running.

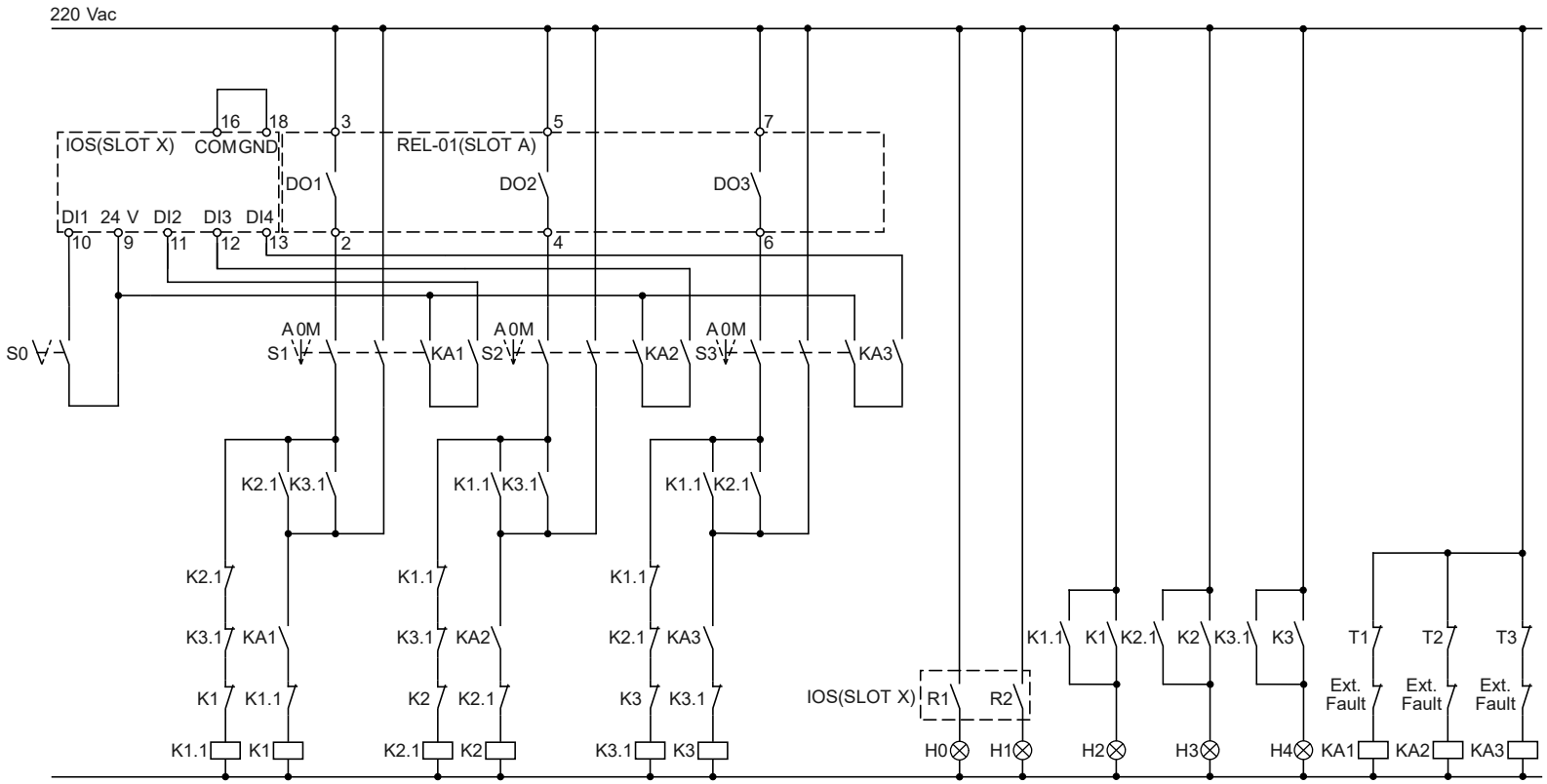


Figure 3.18: *Command connections of the Pump Genius Multipump application with floating control and three pumps in parallel*

3.2.3 Multipump Cascade Control

The system is composed of the association of two to eight pumps in parallel, and the CFW900 frequency inverter can be connected (via inverter output contactor commanded by a digital output) and control the speed of any of the pumps, but always the last started. With the system turned off, the first pump to be started is connected to the inverter via the digital output command. When an additional pump is needed, the previous pump started is commuted to the main power and the next pump to be started will be driven by CFW900 inverter. The interlock that prevents two or more pumps to be connected to the inverter is electrically done as Figure 3.22 on page 3-28.

The Figure 3.19 on page 3-24 presents a typical system with three pumps and control setpoint via HMI, basically composed of:

- 01 CFW900 frequency inverter (D1);
- 03 Electric motor + pump (P1, P2 and P3);
- 01 Sensor with analog output signal to measure the control process variable (A1);
- Command to enable Pump Genius (S0);
- Command to enable the use of the pump 1, 2 and 3 (S1, S2 and S3);
- Status light of the pumps 1, 2 and 3 are running (H1, H2 and H3).

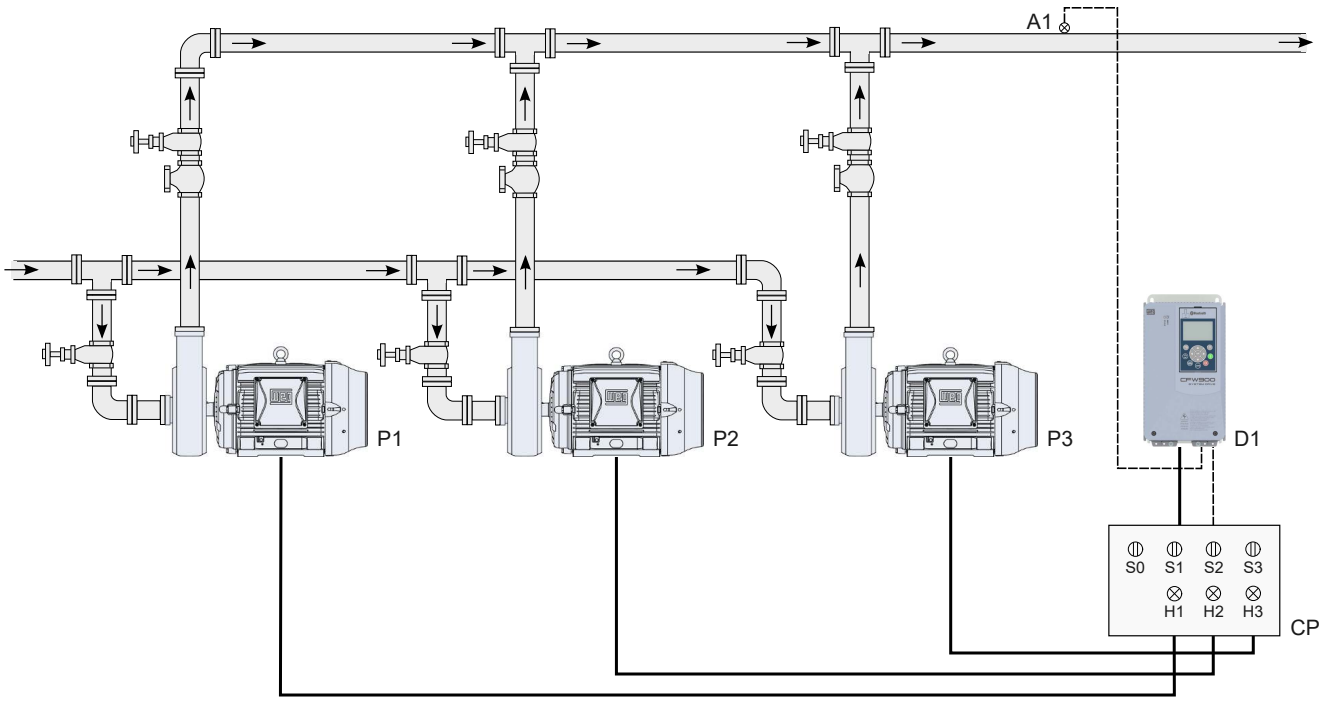
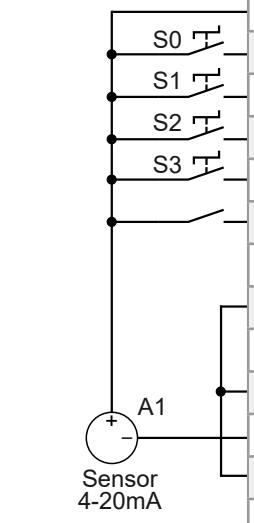


Figure 3.19: *Pump Genius Multipump application with cascade control and control setpoint via HMI*

NOTE!
Use the Pump Genius application wizard in the WPS software to configure the CFW900 frequency inverter to control associated parallel pumps with cascade control configuration.

NOTE!
The signals H1, H2 and H3 are not necessary for the operation of the Pump Genius Multipump with cascade control, because they are used to indicate the operating condition of the pumps on the command panel (CP). In Figure 3.19 on page 3-24,the signals H1, H2 and H3 come from auxiliary contacts of contactors K1, K1.1, K2, K2.1, K3 and K3.1 which start the pumps 1, 2 and 3 as presented in Figure 3.22 on page 3-28.

The Figure 3.20 on page 3-25 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter for a pumping system with three pumps in parallel with cascade control.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1
12	DI3	Digital Input 3: Enable Pump 2
13	DI4	Digital Input 4: Enable Pump 3
14	DI5	Digital Input 5: Cascade Feedback
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: Cascade Function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Start Pump 1
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: Start Pump 2
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: Start Pump 3
7	C3	Common of relay output 3n

Figure 3.20: *Signals on connectors of the IO modules for a pumping system with three pumps in parallel with cascade control*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.2.3.1 Power Connections

The Figure 3.21 on page 3-26 presents the power connection diagram for a system with three pumps in parallel with cascade control.

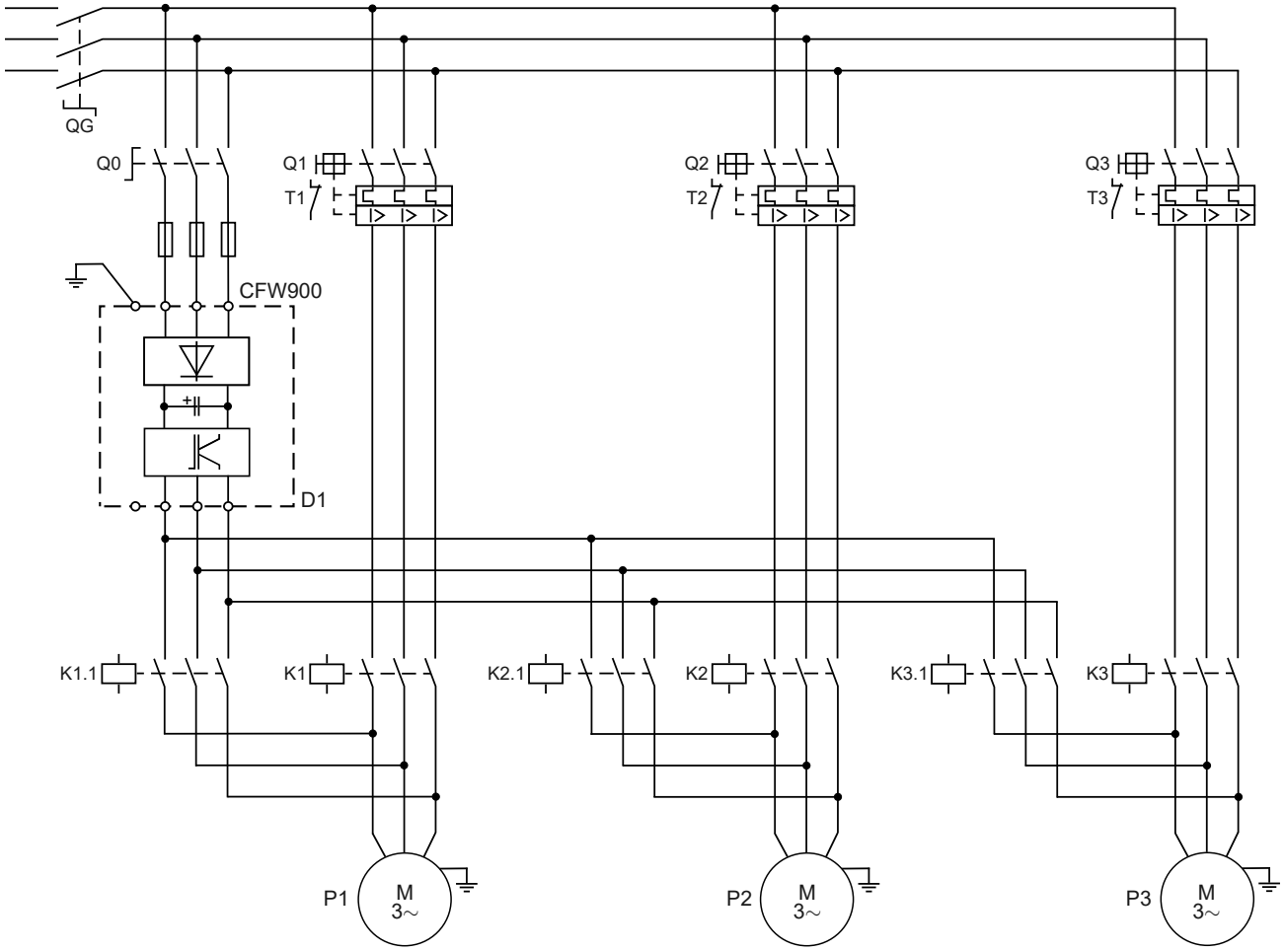


Figure 3.21: *Power connections of the Pump Genius Multipump application with cascade control and three pumps in parallel*

Where:

- QG: Protection circuit breaker for the system power supply;
- Q0: Device for disconnecting the CFW900 frequency inverter supply;
- Q1, Q2 and Q3: Motor circuit breaker for the protection of the pumps;
- K1, K2 and K3: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the CFW900 inverter;
- K1.1, K2.1 and K3.1: Contactors to start the pump with the CFW900 inverter;
- P1, P2 and P3: System pump motors;
- The protection of CFW900 inverter is done with fuses.

NOTE!
It is recommended to install the protection devices of the pump motors and the CFW900 frequency inverter to prevent damage to them.

3.2.3.2 Command Connections

The Figure 3.22 on page 3-28 presents the command connection diagram for three pumps in parallel and cascade control.

Where:

- S0: Start/Stop switch. The “Start” position issues the command for enabling Pump Genius operation. The “Stop” position disables the Pump Genius operation, i.e., it stops all the pumps of the system;
- S1, S2 and S3: Manual / 0 / Automatic commutation switches (optional). The “Manual” position issues the command for starting the pump independent of the pumping control. The “0” position switches off the pump and disables it from the pumping control. The “Automatic” position enables the pump to be used in the Pump Genius;
- K1, K2 and K3: Contactors for starting the pumps directly on line, i.e., when they do not have their speed controlled by the CFW900 inverter;
- K1.1, K2.1 and K3.1: Contactors to start the pump with the frequency inverter (See note);
- KA1, KA2 and KA3: Auxiliary contactors for the pump protection logics;
- KA4: Auxiliary contactor for cascade electrical interlocks;
- T1, T2 and T3: Contact of the pump motors thermal protection;
- External Fault: A sensor, such as a pressure switch, can be used for the protection of the pumps;
- DO1, DO2 and DO3: Relay digital output of the REL-01 accessory module to command pumps 1, 2 and 3;
- R1: Relay connected to the digital transistor output of the I/O accessory CFW900-IOS for cascade electrical interlocks;
- DI1: Digital input of the CFW900-IOS accessory module of the CFW900 frequency inverter to enable the Pump Genius operation;
- DI2, DI3 and DI4: Digital inputs of the CFW900-IOS accessory module of the CFW900 frequency inverter indicating that the pumps are enabled for the Pump Genius;
- DI5: Digital input of the CFW900-IOS accessory module of the CFW900 frequency inverter for the return of the electrical interlock in cascade control;
- H1, H2 and H3: Status light indicating that the pumps 1, 2 and 3 are running.

NOTE!
The auxiliary contacts at DI5 (Cascade Feedback) from K1.1, K2.1 and K3.1 must be **early-make** normally open contacts for the properly working of the system interlock.

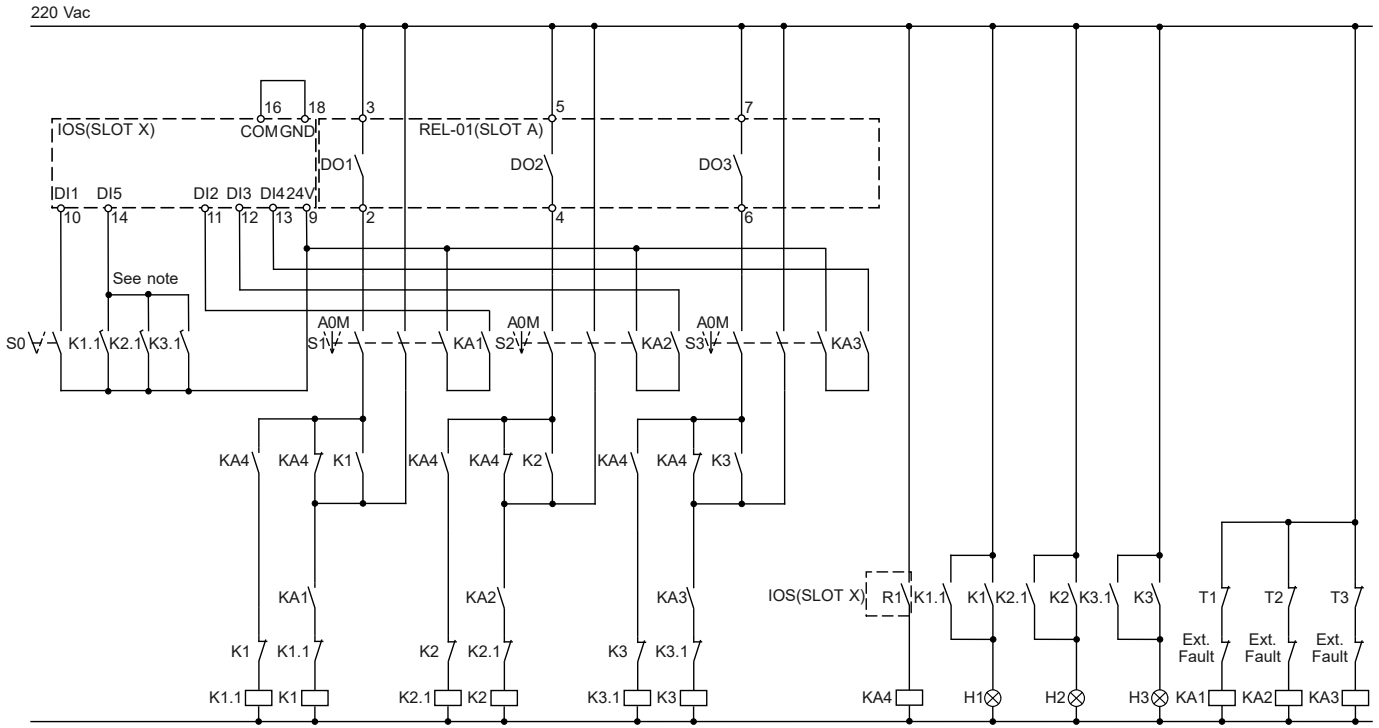


Figure 3.22: *Command connections of the Pump Genius Multipump application with cascade control and three pumps in parallel*

NOTE!
The auxiliary contacts at DI5 (Cascade Feedback) from K1.1, K2.1 and K3.1 must be **early-make** normally open contacts for the properly working of the system interlock.

3.2.4 Multiplex

It is characterized by the fact that the system consists of the association of two or more pumps in parallel and each pump is driven by its respective CFW900 frequency inverter, thus allowing the speed of all pumps in the system to be controlled (all operate at the same speed).

The user can configure the Pump Genius Multiplex application up to eight associated pumps in parallel. The inverter pump(s) configured to be Master/Follower are able to perform the control actions (start/stop, speed reference, etc) and depends on the active Master. The invereter pump(s) configured to be Follower are passive and will depends on the commands received from the active Master. The communication between the inverters is carried out through the SymbiNet communication protocol (over Ethernet port).

The Figure 3.23 on page 3-29 presents a typical system with three pumps in parallel (two master pumps, one follower pump) and control setpoint via HMI, which basically comprises:

- 03 CFW900 frequency inverters (D1 (Master/Follower), D2 (Master/Follower) and D3 (Follower));
- 03 Electric motors and pumps (P1, P2 and P3);
- 02 Sensor with analog output signal for measurement of the control process variable (A1 and A2);
- Command for enabling the Pump Genius (S0);
- Command for enabling the use of the pump driven by CFW900 inverter (S1, S2 and S3);
- Status light for motor running (H1, H2 and H3).

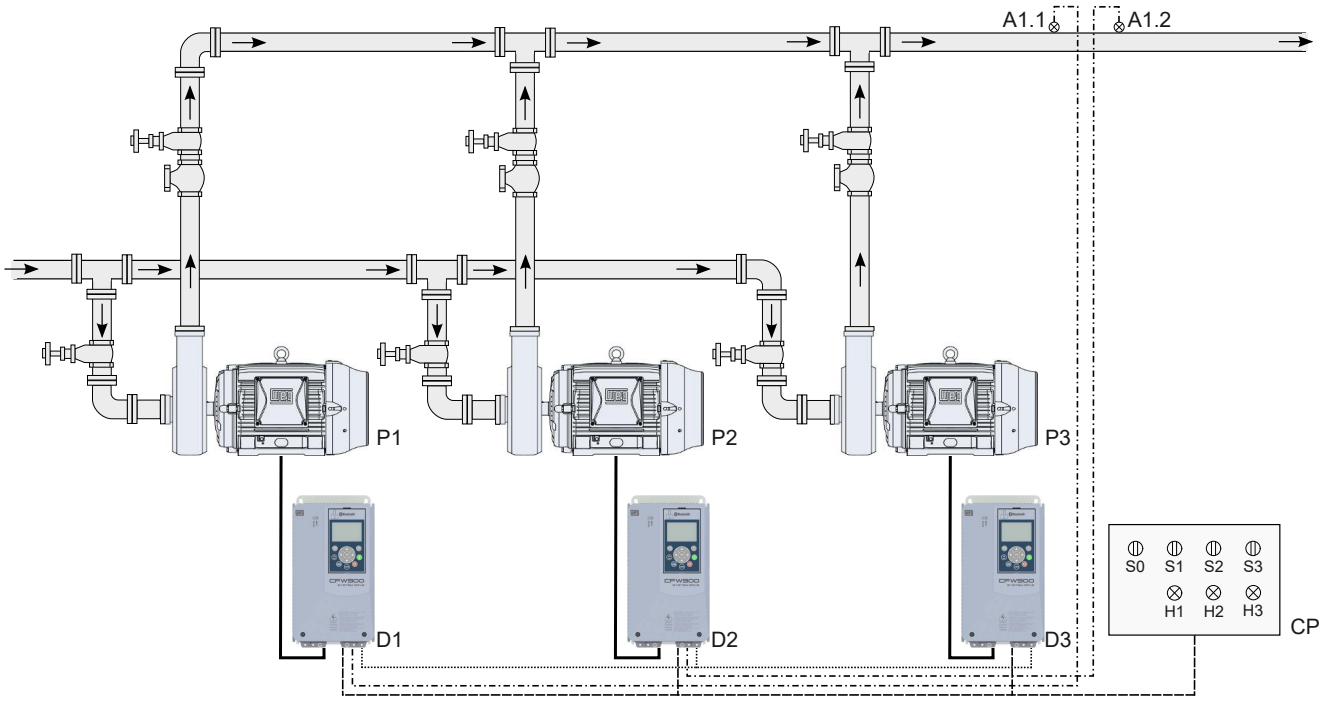
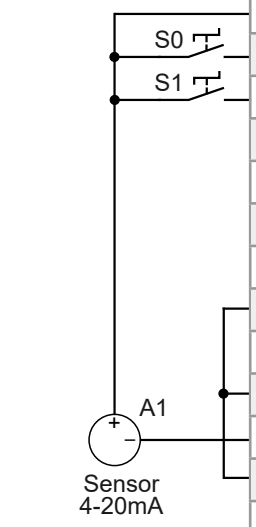


Figure 3.23: *Pump Genius Multiplex application with two master pumps and one follower pump, and control setpoint via HMI*

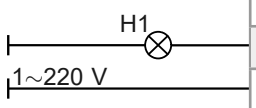
NOTE!
Use the Pump Genius configuration wizard in the WPS software to configure the CFW900 frequency inverter in Multiplex configuration.

NOTE!
The indicating lights H1, H2 and H3 are not necessary for the operation of Pump Genius Multiplex. They only indicate the operating condition of the pumps on the control panel (CP).

The Figure 3.24 on page 3-30, the Figure 3.25 on page 3-31 and the Figure 3.26 on page 3-32 present the control connections (analog inputs, digital inputs/outputs, ethernet) to the connectors of the IO modules of the CFW900 frequency inverter for a pumping system with three pumps in parallel, two master pumps and one follower pump.

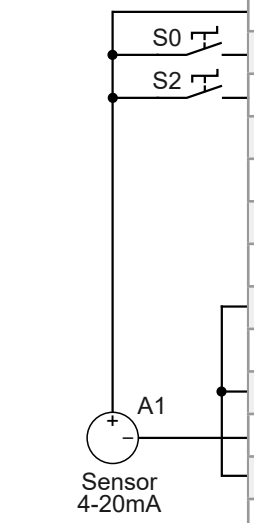


Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 1
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference

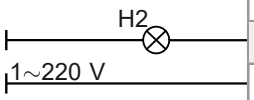


Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.24: *Signals on the control card connectors for a pumping system with three pumps in parallel and Pump Genius Multiplex application (Master/Follower Pump 1)*

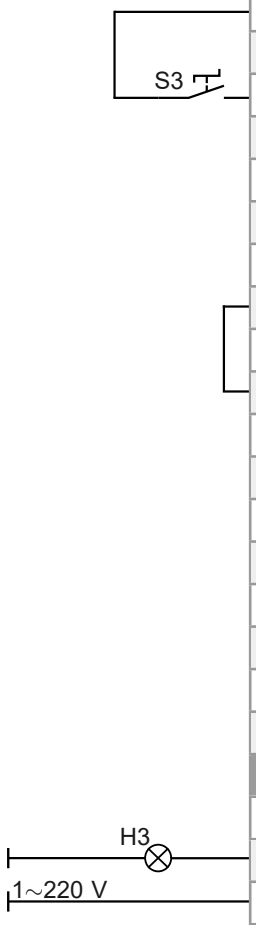


Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Enable Pump 2
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.25: *Signals on the control card connectors for a pumping system with three pumps in parallel and Pump Genius Multiplex application (Master/Follower Pump 2)*



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: No function
11	DI2	Digital Input 2: Enable Pump 3
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: No function
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.26: *Signals on the control card connectors for a pumping system with three pumps in parallel and Pump Genius Multiplex application (Follower Pump 3)*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.2.4.1 Power Connections

A Figure 3.27 on page 3-33 presents the power connection diagram of a pumping system with three pumps in parallel, two master/follower pumps and one follower pump.

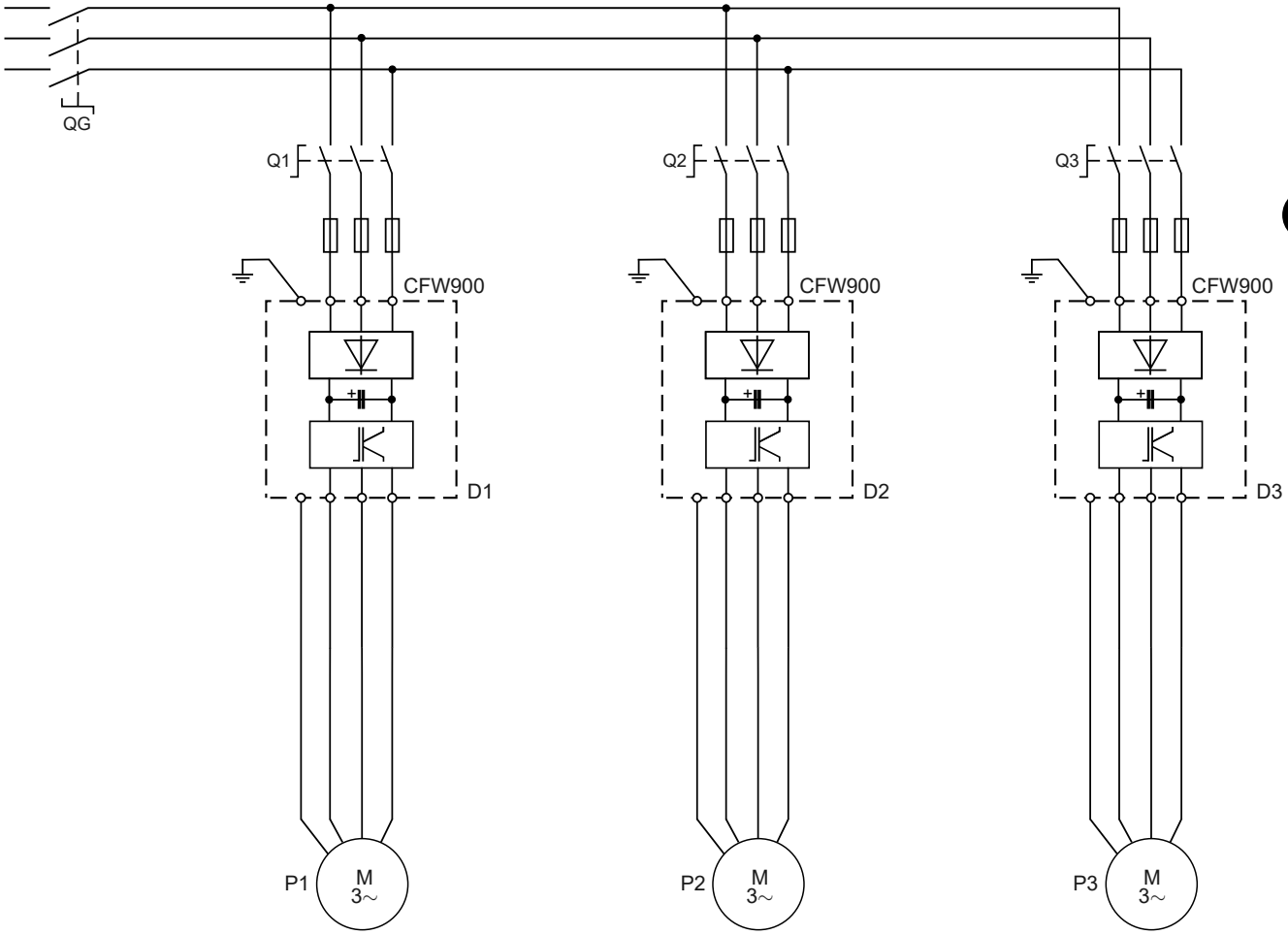


Figure 3.27: *Power connections of the Pump Genius Multiplex application with three pumps in parallel*

Where:

- QG: Protection circuit breaker for the system power supply;
- Q1, Q2 and Q3: Device for disconnecting the CFW900 frequency inverter supply;
- P1, P2 and P3: Pump motors;
- The protection of CFW900 frequency inverters is done with fuses.

NOTE!
It is recommended to install the protection devices of the pump motors and the CFW900 frequency inverter to prevent damage to them.

3.2.4.2 Control Connections

The Figure 3.28 on page 3-34 and the Figure 3.29 on page 3-35 presents the control connections diagram of a pumping system with three pumps in parallel, two master pumps and one follower pump.

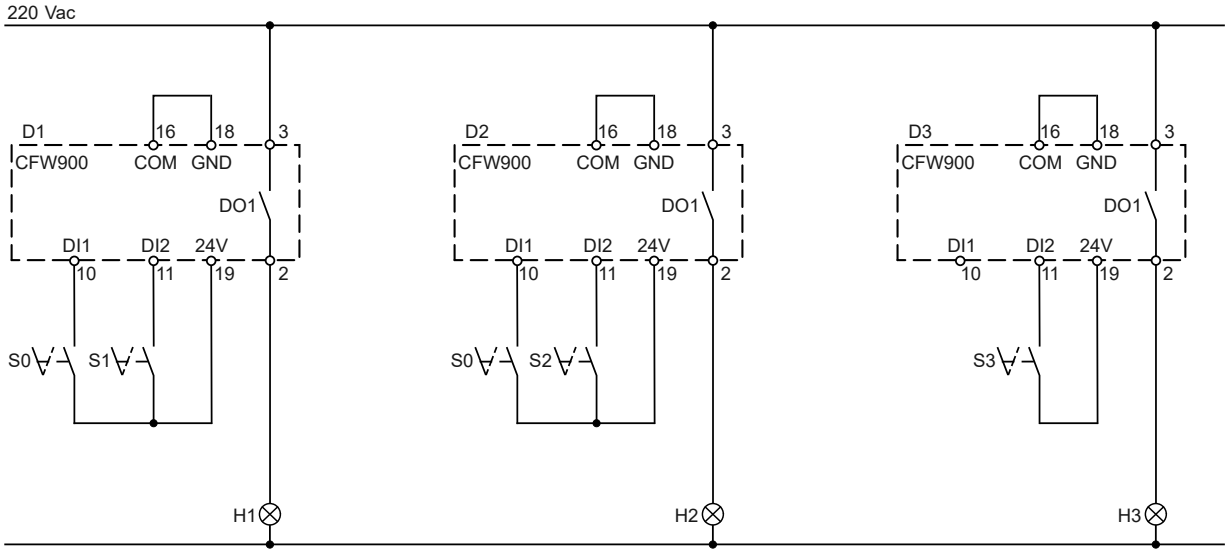


Figure 3.28: *Command connections of the Pump Genius Multiplex application and three pumps in parallel (two master pump and one follower pump)*

Where:

- S0: Start/Stop switch. The “Start” position issues the command for enabling Pump Genius operation. The “Stop” position disables the Pump Genius operation, i.e., it stops all the pumps of the system;
- S1, S2 and S3: Enable/Disable switch. The “Enable” position allows the CFW900 frequency inverter to use the pump as needed by the Pump Genius. The “Disable” position inhibits the CFW900 frequency inverter from using the pump as needed by the Pump Genius;
- DO1: Relay digital output CFW900 frequency inverter for motor running indication;
- DI1: Digital input of the CFW900 frequency inverter to enable Pump Genius;
- DI2: Digital input of the CFW900 frequency inverter to enable the use of the pump;
- H1, H2 and H3: Status light indicating that the pumps 1, 2 and 3 are running.

3.2.4.3 Communication Connection (SymbiNet)

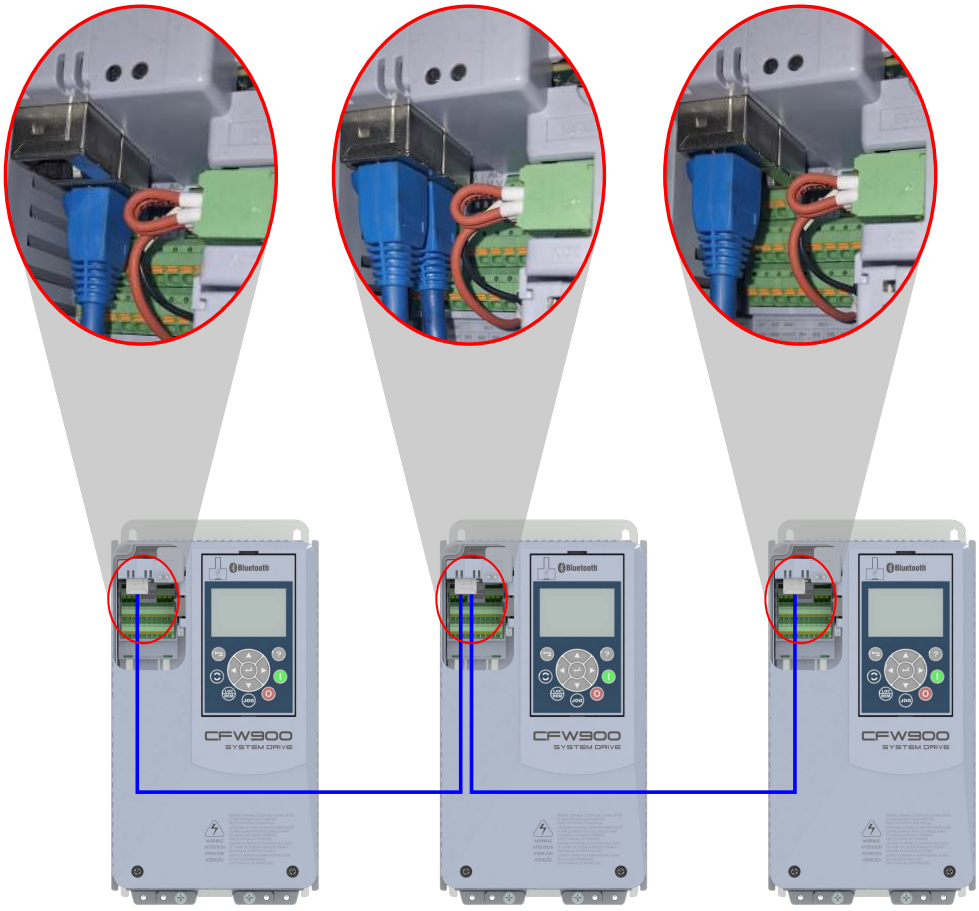


Figure 3.29: *Pump Genius Multiplex communication connection (SymbiNet over Ethernet ports)*

3.3 PUMP PROTECTION

3.3.1 External Sensor

The user can configure the Pump Genius application to have up to four digital external sensors installed on digital inputs of the CFW900 frequency inverter to protect the pump. Which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- 01 Sensor with NO (Normally Open) contact for pump protection (S6);
- Enable Pump Genius Command (S1);
- Status light for motor running (H1).

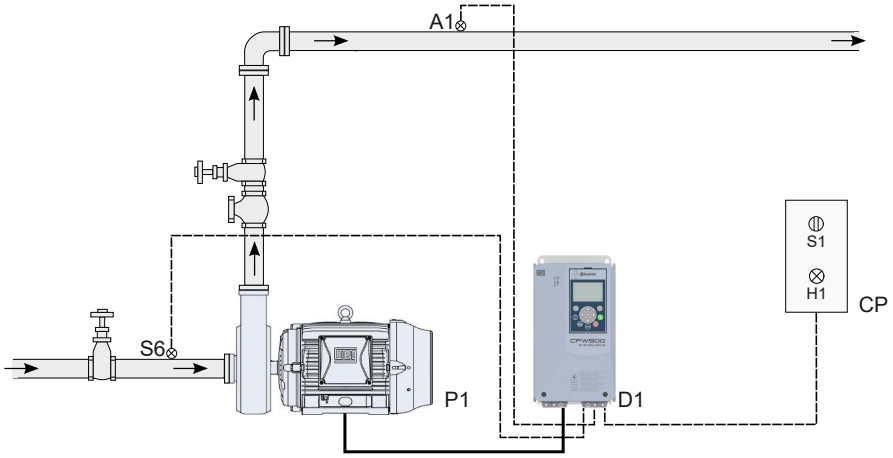
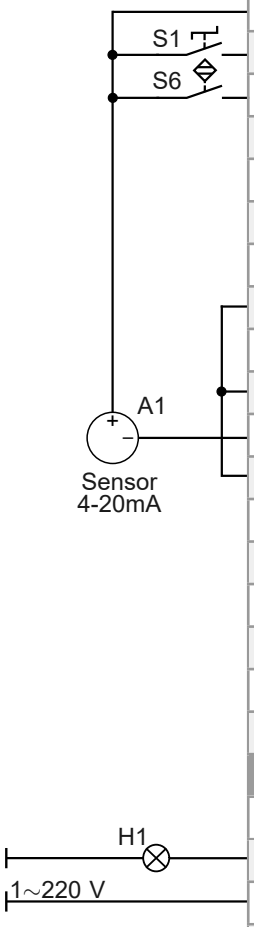


Figure 3.30: *Pump Genius application with pump protection via external sensor in the digital input*

NOTE!
Use the Pump Genius application setup wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with pump protection via an external sensor.

NOTE!
The indicating light H1 is not necessary for the operation of the Pump Genius and pump protection with an external sensor via digital input. It only indicates the condition of the pump operation at the command panel (CP).

A Figure 3.31 on page 3-37 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter to have the pump protection via external sensor in the digital input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: External Sensor
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference
Connector		**Description REL-01 - Slot A**
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.31: *Signals on connectors of the IO modules for pump protection via external sensor in the digital input*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.3.2 Control Auxiliary Variable (Suction Control)

The user can configure the Pump Genius application to have a sensor (suction input pressure) installed on an analog input of the CFW900 frequency inverter to protect the pump. Which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- 01 Sensor with analog output signal for measurement of the control auxiliary variable (A2);
- Enable Pump Genius Command (S1);
- Status light for motor running (H1);
- Status light for inverter no fault (H2);
- Status light for inverter no alarm (H3).

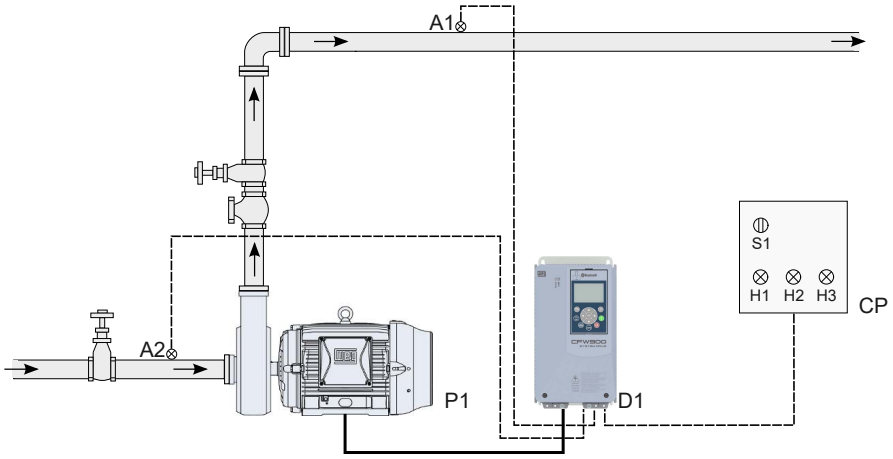
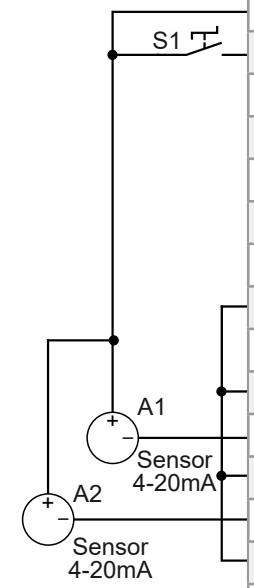


Figure 3.32: *Pump Genius application with pump protection via control auxiliary variable read by analog input*

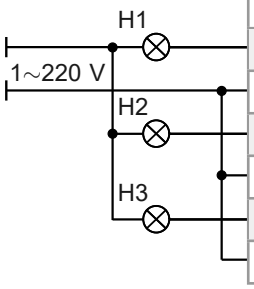
NOTE!
Use the Pump Genius application setup wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with pump protection via control auxiliary variable read by analog input.

NOTE!
The indicating light H1, H2 and H3 are not necessary for the operation of the Pump Genius and pump protection via control auxiliary variable read by analog input. They only indicate the condition of the pump operation at the command panel (CP).

The Figure 3.33 on page 3-39 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter to have the pump protection via control auxiliary variable read by analog input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: No function
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: Control auxiliary variable
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No alarm
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No fault
7	C3	Common of relay output 3n

Figure 3.33: *Signals on connectors of the IO modules for pump protection via control auxiliary variable*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.3.3 Flow Variable (Flow Limit Control)

The user can configure the Pump Genius application to have a sensor (flow measurement) installed on an analog input of the CFW900 frequency inverter to protect the pump. Which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- 01 Sensor with analog output signal for measurement of the flow variable (A2);
- Enable Pump Genius Command (S1);
- Status light for motor running (H1);
- Status light for inverter no fault (H2);
- Status light for inverter no alarm (H3).

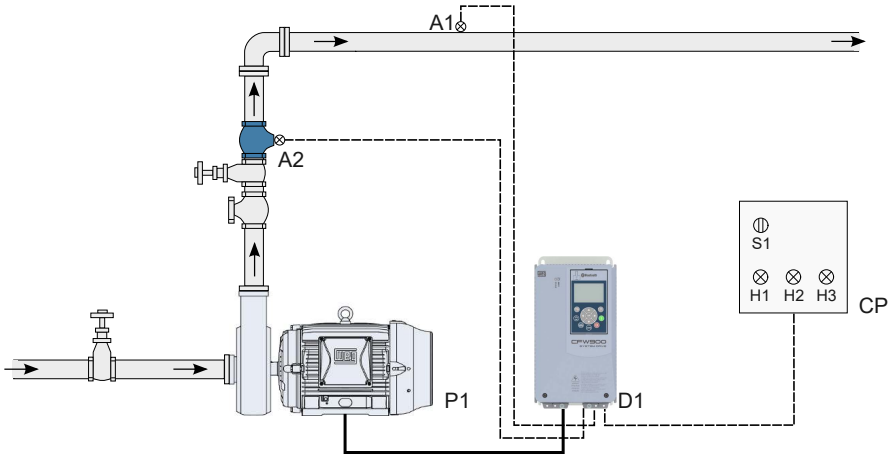
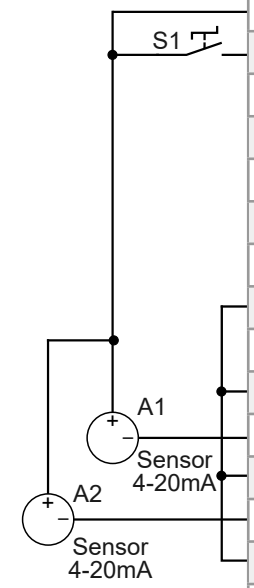


Figure 3.34: *Pump Genius application with pump protection via flow variable read by analog input*

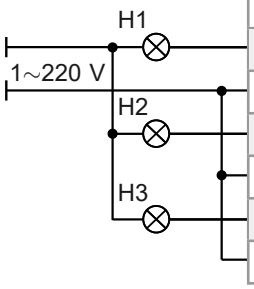
NOTE!
Use the Pump Genius application setup wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with pump protection via flow variable read by analog input.

NOTE!
The indicating light H1, H2 and H3 are not necessary for the operation of the Pump Genius and pump protection via flow variable read by analog input. They only indicate the condition of the pump operation at the command panel (CP).

The Figure 3.35 on page 3-41 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter to have the pump protection via flow variable read by analog input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: No function
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: Flow variable
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No alarm
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No fault
7	C3	Common of relay output 3n

Figure 3.35: *Signals on connectors of the IO modules for pump protection via flow variable*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

3.3.4 Deragging Function with Command via Digital Input

The user can configure the Pump Genius application to have an external command on a digital input of the CFW900 frequency inverter to execute the derraging function to clean and unblock the pump. Which basically comprises:

- 01 CFW900 frequency inverter (D1);
- 01 Electric motor and pump (P1);
- 01 Sensor with analog output signal for measurement of the control process variable (A1);
- Enable Pump Genius Command (S1);
- Command to execute the deragging function (S7);
- Status light for motor running (H1).

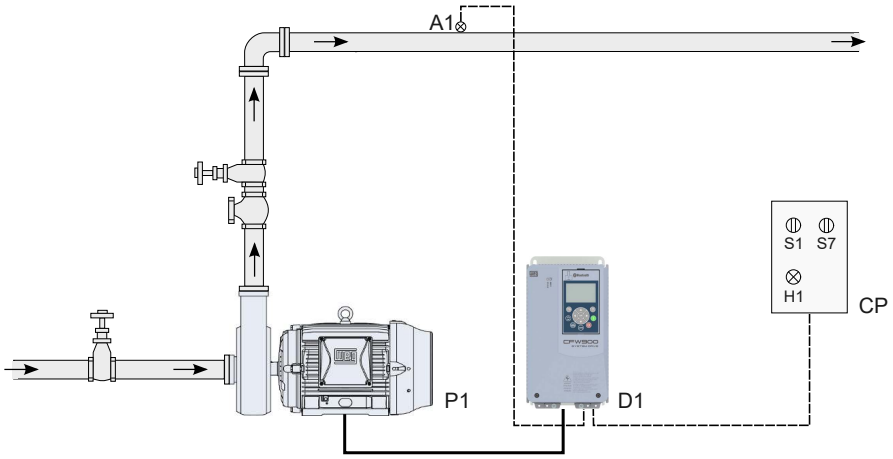
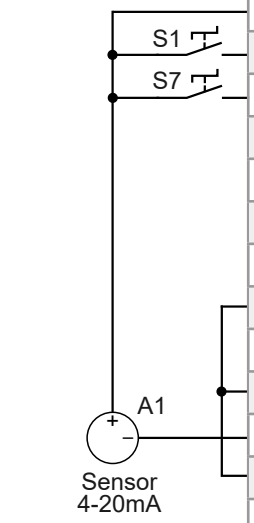


Figure 3.36: *Pump Genius application with external command on a digital input to the pump*

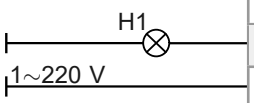
NOTE!
Use the Pump Genius application setup wizard in the WPS software to configure the pump driven by the CFW900 frequency inverter with external command on a digital input to perform the derraging function to clean and unblock the pump.

NOTE!
The indicating lights H1 is not necessary for the operation of the Pump Genius and the deragging function with command via digital input. It only indicates the condition of the pump operation at the command panel (CP).

The Figure 3.37 on page 3-43 presents the control connections (analog inputs/outputs, digital inputs/outputs) to the connectors of the IO modules of the CFW900 frequency inverter to have the deragging function with command via digital input.



Connector		Description CFW900-IOS - Slot X
1	AO1	Analog Output 1
2	AO2	Analog Output 2
3	GND	Control circuit reference
4	C	RS-485 interface reference
5	A(-)	RS-485 interface negative
6	B(+)	RS-485 interface positive
7	VIN	+24 Vdc external power supply input
8	GND	Control circuit reference
9	VOUT	+24 Vdc power supply output
10	DI1	Digital Input 1: Enable Pump Genius
11	DI2	Digital Input 2: Execute deragging function
12	DI3	Digital Input 3: No function
13	DI4	Digital Input 4: No function
14	DI5	Digital Input 5: No function
15	DI6	Digital Input 6: No function
16	COM	Common of the digital inputs
17	10 V	10 V power supply for potentiometer
18	GND	Control circuit reference
19	AI1+	Differential analog input 1: Control process variable
20	AI1-	Differential analog input 1
21	AI2+	Differential analog input 2: No function
22	AI2-	Differential analog input 2
23	DO1	Digital output 1: No function
24	DO2	Digital output 2: No function
25	VOUT	+24 Vdc power supply output
26	GND	Control circuit reference



Connector		Description REL-01 - Slot A
1	NC1	Normally-Closed Contact of relay output 1n
2	NO1	Normally-Open Contact of relay output 1n: Run
3	C1	Common of relay output 1n
4	NO2	Normally-Open Contact of relay output 2n: No function
5	C2	Common of relay output 2n
6	NO3	Normally-Open Contact of relay output 3n: No function
7	C3	Common of relay output 3n

Figure 3.37: *Signals on connectors of the IO modules for deragging function with command via digital input*

NOTE!
Refer to the CFW900 inverter manual and the REL-01 accessory module manuals for more information on connections.

4 A APPLICATION

User Application and Embedded Applications.

Special functions for motor control, processes or user program.

A3 PUMP GENIUS

The Pump Genius application can be used to control one or more pumps.

A3.1 Monitoring

This group of parameters allows the user to monitor the main informations of Pump Genius operation and command the setpoint and controls if the system is configured for network operation.

A3.1 Monitoring		
A3.1.1 Pump Genius Version		
Range:	0.00 ... 9.99	**Default:** 1.00
Properties:		

Description:
This parameter indicates the software version of the Pump Genius application developed for CFW900 frequency inverter.

NOTE!
The Pump Genius application (Simplex, Multipump and Multiplex) only works with the CFW900 frequency inverter with a **firmware version greater than V1.10.**

A3.1 Monitoring		
A3.1.2 Pump Genius Status 1		
Range:	0 ... 65535	**Default:** 0
Properties:		

Description:
This parameter allows the monitoring of the logical status 1 of the Pump Genius application. Each bit represents a state.

Table 4.1: *Description of the logical state 1 of the Pump Genius application*

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Pump 8 Running	Pump 7 Running	Pump 6 Running	Pump 5 Running	Pump 4 Running	Pump 3 Running	Pump 2 Running	Pump 1 Running	Pump 8 Enabled	Pump 7 Enabled	Pump 6 Enabled	Pump 5 Enabled	Pump 4 Enabled	Pump 3 Enabled	Pump 2 Enabled	Pump 1 Enabled

Bits	Values
Bit 0 Pump 1 Enabled	**0:** Indicates that Pump 1 is not enabled **1:** Indicates that Pump 1 is enabled
Bit 1 Pump 2 Enabled	**0:** Indicates that Pump 2 is not enabled **1:** Indicates that Pump 2 is enabled
Bit 2 Pump 3 Enabled	**0:** Indicates that Pump 3 is not enabled **1:** Indicates that Pump 3 is enabled
Bit 3 Pump 4 Enabled	**0:** Indicates that Pump 4 is not enabled **1:** Indicates that Pump 4 is enabled
Bit 4 Pump 5 Enabled	**0:** Indicates that Pump 5 is not enabled **1:** Indicates that Pump 5 is enabled
Bit 5 Pump 6 Enabled	**0:** Indicates that Pump 6 is not enabled **1:** Indicates that Pump 6 is enabled
Bit 6 Pump 7 Enabled	**0:** Indicates that Pump 7 is not enabled **1:** Indicates that Pump 7 is enabled
Bit 7 Pump 8 Enabled	**0:** Indicates that Pump 8 is not enabled **1:** Indicates that Pump 8 is enabled
Bit 8 Pump 1 Running	**0:** Indicates that Pump 1 is stopped **1:** Indicates that Pump 1 is running
Bit 9 Pump 2 Running	**0:** Indicates that Pump 2 is stopped **1:** Indicates that Pump 2 is running
Bit 10 Pump 3 Running	**0:** Indicates that Pump 3 is stopped **1:** Indicates that Pump 3 is running
Bit 11 Pump 4 Running	**0:** Indicates that Pump 4 is stopped **1:** Indicates that Pump 4 is running
Bit 12 Pump 5 Running	**0:** Indicates that Pump 5 is stopped **1:** Indicates that Pump 5 is running
Bit 13 Pump 6 Running	**0:** Indicates that Pump 6 is stopped **1:** Indicates that Pump 6 is running
Bit 14 Pump 7 Running	**0:** Indicates that Pump 7 is stopped **1:** Indicates that Pump 7 is running
Bit 15 Pump 8 Running	**0:** Indicates that Pump 8 is stopped **1:** Indicates that Pump 8 is running

4

A3.1 Monitoring

A3.1.3 Pump Genius Status 2

Range: 0 ... 65535 **Default:** 0

Properties:

Description:

This parameter allows the monitoring of the logical status 2 of the Pump Genius application. Each bit represents a state.

Table 4.2: *Description of the logical state 2 of the Pump Genius application*

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Jockey Pump Running	Priming Pump Running	Alternate Pump Command	Deragging Running	Anti-Cavitation	Friction Loss Compensation	Flow Limiting	Check Valve	Boost Function	Start Level Mode	Wake up Mode	Sleep Mode	Auto. PID	PID Enabled	Pipe Charging	Pump Genius Enabled

Bits	Values
Bit 0 Pump Genius Enabled	**0:** Indicates that Pump Genius is not enabled **1:** Indicates that Pump Genius is enabled
Bit 1 Pipe Charging	**0:** Indicates that pipe charging is not in progress **1:** Indicates that pipe charging is in progress
Bit 2 PID Enabled	**0:** Indicates that the PID controller is not enabled **1:** Indicates that the PID controller is enabled
Bit 3 PID controller in Manual / Automatic	**0:** Indicates that the PID controller is operating in manual mode **1:** Indicates that the PID controller is operating in automatic mode
Bit 4 Sleep Mode	**0:** Indicates that sleep mode is not in progress **1:** Indicates that sleep mode is in progress
Bit 5 Wake up Mode	**0:** Indicates that the wake-up command was not executed **1:** Indicates that the wake-up command was executed
Bit 6 Start Level Mode	**0:** Indicates that the command for start by level mode was not executed **1:** Indicates that the command for start by level mode was executed
Bit 7 Boost Function	**0:** Indicates that the boost function is not in progress **1:** Indicates that the boost function is in progress
Bit 8 Check Valve	**0:** Indicates that check valve is not in progress **1:** Indicates that check valve is in progress
Bit 9 Flow Limiting	**0:** Indicates that flow limiting is not in progress **1:** Indicates that flow limiting is in progress
Bit 10 Friction Loss Compensation	**0:** Indicates that friction loss compensation is not in progress **1:** Indicates that friction loss compensation is in progress
Bit 11 Anti-Cavitation	**0:** Indicates that anti-cavitation protection is not in progress **1:** Indicates that anti-cavitation protection is in progress
Bit 12 Deragging Running	**0:** Indicates that the deragging is not in progress **1:** Indicates that the deragging is in progress
Bit 13 Alternate Pump Command	**0:** Indicates that the command for alternate pump was not executed **1:** Indicates that the command for alternate pump was executed
Bit 14 Priming Pump Running	**0:** Indicates that the priming pump is not running **1:** Indicates that the priming pump is running
Bit 15 Jockey Pump Running	**0:** Indicates that the jockey pump is not running **1:** Indicates that the jockey pump is running

A3.1 Monitoring

A3.1.4 Pump Genius Status 3

Range: 0 ... 65535 **Default:** 0

Properties:

Description:

This parameter allows the monitoring of the logical status 3 of the Pump Genius application. Each bit represents a state.

Table 4.3: *Description of the logical state 2 of the Pump Genius application*

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reservado														Stop Pump in Parallel	Start Pump in Parallel

Bits	Values
Bit 0 Start Pump in Parallel	**0:** Indicates that the command to start the pump in parallel was not executed **1:** Indicates that the command to start the pump in parallel was executed
Bit 1 Stop Pump in Parallel	**0:** Indicates that the command to turn off pump in parallel was not executed **1:** Indicates that the command to turn off pump in parallel was executed
Bit 2 Reservado	Reservado
Bit 3 Reservado	Reservado
Bit 4 Reservado	Reservado
Bit 5 Reservado	Reservado
Bit 6 Reservado	Reservado
Bit 7 Reservado	Reservado
Bit 8 Reservado	Reservado
Bit 9 Reservado	Reservado
Bit 10 Reservado	Reservado
Bit 11 Reservado	Reservado
Bit 12 Reservado	Reservado
Bit 13 Reservado	Reservado
Bit 14 Reservado	Reservado
Bit 15 Reservado	Reservado

4

A3.1 Monitoring

A3.1.5 Pump Genius Command

Range: 0 ... 65535 **Default:** 0

Properties:

Description:

This parameter allows writing Pump Genius commands if the system is configured for network operation (Check A3.2.2, A3.3.1 and A3.5.7). Each bit represents a command.

Table 4.4: *Description of writing Pump Genius commands*

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved						Pump Derag. Command	Pump 8 Enable Command	Pump 7 Enable Command	Pump 6 Enable Command	Pump 5 Enable Command	Pump 4 Enable Command	Pump 3 Enable Command	Pump 2 Enable Command	Pump 1 Enable Command	Pump Genius Enable Command

Bits	Valores
Bit 0 Pump Genius Enable Command	**0:** Disable Pump Genius **1:** Enable Pump Genius
Bit 1 Pump 1 Enable Command	**0:** Disable pump 1 **1:** Enable pump 1
Bit 2 Pump 2 Enable Command	**0:** Disable pump 2 **1:** Enable pump 2
Bit 3 Pump 3 Enable Command	**0:** Disable pump 3 **1:** Enable pump 3
Bit 4 Pump 4 Enable Command	**0:** Disable pump 4 **1:** Enable pump 4
Bit 5 Pump 5 Enable Command	**0:** Disable pump 5 **1:** Enable pump 5
Bit 6 Pump 6 Enable Command	**0:** Disable pump 6 **1:** Enable pump 6
Bit 7 Pump 7 Enable Command	**0:** Disable pump 7 **1:** Enable pump 7
Bit 8 Pump 8 Enable Command	**0:** Disable pump 8 **1:** Enable pump 8
Bit 9 Pump Deragging Command	**0:** Remove the pump deragging command **1:** Commands pump deragging
Bit 10 Reserved	Reserved
Bit 11 Reserved	Reserved
Bit 12 Reserved	Reserved
Bit 13 Reserved	Reserved
Bit 14 Reserved	Reserved
Bit 15 Reserved	Reserved

A3.1 Monitoring

A3.1.6 User Setpoint

Range: -30000 ... 30000 **Default:** 800

Properties:

Description:
This parameter defines the value of the user control setpoint of the Pump Genius in engineering units when the control setpoint source was programmed to be via HMI or communication networks (Check A3.3.1).

The Figure 4.1 on page 4-5 illustrates the operation of the setpoint via HMI/Network, where the setpoint defined in parameter A3.1.6 is passed to the control setpoint value (A3.1.8) after friction compensation (if active).

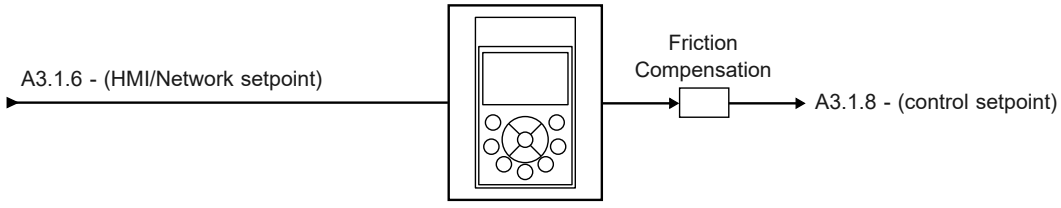


Figure 4.1: *Operation of the setpoint via HMI/Network*

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (C10.2.1 e C10.2.2).

A3.1 Monitoring

A3.1.7 Manual Setpoint

Range: 0 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the PID controller setpoint value when in manual mode. In this mode, the speed value defined in parameter A3.1.7 (setpoint in manual mode) is transferred directly to the output of the PID controller, thus defining the speed reference of the pump driven by the CFW900 frequency inverter.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.1 Monitoring

A3.1.8 Automatic Setpoint

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter shows the current automatic setpoint of the Pump Genius control.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (C10.2.1 e C10.2.2).

A3.1 Monitoring

A3.1.9 Process Variable

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter indicates the value of the Pump Genius process variable according to the source defined in A3.3.2.1 and the scale defined in A3.3.2.2 and A3.3.2.3.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.1 Monitoring

A3.1.10 Auxiliary Variable

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter shows the auxiliary control variable for pump protection (suction control) according to the source of the auxiliary control variable defined in A3.3.4.1 and scale defined in A3.3.4.3 and A3.3.4.4.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 4 (C10.2.7 and C10.2.8).

A3.1 Monitoring

A3.1.11 Flow Variable

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter shows the flow variable used for flow limitation protection according to the source of the flow variable defined in A3.3.5.1 and scale defined in A3.3.5.3 and A3.3.5.4.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 3 (C10.2.5 and C10.2.6).

A3.1 Monitoring

A3.1.12 Pump Speed

Range: 0 ... 30000 **Default:** 0

Properties:

Description:
This parameter indicates the pump speed.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.1 Monitoring

A3.1.13 Inv. Pump Operation

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time (running the pump) value of the CFW900 frequency inverter.

A3.1 Monitoring

A3.1.14 Operation Time Pump 1

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 1. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.15 Operation Time Pump 2

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 2. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.16 Operation Time Pump 3

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 3. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.17 Operation Time Pump 4

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 4. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.18 Operation Time Pump 5

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 5. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.19 Operation Time Pump 6

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 6. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.20 Operation Time Pump 7

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 7. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

A3.1 Monitoring

A3.1.21 Operation Time Pump 8

Range: 0 ... 65535 h **Default:** 0 h

Properties:

Description:
This parameter indicates the operating time value of the pump 8. It is the value used to define which pump in parallel will be turned on or off by Pump Genius.

NOTE!
It is possible to reset the operating time by setting the parameter to the value 65535.

A3.2 Configuration

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

A3.2.1 Configuration Mode

This group of parameters allows the user to configure the operating mode of the Pump Genius.

A3.2.1 Configuration Mode		
A3.2.1.1 Pump Genius Mode		
Range:	0 ... 6	**Default:** 1
Properties:		

Description:
This parameter defines the Pump Genius Mode. This setting depends on the quantity of pumps to be operated and how the pumps will be controlled by the Pump Genius Software. The characteristics of the modes are as follows:

- Simplex: control applies to a single pump operation;
- Multipump Fixed Control: control of up to 9 (nine) pumps associated in parallel, one pump (always the same) driven by the CFW900 frequency inverter, and the others by some other starting method;
- Multipump Floating Control: control of up to 8 (eight) pumps associated in parallel where the first pump to be connected is connected to the CFW900 frequency inverter, and the other pumps are switched on and off via contactors;
- Multipump Cascade Control: control of up to 8 (eight) pumps associated in parallel where the last pump turned on is connected to the CFW900 frequency inverter, and the other pumps are switched on and off via contactors;
- Multipump Floating control and cascade control: allows the exchange of the pump driven by the CFW900 frequency inverter;
- Multiplex: control up to 8 (eight) pumps associated in parallel, each pump is driven by its respective CFW900 frequency inverter, thus allowing the speed of all pumps in the system to be controlled (all operate at the same speed).

The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	Defines the Pump Genius as inactive.
1 = Simplex	Defines the Pump Genius as Simplex.
2 = Multipump Fixed	Defines the Pump Genius as Multipump Fixed.
3 = Multipump Mobile	Defines the Pump Genius as Multipump Floating.
4 = Multipump Cascade	Defines the Pump Genius as Multipump Cascade.
5 = Multiplex Master	Defines the Pump Genius as Multiplex Master.
6 = Multiplex Follower	Defines the Pump Genius as Multiplex Follower.

A3.2.1 Configuration Mode		
A3.2.1.2 Start/Stop Seq.		
Range:	0 ... 1	**Default:** 0
Properties:		

Description:
This parameter defines the criteria to start/stop the pumps operating in parallel. This selection depends on the strategy about the system wearing and maintenance. The following table demonstrates the parameter options.

Indication	Description
0 = Sequential	Defines that the pumps will be activated in parallel (start and stop) in sequence.
1 = Operation Time	Defines that the pumps will be activated in parallel (start and stop) based on operating time.

A3.2.1 Configuration Mode

A3.2.1.3 Pumps Number

Range: 1 ... 8 **Default:** 1

Properties:

Description:
This parameter defines the total number of pumps that will operate in the Pump Genius application in Multipump and Multiplex modes.

NOTE!
For Pump Genius Multipump Fixed, the number of pumps to be adjusted is the number of pumps controlled by digital output commands. This means that the pump controlled directly by the output of the inverter is not included.

A3.2.1 Configuration Mode

A3.2.1.4 Pump Address

Range: 1 ... 8 **Default:** 1

Properties:

Description:
This parameter defines the pump address. This parameter is used in the Pump Genius application in Multiplex mode.

A3.2.1 Configuration Mode

A3.2.1.5 Master Change Time

Range: 0.0 ... 99.9 s **Default:** 0.0 s

Properties:

Description:
This parameter defines the time for another pump to take over the master pump function in Pump Genius Multiplex mode when there is a loss of signal from the pump that was acting as the master (A1858). This signal loss will be detected by the other pumps in the network.

If the time value has elapsed without a signal from the current master pump, a command will be generated for all pumps so that a new pump can take over the master function in Pump Genius. Only pumps programmed with the master pump function can assume this role.

NOTE!
Setting to “0s” disables automatic change of the master pump and enables the alarm “A1854: Change Master Pump? ENTER (yes) ESC (no)” for manual change.

A3.2.2 Pump Enabling

This group of parameters allows the user to configure the pump enable source settings of the Pump Genius.

A3.2.2 Pump Enabling

A3.2.2.1 Enable PG Source

Range: 0 ... 15 **Default:** 1

Properties:

Description:
It enables the use and defines the source to enable the Pump Genius. This is the main function of Pump Genius. If the Pump Genius is not enabled, it means that the system is turned off. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.2 Enable Pump 1 Source		
Range:	0 ... 15	**Default:** 2
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 1 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.3 Enable Pump 2 Source		
Range:	0 ... 15	**Default:** 0
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 2 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.4 Enable Pump 3 Source		
Range:	0 ... 15	**Default:** 0
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 3 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.5 Enable Pump 4 Source		
Range:	0 ... 15	**Default:** 0
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 4 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.6 Enable Pump 5 Source		
Range:	0 ... 15	**Default:** 0
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 5 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling		
A3.2.2.7 Enable Pump 6 Source		
Range:	0 ... 15	**Default:** 0
Properties:		

Description:
It enables the use and defines the source that will be used to enable pump 6 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling
A3.2.2.8 Enable Pump 7 Source
Range: 0 ... 15 **Default:** 0
Properties:

Description:
It enables the use and defines the source that will be used to enable pump 7 of the Pump Genius. The options are shown in parameter A3.2.2.9.

A3.2.2 Pump Enabling
A3.2.2.9 Enable Pump 8 Source
Range: 0 ... 15 **Default:** 0
Properties:

Description:
It enables the use and defines the source that will be used to enable pump 8 of the Pump Genius. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.
15 = Network	It enables the use of the network.

A3.2.2 Pump Enabling
A3.2.2.10 Cascade Feedback Source
Range: 0 ... 14 **Default:** 0
Properties:

Description:
It enables the use and defines the source that will be used to the feedback of the cascade control. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.

Indication	Description
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.

A3.3 Control

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

A3.3.1 Setpoint

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

A3.3.1 Setpoint

A3.3.1.1 Setpoint Selection

Range: 0 ... 4 **Default:** 0

Properties:

Description:
This parameter defines the source of the Pump Genius control setpoint. The following table demonstrates the parameter options.

Indication	Description
0 = HMI/Network	Defines that the source of the Pump Genius control setpoint (PID in automatic) will be the value programmed in parameter A3.1.6 using the frequency inverter HMI or written via communication networks.
1 = Analog Input	Defines that the setpoint source for the control (PID in automatic mode) of the Pump Genius will be the value read by the analog input programmed in parameter A3.3.1.5. The setpoint value can be viewed in parameter A3.1.8.
2 = Electronic Potentiometer	Defines that the setpoint source for the control (PID in automatic mode) of the Pump Genius will be via the Electronic Potentiometer programmed in parameters A3.3.1.6 and A3.3.1.7. The setpoint value can be viewed in parameter A3.1.8.
3 = Multispeed	Defines that the setpoint source for the control (PID in automatic mode) of the Pump Genius will be via the Multispeed programmed in parameters A3.3.1.8, A3.3.1.9, A3.3.1.35, A3.3.1.36, A3.3.1.37 and A3.3.1.38. The setpoint value can be viewed in parameter A3.1.8.
4 = Scheduling	Defines that the setpoint source for the control (PID in automatic mode) of the Pump Genius will be via Scheduling programmed between parameters A3.3.1.10 and A3.3.1.46. The setpoint value can be viewed in parameter A3.1.8.

A3.3.1 Setpoint

A3.3.1.2 Static Compen.

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the level of static compensation (static head of the pump) for friction compensation function.

The Figure 4.2 on page 4-14 presents the operation of the Pump Genius friction compensation. Based on the user's setpoint value, whose source is defined in parameter A3.3.1.1, plus the static compensation (A3.3.1.2), the initial value of the setpoint compensation at the pump's minimum speed (C4.3.1.1.1) is defined. The final value of the setpoint compensation at the pump's maximum speed (C4.3.1.1.2) is the sum of the initial value with the dynamic compensation (A3.3.1.3). The way the compensated setpoint value between the pump's minimum and maximum speed is calculated is defined in parameter A3.3.1.4, which can vary from a linear function (0%) to a quadratic function (100%). The friction compensation function ensures that the considered setpoint provides the desired pressure at a point different from the pump's outlet pressure sensor, with the flexibility to adjust the compensation function to be compatible with system losses.

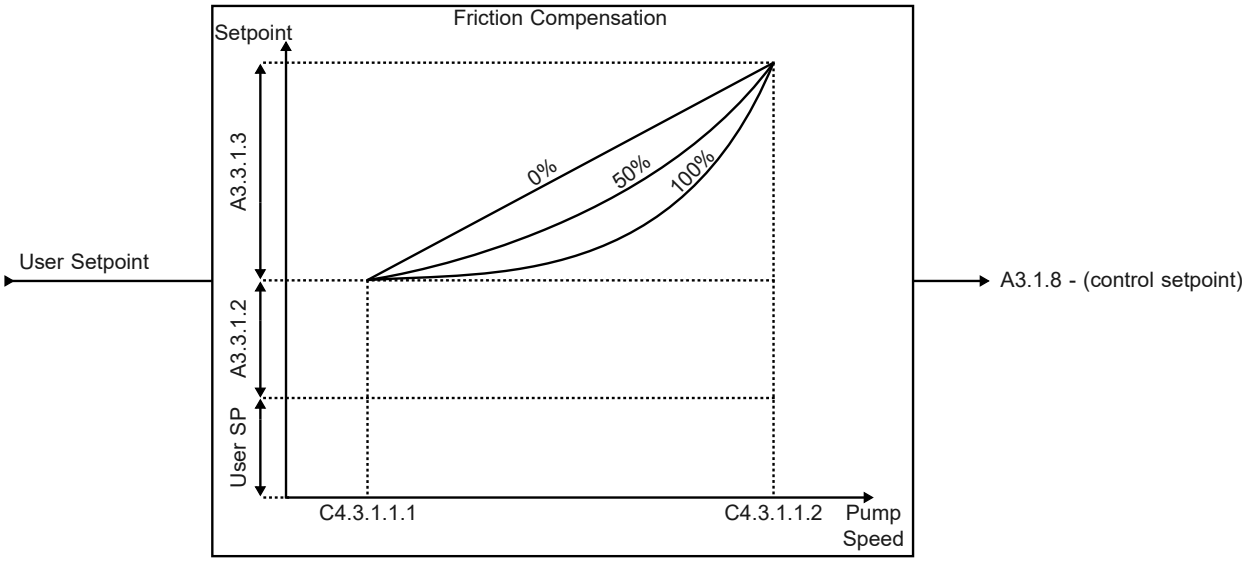


Figure 4.2: *Operating of the Pump Genius friction compensation*

NOTE!
Setting parameters A3.3.1.2 and A3.3.1.3 to "0.0" disables the friction compensation function.

A3.3.1 Setpoint		
A3.3.1.3 Dynamic compen.		
Range:	-30000 ... 30000	**Default:** 0
Properties:		

Description:
This parameter defines the level of dynamic compensation (total pumping loss) for friction compensation function.

NOTE!
Setting parameters A3.3.1.2 and A3.3.1.3 to "0.0" disables the friction compensation function.

A3.3.1 Setpoint		
A3.3.1.4 Friction Comp. Function		
Range:	0.0 ... 100.0 %	**Default:** 0.0 %
Properties:		

Description:
This parameter defines the friction compensation function, where "100%" defines a quadratic curve and "0%" defines a linear compensation.

A3.3.1 Setpoint

A3.3.1.5 Setpoint AI Source

Range: 0 ... 8 **Default:** 2

Properties:

Description:
Defines the analog input that will be the setpoint source when the setpoint selection (A3.3.1.1) is analog input.

The Figure 4.3 on page 4-15 illustrates the operation of the setpoint via analog input, where the input is defined in parameter A3.3.1.5, which is read and passed to the control setpoint value (A3.1.8) after friction compensation (if active).

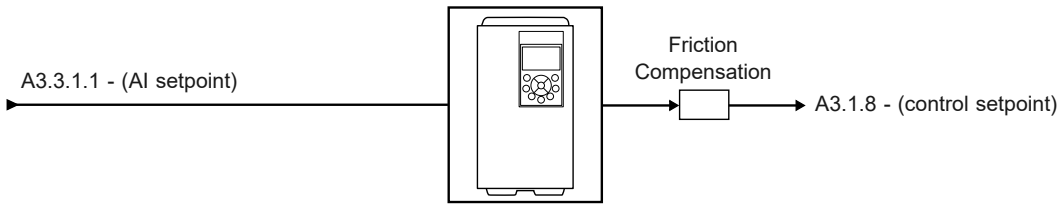


Figure 4.3: *Operation of the setpoint via analog input*

The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the analog input in this function.
1 = AI X-1	It enables the use of the analog input AI1 of Slot X.
2 = AI X-2	It enables the use of the analog input AI2 of Slot X.
3 = AI B-1	It enables the use of the analog input AI1 of Slot B.
4 = AI B-2	It enables the use of the analog input AI2 of Slot B.
5 = AI B-3	It enables the use of the analog input AI3 of Slot B.
6 = AI C-1	It enables the use of the analog input AI1 of Slot C.
7 = AI C-2	It enables the use of the analog input AI2 of Slot C.
8 = AI C-3	It enables the use of the analog input AI3 of Slot C.

A3.3.1 Setpoint

A3.3.1.6 Increase EP Source

Range: 0 ... 14 **Default:** 5

Properties:

Description:
Defines the digital input that will be to increase the setpoint value when the setpoint selection (A3.3.1.1) is electronic potentiometer.

The Figure 4.4 on page 4-16 presents the operation of the electronic potentiometer (EP) function. As the digital input DIx, defined in parameter A3.3.1.6, is activated, the value of the control setpoint (A3.1.8) is increased after friction compensation (if active) and as the digital input DIx defined in parameter A3.3.1.7 is activated, the control setpoint value (A3.1.8) is decreased after friction compensation (if active). If the two digital inputs are activated at the same time, the value remains the same.

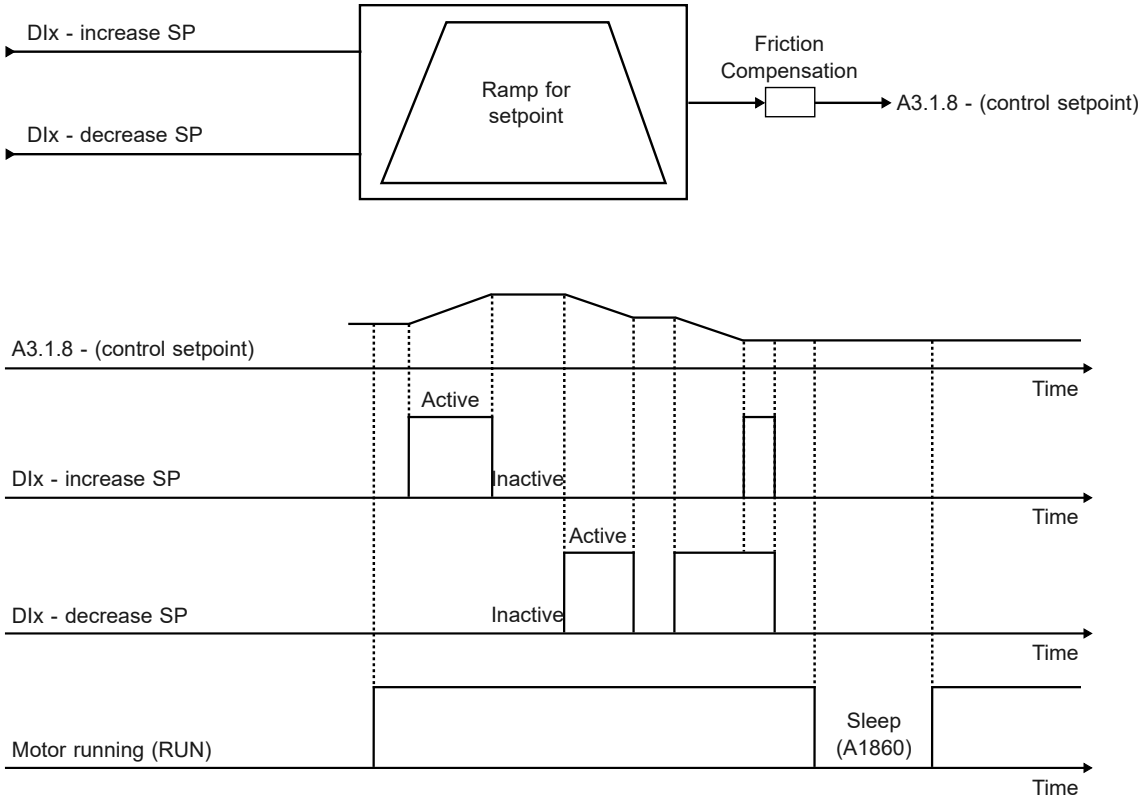


Figure 4.4: *Operational graphic of the electronic potentiometer function (EP)*

The options are shown in parameter A3.3.1.9.

A3.3.1 Setpoint		
A3.3.1.7 Decrease EP Source		
Range:	0 ... 14	**Default:** 6
Properties:		

Description:
Defines the digital input that will be to decrease the setpoint value when the setpoint selection (A3.3.1.1) is electronic potentiometer. The options are shown in parameter A3.3.1.9.

A3.3.1 Setpoint		
A3.3.1.8 Multspd DI #1 Source		
Range:	0 ... 14	**Default:** 5
Properties:		

Description:
Defines the digital input that will be DI1 to change the setpoint value when the setpoint selection (A3.3.1.1) is multispeed.

When the control setpoint is via a logical combination of digital inputs (Multispeed) the following truth table must be applied to obtain the control setpoint of the PID controller.

Table 4.11: *Truth table for control setpoint via logical combination of the digital inputs (Multispeed)*

	A3.3.1.35 - Control Setpoint 1	**A3.3.1.36 - Control Setpoint 2**	**A3.3.1.37 - Control Setpoint 3**	**A3.3.1.38 - Control Setpoint 4**
Digital Input DIx - A3.3.1.8	0	1	0	1
Digital Input DIx - A3.3.1.9	0	0	1	1

The options are shown in parameter A3.3.1.9.

A3.3.1 Setpoint

A3.3.1.9 Multspd DI #2 Source

Range: 0 ... 14 **Default:** 6

Properties:

Description:
Defines the digital input that will be DI2 to change the setpoint value when the setpoint selection (A3.3.1.1) is multispeed. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.

A3.3.1 Setpoint

A3.3.1.10 Scheduling Prog. Mode

Range: 0 ... 4 **Default:** 1

Properties:

Description:
Enables the use and defines the time scheduling (day(s) of the week and hour of the setpoints when the setpoint selection (A3.3.1.1) is scheduling).

The Tables 4.13, 4.14, 4.15 and 4.16 show the times that remain active based on the hour and minute adjustment, and the mode of operation according to the days of the week, in line with the parameter A3.3.1.10 adjustment. For each time scheduling there is a corresponding Process control setpoint (Ex.: For schedule 1 (A3.3.1.11 and A3.3.1.12) the setpoint 1 (A3.3.1.35) is used).

Table 4.13: *Table of start and end of each schedule according to the days of week for A3.3.1.10 = 1*

A3.3.1.10 = 1 (Monday to Sunday)							
Start	**Hour**	**Minute**	**Stop**	**Hour**	**Minute**	**Schedule Setpoint**	
Schedule 1	A3.3.11	A3.3.12	Schedule 2	A3.3.13	A3.3.14	Setpoint 1	A3.3.1.35
Schedule 2	A3.3.13	A3.3.14	Schedule 3	A3.3.15	A3.3.16	Setpoint 2	A3.3.1.36
Schedule 3	A3.3.15	A3.3.16	Schedule 4	A3.3.17	A3.3.18	Setpoint 3	A3.3.1.37
Schedule 4	A3.3.17	A3.3.18	Schedule 5	A3.3.19	A3.3.20	Setpoint 4	A3.3.1.38
Schedule 5	A3.3.19	A3.3.20	Schedule 6	A3.3.21	A3.3.22	Setpoint 5	A3.3.1.39
Schedule 6	A3.3.21	A3.3.22	Schedule 7	A3.3.23	A3.3.24	Setpoint 6	A3.3.1.40
Schedule 7	A3.3.23	A3.3.24	Schedule 8	A3.3.25	A3.3.26	Setpoint 7	A3.3.1.41
Schedule 8	A3.3.25	A3.3.26	Schedule 9	A3.3.27	A3.3.28	Setpoint 8	A3.3.1.42
Schedule 9	A3.3.27	A3.3.28	Schedule 10	A3.3.29	A3.3.30	Setpoint 9	A3.3.1.43
Schedule 10	A3.3.29	A3.3.30	Schedule 11	A3.3.31	A3.3.32	Setpoint 10	A3.3.1.44
Schedule 11	A3.3.31	A3.3.32	Schedule 12	A3.3.33	A3.3.34	Setpoint 11	A3.3.1.45
Schedule 12	A3.3.33	A3.3.34	Schedule 1	A3.3.11	A3.3.12	Setpoint 12	A3.3.1.46

Table 4.14: *Table of start and end of each schedule according to the days of week for A3.3.1.10 = 2*

A3.3.1.10 = 2 (Monday to Friday and Saturday to Sunday)							
Monday to Friday							
Start	**Hour**	**Minute**	**Stop**	**Hour**	**Minute**	**Schedule Setpoint**	
Schedule 1	A3.3.11	A3.3.12	Schedule 2	A3.3.13	A3.3.14	Setpoint 1	A3.3.1.35
Schedule 2	A3.3.13	A3.3.14	Schedule 3	A3.3.15	A3.3.16	Setpoint 2	A3.3.1.36
Schedule 3	A3.3.15	A3.3.16	Schedule 4	A3.3.17	A3.3.18	Setpoint 3	A3.3.1.37
Schedule 4	A3.3.17	A3.3.18	Schedule 5	A3.3.19	A3.3.20	Setpoint 4	A3.3.1.38
Schedule 5	A3.3.19	A3.3.20	Schedule 6	A3.3.21	A3.3.22	Setpoint 5	A3.3.1.39
Monday to Thursday							
Schedule 6	A3.3.21	A3.3.22	Schedule 1	A3.3.11	A3.3.12	Setpoint 6	A3.3.1.40
Friday							
Schedule 6	A3.3.21	A3.3.22	Schedule 7	A3.3.23	A3.3.24	Setpoint 6	A3.3.1.40
Saturday to Sunday							
Schedule 7	A3.3.23	A3.3.24	Schedule 8	A3.3.25	A3.3.26	Setpoint 7	A3.3.1.41
Schedule 8	A3.3.25	A3.3.26	Schedule 9	A3.3.27	A3.3.28	Setpoint 8	A3.3.1.42
Schedule 9	A3.3.27	A3.3.28	Schedule 10	A3.3.29	A3.3.30	Setpoint 9	A3.3.1.43
Schedule 10	A3.3.29	A3.3.30	Schedule 11	A3.3.31	A3.3.32	Setpoint 10	A3.3.1.44
Schedule 11	A3.3.31	A3.3.32	Schedule 12	A3.3.33	A3.3.34	Setpoint 11	A3.3.1.45
Saturday							
Schedule 12	A3.3.33	A3.3.34	Schedule 7	A3.3.23	A3.3.24	Setpoint 12	A3.3.1.46
Sunday							
Schedule 12	A3.3.33	A3.3.34	Schedule 1	A3.3.11	A3.3.12	Setpoint 12	A3.3.1.46

Table 4.15: *Table of start and end of each schedule according to the days of week for A3.3.1.10 = 3*

A3.3.1.10 = 3 (Monday to Friday, Saturday, Sunday)							
Monday to Friday							
Start	**Hour**	**Minute**	**Stop**	**Hour**	**Minute**	**Schedule Setpoint**	
Schedule 1	A3.3.11	A3.3.12	Schedule 2	A3.3.13	A3.3.14	Setpoint 1	A3.3.1.35
Schedule 2	A3.3.13	A3.3.14	Schedule 3	A3.3.15	A3.3.16	Setpoint 2	A3.3.1.36
Schedule 3	A3.3.15	A3.3.16	Schedule 4	A3.3.17	A3.3.18	Setpoint 3	A3.3.1.37
Monday to Thursday							
Schedule 4	A3.3.17	A3.3.18	Schedule 1	A3.3.11	A3.3.12	Setpoint 4	A3.3.1.38
Friday							
Schedule 4	A3.3.17	A3.3.18	Schedule 5	A3.3.19	A3.3.20	Setpoint 4	A3.3.1.38
Saturday							
Schedule 5	A3.3.19	A3.3.20	Schedule 6	A3.3.21	A3.3.22	Setpoint 5	A3.3.1.39
Schedule 6	A3.3.21	A3.3.22	Schedule 7	A3.3.23	A3.3.24	Setpoint 6	A3.3.1.40
Schedule 7	A3.3.23	A3.3.24	Schedule 8	A3.3.25	A3.3.26	Setpoint 7	A3.3.1.41
Schedule 8	A3.3.25	A3.3.26	Schedule 9	A3.3.27	A3.3.28	Setpoint 8	A3.3.1.42
Sunday							
Schedule 9	A3.3.27	A3.3.28	Schedule 10	A3.3.29	A3.3.30	Setpoint 9	A3.3.1.43
Schedule 10	A3.3.29	A3.3.30	Schedule 11	A3.3.31	A3.3.32	Setpoint 10	A3.3.1.44
Schedule 11	A3.3.31	A3.3.32	Schedule 12	A3.3.33	A3.3.34	Setpoint 11	A3.3.1.45
Schedule 12	A3.3.33	A3.3.34	Schedule 1	A3.3.11	A3.3.12	Setpoint 12	A3.3.1.46

Table 4.16: Table of start and end of each schedule according to the days of week for A3.3.1.10 = 4

A3.3.1.10 = 4 (Sunday to Thrusday, Friday, Saturday)							
Sunday to Thrusday							
Start	**Hour**	**Minute**	**Stop**	**Hour**	**Minute**	**Schedule Setpoint**	
Schedule 1	A3.3.11	A3.3.12	Schedule 2	A3.3.13	A3.3.14	Setpoint 1	A3.3.1.35
Schedule 2	A3.3.13	A3.3.14	Schedule 3	A3.3.15	A3.3.16	Setpoint 2	A3.3.1.36
Schedule 3	A3.3.15	A3.3.16	Schedule 4	A3.3.17	A3.3.18	Setpoint 3	A3.3.1.37
Sunday to Wednesday							
Schedule 4	A3.3.17	A3.3.18	Schedule 1	A3.3.11	A3.3.12	Setpoint 4	A3.3.1.38
Thrusday							
Schedule 4	A3.3.17	A3.3.18	Schedule 5	A3.3.19	A3.3.20	Setpoint 4	A3.3.1.38
Friday							
Schedule 5	A3.3.19	A3.3.20	Schedule 6	A3.3.21	A3.3.22	Setpoint 5	A3.3.1.39
Schedule 6	A3.3.21	A3.3.22	Schedule 7	A3.3.23	A3.3.24	Setpoint 6	A3.3.1.40
Schedule 7	A3.3.23	A3.3.24	Schedule 8	A3.3.25	A3.3.26	Setpoint 7	A3.3.1.41
Schedule 8	A3.3.25	A3.3.26	Schedule 9	A3.3.27	A3.3.28	Setpoint 8	A3.3.1.42
Saturday							
Schedule 9	A3.3.27	A3.3.28	Schedule 10	A3.3.29	A3.3.30	Setpoint 9	A3.3.1.43
Schedule 10	A3.3.29	A3.3.30	Schedule 11	A3.3.31	A3.3.32	Setpoint 10	A3.3.1.44
Schedule 11	A3.3.31	A3.3.32	Schedule 12	A3.3.33	A3.3.34	Setpoint 11	A3.3.1.45
Schedule 12	A3.3.33	A3.3.34	Schedule 1	A3.3.11	A3.3.12	Setpoint 12	A3.3.1.46

NOTE!
To disable a specific Schedule setpoint adjust the Hour to 23 and Minute to 59. Example: With parameter A3.3.1.31 set to 23 and A3.3.1.32 set to 59 (schedule 11), setpoint 11 A3.3.1.45 is deactivated.

The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the function.
1 = Mon to Sun	Enables the use of the scheduling function, with this selection the 12 setpoints (Parameter A3.3.1.35 to A3.3.1.46) and schedules (Parameter A3.3.1.11 to A3.3.1.34) apply equally from Monday to Sunday.
2 = Mon to Fri; Sat to Sun	Enables the use of the scheduling function, with this selection the first 6 setpoints (Parameter A3.3.1.35 to A3.3.1.40) and schedules (Parameter A3.3.1.11 to A3.3.1.22) apply from Monday to Friday, and the last 6 setpoints (Parameter A3.3.1.41 to A3.3.1.46) and schedules (Parameter A3.3.1.23 to A3.3.1.34) apply from Saturday to Sunday.
3 = Mon to Fri; Sat; Sun	Enables the use of the scheduling function, with this selection the first 4 setpoints (Parameter A3.3.1.35 to A3.3.1.38) and schedules (Parameter A3.3.1.11 to A3.3.1.18) apply from Monday to Friday, the next 4 setpoints (Parameter A3.3.1.39 to A3.3.1.42) and schedules (Parameter A3.3.1.19 to A3.3.1.26) apply on Saturday, and the last 4 setpoints (Parameter A3.3.1.43 to A3.3.1.46) and schedules (Parameter A3.3.1.27 to A3.3.1.34) apply on Sunday.
4 = Sun to Thu; Fri; Sat	Enables the use of the scheduling function, with this selection the first 4 setpoints (Parameter A3.3.1.35 to A3.3.1.38) and schedules (Parameter A3.3.1.11 to A3.3.1.18) apply from Sunday to Thursday, the next 4 setpoints (Parameter A3.3.1.39 to A3.3.1.42) and schedules (Parameter A3.3.1.19 to A3.3.1.26) apply on Friday, and the last 4 setpoints (Parameter A3.3.1.43 to A3.3.1.46) and schedules (Parameter A3.3.1.27 to A3.3.1.34) apply on Saturday.

A3.3.1 Setpoint

A3.3.1.11 Prog. Hour #1

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #1 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.12 Prog. Minute #1

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #1 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.13 Prog. Hour #2

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #2 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.14 Prog. Minute #2

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #2 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.15 Prog. Hour #3

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #3 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.16 Prog. Minute #3

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #3 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.17 Prog. Hour #4

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #4 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.18 Prog. Minute #4

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #4 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.19 Prog. Hour #5

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #5 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.20 Prog. Minute #5

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #5 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.21 Prog. Hour #6

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #6 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.22 Prog. Minute #6

Range: 0 ... 59 **Default:** 59

Properties:

Description:
This parameter defines the minutes of the Schedule #6 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.23 Prog. Hour #7

Range: 0 ... 23 **Default:** 23

Properties:

Description:
This parameter defines hour of the Schedule #7 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.24 Prog. Minute #7

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #7 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.25 Prog. Hour #8

Range:	0 ... 23	**Default:** 23
Properties:		

Description:
This parameter defines hour of the Schedule #8 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.26 Prog. Minute #8

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #8 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.27 Prog. Hour #9

Range:	0 ... 23	**Default:** 23
Properties:		

Description:
This parameter defines hour of the Schedule #9 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.28 Prog. Minute #9

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #9 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.29 Prog. Hour #10

Range:	0 ... 23	**Default:** 23
Properties:		

Description:
This parameter defines hour of the Schedule #10 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.30 Prog. Minute #10

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #10 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.31 Prog. Hour #11

Range:	0 ... 23	**Default:** 23
Properties:		

Description:
This parameter defines hour of the Schedule #11 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.32 Prog. Minute #11

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #11 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.33 Prog. Hour #12

Range:	0 ... 23	**Default:** 23
Properties:		

Description:
This parameter defines hour of the Schedule #12 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.34 Prog. Minute #12

Range:	0 ... 59	**Default:** 59
Properties:		

Description:
This parameter defines the minutes of the Schedule #12 that will be used when the setpoint selection (A3.3.1.1) is scheduling.

A3.3.1 Setpoint

A3.3.1.35 Control Setpoint 1

Range:	-30000 ... 30000	**Default:** 0
Properties:		

Description:
This parameter defines the value of setpoint 1 (Schedule #1) for the Pump Genius control when the setpoint selection (A3.3.1.1) is multispeed or scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.36 Control Setpoint 2

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 2 (Schedule #2) for the Pump Genius control when the setpoint selection (A3.3.1.1) is multispeed or scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.37 Control Setpoint 3

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 3 (Schedule #3) for the Pump Genius control when the setpoint selection (A3.3.1.1) is multispeed or scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.38 Control Setpoint 4

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 4 (Schedule #4) for the Pump Genius control when the setpoint selection (A3.3.1.1) is multispeed or scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.39 Control Setpoint 5

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 5 (Schedule #5) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.40 Control Setpoint 6

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 6 (Schedule #6) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.41 Control Setpoint 7

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 7 (Schedule #7) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.42 Control Setpoint 8

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 8 (Schedule #8) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.43 Control Setpoint 9

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 9 (Schedule #9) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.44 Control Setpoint 10

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 10 (Schedule #10) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.45 Control Setpoint 11

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 11 (Schedule #11) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.1 Setpoint

A3.3.1.46 Control Setpoint 12

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the value of setpoint 12 (Schedule #12) for the Pump Genius control when the setpoint selection (A3.3.1.1) is scheduling.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.3.2 Process Variable

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

A3.3.2 Process Variable

A3.3.2.1 Process Var. Source

Range: 0 ... 13 **Default:** 1

Properties:

Description:
Defines the source of the process variable. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the analog input in this function.
1 = AI X-1	It enables the use of the analog input AI1 of Slot X.
2 = AI X-2	It enables the use of the analog input AI2 of Slot X.
3 = AI B-1	It enables the use of the analog input AI1 of Slot B.
4 = AI B-2	It enables the use of the analog input AI2 of Slot B.
5 = AI B-3	It enables the use of the analog input AI3 of Slot B.
6 = AI C-1	It enables the use of the analog input AI1 of Slot C.
7 = AI C-2	It enables the use of the analog input AI2 of Slot C.
8 = AI C-3	It enables the use of the analog input AI3 of Slot C.
9 = FI X-5	It enables the use of the frequency input FI5 of Slot X.
10 = FI X-6	It enables the use of the frequency input FI6 of Slot X.
11 = Slot X (AI1 - AI2)	It enables the use of analog inputs AI1 and AI2 (AI1-AI2) of Slot X
12 = Slot B (AI1 - AI2)	It enables the use of analog inputs AI1 and AI2 (AI1-AI2) of Slot B
13 = Slot C (AI1 - AI2)	It enables the use of analog inputs AI1 and AI2 (AI1-AI2) of Slot C

A3.3.2 Process Variable

A3.3.2.2 Min. Range PV Sensor

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the minimum value of the sensor configured for the process variable of the Pump Genius control.

The reading value of A3.1.9 and internal logic manipulation will be limited through this limits (A3.3.2.2 and A3.3.2.3).

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (C10.2.1 e C10.2.2).

A3.3.2 Process Variable

A3.3.2.3 Max. Range PV Sensor

Range: -30000 ... 30000 **Default:** 1000

Properties:

Description:
This parameter defines the maximum value of the sensor configured for the process variable of the Pump Genius control.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (C10.2.1 e C10.2.2).

A3.3.3 Process PID

This group of parameters allows the user to configure the Process PID (PID 1) of the Pump Genius.

The PID controller 1 allows controlling the speed of the motor (pump) driven by the CFW900 frequency inverter by comparing the control process variable (feedback) with the control setpoint required by the user, in order to eliminate the error to keep the variable equal to the control setpoint required by the user. The adjustment of

gains P, I and D determine the speed with which the inverter will respond to eliminate this error. Below the block diagram of the PID controller 1.

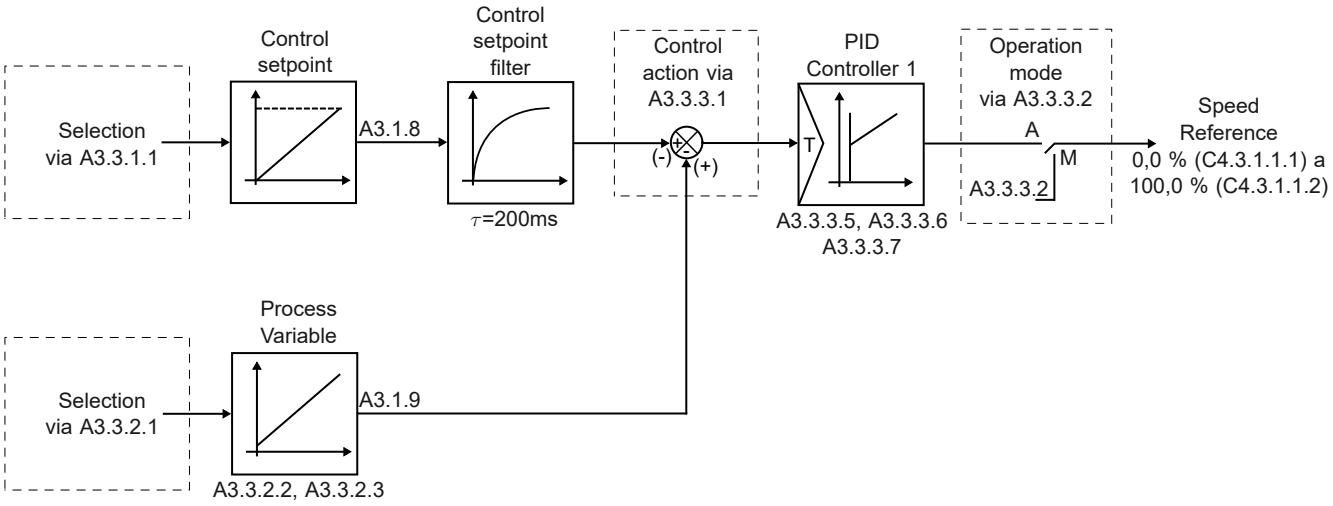


Figure 4.5: *Block diagram of the PID controller 1*

The PID controller 1 will be set up to operate from 0.0 to 100.0%, where 0.0% represents the minimum speed programmed in C.4.3.1.1.1 and 100.0% represents the maximum speed programmed in C.4.3.1.1.2.

The process variable of the control is the one that the PID controller 1 uses as a return (feedback) of its control action, being compared with the control setpoint required by the user, thus generating the error for the control. It is read via analog input or frequency input, therefore, it will be necessary to configure which or which inputs will serve as the control process variable for the PID controller 1.

The ”Academic PID” structure has been adopted as algorithm for the PID controller 1. According to the following equation:

$$y(k) = i(k-1) + K_p \times \left[(1 + K_i T_s + K_d / T_s) \times e(k) - (K_d / Ts) \times e(k-1) \right]$$

Where:
y(k): PID controller output;
i(k-1): PID controller integral part in the previous sampling instant;
K_p(A3.3.3.5): proportional gain;
K_i(A3.3.3.6): integral gain;
K_d(A3.3.3.7): derivative gain;
T_s: PID controller cyclic sampling time (fixed at 50ms);
e(k): error in the present sampling instant, with [SP(k) - PV(k)] for direct action and [PV(k) - SP(k)] for reverse action;
e(k-1): error in the previous sampling instant, with [SP(k-1) - PV(k-1)] for direct action and [PV(k-1) - SP(k-1)] for reverse action;
SP: PID controller control setpoint;
PV: PID controller process variable.

A3.3.3 Process PID		
A3.3.3.1 PID Contr. 1 Action		
Range:	0 ... 2	**Default:** 1
Properties:		

Description:
This parameter defines how the control action of the PID controller will react when the Pump Genius control is enabled. The following table demonstrates the parameter options.

Table 4.19: *Description of the PID controller control action*

A3.3.3.1	Description
Inactive	Defines that the PID controller will be disabled. In other words, there will be no control of the control process variable.
Direct	It defines that the PID controller will be enabled and the regulation or control action will be in direct mode. In other words, the error will be the control setpoint value (A3.1.8) minus the control process variable value (A3.1.9).
Reverse	It defines that the PID controller will be enabled and the regulation or control action will be in reverse mode. In other words, the error will be the control process variable value (A3.1.9) minus the control setpoint value (A3.1.8).

NOTE!
The control action of the PID controller must be selected for direct mode when it is necessary to increase the PID controller output in order to increase the process variable value. E.g.: Pump driven by an inverter and filling a tank. For the level of the tank (process variable) to increase, it is necessary that the flow increase, which is accomplished by increasing the speed of the motor.
The control action of the PID controller must be selected for reverse mode when it is necessary to decrease the PID controller output in order to increase the process variable value. E.g.: Fan driven by inverter cooling a refrigeration tower. When an increase in temperature is desired (process variable), it is necessary to reduce the ventilation by reducing the motor speed.

A3.3.3 Process PID

A3.3.3.2 PID 1 Operation Mode

Range: 0 ... 2 **Default:** 2

Properties:

Description:
This parameter defines the operation mode (Manual/Auto) of the Process PID controller 1 for Pump Genius application. The following table demonstrates the parameter options.

Table 4.20: *Description of the PID controller 1 operation mode*

A3.3.3.2	Description
Manual	It defines that the PID controller 1 will always operate in manual mode. In other words, the process variable will not be controlled according to the control setpoint required by the user, and the PID controller output value will be the setpoint value in manual mode programmed in parameter A3.1.7.
Auto	It defines that the PID controller 1 will operate in automatic mode, that is, the process variable will be controlled according to the control setpoint required by the user and the PID controller output value will respond according to the settings defined by the user.
DIx	It defines the PID controller 1 will be able to operate in manual or automatic mode according to the state of digital input DIx. In other words, if the digital input is in logical level “0”, the PID controller will operate in manual mode; if the digital input is in logical level “1”, the PID controller will operate in automatic mode.

NOTE!
Switching from one operating mode to another while the Pump Genius is running can cause disturbances in the pump control. This can be optimized with the bumpless transfer mode of PID 1, configurable in parameter A3.3.3.4.

A3.3.3 Process PID

A3.3.3.3 Man Auto DI Source

Range: 0 ... 14 **Default:** 0

Properties:

Description:
It defines the source to select the operating mode of PID 1 when the operating mode (A3.3.3.2) is DIx. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.

A3.3.3 Process PID

A3.3.3.4 Bumpless Mode PID 1

Range: 0 ... 3 **Default:** 0

Properties:

Description:
This parameter defines if the PID controller setpoint in automatic mode (A3.1.8) and/or in manual mode (A3.1.7) will be automatically adjusted when the PID controller operation mode changes. The following table demonstrates the parameter options.

Table 4.22: *Description of the PID controller setpoint automatic adjustment*

A3.3.3.4	Description
Inactive	It defines that, in the transition of the PID controller operation mode from manual to automatic, the control setpoint value (A3.1.8) will not be uploaded with the present value of the control process variable (A3.1.9), and in the transition of the PID controller operation mode from automatic to manual, the setpoint value of the PID controller in manual mode (A3.1.7) will not be uploaded with the present value of the motor speed (A3.1.12)
Bumpless Manual	It defines that, in the transition of the PID controller operation mode from manual to automatic, the control setpoint value (A3.1.8) will be uploaded with the present value of the control process variable (A3.1.9), and in the transition of the PID controller operation mode from automatic to manual, the setpoint value of the PID controller in manual mode (A3.1.7) will not be uploaded with the present value of the motor speed (A3.1.12)
Bumpless PV	It defines that, in the transition of the PID controller operation mode from manual to automatic, the control setpoint value (A3.1.8) will not be uploaded with the present value of the control process variable (A3.1.9), and in the transition of the PID controller operation mode from automatic to manual, the setpoint value of the PID controller in manual mode (A3.1.7) will be uploaded with the present value of the motor speed (A3.1.12)
Bumpless Man. + PV	It defines that, in the transition of the PID controller operation mode from manual to automatic, the control setpoint value (A3.1.8) will be uploaded with the present value of the control process variable (A3.1.9), and in the transition of the PID controller operation mode from automatic to manual, the setpoint value of the PID controller in manual mode (A3.1.7) will be uploaded with the present value of the motor speed (A3.1.12)

NOTE!
The adjustment of the control setpoint (A3.1.8) is only valid when the control setpoint source (A3.3.1.1) is selected for HMI or communication networks or via the Electronic Potentiometer function. For others control setpoint sources, the automatic adjustment is overwritten by the reference source (AI, Multispeed, Schedule, etc).

A3.3.3 Process PID		
A3.3.3.5 KP Gain PID 1		
Range:	0.00 ... 100.00	**Default:** 1.00
Properties:		

Description:
This parameter defines the proportional gain value of the PID controller 1 for the Pump Genius.

In a general way, we can say the proportional gain (A3.3.3.5) stabilizes sudden process variable changes, whereas the integral gain (A3.3.3.6) corrects the error between the reference and effective process variable, as well as improves the response near the minimum pump speed.

A3.3.3 Process PID		
A3.3.3.6 KI Gain PID 1		
Range:	0.0 ... 100.0	**Default:** 25.0
Properties:		

Description:
This parameter defines the integral gain value of the PID controller 1 for the Pump Genius.

A3.3.3 Process PID		
A3.3.3.7 KD Gain PID 1		
Range:	0.0 ... 100.0	**Default:** 0.0
Properties:		

Description:
This parameter defines the derivative gain value of the PID controller 1 for the Pump Genius.

NOTE!
The PID controllers of the Pump Genius uses academic structure.

A3.3.4 Auxiliary Control (Suction)

This group of parameters allows the user to configure the auxiliary control (suction) of the Pump Genius.

A3.3.4 Auxiliary Control (Suction)		
A3.3.4.1 Auxiliary Variable Source		
Range:	0 ... 10	**Default:** 0
Properties:		

Description:
Enables the use and defines the source of the control auxiliary variable for pump protection. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the analog input in this function.
1 = AI X-1	It enables the use of the analog input AI1 of Slot X.
2 = AI X-2	It enables the use of the analog input AI2 of Slot X.
3 = AI B-1	It enables the use of the analog input AI1 of Slot B.
4 = AI B-2	It enables the use of the analog input AI2 of Slot B.
5 = AI B-3	It enables the use of the analog input AI3 of Slot B.
6 = AI C-1	It enables the use of the analog input AI1 of Slot C.
7 = AI C-2	It enables the use of the analog input AI2 of Slot C.
8 = AI C-3	It enables the use of the analog input AI3 of Slot C.

Indication	Description
9 = FI X-5	It enables the use of the frequency input FI5 of Slot X.
10 = FI X-6	It enables the use of the frequency input FI6 of Slot X.

A3.3.4 Auxiliary Control (Suction)

A3.3.4.2 Enable Anti-cavitation

Range: 0 ... 2 **Default:** 0

Properties:

Description:
This parameter enables the anti-cavitation function (suction control)(PID 2).

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

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

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

A3.3.4.2 = 1 (Mode 1). The protection on this mode will operate in a way that when the conditions are met, Alarm A1896 will be triggered and PID 2 will act indirectly reducing the output of PID 1. The condition for PID 2 to be activated is that the value of the auxiliary variable (A3.1.10) is less than the cavitation detection level (A3.3.4.5), and to be deactivated, the value of the auxiliary variable (A3.1.10) must be less than the cavitation detection level (A3.3.4.5) plus the auxiliary variable level hysteresis (A3.3.4.6) and the output of PID 2 reaches 0%.

The PID controller 2 allows reducing the setpoint of PID 1 by comparing the auxiliary control variable (feedback) with the cavitation detection level required by the user, with the aim of eliminating the error to keep the auxiliary variable equal to the cavitation detection level required by the user. The adjustment of gains P, I and D determine the speed with which the inverter will respond to eliminate this error. Below the block diagram of the PID controller 2.

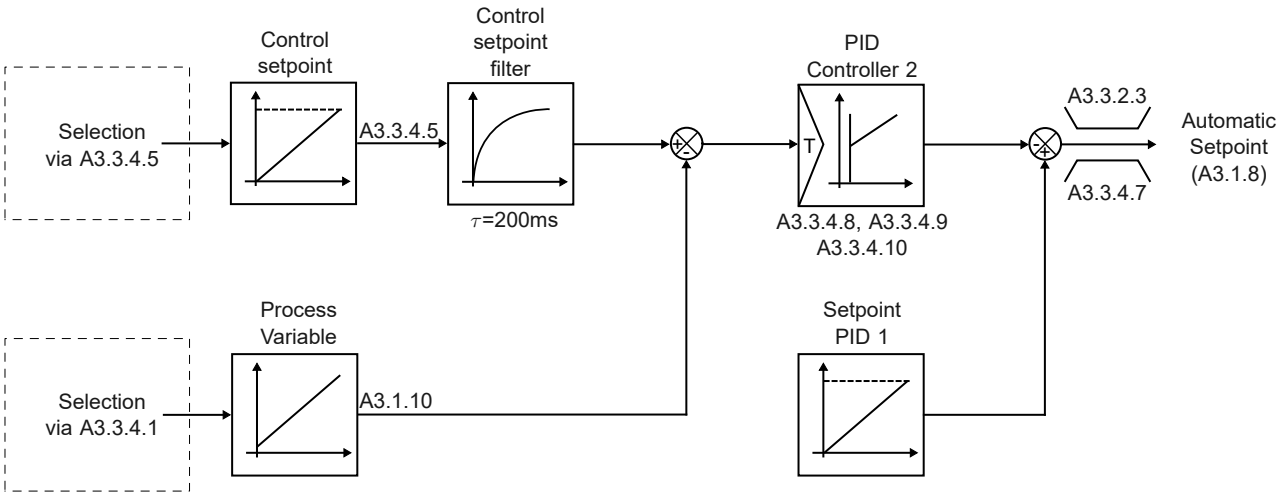


Figure 4.6: *Block diagram of the PID controller 2*

The PID controller 2 will be limited to reduce the setpoint value of PID 1 to a minimum value limited at A3.3.4.7.

The auxiliary control variable is the one that PID controller 2 uses as feedback for its control action, being compared with the cavitation detection level required by the user, thus generating the error for control. It is read via analog input or frequency input, therefore, it will be necessary to configure which input will serve as the auxiliary control variable for PID controller 2.

The "Academic PID" structure has been adopted as algorithm for the PID controller 2. According to the following equation:

$$y(k) = i(k-1) + K_p \times \left[(1 + K_i T_s + K_d/T_s) \times e(k) - (K_d/Ts) \times e(k-1) \right]$$

Where:
y(k): PID controller output;
i(k-1): PID controller integral part in the previous sampling instant;
K_p(A3.3.4.8): proportional gain;
K_i(A3.3.4.9): integral gain;
K_d(A3.3.4.10): derivative gain;
T_s: PID controller cyclic sampling time (fixed at 100ms);
e(k): error in the present sampling instant, with [SP(k) - PV(k)] for direct action;
e(k-1): error in the previous sampling instant, with [SP(k-1) - PV(k-1)] for direct action;
SP: PID controller control setpoint;
PV: PID controller process variable.

The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	Disables the anti-cavitation protection function.
1 = Mode 1	Enables mode 1 of the anti-cavitation protection function, where the output of PID 2 will cascade to the setpoint of PID 1, reducing it.
2 = Not used	Not used.

A3.3.4 Auxiliary Control (Suction)		
A3.3.4.3 AV Sensor Min. Range		
Range:	-30000 ... 30000	**Default:** 0
Properties:		

Description:
This parameter defines the minimum value of the sensor configured for the auxiliary variable.

> **NOTE!**
> This parameter will be viewed according to the selection of the parameters for the engineering unit 4 (C10.2.7 e C10.2.8).

A3.3.4 Auxiliary Control (Suction)

A3.3.4.4 AV Sensor Max. Range

Range:	-30000 ... 30000	**Default:** 1000
Properties:		

Description:
This parameter defines the maximum value of the sensor configured for the auxiliary variable.

> **NOTE!**
> This parameter will be viewed according to the selection of the parameters for the engineering unit 4 (C10.2.7 e C10.2.8).

A3.3.4 Auxiliary Control (Suction)

A3.3.4.5 Cavitation Detec. Level

Range:	-30000 ... 30000	**Default:** 200
Properties:		

Description:
This parameter defines the cavitation detection level to activate the anti-cavitation protection.

> **NOTE!**
> This parameter will be viewed according to the selection of the parameters for the engineering unit 4 (C10.2.7 e C10.2.8).

A3.3.4 Auxiliary Control (Suction)

A3.3.4.6 AV Level Hysteresis

Range:	-30000 ... 30000	**Default:** 50
Properties:		

Description:
This parameter defines the hysteresis level to deactivate the anti-cavitation protection.

> **NOTE!**
> This parameter will be viewed according to the selection of the parameters for the engineering unit 4 (C10.2.7 e C10.2.8).

A3.3.4 Auxiliary Control (Suction)

A3.3.4.7 Min. Proc. PID SP [AV]

Range:	-30000 ... 30000	**Default:** 400
Properties:		

Description:
This parameter defines the minimum value of the setpoint (A3.1.8) generated by the output of PID 2 that will be applied to PID 1 (process control) for anti-cavitation protection.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 4 (C10.2.7 e C10.2.8).

A3.3.4 Auxiliary Control (Suction)		
A3.3.4.8 KP Gain PID 2		
Range:	0.00 ... 100.00	**Default:** 0.10
Properties:		

Description:
This parameter defines the proportional gain value of the PID controller 2 of the Pump Genius (anti-cavitation protection).

In a general way, we can say the proportional gain (A3.3.4.8) stabilizes sudden auxiliary variable (suction) changes , whereas the integral gain (A3.3.4.9) corrects the error between the reference and effective auxiliary variable (suction), as well as improves the response near the minimum pump speed.

A3.3.4 Auxiliary Control (Suction)		
A3.3.4.9 KI Gain PID 2		
Range:	0.0 ... 100.0	**Default:** 1.0
Properties:		

Description:
This parameter defines the integral gain value of the PID controller 2 of the Pump Genius (anti-cavitation protection).

A3.3.4 Auxiliary Control (Suction)		
A3.3.4.10 KD Gain PID 2		
Range:	0.0 ... 100.0	**Default:** 0.0
Properties:		

Description:
This parameter defines the derivative gain value of the PID controller 2 of the Pump Genius (anti-cavitation protection).

NOTE!
The PID controllers of the Pump Genius are of the academic type.

A3.3.5 Flow Limitation

This group of parameters allows the user to configure the flow limitation (PID 3) of the Pump Genius.

The limitation will operate in a way that when the conditions are met, Alarm A1910 will be triggered and PID 3 will act by reducing indirectly the output of PID 1. The condition for PID 3 to be activated is that the value of the flow variable (A3.1.11) is less than the flow limitation enable level (A3.3.5.5), and to be deactivated, the value of the flow variable (A3.1.11) must be less than the flow limitation enable level (A3.3.5.5) minus the flow variable level hysteresis (A3.3.5.6) and the output of PID 3 reaches 0%.

The PID controller 3 allows reducing the setpoint of PID 1 by comparing the flow variable (feedback) with the flow limitation enable level required by the user, with the aim of eliminating the error to keep the flow variable equal to the flow limitation enable level required by the user. The adjustment of gains P, I and D determine the speed with which the inverter will respond to eliminate this error. Below the block diagram of the PID controller 3.

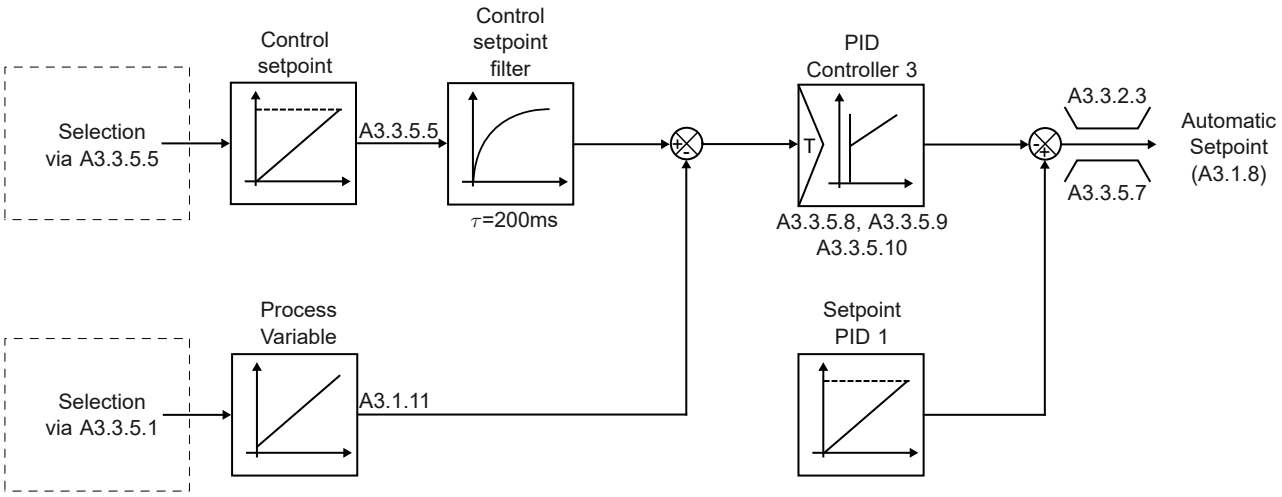


Figure 4.7: *Block diagram of the PID controller 3*

The PID controller 3 will be limited to reduce the setpoint value of PID 1 to a minimum value limited at A3.3.5.7.

The flow variable is the one that PID controller 3 uses as feedback for its control action, being compared with the flow limitation enable level required by the user, thus generating the error for control. It is read via analog input or frequency input, therefore, it will be necessary to configure which input will serve as the flow variable for PID controller 3.

The ”Academic PID” structure has been adopted as algorithm for the PID controller 3. According to the following equation:

$$y(k) = i(k-1) + K_p \times \left[(1 + K_i T_s + K_d/T_s) \times e(k) - (K_d/Ts) \times e(k-1) \right]$$

Where:
y(k): PID controller output;
i(k-1): PID controller integral part in the previous sampling instant;
K_p(A3.3.5.8): proportional gain;
K_i(A3.3.5.9): integral gain;
K_d(A3.3.5.10): derivative gain;
T_s: PID controller cyclic sampling time (fixed at 100ms);
e(k): error in the present sampling instant, with [PV(k) - SP(k)] for reverse action;
e(k-1): error in the previous sampling instant, with [PV(k-1) - SP(k-1)] for reverse action;
SP: PID controller control setpoint;
PV: PID controller process variable.

A3.3.5 Flow Limitation		
A3.3.5.1 Flow Variable Source		
Range:	0 ... 10	**Default:** 0
Properties:		

Description:
Enables the use and defines the source of the flow variable. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the analog input in this function.
1 = AI X-1	It enables the use of the analog input AI1 of Slot X.
2 = AI X-2	It enables the use of the analog input AI2 of Slot X.
3 = AI B-1	It enables the use of the analog input AI1 of Slot B.
4 = AI B-2	It enables the use of the analog input AI2 of Slot B.
5 = AI B-3	It enables the use of the analog input AI3 of Slot B.
6 = AI C-1	It enables the use of the analog input AI1 of Slot C.
7 = AI C-2	It enables the use of the analog input AI2 of Slot C.
8 = AI C-3	It enables the use of the analog input AI3 of Slot C.
9 = FI X-5	It enables the use of the frequency input FI5 of Slot X.
10 = FI X-6	It enables the use of the frequency input FI6 of Slot X.

A3.3.5 Flow Limitation

A3.3.5.2 Flow Limit. Function

Range: 0 ... 1 **Default:** 0

Properties:

Description:
This parameter enables the flow limitation function. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.

A3.3.5 Flow Limitation

A3.3.5.3 Minimum Flow Range

Range: -30000 ... 30000 **Default:** 0

Properties:

Description:
This parameter defines the minimum value of the sensor configured for the flow variable.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 3 (C10.2.5 e C10.2.6).

A3.3.5 Flow Limitation

A3.3.5.4 Maximum Flow Range

Range: -30000 ... 30000 **Default:** 500

Properties:

Description:
This parameter defines the maximum value of the sensor configured for the flow variable.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 3 (C10.2.5 e C10.2.6).

A3.3.5 Flow Limitation

A3.3.5.5 Flow Limit En. Level

Range: -30000 ... 30000 **Default:** 400

Properties:

Description:
This parameter defines the flow level to activate the flow limitation.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 3 (C10.2.5 e C10.2.6).

A3.3.5 Flow Limitation

A3.3.5.6 Flow Level Hysteresis

Range:	-30000 ... 30000	**Default:** 10
Properties:		

Description:
This parameter defines the hysteresis level to deactivate the flow limitation protection.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 3 (C10.2.5 e C10.2.6).

A3.3.5 Flow Limitation

A3.3.5.7 Min. Proc. PID SP [FV]

Range:	-30000 ... 30000	**Default:** 400
Properties:		

Description:
This parameter defines the minimum value of the setpoint (A3.1.8) generated by the output of PID 3 that will be applied to PID 1 for flow limitation.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 3 (C10.2.5 e C10.2.6).

A3.3.5 Flow Limitation

A3.3.5.8 KP Gain PID 3

Range:	0.00 ... 100.00	**Default:** 0.10
Properties:		

Description:
This parameter defines the proportional gain value of the PID controller 3 of the Pump Genius (flow limitation).

In a general way, we can say the proportional gain (A3.3.5.8) stabilizes sudden flow variable changes, whereas the integral gain (A3.3.5.9) corrects the error between the reference and effective flow variable, as well as improves the response near the minimum pump speed.

A3.3.5 Flow Limitation

A3.3.5.9 KI Gain PID 3

Range:	0.0 ... 100.0	**Default:** 1.0
Properties:		

Description:
This parameter defines the integral gain value of the PID controller 3 of the Pump Genius (flow limitation).

A3.3.5 Flow Limitation

A3.3.5.10 KD Gain PID 3

Range: 0.0 ... 100.0 **Default:** 0.0

Properties:

Description:
This parameter defines the derivative gain value of the PID controller 3 of the Pump Genius (flow limitation).

A3.4 Functions

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

A3.4.1 Sleep Mode

This group of parameters allows the user to configure the sleep mode function of Pump Genius.

A3.4.1 Sleep Mode

A3.4.1.1 Sleep Mode Enable

Range: 0 ... 2 **Default:** 1

Properties:

Description:
Enables use and defines the way to enter and exit sleep mode. The following table demonstrates the parameter options.

Table 4.27: *Description of the activation modes for sleep mode*

A3.4.1.1	Description
Inactive	Defines that the sleep mode will be inactive.
Sleep/Deviation	Defines that the sleep mode will be Sleep/Deviation, which determines that the Pump Genius will turn on the pump and control the pumping when the difference between the control process variable and the control setpoint is greater than a specified programmed value (A3.4.1.2), and will turn off when the speed of the only running pump is lower than a specified programmed value.
Sleep/Level	Defines that the sleep mode will be Sleep/Level, which determines that the Pump Genius will turn on the pump and control the pumping when the control process variable reaches a specified value (A3.4.1.3), and will turn off when the speed of the only running pump is lower than a specified programmed value.

A3.4.1 Sleep Mode

A3.4.1.2 Deviation to Wake Up

Range: -30000 ... 30000 **Default:** 10

Properties:

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.1 Sleep Mode

A3.4.1.3 Level to Start

Range: -30000 ... 30000 **Default:** 100

Properties:

Description:
This parameter defines the control process variable level for starting the pump and resuming control of the pumping. With a Direct Mode PID controller, the pumping control will be enabling to start when the control process variable drops lower than A3.4.1.3. With a Reverse Mode PID controller it will be enabling to start when the process variable rises above A3.4.1.3.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.1 Sleep Mode

A3.4.1.4 Time to Wake up

Range:	0.0 ... 99.9 s	**Default:** 2.0 s
Properties:		

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

- **Wake-up Mode**: The control process variable must remain lower (direct PID) or higher (reverse PID) than the deviation defined in A3.4.1.2 for the time programmed in A3.4.1.4 for the pump to be turned on and its speed controlled. If the wake-up condition becomes inactive at any moment, the timer is reset and the time count is restarted;
- **Start by Level Mode**: The control process variable must remain lower (direct PID) or higher (reverse PID) than the level defined in A3.4.1.3 for the time programmed in A3.4.1.4 for the pump to be turned on and its speed controlled. If the level start condition becomes inactive at any moment, the timer is reset and the time count is restarted.

NOTE!
If the Pump Genius is enabled for operation (active “Run / Stop” command or “Enable Pump Genius” command), the condition for Wake Up or Start by Level is active, the time programmed in A3.4.1.6 is not awaited, and thus, the pump will start operating immediately.

A3.4.1 Sleep Mode

A3.4.1.5 Sleep Speed

Range:	0 ... 30000	**Default:** 420
Properties:		

Description:
This parameter defines the motor speed value below which the Pump Genius will turn off the pump and enter sleep mode.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.4.1 Sleep Mode

A3.4.1.6 Time to Sleep

Range:	0.0 ... 99.9 s	**Default:** 10.0 s
Properties:		

Description:
This parameter defines the waiting time with the value of the pump motor speed should remain below the value set in A3.4.1.5 in order for sleep mode to be activated and the pump to be stopped.

NOTE!
The alarm message “A1860: Active Sleep Mode” will be generated on the HMI of the inverter CFW900 to alert that Pump Genius is in sleep mode.

The Figure 4.8 on page 4-41 presents an analysis of the Pump Genius operation with PID controller control action in direct mode when it is configured for Wake up Mode and Sleep Mode.

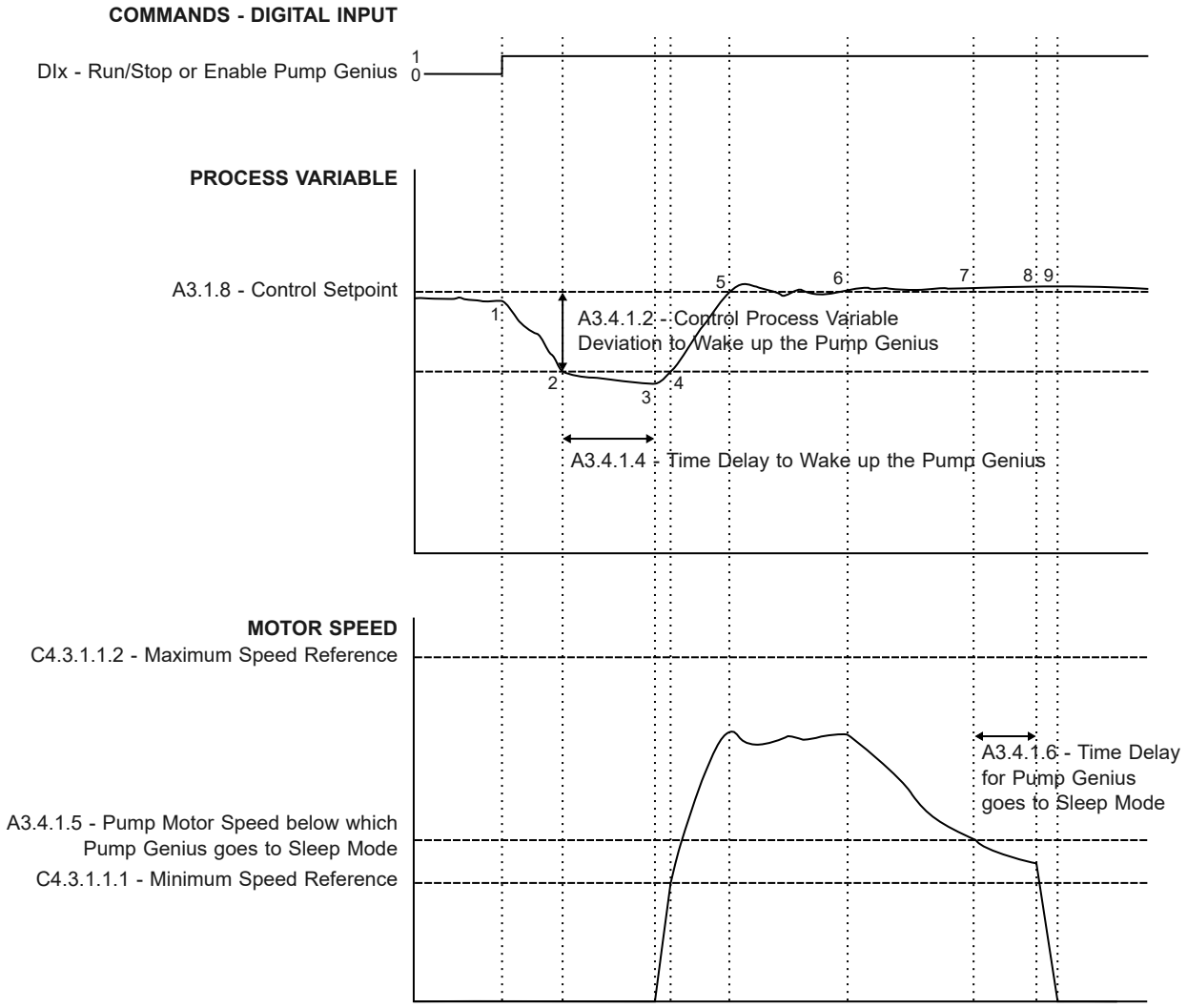


Figure 4.8: *Pump Genius operation for Wake up and Sleep mode*

1. The “Run/Stop” or “Enable Pump Genius” command via digital input DIx enable starting the motor, but also enable the operation of Pump Genius. As the condition to wake up was not detected, the pumping control remains in the sleep mode and the pump remains stopped;
2. The control process variable begins to decrease and is lower than the control process variable deviation programmed to wake up the Pump Genius (A3.4.1.2); in this moment the time count to wake up (A3.4.1.4) is initiated;
3. The control process variable remains smaller than the control process deviation to wake up the Pump Genius (A3.4.1.2) and the time delay to wake up (A3.4.1.4) is elapsed; at this moment the control issues the command to start the pump and resumes controlling the pumping with variable speed;
4. The inverter accelerates the pump up to the minimum speed (C4.3.1.1.1). After that, the PID controller is enabled and starts controlling the pump speed;
5. The resumed Pump Genius allows the value of the control process variable to tracking with the control setpoint required by the user. The PID controller output increases during the tracking phase, raising the pumping speed. A stable phase with constant pumping speed may follow;
6. The value of the control process variable continues above the setpoint due to a decrease in demand and pump speed begins to decrease;
7. The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5); the time counting for Pump Genius goes to sleep mode (A3.4.1.6) is initiated;
8. The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5) and the time delay for Pump Genius goes to sleep mode (A3.4.1.6) is elapsed; at this moment the control issues the command to stop the pump;
9. The inverter driven pump reaches ”zero” speed, and remains stopped; at this moment the Pump Genius goes into sleep mode.

The Figure 4.9 on page 4-43 presents a timing analysis of the Pump Genius operation with a Direct Mode PID controller when it is configured for Start Level Mode and Sleep Mode.

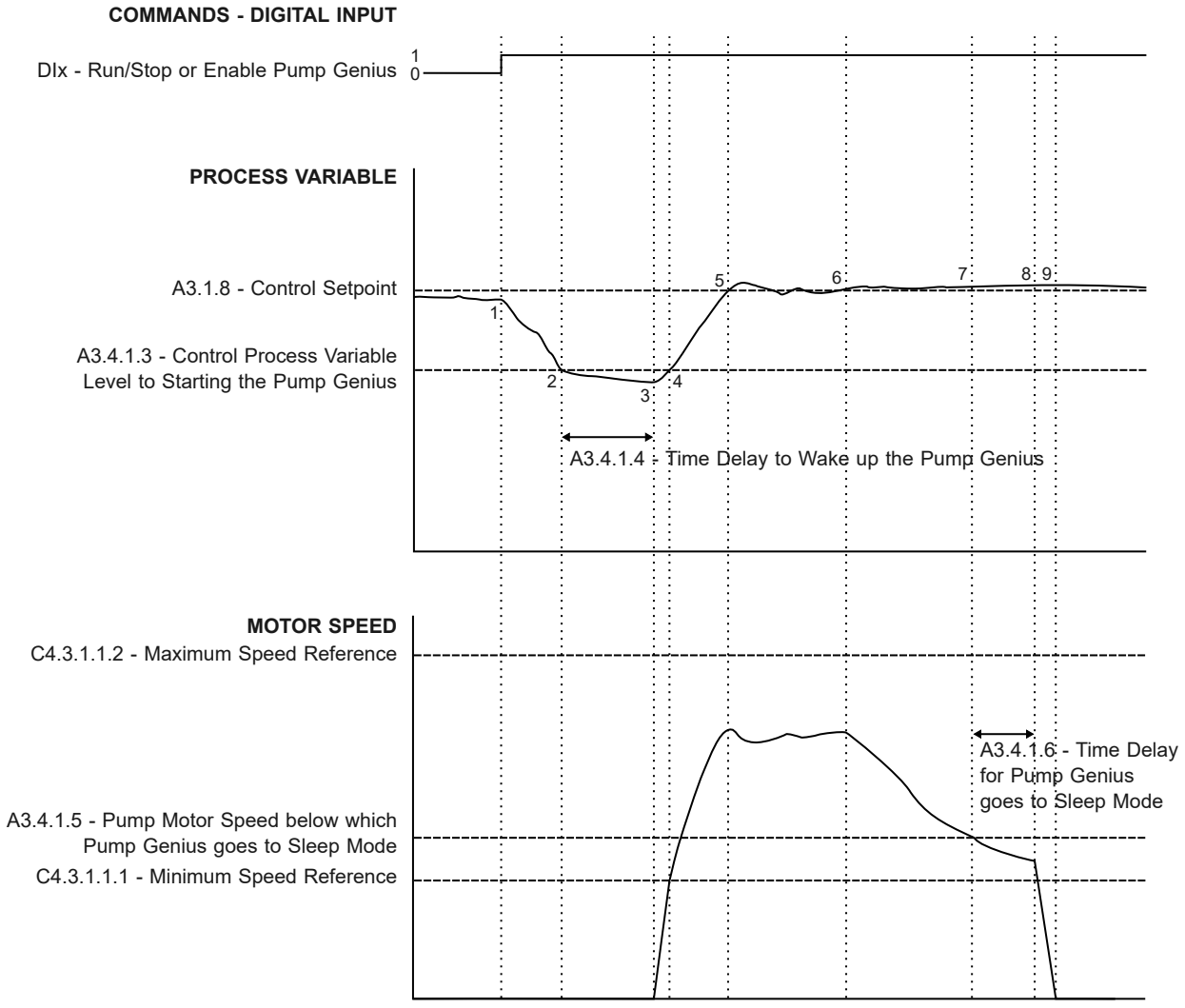


Figure 4.9: *Operation of the Pump Genius for start level mode and sleep mode*

1. The “Run/Stop” or “Enable Pump Genius” command via digital input DI1 enables starting the motor, but also enable the operation of Pump Genius. As the control process variable level condition to start the Pump Genius was not detected, the Pump Genius remains in the sleep mode and the pump remains stopped;
2. The control process variable begins to decrease and is lower than the control process variable threshold programmed starting the Pump Genius (A3.4.1.3); in this moment the time count for starting by level the Pump Genius (A3.4.1.4) is initiated;
3. The control process variable remains smaller than the threshold for starting the Pump Genius (A3.4.1.3) and the time delay for starting by level the Pump Genius (A3.4.1.4) is elapsed; at this moment the control issues the command to start the pump and resumes controlling the pumping with variable speed;
4. The inverter accelerates the pump up to the minimum speed (C4.3.1.1.1). After that, the PID controller is enabled and starts controlling the pump speed;
5. The resumed Pump Genius allows the value of the control process variable to catch up with the control setpoint required by the user. The PID controller output increases during the catch-up phase, raising the pumping speed. A stable phase with constant pumping speed may follow;
6. The value of the control process variable continues above the setpoint due to a decrease in demand and pump speed begins to decrease;
7. The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5); the time count for Pump Genius goes to sleep mode (A3.4.1.6) is initiated;
8. The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5) and the time delay for Pump Genius goes to sleep mode (A3.4.1.6) is elapsed; at this moment the control issues the command to stop the pump;
9. The inverter driven pump reaches ”zero” speed, and remains stopped; at this moment the Pump Genius goes into sleep mode.

A3.4.1 Sleep Mode

A3.4.1.7 Sleep Boost Offset

Range:	-30000 ... 30000	**Default:** 0
Properties:		

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

NOTE!
The alarm message “A1862: Active Boost Function” will be generated on the HMI of the CFW900 inverter to alert that the Pump Genius is executing the sleep boost.

A3.4.1 Sleep Mode

A3.4.1.8 Boost Maximum Time

Range:	0.0 ... 99.9 s	**Default:** 0.0 s
Properties:		

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

NOTE!
A setting of “0” disable the sleep boost function. This function is only enabled to use for control action of the PID controller in direct mode.

The Figure 4.10 on page 4-45 presents a timing analysis of the Pump Genius operation with a Direct Mode PID controller when it is configured for Wake up Mode and Sleep Mode with Sleep Boost enabled.

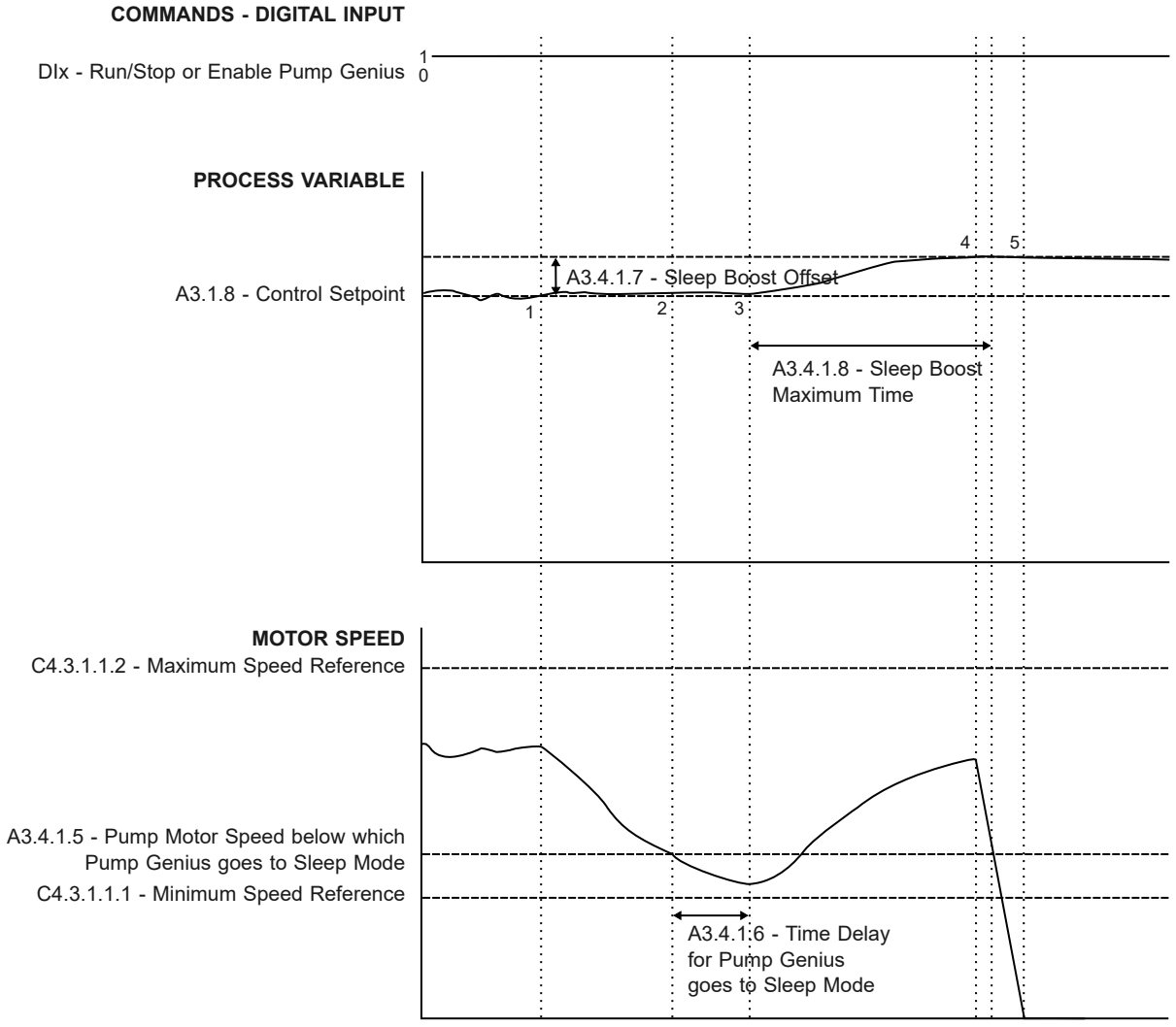


Figure 4.10: *Operation of the Pump Genius for sleep mode with sleep boost enabled*

1. The Pump Genius is keeping the system controlled as the control setpoint required by the user. At this moment the value of the control process variable begins to increase and the speed motor begins to decrease;
2. The pump motor speed output drops below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5); the time count for the Pump Genius go to sleep mode (A3.4.1.6) is initiated;
3. The pump motor speed remains below the speed for Pump Genius goes to sleep mode threshold (A3.4.1.5) and the time delay for Pump Genius goes to sleep mode (A3.4.1.6) is elapsed; at this moment, as the sleep boost is enabled will not be made the command to stop the pump. It will be added the sleep boost offset (A3.4.1.7) to the control setpoint for increase the control process variable; at this moment the count of the sleep boost maximum time (A3.4.1.8) is initiated;
4. The inverter accelerates the pump again as the action of the PID controller and the control process variable reaches the control setpoint value added to the sleep boost active; at this moment the control issues the command to stop the pump before the count of the sleep boost maximum time be elapsed;
5. The inverter driven pump reaches ”zero” speed, and remains stopped; at this moment the Pump Genius goes into sleep mode.

A3.4.2 Pipe Charging

This group of parameters allows the user to configure the pipe charging function of Pump Genius.

A3.4.2 Pipe Charging		
A3.4.2.1 Pipe Charging Enable		
Range:	0 ... 1	**Default:** 1
Properties:		

Description:
This parameter enables the pipe charging function. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.

A3.4.2 Pipe Charging		
A3.4.2.2 Pipe Charging Ramp		
Range:	0.0 ... 999.9 s	**Default:** 10.0 s
Properties:		

Description:
This parameter defines the initial ramp time up to the minimum speed (C4.3.1.1.1) for pipe charging.

A3.4.2 Pipe Charging		
A3.4.2.3 Pipe Charging Time		
Range:	0.0 ... 6000.0 s	**Default:** 20.0 s
Properties:		

Description:
This parameter defines the time for pipe charging with the pump running with minimum speed (C4.3.1.1.1).

NOTE!
The alarm message “A1864: Pipe Charging” will be generated on the HMI of the CFW900 frequency inverter to alert that the Pump Genius is in the process of pipe charging.

The Figure 4.11 on page 4-47 presents an analysis of the Pump Genius operation when it is enabled the pipe charging when starting pumping.

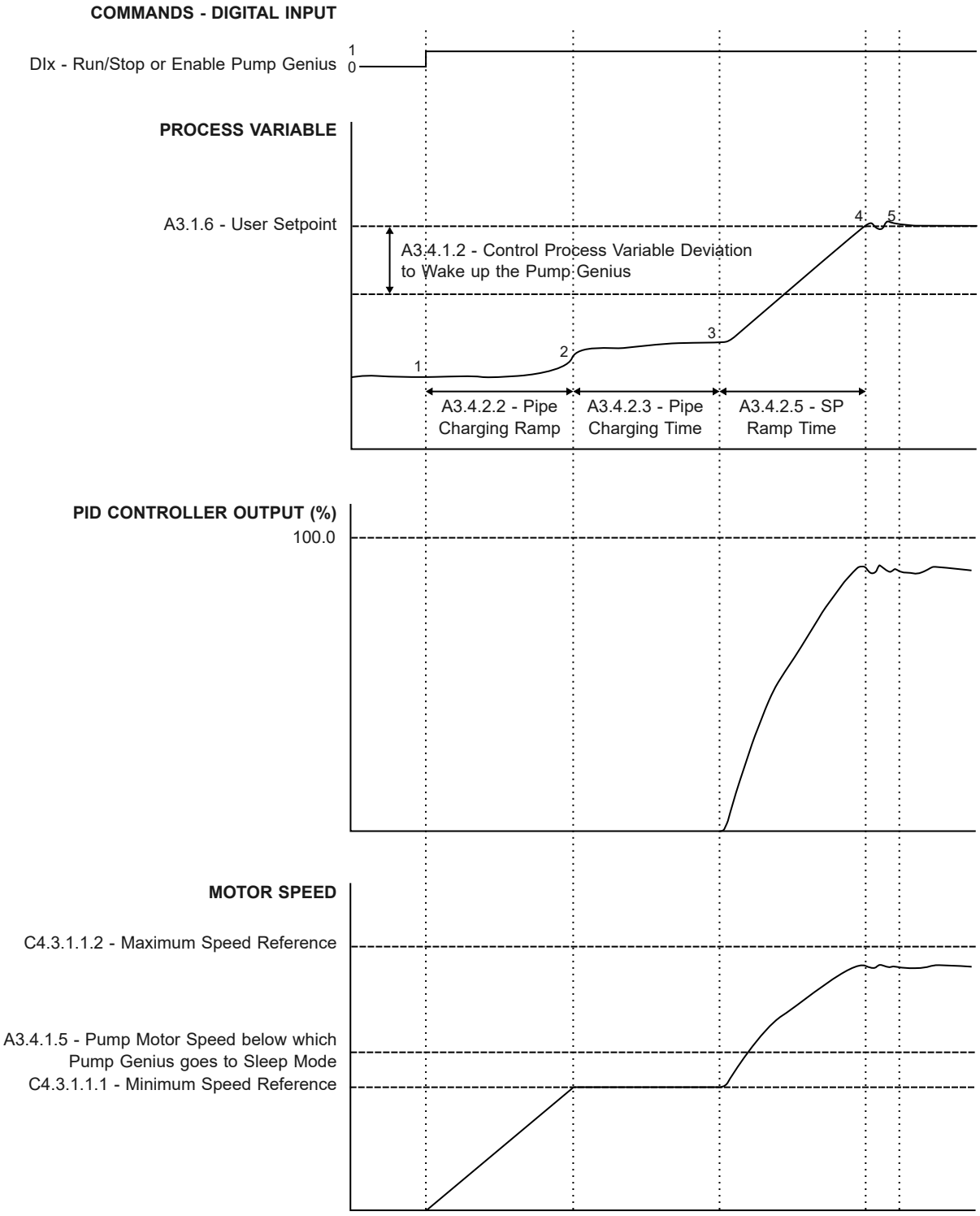


Figure 4.11: *Operation of the Pump Genius with pipe charging enabled*

1. The “Run/Stop” or “Enable Pump Genius” command via digital input DIx enables starting the motor, but also enables the operation of Pump Genius. As the control process variable is lower than the control process deviation for Pump Genius to wake up (A3.4.1.2), the time delay to wake up (A3.4.1.4) is not awaited and the command run is issued. The pump is accelerated to the minimum speed (C4.3.1.1.1) with a slower ramp (A3.4.2.2) in order to avoid the water hammer;
2. The pump speed reaches the value programmed for minimum speed (C4.3.1.1.1) and continues at this speed during the course of time for pipe charging (A3.4.2.3). During this time the PID controller is disabled;
3. The time for pipe charging (A3.4.2.3) is elapsed; at this moment, the PID controller is enabled and the ramp time count of the setpoint (A3.4.2.5) is started, where the setpoint is incremented from the current value of the process variable to the user-defined value; the pump speed is increased to stabilize the process variable value according to the current ramp control setpoint;
4. With increasing the pump speed, the control process variable reaches the control setpoint value;
5. A short time later the control process variable stabilizes and pumping continues at steady speed.

A3.4.2 Pipe Charging

A3.4.2.4 Curr. Lim. Pipe Ch.

Range:	0 ... 300 %	**Default:** 125 %
Properties:		

Description:
This parameter defines the percentage of the nominal motor current value (C2.1.5) during pipe charging to execute the current limitation.

NOTE!
A setting of “0.0” executed the motor current limitation only by the value set in C2.1.5 parameter.

NOTE!
Refer to the CFW900 inverter programming manual for more information on the motor current limitation parameters.

A3.4.2 Pipe Charging

A3.4.2.5 SP PID Ramp Time

Range:	0.0 ... 99.9 s	**Default:** 10.0 s
Properties:		

Description:
This parameter defines setpoint ramp time, to ramp the setpoint from the process variable value during pipe charging time (A3.4.2.3) to the user setpoint (A3.1.6).

A3.4.3 Check Valve

This group of parameters allows the user to configure the check valve function of the Pump Genius.

The check valve function will act in such a way that, during deceleration, it will modify the ramp (A3.4.3.4) between two speed references (A3.4.3.2 e A3.4.3.3) in order to reduce sudden pressure variations in the pipeline, thus preventing valve malfunctions in the system.

The Figure 4.12 on page 4-49 presents the operation check valve function of the Pump Genius.

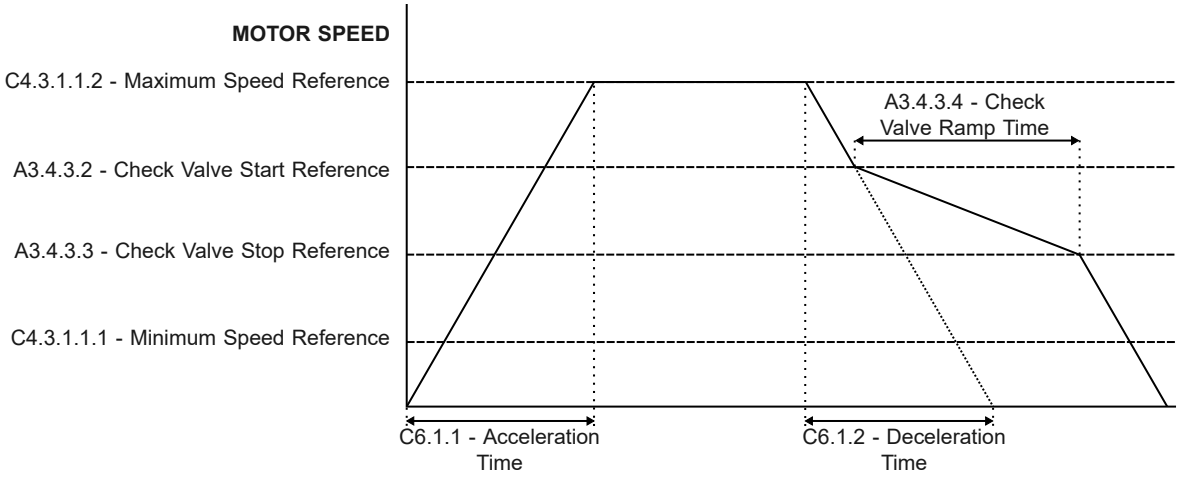


Figure 4.12: *Operation of the Pump Genius with valve check enabled*

A3.4.3 Check Valve

A3.4.3.1 Check Valve Enable

Range: 0 ... 1 **Default:** 0

Properties:

Description:
This parameter enables the check valve function. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.

A3.4.3 Check Valve

A3.4.3.2 Ch. Valve Start Ref.

Range: 0 ... 30000 **Default:** 500

Properties:

Description:
This parameter defines the reference speed to start the valve verification during pump deceleration.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.4.3 Check Valve

A3.4.3.3 Ch. Valve End Ref.

Range: 0 ... 30000 **Default:** 400

Properties:

Description:
This parameter defines the reference speed to finish the valve verification during pump deceleration.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.4.3 Check Valve		
A3.4.3.4 Check Valve Ramp Time		
Range:	0.0 ... 999.9 s	**Default:** 20.0 s
Properties:		

Description:
This parameter defines the deceleration ramp time between the reference speed to start and to finish the valve verification.

A3.4.4 Auxiliary Pump

This group of parameters allows the user to configure the auxiliary pump function of the Pump Genius. The configured auxiliary pump can be of the jockey or priming type.

The priming pump functions to remove air from inside the pump, preventing damage inherent to the pump operating with air, such as:

- Rotor damage due to overheating;
- Cavitation, which has a brief description in parameter A3.3.4.2;
- Premature rotor wear due to the removal of metallic particles;
- Seal failure due to friction and heating from the lack of water lubrication and cooling.

When the auxiliary pump function is selected for the priming pump, at the moment the Pump Genius generates the command to rotate, the priming pump is activated via DOx and the priming pump time count (A3.4.4.5) is started. After the time count ends, the acceleration ramp of the pump connected to the inverter output is initiated. At the moment the Pump Genius withdraws the command to rotate, the deceleration ramp of the pump connected to the inverter output is initiated and, after a complete stop, the priming pump is turned off.

The Figure 4.13 on page 4-50 presents the operation of the priming pump function.

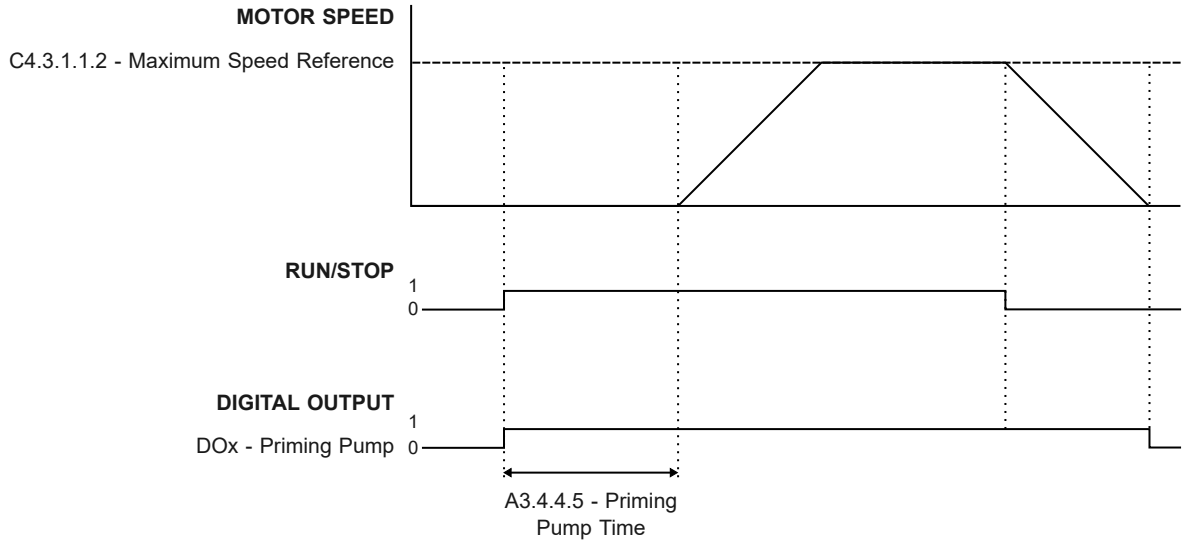


Figure 4.13: *Operation of the Pump Genius with priming pump enabled*

When the auxiliary pump function is selected for the jockey pump, and the Pump Genius is in sleep mode, if the process variable drops below the jockey pump start level (A3.4.4.2), the delay countdown to start the jockey pump (A3.4.4.4) via DOx begins. If the process variable reaches the jockey pump stop level (A3.4.4.3), the jockey pump is turned off. If the process variable remains below the jockey pump stop level (A3.4.4.3), the jockey pump will stay on until the Pump Genius exits sleep mode, at which point the pump connected to the inverter output is turned on to restore system pressure.

The Figure 4.14 on page 4-51 presents the operation of the jockey pump function.

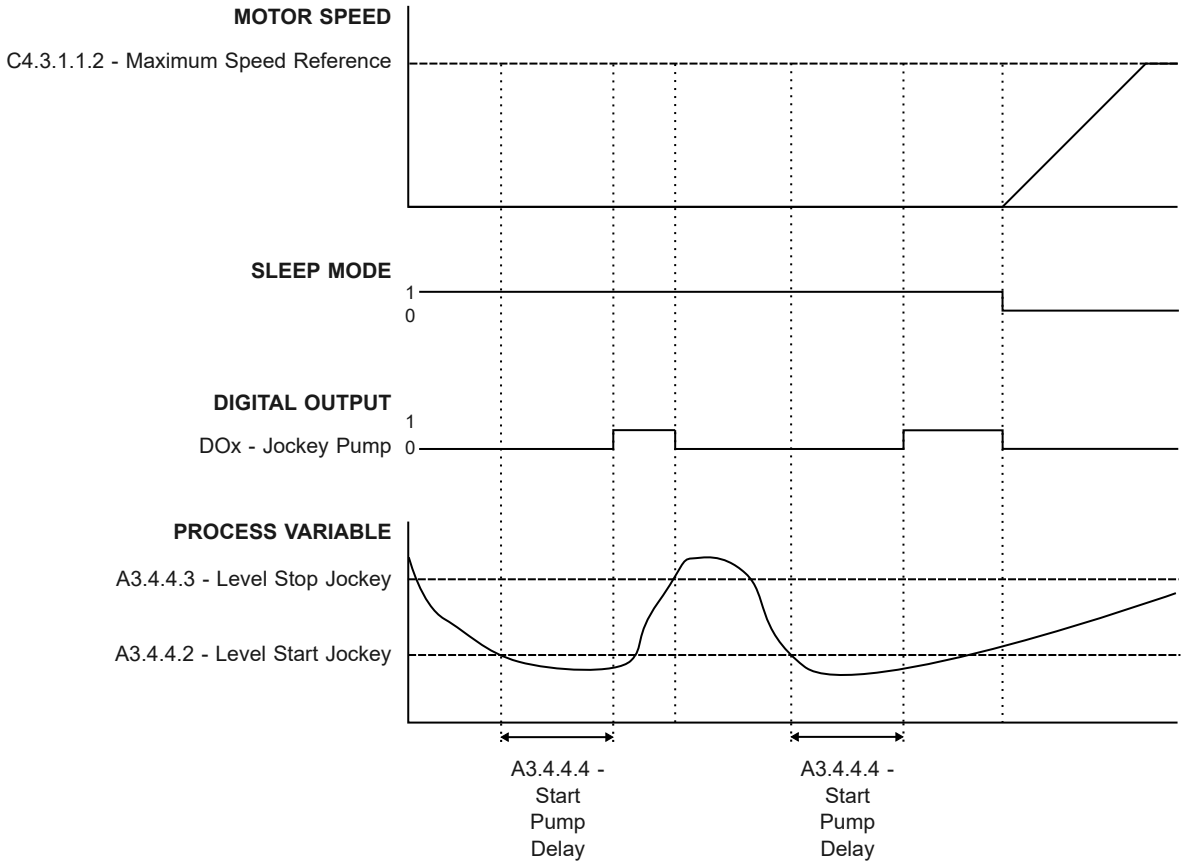


Figure 4.14: *Operation of the Pump Genius with jockey pump enabled*

A3.4.4 Auxiliary Pump

A3.4.4.1 Auxiliary Pump Enable

Range: 0 ... 2 **Default:** 0

Properties:

Description:

This parameter enables the use of an auxiliary pump and defines the type of pump. The options for auxiliary pumps are described below.

Indication	Description
0 = Inactive	Disables the auxiliary pump function.
1 = Priming Pump	Enables the auxiliary pump function and defines it as a priming pump, whose function will be to remove air from inside the pump.
2 = Jockey Pump	Enables the auxiliary pump function and defines it as a jockey pump, whose function will be to maintain the system pressure during periods of low demand.

A3.4.4 Auxiliary Pump

A3.4.4.2 Level Start Jockey

Range: -30000 ... 30000 **Default:** 200

Properties:

Description:

This parameter defines the reference level to start the jockey pump.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.4 Auxiliary Pump		
A3.4.4.3 Level Stop Jockey		
Range:	-30000 ... 30000	**Default:** 300
Properties:		

Description:
This parameter defines the reference level to stop the jockey pump.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.4 Auxiliary Pump		
A3.4.4.4 Start Pump Delay		
Range:	0.0 ... 99.9 s	**Default:** 1.0 s
Properties:		

Description:
This parameter defines the delay to start the jockey pump.

A3.4.4 Auxiliary Pump		
A3.4.4.5 Priming Pump Time		
Range:	0.0 ... 999.9 s	**Default:** 5.0 s
Properties:		

Description:
This parameter defines the delay to start the priming pump.

A3.4.5 Start/Stop Pumps

This group of parameters allows the user to configure the parallel pump start and stop function of Pump Genius.

A3.4.5 Start/Stop Pumps		
A3.4.5.1 Speed Start Pump		
Range:	0 ... 30000	**Default:** 520
Properties:		

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.4.5 Start/Stop Pumps		
A3.4.5.2 Deviation Start Pump		
Range:	-30000 ... 30000	**Default:** 10
Properties:		

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.5 Start/Stop Pumps		
A3.4.5.3 Start Pump Time		
Range:	0.0 ... 99.9 s	**Default:** 1.0 s
Properties:		

Description:
This parameter defines a time delay during which both the conditions of parameters A3.4.5.1 and A3.4.5.2 must remain satisfied before an additional pump is started in parallel in the Pump Genius.

A3.4.5 Start/Stop Pumps		
A3.4.5.4 Start Pump Delay		
Range:	0.00 ... 9.99 s	**Default:** 0.05 s
Properties:		

Description:
This parameter defines a delay for the beginning of the deceleration of the pump driven by the CFW900 frequency inverter when a new pump is started in parallel.

NOTE!
This parameter is only valid for the Pump Genius Multipump application.

NOTE!
Value of the parameter in “0.0” will not apply the deceleration of the pump driven by the CFW900 frequency inverter. The pump remains at the same speed it was before a new pump is started.

The Figure 4.15 on page 4-54 presents a timing analysis of the Pump Genius Multipump operation when the need to start an additional pump in parallel is detected.

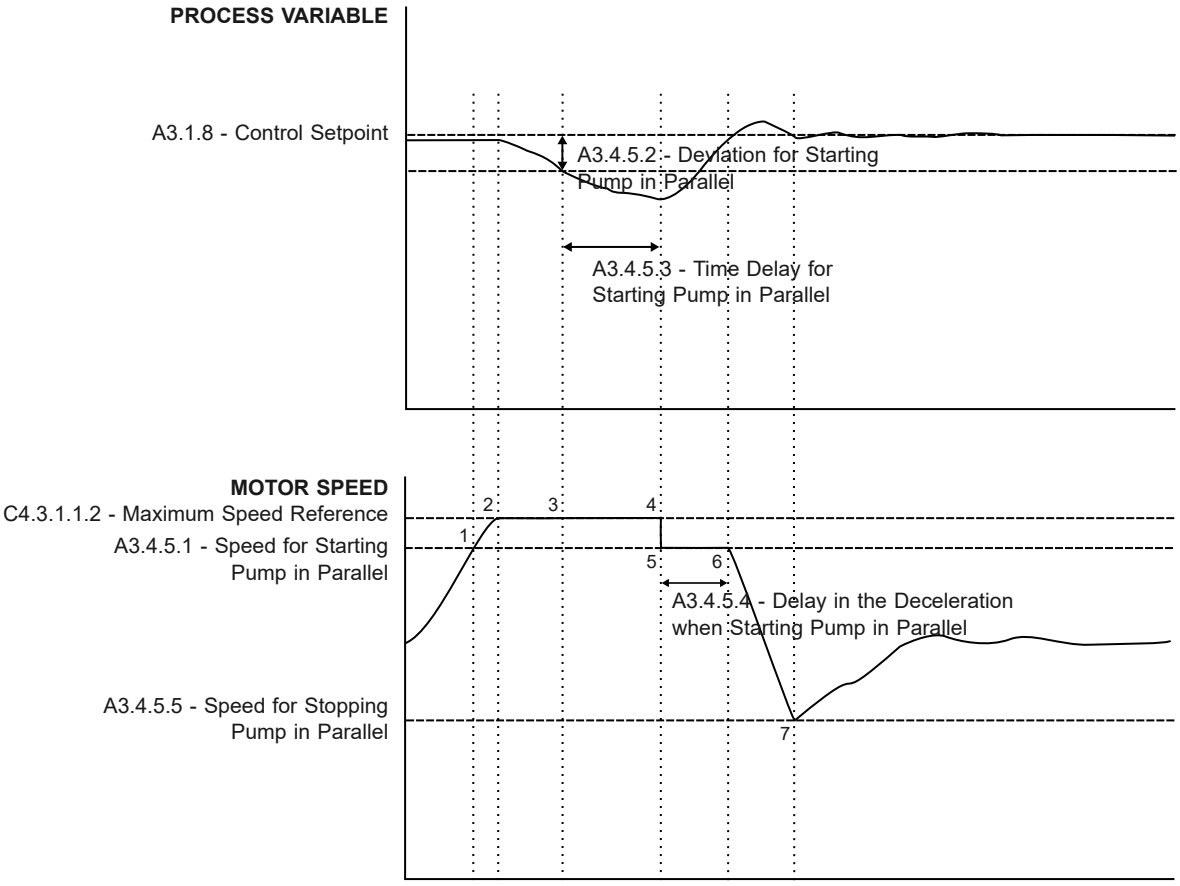


Figure 4.15: *Pump Genius Multipump operation for starting an additional pump in parallel*

1. The Pump Genius is operating with one pump running and it is increasing its speed to keep the pumping control according to the required setpoint. At this moment, it is detected that the PID controller output is above the value set to start one more pump (A3.4.5.1), but the difference between the setpoint and the control process variable remains below the deviation set to start one more pump (A3.4.5.2); therefore, it is not still necessary to start one more pump in parallel;
2. The motor speed reaches the maximum speed programmed for the pump (C4.3.1.1.2) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable continues lower than the deviation set to start one more pump (A3.4.5.2);
3. The motor speed still at the maximum speed programmed for the pump (C4.3.1.1.2) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable is still above the deviation set to start one more pump (A3.4.5.2) and the time to start one more pump in parallel on the pumping control (A3.4.5.3) initiates;
4. The motor speed still at the maximum speed programmed for the pump (C4.3.1.1.2) and the value of the control process variable keeps decreasing, the value of the difference between the setpoint and the control process variable is still above the deviation set to start one more pump (A3.4.5.2) and the time to start one more pump in parallel on the pumping control (A3.4.5.3) elapses; at this moment, a command to start one more pump in parallel on the pumping control is used. The pump to be started will be the one with the shortest operation time among those which are enabled for operation;
5. One pump is started; at this moment, the PID controller goes into the manual control mode and the speed of the pump driven by the inverter goes to the value set in A3.4.5.1. Then the time count of the delay to start the deceleration of the pump driven by the inverter (A3.4.5.4) begins;
6. The time count of the delay to start the deceleration of the pump driven by the inverter (A3.4.5.4) elapses; the PID controller remains in the manual control mode and the speed reference of the pump driven by the inverter goes to the value set in A3.4.5.5;
7. The motor decelerates down to the value set to stop one pump (A3.4.5.5) and the PID controller goes to the automatic control mode. Then the PID controller begins to control the system again to stabilize the pumping control according to the setpoint required by the user, but now with one more pump in parallel.

The Figure 4.16 on page 4-56 presents a timing analysis of the Pump Genius Multiplex operation when the need to start an additional pump in parallel is detected.

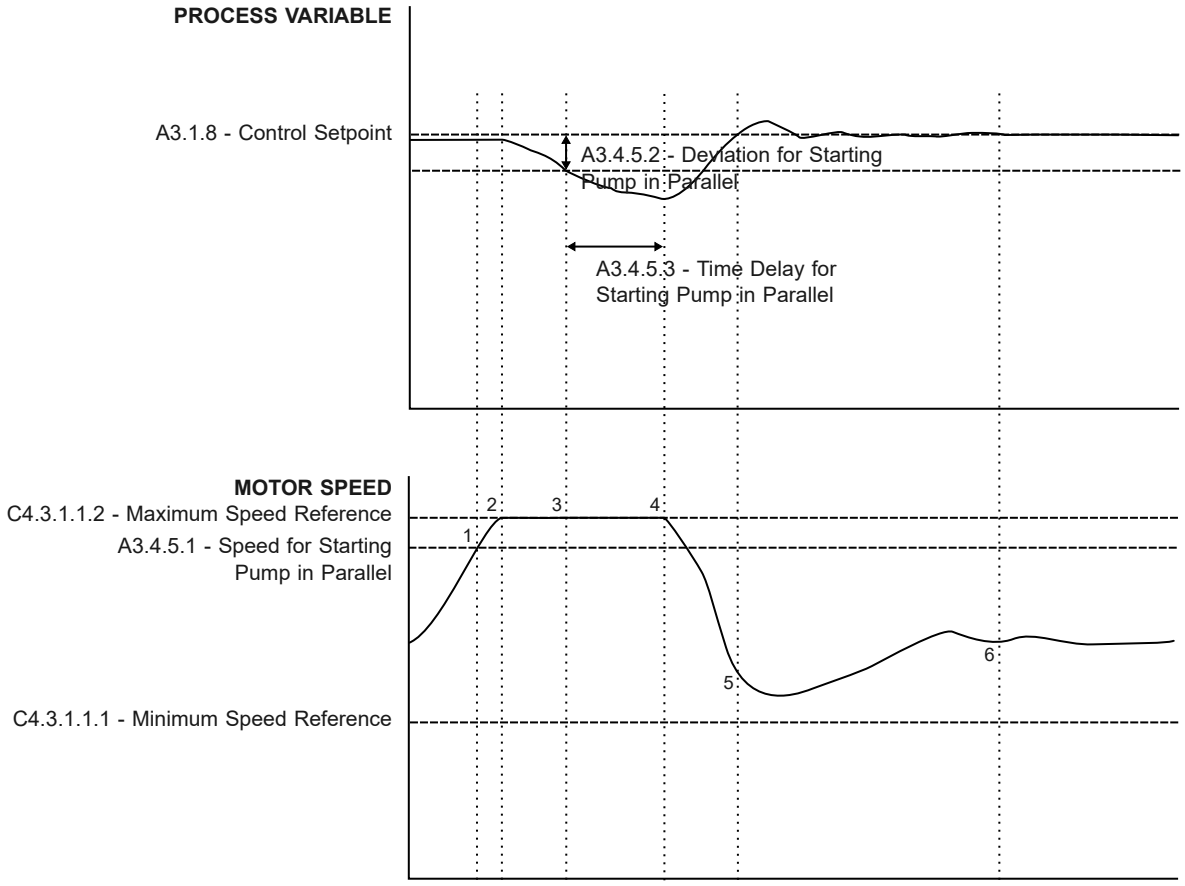


Figure 4.16: *Pump Genius Multiplex operation for starting an additional pump in parallel*

1. The Pump Genius is operating with one pump running and is increasing its speed according to PID control, to keep up with demand. At this moment, the pump motor speed exceeds the threshold value programmed for starting an additional pump (A3.4.5.1). However, the difference between the control setpoint and control process variable remains lower than the deviation programmed for starting an additional pump (A3.4.5.2); it is thus not yet necessary to start an additional pump;
2. The pump motor speed reaches its maximum value (C4.3.1.1.2) and the value of the control process variable begins to decrease, but its deviation from the control setpoint remains lower than the threshold programmed for starting an additional pump (A3.4.5.2); it is thus not yet necessary to start an additional pump;
3. The pump motor speed remains saturated at maximum value (C4.3.1.1.2), as the value of the control process variable continues to decrease. At this point, however, its deviation from the control setpoint exceeds the threshold programmed for starting an additional pump (A3.4.5.2), initiating the time count (A3.4.5.3);
4. The motor speed remains at the maximum value (C4.3.1.1.2) and the value of the control process variable continues to decrease. The difference between the setpoint and the control process variable remains greater than the deviation programmed to start another pump (A3.4.5.2) and the time to connect one more pump in parallel to the Pump Genius (A3.4.5.3) has elapsed. At this moment, a command is made to connect another pump in parallel in the pump control. The pump to be turned on will be the one with the shortest operating time among those that are enabled for use;
5. Another pump in parallel has been successfully connected and the PID controller sends the same speed reference to both pumps. At this moment, it is achieved that the control process variable reaches the control setpoint required by the user, but the pumping control is not yet stabilized;
6. With the addition of one more pump in parallel in the Pump Genius, the PID controller is able to stabilize the pumping control according to the control setpoint required by the user.

A3.4.5 Start/Stop Pumps

A3.4.5.5 Speed Stop Pump

Range:	0 ... 30000	**Default:** 450
Properties:		

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.4.5 Start/Stop Pumps

A3.4.5.6 Deviation Stop Pump

Range:	-30000 ... 30000	**Default:** 10
Properties:		

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

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.4.5 Start/Stop Pumps		
A3.4.5.7 Stop Pump Time		
Range:	0.0 ... 99.9 s	**Default:** 1.0 s
Properties:		

Description:
This parameter defines a time delay during which both conditions of parameters A3.4.5.5 and A3.4.5.6 must remain satisfied before stopping one of the pumps in parallel in the Pump Genius.

A3.4.5 Start/Stop Pumps		
A3.4.5.8 Stop Pump Delay		
Range:	0.00 ... 9.99 s	**Default:** 0.05 s
Properties:		

Description:
This parameter defines a delay for the beginning of the acceleration of the pump driven by the CFW900 frequency inverter when a pump in parallel is stopped.

NOTE!
This parameter is only valid for the Pump Genius Multipump application.

NOTE!
Value of the parameter in “0.0” will not apply the acceleration of the pump driven by the CFW900 frequency inverter, i.e., the pump remains at the same speed it was before a pump is stopped.

The Figure 4.17 on page 4-58 presents a timing analysis of the Pump Genius operation with Direct Mode PID controller, when the need to stop one pump in parallel is detected.

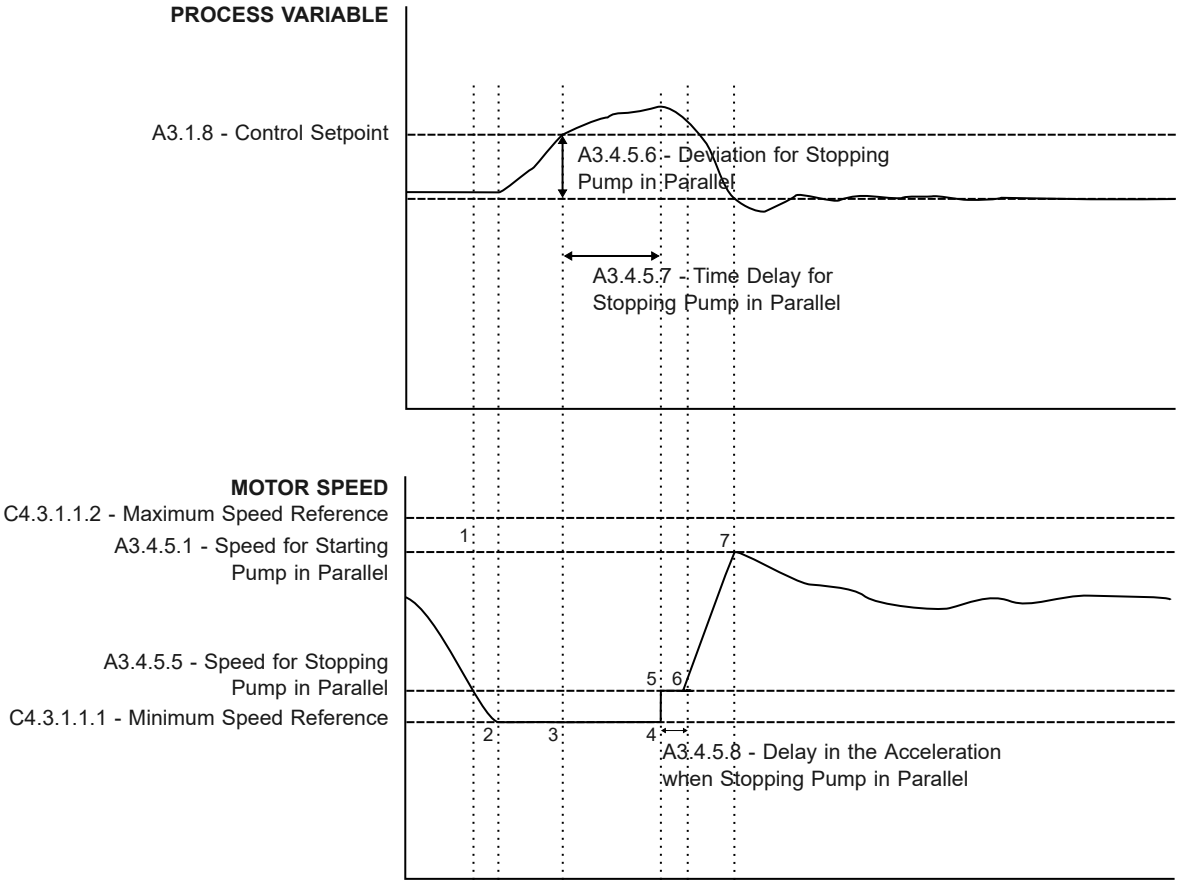


Figure 4.17: *Pump Genius Multipump operation for stop one pump in parallel*

1. The Pump Genius is operating with more than one pump activated and is decreasing its speed to control the process variable. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (A3.4.5.5), but the control process variable deviation from the control setpoint remains lower than the threshold programmed for stopping one pump (A3.4.5.6). Thus, it is not necessary to stop one pump in parallel;
2. The pumps motor speed reaches its minimum (C4.3.1.1.1) and the value of the control process variable begins to increase. however, the difference between the setpoint and the control process variable remains less than the deviation programmed to stop the pump;
3. The pumps motor speed continues at minimum speed (C4.3.1.1.1), as the value of the control process variable continues to increase. At this moment its deviation from the control setpoint exceeds the threshold programmed for stopping one pump in parallel (A3.4.5.6), and the time count (A3.4.5.7) is initiated;
4. The pumps motor speed continues at minimum speed (C4.3.1.1.1) and the value of the control process variable keeps increasing. The difference between the setpoint and the control process variable is still above the deviation set to stop one pump (A3.4.5.6) and the time to start one pump in parallel on the pumping control (A3.4.5.7) elapses. At this moment, a commanded to stop one pump in parallel on the pumping control. The pump to be stopped will be the one with the longest operation time among those which are enabled for operation;
5. One pump stop. At this moment, the PID controller goes into the manual control mode and the speed of the pump driven by the inverter goes to the value set in A3.4.5.5. Then the time count of the delay to start the acceleration of the pump driven by the inverter (A3.4.5.8) begins;
6. The time count of the delay to start the acceleration of the pump driven by the inverter (A3.4.5.8) elapses. The PID controller remains in the manual control mode and the speed reference of the pump driven by the inverter goes to the value set in A3.4.5.1;
7. The motor accelerates up to the value set to start a pump (A3.4.5.1) and the PID controller goes to the automatic control mode. Then the PID controller begins to control the system again to stabilize the pumping control according to the setpoint required by the user, but now with least one pump in parallel.

The Figure 4.18 on page 4-60 presents a timing analysis of the Pump Genius Multiplex operation, when the need to stop one pump in parallel is detected.

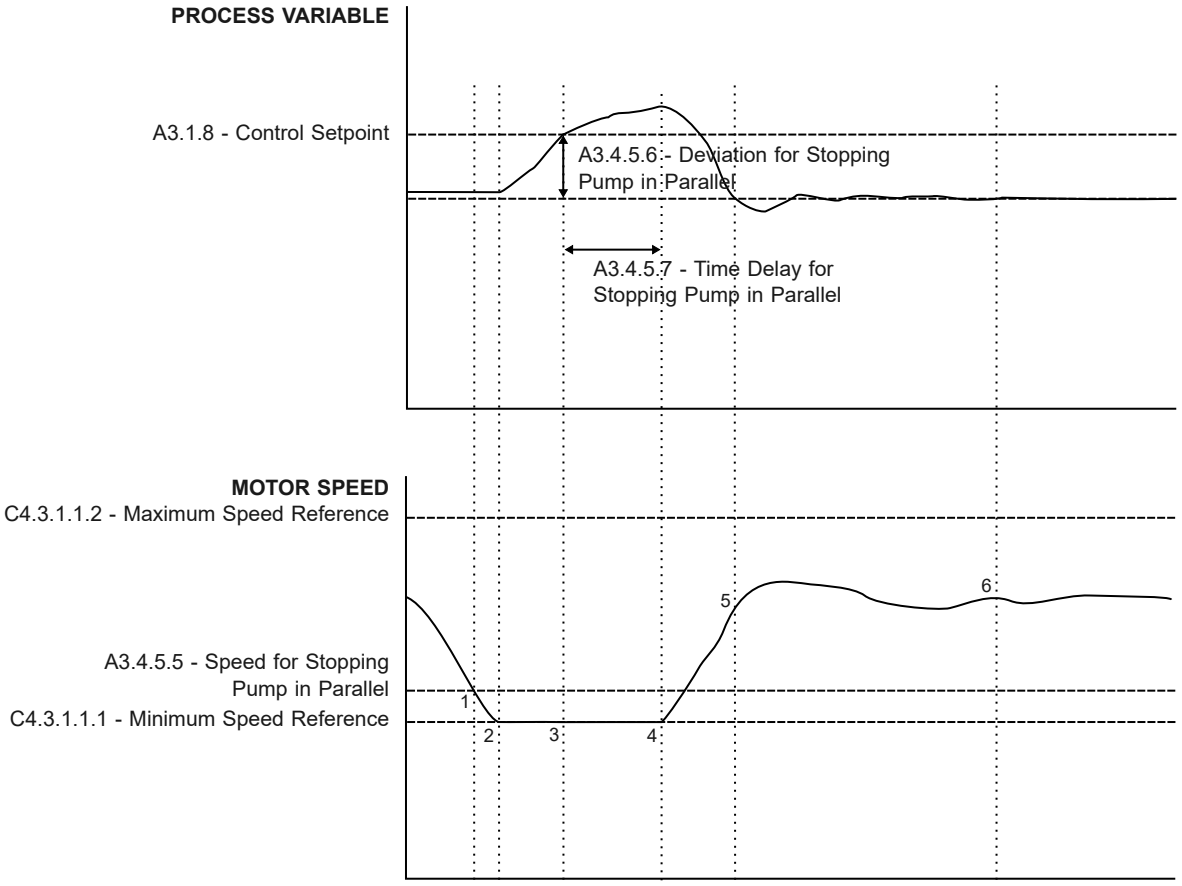


Figure 4.18: *Pump Genius Multiplex operation for stop one pump in parallel*

1. The Pump Genius is operating with more than one pump activated and is decreasing its speed to control the process variable. At this moment the pumps motor speed drops below the threshold programmed for stopping one pump (A3.4.5.5), but the control process variable deviation from the control setpoint remains lower than the threshold programmed for stopping one pump (A3.4.5.6). Thus, it is not necessary to stop one pump in parallel;
2. The pumps motor speed reaches its minimum value (C4.3.1.1.1) and the value of the control process variable begins to increase. However, its deviation from the control setpoint remains lower than the threshold programmed for stopping one pump in parallel (A3.4.5.6). Thus, it is not necessary to stop one pump in parallel;
3. The pumps motor speed continues at minimum speed (C4.3.1.1.1), as the value of the control process variable continues to increase. At this moment its deviation from the control setpoint exceeds the threshold programmed for stopping one pump in parallel (A3.4.5.6), and the time count (A3.4.5.7) is initiated;
4. All processes continue as at time point 3, until the time count (A3.4.5.7) is elapsed. At this moment, a command is made to stop a pump in parallel in the pump control. The pump to be turned off will be the one that has the longest operating time among those that are enabled for use;
5. One of the parallel pumps was successfully stopped; at this moment the control process variable reaches the control setpoint required by the user, but the system is not yet stabilized;
6. With the removal of a pump in parallel from the Pump Genius, the PID controller is able to stabilize the pumping control according to the control setpoint required by the user.

A3.4.5 Start/Stop Pumps		
A3.4.5.9 Delay Contactor Com.		
Range:	0.00 ... 9.99 s	**Default:** 0.10 s
Properties:		

Description:
This parameter defines the time that will be waited to make the command to close the contactor at the output of the frequency inverter, to ensure that power contacts are closed when the frequency converter is to apply voltage to the motor. This delay time is also used to ensure that before generating the command to open the contactor at the frequency inverter output, the frequency inverter is no longer applying voltage to the motor and it is already demagnetized, thus preventing the occurrence of fault F071 in the frequency inverter.

NOTE!
This parameter is valid for the floating and cascade control modes (Pump Genius Multipump application).

A3.4.5 Start/Stop Pumps

A3.4.5.10 Time Contactor Fault

Range: 0.00 ... 9.99 s **Default:** 0.50 s

Properties:

Description:
This parameter defines the time monitoring the inverter current (loss of current on opening and presence of current on closing) the output contactor of the frequency inverter to generate the fault “F1885: Failure to Open/Close Contactor”.

NOTE!
A setting of “0.0” disables the failure to open/close contactor.

NOTE!
This parameter is valid for the cascade control mode (Pump Genius Multipump application).

A3.4.6 Alternation

This group of parameters allows the user to configure the pump alternation function of the Pump Genius.

The Pump Genius will perform the alternation if it remains out of sleep mode with only one pump running, with speed below the speed to force alternation (A3.4.6.1) and for the time defined to force alternation (A3.4.6.2). When the application commands the alternation, the pump is turned off and the pump with the shortest operating time is turned on to continue controlling the pumping according to the user-required setpoint.

There is also the test mode, which alternates the pumps every 60 seconds in a circular, sequential, and uninterrupted manner.

NOTE!
This group of parameters is valid only for Pump Genius Multipump and Multiplex applications.

A3.4.6 Alternation

A3.4.6.1 Alt. Pump Enable

Range: 0 ... 2 **Default:** 0

Properties:

Description:
This parameter enables the pump alternation function in Pump Genius Multipump or Multiplex applications. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.
2 = Test Mode	It enables the test function.

A3.4.6 Alternation

A3.4.6.2 Force Alt. Time

Range: 0 ... 999 h **Default:** 72 h

Properties:

Description:
This parameter defines the operating time of the Pump Genius with only one pump running to trigger the alternation.

NOTE!
The hour count is reset every time the Pump Genius has all pumps turned off.

NOTE!
For the Pump Genius Multiplex application, the operating time will be counted by the frequency inverter CFW900 that is functioning as the system's master pump.

A3.4.6 Alternation

A3.4.6.3 Speed Forcing Alt.

Range: 0 ... 30000 **Default:** 500

Properties:

Description:
This parameter defines the pump motor speed value below which the Pump Genius will be able to force the pumps to alternate.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.5 Protections

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

A3.5.1 Process Var. Level

This group of parameters allows the user to configure the level protections of the process variable of Pump Genius.

A3.5.1 Process Var. Level

A3.5.1.1 Low Level PV Limit

Range: -30000 ... 30000 **Default:** 100

Properties:

Description:
This parameter defines the value below which the low level alarm will be generated for the control process variable (A1898).

NOTE!
Setting it to “0” disables the low level alarm and fault for the control process variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.5.1 Process Var. Level

A3.5.1.2 Low Level PV Time

Range: 0.0 ... 99.9 s **Default:** 0.0 s

Properties:

Description:
This parameter defines how long the low level alarm condition should remain so that the control process variable (A1898) will generate fault “F1899: Control Process Variable Low Level”.

NOTE!
Setting it to “0.0” disables the low level fault for the control process variable.

A3.5.1 Process Var. Level

A3.5.1.3 High Level PV Limit

Range: -30000 ... 30000 **Default:** 1000

Properties:

Description:
This parameter defines the value above which the high level alarm will be generated for the control process variable (A1900).

NOTE!
Setting it to “0” disables the high level alarm and fault for the control process variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 1 (C10.2.1 and C10.2.2).

A3.5.1 Process Var. Level

A3.5.1.4 High Level PV Time

Range: 0.0 ... 99.9 s **Default:** 0.0 s

Properties:

Description:
This parameter defines how long the high level alarm condition should remain so that the control process variable (A1900) will generate fault “F1901: Control Process Variable High Level”.

NOTE!
Setting it to “0.0” disables the high level fault for the control process variable.

A3.5.2 Auxiliary Var. Level

This group of parameters allows the user to configure the level protections of the auxiliary variable of Pump Genius.

A3.5.2 Auxiliary Var. Level		
A3.5.2.1 Low Level AV Limit		
Range:	-30000 ... 30000	**Default:** 40
Properties:		

Description:
This parameter defines the value below which a low-level alarm will be generated for the process auxiliary variable (A1902).

NOTE!
Setting it to ”0” disables the low level alarm and fault for the process auxiliary variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 4 (C10.2.7 and C10.2.8).

A3.5.2 Auxiliary Var. Level		
A3.5.2.2 Time Low Level AV		
Range:	0.0 ... 99.9 s	**Default:** 0.0 s
Properties:		

Description:
This parameter defines how long the low level alarm condition should remain so that the process auxiliary variable (A1902) will generate fault “F1903: Process Auxiliary Variable Low Level”.

NOTE!
Setting it to “0.0” disables the low level fault for the process auxiliary variable.

A3.5.2 Auxiliary Var. Level		
A3.5.2.3 High AV Level Limit		
Range:	-30000 ... 30000	**Default:** 1000
Properties:		

Description:
This parameter defines the value above which the high level alarm will be generated for the process auxiliary variable (A1904).

NOTE!
Setting it to “0” disables the high level alarm and fault for the process auxiliary variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 4 (C10.2.7 and C10.2.8).

A3.5.2 Auxiliary Var. Level

A3.5.2.4 Time High Level AV

Range:	0.0 ... 99.9 s	**Default:** 0.0 s
Properties:		

Description:
This parameter defines how long the high level alarm condition should remain so that the process auxiliary variable (A1904) will generate fault ”F1905: Process Auxiliary Variable High Level”.

NOTE!
Setting it to “0.0” disables the high level fault for the process auxiliary variable.

A3.5.3 Flow Var. Level

This group of parameters allows the user to configure the level protections of the flow variable of Pump Genius.

A3.5.3 Flow Var. Level

A3.5.3.1 Low Flow Limit

Range:	-30000 ... 30000	**Default:** 50
Properties:		

Description:
This parameter defines the value below which a low-level alarm will be generated for the flow variable (A1906).

NOTE!
Setting it to ”0” disables the low level alarm and fault for the flow variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 3 (C10.2.5 and C10.2.6).

A3.5.3 Flow Var. Level

A3.5.3.2 Low Flow Level Time

Range:	0.0 ... 99.9 s	**Default:** 0.0 s
Properties:		

Description:
This parameter defines how long the low level alarm condition should remain so that the flow variable (A1906) will generate fault “F1907: Flow Variable Low Level”.

NOTE!
Setting it to “0.0” disables the low level fault for the flow variable.

A3.5.3 Flow Var. Level

A3.5.3.3 High Flow Limit

Range:	-30000 ... 30000	**Default:** 500
Properties:		

Description:
This parameter defines the value above which the high level alarm will be generated for the flow variable (A1908).

NOTE!
Setting it to “0” disables the high level alarm and fault for the flow variable.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 3 (C10.2.5 and C10.2.6).

A3.5.3 Flow Var. Level

A3.5.3.4 High Flow Level Time

Range: 0.0 ... 99.9 s **Default:** 0.0 s

Properties:

Description:
This parameter defines how long the high level alarm condition should remain so that the flow variable (A1908) will generate fault “F1909: Flow Variable High Level”.

NOTE!
Setting it to “0.0” disables the high level fault for the flow variable.

A3.5.4 External Sensor

This group of parameters allows the user to configure the protection of the external sensor protection of Pump Genius.

A3.5.4 External Sensor

A3.5.4.1 Ext. Sensor#1 Source

Range: 0 ... 14 **Default:** 3

Properties:

Description:
It enables the use and defines the source of external sensor 1. The options are shown in parameter A3.5.4.4.

A3.5.4 External Sensor

A3.5.4.2 Ext. Sensor#2 Source

Range: 0 ... 14 **Default:** 0

Properties:

Description:
It enables the use and defines the source of external sensor 2. The options are shown in parameter A3.5.4.4.

A3.5.4 External Sensor

A3.5.4.3 Ext. Sensor#3 Source

Range: 0 ... 14 **Default:** 0

Properties:

Description:
It enables the use and defines the source of external sensor 3. The options are shown in parameter A3.5.4.4.

A3.5.4 External Sensor

A3.5.4.4 Ext. Sensor#4 Source

Range: 0 ... 14 **Default:** 0

Properties:

Description:
It enables the use and defines the source of external sensor 4. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.

A3.5.4 External Sensor

A3.5.4.5 Time Ext. Sensor

Range: 0.0 ... 99.9 s **Default:** 0.0 s

Properties:

Description:
This parameter defines the waiting time with the conditions of external sensors at logic level “0” while the pump is running, before the external sensor fault “F1891: External Sensor Protection” is generated.

NOTE!
A setting of “0.0” disables the pump protection faults via external sensor.

NOTE!
In the Pump Genius Multiplex application, when this protection acts on the pump inverter that is the system master, alarm A1890 will be generated instead of the F1891 fault to prevent the Pump Genius control from being reset when performing the fault reset on the inverter.

A3.5.5 Dry Pump

This group of parameters allows the user to configure the dry pump protection of Pump Genius.

A3.5.5 Dry Pump

A3.5.5.1 Dry Pump Function

Range: 0 ... 1 **Default:** 0

Properties:

Description:
This parameter enables the dry pump protection function. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.

A3.5.5 Dry Pump

A3.5.5.2 Speed Dry Pump

Range: 0 ... 30000 **Default:** 550

Properties:

Description:
This parameter defines the pump motor speed threshold value, above which evaluation of actual motor current to detect the dry pump condition (A3.5.5.3) is enabled.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.5.5 Dry Pump

A3.5.5.3 Curr. Level Dry Pump

Range: 0.0 ... 100.0 % **Default:** 20.0 %

Properties:

Description:
This parameter defines the current value of the pump motor (%) below which the dry pump condition will be detected, and then the alarm message “A1886: Dry Pump Protection” is generated to indicate this situation.

A3.5.5 Dry Pump

A3.5.5.4 Time Dry Pump Fault

Range: 0.0 ... 99.9 s **Default:** 5.0 s

Properties:

Description:
This parameter defines the waiting time with the dry pump condition (A1886) active, before the dry pump fault “F1887: Dry Pump Protection” is generated.

NOTE!
A setting of “0.0” disables the dry pump fault.

The Figure 4.19 on page 4-69 presents a timing analysis of the Pump Genius operation when a Dry Pump Fault is detected.

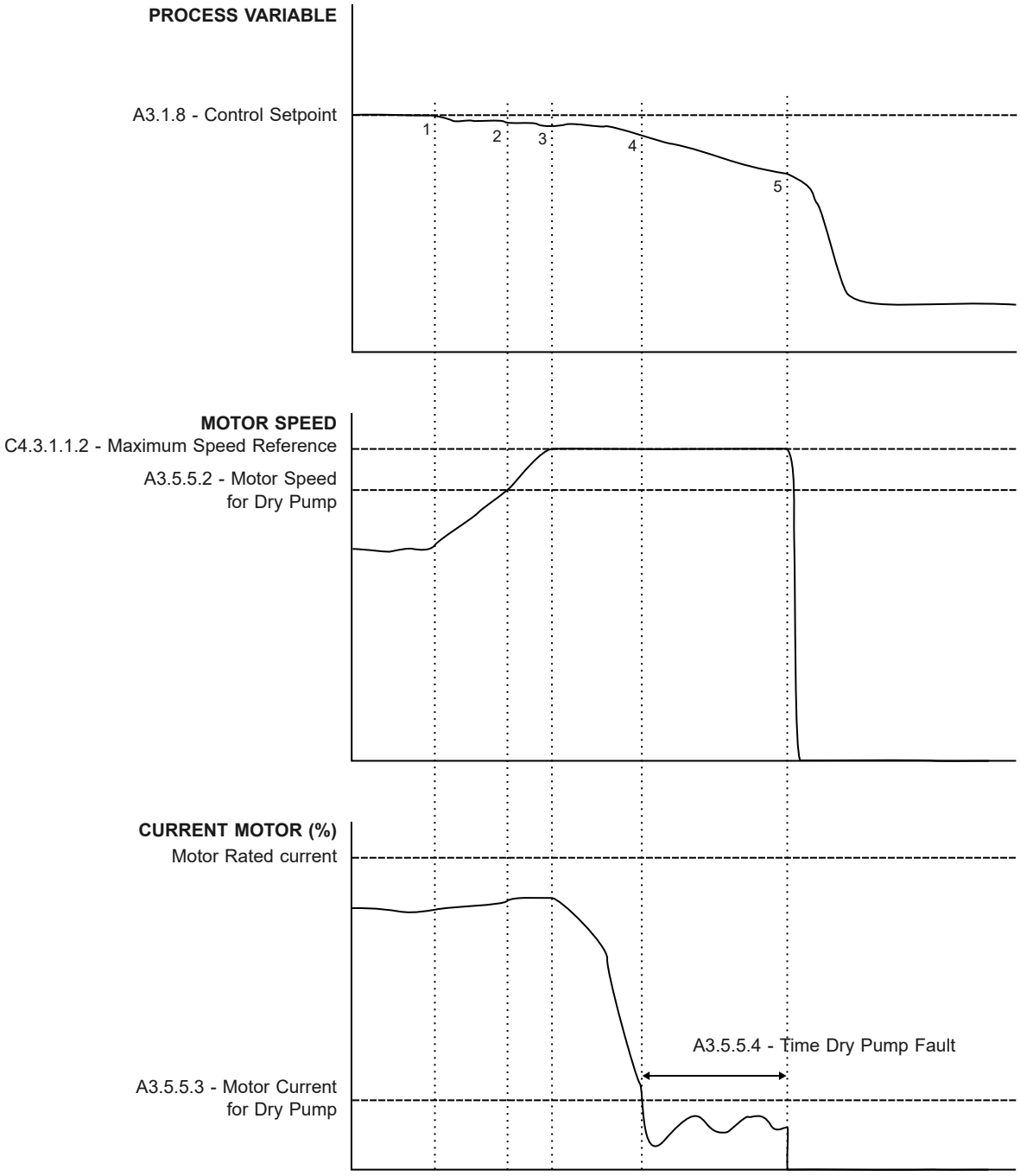


Figure 4.19: *Operation of the Pump Genius for dry pump protection*

1. The Pump Genius is running at a speed satisfying the control setpoint required by the user. At this moment the value of the control process variable begins to decrease and pump speed begins to increase;
2. The pump speed continues to increase and becomes greater than the threshold programmed for detecting dry pump (A3.5.5.2);
3. The pump speed continues to increase and reaches the maximum speed programmed for the pump (C4.3.1.1.2), but as the pump motor torque is still greater than the threshold programmed to detect dry pump (A3.5.5.3), pumping continues while the value of the control process variable continues to decrease;
4. As the pump continues to operate at maximum speed, and the process variable continues to decrease, the pump motor current drops below the threshold programmed to detect dry pump (A3.5.5.3). At this moment the time count to generate Dry Pump Fault (A3.5.5.4) is initiated and the alarm message "A1886: Dry Pump Protection" is generated to alert the user, that the protection for dry pump is about to act and disable the inverter driven pump;
5. The pump continues to operate at maximum speed, and the control process variable continues to decrease, while the pump motor current remains below the threshold programmed to detect Dry Pump (A3.5.5.3). At this moment the time delay to generate Dry Pump Fault (A3.5.5.4) is elapsed, and the fault "F1887: Dry Pump Protection" is generated, disabling the inverter driven pump.

A3.5.6 Pump Leakage

This group of parameters allows the user to configure the pump leakage protection of Pump Genius.

The load of a pump is typically quadratic, meaning the electric current increases quadratically with the motor's rotational speed. Therefore, a typical quadratic curve can be considered, and if the current is lower, it may indicate that the pump is leaking or dry.

The pump leak protection will activate when the current is within the area defined by the pump leak current parameters (A3.5.6.3, A3.5.6.5 and A3.5.6.7) and pump leak speed parameters (A3.5.6.2, A3.5.6.4 and A3.5.6.6), as shown in the shaded area of the figure below. When this occurs, alarm A1888 will be activated. If the alarm persists for longer than the pump leak failure time (A3.5.6.8), fault F1889 will be activated.

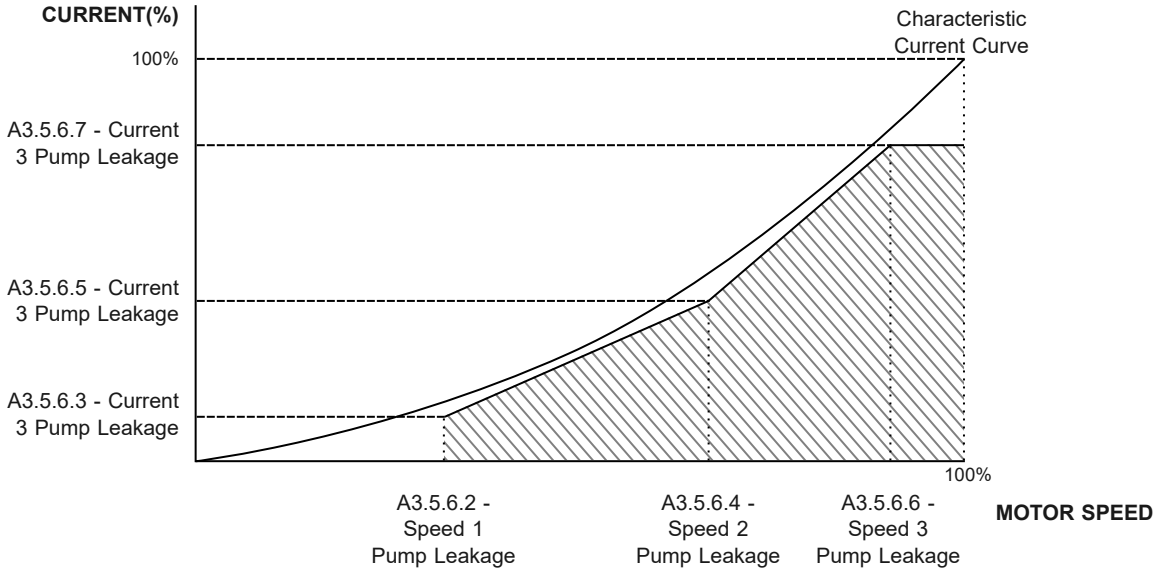


Figure 4.20: *Operation of Pump Genius for pump leakage protection*

A3.5.6 Pump Leakage		
A3.5.6.1 Pump Leakage Function		
Range:	0 ... 1	**Default:** 0
Properties:		

Description:
This parameter enables the pump leakage protection function. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables this function.
1 = Enable	It enables this function.

A3.5.6 Pump Leakage
A3.5.6.2 Speed #1 Pump Leakage
Range: 0 ... 30000 **Default:** 300
Properties:

Description:
This parameter defines the speed 1 of the pump leakage detection function.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.5.6 Pump Leakage
A3.5.6.3 Curr. #1 Pump Leakage
Range: 0.0 ... 100.0 % **Default:** 20.0 %
Properties:

Description:
This parameter defines the current 1 of the pump leakage detection function.

A3.5.6 Pump Leakage
A3.5.6.4 Speed #2 Pump Leakage
Range: 0 ... 30000 **Default:** 500
Properties:

Description:
This parameter defines the speed 2 of the pump leakage detection function.

NOTE!
This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.5.6 Pump Leakage
A3.5.6.5 Curr. #2 Pump Leakage
Range: 0.0 ... 100.0 % **Default:** 40.0 %
Properties:

Description:
This parameter defines the current 2 of the pump leakage detection function.

A3.5.6 Pump Leakage
A3.5.6.6 Speed #3 Pump Leakage
Range: 0 ... 30000 **Default:** 600
Properties:

Description:
This parameter defines the speed 3 of the pump leakage detection function.

> **NOTE!**
> This parameter will be displayed according to the selection of the parameters for the engineering unit 2 (C10.2.3 and C10.2.4).

A3.5.6 Pump Leakage		
A3.5.6.7 Curr. #3 Pump Leakage		
Range:	0.0 ... 100.0 %	**Default:** 60.0 %
Properties:		

Description:
This parameter defines the current 3 of the pump leakage detection function.

A3.5.6 Pump Leakage		
A3.5.6.8 Time Pump Leak. Fault		
Range:	0.0 ... 99.9 s	**Default:** 5.0 s
Properties:		

Description:
This parameter defines the waiting time with the pump leakage condition (A1888) active, before the pump leakage fault “F1889: Pump Leakage Protection” is generated.

> **NOTE!**
> A setting of “0.0” disables the pump leakage fault.

A3.5.7 Deragging

This group of parameters allows the user to configure the deragging protection of Pump Genius.

The protection consists of executing the pump deragging to prevent it from becoming clogged and thus unable to operate.

The basic principle of deragging is to operate the pump in the reverse direction of pumping to remove the accumulated dirt, allowing the pump to function again.

> **NOTE!**
> This function should only be enabled on a pump that can operate in the reverse direction of pumping; otherwise, it may cause damage to the pump.

The Figure 4.21 on page 4-73 presents an analysis of the pump deragging process operation:

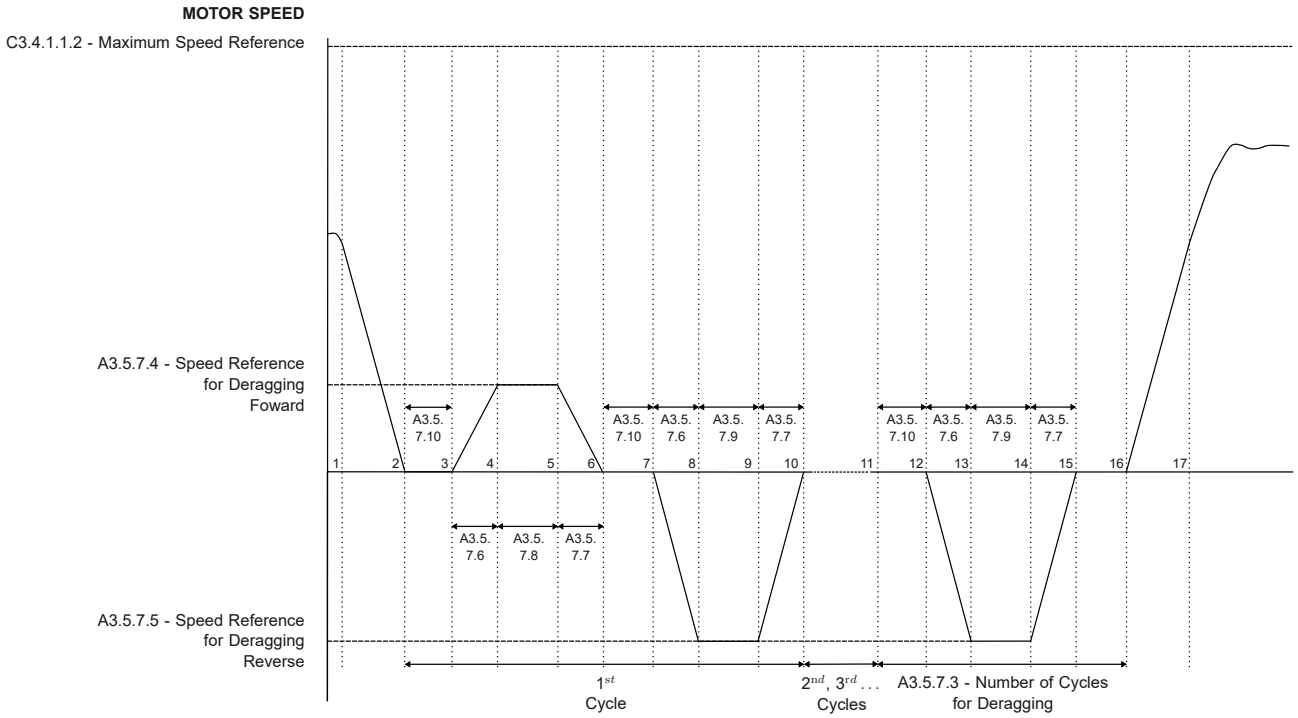


Figure 4.21: *Operation of the pump deragging*

1. Pump Genius is enabled and controlling the pump driven by the frequency inverter CFW900. At this moment, a command is issued to execute the pump deragging. This command can be generated automatically by Pump Genius through detection or manually by the user, depending on the selection of the deragging function (A3.5.7.1). Then, a command is issued to turn off the pump to start the deragging process;
2. The pump is decelerated to “zero” speed using the deceleration ramp defined in parameter C6.1.1 and remains stopped. At this moment, the count for the first deragging cycle begins, and the time count with the pump stopped in the deragging cycle (A3.5.7.10) is initiated;
3. The time with the pump stopped in the deragging cycle (A3.5.7.10) has elapsed; at this moment, a command is issued to start the pump in the pumping direction with the speed reference for deragging in the forward direction (A3.5.7.4); the PID controller remains disabled;
4. The pump is accelerated to the speed reference for deragging in the forward direction (A3.5.7.4) using the acceleration ramp defined in parameter A3.5.7.6 and remains at this speed until the time count with the pump running in the deragging cycle in the forward direction (A3.5.7.8) has elapsed;
5. The time with the pump running in the deragging cycle in the forward direction (A3.5.7.8) has elapsed; at this moment, a command is issued to stop the pump in the pumping direction;
6. The pump is decelerated to “zero” speed using the deceleration ramp defined in parameter A3.5.7.7 and remains stopped. At this moment, the time count with the pump stopped in the deragging cycle (A3.5.7.10) is initiated;
7. The time with the pump stopped in the deragging cycle (A3.5.7.10) has elapsed; at this moment, a command is issued to start the pump in the reverse direction of pumping with the speed reference for deragging in the reverse direction (A3.5.7.5); the PID controller remains disabled;
8. The pump is accelerated to the speed reference for deragging in the reverse direction (A3.5.7.5) using the acceleration ramp defined in parameter A3.5.7.6 and remains at this speed until the time count with the pump running in the deragging cycle in the reverse direction (A3.5.7.9) has elapsed;
9. The time with the pump running in the deragging cycle in the reverse direction (A3.5.7.9) has elapsed; at this moment, a command is issued to stop the pump in the reverse direction of pumping;

10. The pump is decelerated to “zero” speed using the deceleration ramp defined in parameter A3.5.7.7 and remains stopped. At this moment, the cycle counter is incremented and the time count with the pump stopped in the deragging cycle (A3.5.7.10) is initiated; steps 2 to 10 occur again until the number of cycles equals the value set in the number of deragging cycles (A3.5.7.3);
11. The number of cycles reaches the value set in the number of deragging cycles (A3.5.7.3) and the last cycle is initiated; steps 2 to 6 occur again, then the time count with the pump stopped in the deragging cycle (A3.5.7.10) is initiated;
12. The time with the pump stopped in the deragging cycle (A3.5.7.10) has elapsed; at this moment, a command is issued to start the pump in the reverse direction of pumping with the speed reference for deragging in the reverse direction (A3.5.7.5); the PID controller remains disabled;
13. The pump is accelerated to the speed reference for deragging in the reverse direction (A3.5.7.5) using the acceleration ramp defined in parameter A3.5.7.6 and remains at this speed until the time count with the pump running in the deragging cycle in the reverse direction (A3.5.7.9) has elapsed;
14. The time with the pump running in the deragging cycle in the reverse direction (A3.5.7.9) has elapsed; at this moment, a command is issued to stop the pump in the reverse direction of pumping;
15. The pump is decelerated to “zero” speed using the deceleration ramp defined in parameter A3.5.7.7;
16. At this moment, a command is issued to start the pump and resume pumping control, indicating that the deragging process has been completed;
17. The inverter accelerates the pump to the minimum speed. After this, the PID controller is enabled and begins to control the pump speed to stabilize the process variable according to the control setpoint required by the user.

A3.5.7 Deragging

A3.5.7.1 Deragging Function

Range: 0 ... 4 **Default:** 0

Properties:

Description:
This parameter defines the execution mode of the deragging function for the pump driven by the CFW900 inverter. The following table demonstrates the parameter options.

Table 4.35: *Description of execution mode of the deragging function*

A3.5.7.1	Description
0	It defines that the deragging function will not be executed, i.e., is disabled.
1	It defines that the deragging function will be enabled and executed every time there is a command to run the pump. This command can be from HMI, a digital input, via communications networks, etc.
2	It defines that the deragging function will be enabled and executed every time the digital input DIx receives a command, i.e., change the logic level “0” to logic level “1”.
3	It defines that the deragging function will be enabled and executed every time that the clogging of pump is detected via high motor current.
4	It defines that the deragging function will be enabled and executed every time there is a command via network.

NOTE!
In order to be able to execute the deragging function, it is necessary that the application firmware controls the motor speed direction to do with the pump operates in reverse pumping direction. Attention, the deragging function will only operate with the CFW900 inverter in REMOTE mode.

NOTE!
The options 1 and 3 are available only for the Pump Genius Simplex application.

A3.5.7 Deragging

A3.5.7.2 Source DI Deragging

Range: 0 ... 14 **Default:** 0

Properties:

Description:
It enables the use and defines the source to command the deragging when the deragging function (A3.5.7.1) is DIx. The following table demonstrates the parameter options.

Indication	Description
0 = Inactive	It disables the use of the digital input in this function.
1 = DI X-1	It enables the use of the digital input DI1 of Slot X.
2 = DI X-2	It enables the use of the digital input DI2 of Slot X.
3 = DI X-3	It enables the use of the digital input DI3 of Slot X.
4 = DI X-4	It enables the use of the digital input DI4 of Slot X.
5 = DI X-5	It enables the use of the digital input DI5 of Slot X.
6 = DI X-6	It enables the use of the digital input DI6 of Slot X.
7 = DI B-1	It enables the use of the digital input DI1 of Slot B.
8 = DI B-2	It enables the use of the digital input DI2 of Slot B.
9 = DI B-3	It enables the use of the digital input DI3 of Slot B.
10 = DI B-4	It enables the use of the digital input DI4 of Slot B.
11 = DI B-5	It enables the use of the digital input DI5 of Slot B.
12 = DI B-6	It enables the use of the digital input DI6 of Slot B.
13 = DI B-7	It enables the use of the digital input DI7 of Slot B.
14 = DI B-8	It enables the use of the digital input DI8 of Slot B.

A3.5.7 Deragging

A3.5.7.3 Number Cycles Derag.

Range: 0 ... 20 **Default:** 5

Properties:

Description:
This parameter defines the number of times (cycles) that the pump will operate in reverse pumping direction to execute the deragging function for the pump driven by CFW900 inverter.

A3.5.7 Deragging

A3.5.7.4 Foward Derag. Speed

Range: 0 ... 30000 **Default:** 100

Properties:

Description:
This parameter defines the speed reference value for the pump to execute the deragging function in the forward direction.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (C10.2.3 e C10.2.4).

A3.5.7 Deragging

A3.5.7.5 Reverse Derag. Speed

Range: 0 ... 30000 **Default:** 100

Properties:

Description:
This parameter defines the speed reference value for the pump to execute the deragging function in the reverse direction.

NOTE!
This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (C10.2.3 e C10.2.4).

A3.5.7 Deragging
A3.5.7.6 Time Accel. Deragging
Range: 0.1 ... 99.9 s **Default:** 2.0 s
Properties:

Description:
Adjusts the ramp acceleration time for the speed reference during the execution of the deragging function.

A3.5.7 Deragging
A3.5.7.7 Time Decel. Deragging
Range: 0.1 ... 99.9 s **Default:** 2.0 s
Properties:

Description:
Adjusts the ramp deceleration time during the execution of the deragging function.

A3.5.7 Deragging
A3.5.7.8 Derag. Foward Time
Range: 0.1 ... 99.9 s **Default:** 2.0 s
Properties:

Description:
This parameter defines the value of time that the pump will run in the forward direction (with speed reference for deragging) in the deragging cycle execution.

A3.5.7 Deragging
A3.5.7.9 Derag. Reverse Time
Range: 0.1 ... 99.9 s **Default:** 2.0 s
Properties:

Description:
This parameter defines the value of time that the pump will run in the reverse direction (with speed reference for deragging) in the deragging cycle execution.

A3.5.7 Deragging
A3.5.7.10 Deragging Stop Time
Range: 0.1 ... 99.9 s **Default:** 2.0 s
Properties:

Description:
This parameter defines the value of time that the pump remains stopped in the deragging cycle execution.

A3.5.7 Deragging
A3.5.7.11 Detect Clogging Level
Range: 0.0 ... 100.0 % **Default:** 70.0 %
Properties:

Description:
This parameter defines the value of motor current (%) above which will be considered that the pump is running at high current, i.e., the pump is in clogging process.

A3.5.7 Deragging		
A3.5.7.12 Time Detect Clogging		
Range:	0.0 ... 99.9 s	**Default:** 60.0 s
Properties:		

Description:
This parameter define the waiting time with the condition of high current in the pump motor to detect that it is in clogging process, being thus generated the alarm message "A1892: Clogging Detected" to indicate this situation.

A3.5.7 Deragging		
A3.5.7.13 Number Clogging Fault		
Range:	0 ... 20	**Default:** 5
Properties:		

Description:
This parameter defines the number of consecutives clogging detected to generate the fault "F1893: Excess Clogging Protection"

NOTE!
A setting of "0" disables the fault by excess of clogging detected. Every time that the Pump Genius is disabled or goes to sleep mode, i.e., the pump is stopped, the count of clogging is reset.

5 FAULTS AND ALARMS

Fault/Alarm	Description	Possible Causes
A1850: Recognizing SymbiNet Network	It indicates that the CFW900 inverter is in the process of acknowledging the SymbiNet network.	CFW900 inverter was energized and waiting its turn for up to 3 seconds to acknowledge the SymbiNet network.
A1852: SymbiNet is not active	It indicates that the SymbiNet protocol is not configured or there is an error in Ethernet interface.	The user has not enabled the SymbiNet protocol (C9.10.1). If the user has enabled it correctly, there may be an error in other protocol settings.
A1854: Change Master Pump? ENTER (yes) ESC (no)	It indicates the loss of communication with the pump that was master of the Pump Genius. Waiting for user command to execute (Enter=yes) or not execute (Esc=no) the manual change-over of the master pump of the Pump Genius.	Loss of communication with the pump that had assumed the master function of the Pump Genius.
F1855: Two or more Active Masters	It indicates that two or more master pumps have simultaneously assumed the master function in Pump Genius. Setting A3.2.1.5 = 0 disables the fault.	The user programmed two or more pumps for master and after a fault or rebooting of CFW900 inverter, two or more CFW900 inverters assumed the master function of the Pump Genius at the same time.
A1856: Master Pump Configuration Alarm	It indicates that the master pump was not properly configured, i.e., is unable to control the pumping with the PID controller.	The source of control setpoint was not defined or the source of control process variable was not defined.
F1857: Master Pump Configuration Error	It indicates that the master pump was not properly configured, i.e., is unable to control the pumping with the PID controller.	The command for enable the Pump Genius, or to enable use of the pump was executed with the alarm A1856 active.
A1858: Loss of Communication with the Master	It indicates that a follower pump has detected a loss of communication with the master pump in Pump Genius.	Loss of communication with the master pump.
A1860: Active Sleep Mode	It indicates that the Pump Genius is in the sleep mode.	Value of the pump motor speed is below the threshold programmed in A3.4.1.5 during the time programmed in A3.4.1.6.
A1862: Active Boost Function	It indicates that the sleep boost is in execution.	Motor speed was below the value set in A3.4.1.5 during the time set in A3.4.1.6, but before going into sleep mode applies a boost in the control setpoint to increase the process variable.
A1864: Pipe Charging	It indicates that the process of pipe charging is being executed.	Executed the command to enable Pump Genius with pipe charging enabled.
A1866: Force alternation of Pumps	It indicates to the user that the Pump Genius is forcing the alternation of pumps.	The Pump Genius is operating with only one pump running for a longer time than the value set in A3.4.6.2 and the speed value of this pump is lower than the value set in A3.4.6.3.
A1868: Pump 1 Disabled	It indicates that pump 1 was disabled while it was on.	The enabling source of pump 1 went to logic level “0” while pump was on.
A1870: Pump 2 Disabled	It indicates that pump 2 was disabled while it was on.	The enabling source of pump 2 went to logic level “0” while pump was on.
A1872: Pump 3 Disabled	It indicates that pump 3 was disabled while it was on.	The enabling source of pump 3 went to logic level “0” while pump was on.
A1874: Pump 4 Disabled	It indicates that pump 4 was disabled while it was on.	The enabling source of pump 4 went to logic level “0” while pump was on.
A1876: Pump 5 Disabled	It indicates that pump 5 was disabled while it was on.	The enabling source of pump 5 went to logic level “0” while pump was on.
A1878: Pump 6 Disabled	It indicates that pump 6 was disabled while it was on.	The enabling source of pump 6 went to logic level “0” while pump was on.
A1880: Pump 7 Disabled	It indicates that pump 7 was disabled while it was on.	The enabling source of pump 7 went to logic level “0” while pump was on.
A1882: Pump 8 Disabled	It indicates that pump 8 was disabled while it was on.	The enabling source of pump 8 went to logic level “0” while pump was on.
F1885: Failure to Open/Close Contactor	It indicates that the contactor failed to open or close its contacts.	The contactor may be stuck or have a poor connection in its terminals.
A1886: Dry Pump Protection	It indicates that the dry pump condition was detected.	Value of the pump motor speed is above of the threshold programmed in A3.5.5.2 and motor current is below the threshold programmed in A3.5.5.3.
F1887: Dry Pump Protection	It indicates that the pump was stopped due to dry pump protection.	During a time (A3.5.5.4) the value of the pump motor speed remained above of the threshold programmed in A3.5.5.2 and motor current remained below the threshold programmed in A3.5.5.3.

Fault/Alarm	Description	Possible Causes
A1888: Pump Leakage Protection	It indicates that the pump leaking condition has been detected.	The motor current value of the pump is within the area defined by the pump leakage current parameters (A3.5.6.3, A3.5.6.5, and A3.5.6.7) and the pump leakage speed parameters (A3.5.6.2, A3.5.6.4, and A3.5.6.6).
F1889: Pump Leakage Protection	It indicates that the pump leaking condition has been detected.	During a time (A3.5.6.8) the motor current value of the pump remained within the area defined by the pump leakage current parameters (A3.5.6.3, A3.5.6.5, and A3.5.6.7) and the pump leakage speed parameters (A3.5.6.2, A3.5.6.4, and A3.5.6.6).
A1890: External Sensor Protection	It indicates that one or more protections via external sensor are activated.	Pump in operation and one or more digital inputs configured as external sensors are at logical level "0".
F1891: External Sensor Protection	It indicates that the pump was stopped due to protection via external sensor.	Pump in operation and one or more digital inputs configured for external sensor at logical level "0" for a period of time (A3.5.4.5).
A1892: Clogging Detected	It indicates that the clogging of pump was detected due the high current in the pump motor.	Deragging was configured to execute when clogging is detected (A3.5.7.1 = 3) and the motor current was greater than the motor current to detect the pump clogging (A3.5.7.11) during a time to detect the pump clogging (A3.5.7.12).
F1893: Excess Clogging Protection	It indicates that the pump was stopped due a excess number of clogging detected.	Deragging was configured to execute when clogging is detected (A3.5.7.1 = 3) and the number of clogging detected was equal to the value defined as limit to generate a fault by consecutives clogging (A3.5.7.13).
A1894: Running Deragging	It indicates that the deragging function is in execution.	The deragging function is enabled (A3.5.7.1 ≠ 0) and in execution.
A1896: Active Anti-cavitation Protection	It indicates that cavitation has been detected and the anti-cavitation protection is active.	The auxiliary variable value fell below the cavitation detection level (A3.3.4.5) with the pump in operation. The alarm will only be cleared when the auxiliary variable value is greater than the cavitation detection level plus hysteresis (A3.3.4.6) and the PID 2 output is 0%.
A1898: Control Process Variable Low Level	It indicates that the control process variable is in low level.	The control process variable is lower than the value programmed in A3.5.1.1.
F1899: Control Process Variable Low Level	It indicates that the Pump Genius was stopped due to low level of the control process variable.	The control process variable remained for a time (A3.5.1.2) at a value lower than the threshold programmed in A3.5.1.1.
A1900: Control Process Variable High Level	It indicates that the control process variable is in high level.	The control process variable is higher than the value programmed in A3.5.1.3.
F1901: Control Process Variable High Level	It indicates that the Pump Genius was stopped due to high level of the control process variable.	The control process variable remained for a time (A3.5.1.4) at a value higher than the threshold programmed in A3.5.1.3.
A1902: Process Auxiliary Variable Low Level	It indicates that the control auxiliar variable is in low level.	The control process auxiliar is lower than the value programmed in A3.5.2.1.
F1903: Process Auxiliary Variable Low Level	It indicates that the Pump Genius was stopped due to low level of the control auxiliar variable.	The control auxiliar variable remained for a time (A3.5.2.2) at a value lower than the threshold programmed in A3.5.2.1.
A1904: Process Auxiliary Variable High Level	It indicates that the control auxiliar variable is in high level.	The control process auxiliar is higher than the value programmed in A3.5.2.3.
F1905: Process Auxiliary Variable High Level	It indicates that the Pump Genius was stopped due to high level of the control auxiliar variable.	The control auxiliar variable remained for a time (A3.5.2.4) at a value higher than the threshold programmed in A3.5.2.3.
A1906: Flow Variable Low Level	It indicates that the flow variable is in low level.	The flow variable is lower than the value programmed in A3.5.3.1.
F1907: Flow Variable Low Level	It indicates that the Pump Genius was stopped due to low level of the flow variable.	The flow variable remained for a time (A3.5.3.2) at a value lower than the threshold programmed in A3.5.3.1.
A1908: Flow Variable High Level	It indicates that the flow variable is in high level.	The flow variable is higher than the value programmed in A3.5.3.3.
F1909: Flow Variable High Level	It indicates that the Pump Genius was stopped due to high level of the flow variable.	The flow variable remained for a time (A3.5.3.4) at a value higher than the threshold programmed in A3.5.3.3.

Fault/Alarm	Description	Possible Causes
A1910: Active Flow Limiting Protection	It indicates that the flow limitation protection is active.	The flow variable value exceeded the flow limitation enable value (A3.3.5.5) with the pump in operation. The alarm will only be cleared when the flow variable value is below the flow limitation enable level and the PID 3 output is 0%.

6 PARAMETER STRUCTURE

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    - S1.2.2 Details
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  - S1.4 Control Accessory Data
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    - S1.4.2 Slot A
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  - S1.5 Date/Hour
  - S1.6 Control Words
- S2 Measurements
  - S2.1 Motor Speed
  - S2.2 Motor Torque
  - S2.3 Inverter Output
  - S2.4 Motor Temperatures
  - S2.5 Inverter Temperatures
    - S2.5.1 IGBT Temperature
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  - S2.7 DC Link
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  - S3.1 Slot X Status
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    - S3.1.5 Encoder
  - S3.2 Slot A Status
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S Status (cont.)

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  - S5.7 CAN/CANopen/DNet
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- S6 SoftPLC
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- D2 Alarms
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- D3 Hour Control
- D4 Inverter and Control Access.
  - D4.1 Inverter
    - D4.1.1 Fan Speed
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    - D4.1.4 Control Voltages
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  - D4.2 Control Accessories
    - D4.2.1 Diag. Slot A
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D Diagnostics (cont.)

- D4 Inverter and Control Access. (cont.)
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- C9 Communications (cont.)
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7 QUICK REFERENCES

Table 7.1: *Characteristics of parameters*

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
C2 Configurations\Motor							
C2.1	Motor Data						
C2.1.1	Motor Type	0 = Induction 1 = Synchronous - IPSM 2 = Synchronous - SPSM 3 = Synchronous - HSRM 4 = Not used			0	205	
C2.1.2	Motor Power Unit	0 = HP/cv 1 = kW			0	405	
C2.1.3	Rated Power	0.0 to 2000.0	1	C2.1.2	2.0	404	
C2.1.4	Rated Voltage	1 to 690 V	0	V	440	400	
C2.1.5	Rated Current	0.0 to 2223.0 A	1	A	3.6	401	
C2.1.6	Rated Frequency	1 to 500 Hz	0	Hz	60	403	
C2.1.7	Number of Pole Pairs	1 to 90	0		3	431	
C2.1.8	Rated Speed	0 to 30000 rpm	0	rpm	1750	402	
C2.1.9	Rated Efficiency	50.0 to 99.9 %	1	%	90.0	399	
C2.1.10	Rated cos phi	0.50 to 0.99	2		0.82	407	
C2.1.11	Service Factor	1.00 to 1.50	2		1.15	398	
C2.1.12	Ventilation	0 = Self-ventilated 1 = Independent			0	406	
C3 Configurations\Control							
C3.1	Configuration						
C3.1.1	Control Type	0 = Scalar 1 = VVW+ 2 = Encoder Vector 3 = Sensorless Vector			0	202	
C4 Configurations\Commands and References							
C4.1	LOC/REM Mode Config.						
C4.1.1	Command mode	0 = Always Local 1 = Remote 1 2 = Remote 2 3 = Serial 4 = Anybus 5 = CAN/CO/DN 6 = SoftPLC 7 = Not used 8 = Ethernet 9 = Digital Input (DI)			9	220	
C4.1.2	DI Remote 1/Remote 2	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1			2	6011	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.1.3	HMI LOC/REM Key	0 = Disable 1 = Enable			1	9803	
C4.2	Commands						
C4.2.1	R1 Command Config.						
C4.2.1.1	General Enable	0 = Always enabled 1 = HMI 2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Digital Input (DI) 9 = Firmware Application			1	240	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
C4.2.1.2	Run/Stop	0 = HMI I/O Keys 1 = Serial 2 = Anybus 3 = CAN/CO/DN 4 = SoftPLC 5 = Not used 6 = Ethernet 7 = Run/Stop DI 8 = Forward/Reverse DI 9 = 3-Wire Start/Stop DI 10 = Firmware Application			0	224	
C4.2.1.3	Direction of Rotation	0 = Forward 1 = HMI DR Key 2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Direction of Rotation DI 9 = Forward/Reverse DI 10 = Speed Reference 11 = Firmware Application			1	223	
C4.2.1.4	JOG	0 = Inactive 1 = HMI JOG Key 2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Digital Input (DI) 9 = Firmware Application			1	225	
C4.2.2	R2 Command Config.						
C4.2.2.1	General Enable	0 = Always enabled 1 = HMI 2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Digital Input (DI) 9 = Firmware Application			0	241	
C4.2.2.2	Run/Stop	0 = HMI I/O Keys 1 = Serial 2 = Anybus 3 = CAN/CO/DN 4 = SoftPLC 5 = Not used 6 = Ethernet 7 = Run/Stop DI 8 = Forward/Reverse DI 9 = 3-Wire Start/Stop DI 10 = Firmware Application			7	227	
C4.2.2.3	Direction of Rotation	0 = Forward 1 = HMI DR Key			0	226	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Direction of Rotation DI 9 = Forward/Reverse DI 10 = Speed Reference 11 = Firmware Application					
C4.2.2.4	JOG	0 = Inactive 1 = HMI JOG Key 2 = Serial 3 = Anybus 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = Digital Input (DI) 9 = Firmware Application			0	228	
C4.2.3	DI Config. for Commands						
C4.2.3.1	General Enable	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6000	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.2	Run/Stop	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			1	6004	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.3	3-Wire Start	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6005	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.4	3-Wire Stop	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6006	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.5	Forward	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6007	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.6	Reverse	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6008	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.7	Quick Stop	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6001	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.8	Direction of Rotation	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6010	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.9	JOG	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6009	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.10	Ramp Selection	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6003	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.3.11	Fault Reset	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1			0	6002	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.2.4	HMI Config. for Commands						
C4.2.4.1	Stop Key Function	0 = Stop by Ramp 1 = General Enable to Stop 2 = Quick Stop			0	229	
C4.3	References						
C4.3.1	Speed						
C4.3.1.1.1	Minimum Reference	0 to 60000 rpm	0	rpm	90	133	
C4.3.1.1.2	Maximum Reference	1 to 60000 rpm	0	rpm	1800	134	
C4.3.1.2.1	Remote 1 Mode	0 = HMI 1 = E.P. 2 = Multispeed 3 = Serial 4 = Anybus 5 = CAN/CO/DN 6 = Ethernet 7 = Not used 8 = SoftPLC 9 = Analog Input (AI) 10 = Frequency Input (FI) 11 = PID Controller 12 = Firmware Application			0	221	
C4.3.1.2.2	Remote 2 Mode	0 = HMI 1 = E.P. 2 = Multispeed 3 = Serial 4 = Anybus 5 = CAN/CO/DN 6 = Ethernet 7 = Not used 8 = SoftPLC 9 = Analog Input (AI) 10 = Frequency Input (FI) 11 = PID Controller 12 = Firmware Application			9	222	
C4.3.1.3.1	Speed Ref. via HMI	0 to 60000 rpm	0	rpm	90	121	
C4.3.1.3.2	R1 Speed Ref. AI Config.	0 = Inactive			1	6017	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		1 = AI X-1 2 = AI X-2 3 = AI A-1 4 = AI A-2 5 = AI A-3 6 = Not used 7 = AI B-1 8 = AI B-2 9 = AI B-3 10 = Not used 11 = AI C-1 12 = AI C-2 13 = AI C-3 14 = Not used 15 = AI D-1 16 = AI D-2 17 = AI D-3 18 = Not used 19 = AI E-1 20 = AI E-2 21 = AI E-3 22 = Not used 23 = AI F-1 24 = AI F-2 25 = AI F-3 26 = Not used 27 = AI G-1 28 = AI G-2 29 = AI G-3 30 = Not used					
C4.3.1.3.3	Speed Ref. FI Config.	0 = Inactive 1 = FI X-5 2 = FI X-6			1	6018	
C4.3.1.3.4	R2 Speed Ref. AI Config.	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI A-1 4 = AI A-2 5 = AI A-3 6 = Not used 7 = AI B-1 8 = AI B-2 9 = AI B-3 10 = Not used 11 = AI C-1 12 = AI C-2 13 = AI C-3 14 = Not used 15 = AI D-1 16 = AI D-2 17 = AI D-3 18 = Not used 19 = AI E-1 20 = AI E-2 21 = AI E-3 22 = Not used 23 = AI F-1 24 = AI F-2 25 = AI F-3 26 = Not used 27 = AI G-1 28 = AI G-2			1	6019	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		29 = AI G-3 30 = Not used					
C4.3.1.4.1	DI Increase E.P.	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6			0	6033	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		61 = DI G-7 62 = DI G-8					
C4.3.1.4.2	DI Decrease E.P.	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6 53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6			0	6034	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		61 = DI G-7 62 = DI G-8					
C4.3.1.5.1	Multispeed Ref. 1	0 to 60000 rpm	0	rpm	90	124	
C4.3.1.5.2	Multispeed Ref. 2	0 to 60000 rpm	0	rpm	300	125	
C4.3.1.5.3	Multispeed Ref. 3	0 to 60000 rpm	0	rpm	600	126	
C4.3.1.5.4	Multispeed Ref. 4	0 to 60000 rpm	0	rpm	900	127	
C4.3.1.5.5	Multispeed Ref. 5	0 to 60000 rpm	0	rpm	1200	128	
C4.3.1.5.6	Multispeed Ref. 6	0 to 60000 rpm	0	rpm	1500	129	
C4.3.1.5.7	Multispeed Ref. 7	0 to 60000 rpm	0	rpm	1800	130	
C4.3.1.5.8	Multispeed Ref. 8	0 to 60000 rpm	0	rpm	1650	131	
C4.3.1.5.9	Multispeed 1 DI Config.	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6			0	6030	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.3.1.5.10	Multispeed 2 DI Config.	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6			0	6031	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.3.1.5.11	Multispeed 3 DI Config.	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI A-1 8 = DI A-2 9 = DI A-3 10 = DI A-4 11 = DI A-5 12 = DI A-6 13 = DI A-7 14 = DI A-8 15 = DI B-1 16 = DI B-2 17 = DI B-3 18 = DI B-4 19 = DI B-5 20 = DI B-6 21 = DI B-7 22 = DI B-8 23 = DI C-1 24 = DI C-2 25 = DI C-3 26 = DI C-4 27 = DI C-5 28 = DI C-6 29 = DI C-7 30 = DI C-8 31 = DI D-1 32 = DI D-2 33 = DI D-3 34 = DI D-4 35 = DI D-5 36 = DI D-6 37 = DI D-7 38 = DI D-8 39 = DI E-1 40 = DI E-2 41 = DI E-3 42 = DI E-4 43 = DI E-5 44 = DI E-6 45 = DI E-7 46 = DI E-8 47 = DI F-1 48 = DI F-2 49 = DI F-3 50 = DI F-4 51 = DI F-5 52 = DI F-6			0	6032	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		53 = DI F-7 54 = DI F-8 55 = DI G-1 56 = DI G-2 57 = DI G-3 58 = DI G-4 59 = DI G-5 60 = DI G-6 61 = DI G-7 62 = DI G-8					
C4.3.1.6.1	Speed 1	0 to 60000 rpm	0	rpm	600	303	
C4.3.1.6.2	Speed 2	0 to 60000 rpm	0	rpm	900	304	
C4.3.1.6.3	Speed 3	0 to 60000 rpm	0	rpm	1200	305	
C4.3.1.6.4	Skip Range	0 to 750 rpm	0	rpm	0	306	
C4.3.2	JOG Speed						
C4.3.2.1	JOG Reference	0 to 60000 rpm	0	rpm	150	118	
C4.3.3	Torque						
C4.3.3.1	Torque Reference via HMI	-400.0 to 400.0 %	1	%	0.0	119	
C4.3.3.2	Maximum Torque	0.0 to 400.0 %	1	%	400.0	3070	
C4.3.3.3	Minimum Torque	0.0 to 400.0 %	1	%	0.0	3071	
C4.3.3.4	Torque Ref. Source	0 = HMI 1 = Analog Input (AI) 2 = Frequency Input (FI)			0	9802	
C4.3.3.5	Torque Ref. AI Config.	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI A-1 4 = AI A-2 5 = AI A-3 6 = Not used 7 = AI B-1 8 = AI B-2 9 = AI B-3 10 = Not used 11 = AI C-1 12 = AI C-2 13 = AI C-3 14 = Not used 15 = AI D-1 16 = AI D-2 17 = AI D-3 18 = Not used 19 = AI E-1 20 = AI E-2 21 = AI E-3 22 = Not used 23 = AI F-1 24 = AI F-2 25 = AI F-3 26 = Not used 27 = AI G-1 28 = AI G-2 29 = AI G-3 30 = Not used			0	9801	
C4.3.3.6	Torque Ref. FI Config.	0 = Inactive 1 = FI X-5 2 = FI X-6			0	9800	
C6 Configurations\Ramps							
C6.1	Speed Control Ramps						
C6.1.1	Acceleration Time	0.1 to 999.9 s	1	s	20.0	100	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
C6.1.2	Deceleration Time	0.1 to 999.9 s	1	s	20.0	101	
C6.1.3	1st/2nd Ramp Selection	0 = 1st Ramp 1 = 2nd Ramp 2 = Serial 3 = Not used 4 = CAN/CO/DN 5 = SoftPLC 6 = Not used 7 = Ethernet 8 = DI Ramp Selection 9 = Firmware Application			0	105	
C6.1.4	2nd Ramp Acceleration Time	0.1 to 999.9 s	1	s	10.0	102	
C6.1.5	2nd Ramp Deceleration Time	0.1 to 999.9 s	1	s	10.0	103	
C6.1.6	Quick Stop Time	0.1 to 999.9 s	1	s	5.0	106	
C6.1.7	Ramp Type	0 = Linear 1 = S Ramp			0	104	
		C9 Configurations\Communications					
C9.4	Ethernet						
C9.4.1	IP Address Settings	0 = Parameters 1 = DHCP			1	850	
C9.4.2	IP Address	0.0.0.0 to 255.255.255.255			192.168.0.10	852	
C9.4.3	Network Mask	0 = Not used 1 = 128.0.0.0 2 = 192.0.0.0 3 = 224.0.0.0 4 = 240.0.0.0 5 = 248.0.0.0 6 = 252.0.0.0 7 = 254.0.0.0 8 = 255.0.0.0 9 = 255.128.0.0 10 = 255.192.0.0 11 = 255.224.0.0 12 = 255.240.0.0 13 = 255.248.0.0 14 = 255.252.0.0 15 = 255.254.0.0 16 = 255.255.0.0 17 = 255.255.128.0 18 = 255.255.192.0 19 = 255.255.224.0 20 = 255.255.240.0 21 = 255.255.248.0 22 = 255.255.252.0 23 = 255.255.254.0 24 = 255.255.255.0 25 = 255.255.255.128 26 = 255.255.255.192 27 = 255.255.255.224 28 = 255.255.255.240 29 = 255.255.255.248 30 = 255.255.255.252 31 = 255.255.255.254			24	855	
C9.4.4	Gateway	0.0.0.0 to 255.255.255.255			0.0.0.0	856	
C9.10	SymbiNet						
C9.10.1	Enable Protocol	0 = Disable 1 = Enable			0	1060	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
C9.10.2	Publication Time	2 to 100 ms	0	ms	20	1061	
		C10 Configurations\SoftPLC					
C10.2	Engineering Unit						
C10.2.1	Engineering Unit 1	0 = No Unit 1 = A 2 = bar 3 = °C 4 = CPM 5 = CV 6 = ft³ 7 = ft³/h 8 = ft³/min 9 = ft³/s 10 = m³ 11 = m³/h 12 = m³/min 13 = m³/s 14 = °F 15 = ft 16 = ft/h 17 = ft/min 18 = ft/s 19 = gal 20 = gal/h 21 = gal/min 22 = gal/s 23 = H 24 = Hz 25 = HP 26 = h 27 = in 28 = InWC 29 = K 30 = kg 31 = kgf 32 = kgf/cm² 33 = kgf/m² 34 = kl/h 35 = kPa 36 = kW 37 = kWh 38 = l 39 = l/h 40 = l/min 41 = l/s 42 = lbf 43 = mA 44 = mca 45 = m 46 = m/h 47 = m/min 48 = m/s 49 = mbar 50 = ms 51 = min 52 = MPa 53 = mwc 54 = N 55 = Nm 56 = Pa 57 = % 58 = psi			2	5120	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		59 = rpm 60 = s 61 = V 62 = W 63 = W/m² 64 = Wh/m²					
C10.2.2	Dec. Point Eng. Unit 1	0 to 3	0		2	5121	
C10.2.3	Engineering Unit 2	0 = No Unit 1 = A 2 = bar 3 = °C 4 = CPM 5 = CV 6 = ft³ 7 = ft³/h 8 = ft³/min 9 = ft³/s 10 = m³ 11 = m³/h 12 = m³/min 13 = m³/s 14 = °F 15 = ft 16 = ft/h 17 = ft/min 18 = ft/s 19 = gal 20 = gal/h 21 = gal/min 22 = gal/s 23 = H 24 = Hz 25 = HP 26 = h 27 = in 28 = InWC 29 = K 30 = kg 31 = kgf 32 = kgf/cm² 33 = kgf/m² 34 = kl/h 35 = kPa 36 = kW 37 = kWh 38 = l 39 = l/h 40 = l/min 41 = l/s 42 = lbf 43 = mA 44 = mca 45 = m 46 = m/h 47 = m/min 48 = m/s 49 = mbar 50 = ms 51 = min 52 = MPa 53 = mwc 54 = N 55 = Nm			24	5122	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		56 = Pa 57 = % 58 = psi 59 = rpm 60 = s 61 = V 62 = W 63 = W/m² 64 = Wh/m²					
C10.2.4	Dec. Point Eng. Unit 2	0 to 3	0		1	5123	
C10.2.5	Engineering Unit 3	0 = No Unit 1 = A 2 = bar 3 = °C 4 = CPM 5 = CV 6 = ft³ 7 = ft³/h 8 = ft³/min 9 = ft³/s 10 = m³ 11 = m³/h 12 = m³/min 13 = m³/s 14 = °F 15 = ft 16 = ft/h 17 = ft/min 18 = ft/s 19 = gal 20 = gal/h 21 = gal/min 22 = gal/s 23 = H 24 = Hz 25 = HP 26 = h 27 = in 28 = InWC 29 = K 30 = kg 31 = kgf 32 = kgf/cm² 33 = kgf/m² 34 = kl/h 35 = kPa 36 = kW 37 = kWh 38 = l 39 = l/h 40 = l/min 41 = l/s 42 = lbf 43 = mA 44 = mca 45 = m 46 = m/h 47 = m/min 48 = m/s 49 = mbar 50 = ms 51 = min 52 = MPa			11	5124	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		53 = mwc 54 = N 55 = Nm 56 = Pa 57 = % 58 = psi 59 = rpm 60 = s 61 = V 62 = W 63 = W/m² 64 = Wh/m²					
C10.2.6	Dec. Point Eng. Unit 3	0 to 3	0		1	5125	
C10.2.7	Engineering Unit 4	0 = No Unit 1 = A 2 = bar 3 = °C 4 = CPM 5 = CV 6 = ft³ 7 = ft³/h 8 = ft³/min 9 = ft³/s 10 = m³ 11 = m³/h 12 = m³/min 13 = m³/s 14 = °F 15 = ft 16 = ft/h 17 = ft/min 18 = ft/s 19 = gal 20 = gal/h 21 = gal/min 22 = gal/s 23 = H 24 = Hz 25 = HP 26 = h 27 = in 28 = InWC 29 = K 30 = kg 31 = kgf 32 = kgf/cm² 33 = kgf/m² 34 = kl/h 35 = kPa 36 = kW 37 = kWh 38 = l 39 = l/h 40 = l/min 41 = l/s 42 = lbf 43 = mA 44 = mca 45 = m 46 = m/h 47 = m/min 48 = m/s 49 = mbar			2	5126	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		50 = ms 51 = min 52 = MPa 53 = mwc 54 = N 55 = Nm 56 = Pa 57 = % 58 = psi 59 = rpm 60 = s 61 = V 62 = W 63 = W/m² 64 = Wh/m²					
C10.2.8	Dec. Point Eng. Unit 4	0 to 3	0		2	5127	
		A3 Application\Pump Genius					
A3.1	Monitoring						
A3.1.1	Pump Genius Version	0.00 to 9.99	2		1.00	5200	ro
A3.1.2	Pump Genius Status 1	0 to 65535	0		0	5201	ro
A3.1.3	Pump Genius Status 2	0 to 65535	0		0	5202	ro
A3.1.4	Pump Genius Status 3	0 to 65535	0		0	5203	ro
A3.1.5	Pump Genius Command	0 to 65535	0		0	5204	
A3.1.6	User Setpoint	-30000 to 30000	C10.2.2	C10.2.1	800	5205	
A3.1.7	Manual Setpoint	0 to 30000	C10.2.4	C10.2.3	0	5206	
A3.1.8	Automatic Setpoint	-30000 to 30000	C10.2.2	C10.2.1	0	5207	
A3.1.9	Process Variable	-30000 to 30000	C10.2.2	C10.2.1	0	5208	ro
A3.1.10	Auxiliary Variable	-30000 to 30000	C10.2.8	C10.2.7	0	5209	ro
A3.1.11	Flow Variable	-30000 to 30000	C10.2.6	C10.2.5	0	5210	ro
A3.1.12	Pump Speed	0 to 30000	C10.2.4	C10.2.3	0	5211	ro
A3.1.13	Inv. Pump Operation	0 to 65535 h	0	h	0	5212	
A3.1.14	Operation Time Pump 1	0 to 65535 h	0	h	0	5213	
A3.1.15	Operation Time Pump 2	0 to 65535 h	0	h	0	5214	
A3.1.16	Operation Time Pump 3	0 to 65535 h	0	h	0	5215	
A3.1.17	Operation Time Pump 4	0 to 65535 h	0	h	0	5216	
A3.1.18	Operation Time Pump 5	0 to 65535 h	0	h	0	5217	
A3.1.19	Operation Time Pump 6	0 to 65535 h	0	h	0	5218	
A3.1.20	Operation Time Pump 7	0 to 65535 h	0	h	0	5219	
A3.1.21	Operation Time Pump 8	0 to 65535 h	0	h	0	5220	
A3.2	Configuration						
A3.2.1	Configuration Mode						
A3.2.1.1	Pump Genius Mode	0 = Inactive 1 = Simplex 2 = Multipump Fixed 3 = Multipump Mobile 4 = Multipump Cascade 5 = Multiplex Master 6 = Multiplex Follower			1	5225	
A3.2.1.2	Start/Stop Seq.	0 = Sequential 1 = Operation Time			0	5226	
A3.2.1.3	Pumps Number	1 to 8	0		1	5227	
A3.2.1.4	Pump Address	1 to 8	0		1	5228	
A3.2.1.5	Master Change Time	0.0 to 99.9 s	1	s	0.0	5229	
A3.2.2	Pump Enabling						
A3.2.2.1	Enable PG Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5			1	5230	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network					
A3.2.2.2	Enable Pump 1 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			2	5231	
A3.2.2.3	Enable Pump 2 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			0	5232	
A3.2.2.4	Enable Pump 3 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			0	5233	
A3.2.2.5	Enable Pump 4 Source	0 = Inactive 1 = DI X-1			0	5234	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network					
A3.2.2.6	Enable Pump 5 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			0	5235	
A3.2.2.7	Enable Pump 6 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			0	5236	
A3.2.2.8	Enable Pump 7 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			0	5237	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		15 = Network					
A3.2.2.9	Enable Pump 8 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8 15 = Network			0	5238	
A3.2.2.10	Cascade Feedback Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			0	5239	
A3.3	Control						
A3.3.1	Setpoint						
A3.3.1.1	Setpoint Selection	0 = HMI/Network 1 = Analog Input 2 = Electronic Potentiometer 3 = Multispeed 4 = Scheduling			0	5240	
A3.3.1.2	Static Compen.	-30000 to 30000	C10.2.2	C10.2.1	0	5241	
A3.3.1.3	Dynamic compen.	-30000 to 30000	C10.2.2	C10.2.1	0	5242	
A3.3.1.4	Friction Comp. Function	0.0 to 100.0 %	1	%	0.0	5243	
A3.3.1.5	Setpoint AI Source	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI B-1 4 = AI B-2 5 = AI B-3 6 = AI C-1 7 = AI C-2 8 = AI C-3			2	5244	
A3.3.1.6	Increase EP Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5			5	5245	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8					
A3.3.1.7	Decrease EP Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			6	5246	
A3.3.1.8	Multspd DI #1 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			5	5247	
A3.3.1.9	Multspd DI #2 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			6	5248	
A3.3.1.10	Scheduling Prog. Mode	0 = Inactive 1 = Mon to Sun 2 = Mon to Fri; Sat to Sun 3 = Mon to Fri; Sat; Sun 4 = Sun to Thu; Fri; Sat			1	5249	
A3.3.1.11	Prog. Hour #1	0 to 23	0		23	5250	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
A3.3.1.12	Prog. Minute #1	0 to 59	0		59	5251	
A3.3.1.13	Prog. Hour #2	0 to 23	0		23	5252	
A3.3.1.14	Prog. Minute #2	0 to 59	0		59	5253	
A3.3.1.15	Prog. Hour #3	0 to 23	0		23	5254	
A3.3.1.16	Prog. Minute #3	0 to 59	0		59	5255	
A3.3.1.17	Prog. Hour #4	0 to 23	0		23	5256	
A3.3.1.18	Prog. Minute #4	0 to 59	0		59	5257	
A3.3.1.19	Prog. Hour #5	0 to 23	0		23	5258	
A3.3.1.20	Prog. Minute #5	0 to 59	0		59	5259	
A3.3.1.21	Prog. Hour #6	0 to 23	0		23	5260	
A3.3.1.22	Prog. Minute #6	0 to 59	0		59	5261	
A3.3.1.23	Prog. Hour #7	0 to 23	0		23	5262	
A3.3.1.24	Prog. Minute #7	0 to 59	0		59	5263	
A3.3.1.25	Prog. Hour #8	0 to 23	0		23	5264	
A3.3.1.26	Prog. Minute #8	0 to 59	0		59	5265	
A3.3.1.27	Prog. Hour #9	0 to 23	0		23	5266	
A3.3.1.28	Prog. Minute #9	0 to 59	0		59	5267	
A3.3.1.29	Prog. Hour #10	0 to 23	0		23	5268	
A3.3.1.30	Prog. Minute #10	0 to 59	0		59	5269	
A3.3.1.31	Prog. Hour #11	0 to 23	0		23	5270	
A3.3.1.32	Prog. Minute #11	0 to 59	0		59	5271	
A3.3.1.33	Prog. Hour #12	0 to 23	0		23	5272	
A3.3.1.34	Prog. Minute #12	0 to 59	0		59	5273	
A3.3.1.35	Control Setpoint 1	-30000 to 30000	C10.2.2	C10.2.1	0	5274	
A3.3.1.36	Control Setpoint 2	-30000 to 30000	C10.2.2	C10.2.1	0	5275	
A3.3.1.37	Control Setpoint 3	-30000 to 30000	C10.2.2	C10.2.1	0	5276	
A3.3.1.38	Control Setpoint 4	-30000 to 30000	C10.2.2	C10.2.1	0	5277	
A3.3.1.39	Control Setpoint 5	-30000 to 30000	C10.2.2	C10.2.1	0	5278	
A3.3.1.40	Control Setpoint 6	-30000 to 30000	C10.2.2	C10.2.1	0	5279	
A3.3.1.41	Control Setpoint 7	-30000 to 30000	C10.2.2	C10.2.1	0	5280	
A3.3.1.42	Control Setpoint 8	-30000 to 30000	C10.2.2	C10.2.1	0	5281	
A3.3.1.43	Control Setpoint 9	-30000 to 30000	C10.2.2	C10.2.1	0	5282	
A3.3.1.44	Control Setpoint 10	-30000 to 30000	C10.2.2	C10.2.1	0	5283	
A3.3.1.45	Control Setpoint 11	-30000 to 30000	C10.2.2	C10.2.1	0	5284	
A3.3.1.46	Control Setpoint 12	-30000 to 30000	C10.2.2	C10.2.1	0	5285	
A3.3.2	Process Variable						
A3.3.2.1	Process Var. Source	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI B-1 4 = AI B-2 5 = AI B-3 6 = AI C-1 7 = AI C-2 8 = AI C-3 9 = FI X-5 10 = FI X-6 11 = Slot X (AI1 - AI2) 12 = Slot B (AI1 - AI2) 13 = Slot C (AI1 - AI2)			1	5286	
A3.3.2.2	Min. Range PV Sensor	-30000 to 30000	C10.2.2	C10.2.1	0	5287	
A3.3.2.3	Max. Range PV Sensor	-30000 to 30000	C10.2.2	C10.2.1	1000	5288	
A3.3.3	Process PID						
A3.3.3.1	PID Contr. 1 Action	0 = Inactive 1 = Direct 2 = Reverse			1	5289	
A3.3.3.2	PID 1 Operation Mode	0 = Manual 1 = Auto 2 = DIx			2	5290	
A3.3.3.3	Man Auto DI Source				0	5291	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8					
A3.3.3.4	Bumpless Mode PID 1	0 = Inactive 1 = Bumpless Manual 2 = Bumpless Setpoint 3 = Bumpless Man. + SP			0	5292	
A3.3.3.5	KP Gain PID 1	0.00 to 100.00	2		1.00	5293	
A3.3.3.6	KI Gain PID 1	0.0 to 100.0	1		25.0	5294	
A3.3.3.7	KD Gain PID 1	0.0 to 100.0	1		0.0	5295	
A3.3.4	Auxiliary Control (Suction)						
A3.3.4.1	Auxiliary Variable Source	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI B-1 4 = AI B-2 5 = AI B-3 6 = AI C-1 7 = AI C-2 8 = AI C-3 9 = FI X-5 10 = FI X-6			0	5296	
A3.3.4.2	Enable Anti-cavitation	0 = Inactive 1 = Mode 1 2 = Not used			0	5297	
A3.3.4.3	AV Sensor Min. Range	-30000 to 30000	C10.2.8	C10.2.7	0	5298	
A3.3.4.4	AV Sensor Max. Range	-30000 to 30000	C10.2.8	C10.2.7	1000	5299	
A3.3.4.5	Cavitation Detec. Level	-30000 to 30000	C10.2.8	C10.2.7	200	5300	
A3.3.4.6	AV Level Hysteresis	-30000 to 30000	C10.2.8	C10.2.7	50	5301	
A3.3.4.7	Min. Proc. PID SP [AV]	-30000 to 30000	C10.2.2	C10.2.1	400	5302	
A3.3.4.8	KP Gain PID 2	0.00 to 100.00	2		0.10	5303	
A3.3.4.9	KI Gain PID 2	0.0 to 100.0	1		1.0	5304	
A3.3.4.10	KD Gain PID 2	0.0 to 100.0	1		0.0	5305	
A3.3.5	Flow Limitation						
A3.3.5.1	Flow Variable Source	0 = Inactive 1 = AI X-1 2 = AI X-2 3 = AI B-1 4 = AI B-2 5 = AI B-3 6 = AI C-1 7 = AI C-2 8 = AI C-3 9 = FI X-5 10 = FI X-6			0	5306	
A3.3.5.2	Flow Limit. Function	0 = Inactive			0	5307	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		1 = Enable					
A3.3.5.3	Minimum Flow Range	-30000 to 30000	C10.2.6	C10.2.5	0	5308	
A3.3.5.4	Maximum Flow Range	-30000 to 30000	C10.2.6	C10.2.5	500	5309	
A3.3.5.5	Flow Limit En. Level	-30000 to 30000	C10.2.6	C10.2.5	400	5310	
A3.3.5.6	Flow Level Hysteresis	-30000 to 30000	C10.2.6	C10.2.5	10	5311	
A3.3.5.7	Min. Proc. PID SP [FV]	-30000 to 30000	C10.2.2	C10.2.1	400	5312	
A3.3.5.8	KP Gain PID 3	0.00 to 100.00	2		0.10	5313	
A3.3.5.9	KI Gain PID 3	0.0 to 100.0	1		1.0	5314	
A3.3.5.10	KD Gain PID 3	0.0 to 100.0	1		0.0	5315	
A3.4	Functions						
A3.4.1	Sleep Mode						
A3.4.1.1	Sleep Mode Enable	0 = Inactive 1 = Sleep/Deviation 2 = Sleep/Level			1	5320	
A3.4.1.2	Deviation to Wake Up	-30000 to 30000	C10.2.2	C10.2.1	10	5321	
A3.4.1.3	Level to Start	-30000 to 30000	C10.2.2	C10.2.1	100	5322	
A3.4.1.4	Time to Wake up	0.0 to 99.9 s	1	s	2.0	5323	
A3.4.1.5	Sleep Speed	0 to 30000	C10.2.4	C10.2.3	420	5324	
A3.4.1.6	Time to Sleep	0.0 to 99.9 s	1	s	10.0	5325	
A3.4.1.7	Sleep Boost Offset	-30000 to 30000	C10.2.2	C10.2.1	0	5326	
A3.4.1.8	Boost Maximum Time	0.0 to 99.9 s	1	s	0.0	5327	
A3.4.2	Pipe Charging						
A3.4.2.1	Pipe Charging Enable	0 = Inactive 1 = Enable			1	5328	
A3.4.2.2	Pipe Charging Ramp	0.0 to 999.9 s	1	s	10.0	5329	
A3.4.2.3	Pipe Charging Time	0.0 to 6000.0 s	1	s	20.0	5330	
A3.4.2.4	Curr. Lim. Pipe Ch.	0 to 300 %	0	%	125	5331	
A3.4.2.5	SP PID Ramp Time	0.0 to 99.9 s	1	s	10.0	5332	
A3.4.3	Check Valve						
A3.4.3.1	Check Valve Enable	0 = Inactive 1 = Enable			0	5333	
A3.4.3.2	Ch. Valve Start Ref.	0 to 30000	C10.2.4	C10.2.3	500	5334	
A3.4.3.3	Ch. Valve End Ref.	0 to 30000	C10.2.4	C10.2.3	400	5335	
A3.4.3.4	Check Valve Ramp Time	0.0 to 999.9 s	1	s	20.0	5336	
A3.4.4	Auxiliary Pump						
A3.4.4.1	Auxiliary Pump Enable	0 = Inactive 1 = Priming Pump 2 = Jockey Pump			0	5337	
A3.4.4.2	Level Start Jockey	-30000 to 30000	C10.2.2	C10.2.1	200	5338	
A3.4.4.3	Level Stop Jockey	-30000 to 30000	C10.2.2	C10.2.1	300	5339	
A3.4.4.4	Start Pump Delay	0.0 to 99.9 s	1	s	1.0	5340	
A3.4.4.5	Priming Pump Time	0.0 to 999.9 s	1	s	5.0	5341	
A3.4.5	Start/Stop Pumps						
A3.4.5.1	Speed Start Pump	0 to 30000	C10.2.4	C10.2.3	520	5342	
A3.4.5.2	Deviation Start Pump	-30000 to 30000	C10.2.2	C10.2.1	10	5343	
A3.4.5.3	Start Pump Time	0.0 to 99.9 s	1	s	1.0	5344	
A3.4.5.4	Start Pump Delay	0.00 to 9.99 s	2	s	0.05	5345	
A3.4.5.5	Speed Stop Pump	0 to 30000	C10.2.4	C10.2.3	450	5346	
A3.4.5.6	Deviation Stop Pump	-30000 to 30000	C10.2.2	C10.2.1	10	5347	
A3.4.5.7	Stop Pump Time	0.0 to 99.9 s	1	s	1.0	5348	
A3.4.5.8	Stop Pump Delay	0.00 to 9.99 s	2	s	0.05	5349	
A3.4.5.9	Delay Contactor Com.	0.00 to 9.99 s	2	s	0.10	5350	
A3.4.5.10	Time Contactor Fault	0.00 to 9.99 s	2	s	0.50	5351	
A3.4.6	Alternation						
A3.4.6.1	Alt. Pump Enable	0 = Inactive 1 = Enable 2 = Test Mode			0	5352	
A3.4.6.2	Force Alt. Time	0 to 999 h	0	h	72	5353	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
A3.4.6.3	Speed Forcing Alt.	0 to 30000	C10.2.4	C10.2.3	500	5354	
A3.5	Protections						
A3.5.1	Process Var. Level						
A3.5.1.1	Low Level PV Limit	-30000 to 30000	C10.2.2	C10.2.1	100	5360	
A3.5.1.2	Low Level PV Time	0.0 to 99.9 s	1	s	0.0	5361	
A3.5.1.3	High Level PV Limit	-30000 to 30000	C10.2.2	C10.2.1	1000	5362	
A3.5.1.4	High Level PV Time	0.0 to 99.9 s	1	s	0.0	5363	
A3.5.2	Auxiliary Var. Level						
A3.5.2.1	Low Level AV Limit	-30000 to 30000	C10.2.8	C10.2.7	40	5364	
A3.5.2.2	Time Low Level AV	0.0 to 99.9 s	1	s	0.0	5365	
A3.5.2.3	High AV Level Limit	-30000 to 30000	C10.2.8	C10.2.7	1000	5366	
A3.5.2.4	Time High Level AV	0.0 to 99.9 s	1	s	0.0	5367	
A3.5.3	Flow Var. Level						
A3.5.3.1	Low Flow Limit	-30000 to 30000	C10.2.6	C10.2.5	50	5368	
A3.5.3.2	Low Flow Level Time	0.0 to 99.9 s	1	s	0.0	5369	
A3.5.3.3	High Flow Limit	-30000 to 30000	C10.2.6	C10.2.5	500	5370	
A3.5.3.4	High Flow Level Time	0.0 to 99.9 s	1	s	0.0	5371	
A3.5.4	External Sensor						
A3.5.4.1	Ext. Sensor#1 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			3	5372	
A3.5.4.2	Ext. Sensor#2 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			0	5373	
A3.5.4.3	Ext. Sensor#3 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5			0	5374	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
		12 = DI B-6 13 = DI B-7 14 = DI B-8					
A3.5.4.4	Ext. Sensor#4 Source	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			0	5375	
A3.5.4.5	Time Ext. Sensor	0.0 to 99.9 s	1	s	0.0	5376	
A3.5.5	Dry Pump						
A3.5.5.1	Dry Pump Function	0 = Inactive 1 = Enable			0	5377	
A3.5.5.2	Speed Dry Pump	0 to 30000	C10.2.4	C10.2.3	550	5378	
A3.5.5.3	Curr. Level Dry Pump	0.0 to 100.0 %	1	%	20.0	5379	
A3.5.5.4	Time Dry Pump Fault	0.0 to 99.9 s	1	s	5.0	5380	
A3.5.6	Pump Leakage						
A3.5.6.1	Pump Leakage Function	0 = Inactive 1 = Enable			0	5381	
A3.5.6.2	Speed #1 Pump Leakage	0 to 30000	C10.2.4	C10.2.3	300	5382	
A3.5.6.3	Curr. #1 Pump Leakage	0.0 to 100.0 %	1	%	20.0	5383	
A3.5.6.4	Speed #2 Pump Leakage	0 to 30000	C10.2.4	C10.2.3	500	5384	
A3.5.6.5	Curr. #2 Pump Leakage	0.0 to 100.0 %	1	%	40.0	5385	
A3.5.6.6	Speed #3 Pump Leakage	0 to 30000	C10.2.4	C10.2.3	600	5386	
A3.5.6.7	Curr. #3 Pump Leakage	0.0 to 100.0 %	1	%	60.0	5387	
A3.5.6.8	Time Pump Leak. Fault	0.0 to 99.9 s	1	s	5.0	5388	
A3.5.7	Deragging						
A3.5.7.1	Deragging Function	0 = Inactive 1 = Enable on Run Command 2 = Enable via DI 3 = Enable via Detection 4 = Enable via Network			0	5389	
A3.5.7.2	Source DI Deragging	0 = Inactive 1 = DI X-1 2 = DI X-2 3 = DI X-3 4 = DI X-4 5 = DI X-5 6 = DI X-6 7 = DI B-1 8 = DI B-2 9 = DI B-3 10 = DI B-4 11 = DI B-5 12 = DI B-6 13 = DI B-7 14 = DI B-8			0	5390	
A3.5.7.3	Number Cycles Derag.	0 to 20	0		5	5391	

Parameter	Description	Range of values	Decimal places	Eng. Unit	Default	Net Id	Prop.
A3.5.7.4	Foward Derag. Speed	0 to 30000	C10.2.4	C10.2.3	100	5392	
A3.5.7.5	Reverse Derag. Speed	0 to 30000	C10.2.4	C10.2.3	100	5393	
A3.5.7.6	Time Accel. Deragging	0.1 to 99.9 s	1	s	2.0	5394	
A3.5.7.7	Time Decel. Deragging	0.1 to 99.9 s	1	s	2.0	5395	
A3.5.7.8	Derag. Foward Time	0.1 to 99.9 s	1	s	2.0	5396	
A3.5.7.9	Derag. Reverse Time	0.1 to 99.9 s	1	s	2.0	5397	
A3.5.7.10	Deragging Stop Time	0.1 to 99.9 s	1	s	2.0	5398	
A3.5.7.11	Detect Clogging Level	0.0 to 100.0 %	1	%	70.0	5399	
A3.5.7.12	Time Detect Clogging	0.0 to 99.9 s	1	s	60.0	5400	
A3.5.7.13	Number Clogging Fault	0 to 20	0		5	5401	

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