DBR AUTOMATION

rexroth
A Bosch Company

Sytronix

SvP 5030
Variable-Speed Pump Drive System

Quick Start Guide
R912009173

Edition 02

Record of Revision

Edition	Release Date	Notes
DOK-RCON03-SVP5030****-QU01-EN-P	2023.04	First release
DOK-RCON03-SVP5030****-QU02-EN-P	2023.11	Contents upgrade

Version matching table

SvP 5030 firmware version	EFC 5620 firmware version
01V02	05V04·02 and after
01V02	05V04·02 and after

Introduction to this documentation

This **Quick Start Guide** is derived from the **Operating Instructions** which include detailed product data.

⚠ WARNING **Personal injury and property damage caused by incorrect application, installation or operation!**

Never work with or control the product before reading the

- **Safety Instructions** delivered with EFC 5620
- Safety descriptions in the **Operating Instructions**

Reference

For documentation available in other form or language, please consult your local sales partner or check www.boschrexroth.com.

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Liability

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1 Type code

1.1 Pump controller type code description

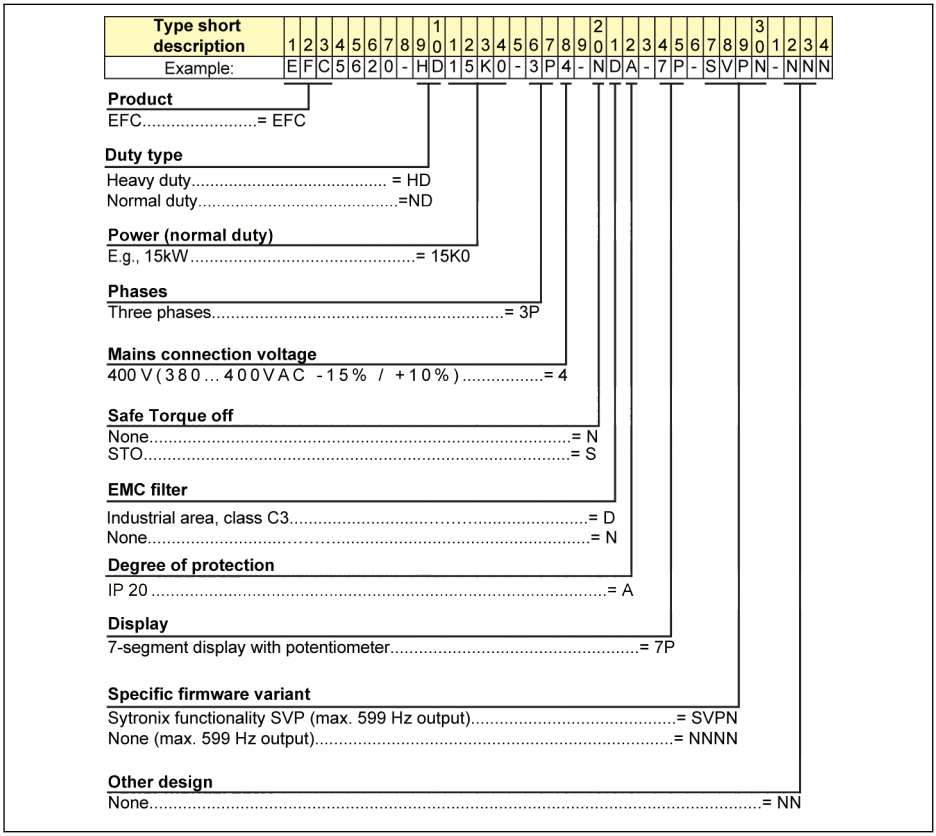


Fig. 1-1: EFC 5620 type code

This type code can be found on the Rexroth EFC converter.

1.2 SvP 5030 ASF type code description

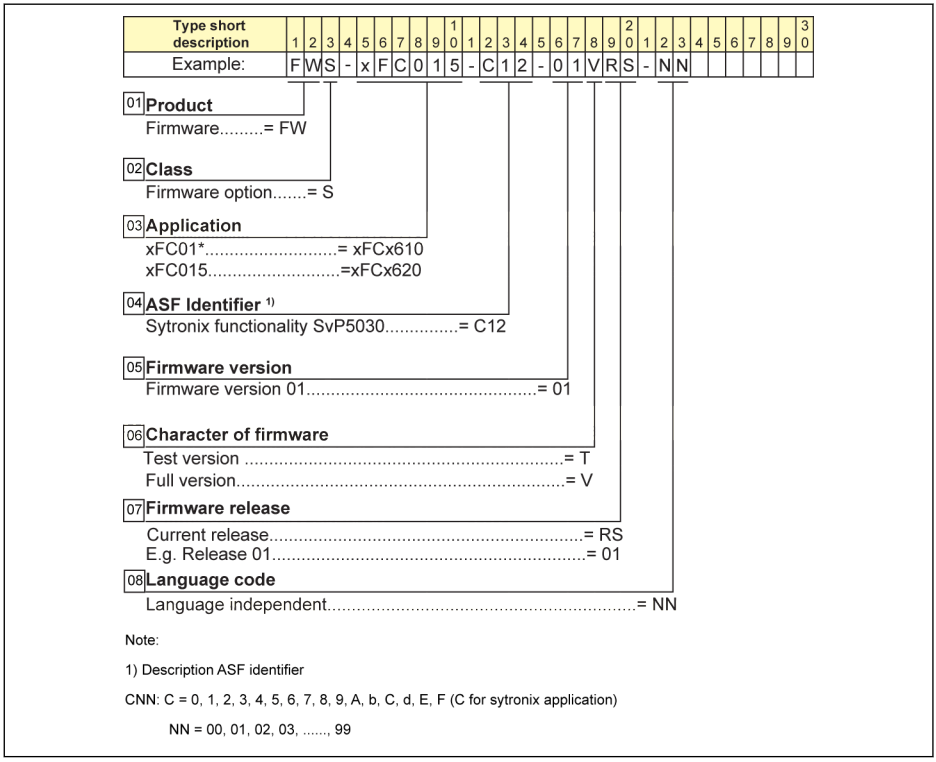


Fig. 1-2: SvP 5030 ASF type code

SvP 5030 ASF software type code: FWS-XFC015-C12-01VRS-NN

ASF: Application-Specific Firmware.

The ASF type code will not be printed and placed on the EFC converter. Only a square adhesive label is provided at the side, which represents important information from the ASF type code:

For example:

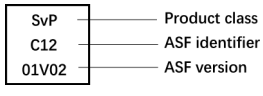


Fig. 1-3: ASF version information

Parameter	Name	Value
F0.01	ASF version	*
F0.02	ASF identifier	0x0C12
F0.03	ASF API required version	*
F0.06	ASF evaluation time	*
F0.07	ASF API version	*
F0.10	ASF status	Bit0: ASF valid
		Bit1: API compatible
		Bit2: ASF certified
		Bit3...Bit7: Reserved
		Bit8: ASF evaluation period expired
		Bit9: ASF invalid
		Bit10: ASF API incompatible
		Bit11: Reserved
		Bit12: ASF runtime exceeded
		Bit13: ASF stack overflow
		Bit14...Bit15: Reserved

Tab. 1-1: SvP 5030 ASF basic information

* For accurate information, refer to the actual data provided on the product.

2 Scope of supply

If any item is found missing from standard supply package as listed below, please contact Bosch Rexroth's local sales partner at your earliest convenience.

- Frequency Converter EFC 5620 with integrated Sytronix firmware
- Safety Instructions (available in multiple languages)
- EFC 5620 Quick Start Guide

3 Documentation reference

Following documentations about the components can be found on the Bosch Rexroth homepage via the product catalog or dirctly via the following link:

www.boschrexroth.com/mediadirectory

Title	Document number	Document type
Rexroth Frequency Converter EFC 5620 Series	R912008896	Quick Start Guide
Rexroth Frequency Converter EFC 5620 Series	R912009312	Operating Instructions
Pressure sensor for hydraulic applications, type HM20	RE 30272	Data sheet
SvP 5030 Variable-Speed Pump Drive System	RE 62323	Operating Instructions

Tab. 3-1: Documentation reference

4 Function specification

A SvP system provides fine open-loop hydraulic flow control with closed-loop pressure override functionality (p/Q control). It can also operate purely as a highly accurate hydraulic pressure source.

The pressure command value for the pump controller is set by the higher-level machine control. The actual pressure value is measured by a pressure sensor in the hydraulic system and feedback to the pump controller. The pump controller manages the speed of the servo motor so that the hydraulic pump driven by it displaces exactly the oil volume required for regulating the command pressure. Alternatively, a flow command value for the pump controller is set. The pump controller then controls the speed of the servo motor so that the hydraulic pump driven by it displaces exactly the oil volume corresponding to the flow command value.

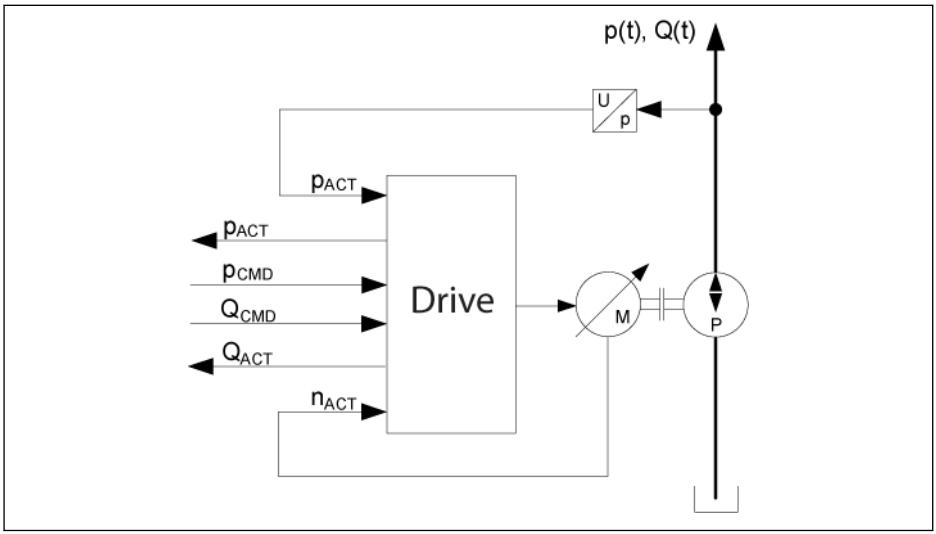


Fig. 4-1: System principle

The product provides the following features.

- Pressure / flow setting
  - Easy command setting (internal commands)
  - Command setting possibility via analog or communication*
  - Digital filtering for pressure command rising and dropping
  - Preset standby mode (with minimum flow and pressure)

  *Optional communication board is required.

  *Supported communication protocols: PROFIBUS, Sercos, PROFINET IO, EtherCAT, EtherNet/IP.
- Pressure signal feedback

  - Compatible with different types of pressure sensors (flexible scaling for the analog input signal for voltage and current sensors)
  - Highly resistant to electromagnetic interference (with the use of high-precision digital filter device for signal filtering)
  - Quick configuration for Rexroth HM20 pressure sensor
- Quick configuration for Rexroth servo motor
- p/Q PID control
  - p/Q control with automatic switching between pressure and flow control modes
  - Provided with 4 groups of switchable parameters
- Restore ASF parameters
- Extension functions
  - Master / slave control
  - Two-points / double pump control
  - Pump power limitation
  - Leakage compensation
- Protection function
  - Pressure feedback fault monitoring
  - Actual pressure monitoring
  - Maximum pressure / flow command limitation
  - Minimum pressure / flow command limitation

5 Initial start-up

5.1 Starting up with parameters

After the electric and the hydraulic system have been correctly installed, the initial start-up can be carried out according to the following steps:

1. Select pressure sensor via F2.10 (for option "0: Others", please set F2.06, F2.07 manually).
2. Choose motor parameters via F1.15 and F1.16 for Rexroth servo motor.
3. Set pressure command via F1.03, F1.05 and flow command via F1.11, F1.12.
4. Run the SvP system.

- The pressure command F1.05 and flow command F1.12 default values are set to low values to prevent potential machine damage caused by improper use during initial start up.
- Before running the system, it is necessary to degas the system with low speed , to protect the pump.

Code	Name	Setting range	Default	Min.	Attri.
F1.03	Pressure command source	0: Use digital value set in parameter F1.05 2: Analog input 3: Communication	2	-	Stop
F1.05	Pressure command digital setting	0.0...1,000.0 bar	5.0	0.1	Run
F1.11	Flow command source	0: Use digital value set in parameter F1.12 1: Analog input (positive / negative) 2: Communication	1	-	Stop
F1.12	Flow command digital setting	0...5,000 rpm	40	1	Run
F1.15	Motor type	0: Others 1: Rexroth MS2N 2: Rexroth MSH	2	-	Stop

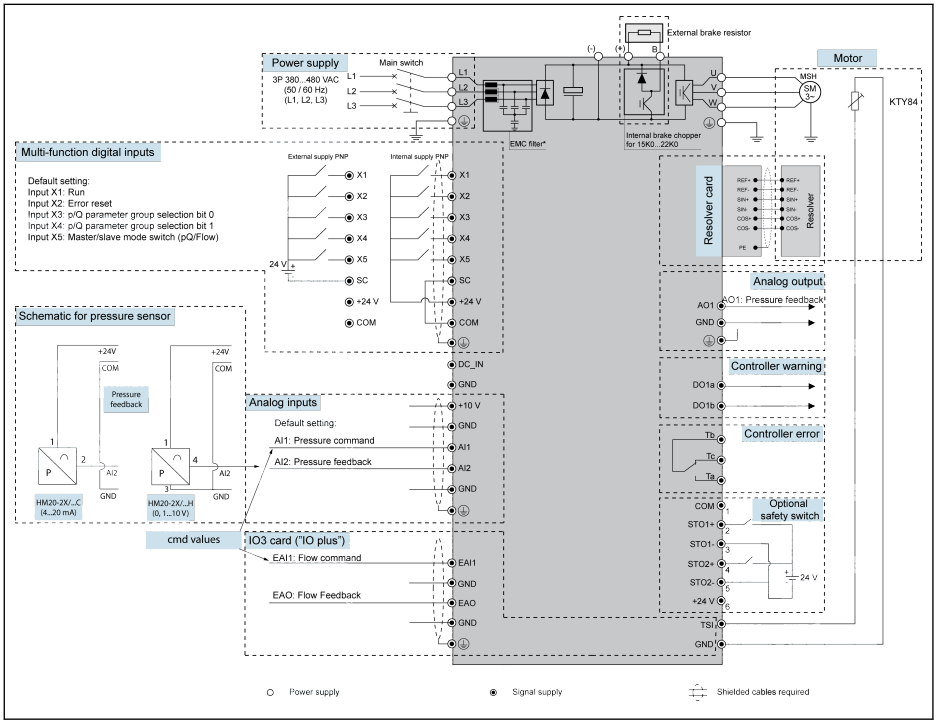
Code	Name	Setting range	Default	Min.	Attri.
F1.16	Motor power level	0: No selection (F1.15 = 1: Rexroth MS2N) 12: MS2N10-D0BHN 13: MS2N10-D0BHA/B 14: MS2N10-D0BNA/B 15: MS2N10-E0BHA/B 16: MS2N10-E0BNA/B 17: MS2N10-F0BHA/B 18: Reserved 19: Reserved (F1.15 = 2: Rexroth MSH) 12: MSH215-65 13: MSH215-80 14: MSH215-105 15: MSH215-130 16: MSH215-155 17: MSH215-200 18: MSH300-300 19: MSH300-370	DOM	-	Stop
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F2.07	Pressure feedback null offset in V or mA	0.0...5.0 V, mA	0.1	0.1	Stop
F2.10	Pressure sensor type	0: Others 1: HM20-2X/10-C 2: HM20-2X/50-C 3: HM20-2X/100-C 4: HM20-2X/160-C 5: HM20-2X/250-C 6: HM20-2X/315-C 7: HM20-2X/400-C 8: HM20-2X/630-C 9: Other 4-20mA pressure sensors 11: HM20-2X/10-H 12: HM20-2X/50-H 13: HM20-2X/100-H 14: HM20-2X/160-H 15: HM20-2X/250-H 16: HM20-2X/315-H 17: HM20-2X/400-H 18: HM20-2X/630-H 19: Other 0.1-10V pressure sensors	15	-	Stop

Tab. 5-1: Parameter list of initial start-up

6 IO configuration

6.1 Overview of electrical connection



* Effective from ASF version 01V02

Fig. 6-1: Example wiring diagram with Rexroth MSH motor analog set point control scheme

- The SvP 5030 I/O functionality is given higher priority over standard EFC functions. The standard EFC functionality assigned to terminal will be ignored and taken over by the ASF terminal assignment (non-zero entries in ASF).
- For details about optional I/O Plus Card, please refer to I/O Plus Card Product Insert (R912007670).
- For details about Resolver Card, please refer to Resolver Card Product Insert (R912007839).

6.2 Analog inputs

6.2.1 General

This section shows how the analog input can be configured. The following figure is an example of analog input AI2, which has been assigned to pressure feedback. The configurations for AI1, EAI1 and EAI2 are similar to AI2, only with different parameters shown in the table below.

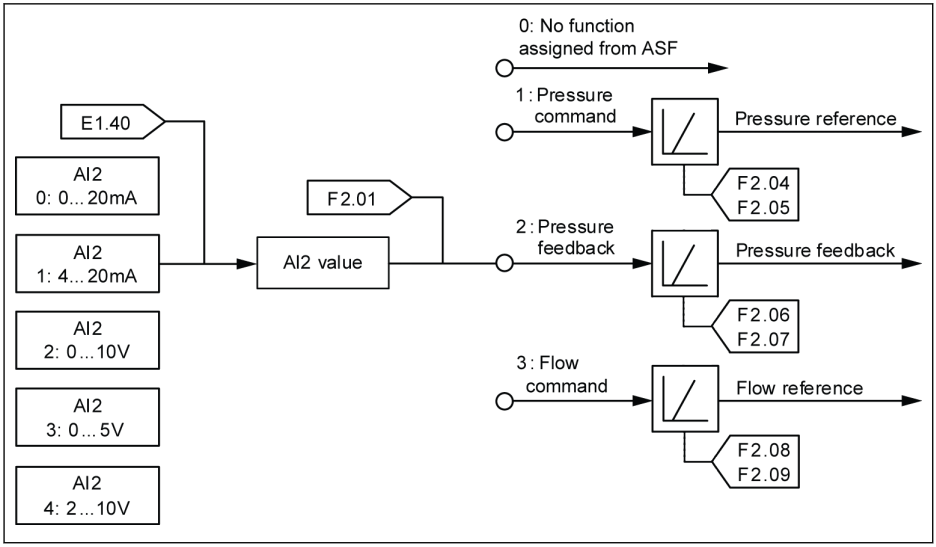


Fig. 6-2: Example with analog input AI2 assigned to pressure feedback

Code	Name	Setting range	Default	Min.	Attri.
E1.35	AI1 input mode	0: 0...20 mA	2	-	Run
E1.40	AI2 input mode	1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V	2	-	Run
H8.05	EAI1 input mode	0...4 (same as E1.35)	2	-	Stop
H8.30	EAI2 input mode	5: -10V...10V			
F2.00	Analog input AI1	0: No function assigned from ASF	1	-	Stop
F2.01	Analog input AI2	1: Pressure command	2	-	Stop
F2.02	External analog input EAI1	2: Pressure feedback	3	-	Stop
F2.03	External analog input EAI2	3: Flow command 5: Slave flow command	5	-	Stop

Code	Name	Setting range	Default	Min.	Attri.
F2.04	Pressure command corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	175.0	0.1	Stop
F2.05	Pressure command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop
F2.07	Pressure feedback null offset in V or mA	0.0...5.0 V, mA	0.1	0.1	Stop
F2.08	Flow command corresponding to 5V, 10V or 20mA	1...5,000 rpm	2,000	1	Stop
F2.09	Flow command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F4.43	Slave flow command corresponding to 5V, 10V or 20mA	0 --- 5000 rpm	3,000	1	Stop
F4.44	Slave flow command null offset in V or mA	0.0 --- 5.0 V, mA	0.0	0.1	Stop
F4.45	Slave flow command linear offset in V	-0.10---0.10V	0.00	0.01	Run

Tab. 6-1: Analog input parameter list

With the default SvP 5030 configuration, analog input AI2 [F2.01 = 2] is configured as pressure feedback input. Analog input AI1 [F2.00 = 1] is configured as pressure command input, analog input EA1 [F2.02 = 3] is configured as flow command input.

The analog inputs F2.00...F2.03 are mutually exclusive and therefore do not allow for any identical setting (except 0) between the parameters. When a repeated non-zero value is entered, the former will reset to 0 automatically, i.e. the last entered value is active.

Analog input function could be selected by E parameter (none Sytronix application), or F parameter (Sytronix application). For this conflict the F parameter has higher priority, that means for example: If Analog input AI1 is assigned by F2.00≠0, then AI1 channel cannot be assigned by E0.00, E0.02 or E1.60 even these parameter select AI1.

For broken wire protection of analog input, please check the following table for setting range of E1.61. For more information, please refer to EFC 5620 converter document (R912008896).

Code	Name	Setting range	Default	Min.	Attri.
E1.36	Wire break protection	0: Inactive 1: Warning 2: Error	0	-	Stop
E1.41	Wire break protection	0: Inactive 1: Warning 2: Error	0	-	Stop
E1.37	AI1 Broken wire protection level	0.00-100.00%	0	0.01	Stop
E1.38	AI1 Broken wire protection action delay time	0.00-600.00s	0	0.01	Stop
E1.42	AI2 Broken wire protection level	0.00-100.00%	0	0.01	Stop
E1.43	AI2 Broken wire protection action delay time	0.00-600.00s	0	0.01	Stop

Tab. 6-2: Parameter E1.36/E1.41/E1.37/E1.38/E1.42/E1.43 for broken wire protection

Wire break monitoring function for all analog inputs can be activated by E1.61. Default value of E1.61 has been set to 0 in SvP 5030 default setting.

6.2.2 Flow command processing

Parameter F1.11 defines the source of flow command. The flow command value can come either from predefined SvP 5030 parameters, analog input or using fieldbus communication.

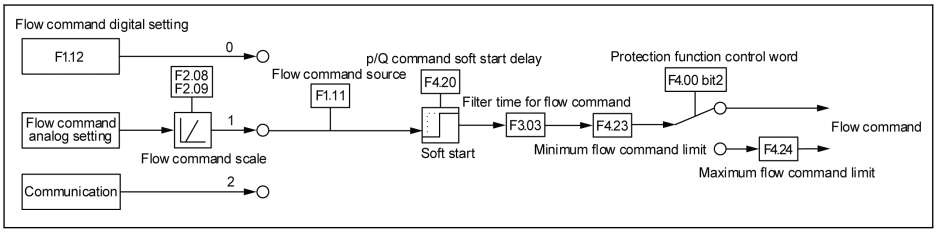


Fig. 6-3: Flow command processing

Code	Name	Setting range	Default	Min.	Attri.
F1.11	Flow command source	0: Use digital value set in parameter F1.12 1: Analog input (positive / negative) 2: Communication	1	-	Stop
F1.12	Flow command digital setting	0...5,000 rpm	40	1	Run
F2.00	Analog input AI1	0: No function assigned from ASF 1: Pressure command 2: Pressure feedback 3: Flow command 5: Slave flow command	1	-	Stop
F2.01	Analog input AI2		2	-	Stop
F2.02	External analog input EAI1		3	-	Stop
F2.03	External analog input EAI2		5	-	Stop
F2.08	Flow command corresponding to 5V, 10V or 20mA	1...5,000 rpm	2,000	1	Stop
F2.09	Flow command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F3.03	Filter time for flow command	0...999 ms	4	1	Run
F4.00	Protection control word	Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.20	p/Q command soft start delay	0.0...1,000.0 s	0.0	0.1	Stop
F4.23	Minimum flow command limit	0...[F4.24] rpm	40	1	Stop
F4.24	Maximum flow command limit	[F4.23]...5,000 rpm	3,000	1	Stop

Tab. 6-3: Parameter list of flow command processing

F2.08, F2.09: Scaling for flow command

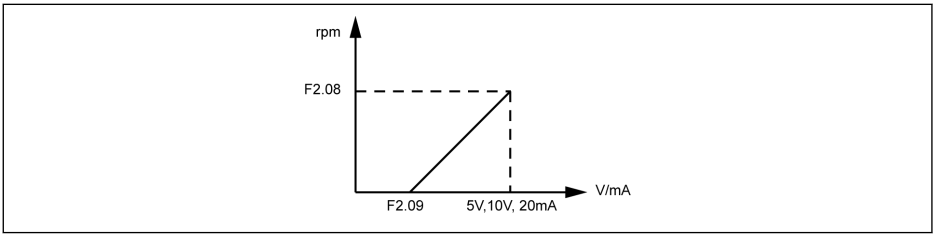


Fig. 6-4: Flow command scaling

6.2.3 Pressure command processing

The pressure command can be generated from multiple sources such as predefined in the parameters, analog input or fieldbus communication. The pressure command source has to be defined prior to the start-up of the system.

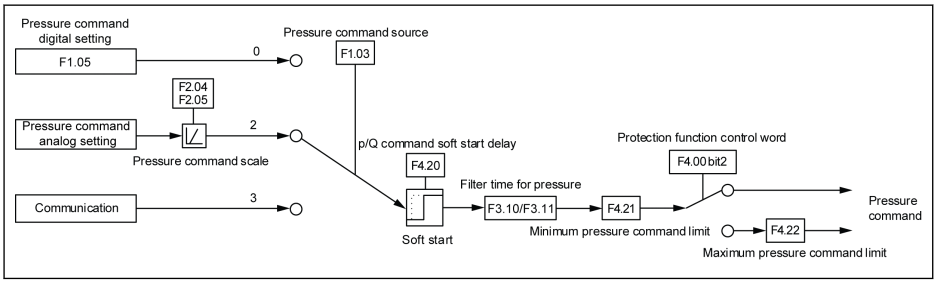


Fig. 6-5: Pressure command processing

Code	Name	Setting range	Default	Min.	Attri.
F1.03	Pressure command source	0: Use digital value set in parameter F1.05 2: Analog input 3: Communication	2	-	Stop
F1.05	Pressure command digital setting	0.0...1,000.0 bar	5.0	0.1	Run
F2.00	Analog input AI1	0: No function assigned from ASF 1: Pressure command 2: Pressure feedback 3: Flow command 5: Slave flow command	1	-	Stop
F2.01	Analog input AI2		2	-	Stop
F2.02	External analog input EAI1		3	-	Stop
F2.03	External analog input EAI2		5	-	Stop
F2.04	Pressure command corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	175.0	0.1	Stop
F2.05	Pressure command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F4.00	Protection control word	Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.20	p/Q command soft start delay	0.0...1,000.0 s	0.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F4.21	Minimum pressure command limit	0.0...[F4.22] bar	5.0	0.1	Stop
F4.22	Maximum pressure command limit	[F4.21]...1,000.0 bar	175.0	0.1	Stop

Tab. 6-4: Parameter list of pressure command processing

F2.04, F2.05: Scaling for pressure command

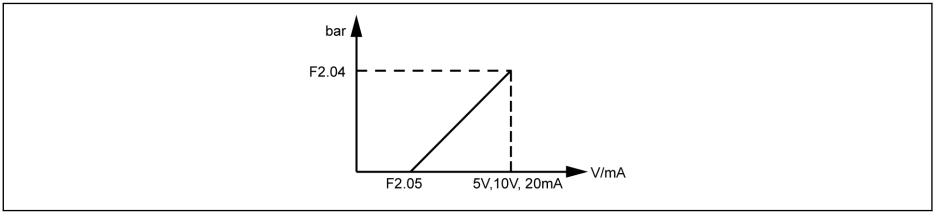


Fig. 6-6: Pressure command scaling

6.3 Analog output

This section shows how the analog output can be configured. The following figure is an example of analog input AO1. The configuration for EAO is similar to AO1, only with different parameters as shown in the table below.

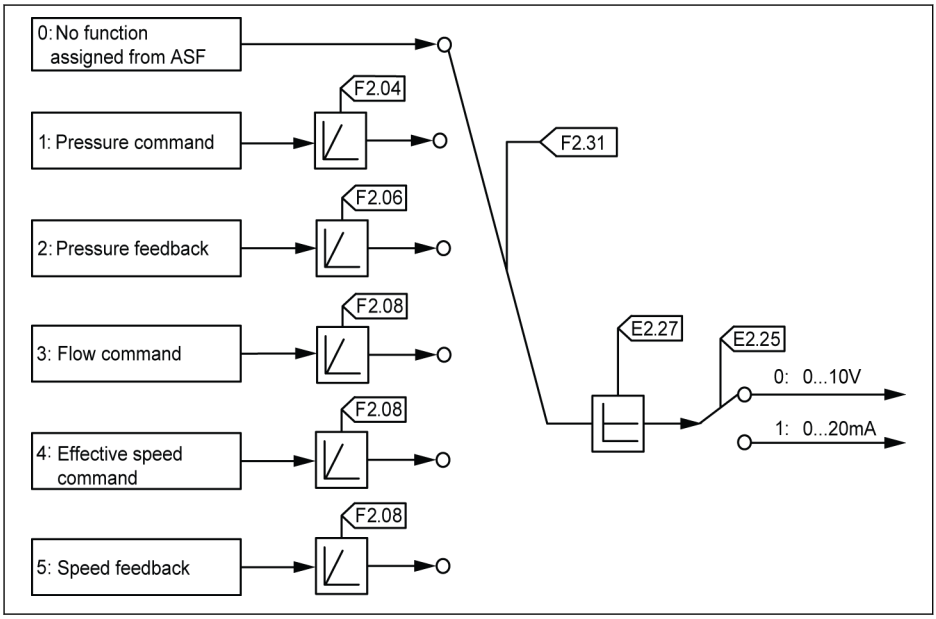


Fig. 6-7: Example with analog output AO1

Code	Name	Setting range	Default	Min.	Attri.
E2.25	AO1 output mode	0: 0...10 V 1: 0...20 mA 3: 2.....10V 4: 4.....20mA	0	-	Run
E2.27	AO1 gain setting	0.00...10.00	1.00	0.00	Run
F2.04	Pressure command corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	175.0	0.1	Stop
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop
F2.08	Flow command corresponding to 5V, 10V or 20mA	1...5,000 rpm	3,000	1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F2.31	AO1 output	0: No function assigned from ASF	2	-	Run
F2.32	EAO output	1: Pressure command 2: Pressure feedback 3: Flow command 4: Effective speed command 5: Speed feedback	5	-	Run
H8.25	EAO output mode	0: 0...10 V 1: 0...20 mA 2: -10...10 V (only for IO plus card) 3: 2.....10V 4: 4.....20mA	2	-	Run
H8.27	EAO gain setting	0.00...10.00	1.00	0.01	Run
H8.39	EAO curve minimum	-100.0 %...[H8.41]	0.0	0.1	Run
H8.40	EAO curve minimum value	-100.0...100.0 %	0.00	0.01	Run
H8.41	EAO curve maximum	[H8.39]...100.0 %	100.0	0.1	Run
H8.42	EAO curve maximum value	-100.0...100.0 %	100.00	0.01	Run

Tab. 6-5: Analog output parameter list

As the default configuration, SvP 5030 ASF sets the AO1 output, i.e. [F2.31] = 2. The AO1 output can be used by SvP 5030. If SvP 5030 ASF does not set the AO1 output, i.e. [F2.31] = 0, the AO1 output can be used by the EFC function.

Analog output setting:

For example:

- F2.31=1: Pressure command

$$AO1 = \frac{Pressure\ command\ output}{F2.04} * 10V\ (20mA)$$

- F2.31 = 2: Pressure feedback

$$AO1 = \frac{Pressure\ feedback\ output}{F2.06} * 10V\ (20mA)$$

- F2.31 = 3: Flow command

$$AO1 = \frac{Flow\ command}{F2.08} * 10V\ (20mA)$$

- F2.31 = 4: Effective speed command

$$AO1 = \frac{Active\ speed\ command}{F2.08} * 10V\ (20mA)$$

- F2.31 = 5: Speed feedback

$$AO1 = \frac{Speed\ feedback}{F2.08} * 10V\ (20mA)$$

6.4 Digital inputs

Code	Name	Setting range	Default	Min.	Attri.
F2.16	X1 input	0: No function 3: p/Q parameter group bit 0 4: p/Q parameter group bit 1 5: Master/slave mode switch (pQ/Flow) 6: External warning with delay 7: External warning without delay 9: External error with delay 10: External error without delay 12: Pump switch condition B enable	0 (RUN *)	-	Run
F2.17	X2 input		0 (Error reset *)	-	Run
F2.18	X3 input		3	-	Run
F2.19	X4 input		4	-	Run
F2.20	X5 input		5	-	Run
F2.21	EX1 input		0	-	Run
F2.22	EX2 input		0	-	Run
F2.23	EX3 input		0	-	Run
F2.24	EX4 input		0	-	Run
F2.25	EX5 input		0	-	Run

Tab. 6-6: Digital input parameter list

*: The functions in brackets come from presetting of EFC parameters. See chapter 8.6 "Auto-modified EFC parameters in SvP initialization" on page 60.

6.5 Digital and relay outputs

Code	Name	Setting range	Default	Min.	Attri.
F2.36	DO1 output	0: No function 1: Controller warning	1	-	Run
F2.37	EDO1 output	0: No function 1: Controller warning 2: Two-points / double pump control	0	-	Run
F2.38	EDO2 output				
F2.40	Relay 1 output				

Tab. 6-7: Parameter list of digital and relay output

Both digital in-/output function could be selected by E parameter (none Sytronix application), or F parameter (Sytronix application). For this conflict the F parameter has higher priority, that means for example: If digital output DO1 is assigned by F2.36=1, then DO1 channel cannot be assigned by E2.01, even if E2.01 is pointed to some function for DO1.

The SvP 5030 default setting of DO1 is "1", i.e. pump controller warning. Meanwhile, the default setting of relay, EDO1 and EDO2 when connected to ASF is "0", which means the function of relay and EDO1 / EDO2 is assigned by EFC firmware.

The EFC parameter E2.15 has been set to "14" (pump controller error) by ASF as SvP default setting. For more EFC parameters changed as SvP default setting, please refer to chapter 8.6 "Auto-modified EFC parameters in SvP initialization" on page 60.

6.6 Quick configuration for Rexroth servo motor

When a Rexroth servo motor is used with SvP 5030 ASF applications, saved motor parameters can be loaded via F1.15 and F1.16. Please keep [F1.15] = 2 for Rexroth MSH motors.

Code	Name	Setting range	Default	Min.	Attri.
F1.15	Motor type	0: Others 1:Rexroth MS2N 2: Rexroth MSH	2	-	Stop
F1.16	Motor power level	0: No selection (F1.15 = 1: Rexroth MS2N) 12: MS2N10-D0BHN 13: MS2N10-D0BHA/B 14: MS2N10-D0BNA/B 15: MS2N10-E0BHA/B 16: MS2N10-E0BNA/B 17: MS2N10-F0BHA/B 18: Reserved 19: Reserved (F1.15 = 2: Rexroth MSH) 12: MSH215-65 13: MSH215-80 14: MSH215-105 15: MSH215-130 16: MSH215-155 17: MSH215-200 18: MSH300-300 19: MSH300-370	0	-	Stop

Tab. 6-8: Motor parameter list

- If [F1.15] = is set to 0 or [F1.16] is set to reserved options, no motor parameter loading will be triggered.
- If [F1.15]] is values other than 0, motor parameter will be loaded by switching active values of [F1.16].

If the motor parameters are selected from F1.15 / F1.16, the following parameters in the EFC converter will be changed automatically.

Code	Name	Code	Name
C1.05	Motor rated power	C1.72	Motor thermal sensor type
C1.06	Motor rated voltage	C1.73	Motor thermal sensor protection level
C1.07	Motor rated current	C3.00	Speed loop proportional gain 1
C1.08	Motor rated frequency	C3.01	Speed loop integral time 1
C1.09	Motor rated speed	C3.02	Speed loop proportional gain 2
C1.11	Motor poles	C3.03	Speed loop integral time 2
C1.13	Motor inertia mantissa	C3.05	Current loop proportional gain
C1.14	Motor inertia exponent	C3.06	Current loop integral time
C1.15	Motor torque constant	C3.22	Encoder commutation offset
C1.16	Motor EMF constant	H7.01	Encoder direction
C1.21	Stator resistance	H7.31	Resolver poles
C1.23	Leakage inductance	C0.07	Voltage Overmodulation
C3.30	Maximum FW current factor for SM	C3.44	Torque limit positive
C3.45	Torque limit negative		

Tab. 6-9: Auto-modified EFC motor control parameter list of MS2N

Code	Name	Code	Name
C1.05	Motor rated power	C3.01	Speed loop integral time 1
C1.06	Motor rated voltage	C3.02	Speed loop proportional gain 2
C1.07	Motor rated current	C3.03	Speed loop integral time 2
C1.08	Motor rated frequency	C3.05	Current loop proportional gain
C1.09	Motor rated speed	C3.06	Current loop integral time
C1.13	Motor inertia mantissa	C3.10	Speed loop switching frequency 1
C1.14	Motor inertia exponent	C3.11	Speed loop switching frequency 2
C1.21	Stator resistance	C3.22	Encoder commutation offset
C1.26	d-axis inductance	C3.30	Maximum FW current factor for SM
C1.27	q-axis inductance	C3.44	Torque limit positive
C1.72	Motor thermal sensor type	C3.45	Torque limit negative
C1.73	Motor thermal sensor protection level	C0.15	Brake chopper start voltage
E1.60	Motor temperature sensor channel	b3.01	Field weakening Kp
E0.08	Maximum output frequency	b3.02	Field weakening Ki
E0.09	Output frequency high limit	b3.03	Field weakening current filter factor
C3.00	Speed loop proportional gain 1	b3.06	Over modulation factor1

Code	Name	Code	Name
b3.07	Over modulation factor2	b3.08	Inertia factor for Te compensation
H7.01	Encoder direction	H7.31	Resolver poles

Tab. 6-10: Auto-modified EFC motor control parameter list of MSH

Once motor control mode (C0.00=1 or 2) is changed, please reload motor parameter by setting F1.16 again.

6.7 Quick configuration for Rexroth HM20 pressure sensor

For applications using the Rexroth HM20 pressure sensor, configuration parameters of the HM20 sensor can be automatically loaded by selecting the corresponding type code in parameter F2.10. Please make sure the right analog input channel has been set through [F2.00]...[F2.03] before setting [F2.10], since the configuration parameters (AI input mode and scaling factors) will be set for the selected channel for pressure feedback.

Code	Name	Setting range	Default	Min.	Attri.
E1.35	AI1 input mode	0: 0...20 mA	2	-	Run
E1.40	AI2 input mode	1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V	2	-	Run
H8.05	EAI input mode	0...4 (same as E1.35) 5: -10...10 V	2	-	Stop
F2.00	Analog input AI1	0: No function assigned from ASF	1	-	Stop
F2.01	Analog input AI2	1: Pressure command	2	-	Stop
F2.02	External analog input EAI1	2: Pressure feedback	3	-	Stop
F2.03	External analog input EAI2	3: Flow command 5: Slave flow command	5	-	Stop
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F2.07	Pressure feedback null offset in V or mA	0.0...5.0 V, mA	0.1	0.1	Stop
F2.10	Pressure sensor type	0: Others 1: HM20-2X/10-C 2: HM20-2X/50-C 3: HM20-2X/100-C 4: HM20-2X/160-C 5: HM20-2X/250-C 6: HM20-2X/315-C 7: HM20-2X/400-C 8: HM20-2X/630-C 9: Other 4-20mA pressure sensors 11: HM20-2X/10-H 12: HM20-2X/50-H 13: HM20-2X/100-H 14: HM20-2X/160-H 15: HM20-2X/250-H 16: HM20-2X/315-H 17: HM20-2X/400-H 18: HM20-2X/630-H 19: Other 0.1-10V pressure sensors	15	-	Stop

Tab. 6-11: Parameter list of HM20 pressure sensor auto-selection

If applications use the other pressure sensor, AI2 input is predefined as the pressure sensor input. The user may select a different type of pressure sensor and scaling factor. The following parameter list can configure the pressure sensor.

Code	Name	Setting range	Default	Min.	Attri.
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop
F2.07	Pressure feedback null offset in V or mA	0.0...5.0 V, mA	0.1	0.1	Stop
F3.02	Filter time for pressure feedback	0...999 ms	4	1	Run

7 Main functions

7.1 Overview

The following figure shows an overview of control functions in this ASF. For detailed information, refer to the chapter number which is shown under each function.

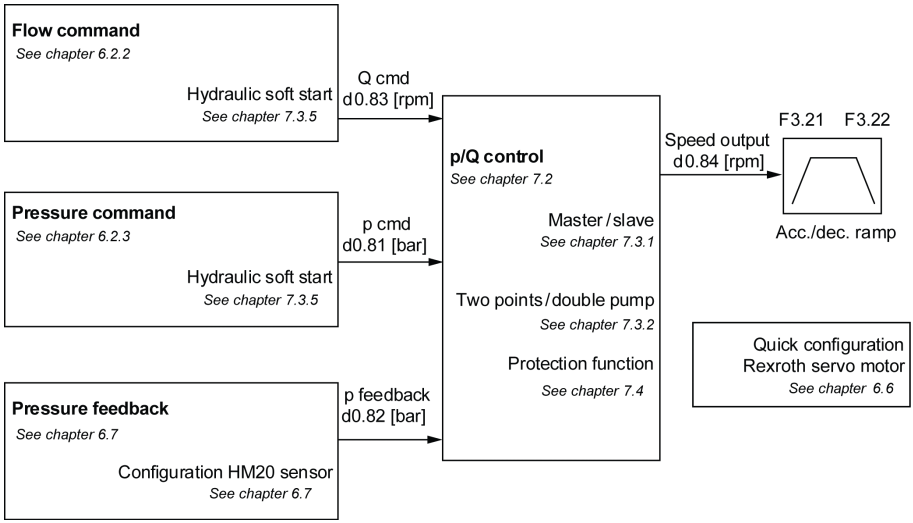


Fig. 7-1: p/Q PID-control and relevant functions

7.2 p/Q PID-control

7.2.1 Basic p/Q control structure and related parameters

The basic p/Q control structure and related parameters are shown in the following figure in 5 sections:

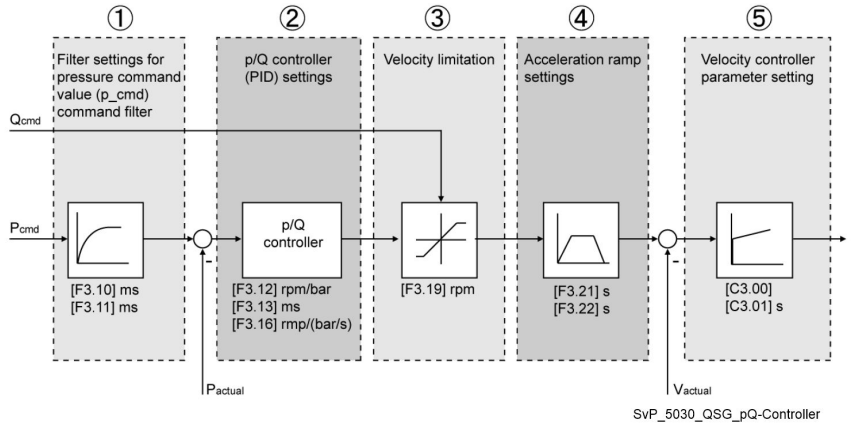


Fig. 7-2: p/Q controller structure

The information in this chapter will help you optimize the p/Q controller according to the customer application at hand.

Code	Name	Setting range	Default	Min.	Attri.
F3.10	Filter time for pressure rising [0]	0...999 ms	40	1	Run
F3.11	Filter time for pressure dropping [0]	0...999 ms	20	1	Run
F3.12	Proportional gain [0]	0.00...500.00 rpm/bar	6.00	0.01	Run
F3.13	Integral time 1 [0]	0...999 ms	30	1	Run
F3.14	Integral time 2 [0]	0...999 ms	0	1	Run
F3.15	Integral time TI switch threshold [0]	-150.0...0.0 bar (set to 0, the switching function is invalid)	0.0	0.1	Run
F3.16	Derivative gain [0]	0.000...10.000 (rpm/bar)*s	0.100	0.001	Run
F3.17	Filter time for Kd [0]	0...999 ms	35	1	Run
F3.18	Lower limit for I+D [0]	-5,000...5,000 rpm	0	1	Run
F3.19	System minimum speed [0]	-5,000...5,000 rpm	-1,500	1	Run
F3.21	SvP acceleration	1...65,535 rad / s^2	8,000	1	Run
F3.22	SvP deceleration	1...65,535 rad / s^2	12,000	1	Run
F3.30	Filter time for pressure rising [1]	0...999 ms	80	1	Run
F3.31	Filter time for pressure dropping [1]	0...999 ms	40	1	Run
F3.32	Proportional gain [1]	0.00...500.00 rpm / bar	6.00	0.01	Run

Code	Name	Setting range	Default	Min.	Attri.
F3.33	Integral time 1 [1]	0...999 ms	30	1	Run
F3.34	Integral time 2 [1]	0...999 ms	0	1	Run
F3.35	Integral time TI switch threshold [1]	-150.0...0.0 bar (set to 0.0, the switching function is invalid)	0.0	0.1	Run
F3.36	Derivative gain [1]	0.000...10.000 (rpm/bar)*s	0.300	0.001	Run
F3.37	Filter time for Kd [1]	0...999 ms	35	1	Run
F3.38	Lower limit for I+D [1]	-5,000...5,000 rpm	0	1	Run
F3.39	System minimum speed [1]	-5,000...5,000 rpm	-1,500	1	Run
F3.50	Filter time for pressure rising [2]	0...999 ms	100	1	Run
F3.51	Filter time for pressure dropping [2]	0...999 ms	60	1	Run
F3.52	Proportional gain [2]	0.00...500.00 rpm/bar	6.00	1.00	Run
F3.53	Integral time 1 [2]	0...999 ms	30	1	Run
F3.54	Integral time 2 [2]	0...999 ms	0	1	Run
F3.55	Integral time TI switch threshold [2]	-150.0...0.0 bar	0.0	1.0	Run
F3.56	Derivative gain [2]	0.000...10.000 (rpm/bar)*s	0.100	1.000	Run
F3.57	Filter time for Kd [2]	0...999 ms	35	1	Run
F3.58	Lower limit for I+D [2]	-5,000...5,000 rpm	0	1	Run
F3.59	System minimum speed [2]	-5,000...5,000 rpm	-1,500	1	Run
F3.70	Filter time for pressure rising [3]	0...999 ms	120	1	Run
F3.71	Filter time for pressure dropping [3]	0...999 ms	80	1	Run
F3.72	Proportional gain [3]	0.00...500.00 rpm/bar	6.00	1.00	Run
F3.73	Integral time 1 [3]	0...999 ms	30	1	Run
F3.74	Integral time 2 [3]	0...999 ms	0	1	Run
F3.75	Integral time TI switch threshold [3]	-150.0...0.0 bar	0.0	1.0	Run
F3.76	Derivative gain [3]	0.000...10.000 (rpm/bar)*s	0.000	1.000	Run
F3.77	Filter time for Kd [3]	0...999 ms	35	1	Run
F3.78	Lower limit for I+D [3]	-5,000...5,000 rpm	0	1	Run
F3.79	System minimum speed [3]	-5,000...5,000 rpm	-1,500	1	Run

Tab. 7-1: Parameter list of p/Q PID control

7.2.2 Effect of the controller parameters

The designation and the effect of the controller parameters is explained with the parameters for parameter set 0.

Code	Name	Setting range	Default	Min.	Attri.
F3.12	Proportional gain [0]	0.00...500.00 rpm/bar	6.00	0.01	Run

Tab. 7-2: Parameter list of p/Q PID controller proportional gain setting

Parameter F3.12 is used to set the proportional gain of the p/Q PID-controller. Pressure loop response is faster with a higher proportional gain. But excessively high proportional gain can cause pressure overshoot and pressure oscillation.

Code	Name	Setting range	Default	Min.	Attri.
F3.13	Integral time 1 [0]	0...999 ms	30	1	Run
F3.14	Integral time 2 [0]	0...999 ms	0	1	Run
F3.15	Integral time TI switch threshold [0]	-150.0...0.0 bar (the switching function is invalid when the setting is 0.0)	0.0	0.1	Run

Tab. 7-3: Parameter list of p/Q PID controller integral time setting

The parameters in the table above are used to set the integrator update rate delay of the p/Q PID controller. Increasing integrator values will slow down the pressure loop system response which reduces the pressure system response against external disturbance, but will result in higher system stability. Both integral time TI_1 and TI_2 can be utilized after setting F3.15 to values smaller than 0. Based on the pressure difference (pressure command - pressure feedback), the system will switch to a suitable integrator delay time.

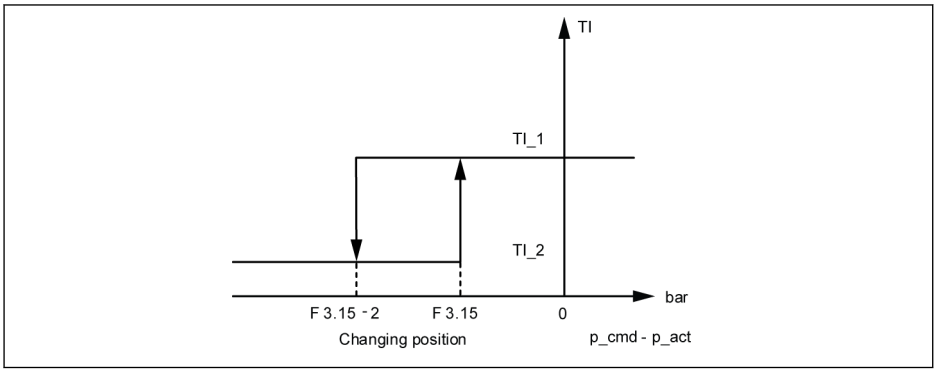


Fig. 7-3: p/Q PID integrator switching

When the integrator time TI switching threshold is set to 0, the switching function is inactive, and integrator interval T1_1 becomes dominant and fixed.

Code	Name	Setting range	Default	Min.	Attri.
F3.16	Derivative gain [0]	0.000...10.000 (rpm/bar)*s	0.100	0.001	Run
F3.17	Filter time for Kd [0]	0...999 ms	35	1	Run

Tab. 7-4: Parameter list of p/Q PID controller derivative gain setting

Parameter F3.16 is used to set the derivative gain of the p/Q PID-controller. The greater the derivative gain, the less the system pressure overshoots, but the slower the pressure response. An excessively large derivative gain would affect the system stability.

Parameter F3.17 is used to set the filter time at the derivative part of the p/Q PID-controller. Setting this parameter properly can help to suppress high frequency oscillation in the derivative part of the PID-controller.

Code	Name	Setting range	Default	Min.	Attri.
F3.18	Lower limit for I+D [0]	-5,000...5,000 rpm	0	1	Run

Tab. 7-5: Parameter list of p/Q PID-controller integral output setting

Parameter F3.18 is used to set the minimum value of the integral output for preventing pressure undershoots in case of descending pressure steps.

Code	Name	Setting range	Default	Min.	Attri.
F3.19	System minimum speed [0]	-5,000...5,000 rpm	-1,500	1	Run

Tab. 7-6: Parameter list of p/Q PID controller minimum output setting

Parameter F3.19 is used to set the lower limit of the p/Q PID-controller output.

Parameter set [1] F3.32...F3.39, set [2] F3.52...F3.59, set [3] F3.72...F3.79 have the same function as parameter set [0] F3.12...F3.19.

⚠ WARNING

In case of using a check valve in the pressure line, a negative speed as minimum system speed is not allowed.

7.2.3 p/Q-Parameter sets

The SvP5030 system provides 4 different parameter groups for the p/Q controller parameters. This allows the user to adjust the controller parameters depending on the hydraulic load by switching to another group. As default setting the p/Q parameter group 0 (F3.12...F3.19) is selected, switching to the other parameter set during operation is also possible. For details, please refer to the following table and figure.

Code	Name	Setting range	Default	Min.	Attri.
F3.00	p/Q parameter selection source	0: Use digital value set in parameter F3.01 1: Digital input 2: Communication	0	-	Stop
F3.01	p/Q parameter digital selection	0: Parameter group 0 1: Parameter group 1	0	-	Run

Tab. 7-7: Parameter list of p/Q parameter selection

How to select a p/Q parameter group is described in the following figure.

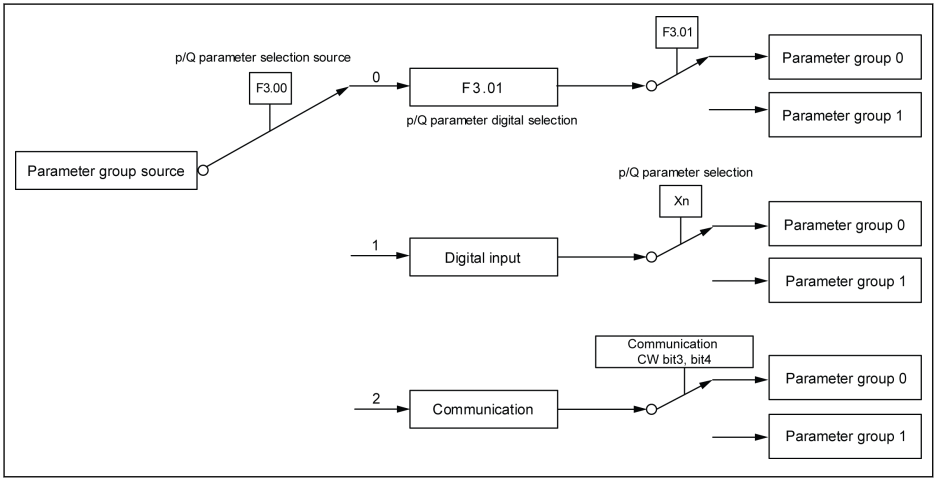


Fig. 7-4: p/Q parameter group selection

⚠ WARNING **When the system operating at condition of pressure-holding , Please note the following points.**

Pressure holding under rated pressure (≤120 bar)	Maximum duration	s	180
	Maximum speed	rpm	100
Pressure holding standby pressure (5 bar)	Maximum duration	s	180
	Maximum speed	rpm	50

7.3 Additional functions

7.3.1 Master / slave function

The master / slave pump function is designed for multiple pumps working as a group to achieve a larger flow. In this application, a "master" pump controller is needed to control the speed / flow of downstream "slave" pump controllers.

Code	Name	Setting range	Default	Min.	Attri.
F1.03	Pressure command source	0: Use digital value set in parameter F1.05 2: Analog input 3: Communication	2	-	Stop
F1.11	Flow command source	0: Use digital value set in parameter F1.12 1: Analog input (positive / negative) 2: Communication	0	-	Stop
F2.00	Analog input AI1	0: No function assigned from ASF 1: Pressure command 2: Pressure feedback 3: Flow command 5: Slave flow command	1	-	Stop
F2.01	Analog input AI2		2	-	Stop
F2.02	External analog input EAI1		3	-	Stop
F2.03	External analog input EAI2		5	-	Stop
F2.04	Pressure command corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	175.0	0.1	Stop
F2.05	Pressure command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F2.08	Flow command corresponding to 5V, 10V or 20mA	1...5,000 rpm	2,000	1	Stop
F2.09	Flow command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F2.31	AO1 output	0: No function assigned from ASF 1: Pressure command 2: Pressure feedback 3: Flow command 4: Active speed command 5: Speed feedback	2	-	Run
F2.32	EAO output		5	-	Run
F3.03	Filter time for flow command	0...999 ms	4	1	Run

Code	Name	Setting range	Default	Min.	Attri.
F4.03	Pump control word	Bit 0: Pump power limit Bit 2: Master/slave Bit 3: Two-points / double pump Bit 6: Monitoring speed direction reverse Other bits: Reserved	0b 0000 0000 0100 0000	-	Run
F4.20	p/Q command soft start delay	0.0...1,000.0 s	0.0	0.1	Stop
F4.23	Minimum flow command limit	0...[F4.24] rpm	40	1	Stop
F4.24	Maximum flow command limit	[F4.23]...5,000 rpm	3,000	1	Stop
F4.39	Master/slave (pQ/Flow) switch source	0: Use digital value set in parameter F4.03 1: Digital input 2: Communication	0	-	Stop
F4.40	Slave pump speed command lower limit	-5,000...5,000 rpm	0	1	Run
F4.41	Slave pump flow mode switch delay	0...500 ms	100	1	Stop
F4.42	Slave flow command source	0: No 1: Analog input 2: Communication	1	-	Stop
F4.43	Slave flow command corresponding to 5V, 10V or 20mA	0 --- 5000 rpm	3,000	1	Stop
F4.44	Slave flow command null offset in V or mA	0.0 --- 5.0 V, mA	0.0	0.1	Stop
F4.45	Slave flow command linear offset in V	-0.10---0.10V	0.0	0.01	Run

Tab. 7-8: Parameter list of master / slave function

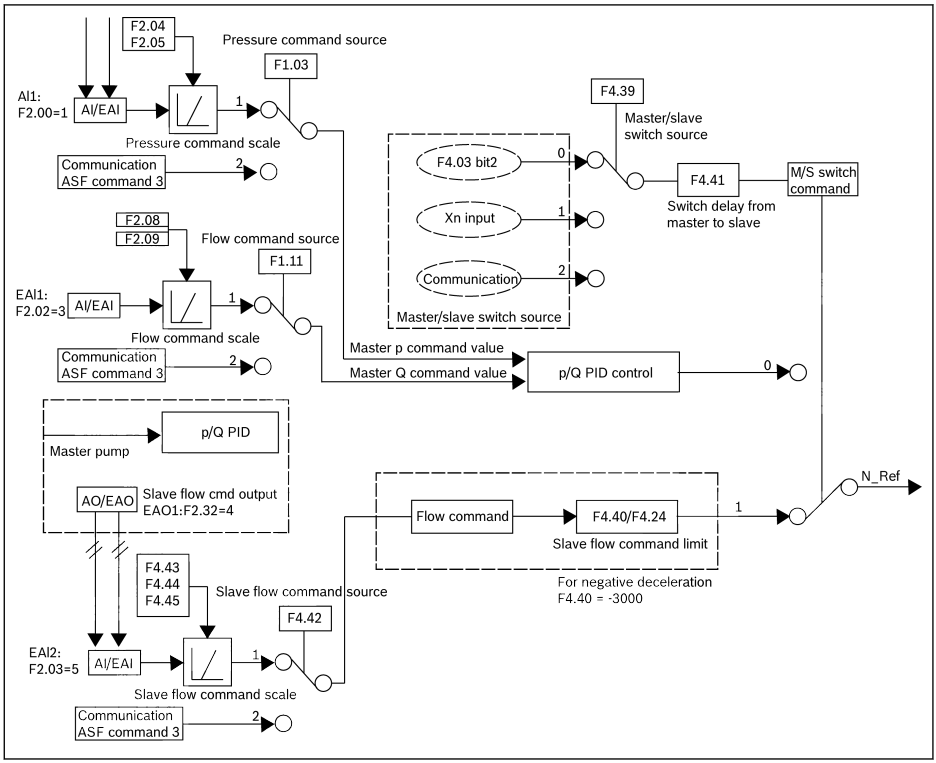


Fig. 7-5: Master / slave control function

7.3.2 Two-points / double pump control

Code	Name	Setting range	Default	Min.	Attri.
F2.37	EDO output	0: No function	0	-	Run
F2.38	EDO2 output	1: Controller warning	0	-	Run
F2.40	Relay 1 output	2: Two-points /double pump control	0	-	Run
F4.03	Pump control word	Bit 0: Pump power limit Bit 2: Master/slave Bit 3: Two-points/double pump Bit 6: Monitoring speed direction reverse Other bits: Reserved	0b 0000 0000 0100 0000	-	Run
F4.28	Two-points / double pump selection	0: Two-points pump 1: Double pump	0	-	Stop
F4.29	Pump logic selection	0: Positive 1: Negative	0	-	Stop
F4.30	Pump Vg1	0...1,000 ccm	0	1	Stop
F4.31	Pump Vg2	0...1,000 ccm	0	1	Stop
F4.32	Upper pressure difference switching threshold	0.0...350.0 bar	15.0	0.1	Stop
F4.33	Lower pressure difference switching threshold	0.0...350.0 bar	10.0	0.1	Stop
F4.34	Speed switching threshold adjustment	0.1...1.0	0.9	0.1	Stop
F4.78	Pump switch condition B activity selection	0: Enabled always 1: Enabled by DI (option 12) 2: Enabled by communication control word (F0.20 bit 6) 3: Disabled	3	-	Stop
F4.86	EZ switch pressure_cmd for B Vgmin	F4.87 --- 600.0 bar	0.0	0.1	Run
F4.87	EZ switch pressure_cmd for B Vgmax	0 --- F4.86 bar	0.0	0.1	Run
F4.88	EZ switch pressure_fb for B Vgmin	F4.89 --- 600.0 bar	0.0	0.1	Run
F4.89	EZ switch pressure_fb for B Vgmax	0 --- F4.88 bar	0.0	0.1	Run

Code	Name	Setting range	Default	Min.	Attri.
F4.90	EZ switch delay for B Vgmin	0 --- 5000 ms	50	1	Run
F4.91	EZ switch delay for B Vgmax	0 --- 5000 ms	50	1	Run

Tab. 7-9: Parameter list of Two-points / double pump control

For the two-points pump, F4.30 Pump Vg1 represents the maximum displacement Vg_max, and F4.31 Pump Vg2 represents the smaller displacement Vg_min.

Two-points pump control have two modes of operation: Mode 1and 2.

When F4.78=0 (0 means always active, 1 means active when digital input is available, and 2 means active when communication input is available), the mode1 is active, the pump displacement should switch only according to pressure command and feedback value, it goes to Vg_min when both p_cmd and p_feedback is higher than the setting of F4.86 and F4.88 and goes to Vg_max when one of them is lower than setting of F4.87 and F4.89, after the delay time F4.90/F4.91.

Application example for mode 1:

Connect the 24 V power supply, normally open relay terminal Ta, Tb (wiring refer to the Rexroth Frequency Converter EFC 5620 Series R912009312) and Rexroth two-points pump controller in series, [F2.40] is set to "2" which assigns the relay output to switch the pump displacements, and set [F4.78] to "0" which actives the Mode 1, then set [F4.86.....F4.91] according to the switching pressure/delay as required, the pump goes to Vg_max or Vg_min when the pressure meets the condition as required.

Please kindly remind the maximal life cycle of relay output is 100,000 times, for application with higher switching time, please use DO with external solid relay.

When the F4.78=3, the mode 2 is active. according to the pressure feedback, actual speed, F4.32, F4.33 and F4.34, the pump switching logic will be calculated and carried out via the digital output, once the output has been set. Via parameter F4.28, pump type can be selected between two-points and double pump. For the two-position pump, F4.30 (Vg1) represents the maximum displacement, and F4.31 (Vg2) represents the smaller displacement. for double pumps, F4.30 (Vg1) refers to the main pump, and F4.31 (Vg2) corresponds to the displacement of an additional pump.

Please refer to the figure below for pump switching logic for mode 2 (F4.28 = 0, F4.29 = 0). This pump switching logic can also be inversed via F4.29 or different terminal connecting from relay.

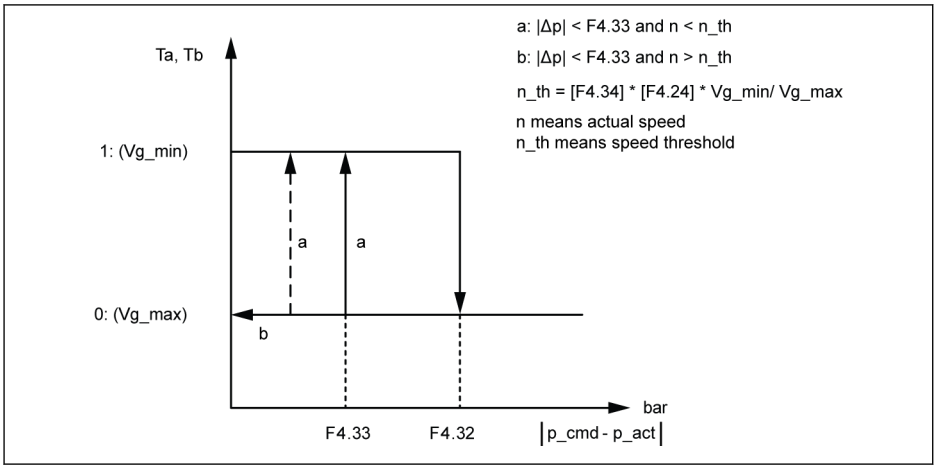


Fig. 7-6: Action logic of relay

$\Delta p = p_{cmd} - p_{actual}$

Vg_max is always active if:IΔpI > F4.32. For switching to Vg_min, IΔpI must be<F4.33 and the actual speed must be lower than N_th.

The switch back condition to Vg_max depends again only from the IΔpI > F4.32.

To avoid switching back and forth, be sure that a pressure overshoot is smaller than the value of F4.32.

When the pump logic has been switched to a different logic (Vg_{max} or Vg_{min}), the control parameters need also to be changed:

For logic Vg_{max}:

- Vg = Vg1 (two-points) or Vg = Vg1 + Vg2 (double pump)
- p/Q controller parameter group [0], [F3.10]...[F3.19]

For logic Vg_{min}:

- Vg = Vg2 (two-points) or Vg = Vg1 (double pump)
- p/Q controller parameter group [1], [F3.30]...[F3.39]

When the two-points / double pump control is active, the p/Q parameter selection function via digital input (F2.16...F2.25) is deactivated.

Application example for mode 2:

24 V power supply, normally open relay terminal Ta, Tb and Rexroth two-points pump controller are connected in series, [F4.28] is set to "0: Two-points pump" and [F4.29] are set to "0: Positive", when Δp and n_{th} satisfy the condition of relay action, the pump switches to the minimum displacement.

7.3.3 Sleep / wake function

This function is used to achieve the maximum extent of energy-saving according to the type of loads in the actual application, for example hydraulic system with small leakage or accumulator. This function works according to the PID-control mode, when SvP 5030 ASF is active. The function is assigned to the p/Q PID-controller in ASF, and the basic PID-controller of EFC is deactivated.

Code	Name	Setting range	Default	Min.	Attri.
E5.15	Sleep level	0.00...[E0.09] Hz	0.00	0.01	Run
E5.16	Sleep delay	0.0...3,600.0 s	60.0	0.1	Run
E5.19	Wake up level	0.0...100.0 %	0.0	0.1	Run
E5.20	Wake up delay	0.0...60.0 s	0.5	0.1	Run

Tab. 7-10: Parameter list of sleep / wake function

The frequency converter may go into the sleep mode when all the conditions below are met:

- [PID feedback] ≥ Pressure command value
- [PID output] < [E5.15] "Sleep level"
- [Duration] t ≥ [E5.16] "Sleep delay"

- PID feedback means pressure feedback in SvP 5030. The unit of wake up level or sleep boost amplitude has is percentage. This percentage is referred to the pressure command value in bar.
- PID output means the speed output from the p/Q controller in SvP 5030. This value has the same unit as the sleep level, i.e. Hz.

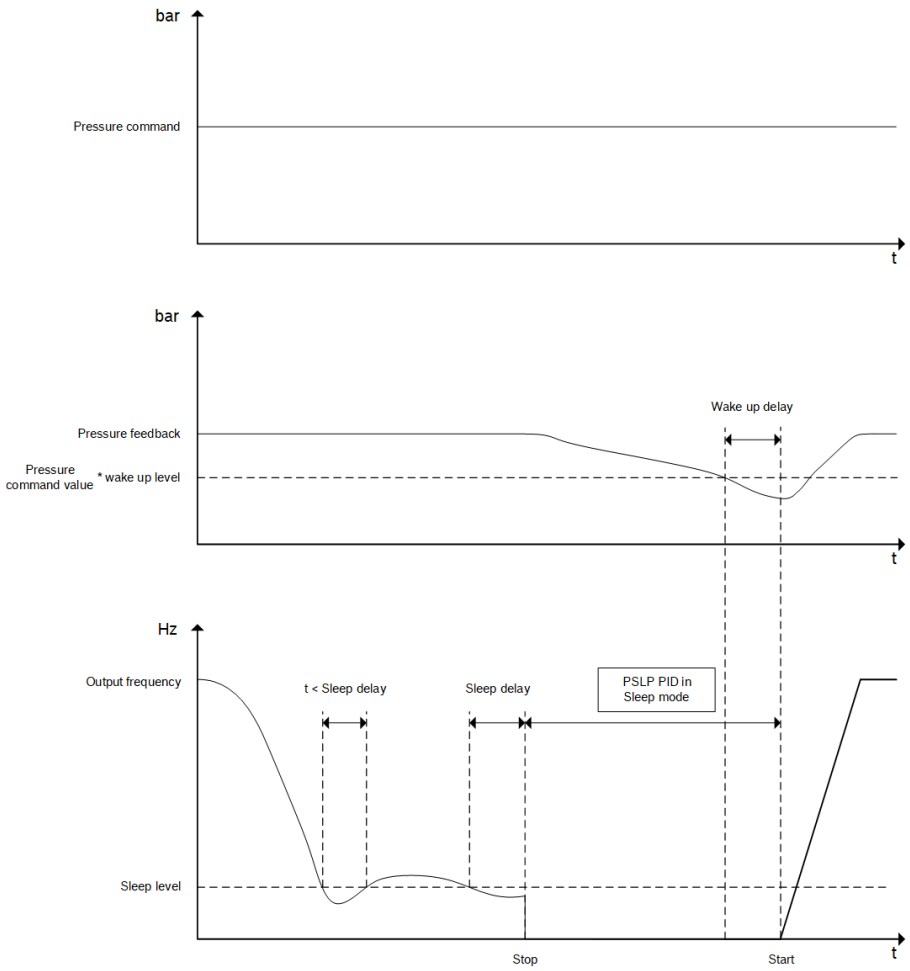


Fig. 7-7: Sleep and wake-up process in SvP

After [E5.16] "Sleep delay" the pump controller goes to the sleep mode. In the sleep mode, the pump controller stops output with "PSLP" displayed on the operating panel.

During sleeping, the frequency converter monitors the actual PID feedback and wakes up when the following two conditions are met:

- [PID feedback] < Pressure command value x [E5.19] "Wake up level"

- [Duration] t ≥ [E5.20] "Wake up delay"

The frequency converter resumes its previous running status after waking up.

7.3.4 Pump power limitation

Code	Name	Setting range	Default	Min.	Attri.
F4.03	Pump control word	Bit 0: Pump power limit	0b	-	Run
		Bit 2: Master/slave	0000		
		Bit 3: Two-points/double pump	0000		
		Bit 6: Monitoring speed direction reverse	0100		
		Other bits: Reserved	0000		
F4.30	Pump Vg1	0...1,000 ccm	0	1	Stop
F4.31	Pump Vg2				
F4.35	Pump power	0.00...315.00 kW	0.00	0.01	Stop

Tab. 7-11: Parameter list of pump power limitation

The pump power limitation function can be activated via bit 0 of F4.03.

The real-time pump power can be calculated from the pressure feedback, the actual speed and the pump displacement. If the calculated pump power output exceeds the pump power limitation [F4.35] then the speed will be reduced to keep the pump power output within the limit and a warning is issued.

7.3.5 Hydraulic soft start

Code	Name	Setting range	Default	Min.	Attri.
F4.20	p/Q command soft start delay	0.0...1,000.0 s	0.0	0.1	Stop
F4.21	Minimum pressure command limit	0.0...[F4.22] bar	5.0	0.1	Stop
F4.23	Minimum flow command limit	0...[F4.24] rpm	40	1	Stop

Tab. 7-12: Parameter list of hydraulic soft start

The soft start function is designed to reduce the p/Q command or potential overcurrent condition during start-up. Once this function is active (set F4.20 > 0), the p/Q commands will be switched to F4.21 and F4.23 within a time period of F4.20 after every run command.

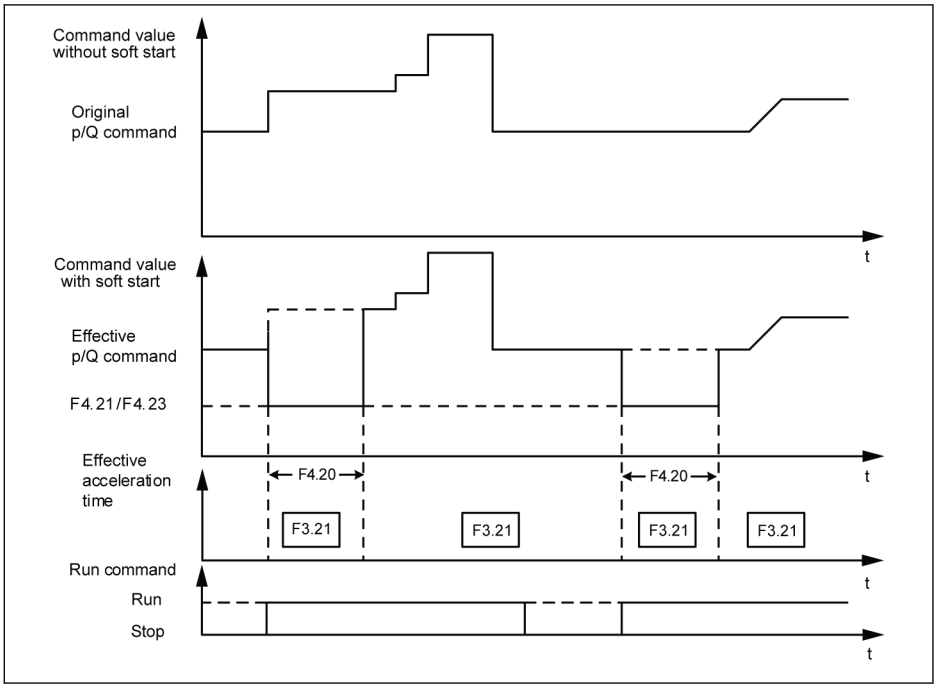


Fig. 7-8: Hydraulic soft start

7.3.6 Leakage compensation

Code	Name	Setting range	Default	Min.	Attri.
F4.26	Leakage compensation determination pressure	0.0...1,000.0 bar	0.0	0.1	Run
F4.27	Leakage compensation determination flow	0...3,000 rpm	0	1	Run

Tab. 7-13: Parameter list of leakage compensation

The leakage compensation serves to guarantee an exact oil flow from the pump. It compensates, for example, the leakage within the pump so that the cylinders work at a constant speed. Without leakage compensation, a difference between the command value specified by the external control and the actual oil flow in the system will result due to the pressure-dependent leakage.

The principle of operation is as follows:

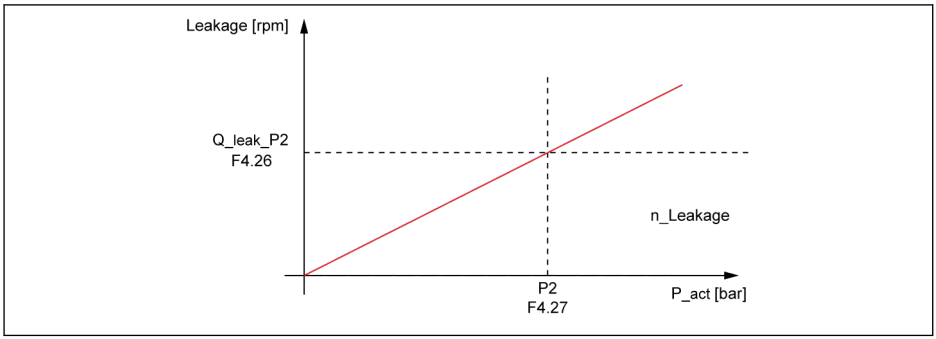


Fig. 7-9: Leakage compensation

The value calculated for the leakage compensation is added to the flow command. The compensation value is shown in the figure above by means of the line which shows the working point with the following two parameters.

- Leakage compensation determination pressure: F4.26
- Leakage compensation determination flow: F4.27

7.4 Protection functions

7.4.1 Overview

SvP 5030 ASF provides a multiple of protection functions, including detection of pressure sensor fault, actual pressure monitoring, pressure / flow command monitoring, pump power limitation.

7.4.2 Pressure sensor fault detection

Code	Name	Setting range	Default	Min.	Attri.
F4.00	Protection control word	Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.06	Pressure sensor fault detection threshold 1 (negative direction)	-5,000...0 rpm	-1	1	Stop
F4.07	Pressure sensor fault detection time 1 (negative direction)	0.1...100.0 s	10.0	0.1	Stop
F4.08	Pressure sensor fault detection threshold 2 (positive direction)	0...5,000 rpm	200	1	Stop
F4.09	Pressure sensor fault detection time 2 (positive direction)	0.1...100.0 s	10.0	0.1	Stop

Tab. 7-14: Parameter list of pressure sensor fault detection

The pressure sensor fault detection can be activated via bit0 of F4.00.

The pressure sensor fault detection works in two different phases:

- Motor runs in negative direction

  Once the motor runs in negative direction, this function will check if the motor speed is consistently lower than [F4.06] for [F4.07] seconds and signal a fault for this.

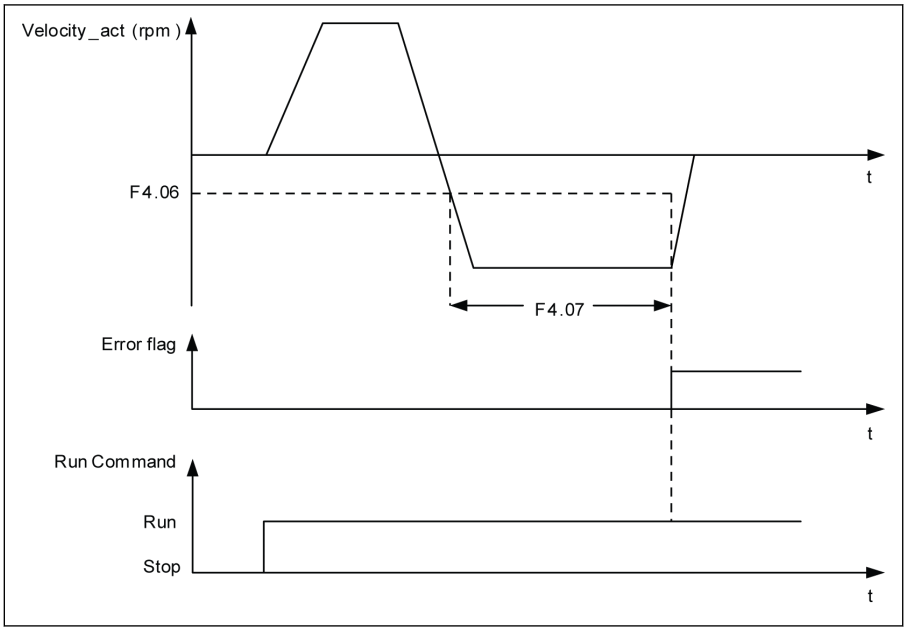


Fig. 7-10: Motor reverse speed limit

- Motor runs in positive direction

  Once the motor runs in positive direction at a speed higher than [F4.08], this function will check if the pressure feedback is consistently lower than 0.5 bar for [F4.09] seconds and signal a fault for this.

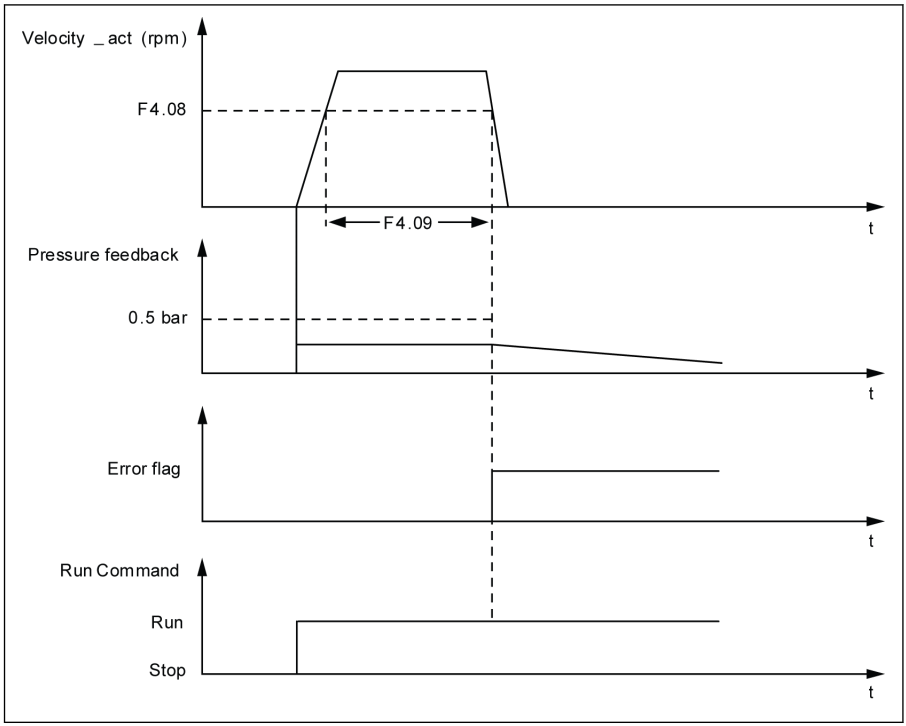


Fig. 7-11: Motor forward speed limit

7.4.3 Actual pressure monitoring

Code	Name	Setting range	Default	Min.	Attri.
F4.00	Protection control word	0...7 Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.15	Maximum system pressure (warning)	0.0...[F4.16] bar	200.0	0.1	Stop
F4.16	Maximum pump pressure (error)	[F4.15]...4,000.0 bar	350.0	0.1	Stop
F4.17	Maximum system pressure warning time delay	0.0...6000.0s	0.0	0.1	Run
F4.18	Maximum pump pressure error time delay	0.0...6000.0s	0.0	0.1	Run

Tab. 7-15: Parameter list of pressure over limit detection

The detection of pressure feedback can be activated via bit1 of F4.00.

F4.15: When the feedback pressure goes beyond [F4.15] bar, the warning (d0.88 = 1) will be triggered for the pressure feedback exceeding the maximum system pressure allowed.

F4.16: When the feedback pressure goes beyond [F4.16] bar, the fault (d0.89 = 1) will be triggered for the pressure feedback exceeding the pump limit pressure, and then the drive stops.

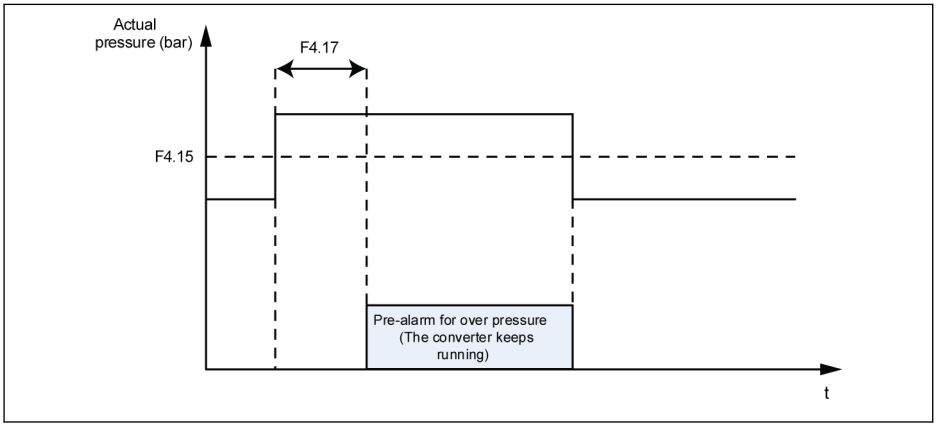


Fig. 7-12: F4.15 maximum system pressure warning

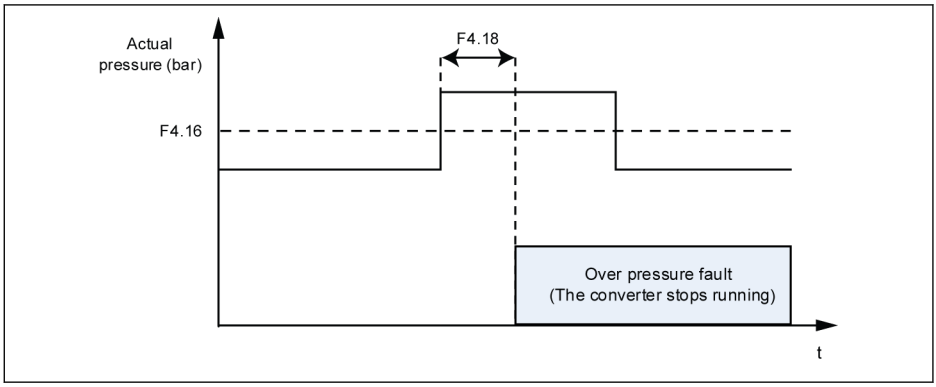


Fig. 7-13: F4.16 maximum pump pressure fault

Actual pressure monitoring function works all the time, no matter whether the drive is in operation or standby.

7.4.4 Pressure and flow command limit

Code	Name	Setting range	Default	Min.	Attri.
F4.00	Protection control word	0...7 Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.21	Minimum pressure command limit	0.0...[F4.22] bar	5.0	0.1	Stop
F4.22	Maximum pressure command limit	[F4.21]...1,000.0 bar	175.0	0.1	Stop
F4.23	Minimum flow command limit	0...[F4.24] rpm	40	1	Stop
F4.24	Maximum flow command limit	[F4.23]...5,000 rpm	3,000	1	Stop

Tab. 7-16: Parameter list of pressure and flow command limit

The maximum pressure and flow command limitation can be activated via bit2 of F4.00. This function will check whether the pressure or flow command given by the customer exceeds the limitation set in [F4.22] and [F4.24]. If a given command exceeds its limitation, the active command value will be limited to the maximum limit, and a warning signal will be issued.

8 SvP 5030 parameter list

8.1 Terminology and abbreviation in parameter list

- **Code:** Function / parameter code, written in Cx.xx, dx.xx, Ex.xx, Fx.xx
- **Name:** Parameter name
- **Default:** Factory default
- **Min.:** Minimum setting step
- **Attri.:** Parameter attribute
  - **Run:** Parameter setting can be modified when the controller is in run or stop status.
  - **Stop:** Parameter setting can only be modified when the controller is in stop status.
  - **Read:** Parameter setting is read-only and cannot be modified.

8.2 Group F1: Quick start parameters

Code	Name	Setting range	Default	Min.	Attri.
F1.00	ASF parameter initialization	0: Inactive 1: Restore to SvP default settings 2: Deactivate ASF	0	-	Stop
F1.02	Control mode	0: p/Q control	0	-	Stop
F1.03	Pressure command source	0: Use digital value set in parameter F1.05 2: Analog input 3: Communication	2	-	Stop
F1.05	Pressure command digital setting	0.0...1,000.0 bar	5.0	0.1	Run
F1.11	Flow command source	0: Use digital value set in parameter F1.12 1: Analog input (positive / negative) 2: Communication	1	-	Stop
F1.12	Flow command digital setting	0...5,000 rpm	40	1	Run

Code	Name	Setting range	Default	Min.	Attri.
F1.15	Motor type	0: Others 1:Rexroth MS2N 2: Rexroth MSH	2	-	Stop
F1.16	Motor power level	0: No selection 12: MS2N10-D0BHN 13: MS2N10-D0BHA/B 14: MS2N10-D0BNA/B 15: MS2N10-E0BHA/B 16: MS2N10-E0BNA/B 17: MS2N10-F0BHA/B 18: Reserved 19: Reserved (F1.15 = 2: Rexroth MSH) 12: MSH215-65 13: MSH215-80 14: MSH215-105 15: MSH215-130 16: MSH215-155 17: MSH215-200 18: MSH300-300 19: MSH300-370	DOM	-	Stop

Tab. 8-1: Parameter list of group F1

8.3 Group F2: Input and output parameters

Code	Name	Setting range	Default	Min.	Attri.
F2.00	Analog input AI1	0: No function assigned from ASF	1	-	Stop
F2.01	Analog input AI2	1: Pressure command	2	-	Stop
F2.02	External analog input EAI1	2: Pressure feedback	3	-	Stop
F2.03	External analog input EAI2	3: Flow command 5: Slave flow command	5	-	Stop
F2.04	Pressure command corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	175.0	0.1	Stop
F2.05	Pressure command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop
F2.06	Pressure feedback corresponding to 5V, 10V or 20mA	0.1...1,000.0 bar	250.0	0.1	Stop
F2.07	Pressure feedback null offset in V or mA	0.0...5.0 V, mA	0.1	0.1	Stop
F2.08	Flow command corresponding to 5V, 10V or 20mA	1...5,000 rpm	2,000	1	Stop
F2.09	Flow command null offset in V or mA	0.0...5.0 V, mA	0.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F2.10	Pressure sensor type	0: Others 1: HM20-2X/10-C 2: HM20-2X/50-C 3: HM20-2X/100-C 4: HM20-2X/160-C 5: HM20-2X/250-C 6: HM20-2X/315-C 7: HM20-2X/400-C 8: HM20-2X/630-C 9: Other 4-20mA pressure sensors 11: HM20-2X/10-H 12: HM20-2X/50-H 13: HM20-2X/100-H 14: HM20-2X/160-H 15: HM20-2X/250-H 16: HM20-2X/315-H 17: HM20-2X/400-H 18: HM20-2X/630-H 19: Other 0.1-10V pressure	15	-	Stop
F2.16	X1 input	0: No function 3: p/Q parameter group bit 0 4: p/Q parameter group bit 1 5: Master/slave mode switch (pQ/ Flow) 6: External warning with delay 7: External warning without delay 9: External error with delay 10: External error without delay 12: Pump switch condition B enable	0 (RUN)	-	Run
F2.17	X2 input		0 (Error reset)	-	Run
F2.18	X3 input		3	-	Run
F2.19	X4 input		4	-	Run
F2.20	X5 input		5	-	Run
F2.21	EX1 input		0	-	Run
F2.22	EX2 input		0	-	Run
F2.23	EX3 input		0	-	Run
F2.24	EX4 input		0	-	Run
F2.25	EX5 input		0	-	Run

Code	Name	Setting range	Default	Min.	Attri.
F2.31	AO1 output	0: No function assigned from ASF	2	-	Run
F2.32	EAO output	1: Pressure command 2: Pressure feedback 3: Flow command 4: Effective speed command 5: Speed feedback	5	-	Run
F2.36	DO1 output	0: No function 1: Controller warning	1	-	Run
F2.37	EDO1 output	0: No function	0	-	Run
F2.38	EDO2 output	1: Controller warning	0	-	Run
F2.40	Relay 1 output	2: Two-points/double pump control	0	-	Run

Tab. 8-2: Parameter list of group F2

8.4 Group F3: p/Q PID parameters

Code	Name	Setting range	Default	Min.	Attri.
F3.00	p/Q parameter selection source	0: Use digital value set in parameter F3.01 1: Digital input 2: Communication	0	-	Stop
F3.01	p/Q parameter digital selection	0: Parameter group 0 1: Parameter group 1 2: Parameter group 2 3: Parameter group 3	0	-	Run
F3.02	Filter time for pressure feedback	0...999 ms	4	1	Run
F3.03	Filter time for flow command	0...999 ms	4	1	Run
F3.10	Filter time for pressure rising [0]	0...999 ms	40	1	Run
F3.11	Filter time for pressure dropping [0]	0...999 ms	20	1	Run
F3.12	Proportional gain [0]	0.00...500.00 rpm/bar	6.00	0.01	Run
F3.13	Integral time 1 [0]	0...999 ms	30	1	Run
F3.14	Integral time 2 [0]	0...999 ms	0	1	Run
F3.15	Integral time TI switch threshold [0]	-150.0...0.0 bar (set to 0.0, the switching function is invalid)	0.0	0.1	Run
F3.16	Derivative gain [0]	0.000...10.000 (rpm/bar)*s	0.100	0.001	Run
F3.17	Filter time for Kd [0]	0...999 ms	35	1	Run
F3.18	Lower limit for I+D [0]	-5,000...5,000 rpm	0	1	Run
F3.19	System minimum speed [0]	-5,000...5,000 rpm	-1,500	1	Run
F3.21	SvP acceleration	1...65,535 rad / s^2	8,000	1	Run
F3.22	SvP deceleration	1...65,535 rad / s^2	12,000	1	Run
F3.30	Filter time for pressure rising [1]	0...999 ms	80	1	Run
F3.31	Filter time for pressure dropping [1]	0...999 ms	40	1	Run
F3.32	Proportional gain [1]	0.00...500.00 rpm/bar	6.00	0.01	Run
F3.33	Integral time 1 [1]	0...999 ms	30	1	Run
F3.34	Integral time 2 [1]	0...999 ms	0	1	Run
F3.35	Integral time TI switch threshold [1]	-150.0...0.0 bar (set to 0.0, the switching function is invalid)	0.0	0.1	Run
F3.36	Derivative gain [1]	0.000...10.000 (rpm/bar)*s	0.300	0.001	Run

Code	Name	Setting range	Default	Min.	Attri.
F3.37	Filter time for Kd [1]	0...999 ms	35	1	Run
F3.38	Lower limit for I+D [1]	-5,000...5,000 rpm	0	1	Run
F3.39	System minimum speed [1]	-5,000...5,000 rpm	-1,500	1	Run
F3.50	Filter time for pressure rising [2]	0...999 ms	100	1	Run
F3.51	Filter time for pressure dropping [2]	0...999 ms	60	1	Run
F3.52	Proportional gain [2]	0.00...500.00 rpm/bar	6.00	1.00	Run
F3.53	Integral time 1 [2]	0...999 ms	30	1	Run
F3.54	Integral time 2 [2]	0...999 ms	0	1	Run
F3.55	Integral time TI switch threshold [2]	-150.0...0.0 bar	0.0	1.0	Run
F3.56	Derivative gain [2]	0.000...10.000 (rpm/bar)*s	0.100	1.000	Run
F3.57	Filter time for Kd [2]	0...999 ms	35	1	Run
F3.58	Lower limit for I+D [2]	-5,000...5,000 rpm	0	1	Run
F3.59	System minimum speed [2]	-5,000...5,000 rpm	-1,500	1	Run
F3.70	Filter time for pressure rising [3]	0...999 ms	120	1	Run
F3.71	Filter time for pressure dropping [3]	0...999 ms	80	1	Run
F3.72	Proportional gain [3]	0.00...500.00 rpm/bar	6.00	1.00	Run
F3.73	Integral time 1 [3]	0...999 ms	30	1	Run
F3.74	Integral time 2 [3]	0...999 ms	0	1	Run
F3.75	Integral time TI switch threshold [3]	-150.0...0.0 bar	0.0	1.0	Run
F3.76	Derivative gain [3]	0.000...10.000 (rpm/bar)*s	0.000	1.000	Run
F3.77	Filter time for Kd [3]	0...999 ms	35	1	Run
F3.78	Lower limit for I+D [3]	-5,000...5,000 rpm	0	1	Run
F3.79	System minimum speed [3]	-5,000...5,000 rpm	-1,500	1	Run

Tab. 8-3: Parameter list of group F3

8.5 Group F4: System protection and pump function parameters

Code	Name	Setting range	Default	Min.	Attri.
F4.00	Protection control word	Bit 0: Pressure sensor fault (PSF) Bit 1: Actual pressure monitoring Bit 2: p/Q maximum command limit Other bits: Reserved	0b0000 0000 0000 0000	-	Run
F4.03	Pump control word	Bit 0: Pump power limit Bit 2: Master/slave Bit 3: Two-points/double pump Bit 6: Monitoring speed direction reverse Other bits: Reserved	0b 0000 0000 0100 0000	-	Run
F4.06	Pressure sensor fault detection threshold 1 (negative direction)	-5,000...0 rpm	-1	1	Stop
F4.07	Pressure sensor fault detection time 1 (negative direction)	0.1...100.0 s	10.0	0.1	Stop
F4.08	Pressure sensor fault detection threshold 2 (positive direction)	0...5,000 rpm	200	1	Stop
F4.09	Pressure sensor fault detection time 2 (positive direction)	0.1...100.0 s	10.0	0.1	Stop
F4.15	Maximum system pressure (warning)	0.0...[F4.16] bar	200.0	0.1	Stop
F4.16	Maximum pump pressure (error)	[F4.15]...4,000.0 bar	350.0	0.1	Stop
F4.17	Maximum system pressure warning time delay	0.0...6000.0s	0.0	0.1	Run
F4.18	Maximum pump pressure error time delay	0.0...6000.0s	0.0	0.1	Run
F4.20	p/Q command soft start delay	0.0...1,000.0 s	0.0	0.1	Stop
F4.21	Minimum pressure command limit	0.0...[F4.22] bar	5.0	0.1	Stop
F4.22	Maximum pressure command limit	[F4.21]...1,000.0 bar	175.0	0.1	Stop
F4.23	Minimum flow command limit	0...[F4.24] rpm	40	1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F4.24	Maximum flow command limit	[F4.23]...5,000 rpm	3,000	1	Stop
F4.26	Leakage compensation determination pressure	0.0...1,000.0 bar	0.0	0.1	Run
F4.27	Leakage compensation determination flow	0...3,000 rpm	0	1	Run
F4.28	Two-points / double pump selection	0: Two-points pump 1: Double pump	0	-	Stop
F4.29	Pump logic selection	0: Positive 1: Negative	0	-	Stop
F4.30	Pump Vg1	0...1,000 ccm	0	1	Stop
F4.31	Pump Vg2	0...1,000 ccm	0	1	Stop
F4.32	Upper pressure difference switching threshold	0.0...350.0 bar	15.0	0.1	Stop
F4.33	Lower pressure difference switching threshold	0.0...350.0 bar	10.0	0.1	Stop
F4.34	Speed switching threshold adjustment	0.1...1.0	0.9	0.1	Stop
F4.35	Pump power	0.00...315.00 kW	0.00	0.01	Stop
F4.38	Effective pump Vg	-	0	-	Read
F4.39	Master/slave (pQ/Flow) switch source	0: Use digital value set in parameter F4.03 1: Digital input 2: Communication	0	-	Stop
F4.40	Slave pump speed command lower limit	-5,000...5,000 rpm	0	1	Run
F4.41	Slave pump flow mode switch delay	0...500 ms	100	1	Stop
F4.42	Slave flow command source	0: No 1: Analog input 2: Communication	1	-	Stop
F4.43	Slave flow command corresponding to 5V, 10V or 20mA	0 --- 5000 rpm	3,000	1	Stop
F4.44	Slave flow command null offset in V or mA	0.0 --- 5.0 V, mA	0.0	0.1	Stop
F4.45	Slave flow command linear offset in V	-0.10 --- 0.10V	0.00	0.01	Run
F4.47	Maximum torque limitation	200.0...400.0 %	200.0	0.1	Stop

Code	Name	Setting range	Default	Min.	Attri.
F4.50	External warning / error delay time	0...1,000 s	60	1	Run
F4.78	Pump switch condition B activity selection	0: Enabled always 1: Enabled by DI (option 12) 2: Enabled by communication control word (F0.20 bit 6) 3: Disabled	3	-	Stop
F4.86	EZ switch pressure_cmd for B Vgmin	F4.87 --- 600.0 bar	0.0	0.1	Run
F4.87	EZ switch pressure_cmd for B Vgmax	0 --- F4.86 bar	0.0	0.1	Run
F4.88	EZ switch pressure_fb for B Vgmin	F4.89 --- 600.0 bar	0.0	0.1	Run
F4.89	EZ switch pressure_fb for B Vgmax	0 --- F4.88 bar	0.0	0.1	Run
F4.90	EZ switch delay for B Vgmin	0 --- 5000 ms	50	1	Run
F4.91	EZ switch delay for B Vgmax	0 --- 5000 ms	50	1	Run

Tab. 8-4: Parameter list of group F4

8.6 Auto-modified EFC parameters in SvP initialization

Code	Name	Setting range	Default	Min.	Attri.
C0.00	Control mode (EFC 5620 only)	0: V/f control 1: Sensorless vector control 2: Vector control with encoder	2	-	Stop
C1.00	Motor type	0: Asynchronous motor 1: Synchronous motor (only for EFC 5620)	1	-	Stop
E0.01	First run command source	0...2	1	-	Stop
E0.02	Second frequency setting source	0...21	0	1	Stop
E0.17	Direction control	0: Forward / reverse 1: Forward only 2: Reverse only 3: Swap default direction	3	-	Stop
E1.00	X1 input	0...52	35	-	Stop
E1.01	X2 input	0...51	34	-	Stop
E1.40	AI2 input mode	0: 0...20 mA 1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V	2	-	Run
E1.60	Motor temperature sensor channel	0: Inactive 1: AI1 analog input 2: AI2 analog input 3: EAI1 analog input 4: EAI2 analog input 5: TSI input (only for IO plus card)	5	-	Stop
E2.15	Relay1 output selection	0...25	14	-	Stop
H8.05	EAI1 input mode	0: 0...20 mA 1: 4...20 mA 2: 0...10 V 3: 0...5 V 4: 2...10 V 5: -10...10 V	2	-	Stop

Code	Name	Setting range	Default	Min.	Attri.
H8.25	EAO output mode	0: 0...10 V 1: 0...20 mA 2: -10...10 V (only for IO plus card)	2	-	Run
H8.30	EAI2 input mode	0...4 (same as E1.35) 5: -10V...10V	5	-	Stop
H8.39	EAO curve minimum	-100.0 %...[H8.41]	-100	0.1	Run
H8.40	EAO curve minimum value	-100.0...100.0 %	-100	0.1	Run
U1.00	Run monitoring display	0: Output frequency	1	-	Run
U1.10	Stop monitoring display	1: Actual speed 2: Setting frequency 3: Setting speed	3	-	Run

Tab. 8-5: Auto-modified EFC parameter list

8.7 Monitoring parameters

Name	Description	Displaying range
d0.80	ASF status word*	0x0000...0xFFFF
d0.81	Pressure command	0...10000 (0.0...1,000.0 bar)
d0.82	Pressure feedback	0...10000 (0.0...1,000.0 bar)
d0.83	Flow command	-5,000...5,000 (-5,000...5,000 rpm)
d0.84	Effective speed command	-5,000...5,000 (-5,000...5,000 rpm)
d0.85	Speed feedback	-5,000...5,000 (-5,000...5,000 rpm)
d0.86	Slave flow command	-5,000...5,000 (-5,000...5,000 rpm)
d0.88	Warning type	0: No warning 1: Pressure feedback exceeds limit 2: Pressure command exceeds limit 3: Flow command exceeds limit 4: External warning with delay 5: External warning without delay 10: Pump power limitation warning
d0.89	Error type	0: No error 1: Pressure exceeds pump limit 2: Pressure sensor error 3: Host parameter access error 4: External error with delay 5: External error without delay

Tab. 8-6: Monitoring parameter

* For detailed information of d0.80 ASF status word, please refer to tab. 9-3 "ASF status word d0.80 definition" on page 64.

9 Fieldbus communication

9.1 Brief introduction

The SvP 5030 pump controller provides the possibility to communicate with an overlying plc via different fieldbus systems. Via this communication, the pump controller can receive control words and command values. On the other side, the controller can transmit status words and actual values. The controller can be equipped with different communication option cards.

Two option cards are available:

- A Profibus option for PROFIBUS DP
- A Multi-Ethernet card for the Ethernet-based fieldbus systems.
  - PROFINET I/O
  - EtherCAT CoE
  - Ethernet / IP
  - Sercos

- Cycle time for command and status value exchanging is 2ms.
- Bus communication and internal ASF data communication are not synchronized.

9.2 Command values MDT

Command values are written on the parameters F0.20.....F0.22.

Code	Name	Description	Setting range
F0.20	ASF command 1	ASF control word	0...65,535
F0.21	ASF command 2	Pressure command	0...10,000 (0.0...1000.0 bar)
F0.22	ASF command 3	Flow command	0...5,000 (0...5,000 rpm)

Tab. 9-1: Communication protocol

The ASF control word has the following bit assignment.

Bit	Description	Setting range
0, 1	Reserved	-
2	Master / slave selection	0: Master 1: Slave
3, 4	p/Q parameter group selection	0: Select Parameter group 0 1: Select Parameter group 1 2: Select Parameter group 2 3: Select Parameter group 3

Bit	Description	Setting range
5...14	Reserved	-
15	ASF control word enable	0: Inactive 1: Active

Tab. 9-2: ASF control word F0.20 definition

To activate the ASF control word it is recommended to keep bit 15 enabled permanently.

9.3 Actual values AT

There is a big variety of actual values available in the SvP 5030 pump controller. It is possible to configure the AT telegram. Every d-parameter can be sent back to the plc.

More information about the available d-parameters can be found in EFC5620 operating instructions: R912009312.

The ASF status word has the following bit assignment.

Bit	Description	Setting range
0, 1	ASF control mode	0: P/Q Others: Reserved
2	Master / slave status	0: Master 1: Slave
3	Reserved	-
4	Leakage compensation function status	0: Function disabled 1: Function enabled
5	Pump power limitation function status	0: Function disabled 1: Function enabled
6, 7	p/Q parameter group selection	0: Parameter set 0 selected 1: Parameter set 1 selected 2: Parameter set 2 selected 3: Parameter set 3 selected
8	Reserved	-
9	Two-points / double pump function status	0: Function disabled 1: Function enabled
10	Two-points / double pump control status	0: Vg_{max} 1: Vg_{min}

Bit	Description	Setting range
11	Speed command direction	0: Forward 1: Reverse
12	Reserved	-
13	ASF status	0: Active 1: Inactive
14	ASF warning	0: No warning 1: Warning
15	ASF error	0: No error 1: Error

Tab. 9-3: ASF status word d0.80 definition

Hydraulic specific monitoring parameters are listed in the following table.

Code	Description	Unit
H0.01	Status word standard firmware	-
H0.02	Extended status word	-
d0.80	ASF status word	-
d0.82	Pressure feedback	bar
d0.85	Speed feedback	rpm
d0.88	Warning type	-
d0.89	Error type	-

This configuration of the cyclic data is a suggestion and can be adjusted by the user. A list of parameters which can be configured in the AT telegram is shown in parameter b8.62.

10 Diagnosis

10.1 Warning code

Function code	Error information	DiagCode	LED display	Reason	Solution
d0.88	0: No warning	-	-	-	-
	1: Pressure feedback exceed limit	0xE5601	"PFLi"	1. Excessive pressure setting exceeding [F4.15] 2. Pressure sensor fault	1. Set pressure to a lower value 2. Check if the wiring is properly connected for pressure feedback transmission
	2: Pressure command exceed limit	0xE5602	"PCLi"	Pressure command upon user's input exceeding [F4.22]	Set pressure to a lower value
	3: Flow command exceed limit	0xE5603	"FCLi"	Flow command upon user's input exceeding [F4.24]	Set flow to a lower value
	4: External warning with delay	0xE5604	"Et.Fd"	-	Check external alarm source
	5: External warning without delay	0xE5605	"Et.F"	-	Check external alarm source
	10: Pump power limitation warning	0xE5610	"PU.PL"	Required pump power exceeds limitation set in F4.35	Adjust limitation or system load

Tab. 10-1: Warning code

10.2 Error code

Function code	Error information	DiagCode	LED display	Reason	Solution
d0.89	0: No error	-	-	-	-
	1: Pressure feedback exceed pump limit	0xF5601	"PEPL"	Actual pressure exceeding [F4.16] (pump maximum pressure)	1. Set pressure to a lower value 2. Check if the wiring is properly connected for pressure feedback transmission 3. Increase [F4.16]
	2: Pressure sensor error	0xF5602	"PSE-"	1. The motor negative speed exceeding [F4.06] with duration time exceeding [F4.07] 2. The slow decrease of actual pressure after the shutdown	1. Check if pressure sensor can work properly. Increase the setting of F4.06, F4.07, F4.08 and F4.09 2. Check if pressure sensor can work properly.
	3: Parameter setting error	0xF5603	"PrAE"	Parameter setting repetition	Check if parameter settings are in conflict
	4: External error with delay	0xF5604	"Et.Ed"	-	Check external error source
	5: External error without delay	0xF5605	"Et.E"	-	Check external error source

Tab. 10-2: Error code

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Notes

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