

Softstarters

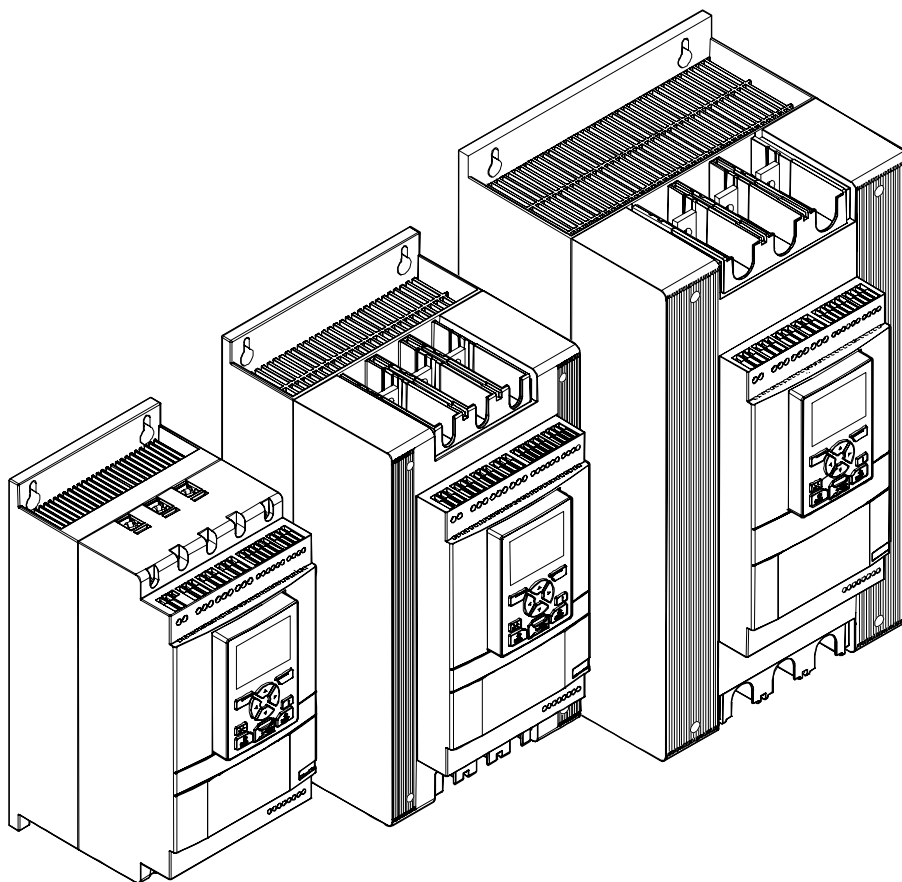
Type PSTX

Fieldbus communication, Anybus

Profibus DPV1

1SFC132085M0201

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ABB

1 Profibus

The Profibus protocol is a fieldbus protocol that provides full control and status information of the softstarter, reading as well as writing of parameters. Through the fieldbus it is possible to start and stop the motor, read out currents and frequency, achieve information about protections, warnings, faults and much more. See chapter 8 in the Installation and commissioning manual, document SFC132081M0201 for fieldbus related settings available.

Before the Profibus DP fieldbus can be taken in operation following parameters must be set in the softstarter:

- Parameter FB interface connector set to Anybus
- Parameter Fieldbus control set to On
- Parameter Fieldbus address set to desired Profibus station address

To do the programming of the PLC, following GSD files are available:

GSD file	Type of protocol
PSTX0EFC.gsd	Profibus DP V1

Note that the GSD file contains information about different software versions of the softstarter. Check that correct part of the file is used in relation to the actual softstarter version.



Caution!

The motor may start unexpectedly if there is a start signal present when doing any of the actions listed below.

- *Switching from one type of control to another (fieldbus control/hardwire control)*
- *Reset all Settings*

1.1 Digital input telegram

To PLC from softstarter.

Word in input data area	Digital input byte	Bit	Data	Description
0	0	0	Auto Mode status ¹	0 = softstarter control from fieldbus not allowed
		1	Event status	0 = No active fault/warning/protection
		2	Ready To Start	0 = A start will probably cause a fault, 1 = A start will probably not cause a fault
		3	FBT Response 0	See Fieldbus Tasks
		4	FBT Response 1	See Fieldbus Tasks
		5	FBT Toggle Bit	See Fieldbus Tasks
		6	Programmable Digital Input 1	Function of programmable digital input, see table 1.2.
		7	Programmable Digital Input 2	
	1	8 (0)	Programmable Digital Input 3	
		9 (1)	Programmable Digital Input 4	
		10 (2)	Programmable Digital Input 5	
		11 (3)	Programmable Digital Input 6	
		12 (4)	Programmable Digital Input 7	
		13 (5)	Programmable Digital Input 8	
		14 (6)	Programmable Digital Input 9	
		15 (7)	Programmable Digital Input 10	

1) Auto mode reflects the control state of the Softstarter. This is affected by a combination of:

- The Auto mode input signal from the PLC (Digital output telegram).
- The state of the Local/Remote switch on the Fieldbus Plug Accessory.
- The state of the Local/Remote switch on the HMI.
- The parameter 'Fieldbus control'.
- The digital input 'Fieldbus disable'.

1.2 Programmable Digital Inputs

The function of the programmable Digital inputs are controlled by the parameters *Fieldbus DI 1* through *Fieldbus DI 10*. The following functions are available for selection:

Function	Data
None	Value is set to 0.
Start feedback	Status of Start signal.
Stop feedback	Status of Stop signal.
Fault reset feedback	Status of Reset signal.
Slow speed reverse feedback	Status of Slow speed reverse signal.
Slow speed forward feedback	Status of Slow speed forward signal.
Start 1 feedback	Status of Start 1 signal.
Start 2 feedback	Status of Start 2 signal.
Start 3 feedback	Status of Start 3 signal.
Motor heating feedback	Status Motor heating signal.
User defined feedback	Status of User defined protection signal.
Stand still brake feedback	Status of Stand still brake signal.
Emergency mode feedback	Status of Emergency mode signal.
Start reverse feedback	Status of Start reverse signal.
Run status	1 = Indicates when the softstarter gives voltage to the motor.
TOR status	Top of Ramp. 1 = Indicates that motor runs on full voltage.
Line or Inside Delta Connection	0 = Line, 1 = Delta.
Phase sequence	0 = L1, L2, L3; 1 = L1, L3, L2.
Event group 0 status	0 = No active events present in group 0.
Event group 1 status	0 = No active events present in group 1.
Event group 2 status	0 = No active events present in group 2.
Event group 3 status	0 = No active events present in group 3.
Event group 4 status	0 = No active events present in group 4.
Event group 5 status	0 = No active events present in group 5.
Event group 6 status	0 = No active events present in group 6.
Sequence 1 Run status	Run status of sequence connected motor 1.
Sequence 2 Run status	Run status of sequence connected motor 2.
Sequence 3 Run status	Run status of sequence connected motor 3.
Sequence 1 TOR status	Top of Ramp status of sequence connected motor 1.
Sequence 2 TOR status	Top of Ramp status of sequence connected motor 2.
Sequence 3 TOR status	Top of Ramp status of sequence connected motor 3.
Run reverse status	1 = Indicates when the softstarter gives voltage to the motor after a reverse start.

1.3 Analog input telegram

To PLC from the softstarter.

All analog data is represented as 16-bit values.

A protocol for Fieldbus tasks is used to read and write parameters. It is applicable for all Fieldbuses.

Word in input data area	Analog input word	Data	Representation
1	0	FBT Return Value	See Fieldbus Tasks
2	1	Programmable Analog Input 1	Function of programmable analog input, see table 1.4.
3	2	Programmable Analog Input 2	
4	3	Programmable Analog Input 3	
5	4	Programmable Analog Input 4	
6	5	Programmable Analog Input 5	
7	6	Programmable Analog Input 6	
8	7	Programmable Analog Input 7	
9	8	Programmable Analog Input 8	
10	9	Programmable Analog Input 9	
11	10	Programmable Analog Input 10	

1.4 Programmable Analog Inputs

The function of the programmable analog inputs are controlled by the parameters *Fieldbus AI 1* through *Fieldbus AI 10*. The following functions are available for selection:

Function	Representation
None	Value is set to 0
Phase L1 current ¹	Value = 1000 ⇒ 100A
Phase L2 current ¹	Value = 1000 ⇒ 100A
Phase L3 current ¹	Value = 1000 ⇒ 100A
Active power (HP)	Value = 1000 ⇒ 10hp
Active power	Value = 1000 ⇒ 10kW
Apparent power	Value = 1000 ⇒ 10VA
Mains voltage	Value = 1000 ⇒ 100V
Power factor	Value = 100 ⇒ 1 Example: 87 ⇒ 0.87
Motor voltage	Value = 100 ⇒ 100%
Active energy (resettable)	Value = 1000 ⇒ 10kW
EOL time to trip	Value = 100 ⇒ 100s Value = 65535 ⇒ No overload Value = 0 ⇒ Trip already occurred
Mains frequency	Value = 1000 ⇒ 100Hz
Max phase current ¹	Value = 1000 ⇒ 100A
Motor current	Value = 1000 ⇒ 100A
Motor run time (resettable)	Value = 100 ⇒ 1000h
Motor temperature	Value = 100 ⇒ 100°C
Motor temperature percent	Value = 100 ⇒ 100%
Number of starts (resettable)	Value = 1 ⇒ 100
Phase sequence	Value = 0 ⇒ L1->L2->L3 Value = 1 ⇒ L1->L3->L2 Value = 2 ⇒ No sequence detected
PT100 temperature	Value = n ⇒ n/10 – 50°C Example: 750 ⇒ 25°C
PTC resistance	Value = 100 ⇒ 100Ω
Reactive energy (resettable)	Value = 1000 ⇒ 10kVAr
Reactive power	Value = 1000 ⇒ 100VAr
Remaining time to start	Value = 100 ⇒ 100s
Thyristor temperature	Value = 100 ⇒ 100°C
Thyristor temperature percent	Value = 100 ⇒ 100%
EOL time to cool	Value = 100 ⇒ 100s
Top event code	Value = 1000 ⇒ 1000
Motor current in percent of IE.	Value = 100 ⇒ 100%
Thyristor run time (resettable)	Value = 1 ⇒ 10h
Motor connection	Value = 0 ⇒ auto Value = 1 ⇒ In-line Value = 2 ⇒ Inside delta – UI Value = 3 ⇒ Inside delta – IU Value = 4 ⇒ 2-phase L1 shorted Value = 5 ⇒ 2-phase L2 shorted Value = 6 ⇒ 2-phase L3 shorted

1) Phase current L1, L2 and L3 indicate the current through the softstarter, while the Max phase current is **always** the line current.

1.5 Digital output telegram

From PLC to the softstarter.

Word in output data area	Digital output byte	Bit	Data	Description
0	0	0	Start	Commence a start when signal is set.
		1	Stop	Commence a stop when signal is negated.
		2	Fault reset	Reset signal for possible events.
		3	Auto mode	This must be set for controlling the motor.
		4	Slow speed reverse	Perform slow speed reverse when signal is set.
		5	Slow speed forward	Perform slow speed when signal is set.
		7	Start1	Start1 if sequence start.
	1	8 (0)	Start2	Start2 if sequence start.
		9 (1)	Start3	Start3 if sequence start.
		10 (2)	Motor heating	Perform motor heating when signal is set.
		11 (3)	Stand still brake	Perform stand still brake when signal is set.
		12 (4)	Start reverse	Commence a reverse start when signal is set.
		14 (6)	Emergency mode	Set to "1" to enable emergency mode.
		15 (7)	FBT Toggle Bit	See Fieldbus Tasks.
1	2	16 (0)	User defined trip	Set to "1" to trigger user defined protection.
		17 (1)	Spare	
		18 (2)	Spare	
		19 (3)	Spare	
		20 (4)	Spare	
		21 (5)	Spare	
		22 (6)	Spare	
		23 (7)	Spare	
	3	24 (0)	Spare	
		25 (1)	Spare	
		26 (2)	Spare	
		27 (3)	Spare	
		28 (4)	Spare	
		29 (5)	Spare	
		30 (6)	Spare	
		31 (7)	Spare	

1.6 Analog output telegram

From PLC to the softstarter.

All analog data is represented as 16-bit values.

Word in output data area	Analog output word	Data	Representation
2	0	FBT Control Word	See Fieldbus Tasks
3	1	FBT Argument 2	See Fieldbus Tasks
4	2	FBT Argument 3	See Fieldbus Tasks

1.7 Input address map

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Digital In, Byte 1									Digital In, Byte 0						
1	Analog In, Word 0															
2	Analog In, Word 1															
3	Analog In, Word 2															
4	Analog In, Word 3															
5	Analog In, Word 4															
6	Analog In, Word 5															
7	Analog In, Word 6															
8	Analog In, Word 7															
9	Analog In, Word 8															
10	Analog In, Word 9															
11	Analog In, Word 10															

1.8 Output address map

	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
0	Digital Out, Byte 1	Digital Out, Byte 0
1	Digital Out, Byte 3	Digital Out, Byte 2
2	Analog Out, Word 0	
3	Analog Out, Word 1	
4	Analog Out, Word 2	

2 Fieldbus Tasks

By using Fieldbus Tasks it is possible to read/write parameters and set the real-time clock.

Which task to execute is selected by filling in the *FBT Control Word*. There are three signals for arguments to the task:

- *FBT Argument 1* is packed together with the *Task ID* in the *FBT Control Word*.
- There are two additional 16-bit arguments in separate analog output signals, *FBT Argument 2* and *FBT Argument 3*.

To control when the task is executed, the digital output signal *FBT Toggle Bit* is changed. The softstarter will detect the change, execute the task, fill in the return values, and toggle the digital input signal *FBT Toggle Bit* as acknowledgement. Thus, the return values must be disregarded if the two toggle bits have different value.

2.1 FBT Control Word

The control word is a 16-bit analog output value sent from the PLC to the softstarter. It consists of a Task ID and an 11-bit argument packed together.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Task ID					Argument 1										

2.2 Task ID

The task identifier controls which function should be performed.

Task ID	Task	Response ID	
		Positive	Negative
0	No task	0	-
1	Request parameter value	1	2
2	Change parameter value	1	2
3	Set date and time	1	2

2.3 Response ID

The response ID is the softstarter response to a task. It tells whether a task was executed successfully. If there was an error, an additional error code is returned in the *FBT Return Value* analog input. The Response ID is transmitted as two digital input signals, *FBT Response 0* and *FBT Response 1*.

Response ID	FBT Response 1	FBT Response 0	Explanation
0	0	0	No response
1	0	1	Task executed
2	1	0	Task cannot be executed (with error number)
3	1	1	Reserved.

2.4 Error codes

The following error codes are sent when a task cannot be executed.

Error code	Explanation
0	Illegal parameter number
1	Parameter value cannot be changed
3	Lower or upper limit violated
4	Invalid argument
5	No error

2.5 Request parameter value

This task reads the current value of specified parameter. See chapter 2.8 for parameter number and value scaling.

2.5.1 Arguments

- FBT Argument 1: parameter number.

2.5.2 Return Value

- Response ID 1 and parameter value in FBT Return Value on success.
- Response ID 2 and error number in FBT Return Value on failure.

2.6 Change parameter value

This task writes a specified value to a parameter. See chapter 2.8 for parameter number and value scaling.

2.6.1 Arguments

- FBT Argument 1: parameter number.
- FBT Argument 2: parameter value

2.6.2 Return Value

- Response ID 1 on success.
- Response ID 2 and error number in FBT Return Value on failure.

2.7 Set date and time

This task updates the real-time clock on the softstarter. The date and time fields have the following limits:

- Year: 0-63 (2000-2063)
- Month: 1-12
- Day: 1-31
- Hour:0-23
- Minute:0-59
- Second:0-59

2.7.1 Arguments

- FBT Argument 2: year, month, day and least significant bit of seconds

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
s0	year						month				day				

- FBT Argument 3: hour, minute, seconds, bit 1-5

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
hour					minute					seconds, bit 1-5					

2.7.2 Return Value

- Response ID 1 on success.
- Response ID 2 and error number in FBT Return Value on failure. In case the supplied time didn't differ from the set time, error code 5 (no error) is used.

2.8 Parameter numbers and values

To access parameters from the fieldbus a unique parameter number is needed, this can be found in document 1SFC132081M0201, Chapter 7.19 Complete parameter list, Table 5.

Since the parameter values need to be represented as integers on the fieldbus while, the parameter values with greater precision need to be scaled. In document 1SFC132081M0201, Chapter 7.19 Complete parameter list, Table 5, there is a column specifying the number of decimals for each parameter.

- Parameter values that are read from the fieldbus needs to be divided by $10^{\text{numbers of decimals}}$.
- Parameters values that are written from the fieldbus needs to be multiplied by $10^{\text{numbers of decimals}}$.

For example:

The parameter Kick start time has parameter number 24 and 2 decimals. To read this parameter:

1. Set FBT Task ID to 1.
2. Set FBT Argument 1 to 24.
3. Toggle FBT Toggle Bit output and wait for the FBT Toggle Bit input to update.
4. Response ID 1 should now contain value 1, indicating success.
5. FBT Return Value contains the value 50 (this is an example and depends on the actual set value).
6. The return value should be interpreted as $50/10^2 = 0.5\text{s}$.

To change the *Kick start time* parameter to 1s:

1. Set FBT Task ID to 2.
2. Set FBT Argument 1 to 24.
3. Set FBT Argument 2 to $1 \cdot 10^2 = 100$.
4. Toggle FBT Toggle Bit output and wait for the FBT Toggle Bit input to update.
5. Response ID 1 should now contain value 1, indicating success.