SOFTSTARTER TYPE PSTX

Fieldbus communication

Anybus CompactCom DeviceNet

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Motor Starting & Safety Softstarters	1SFC132084M0201	F	en	1/17

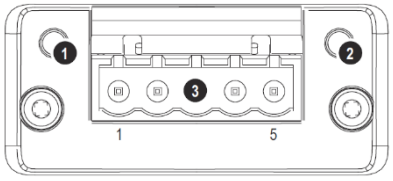
Contents

Information

When fastening the module into the com1 port, make sure that the module is properly aligned in the socket prior to applying any force. Rough handling and/or excessive force in combination with misalignment may cause mechanical damage to the module and/or the com1 and socket.

1. Module front view

#	Item
1	Network Status LED
2	Module Status LED
3	DeviceNet Connector



1.1. Network Status

State	Indication
Off	Not online / No power
Green	On-line, one or more connections are established
Flashing Green (1 Hz)	On-line, no connections established
Red	Critical link failure
Flashing Red (1 Hz)	One or more connections timed-out
Alternating Red/Green	Self-test

1.2. Module Status

State	Indication
Off	No power
Green	Operating in normal condition
Flashing Green (1 Hz)	Missing or incomplete configuration, device needs commissioning
Red	Unrecoverable Fault(s)
Flashing Red (1 Hz)	Recoverable Fault(s)
Alternating Red/Green	Self-test

1.3. DeviceNet Connector

This connector provides DeviceNet connectivity.

Pin	Signal	Description
1	V-	Negative bus supply voltage
2	CAN_L	CAN low bus line
3	SHIELD	Cable shield
4	CAN_H	CAN high bus line
5	V+	Positive bus supply voltage

1.4. Software compatibility

DeviceNet is supported from PSTX_CB v1.34.6.

2. DeviceNet

DeviceNet is a digital, multi-drop network that connects and serves as a communication network between industrial controllers and I/O devices. DeviceNet utilizes CAN (Controller Area Network) for its data link layer. DeviceNet uses a trunkline-dropline topology and has DC power available on the network cable to simplify installations by providing a single connection point for network communications and device power up to 24 Vdc, 8 Amps.

DeviceNet operates in a master-slave or a distributed control architecture using peer-to-peer communication, and it supports both I/O and explicit messaging for a single point of connection for configuration and control. DeviceNet utilizes the Common Industrial Protocol (CIP) for its upper layers. CIP Networks follow the Open Systems Interconnection (OSI) model, which defines a framework for implementing network protocols in the seven layers: physical, data link, network, transport, session, presentation and application.

The DeviceNet 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, get information about protections, warnings, faults and much more.

See chapter 8 in the Installation and commissioning manual, document SFC132081M0201, for fieldbus related settings.

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

- Parameter 12.2 FB interface connector set to **Anybus**
- Parameter 12.3 Fieldbus control set to **On** (This parameter can be set to **Off** if the fieldbus interface is only used to monitor the softstarter)
- Parameter 12.9 FB baud rate set to **DeviceNet network baud rate**. Supported baud rates are 125, 250, 500 kBaud
- Parameter 12.4 Fieldbus address set to **DeviceNet MAC ID (0-63)**

For technical data and descriptions of the DeviceNet Anybus CompactCom, see document 2CDC193001D0205, available at www.abb.com/lowvoltage.

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

Softstarter FB-version	EDS file
FB 1.1	AB_DN_PSTX_1_1.eds

Information
After changing any of the communication parameters it is needed to perform a power cycle of the device for the parameter values to be taken into effect. Or another way for a communication parameter value change to be taken into effect is to set parameter 12.2 FB interface connector to “None” and then set it back to "Anybus".

Information
If there is no message passed between the PSTX softstarter and the Anybus module for more than the configured fieldbus failure timeout time (parameter 19.12), the PSTX softstarter will trip on fieldbus communication failure protection (P1E00) and with the default configuration the motor will be stopped. If the communication system is setup in such a way that commands/requests are not continuously passed between the PLC and softstarter, this protection function should be disabled. The parameter 19.4 (Fieldbus failure op) can then be set to "Off".

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**

3. Input data

By convention, input data is as seen from the network’s perspective. Hence the meaning here is data sent from the softstarter to the network (i.e. a PLC). The input data is updated every 20 ms.

3.1. Digital input telegram

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

Word in input data area	Digital input byte	Bit	Data	Description
		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 section 3.2.
		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 output signal from the PLC (Digital output telegram).
- The state of the Local/Remote switch on the HMI.
- The parameter Fieldbus control.
- The digital input Fieldbus disable.

3.2. Programmable Digital Inputs

The functions 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.

Function	Data
Start feedback	Status of Start signal.
Stop feedback	Status of Stop signal.
Fault reset feedback	Status of Reset signal.
Slow speed rev feedback	Status of Slow speed reverse signal.
Slow speed forw2566 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	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.
Enable status	Status of Enable signal.
Digital In0 status	Status of Internal IO In0.
Digital In1 status	Status of Internal IO In1.
Digital In2 status	Status of Internal IO In2.
Local control status	0 = Remote control, 1 = Local control (HMI).
Cancel brake feedback	Status of Cancel brake signal.
Pump cleaning auto status	Status of automatic pump cleaning.
Pump cleaning forward status	Status of forward pump cleaning.

Function	Data
Pump cleaning backward status	Status of reverse pump cleaning.
External digital 1DI0 status	Status of external IO 1DI0.
External digital 1DI1 status	Status of external IO 1DI1.
External digital 1DI2 status	Status of external IO 1DI2.
External digital 1DI3 status	Status of external IO 1DI3.
External digital 1DI4 status	Status of external IO 1DI4.
External digital 2DI5 status	Status of external IO 2DI5.
External digital 2DI6 status	Status of external IO 2DI6.
HW DI Start status	Status of the hard wire internal digital input Start.
HW DI Stop status	Status of the hard wire internal digital input Stop.
Ready to start (line contactor)	Same conditions as the Ready to Start bit except that the incoming three phase voltage condition is excluded. The bit can be used when a line contactor is connected.

3.3. Analog input telegram

All analog data is represented as 16-bit values.

Word in input data area	Analog input word	Data	Representation
1	0	FBT Return Value	See Fieldbus Tasks, section 5.
2	1	Programmable Analog Input 1	Function of programmable analog input, see section 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	

3.4. Programmable Analog Inputs

The functions 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 ⇒ 10kVA
Mains voltage	Value = 1000 ⇒ 100V
Power factor	Value = 100 ⇒ 1 Example: 87 ⇒ 0.87
Motor voltage	Value = 100 ⇒ 100%
Active energy (resettable)	Value = 1000 ⇒ 10kWh
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℃
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℃ Example: 750 ⇒ 25℃
PTC resistance	Value = 100 ⇒ 100Ω
Reactive energy (resettable)	Value = 1000 ⇒ 10kVArh
Reactive power	Value = 1000 ⇒ 100VAr
Remaining time to start	Value = 100 ⇒ 100s
Thyristor temperature	Value = 100 ⇒ 100℃
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

Function	Representation
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
Phase L1 current high range[2]	Value = 100 ⇒ 100A
Phase L2 current high range[2]	Value = 100 ⇒ 100A
Phase L3 current high range[2]	Value = 100 ⇒ 100A
Active power (hp) high range[2]	Value = 100 ⇒ 100hp
Active power high range[2]	Value = 100 ⇒ 100kW
Apparent power high range[2]	Value = 100 ⇒ 100kVA
Reactive power high range[2]	Value = 100 ⇒ 100kVAr
Max phase current high range[2]	Value = 100 ⇒ 100A
Max motor current high range[2]	Value = 100 ⇒ 100A
Active energy high range[2]	Value = 1 ⇒ 10000kWh
Reactive energy high range[2]	Value = 1 ⇒ 10000kVArh
Number of starts (high precision)	Value = 1 ⇒ 1

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

[2)] High Range alternatives are available for a few signals where there is a possibility for the values to wrap. The values are 16-bit so the maximum value for each signal is 65535. The High Range alternatives have different scaling and will never wrap around but instead have lower precision.

4. Output data

By convention, output data is as seen from the network's perspective. Hence the meaning here is data sent from the network (i.e. a PLC) to the softstarter.

4.1. Digital output telegram

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.

Word in output data area	Digital output byte	Bit	Data	Description
		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.
		6	Spare	
		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.
		13 (5)	Spare	
		14 (6)	Emergency mode	Set to “1” to enable emergency mode.
		15 (7)	FBT Toggle Bit	See Fieldbus Tasks, section 5.
1	2	16 (0)	User defined trip	Set to “1” to trigger user defined protection.
		17 (1)	Switch to remote control	Switch to remote control when signal is set (rising edge triggered).
		18 (2)	Pump cleaning automatic	Perform automatic pump cleaning when signal is set.
		19 (3)	Pump cleaning forward	Perform forward pump cleaning when signal is set.
		20 (4)	Pump cleaning reverse	Perform reverse pump cleaning when signal is set.
		21 (5)	K4 relay command	Set “1” to activate the internal K4 output relay. Note that parameter 10.4 K4 function has to be set as “Fieldbus”
		22 (6)	K5 relay command	Set “1” to activate the internal K5 output relay. Note that parameter 10.5 K5 function has to be set as “Fieldbus”
		23 (7)	K6 relay command	Set “1” to activate the internal K6 output relay. Note that parameter 10.6 K6 function has to be set as “Fieldbus”

Word in output data area	Digital output byte	Bit	Data	Description
	3	24 (0)	1DO0 relay command	Set “1” to activate the external 1DO0 output relay. Note that parameter 11.9 1DO0 function has to be set as “Fieldbus”
		25 (1)	1DO1 relay command	Set “1” to activate the external 1DO1 output relay. Note that parameter 11.10 1DO1 function has to be set as “Fieldbus”
		26 (2)	2DO2 relay command	Set “1” to activate the external 2DO2 output relay. Note that parameter 11.11 2DO2 function has to be set as “Fieldbus”
		27 (3)	2DO3 relay command	Set “1” to activate the external 2DO3 output relay. Note that parameter 11.12 2DO3 function has to be set as “Fieldbus”
		28 (4)	Refresh parameters	Restart fieldbus interface to refresh communication parameters
		29 (5)	Spare	
		30 (6)	Spare	
		31 (7)	Spare	

4.2. Analog output telegram

All analog data is represented as 16-bit values.

Word in output data area	Analog output word	Data	Representation
2	0	FBT Control Word	This register is used to read parameters (see fieldbus tasks).
3	1	Fieldbus AO 1 (FBT Argument 2 or Internal analog output)	Parameter 12.37 Fieldbus AO1 decides the use of this register. If set as "FBT Argument 2”, it is used to write parameters and set time (see fieldbus tasks). If set as “Internal analog output” this value of this register controls the internal analog output. Note that parameter 10.8 AO type needs to be set as “Fieldbus [%]”.
4	2	Fieldbus AO 2 (FBT Argument 3 or External analog output)	Parameter 12.38 Fieldbus AO2 decides the use of this register. If set as "FBT Argument 3”, it is used to write parameters and set time (see fieldbus tasks). If set as “External analog output” this value of this register controls the external analog output. Note that parameter 11.14 1AO0 type needs to be set as “Fieldbus [%]”.

5. Fieldbus tasks

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

The 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.

– FBT Argument 2 is a separate analog output signal

– FBT Argument 3 is a separate analog output signal

To control when the task is executed, the digital output signal FBT Toggle Bit shall be 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.

5.1. 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	-	FBT Argument 1

5.2. 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, lower word	1	2
2	Change parameter value	1	2
3	Set date and time	1	2
4	Request parameter value, upper word		

5.3. 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.

5.4. 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
6	Invalid task number

5.5. Request parameter value, lower word

This task reads the lower 16 bits of the specified parameter. See chapter 5.9 for parameter number and value scaling.

5.5.1. Arguments

– FBT Argument 1: parameter number.

5.5.2. 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.

5.6. Change parameter value

This task writes a specified value to a parameter. See chapter 5.9 for parameter number and value scaling.

5.6.1. Arguments

– FBT Argument 1: parameter number.

– FBT Argument 2: parameter value (lower word).

– FBT Argument 3: parameter value (upper word).

5.6.2. Return Value

– Response ID 1 on success.

– Response ID 2 and error number in FBT Return Value on failure.

5.7. 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

5.7.1. 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

5.7.2. 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.

5.8. Request parameter value, upper word

This task reads the upper 16 bits of the specified parameter's value. See chapter 5.9 for parameter number and value scaling.

5.8.1. Arguments

- FBT Argument 1: parameter number.

5.8.2. 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.

5.9. Parameter numbers and values

To access parameters from the fieldbus a unique parameter number is needed, this can be found in document 1SFC132081M0201, Chapter 7.25 Complete parameter list.

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 7.25 Complete parameter list, 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 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 $50/10^2 = 0.5$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 $1*10^2 = 100$.
4. Set FBT Argument 3 to 0 as 100 <= 65535 which means it doesn't require more than 16 bits.
5. Toggle FBT Toggle Bit output and wait for the FBT Toggle Bit input to update.
6. Response ID should now contain value 1, indicating success.

5.9.1. Negative values

Negative values are represented internally using 32-bit two's complement numbers.

Example:
Setting parameter 17.5 PT100 reset temp (parameter number 249) to a value of -25°C:

The two's complement of -25 is $FFFFFFE7_{hex}$. The upper word is $FFFF_{hex}$ and the lower $FFE7_{hex}$, in decimal notation 65535 and 65511.

1. Set FBT Task ID to 2 for Change parameter value.
2. Set FBT Argument 1 to 249 to specify the parameter.
3. Set FBT Argument 2 to 65511 to specify the lower word.
4. Set FBT Argument 3 to 65535 to specify the upper word.
5. Toggle FBT Toggle Bit output and wait for the FBT Toggle Bit input to update.
6. Response ID 1 should now contain value 1, indicating success.

6. Contact us

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