SIEMENS

9782

DESIGO™ I/O-OPEN / UNIGYR™

SED2 Solution PTE-SED2

For integration of the Siemens SED2 variable speed drives

Interface module for integration of the Siemens SED2 variable speed drives into a DESIGO V2.2 building automation and control system.
The PTE-SED2 module can be used to integrate up to four variable speed drives.

Note *This document includes the engineering notes for the version DESIGO V2.2.*
For engineering notes for DESIGO V2.1 and UNIGYR see document CA2J9782en.

Application

The interface module enables up to 4 variable speed drives to be integrated into a DESIGO V2.2 building automation and control system. The variable speed drives are integrated into a PXC64-U or PXC128-U automation station via the P-bus connection.

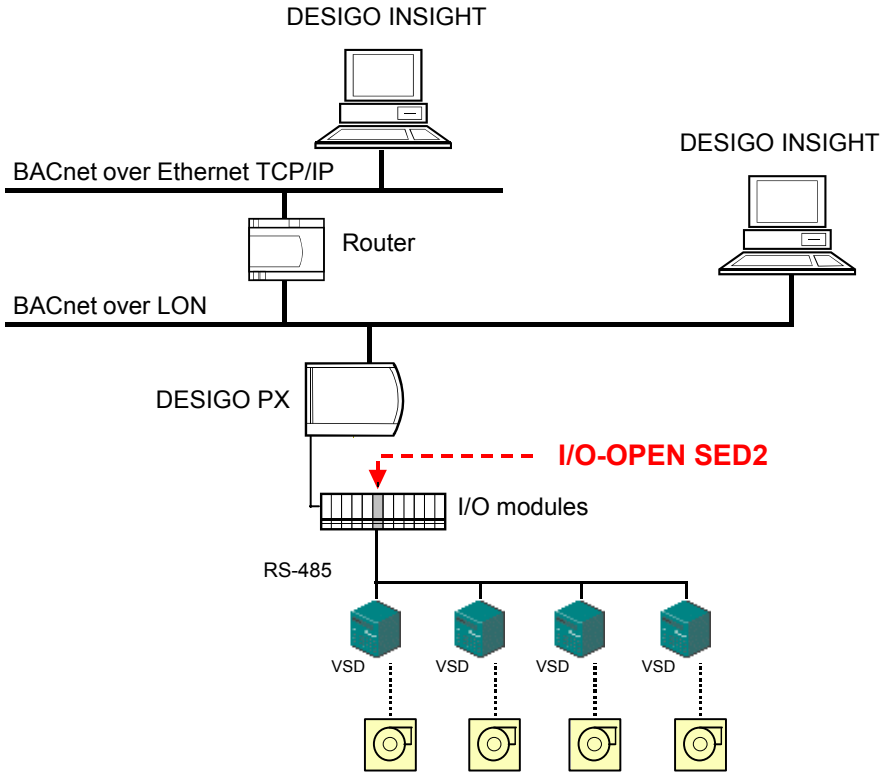
Functions

General

The interface module provides the following functions for each variable speed drive:

- General control: on/off and setpoint definition (frequency, % PID or pressure) both with feedback
- Variable speed drive data points: output frequency (Hz), output current (A), cumulative energy (kWh) and power (kW)
- Errors: display and acknowledgement (for details refer to "Operating states").

System topology: DESIGO V2.2



VSD data points

The table shows the variable speed drive data points which can be integrated via the interface module:

Data point name	Value range	Data point type [1]	Direction of data flow [2]
Variable speed drive: OFF/ON	0 / 1	DOS	S → VSD
Error acknowledgement	0 / 1	DOS	S → VSD
VSD bus address [3]	1 … 31	AOS	S → VSD
VSD frequency setpoint [4] VSD fixed PID setpoint in % VSD pressure setpoint in Pa	0 ... 150 Hz 0 … 100 % –200 … + 200 Pa	AOS	S → VSD (P2201) (P2201)
PID feedback signal	Signal AIN2	AIS	VSD → S
Output frequency	0 ... 75 Hz	AIS	VSD → S
Output current	0 ... 1638.3 A	AIS	VSD → S
Energy	0 ... 2.684e8 kWh	DIS	VSD → S
Power	0 … 163.83 kW	AIS	VSD → S
Error code	0 ... 255	AIS	FU → S
Error display: Normal/Error	0 / 1	DIS	VSD → S
VSD running: OFF/ON	0 / 1	DIS	VSD → S
VSD: AUTO/MANUAL	0 / 1	DIS	VSD → S

1) Data point types:

DI**S**, DO**S**, AI**S** and AO**S** are digital/analog inputs/outputs with a **s**tatus bit. They are the virtual P-bus data points used for integration of the SED2 drives.

2) Direction of data flow:

VSD	→ S	indicates data flowing from the variable speed drive to the SYSTEM
S	→ VSD	indicates data flowing from the SYSTEM to the variable speed drive.

3) Bus address:

For each variable speed drive, there is a data point for setting the slave address, (SlvAddr, P2011). All addresses must be within the range 1 to 31. Duplicate addresses are not allowed. The module only updates a VSD compound to which a valid address (1 -31) has been allocated. The address must be set retrospectively in the CFC.
If the slave address is set to zero, then neither the associated variable speed drive compound nor its data points will be updated by the module.

4) Variable speed drive setpoints:

The PTE-SED2 module can specify a frequency setpoint, a fixed PID setpoint or a pressure setpoint for the VSD. The different setpoint options are selected by using different compounds. There are three categories of SED2 compounds: Pumps (Pu), Motors (Mot) and Fans (Fan). Each category has three setpoint options: frequency (Hz), % PID (%) and pressure (Pa). There are therefore **nine** SED2 compounds in the CAS library.

For a frequency-controlled variable speed drive, the available compounds are PuFqSED, MotFqSED and FanFqSED. This enables a frequency of 0 to 150 Hz to be set.

If the chosen setpoint is a fixed PID percentage value, the compounds PuMdItSED, MotMdSED and FanMdSED are available. This enables a %-value from 0 to 100% to be set. The PID settings are carried out on the VSD itself.

Finally, compounds PuPSED, MotPSED and FanPSED are available for the integration of a pressure-controlled variable speed drive. The pressure can be set in the range –200 to +200 Pa. The internal PID controller settings are carried out on the variable speed drive itself.

Data point name	Value range	Data point type [1]	Direction of data flow[2]
VSD frequency setpoint VSD fixed PID setpoint in % VSD pressure setpoint	0 ... 150 Hz 0 … 100 % –200 … 200 Pa	AOS	S → VSD (P2201) (P2201)

VSD frequency setpoint	**Adjustment value:**		
Frequency setpoint 0 to 150 Hz	0 … 150		
e.g. 50 Hz	50		

VSD fixed PID setpoint	**Adjustment value:**		**(P2201)**
Setpoint for pressure control 0 to 100 %	0 … 100%		
e.g. 80 %	80		80

VSD pressure setpoint	**Adjustment value:**		**(P2201)**
Pressure control setpoint –200 to 200 Pa	–200 … + 200 Pa		
e.g. 75 Pa	75		75

When the fixed PID setpoint or pressure setpoint is used, in each case the PTE-SED2 writes parameter **P2201** of the SED2 variable speed drive. This is how setpoints for pressure or room temperature control can be set via the module. The CAS library is delivered with a pressure, frequency and % PID solution. The integral PID controller in the variable speed drive can control engineering units other than pressure. This can be done by using the xxMdSED or xxPSED compounds as a template, modifying and saving this as a new solution in the library, and by carrying out the relevant settings on the variable speed drive.

When commissioning and configuring the PID controller in the SED2, the relevant parameters must be set in accordance with Section 6.4, "HVAC functions of the SED2", in document CM1U5192.

Access

Access to this data is as follows:

- Locally, on the variable speed drive itself
- Centrally, via the PC user interface

Applications

The interface module comprises a combination of virtual I/O modules in sequence, which are addressed individually, starting from a base address. The variable speed drive data points are mapped internally in the interface module to normal I/O data points, which are then integrated into the automation stations.

The variable speed drive data points are integrated through the communication between the variable speed drive and the automation station. This data can be displayed and set centrally via the building automation and control system.

Display options on the interface module

The interface module has two LEDs, used to indicate the consistency of the communications.

Safety and reliability

Refer to the "Technical design" section for information on operational reliability and system safety precautions.

Types

Ordering	The I/O-OPEN SED2 variable speed drive interface modules should be ordered via the Logistics department, using the ASN number: **PTE-SED2**
Delivery	The base unit and electronics module are delivered in separate but interlinked packages.
Accessories	Accessories must be ordered as separate items. For general I/O accessories refer to data sheet 8105.

Compatibility

Automation stations	The interface module can be connected to any Siemens automation stations which have a P-bus connection and which provide software support for the required module type (AIS, AOS, DOS and DIS). In DESIGO V2.2 these are the PXC64-U and PXC128-U modular automation stations.
Variable speed drives	The PTE-SED2 module is basically suitable for the integration of all variable speed drives in the SED2 product range. Document CM1U5192 contains an overview of the various VSDs in the range.

Technical design

General

The interface module can be used to map data points from the SED2 variable speed drive to the P-bus, enabling the automation station to read all the data points via the assigned addresses and channels. The module reads the data points from the variable speed drives at regular intervals and updates the internal database with the actual values. When an automation station requests a reading, the data points are transferred from the interface module to the automation station. In the opposite direction, values are written from the automation station to the interface module via the P-bus.

Creating a program

From a functional point of view, the interface module contains 14 I/O virtual-module addresses (2 x [4 AOS], 2 x [4 DOS], 5 x [4 DIS] und 5 x [4 AIS]). They are referred to as "virtual" in the sense that they do not exist as individual physical modules. Module address 15 remains unused, and address 16 is used for the module production test. The values and attributes of the variable speed drives of these module addresses require scaling and decoding. The library elements already contain these settings, which are described further below.

Data transmission

P-bus

The data is transmitted between the interface module and the automation stations via the 3-wire P-bus (process bus). For details, refer to data sheet N8022, "Process bus".

USS protocol via RS485

Data is transmitted between the interface module and the variable speed drive network in accordance with the requirements of the USS protocol. Consult the relevant Siemens Universal Serial Protocol (USS) literature for further information.

The data is transmitted at 9600 baud, in 8-bit binary format with one stop/start bit and even parity.

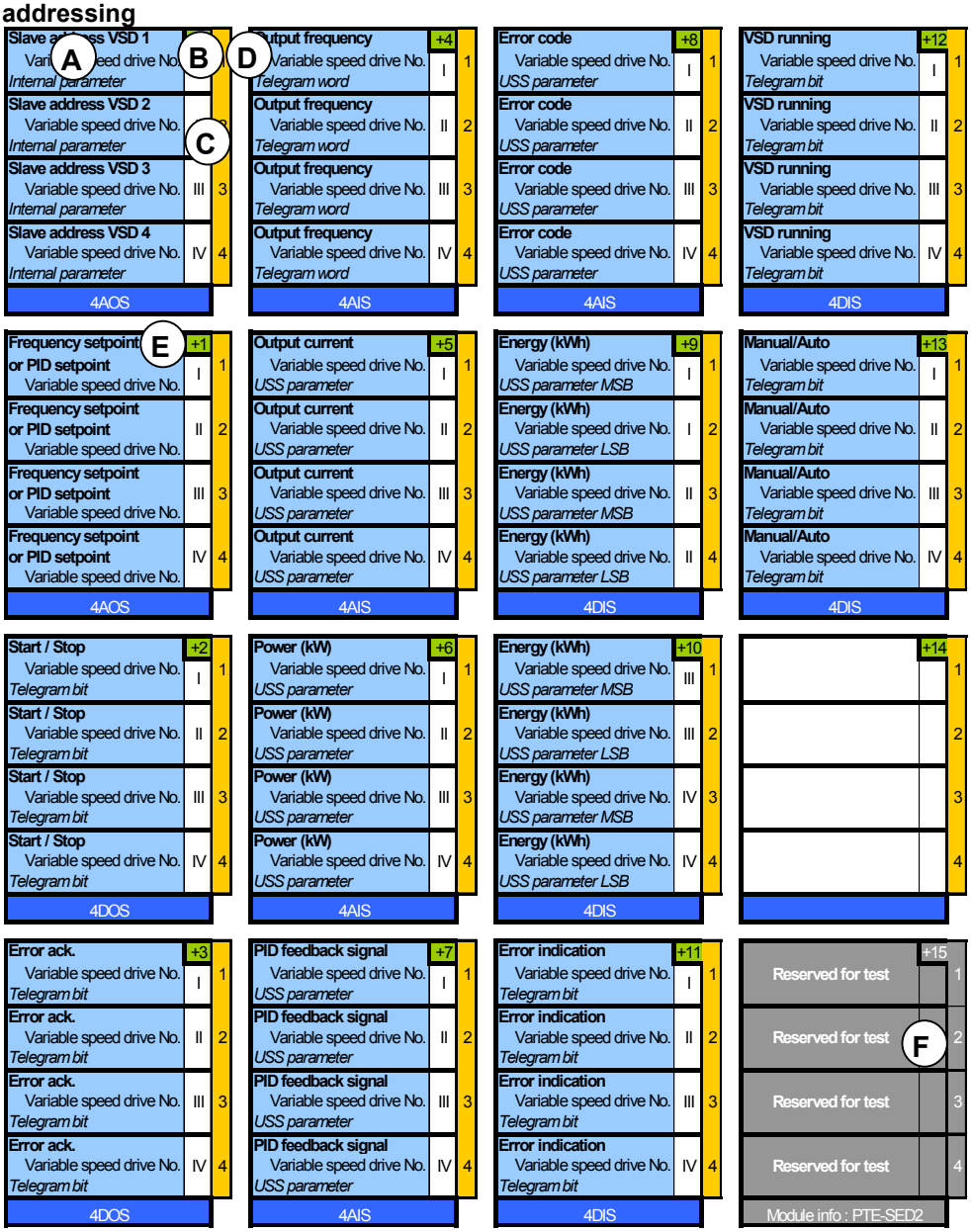
Addressing

For transmission over the P-bus, each data point is assigned an address.
This "P-bus address" comprises:

- Basic address
- Offset address
- Channel number

Data point addressing

The table below shows how the data points are addressed via the automation station.



Key

A. Data points

B. Address plug + offset

C. Internal VSD number

D. Channel number

E. P-bus I/O module type

F. Reserved for production test

A basic address (the hardware address) is assigned to the interface module by means of an address plug. The interface module uses fixed offset addresses.
In order for all the data points in the interface module to be addressed on the P-bus, the highest address which may be used is address plug 241.

Note

In this context it should be noted that the permissible number of load units in the automation stations must not be exceeded. The **PTE-SED2** module takes up 4 load units in the automation stations.

LED indicators on the interface module

The two LEDs, "P-bus" and "RS485" indicate the operating state of the interface module.

The table below shows the information associated with these LEDs.

Phase	P-bus LED 1	RS485 LED 2	Description
Start-up phase (approx. 5 s)	On		Normal operation
	Off		No P-bus module power supply
	Flashing		Faulty module
Normal operation	On	On	Normal operation
	On	Flashing	Error in transmission between module and RS485 interface
	Off	Off	No P-bus module power supply or no AC 24 V operating voltage
	On	Off	No communication with the RS485 interface

DESIGO V2.2 operating states in detail

Operating states	PTE-SED2 module P-bus LED 1	RS485 LED 2	PXM20 Error LED	DESIGO PXC-U Compound	Alarm list	Comments
First poll of SED2						
No slaves polled yet	On	Off	Flashing	Reliability 1	Display	Applies to all data points
All slaves can be read	On	On	Off	Reliability 0	None	Applies to all data points
Slave A not responding	On	Flashing	Flashing	Reliability 1	Display	Applies to all data points of Slave A
Individual DPs of Slave A not present	On	Flashing	Flashing	Reliability 1	Display	Applies to individual data points of Slave A
Repeated poll of SED2						
All slaves can be read	On	On	Off	Reliability 0	None	
Slave A not responding	On	Flashing	Flashing	Reliability 4	Display	Applies to all data points of Slave A
Individual DPs of Slave A not present	On	Flashing	Flashing	Reliability 4	Display	Applies to individual data points of Slave A
P-bus power off	Off	Off	Flashing	Reliability 1	Display	
P-bus power-on (start-up phase approx. 5s)	On	On	Flashing	Reliability 1	Display	No synchronization with controller yet
P-bus power-off	On	On	Off	Reliability 1	Display	Directly after synchronization with controller
	On	On	Off	Reliability 0	None	All data points read
Faulty module	Flashing	Flashing	Flashing	Reliability 1	Display	
Module <-> SED2 connection interrupted	On	Off	Flashing	Reliability 4	Display	

System safety and operational reliability

Start-up response

After switching on the power supply (reference voltage BEZ and system voltage G) and synchronization with a PXC… automation station, the interface module is ready within 0.5 seconds to start communication with the M-bus subscribers, i.e. to receive datagrams.

Reliability of data transmission

- Faulty data transmission identified, data not accepted.
  The CRC code guarantees the integrity of the data transmission.
- A PXC… automation station must transmit updated output values in an error-free datagram to the PTE-SED2 interface module within a period of 4-seconds. If no datagram is transmitted within this period, the default values for the interface module are enabled.

Short-circuit resistance

Both bus cables are short-circuit proof.

Working with module connected to power supply

Connecting and disconnecting the interface module with the power switched on will not cause damage to the module.

Note

The full functional scope of the interface module covers both the module hardware and the signal processing in the automation station software.
For a complete understanding of the module functions, it is important to take note of the relevant processing steps. The technical principles of the I/O modules are described in document CM2Z8102.

Design

The interface module comprises a plastic housing with a base unit and electronic assembly, for plugging into an I/O terminal bar. Signals and voltages are picked up via the contact springs of the conductor rails in the I/O terminal bar.

The connection terminals of the interface module on the I/O terminal bar have the same function as the terminal strips conventionally installed in the control panel for outgoing cables. They also meet the standards and guidelines applicable to the latter. They can be labeled with a plant-specific reference and are designed as test terminals.

The module has a transparent front section for insertion of the plant-specific module label. The labels are created with DESIGO TOOLSET on pre-printed and perforated labeling sheets.

The front plate also incorporates the socket for the address plug and the two LEDs for the P-bus and the RS485 interface. There are no operator controls on the module.

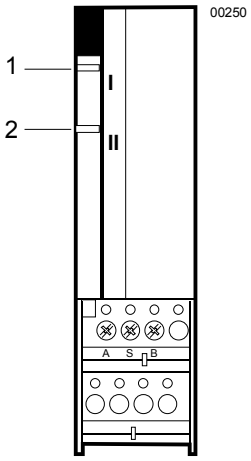
For accessories (for all modules in general) refer to data sheet N8105.

Note

For an in-depth description of the design: refer to the relevant section of document CM2Z8102, “Technical principles of I/O Module System”.

Front view

PTE-SED2



1 - LED indicator for P-bus
2 - LED indicator for RS485/USS interface

Engineering notes

Document CM2Z8102 "Technical principles of I/O Module System" contains project engineering information relevant to the system and should be read before proceeding with the sections which follow.

Special attention should be paid to the safety information.

Appropriate use

The interface module should be used in the overall system only for the applications described in document CM2Z8102 "Technical principles of I/O Module System". Special attention should be paid to the brief description on the title page (printed in bold type) and to the sections headed "Use", "Engineering notes" and "Technical data".

System integration

The interface module represents a combination of several I/O modules in sequence, each of which is addressed individually, starting from the basic address. The data points of the automation station are mapped internally in the interface module to normal I/O data points, which can then be integrated into the automation stations.

System adjustment parameters and defaults

The parameters / standard values in the PTE-SED2 interface module are as follows:

Data point description	Data point type	Address (+ Basic)	Default value
Slave address, VSD 1	AOS	0.1	0
Slave address, VSD 2	AOS	0.2	0
Slave address, VSD 3	AOS	0.3	0
Slave address, VSD 4	AOS	0.4	0
Frequency setpoint or fixed PID setpoint	AOS	1.1 to 1.4	0
Start / Stop	DOS	2.1 to 2.4	0
Error acknowledgement	DOS	3.1 to 3.4	0

Library elements

The CAS library contains the following compounds:

- Pumps: PuFqSED, PuPSED, PuMdltSED
  Path: U\Charts\UEqp\Pu\
- Fans FanFqSED, FanPSED, FanMdSED
  Path: A\Charts\AEqp\Fan\
- Motor: MotFqSED, MotPSED, MotMdSED
  Path: U\Charts\UEqp\Mtr\

The compounds are stored one level down in the hierarchy in "envelopes" (xxxTpl), to allow the creation of instances in System Design. These "envelopes" are designed solely to simplify the process described, and have no other function in the CFC. The two SED2 compounds are described in detail in the CAS documentation.

Engineering in System Design

There are two ways of creating an instance of an SED2 solution in System Design:
With the "Append data point" function
With the Solution Browser

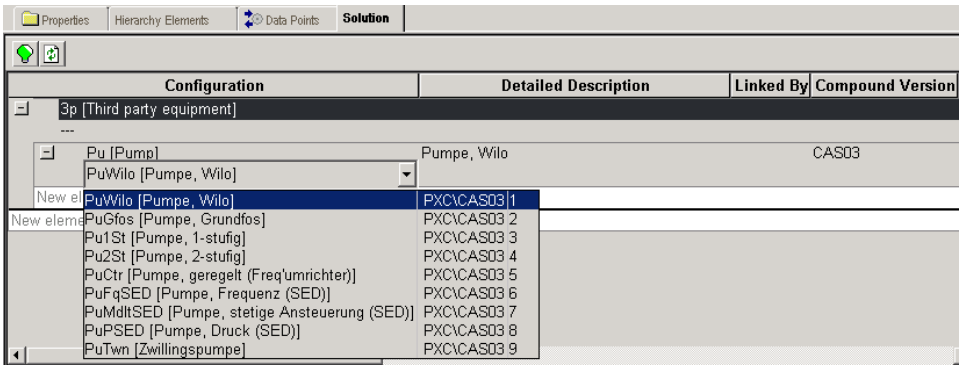
Append data point

In a plant, partial plant or aggregate, a data point can be added with the option **Generate →Data point**. The appropriate family (Fan, Mot or Pu) must be selected as the DP type. The signal type is then defined by selecting the type of control (frequency, PID or pressure control). Although the SED2 solutions all consist of a number of data points, they are represented in System Design as single data points. When creating an instance of an SED2 solution, the plus sign (+) indicates that this compound incorporates more than one data point.

	1 2	DP Typ e	#Stat es	Signal Type	Feedback	Unit	User Designation	Lock	I/O Address
1	⊟	Pu		Pump, pressure (SED) templ			SED Pump Pr		20.01
		BO		Digital output (with status)	Digital inpu	Off/On			22.1 ; 32.1
		CI		Digital input (with status)		kWh			29.1 ; 29.2
		AI		Analog input (with status)		A			25.1
		BO		Digital output (with status)		Unack/Ack			23.1
		AI		Analog input (with status)		no-units			28.1
		BI		Digital input (with status)		Normal/Fault			31.1
		AI		Analog input (with status)		Hz			24.1
		BI		Digital input (with status)		Auto/Manual			33.1
		AI		Analog input (with status)		W			26.1
		AO		Analog output (with status)		no-units			20.1
		AO		Analog output (with status)	Analog inp	Pa			21.1 ; 24.1

Solution Browser

In addition to the standard CAS pumps, fans and motors, it is also possible to select different SED2 versions in a predefined CAS solution. The interfaces are compatible. Options (e.g. pump kick) are not supported in V2.2. The compounds are saved as "maximum" versions. If this function is not required, it must be deleted afterwards in the CFC.



Internal structure of an SED2 VSD compound

Unlike the PTE-MBUS.60, the PTE-SED2 module does not require a "Setting" compound. The slave address is set directly in the relevant variable speed drive compound. The baud rate and other communications parameters are fixed, and cannot be modified.

A standard AO is also used here for the slave address (SlvAddr). Standard AI blocks have been used, except for the cumulative values. These are addressed by means of (AIS) modules. The cumulative values are mapped to Counter objects (CI). For this purpose, a dual syntax is used (e.g. P=9.1;9.1 (DIS)), in order to re-construct 28-bit values. These blocks read in the values through DIS modules simulated by the PTE-SED2.

The other digital inputs (e.g. error dislpay etc.) are mapped to DIS, but use simple syntax (i.e. only one address, e.g. P=12.1 (DIS)).

The following SED2 data points are mapped to BACnet:

Data point name	**Pin name**
Variable speed drive ON/OFF	Cmd
Error acknowledgement	FltAck
VSD bus address	SlvAddr
VSD frequency setpoint VSD PID setpoint VSD fixed PID setpoint	SpFq SpMdlt SpP
PID or pressure feedback signal	Not available with xxFqSED As FbVal of SpP wth xxPSED As FbVal of SpMdt with xxMdSED
Output frequency	As FbVal of SpFq with xxFqSED As Fq with xxPSED As Fq with xxMSED
Output current	Curr
Energy	CumEg
Power	Pwr
Error code	FltCode
Error display	FltInd
VSD running:	As FbVal of Cmd
VSD Manual / Auto	ManInd
Slave address	SlvAddr

Setting the slope

The slope value should be set as follows for the data points below:

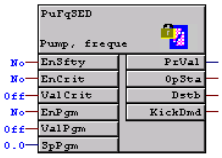
Data point	**Slope**
Power	0.01
Output frequency	0.1
Output current	0.1
PID feedback signal	0.1

All xxPSED and xxMdSED compounds also have an intercept value of 1000 for their data point setpoints, so that the PTE-SED2 module will write these values to parameter 2201 instead of interpreting them as frequency values. The library elements already contain all these settings.

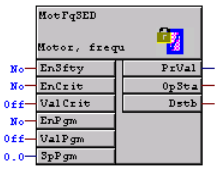
Compound interfaces

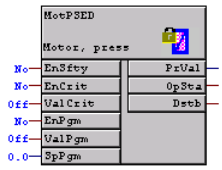
The SED2 compound interfaces comply with the interfaces defined by CAS.

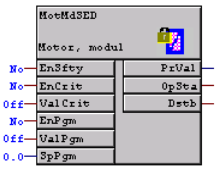
Pump compounds:



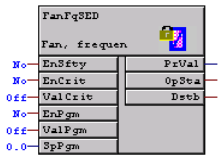
Motor compounds

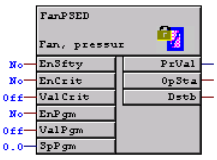


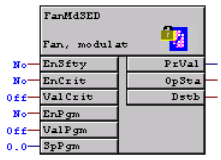




Fan compounds:

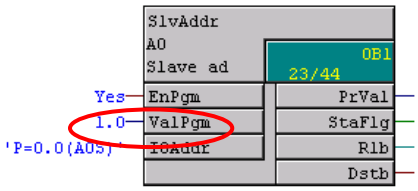






Setting the slave address

The slave addresses must be entered retrospectively in the CFC, after synchronization of System Design and PX-Design. To do this, the variable speed drive address must be set at the "ValPgm" pin of the SlvAddr block (2nd page in CFC). The default value is 1.



Note

In addition, for each compound, suitably adjusted values for Critical Off and Critical On must be entered in the SELBO_R block. These are the setpoints for critical on/off switching.

The default values are as follows:

Compound	Critical Off	Critical On
PuFqSED, MotFqSED, FanFqSED	0 Hz	50 Hz
PuPSED, MotPSED, FanPSED	0 Pa	30 Pa
PuMdltSED, MotMdSED, FanMdSED	0 %	100 %

Setting VSD parameters for communication

To enable the PTE-SED2 module to communicate with variable speed drives via the USS protocol, the following VSD parameters must be set as shown below. Refer to the procedure for modifying parameters, as described in the product documentation for the SED2 variable speed drive, e.g. in document CM1U5192.

P0003 = 3	**User access level** 3=Expert: User can carry out USS settings
P0700[0] = 5	**Selection of command source** 5=USS to COM link
P1000[0] = 5	**Selection of frequency setpoint** 5=USS to COM link
P2009[0] = 1	**USS scaling** (COM-Link serial port) 1=Enabled
P2010[0] = 6	**USS baud rate** (COM-Link serial port) 6= 9600 baud
P2011[0] = 1 ... 31	**USS address** (slave address) Address range 1 to 31
P2014[0] **= 0 ... 65535ms**	**USS telegram timeout** If no telegram is received via the USS channels within the defined period, an error message will be generated (F0072).

Note

The way in which the VSD responds to an error can be defined variously (no message, warning message, or switch-off). Critical errors such as overvoltage always cause the VSD to switch off. An error code can be entered in P2100[0…3], and the associated response in P2101[0..3]. Thus, means that the response to a USS telegram timeout error (F0072) can be selected so that the variable speed drive transmits only a warning, and otherwise continues to operate using the previously received setpoint. Refer also to the product literature for the SED2 variable speed drive, e.g. document CM1U5192.

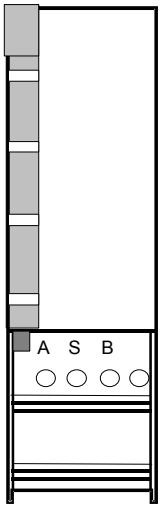
SED2 parameters

The table below shows the correspondence between the data points supported by the PTE-SED2 and the SED2 parameters.

Data point name	Value range in V2.2	SED2 parameters
Variable speed drive Off/On	OFF/ON	r0967 Bit 00
Error acknowledgement	Unack. /Ack	--
VSD bus address [3)]	1 ... 31	P2011[0]
VSD frequency setpoint [4)]	0 ... 150 Hz	r0020
VSD fixed PID setpoint in %	0 … 100 %	P2201
VSD pressure setpoint in Pa	–200 … + 200 Pa	P2201
PID feedback signal	Signal AIN2	r0754[1]
Present output frequency	0 ... 150.0 Hz	r0021
Output current	0 ... 16383.3 A	r0027
Energy	0 ... 2.684e8 kWh	r0039
Power	0 … 163.83 kW	r0032
Current error code	0 … 16383	r0947[0]
Error display	Normal/Error	r0968 Bit 03
VSD running:	OFF/ON	r0968 Bit 02
Manual indication	Automatic / Manual	r0718[0]

Connections and wiring

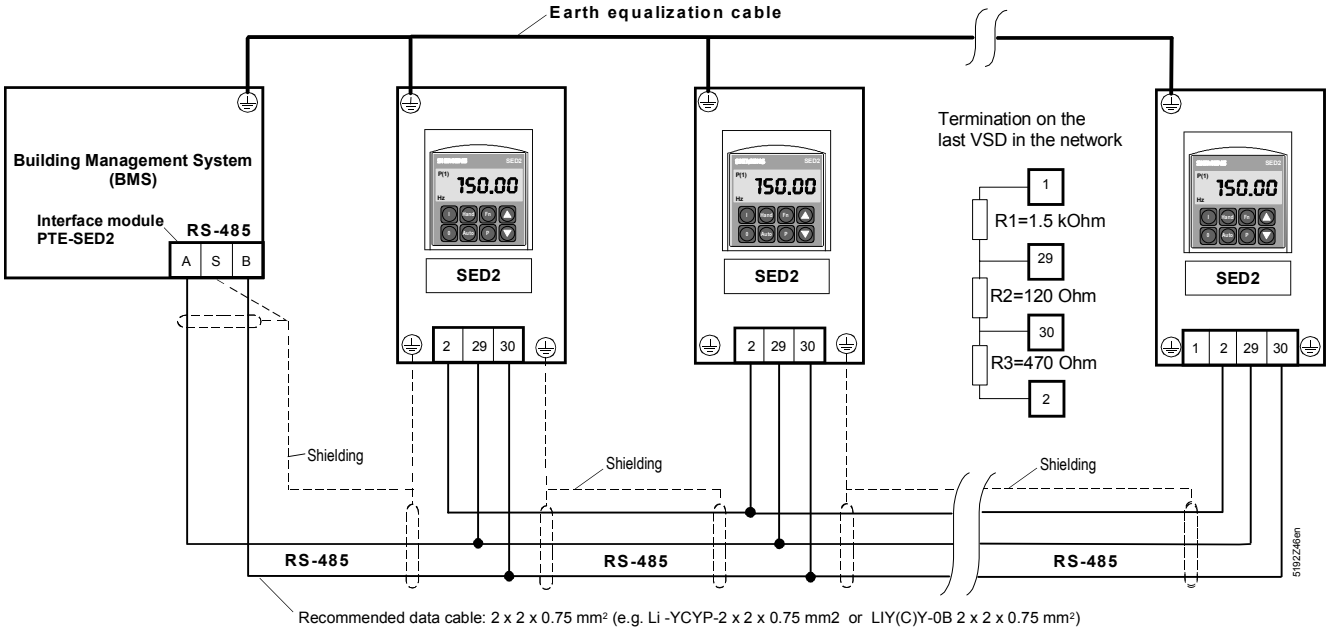
The SED2 variable speed drives are connected to each other in parallel and linked to the PTE-SED2 module via terminals A, S and B.



I/O interface module
PTE-SED2

A = + Tx / Rx
S = Screen
B = – Tx / Rx

The following illustrates the connection between the module and the VSD drives:



Caution

For information on the screening and earthing strategy, please also consult the commissioning guide for the SED2 variable speed drive, document CM1G5192.

Terminating resistors

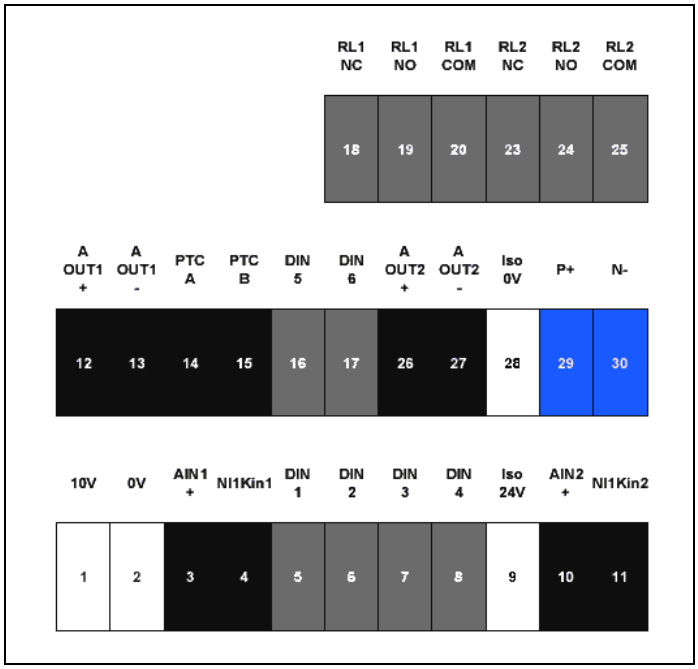
To terminate the bus, the resistances shown above must be connected to **the last (and only the last) variable speed drive** on the bus:

Caution

For information on the bus termination resistances, please also consult the commissioning guide for the SED2 variable speed drive, document CM1G5192.

Connection terminals on the SED2

The following schematic shows the designations of the VSD connection terminals.



Designation of the SED2 terminals

Technical data

Power supply	Operating voltage	AC 24 V ± 20%
	Safety low voltage (SELV) in accordance with	EN 60 730
	Frequency	50 Hz / 60 Hz
	Power consumption	1.2VA
	I/O module supply via P-bus	DC 24 V (against G0)
	Load units	4 load units connected
Module addresses	Numerical range for basic addresses	1 … 241
	Valid offset addresses	0 … 15
P-Bus	See document CM2N8022 "Process bus"	
RS485 bus	Interface type	RS-485 (electrically isolated)
	Transmission speed	9600 bps
	Data bits	8 bits
	Stop bits	1
	Parity	Even
	Cable type	Select good-quality communications cable (screened, twisted pairs) recommended for RS-485 interfaces
	Maximum cable length	1 200 m
	Cross-section	2x ≈ 0.5mm²
Conformity	Meets the requirements for CE marking in	
	EU Directive: Electromagnetic compatibility	89/336/EEC

Note Technical data which is applicable to all I/O modules is described in document CM2Z8102 “Technical principles of I/O Module System”.

Mounting

For mounting instructions, refer to: "Installation guide I/O Module System", document CM2M8102.
Instructions for mounting the I/O modules on the rails and I/O terminal bar are printed on the packaging.

Connection diagrams

Internal diagram See page 7

RS485 bus

A	Data cable, positive
B	Data cable, negative
S	Protective earth

Dimensions

Dimensions in mm