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Overview

The SIPART DR21 process controller is a digital controller. It offers a large number of prepared functions in its program memory for controlling engineering processes that the user can easily use as a basis without programming experience or other tools.

Application

The SIPART DR21 controller is very flexible in its use and can be easily and quickly adapted to the respective task. An adaptation method is installed by default.

The SIPART DR21 controller can be used as:

- Fixed-setpoint controller for control of one, two or three components, optionally also with two setpoints
- DDC fixed-setpoint controller for control of one, two or three components
- Slave controller, synchronous controller or SPC controller, optionally with internal or external switchover
- Fixed or guided ratio controller with internal/external switchover
- Master and manual control system, process indicator or setpoint sensor. The control algorithm is turned off here.

Design

SIPART DR21 has a modular structure, is easy to convert and retrofit and is therefore service-friendly. The basic unit is already fully functional with numerous features. To expand the range of application, additional modules can be inserted into the slots on the back of the closed device.

Slot assignment:

- Slot 1: Analog input 3 (AE3)
- Slot 2: Analog input 4 (AE4)
- Slot 3: Binary inputs and outputs (BE/BA)
- Slot 4: Interface module

The basic unit consists of:

- Front module (operator control and display unit with main circuit board and CPU)
- Rear panel module
- Polycarbonate enclosure with clamping elements for installation in control panels, consoles or machines

SIPART DR21 process controller, rear view, slots

Mode of operation

A large number of functions for controlling process plants is stored in the memory of the SIPART DR21. By means of configuration - setting parameters and configuring switches - users themselves can select the desired functions for their task.

The device is configured either via the front display or using a PC with the SIMATIC PDM software. Settings are saved permanently.

The SIPART DR21 process controller can be operated as P, PD, PI or PID controller.

Adaptation method

The SIPART DR21 process controller has a strong adaptation method that significantly simplifies commissioning even of critical controlled systems.

The controller hereby determines the control parameters independently on request without requiring the user to have prior knowledge about the process behavior. The applied method is suitable for systems with compensation and acyclic settling behavior. Dead times are also taken into account.

Analog input area

The SIPART DR21 process controller has a total of 4 analog inputs, of which 2 are already contained in the basic unit; the other inputs can be added as an option.

In each analog input channel, a first-order filter to suppress external interferences and a root-extracting element can be added.

A linearizer with 13 grid points can be assigned to one of the analog inputs.

Controller manipulated variables

C-controller (continuous output)

With this controller structure, the manipulated variable is output as a standardized current signal. The signal range (0 to 20 mA or 4 to 20 mA) is specified by structuring.

S-controlling (switching output)

The two floating relay contacts should preferably be used to output the manipulated variable. These are provided with a protective circuit which is designed for contactor coils.

The relay contacts are mutually interlocked. This interlock can be removed for a universal binary output.

Two-point controller

The manipulated variable *y* is output as sampling ratio with adjustable time period. As a two-point controller with heating/cooling outputs, a different time period can be assigned to each output. The sampling ratio 0 to 100 % is run through in each section. The dead zone between heating/cooling is parameterizable.

Main application of this controller type. Temperature controller which switches electrical power for heating or cooling or opens and closes a solenoid valve, for example.

One of the outputs for heating/cooling can optionally be output as analog signal 0/4 to 20 mA.

Binary input and output area

For structuring of the controller, the two binary inputs and outputs present in the basic unit are assigned to the binary functions needed for the respective application.

They are non-isolated and act in a normal or inverted manner depending on the configuration.

The binary outputs are active. They return a DC voltage signal.

The number of binary inputs or outputs can be increased using option modules.

Furthermore, a coupling relay module can be clipped to a mounting rail on the back of the controller. This additional module can contain either two or four relays with one changeover contact each for 250 V AC, 8 A, which can be controlled from the binary outputs.

The following functions are available for assignment to the binary inputs and outputs:

Binary inputs	
CB	Computer readiness
He	Manual mode, external
N	Tracking
Si	Safety mode
P	P-operation of the controller
tS	Disabling the setpoint ramp time
±yBL	Direction-dependent blocking of the manipulated variable
BLB	Blocking of the input level
BLS	Blocking of structuring
BLPS	Blocking of parameter assignment and structuring
tSH	Holding the setpoint ramp

Binary outputs	
RB	Computer readiness
RC	Computer operation
H	Manual mode
N_W	Follow-up mode setpoint
A1,2,3,4	Alarm limit monitor A1, A2, A3, A4
MUF	Transmitter fault
±Δw	Incremental w adjustment

Display technology

Equipping the SIPART DR21 process controller with displays is convenient and complies with NAMUR requirements.

The controller has one analog display each for the actual value *x* and the setpoint *w*, one digital display which can be switched between *x* and *w*, one digital display for the manipulated variable *y*, as well as message and status displays.

The two analog displays are designed as vertical LED bar graphs. Because the actual value and setpoint displays are arranged next to one another, a setpoint/actual value comparison for a dynamic trend display can easily be performed.

The red digital display for the actual value and the setpoint has four digits and can be configured as a physical unit or a percentage.

There are 11 LEDs on the front of the device for displaying operating states and alarms.

In the configuring levels, some of these displays and operator controls have a different meaning.

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Function

Additional functions

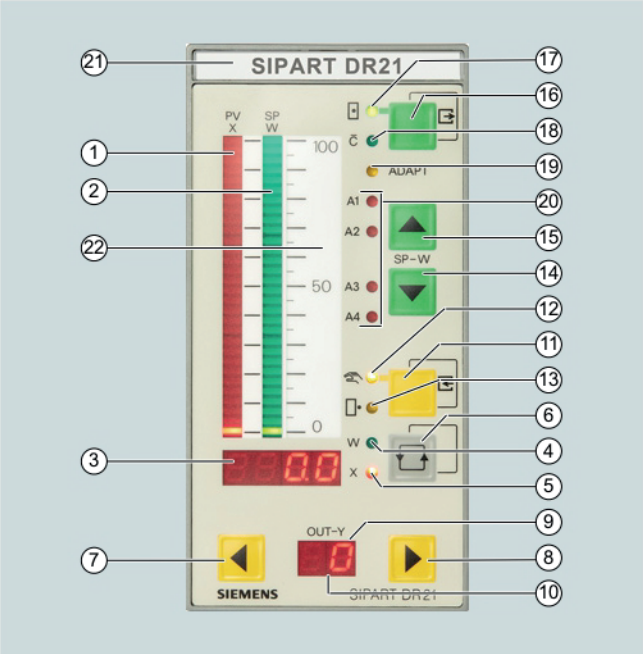
Additional configurable functions that increase the convenience and reliability of the SIPART DR21 process controller operation:

- Transmitter monitoring
- Setpoint limitation
- Setpoint ramp
- *x* tracking
- Filter and response threshold of the control deviation
- Adjustment of the direction of action
- Special features of the control algorithm:
  Switchover from PI(D) to P(D) control takes place based on a control signal. Switchover from automatic to manual mode and vice versa as well as switchover from all other operating modes to automatic mode is harmonious.
- Limitation of manipulated variable
- Limit monitor
- Restart conditions:
  Brief interruptions of the operating voltage are bridged depending on the current load of the device by the storage effect of the power supply unit.
  In the event of a longer power failure, the configured parameters and structures are retained in a non-volatile user program memory. The last operating mode, the last setpoint and the last manipulated variable are also loaded into a non-volatile memory.
  On voltage return after power supply interruptions or after reclosing, the controller starts autonomously with the structured operating modes, setpoint and manipulated value. Optical signaling on voltage return after power failure is possible.
- Self-diagnostics:
  Comprehensive monitoring routines check the internal data traffic cyclically or after a POWER ON or watchdog reset.
  If a fault is detected, an error message is automatically output on the w/x digital display which indicates the cause of the error and options for resolving it.
- Communication with higher-level systems

Signal converters (additional modules)

The hardware features of the basic unit can be expanded for specific requirements. A range of modules are available for this purpose and can be ordered as accessories.

The modules are inserted in the slots on the back of the controller. The slots are coded against incorrect insertion.



SIPART DR21 process controller, front operator control and display

1 Analog display actual value x
2 Analog display setpoint w
3 w/x digital display (other values can be displayed)
4 Indicator light w - lights up when w is displayed
5 Indicator light x - lights up when x is displayed
6 Switchover button for w/x digital display, acknowledgment button for flashing after power return and entry button to the selection level
7 Button for changing the manipulated value - closed (open)
8 Button for changing the manipulated value - open (closed)
9 y digital display
10 Indicator lights of the Δy binary outputs on the S-controller
11 Switchover button manual/automatic and "Enter" button from the selection level to the configuration level
12 Indicator light manual mode
13 Indicator light y external operation
14 Button "setpoint falling"
15 Button "setpoint rising"
16 Switchover button setpoint internal/external and "Exit" button from the configuring and selection level into the process control level
17 Indicator light setpoint internal
18 Indicator light computer (with w_{ext}) switched off
19 Indicator light adaptation method in progress
20 Indicator lights for "Threshold addressed"
21 Measuring point label
22 Measuring range scale

Technical specifications

General data	
Mounting position	Any
Climate class according to IEC 721	
• Part 3-1 Storage 1K2	-25 ... +75 °C
• Part 3-2 Transport 2K2	-25 ... +75 °C
• Part 3-3 Operation 3K3	0 ... +50 °C
Degree of protection according to EN 60 529	
• Front	IP64
• Enclosure	IP30
• Connections	IP20

Device design

Electrical safety
- According to DIN EN 61010-1
- Protection class I according to IEC 536
- Protective separation of line connection and field signals
- Clearance and creepage distances, unless expressly mentioned otherwise, for overvoltage category III and pollution degree 2

CE mark compliance with respect to
- EMC Directive 2014/30/EU
- LVD Directive 2014/35/EU

Interference emission, noise immunity according to DIN EN 61326-1, NAMUR NE21

Weight, basic unit	Approx. 1.2 kg
Color	
• Frame of the front module	RAL 7037
• Front surface	RAL 7035

General data	
Material	
• Enclosure and front frame	Polycarbonate, glass-fiber reinforced
• Front film	Polyester
Auxiliary power terminal	
• 115/230 V AC	Polycarbonate, glass-fiber reinforced according to IEC 320/V
• 24 V UC	Two-pin plug
Connection system for process signals	Multi-pin screw terminal blocks, coded, plug-in for conductor cross-section 1.5 mm^2 (AWG 14)
Protective conductor connection	Grounding screw

Furthermore, a coupling relay module can be clipped to a mounting rail on the back of the controller. The mounting rail is included in the scope of delivery of the coupling relay module.

The connection plugs for the auxiliary power and the screw terminals for the process signals are included in the scope of delivery of the basic unit or for all optionally available modules (options).

Exception:

Interface module 6DR2803-8C and PROFIBUS DP module 6DR2803-8P. The connection plugs must be ordered separately.

Auxiliary power				
Nominal voltage	230 V AC, switchable	115 V AC, switchable	24 V UC	24 V UC
Operating voltage range	195 ... 264 V AC	97 ... 132 V AC	20 ... 28 V AC	20 ... 35 V DC [1]
Frequency range	48 ... 63 Hz	48 ... 63 Hz	48 ... 63 Hz	–
External current I_{Ext} [2]	200 mA	200 mA	200 mA	200 mA
Power consumption				
Active power/apparent power (capacitive)				
Basic unit				
• Without options, without I_{Ext}	5 W/9 VA	5 W/9 VA	4 W/6 VA	4 W
• With options, without I_{Ext}	11 W/15 VA	11 W/15 VA	8.5 W/12 VA	8.5 W
• With options, with I_{Ext}	15 W/19 VA	15 W/19 VA	12 W/17 VA	12 W
Permissible voltage dips at 0.85 U_N and max. load	≤ 20 ms	≤ 20 ms	≤ 20 ms	≤ 20 ms

1) Including harmonics.

2) $L+$, BA, AA to external consumers of produced current.

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Technical specifications (continued)

Basic unit	
Analog inputs AE1, AE2	
Current	0/4 ... 20 mA
Input resistance	248 Ω
Total operating range	-0.1 ... +22 mA
Filter time constant	10 ms
Transmitter supply *L+*	
Nominal voltage	20 ... 26 V
Load current	≤ 60 mA, short-circuit proof
Short-circuit current	≤ 200 mA, clocked
Binary inputs BE1 and BE2	
Signal state "0"	≤ 4.5 V or open
Signal state "1"	≥ 13 V
Input resistance	≥ 27 kΩ
Binary outputs BA1 and BA2 (with wired OR diodes)	
Signal state "0"	≤ 1.5 V
Signal state "1"	+19 ... 26 V
Load current	≤ 30 mA
Short-circuit current	≤ 50 mA, clocked
Analog output *ly*	
Nominal signal range	0 ... 20 mA or 4 ... 20 mA
Total operating range	0 ... 20.5 mA or 3.8 ... 20.5 mA
Load voltage	-1 ... +18 V
Max. permissible inductive load	0.1 H
Relay output	
Contact material	Ag-Ni
Contact rating	
Max. switching voltage	250 V AC/DC
Max. switching current	
• Contacts interlocked	8 A
• Contacts unlocked	2.5 A
Max. switching capacity	
• AC	250 VA
• DC	100 W at 24 V, 30 W at 250 V

Basic unit	
Lifetime	
• Mechanical	$2 \bullet 10^7$ switching cycles
• Electr. 230 V AC, ohmic load	10^5 switching cycles
Spark extinguishing element	Series connection of 22 nF with 220 Ω, 420 V varistor in parallel
CPU data	
• Cycle time	100 ms
A/D conversion	
• Process	Successive approximation, per input > 120 conversions and averages within 20 or 16.67 ms
• Resolution	11 bits = 0.06 %
• Zero point error	≤ 0.2 % of measuring span
• Full-scale value error	≤ 0.2 % of measuring span
• Linearity error	≤ 0.2 % of measuring span
Display technology	
Digital *x/w* indicator	Four digits, red, 7-segment LED display
• Number height	7 mm
• Display range	Beginning and end adjustable
• Number range	-1999 ... +9999
• Decimal point	Can be set as fixed value
• Repeat rate	0.1 ... 9.9 s, can be set
Analog *x* indicator	LED display, vertical
	30 LEDs (red)
Analog *w* indicator	LED row, vertical
	30 LEDs (green)
• Display range	0 ... 100 %
• Resolution	1.7 %
Digital *y* indicator	Two-digit, red, 7-segment LED display
• Number height	7 mm
• Display range	0 ... 100 %
• Resolution	1 %
• Repeat rate	0.1 ... 9.9 s, can be set

Selection and ordering data	Article No.
SIPART DR21 process controller	
Basic unit in 72 × 144 mm format, with • 2 analog inputs • 2 binary inputs • 1 analog output • 2 relay outputs • 2 binary outputs	
Design	
• For auxiliary power 24 V UC	**6DR2100-4**
• For auxiliary power 230 V AC, can be switched to 115 V AC	**6DR2100-5**
Accessories (signal converters)	
Module for analog signals	
• For current 0/4 ... 20 mA or voltage 0/0.2 ... 1 V or 0/2 ... 10 V	**6DR2800-8J**
• For resistance-based sensors (R module)	**6DR2800-8R**
• UNI module for TC/RTD/R/mV signals, programmable	**6DR2800-8V**
• Reference junction terminal for TC, internal (use in connection with UNI module)	**6DR2805-8A**
Module for switching signals	
• With 5 binary inputs	**6DR2801-8C**
• With 4 binary outputs and 2 binary inputs	**6DR2801-8E**
• With 2 relay outputs	**6DR2801-8D**
Coupling relay module	
• With 4 relays (250 V AC)	**6DR2804-8A**
• With 2 relays (250 V AC)	**6DR2804-8B**
Documentation	
The entire documentation is available for download free of charge in various languages at: http://www.siemens.com/processinstrumentation/documentation	
SIPART DR21 - Controller 6DR210*-*	
• German	**C73000-B7400-C143**
• English	**C73000-B7476-C143**
Serial SIPART 6DR210x bus interface, operating instructions • German, English	**C73000-B7400-C145**

Scope of delivery

The scope of delivery of the SIPART DR21 process controller includes:

- 1 process controller according to the configuration
- 1 device plug according to IEC 320/V with auxiliary power 115/230 V AC or one plug with auxiliary power 24 V UC
- 2 clamping elements, plug-in

Signal converters and accessories

The signal converters/modules are described in Catalog MP 31, section 5.

The software for assigning parameters via PC, coupling to systems and the accessories for coupling (plugs, cable drivers etc.) can be found in catalog section 6.

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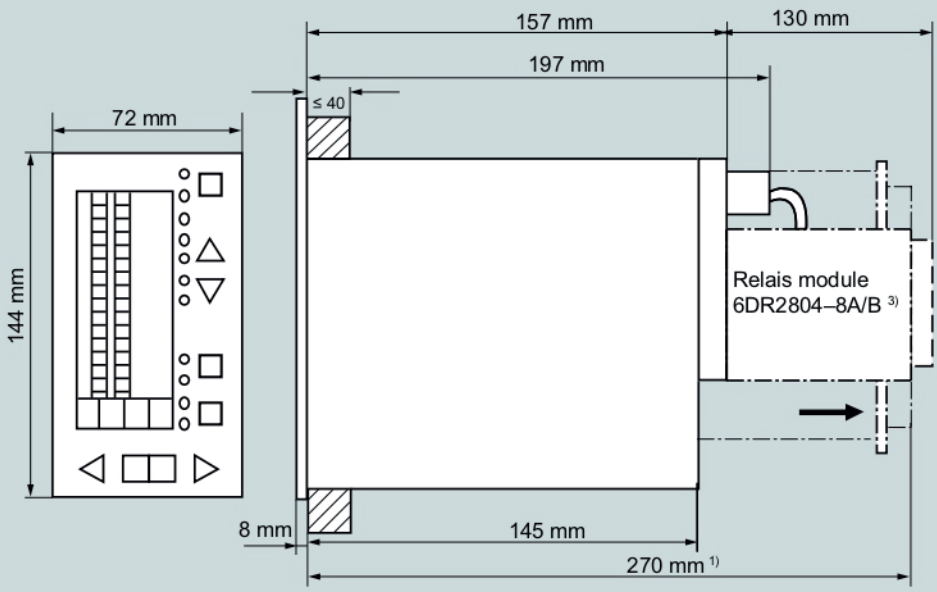
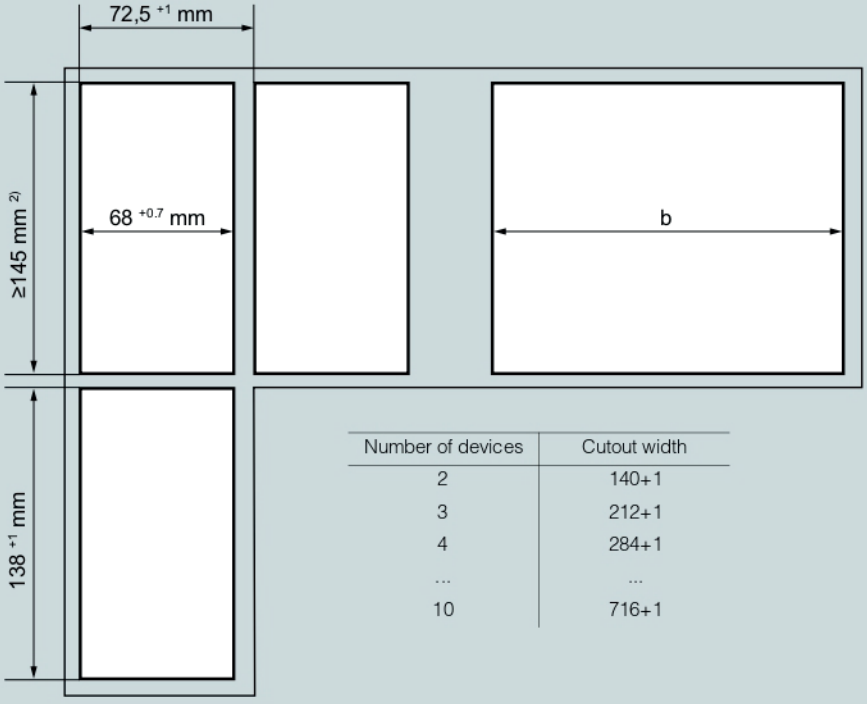
Dimensional drawings





Number of devices	Cutout width
2	140+1
3	212+1
4	284+1
...	...
10	716+1

SIPART DR21 process controller and panel cutouts, dimensions in mm

1) Space requirements for switching the main circuit board and modules.

2) When mounting closely on top of one another, observe the permissible ambient temperature.

3) A relay module with 2 or 4 relays (6DR2804-8A/-8B) can be clipped onto the rear of the controller. When this is used, the installation depth is 130 mm greater.