

# SIPART DR21 Controllers

# 5



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# SIPART DR21 Controllers

## Description



Fig. 5/1 SIPART DR21 controller

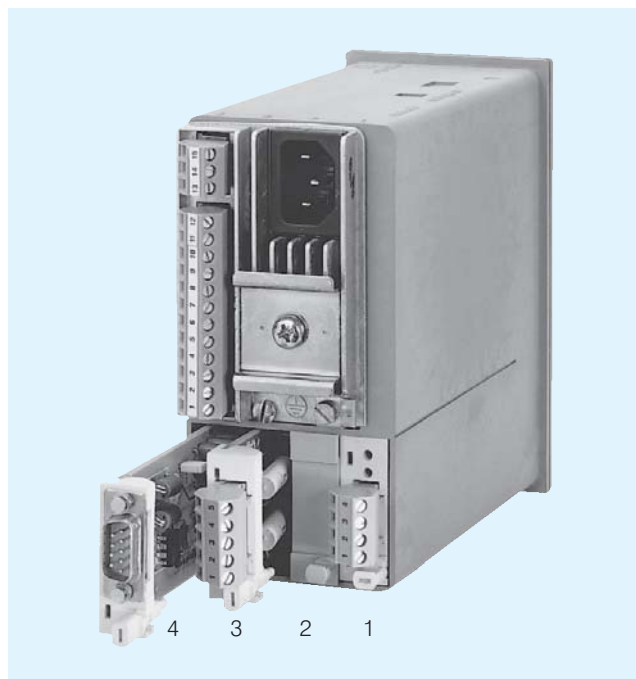


Fig. 5/2 SIPART DR21 controller - rear view, slots

## Application

The SIPART DR21 process controller is a digital controller. Its internal program memory contains a large number of standard functions for the control of process engineering applications. A user with no programming knowledge can simply call up and execute these functions.

The SIPART DR21 controller is very flexible and can be quickly and easily configured to meet the requirements of the application.

An adaptation process is built in as standard.

The SIPART DR21 controller can be used as a:

- Fixed setpoint controller for one, two or three component control, with the option of two setpoint values
- DDC fixed setpoint controller for one, two or three component control
- Slave, synchro or SPC controller, with the option of internal/external switchover
- Fixed or controlled ratio controller with internal/external switchover
- M/A control station, process variable indicator or setpoint transmitter. The control algorithm is disabled in these cases.

## Design

The SIPART DR21 process controller is of modular design and consequently easy to service and simple to reconfigure or retrofit. The standard unit itself is fully functional and extremely well equipped. Additional modules can be inserted in the slots in the rear of the closed unit in order to extend its range of applications (Fig. 5/2).

Slot assignments:

- slot 1 analog input 3 (AE3)
- slot 2 analog input 4 (AE4)
- slot 3 digital inputs/outputs (BE/BA)
- slot 4 interface modules

The standard unit comprises

- Front module (controls and displays with motherboard and CPU)
- Backplane
- Plastic moulded housing with fittings for installation in control panels, consoles or machines.

## Description

The backplane contains the power supply unit and connectors. It is installed in the rear of the housing and connected to the front module by a ribbon cable.

The standard controller has two fixed, non-isolated analog inputs for input current signals of 0/4 to 20 mA and two digital inputs.

The following outputs are available for the manipulated variable or the status signals:

- Analog output 0/4 to 20 mA
- 2 relay outputs
- 2 digital outputs.

The number of inputs and outputs can be increased by adding extra modules.

Input/output modules are available for:

- Current or voltage input (U/I)
- UNI module for TC/RTD/R/mV, also mA and V with adapter; galvanically isolated
- Resistance input (potentiometer) (R)
- Digital inputs and outputs (BE/BA)
- Relay outputs (Rel)
- Serial interface (SES)
- PROFIBUS DP module

Electrical supply for the transmitters is provided by a short-circuit-proof  $L+$  output.

The tagging label and scale can be replaced.

Available versions:

- 6DR2100-4 for power supply 24 V AC/DC
- 6DR2100-5 for power supply 230 V AC, switchable to 115 V AC.

## Mode of operation

The SIPART DR21 controller is based on a modern, highly integrated microcontroller using C-MOS technology.

The instrument's internal program memory contains a large number of functions for the control of process engineering applications.

Configuring – the setting of parameters and configuring switches – enables the users themselves to select the functions required for their applications.

The instrument can be configured from either the front panel or via a PC using the SIMATIC PDM software package.

On leaving the factory, the SIPART DR21 controller is configured as a fixed setpoint controller. In most cases only a few additional settings therefore need to be made.

The instrument parameters are stored in non-volatile memory and are consequently safe from the effects of a power failure. A backup battery is not required.

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

## Adaptation procedure

SIPART DR21 utilises a rugged adaptation procedure that significantly simplifies the commissioning of even the most critical control loops.

The controller automatically calculates the optimum control parameters, and does not assume that the user has any prior knowledge of how the control loop might respond. The procedure used is suitable for loops with compensation and an aperiodic transient response. Dead times are also taken into account.

## Analog input

The SIPART DR21 controller has a total of 4 analog inputs, 2 of which are already included in the standard unit. The other inputs can be configured if required.

These inputs can be connected to the "function inputs"  $x_1$ ,  $x_2$ ,  $x_3/w_e$ ,  $y_N$ ,  $y_R$  and  $z$ .

The function inputs act as the analog input channels for the different types of controller. What role the function inputs have therefore depends on the configuration of the controller.

Function input  $z$  is used as an input for feedforward control, where the disturbance  $z$  can either be connected dynamically via the D element or statically, weighted by a factor, to the manipulated variable  $y$ .

A 1st order filter for the suppression of external interference and a square-root extractor can be connected in each analog input channel.

A lineariser with 13 vertices and knee-point smoothing can be connected to one of the analog inputs.

## Controller manipulated variables

### ■ K controller (continuous output)

In this configuration of controller, the manipulated variable is output as a standardized current signal. The signal range (0/4 to 20 mA) is determined when the controller is configured.

### ■ S controller (switching output)

It is preferably to use the floating relay contacts to output the manipulated variable. These contacts are provided with a protection circuit adapted to the contactor coils.

It is important to ensure that the maximum switching voltage is not exceeded. Phase shifting motors must therefore only be connected via intermediate switching devices.

The relay contacts are mutually interlocked. This interlock can be disabled for a universal digital output.

Digital outputs are at disposition to output the manipulated variable at a high switching rate.

Used as S controller, the analog output can then be used for output of an internal process quantity ( $x$ ,  $w$  or  $x_d$ ).

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### ■ Two-step controller

The manipulated variable  $y$  is output as a pulse duty factor with a variable period. In the case of two-step controllers with heating/cooling outputs, a different period can be allocated to each output. Each stage then runs through the pulse duty factor from 0 to 100 %. The dead zone between the heating/cooling stages can be entered as a parameter.

Main application for this type of controller: temperature controller that, for example, switches the heating or cooling power on and off, or that opens and closes a solenoid valve.

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

### Digital inputs and outputs

The 2 digital inputs and outputs in the standard controller are connected during configuring to the digital functions required for the application.

They are non-isolated and operate in either normal or inverted mode, depending on how the controller is configured.

The digital outputs are active. They provide a DC voltage signal.

The number of digital inputs and outputs can be increased by installing additional option modules.

In addition, a coupling relay module can be snapped onto the DIN rail on the rear of the controller. This module can have either 2 or 4 relays, each with 1 changeover contact for 250 V AC, 8 A, which are controlled from the digital outputs.

The following functions can be connected to the digital inputs and outputs.

### ■ Digital inputs

<b>CB</b>	Computer ready
<b>He</b>	Manual mode, external
<b>N</b>	Tracking
<b>Si</b>	Safety mode
<b>P</b>	Controller P mode
<b>tS</b>	Disable setpoint ramp time
<b>± yBL</b>	Direction-dependent blocking of manipulated variable
<b>BLB</b>	Blocking of command level
<b>BLS</b>	Blocking of configuring
<b>BLPS</b>	Blocking of parameterization and configuring
<b>tSH</b>	Stopping of setpoint range

### ■ Digital outputs

<b>RB</b>	Computer relay
<b>RC</b>	Computer mode
<b>H</b>	Manual mode
<b>N<sub>w</sub></b>	Setpoint tracking mode
<b>A1,2,3,4</b>	Alarm monitor A1, A2, A3, A4
<b>MUF</b>	Transmitter fault
<b>± Δw</b>	Incremental $w$ adjustment

### Display technology

The SIPART DR21 controller is equipped with easy to read displays that conform to NAMUR requirements.

There is an analog indicator for both the actual value  $x$  and the setpoint value  $w$ , a digital indicator that can be switched between  $x$  and  $w$ , a digital indicator for the manipulated variable  $y$ , plus alarm and status indicators.

Both analog indicators are implemented as vertical LED bargraphs. As the actual value and setpoint indicators are located next to each other, a setpoint/actual comparison for dynamic trend purposes is very easy.

The red digital indicators for the actual and setpoint values have 4 digits and can be configured in an engineering unit or as a percentage value.

11 LEDs are situated on the front of the controller for indicating operating status and alarm conditions.

Some of these displays and controls may be assigned different functions in the configuring levels.

### Configurable functions

Application-specific circuits are prewired in the EPROM of the SIPART DR21 controller and can be easily called up.

The configurable functions of the controller (configuring switch S1) are shown below as block diagrams and described briefly. For the sake of clarity, only the most important functions are discussed. Other configuring options applicable to all types of controller are described in the subsequent pages.

The constants  $c_1$  to  $c_7$  shown in the following diagrams can be entered as parameters.

An additional disturbance can be superimposed on the manipulated variable either dynamically via the D element or as a static value through the function input  $z$ .

**Description**

- Configuring switch S1 = 0, fixed setpoint controller

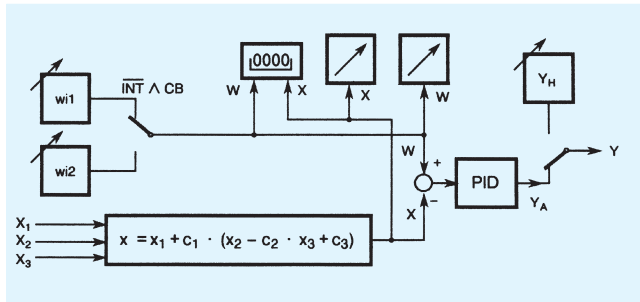


Fig. 5/3 Fixed setpoint controller with one or two independent setpoints as one, two or three-component controller

The setpoints  $w_{11}$  and  $w_{12}$  can be individually adjusted from the front module. The switchover function can be blocked.

- Configuring switch S1 = 2, DDC controller

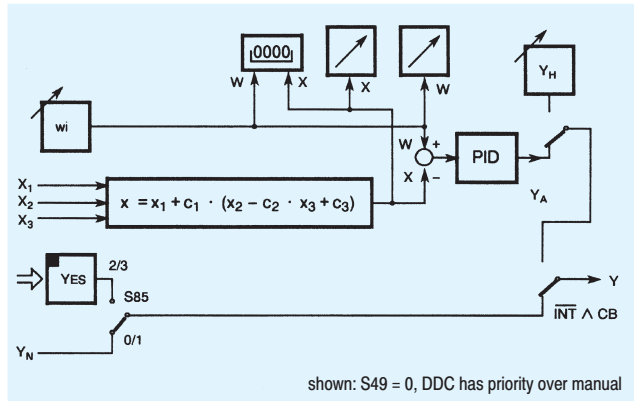


Fig. 5/5 DDC fixed setpoint controller as one, two or three-component controller

In DDC mode (Direct Digital Control) the control function is handled directly by a process computer. The function of the control loop is safeguarded in the event of a computer failure by having a compact controller wired in parallel.

- Configuring switch S1 = 1, slave, synchro or SPC controller

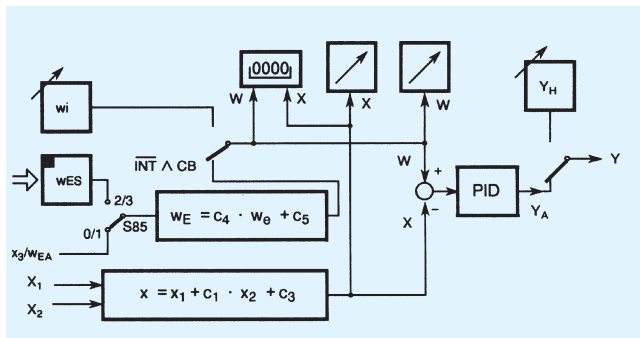


Fig. 5/4 Slave, synchro or SPC controller (Setpoint Control) with internal/external switchover

The remote setpoint can be entered in the controller as an analog signal through the function input  $x_3$  or via the serial interface.

For synchronization purposes, the constant  $c_5$  can be added to the setpoint, which can be also weighted by the factor  $c_4$ .

- Configuring switch S1 = 3, ratio controller

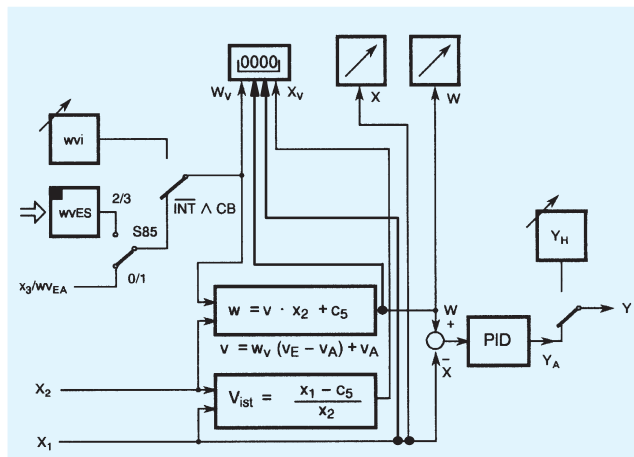


Fig. 5/6 Fixed or controlled ratio controller with internal/external switchover

The controlled variable and weighted command variable are entered in the controller through the function inputs  $x_2$  and  $x_1$ . With this type of controller, the variable setpoint value is not an absolute value, but is specified as a factor  $v$  ( $w_v$ ) derived from the ratio between the controlled variable and the command variable.

The standardized setpoint ratio  $w_v$  or actual ratio  $x_v$  can be displayed in the 4-digit digital indicator (switchable). The controlled variable  $x$  and the setpoint  $w$  can be displayed in the physical range if required. The controlled variable  $x$  and the weighted setpoint  $w$  are displayed in the analog indicators.

The ratio factor can be controlled externally. In this case the switchover structure is the same as that of a slave controller. As the switchover can be blocked, though, the instrument can also be used as a ratio controller in this configuration.

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- Configuring switch S1 = 4, control station/process variable indicator

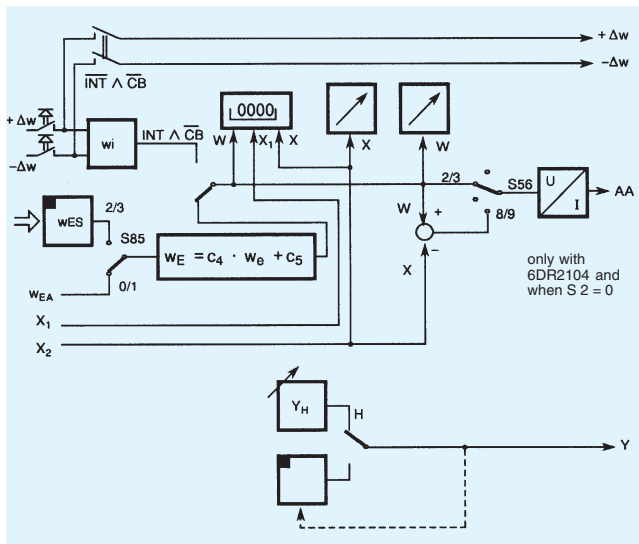


Fig. 5/7 M/A control station/process variable indicator

In this configuration, the SIPART DR21 is used as a:

- M/A control station for parallel process operation, e. g. with a SIPART DR22 controller
- Manual control unit for the output of an analog or switching setpoint or manipulated variable value
- Process variable indicator for up to 3 measured values.
  - two analog indicators with parallel digital indicator; if the measuring range is the same, the physical value can also be displayed
  - a digital indicator 0 to 100 %.
  - monitoring of up to 4 limit values
  - if analog indication is being used, the limit values can be output on the second analog indicator.

## Other configurable functions to enhance the ease of use and operational safety of the SIPART DR21 controller

- Transmitter monitoring

A message is output on the 4-digit digital indicator whenever the measurements go out of limits ( $< -3\%$  or  $> +103\%$  of the signal range). A different message can be output for each input. A group fault message can be output on the MUF digital output.

Furthermore, automatic switchover to manual mode, starting with the value of the last manipulated variable or the safety value, can be selected.

- Setpoint limitation

The effective setpoint value is always limited.

- Setpoint ramp

The  $t_s$  parameter specifies the rate of change of the setpoint value.

- x-tracking

In manual, tracking and DDC mode, and also when the safety value is active, the setpoint  $w$  tracks the controlled variable  $x$ .

- Filter and response threshold of control difference

The control difference is controlled by an adaptive filter (tF) so that low-frequency interference can also be filtered out.

If the output of the controller needs to be stabilized more, a response threshold for the control difference can be entered.

- Varying the direction of control

The default setting of the controller is for normal-action control loops. The direction of action of the controller should be inverted in the case of reverse-action control loops.

- Special features of the control algorithm

The P(D) and PI(D) control algorithm for the controller is implemented as a non-interacting parallel structure and is independent of the output structure (S or K) of the controller.

The switchover from PI(D) to P(D) control is performed by a control signal. In P(D) mode, the specified  $K_P$  value multiplied by the constant  $c_7$  is used.

The switchover from automatic to manual mode (and vice versa), plus the switchover to automatic from all other modes of operation, is bumpless.

This function is also operative in P(D) mode with automatic setting of the working point  $Y_0$ .

If this is undesirable, the working point in P(D) operation can be set manually if required (using parameter  $Y_0$ ). Switchover to automatic will then not be bumpless. In the case of S controllers, P mode is only permitted with external position feedback.

## Description

### ■ Limiting the manipulated variable

The parameters YA and YE can be used with K output and S output with external feedback to limit the manipulated variable.

Limiting the manipulated variable like this is – depending on how the controller is configured – only possible in automatic mode or in all modes.

In addition to the fixed limiting of the manipulated variable described here, an additional, direction-dependent limiting of the manipulated variable is provided in the SIPART DR21 controller. This limiting is activated by the control signals +yBL and –yBL and is effective in all modes of operation.

### ■ Limit monitor

The alarm functions A1/A2 and A3/A4 can be assigned in pairs to monitor all internal controller process variables. They can also be configured to monitor maximum-minimum, maximum-maximum or minimum-minimum values.

Violations of minimum/maximum values are indicated on the A1/A2 and A3/A4 LEDs and can be configured to output messages on the digital outputs, the logic of which can be inverted.

The limit values are normally specified in the parameterization level. The alarms may also be specified and displayed in the process operation level (x/w digital indicator).

In addition, the limit values can be indicated continuously on the green LED bargraphs. The analog setpoint indicator is then omitted. The appropriate LED starts to flash when a limit value is violated.

The hysteresis for the pairs of limit monitors is specified as a parameter.

### ■ Restart conditions

Short dips in the mains voltage are, depending on the current loading of the instrument, handled by the buffering capability of the power supply unit.

In the case of a longer power failure, the parameters and configuring data that have been entered are retained in a non-volatile user program memory. The most recent mode of operation and the last setpoint and manipulated variable values are also held in non-volatile memory.

When power is restored following a power failure or after the controller is switched on, the controller automatically restarts using the configured mode of operation, setpoint and manipulated variable values.

An optical signal can also be generated to indicate that power has been restored following a power failure.

### ■ Self-diagnosis

Comprehensive monitoring routines check the internal data traffic cyclically or following a POWER-ON or Watchdog reset.

If an error is detected, an error message is automatically output on the w/x digital indicator. The error message indicates the cause of the error and how it can be remedied.

### ■ Communication with higher-level systems

The SIPART DR21 controller can transmit and receive status flags, process variables, parameters and configuring switch settings via interface module (option).

The following interface modules are available:

#### **PROFIBUS DP module**

- Transmission rate up to 1.5 Mbits/s
- Address range up to 125  
(number of possible stations on the PROFIBUS is determined by the master interface module, the data range of the interface module, and the number of parameterized process data)

#### **SES module RS 232/RS 485**

- Transmission rate 9.6 kbits/s
- RS 232 as point-to-point connection
- RS 485 up to 32 stations

The advantages of the stand-alone SIPART DR21 controller can still be utilized to the full, even when used in conjunction with supervisory systems:

- Straightforward adaptation of each controller to meet the requirements of the task in hand
- Operational safety: if the supervisory system, or part of it, shuts down or fails, the SIPART DR21 controller continues to function as an independent controller under the same conditions as before
- Flexibility: modifications or additions to individual control loops are also possible while the system is in use
- Downloading the functions of the controller to individual devices in SPC mode lightens the load on the supervisory system
- The distributed structure of the system enhances overall clarity.

#### Input/output modules (option modules)

The hardware configuration of the standard unit can be extended to cater for special requirements. A range of modules, which can be ordered as accessories, are provided for this purpose.

These modules are inserted in slots in the rear of the controller. The slots are coded to prevent modules being inserted incorrectly.

Some settings on the modules may need to be modified before they are inserted in the controller.

Configuring switches are used to make the necessary connections to the inputs and outputs.

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## Description

### Control and display functions

The setting of parameters is distributed over several configuring levels. This makes it very straightforward and simple to modify the controller configuration to the task in hand.

To enter the individual levels, several inputs have to be made explicitly within a specified time limit. Incorrect operation of the controller is therefore practically impossible.

Operation of the SIPART DR21 controller takes place at 3 levels:

- Process operation level
- Selection level
- Configuring level

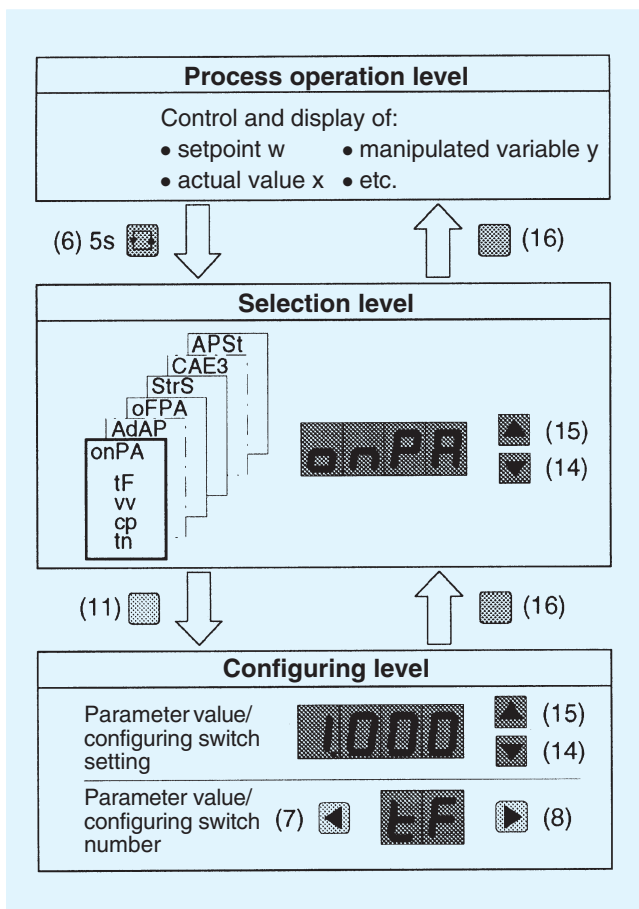


Fig. 5/8 Control levels of SIPART DR21 controller

### Process operation level (Fig. 5/9)

The layout and color of controls, displays and the front fascia itself make operation of the SIPART DR21 controller in this mode self-explanatory.

Depending on the configuration, the four-digit digital indicator (3) shows either the actual value  $x$ , the setpoint  $w$  or the limit values A1 to A4. Use pushbutton (6) to toggle the indicator.

The LEDs (4 and 5) and the digital indicator (9) indicate which of the above mentioned variables is currently being displayed.

The green LED bargraph (2) shows the setpoint value or the enabled alarms, the red LED (1) the actual value.

The internal setpoint value of the SIPART DR21 controller is set using pushbuttons (14 and 15). The rate of change of the value increases the longer a button is pressed.

Pushbutton (16) is used to toggle between internal and external mode. LED (17) illuminates when in internal mode. Setpoint switchover is disabled when the controller is shipped from the factory.

The yellow pushbutton (11) toggles between manual and automatic mode. Which mode is active is signalled by the yellow LED (12).

Another yellow LED (13) indicates external modification of the manipulated variable, e. g. in tracking mode. The manipulated variable can be set in manual mode using the yellow pushbuttons (7 and 8). The value is displayed on the red, two-digit digital indicator (9).

On K controllers, the rate of change of the value increases the longer a button is pressed.

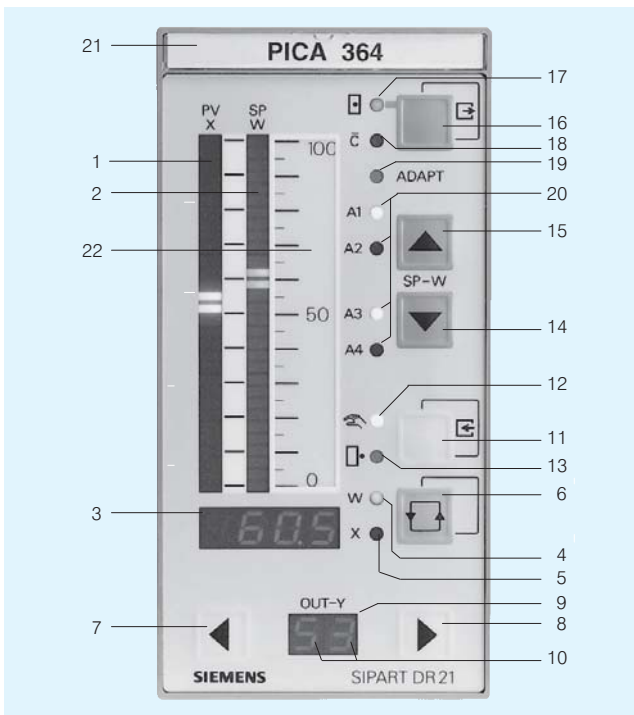
The red LEDs (10) display the +/- $\Delta$  increment in all modes of S and two-step controllers.

Violation of limit values is indicated by the LEDs (20).

LED (19) signals the progress of parameter optimization during adaptation through either a steady or flashing light.



## Description



- 1 Analog indicator actual value x
- 2 Analog indicator setpoint w
- 3 w/x digital indicator (other values can be displayed)
- 4 Signal lamp w - illuminates when w is being displayed
- 5 Signal lamp x - illuminates when x is being displayed
- 6 Toggle button for w/x digital indicator, button to acknowledge flashing following restoration of power and entry button for selection level
- 7 Button to modify manipulated variable - down (up)
- 8 Button to modify manipulated variable - up (down)
- 9 y digital indicator
- 10 Signal lamps of  $\Delta y$  digital outputs on S controller
- 11 Toggle button Manual/Automatic and button to enter configuring level from selection level
- 12 Signal lamp Manual mode
- 13 Signal lamp "y-external mode"
- 14 Reduce setpoint value button
- 15 Increase setpoint value button
- 16 Toggle button - internal/external setpoint and button to exit configuring and selection levels and return to process operation level
- 17 Signal lamp "Internal setpoint"
- 18 Signal lamp "Computer (with  $w_{ext}$ ) switched off"
- 19 Signal lamp "Adaptation in progress"
- 20 Alarm lamps "Limit value violated"
- 21 Tagging label
- 22 Scale

Fig. 5/9 Controls and displays

Selection and configuring levels

First of all, the function of the front control and display panel is switched from the process operation level to the selection level.

This is done by pressing and holding the pushbutton (6) until a flashing "PS" is displayed on the 2-digit digital indicator. On releasing the pushbutton, "PS" is displayed constantly and "onPA" appears in the w/x digital indicator (3). The controller is now in the selection level, from where the parameter lists, the configuring switch list or commissioning functions can be selected.

Use the pushbuttons (14 and 15) to page through the selection level.

Having changed to configuring level, the parameter and configuring switch settings of the selected lists can be displayed and modified.

You can switch to the relevant mode by pressing the Enter button (11) as soon as the letters indicating parameterization or configuring mode appear in the display (3). The parameter or configuring switch is selected using pushbuttons (7 and 8) and then modified according to the tables on page 5/11 using push-buttons 14 and 15.

Press the Exit button (16) to quit the selected level.

Control mode remains active while the "on-line parameters" are being set. The response of the system to modifications to control parameters can therefore be seen immediately.

The output of the controller is blocked when setting the configuring switches, the off-line parameters or the settings of the UNI module.

- The K controller freezes the last control current.
- The two-step controller freezes the last pulse duty factor.
- The S controller issues no more positioning pulses.

A zebra pattern is displayed in the green analog indicator to indicate off-line mode.

The configuring levels

**AdAP** (adaptation) and

**CAE3** (calibration "UNI module" on analog input 3)

are only displayed if they have been configured.

Lamp test

If pushbutton (6) is pressed and held for more than 5 sec., all LEDs on the front of the controller are illuminated, regardless of what is currently being displayed, until the button is released. The displays revert to their original form when the lamp test is complete.

Display of firmware status

The present firmware status of the SIPART DR21 controller can be displayed if required.

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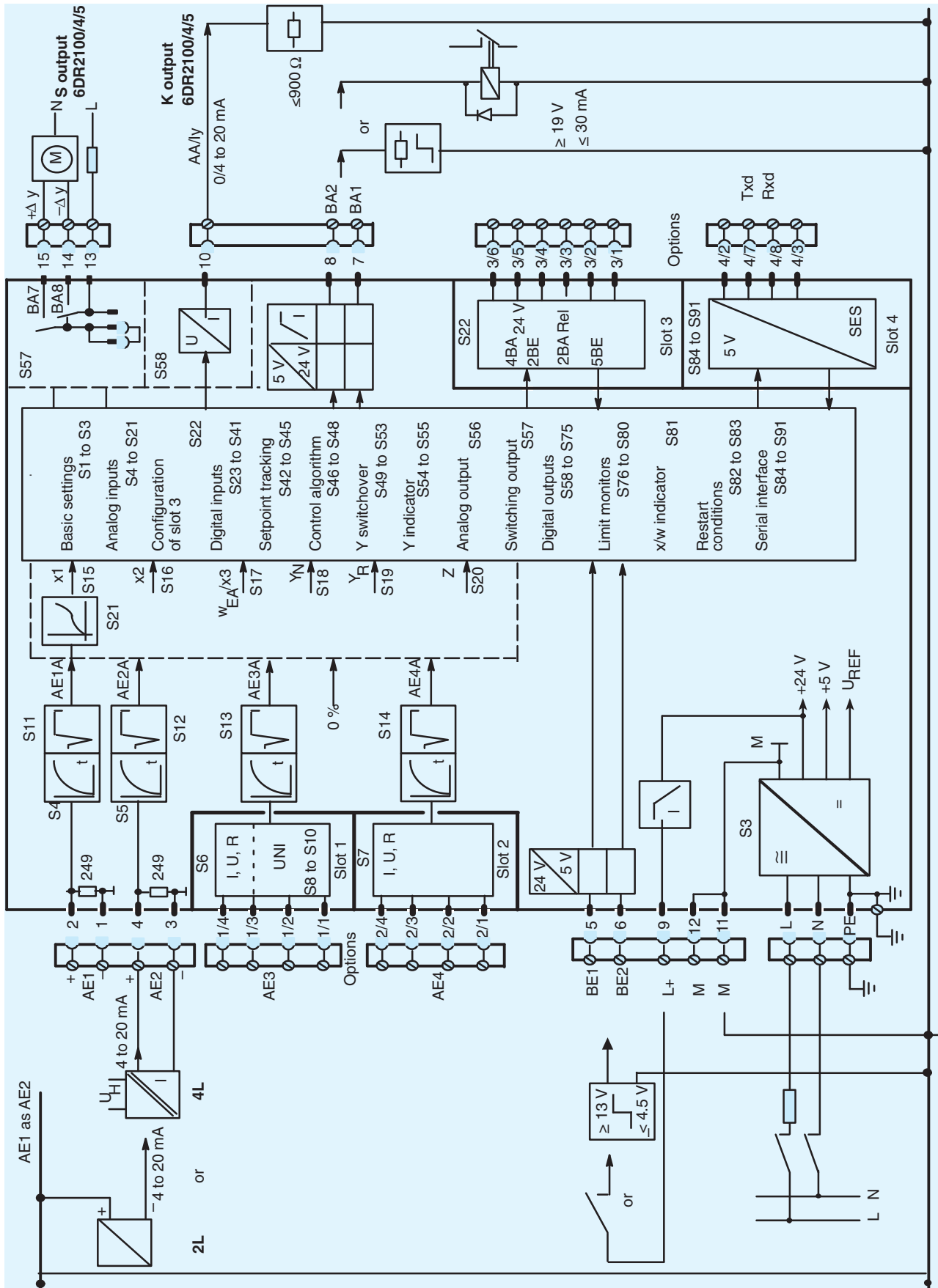


Fig. 5/10 SIPART DR21 controller, function diagram

## Description

## Configuring switch list

Configuring switch	Function
S1	Type of controller
0	Fixed setpoint / three-component controller, both with 1 or 2 independent setpoints
1	Slave / synchronization/ SPC controller
2	DDC controller
3	Ratio controller
4	Control station / Process variable indicator
5	Fixed setpoint controller for coupling to a process control system, from firmware release A05 onwards
6	Slave controller for coupling to a process control system, from firmware release A7 onwards
S2	Output configuration
0	K controller
1	Two-step controller for heating/cooling
2	S controller with internal feedback
3	S controller with external feedback
S3	Mains frequency suppression
0	50 Hz
1	60 Hz
S4 and S5	Signal range 0 or 4 to 20 mA of analog inputs AE1 and AE2
S6 and S7	Configuration of slots 1 (AE3) and 2 (AE4)
S8 to S10	Specifying of measured variable, type of sensor and engineering unit for slot 1 (AE3) when configured with UNI module
S11 to S14	Extract square root of analog inputs AE1 to AE4
S15 to S20	Assignment of function inputs $x_1$ , $x_2$ , $x_3/w_e$ , $y_N$ , $y_R$ , $z$ to analog inputs AE1 to AE4
S21	Assignment of lineariser to AE1 to AE4 or $x_1$
S22	Slot 3 configuration

S23 to S33	Assignment of control signals CB, He, N, Si, P, ts, +yBL, -yBL, BLB, BLS, BLPS to digital inputs BE1 to BE7
S34 to S40	Logic of control signals
S41	Effect of control signal CB, static or dynamic (pulse)
S42 to S45	Setpoint switchover
S46	Direction of action of controller
S47	Feedforward control of D element
S48	Adaptation: type of adaptation
S49 to S53	Manual/Automatic, switchover, priority N or H, disable $y$ , $y$ limiting
S54 and S55	Manipulated variable display: Selection of displayed variable and logic
S56	Assignment of internal controller signals to the analog output
S57	Assignment of the $+/-\Delta y$ outputs to the digital outputs BA1/BA2 or the relay outputs BA7 and BA8
S58 to S68	Assignment of alarm signals RB, RC, H, Nw, A1, A2, A3, A4, MUF, $+\Delta w$ , $-\Delta w$ to digital outputs BA1 or BA6 or the relay outputs BA7 and BA8
S69 to S75	Logic of alarm signals
S76 and S77	Assignment of limit monitors A1/A2 and A3/A4 to internal process variables
S78 a. S79	Function of limit monitors A1/A2 and A3/A4
S80 and S81	Selection of display values for the w/x digital indicator
S82 and S83	Restart conditions following restoration of power supply
S84 to S91	Serial interface settings: station no., data transmission rate, parity
S92	Assignment of control signal tSH to digital inputs BE1 to BE7

## On-line parameters

tF	Filter time constant for filter xd (adaptive)
Vv	Derivative action gain
$K_P$	Proportional gain
$T_n$	Reset time
$T_v$	Derivative action time
AH	Response threshold
$Y_0$	Working point - P(D) controller
YA	Lower limit of manipulated variable
YE	Upper limit of manipulated variable
tP	Increase $y$ time / duration of heating period
tM	Decrease $y$ time / duration of cooling period
tA	Min. positional pulse interval
tE	Min. positional pulse length
t1 to t4	Filter time for the inputs AE1 to AE4
c1 to c7	Constants c1 to c7
dr	Display refresh rate

## Off-line parameters

dP	Decimal point (w/x digital indicator)
dA	Start-of-scale digital indicator
dE	Full-scale digital indicator
A1 to A4	Alarms A1 to A4
HA	Hysteresis A1 to A4
SA	Lower setpoint limit
SE	Upper setpoint limit
SH	Safety setpoint
tS	Setpoint ramp time
vA	Lower ratio factor
vE	Upper ratio factor
YS	Safety manipulated variable
Y1	Dual setpoint contr.: split range left (heating)
Y2	Dual setpoint contr.: split range right (cooling)
L 1 to L11	Output vertices for lineariser (input vertices are equidistant)
Pd	Decimal point
Ad	Start-of-scale value
Ed	Full-scale value

} for S1 = 3 only

# SIPART DR21 Controllers

## Technical data

### Technical data

#### General

Mounting position	Any
Climatic classes	
- Storage: 1K2 according to DIN IEC 721 Part 3-1	-25 to +75 °C
- Transport: 2K2 according to DIN IEC 721 Part 3-2	-25 to +75 °C
- Operation: 3K3 according to DIN IEC 721 Part 3-3	0 to +50 °C
Protection acc. to EN 60 529	
Front	IP 64
Housing	IP 30
Terminals	IP 20

#### Controller design

##### Electrical safety

- to DIN EN 61 010 Part 1
- Protection class I
- Safe separation between supply connection and field signals
- Clearances and creepage paths for surge class III and pollution level 2, unless stated otherwise

EC Declaration of Conformity No. A5E00065058I - 01

#### Conformity

The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

#### 2004/108/EC EMC

Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.

#### 2006/95/EC LVD

Directive of the European Parliament and of the Council on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

Emitted interference, immunity to interference to EN 61 326, NAMUR NE21 8/98

Weight of standard controller	Approx. 1.2 kg
Color	
Fascia frame	RAL 7037
Fascia	RAL 7035
Material	
Housing and fascia frame	Polycarbonate, reinforced with glass fiber
Front foil	Polyester
Power supply connections	
115/230 V AC	3-pin earthed plug IEC 320/V DIN 49 457A
24 V AC/DC	Special 2-pin plug
Connections for process signals	Multi-pin screw-type terminal blocks, protected against reversed polarity for cables of 1.5 mm <sup>2</sup> (AWG 14) diameter
Protective earth connection	Earthing screw

A rail can be mounted on the rear panel of the power supply. The rail is included in the delivery of the coupling relay mode.

The connectors for the auxiliary supply and the screw-type terminal blocks for the process signals are part of the scope of the supply of the standard controller or the option modules.

Exception:  
6DR2803-8C interface module and 6DR2803-8P PROFIBUS DP module.  
The connectors have to be ordered separately..

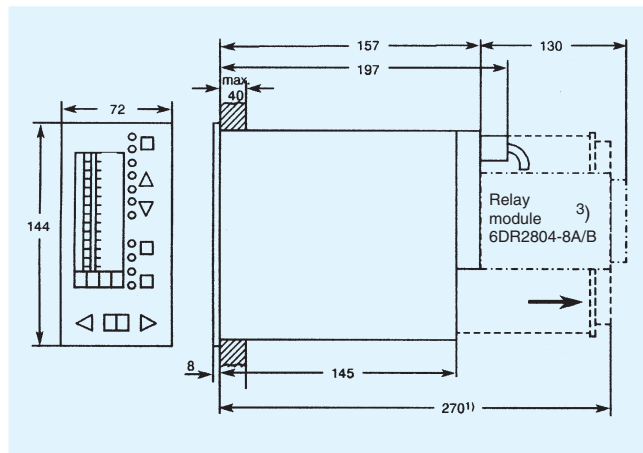
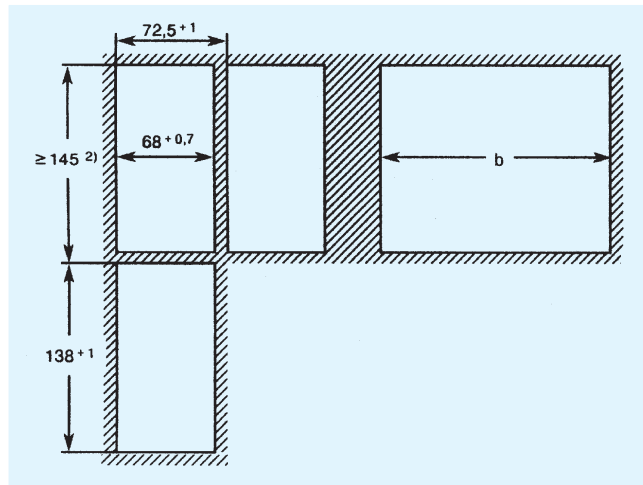


Fig. 5/11 SIPART DR21 controller, dimensions in mm



No. of devices	Cut-out width
2	140 + 1
3	212 + 1
4	284 + 1
.	.
10	716 + 1

Fig. 5/12 Panel cut-outs, dimensions in mm

<sup>1)</sup> Space required to change motherboard and module.

<sup>2)</sup> Observe ambient temperature when stacking with no intermediate spacing.

<sup>3)</sup> A relay module with 2 or 4 relays (6DR2804-8A/-8B) can be snapped onto the rear of the controller. This will increase the mounting depth by 130 mm.

## Technical data

Technical data (continued)				
Power supply				
Rated voltage	Switchable		24 V AC/DC	
	230 V AC	115 V AC		
Operating voltage range	195 to 264 V AC	97 to 132 V AC	20 to 28 V AC	20 to 35 V DC <sup>1)</sup>
Frequency range	48 to 63 Hz			-
Peak voltages to IEC 801-5 (Pulse: 1.2/50 µs)				
symmetric	1 kV	1 kV	0.5 kV	0.5 kV
asymmetric	2 kV	2 kV	1 kV	1 kV
Total of all output currents (L+, BA, AA and SES)	Max. 200 mA			
Power consumption				
Apparent power (capacitive)				
Standard controller				
- no 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
Permitted voltage dips at $0.85 U_N$				
Standard controller with options	20 ms			
Test voltages (1 min)				
- Primary-secondary	1.5 kV AC		500 V AC	
- Primary-protective conductor	1.5 kV AC		500 V AC	
- Secondary-protective conductor	700 V DC		700 V DC	

<sup>1)</sup> Includes harmonic content.

Standard controller		
Analog inputs AE1, AE2		
Current		0/4 to 20 mA
Input impedance		248 Ω
Output range		-0.1 to +22 mA
Filter time constant		10 ms
Transmitter supply L+		
Rated voltage		20 to 26 V
On-load current		≤ 60 mA, short-circuit proof
Short-circuit current		≤ 200 mA, pulsed
Digital inputs BE1 and BE2		
Signal status "0"		≤ 4.5 V or open
Signal status "1"		≥ 13 V
Input impedance		≥ 27 kΩ
Digital outputs BA1 and BA2 (with wired OR diodes)		
Signal status "0"		≤ 1.5 V
Signal status "1"		+19 to 26 V
On-load current		≤ 30 mA
Short-circuit current		≤ 50 mA, pulsed
Analog output Iy		
Rated signal range		0 to 20 mA or 4 to 20 mA
Output range		0 to 20.5 mA or 3.8 to 20.5 mA
Load voltage		-1 to +18 V
Max. permitted inductive load		0.1 H
Relay output		
Contact material		Ag-Ni
Contact rating		
Max. switching voltage	250 V AC	250 V DC
Max. switching current	8 A	8 A
Max. switching capacity	1250 VA	100 W at 24 V 30 W at 250 V
Service life		
Mechanical		$2 \cdot 10^7$ switching operations
Electrical 230 V AC, Ω loading		$2 \cdot 10^6$ switching operations
Spark suppressor		22 nF and 220 Ω connected in series with a 420 V varistor wired in parallel
CPU data		
Cycle time		100 ms
A/D conversion		
Method		Successive approximation with > 120 measurements per input and averaging within 20 or 16.67 ms
Resolution		11 bit $\Delta$ 0.06 %
Zero error		≤ 0.2 % of measuring span
Gain error		≤ 0.2 % of measuring span
Linearity deviation		≤ 0.2 % of measuring span
Display technology		
Digital x/w indicator		4-digit, red, 7 segment LED display
Character height		7 mm
Display range		Adjustable start and full scale
Numerical range		-1999 to +9999
Decimal range		Adjustable (fixed-point)
Refresh rate		0.1 to 9.9 s, variable
Analog x indicator		Vertical row of 30 LEDs (red)
Analog w indicator		Vertical row of 30 LEDs (green)
Display range		0 to 100 %
Resolution		1.7 %
Digital y indicator		2-digit, red, 7 segment LED display
Character height		7 mm
Display range		0 to 100 %
Resolution		1 %
Refresh rate		0.1 to 9.9 s, variable

## SIPART DR21 Controllers

## Ordering data

Ordering data	
	Order No.
<b>SIPART DR21 controller 72 x 144,</b> Basic unit with <ul style="list-style-type: none"> <li>- 2 analog inputs</li> <li>- 2 digital inputs</li> <li>- 1 analog output</li> <li>- 2 relay outputs</li> <li>- 2 digital outputs</li> <li>- power supply AC/DC 24 V</li> <li>- power supply AC 230 V, switchable to AC 115 V</li> </ul>	<b>6DR2100-4</b>  <b>6DR2100-5</b>
<b>Input/output modules</b>  <b>Module for analog signals</b> <ul style="list-style-type: none"> <li>- For current input 0/4 to 20 mA or 0/0.2 to 1 V or 0/2 to 10 V voltage input (6DR2800-8J)</li> <li>- For resistance-based sensor (R module) (6DR2800-8R)</li> <li>- For TC/RTD/R/mV signals, programmable (UNI module) (6DR2800-8V)</li> <li>- Reference junction terminal for TC, internal (to be used in conjunction with UNI module (6DR2805-8A))</li> <li>- Measuring range connector for <math>I = 20</math> mA and <math>U = 10</math> V (to be used in conjunction with UNI module (6DR2805-8J))</li> </ul> <b>Switching signal module</b> for the output of limit signals <ul style="list-style-type: none"> <li>- with 5 digital inputs (6DR2801-8C)</li> <li>- with 4 digital outputs and two digital inputs (6DR2801-8E)</li> <li>- with 2 relay outputs (6DR2801-8D)</li> </ul> <b>Coupling relay module</b> <ul style="list-style-type: none"> <li>- With 4 relays (AC 250 V) (6DR2804-8A)</li> <li>- With 2 relays (AC 250 V) (6DR2804-8B)</li> </ul> <b>Interface modules</b> <ul style="list-style-type: none"> <li>- for serial communications (SES) via RS 232</li> <li>- PROFIBUS DP module (6DR2803-8P)</li> </ul>	See Catalog Section 8

## Ordering data

## Documentation

**Quick reference "Operating and configuring"**

- German/English
- French/Spanish/Italian

[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)  
[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)

**Assembly and installation instructions**

- German/English
- French/Spanish/Italian

[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)  
[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)

**Manual**

- German
- English

[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)  
[www.siemens.com/sipartdr](http://www.siemens.com/sipartdr)

Additional Instructions can be downloaded from Internet ([www.siemens.com/sipartdr](http://www.siemens.com/sipartdr))

**SIPART DR****PROFIBUS interface / Instructions**

(Description of the communication via PROFIBUS DP with the controller SIPART DR19/20/21/22/24)

- German
- English

**SIPART DR21****Serial SIPART 6DR210x Bus interface / Instructions**

(Description of the communication via RS 232, RS 485 or PROFIBUS DP with the controller SIPART DR21)

- German
- English

**Scope of supply**

The scope of supply of a SIPART DR21 controller includes:

- 1 controller as ordered
- 1 power supply connector 115/230 V or a special connector for 24 V AC/DC supply
- 2 clamping elements, pluggable
- 1 CD-ROM with complete documentation

**Available ex-stores**

Items marked ■ are available ex-stores.

**Input/output modules and accessories**

The input/output modules are described in section 8.

Section 9 of the catalog contains details about software for parameterizing the controller from a PC, interfacing to systems and the necessary accessories (connectors, line drivers, etc.).

