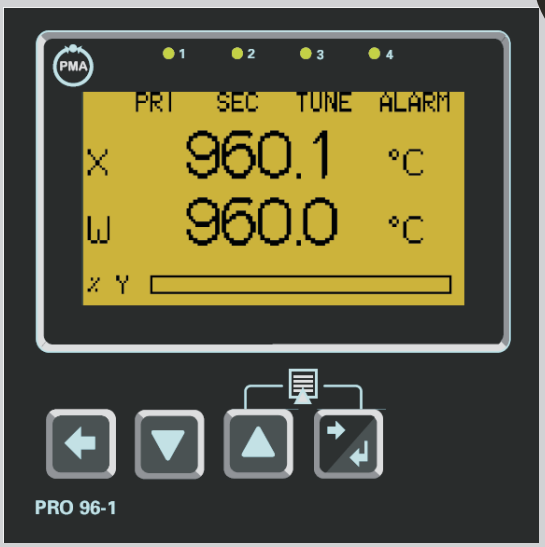


PRO 96-1

Universal program controller

LC-display (green/red) for graphics and text

BluePort® interface and BlueControl software

Optional programmer
max. 255 segments in max. 64 programs
Plain text programs with 5 control tracks

Optional datalogger
Data, alarms, and events

Interfaces for:
RS 485 (Modbus RTU) and Ethernet (Modbus TCP)
Optional front USB port on the frontside

5 operating languages
Englisch, German, French, Italian, Spanish

advanced line

- 100 ms cycle time, i.e. also suitable for fast control loops
- Up to three freely configurable analog outputs, e.g. as process value output
- Up to 9 relay outputs
- Customer-specific linearization for all sensors
- Settings can be blocked via password and internal switch for high security
- Extended temperature range up to 55 °C allows mounting close to the process
- Modular design
  The numerous possibilities this offers leads to a very wide range of applications, but with reduced stocks of spare parts
- Easy 2-point or offset measurement correction
- Logical combination of digital outputs, e.g. for general alarm
- RS 422/485 Modbus RTU interface
- Ethernet interface
- USB port
- Configuration interface
- Optional built-in transmitter power supply
- Splash-water proof front IP 66 (with USB interface IP 65)
- Setup-Wizard

APPLICATIONS

- chamber ovens
- melting and pot furnaces
- climatic and test chambers
- driers
- heat treatment
- test beds
- textile treatment (dyeing)

DESCRIPTION

The PRO 96-1 is a cost-effective temperature and industrial controller with expanded functionality, including a programmer and a datalogger.

The versatile LC display offers comprehensive text and graphical functions for simplified operation, reduced maintenance periods, and faster commissioning.

Instead of cryptic codes – as found in the LED displays of many other products – clear, unambiguous messages in plain text ensure confident and safe operation. Information is presented in a logical sequence, which minimizes the risk of operating errors.

During the configuration of functions, only the relevant operating pages are displayed, whereby an optimized menu structure is created for improved navigation through the operating sequences.
Similarly, the access to specified adjustments and parameters is limited by means of password protection and the definition of Supervisor and Configuration Levels.

Configuration of the PRO 96-1 is supported by a convenient Setup Wizard, which starts automatically with first power-up. Step by step, and in the shortest time, the user is guided safely through the general settings.

Via the front USB port, the entire configuration can be saved to a USB memory stick, e.g. for uploading into identical PRO 96-1 controllers. For configuration, the BlueControl® software package can be used online as well as offline.

Thanks to the flexible input/output modules, the controller can be adapted precisely to individual applications.

For example, the available modules include a universal input (thermocouple, Pt 100, and standard signals), digital inputs, external setpoint input, interfaces for RS 485 and Ethernet (Modbus TCP), and up to nine outputs (relay, SSR driver, triac, standard signals, and 24 VDC transmitter supply).

An optional programmer provides up to 255 segments for max. 64 programs, whereby the available seg-

ments are Ramp, Pause, Stop, Repeat, and Jump to another program.

The programmer can be operated either via the front panel, via an external input, or by means of the internal timer.

Nowadays, the demand for recording the process values for reasons of quality assurance is increasing continuously.
For this purpose, the optional datalogger provides a cost effective means of recording historic data in the form of an exportable *.csv file.

MMI display

- Graphical, clearly readable red or green display *(160 x 80 pixels)*
- Dual colour display (green / red)
- Colour changes e.g. on alarm
- Multi-language option (English, French, German, Italian, Spanish)
- Custom splash-screen on startup (bitmap file)
- Alarm status view
- Trend view
- Status LEDs for heating / cooling
- Self-tuning function and alarm

Configuration and operation

- Convenient setup Wizard for simple configuration (inputs, alarms, outputs, communication, and real-time clock)
- Universal input for thermocouple, RTDs, and standard signals (mA, mV or V)
- Versatile output options: Relay, SSR driver, Triac, and standard signals (max. 9) for precise adaptation to the process.
- Digital inputs (2 max) for setpoint selection, programmer control, datalogger start/stop, control output enable/disable or auto/manual control.
- Configurable menus (via BlueControl® software)
- USB port for local upload/download of configuration files & download of logged data.
- Password protected Supervisor and Configuration mode
- Pre-tune and self-tune function
- Master-slave configuration for multi-zone applications

Programmer (optional)

- Up to 255 segments for free allocation in max. 64 programs.
- Ramp, Dwell, Hold, Loop, or Jump to other program.
- User-defined program names.
- Delayed or real-time (date/time) program start.
- Up to 5 event outputs.

Datalogger (optional)

- Recording of historic process data for analysis or reporting.
- Data exported as *.csv files via front USB port or rear interface.
- Logging of process values, setpoints or alarms (including min, max, and average).
- Run-then-stop or FIFO (first in – first out) buffer recording.
- Logging intervals from 1sec to 30 minutes.

Plug-in unit

PRO 96-1 program controllers are built as plug-in modules. This permits a controller to be replaced very quickly without disturbing the wiring.
All that is needed is a screwdriver to release the front catch.

Display and operation

The high-resolution LC display (160 x 80 pixels) permits operation and display also in unfavourable lighting conditions and viewing angles, thus reducing possible operating errors.

Event-driven switchover of display colour (red/green) and display mode (direct/inverse) increase operator awareness.

Front interface and Engineering Tools

Control parameter adjustment in seconds has now also been implemented in the PRO 96-1 class of instruments.

Via the BlueControl software incl. its simulation functions, and the BluePort® front panel interface, the required set-up for a specific control task can be determined without a detailed study of the operating instructions. Of course almost all adjustments can be done comfortably over the instrument front.

TECHNICAL DATA

INPUTS

PROCESS VALUE INPUT INP1

Scanning cycle:	100 ms
Resolution:	16 bits, always four times better than display resolution.
Input resistance:	>10 MÙ, except for DC mA (5 Ù) and DC V (47 kÙ).
Temperature stability:	Error <0,01% of span per °C change in ambient temperature.
Power supply effect:	Supply voltage influence negligible within supply limits.
Humidity influence:	Negligible if non-condensing.
Process value display:	Display range up to 5% over and 5% under span limits.
Process variable input offset:	Reading adjustable ± controller span. Positive values are added to the measured process value, and negative values are subtracted.
Galvanic isolation:	All outputs (except SSR driver) isolated from each other with 240 VAC.

Thermocouples

Optional decimal point:	With thermocouple input, display can show up to 999.9 °C/°F.
Thermocouple error:	±0,1% of full range, ±1 digit (±1 °C for thermocouple CJC).Linearization error: max. ±0,2 °C (±0,05 typical) on ranges marked * in the table above. Linearization error for other ranges is max. ±0,5 °C. BS 4937, NBS 125 & IEC 584
Sensor break detection	In case of a sensor break, the output is set to the predefined state or value, and the sensor break and max. alarms are triggered.

Pt 100 - RTD

Optional decimal point:	With RTD input, a display up to 999.9 °C/°F is possible.
Error:	0,1% of input range ±1 digit.Linearization error: max. ±0,2 °C (typically ±0,05)Pt 100 sensors to DIN 43760 and BS 1904 (0,00385 Ù/°C).
Lead resistance effect:	<0,5% of input range with max. 50 Ù per lead (symmetric).
Sensor current:	150 µA ±10%.
Sensor break detection:	In case of a sensor break, the output is set to the predefined state or value, and the sensor break and max. alarms are triggered.

Standard signals

Scalable	-9999...9999,9
Decimal point:	Selectable from 0 to 3 places, but limited to 5 display digits (e.g. 9999.9)
Sensor break detection:	Linear (only with 4...20 mA, 2...10 V, and 1...5 V) In case of an open circuited input, the output is set to the predefined state or value, and the sensor break and min. alarms are triggered.
Max. overload:	1 A with current inputs, 30 V with voltage inputs.
Error:	±0,1% of full range, ±1 digit

Measuring range

Thermocouple type		Measuring range	
B	PtRh-Pt6%	+100...1824 °C	+211...3315 °F
C	W5%Re-W26%Re	0...2320 °C	32...4208 °F
D	W3%Re-W25%Re	0...2315 °C	32...4199 °F
E	NiCr-CuNi	-240...1000 °C	-400...1832 °F
J*	Fe-CuNi	-200...1200 °C	-328...2192 °F
K*	NiCr-Ni	-240...1373 °C	-400...2503 °F
L*	Fe-CuNi (DIN)	0...762 °C	32...1402 °F
N*	Nicrosil/Nisil	0...1399 °C	32...2551 °F
	PtRh 20%:40%	0...1850 °C	32...3362 °F
R	PtRh-Pt 13%	0...1759 °C	32...3198 °F
S	PtRh-Pt 10%	0...1762 °C	32...3204 °F
T*	Cu-CuNi	-240...400 °C	-400...752 °F
Optional digits up to 999,9 °C/°F displayable.			

(1) Specification valid from 400°C

Resistance transducers and -ranges

Type	Range	
Pt100 (3-wire)	-199...800 °C	-328...1472 °F
Nl 120	-80...240 °C	-112...464 °F

Current and voltage

Type	Range	Live-Zero
mA DC	0...20 mA DC	4...20 mA DC
mV DC	0...50 mV DC	10...50mV DC
V DC	0...5 V DC	1...5 V DC
V DC	0...10 V DC	2...10 V DC

Inputsignals and -ranges

Type	Option card A	Option card B
mA DC	0...20, 4...20 mA	0...20, 4...20 mA
mV DC		0...50, 10...50mV 0...100 mV
V DC	0...5, 1...5, 0...10, 2...10 V	0...5, 1...5, 0...10, 2...10 V
Potentiometer		<2000 Ω
scalable -9999...9999,9. digit selectable 0 to 3, but limited to 5 digits in the display (e.g. 9999.9)		

Selectable functions

Function	logic'1'	logic '0'
Set-point switch-over	External SP	Internal SP
Auto- /Manual switch-over	Automatic operation	Manual operation
Control outputs	De-activated	Activated
Programmer Start/Hold/End	Start	Hold
Release Hold-segment	Release	*No action*
Program termination	Termination	*No action*
Datalogger	Termination	Start

Linearization curve:	Up to 15 data points can be defined anywhere between 0,1 and 100% of input.

AUXILIARY INPUTS

Error:	±0,25 of input range ±1 digit
Sampling rate:	250 ms
Resolution:	16 bits
Input resistance:	>10 MΩ, except with mA signals (5Ω), and V signals (47 kΩ)
Sensor break detection:	Only with 4...20 mA, 2...10 V, and 1...5 V If the active setpoint is supplied via the auxiliary input, the output value is set to the predefined state or value.
Galvanic isolation:	Double isolation between outputs and inputs (except digital input B)
Auxiliary input scaling:	Scalable as remote setpoint input between –9999 and +9999, but is constrained by the setpoint limit settings.

DIGITAL INPUTS

Potential-free contacts (or TTL):	Open contacts (>5000 Ω) or 2...24 VDC signal = logic '1' / Closed contacts (<50 Ω) or -0,6 to +0,8 VDC signal = logic '0'.
Galvanic isolation:	Double isolation between inputs and other outputs.
Sensitivity of digital inputs:	Edge-triggered. Requires transition from logic '1' to '0' or vice-versa.Response: within 0,25 second

OUTPUTS

⚠ Plastic pegs prevent fitting of older modules without double isolation. Remove the peg to fit dual relays (all dual-relay modules have double safety isolation).

Single relay

Function/contact rating:	Single pole changeover contacts; 2 A resistive at 120/240 VAC.
Lifetime:	>500.000 operations at rated voltage/current.
Galvanic isolation:	Double safety isolation between inputs and other outputs.

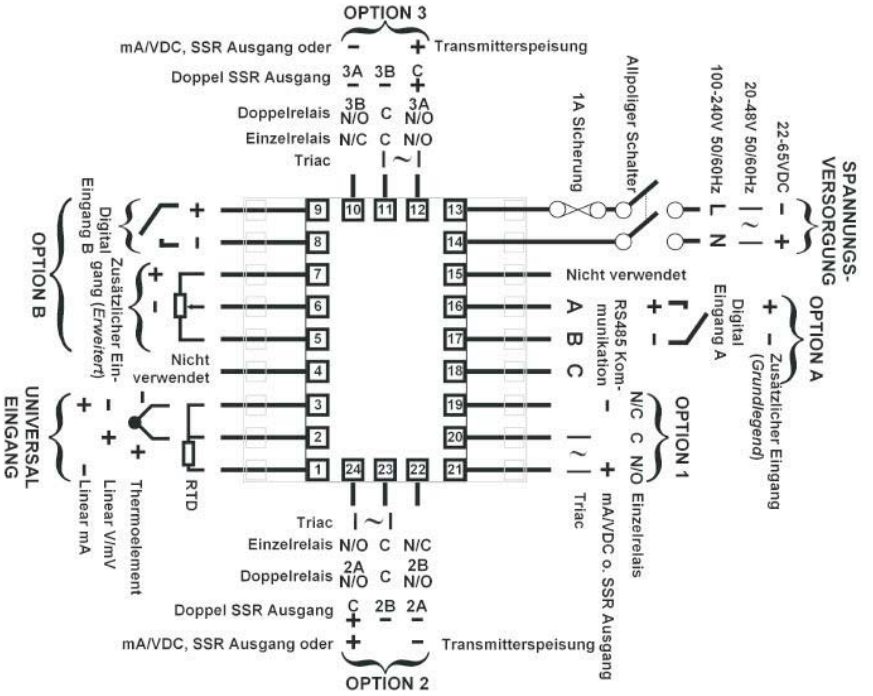
Dual relay

Function/contact rating:	Single pole, normally open; 2 A resistive at 120/240 VAC. Dual relay modules have a common terminal.
Lifetime:	>200.000 operations at rated voltage/current.
Galvanic isolation:	Double safety isolation between inputs and other outputs.

Quad relay

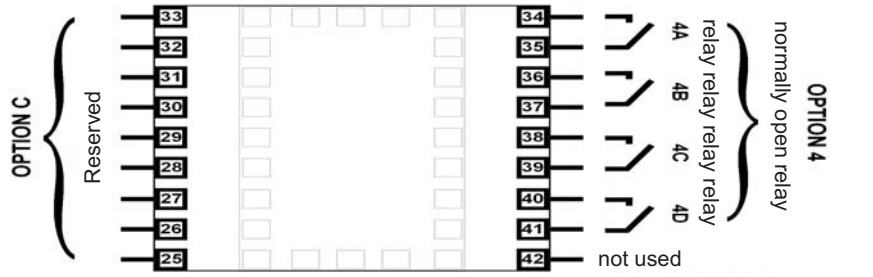
Function/contact rating:	Single pole, normally open; 2 A resistive at 120/240 VAC.
Lifetime:	>500.000 operations at rated voltage/current.
Galvanic isolation:	Double safety isolation between inputs and other outputs.

Electrical connections: Main connections:



The wiring diagrams show all possible option combinations, whereby the necessary connections depend on the options fitted. Use single strand (max. 1,2 mm²) copper wire throughout, except for the thermocouple input, where the correct thermocouple or compensating cable and connectors should always be used.

Additional clamps (optional modules)



SSR drive output

Control signal:	SSR driver voltage >10 V into ³500 Ù.
Galvanic isolation:	Not isolated from the universal input, Ethernet communications or other SSR driver outputs.

Triac output

Supply voltage:	20...280 Vrms (47...63 Hz)
Contact rating:	0,01...1 A (full cycle rms on-state @ 25 °C); de-rates linearly above 40 °C down to 0,5 A @ 80 °C.
Galvanic isolation:	Double safety isolation between inputs and other outputs.

Direct current

Measuring ranges:	0...5, 0...10, 1...5, 2...10 V and 0...20, 4...20 mA (selectable) with 2% over/under drive when used as controller output.
Resolution:	8 bits in 250 ms (typically 10 bits in 1 s or >10 bits in >1 s).
Error:	±0,25% of range, (mA into 250 Ù, V into 2 kÙ). Degrades linearly to ±0,5% for increasing burden (to specification limits).
Galvanic isolation:	Double safety isolation between inputs and other outputs.

Transmitter supply

Supply voltage: 19...28 VDC (24 V nom.) into at least 910 Ù (optionally	the 0...10 VDC output can be used for transmitter energization).
Galvanic isolation:	Double safety isolation between inputs and other outputs.

INTERFACES

Interface for configuration via PC

Connection:	RS 232 to RJ11 socket under case via PC configurator cable.
Galvanic isolation:	Not isolated from universal input or SSR driver outputs. Not for configuration in the field.Caution: Do not connect while controller is in operation.

RS 485

Connection:	Plugs into Option Slot A. Connection via rear terminals (refer to wiring diagram).
Protocol:	Modbus RTU.
Slave/Master mode	Slave address range 1...255 or Master mode.
Supported speeds:	4800, 9600, 19.200, 38.400, 57.600 or 115.200 bits/s.
Parameters:	8 data bits + 1 stop bit. Odd, even or no parity.
Galvanic isolation:	Double safety isolation (240 V) from all inputs and outputs.

Ethernet

Connection:	Plugs into Option Slot A. Connection via RJ45 connector on top of case.
Protocol:	Modbus TCP. Slave only.
Transmission:	10BaseT or 100BaseT
Galvanic isolation:	Double safety isolation (240 V) from the supply, inputs and outputs (except SSR drivers).

USB

Connection:	Plugs into Option Slot C. Connection via front USB port.
Protocol:	USB 1.1 or 2.0 compatible. Mass storage class.
Supply current:	Max. 250 mA.
Storage medium:	USB memory stick.
Galvanic isolation:	Double safety isolation between all inputs and outputs.

CONTROL BEHAVIOUR

Self-tuning types:	Pre-tune, Auto pre-tune, Self-tune or Manual tuning.
Proportional bands:	Primary and secondary outputs (e.g. heating & cooling) 0,5...999,9 % of input span in 0,1 % increments, or On/Off control.
Integral action time Tn:	1 second up to 99 minutes 59 seconds, and Off
Derivative action time Tv:	1 second up to 99 minutes 59 seconds, and Off
Working point:	Adjustable 0...100 % (-100... +100 % of primary and secondary outputs).
Dead band / overlap:	-20...+20% of primary and secondary proportional bands
Switching difference:	Adjustable 0,1...10 % of input span
Auto/manual switchover:	"Bumpless" transfer when switching between automatic and manual control.
Duty cycle:	Adjustable 0,5...512 seconds
Ramping setpoint:	Ramp rate selectable 1...9999 digits/hour and infinite.

ALARMS

Functions of Alarms 1 & 2	Up to 5 alarm types selectable, e.g. min/max process value, tolerance band, control deviation, rate of signal change (per minute), sensor/input break, loop alarm. Tolerance band and control deviation (min/max) alarm values are relative to the active setpoint value.
Alarm hysteresis:	A deadband of 1 digit to full span (in display units) is adjustable for process, tolerance band or control deviation alarms.Rate of change alarm hysteresis is the shortest time (1...9999 secs) during which the rate of change must be above/below the threshold for the alarm to be activated/deactivated. Note:If the duration is less than this time, the alarm will not be activated, no matter how fast the rate of change.
Combination alarm outputs:	Logic OR for:Alarms 1 and 2, 1 to 3, 1 to 4 or 1 to 5.Logical AND for alarms 1 to 5 with programmer events 1 to 5.

OPERATING CONDITIONS (INDOORS)

Ambient temperature:	0...55 °C (operating),
-20...+80 °C (storage).	
Relative humidity:	20...95 %, non-condensing.

ENVIRONMENTAL CONDITIONS

EMC:	CE: Complies with EN 61326.
Safety:	CE: Complies with EN 61010-1.Pollution degree 2, Overvoltage category II.
Protection class (front panel):	IP 66 (IP 65 for front with USB port), IP 20 at rear.

DISPLAY

Type:	160 x 80 pixels, monochrome graphic LCD with a dual colour (red/green) backlight.
Size:	66,54 x 37,42 mm (W x H).
Displayable characters:	0...9, A...Z, a...z, plus ( ) - and _
Trend display:	120 of 240 data points are visible in a scrollable window. Trend display data are lost in case of power failure or if time base is changed.
Displayed data:	Process value (continuous line), setpoint (dotted line), and every active alarm at the time of scan – min/max of process value also between scans (candle-stick graph).Automatic scaling from 2...100% of input span.

DATA LOGGER

Recording memory	1 Mbyte non-volatile Flash memory. Data retained in case of power failure.
Recording interval:	1; 2; 5; 10; 15; 30 seconds or 1; 2; 5; 10; 15; 30 minutes.
Recording duration:	Depends on sampling rate and number of values recorded. Two values can be recorded for up to 7 days at 10s intervals. More values or faster sampling rates reduce the maximum duration.
Buffer battery for RTC:	CR 1616 3V Lithium. Clock runs for >1 year without mains power.
Real-time clock error:	<1 second per day.

PROGRAMMER

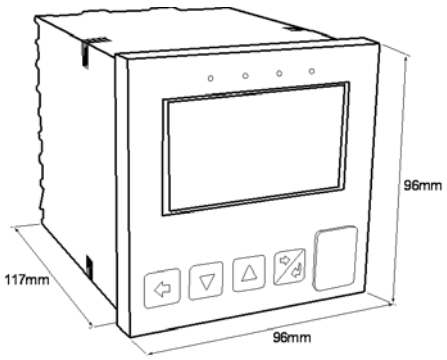
Controllers supplied without the programmer option installed can be upgraded in the field by purchasing a licence code number from your supplier.

Programs:	Max. number of programs = 64.Total number of segments (all programs) = max. 255.
Loop back:	1...9999 Program loops back to specified segment.
Program repeat:	1...9999 program repeats or continuous.
Repeat sequence:	1...9999 repeats of a program sequence or continuous.
Segment types:	Ramp up/down over time, Ramp rate up/down, Step, Dwell, Hold, Join programs, End, Repeat sequence then End.
Timebase:	hh:mm:ss (hours, minutes, seconds).
Segment duration:	Max. segment duration 99:59:59 (hh:mm:ss). Use loop-back for longer segments (e.g. 24:00:00 x 100 loops = 100 days)
Ramp rate:	0,001...9999,9 display units per hour.
Release of a Hold segment:	By pressing a key, timer-controlled, or with a digital input signal.
Start from:	1. Segment starts at respective setpoint or input signal level.
Delayed start:	After 0 to 99:59 (hh:mm) delay, or at a specified date & time.
Behaviour at End:	Continue with last program or controller setpoint, or control outputs 'Off'.
Behaviour at Abort:	Continue with last program or controller setpoint, or control outputs 'Off'.
Behaviour on power failure/signal loss:	Continue program, restart program, maintain last program or controller setpoint, or control outputs 'Off'.
Auto-Hold:	If tolerance band of a segment has been exceeded.
Programmer control:	Run, manual Hold/Release, Abort or Jump to next segment.
Timer accuracy:	Basic timer error: 0,2%.±<0,5 second per Loop, End or Join segment.
Segment events:	Events are active for the duration of the segment. After an End segment, the event state persists until another program starts, the user exits from programmer mode, or the unit is switched off.

DIMENSIONS

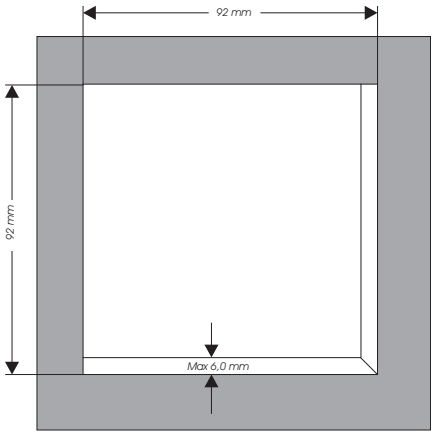
Weight:	max. 0,65 kg
Front format:	96 x 96 mm

Dimensions



Depth behind panel:	117 mm
Mounting panel:	Panel must be rigid, max. thickness 6,0 mm.
Panel cut-out:	92 x 92 mm Tolerance: +0,5 / -0,0 mm.

Panel cut out



Ventilation:	20 mm gap required above, below and behind.

Accessories supplied with unit

Operating instructions
Fixing clamps

ACCESSORY EQUIPMENT

BlueControl (Engineering Tool)

PC-based program for configuring, setting parameters, and operating (commissioning) the PRO 96-1. Moreover, all the settings are saved, and can be printed on demand.

Simulation

The built-in simulation serves to test the controller settings, but can also be used for general training and observing the interaction between controller and control loop.

Software requirements

Windows 95/98/NT/2000.

Hardware requirements

A PC adapter (see "Accessories") or a USB stick is required for connecting the controller.

Updates and demo software can be downloaded from:
www.pma-online.de

ACCESSORIES FOR PRO 96-1

Optional module 1	
Relay output	PO1-R10
SSR-triggering	PO1-S20
mA/VDC-output, linear	PO1-C21
Triac-output	PO1-T80
Optional module 2 and 3	
Relay output	PO2-R10
SSR-triggering	PO2-S20
mA/VDC-output, linear	PO2-C21
Triac-output	PO2-T80
2-x-relay output	PO2-W09
2-x-SSR-triggering	PO2-S22
24VDC MU-supply	PO2-W08
Optional module 4	
4-x-relay output	PO4-R14
Optional module A	
serial RS 485-interface	PA1-W06
digital input 1	PA1-W03
external set-point, input A	PA1-W04
Ethernet-interface	PA1-ETH
Optional-plug position B	
Auxiliary input B	PB1-W0R
BlueControl Basic	9407-999-16001
BlueControl Expert	9407-999-16011
BlueControl Universal	9407-999-19011

VERSIONS

Programmer PRO 96-1	**P96-**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**0**	**x**	**0**	**00**
Device type														
PRO 96-1 controller		**C**												
PRO 96-1 controller with USB-port		**U**												
PRO 96-1 controller with datalogger and USB-port		**R**												
Programmer														
not built in			**0**											
Programmer			**P**											
Power supply														
100...240 VAC				**0**										
24…48V universal supply				**2**										
Optional-slot 1														
not built in					**0**									
Relay output					**1**									
SSR-triggering					**2**									
mA/VDC-output, linear					**L**									
Triac-output					**8**									
Optional-slot 2														
not built in						**0**								
Relay output						**1**								
SSR-triggering						**2**								
mA/VDC-output, linear						**L**								
Triac-output						**8**								
2-x-relay output						**9**								
2-x-SSR-triggering						**S**								
24VDC MU-supply						**T**								
Optional-slot 3														
not built in							**0**							
Relay output							**1**							
SSR-triggering							**2**							
mA/VDC-output, linear							**L**							
Triac-output							**8**							
2-x-relay output							**9**							
2-x-SSR-triggering							**S**							
24VDC MU-supply							**T**							
Optional-slot 4														
not built in								**0**						
4-x-relay output								**1**						
Options-Steckplatz A														
not built in									**0**					
serial RS 485-interface									**1**					
digital input 1									**3**					
external set-point, input A									**4**					
Ethernet-interface									**5**					
Optional-slot B														
not built in										**0**				
Auxiliary input B										**R**				
Language of display and operating manual														
English												**1**		
French												**2**		
German												**3**		
Italian												**4**		
Spanish												**5**		
Russian												**6**		
Customer specific device/ front														**xx**

PMA
Prozess- und Maschinen- Automation GmbH
P.O Box 31 02 29
D - 34058 Kassel
Tel.: +49 - 561 - 505 1307
Fax: +49 - 561 - 505 1710
E-mail: mailbox@pma-online.de
Internet: http://www.pma-online.de

Your local representative:

Printed in Germany - Edition 09/2008 - Subject to alteration without notice - 9498 737 59313