

176-821/2/3

# The Unit

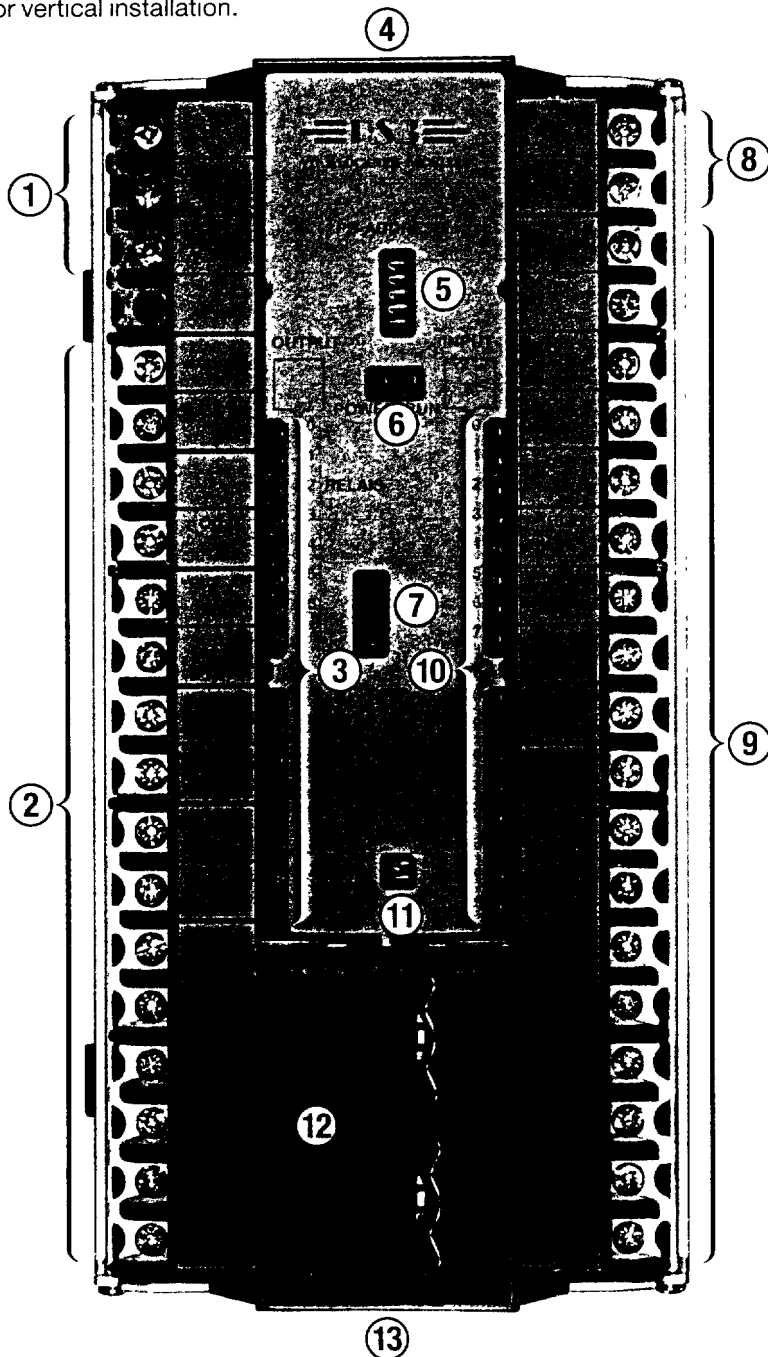
The PS 3 programmable controller is a modern, compact unit suitable for a variety of applications.

Having binary and analogue inputs and outputs, program modules such as timers, counters, comparators, and shift registers, an inbuilt real time clock for time and date-dependent functions; arithmetic commands for the four basic arithmetical functions, it covers virtually all conceivable requirements. For simple positioning controls, the high speed counter input can monitor signals up to 10 kHz.

Data can be processed in bit, byte, or word format, thus speeding up the program cycle time to – typically – 5 ms for 1 000 instructions, making programming quick and simple.

In small control systems, the unit operates as a stand-alone programmable controller. Where the number of inputs and outputs proves insufficient, or where considerable distances are to be bridged between the various input and output locations, up to four PS 3 units can be linked together, or up to 30 PS 3s can be linked to a superordinate PS 32 controller or to a personal computer, via the data interface.

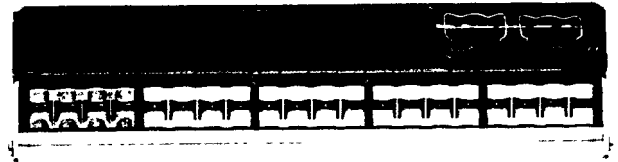
The photograph shows the PS3-AC, with front plate for vertical installation.



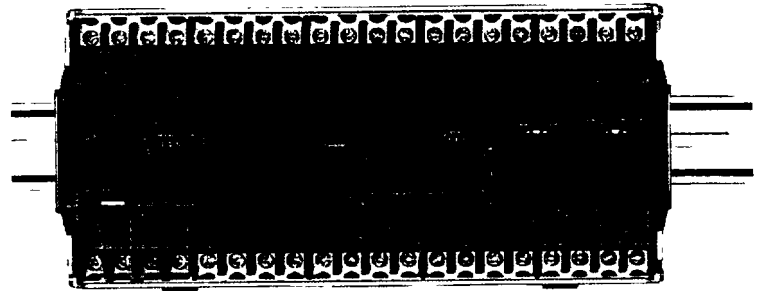
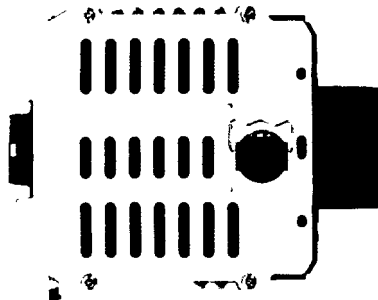
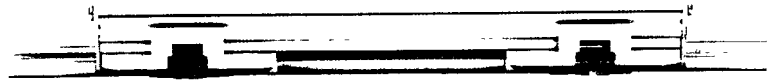
- ① Mains supply
- ② Binary outputs
- ③ LED indication for binary outputs
- ④ Analogue inputs  
Analogue outputs
- ⑤ Setting for mode of operation
- ⑥ Power on, and RUN  
mode indicators
- ⑦ Battery compartment
- ⑧ Power supply for inputs
- ⑨ Binary inputs
- ⑩ LED indication for binary inputs
- ⑪ Interface matching
- ⑫ Interface sockets  
for programming units  
and data links
- ⑬ High speed counter input

# Mounting

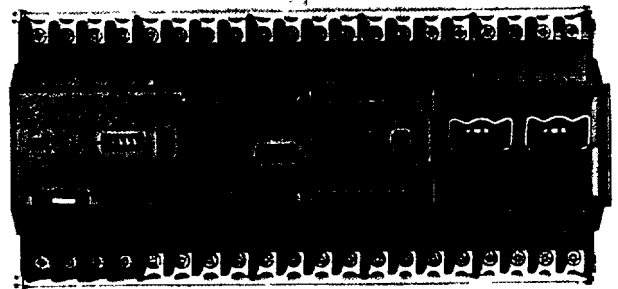
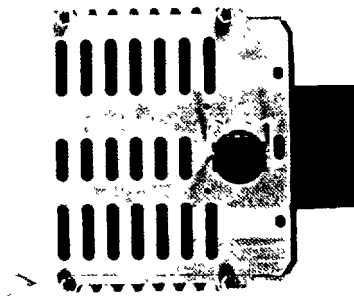
The PS3 can be mounted vertically or horizontally



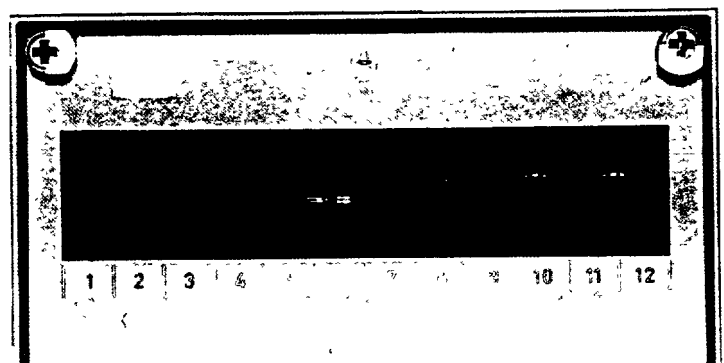
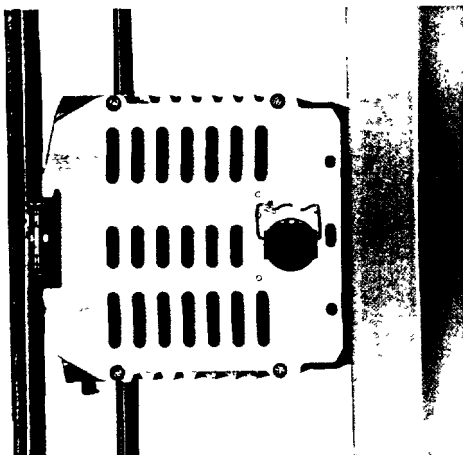
Snap fitted on standard EN 50022 top hat rail



Screw fixing, with mounting brackets

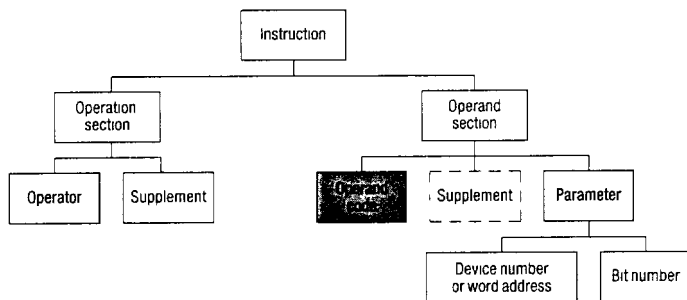


Mounting in service distribution boards



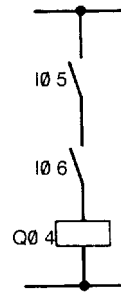
# The Program

The program is the working specification for a programmable controller. Step by step, it describes the entire control sequence. The descriptive elements for a program may vary, but the basis for nearly all program descriptions is the instruction set. This comprises a series of instructions ('orders') to the processor of the controller, which tell it what to do in each case. An instruction is the smallest component part of a program. Every instruction comprises an operation and an operand.



In the operation section, the operator (e.g. L, A, =) lays down how the processor is to use the given operand to deal with the previous result of its operations. The operand section comprises the operand code, any relevant supplement, and the parameter section. The operand code, (e.g. I; Q) describes the type of operand, while the supplement, together with the parameter, make the final, precise selection (e.g. 0.5; 0.6; 0.4).

## Example:



Instruction	Brief explanation	Instruction set (IS)
L I 0 5	Load input 0 5 Load working register with the status of input I 0 5	000 LI 0 5
A I 0 6	AND input 0 6 AND sequence the contents of the working register with the status of input I 0 6	001 AI 0 6
= Q 0 4	= output 0 4 Transfer the contents of working register to output Q 0 4	002 =Q 0 4

Their sequence is important for the correct processing of instructions. For this reason, every instruction is allocated a fixed memory location, which is identified by an address. During processing, these addresses are called up in sequence.

The example corresponds to a current path in a circuit diagram. **One** input or **one** output is always addressed per instruction. Instructions of this nature are known as bit instructions, because the operands can never have more than one status, ON or OFF.

This bit processing can be complex and time consuming when processing analogue signals – converted into digital – or for instance, when monitoring preselector switches or processing arithmetical functions. The PS3 controller therefore allows the simultaneous processing of 8 bit or 16 bit operands, i.e. of 1 byte (8 bit) or 1 word (16 bit) length. Instructions may be in bit, byte, or word format.

Address	Operation Operator	MB	Parameter
008	ADD	2	.0
Bit instruction	000-999	L = Load A = AND O = OR XO = EXCL OR = = Allocation S = Set R = Reset	0 = basic unit 1 = 1st extension 2 = 2nd extension 3 = 3rd extension
Byte instruction	000-999	L = Load A = AND O = OR XO = EXCL OR = = Allocation ADD = Add SUB = Subtract MUL = Multiply DIV = Divide NOT = Negation	0 = basic unit 1 = 1st extension 2 = 2nd extension 3 = 3rd extension
Word instruction	000-999	L = Load = = Allocation	0 = basic unit 1 = 1st extension 2 = 2nd extension 3 = 3rd extension

# The System Modules

Like the instructions, system modules are also descriptive elements of a program. They are used to transmit to the control system, orders which would be difficult or complex to formulate as individual instructions. System modules are prefabricated program segments in which only the parameters need to be inserted. They occupy the same space in the user program as does an instruction, and are called up using their abbreviated code and the module number.

A system module is so programmed that it can be entered like an instruction. The system then replies, and requests entry of the necessary parameters. When all the parameters have been entered, the system returns to the instruction set.

## Example:

Instruction set for a counter module	Entry	Data type
xxx	C 0-31	-
C0*U	Shift forwards	Bit
C0*D	Shift backwards	Bit
C0*S	Set input	Bit
C0*R	Reset input	Bit
C0*IW	Reference (preset) value	Word
C0*Z	Counter status „0“	Bit
C0*QW	Counter output	Word

xxx + 1 Continuation of IS program

## High speed counter input

The PS 3-AC/DC can process signals up to 10 kHz. The high speed counter input functions as a divider, and enables the PS 3 to record pulses which are quicker than the cycle time.

## Analogue inputs and outputs

The PS 3-AC/DC can process and transmit, analogue signals from 0 V to 10 V d.c. with an 8 bit (1 byte) resolution. Devices which can be connected to an analogue input include remote potentiometers for setting timing elements.

## Arithmetical functions

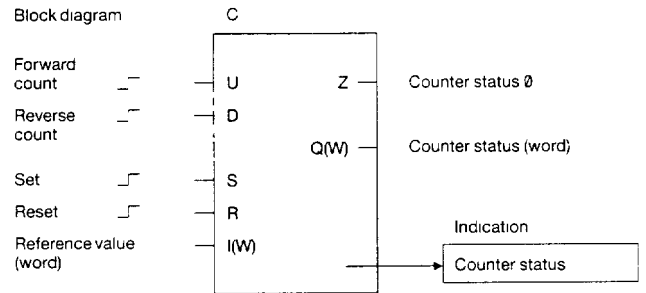
The PS 3 is able to carry out the four basic arithmetical functions:

Add	ADD
Subtract	SUB
Multiply	MUL
Divide	DIV

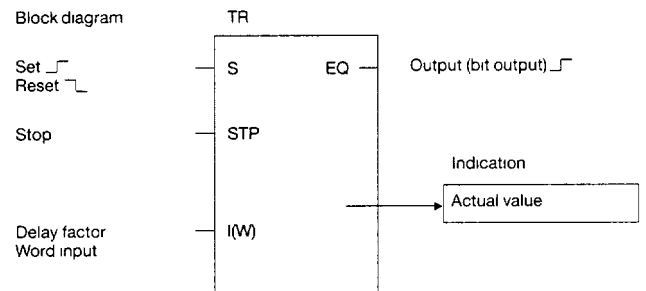
The arithmetical functions are included in the byte operations. Numbers from 0 to 255 can be processed by means of these functions.

The PS 3 permits the use of:

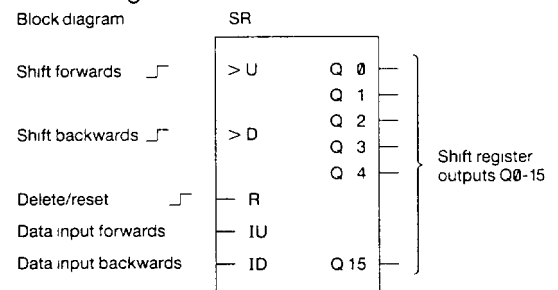
### 32 counter modules



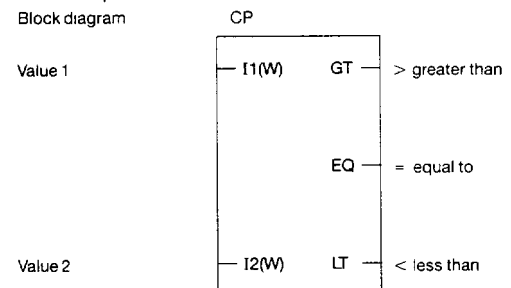
### 32 timer modules



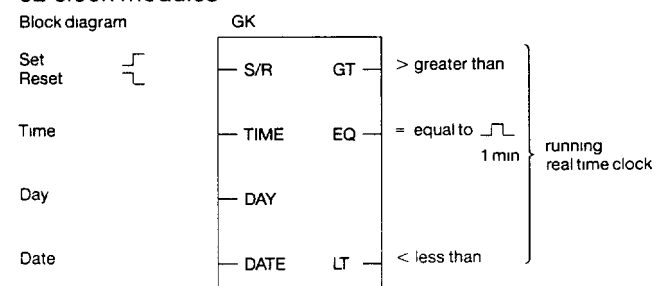
### 32 shift register modules



### 32 comparator modules



### 32 clock modules



# The Programmers

PS 3 controllers can be programmed by means of various programmers, matched to the purpose in hand.

## PRG3 hand held programmer



①

Light emitting diode to indicate the PS3 run mode

②

16 character alphanumerical LCD display

③

Light emitting diodes to indicate the current sub-menu

④

RS 485 data interface to link with the PS 3, and for the 9V d.c. power supply

The operating software for the PRG3 hand held programmer is divided up into several menus

### 1. PROGRAM

In this menu, programs are generated, read out, and modified, in the Instruction Set Programming may be carried out while the controller is connected (on line) in either HALT or RUN mode, or without the controller connected (off line) While instructions are being entered, the entry is monitored for errors in form or syntax, and is not accepted until it is perfect. Instructions may be overwritten or inserted in an existing program

### 2. TRANSFER/VERIFY

Transfer of programs into or out of the controller, followed by checking for transfer errors.

### 3. RUN/HALT

Starting or stopping of the program in the controller

### 4. DELETE

Deletion of programs or program segments in the programmer.

### 5. SEARCH

The finding of operands in the programmer's user program. The following can be found:

- I = inputs
- O = outputs
- M = markers
- K = constants
- IA = analogue inputs
- QA = analogue outputs

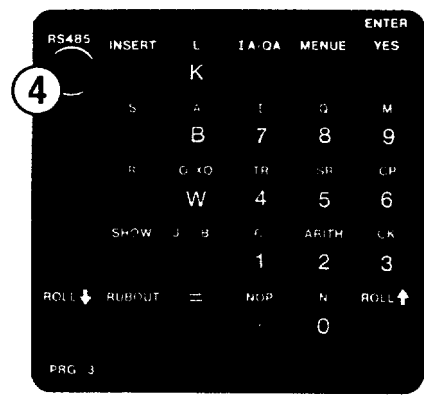
### 6. TIME/DATE

Entry and readout of time and date.

### 7. STATUS/RESTART

Recognition of status of individual PS3 units, with fault annunciation and definition of start criteria in the event of power loss and return.

While the programmer is in the neutral status (no menu selected), the actual status of bit functions, timers, and counters can be monitored.



The hand held PRG3 programmer, in its robust, compact housing, is particularly suitable for programming, testing, and commissioning, in industrial environments. The operating software is divided into several sub-menus.

Programming is carried out in the simple and easily understood, instruction set principle. The various operations or handling functions are called up by way of multi-function keys, the operating software ensuring that only those keys or functions suitable for correct continuation of the program are enabled. This effectively rules out the risk of a malfunction being caused by pressing the wrong key

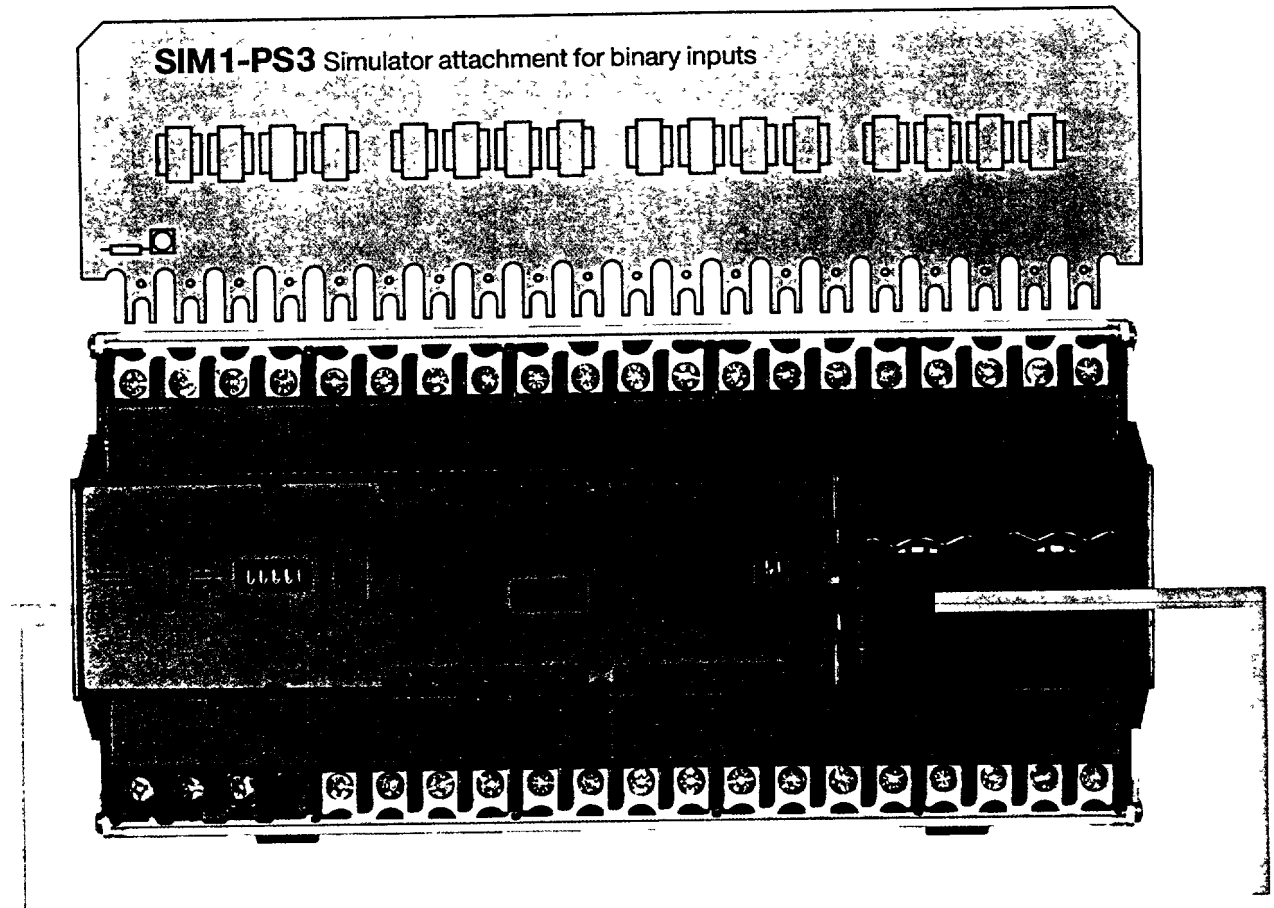
## PRG 300 light pen programmer

For clear, graphical ladder diagram programming directly on the screen.

## Programming with personal computers

Software package with maximum-convenience programming, designed for use with personal computers

# The Program Test



## **SIM2-PS3**

Simulator attachment for analogue inputs and outputs

## **PS3**

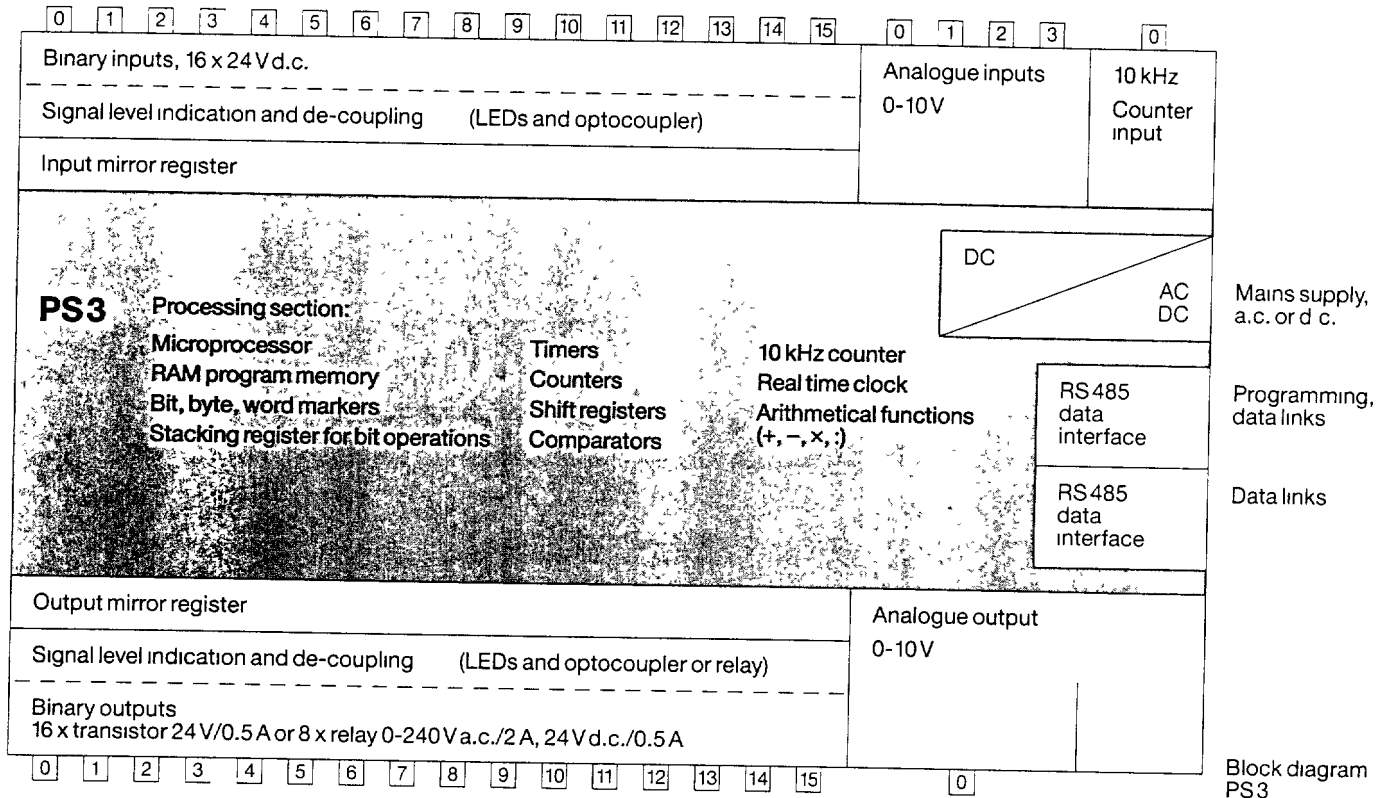
Programmable controller

## **PRG3**

Programmer

The PS3 programmable controller has two simulator attachments, enabling the completed program to be tested straight away. These are the SIM 1-PS3 for the simulation of binary input signals, and the SIM 2-PS3 for the analogue input and output signals. The power supply for both simulators is taken from the PS3 controller.

# Operation



As with all programmable controllers, the PS3 processes the user program which has been entered, sequentially, one instruction after the other. During the course of processing, the input information is used to create the output information, in accordance with the program.

The information entered can be processed directly, in bits, bytes (8 bit), or words (16 bit), depending on the nature of the instruction. Input signals from operating and control devices for instance, are best processed in bit form, and the input from decade preselector switches in byte or word form.

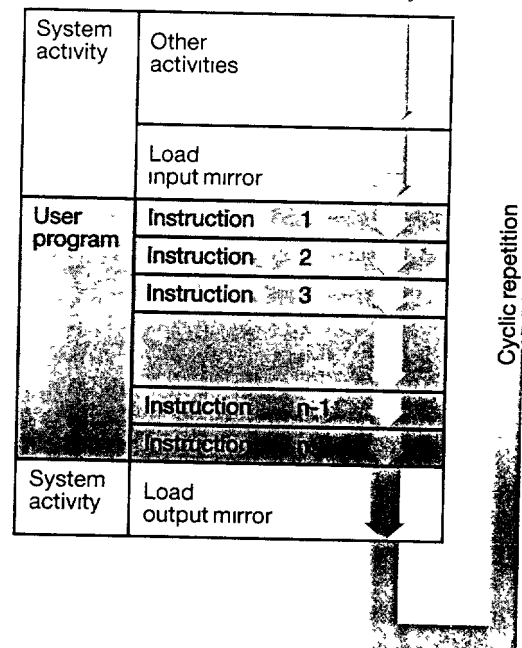
In order that the program can operate from constant information while it is running, the status of the binary inputs is monitored at the beginning of the cycle, and this information stored in the input mirror register. The program then operates with the information in this register.

In similar manner, all the binary output information is held in the output mirror register, and is passed to the physical outputs at the end of the cycle.

Externally, the use of these mirror registers creates the impression of parallel processing, although internally, it is actually processed sequentially.

The inbuilt LEDs show the current status of the relevant physical inputs and outputs.

The time which the controller takes to run through the complete program is known as the cycle time. It is typically 5 ms for 1000 instructions.



1 process run-through = 1 cycle

# The Applications

The PS 3 programmable controller is a unit which, by virtue of its characteristics and its outstanding price/performance ratio, lends itself admirably to a variety of applications:

- The analogue inputs can be used to advantage for simple regulating tasks, or for controlling externally adjustable timers.
- Time and date dependent functions can be carried out with the aid of the real time clock.
- The high speed counter input is particularly suitable for rapid counting duties and simple positioning controls.
- On high speed machines, the extremely short cycle time can help to increase productivity.
- If valves are to be opened and closed frequently, the version with semi-conductor outputs is recommended.
- Remote controls at distances up to 600 metres can be built up, using separate units, connected by means of a screened, two core cable.

## Typical example

### Energy saving through controlled heating system

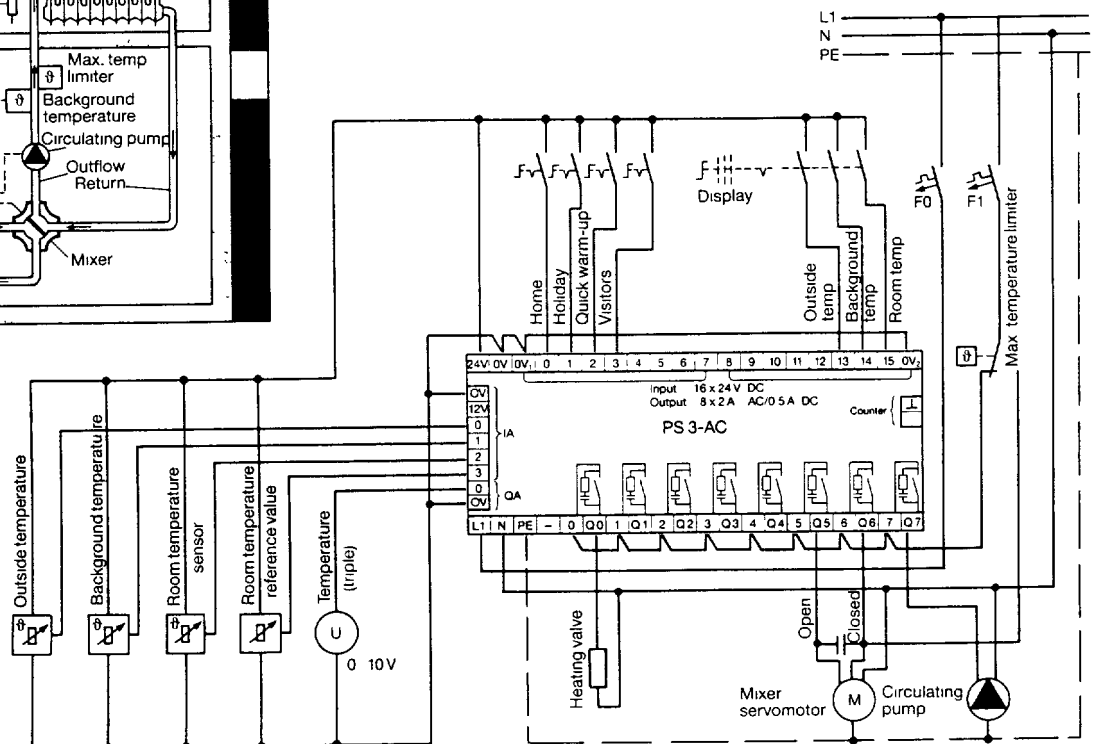
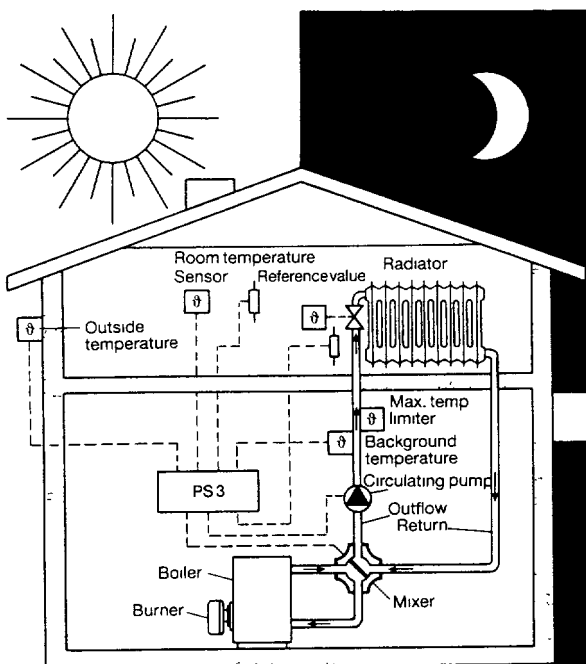
No heating system, whether controlled by room thermostats or by the weather, is complete unless it has provision for an automatic reduction in temperature (night time temperature reduction facility).

The PS3 programmable controller will permit – as an example – the following control program

Individual, separate thermal sensors monitor the outside temperature, the background temperature, and the room temperature. The background temperature is regulated via the inbuilt calendar section of the real time clock, in accordance with the season.

The outside temperature and – depending on the time of day – the room temperature, have an effect on this regulating circuit. The daytime temperature is set on the reference value potentiometer. If all control switches are switched off, the background temperature will fall between the hours of 9 p.m. and 5 a.m., and between 7 a.m. and 3 p.m. The room temperature – controlled via heater resistances in the room thermostat valves – will also fall by about 5°C. The temperature drop between 7 a.m. and 3 p.m. is cancelled by means of the control switch "Home", and the drop after 9 p.m. by the 'Visitors' switch. The control switch 'Holiday' reduces the room temperature to approximately 10°C for the full 24 hours, while the "Quick warm-up" switch bypasses all regulating functions until the preset room temperature has been reached. In the interests of safety, the maximum temperature limiter in the background circuit switches off the circulating pump, and closes the mixer valve, if the maximum permissible background temperature is exceeded.

A voltmeter connected to the analogue output, controls the display of outside, background, or room temperature, in accordance with the function as selected on the selector switch "Display"

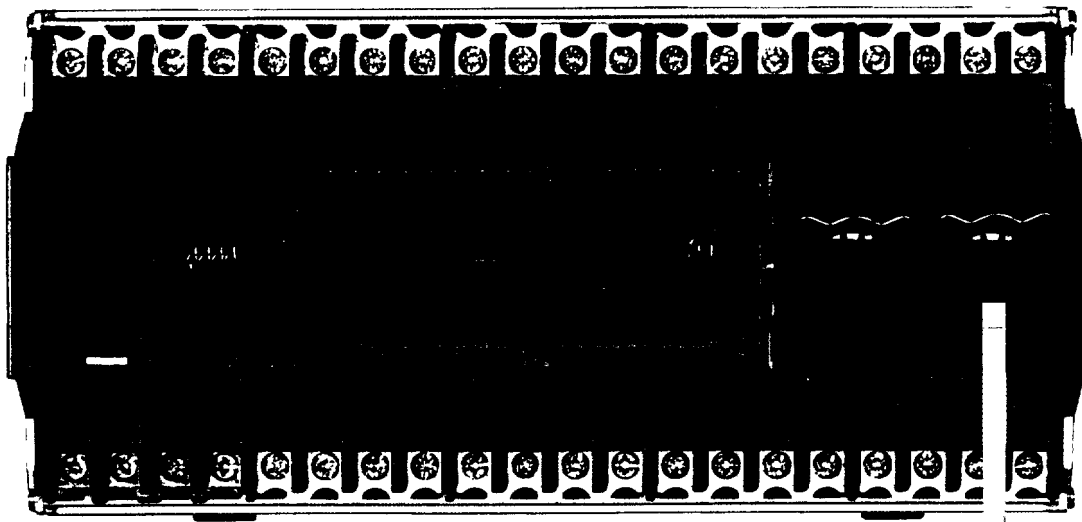




# The Extensions

If the number of inputs or outputs available should prove inadequate for a given control task, or if the system under control involves widely dispersed sections, up to four PS3 units can be linked together.

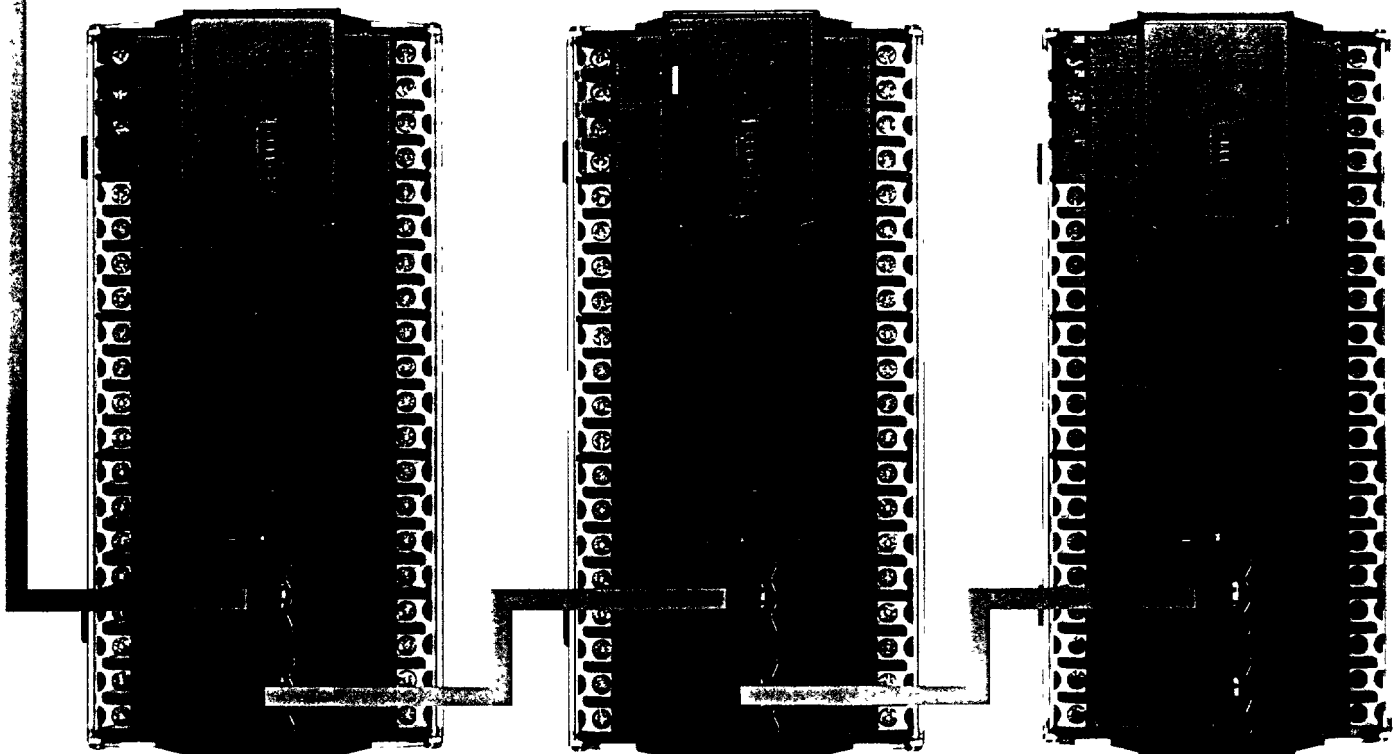
The units are linked via the RS485 serial data interface, which operates at a transfer rate of 187.5 k baud, and a maximum distance of 600 metres. The units may be PS3-AC, PS3-8, PS3-DC, or any combination of the three. The user himself specifies by means of the coding switch on the front of the units, which is to be the basic unit, and which the extensions.



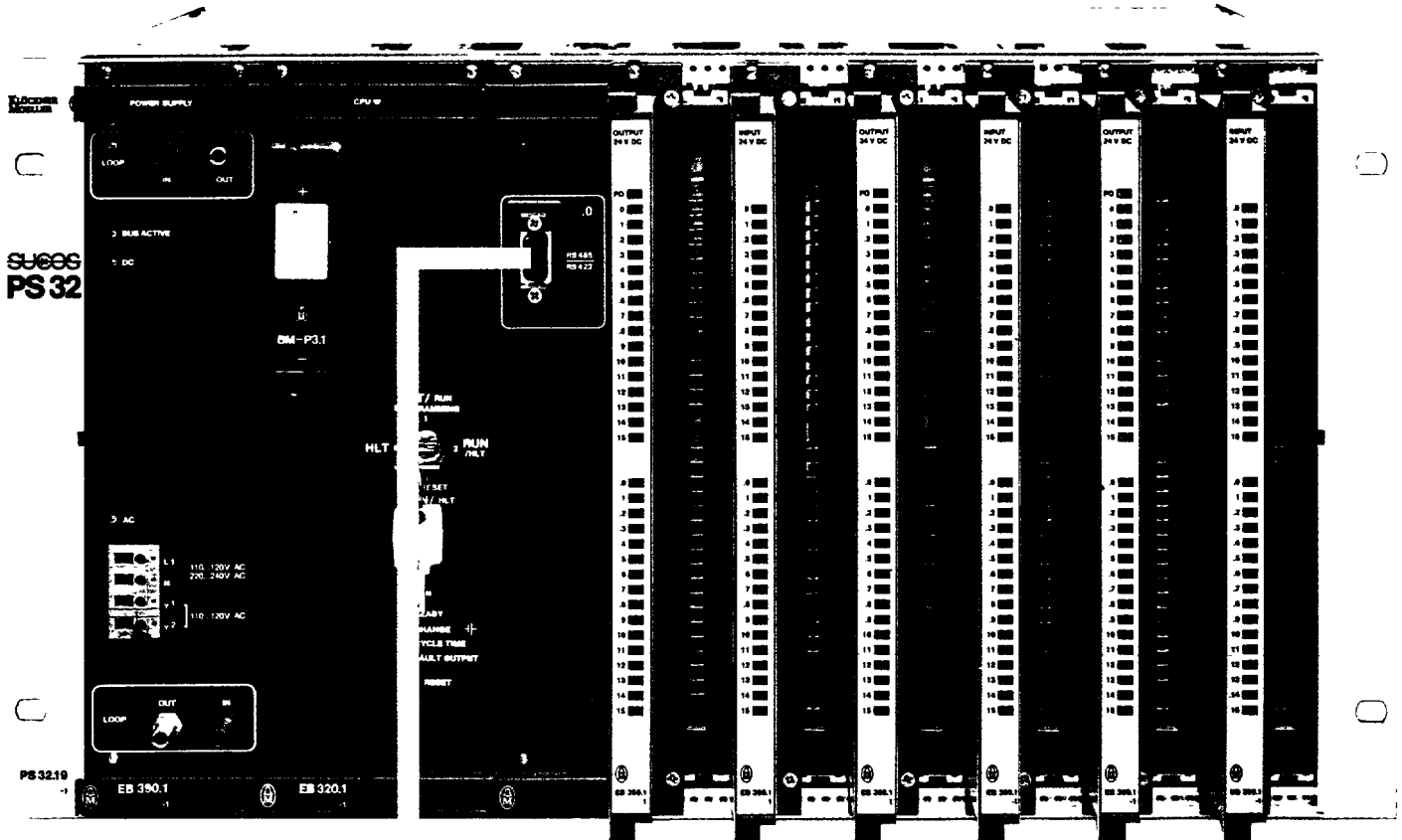
Maximum:

- 64 binary inputs
- 16 analogue inputs
- 64 binary outputs
- 4 analogue outputs
- 4 counter inputs
- 10 kHz

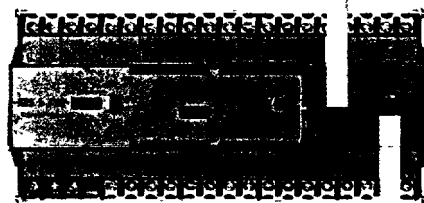
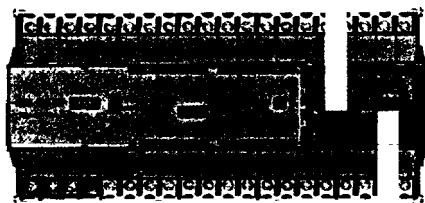
SUCONET field bus



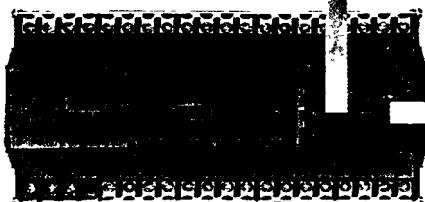
# The Control Group



SUCONET field bus



up to 30 x PS 3



Complex or widespread process and system control schemes often face problems in monitoring decentralised signals and metered values, or in the transmission of decentralised signals and commands; in other words, in the creation of a control group. All PS3 units are capable – by virtue of their RS485 serial interface – of working as part of a control group or network. Operating protocols are for SUCONET, the Klockner-Moeller field bus system. Either the PS32 programmable controller, which has an intelligent bus interface card, or any IBM personal computer with appropriate interface card, can be used as a superordinate control system. Up to 30 PS3s can be connected to each interface, as decentralised units, and appear in the main unit as normal inputs and outputs. Any transfer errors which may arise are corrected automatically. Signals may be transmitted up to 600 metres without the need for an amplifier.

# The Technical Data

Controllers	PS 3-AC	PS 3-8	PS 3-DC
Specifications	IEC 332, VDE 0160, VDE 0110, VDE 0411 Part 1, Draft 81, VDE 0660 Part 200, DIN 19 240		
Mounting	Snap-on fitting on standard EN 50022 top hat rail or screw fixing, horizontal or vertical		
Power supply	220/240 V a.c. 110/120 V a.c.	220/240 V a.c. 110/120 V a.c.	24 V d.c.
Inputs			
digital + 24V	16	8	16
analogue 0-10 V d.c.	4	—	4
high speed counter input 10 kHz	1	—	1
Outputs			
semi-conductor + 24V, 0.5 A	—	—	16
relay 24-240 V a.c., 2 A, 24 V d.c., 0.5 A	8	8	—
analogue 0-10 V d.c.	1	—	1
User program memory	1K instructions	1K instructions	1K instructions
System modules			
timers, counters	32 of each	32 of each	32 of each
comparators, shift registers	32 of each	32 of each	32 of each
clock modules	32	—	32
real time clock with calendar	yes	—	yes
arithmetics (+, -, x, /)	yes	yes	yes
bit, byte, and word markers	yes	yes	yes
Cycle time for 1K instructions	< 5 ms typically	< 5 ms typically	< 5 ms typically

## System combinations

### PS 3 with PS 3

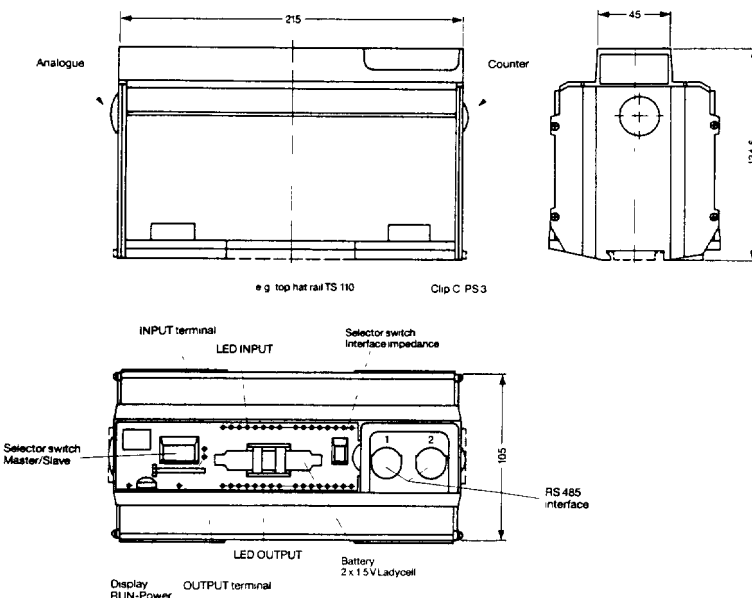
Linking of up to four units in order to expand inputs and/or outputs. Each unit may be used optionally as basic or extension unit. Maximum distance 600 metres.

### PS 3 with PS 32, PS 3 with (IBM-)PC

Connection of up to 30 PS 3 units as decentralised I/O, to monitor operating data and metered values, via SUCONET field bus system. Data transfer rate 187.5 k baud, maximum distance 600 metres.

Programmiers	PRG 3	PRG 300*)	(IBM-)PC*)
Instruction set	yes	yes	yes
Ladder diagram	—	yes	yes
*) in preparation			

## Dimensions



## Styles

