Protronic PS

Process controller
Universal controller PS
serial interface

Interface description

42/62-64 EN

Rev. 07

Contents

1 Description

The Protronic PS controllers have a serial interface through which the instruments can be coupled to higher-level systems. This Manual describes the electrical data and the software structure of the controllers and the required data telegrams.

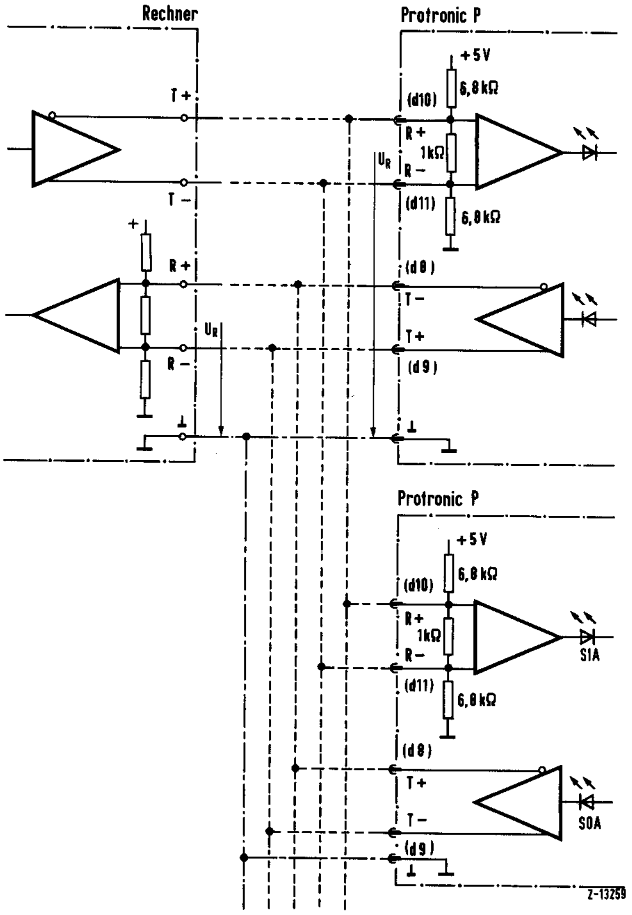


Fig. 1 RS-422 A interface
U_r = Quiescent level (≧ 0.2 V)

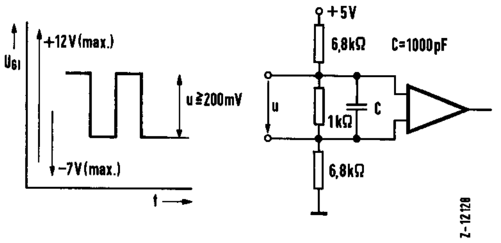


Fig. 2 Internal circuit of receivers

2 Technical data

RS-422 A to EIA Standard

Originally, standard RS-422 A described only a point-to-point connection. For many years now this standard has been internationally extended to a bus-capable system by elevating the quiescent levels of the transmission and reception lines by a few volts.
The level elevation is effected in the Protronic PS in each instrument at the reception side. The reception lines of the higher-level computer must be elevated accordingly within or outside the computer (see Section 7 and Fig. 1).

Electrical data

Sender output voltage	approx. 2 V on 100 Ω
Min. input voltage	200 mV
Input resistance	1000 Ω
Permissible common-mode voltage U_{GI}	−7 to +12 V
Baud rate	Adjustable between 300 and 4800. Other, non-standardized baud rates can be configured. In the controller the baud rate is specified by the value in address 8703. See Section 4.2.
Permitted bus addresses	Hex numbers from 10H to EFH. 00H: as from software 07/86 (IC 15 with index "F"). FFH: as from software 03/87 (IC 15 with index "J"). All connected units accept a telegram, irrespective of their address, but do not send an acknowledge.

3 Software

3.1 Memory assignment of the controller

Area		Contents
EEPROM IC 19	C7FF C400	Area B Image of 8400 to 87FF
	C3FF C000	Area A Image of 8400 to 87FF
RAM IC 18	87FF 8700	Control codes Various functions
	86FF 8400	Program lines Source variable 2 to 86FF Source variable 1 to 85FF Op codes to 84FF
	81FF 80FF	Value list High-order byte } Analog Low-order byte } variable
EPROM IC 15	7FFF 4000	Firmware
EPROM IC 14	3FFF 2000	For special functions only
Int. ROM	0FFF 0000	Not accessible Processor, internal
Int. RAM	7F 00	incl. binary variables Processor, internal

Table 1

3.1.1 E(E)PROM (IC 19), Area C000 to C7FF

The IC 19 is a plug-in option.

Either (special) configurations or sectorwise value definitions, for example for programmers, can be stored in this IC.

When configurations are stored, the contents correspond to the RAM area 8400H to 87FFH. The addresses C300H and/or C700H must then have the value "87H".

If the data is stored in sectors in one area, the address C300H or C700H then has the value "78H".

3.1.2 RAM (IC 18), Area 8000 to 87FF

The RAM contains the current command set.

A detailed description of the RAM area and possible changes are given in the "Protronic Equipment Manual".

The individual variables are stored under their hexadecimal names in the value lists and the program lines.

Example:

The value of x, the hexadecimal name of which is E2H, is located at memory positions

80E2H and 81E2H

The calculation specification required to form x is located at memory positions

84E2H = op code
calculation specification "-" = 49H

85E2H = 1st source variable
e.g. input 1 = 3FH

86E2H = 2nd source variable
e.g. input 2 = 3EH

This example gives:

Clear text	:	x = E1 - E2		
Memonic text x of configurator	:	X	:	SUB, /E1 ,/E2
Hex text E2H	:	E2H	:	49H, 3FH, 3EH

The analog variables and binary variables are listed in full in the Annex.

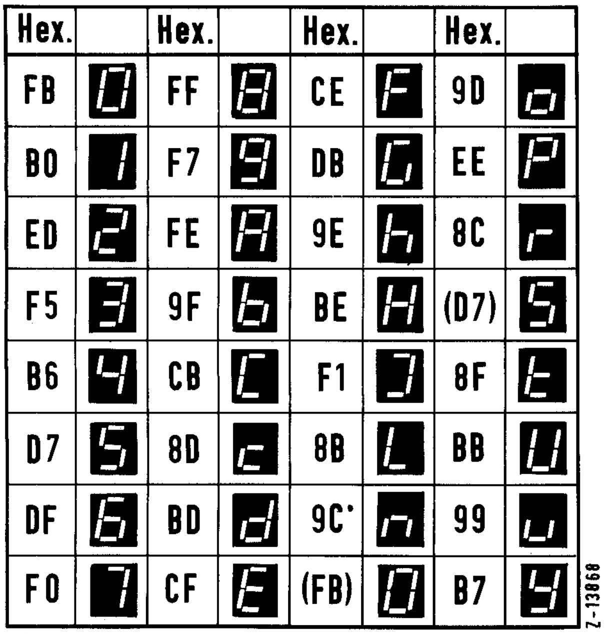


Fig. 3 Readable characters of the seven-segment modules. 80H = blank. Characters with decimal point have a code reduced by 80H.

3.1.3 EPROM (IC 15)

EPROM IC 15 contains the firmware. For the user of the serial interface, only those addresses 5FF0H to 5FF9H in which the type "S", the software date, e. g. "20.87" and the Version No. "2.8" are stored, are of interest. When this information is interrogated, the reply should be interpreted as per Fig. 3.

5FF...	1	2	3	4	5	6	7	8	9
Contents	D7	80	80	ED	7B	FF	70	6D	EF
Meaning	S			2	0.	8	7.	2.	8.

3.1.4 EPROM (IC 14)

EPROM IC 14 is normally not fitted. Special functions can be implemented with this EPROM.

When it is used, the addresses 2043H to 2048H contain the software date, e.g. "36.86", and an identifier, e.g. "n.l". (see 3.1.3).

3.1.5 Internal ROM

The program in the processor-internal ROM is not accessible to the user of the units.

3.1.6 Internal RAM

The binary variables are also resident in the processor-internal RAM. Their meaning and addresses are listed in the Annex in the "Binary variables" table. The values can be read via the monitor "Md".

3.2 Calculation of values

In the Protronic P, all values except the time values Tn, Td and values for the time sections of the programmer are specified in %, it being possible to define the position of the decimal point in the display by means of additional masking.

The hexadecimal value is calculated according to the following rules:

a) Positive values
Per cent · 160 + 32768

b) Negative values
Per cent · 160

Depending on the decimal point position desired in the display, the following values must be added:

00 for xxx . x
01 for xx . xx
02 for x . xxx
03 for xxxx .

This decimal point position is passed on in the computation but not taken into account mathematically.

With the exception of the variables altered by the USER RANGE, the numerals displayed are interpreted as follows:

Display	Computed value
1 2 3 4	123.4% = 1.234
1 2 3.4	123.4% = 1.234
1 2.3 4	123.4% = 1.234
1.2 3 4	123.4% = 1.234

Table 2

For time variables, the time scale is defined by the decimal point position or by adding 00 to 03.

Display	Time
1 2 3 4	1234.00 seconds
1 2 3.4	123.40 minutes
1 2.3 4	12.34 hours
1.2 3 4	1234.00 hours

Table 3

Conversion between decimal values and hexadecimal values is accomplished in the higher-level system and is described in the associated manuals.

The resulting hex value has four digits. If the hex value has fewer than four positions, it should be made up to four digits by adding leading zeros.

The two left-hand positions form the

HB = high-value byte;

the two right-hand positions form the

LB = low-value byte.

They should be inserted in the telegram in this way.

Examples:

a) 70.0 % multiplied by 160 = 11,200
+ 32,768
43,968 decimal
gives: ABCOH
HB = ABH
LB = COH

b) (–) 1.5 % times 160 = 240
+ 0
240 decimal
gives: EOH = 00EOH
HB = 00H
LB = EOH

3.3 Checkback signal of operating modes

Familiarity with this chapter is only necessary if the possibilities offered by the system image (binary status) are not adequate.

The operating mode effective in the controller is stored in bytes 28H to 2AH.

Each of the mode selector switches has 8 possible switch positions. Which of these positions are reachable by key operation or via the interface is described by the contents of addresses

8779 for the H/A switch
877A for the F switch
and 877B for the I/E switch.

Normally the functions I and E, and A and H are configured for single-channel or two-channel units.

In two-channel units the channel 1 and channel 2 functions are also present for the F switch.

3.3.1 Y-switch

The following values are assigned to the following functions:

Byte 28H (Write address 56H)

Bit hex	Controller (single-channel)	Programmer (single-channel)	Controller (two-channel)	Programmer (two-channel)	Programmed controller	Cascade controller	Override controller	Value hexadecimal	decimal
60H	H	h	H	h	H	H	H	1	1
61H	E*	r	E*	r	E*	E*	E*	2	2
62H	A	r.	A	r.	A	A	A	4	4
63H	F*	t	F*	t	F*	F*	F*	8	8
64H	H*	H*	H*	h	h	H*	H*	10	16
65H	F*	F*	F*	r	r	F*	F*	20	32
66H	A*	A*	A*	r.	r.	A*	A*	40	64
67H	F*	F*	F*	t	t	F*	F*	80	128

Table 4 * not used

3.3.2 F-switch

Byte 29H (Write address 57H)

Bit hex	Controller (single-channel)	Programmer (single-channel)	Controller (two-channel)	Programmer (two-channel)	Programmed controller	Cascade controller	Override controller	Value hexadecimal	decimal
68H	*	*	1	P	*	1	1	1	1
69H	2*	2*	2.	P.	P.	2.	2.	2	2
6AH	G*	G*	G*	G*	G*	G*	G*	4	4
6BH	S*	S*	S*	S*	S*	S*	S*	8	8
6CH	0*	0*	0*	0*	0*	0*	0*	10	16
6DH	P*	P*	P*	P*	P*	P*	P*	20	32
6EH	*	*	*	*	*	*	*	40	64
6FH	*	*	*	*	*	*	*	80	128

Table 5 * not used

3.3.3 W-switch

Byte 2AH (Write address 58H)

Bit hex	Controller (single-channel)	Programmer (single-channel)	Controller (two-channel)	Programmer (two-channel)	Programmed controller	Cascade controller	Override controller	Value hexadecimal	decimal
70H	I	I	I	I	I	o	I	1	1
71H	F*	F*	F*	F*	F*	c	F*	2	2
72H	E	P	E	P	P	E*	E	4	4
73H	C*	C*	C*	C*	C*	C*	C*	8	8
74H	I*	I*	I	I	I*	I*	I	10	16
75H	*	*	*	*	*	*	*	20	32
76H	P*	E*	E	P	P	P*	E	40	64
77H	*	*	*	*	*	*	*	80	128

Table 6 * not used

3.4.4 Binary functions

The binary variables, containing for example the result of an alarm value comparison, are listed in Annex 2.

These variables are stored in the internal RAM of the microprocessor, 8 binary variables being combined in one byte. The variable with the lowest hex name has the value 2^0 in the byte.

3.4 Write protection

If it is intended to prevent control intervention by the computer on the controller occasionally or permanently while maintaining the ability to read out data from the controller, bit 0 in byte 871BH must be set = "0".

Write intervention can then be enabled or inhibited via the binary variable SC1.

S3/4 is normally configured with SC1 in such a way that
S3/4 = 0 inhibits write intervention
S3/4 = 1 enables write intervention

The unit can be configured so that SC1 can be controlled via another logical combination, e.g. via a binary input.

4 Data transfer

For data transfer a combination of data words is put together in telegrams. These telegrams also assume the "handshake" function by each telegram from computer to controller having to be confirmed before the next is sent.

To prepare for data transfer, baud rate and controller address must be set in the controller. This may be done, inter alia, via the auxiliary routine monitor M_C. The monitor routines M_E and M_d may also be used for test purposes. They are called up acc. to Fig. 4.

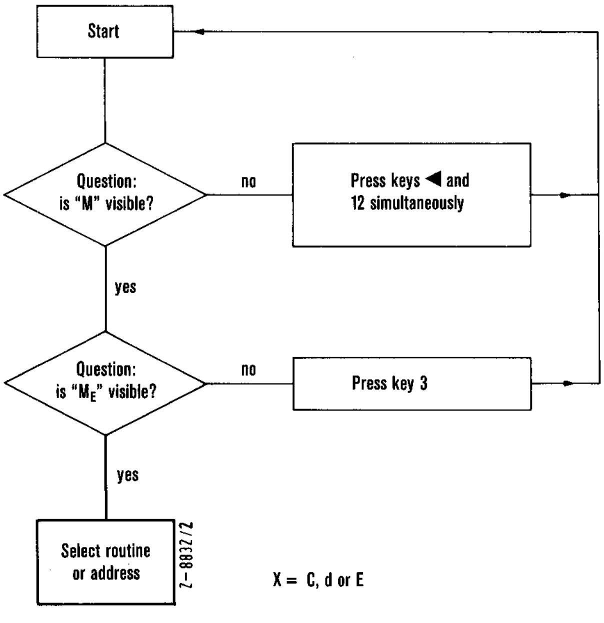

Start
Question: is "M" visible?
no
Press keys ◀ and 12 simultaneously
yes
Question: is "M_E" visible?
no
Press key 3
yes
Select routine or address
7-8832/2
X = C, d or E

Fig. 4 Flow diagram for selecting a monitor routine

4.1 Selecting a monitor routine

Turn switch S4 to "MONIT+TEST" and operate key S5 (see rear fold-out page). Very different displays may now appear in the digital display. What is displayed in detail depends on whether monitor routines used earlier were terminated correctly or not. The flow diagram shows what keys should be operated depending on the display (see Fig. 4).

The address is selected with keys ▲ and ▼. Only those digits can be altered at which the decimal point is located as cursor at present. This cursor is moved by pressing key 10 and one of keys ▲ or ▼. Key ▲ moves the cursor to the left, while key ▼ moves it to the right.

The display fields next to keys 10 and 12 show the current contents (value) of the selected addresse, read from top to bottom.

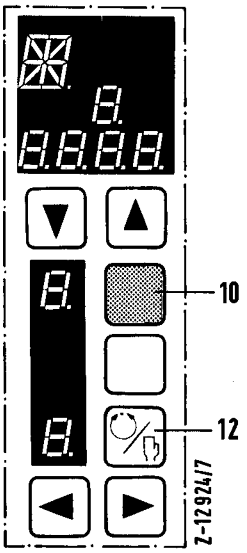


Fig. 5

The displayed value can be increased with key ▶ and decreased with key ◀. Here too the value can only be changed in the field in which the cursor is visible. In this case the cursor is moved by actuating key 10 while pressing one of keys ◀ or ▶. If the contents of one of the two display fields is altered with key ◀ or ▶, both fields begin to flash. The flashing indicates that the new value can be confirmed and thus written into memory by pressing key 12. If key 12 is operated, the flashing stops. When writing the data into memory, the entry for each address field must be confirmed separately.

If the desired hexadecimal number is visible in both display fields without flashing, it is possible to switch over to the next address and there enter the next hex number.

Each entry is effective in the instrument as soon as the flashing is acknowledged with key 12. This may temporarily give rise to irrational command sequences during entry. The configuration therefore cannot be tested and evaluated until entry is complete.

This routine is terminated by turning switch S4 to "NORMAL" and operating key S5.

4.2 Controller address

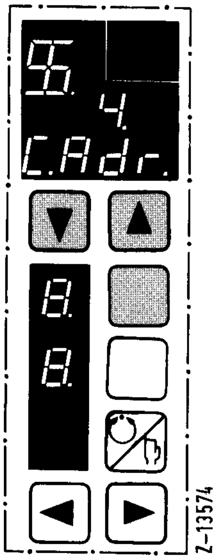


Fig. 6

To operate the controller at a serial bus, an individual controller address is required.

This can be entered in hexadecimal form to address 87E0H or via monitor routine MC 0014.

The address set is displayed next to keys 10 and 18, and if necessary changed with the same keys.

4.3 Baud rate

In the test routine, the baud rate set can be read and may be modified with the write protection open.

The following baud rates may be set by pressing key ▲

Display	Baud rate
00.30	300
00.60	600
01.20	1.200
02.40	2.400
04.80	4.800
10.42	10.420
20.83	20.833

Table 7

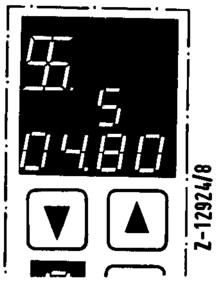


Fig. 7

Other, non-standardized baud rates can be configured by entering in the controller at address 8703H a hex number taken from Table 8 or calculated as follows: Decimal: 256 – n is converted to hex number. The resulting baud rate is

62,500 : n = baud rate.

n	Hex	Baud Rate	n	Hex	Baud Rate
3	FD	20.833	12	F4	5.208
4	FC	15.625	**13**	**F3**	**4.808**
5	FB	12.500	14	F2	4.464
6	FA	10.417	15	F1	4.167
7	F9	8.929	20	F0	3.125
8	F8	7.813	**26**	**E6**	**2.404**
9	F7	6.944	**52**	**BB**	**1.202**
10	F6	6.250	**104**	**98**	**601**
11	F5	5.682	**208**	**30**	**300**

Table 8

The maximum transfer speed is also determined by the cycle time of the controller as in each cycle a maximum of 6 telegrams can be received or the associated replies transmitted by the controller.

4.4 Data word

For data transfer, the information to be sent is combined with other information to form an 11-bit data word in "UART" format[1].

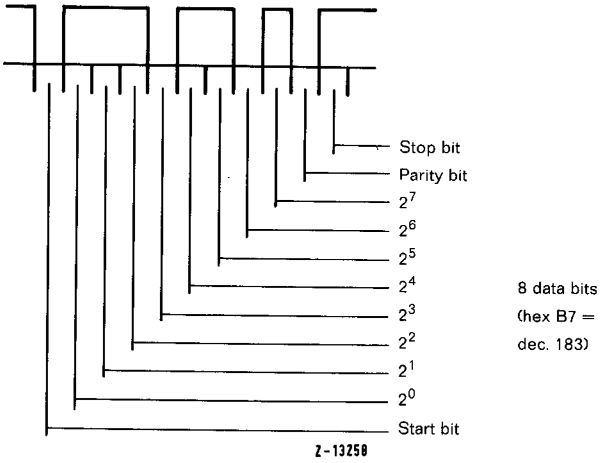


Fig. 8 Data word

Start bit:	Transition from "1" to "0" for 1 unit of time.
8 data bits:	Byte to be transmitted in ascending order.
Parity:	Even parity checksum of data byte if check sum even: parity bit = 0. if check sum odd: parity bit = 1.
Stop bit:	1 for one or more units of time.

4.5 Check byte (check sum CS)

For all telegram types the last word transferred is the sum of all data words without overflow over 255.

e.g. C5H Data telegram
D2H Set point
COH } 70%
+ ABH
3 02H

The check byte has the value 02.

[1] As per Draft IEC – TC 57 Telecontrol Equipment and Systems Part 5; Transmissions Protocols, Format Class FT 1,2

4.6 Time requirement

The time requirement for an exchange of telegrams depends on:

- the baud rate
- the number of data words in the two telegrams T0
- the response time of controller T1
- the response time of computer T2

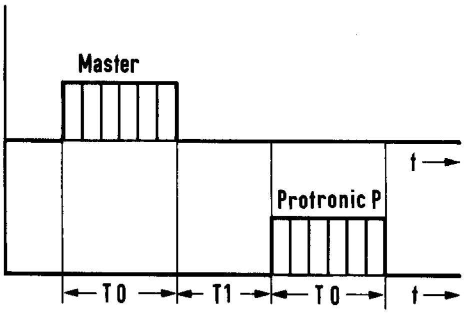


Fig. 9

Z-14233

With a baud rate of 4800 and a telegram length of 6 words we have:

$$T0 = \frac{6 \times 11}{4800} = 13.75 \text{ ms}$$

The mean response time of the controller is 3 ms. Without the response time of the computer, with maximum telegram length there is therefore a time requirement of approximately 30 ms for exchange of a pair of telegrams.

The response time may increase to as much as 100 ms if a ROM check is performed at the same time.

Timeout monitoring may not intervene until after expiry of the worst-case time (100 ms). In order to lose no time, a program sequence as per Fig. 10 is recommended.

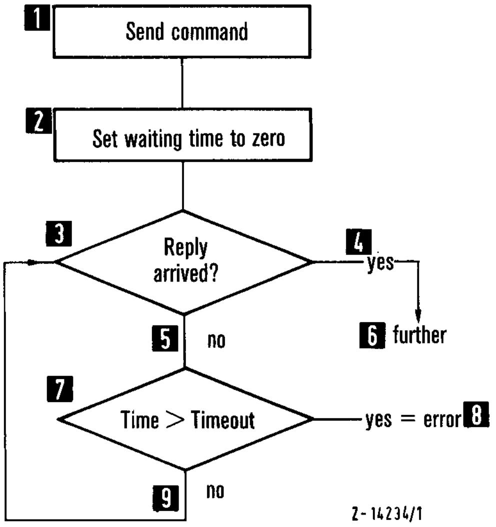


Fig. 10

4.7 Displays

The Protronic control systems PS disposes of verification possibilities which allow observation of the telegram traffic on the RS-422 bus and even on the configurator interfaces lines.

Light emitting diode SIA (LED) flashes when the controller receives data. A reaction from the controller cannot be expected as long as this LED is not flashing, although serial signals are present at the input.

Light emitting diode SOA (LED) flashes when the controller is transmitting data.

4.8 Transmission and reception buffer

Data received are stored in a buffer memory in the reception buffer (internal RAM, address 63H to 68H). By selecting the test routine monitor M_d and the addresses mentioned, a check can be carried out if, and which, data the controller has received.

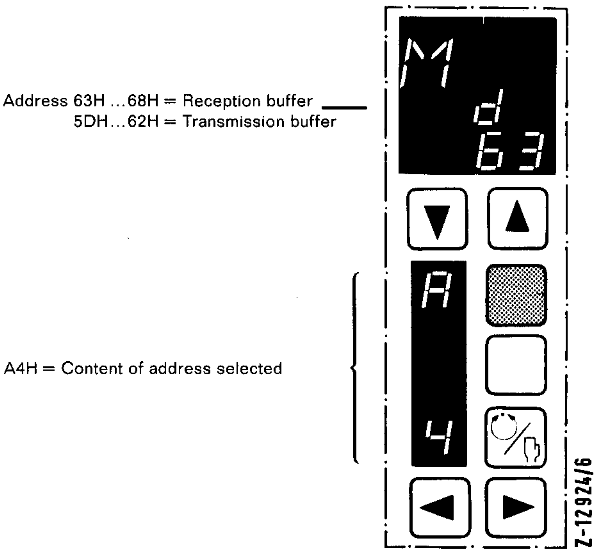
Data to be transmitted stored in a buffer memory in the transmission buffer (internal RAM 52H to 62H).

The bottom (second) figure of address 5DH shows the number of valid transmission data.

F3 means that only the values in the addresses

5DH, 5EH, 5FH

are valid and also that only these are transmitted.



Address 63H ...68H = Reception buffer
5DH...62H = Transmission buffer
A4H = Content of address selected
M
d
63
A
4
Z-12924/6

Fig. 11

The bottoms figure of address 63H shows the number of valid memory addresses.

4 means that the addresses 63H, 64H, 65H and 66H contain the telegram received.

Addresses 67H and 68H invalid, old values which cannot be evaluated.

If the contents of these addresses are changed manually with key ▶ or ◀, the displays begin to flash.

The changed value is entered by pressing key 12, and flashing is terminated. Each telegram, recognized as being correct, overwrites the manual entry. The displays begin to flash again. The valid contents are entered into to the display by pressing key 10.

5 Telegram types

The data exchange always starts with a telegram from the computer to the controller in which one of the connected controllers is selected. The selected controller sends a reply and usually remains in ready-to-receive status.

This ready-to-receive status is terminated by:

- a telegram with a foreign bus address
- processing of
  command telegrams
  bit manipulation telegrams
  Y increment/decrement telegrams
  single value input telegrams
- Pressing of key S5
- 2 directly successive "repeat telegrams"

5.1 Short telegrams

5.1.1 Request telegram

The Request telegram calls up one of the connected controllers and causes it to send an acknowledgement telegram.

There are two different request telegrams:

V.24 (RS 232 C) interface or only one subscriber on the RS 422 interface:

Command length / Reset code / CS
A3 / 24 / C7
A3 + 24 = C7

This telegram may not be sent in RS 422 systems with several controllers connected, as it would cause all controllers to be activated and send a reply.

It must now comprise a bus address:

Command length / Reset code / address / CS
A4 / 24 / – / –

Address = is the address of the controller at the bus. The acknowledge telegram sent back by the controller conforms structurally to the request telegram:

D3/24/F7 follows A3/24/C7
F4/24/address/CS follows A4/24/address/CS

The ready-to-receive status continues to exist.

5.1.2 Status telegram

A4/25/address/cs

This telegram causes the addressed controller to send its binary status (see Section 3.3) in the form of the status telegram (see 6.1).

The answer reads:

E6/25/address/bit 1/bit 2/CS

The ready-to-receive status continues to exist.

The variables in question and their positions within the two bytes are as follows:

1st byte

Bit position in byte	Function	
7	Q12	controller output more + Z
6	Q11	controller output D less
5	OL2	flag bit single channel/ two-channel
4	ERF	error bit
3	Q04	status of G4
2	Q03	status of G3
1	Q02	status of G2
0	Q01	status of G1

If the status messages are not to be transferred, e.g. if the units are used as programmers, a hex numeral, the value of which is calculated from the table below must be entered in address 871BH of the unit:

871BH								
Bit	7	6	5	4	3	2	1	0
Variable	Q04	Q03	Q02	Q01				
Contents	1	1	1	1	1	1	1	*
Hex numeral	F				F			

Table 9

1 = Transfer status to the status telegram.
0 = Do not transfer status to the status telegram.
* = see 3.4

2nd byte

Position in byte	Function	
7	–	Freely definable
6	–	Freely definable
5	–	Freely definable
4	–	Freely definable
3	WC1	See Table 3
2	WC0	See Table 3
1	YC1	See Table 4
0	YC0	See Table 4

WC. and YC. are derived variables:

W_3	W_2	W_1	W_0	WC1	WC0	
0	0	0	1	0	0	Internal
0	0	1	0	0	1	
0	1	0	0	1	0	External
1	0	0	0	1	1	

Table 10

Y_3	Y_2	Y_1	Y_0	YC1	YC0	
0	0	0	1	0	0	Manual
0	0	1	0	0	1	
0	1	0	0	1	0	Automatic
1	0	0	0	1	1	

Table 11

The freely definable variables must be entered with their hex names in controller addresses 871CH to 871FH.

For the two-channel controllers the following (alterable) binary variables are preset:

871CH 64H = Manual 2nd channel
871DH 66H = Automatic 2nd channel
871EH 74H = Internal 2nd channel
871FH 76H = External 2nd channel

5.1.3 System image telegram

With this telegram the addressed controller is made to send the values of the variables stored in the indirect value address (IWA).

A5/26/bus address/IWA/CS

The reply telegram to this is:

E6/Date 1/Date 2/Date 3/Date 4/CS
E6/ LB1 / HB1 / LB2 / HB2 /CS
E6/ variable 1 / variable 2 /CS

Only the values 08H and 0CH are allowed as IWA in the controller software up to March 1986. As from Software 07/86 (IC 15 with Index F), almost all values between 00H and FFH are allowed as IWA.

If an IWA is stated in a telegram, the controller sends the value of the stated IWA and that of the next lower IWA.

IWA	Variable in the telegram (cannot be altered)
0	"Inoperable" acknowledgement
1	DU, DU
2	G4, DU
3	G3, G4
4	G2, G3
5	G1, G2
6	XD, G1
7	DR, XD
8	DL, DR

Table 12

For each controller further analog variables specific to the application can be defined by entering their hex names in controller addresses 8721H to 872DH [1].

For the two-channel controllers the following (alterable) variables are preset in the units:

Address	IWA	Var.	Function
8721H	09H	D.L.	As DL, but 2nd channel
8722H	0AH	D.R.	As DR, but 2nd channel
8723	0BH	D.U.	As DU, but 2nd channel
8724	0CH	X.D.	As XD, but 2nd channel
8725	0DH		Free
8726	0EH		Free
8727	0FH		Free
8728	10H		Free
8729	11H		Free
872A	12H		Free
872B	13H		Free
872C	14H		Free
872D	15H		Free
(872E)	16H		Cannot be used for step controllers
(872F)	17H		

Table 13

In addition, the variables of the display loop (Table 14) or the remotely controllable variables (Table 15) can be directly interrogated. The Tables show the variables preset in the standard configurations.

Address	IWA	Var.	Function
8760H	48H	X	Controlled variable
8761H	49H	W	Set point
8762H	4AH	Y	Output variable
8763H	4BH	XD	Control deviation
8764H	4CH	D	Difference W - WE
8765H	4DH	G1	Setting of G1
8766H	4EH	G2	Setting of G2
8767H	4FH	G3	Setting of G3
8768H	50H	G4	Setting of G4
8769H	51H		Free
876AH	52H		Free
876BH	53H		Free
876CH	54H		Free
876DH	55H		Free
876EH	56H	XP	Proportional band
876FH	57H	TN	Integral action time
8770H	58H	TD	Derivative action time
8771H	59H	Y0	Operating point for P and PD
8772H	5AH	YL	Lower output limit
8773H	5BH	YH	Upper output limit
8774H	5CH	WL	Lower set point limit
8775H	5DH	WH	Upper set point limit
8776H	5EH	X0	Minimum non-return pointer
8777H	5FH	X1	Maximum non-return pointer

Table 14 Configuration of the variables in the display loop of the single-channel continuous controller.

		Single-channel	Two-channel
Address	IVA	variable	variable
8710H	E8H	W	W
8711H	E9H	/R3	/R3
8712H	EAH	G1	G1
8713H	EBH	G2	G2
8714H	ECH	XP	W
8715H	EDH	TN	/R2
8716H	ECH	WL	G.1
8717H	EDH	WH	G.2

Table 15 Remotely controllable variables for the single and two-channel controllers.

For a given control code address the IWA is calculated as follows:

8700H to 8717H: IWA = LB (00H...17H) + D8H
8721H to 87FFH: IWA = LB (21H...FFH) − 18H

The ready-to-receive status is maintained after each telegram with the data of two successive variables. Further variables can be called up with the acknowledgement telegram of the computer:

F4/1E/address/CS

This telegram has the same function a system image telegram with the IWA reduced by 2.

The transmission is terminated if IWA has been counted down to 0, no acknowledgement or no further new system image telegram is sent, or it is terminated when another unit is called up.

5.1.4 Single value request telegram

As from controller software 07/86 (IC 15 with Index F) it is possible to transfer single analog values in a pair of telegrams directly from the controller to the computer.

A5/27/address/value address/CS

Value address = Hex-name of the wanted variable.

The reply telegram has the form:

E6/27/address/valueLB/value HB/CS

The ready-to-receive status is terminated.

5.1.5 Pair of values request telegram

As from controller software "J" (March 1987) it is possible to transfer two arbitrary values in pairs in one telegram from the controller to the computer.

The request from the computer is effected by:

A6/27/address/WA1/WA2/CS

WA1 and WA2 are the value addresses (hex names) of the wanted variables.

The reply telegram has the form:

E6/value LB1/value HB1/value LB2/value HB2/CS

The ready-to-receive status is terminated.

[1] Up to controller software 07/86 (index "E" on EPROM IC 15), further variables can be defined only in the addresses 8721H to 8724H.

5.1.6 Error telegrams

The status telegram (see 5.1.2) contains the global error alarm ERF.

If more precise information is required concerning the nature of the error which has arisen, the error telegram can be used for this purpose:

A4/28/address/CS

receives the reply

E6/28/address/byte 1/byte 2/CS

Where:

Byte 1

Bit	Var.	Meaning
0	D00	Forced manual mode
1	EA1	Error in output 1
2	EA2	Error in output 2
3	EUG	Error in transmitter supply voltage
4	E_2	Incomplete signal processing
5	E00	Unacknowledged re-initialization
6	ELP	Supply voltage too low
7	EH_	Hardware fault

Byte 2

Bit	Var.	Meaning
0	ELE	Input/inputs below 0 %
1	EAU	Outputs unequal output value
2	ENA	Data transfer (RCL, STO) unsuccessful
3	EDR	Value in 8700H not 87
4	EDI	Configuration write-protected
5	EBA	Battery fault
6	SC1	Inhibit computer intervention
7	Q00	Variable Q00

Table 19

The ready-to-receive status is terminated.

5.1.7 Extended status telegram

As from controller software "J" (March 1987) it is possible with one request telegram to transfer the four bytes of the status telegram and of the error telegram in one reply telegram from the controller to the computer.

The request is effected by:

A4/29/address/CS

The reply telegram has the form:

E6/Byte 1/Byte 2/Byte 3/Byte 4/CS

Byte 1 = Byte 1 of error telegram (5.1.6)
Byte 2 = Byte 2 of error telegram
Byte 3 = Byte 1 of status telegram (5.1.2)
Byte 4 = Byte 2 of status telegram

The ready-to-receive status is terminated.

5.1.8 Internal RAM telegram

The status telegram provides information on the status of important binary variables.

In response to the telegram:

B5/2F/address/byte addr./CS

the controller replies:

E6/2F/address/byte addr./byte value/CS

The byte address and its meaning is given in the "Binary variables" Table in the Annex.

The required bit then has to be isolated and evaluated in the computer by means of appropriate routines.

Example:

"byte value" AND "32" isolates bit 5

5.1.9 Bit processing telegram

A5/function code/bus address/bit address/CS

With this telegram a single binary variable (a single bit) is changed in the addressed controller.

Function code:
31 = Bit = 1 (set)
32 = Bit = 0 (delete)
33 = Invert bit
1 becomes 0 and 0 becomes 1.
34* = Bit is set, all other bits of the byte are set to "0".
35* = Bit is set, all other bits of the half byte are set to "0".

* Can only be used for bits 60H to 77H

The controller acknowledges the command with

F4/20/address/CS (for acknowledge codes see 5.3)

00H is also allowed as an address.

The ready-to-receive status is terminated.

5.1.10 Y-crement telegram

A5/function code/bus address/amount/CS

With this telegram, if the addressed controller is switched to manual, the output signal is altered by the specified amount.

Function code:
40 = Increment Y (raise)
41 = Decrement Y (lower)
42 = Increment Y. (raise)
43 = Decrement Y. (lower)

Enter the following values as amount:

Continuous controller: 00H...FFH = 0...25.5 %
Step controller: 00H...FFH = (0...255) · 120 ms
The resulting process correction distance depends on the motor running time.

The controller acknowledges the command with

F4/20/address/CS (see 5.3 for acknowledge codes)

00H is also permitted as address.

The ready-to-receive status is terminated.

5.1.11 Single value input telegram

As from controller software 07/86 (IC 15 with index F), it is possible to transfer single analog values in a pair of telegrams directly from the computer to the controller.

96/address/value address/valueLB/valueHB/CS

The corresponding acknowledge telegram has the form:

F4/20/address/CS

The address 00H is allowed.

The ready-to-receive status is terminated.

5.1.12 External memory telegram

With telegram

A6/BB/address/byte addr.H/byte addr.L/CS

individual values can be read selectively from the RAM and ROM memory cells external to the processor.

byte addr.H = high-order address byte
byte addr.L = low-order address byte

The reply is as follows:

E6/address/byte addr.H/byte.addr.L/byte value/CS

Byte value is the value sought.

Table 1 shows the structure of the memory.

With this type of telegram it is possible, inter alia, to check whether an IC 19 with a configuration is plugged in. The following values are then present at the addresses C300H and/or C700H:
"87" when a configuration, and
"78" when the IC 19 is loaded sectorwise.

5.1.13 Switch-status telegram

As from controller software "J" (March 1987) it is possible to call up the status of the three switches "Y", "F" and "W" and the information of byte 1 of the status telegram (see 5.1.2) in a single pair of telegrams.

Telegram
A4, 2A, Addr, CS
is followed by the answer
E6, (byte 28), (byte 29), (byte 2A), byte 1, CS
(Byte 28) = contents of byte 28
See Section 5.1.2 for byte 1.

The ready-to-receive status is terminated.

5.2 Command and data telegram

The command and data telegrams are used in the same form both at the serial operator interface (RS 422) and at the interface to the configurator. They therefore contain no bus address. They always require a preceding request telegram.

If the data specified in a command telegram cannot be exchanged with one data telegram, the command telegram is followed by the necessary number of data telegrams alternating with an "understood" telegram from the respective receiving unit (see 6.2).

The following command telegrams are provided:

5.2.1 Program lines starting at an address

Successive program lines beginning at a start address are transferred.

The command telegram contains the start address and the number n of program lines to be transferred (n = 0 ≙ 256).

The data telegram contains the three elements of a program line associated with the current address (op code from 84..H, source variable 1 from 85..H and source variable 2 from 86..H).

5.2.2 Changed program lines

Selected program lines including their address are transferred. Application: configurator or computer send only the program lines changed since the last deletion of a memory field.

The command telegram contains the number of program lines to be transferred.

The data telegrams contain the current address and the three associated elements of the program line.

5.2.3 Sequential data

Successive bytes of the RAM area are transferred, irrespective of their meaning, beginning at a start address.

The command telegram contains the start address and the end address incremented by 1. It has the following format:

B6/command code/addrH/addrL1/addrL2/CS

The information required is computed as follows:

Start address: 8xyz
End address: 8abc

AddrH = ax with "a" from the (end address +1) and "x" from the start address.
"a" is to be raised by 1, if the area 8x00H to 8xFFH should be transferred.
AddrL1 = yz from the start address
AddrL2 = bc from the end address + 1

Example: start address: 8700H
end address : 87FFH
+1 = 8800 H
AddrH = 87H
AddrL1 = 00H
AddrL2 = 00H

The data telegram generally contains three data (bytes), the last data telegram may contain only one or two bytes.

5.2.4 Value list starting at an address

Successive values are transferred beginning at a start address.

The command telegram contains the start address and the total number n of values to be transmitted (n = 0 ≙ 256).

A data telegram contains the current address and the low byte and high byte of the associated value.

5.2.5 Changed values

Selected (e.g. changed) values are transferred. (Application: configurator or computer send only those values that have been processed since the last deletion of a memory field.)

The command telegram contains the number of values to be transferred.

A data telegram contains the address and the value as low byte and high byte.

5.2.6 Internal RAM

The data from the internal RAM are transferred with the command telegram "internal RAM".

The command telegram specifies the start address and the number of data items to be transferred.

The data telegram contains the address of the next following data item and a maximum of altogether 3 data items. The number of data items depends on the required number. If more than two data items are to be transferred, three data items are transferred.

5.3 Acknowledge telegram

The **computer** always sends acknowledge telegrams:
D3/acknowledge code/check byte.
Exception: system image (see 5.1.3)
The **controller**
acknowledges A3/code/CS with D3/code/CS
and A4/code/address/CS with
F4/code/address/CS.

The following acknowledge codes exist therein:

Write protection:.. 1D = Controller: when write protection is set.
Understood: ..... 1E = Controller and computer, when data have been understood (see also system image).
Repeat:.......... 1F = Controller and computer
Executed:........ 20 = Controller: when a bit manipulation telegram or an Y increment/decrement telegram has been executed or when the controller has finished sending data (not system image).
Unclear:......... 21 = Controller: when command sequence contained error.
Ready: .... 22 = Controller: after reset.
Init: .... 23 = Controller: after command.

6 Examples

6.1 Status interrogation

a) Status telegram to controller
A4/25/bus address/CS

b) Status telegram to computer
E6/25/bus address/data1/data2/CS

6.2 Retrieve system image in the computer

a) System image telegram to controller:
A5/26/bus address/0C/CS

b) System image data to computer
E6/data1/data2/data3/data4/CS

c) Acknowledgement "understood" to controller
F4/1E/bus address/CS

d) System image data to computer
E6/data1/data2/data3/data4/CS

c) and d) are repeated.

6.3 Automatic/manual switchover

a) Bit processing telegram to controller:
A5/34/bus address/60/CS

b) Acknowledgement telegram to computer
F4/20/bus address/CS

6.4 Manual/automatic switchover

a) Bit processing telegram to controller:
A5/34/bus address/62/CS

b) Acknowledgement telegram to computer
F4/20/bus address/CS

6.5 Change set point

a) Hex name for W = D2H
70 % corresponds to ABC0H
Low order byte LB = C0H
High order byte HB = ABH

b) Telegrams:

6.5.1 Single value input telegram

b.1 Input telegram to controller
96/address/D2/C0/AB/CS

b.2 Acknowledge telegram to computer
F4/20/address/CS

6.5.2 Command and data telegrams

b.1 Reset telegram to controller
A4/24/bus address/CS

b.2 "Ready" acknowledgement to computer
F4/22/bus address/CS

b.3 Command telegram to controller: "Change value"
B4/0B/01/C0

b.4 "Init" acknowledgement to computer
F4/23/bus address/CS

b.5 Data telegram to controller
C5/D2/C0/AB/02

b.6 "Understood" acknowledgement to computer
F4/1E/bus address/CS

6.6 Change output variable

a) Y-crement telegram
A5/function code/bus addr./amount/CS

b) Acknowledgement to computer
F4/20/bus address/CS

6.7 Interrogate values from the controller (general)

Example: XP = ECH

6.7.1 Single value request telegram

a.1 Request telegram to controller
A5/27/address/EC/CS

a.2 Single value telegram to computer
E6/27/address/80/BE/CS

6.7.2 Command and data telegram

a.1 Reset telegram to controller
A4/24/bus address/CS

a.2 Acknowledge "ready" to computer
F4/22/bus address/CS

a.3 Command telegram to controller
B5/08/EC/01/AA

a.4 Acknowledgement "init" to computer
F4/23/bus address/CS

a.5 Acknowledgement "understood" to controller
D3/1E/F1

a.6 Data telegram to computer
C5/EC/80/BE/CS

a.7 Acknowledgement "understood" to controller
D3/1E/F1

a.8 Acknowledgement "executed" to computer
F4/20/bus address/CS

b) Convert the value of XP from hex to dec.

80/BE written correctly gives BE80H.

In decimal numbers, this gives:

B = 11 times 16^3 = 45,056
E = 14 times 16^2 = 3,584
8 = 8 times 16 = 128
0 = 0 times 16 = 0

48,768
minus 32,768

16,000 : 160 = 100.0 %
= proportional range 1000 %

6.8 CLEAR 0 via serial interface

a.1 Reset telegram to controller:
A4/24/bus address/CS

a.2 "Ready" acknowledgement to computer:
F4/22/bus address/CS

a.3 Command telegram to controller:
B5/09/34/1/F3

a.4 "Init" acknowledgement to computer
F4/23/bus address/CS

a.5 Data telegram to controller:
C4/34/98/80
34 = Image of switch S4
first 9 = 9th position = CLEAR 0
then 8 = 8th position = NORMAL

a.6 "Understood" acknowledgement to computer:
F4/1E/bus address/CS

6.9 STO PARAM via serial interface

As CLEAR 0 (6.8), but data telegram:
C4/34/68/50
34 = Image of switch S4
first 6 = 6th position = STO PARAM
then 8 = 8th position = NORMAL

7 Trouble-shooting

If no data exchange takes place, please check the following points:

7.1 PC (IBM or compatible)

Normally, the PC has two interfaces COM 1 and COM 2. If the PC has only one interface it must be configured as COM 1, otherwise the interface is not, or is incorrectly, driven by the operating system.

The following check must be carried out on the controller when there is evidence of serial signals originating from the computer (interface tester, oscilloscope):

7.2 Controller

If the yellow LED SIA (La 3) does not flash this may be because of:

- ● Incorrect mode
- ● Incorrect baud rate
- ● Incorrect address
- ● Incorrect format of the data word (frame format)
- ● Incorrect polarity of the reception lines
- ● Incorrect interface version
- ● Incorrect software status of controller
- ● Incorrect signal amplitude
- ● Incorrect quiescent level

Incorrect mode

When using the rear interface, neither one of the cassette operating modes may be selected nor ENAB CONFI. The operating mode ENAB CONFI must be selected when using the configurator interface.

Incorrect baud rate

The baud rate on the controller must coincide with that of the computer (see 4.3). Telegrams being entered with an incorrect baud rate are ignored.

Incorrect address

The bus address set on the controller can be verified via the monitor MC, routine 0014 (see 4.1 and 4.2).

Incorrect format of the data word (frame format)

The data word must correspond to the specifications in Section 4.4. Telegrams with incorrect frame formats are ignored.

If the value 02 is entered in address 8372 via monitor ME, the unit is "selected". In this status it responds to incomprehensible telegrams with a repeat request.

F4/1F/Adr/CS

The bottom LED SDA (La 4) flashes and the data mentioned above are in the transmission buffer. On reception of an incomprehensible telegram or by pressing S6, the contents of address 8372H are reset.

Incorrect polarity

Incorrect polarity of the reception lines is permissible without having detrimental effect on the electronics.

Incorrect interface version

As standard versions, the Protronic PS controllers are delivered with the interface RS-422 A. Some units have been delivered with the interface RS-232 C as a special version. The same software may be used for both versions (depending on IC 15).

The interface type RS-422 A can be recognized by the text.

P1-UNIVERSAL
RS-422 A

which is engraved in the circuit board, to the left in the slide-in drawer of the unit, at the bottom edge.

If this specification is not engraved, the unit has an interface RS-232 C.

Units with different interfaces cannot mutually communicate.

As from software index F, any arbitrary value is accepted as a valid bus address for RS-232 C. When there is no collector disturbance Q00 the RS-232 C interface is switched off and the configurator interface is activated.

Incorrect software status

In the description of the telegram types in Section 5, reference is made to this fact if a type is available only as from a particular software status.

Index on IC 15	Date	Version
A	16,85	1.0
B	34,85	2.0
C	37.85	2.1
D	42.85	2.2
E	45.85	2.3
F	07.86	2.4
H	35.86	2.6
J	11.87	2.7
K	25.87	2.8

Table 17

Communication disturbances may occur on reception of invalid or mutilated telegrams when using software with index A, B or C. In this case, the software should be replaced by the current software version. (See Replacement Parts List 62–5.90 EN in the Operating Manual).

Incorrect signal amplitude

The differential signal amplitude on both pairs of lines should amount to at least 200 mV peak/peak. The peak value should not exceed the permissible common-mode voltage (−7...+12 V).

Incorrect quiescent level

A defined quiescent level of ≧ 2 V against ⊥ is generated on the reception side by virtue of the fact that each Protronic P unit has a circuit provided for this purpose.

Provision of a corresponding quiescent level for the reception lines of the computer must be made so as to permit perfect communication. It must be possible to measure a voltage of ± 0.2 V at the terminals T+ and T− in the fully wired system which is ready for operation. If this bias voltage is not available, capacitive couplings produce "echo effects": Signals transmitted by the computer are received as correct or as mutilated signals again simultaneously.

Most interface cards known permit the quiescent level to be set by means of plug-in jumpers or switches. If necessary, an external circuit with a battery of 1.5...9 V having an internal resistance of 1...10 kΩ may be used.

With the aid of an external voltage divider, the transmitter supply source of a Protronic P may also be used.

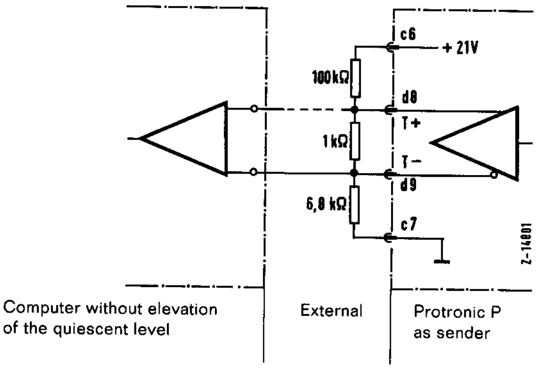


Fig. 12

8 Annex

8.1 List of the telegrams in Protronic P

Telegram from: computer to controller	controller to computer	From[1]	Purpose
1) A3, 24, CS A4, 24, addr, CS	D3, ack, CS F4, ack, addr, CS	A	Calling up a controller for command and data telegram see 5.1.1
2) A4, 25, addr, CS	E6, 25, addr, byte 1, byte 2, CS	A	Read status alarms Are coded in bytes 1 and 2 see 5.1.2
3) A5, 26, addr, IWA, CS then F4, IE, addr, CS or A5, 26, addr, IWA-2, CS	E6, LB1, HB1, LB2, E6, LB1, HB1, LB2, HB2, CS	A (F)	Read 2 values from system image Read 2 further values from system image see 5.1.3
4) A4, 27, addr, WA, CS	E6, 27, addr, LB, HB, CS	F	Read the value with value address WA see 5.1.4
5) A6, 27, addr, WA1, WA2, CS	E6, LB1, HB1, LB2, HB2, CS	J[2]	Read the values with value addresses WA1 and WA2 see 5.1.5
6) A4, 28, addr, CS	E6, 28, addr, byte 1, byte 2, CS	H	Read error alarms see 5.1.6
7) A5, 29, addr, CS	E6, By1, By2, By3, By4	J[2]	Combination of status telegram (5.1.2) and error telegram (5.1.6) see 5.1.7
8) A4, 2A, addr, CS	E6,(B28),(B29),(B2A),By1,CS	J[2]	Read the contents of byte 28, byte 29, byte 2A and status byte 1 (3.3), see 5.1.13
9) A5, 2F, addr, BA, CS	E6, 2F, addr, BA, byte, CS	H	Read a byte from the internal RAM (binary variable) see 5.1.8
10) A5, 31, addr, BA, CS A5, 32, addr, BA, CS A5, 33, addr, BA, CS A5, 34, addr, BA, CS A5, 35, addr, BA, CS	F4, ack, addr, CS F4, ack, addr, CS F4, ack, addr, CS F4, ack, addr, CS F4, ack, addr, CS	A	Set bit in internal RAM Clear bit in internal RAM Complement bit in internal RAM Set a single bit in the byte Set a single bit in the half-byte (nibble) see 5.1.9
11) A5, 40, addr, Cr, CS A5, 41, addr, Cr, CS A5, 42, addr, Cr, CS A5, 43, addr, Cr, CS	F4, ack, addr, CS F4, ack, addr, CS F4, ack, addr, CS F4, ack, addr, CS	A	Increment output 1 (Y) Decrement output 1 (Y) Increment output 2 (Y.) Decrement output 2 (Y.) see 5.1.10
12) 96, addr, WA, LB, HB, CS	F4, ack, addr, CS	F	Send a value to the controller for the value address WA see 5.1.11
13) A6, BB, addr, BAH, BAL, CS	E6, addr, BAH, BAL, byte, CS	H	Fetch data from the ROM, EPROM, EEPROM see 5.1.12

[1] Software status (index on IC 15)

[2] Software status J ≙ March 1987

8.2 Sequence of command and data telegrams (see 5.2)

Protronic is receiver

Function	Code	Command telegram	Data telegram
Program lines	1 2	B5/code/start address/number/CS	C6/address/data1/data2/data3/CS
Program changes	3	B4/3/number/CS	C6/address/data1/data2/data3/CS
Sequential data	5 6	B6/Code/addrH/addrL1/addrL2/CS	Cn/data1/(data2)/(data3)/CS
Value list data	7 8	B5/code/start address/number/CS	C5/address/data1/data2/CS
Value list changes	B	B4/B/number/CS	C5/address/data1/data2/CS
Internal RAM	9 A	B5/Code/start address/number/CS	Cm/address/data1/(data2)/(data3)/CS

CS = Checkbyte
Code odd = Protronic is receiver
Code even = Protronic is transmitter

n = 3, 4 or 5
m = 4, 5 or 6

Computer to controller	Controller to computer	Purpose
A4, 24, addr, CS	F4, ack, addr, CS	Calling up a controller acknowledgement = 24 = controller ready
Command telegram	F4, ack, addr, CS	acknowledgement = 23 = controller has understood command
Data telegram	F4, ack, addr, CS	acknowledgement = 1E = controller has understood telegram
...		
Data telegram	F4, ack, addr, CS	acknowledgement = 1E = controller has understood telegram

...until command telegram has been executed or computer sends no further data telegram

Protronic is transmitter (5.2)

Computer to controller	Controller to computer	Purpose
A4, 24, addr, CS	F4, ack, addr, CS	Calling up a controller acknowledgement = 22 = controller ready
Command telegram	F4, ack, addr, CS	acknowledgement = 23 = controller has understood command
D3, ack, CS	Data telegram	acknowledgement = 1E = computer has understood reply of controller
D3, ack, CS	Data telegram	acknowledgement = 1E = computer has understood reply of controller
...		
D3, ack, CS	F4, ack2, addr, CS	acknowledgement 2 = 20 = command completely executed

...telegram traffic can be interrupted by computer not sending any further acknowledgement.

List of abbreviations used:

addr = address of controller on bus
By = value of one byte (= binary variable)
BA = byte address
BAH = byte address high-byte
BAL = byte address low-byte
Cr = amount (crement) by which Y(Y.) shall be incremented
CS = test sum
HB = high-byte of a value
IWA = indirect value address (in list of control codes)
IWA-2 = IWA reduced by 2
LB = low-byte of a value
QUIT = acknowledgement code
WA = direct value address (hexadecimal code of the variable name)
WA1 = direct value address 1
WA2 = direct value address 2
4.4.1.. = reference to the corresponding sections of Operating manual 42/ 62-64-... EN

8.3 Variables in Protronic P

Analog source variables, inputs and constants

Variable	Display	Hex	Function
Blank	Space	00	Free
/W8	w8	01	Free
/W7	w7	02	Free
/W6	w6	03	Free
/W5	w5	04	Free
/W4	w4	05	Free
/W3	w3	06	Free
/W2	w2	07	Free
/W1	w1	08	Free
/W0	w0	09	Free
/W	w	0A	Free
/UF	uF	0B	Free
/UE	uE	0C	Free
/UD	ud	0D	Free
/UC	uC	0E	Free
/UB	ub	0F	Free
/UA	uA	10	Free
/U9	u9	11	Free
/U8	u8	12	Free
/U7	u7	13	Difference signal controller 2
/U6	u6	14	D action controller 2
/U5	u5	15	I action controller 2
/U4	u4	16	P + D + S controller 2
/U3	u3	17	Difference signal controller 1
/U2	u2	18	D action controller 1
/U1	u1	19	I action controller 1
/U0	u0	1A	P + D + S controller 1
/R4	r4	1B	Remote-controlled variable
/R3	r3	1C	Output of control module 1
/R2	r2	1D	Output of control module 2
/R1	r1	1E	Digital displayed variable
/R0	r0	1F	Sawtooth test signal
/N8	n8	20	Fixed value 100.0 %
/N7	n7	21	Fixed value 75.0 %
/N6	n6	22	Fixed value 50.0 %
/N5	n5	23	Fixed value 25.0 %
/N4	n4	24	Fixed value 10.0 %
/N3	n3	25	Fixed value 1.0 %
/N2	n2	26	Fixed value 0.1 %
/N1	n1	27	Fixed value 0.0 %
/MF	mF	28	Free
/ME	mE	29	Free
/MD	md	2A	Free
/MC	mC	2B	Free
/MB	mb	2C	Free
/MA	mA	2D	Free
/M9	m9	2E	Free
/M8	m8	2F	Free
/M7	m7	30	Free
/M6	m6	31	Free
/M5	m5	32	Free
/M4	m4	33	Free
/M3	m3	34	Free
/M2	m2	35	Free
/M1	m1	36	Free
/M0	m0	37	Free
/E8	e8	38	(Input 8)
/E7	e7	39	(Input 7)
/E6	e6	3A	Input 6
/E5	e5	3B	Input 5
/E4	e4	3C	Input 4
/E3	e3	3D	Input 3
/E2	e2	3E	Input 2
/E1	e1	3F	Input 1

The free variables relate to the single-channel continuous controller.

The variables that are free with the other controller functions are given in the Configuration Manual 42/62-63- EN.

Analog Variables

Variable	Display	Function
A1 #	40	Output 1
A2 #	41	Output 2
A3 #	42	Output 3
A4 #	43	Output 4
B	44	B = E1 · K1 + C1
B.	45	Free
C	46	Free
C.	47	Free
C0	48	Free
C.0	49	Free
C1	4A	C1
C.1	4B	Free
C2	4C	C2
C.2	4D	Free
C3	4E	C3
C.3	4F	Free
C4	50	C4
C.4	51	Free
C5	52	Free
C.5	53	Free
C6	54	Free
C.6	55	Free
C7	56	Free
C.7	57	Free
C8	58	On/off controller
C.8	59	
C9	5A	
C.9	5B	
D	5C	W - WE
D.	5D	Free
DL #	5E	Left analog system display
D.L #	5F	Free
DR #	60	Right analog system display
D.R #	61	Free
DU #	62	Display across bottom
D.U #	63	Free
E	64	Difference X - W
E.	65	Free
F	66	Free
F.	67	Free
F1	68	Preparation for external control of output limits
F.1	69	
F2	6A	
F.2	6B	
F3	6C	
F.3	6D	
G1	6E	Alarm value 1
G.1	6F	Free
G2	70	Alarm value 2
G.2	71	Free
G3	72	Alarm value 3
G.3	73	Free
G4	74	Alarm value 4
G.4	75	Free
H	76	Free
H.	77	Free
I	78	Free
I.	79	Free
J	7A	Free
J.	7B	Free
K	7C	Free
K.	7D	Free
K0	7E	Free
K.0	7F	Free
K1	80	K1
K.1	81	Free
K2	82	K2
K.2	83	Free
K3	84	K3
K.3	85	Free

Analog Variables

Variable	Hex	Function
K4	86	K4
K.4	87	Free
K5	88	Free
K.5	89	Free
K6	8A	Free
K.6	8B	Free
K7	8C	Non-return pointer
K.7	8D	Free
K8	8E	Non-return pointer
K.8	8F	Free
KP	90	1/XP (not adjustable)
K.P	91	1/XP. (not adjustable)
L	92	Free
L.	93	Free
M	94	Intermediate variable for alarm value
M.	95	Intermediate variable for alarm value
M1	96	Intermediate variable for alarm value
M.1	97	Free
N	98	Transfer XD or I XD I
N.	99	Free
N1	9A	Free
N.1	9B	Free
P	9C	Intermediate variable for w
P.	9D	Free
P0	9E	Free
P.0	9F	Free
P1	A0	P1 = E1 · K
P.1	A1	Free
P2	A2	P2 = E2 · K
P.2	A3	Free
P3	A4	P3 = E3 · K
P.3	A5	Intermediate variable
P4	A6	P4 = E4 · K prepared
P.4	A7	Free
P5	A8	Free
P.5	A9	Free
P6	AA	Free
P.6	AB	Free
P7	AC	On/off controller
P.7	AD	
P8	AE	
P.8	AF	
P9	B0	
P.9	B1	
Q	B2	Intermediate variable for W
Q.	B3	Free
R	B4	Intermediate variable for W
R.	B5	Free
S #	B6	Disturbance variable feedforward to Y
S. #	B7	Disturbance variable feedforward to Y
T0	B8	Free
T.0	B9	Free
T1	BA	Free
T.1	BB	Free
T2	BC	Free
T.2	BD	Free
T3	BE	Free
T.3	BF	Free
T4	C0	Free
T.4	C1	Free
TD #	C2	Derivative action time
T.D #	C3	Free
TN #	C4	Integral action time
T.N #	C5	Free
TU	C6	Free
T.U	C7	Free
U	C8	Free
U.	C9	Free
V	CA	Free
V.	CB	Free

Analog variables

Variable	Hex	Function
V0	CC	Free
V.0	CD	Free
V1	CE	Free
V.1	CF	Free
V2	D0	Free
V.2	D1	Free
W	D2	Set point
W.	D3	Set point
W0	D4	Intermediate variable
W.0	D5	Free
W1	D6	Intermediate variable
W.1	D7	Free
W2	D8	Intermediate variable
W.2	D9	Free
WE	DA	WE = E2 · K2 + C2
W.E	DB	Free
WH	DC	Upper set point limit
W.H	DD	Free
WI	DE	Free
W.I	DF	Free
WL	E0	Lower set point limit
W.L	E1	Free
X	E2	Actual value X
X.	E3	Free
X0	E4	Non-return pointer
X.0	E5	Free
X1	E6	Non-return pointer
X.1	E7	Free
X2	E8	Free
X.2	E9	Free
XD #	EA	Control deviation X – W
X.D #	EB	Free
XP #	EC	Proportional range
X.P #	ED	Free
XU #	EE	Intermediate variable
X.U #	EF	Free
Y	F0	Controller output value
Y.	F1	Free
Y0 #	F2	Operating point
Y.0 #	F3	Free
Y1	F4	Free
Y.1	F5	Free
Y2	F6	Free
Y.2	F7	Free
YH #	F8	Upper output limit
Y.H #	F9	Free
YL #	FA	Lower output limit
Y.L #	FB	Free
YR #	FC	External feedback
Y.R #	FD	Free
Z	FE	Free
Z.	FF	Free

= Variable has fixed, unalterable meaning.

Variables with points and # may be used freely as long as only the first channel is enabled.

Binary variables

Variable	Hex	Byte	Function	
'00	00H	1CH	Intermediate variable	
'01	01H		Intermediate variable	
'02	02H		Intermediate variable	
'03	03H		Intermediate variable	
'04	04H		Intermediate variable	
'05	05H		Intermediate variable	
'06	06H		Intermediate variable	
'07	07H		Free	
'08	08H	1DH	Free	
'09	09H		Free	
'0A	0AH		Free	
'0B	0BH		Free	
'0C	0CH		Free	
'0D	0DH		Free	
'0E	0EH		Free	
'0F	0FH		Free	
'10	10H	1EH	Free	
'11	11H		Free	
'12	12H		Free	
'13	13H		Free	
'14	14H		Free	
'15	15H		Free	
OL2#	16H		OL2 = 1 activates 2nd control loop on front	
Q00#	17H		Q00 = 1 sets output Q00	
Q05#	18H	1FH	Output Q05	
Q06#	19H		Output Q06	
Q07#	1AH		Output Q07	
Q08#	1BH		Output Q08	
Q09#	1CH		Output Q09	
Q10#	1DH		Output Q10	
Q11#	1EH		Output Q11	
Q12#	1FH		Output Q12	
BLX #	20H	20H	1= X pointer is switched off	Enables flashing of displays
BLW#	21H		1= W pointer is switched off	
BLY #	22H		1= Y pointer is switched off	
BLD #	23H		1= 7-segment displays from s. 8744	
Q01#	24H		Alarm value 1 = Q01	
Q02#	25H		Alarm value 2 = Q02	
Q03#	26H		Alarm value 3 = Q03	
Q04#	27H		Alarm value 4 = Q04	
SC1	28H	21H	Switchoff computer access see 3.4	
SC2	29H		Free under „SC_2“	Assignable to digital display as message
SC3	2AH		Free under „SC_3“	
SC4	2BH		Free under „SC_4“	
AL1	2CH		Free under „AL_1“	
AL2	2DH		Free under „AL_2“	
AL3	2EH		Free under „AL_3“	
AL4	2FH		Free under „AL_4“	
YST#	30H	22H	1 = Y key one step further	
FST#	31H		1 = F key one step further	
WST#	32H		1 = W key one step further	
YSM#	33H		1 = Manual	
YSA#	34H		1 = Automatic	
WSI#	35H		1 = Internal	
WSE#	36H		1 = External	
OKD#	37H		1 = Transfer without flashing (without pause)	
CC2#	38H	23H	Characteristic of loop 2	1 = falling INV
CD2#	39H		D action 2 on/off	1 = on
CI2#	3AH		I action 2 on/off	1 = on
CT2#	3BH		Track bit 2	1 = on (Y. = Y.R)
CC1#	3CH		Characteristic of loop 1	1 = falling INV
CD1#	3DH		D action 1 on/off	1 = on
CI1#	3EH		I action 1 on/off	1 = on
CT1#	3FH		Track bit 1	1 = on (Y = YR)

= Variable has a fixed, unalterable meaning

Binary variables

Binary variables 40H to FFH can be used in configurations; their status (0 or 1) cannot, however, be directly changed by these.

Variable	Hex	Byte	Function	
T1S	40H	24H	Time register 1 s	A pulse for the duration of a cycle at the specified interval
T2S	41H		Time register 2 s	
T4S	42H		Time register 4 s	
T8S	43H		Time register 8 s	
THS	44H		Time register 16 s	
T1M	45H		Time register 1 min.	
T2M	46H		Time register 2 min.	
T4M	47H		Time register 4 min.	
TF1	48H	25H	Flasher 1 5 Hz (100 ms on, 100 ms off)	
TF2	49H		Flasher 2 2,5 Hz (200 ms on, 200 ms off)	
TF4	4AH		Flasher 3 1 Hz (400 ms on, 600 ms off)	
TF8	4BH		Flasher 4 1 Hz (200 ms on, 800 ms off)	
T01	4CH		Time register 0.1 s	A pulse for the duration of a cycle at the specified interval
T02	4DH		Time register 0.2 s	
T04	4EH		Time register 0.4 s	
T0H	4FH		Time register 1.6 s	
C1D	50H	26H	Controller 1 „off“	
C2E	51H		Controller 2 „on“	
ERF	52H		Error bit = Combination of errors as output Q00	
NFL	53H		Program lines off	
NDI	54H		Enable digital display	
N00	55H		Monitor and other routines on front	
NEC	56H		Reserved	
CTL	57H		CTL key	
CL0	58H	27H	CLEAR 0	
CL1	59H		CLEAR 1	
CL2	5AH		CLEAR 2	
CL3	5BH		CLEAR 3	
CL4	5CH		CLEAR 4	
SPA	5DH		STO PARAM	
RPA	5EH		RCL PARAM	
SPG	5FH		STO PROGM	
Y_0	60H	28H (56H)[1]	H	Manual or hold Switch positions of Y switch
Y_1	61H		S	
Y_2	62H		A	
Y_3	63H			
Y_4	64H			
Y_5	65H			
Y_6	66H			
Y_7	67H		0	
F_0	68H	29H (57H)[1]	H	Switch positions of F switch
F_1	69H		F	
F_2	6AH		G	
F_3	6BH		S	
F_4	6CH		O	
F_5	6DH		P	
F_6	6EH			
F_7	6FH			
W_0	70H	2AH (58H)[1]	I	Switch positions of W switch
W_1	71H		F	
W_2	72H		E	
W_3	73H		C	
W_4	74H			
W_5	75H			
W_6	76H			
W_7	77H		P	
'78#	78H	2BH	Index display	Is 1 when decimal point at display position = on
'79#	79H		Left digit	
'7A#	7AH		Second digit	
'7B#	7BH		Third digit	
'7C#	7CH		Right digit	
'7D#	7DH		Display for W key	
'7E#	7EH		Display for F key	
'7F#	7FH		Display for Y key	

[1] If these bytes are to be modified via the serial interface, writing must take place in the addresses 56H...58H (inter. RAM telegrams); however, the telegrams acc. to Section 5.1.9 should be given preference.

Binary variables

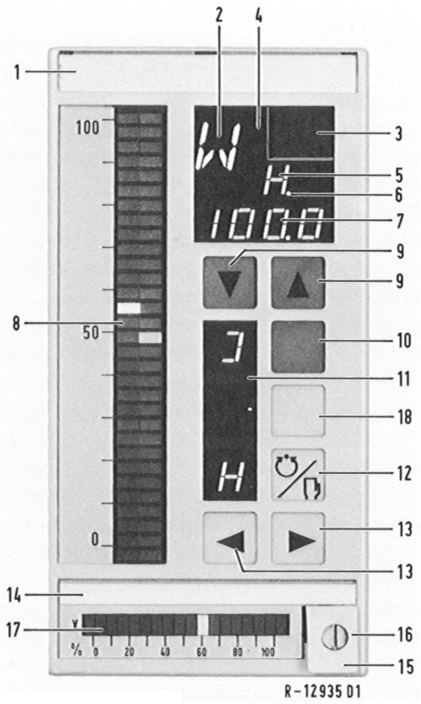
Variable	Hex	Byte	Function	
KP1	80H	2CH	Display selector switch	Duration of key depression
KP2	81H		Key with down arrow	
KP3	82H		Key with up arrow	
KP4	83H		Int/Ext key	
KP5	84H		F key	
KP6	85H		Y key	
KP7	86H		Key with arrow to right	
KP8	87H		Key with arrow to left	
KA1	88H	2DH	Display selector switch	Irrespective of the duration of key depression, the bit is set only once for the duration of a cycle.
KA2	89H		Key with down arrow	
KA3	8AH		Key with up arrow	
KA4	8BH		Int/Ext key	
KA5	8CH		F key	
KA6	8DH		Y key	
KA7	8EH		Key with arrow to right	
KA8	8FH		Key with arrow to left	
ET0	90H	2EH	„to“ = Cycle time exceeded	
ETC	91H		„Tc“ = No telegram since (8706) sec	
ETS	92H		„tS“ = (8707) repeat telegrams since last 4 min clock pulse	
ECS	93H		„CS“ = RS 232-C circuit board	
EDR	94H		„dr“ = RAM contents incorrect (8700H not 87H)	
EDI	95H		„di“ = Write protection switch set	
ESS	96H		„S5“ = Op code in wrong area	
ESC	97H		„SC“ = Undefined op code	
'98#	98H	2FH	Internal general register	
'99#	99H			
'9A#	9AH			
'9B#	9BH			
'9C#	9CH			
'9D#	9DH			
'9E#	9EH			
'9F#	9FH			
D00	A0H	30H	„nn“ = Binary input D00	
EA1	A1H		„A1“ = A1 load too high	
EA2	A2H		„A2“ = A2 load too high	
EUG	A3H		„UG“ = Error bit transmitter supply	
EI1	A4H		„I1“ = Interface module 1 malfunctioning	
EJ1	A5H		„I. 1“ = Interface module 1 defective	
EI2	A6H		„I2“ = Interface module 2 malfunctioning	
EJ2	A7H		„I. 2“ = Interface module 2 defective	
ELE	A8H	31H	„LE“ = Error bit inputs less than 0	
EAU	A9H		„AU“ = Error bit output supervision	
ENA	AAH		„nA“ = Unsuccessful read/write access	
EPE	ABH		„PE“ = Program derailment	
ERR	ACH		„rr“ = Frequent reset	
EBA	ADH		„bA“ = Error bit battery	
ELP	AEH		„LP“ = Error bit power supply too low	
EH_	AFH		„H_“ = Error bit hardware fault	
E_6	B0H	32H	Reserved	
E_5	B1H		„_5“ = Error programmer	
E_4	B2H		„_4“ = After new program standardization	
E_3	B3H		„_3“ = Serial port „on“ at front, „off“ at back	
E_2	B4H		„_2“ = No processing of interconnection	
E00	B5H		„00“ = Initial program loading has taken place	
ERT	B6H		„rt“ = Error bit clock not going	
EFP	B7H		„FC“ = E(E)PROM fault (IC 19)	
LLL	B8H	33H	Binary 0	
I00	B9H		= 1 in first cycle after hold and return of power	
IFF	BAH		= 1 in first 256 cycles after return of power	
IUD	BBH		= 1 in first n cycles (n in 87D9) after return of power	
IPD	BCH		= 1 in first n cycles with return of power after failure = 0.8 s	
III	BDH		= 1 in first n cycles with Er. 00 (see Operating Manual)	
MT1	BEH		Timing mark 1	
MT2	BFH		Timing mark 2	

Binary variables

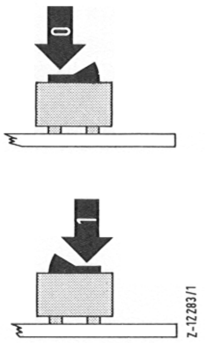
Variable	Hex	Byte	Function	
'C0	C0H	34H	Previous switch position of S4 (Hold = 0, continues clockwise)	
'C1	C1H			
'C2	C2H			
'C3	C3H			
'C4	C4H		Current switch position of S4 (Hold = 0, continues clockwise)	
'C5	C5H			
'C6	C6H			
'C7	C7H			
S31	C8H	35H	Switch S3/1	see Operating Manual
S32	C9H		Switch S3/2	
S33	CAH		Switch S3/3	
S34	CBH		Switch S3/4	
S41	CCH		Switch S4/1 1	Switch position of S4 Hold = 0 counted in binary in clockwise direction
S42	CDH		Switch S4/2 2	
S44	CEH		Switch S4/4 4	
S48	CFH		Switch S4/8 8	
S21	D0H	36H	Switch S2/1	See Operating Manual
S22	D1H		Switch S2/2	
S23	D2H		Switch S2/3	
S24	D3H		Switch S2/4	
S25	D4H		Switch S2/5	
S26	D5H		Switch S2/6	
S27	D6H		Switch S2/7	
S28	D7H		Switch S2/8	
S11	D8H	37H	Switch S1/1	See Operating Manual
S12	D9H		Switch S1/2	
S13	DAH		Switch S1/3	
S14	DBH		Switch S1/4	
S15	DCH		Switch S1/5	
S16	DDH		Switch S1/6	
S17	DEH		Switch S1/7	
S18	DFH		Switch S1/8	
R11	E0H	38H	Bit „+“	step action controller 1
R12	E1H		Bit „–“	
R13	E2H		Reserved	
R14	E3H		Reserved	
R21	E4H		Bit „+“	step action controller 2
R22	E5H		Bit „–“	
R23	E6H		Reserved	
R24	E7H		Reserved	
P21	E8H	39H	1	Set by PW. Binary function programmer 2
P22	E9H		2	
P23	EAH		4	
P24	EBH		8	
P25	ECH		1	Set by PT. Binary function programmer 1
P26	EDH		2	
P27	EEH		4	
P28	EFH		8	
P11	F0H	3AH	1	Set by PW. Binary function programmer 1
P12	F1H		2	
P13	F2H		4	
P14	F3H		8	
P15	F4H		1	Set by PT. Binary function programmer 1
P16	F5H		2	
P17	F6H		4	
P18	F7H		8	
D01	F8H	3BH	Binary input D01	
D02	F9H		Binary input D02	
D03	FAH		Binary input D03	
D04	FBH		Binary input D04	
D05	FCH		Binary input D05	
D06	FDH		Binary input D06	
D07	FEH		Binary input D07	
D08	FFH		Binary input D08	

9 BASIC program for IBM-PC for testing the data interface

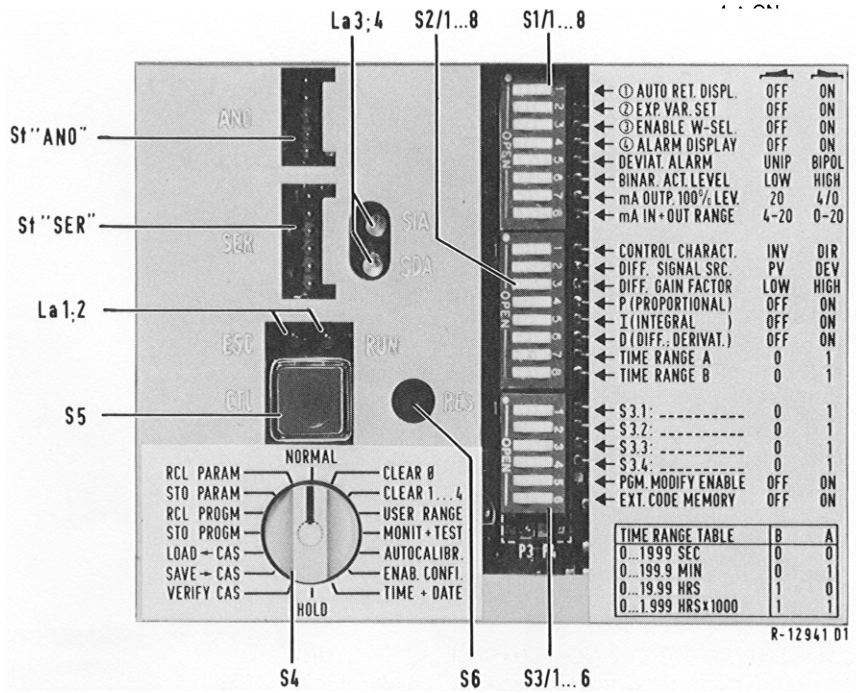
```
 10 REM NAME: "COMUTEST.BAS“         DATUM: 19.12.86
 20 '****************************************************************************************'
 30 REM DATA INTERFACE TEST PROGRAM FOR INTERPRETER BASIC. Will run on any version as from A 2.00.
 40 REM (Will run with D 2.00 when COM and ON COM instructions removed!)
 50 CLS:KEY OFF
 60 DEF FNNIH(H$) = (ASC(LEFT$(H$,1))-48+(ASC(LEFT$(H$,1))>64)*7)
 70 DEF FNNIL(H$) = (ASC(RIGHT$(H$,1))-48+(ASC(RIGHT$(H$,1))>64)*7)
 80 LOCATE 25,1 :PRINT"CONTINUE: CR=REPEAT, A=MODIFY, N=NEW TELEGR., P=PARITY ERROR,
    E=END“ LOCATE 1,1:
 90 PRINT"          THIS IS A SIMPLE PROGRAM TO TEST THE COUPLING BEETWEEN“
100 PRINT"                                   PROTRONIC PS CONTROLLERS AND IBM PC.“
110 PRINT :PRINT"For telegram input enter hex bytes separated by commas.“
120 PRINT"Upper case and lower case letters are allowed and leading zeros may be omitted.“
130 PRINT"ENTER '+' at the appropriate point automatically complements the checksum.“
140 PRINT"For less than 6 bytes, enter 1 comma for each missing byte (up to 5)“ :PRINT
150 :
160 INPUT"ENTER COM-ADR 1 OR 2“;CO
170 IF CO=2 THEN O=&H2F8 :OPEN "COM2:,,,,CS,DS,CD“ AS #1 :COM(2)ON :ON COM(2) GOSUB 650 :GOTO 180
180 IF CO=1 THEN O=&H3F8 :OPEN "COM1:,,,,CS,DS,CD“ AS #1 :COM(1)ON :ON COM(1) GOSUB 650 :GOTO 180
190 GOTO 140
200 INPUT"BAUDRATE (IN BAUD)          “;R :IF R<110 THEN BEEP :PRINT"TOO SMALL!“ :GOTO 180
210 R1=115200!/R :RH=R1/256 :RL=R1 MOD 256
220 FEHL=0 :INPUT;"TELEGRAMM                          “;T$(1),T$(2),T$(3),T$(4),T$(5),T$(6),
230 FOR I =1 TO 6 :T$(I)=LEFT$(T$(I),2)
240 IF LEFT$(T$(I),1)="+“ THEN T$(I)="+“ :GOSUB 660 :F$(I)=CHR$(T(I)) :PRINT"     ['+' = “;HEX$(T(I));"]“;:I=6 :GOTO 260
250 IF LEN(T$(I))=1 THEN T$(I)="0“+T$(I)
260 IF T$(I)="“ THEN T$(I)="00“
270 T1 = FNNIH(T$(I)) : IF T1 > 15 THEN T1 = T1 - 32
280 T2 = FNNIL(T$(I)) : IF T2 > 15 THEN T2 = T2 - 32
290 T(I) = T1 * 16 + T2: IF T(I) < 0 OR T(I) > 255 THEN ERR = 1: I = 6: GOTO 310
300 F$(I) = CHR$(T(I))
310 NEXT I :IF FEHL =1 THEN PRINT" INPUT ERROR!“ :GOTO 200
320 PRINT
330 OUT O+3,&H9B    :REM  ADDRESS DIVIDER REGISTER
340 OUT O,RL        :REM } BAUD RATE
350 OUT O+1,RH      :REM }
360 OUT O+3,&H1B    :REM  ADDRESS TRANSMITTER BUFFER, 8 BIT, EVEN PARITY
370 L=T(1) MOD 16 :IF L>6 THEN L=6
380 T$="“
390 FOR I=1 TO L
400 T$=T$+F$(I)
410 NEXT I
420 PRINT#1,T$;
430 PRINT "REPLY TELEGRAM:“,
440 A = TIMER
450 Z=LOC(1) :IF Z>2 THEN 480
460 IF TIMER < A + .2 THEN 450
470 IF Z=0 THEN PRINT"NO REPLY“ :GOTO 580
480 E$=INPUT$(Z,1)
490 E$(1) = LEFT$(E$,1): E(1) = ASC(E$(1)): N = E(1) MOD 16
500 IF Z = N THEN 520
510 GOTO 450
520 PRINT RIGHT$("00“+HEX$(E(1)),2)“ “;
530 FOR I=1 TO Z
540 E$(I)=MID$(E$,I,1) :E(I)=ASC(E$(I)) :Q$(I)=HEX$(E(I))
550 IF LEN(Q$(I))=1 THEN Q$(I)="0“+Q$(I)
560 Q$(I)=Q$(I)+" “ :PRINT Q$(I); :NEXT I
570 PRINT
580 F$=INKEY$ :IF F$="“ THEN 480
590 IF F$=CHR$(13) THEN 310
600 IF F$="N“ OR F$="n“ THEN 200
610 IF F$="A“ OR F$="a“ THEN GOSUB 670 :GOTO 200
620 IF F$="P“ OR F$="p“ THEN OUT O+3,&HB :OUT O,85 :OUT O+3,&H1B :GOTO 380
630 IF F$="E“  OR F$="e“ THEN END
640 GOTO 580
650 REM   SUBROUTINES FOLLOW!
660 T=0 :BEEP :FEHL =1 :RETURN
670 BEEP :RETURN
680 SUM=0 :FOR K=1 TO (I-1) :SUM=SUM+T(K) :NEXT K :T(I)=SUM MOD 256 :RETURN
690 PRINT"                              “; :FOR I=1 TO 5 :PRINT T$(I);",“;   :NEXT :PRINT T$(6);
700 LOCATE CSRLIN,1: RETURN
```



1 Top legend plate
2 Code letter display
3 Selector switch for digital display
4 Digital display field
5 Index for code letters
6 Decimal point for 5, lights up when the variable displayed by 2 and 5 is adjustable
7 Four-digit display
8 Analog display: actual value red
set point green
9 "Raise/lower" keys for set point and parameter
10 Set point selection (can be inhibited)
11 Status display
12 Selection manual/automatic
13 "Raise/lower" keys for output variable
14 Lower legend plate
15 Handle for removal
16 Module locking screw
17 Output variable display
18 Multi-function key (F-key)



0 ≙ OPEN
1 ≙ ON



← ① AUTO RET. DISPL.	OFF	ON
← ② EXP. VAR. SET	OFF	ON
← ③ ENABLE W-SEL.	OFF	ON
← ④ ALARM DISPLAY	OFF	ON
← DEVIAT. ALARM	UNIP	BIPOL
← BINAR. ACT. LEVEL	LOW	HIGH
← mA OUTP. 100% LEV.	20	4/0
← mA IN + OUT RANGE	4-20	0-20
← CONTROL CHARACT.	INV	DIR
← DIFF. SIGNAL SRC.	PV	DEV
← DIFF. GAIN FACTOR	LOW	HIGH
← P (PROPORTIONAL)	OFF	ON
← I (INTEGRAL)	OFF	ON
← D (DIFF.; DERIVAT.)	OFF	ON
← TIME RANGE A	0	1
← TIME RANGE B	0	1
← S3.1: ----------	0	1
← S3.2: ----------	0	1
← S3.3: ----------	0	1
← S3.4: ----------	0	1
← PGM. MODIFY ENABLE	OFF	ON
← EXT. CODE MEMORY	OFF	ON

TIME RANGE TABLE	B	A
0...1999 SEC	0	0
0...199.9 MIN	0	1
0...19.99 HRS	1	0
0...1.999 HRS×1000	1	1

Fig. 14 Display and manual control elements of the processing electronics

Universal Controller Protronic PS

Supplement to Operating Manual 42/62-64-7 EN

Modifications of the firmware version IC153100287.0 from index E

Additional communication log

Apart from the Protronic P log being used up till now, there is now an alternative log also available for computer coupling corresponding to Digitric P (with telegram formats based on the PROFIBUS Norm proposal). This log particularly supports parallel operation of Digitric P and Protronic PS2 instruments sharing a common bus via uniform driver software.

The log is selected in autotest or auxiliary routine 14, see Section 9.4.3 of Operating Manual 42/62-61 EN, in which the unit address is set, as has been the case up till now. Using the ▲ key one can switch the upper display between

„C.Adr.“ = Select "old log" and
„P.Adr.“ = Select "new log".

A short summary of the telegram types of the new log is given at the end. In the following text special features of the new log vis-à-vis Digitric P are described.

Even when selecting the "new log" the old log is always active in the "ENAB.CONFI" mode for the front configuration interface so that the established auxiliary programs PROKON, PRODOK, KOPROT as well as the configurator, as applicable, can be used easily.

The new log can be operated at all the baud rates 300 ... 28,000 bauds given in the autotest or auxiliary routine 15; for this entire range of baud rates it features corresponding time monitoring for the reception of frames (Digitric P only 9600 and 19,200). Intervals between individual frames > 0.3 · frame length effect resetting of the reception buffer pointer, i.e. wait for a valid telegram start. Any byte sequence within a telegram (without intervals) which by coincidence represents a valid reception telegram for another bus subscriber is ignored by the new log. Accordingly, the new log is more appropriate than the old one for operation on an RS-485 2-wire bus.

Telegrams are received, interpreted and answered in principle per interrupt, thus guaranteeing a determined reaction time (processing time approx. 50 ... 2000 µ + 3 blank frames). In respect of command telegrams for value modification and status modification, the command is however not executed in the interrupt program but synchronously to the instrument cycle. This means that e.g. incremental value modifications for one and the same value are to be transmitted at intervals of at least one cycle length (approx. 40 ... 100 ms) so that they do not remain ineffective, despite positive acknowledgment.

Just as Digitric P provision has been made for only 2 types of acknowledgment. A positive acknowledgment is always transmitted if a command can be at least partially executed. A negative acknowledgment is transmitted if the entire command is rejected under the given circumstances. Commands comprising only write operations in a write-protected RAM area are always negatively acknowledged, without data being compared. With the DIL switch 3.5 in the appropriate position, the following RAM areas feature write protection: 84XX ... 87XX, 8CXX ... 8FXX, 94XX ... 97XX, 9CXX ... 9FXX. The address range 9080 ... 90FF is blocked for telegrams, irrespective of the write-protection switch.

The interlock for computer interventions via DIL switch and control code in the log under certain conditions is not active for the new log and no provision has been made for it.

Unlike Digitric P with the Protronic P hardware it is inevitable that on Power-On-Reset of an instrument, the latter's transmission driver is activated briefly (approx. 40 ms), thus disrupting the running telegram traffic.

When reading data from external storages bear in mind that Protronic PS2 features RAM and (EP)ROM in the address range 8000 to BFFF. The telegram format for reading a partition has been extended with one more memory code type than Digitric P.

Protronic P and Digitric P have differently organized analog value lists and different addresses for the partial quantity of the values of the same meaning. Therefore another value (FF) different from Digitric P (7F) was defined for the Protronic P new log as a global address, i.e. the address at which commands of all subscribers are accepted unanswered. Otherwise, it would not be possible to effect via a common bus value modifications for all instruments of a single type using so-called broadcast telegrams.

The newly defined list area in the control code, with which the analog values called by the standard interrogation telegram are specified, has been assigned as follows for all standard configurations:

8725H:	08H;	Length transmit 8 values
8726H:	5EH;	DL: Value in left analog display (in general X)
8727H:	60H;	DR: Value in right analog display (in general W)
8728H:	62H;	DU: Value in bottom analog display (in general Y)
8729H:	EAH;	XD: Control deviation
872AH:	6EH;	G1: Alarm value 1
872BH:	70H;	G2: Alarm value 2
872CH:	72H;	G3: Alarm value 3
872DH:	74H;	G4: Alarm value 4

If one changes the length specifications from 08 to 66 for 2-channel units, a total of 12 values are transmitted in the following order:

DL/DR/DU/XD/G1/G2/D.L/D.R/D.U/X.D/G.1/G.2

Brief summary of the new Protronic P telegrams

10H/DA/SA/01H/FCS/16H	Presence inquiry/Global status

10H/DA/SA/02H/FCS/16H	Standard interrogation binary signals
	ERR0 = div. error bits
	ERR1 = div. error bits
	ERR2 = div. error bits
	ERR3 = div. error bits
	BWL05 = Reportable intermediate variable
	FUSEL_Y = Status bits H/A etc. channel 1+2
	FUSEL_F = Status bits F key (channel 1+2)
	FUSEL_W = Status bits I/E etc. channel 1+2
	STATUS = Bit 0...3 = BWL03.4...BWL03.7
	Binary outputs/alarm value Q01...Q04
	to the extent enabled in mask 871BH;
	1 means "Alarm value not infringed"
	0 means "Alarm value infringed"
	Bit 4 = ERF, bit 5 = 0L2
	Bit 6 = MT1, bit 7 = MT2
	BWL03 = Binary outputs Q05...Q12

10H/DA/SA/03H/FCS/16H	Standard interrogation binary and analog signals (list for 8 analog addresses in 8726H-872DH Length in 8725H; low and high nibble must each be ≦ 8! In the case of high 0 < n ≦ 8, the first n analog values are appended with address increased by 1 acc. to the list)
A2H/DA/SA/04H/A1/A2/A3/A4/A5/A6/A7/A8/FCS/16H	Interrogate 8 directly addressed values
A2H/DA/SA/05H/A1/L/X/X/X/X/X/X/FCS/16H	Interrogate partition from internal RAM of µC
A2H/DA/SA/06H/AH1/AL1/L/C/X/X/X/X/FCS/16H	Interrogate partition from external memories (C < 80H: from ext. RAM, C > 7 FH from ROM/EPROM)

A2H/DA/SA/07H/C1/A1/DH1/DL1/C2/A2/DH2/DL2/FCS/16H	Set/modify 2 directly addressed values:
	C = 01 set value
	C = 02 modify value
	C = 00 no action

A2H/DA/SA/08H/D1/D2/D3/D4/D5/D6/X/X/FCS/16H	Set status bits: D1 H/A etc. channel 1 (e.g. 01 = man.) D2 H/A etc. channel 2* (e.g. 04 = auto.) D3 F key channel 1 (e.g. 00 no action) D4 F key channel 2* D5 I/E etc. channel 1 (e.g. 04 = ext) D6 I/E etc. channel 2* * Ignored, if no split
A2H/DA/SA/09H/A1/OP1/S11/S12/A2/OP2/S12/S22/ FCS/16H	Modify 2 program lines (with write-protection: negative acknowledgment)
A2H/DA/SA/0DH/A1/L/D1/D2/D3/D4/D5/D6/FCS/16H	Modify partition 1-6 bytes in interal RAM of µC
A2H/DA/SA/0EH/A1H/A1L/L/D1/D2/D3/D4/D5/FCS/16H	Modify partition 1-5 bytes in external RAM of µC (with write-portection: negative acknowledgment)
A2H/DA/SA/0FH/A1/D1/A2/D2/A3/D3/A4/D4/FCS/16H	Modify 1-4 bytes in internal RAM of µC
A2H/DA/SA/1FH/A1/D1/A2/D2/A3/D3/A4/D4/FCS/16H	Set single bits in 1-4 bytes in internal RAM of µC
A2H/DA/SA/2FH/A1/D1/A2/D2/A3/D3/A4/D4/FCS/16H	Delete single bits in 1-4 bytes in internal RAM of µC
A2H/DA/SA/3FH/A1/D1/A2/D2/A3/D3/A4/D4/FCS/16H	Modify single bits in 1-4 bytes in internal RAM of µC
10H/DA/SA/10H/FCS/16H	Positive acknowledgment (only in the direction PROTRONIC → computer)
10H/DA/SA/11H/FCS/16H	Negative acknowledgment (only in the direction PROTRONIC → computer)
10H/DA/SA/12H/FCS/16H	Repeat request (only in the direction computer → PROTRONIC.
68H/LE/LE/68/DA/SA/FC/ DATA-UNIT /FCS/16	Answer telegrams upon request (only in the PROTRONIC → computer)

DA = Target address
LE = Length unit of entire number of frames – 6
FCS = 1 byte checksum (as from DA)

SA = Source address
FC = Function code of request telegram

Subject to technical changes.

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