DIEGON

*Manual*

# DSA-XXXX

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## Appendices

# 1. Introduction

## *1.1. General*

The microcontroller-based display DSA-SXXX has a SSI-input for single- and multiturn rotary encoders or for linear displacement sensors with a SSI-interface. It also has the following (optional) features:

- 5 digital inputs
- 5 digital outputs
- analogue voltage-output (electrically isolated)
- analogue current-output (electrically isolated)
- RS485 serial communication
- 24 digital inputs and 24 digital outputs

All digital inputs and outputs are optically isolated.
The internal parameters are programmable and determine the functions of the DSA. These parameters are being stored in the EEPROM, to prevent loss of data in case of a voltage-drop.
It is possible to program 8 different presets to realise several kinds of outputs (cam, range-signals etc.). The preset-values are also being stored in the EEPROM.

Using the SSI-protocol one can choose between 13- and 25-bit datatransfer. In the case of connecting a rotary encoder the number of bits that will be processed is programmable.

Other features of the DSA are:

- multiplicator
- electronic adjustment of rotary encoders
- 2 fully programmable 14-bit analogue outputs (voltage and current)
- RS485-communication (for example to program parameters)
- parallel output to convert the sensor value to binary-, BCD- or Gray-Code
- parallel input (to read other sensor values or external preset-value)

## *1.2. Important information*

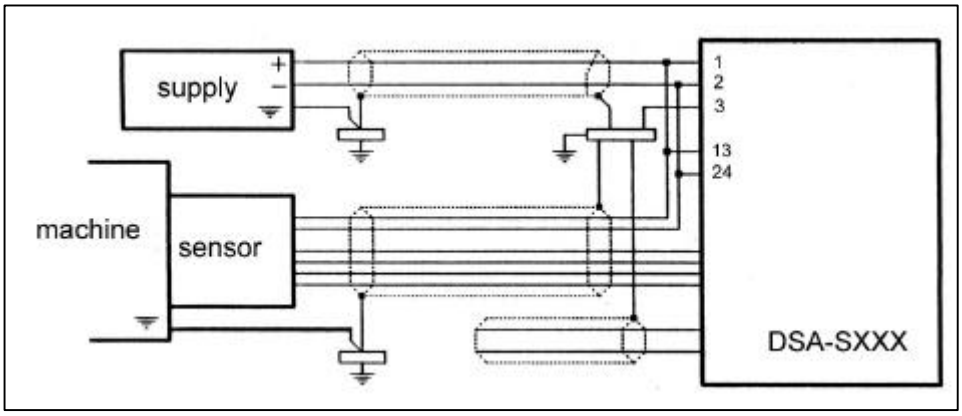
- ✓ The DSA-XXXX is a high-tech electronic product. To ensure safety and a correct functioning of the product it is important that only qualified specialists will install and operate the DSA-XXXX.
- ✓ If through a failure or fault the DSA-XXXX an endangering of persons or damage to plant is possible, this must be prevented using additional safety measures. These must remain operational in all possible modes of the DSA-XXXX.
- ✓ Necessary repairs to the DSA-XXXX are only to be carried out by the manufacturer or specifically authorised agents.

### *1.3. EMC measures*

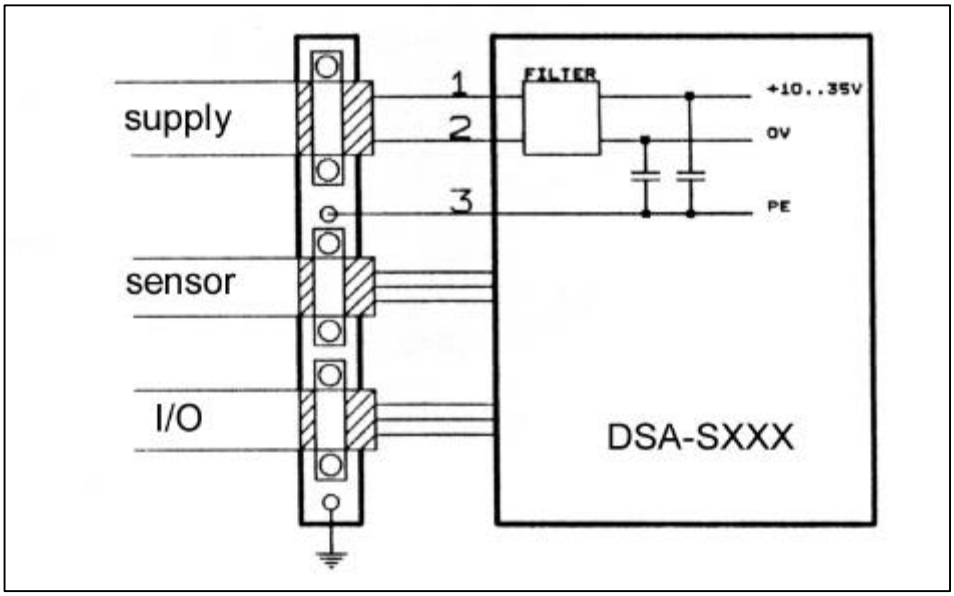
To ensure the best possible electromagnetic compatibility, it is recommended to pay attention to shielding and grounding the DSA-XXXX:

- ✓ Shielding on both sides and with the largest possible contact area.
- ✓ Keep wiring as short as possible.
- ✓ Earth-connections should be short and with the highest possible wiring-diameter.
- ✓ Signal-connections and supply-connections must be separated.

**Supply:**




**Shielding:**



# 2. Operation

## *2.1. Key-functions*


- Browse through monitor
- Activate programming mode (in combination with other keys)
- Deactivate programming mode
- Break off edit mode for presets and parameters
- LED burns when edit mode for presets and parameters is active


- view type number
- increase preset/parameter number
- increase value

- view software version
- activate edit mode
- shift one digit in edit mode

- view status in- and outputs
- store changes in programming
- increase preset/parameter number

## *2.2. Displayfunctions*

SWITCH ON

App. 1 second


App. 1 second

AUTOMATIC MODE


### 2.2.1. Error-reports

| | |
|---|---|
|   | SSI-datatransfer error. Reset through input ERROR RESET |
|   | Input PAR-08 invalid. X3 or 3X is not permitted. |
|   | Range signal B1.<br>end value <= begin value |
|   | Range signal B2.<br>End value <= begin value |
|   | Range signal B3.<br>End value <= begin value |
|   | Range signal B4.<br>End value <= begin value |

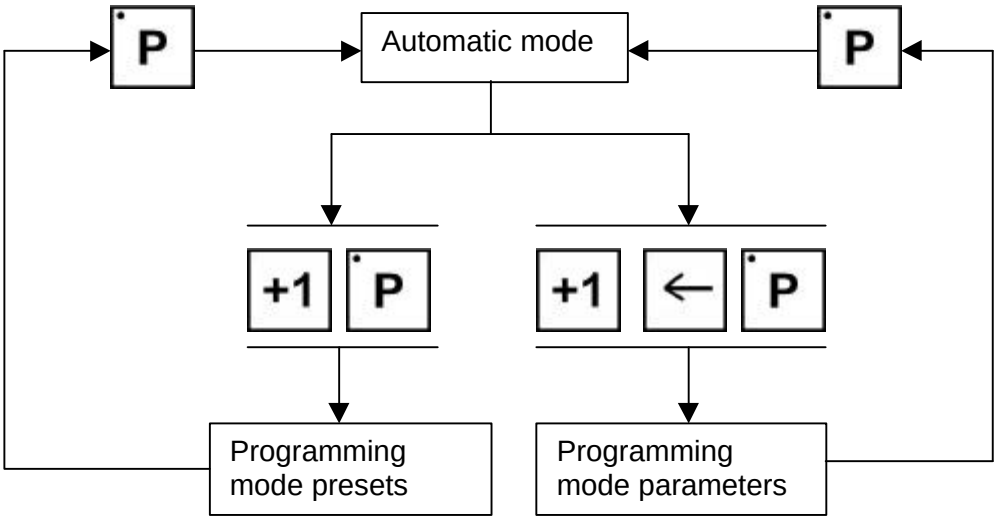
| | |
|---|---|
|  | Range signal B1.<br>End value – hysteresis <= begin value |
|  | Range signal B2.<br>End value – hysteresis <= begin value |
|  | Range signal B3.<br>End value – hysteresis <= begin value |
|  | Range signal B4.<br>End value – hysteresis <= begin value |
|  | No access to parameters. PAR-08 |
|  | No access to presets. PAR-08 |
|  | Adjusting value PAR-07 too high. |
|  | Singleturn bits PAR-04 > 13 bit. |
|  | Multiturn bits PAR-04 > 12 bit. |
|  | Singleturn bits PAR-04 = 0 or<br>Singleturn bits + multiturn bits PAR-04 = 0. |
|  | DATA-VALID and – sign on the same input (datamodule). PAR-26 |
|  | DATA-VALID not possible when using external thumbwheelswitch. PAR-26/27 |
|  | Active bits data-input =0 or:<br>bits >23 (pin 25 is – sign or DATA VALID)<br>bits >22 (pin 12 is – sign or DATA VALID) |
|  | - sign and DATA READY on same output (datamodule) |
|  | - sign and/or DATA READY on same output with selection signals (datamodule) |

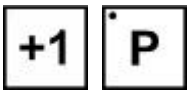
| | |
|---|---|
|   | Output 3 and/or output 4 active using difference measurement.<br>PAR-26 = 5.X.X.X.XX |
|   | Binary or DATA-READY not active using difference measurement.<br>PAR-26 = 5.X.X.X.XX |
|   | Umin invalid (DA1, voltage-output) |
|   | Umax invalid (DA1, voltage-output) |
|   | Umax <= Umin (DA1, voltage-output) |
|   | Delta-s too small (DA1, voltage-output) |
|   | Umin invalid (DA2, current-output) |
|   | Umax invalid (DA2, current-output) |
|   | Umax <= Umin (DA2, current-output) |
|   | Delta-s too small (DA2, current-output) |
|   | Preset-input not possible (only external) |
|   | FATAL RAM-ERROR. |
|   | FATAL MEMORY-ERROR |

## 3. Operating modes

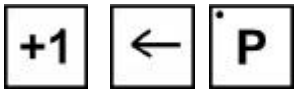
The DSA-XXXX has 3 operating modes:

- Automatic mode
- Programming mode for presets
- Programming mode for parameters




To access the preset: press and hold the +1 key, then press the p-key.



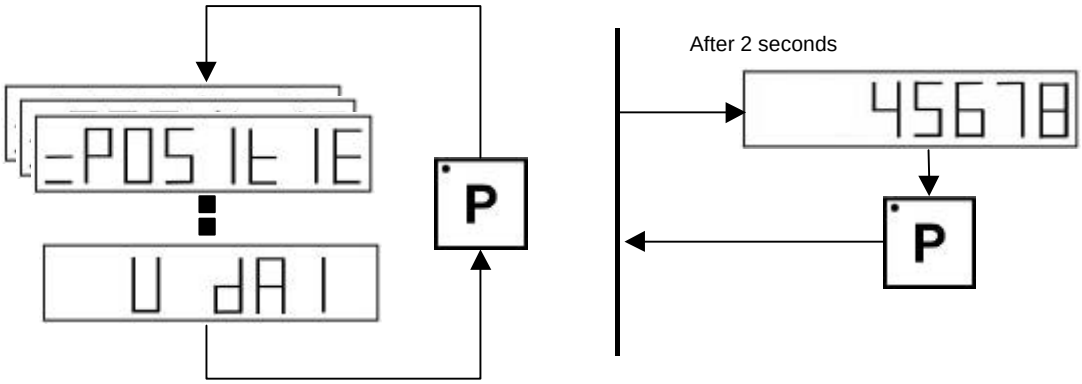

To access the parameters: press and hold the +1 key, then press the arrow-key 5 times, then press the p-key.

### *3.1. Automatic mode*

In Automatic mode the SSI-data is processed and the actual value (=POSITIE) is displayed. The displayed value depends on the programming of several parameters.

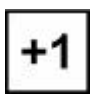
### 3.1.1. Monitorfunction

In automatic mode it is possible to view certain information. Using the p-arrow one can scroll through.




| | |
|---|---|
| -POSITIE | Actual position [dispU] |
| U dA1 | Actual voltage [V] |
| I dA2 | Actual current [mA] |
| SEr dAtA | Serial data (if PAR-25 =1 or 2) |

### 3.1.2. Displaying type and softwareversion

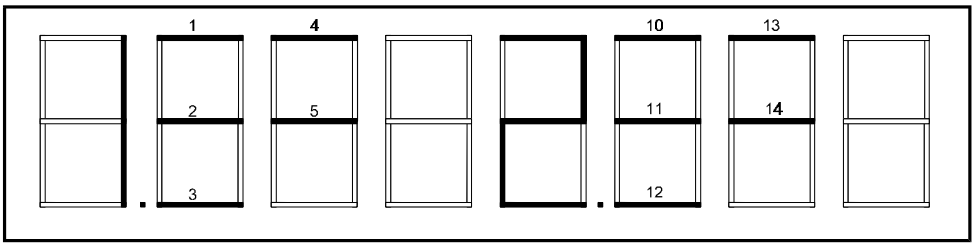
Type: press 


Software: press 

### 3.1.3. Status in- and outputs

To view the status of the in- and outputs press 

Viewing the status is only possible in automatic mode. When the LED turns on the input or output is high.



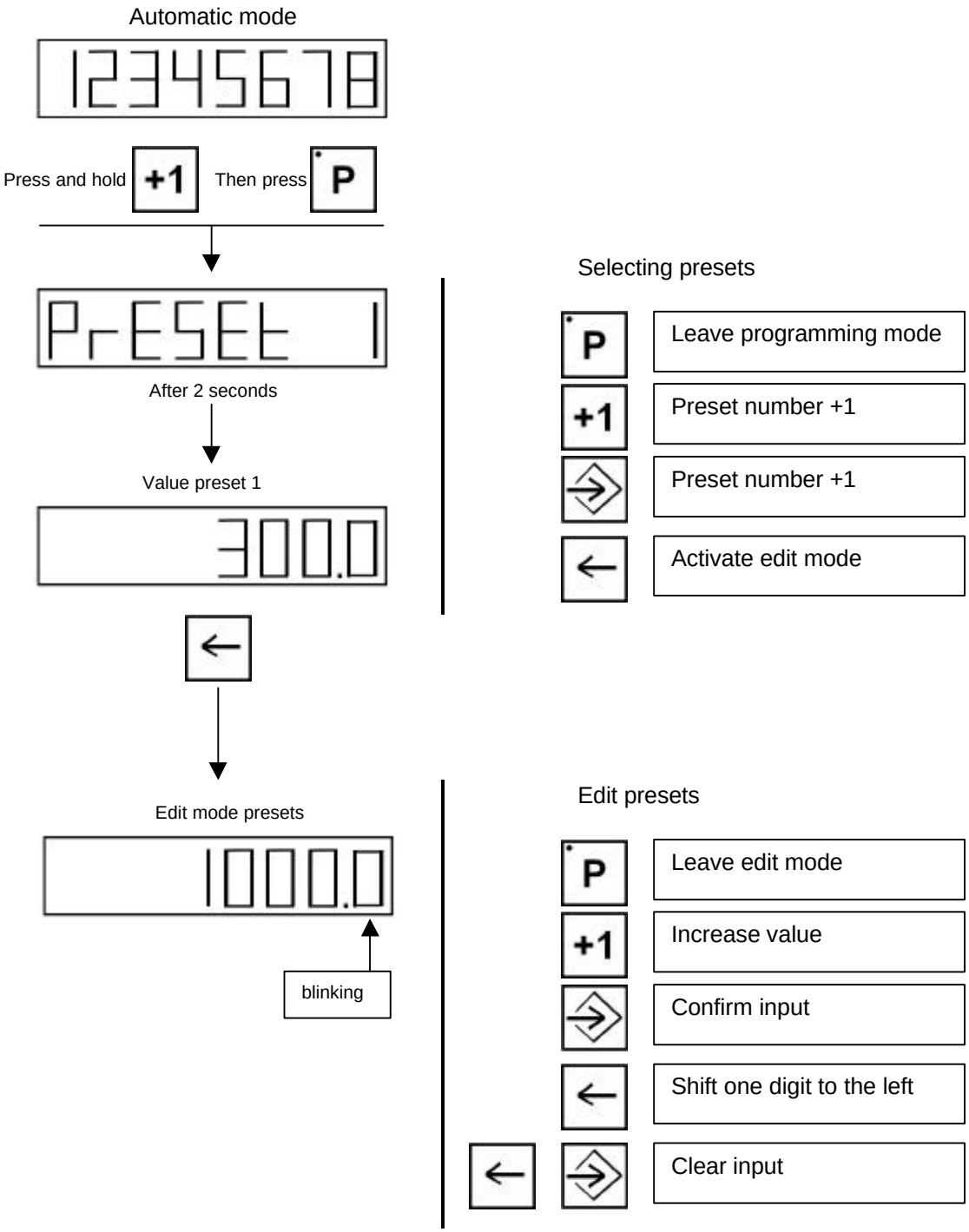

**Inputs (1. )**

1 store
2 enable (parallel data-output)
3 zero-set
4 error reset
5 function input

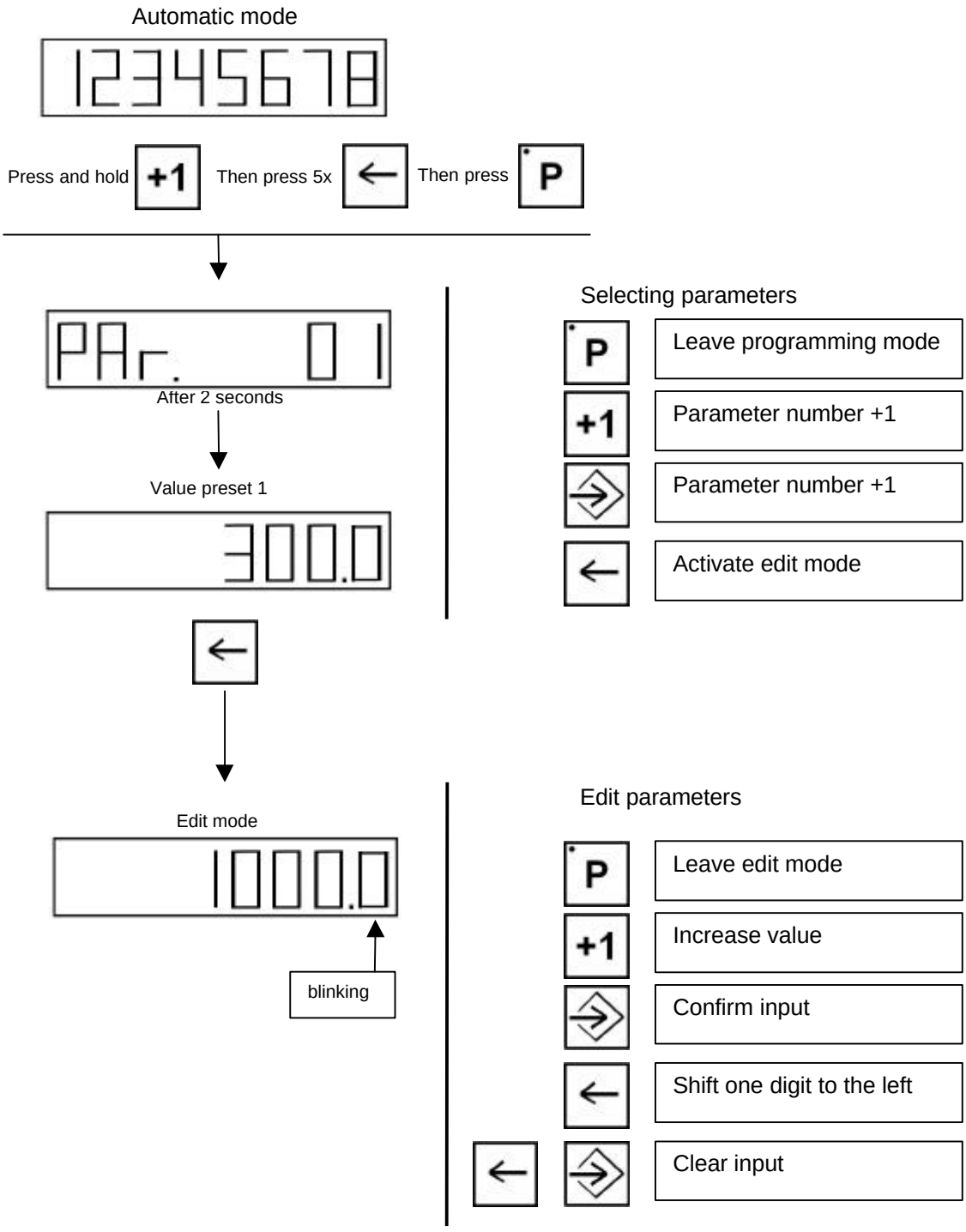
**Outputs (2. )**

10 output 1
11 output 2
12 output 3
13 output 4
14 error output

## *3.2. Programming presets*



### *3.3. Programming parameters*



# 4. Functions

## *4.1. Definitions*

### 4.1.1. Display Units (DispU)

The dimension of a value in the display is [DispU] (display units). This is the value without the decimal point. The DSA-XXXX does internally not use the decimal point.

123.00 = 12300 [DispU]

### 4.1.2. Actual position

The actual position (=POSITIE) stands for the actual sensor value recalculated with the parameters.

## *4.2. SSI protocol*

The Synchronous Serial Interface (SSI) transmits the sensor value to the DSA-SXXX. The value transmitted is in Gray-code. In PAR-02 one can choose between 25 bit and 13 bit SSI (also see Appendix B). PAR-02 can also be used to invert the count direction.

## *4.3. Active number of SSI-bits*

The number of bits that can be used depends on the sensor. The number of SSI bits that will be used by the DSA-SXXX is set in PAR-04.

### 4.3.1. SSI-bits using rotary encoders

In case a rotary SSI-encoder is connected with 1024 positions per revolution and with 512 revolutions, there are 19 databits. In case the encoder has 4096x4096 positions there are 24 databits ($2^{24}$ positions). In PAR-04 one can program the number of active bits.

Format PAR-04: XX.XX

**XX**.XX Number of bits for each revolution.
XX.**XX** Number of bits for positions per revolution.

For example:
1024 positions and 512 revolutions: PAR-04 = 10.09
4096 positions and 4096 revolutions: PAR-04 = 12.12

It is possible to set the number of active bits smaller than the encoder is transmitting.

### 4.3.2. SSI-bits using linear displacement sensors

If a Temposonics linear displacement sensor is connected, this sensor should have a 25 bit protocol with Gray-code. The sensor has one of the following resolutions:

0,005 mm (5µm) standard resolution
0,01 mm
0,02 mm
0,05 mm
0,1 mm

In PAR-04 the resolution can be adjusted.
The multiturn-part of PAR-04 should be 8 bit, which is enough for the maximum resolution of 0,005 mm combined with the maximum sensor length. In case of inverting the count direction it is not possible to have a negative value in PAR-01 which is larger then the maximum input value.

Resolution in mm of the DSA:

| PAR-04 | SENSOR RESOLUTION | | | | |
|---|---|---|---|---|---|
| | **0,005 mm** | **0,01 mm** | **0,02 mm** | **0,05 mm** | **0,1 mm** |
| **8.13** | 0.005 | 0.01 | 0.02 | 0.05 | 0.1 |
| **8.12** | 0.01 | 0.02 | 0.04 | 0.1 | 0.2 |
| **8.11** | 0.02 | 0.04 | 0.08 | 0.2 | 0.4 |
| **8.10** | 0.04 | 0.08 | 0.16 | 0.4 | 0.8 |
| **8.09** | 0.08 | 0.16 | 0.32 | 0.8 | 1.6 |
| **8.08** | 0.16 | 0.32 | 0.64 | 1.6 | 3.2 |
| **8.07** | 0.32 | 0.64 | 1.28 | 3.2 | 6.4 |
| **8.06** | 0.64 | 1.28 | 2.56 | 6.4 | 12.8 |

## *4.4. Multiplicator*

In case the display value (=POSITIE) does not match the desired value, this value can be recalculated using the multiplicator (PAR-03).

Example:

800 positions of the sensor matches 75 mm displacement.
Resolution = 0,1 mm.

Multiplicator = (75/0,1)/800 = 750/800 = 0.9375

### 4.4.1. Multiplicator for the display

PAR-24 allows one to set a multiplicator for the display only. It does not affect the internal resolution with which the DSA calculates. The multiplicator for the display can be 0,1 or 0,01.

## *4.5. Adjustment of rotary encoders*

To adjust an encoder there are two possibilities (PAR-12):

- Adjustment using PAR-07
- Adjustment using ZERO-SET

It is nor necessary to adjust the encoder mechanically.

### 4.5.1. Adjustment using PAR-07

This function is active when PAR-12 = 1.
In PAR-07 the value is set which is used to adjust the encoder clockwise or counter-clockwise. This value is added to the sensor value and recalculated for the maximum display value.
The maximum value for PAR-07 is:

**((positions/revolution x number of revolutions) –1) x M**

M = multiplicator PAR-03.

### 4.5.2. Adjustment using ZERO-SET

This function is active when PAR-12 = 2.
Using this function it is possible to adjust the encoder to zero. The value is stored in EEPROM.
To activate this function the logical input ZERO-SET requires a rising or falling flank.

## *4.6. Zero-point*

In PAR-01 one can add an off-set value to the sensor value. This off-set value can be positive or negative.

Example:
Display value is 0..+6000
PAR-01 = -3000

The new display value will be -3000..+3000.

## *4.7. Input "Function"*

This input is used for several extra functions like ZERO-SET and denying access to the programming modes. The function is determined in PAR-08.
If the external presets are being used this input is used as an enable signal.

## *4.8. Output "SSI error"*

If PAR-13 = 0 the SSI-datatransfer is being checked.
In case an error is detected, the DSA will read the data a second time. If again en error is detected the display will show ERROR 01. The output ERROR will be set to low.
The ERROR can be reset by putting a high signal on the input ERROR RESET.

## *4.9. Function "Store"*

This function will store the position value in the display and the parallel output for as long as the signal is high.

### *4.10. Input "Enable"*

This input is used to enable or disable the parallel data-output.
Signal low : active
Signal high: not active

## 5. Outputs 1..4

The DSA-XXXX has 4 programmable outputs. All outputs can be programmed for 3 different functions:

- Range signal
- Pulse
- Free programmable for RS485 (see also 7.2.5)

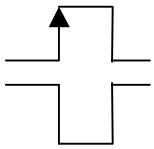
The function is programmed in PAR-09.

### *5.1. Release outputs*

If necessary the outputs can be released using 2 external signals (start / stop):

Input FUNCTION = start

Input ZERO-SET = stop



In case PAR-08 = 3.3

The value of an external data input for relative range signals will be taken over with a rising flank.

### *5.2. Output programmed as range signal*

Every single output has a begin and end value or just a begin value. These values are based on absolute positions (=POSITIE) or on relative positions (external data input minus =POSITIE).

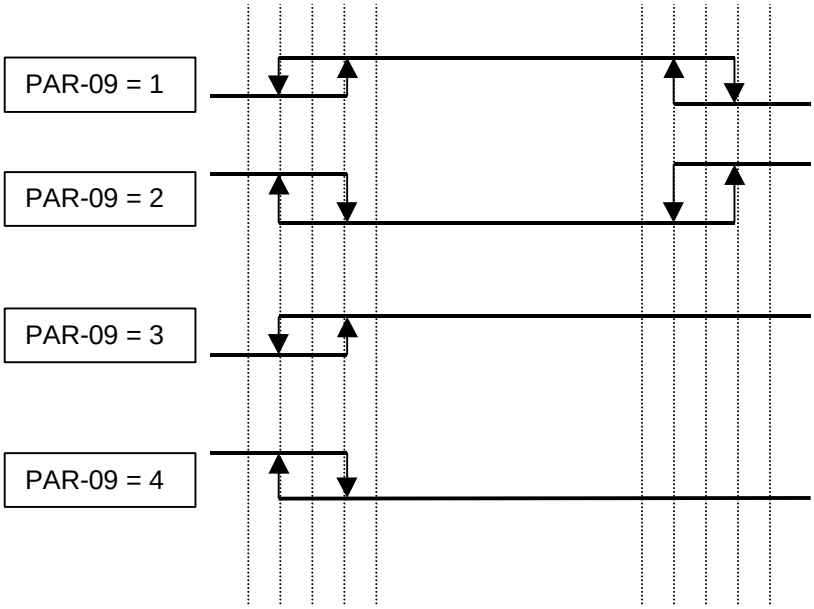
Programming PAR-09:

| PAR-09 | Output high if: |
|---|---|
| 1 | begin value <= **=POSITIE** < end value |
| 2 | **=POSITIE** < begin value AND **=POSITIE** >= end value |
| 3 | **=POSITIE** >= begin value |
| 4 | **=POSITIE** < begin value |

**=POSITIE** is the actual value in the display

In PAR-10 the hysteresis can be programmed.

Example:
Hysteresis: PAR-10 = 2.




### *5.3. Output programmed as pulse-output*

Every output has 1 begin value only. This value can be absolute or relative (external data input minus =POSITIE). See also 8.2.5.

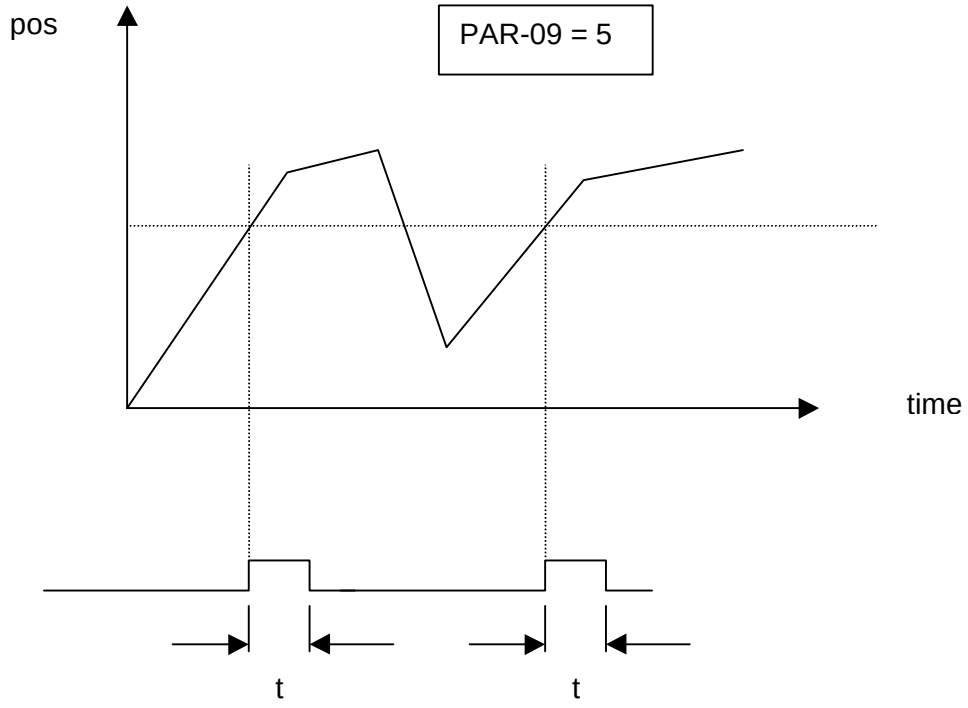
Programming PAR-09:

| PAR-09 | Output high if: |
|---|---|
| 5 | **=POSITIE** >= begin value |
| 6 | **=POSITIE** <= begin value |
| 7 | **=POSITIE** >= begin value OR **=POSITIE** <= begin value |

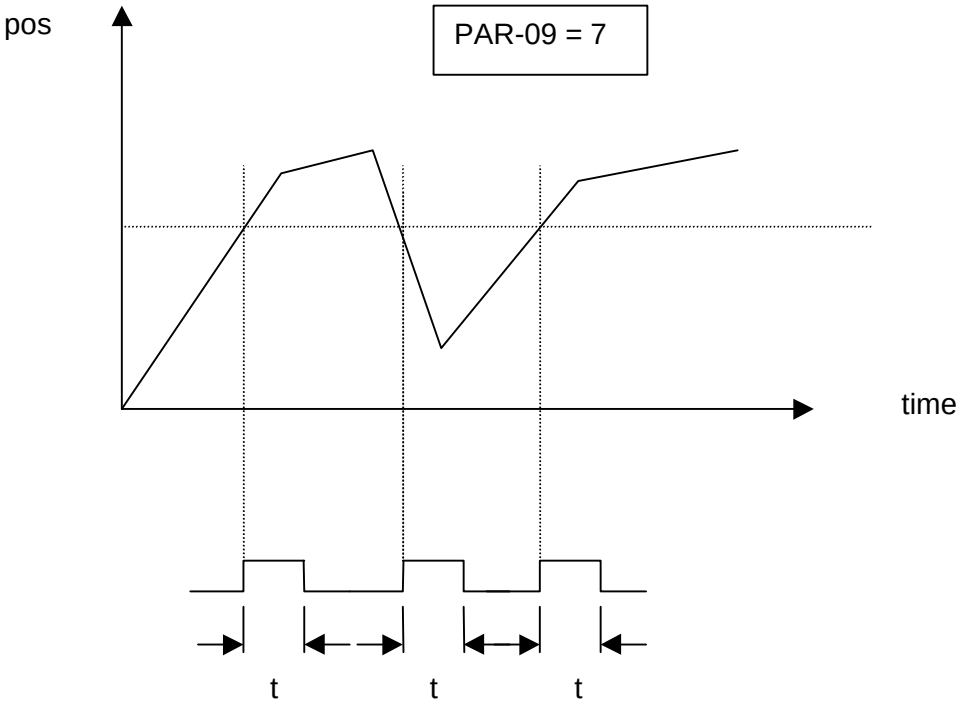
**=POSITIE** is the actual value in the display

The duration of the pulse can be programmed in PAR-11. Before a new pulse will be triggered the time of the old pulse must have passed.

Example 1:

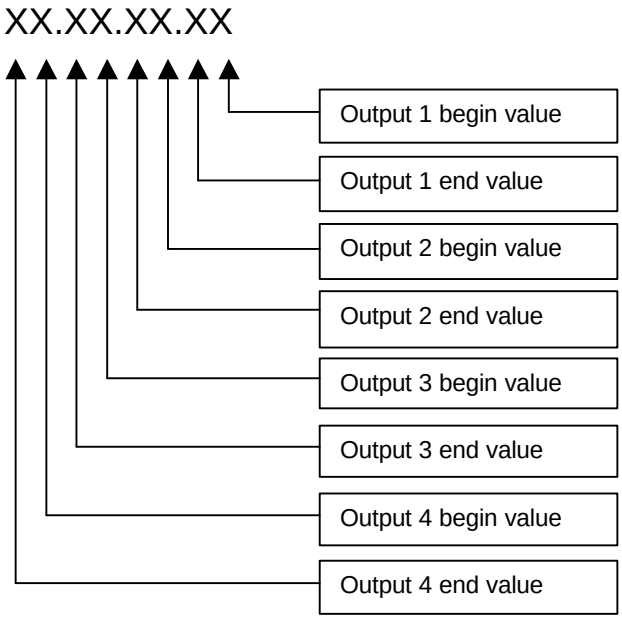



Example 2:



### *5.4. Configuration of the presets*

The begin and end values needed for the outputs are programmed in the presets 1..8. Which preset value belongs to which output is programmed in PAR-15:




For example, if PAR-15 = 54433221 then the following values will be used:

| | |
|---|---|
| PRESET-1 | output 1 begin value |
| PRESET-2 | output 1 end value |
| PRESET-2 | output 2 begin value |
| PRESET-3 | output 2 end value |
| PRESET-3 | output 3 begin value |
| PRESET-4 | output 3 end value |
| PRESET-4 | output 4 begin value |
| PRESET-5 | output 4 end value |

## 6. Analogue outputs

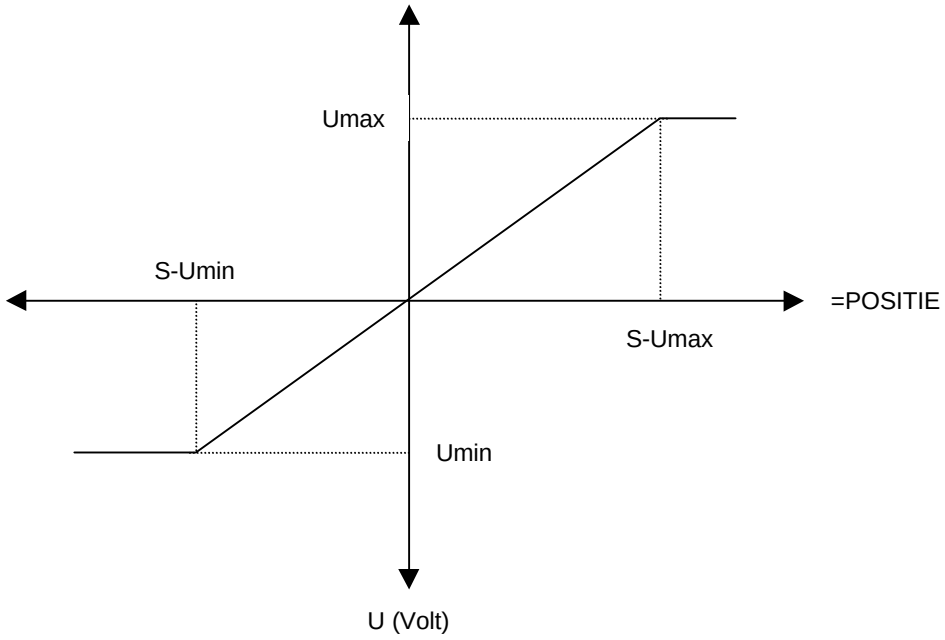
The DSA-XXXX has 2 14-bit programmable analogue outputs. These outputs are electrically isolated.

DA1 Voltage, max. ±10V
DA2 Current, max. ±20mA

### *6.1. Programming DA1 (voltage)*

DA1 is a voltage-output with a resolution of 1,22 mV. Programming parameters:

PAR-16 = Umin
PAR-17 = Umax
PAR-18 = actual value (=POSITIE) at Umin
PAR-19 = actual value (=POSITIE) at Umax

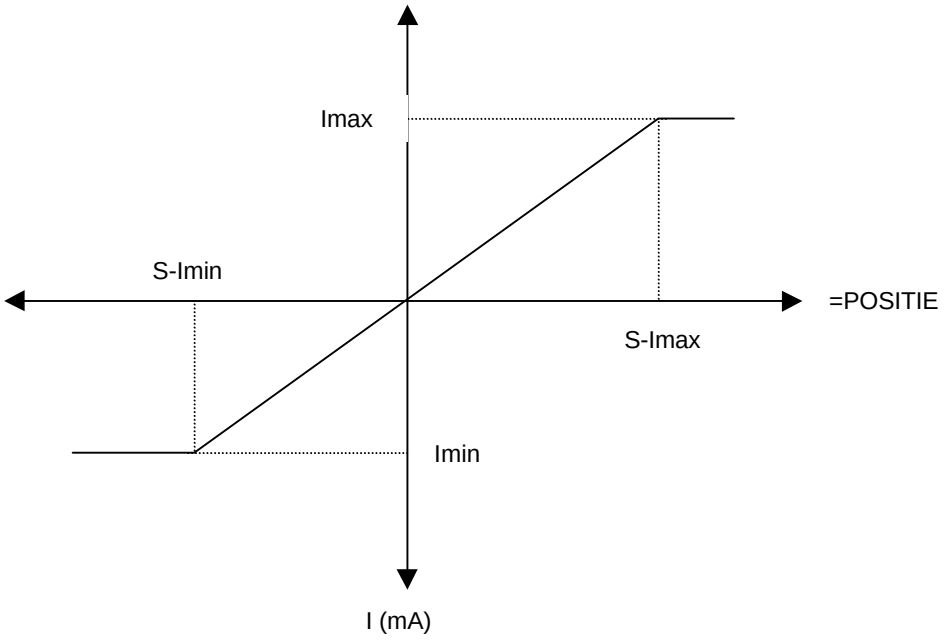



*The following is also possible:*
Umax = 10,000 Volt ; S-Umax = -700.0
Umin = -8.000 Volt, S-Umin = 1100.0

## *6.2. Programming DA2 (current)*

DA2 is a current-output with a resolution of 2,44 mV. Programming parameters:

PAR-20 = Imin
PAR-21 = Imax
PAR-22 = actual value (=POSITIE) at Imin
PAR-23 = actual value (=POSITIE) at Imax



# 7. RS485 Serial communication

## *7.1. Hardware*

The DSA-XRXX has a serial RS485 communicationsdevice for communication with a PC or PLC. A 9-pole sub-D connector is used to connect the wiring. The RS485 device is not electrically isolated.
The baudrate and address are programmable (PAR-14).

### 7.1.1. Converter

To convert the RS485 signal to RS232 (available on PC) it is possible to use the following converter: Phoenix PSM-V24/RS485/BB with PSM-NT-230 AC/15 DC/100.

## *7.2. Protocol TS1*

### 7.2.1. General

Dataformat:

1 startbit, 8 databits, 1 paritybit (even), 1 stopbit.

The values used in the manual are generally hexadecimal, recognisable by H (82H). In some cases the values are BCD, recognisable by D (123450D).

SEND (write) = data from PC, PLC to DSA
RECEIVE (read) = data from DSA to PC, PLC

### 7.2.2. Basic telegram structure

| HEAD | DATA | CHECK BYTE |
|---|---|---|
| 2 bytes | n bytes | 1 byte |

HEAD
1. byte = 82H (LSB)
2. byte = 96H (MSB)

DATA
1. byte = number of following bytes (incl. test byte)
2. byte = function
3. to n byte = data (max 10 bytes)

CHECK BYTE
Logical bit-by-bit XOR operation of all data bytes.

This results in the following structure:

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | XXH | XXH | …… | XXH |
| Receiving | 82H 96H | XXH | XXH | …… | XXH |

***Important***
The LSB is always transmitted first in the datablock. If a databyte is 82H in the datablock the byte will be transmitted again to prevent misinterpretation. This second byte 82H will not be included in the number of bytes or checkbyte.
The byte that stands for the number of bytes has a maximum of 10 (0AH) and can therefore not be 82H.
The transmitted values do not include a decimal point, i.e. the value is in dispU:
1234.0 DispU = 123450D or 1E23AH.

Errormessages have the following structure:

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Receiving | 82H 96H | 03H | FFH | Error message | XXH |

### 7.2.3. Function overview

00H select DSA (HEX)
01H read actual data (=POSITIE) in HEX
02H read actual data (=POSITIE) in BCD
03H read in- and outputs
04H read actual values DA1 and DA2 in HEX
05H read actual values DA1 and DA2 in BCD
10H read presets in BCD
11H write presets in BCD
20H read parameters in BCD
21H write parameters in BCD
40H read type number DSA-XXXX in BCD
41H read softwareversion in BCD
50H read error-memory in BCD
51H reset SSI-error
60H write “SER DATA” in HEX
61H write “SER DATA” in BCD
62H write “SER DATA” in bit-format
70H write output 1..4
80H read data input in HEX (24 bit)

### 7.2.4. Functions

**00H select DSA (HEX)**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 00H | DSA-address | XXH |
| Receiving | 82H 96H | 03H | 00H | DSA-address | XXH |

DSA-address = 1 byte
00H .. 1FH = DSA-address 0..31

The DSA-address is stored in PAR-14 in the DSA. If there is no DSA with the transmitted address, there will be no response (time-out master).

The DSA with the address 00H is always responding, even if another DSA is selected.

**01H read actual data (=POSITIE) in HEX**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 01H | --- | 03H |
| Receiving | 82H 96H | 06H | 01H | XXH XXH XXH XXH | XXH |

If the selected DSA-SRXX has a SSI-error, the DSA responds with the following error message: 82H 96H 03H FFH 11H EDH

**02H read actual data (=POSITIE) in BCD**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 02H | --- | 00H |
| Receiving | 82H 96H | 06H | 02H | XXH XXH XXH XXH | XXH |

If the selected DSA-SRXX has a SSI-error, the DSA responds with the following error message: 82H 96H 03H FFH 11H EDH

The -sign (minus) is equal to AXH: for the value –1234567 the DSA responds with:
82H 96H 06H 02H 67H 45H 23H A1H A4H

**03H read in- and outputs**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 03H | --- | | 00H |
| Receiving | 82H 96H | 04H | 03H | INPUTS | OUTPUTS | XXH |

**Inputs:**

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **X** | **X** | **X** | **X** | **X** |

0 = STORE
1 = ENABLE
2 = ZERO-SET
3 = ERROR RESET
4 = FUNCTION

**Outputs:**

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **X** | **X** | **X** | **X** | **X** |

0 = output 1
1 = output 2
2 = output 3
3 = output 4
4 = error

**04H read actual values DA1 and DA2 in HEX**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 04H | DA number | | XXH |
| Receiving | 82H 96H | 07H | 04H | DA NR | XXH XXH XXH XXH | XXH |

DA NR 01H = DA1
DA NR 02H = DA2

**05H read actual values DA1 and DA2 in BCD**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 05H | DA number | | XXH |
| Receiving | 82H 96H | 07H | 05H | DA NR | XXH XXH XXH XXH | XXH |

DA NR 01H = DA1
DA NR 02H = DA2

The -sign (minus) is equal to AXH.

**10H read presets in BCD**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 10H | Preset number | | XXH |
| Receiving | 82H 96H | 07H | 10H | Pre.nr | XXH XXH XXH XXH | XXH |

Presetnumber 01H..08H.
The -sign (minus) is equal to AXH.

**11H write presets in BCD**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 07H | 11H | Pre.nr | XXH XXH XXH XXH | XXH |
| Receiving | 82H 96H | 03H | 11H | Presetnumber | | XXH |

Presetnumber 01H..08H.
The -sign (minus) is equal to AXH.

The response time of the DSA is app. 100 ms longer (writing EEPROM).

**20H read parameters in BCD**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 20H | Parameter number | | XXH |
| Receiving | 82H 96H | 07H | 20H | Par.nr | XXH XXH XXH XXH | XXH |

Parameter number is 1 byte.
01H..25H = parameter 1..25
The -sign (minus) is equal to AXH.

**21H write parameters in BCD**

| | Head | Number | Function | Data | | Check byte |
|---|---|---|---|---|---|---|
| Transmitting | 82H 96H | 07H | 21H | Par.nr | XXH XXH XXH XXH | XXH |
| Receiving | 82H 96H | 03H | 21H | Parameter number | | XXH |

Parameter number is 1 byte.
01H..25H = parameter 1..25
The -sign (minus) is equal to AXH.

The response time of the DSA is app. 100 ms longer (writing EEPROM).

**40H read type number DSA-XXXX in BCD**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 40H | --- | 42H |
| Receiving | 82H 96H | 03H | 40H | Type number | XXH |

Type number 1 byte: A2H = DSA-SXXX

**41H read softwareversion in BCD**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 41H | --- | 43H |
| Receiving | 82H 96H | 04H | 41H | (LSB) (MSB) | XXH |

For standard software the MSB is always 00H

**50H read error-memory in BCD**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 50H | --- | 52H |
| Receiving | 82H 96H | 03H | 50H | Error number | XXH |

See 2.2.1.

**51H reset SSI-error**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 51H | --- | 53H |
| Receiving | 82H 96H | 02H | 51H | --- | 53H |

**60H write “SER DATA” in HEX**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 06H | 60H | XXH XXH XXH XXH | XXH |
| Receiving | 82H 96H | 02H | 60H | --- | 62H |

Decimal point according to PAR-06.
The -sign (minus) is equal to AXH.

**61H write “SER DATA” in BCD**

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 06H | 61H | XXH XXH XXH XXH | XXH |
| Receiving | 82H 96H | 02H | 61H | --- | 63H |

Decimal point according to PAR-06.
The -sign (minus) is equal to AXH.

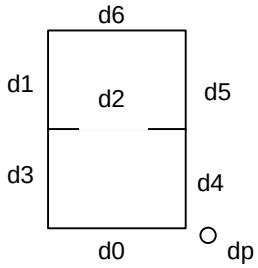
## 62H write "SER DATA" in bit-format

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 0AH | 62H | D1 D2 D3 D4 D5 D6 D7 D8 | XXH |
| Receiving | 82H 96H | 02H | 62H | --- | 60H |

D1 = DECADE $10^0$

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

0 = d0
1 = d1
2 = d2
3 = d3
4 = d4
5 = d5
6 = d6
7 = dp




## 70H write output 1..4

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 03H | 70H | outputs | XXH |
| Receiving | 82H 96H | 02H | 70H | --- | 60H |

(PAR-09 must be 8)

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **0** | **X** | **X** | **X** | **X** |

0 = output 1
1 = output 2
2 = output 3
3 = output 4

## 80H read data input in HEX (24 bit)

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Transmitting | 82H 96H | 02H | 80H | --- | 82H |
| Receiving | 82H 96H | 06H | 80H | XXH XXH XXH XXH | XXH |

### *7.3. Errors*

When an error occurs, the DSA is sending FFH back instead of the function number.

| | Head | Number | Function | Data | Check byte |
|---|---|---|---|---|---|
| Receiving | 82H 96H | 03H | FFH | Error message | XXH |

Errors:

| **Error** | **Description** |
|---|---|
| 01H | Parity error |
| 02H | Framing error (stopbit has wrong polarity) |
| 03H | Overrun error (buffer overwritten before reading) |
| 04H | Checkbyte error |
| 05H | Break detection |
| 10H | Not valid function number |
| 11H | SSI-error |
| 12H | Presetnumber, parameternumber or DA number not valid |
| 13H | Data is not in BCD-code |
| 16H | Action not possible in programming mode |
| 20H | Error calculating parameter or preset |
| 30H | Error writing to EEPROM |

# 8. Parallel datacommunication

## *8.1. General*

The microcontroller based DSA-XXXP has an electrically isolated parallel datamodule with 24 inputs and 24 outputs. The inputs and outputs are connected with two 25-pol Sub-D connectors. The functions for the data input can be programmed through PAR-26 and PAR-27. The functions for the data output can be programmed through PAR-28.

## *8.2. Data input*

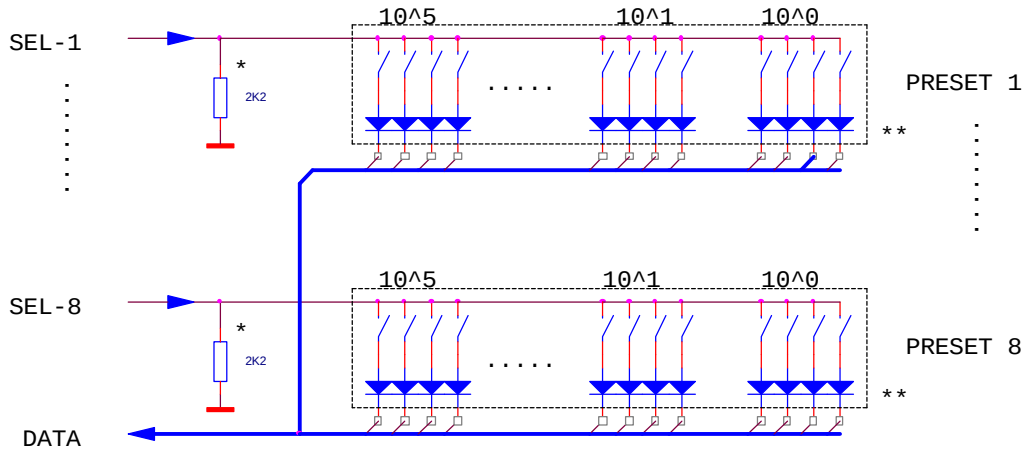
### 8.2.1. Input Data-ready

A high signal on this input means that the data on the external data input is valid. If data-ready is low, the DSA will use the old value.

### 8.2.2. External preset-input

This function is active when PAR-26 = 1.0.X.X.XX.
The preset value should always be in BCD-code and all the bits will be read, no matter the programming in PAR-26.
In PAR-27 one can choose per preset if the value is internally or externally provided. If more preset value are provided externally, one should use selecting signals to select the right thumbwheelswitch.
Preset values are being read when:

- The DSA is activated
- High flank on the input “FUNCTION”.



### 8.2.3. Input correctionvalue for actual position

This function is active when
PAR-26 = 3.X.X.X.XX : =POSITIE minus external data

Or

PAR-26 = 4.X.X.X.XX. : =POSITIE plus external data

It is possible to use the DSA-XXXP as an external display only:
PAR-26 = 2.X.X.X.XX. The =POSITIE is then equal to the external data input.
Remember to disable the SSI-input through PAR-02 to avoid a SSI-error.

### 8.2.4. Difference measurement

This function is active when PAR-26 = 5.0.X.0.XX.
Conditions:

- Binary-Code only
- No data-ready active

In this function the =POSITIE is calculated from the difference between 2 externally provided binary values. To select the data output 3 and output 4 are used. These are not available for other functions.

**=POSITIE = (A-B) x M + N**

M = multiplicator PAR-03
N = Zero-point PAR-01

### 8.2.5. Nominal value for relative range-signals

This function is active when PAR-26 = 6.X.X.X.XX.

The nominal value read at the data input is used to create relative range signals. The range signals react to the difference between the external value and the =POSITIE:

**Preset = External data minus =POSITIE**

## *8.3. Data-output*

Using the data output it is possible to send the =POSITIE (actual position) to other controllers like a PLC. The input “STORE” will lock the data. In case multiple DSA’s are in bus the input “ENABLE” is used to select the right DSA.

### 8.3.1. Output "DATA-READY"

This output becomes high after the data on the parallel output is stable. If the output “DATA READY” is not active the data on the parallel output is updated every 5 ms.

In parameter PAR-28 it is possible to select the format: Binary, BCD, Gray or one of these inverted.

# APPENDIX A PARAMETERS

## PAR-01 ZERO-POINT

XXXXXXXX -9999999 .. +99999999

## PAR-02 SSI

XX X.**X** 0 = 25 bit
1 = 13 bit
2 = no SSI

**X**.X 0 = normal direction
1 = invert direction

## PAR-03 MULTIPLICATOR

XXXXXXX 0.000001 .. 9.999999
(input 0 = x1)

## PAR-04 NUMBER OF ACTIVE BITS

XXXX XX.**XX** 0 .. 13 bit (singleturn)

**XX**.XX 0 .. 12 bit (multiturn)
Only if PAR-02 = X0

## PAR-05 STORE

X 0 = not active
1 = high signal active
2 = low signal active

## PAR-06 DECIMAL POINT

X 0 = not active
1 = X.X
2 = X.XX
3 = X.XXX
4 = X.XXXX
5 = X.XXXXX
6 = X.XXXXXX

## PAR-07 ADJUSTING VALUE

XXXXXXXX -9999999 .. +99999999
maximum value = $(\pm 2^{\text{number of bits}} \times M) - 1$

## PAR-08 INPUT FUNCTION AND ZERO-SET

XX

X.**X** ZERO-SET
0 = not active
1 = zero-set at rising flank
2 = zero-set at falling flank

3 = disable range signals 

**X**.X FUNCTION
0 = not active
1 = no access to programming mode for parameters if low signal on input
2 = no access to programming mode for parameters and presets if low signal on input
3 = enable range signals (rising flank)

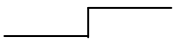
## PAR-09 OUTPUT 1 .. 4

XXXX

X.X.X.**X** output 1
X.X.**X**.X output 2
X.**X**.X.X output 3
**X**.X.X.X output 4

0 = not active
1 = range signal 

2 = range signal 

3 = =POSITIE >= PRESET 

4 = =POSITIE < PRESET 

5 = pulse if =POSITIE >= PRESET

6 = pulse if =POSITIE <= PRESET

7 = pulse with function as 5 and 6

8 = output RS485

## PAR-10 HYSTERESIS

XXXXXXX

0 .. 9999999
(input 0 = no hysteresis)

**PAR-11 TIME FOR PULSE OUTPUT 1..4**

XXX 0.01 .. 1.99 s
(input 0 = 0.01 s)

**PAR-12 ADJUSTING METHOD**

X 0 = not active
1 = using PAR-07
2 = ZERO-SET

**PAR-13 SSI-ERROR**

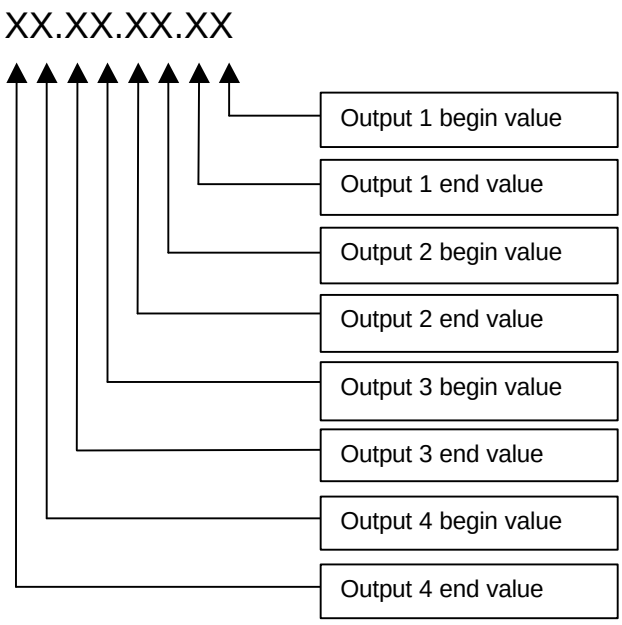
X 0 = active
1 = not active

**PAR-14 RS485 SETTINGS**

XXX X.**XX** ADRESS
0..31 (in case of 1 DSA use 0)

**X**.XX BAUDRATE
0 = not active
1 = 1200 bits/s
2 = 2400 bits/s
3 = 4800 bits/s
4 = 9600 bits/s
5 = 19200 bits/s
6 = 38400 bits/s

**PAR-15 PRESET NUMBERS**



**PAR-16 Umin DA1**

XXXXX -10.000 .. +9.999 V

**PAR-17 Umax DA1**

XXXXX -9.999 .. +10.000 V

To disable DA1 set PAR-16..PAR19 to 0

**PAR-18 S-Umin DA1**

XXXXXXX -9999999 .. +99999999

**PAR-19 S-Umax DA1**

XXXXXXX -9999999 .. +99999999

**PAR-20 Imin DA2**

XXXXX -20.000 .. +19.999 mA

**PAR-21 Imax DA2**

XXXXX -19.999 .. +20.000 mA

To disable DA2 set PAR-20..PAR23 to 0

**PAR-22 S-Imin DA2**

XXXXXXX -9999999 .. +99999999

**PAR-23 S-Imax DA2**

XXXXXXX -9999999 .. +99999999

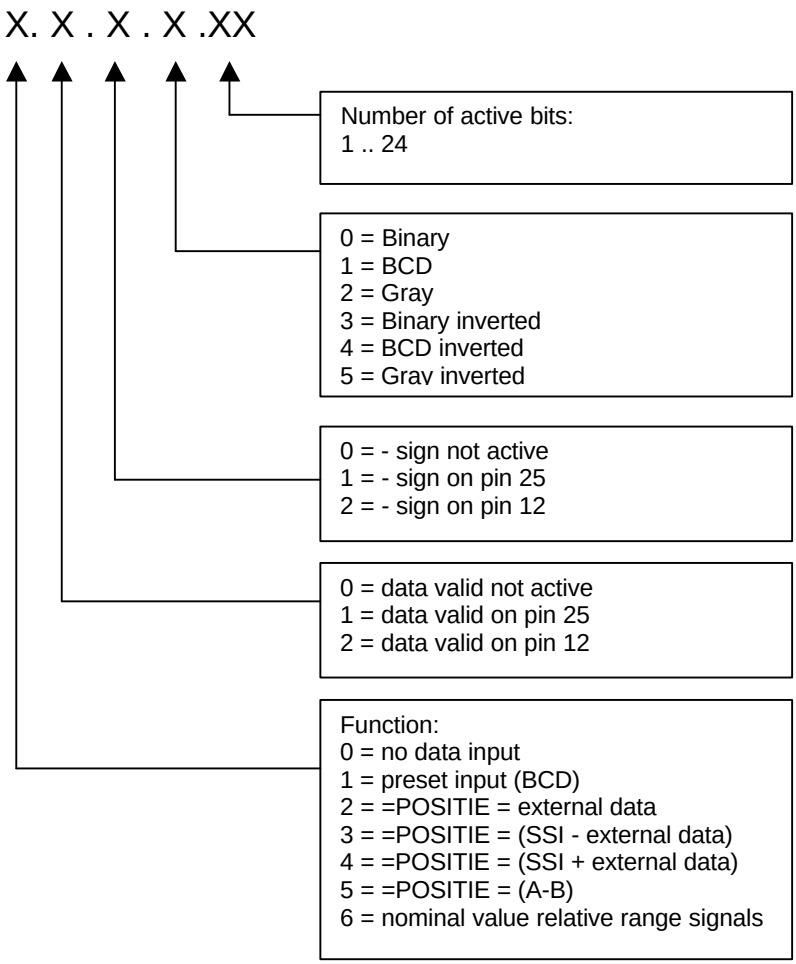
**PAR-24 MULTIPLICATOR DISPLAY**

X
0 = not active
1 = x 0,1
2 = x 0,01

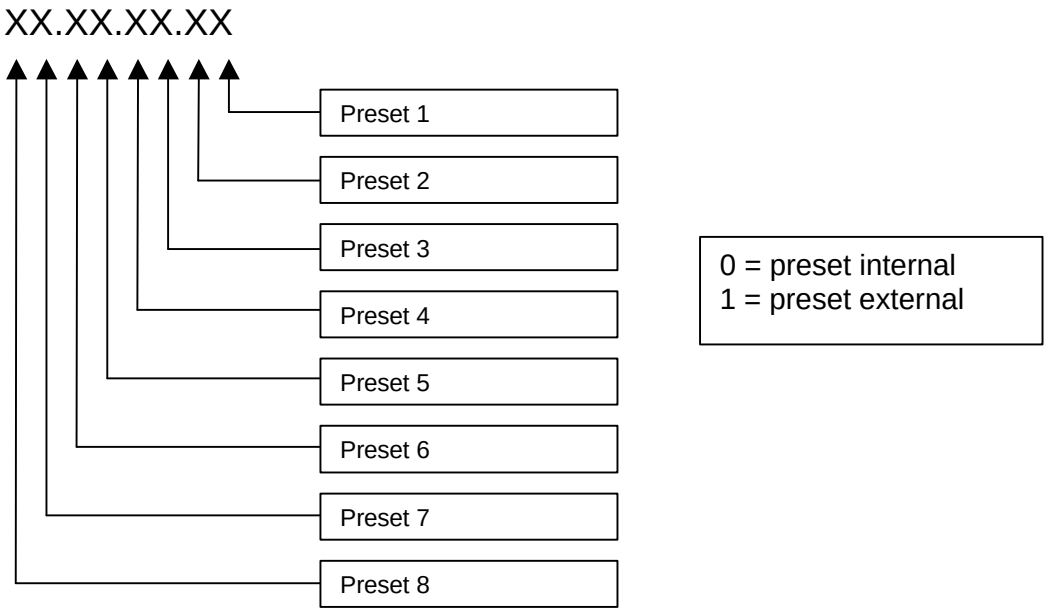
**PAR-25 SERIAL DATA IN MONITOR FUNCTION**

X
0 = not active
1 = active
2 = active and visible when writing

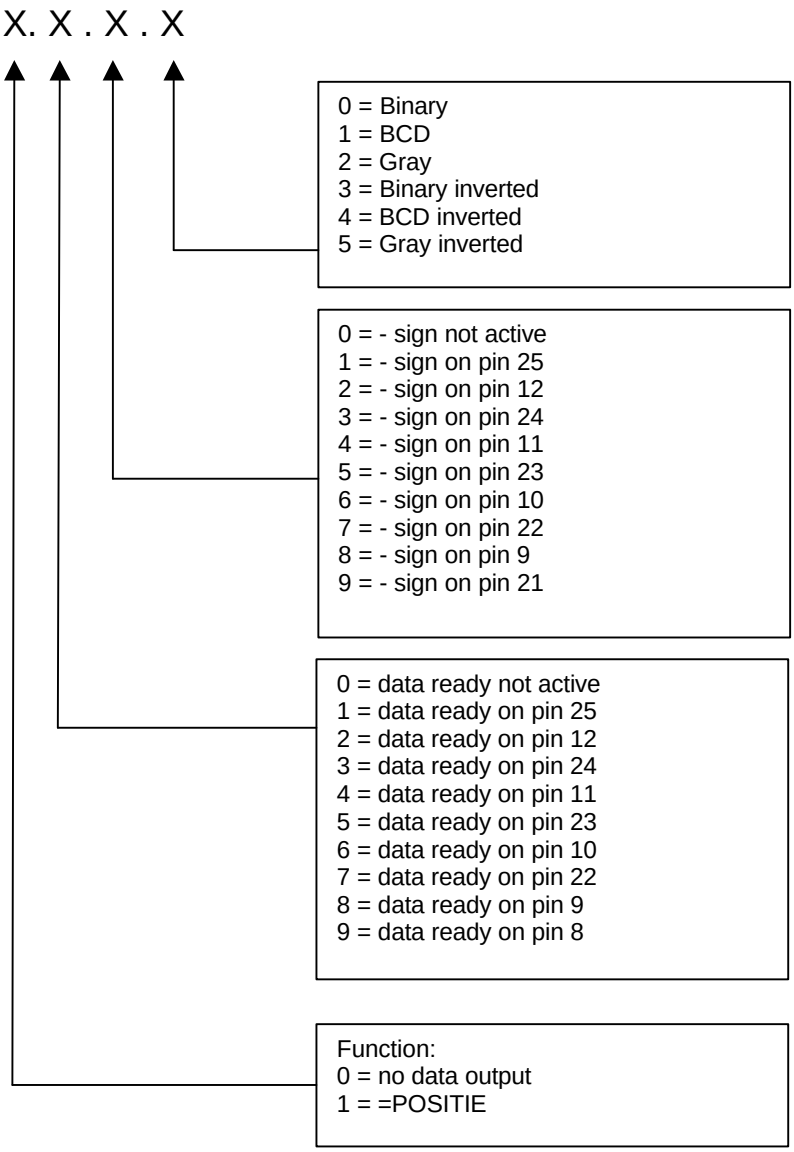
## PAR-26 FORMAT PARALLEL DATA INPUT



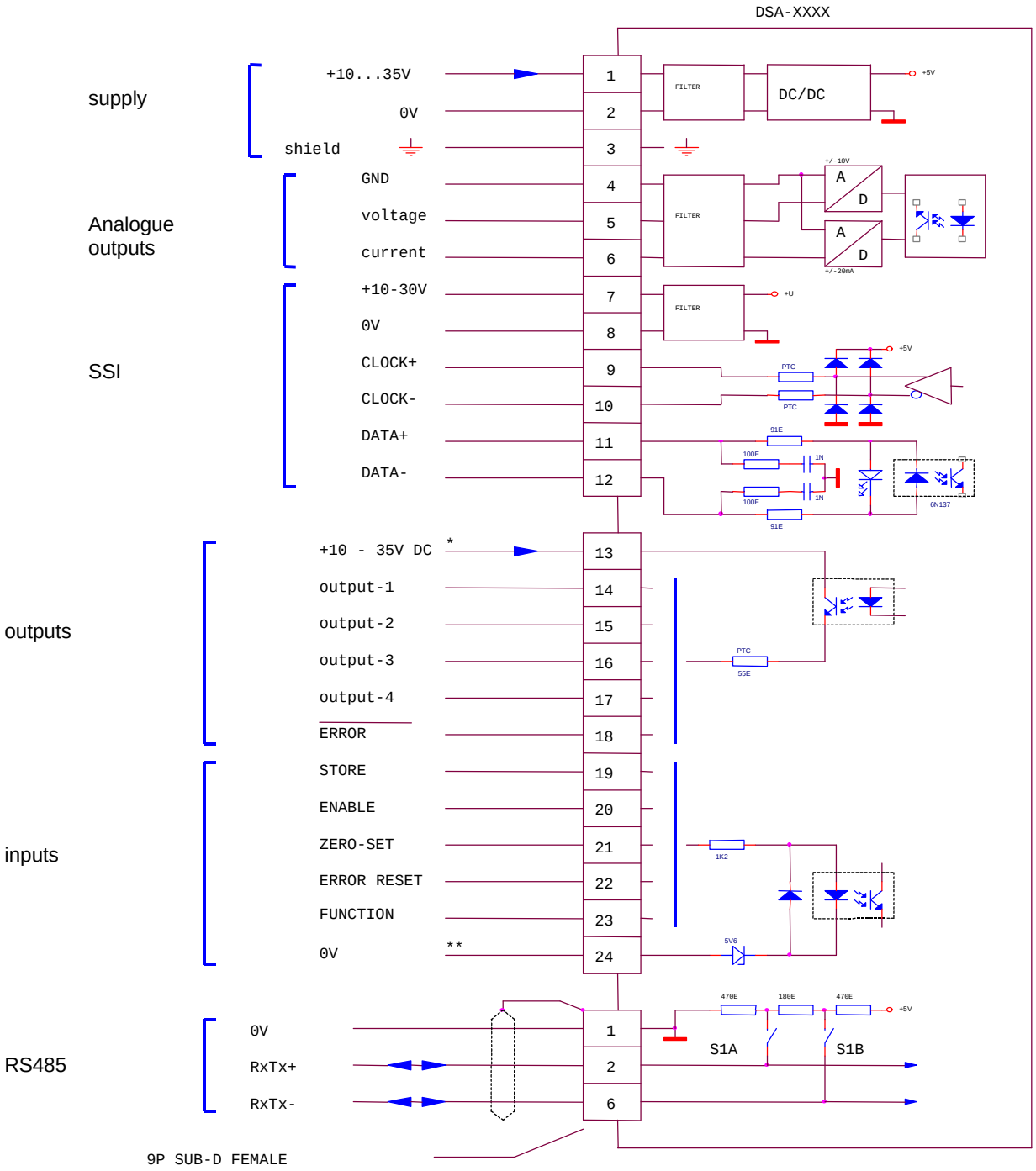

## PAR-27 EXTERNAL PRESETS



## PAR-28 FORMAT PARALLEL DATA OUTPUT



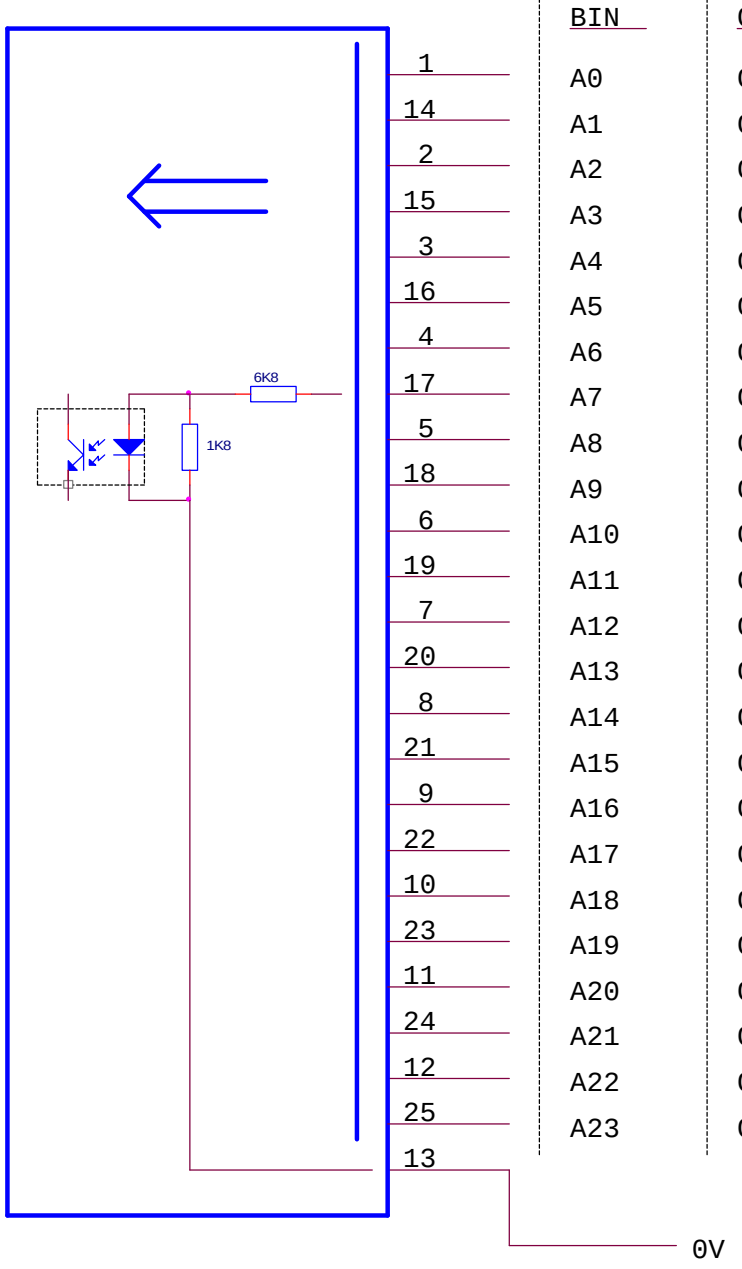
## APPENDIX B CONNECTIONS




* Supply for outputs

** 0V inputs

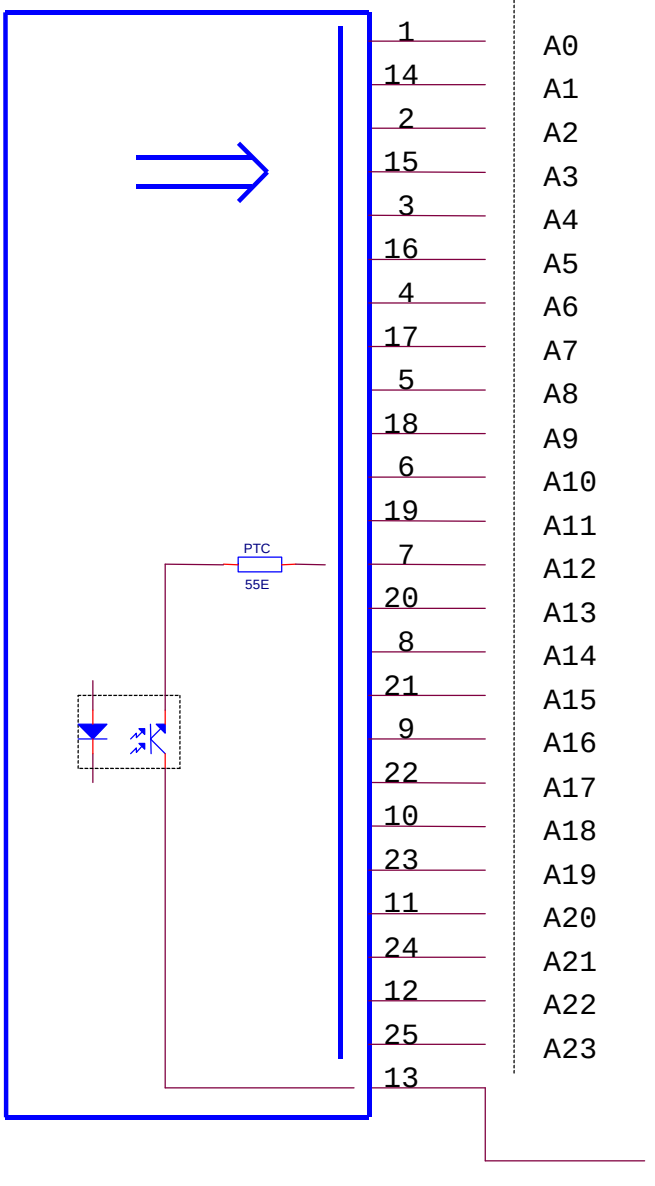
DATA INPUT




| | BIN | GRAY | BCD | |
|---|---|---|---|---|
| 1 | A0 | G0 | 2^0 | |
| 14 | A1 | G1 | 2^1 | 10^0 |
| 2 | A2 | G2 | 2^2 | |
| 15 | A3 | G3 | 2^3 | |
| 3 | A4 | G4 | 2^0 | |
| 16 | A5 | G5 | 2^1 | 10^1 |
| 4 | A6 | G6 | 2^2 | |
| 17 | A7 | G7 | 2^3 | |
| 5 | A8 | G8 | 2^0 | |
| 18 | A9 | G9 | 2^1 | 10^2 |
| 6 | A10 | G10 | 2^2 | |
| 19 | A11 | G11 | 2^3 | |
| 7 | A12 | G12 | 2^0 | |
| 20 | A13 | G13 | 2^1 | 10^3 |
| 8 | A14 | G14 | 2^2 | |
| 21 | A15 | G15 | 2^3 | |
| 9 | A16 | G16 | 2^0 | |
| 22 | A17 | G17 | 2^1 | 10^4 |
| 10 | A18 | G18 | 2^2 | |
| 23 | A19 | G19 | 2^3 | |
| 11 | A20 | G20 | 2^0 | |
| 24 | A21 | G21 | 2^1 | 10^5 |
| 12 | A22 | G22 | 2^2 | |
| 25 | A23 | G23 | 2^3 | |
| 13 | | | | |

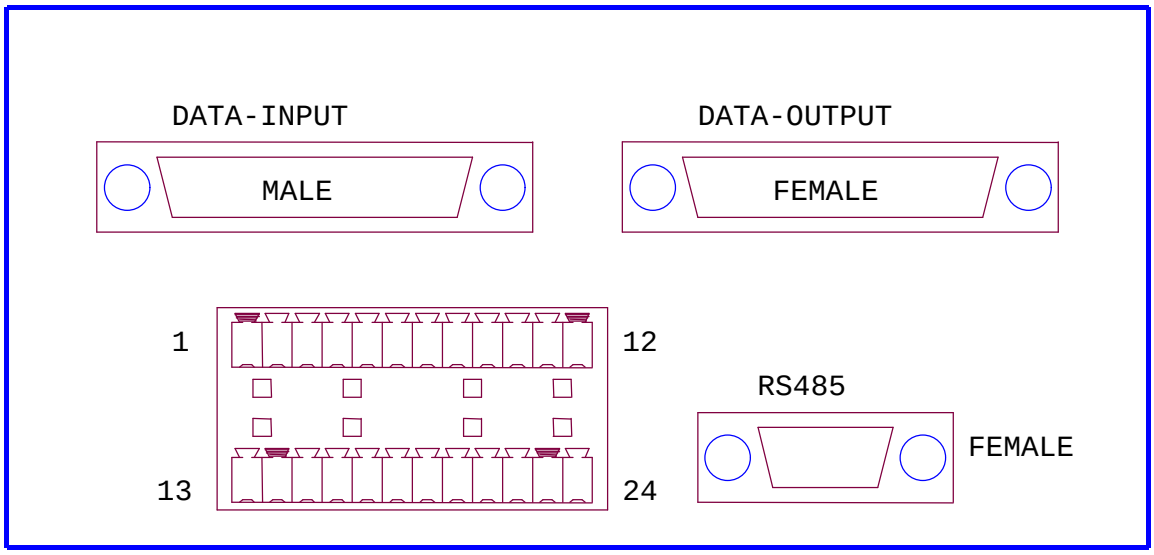
0V

DATA OUTPUT

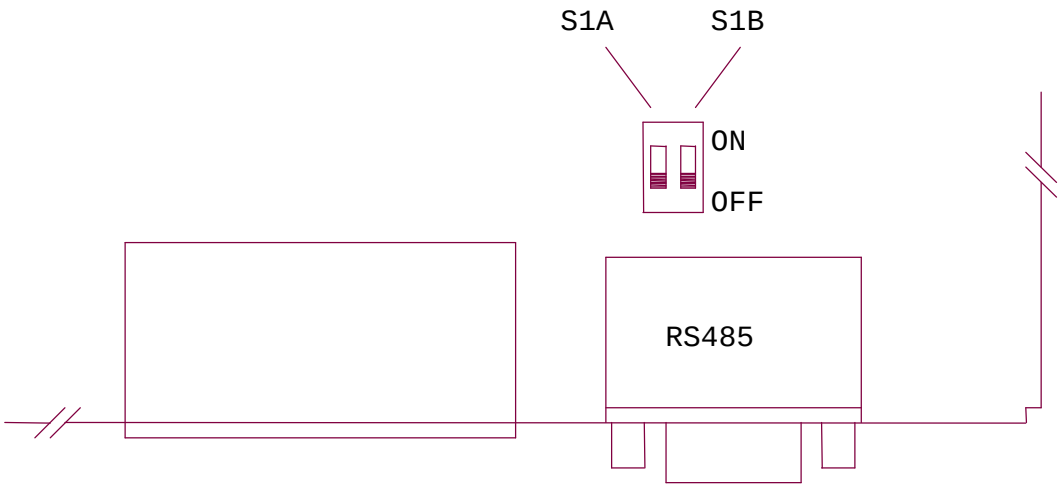



| | BIN | GRAY | BCD | | |
|---|---|---|---|---|---|
| 1 | A0 | G0 | 2^0 | | |
| 14 | A1 | G1 | 2^1 | 10^0 | |
| 2 | A2 | G2 | 2^2 | | |
| 15 | A3 | G3 | 2^3 | | |
| 3 | A4 | G4 | 2^0 | | |
| 16 | A5 | G5 | 2^1 | 10^1 | |
| 4 | A6 | G6 | 2^2 | | |
| 17 | A7 | G7 | 2^3 | | |
| 5 | A8 | G8 | 2^0 | | |
| 18 | A9 | G9 | 2^1 | 10^2 | |
| 6 | A10 | G10 | 2^2 | | |
| 19 | A11 | G11 | 2^3 | | |
| 7 | A12 | G12 | 2^0 | | |
| 20 | A13 | G13 | 2^1 | 10^3 | |
| 8 | A14 | G14 | 2^2 | | |
| 21 | A15 | G15 | 2^3 | | |
| 9 | A16 | G16 | 2^0 | | SEL-8 |
| 22 | A17 | G17 | 2^1 | 10^4 | SEL-7 |
| 10 | A18 | G18 | 2^2 | | SEL-6 |
| 23 | A19 | G19 | 2^3 | | SEL-5 |
| 11 | A20 | G20 | 2^0 | | SEL-4 |
| 24 | A21 | G21 | 2^1 | 10^5 | SEL-3 |
| 12 | A22 | G22 | 2^2 | | SEL-2 |
| 25 | A23 | G23 | 2^3 | | SEL-1 |
| 13 | +10 - 35V | | | | |

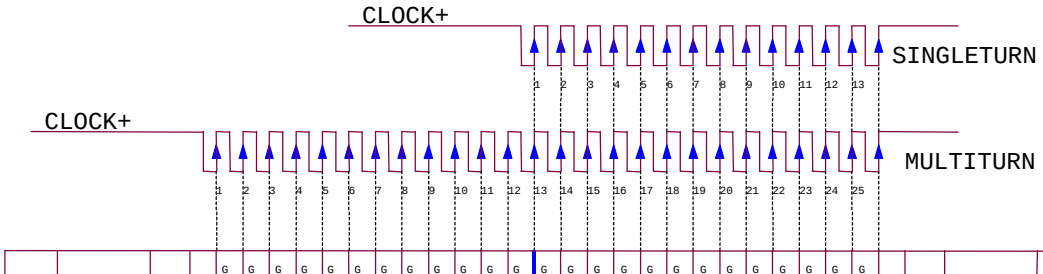
CONNECTORS




SETTINGS DIP-SWITCH SA1
(RS485)



## APPENDIX C SSI DATAFORMAT




| Z | $2^Z$ | | | GA11 | GA10 | GA+9 | GA+8 | GA+7 | GA+6 | GA+5 | GA+4 | GA+3 | GA+2 | GA+1 | GA | GA-1 | GA-2 | GA-3 | GA-4 | GA-5 | GA-6 | GA-7 | GA-8 | GA-9 | GA10 | GA11 | GA12 | GA13 | TM | | $2^A$ | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 4096 | 1 | 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 1 | 8192 | 13 |
| 11 | 2048 | 1 | 1 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 1 | 4096 | 12 |
| 10 | 1024 | 1 | 1 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 1 | 2048 | 11 |
| 9 | 512 | 1 | 1 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 1 | 1024 | 10 |
| 8 | 256 | 1 | 1 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 1 | 512 | 9 |
| 7 | 128 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 256 | 8 |
| 6 | 64 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 128 | 7 |
| 5 | 32 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 64 | 6 |
| 4 | 16 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 32 | 5 |
| 3 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 16 | 4 |
| 2 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 3 |
| 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 2 |

PARALLEL DATA IN GRAYCODE

REVOLUTIONS

POSITIONS/REV.

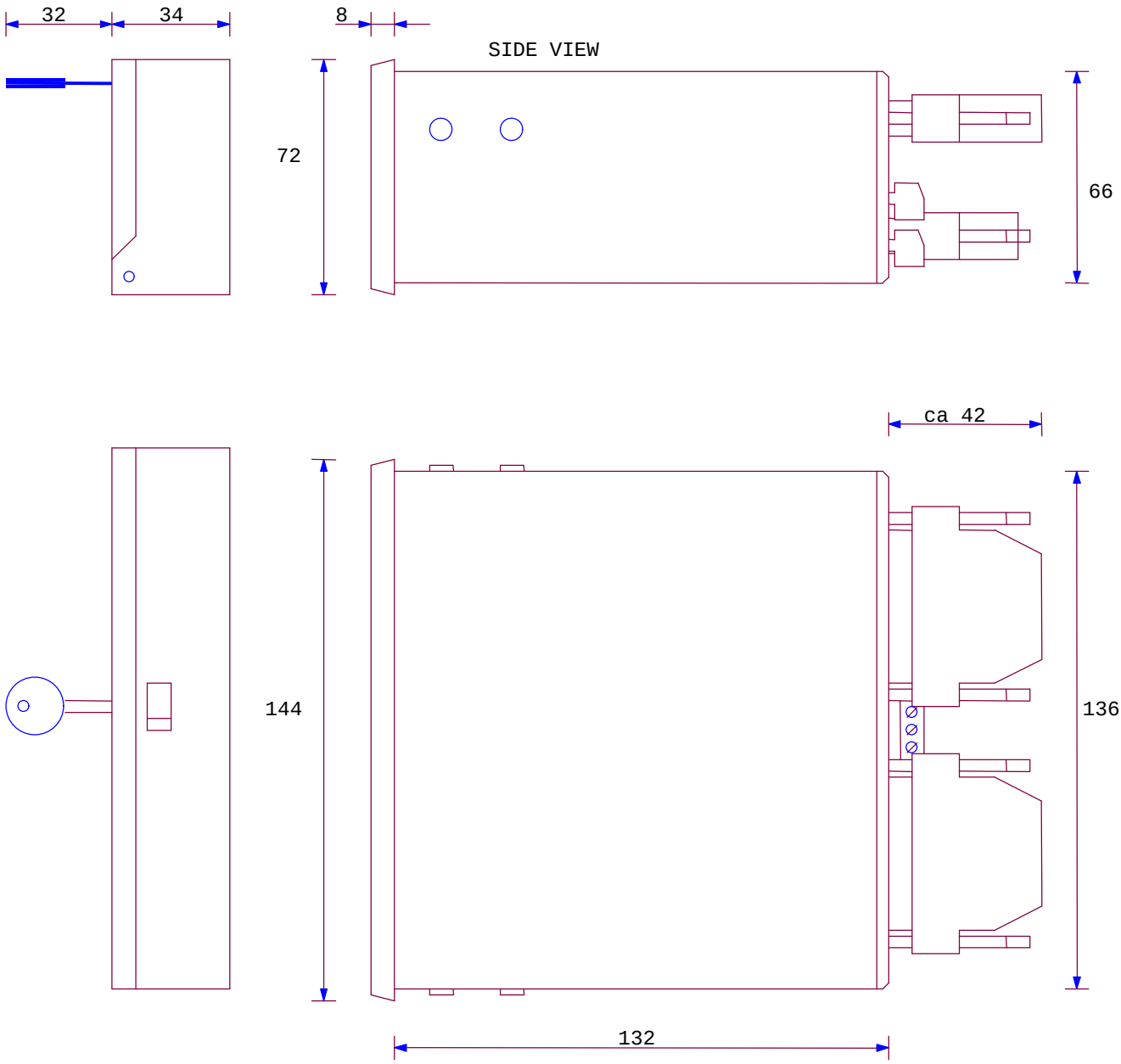
## APPENDIX D TECHNICAL DATA

| | |
|---|---|
| Supply | 10..35 VDC |
| Consumption | < 250 mA (< 150 mA at 24 VDC) |
| SSI data input | Optocoupler RS422 |
| SSI clock output | Driver RS422 |
| SSI clockfrequency | 125 kHz |
| Logical inputs | Optically isolated; low = 0..+5V ; high = +10..+35V |
| resistance | 1,8 kOhm at 24V |
| Logical outputs | Optically isolated; NPN-transistor; open emitter with PTC |
| current | 50 mA max. |
| supply | 35 V max. |
| output voltage | Supply minus 3,5 V (at 50 mA) |
| Analogue voltage output | |
| range | -10.000 .. +10.000 V |
| resolution | 1,22 mV (14-bit D/A) |
| max. off-set error | 1 mV at 25°C |
| off-set temp.coëff. | D.N.A. |
| max. current | 10 mA (short circuit proof) |
| Analogue current output | |
| range | -20.00 .. +20 mA |
| resolution | 2,44 mA (14-bit D/A) |
| max. off-set error | 2µA at 25°C |
| off-set temp.coëff. | D.N.A. |
| Rmax | 550E |
| Parallel data input | Optically isolated; low = 0..+5V ; high = +10..+35V |
| resistance | 6,8 kOhm at 24V |
| Parallel data output | Optically isolated; NPN transistor; open emitter with PTC |
| current | 50 mA max. |
| supply | 35 V max. |
| output voltage | Supply minus 3,5 V (at 50 mA) |
| Serial communication | RS485 acc. EIA standard RS485 |
| Counting range | 99999999 .. –9999999 |
| Cycle time | 5 ms |
| Data memory | EEPROM |
| Display | 8x 7-segment red LED; 14mm high |
| Temperature range | 0 .. 50°C |
| Connection cross-section | 1,5mm$^2$ |
| Weight | < 0,6 kg |
| Protection class | Front IP50; with hood IP54 |
| | Rear IP20 |

## APPENDIX E SIZES

OPTION

PROTECTIVE HOOD



## APPENDIX F TYPE CODING