TWK

Programmable Absolute Electro - Optical Encoders
Models CRP 58 - CRP 65 - CRP 66 - CRP 105
MULTI-TURN □ Parallel or Serial Interface *SSI* or ASA

CRP 10113 DE

01 / 2000

The optical encoders in the CRP Series can be programmed as required by the user. This enables quick matching to the requirements of different mechanical and electrical applications. The following parameters can be programmed :

1. Resolution : Positions per turn in the range from 0.0002 to 4096.0000.

2. Measuring range : Number of turns for one pass through the code in the range from 1 to 4096 turns in steps of powers of 2.

3. Output code : Gray, Natural Binary or BCD.

4. Parity bit : ODD or EVEN.

5. Logic polarity : Positive or negative.

6. A reference value : For setting a reference point within the measurement ranges.

The programming of these parameters takes place using the PROGRAMMER MC. It can also be used to change above parameters (see page 6).

Construction

Flange and case in aluminium - shaft in stainless steel 12 mm ball-bearings with Nilos ring or radial packing ring seal code disc in deformation resistant plastic -GaAlAs diodes photo-transistor array - gate array - customer specific microprocessor - SMD technology.

The Models CRP 58, CRP 55, CRP 66 and CRP 105 have different shaft, flange and case dimensions and different types of electrical connections (for details see page 5).

Functional description

The gray coded information in the single-turn and multi-turn sections are converted by a microprocessor depending on the parameter selection. The storage of the selected parameters takes place in an EEPROM. The PROGRAMMER MC can be connected through the 5-pin programming socket in the case cover.

Electrical Data (PRO = programmable)
(Valid for all versions unless otherwise stated)

- Sensor system : GaAlAs diode, photo-transistor array
- Parallel outputs circuits :
  - A = Open collector Darlington
  - C = Open emitter Darlington
  - D = Push-pull
- Serial outputs : *SSI* and **ASA** : Differential data output to RS 422,
- Clock input **SSI** : Differential (opto-coupler) for data driver to RS 422
- Supply voltage range : + 11 V to + 30 VDC
- Supply current : 80 mA typ. / 120mA max.

- Measuring range (PRO) : 1, 2, 4...4096 turns
- Total number of positions : 2^{12} x 2^{12} = 2^{24}

- Resolution (PRO) : 0.0002 to 4096.0000pos. / 360°
- Output frequency*: 2 kHz max.
- Measurement position deviation : $\leq \pm 2'\,38"$
- Disc coding : Gray code
- Output code Gray, Natural Binary or BCD
  - Parallel (PRO) : (max. 26 data Bit)
  - Serial (PRO) : (max. 29 data Bit)
- Code sense: CW or CCW (signal input E6)
- Parity bit (PRO) : ODD or EVEN
- Error bit output : LED and output circuit
- Logic polarity (PRO) : Positive or negative
- Reference value (PRO) : 0 to total no. of positions
- Set reference point via : SET - input E6 or SET - plug or PROGRAMMER MC
- Memory circuit* (latch): Store or not store signal input E6
- Enable circuit for bus operation*: Active or inactive, (signal input E6)

  *Only for parallel interface

Mechanical Data

- Operating speed: 3000 rpm max. (continuous) 4000 rpm max. (short period)
- Angular acceleration: 10^5 rad/s^2 max.
- Inertial mass of rotor: 50 gcm^2
- Operating torque: $\leq$ 5 Ncm (8 Ncm - CRP 66)
- Wind-up torque: $\leq$ 1 Ncm (4 Ncm - CRP 66)
- Permissible axial and radial shaft load: 250 N max.
- Bearing life expectancy : 10^9 turns

Environmental Data

- Operating temperature range : –20°C to +60°C
- Storage temperature range : –25°C to +70°C
- Permissible rel. humidity : 85% without condensation
- Resistance to shock : 200 m/s^2; 11 ms (DIN IEC 68)
- Resistance to vibration : 5 Hz ... 1000 Hz ; 100 m/s^2 (DIN IEC 68)
- Protection class (DIN 40050)
  - CRP 58, 65 and 105 : IP 65 (Nilos ring)
  - CRP 66 : IP 66 (radial packing ring)
- Mass: CRP 58, 65, 66 = 0.7 kg
  - CRP 105 = 1.3 kg

Electrical connections (standard versions) :

- CRP 58, 65 and 66 parallel : Lead with connector DC 37 (IP 30)
- CRP 58, 65 and 66 serial : Round connector 12-way, (IP 65) on case
- CRP 105 parallel and serial : Connector DC 37 (IP 65) on case

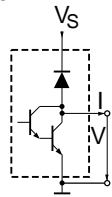Mating connectors included in supplied items. Other types of connections on request.

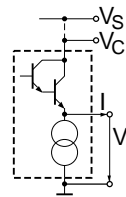## The parallel interfaces

Block diagram (Output A)
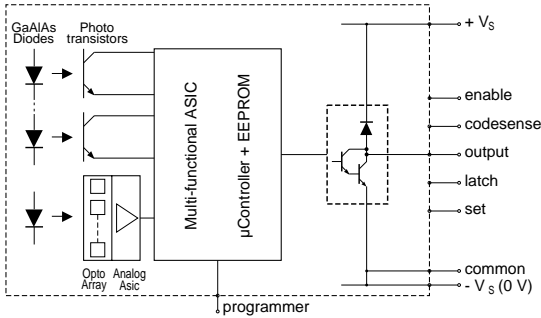
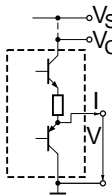### Output circuits

A

Vmax. = V_S
I max. = 50 mA
Log1 = V_S
Log0 = 1.1 V

C

Vmax. = V_C
I max. = 20 mA
Log1 = V_C
Log0 = 0.5 V

D

(not for bus mode)
Vmax. = V_C
I max. = 10 mA
Log1 = V_C - 3 V
Log0 = 2 V

Signal input

E6 active "high"

Log 0 < 3.5 V or not connected
Log 1 = 11...26 V

Timing - Diagrams

Storage

Latch $U(eH)$ $U(eL)$

t(LA) min. 500µs

Data bits — latched — new value

max. 500µs   max. 500µs

Set reference value

Latch $U(eH)$ $U(eL)$ min. 500µs

SET $U(eH)$ $U(eL)$ min. 500µs

Data bits — latched — reference point
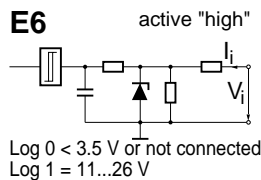
max. 500µs
max. 90ms
max. 500µs
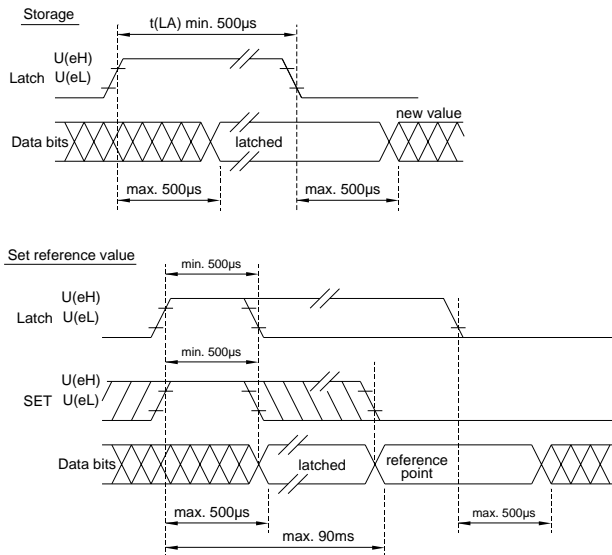
Note 1 : Latch and SET must be set to logic "1" to set the reference point.

Note 2 : The reference value will appear only after SET has been set to logic "0" again.

Enable

Enable $U(eH)$ $U(eL)$

Data bits — inactive (Z)

max. 100µs   max. 100µs

The *SSI* 32 Bit synchronous serial interface
(standard version E01)

The output shift register has a width of 32 bits and is updated by an internal microprocessor every 500 µs.(Example 1 / Page 3).

The LSB of the programmed total number of positions is always written to the last location in the shift register. With the maximum 29 significant data bits, the error bit and the parity can be transmitted.

The error bit is placed in the 1st location, the parity bit in the 2nd, a zero in the 3rd and the MSB of a 29 bit data word is in the 4th location.

With shorter data words (Example 2), e.g. 18 bits, zeroes are positioned in the 4th to the 14th locations, the MSB is positioned in the 15th location and the LSB is always placed in location 32. Both of the following locations are set to zero for multiple transmission.

There is no difference between the SINGLE-TURN and the MULTI-TURN bits (transfer tree structure) so that transmission in BCD code is also possible.

The SPC Serial-Parallel Converter Card with a 32 bit wide shift register can be used when operating the encoder. (Data Sheet SPC 10109).

The *SSI* 25 Bit synchronous serial interface

With this variant the shift register in the encoder is 25 bits wide. As with the standard version, the LSB is always located in the last, i.e. the 24th location.
For multiple transmission both of the following locations are set with zero. The MSB is placed in the first location if 4096 turns have been programmed.

If the number of positions per turn are always programmed with 4096 (12 bits) in Gray or Natural Binary code, then information is output according to the classical SSI protocol (Examples 3 and 4). The number of positions per turn must be set here through the number of clock cycles. 22 cycles are sufficient for transmission of 1024 positions per turn.

If a number of positions per turn lower than 4096 is programmed, then the data word is shifted in the direction of the 25th location (LSB). This can lead to erroneous interpretation at the receiver.

There is no restriction when programming the number of turns in powers of 2 with a figure smaller than 2^{12}. For example, with 2^{10} (1024) turns leading zeroes are placed in both of the first locations.
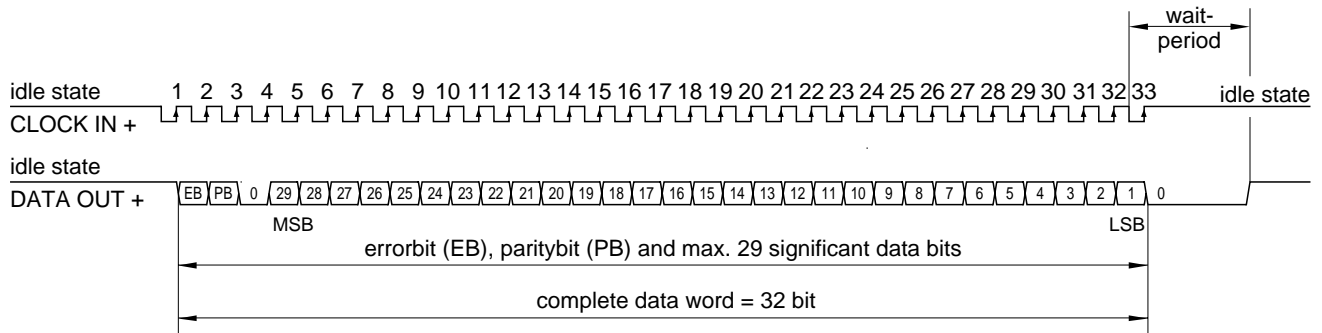
The error bit and the parity bit are not available.

Block diagram *SSI*
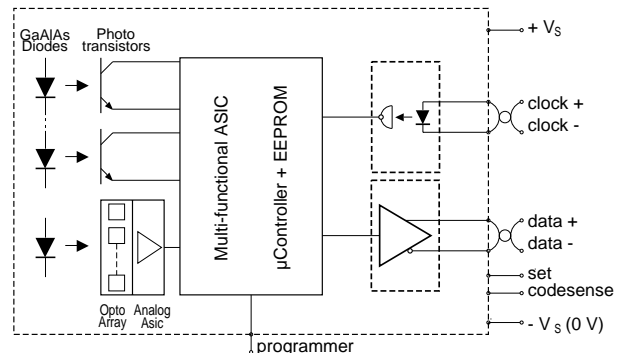
Interfaces profile 32 Bit *SSI*

Example 1: Programmable multi-turn encoder with complete data word = 32 bits = width of shift register


errorbit (EB), paritybit (PB) and max. 29 significant data bits

complete data word = 32 bit

Example 2 : Programmable multi-turn encoder with complete data word = 32 bits = width of shift register

errorbit (EB), paritybit (PB) and max. 18 significant data bits

complete data word = 32 bit
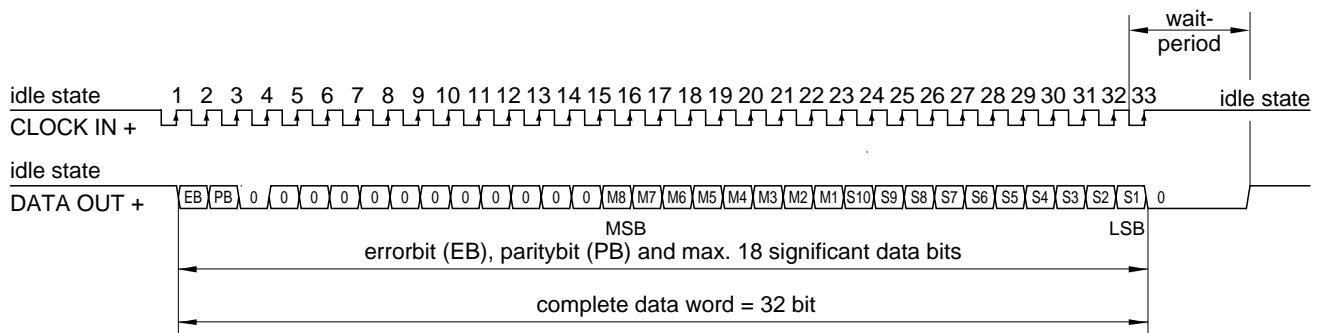
Interfaces profile 25 Bit *SSI*

Example 3 : Programmable multi-turn encoder with 4096 positions / 360° and 4096 turns

24 significant data bits

complete data word = 25 bit
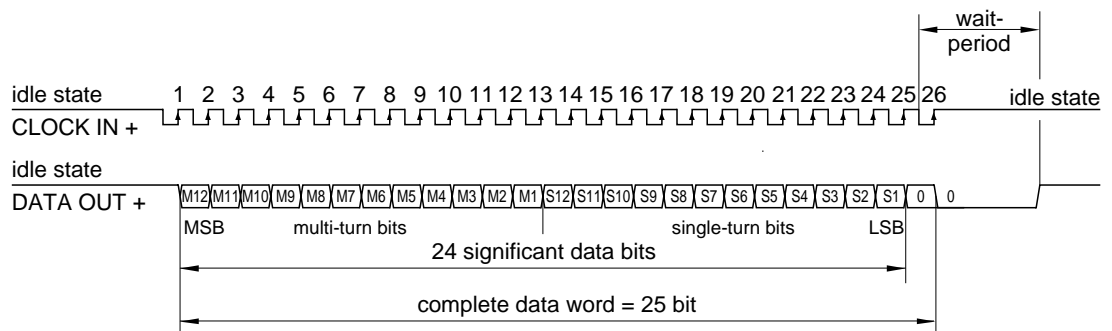
Example 4 : Programmable multi-turn encoder with 1024 positions / 360° and 256 turns

18 significant data bits

complete data word = 25 bit
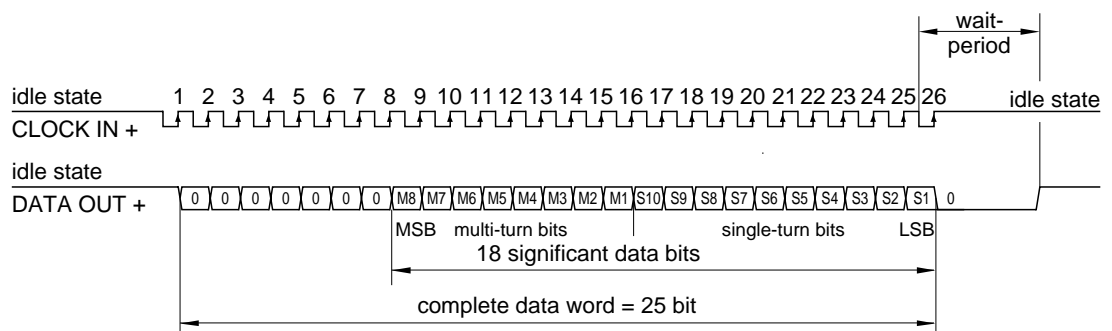
The *ASA* asynchronous serial interface

The data bits are transmitted in ASCII form 24 bit or 6 decades. A position signal is transferred in 6 blocks (ASII characters) + CR symbol.

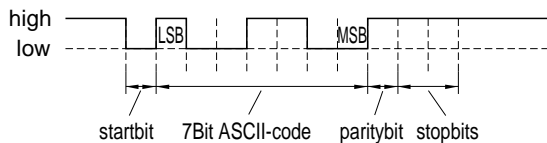In the ASCII form 4 bit ASCII characters are transmitted.

With BCD code the characters are 0-9, and with Gray and Natural Binary code the characters are 0-F (hexadecimal notation).

- Standard baud rate: 62.5 kBaud
- Other baud rates: 4.8 kBaud up to 187.5 kBaud
                                 upon request
- Line drivers: to RS 485.

Basic block diagram
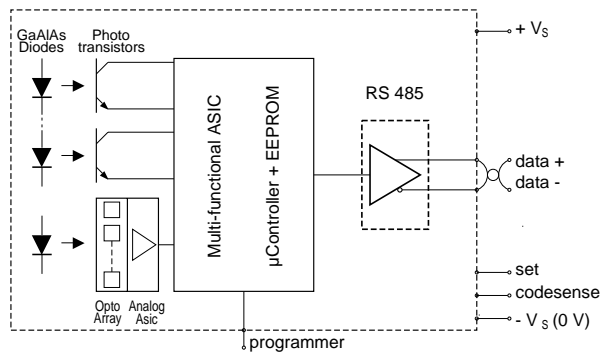
Character format

Format of a position signal with 6 data character + CR

1 position cycle
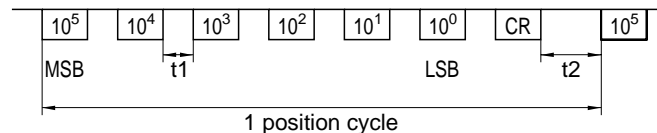
Data output in case of error

$$t1 = \frac{3}{\text{baud rate}} \qquad t2 = \frac{13}{\text{baud rate}} \quad (\geq 400\mu s)$$
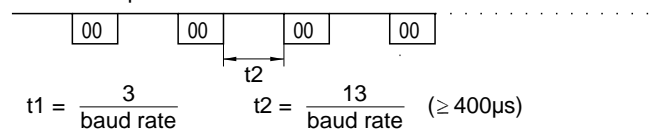
Reference value and setting the reference point for all versions

The reference value can be programmed by the user within the total number of positions with the aid of the PROGRAMMER MC. It is also possible to change the value in the same manner.

The reference point is the point at which the previously programmed reference value is applied to the data output (connector). There are three methods of setting the reference point.

1.   By briefly plugging the SET plug into the pro-gramming socket in the rear cover of the encoder.

2.   By the SET input on the encoder connector.

3.   By using the PROGRAMMER MC connected to the programming socket on the encoder.
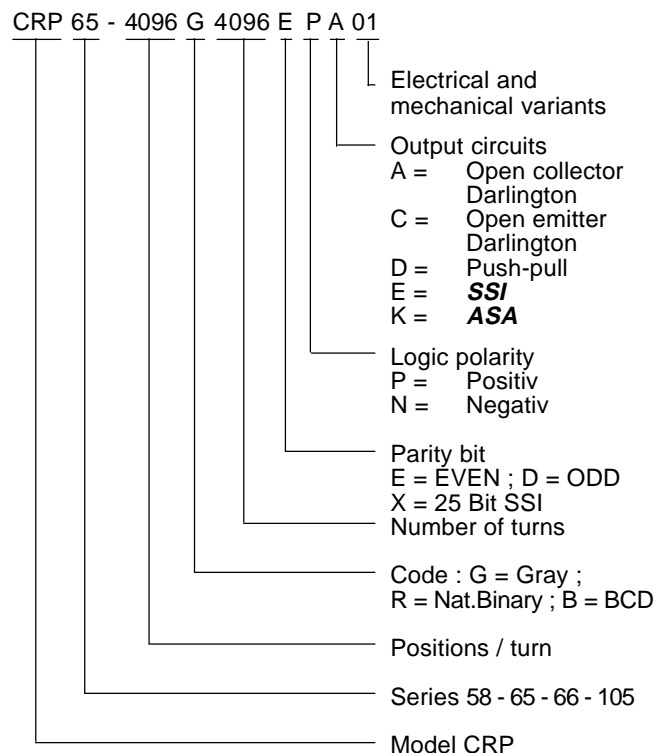
Programmed values as supplied

Unless agreed otherwise, the encoders are supplied with the following ex-works programming:

- Resolution: 4096 positions / turn
- Measurement range: 4096 turns
- Output code: Gray
- Parity bit: EVEN
- Logic polarity: Positive
- Reference value: Zero

Order code: CRP ... - 4096 G 4096 E P A01   (parallel)
              CRP ... - 4096 G 4096 E P E01   (serial)

Order code format

CRP 65 - 4096 G 4096 E P A 01

- Electrical and mechanical variants
- Output circuits
  A =   Open collector Darlington
  C =   Open emitter Darlington
  D =   Push-pull
  E =   *SSI*
  K =   *ASA*
- Logic polarity
  P =   Positiv
  N =   Negativ
- Parity bit
  E = EVEN ; D = ODD
  X = 25 Bit SSI
- Number of turns
- Code : G = Gray ;
  R = Nat.Binary ; B = BCD
- Positions / turn
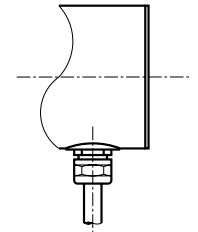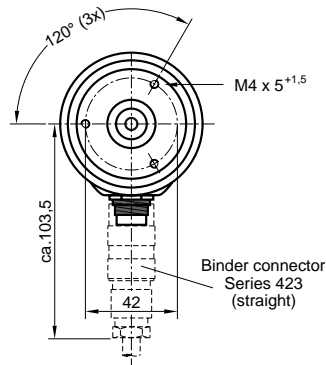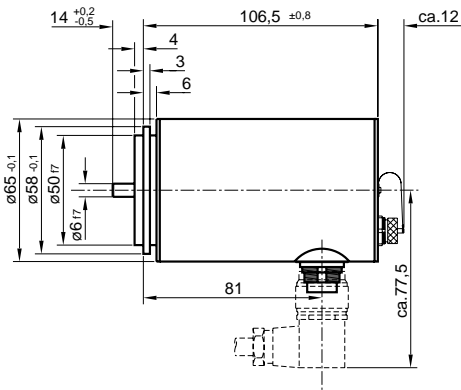- Series 58 - 65 - 66 - 105
- Model CRP

Accessories and supplementary equipment

- PROGRAMMER MC - 01 (Data Sheet PMC 10101)
- SET - plug SET - 01
- For CRP 105 :   Thermostatically controlled heater for extended operating temperature range down to –20°C.
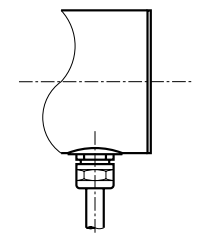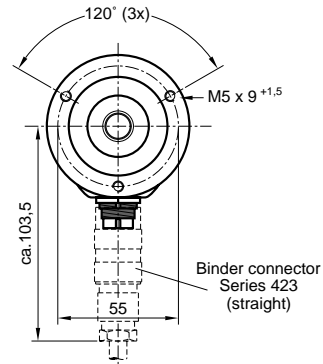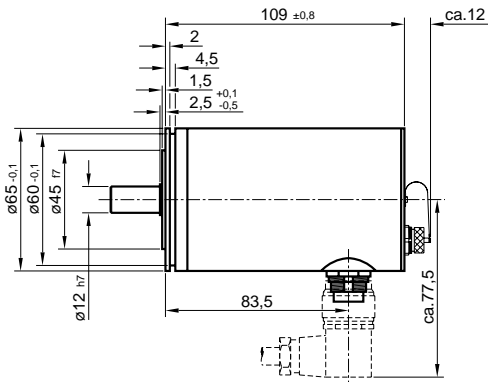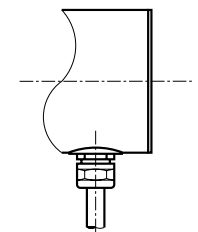- For CRP 105 :   Mounting base.
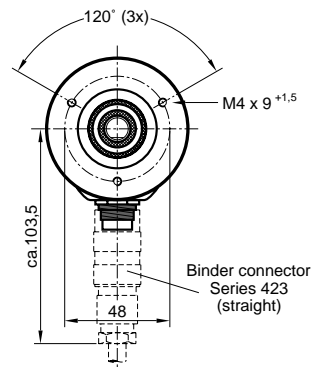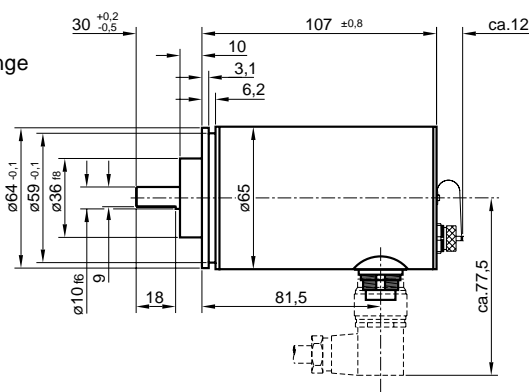
Dimensions in mm

Model CRP 58
with synchro-flange

Model CRP 65
with synchro-flange

Model CRP 66
with clamping flange

Shaft with flat

Binder connector
Series 423
(straight)

Standard :
Lead 300 mm long with
connector DC 37 P + S

M4 x 5 $^{+1,5}$

M5 x 9 $^{+1,5}$

M4 x 9 $^{+1,5}$

Error-LED

programming
socket
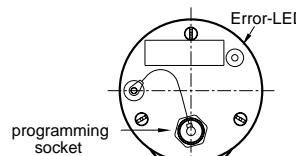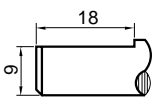
CRP 58, 65 and 66

SSI
12-way Bi 423 / IP 65
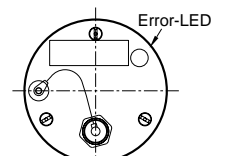
Parallel
DC 37 / IP 30

Model CRP 105

M6 - 12
deep

connector
case

Error-
LED

programming
socket
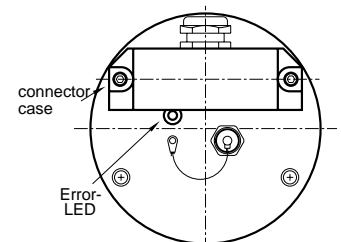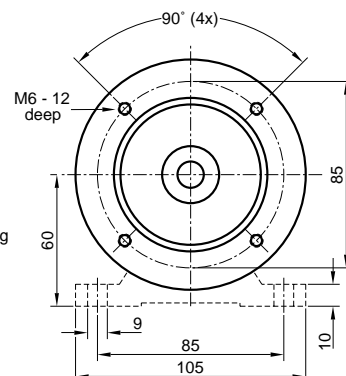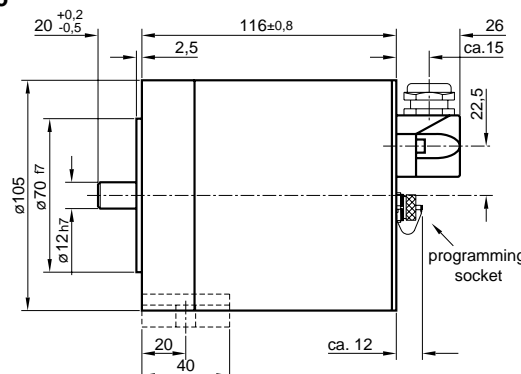
Function and construction

In conjunction with the above mentioned encoders the programming unit **"PROGRAMMER MC" (PMC)** provides editing (modification) and programming of the coding parameters.

The **PMC** has an LCD display, a keyboard with 16 function keys and a micro-controller with a serial interface which is specially matched to the encoder. The power supply (+30 mA) for the **PMC** is provided by the encoder via the interface lead.

Technical Data

- Housing: ABS - plastic

- Display: LCD, 4 lines,
  16 characters, 4 mm high
- Keyboard: Keybutton with protection film
- Mass: Approx. 400 g
- Interface lead: 5 core, 1,5 m long,
  with connectors

Principle of operation

After connecting the **PMC** with an operationally ready CRP encoder (the power supply must be applied to the CRP), both devices carry out a number of checking routines. Here, the program and parameter memories are checked for erroneous contents. Errors are indicated by the error bit and an LED on the encoder as well as by error messages in the display. Up to ten sets of parameters can be permanently stored in the **PMC**. The menu guidance can be selected in the languages German, English or French.

A comprehensive operating manual is supplied.
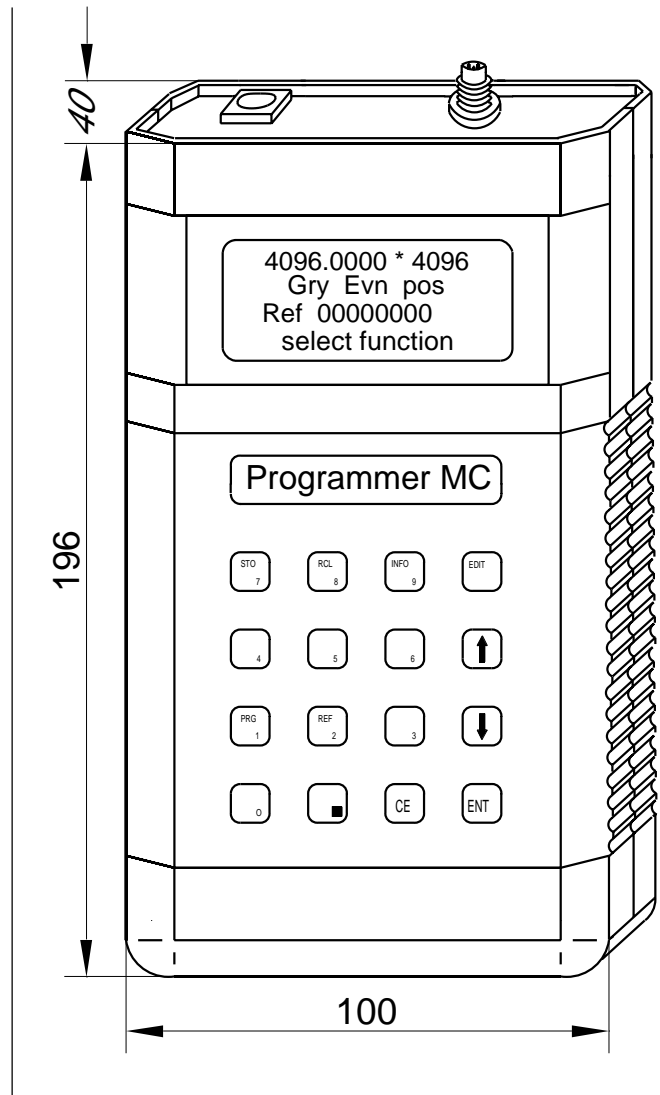
Operation of the **PMC** is subdivided as follows:

Function	Key	Description
Language selection	6	Sets the language for the display.
Entry / Edit	EDIT	Selection of parameters and entry / editing of values.
Store	STO	Storage of a set of parameters in a non-volatile register; 10 parameter registers are available.
Recall set of parameters	RCL	Recalls a set of parameters from a register.
Information	INFO	Displays additional information about connected encoder and about current set of parameters.
Programming	PRG	Programs the encoder with the current set of parameters and sets the reference value.
Programming	REF	Programs the encoder with the reference value only and sets the reference point.

The following parameters can be modified :

- Resolution : From 0.0002 to 4096.0000
  positions / 360° ⚡
- Measuring range : From 1 to 4096 turns
  in steps of powers of 2
- Output code : Gray, Natural Binary or BCD
- Parity bit : ODD or EVEN
- Reference value : Each value within the programmed
  measuring range

Note :

Apart from with the **PMC**, the reference point can be set externally with the SET plug (SET-01) or via the SET input on the encoder.

A detailed description of all functions is given in the Operating Manual TY 1026 which is supplied with each MC Programmer.

TWK

Display:
```
4096.0000 * 4096
Gry  Evn  pos
Ref  00000000
select function
```

Programmer MC

STO 7	RCL 8	INFO 9	EDIT
4	5	6	↑
PRG 1	REF 2	3	↓
0	■	CE	ENT

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