Operating instructions

Interface description
N 152 spindle position display (SPA)
Firmware 01
Version 1.10 and up

Contents   Page

1. General information

1.1. Safety precautions

General remarks

The equipment is designed and assembled according to the prevailing regulations of technology. The equipment left the manufacturer in perfect working order and in line with all safety-relevant conditions. To maintain this status of the equipment, it is imperative to stick to the following when installing and using the device:
- use only according to the intended purpose,
- observation of any precautions regarding safety and hazards,
- observe the present manual and especially the relevant safety precautions!

Make sure that the operating manual and especially the chapter describing the safety precautions is read and well understood by the staff in charge. Supplementary to the operating instructions, ad other generally or legally relevant regulations regarding accident prevention and environmental care are to be considered and observed. This manual is a supplement to already existing documentation (product information, mounting instructions, catalogues).

Intended purpose of the equipment

Intended purpose of the equipment is industrial process monitoring and control in metal, wood, plastic, paper, glass and textile etc. industry.
It is imperative that the equipment is applied only
- in properly installed condition and
- in line with the relevant technical data!

Any operation outside the technical specifications/parameters is improper use and in conjunction with the equipment/processes/machines to be monitored/controlled might lead to
- fatal injuries
- serious damage to health,
- damage to property or corporate equipment or
- damage to the device!

Any overvoltage the device might be exposed to at its connecting terminals has to be limited to the values stipulated in overvoltage category II (see technical data).

The device must not be operated
- in hazardous areas where is danger of explosion,
- as medical equipment or in medical areas,
- or in any applications expressly named in EN 61010!

If the device is utilized for control/monitoring of machines or processes where as the result of a failure/malfunction or incorrect operation of the device might occur
- any threats to life,
- risks of damage to health or
- any risk of damage to property or environment
the corresponding appropriate safety precautions must be taken!

Do not open the housing of the device or proceed any modifications! Any modifications of the device can affect operating safety and result in danger!
Do not proceed any repairs but return defective devices to the manufacturer!

Installation/commissioning

In case of any extraordinary incidents (including in the operating behaviour) that impair safety switch off the device immediately.
Installation must be carried out by suitably trained experts only. After proper mounting and installation the device is ready for operation.
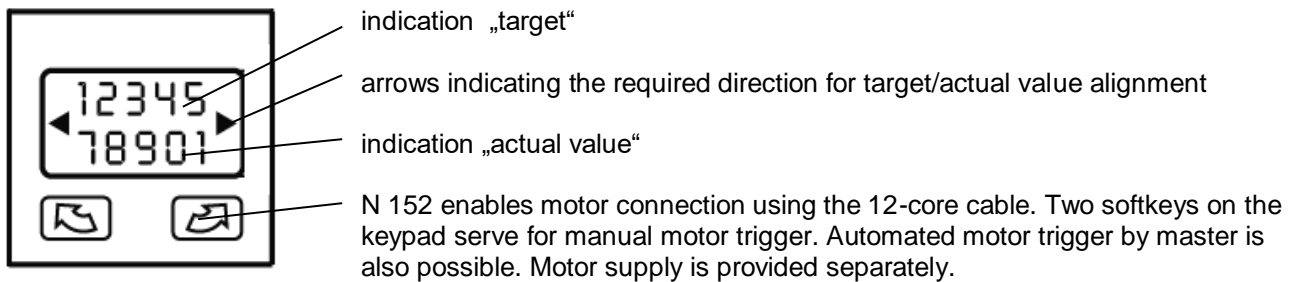
Maintenance/repairs

Always disconnect the power supply of all appliances involved. Maintenance and repair work must only be carried out by suitably trained experts.
If troubleshooting is unsuccessful, do not continue using the device but contact the manufacturer.

1.2. SPA description and explanation

Mounting the spindle position display (SPA) is by docking hollow shaft onto spindle shaft (max.14 mm in diameter).The hollow shaft is fixed to the spindle shaft by hexagon screw and secured by power grip.
This way, the SPA is mounted in an overhung position and secured against torsion by torque support provided at rear of the housing. The SPA features an absolute multiturn sensing system capable of detecting the position after several spindle turns even in powerless state. Position data will be retained even in case of power failure (min. 10 years).
The current position value is indicated in the two-line backlit LCD display (2x 5 digits, numeric), optionally together with the target transmitted by the control (master). Two arrows indicate the editing engineer the direction the spindle must be turned to for aligning actual value with target. As soon as actual value is in alignment with target and within the permitted tolerances, the target will disappear. By corresponding master parameterization the display can be turned by 180° enabling vertical respectively horizontal installation. SPAs are networked by M8 connector, power supply is by the same cable directly from master. SPA parameterization by master only.

indication „target"

arrows indicating the required direction for target/actual value alignment

indication „actual value"

N 152 enables motor connection using the 12-core cable. Two softkeys on the keypad serve for manual motor trigger. Automated motor trigger by master is also possible. Motor supply is provided separately.

2. Terminal assignment

Pin	Assignment	Core colour DIN47100	IEC757
Pin 1	Tx/Rx-, RS485	white	orange
Pin 2	Tx/Rx+, RS485	brown	brown
Pin 3	Sensor supply +24 V	yellow	red
Pin 4	Sensor supply 0 V	green	black

Connector M8

Titel:
N150-05.eps
Erstellt von:
FreeHand 9.0
Vorschau:
Diese EPS-Grafik wu
mit einer enthaltenen
Kommentar:

Connecting motor to SPA N152

Motor connection to SPA is provided by 12-pin female connector.

Pin	Assignment	Significance	Core colour
Pin A	--	n.c.	--
Pin B	IN 1	motor ccw	yellow
Pin C	IN 2	motor cw	blue
Pin D	IN 4*	speed	green
Pin E	--	n.c.	--
Pin F	--	n.c.	--
Pin G	--	n.c.	--
Pin H	--	n.c.	--
Pin J	--	n.c.	--
Pin K	OUT 3	error signal	white
Pin L	IN 3*	speed	brown
Pin M	GND	GND	black

Titel:
N142-04.eps
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IN 3*	IN 4*	speed	rpm Dunker
1	0	slow	200
0	1	medium	--
1	1	high	3600

Circuit diagram

Titel:
Schaltung-SPA-WE-X-01_DE.eps
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an andere Druckertypen.

Connecting the motor supply

Motor supply is by 8-pin connector provided at the motor.

Pin	Assignment	Significance	Core colour
Pin 1	Ue	+ 24 V motor supply	red
Pin 2	GND	0 V ground relating to UE	blue
Pin 3	OUT ccw	start ccw run	white
Pin 4	IN ccw	start ccw run	brown
Pin 5	OUT cw	start cw run	green
Pin 6	IN cw	start cw run	yellow
Pin 7	Enable	logic +24 V	grey
Pin 8	n.c.	n.c.	pink

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Circuit diagram

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⚠ Connect power supply that is free from interference emission. The supply must not be used as parallel supply of drives, shields, magnetic valves, etc.
Apply DC according to the terminal assignment
Power supply: 24 VDC ±10 %

Shield
Use shielded cables only. Ground of the shield must be provided at the machine.
(two examples corresponding to the cable applied, see drawings).

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Kabelabschirmung.eps
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Titel:
Z165-D05-01.eps
Erstellt von:
FreeHand 9.0
Vorschau:
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3. Interface

3.1. Interface data

Type:	RS485
Baudrate:	19200
Parity:	No
Data bits:	8
Stop bits:	1
Handshake:	Nein
Checksum:	Ja (CRC)
Timeout reply*:	0,1...60 ms
BUS switching time**:	<0,1 ms

* To avoid bus collisions a minimum timeout reply of 1 ms (default parameter) is to be kept, i.e. the time elapsed between transmitting the last bit of the query until start transmitting the 1st bit of the SPA response. The operator should see that due to the minimized timeout reply of 1 ms the bus switching time after having transmitted the last bit must not exceed 1 ms.
The default parameter of 1 ms can optionally be altered by serial interface in steps of 0,1 ms within the range of 0,1 ... 60 ms. Refer to command „x" (78h).

** The BUS switching time is the time the SPA requires to be ready again for transmission receipt after having replied to host.

3.2. Protocol

The spindle position display operates with ASCII protocol (clear text protocol). Depending on the command, the protocol data package varies between 5 and 17 bytes.

Byte	Hex code	Significance	Values
1	01H	SOH = start of heading	permanent 01h
2	XXh	Adr = identifier	00...31dez + 20h offset (identifier 00 = 20h)
3	XXh	Cmd = command code	specific commands
4-n	[XXh..XXh]	[Data] = data	20h-7Fh
n+1	04h	EOT = end of transmission	permanent 04h
n+2	XXh	CRC = checksum	00h...FFh

3.3. Checksum (Cyclic Redundancy Check)

For optimized error-free data transmission the CRC byte is added after the footer token (EOT, end of transmission) to the string to be transmitted. Upon receiving a command the CRC byte transmitted is crosschecked with the auto-calculated CRC byte.

Algorithm:
1) Reset CRC byte.
2) Rotate CRC byte by 1 bit to the left.
3) Link result to first data byte XOR.
4) Rotate result by 1 bit to the left.
5) Link result to the second data byte XOR.
     :
x) Rotate result by 1 bit to the left.
y) Link result to the last data byte (ever 04H) XOR.
z) Add result as CRC after the footer token (04H) to the string transmitted.

Note: | 1101 0000 | RL | 1010 0001 | Important: Bit 7 is shifted in bit 0 during rotation

Example:
Transmitted string less CRC =   01h 20h 43h 04h
CRC-Byte   =   0Ah

| 0000 0000 | RL | 0000 0000 | XOR | 0000 0001 (01h) | = | 0000 0001 |

| 0000 0001 | RL | 0000 0010 | XOR | 0010 0000 (20h) | = | 0010 0010 |

| 0010 0010 | RL | 0100 0100 | XOR | 0100 0011 (43h) | = | 0000 0111 |

| 0000 0111 | RL | 0000 1110 | XOR | 0000 0100 (04h) | = | **0000 1010** | = CRC |

Legend: RL = rotate left; XOR = antivalence link

3.4. Data transmission properties

For reasons of compatibility, within the complete multicon system the amount of data is always the same (see table in chapter 6), no matter how many digits are in the display. For example, command "R" (read actual value) comprises a transmitted data amount of 6 bytes, but only 5 digits are indicated in the display. If it is a negative value, digit 6 respectively digit 5 is always 0 (30h).

3.5. Broadcast commands

Some specific commands are designated so-called broadcast commands. As soon as the master broadcasts a command to identifier 99, the command is addressed to every multicon devices in the network. Each individual SPA will accomplish the respective command but will not respond any confirmation to master.

3.6. Data saving

Specific parameters are saved in EEPROM (1.000.000 writing cycles). Data saving is via interface upon every parameter transmission to SPA.
Important:
There should not be a cyclic transmission of these parameters to SPA but only if necessary, for example in case of parameter alteration. The relevant parameters saved in EEPROM are listed in the charts in chapter "Command explanations" or "Overview on commands".

3.7. Transmitting and reading negative values

The minus sign (2DHex) is always transmitted by digit 6 of the data field.
Example: Taking for granted a negative target of –1,5 and a programmed resolution of 1/10, the transmitted value is –00015.

3.8. Transmitting and reading position values (decimal point)

Position values as for example target (command „S") offset (command „U") or end positions (command "g") are generally transmitted and read without decimal point. Visualization in the display corresponds to the format in the data field of the interface command.
Thus, the transmission format depends on the resolution (see command „a").

Example 1: resolution = 1/100; target = 278.50; actual value = 1.00

SOH	Adr	Cmd	Profile no=17		Target = 278.50						EOT	CRC
01h	20h	53h	31h	37h	**30h**	**32h**	**37h**	**38h**	**35h**	**30h**	04h	29h

Display

2 7 8.5 0
1.0 0

Example 2: resolution = 1/10; target = 278.5; actual value = 1.0

SOH	Adr	Cmd	Profile no=17		Target = 278.5						EOT	CRC
01h	20h	53h	31h	37h	**30h**	**30h**	**32h**	**37h**	**38h**	**35h**	04h	29h

2 7 8.5
1.0

4. Command explanations

4.1. General information

The following is describing the individual interface commands broken down into the four groups below:

- operating commands   [commands required during operation]
- parameter commands   [commands for SPA parameterization]
- identifier commands   [commands to indicate or alter the device identifier (address)]
- specific commands   [commands for specific functions as device reset or version number readout]

The following abbreviations are applied:

SOH = start of heading (header token)
EOT = end of transmission (footer token)
Adr   = device identifier, including offset 20h
Cmd = command
Sub   = sub-Command
Data = data transmitted or received
CRC = checksum (cyclic redundancy check)

4.2. Operating commands

Command code	Data amount in Bytes	read	write	Broad-cast	Saved in EEPROM	Signficance
C (43h)	3 / 11	X	-	-	-	Check if actual value = target
D (44h)	1	X	X	X	-	Start motor
F (46h)	4	X	-	-	-	Read device status and error
R (52h)	6	X	-	-	-	Read actual value
S (53h)	8	X	X	-	X	Read / write target
U (55h)	6	X	X	-	-	Offset
V (56h)	2	X	X	X	X	Read / write profile number
Z (5Ah)	6	X	X	X	X	Set preset
t (74h)	6	-	X	-	-	Transmit tool number
u (75h)	6	-	X	-	-	Transmit optional column of figures

4.2.1. Check Position „C" (43h)

This command provides the alignment status of target versus actual value. If the actual value is within the target tolerance window, the response will be „o" (6Fh) for OK together with the current profile number. If the actual value is outside the tolerances, „x" (78H) followed by the current profile number will be replied. In case of any SPA error occurred, the response will be "e" together with the active profile number.

Example: (active profile number = 05)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	43h	04h	0Ah

Response if actual value within the tolerances:

Response	SOH	Adr	Cmd	Status	Profil-Nr. = 05		EOT	CRC
	01h	20h	43h	**6Fh**	**30h**	**35h**	04h	A5h

Response if actual value is outside the tolerances:

Response	SOH	Adr	Cmd	Status	Profil-Nr. = 05		EOT	CRC
	01h	20h	43h	**78h**	**30h**	**35h**	04h	1D

Following values relating to status are possible:

Status	Significance
o (6Fh)	Actual value = target
x (78h)	Actual value ≠ target
e (65h)	SPA error

Command extension Check Position „CX"

Command extension „Check Position CX "provides besides the alignment status target versus current value also the contents of the status and error register as well as the current value. The profile number is not transmitted. For the relevant status parameters (status) refer to the table above, the significance of the individual bits in the status and error register is explained under command *readout device status „F"*.

Example:

Transmission	SOH	Adr	Cmd	SCmd	EOT	CRC							
	01h	20h	43h	58h	04h	A8h							

Response	SOH	Adr	Cmd	Status	Status-Reg		Error-Reg		Actual value = -12.50					EOT	CRC
	01h	20h	43h	78h	80h	80h	80h	80h	2Dh	30h	31h	32h	35h	30h	04h	0Fh

4.2.2. Motor start enable „D" (44h)

This command is utilized to read the actual SPA enable status or to set respectively clear motor start enable. The following modes are available:

Status		Significance
0	(30h)	abort enable motor start, motor stop
1	(31h)	start enable SPAs of group 1
2	(32h)	start enable SPAs of group 2
3	(33h)	start enable SPAs of group 3
:	:	:

Start is also enabled by broadcast command (identifier = 99) to all SPAs at the same time. Refer to example 3.

Example 1: read current enable status (status = 0 = disable)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	44h	04h	04h

Response	SOH	Adr	Cmd	Stat.	EOT	CRC
	01h	20h	44h	**30h**	04h	64h

Example 2: start enable of a specific motor

Transmission	SOH	Adr	Cmd	Stat.	EOT	CRC
	01h	20h	44h	**31h**	04h	66h

Response	SOH	Adr	Cmd	Stat.	EOT	CRC
	01h	20h	44h	**31h**	04h	66h

Example 3: start enable for all motors by broadcast command (identifier=99)

Transmisison	SOH	Adr	Cmd	Stat.	EOT	CRC
	01h	83h	44h	**31h**	04h	7Bh

Response	Not confirmed

Motor holding torque on / off „DB" (44h, 42h)

Prior to utilizing "DB" command to activate / deactivate the holding torque it must be enabled first in command „m" since otherwise command „DB" remains ineffective.
Holding torque ever ON means that only motive shaft positioning operations are possible - either by aid of the two keys provided or by a corresponding command via interface. The holding torque is automatically deactivated as soon as the motor is getting a start command and is later autonomously re-enabled. Manual positioning operations by hand cranks etc require deactivating the holding torque first by command "DB".

Following modes are available::

Status		Function
0	(30h)	holding torque off
1	(31h)	holding torque on

Example 1: Read current status (status = 0: no holding torque)

Transmission	SOH	Adr	Cmd	SCmd	EOT	CRC
	01h	20h	44h	42h	04h	80h

Response	SOH	Adr	Cmd	SCmd	Stat.	EOT	CRC
	01h	20h	44h	42h	**30h**	04h	6Dh

Example 2: holding torque off (status = 0: unblock holding torque)

Transmission	SOH	Adr	Cmd	SCmd	Stat.	EOT	CRC
	01h	20h	44h	42h	**30h**	04h	6Dh

Response	SOH	Adr	Cmd	SCmd	Stat.	EOT	CRC
	01h	20h	44h	42h	**30h**	04h	6Dh

Example 3: holding torque off for all motors by broadcast command (ID=99)

Transmission	SOH	Adr	Cmd	SCmd	Stat.	EOT	CRC
	01h	83h	44h	42h	**30h**	04h	57h

Response	not confirmed

Note: If the holding torque is enabled (command „m") the clamping is always active upon power on, reason why holding torque OFF by command „DB0" is only effective whilst device is under power supply.

4.2.3. Read device status „F" (46h)

This command provides the device statii Stat1 and Stat2 together with error flags Err1, Err2. In case of error check command "C" will come with an "e" in reply.

Example:

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	46h	04h	00h

Response	SOH	Adr	Cmd	Stat1	Stat2	Err1	Err2	EOT	CRC
	01h	20h	46h	**80h**	**80h**	**80h**	**80h**	04h	4Bh

Stat1: 1 0 0 0 0 0 0 0

reserved
ever 1

Stat2: 1 0 0 0 0 0 X X

1 = Motor is running (Moving Bit). The bit is set with running motor including loop interval. With active clamping the bit will remain as set whilst the clamping is open.

1 = Manual SPA abort. Bit is set if during an automated positioning operation any key at the SPA is actuated.

reserved
ever 1

Err1: 1 0 0 0 0 0 X X

1 = Err 8 - target > MAX limit position (motor does not start)
1 = Err 9 - target < MIN limit position (motor does not start)
reserved
reserved
reserved
ever 1

Err2: 1 0 X X X X X X

1 = Err 1 - MAX limit position is hurt
1 = Err 2 - MIN limit position is hurt
1 = Err 3 – no shaft rotation
1 = Err 4 – Motor failure (overcurrent)
1 = Err 5 – target window not achieved
1 = Err 6 – trailing error
reserved
ever 1

4.2.4. Read actual value „R" (52h)

This command is for reading the 5-digit actual value (bottom display). Data amount is always 6 bytes. In case of a negative value, the minus sign (2Dh) together with 5 data bytes is replied. Positive values are represented by 6 data bytes without sign. Values inferior to 5(4) digits will come with preceding zeroes. Please note that N 152 provides a 5-digit actual value.

Example: Actual value = -32.50

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	52h	04h	40h

Response	SOH	Adr	Cmd	Actual value = –32.50					EOT	CRC
	01h	20h	52h	**2Dh**	**30h**	**33h**	**32h**	**35h**	**30h**	04h	54h

4.2.5. Read / write target profile „S" (53h)

This command is utilized to read the presently active target (profile value) respectively to read or write a specific target. Data are composed by profile number (2 bytes) and target (6 bytes). Note: Negative targets are transmitted as 5-digit number (see example 3). Please consider that SPA targets comprise 5 digits only.

Example 1: Read active target (profile number = 12; target = 12.50)

Transmission	SOH	Adr	Cmd	EOT	CRC								
	01h	20h	53h	04h	2A								

Response	SOH	Adr	Cmd	Profile no. = 12		Target = 12.50						EOT	CRC
	01h	20h	53h	**31h**	**32**	**30h**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	3E

Response upon clearing all targets:

Response	SOH	Adr	Cmd	Profile no= FFh		Target = FFFFFFh						EOT	CRC
	01h	20h	53h	**3Fh**	**3F**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	04h	2Ah

Example 2: Read specific target (profile number = 17; target = 12.50)

Transmission	SOH	Adr	Cmd	Profile no. = 17	EOT	CRC
	01h	20h	53h	**31h**	**37h**	04h	16h

Response	SOH	Adr	Cmd	Profile no. = 17		Target = 12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	**30h**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	BCh

Example 3: Write specific target (profile number = 17; target = -12.50)

Transmission	SOH	Adr	Cmd	Profile no. = 17		Target = -12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	**2Dh**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	FBh

Response	SOH	Adr	Cmd	Profile no. = 17		Target = -12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	**2Dh**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	FBh

Note: Instead of command „S" also command „SP" may be utilized. The function is fully identical to command "S". If command SD is utilized it might be easier to apply command SP due to their identical protocol length. Please consider that with anterior or other multicon devices command „SP" maybe is not available.

Example 4: As in example 3 but utilizing command „SP"

Transmission	SOH	Adr	Cmd	Sub	Profile no.=17		Target = -12.50						EOT	CRC
	01h	20h	53h	**50h**	31h	37h	2Dh	30h	31h	32h	35h	30h	04h	29h

Response	SOH	Adr	Cmd	Sub	Profile no.=17		Target = -12.50						EOT	CRC
	01h	20h	53h	**50h**	31h	37h	2Dh	30h	31h	32h	35h	30h	04h	29h

Direct positioning „SD"

This command may be utilized for direct positioning operations. Only the target less any profile number is transmitted to SPA. The profile number after the command "S" is replaced by sub command "D" (= dimension). Motor start enable requires transmitting in addition motor start command "D".

Example 4: Write position value for direct positioning operation (less profile)

Transmission	SOH	Adr	Cmd	Sub	Position value = 278.25						EOT	CRC
	01h	20h	53h	**44h**	**30h**	**32h**	**37h**	**38h**	**32h**	**35h**	04h	6Bh

Response	SOH	Adr	Cmd	Sub	Position value = 278.25						EOT	CRC
	01h	20h	53h	**44h**	**30h**	**32h**	**37h**	**38h**	**32h**	**35h**	04h	6Bh

Note: The position value is saved in the non-volatile memory and will be retained in case of power failure. In this case the previously selected profile is utilized again.

Transmitting targets with simultaneous motor start signal

Specific applications require autonomous re-alignment of shafts to the new target when it is received without prior enable signal by command „D". For this intention the following commands are available:

SPF transmits to SPA profile number together with motor start signal for automated positioning operations
SDF transmits to SPA position value together with motor start signal for automated positioning operations

The addressed SPA is enabled by adding sub-command „F" to the respective basic command. Since it is a pure individual positioning operation, defined groups are not affected. Collision prevention is up to the operator.

Example: Write specific target utilizing command „SPF" (profile number = 17; target = -12.50)

Transmission	SOH	Adr	Cmd	Sub1	Sub2	Profile=17		Target = -12.50						EOT	CRC
	01h	20h	**53h**	**50h**	**46h**	31h	37h	2Dh	30h	31h	32h	35h	30h	04h	A0h

Response	SOH	Adr	Cmd	Sub1	Sub2	Profile=17		Target = -12.50						EOT	CRC
	01h	20h	**53h**	**50h**	**46h**	31h	37h	2Dh	30h	31h	32h	35h	30h	04h	A0h

4.2.6. Read / write offset „U" (55h)

This command is utilized to read or write the offset that is added to the true current value. First however the function must be enabled in command bit parameter ‚a' (61h).

Example 1: Read offset

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	55h	04h	26h

Example 2: Write offset

Transmission	SOH	Adr	Cmd	Data (offset = –20.00)					EOT	CRC
	01h	20h	55h	**2Dh**	**30h**	**32h**	**30h**	**30h**	**30h**	04h	C3h

Response in both examples:

Response	SOH	Adr	Cmd	Data (offset = –20.00)					EOT	CRC
	01h	20h	55h	**2Dh**	**30h**	**32h**	**30h**	**30h**	**30h**	04h	C3h

4.2.7. Read / write profile number „V" (56h)

This command is for readout the number of the presently active profile respectively for profile alteration.

Example 1: Read active profile (active profile number = 38)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	56h	04h	20h

Response	SOH	Adr	Cmd	Profile no. = 38	EOT	CRC
	01h	20h	56h	**33h**	**38h**	04h	28h

Response after reset upon having cleared all profiles:

Response	SOH	Adr	Cmd	Profile no. = FF	EOT	CRC
	01h	20h	56h	**3Fh**	**3Fh**	04h	16h

Example 2: Transmit new profile (new profile number = 17)

Transmission	SOH	Adr	Cmd	Profile no. = 17	EOT	CRC
	01h	20h	56h	**31h**	**37h**	04h	3E

Response	SOH	Adr	Cmd	Profile no. = 17	EOT	CRC
	01h	20h	56h	**31h**	**37h**	04h	3E

Example 3: New profile by broadcast command to all SPAs (Identifier = 99 (83h); new profile number = 17)

Transmission	SOH	Adr	Cmd	Profile no. = 17	EOT	CRC
	01h	83h	56h	**31h**	**37h**	04h	04

Response	Not confirmed

To check whether the new profile has been adopted by all SPAs utilize check command „C" (43h).

4.2.8. Set actual value as preset „Z" (5Ah)

Command "Z" is utilized to set the actual value at any optional value. The required position value is transmitted to SPA. The SPA will calculate a so-called "preset offset" value relating to the true absolute encoder position. When calculating the preset offset, any programmed offset transmitted by command "U" will be considered, so that after having accomplished command "Z" the current value always equals the preset.

Note: If the resolution is altered (see command "a") from 1/100 to 1/10 or vice-versa, the previously programmed preset has to be set anew. The auto-calculated offset is provided in the previously selected resolution.

The actual value displayed is composed as follows:

$$\text{actual value}_{displz} = \text{actual value}_{abs} + \text{preset offset} + \text{Offset}$$

Immediately after having accomplished command „Z" applies preset value = current value t_{displ}

Current value$_{displ}$	actual value indicated in the display and read out by interface
Current value$_{abs}$	internal absolute actual value (not corresponding to the transmitted preset value).
Preset offset	offset generated by command „Z".
Offset	Additional offset enabled by command „U". This function must be enabled first in command bit parameter ‚a' (61h), otherwise the offset is 0.

Example 1: Read out presently active preset value

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	5Ah	04h	38h

Response	SOH	Adr	Cmd	Preset value = 2.50						EOT	CRC
	01h	20h	5Ah	30h	30h	30h	32h	35h	30h	04h	27h

Example 2: Set actual value as preset value (preset value = 17.25)

Transmission	SOH	Adr	Cmd	Preset value = 17.25						EOT	CRC
	01h	20h	5Ah	30h	30h	31h	37h	32h	35h	04h	09h

Response	SOH	Adr	Cmd	Preset value = 17.25						EOT	CRC
	01h	20h	5Ah	30h	30h	31h	37h	32h	35h	04h	09h

Example 3: Set actual value as preset at all SPAs by broadcast command

Transmission	SOH	Adr	Cmd	Preset value = 17.25						EOT	CRC
	01h	83h	5Ah	30h	30h	31h	37h	32h	35h	04h	AAh

Response	Not confirmed

4.2.9. Indicate optional column of figures in upper line „t" (74h)

This command is utilized to indicate a 5-digit number in the upper line of the display. The numerical column is indicated less dot respectively comma. Preceding zeroes as well as both arrows are suppressed. The bottom line still indicates the actual value.
The numerals are indicated in the display until any command except „t", „u" or „R" is received. The number will be retained after power failure.

Example: (Column of figures = 054321)

Transmission	SOH	Adr	Cmd	Column of figures = 054321						EOT	CRC
	01h	20h	74h	30h	35h	34h	33h	32h	31h	04h	C6h

Response	SOH	Adr	Cmd	Column of figures = 054321						EOT	CRC
	01h	20h	74h	30h	35h	34h	33h	32h	31h	04h	C6h

4.2.10. Indicate optional column of figures in bottom line „u" (75h)

The command is utilized to indicate a 5-digit column of figures in the bottom line of the display. The number is indicated less dot respectively comma. Preceding zeroes as well as both arrows are suppressed. The upper line still indicates actual target or the column of figures.
The column is indicated until any optional command except „t", „u" or „R" is received by the interface. The number will be retained after power failure.

Example: (Column of figures = 012345)

Transmission	SOH	Adr	Cmd	Column of figures = 012345						EOT	CRC
	01h	20h	75h	30h	31h	32h	33h	34h	35h	04h	B6h

Response	SOH	Adr	Cmd	Column of figures = 012345						EOT	CRC
	01h	20h	75h	30h	31h	32h	33h	34h	35h	04h	B6h

Note:
Command "t" in conjunction with command "u" enables indication of a 10-digit number.
Both columns are not saved in EEPROM.

4.3. Parameter commands

Command code	Data amount in bytes	read	write	Broad-cast	Saved in EEPROM	Significance
a (61h)	5	X	X	-	X	Read / write general parameters
b (62h)	8	X	X	-	X	Parameter: tolerance compensation, window
c (63h)	8	X	X	-	X	Parameter: Scaling of spindle pitch
g (67h)	12	X	X	-	X	Parameter: Limit positions MIN, MAX
h (68h)	12	X	X	-	X	Parameter: Switching points motor speed
i (69h)	1	X	X	X	X	Parameter: mm / inch
j (69h)	3	X	X	X	X	Parameter: Timeout bus error
k (6Bh)	9	X	X	-	X	Parameter: motor system times
l (6Ch)	5	X	X	-	X	Parameter: Jog function
m (6Dh)	5	X	X	-	X	Read / write general parameters

4.3.1.Read / write bit parameters „a" (61h)

To exploit maximum memory capacity, several parameters are put together and transferred as "data pack" under the following parameter codes:

```
Data1:      1 0 X X 0 X 0 X
                    │ │ │   │ │
                    │ │ │   │ └──── positioning direction  0/1        (UP/DOWN)
                    │ │ │   └────── counting direction      0/1        (UP/DOWN)
                    │ │ └────────── arrows                  0/1/2/3    (UP/DOWN/UNI/OFF)
                    └────────────── 1

Data2:      1 0 X X X X 0 X
                    │ │ │ │   │
                    │ │ │ │   └──── round actual value       0/1        (OFF/ON)
                    │ │ │ └──────── turn display              0/1        (OFF/ON)
                    │ │ └────────── dimension                 0/1        (OFF/ON)
                    │ └──────────── actual value correction   0/1/2      (OFF/ON/On+Key)
                    └────────────── reserved
                                    1

Data3:      1 0 0 0 0 X X X
                            │ │ │
                            │ └─┴── hide target               0/1/2      (ON/OFF/EVER)
                            └────── resolution                0/1        (1/100;1/10)
                                    reserved
                                    1

Data4/5:    0 0 1 1 0 0 0 0
                    │
                    └────────────── reserved
```

Important: Only bits marked 'X' may be altered. The permanent parameters „1" and „0" must not be altered since this might create a control token (tokens < 20h) what is not permitted in ASCII protocol.

Example 1: read bit parameter (data1 to data3 = 80h; data4 to data5 = 30h)

Transmission	SOH	Adr	Cmd	EOT	CRC					
	01h	20h	61h	04h	4E					

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**80h**	**80h**	**80h**	**30h**	**30h**	04h	F1

bit parameter default

Example 2: write bit parameter (positioning direction = down; turn display = On)

Transmission	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**81h**	**84h**	**80h**	**30h**	**30h**	04h	91h

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**81h**	**84h**	**80h**	**30h**	**30h**	04h	91h

Significance of parameter „a"

Positioning direction
This parameter defines the direction the target is aimed for. Tolerances that occur for example at cogwheels, joints, shafts etc during a precise positioning operation requires a tolerance compensation. The tolerance compensation is proceeded by aiming for the target position always from the same direction utilizing so-called loops. Loops mean that the target position is first crossed by a defined distance and then aimed for again from the opposite direction. The parameter for the crossing distance is programmed by command "b". Whether a loop is required or not is indicated by the arrows in the display. A flashing arrow means tolerance compensation required. Upon reaching the turning point the direction changes and the arrow stops flashing. Targets allowing direct positioning are marked by a non-flashing arrow. Upon achieving the target within the programmed tolerances (see command "b") the arrows will not disappear until the required tolerance compensation has been completed.

00 = Up	Direct positioning if target position > actual position; otherwise proceed tolerance compensation
01 = Down	Direct positioning if target position < actual position; otherwise proceed tolerance compensation

Counting mode

This parameter assigns either „ascending" or „descending" counted values in relation to the shaft's direction of rotation. Following parameters are available:

00 = Up	Clockwise rotation, ascending counted values
01 = Down	Clockwise rotation, descending counted values

Arrows

This parameter relates to the arrows in the display that indicate the operator the direction (to the right or to the left) of the new positioning operation. Following parameters are available:

00 = Up	If actual value < target = arrow to the right; actual value > target = arrow to the left
01 = Down	As „Up", but inverted arrows direction
10 = Uni	If actual value ≠ target arrows ever indicated
11 = Off	Arrows ever hidden

Note: A loop operation (as backlash compensation) is only performed with settings *Up* and *Down*. *Uni* and *Off* always implicate a direct movement to the target without backlash compensation.

Rounding the actual value

This means that the actual value being within the tolerances but still differing from the target is rounded up or down to the target value as soon as the shaft remains idle for approx. 3 seconds. The rounding operation is only visualized, the true internal actual value remains unchanged. For actual value readout by serial interface (command "R") the true, not rounded actual position value is provided. The true actual value will immediately reappear on the display upon key actuation. If the position is still within the tolerance window the rounding operation will be repeated after 3 seconds.

Note: In operating mode „Suppress target = Ever" the target is deactivated and the SPA serves as pure actual value display with disabled rounding function. The following parameters are available:

0 = Off	Round actual value disable
1 = On	Round actual value enable

Turn display

This parameter is utilized to turn the display by 180°.

0 = Off	Display readout with standard mounting, i.e. display above keypad
1 = On	Display readout with inverted mounting, i.e. display below keypad

Dimension

Only in conjunction with N 242 master. By this parameter the master enables indication of actual value and direct positioning (so-called dimension). Refer also to N 242 user manual.

Utilized with other controls (PLC or PC) this parameter may be assigned to general identifications.

0 = Off	Device not indicated in N 242 master
1 = On	Device indicated in N 242 master. Direct target input possible

Offset

Command „U" is utilized for programming the offset that is added to actual value and actual target. This parameter defines whether the offset is considered in the calculation.

0 = Off	Offset disabled. Any offset previously transmitted is NOT added neither to actual value nor target.
1 = On	Offset enabled. Offset is added to actual value and actual target.
2 = On + Key	As setting 1. The offset can be altered by keypad.

Suppress target

This parameter defines when to indicate the target in the upper line of the display.

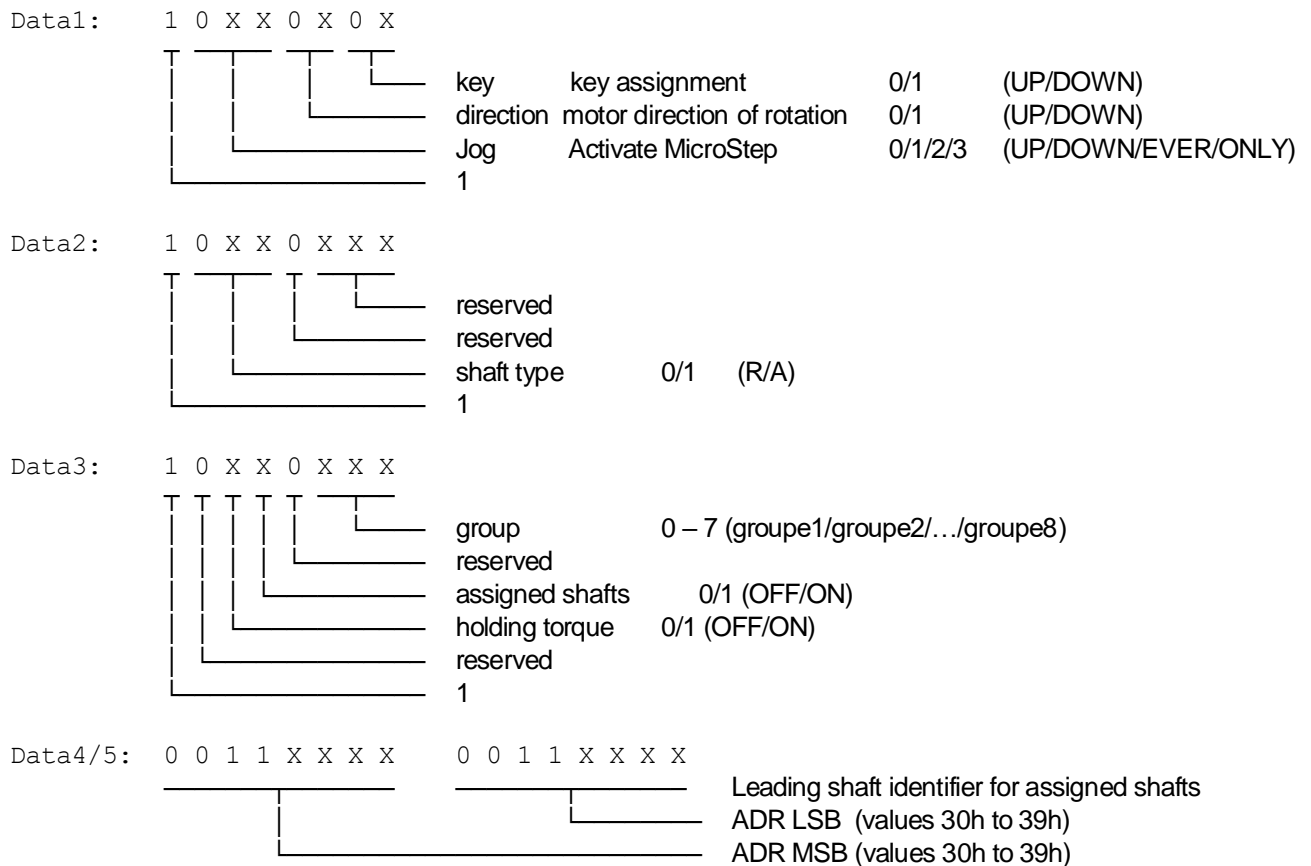|	
0 = On	Target indicated if target ≠ current value.
1 = Off	Target ever indicated, also if target = current value. Indicate arrows too if target ≠ current value.
2 = Ever	Target and arrows ever suppressed.

Resolution

This parameter defines the resolution of the actual value. Upon altering the resolution the decimal point is shifted correspondingly by one digit to the right or left, same applies also to actual value and target. The target values however are not converted correspondingly but only the decimal point is shifted. When editing the machine please pay attention to defining the resolution first so that the target values are transmitted to the SPAs with the corresponding resolution.

0	Resolution 1/100 mm resp. 1/1000 inch	visualized in the display: 000.00 mm resp. 00.000 inch
1	Resolution 1/10 mm resp. 1/100 inch	visualized in the display: 0000.0 mm resp. 000.00 inch

4.3.2. Read / write bit parameter motor „m" (6Dh)

To exploit maximum memory capacity, several parameters are put together and transferred as "data pack" under the following parameter codes:

```
Data1:    1 0 X X 0 X 0 X
                  │ │ │ └── key        key assignment              0/1      (UP/DOWN)
                  │ │ └──── direction  motor direction of rotation 0/1      (UP/DOWN)
                  │ └────── Jog        Activate MicroStep          0/1/2/3  (UP/DOWN/EVER/ONLY)
                  └──────── 1
```

```
Data2:    1 0 X X 0 X X X
                  │ │ │ └── reserved
                  │ │ └──── reserved
                  │ └────── shaft type         0/1    (R/A)
                  └──────── 1
```

```
Data3:    1 0 X X 0 X X X
              │ │ │ │ └──── group            0 – 7 (groupe1/groupe2/…/groupe8)
              │ │ │ └────── reserved
              │ │ └──────── assigned shafts    0/1 (OFF/ON)
              │ └────────── holding torque   0/1 (OFF/ON)
              │ └────────── reserved
              └──────────── 1
```

```
Data4/5:  0 0 1 1 X X X X    0 0 1 1 X X X X
                                          └──── Leading shaft identifier for assigned shafts
                                      └──────── ADR LSB  (values 30h to 39h)
                              └──────────────── ADR MSB (values 30h to 39h)
```

Important: Only bits marked 'X' may be altered. The permanent values „1" and „0" must not be altered since thereby a control token (tokens < 20h) might be created what is not permitted in ASCII.

Example 1: Read bit parameter (data 1 to data 3 = 80h; data 4 to data 5 = 30h)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	6Dh	04h	56h

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC	bit parameter default
	01h	20h	6Dh	**80h**	**80h**	**80h**	**30h**	**30h**	04h	F2h	

Example 2: Write bit parameter (key assignment = down; motor direction of rotation = Down)

Transmission	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	6Dh	**81h**	**84h**	**80h**	**30h**	**30h**	04h	92h

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	6Dh	**81h**	**84h**	**80h**	**30h**	**30h**	04h	92h

Significance of parameter „m"

Key assignment
This parameter assigns a specified direction of rotation to a certain key. For the mounting option "keypad below display" and the remaining default parameters applies the following:

0 = Up   left/right key actuation = shaft rotation ccw/cw, counting mode UP/DOWN
1 = Down   left/right key actuation = shaft rotation cw/ccw, counting mode UP/DOWN

Motor direction of rotation
The parameter "motor direction of rotation" enables inversion of the two output signals for motor ccw (pin B) and motor cw (pin C) provided at the motor cable.

0 = Up   Standard direction of rotation
1 = Down   Inverted direction of rotation

Jog
The jog function makes the motor run by a defined number of steps upon a short stroke on a key. The holding time does not matter as long as it is not less than 400 ms. A holding time of > 400 ms results in permanent motor run. Inferior holding times are accomplished as Jog. The number of steps is defined under parameter command „l", default parameter is 1.

Note: The respective step is always accomplished completely and cannot be stopped or restarted by actuating any key during the motor positioning operation. However a stop by interface (command "D") is possible. With running motor the moving bit is set to 1 (refer also command "F").
Setting the step width to 0 will disable the Jog function, both by keypad and by external inputs.

00 = Up   Jog only enabled with counting mode UP
01 = Down   Jog only enabled with counting mode DOWN
10 = Ever   Jog enabled with both counting modes UP/DOWN
11 = Only   Jog only enabled. Continuous movements actuated by keypad are disabled

Shaft type
The shaft type parameter assigns the shaft type.
Some applications may call for different treatment of radially and axially operated shafts what is already taken into consideration when utilizing the Baumer master. For example, only certain shafts shall be displayed in DIM mode. Other controls (for example PLC or PC) may utilize this parameter for general assignments.

0 = R   Shaft type R
1 = A   Shaft type A

Groups
Parameter for division in groups. Individual SPAs can be bundled to 8 different groups to be started in successive order group by group (command „D") in order to prevent collisions.

0 = group 1   Start command „D" must comprise the designated group number to start the respective group.
1 = group 2
:   :
7 = group 8

Assigned shafts
This parameter assigns two or more shafts to a leading shaft and is applied when utilizing the Baumer Master. For detailed description please refer to the Baumer master user manual, chapter specific functions. Other controls (for example PLC or PC) may utilize this parameter for general assignments.

0 = Off   Not assigned
1 = On   Assigned. This SPA is assigned to a leading shaft. The leading shaft's identifier is specified in data 4/5 of command "m" in the leading shaft identifier.

Holding torque

This parameter is utilized to enable respectively disable the motor holding torque. Both directional signals "motor ccw" and "motor cw" are activated by the spindle position display (SPA). Thus, the motor is hold at its actual position. Refer also to command „DB" for temporary holding torque disabled.

0 = Off   holding torque disabled
1 = On   holding torque enabled

4.3.3. Read / write spindle tolerance compensation and window „b" (62h)

This command is utilized to read or write the parameters tolerance compensation and tolerance window.

Example 1: Read parameter (tolerance compensation = 0.15; tolerance window = 0.25)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	62h	04h	48h

Response	SOH	Adr	Cmd	tolerance compensation=0.5				tolerance window=0.25				EOT	CRC
	01h	20h	62h	**30h**	**30h**	**35h**	**30h**	**30h**	**30h**	**32h**	**35h**	04h	0Bh

Example 2: Write parameter (tolerance compensation = 1.30; tolerance window = 0.75)

Transmission	SOH	Adr	Cmd	tolerance compensation =1.30				tolerance window =0.75				EOT	CRC
	01h	20h	62h	**30h**	**31h**	**33h**	**30h**	**30h**	**30h**	**37h**	**35h**	04h	1Eh

Response	SOH	Adr	Cmd	tolerance compensation =1.30				tolerance window =0.75				EOT	CRC
	01h	20h	62h	**30h**	**31h**	**33h**	**30h**	**30h**	**30h**	**37h**	**35h**	04h	1Eh

4.3.4. Read / write spindle pitch (scaling) „c" (63h)

This command is utilized to read or write the scaling factor relating to the spindle pitch within the range from 0,0000001...9,9999999. The decimal point is not transmitted.
Resolution per turn is 1440 steps. A scaling factor of 1.000000 will increase respectively decrease the indicated value by 14.4 mm.

How to calculate the scaling factor:
Resolution per turn: 14.40 mm   (corresponding to length with scaling factor 1.0000000)
Spindle pitch: 4.00 mm

$$scaling = \frac{Spindle\ pitch}{resolution\ per\ revolution} = \frac{4.00}{14.40} = 0.2777777$$

Example 1: Read scaling (scaling factor = 1.000000)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	63h	04h	4Ah

Response	SOH	Adr	Cmd	Scaling factor = 1.0000000								EOT	CRC
	01h	20h	63h	**31h**	**30h**	**30h**	**30h**	**30h**	**30h**	**30h**	**30h**	04h	4B

Example 2: Write scaling (scaling factor = 0.2777777)

Transmission	SOH	Adr	Cmd	Scaling factor = 0.2777777								EOT	CRC
	01h	20h	63h	**30h**	**32h**	**37h**	**37h**	**37h**	**37h**	**37h**	**37h**	04h	30h

Response	SOH	Adr	Cmd	Scaling factor = 0.2777777								EOT	CRC
	01h	20h	63h	**30h**	**32h**	**37h**	**37h**	**37h**	**37h**	**37h**	**37h**	04h	30h

4.3.5. Read / write limit positions „g" (67h)

This command is utilized to read or write the MIN and MAX limit positions within the range from -999.99 to 9999.99. The decimal point is not transmitted.

Example 1: Read limit positions (MIN = 15.00; MAX = 850.25)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	67h	04h	42h

Response	SOH	Adr	Cmd	MIN limit position = 0015.00						MAX limit position = 0850.25						EOT	CRC
	01h	20h	67h	**30h**	**30h**	**31h**	**35h**	**30h**	**30h**	**30h**	**38h**	**35h**	**30h**	**32h**	**35h**	04h	1Fh

Example 2: Write limit positions (MIN = -33.22; MAX = 1234.56)

Transmission	SOH	Adr	Cmd	MIN limit position = -033.22						MAX limit position = 1234.56						EOT	CRC
	01h	20h	67h	**2Dh**	**30h**	**33h**	**33h**	**32h**	**32h**	**31h**	**32h**	**33h**	**34h**	**35h**	**36h**	04h	92h

Response	SOH	Adr	Cmd	MIN limit position = -033.22						MAX limit position = 1234.56						EOT	CRC
	01h	20h	67h	**2Dh**	**30h**	**33h**	**33h**	**32h**	**32h**	**31h**	**32h**	**33h**	**34h**	**35h**	**36h**	04h	92h

4.3.6. Read / write motor speed switching points „h" (68h)

This command is utilized to read or write the motor speed switching points. Prior to reaching the target the motor speed can be slowed down by two optional speeds (slow and precision) for absolutely precise positioning to the target. The motor's switchoff point might also be set to a certain value prior to reaching the target. The following 3 parameters are available:

    Slow speed: point where SPA changes from high speed to slow speed.
    Precision speed: point where SPA changes from slow speed to precision speed.
    Switchoff point: Position where motor is stopped by SPA .

The individual switching points are indicated in relation to the target.

Example 1: Read parameter (slow speed = 2.00; precision speed = 0.70; switchoff point= 0.02)

Transmisison	SOH	Adr	Cmd	EOT	CRC
	01h	20h	68h	04h	5Ch

Response	SOH	Adr	Cmd	Slow speed =2.00				Precision speed =0.70				Switchoff point =0.00				EOT	CRC
	01h	20h	68h	**30h**	**32h**	**30h**	**30h**	**30h**	**30h**	**37h**	**30h**	**30h**	**30h**	**30h**	**30h**	04h	72h

Example 2: Wirte parameter (slow speed = 1.25; precision speed = 0.50; switchoff point = 0.01)

Transmission	SOH	Adr	Cmd	Slow speed =1.25				Precision speed =0.50				Switchoff point =0.01				EOT	CRC
	01h	20h	68h	**30h**	**31h**	**32h**	**35h**	**30h**	**30h**	**35h**	**30h**	**30h**	**30h**	**30h**	**31h**	04h	EAh

Response	SOH	Adr	Cmd	Slow speed =2.00				Precision speed =0.50				Switchoff point =0.01				EOT	CRC
	01h	20h	68h	**30h**	**31h**	**32h**	**35h**	**30h**	**30h**	**35h**	**30h**	**30h**	**30h**	**30h**	**31h**	04h	EAh

4.3.7. Read / write measuring unit „i" (69h)

The command is for utilized to read or write the measuring unit in mm or inches.
    Data = 0 (30h) = mm
    Data = 1 (31h) = inch

Example 1: Read parameter (setting = mm)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	69h	04h	5E

Response	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**30h**	04h	D0h

Example 2: Change measuring unit into inches

Transmisison	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**31h**	04h	D2

Response	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**31h**	04h	D2

Example 3: Write measuring unit mm in all SPAs by broadcast command (identifier=99)

Transmission	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	69h	**30h**	04h	CDh

Response	not confirmed

Important: Parameters are programmed in mm and auto-converted by SPA into inches upon displaying the position values.

4.3.8. Read / write timeout at bus error RS485 „j" (6Ah)

This command is utilized to read or write the system time: timeout at bus error. Value range is within 00,1 s to 99,9 s. Tolerance: ±7% at minimum time; < 1‰ at maximum time, approx. 1% at 1.

Function: RS485 bus monitoring during motive shaft positioning operations. If there is no interface activity within the programmed timeout the motor will stop (EMERGENCY OFF) upon occurring a bus error or in case of an inactive control. A motor restart requires transmitting the profile (command „S" or „V") together with start signal (command „D"). Setting 0.00 s means function disabled.

Example 1: Read parameter (time= 2.5 s)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	6Ah	04h	58h

Response	SOH	Adr	Cmd	Time =2.5 s			EOT	CRC
	01h	20h	6Ah	30h	32h	35h	04h	C5h

Example 2: Write parameter (time = 13.5 s)

Transmission	SOH	Adr	Cmd	Loop =13.5 s			EOT	CRC
	01h	20h	6Ah	31h	33h	35h	04h	C9h

Response	SOH	Adr	Cmd	Loop =13.5 s			EOT	CRC
	01h	20h	6Ah	31h	33h	35h	04h	C9h

4.3.9. Read / write motor system times „k" (6Bh)

This command is utilized to read or write the individual motor system times within the range of 00,1 s to 99,9 s. Tolerance: ±7% at minimum time; < 1‰ at maximum time, approx. 1% at 1 s.
The following 3 parameters are available:

Loop: Waiting time at turning point during loop operation.
Trailing error: Timeout of motor signals, if shaft does not rotate after motor start.
Clamping: timeout reply between loose/active clamping or break
prior to motor start / after motor stop.

Example 1: Read parameter (loop = 1.0 s; trailing error = 3.5 s; clamping = 0.5 s)

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	20h	6Bh	04h	5Ah

Response	SOH	Adr	Cmd	Loo p=1.0 s			Traling error=3.5s			Clamping =0.5			EOT	CRC
	01h	20h	6Bh	30h	31h	30h	30h	33h	35h	30h	30h	35h	04h	E3h

Example 2: Write parameter (loop = 2.0 s; trailing error = 6.5 s; clamping = 1.5 s)

Transmission	SOH	Adr	Cmd	Loop =2.0 s			Trailing error=6.5s			Clamping =1.5			EOT	CRC
	01h	20h	6Bh	30h	32h	30h	30h	36h	35h	30h	31h	35h	04h	44h

Response	SOH	Adr	Cmd	Loop =2.0 s			Trailing error=6.5s			Clamping =1.5			EOT	CRC
	01h	20h	6Bh	30h	32h	30h	30h	36h	35h	30h	31h	35h	04h	44h

4.3.10. Setting the jog step scale „I" (6Ch)

This command is utilized to read or write the jog step scale within the range from 0- 999.
Parameter 0 will disable the Jog function, both by keypad and by external inputs.
Note: The jog function must be enabled in command „m", lock in one direction is possible as an option.
The respective jog step is always completely accomplished during a motor positioning operation and cannot be stopped or restarted by actuating another key. However it is possible to stop by interface (command „D"). With running motor the moving bit is set to 1 (refer also command "F").

Example 1: Read jog step

Transmission	SOH	Adr	Cmd	SCmd	EOT	CRC
	01h	20h	6C	53h	04h	5Ah

Response	SOH	Adr	Cmd	SCmd	Jog step = 25			EOT	CRC
	01h	20h	6Ch	53h	30h	30	32	35	04h	44h

Example 2: Write jog step

Transmission	SOH	Adr	Cmd	SCmd	Jog step = 50				EOT	CRC
	01h	20h	6Ch	53h	**30h**	**30**	**35**	**30**	04h	52h

Response	SOH	Adr	Cmd	SCmd	Schrittweite = 50				EOT	CRC
	01h	20h	6Ch	53h	**30h**	**30**	**35**	**30**	04h	52h

Example 3: Value transmitted is too high (4 digits)

Transmission	SOH	Adr	Cmd	SCmd	Jog step = 2345				EOT	CRC
	01h	20h	6Ch	53h	**32h**	**33**	**34**	**35**	04h	64h

Response	SOH	Adr	Cmd	SCmd	Jog step = 0345				EOT	CRC
	01h	20h	6Ch	53h	**30h**	**33**	**34**	**35**	04h	44h

SPA adopts only 3-digit values, the 4th digit is automatically replaced by zero.

4.3.11. Read / write specific parameter „x" (78h)

The specific parameter „x" comprises several sub-parameters enabling alteration of originally permanent parameters to adapt them to new circumstances. Presently the following sub-parameter is available:

   D (44h) = delaytime for minimized timeout reply of serial interface

Sub parameter: Delaytime „D" (44h)
This parameter defines the minimum delay time (break) between the last bit received and the first bit of the response transmitted. Delay time is in steps of 0,1 ms from 00.0 ... 60.0 ms. Default is 1.0 ms.

Example 1: Read actual delay time

Transmission	SOH	Adr	Cmd	Sub	EOT	CRC
	01h	20h	78h	44h	04h	7Ch

Response	SOH	Adr	Cmd	Sub	Delaytime = 4.5				EOT	CRC
	01h	20h	78h	44h	**30h**	**30h**	**34h**	**35h**	04h	BBh

Example 2: Write new delay time

Transmission	SOH	Adr	Cmd	Sub	Delaytime = 15.0				EOT	CRC
	01h	20h	78h	44h	**30h**	**31h**	**35h**	**30h**	04h	BDh

Response	SOH	Adr	Cmd	Sub	Delaytime = 15.0				EOT	CRC
	01h	20h	78h	44h	**30h**	**31h**	**35h**	**30h**	04h	BDh

Please not that the true delaytime might be prolonged. It depends on the required processing time as well as on internal software cycles. Tolerance is approx. 8 ms.

4.4. Identifier (address) commands

Command code	Data amount in bytes	read	write	Broad-cast	Save in EEPROM	function
A (41h)	2	X	X	X	X	Assign or indicate device identifier
B (42h)	2	-	-	-	-	SPA feedback in addressing mode

4.4.1.Assigning device identifiers in the network „A" (41h)

This command is creating an automated process assigning the device identifier in successive order to every single SPA upon commissioning of the system. The first identifier to be assigned is broadcasted to all networked SPAs as follows:

Transmission	SOH	Adr	Cmd	identifier = 01		EOT	CRC
	01h	83h	41h	**30h**	**31h**	04h	B4h

All SPAs now show the identifier just transmitted and that is to be assigned in the upper display. The bottom line indicates the device-specific identifier.To make the SPA adopt the new identifier, the shaft must be turned by half at least (direction does not matter). The identifier is now adopted and indicated in the bottom line of the display (as new device-specific identifier). Both identifiers are now identical. As soon as the shaft is in idle position again and after having elapsed 3 seconds, the SPA will transmit the following command **„B" (42h)** as confirmation to master:

Transmission to master	SOH	Adr	Cmd	identifier = 01		EOT	CRC
	01h	21h	42h	**30h**	**31h**	04h	86h

The Master can now transmit command „A" with the next identifier to be assigned as previously described.
This way, the different (successive) identifiers are automatically assigned to all networked SPAs, one after the other.
Important: Confirmatory command **„B"** transmitted by SPA to master will be repeated after 3 seconds provided the master has not previously transmitted another „A" command.

Indicate identifier in the display „A" (41h)

This command less parameters as a broadcast command (address/Identifier=99) will make every networked SPA indicate the device-specific identifier in the bottom line of the display. The upper line is blind.
This command is a designated broadcast command.

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	83h	41h	04h	80h

Response	Not confirmed

SPA remains in this mode until being switched off and on again or until transmission of another command except „A", „R", „t" or „u".

If this command is transmitted to a valid device identifier (except 99) without any parameters, the respective SPA will return to standard operating mode and reply the actual device identifier.

Transmission	SOH	Adr	Cmd	EOT	CRC
	01h	21h	41h	04h	0Ah

Response	SOH	Adr	Cmd	Identifier =01		EOT	CRC
	01h	21h	41h	**30h**	**31h**	04h	9Eh

Extended identifier command „AX" (41h, 58h)

This extended command is utilized to address individual SPAs in the bus network in a similar way as described above. By broadcast command the identifier to be assigned is transmitted to all networked SPAs as follows:

Transmission	SOH	Adr	Cmd	Cmd2	Identifier = 01		EOT	CRC
	01h	83h	41h	58h	**30h**	**31h**	04h	40h

Similar to the standard command all SPAs now indicate the identifier just transmitted which is to be assigned in the upper display. Adopting the identifier is in the same way. However, contrary to the above there is not any acknowledgement „B" in reply. Checking whether the new identifier has been adopted is up to master, for example utilizing command "R" (read actual value). The R-command with the corresponding identifier is transmitted to the SPA. If the addressed SPA confirms that the assignment was successful, the master can proceed with next identifier. Regarding other commands the display of the respective SPA switches to standard operation.

4.5. Specific commands

Command code	Data amount in bytes	read	write	Broad-cast	Saved in EEPROM	Significance
K (4Bh)	-	-	X	X	X	Specific command: profile reset (clear)
Q (51h)	1	-	X	X	X	Specific command: SPA reset
X (58h)	2 / 4 / 8	X	-	-	-	Specific commands

4.5.1. SPA profile reset „K" (4Bh)

This command is clearing all previously programmed profiles.

Example 1: profile reset of a specific SPA

Transmission	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	4Bh	**7Fh**	04h	C6h

Response	SOH	Adr	Data	EOT	CRC	
	01h	20h	**6Fh**	04h	52h	SPA replies by standard response ‚o' (6Fh) = OK

Example 2: profile reset in all SPAs by broadcast command (identifier=99)

Transmission	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	4Bh	**7Fh**	04h	DBh

Response	Not confirmed

Important: After profile reset all profile data are set to FFFFFFhex, the current profile number to FFhex. The SPA display now is indicating 5 hyphens instead of target.

4.5.2. SPA restore default „Q" (51h)

This command restores default either of individual or collective parameters.

    Data = q (71h) = Restore default parameters
    Data = t (74h) = Device identifier = 98
    Data = x (78h) = Multiturn counter reset to 0. No singleturn reset possible.
    Data = Δ (7Fh) = All above functions are accomplished.

Note: No profile reset. Profile reset by command „R".

Example 1: Restore default in specific SPA

Transmission	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	51h	**7Fh**	04h	AEh

Response	SOH	Adr	Data	EOT	CRC	
	01h	20h	**6Fh**	04h	52h	SPA replies by standard response ‚o' (6Fh) = OK

Example 2: Restore default in all SPAs by broadcast command (identifier=99)

Transmission	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	51h	**7Fh**	04h	B3

Response	Not confirmed

4.5.3.Read version, type or serial number „X" (58h)

This command is utilized to read version number, device type or serial number. The following sub-commands are available:

    Data = V (56h) = read version
    Data = T (54h) = read device type
    Data = S (53h) = read serial number

Example 1 : Read version number

Transmission	SOH	Adr	Cmd	Data	EOT	CRC		
	01h	20h	58h	**56h**	04h	D8h		

Response	SOH	Adr	Cmd	Data	Version number = 2.00			EOT	CRC
	01h	20h	58h	56h	**20h**	**32h**	**30h**	**30h**	04h	FAh

Example 2: Read device type (device type = N 152; firmware = 01)

Transmisison	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	58h	**54h**	04h	DCh

Response	SOH	Adr	Cmd	Data	Type		EOT	CRC
	01h	20h	58h	54h	**90h**	**81h**	04h	26h

Code configuration of the transmitted device type:

```
1 0 0 1 0 0 0 0   1 0 0 0 0 0 0 1   =  90 81 hex
┬ ─────── │ ┬   ┬ ─────── │
│       │   │     │       └──── software number 01h = firmware 01
│       │   │     └──────────── permanent 1
│       │   └────────────────── device type 10h = N 152
│       └────────────────────── permanent 1
└────────────────────────────── permanent 1
```

Example 3: Read serial number

Transmission	SOH	Adr	Cmd	Data	EOT	CRC						
	01h	20h	58h	**53h**	04h	D2h						

Response	SOH	Adr	Cmd	Data	Coded serial number = 07090EA4								EOT	CRC
	01h	20h	58h	53h	**30h**	**37h**	**30h**	**39h**	**30h**	**3Eh**	**3Ah**	**34h**	04h	20h

Code configuration of the transmitted serial number:

The Low-Nibble (lower 4 bits of a byte) of the 8 data bits received equal together a 4 byte value comprising the serial number.
The serial number is composed by date and time of production. Since also the seconds are coded and by assigning only one number per second the serial number is unique.

Example: serial number for   **01.06.2005 16:58:36 = 15 83 0E A4** hex

```
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 X X X X X X X   bit position
J J J J J J M M   M M T T T T T h   h h h h m m m m   m m s s s s s s   content
0 0 0 1 0 1 0 1   1 0 0 0 0 0 1 1   0 0 0 0 1 1 1 0   1 0 1 0 0 1 0 0   example = 15 83 0E A4 hex

                                                          └──────── seconds 10 0100 = 24h = 36d
                                                  └──────────────── minutes 11 1010 = 3Ah = 58d
                                          └──────────────────────── hours    1 0000 = 10h = 16d
                                  └────────────────────────────────── day       0 0001 = 01h = 01d
                          └────────────────────────────────────────── month       0110 = 06h = 06d
                  └────────────────────────────────────────────────── year 00 0101 = 05h = 05d

                                                          01.06.05  16:58:36 <──────┘
```

5. Error warnings

5.1. CRC error

Upon recognizing a CRC error in a transmitted command the SPA will respond as follows:

Response	SOH	Adr	Error	EOT	CRC
	01h	20h	65h	04h	46h

Error = „e" (65h) = CRC error

5.2. Format error

Upon recognizing a format error (incorrect length of protocol or void command (Cmd) in a command transmitted the SPA will respond as follows:

Response	SOH	Adr	Error	EOT	CRC
	01h	20h	66h	04h	40h

Error = „f" (66h) = format error

5.3. Display error indication

Error warnings are visualized by a flashing upper display line, indicating alternately both error signal and current value (usually target).

Titel:
N142-Er_A.eps
Erstellt von:
FreeHand 9.0

MAX limit of SPA hurt by manual positioning operation (utilizing key)

Troubleshooting: Set SPA to the admissible positioning range.

Titel:
N142-Er_1.eps
Erstellt von:
FreeHand 9.0

MIN limit of SPA hurt by manual positioning operation (utilizing key)

Troubleshooting: Set SPA to the admissible positioning range.

Titel:
N142-Er_2.eps
Erstellt von:
FreeHand 9.0

SPA is giving a motor start signal but SPA hollow shaft does not rotate.

Troubleshooting: Check motor, cable and mechanical connections from motor to shaft to SPA.

Titel:
N142-Er_3.eps
Erstellt von:
FreeHand 9.0

Motor failure at SPA.
(Failure is indicated for approx. 5 seconds if motor start is released by interface or pushbutton)

Troubleshooting: Take corrective actions.

Titel:
N142-Er_4.eps
Erstellt von:
FreeHand 9.0

SPA did not reach the target window.

Troubleshooting: Extend the tolerance window. Set switchover to precision speed at an earlier point.

Titel:
N142-Er_5.eps
Erstellt von:
FreeHand 9.0

Direction error. Shaft positioning is in the wrong direction.

Troubleshooting: Verify SPA parameterization (for example motor direction of rotation, or motor cable connection)

```
Titel:
N142-Er_6.eps
Erstellt von:
FreeHand 9.0
```
Target transmitted respectively DIM parameter is above the MAX limit.
Note: Take loops into consideration.

Troubleshooting: Transmit new admissible position value.

```
Titel:
N142-Er_8.eps
Erstellt von:
FreeHand 9.0
```
Target transmitted respectively DIM parameter is below the MIN limit.
Note: Take loops into consideration.

Troubleshooting: Transmit new admissible position value.

6. Overview on commands

The following chart shows in alphabetical order all available commands (Cmd) as well as options regarding read and write (parameterization).

Command code	Data amount in bytes	read	write	Broadcast	Saved in EEPROM	Significance
a (61h)	5	X	X	-	X	Read / write general parameters
b (62h)	8	X	X	-	X	Parameter: Tolerance compensation, window
c (63h)	8	X	X	-	X	Parameter: Scaling factor spindle pitch
g (67h)	12	X	X	-	X	Parameter: Limits MIN, MAX
h (68h)	12	X	X	-	X	Parameter: Switching points motor speed
i (69h)	1	X	X	X	X	Parameter: mm / inch
j (69h)	3	X	X	X	X	Parameter: Timeout interval bus error
k (6Bh)	9	X	X	-	X	Parameter: Motor system cycles
l (6Ch)	5	X	X	-	X	Parameter: Jog step
m (6Dh)	5	X	X	-	X	Read/write general parameters
t (74h)	6	-	X	-	-	Transmit tool number
u (75h)	6	-	X	-	-	Transmit optional column of figres
x (78h)	5	X	X	-	X	Read / write specific parameters
A (41h)	2	X	X	X	X	Assign or display device identifier
B (42h)	2	-	-	-	-	SPA response in addressing mode
C (43h)	3	X	-	-	-	Check if current value = target
D (44h)	1	X	X	X	-	Motor start enable
F (46h)	4	X	-	-	-	Readout device status and error
K (4Bh)	-	-	X	X	X	Specific command: Profile reset (clear)
Q (51h)	1	-	X	X	X	Specific command: SPA reset
R (52h)	6	X	-	-	-	Read current value
S (53h)	8	X	X	-	X	Read / write target
U (55h)	6	X	X	-	-	Offset
V (56h)	2	X	X	X	X	Read / write profile number
X (58h)	4	X	-	-	-	Specific command: read device data
Z (5Ah)	6	X	X	X	X	Set preset

7. Technical data

Technical data – electrical ratings

Supply voltage	24 VDC ±10 %
Power consumption	<40 mA
Display	LCD, 7segment, 2 lines, backlit
Sensing principle	Absolute multiturn sensing
Sensing range	-99.99...+999.99 mm
	-9.999...+99.999 inch
Number of steps/revolution	1440
Number of revolutions	4096 / 12 Bit
Spindle pitch	≤14 mm
Interface	RS485 (ASCII-protocol)
Data saving	Parameter buffer: EEPROM
	Actual value buffer: >10 years by integrated 3 V Lithium battery
Programmable	Display position horizontal/vertical
parameters	Measuring unit mm/inch
	Spindle pitch
	Counting direction
	Spindle tolerances
	Positioning direction
	Directional arrows
	Tolerance window
	Rounding function
Motive positioning	Two softkeys with jog operation for format alignment
	Direct motor connection of N 152 by motor cable
Standard DIN EN 61010-1	Protection class II
	Overvoltage category II
	Pollution degree 2
Interference emission	DIN EN 61000-6-3
Interference immunity	DIN EN 61000-6-2
Approvals	UL/cUL

Technical data – mechanical design

Hollow shaft	ø14 mm
Operating speed	≤600 rpm (short-term)
Protection DIN EN 60529	IP 65
Operating temperature	-10...+50 °C
Storage temperature	-20...+70 °C
Relative humidity	80 % not condensing
Torque support	Torque pin provided at housing
E-connection	- cable output (15 cm) with 4-pin M8 connector
	- motor cable with female 12-pin M16 connector
User surface / keypad	Keypad with two softkeys
Housing	With hollow shaft for direct shaft mount
Dimensions W x H x L	37 x 75 x 45 mm
Mounting	Hollow-shaft mount
Weight approx.	120 g
Material	Polyamide black, UL 94V-0

7.1. Dimensions

Titel:
N152-MZ-X-01_EN.eps
Erstellt von:
Adobe Illustrator(R) 12
Vorschau:
Diese EPS-Grafik wurde nicht gespeichert
mit einer enthaltenen Vorschau.
Kommentar:
Diese EPS-Grafik wird an einen
PostScript-Drucker gedruckt, aber nicht
an andere Druckertypen.

8. Part number

	Reference	Interface
	1	RS485
		E-connection
	1	Connector output M8, motor cable 0.5 m
	2	Cable output M8, motor cable 1.5 m
		Supply voltage
	3	24 VDC
		Display
	A	At slope
	B	At face
		Hollow shaft
	A	ø14 mm

N 152.1 ☐ **3** ☐ **A01**