



DKC21.3 for Roll Feeds with ELC and BTV04

Application

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1 Introduction

This document describes the standard program for roll feed applications selected using the F functions.

This makes a quick and secure integration of a Rexroth Indramat system for a functioning roll feed possible (Turnkey solution).

For applications with expanded functions, all services are available via the Service menu of the single-axis control ELC for free programming. (See documentation on single-axis control ELC **DOK-ECODR3-FLP-01VRS**
FK01-DE-P** MN 287131 or **DOK-ECODR3-FLP-01VRS**
FK01-DE-P** MN 287131).

The customer thus has at his disposal all options for a quick and flexible application of the Rexroth-Indramat solution.

2 Standard Roll Feed

2.1 The Tasks of a Roll Feed

It is the task of a roll feed to transport material (sheet-metal, wiring and so on) under a press, cutter or stamper. The material may only be transported if the stamping or cutting tool is open. The synchronisation between feed and press is controlled with an external signal (feed area) which signals the position of the press.

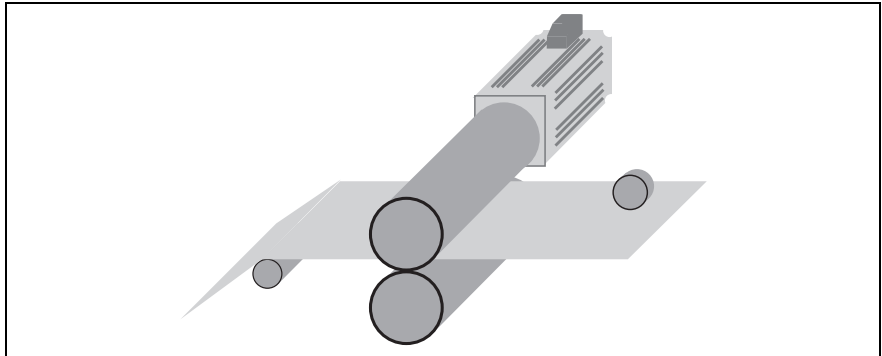


Fig. 2-1: Roll Feed

2.2 The Hardware Needed

The Indramat system for a standard roll feed with ELC control is made up of the following hardware components:

Drive controller DKC21.3
 Servo motor MKD o MHD
 BTV04 operator terminal

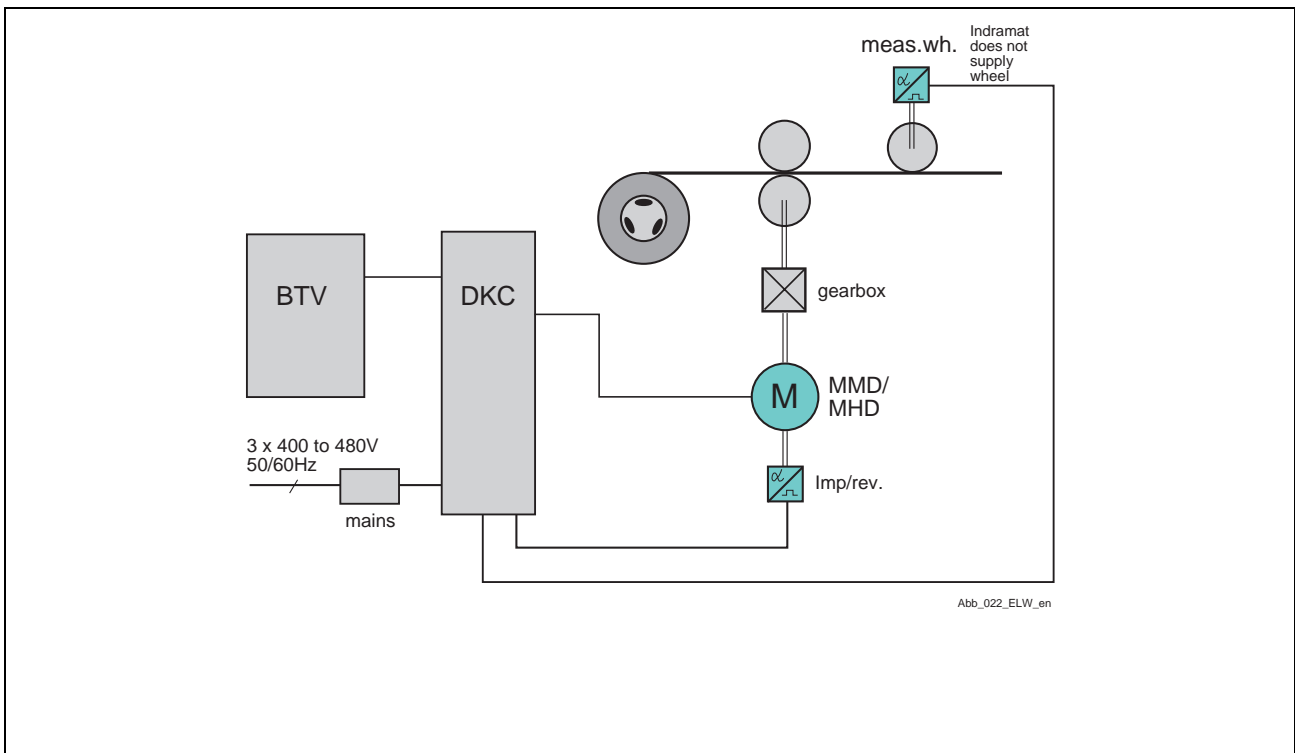


Fig. 2-2: Block diagram

2.3 Program Structure in the Control

Feed before the Press (Program example)

The program sequence of a standard roll feed in the ELC control. The feed takes place before the press hub (feed guides) and the press is operated in a single hub.

```

ELC program
Block number
0000 JMP 0005      unconditional jump to block number 0005
0001 NOP
0002 NOP          space
0003 NOP
0004 NOP
0005 APE 0 0000000000    outputs (press) switched off
0006 AKN 02 1 0009      query whether cycle stop applied
0007 JMP 0009          unconditional jump to block number 0009
0008 NOP
0009 AKN 01 1          query if press on top
0010 PSI 1 | +147,000 | 55,9 ; feed length and speed
0011 JMP 0015          unconditional jump to block number 0015
0012 NOP
0013 NOP
0014 NOP
0015 APE 0 0100000000    outputs (press) switched on
0016 AKN 01 0          query if press below
0017 JMP 0020 ;        unconditional jump to block number 0020
0018 NOP
0019 NOP
0020 BAC 0005 +0000 00010 item counter
0021 APE 0 0000000000    outputs (press) switched off
0022 NOP
0023 NOP
0024 NOP
0025 JST 0000          block jump with stop

```

Press before feed (Program example)

Program sequence for a standard roll feed in the ELC control. The press hub is ahead of the feed (press guides) and the press is operated in a single hub.

```

ELC program
block number
0000 JMP 0004      unconditional jump to block number 0004
0001 NOP
0002 NOP          empty
0003 NOP
0004 AKN 02 1      query if cycle stop applied
0005 APE 0 0100000000    outputs (press) switched on
0006 AKN 01 0      query if press below
0007 JMP 0015          unconditional jump to block number 0015
0008 NOP
0009 AKN 01 1      query if press above
0010 PSI 1 | +147,000 | 55,9, feed length and speed
0011 JMP 0020          unconditional jump to block number 0020
0012 NOP
0013 NOP
0014 NOP

```



```
0015 APE 0 0000000000          outputs (press) switched off
0016 JMP 0009          unconditional jump to block number 0009
0017 NOP
0018 NOP
0019 NOP
0020 BAC 0004 +0000 00010          item counter
0021 APE 0 0000000000          outputs (press) switched off
0022 NOP
0023 NOP
0024 NOP
0025 JST 0000          block jump with stop
```

Application-related program changes can be inserted into the empty lines.

Note: The commands APE, PSI and BAC must be set in the block numbers indicated in the program example as otherwise the BTV program will not function.

In the programming examples above, Output 1 (X210/Pin 21) is used to start the press. The feed range is transmitted via Input 1 (X210/Pin 7). The program cycle is interrupted via Input 2 (X210/Pin 8). Using the cycle interrupt, the program flow can be stopped at the current location, even if the programmed piece count has not yet been reached. As soon as this "on" signal (X210/Pin 8) goes back to zero, the program continues (without a start command) from the same place it was stopped.

2.4 Programming with the BTV04

Note: The DKC programming module must be set to drive address 05.

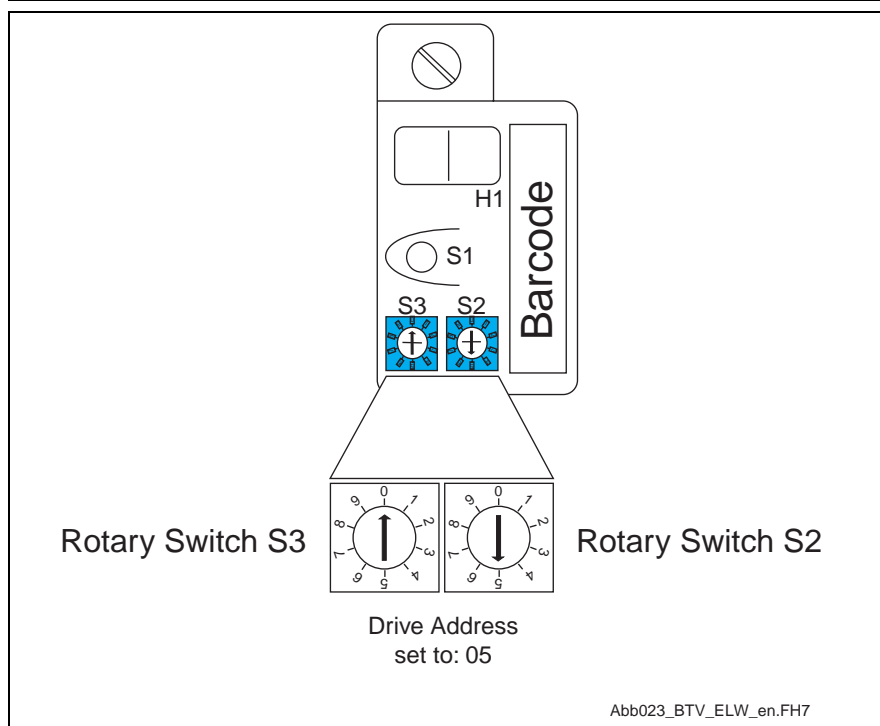


Fig. 2-3: Setting the Drive Address

Selection Menu

After the BTV 04 has been switched on, the following appears on the display.

Roll Feed	
F1 = length and speed	▲
F2 = item number	
F3 = tool selection	
F4 = drive information	
F5 = I/Os	▼
F6 = operating mode	
Help = diagnoses	
Shift + Help = service	

Fig. 2-3: Selection menu

Since only six lines can be simultaneously displayed, the three lower sections of the text can only be reached by scrolling with ▲▼ keys.

The relevant submenu can be called up by pressing the specified F-key or scrolling with the arrows and then pressing the „OK key“. The return from one menu back to the previous one is possible with the „ESC key“. With the „Main menu“ key the user returns immediately to the selection menu. All keys that have a function in a menu are illuminated.

Programming Feed Data (F1)

If the function „lengths and speed input“ is pre-selected, then the following picture appears:

momentary length	
+ XXXXX.XXX mm	▼
velocity	
XX % of V_{max}	▲
$V_{max} = XX$ m/min	

Fig. 2-4: Feed data

Feed length and speeds can be programmed in the dark fields. Using the ▲▼ keys, it is possible to move between the fields. Each input must be confirmed with “OK”. The maximum possible speed of the machine is displayed in the lower line.

Number of pieces input (F2)

To input the number of pieces, the following appears with actual and setpoint number. The setpoint number can be changed in the dark field. This input must be confirmed with the „OK“ key.

Number of pieces	
Actual	Setpoint
XXXXXX	XXXXXX
Input	XXXXXX

Fig. 2-5: Feed data

Programmable outputs (Tool selection) (F3)

Four outputs can be set in this menu with which the press, scissors or other tools can be controlled. The status of the outputs can be changed once prior to the feed and once after the feed.

The following appears for this setting

Tool before feed	
0001	▼
tool no. 12345678	
0112	▲
tool after feed	

Fig. 2-6: Feed data

The status of the eight outputs can be altered in the darkened field.

0 means the output is switched off
1 means the output is switched on
2 means the output remains unchanged

The place to be changed can be reached with the ◀▶ key. The input must be confirmed with the „OK“ key.

Drive Information (F4)

This menu can display information from the motor encoder or measuring wheel encoder. The length and speed of the relevant encoder are specified. The clear key that is now illuminated can re-set the length back to „000000,00“.

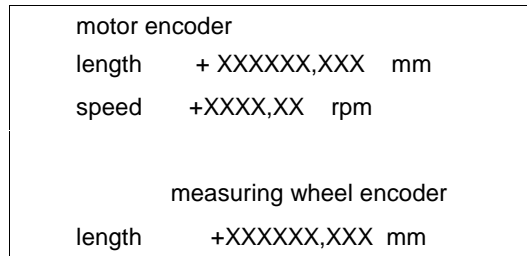


Fig. 2-7: Drive information

Note: The data referencing the measuring wheel are only displayed is the measuring wheel mode is set in the ELC parameter A100.

System I/Os

(F5 by Firmware ELC)

The I/O menu can be used to check the current state of the system inputs and outputs. System inputs support the ELC control and are permanently assigned. The customer cannot use these for any other purpose. The following inputs are assigned to the system inputs:

Parameter, manual/automatic, start, stop, jog forward, jog backward.

The customer cannot program system outputs that are status messages. The following outputs are system outputs: manual, automatic, interference and run.

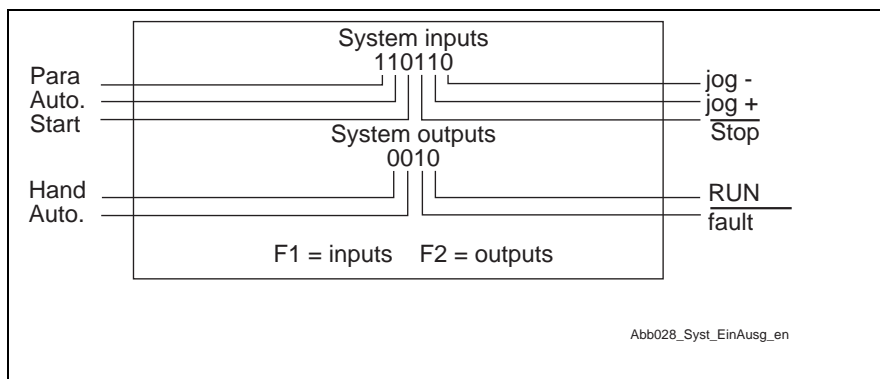


Fig. 2-8: System I/Os

A „1“ shows that the relevant input is active and the „0“ displays inactive. This menu can also be used to display the freely-programmable I/Os.

Free Use Inputs

The following appears if this menu is called up:

free-use inputs		
110110 1101		1-10

Fig. 2-9: System I/Os

The switched on inputs are displayed as „1“ and the switched off ones with „0“.

Outputs and markers

The outputs can be switched by the customer in the user program and support the control of the external components. Markers can also be set in the user program but do not lead outward. They can only be queried internally in the program.

If this menu is called up, then the following appears:

outputs / marker 1-32		
000111 110110 1101		1-16
000111 110110 1101		17-32
F1= marker 33-64		

Fig. 2-10: Outputs and markers

The switched on outputs are displayed with „1“, those off with „0“.

Since not all 99 outputs or markers can be displayed at the same time, they are distributed over three pictures. To move on, use the F1 key.

Markers 33 to 64

The following is visible in this menu:

Marker 33-64	
000111 110110 1101	33-48
000111 110110 1101	49-64
F1= Marker 33-64	

Fig. 2-11: Marker 33-64

The switched on markers are displayed with „1“ and those off with „0“. Further markers can be displayed by actuating the F1 key.

Markers 65 to 99

The following appears in this menu:

Marker 65-99	
000111 110110 1101	65-80
000111 110110 1101	81-96
010	97-99

Fig. 2-12: Marker 65-99

The switched on markers appear with a „1“, and those off with „0“. The „ESC“ key brings the user back to the previous menu.

Stroke Count/Load (only for FLP Firmware)

If the F5 key is pressed while using the FLP firmware, information about the press stroke count and the required feed time as a percentage of the feed distance is displayed. Activating the parameter for Feed Monitoring (A116) is required for this to function.

Stroke Count	
XXXX	Strokes/min
Load	
XX	in %

Fig. 2-13: Stroke Count/Load

Operating mode (F6)

If the F6 is pressed in the main menu, then an operating mode is pre-selected and the currently valid mode displayed. The contrast can also be changed here. The following display appears.

<p>F1 = operating mode selection F2 = current operating mode F3 = contrast setting</p>
--

F1 Operating mode selection (Password Protection Level 1 possible)

If F1 has been actuated, then it is possible to select an operating mode in single steps in set-up mode and automatic mode. If one of the following menus is selected, then complete programs are transmitted into the ELC. The following appears:

Operating mode selection

<p>F1 = single step in set-up mode F2 = automatic mode</p>
--

If F1 single step in set-up mode is selected, then the following appears:

Operating mode selection

<p>F1 = feed before press (VvP) F2 =press before feed (PvV)</p>
--

The F1 and F2 keys can be now used to select an operating mode and to transmit the relevant program into the ELC. The message that the selected operating mode has been transmitted comes after about five seconds.

In single step set-up mode a new start signal must come after every step. If „operating mode select“ F2 for automatic mode has been selected, then the following appears:

Operating mode selection
F1 = feed leads / single
F2 = feed leads / continuous
F3 = press leads / single
F4 = press leads / continuous

Using keys F1 to F4 it is now possible to select various operating mode combinations (feed leads, press leads, press single hub and press continuous run). After actuating the relevant key, the required program is transmitted into the ELC and a message that states that the transmission is completed comes after about five seconds.

Note: For the transmitted programs to work in set-up and automatic modes and for the operating mode display to be correct on the BTV, task3 of the ELC in block number 0035 must be released.

Parameter AA00 = XXXX 0035 X

F2 Current operating mode

If „Operating mode“ has been selected with F2, then the currently programmed operating mode selected appears, as is shown below:

Current operating mode
automatic mode
press single hub
feed leads

Note: To correctly display the operating mode, markers 40 to 46 are processed in task3. The commands for this are automatically sent with the operating mode.

F3 Contrast Settings

If the contrast setting was selected in menu „Operating mode“ with F3, then the following appears:

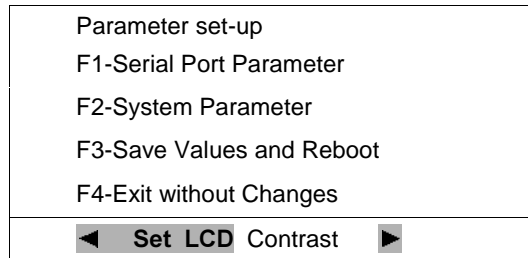


Fig. 2-13: Contrast setting

Using the arrows ▶ ◀ the display can be adjusted to the actual light conditions. If this setting is to be stored, then it is necessary to leave this menu using the F3 key. If this menu is left using the F4 key, then the contrast is not stored. The previous contrast setting is retained. All other parameters that can be selected in this menu can be protected in the BTV system parameters by inputting a password.

Diagnoses

To receive information about the drive, then it is possible to branch off into the diagnoses menu with „HELP“.

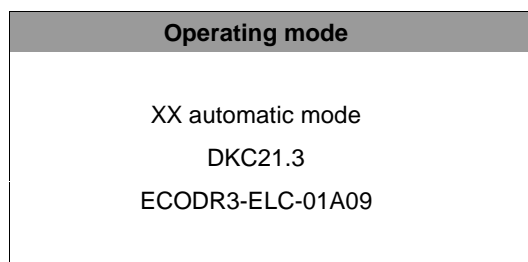


Fig. 2-14: Operating mode

The present operating mode with status number is displayed in this menu. The connected DKC type with the firmware version also appears. Both status messages and warnings are also displayed here.

In the event of a fault, not warnings, the diagnostics menu is automatically switched into and the following picture appears.

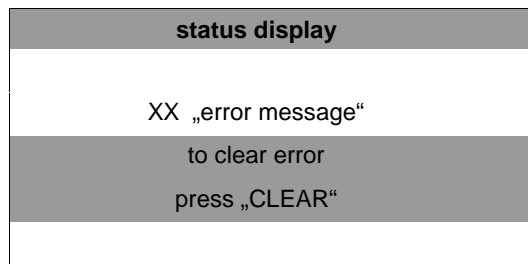


Fig. 2-15: Status display

The presently pending error is displayed in clear text along with the error code number. The "Clear key" is also illuminated.

It is not possible to leave this menu until the error has been cleared and acknowledged via the „Clear key“.

Exception: service menu call up via the key combination „SHIFT“ and „HELP“.

Service Menu

The service menu permits complete programming and parametrization of the ELC control. This menu can be protected in the BTV by allocating a password to it.

This menu is called up with key combination „SHIFT“ and „HELP“ in the main menu. This is followed by the request to input the password if this is activated in the BTV's system parameters.

Language

The BTV automatically goes to the language set in the ELC parameter B000.

B000	00 = German	
	01 = English	
	02 = French	(in preparation)
	03 = Spanish	(in preparation)
	04 = Italian	(in preparation)
	05 = Dutch	(in preparation)

Serial System Control

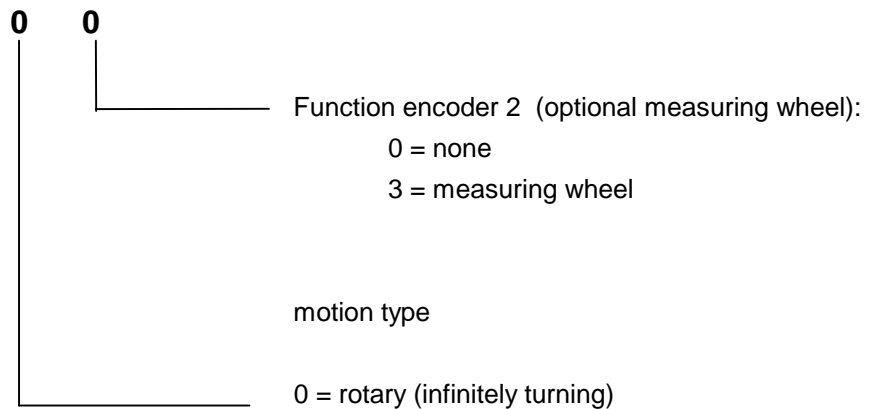
If serial system control is activated in Parameters B009 and B010, the drives can be jogged using the 'jog keys' (Jog+/Jog-) on the BTV. The operating mode can be selected by using the 'Auto' key. The automatic program can then be controlled using the 'Start' and 'Stop' keys. Then, the hardware inputs (system inputs) via the DIO card are no longer necessary.

B009 1 200 / B010 1

2.5 Parameter ELC

The most important parameters for a roll feed are listed below. These must be adapted to the situation and conditions in and at the facility. The precise definition of the parameters and the complete parameter descriptions are listed in the ELC documentation.

A100 Applications



A101 Feed Constant

0100.0000
feed constant in EGE

Input min : 0.1000
Input max: 5000.0000

The length resulting from one motor revolution to be run is entered here if the encoder ratio is not to be given especial consideration (parameter A102 = 0001 0001).

If the gear ratio is entered in parameter A102, then the feed constant is the circumference of the draw-off roll.

A102 Gearbox

1000 2000
load gear output revolutions
load gear input revolutions

Input min : 1
Input max: 9999

gear ratio between motor and draw-off roll

A106 Maximum Speed

123456.789

Material speed in EGE/sec

Input min : 0.010

Input max: depends on drive and amplifier power
200000.000

$A106_{\max} = \frac{\text{maximum speed (CM03)} \times \text{VK(A101)}}{60 \times i}$

A107 Set-up Speed

123456.789

set-up speed in EGE/sec
travel speed in jog mode

Input min : 0.001

Input max: depends on drive and amplifier power
200000.000

A108 Bipolar Acceleration

12345678

acceleration in EGE/sec²

Input min : 1

Input max: 99999999

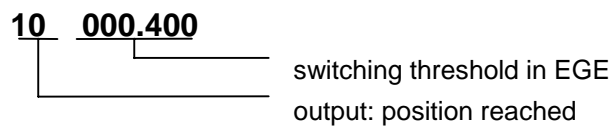
The maximum possible bipolar acceleration describes the maximum allowed acceleration symmetric for both directions (accel and decel).

Limitations for this can be set in parameter A109 or via command ACC and DEC.

A jerk limit can also be activated in parameter A110.

(See function description: ELC).

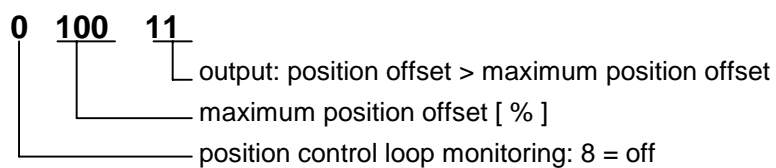
A111 Switching Threshold, Positioning Window



Input min : 0.001
Input max: 9999.999

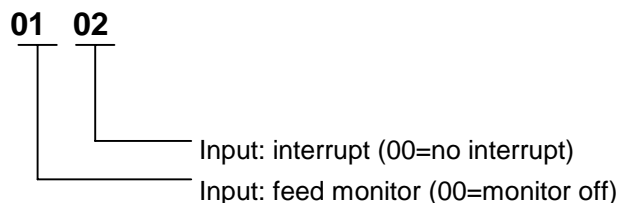
The output is set when the residual path of the feed length is smaller than the value programmed here.

A115 Monitoring



The position control loop is constantly monitored. The maximum tolerable offset can be input in this parameter as a per cent value. If the allowed offset is exceeded, then an error message is generated. If the monitor is, however, deactivated and the allowed offset exceeded, then no error message is issued, but the programmed output is switched off.

A116 Feed Monitoring



Feed monitor (press in OT):

If the input signal programmed here fails, then feed motion is not possible. Any running feed is terminated and a fault message generated.

Interruption:

If the input signal programmed here fails, then a feed in progress is interrupted. If the input is re-set, then the residual feed is completed without the need of a new start signal.

A117 Monitoring encoder difference (measuring wheel mode only)

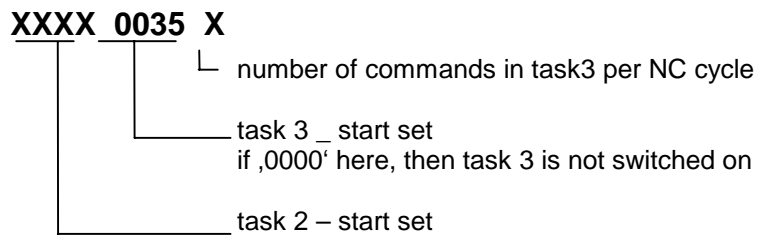
123



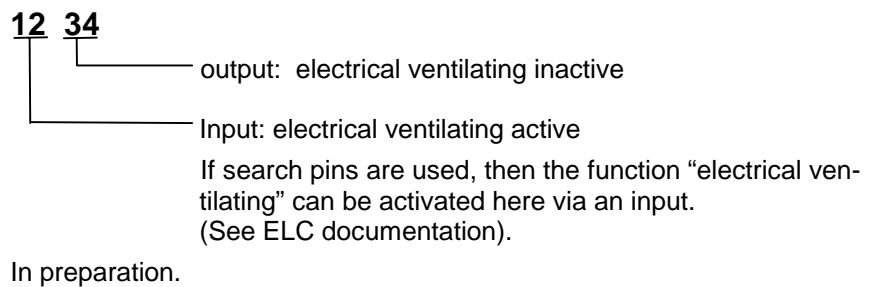
Monitoring window in ‰ in terms of C007
000 = no monitoring

The maximum allowed offset (slip) between motor encoder and measuring wheel encoder is entered here as a per cent value.

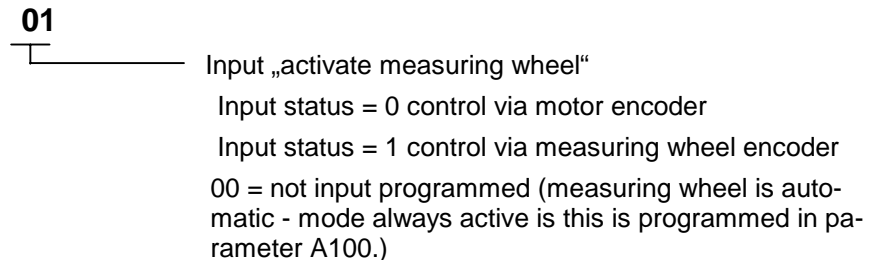
AA00 Tasks 2 & 3



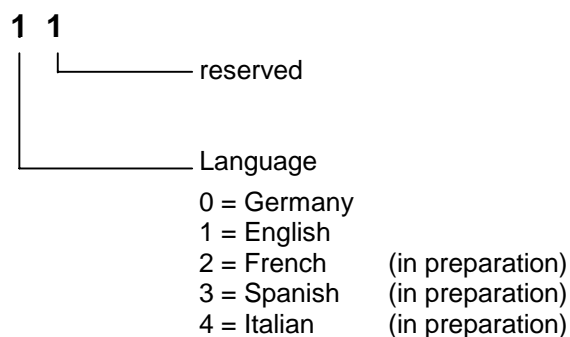
AA05 Electrical Ventilating



AA07 Measuring wheel mode

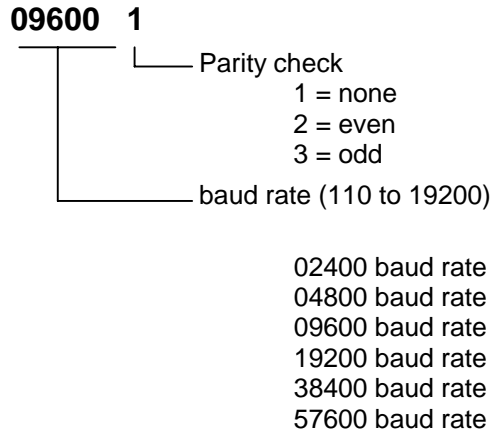


B000 Display

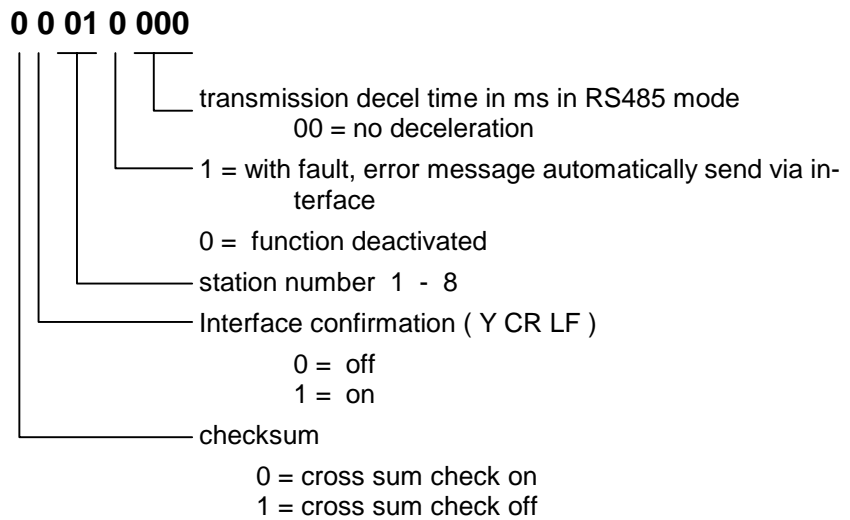


2.6 Interface Parameter

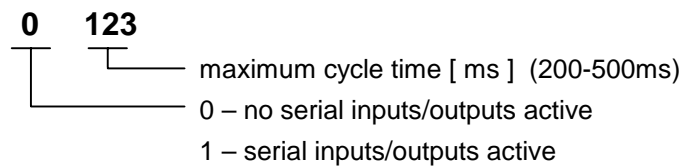
B001 Interface Parameter



B002 Interface Parameter



B009 Serial Inputs and Outputs



Via the serial interface, inputs X4 and outputs X5 can be read and written using the BTV04. The transmission rate is determined by the type of transmission and the baud rate. The cyclic transmission is monitored by the control. If no new telegram is received within the maximum cycle time, the control generates the following warning or error:

- E-0105 No serial real-time communication
- F-0317 Serial real-time communication error

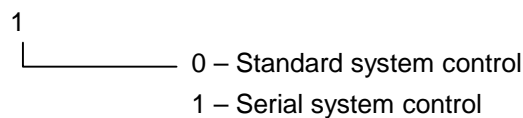
The following can be transmitted:

11 inputs, I1.03.0 to I1.04.1

12 outputs Q1.03.0 to Q1.04.2

When the inputs/outputs are activated, the keys can be read.

B010 System Control



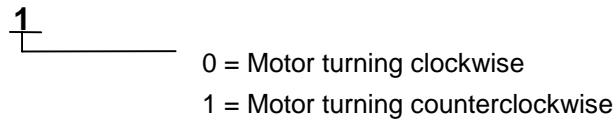
System control can also take place via the serial interface. Then, cyclic transmission of the system inputs and outputs via the serial interface is monitored. If no new telegram is received within the maximum cycle time, the following warning or error is generated:

- E-0104 No system control possible
- F-0316 System control error

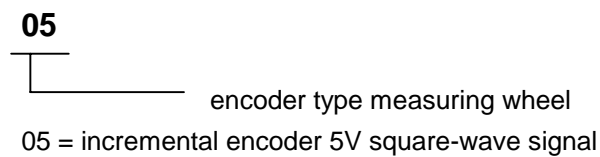
The warning E-0104 is generated when system control takes place via the serial interface and the control is in 'Parameter' mode. The error F-0316 is generated when system control takes place via the serial interface and the control is in 'Manual' or 'Automatic' mode.

2.7 Drive Parameter

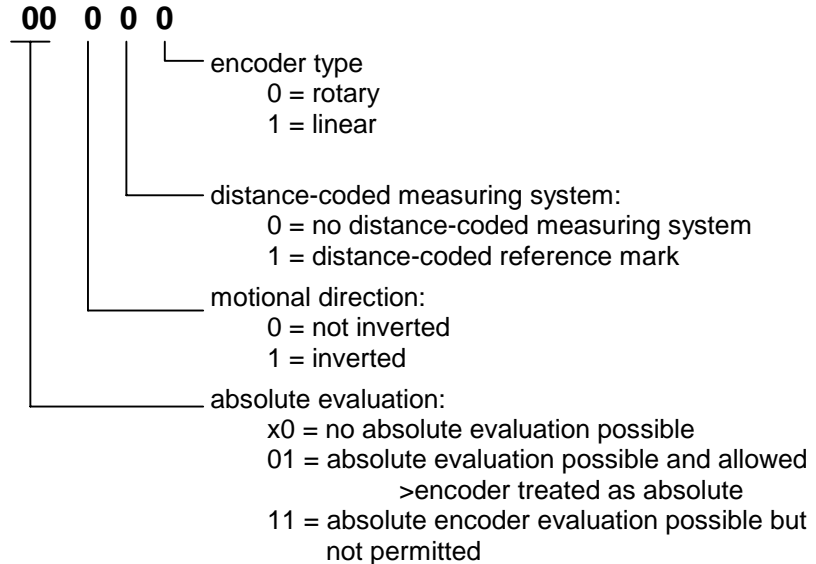
C000 Working Polarity



C004 Interface encoder 2 (measuring wheel mode only)



C005 Position encoder type 2 (measuring wheel mode only)



C006 Resolution 2 (measuring wheel mode only)**00005000**

divisional lines / revolutions (rotary encoder)
lines / mm (linear encoder)

C007 Feed constant 2 (measuring wheel mode only)**1234.5678**

feed constant in EGE

Extent of measuring wheel.

CR07 Kv Factor**02.00**

Kv factor

Input min: 00.01

Input max: 30.00

2.8 Parameter List ELC

Software : _____ Com. no. : _____
 Date : _____ Customer/End user _____
 Clerk : _____ Serial no. : _____

Designation	Parameter	Data
Application	A100	
Feed constant	A101	
Gearbox	A102	
Travel range limit switch negative	A103	
Travel range limit switch positive	A104	
Modulo value	A105	
Maximum velocity	A106	
Set-up speed	A107	
Acceleration bipolar	A108	
Accel / decel	A109	
Bipolar jerk limit constant	A110	
Switching threshold, positioning window	A111	
reserved	A112	
Positioning window	A113	
Pre-signal	A114	
Monitoring	A115	
Feed monitoring	A116	
Monitor encoder difference	A117	
Absolute encoder monitoring window	A118	

Task 2 & 3	AA00	
Hand vector	AA01	
Interrupt vector	AA02	
Re-start	AA03	
Override	AA04	
Electrical ventilation	AA05	
Motor brake	AA06	
Measuring wheel mode	AA07	

Display	B000	
Interface parameter	B001	
Interface parameter	B002	
analogue-output 1, select signal	B003	
analogue-output 1, expanded signal select	B004	
analogue-output 1, evaluation [1/10V]	B005	
analogue-output 2, signal select	B006	
analogue-output 2, expanded signal select	B007	
analogue-output 2, evaluation [1/10V]	B008	

working polarity	C000	
Interface encoder 1	C001	
type of position encoder 1	C002	
resolution position encoder 1 (Motor)	C003	
Interface encoder 2	C004	
type of position encoder 2	C005	
resolution 2	C006	
feed constant 2	C007	
reserved	C008	
Homing a	C009	
Homing b	C010	
reference dimension	C011	
reference switch offset	C012	
distance-coded reference dimension	C013	
encoder emulation type	C014	
encoder emulation resolution	C015	
reference pulse offset	C016	

current controller P-gain 1	CR00	
current controller offset 1	CR01	
velocity controller P-gain	CR02	
velocity controller offset time	CR03	
velocity controller smoothing time constant	CR04	
lock frequency velocity controller	CR05	
bandwidth lock filter velocity controller	CR06	
Kv factor	CR07	
amplifier accel pre-control	CR08	
switching frequency	CR09	

Motor type	CM00	
peak current of motor	CM01	
standstill current of motor	CM02	
maximum speed of motor	CM03	
pole pair number / pole pair width	CM04	
torque/force constant	CM05	
rotor moment of inertia	CM06	
holding brake type	CM07	
holding brake current	CM08	

magnetisation current	CA00	
pre-magnetisation factor	CA01	
slip factor	CA02	
slip ramp	CA03	
pull-out current	CA04	
field controller P-gain	CA05	
field controller offset time	CA06	
motor idle voltage	CA07	
motor maximum voltage	CA08	

3 Terminal diagrams

3.1 BTV-DKC Interface and Power Connections

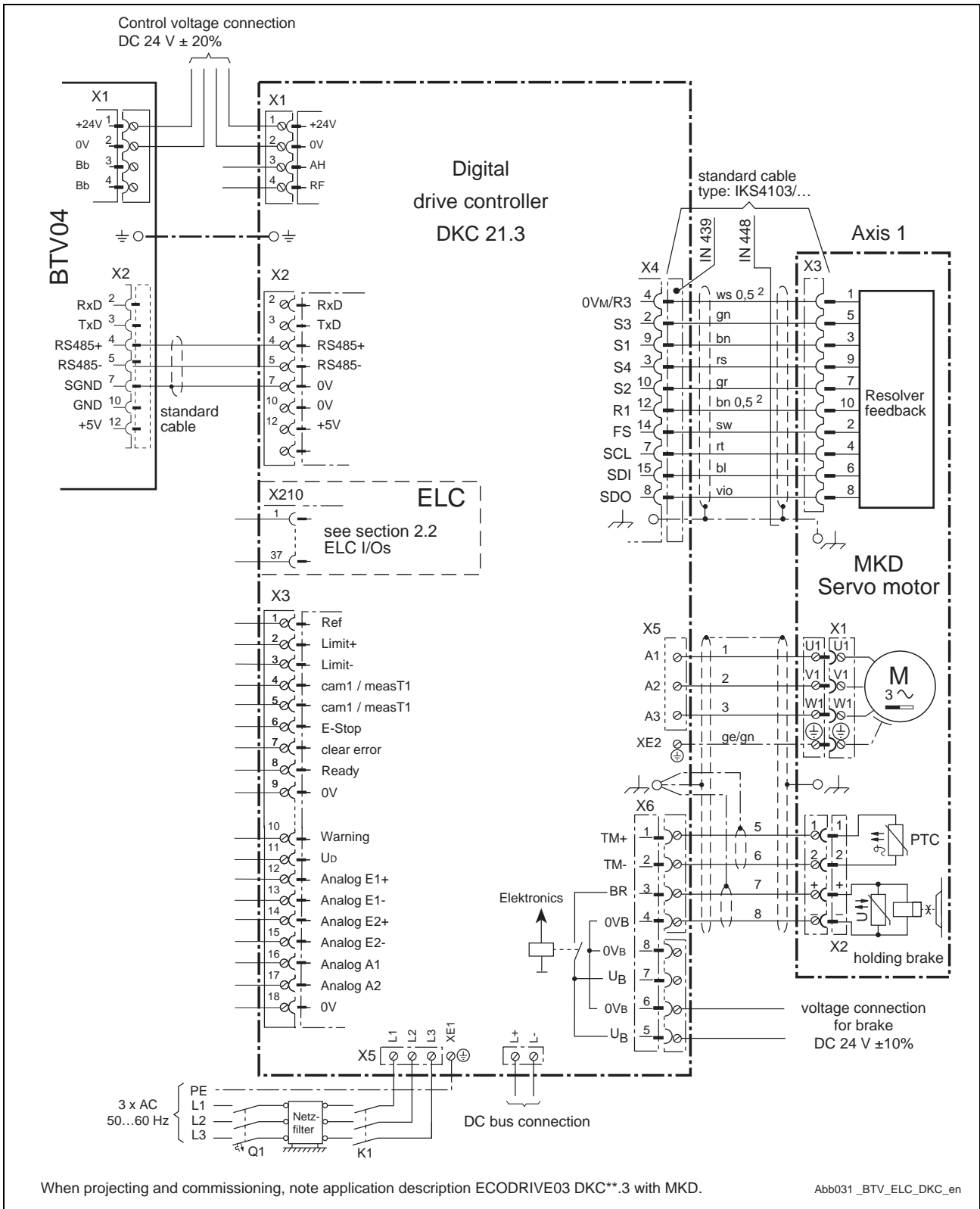


Fig. 3-1: Terminal diagram

3.2 ELC I/Os

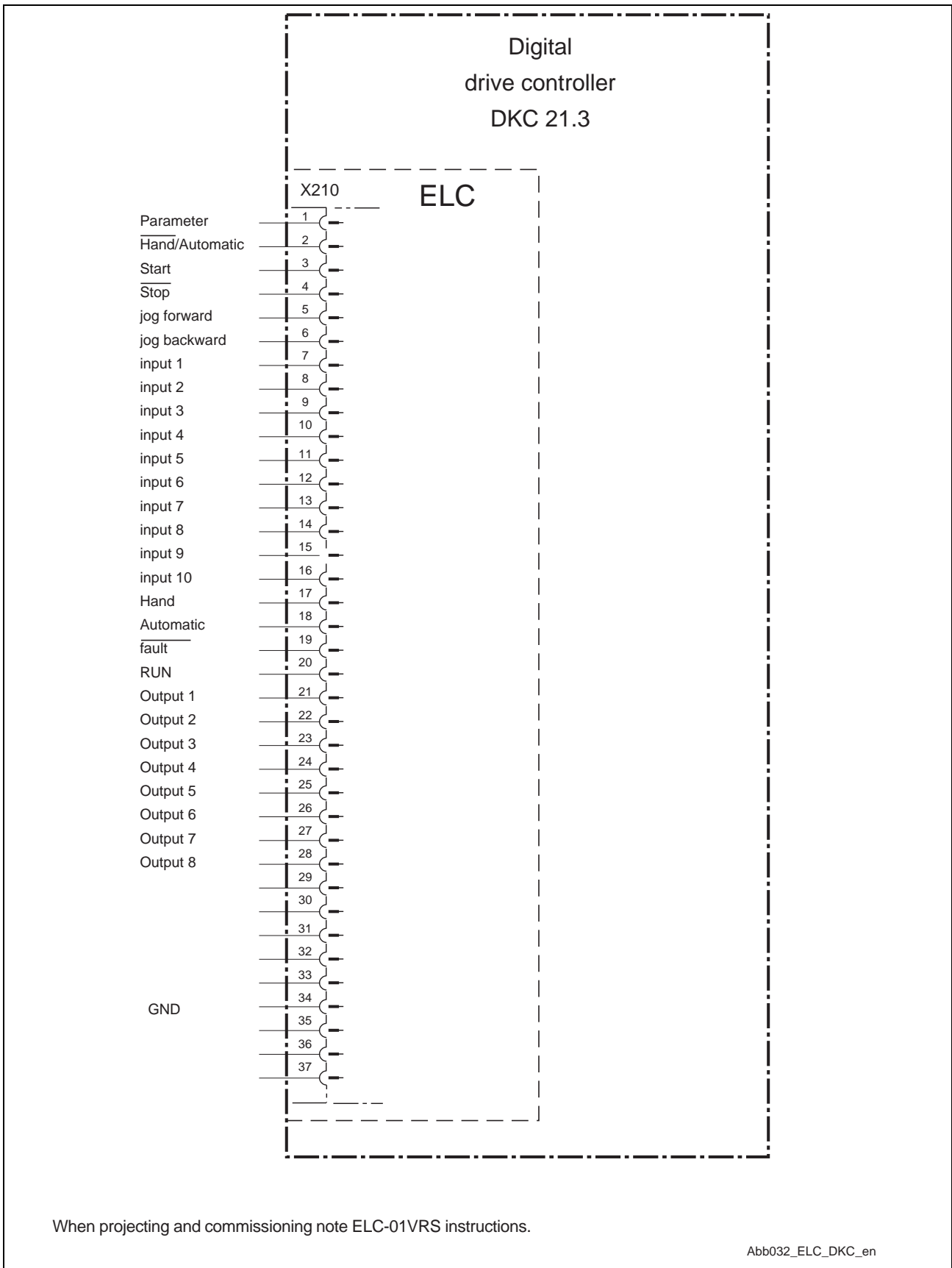


Fig. 3-2: ELC I/Os

3.3 Accessories and Firmware

BTV04 with Firmware and software

Product	mat. no.	Note
BTV04.2GN-FW	282182	
FWA-BTV04*-ELW-01VRS	287128	
**SWA-BTV04*-SCM-02VRS **SWA-BTV04*-ELW-01VRS-MS **FWC-BTV04*-DOL-01VRS-MS		** is in FWA-BTV04-ELW-01VRS.

Drive controller

Product	mat. no.	Note
DKC21.3-xxx-7-FW	1)	1) Select per power data
FWA-ECODR3-ELC-01VRS-MS	285683	

Drive controller data and further components

Product	Power/unit	Note
DKC21.3-040-7-FW DKC21.3-100-7-FW DKC21.3-200-7-FW	0.15 KW 0.50 KW 1.00 KW	Bleeder continuous power DKC, also see 3)
DKC21.3-040-7-FW DKC21.3-100-7-FW DKC21.3-200-7-FW	0.27 mF 0.675 mF 1.5 mF	nominal DC bus capacity of DKC, also see 3)
auxiliary bleeder auxiliary capacitor	3) technical data	3) DC bus capacity and auxiliary bleeder for DKC described in document ECODRIVE03 drive controller, project planning, MN 280107

Motor

Product	mat. no.	Note
MKD	1)	1) select as per power data
MHD	1)	

Standard connecting cable

Product	mat. no.	Note
IKB0017	282872	BTV-DKC interface RS485
		2) material number depends on cable length
IKS4103	2)	DKC-MKD motor encoder cable
IKS4019	2)	For 2 nd encoder motor measuring wheel (option with measuring wheel encoder increments of 5V square)
IKG	1)	Motor power cable type dependent on motor



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