Kuhnke Electronics

Instruction manual
Posi Control
KUAX 671

E 796 GB 12.06.1992

KUHNKE

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1. General

The KUAX 671, the electronic cam control unit, is intended not only to replace mechanical program controls, but also to execute their functions more precisely, to expand their range of applications and to reduce susceptibility to wear and tear. It gives the operator the possibility of flexible manufacturing with of the shortest possible set-up times. Utilizing modern electronic concepts has simplified operation and programming.

The KUAX 671 can be used wherever control functions are to be executed in accordance with the position of a shaft. To enhance versatility we have separated the cam controller itself from the programming and display unit (the hand terminal). It may thus be installed independently at any convenient location in the switching cabinet.

The hand terminal can, of course, be connected to the cam controller at any time via the interface; this facilitates checking or changing programs right at the machine.

Programming the KUAX 671 is as simple as could be, using the hand terminal. But a personal computer (IBM PC with MS-DOS and compatible computers) may also be used. This makes it possible to store the programs on floppy disks.The cam programs can also be printed as an instruction list or diagram.

Copying programs within the cam controller is possible; and you can also copy from one cam controller to another.

The hard terminal is also designed for front panel mounting; this gives you continuous access to the cam controller.

As encoder systems, wear-free absolute angle encoders are employed with a resolution of 180, 360 and 1000 divisions per revolution.

2. Explanations of the function of the KUAX 671

2.1 The principle

To make it easy to understand operation and programming we have followed the basic principles utillized in a mechanical cam controller in developing the electronic cam controller.

A mechanical cam controller opens and closes contacts as the high sectors of a circular wheel pass by the contacts. This raised profile along the wheel is known as a "cam".

Each wheel represents an "output". The number of wheels mounted in parallel is equal to the number of outputs.

This principle has been adopted in designing the KUAX 671 electronic cam controller. Programming a particular cam thus consists of entering the positions at which the cam is to close or open the contacts. The output is "on" (contacts closed) between these two switching points.

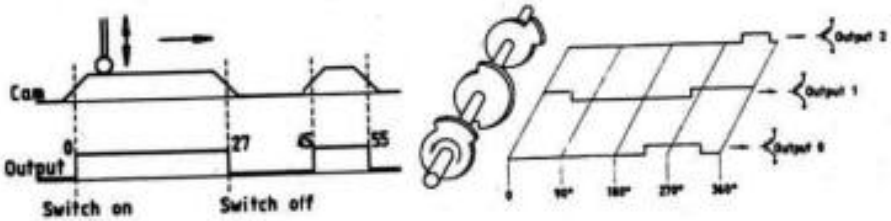


Illustration of the cam controller operation

Moreover, the use of electronics makes the following expansions of the controller functions possible:

- A large number of cams can be programmed in sequence to the same output, each with precise switching points.
- Every programmed cam can easily be changed or deleted.
- If a cam is programmed which overlaps with an existing cam, the two will be "fused" to form a single cam.
- If a new cam is defined within the switching points of an existing cam, the new cam will be ignored.
- The cams can be copied precisely onto other units.

3. KUAX 671 dyn

3.1. Definition of dead-time compensation

When changing the encoder rotation speed, the physical dead-time compensation of mechanical positioning elements (e.g. relays, magnetic valves, rotation magnets etc.) may appear as interference.

In order to compensate this interference, it is necessary to attribute to the switch-on and switch-off values of a cam a constant time factor (dead-time compensation) independent of the rotation speed. Thus, the dead-time compensation of the positioning element is considered a constant factor at any encoder rotation speed.

The KUAX 671 dyn offers four groups of dead-time compensation united into 8 outputs respectively. In each dead-time compensation group the dead-time compensation for the whole group can be set in milliseconds independently of each other. The time range is 1 to 250 ms. The times thus set affect all 8 outputs of the selected dead-time compensation group and are valid for 7 programs.

dead-time compensation group 0 = Outputs 0 to 7
dead-time compensation group 1 = Outputs 8 to 15
dead-time compensation group 2 = Outputs 16 to 23
dead-time compensation group 3 = Outputs 24 to 31

The dead-time compensation can be programmed either via the hand terminal (as from version 3.1 on) using the function key Ctrl-N or by using the PC editor "NOBES".

The maximum encoder rotation speeds are set as follows:

Absolute value encoder 180 steps/rev.: 500 rpm
Absolute value encoder 360 steps/rev.: 250 rpm
Absolute value encoder 1000 steps/rev.: 120 rpm

If the maximum rotation speed is reached, the Parity LED lights up.

Note:
If the rotation speed is increased any further, the function remains active up to ca. 150 % of the maximum rotation speed. Only the resolution is reduced.

You can call the encoder rotation speed up by pressing the *key. It is shown up to 60 % of the maximum rotation speed with the following resolution:

180/360 encoder = 3 rpm
1000 encoder = 1 rpm

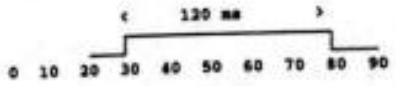
Examples of compensation of the dead-time compensation

In the examples below an explanatory illustration is given. We assume that at a certain encoder resolution and rotation speed the cam closes for an according time.

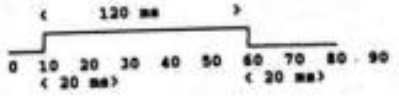
Example:

If, for example, a cam is set for a dead-time compensation of 20 ms, the output always switches on and off 20 ms before the switching-on/-off values programmed before at every encoder rotation speed. In this example, the cam is moved forwad at an increasing rotation speed.

Original cam



Dyn cam 20 ms
dead-time compensation



4. Hardware of the KUAX 671

4.1. General

The control electronics of the cam control unit KUAX 671 is mounted in a robust, finished metal housing suitable for industrial applications. The housing can be installed either with a mounting angle or, if desired, using couplers for mounting rails complying with DIN 46277.

4.2 Mechanical design

The electronics comprise two modules:

1. The CPU module with
   - integrated power pack
   - programming interface

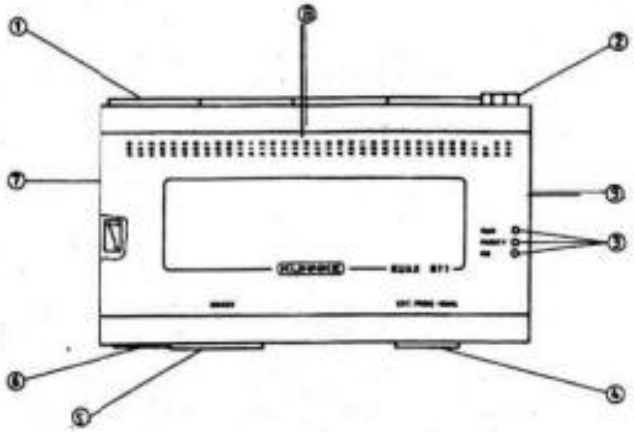
2. Input/output module with
   - connector plug (D-Sub) for the encoder
   - terminal strip for connecting the external program selection device
   - connection terminals for the outputs
   - integrated output LEDs (optional)

A terminal block is used as the attachment point to supply power both to the internal power pack for the cam controller (24 V DC, I ≤ 0.5 A) and to the outputs. This terminal block is located to the right of the output terminal strip. Since the amount of power drawn by the outputs depends on the load, the power pack must be selected so as to be able to deliver the required amount of current.

Three LEDs are provided on the front panel to indicate normal operation and to signal malfunctions:

Display:			
	RUN	→	Controller is running
	PARITY	→	There is an error in the program
		→	Encoder has reached maximum speed (with dynamic version only)
	SHORT (KS)	→	Short circuit indicator
		→	Flat battery (depending on type)
	Report outputs	→	Short circuits and parity, battery check. (Order No.: 671.022.16 or 32)

4.3. Illustration of the control unit



1 Output terminals 0 to 15 or 0 to 31.

2 24 V DC input for the built-in power supply to the cam controller and to the outputs.

3 Operation and malfunction indicators.

4 Terminal block for the external program selection.

5 25pole D plug for the absolute angle encoder.

6 Plug connector for the hand terminal.

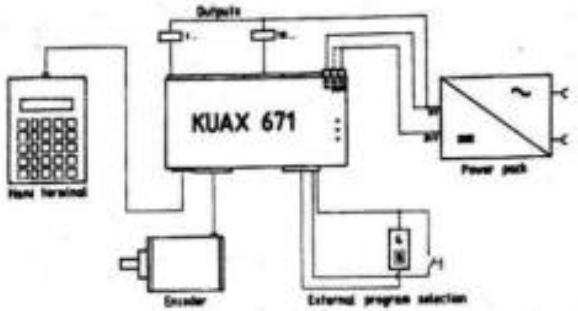
7 Hook switch to reverse the direction of encoder rotation (accessible only after unscrewing the side panel).

8 Output LEDs.

9 Battery compartment for Lithium battery.

4.4. Installation plan

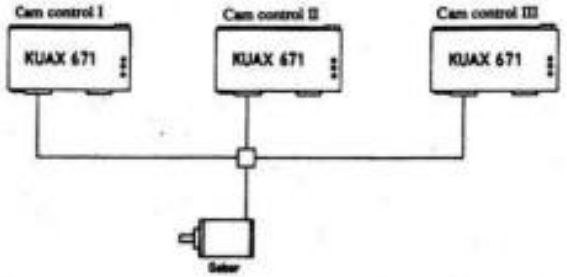
KUAX671 with hand terminal and external program selection



The supply voltage (24 V DC) must be applied to both connector terminals if more than 16 outputs are utilized.

4.5. Expansion steps

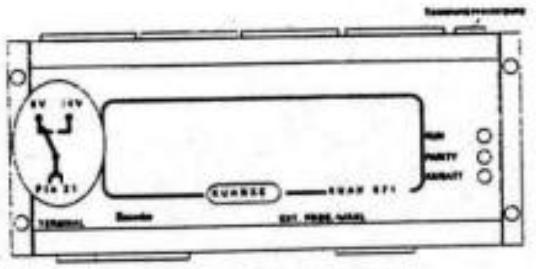
A maximum of three controls can be connected via an adapter. Thus, the number of outputs can be expanded by 16 or 32 to a maximum number of 96 outputs.



4.6. Counting direction of the rotation encoder

The counting of the rotation encoder can be reversed by a hook switch inside the control (see diagram).

You can decide between: clockwise rotation ---> counting upwards
anti-clockwise rotation ---> counting upwards



Switch positions: Rotation directions



Encoder counts upwards during clockwise rotation

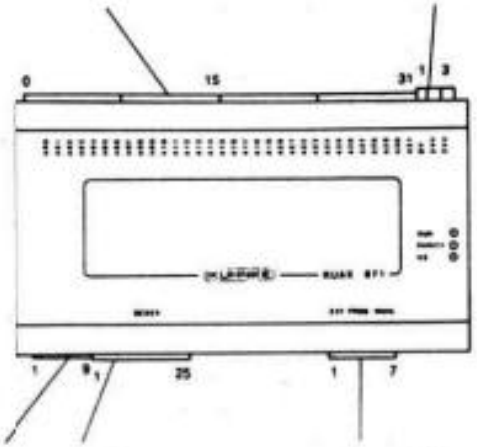


Encoder counts upwards during anti-clockwise rotation

4.7. Plug connectors and pin wiring plans

Output terminals
0 to 15 or 0 to 31 in
block of 8

Connector for the power supply
3pol. terminal strip PIN 1 GND
PIN 2 24 V DC
PIN 3 24 V DC



Terminal connector
9pole D plug

Encoder connector
25pole D plug

Connection for
external program selection
7pole terminal strip

Pin wiring only
on request

see ch. 4.9.

PIN	
Track 1	
2	Track 2
3	Track 3
4	Track 4
5	Track 5
6	Track 6
7	Track 7
8	Track 8
9	Track 9
10	Track 10 (only for 1000-division encoder button
21	Reversing rotation direction
23	Shield
24	24 V DC
25	GND

PIN	
1	2^0
2	2^1
3	2^2
4	Special function
5	Special function
6	Start program
7	24 V DC

We recommend using BCD coding switches with a separate start

4.8. Posi Control with report outputs

Order No. 671.022.16 or 32

This model has the following special functions:

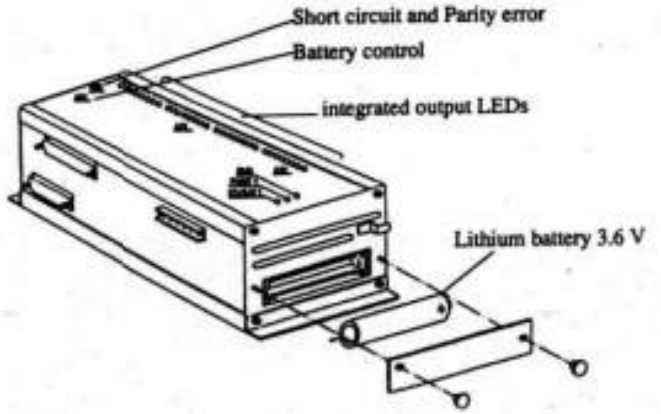
1. Individual switch-off of outputs in case of a short circuit. Only the output with a short circuit is switched off.
2. Interpretation of parity errors. If there is a parity error in the current program, this error will be reported without interrupting the processing of the program.
3. Reporting of error messages. Additionally to the LEDs indicating malfunctons, possible error messages are reported via outputs A00 and A01.

Output A00 a) Short circuit is at one of the outputs
b) Parity error in the current program

In the case of an error, the output is switched off and the LED goes out. Depending on the type of error, the appropriate malfunction LED lights up additionally.

Output A01 Control of battery voltage

The output is switched off. The output LED goes out in the case of the battery voltage sinking below 3.4 V. Additionally, the KS/BATT malfunction LED lights up.
If this error message occurs, the Lithium battery has to be replaced within 4 weeks.

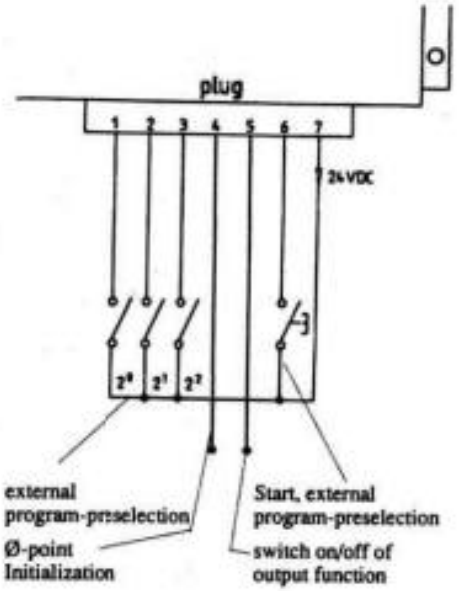


Note: Change battery only while the unit is switched on. After removing the cause of the error the cam controller can be reactivated via the PG 571 hand terminal pressing CTRL 2.

4.9. External program selection

It is possible to set up the system for external program selection in addition to selecting the program at the hand terminal. A terminal strip with supplementary inputs is used for this purpose.
The desired program number can be entered in binary code using three input terminals (pins 1 to 3). The program is then started with a supplementary push-button contact which is connected at pin 6. The 24 V required for the selection routine is available at pin 7.
A key switch should be used to secure the program start button; this will eliminate the possibility of an inadvertent change of programs.
We recommend the use of a BCD switch to encode the program selection.

Note: After switching the power supply on, always the program number selected last is set.



External program-preselection

Program No.	2^0	2^1	2^2
0	—	—	—
1	X	—	—
2	—	X	—
3	X	X	—
4	—	—	X
5	X	—	X
6	—	X	X
7	X	X	X

x = switch closed

4.10. Special functions by external selection

Input Pin 4: Any angle position of the encoder can be initialized as zero point via pin 4 (active 24 V DC) at any time.

Input Pin 5: The outputs can be switched off via pin 5 (outputs active = 0 V DC).

5. The KUAX 671 PG hand terminal

5.1. General

The hand terminal for the KUAX 671 is enclosed in a sturdy and convenient plastic case. The display and control elements are compact but easy to read and use and are arranged for industrial use.

The terminal carries out essentially three functions:

- Program generation
- Calling up the programs thus generated
- Initializing the cam controller when putting the unit into operation

The two-line, 16-character display simplifies programming. The operator is lead through the procedures by menus in most cases.

The program generation is logical and uncomplicated. It is carried out by using a touch-pad key panel. Assigning multiple functions to the keys was avoided wherever possible.

The program number is always shown in the display as well as the encoder position and the status indicators for the outputs.

The hand terminal is fitted with an internally buffered memory so that programs can also be transferred to other cam controllers.

For installing the hand terminal a bracket can be used. A mounting frame makes a front panel fitting possible (cf. ch. 6.2.1.).

A 2.5 meters long cable is used to make the connection to the cam controller.

6. Technical specifications of the KUAX 671

Power supply

24 V DC, +20 %/-20 %, residual ripple < 5 %, isolation of potential, safeguards against reversing polarity, resistant to shorts. The power drawn by the cam controller, including the hand terminal and the encoder is I ≤ 0.5 ampere. Total power drawn at the outputs will depend on the number of out- puts and the load applied to them.

Inputs

Input voltage 24 V from the rotation encoder, potentially isolated with optical couplers.

Outputs

16 or 32 (671.022.XX: 14 or 30) outputs; voltage isolated with optical couplers.Driver stage: "open emitter" (the positive lead is switched). 24 V, I = 0.4 A, retant to shorts; all outputs are switched off in case of a short circuit at any output. Reset by switching the supply voltage back on. Integrated diodes for inductive power consumers.

Output voltage

Absolute angle encoder (modified Gray code) with 24 V supply voltage.

8 (encoder type with compensation of dead-time compensation: 7)

Rotation encoder

max. 128,000; may be assigned to the various outputs and programs as desired.

Data protection

PG 671 hand terminal:
Battery buffering for approx. 6 months.

KUAX 571 controller:

a) Battery buffering for approx.

Number of programs:
Number of cams:

b) Lithium battery approx. 10 years.

Exception: If the cam control unit is installed with the battery facing vertically downwards with its positive pole, the buffering time is reduced to approx. 5 years.

Processing time per pulse:	standard type dynamic type	approx. 240 µs approx. 670 µs
Max. rotation speed of the encoders during standard operation:	Absolute angle encoder approx. 1400 rpm	180 pulses/rev.,
	Absolute angle encoder approx. 700 rpm	360 pulses/rev.,
	Absolute angle encoder approx. 250 rpm	1000 pulses/rev.,
Max. rotation speed of the encoders with dead time compensation	Absolute angle encoder approx. 500 rpm	180 pulses/ rev.,
	Absolute angle encoder approx. 250 rpm	360 pulses/rev.,
	Absolute angle encoder approx. 120 rpm	1000 pulses/rev.,
Ambient temperature:	0 C to 55 C	
Protective system:	Cam controller Hand terminal Installed in front panel	IP 20 IP 40 IP 65

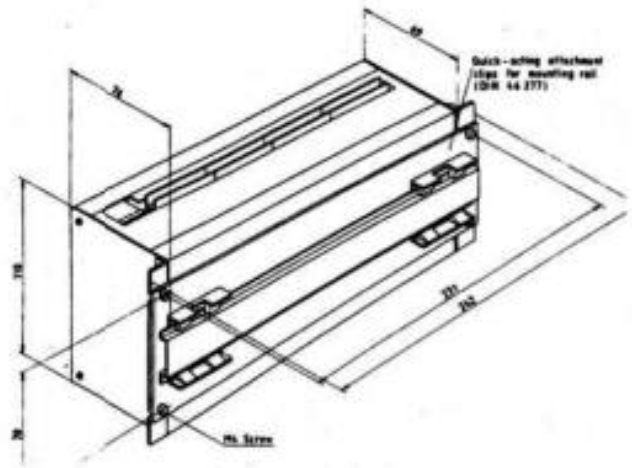
Dimensions :

Device	W	H	D
Cam controller	242	110	69
Hand terminal	102	190	28,8
Encoder	cf. ch. 7.5.		

Disposal:
Please dispose of used batteries at the according public authorities or send them bact to one of the branches of the Sonnenschein company

Caution: security note
Excerpts from hand- ling instructions and secrurity notes issued by the Son nenschein company concerning the handling of Lithium batteries. There is danger of inflammation, explosion or serious burning in case of incorrect usage. These batteries must not be charged, heated above a temperature of 100 C or burnt; the contents of the batteries must not get into contact with water. The electrolyte is extremely caustic. Therefore never force a battery open, solder or weald it

6.1. Dimensions of the KUAX 671 cam controller



6.2. Dimensions of the KUAX 671 PG hand terminal

