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 hand 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.

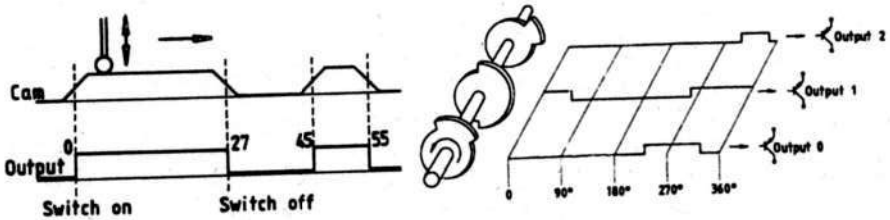


Illustration of the cam controller operation

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.

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

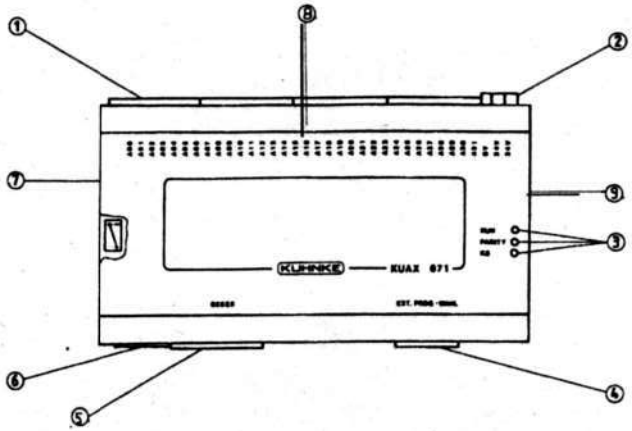
2. Input/output module with
   - connector plug (D-Sub) for the encoder
   - terminal strip for connecting the external program selection device
   - connection terminals for the outputs
   - integrated output LEDs (optional)

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).

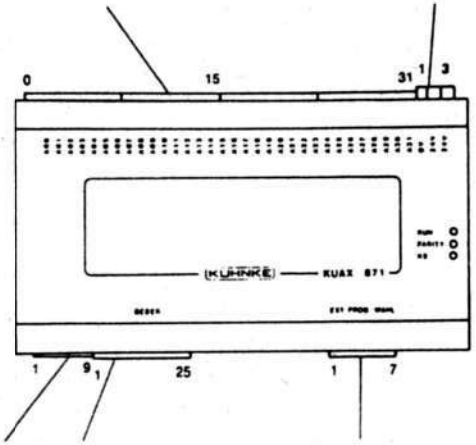
8 Output LEDs.

9 Battery compartment for Lithium battery.

4.7. 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 1GND
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 1

see ch. 4.9.

PIN		PIN
Track 1		1 2^0
2	Track 2	2 2^1
3	Track 3	3 2^2
4	Track 4	4 Special function
5	Track 5	
6	Track 6	5 Special function
7	Track 7	6 Start program
8	Track 8	7 24 V DC
9	Track 9	
10	Track 10 (only for 1000-division encoder button	We recommend using BCD coding switches with a separate start
21	Reversing rotation direction	
23	Shield	
24	24 V DC	
25	GND	

4.8. Posi Control with report outputs

Order No. 671.022.16 or 32

This model has the following special functions:

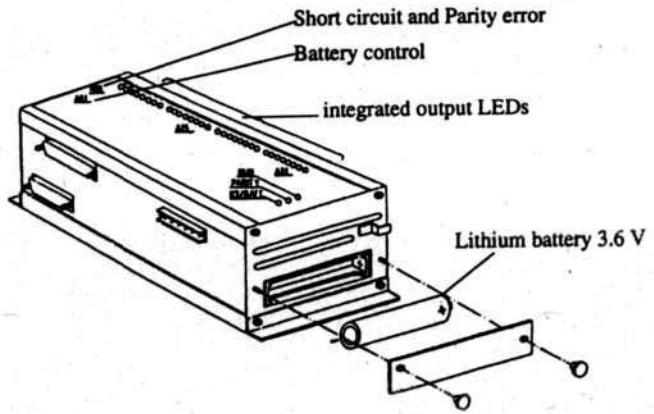
1. Individual switch-off of outputs in case of a short circuit. Only the output with a short circuit is switched off.
2. Interpretation of parity errors. If there is a parity error in the current program, this error will be reported without interrupting the processing of the program.
3. Reporting of error messages. Additionally to the LEDs indicating malfunctions, 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 671 hand terminal pressing CTRL 2.

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 671 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.		

12. Handling and installation instructions for the KUAX 671

12.1. Handling instructions

- Storage temperature: - 25 °C to + 85 °C
- The usual precautions are to be observed to protect against the effects of static electricity.

12.2. Installation instructions

- The KUAX 671 cam controller is to be installed in such a way that heat will not accumulate.
- The maximum permissible ambient temperature of 55 °C may not be exceeded.
- The shielding must always be connected (pin 23 at the 25pole D-sub plug) when lengthening the transducer cable.
- Only a single conductor may be connected at each terminal.
- Operating voltage and the control line (24 V DC) are to be routed separately within the switching cabinet. Use separate cables outside the switching cabinet.
- The outputs are equipped with diodes to suppress inductive voltage peaks. If, however, there is a switch between the outputs and the using unit the latter must also be fitted with a diode.
- No outside voltages may be applied to the outputs.
- The user must always observe the VDE-recommendations and other applicable regulations when working with or on the system.