Instruction manual

Electronic cam control
LOCON 7 / LOCON 9

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Foreword

This operating manual provides users and OEM customers with all the information necessary for the installation and operation of the product described in this manual.

All details contained in this manual have been checked carefully, however, they do not represent an assurance of product characteristics. No liability can be accepted for errors. DEUTSCHMANN AUTOMATION reserves the right to carry out alterations to the described products in order to improve the reliability, function or design thereof. DEUTSCHMANN AUTOMATION only accepts liability to the extent as described in the terms and conditions of sale and delivery.

Bad Camberg, May 2004

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1 Introduction

1.1 On this manual

This manual documents installation, functions and operation of the Deutschmann unit specified on the cover sheet and in the header.

1.1.1 Symbols

Particularly **important text sections** can be seen from the adjacent pictogram.

You should **always** follow this information since, otherwise, this could result in malfunctions or operating errors.

1.1.2 Concepts

The expressions ‘LOCON’ and ’TERM’ are frequently used throughout this manual with no further model specifications. In such cases, the information applies to the entire model series.

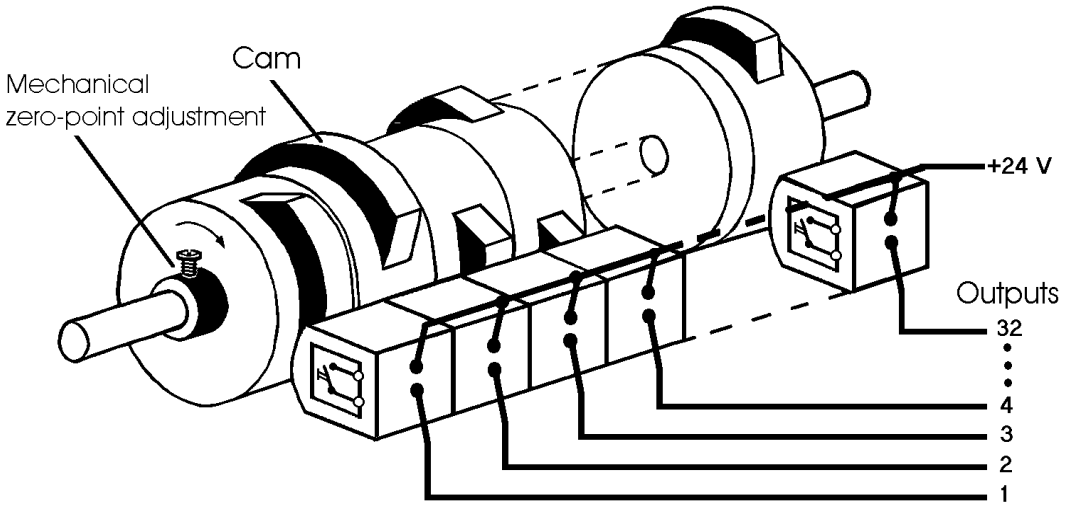
1.1.3 Suggestions

We are always pleased to receive suggestions and wishes etc. and endeavour to allow for these. It is also helpful if you bring our attention to any errors.

1.2 From the mechanical system to an electronic system

The purpose of electronic programming limit switches is not only to take the place of mechanical controllers but to render their function more precise and simpler, to provide a universal range of application and to reduce wear.

The mechanical cam control actuates a switch over sections of a circle, and this switch is closed over the length of this section. Such a section is defined as a "cam".
Each switch represents one output. Several circuits arranged in parallel produce the number of outputs.



Picture 1: Mechanical cam control

This basic principle has been adopted from the mechanical cam controls. A cam is programmed for an output by entering a switch-on point and a switch-off point. The output is switched on between these points.

Thanks to twenty years of experience, consistent further development and the use of ultra-modern technology, DEUTSCHMANN AUTOMATION has now become one of the leading suppliers of electronic cam controls.

1.3 Deutschmann Automation’s range of products

See our homepage at http://www.deutschmann.de.

2 EMC Directives for products of Deutschmann Automation

The installation of our products has to be carried out considering the relevant EMC directives as well as our internal instructions.

For more information see ’EMC Directives’ on our homepage at http://www.deutschmann.de.

3 Cam control LOCON 7 and LOCON 9

3.1 Structure of the unit

According to the picture below, the complete device is stored in a plastic housing for DIN-rail mounting (79x96x25 WxHxD):

3.2 Pin assignment LOCON 7 and LOCON 9

18 pol. screw-plug connector with the following assignment:

Pin-No.	Connection SSI-encoder	Connection incremental encoder	Count-/direction signals
1	SSIDAT+	SelectNumber	SelectCount
2	SSIDAT-	Clear+	Clear+
3	SSICLK-	Inc-track B	Down
4	SSICLK+	Inc-track A	Count
5	Prog-No. 1		
6	Prog-No. 2	Clear Enable+ (X42 only)	
7	Output 1		
8	Output 2		
9	Output 3		
10	Output 4		
11	Output 5		
12	Output 6		
13	Output 7		
14	Output 8		
15	Tx-LOCON / DICNET+		
16	Rx-LOCON / DICNET-		
17	GND		
18	+24V		

The power consumption at +24V is max. 100mA without load. The power that is required as load on the output 1 to output 8 (max. 1A), must additionally be available over +24V.

3.3 Display elements LOCON 7 and LOCON 9

LED 1	(yellow)	Program-No. 1 active
LED 2	(yellow)	Program-No 2 active
LED 3	(green)	SSI-Interface ok
LED 4	(red)	Error-LED
LED 5	(green)	Output 1 active
LED 6	(green)	Output 2 active
LED 7	(green)	Output 3 active
LED 8	(green)	Output 4 active
LED 9	(green)	Output 5 active
LED 10	(green)	Output 6 active
LED 11	(green)	Output 7 active
LED 12	(green)	Output 8 active

3.4 Mechanical installation

LOCON 7 and LOCON 9 are designed for DIN-rail mounting .

3.5 Electrical installation

The complete electrical wiring of the basic device LOCON is carried out via the 18 pol. screw-plug-connection on the front side.

3.5.1 Connecting the supply voltage

The supply voltage is 18..28V DC (typ. 24V DC) and is wired according to chapter "Connection elements".
Before switching on the supply voltage the corresponding inputs and outputs have to be wired, to avoid malfunctions.

3.5.2 Connecting inputs and outputs

As signal encoder of the machine SSI-, pulse- or incremental-encoders are used. They are connected to the pins 1 - 4 (see pin assignment).

The output pins 7 - 14 of LOCON 7/9 are plus-switching 24V; that means an active output has a level of 24V compared with GND, a deleted output is high-ohmic.
The outputs are short-circuit-proof and can drive max. 300mA, at which point the 8 outputs may only be loaded with max. 1A.

In case of a permanent short-circuit or an overload the corresponding outputs are switched off, the error-LED flashes, and a corresponding error message is shown on a connected display.

3.5.3 Connecting the external program selection

The pins "Program selection 1" and "Program selection 2" have to be wired only, in case the external program switch (e. g. via PLC) shall be made. Please note that a program shift is carried out with every change on the input pins; that means, if a program is chosen via the plugs, the signals "Program-selection 1" and "Program-selection 2" must be held on the respective level, until a new program selection shall be made.
The following assignment applies:

Prog.-selection 2	Prog.-selection 1	Program
0	0	0
0	24V	1
24V	0	2
24V	24V	3

3.5.4 Connecting the serial RS232-interface

For connecting a serial RS232-interface to a PC a mass-produced cable (9 pol. D-SUB plug on one end and an open cable end on the other end) can be ordered from Deutschmann Automation.

The following assignment applies: white = Tx-LOCON7
green = Rx-LOCON7
brown = GND

Please note that at the RS232-interface the Tx-wire of one participant is connected with the Rx-wire of the other participant and vice versa.

4 Networking terminals with cam controls and PCs

The chapters below illustrate certain connection examples between the units and a PC, via the DICNET bus as well as via the RS232 interface.
All DEUTSCHMANN controls (LOCON, ROTARNOCK ...) with a DICNET bus can be included in this network. The following principles apply in general:

4.1 RS232 link

An RS232 link is always a **point-to-point link for 2 users**.
Here, it must be borne in mind that, on connection, the Tx end of one user is connected to the Rx end of the other user and vice versa. Moreover, the device ground potentials must be interconnected.

4.2 RS485-connection (DICNET®) - LOCON 9 only

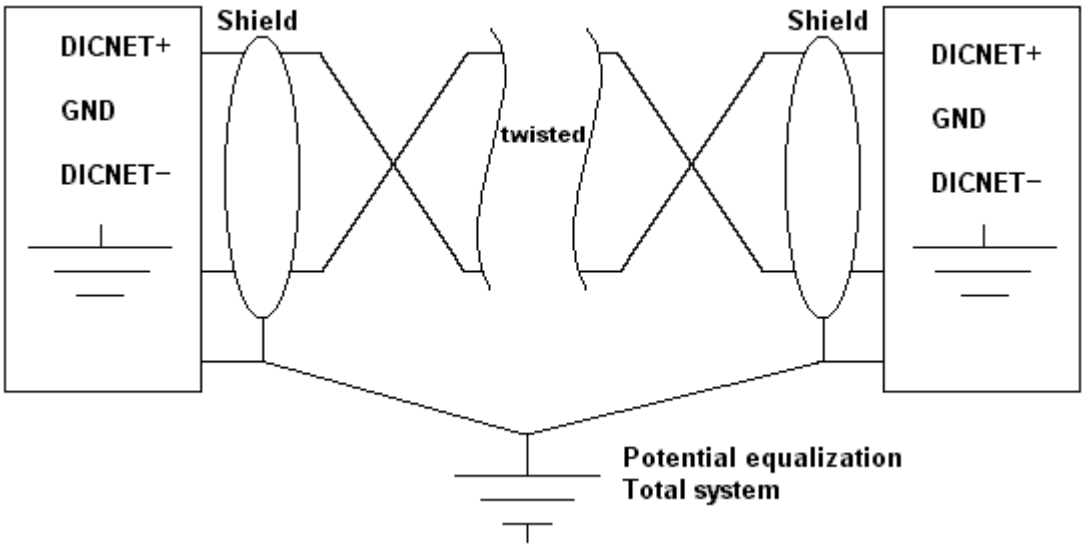
A DICNET link is a bus system to which at maximum configuration level 16 cam controls (LOCON 32, LOCON 9 ...), 16 display units (TERM 4), 3 operating terminals (TERM 6, TERM 24 ...) and 1 PC can be connected **simultaneously** via a **twisted two-wire line** which should be shielded.
All "DICNET+“ ports are interconnected and all "DICNET-" ports are interconnected. A wiring as on the RS232 interface is not made.
Likewise, a connection of the individual device ground potentials as on the RS232 interface has not necessarily to be made; **however, you must ensure that the potential difference between the individual devices does not exceed 7 V.**
Consequently, equipotential bonding is generally carried out in practice at a central point (for example, in the switch cabinet).
Moreover, please ensure that the two bus users feature bus termination resistors at the start and end of the bus by connecting DICNET+ to R+ and DICNET- to R-, since, otherwise, serious transmission problems could occur.
If the devices are connected to the bus with a stub-end feeder, the length of the stub-end feeder may not exceed 1 m, so as to guarantee trouble-free operation.

By default LOCON 9 is supplied with activated bus termination resistor.

4.3 Cable type for DICNET®

A shielded, twisted, 2-core cable (twisted pair) is recommended to be used as bus cable. The shield serves to enhance electromagnetic compatibility (EMC). However, an unshielded cable may also be used if ambient conditions permit it, i. e. if no electromagnetic interference (EMI) is to be expected.
The characteristic impedance of the cable should be between 100 and 130 *Ω at f > 100 kHz; the cable capacitance should be < 60 pF/m wherever possible and the wire cross-section should be minimum 0.22 mm^2 (24 AWG).
A cable that fully complies with these specifications and that has been developed specifically for use in field bus systems is the UNITRONIC®-BUS LD cable 2 x 2 x 0.22, available on a drum from LAPP KABEL in Stuttgart, or by the meter from Deutschmann Automation.

The minimum wiring with shielding between two bus users is shown in the following illustration:



Picture 2: DICNET-wiring

The two signal wires may not be reversed!
GND of the two devices do not necessarily have to be connected.
The potential difference between the data reference potentials GND of all interface connections may not exceed ± 7 V.

4.3.1 Earthing, shielding

If using a shielded bus cable, we recommend that the shield is connected at both ends and with low inductance with the protective ground in order to achieve optimum EMC wherever possible.

4.3.2 Line termination at DICNET®

The two ends of the entire bus cable must each be fitted with a line termination. This avoids signal reflections on the line and ensures a defined open-circuit potential if no user is transmitting (state of rest between the telegrams, so-called idle state).
In this case, please ensure that the line termination is made at the physical ends of the bus cable, i. e. the integrated bus termination resistor must be activated at both devices located at the start and end of the bus.

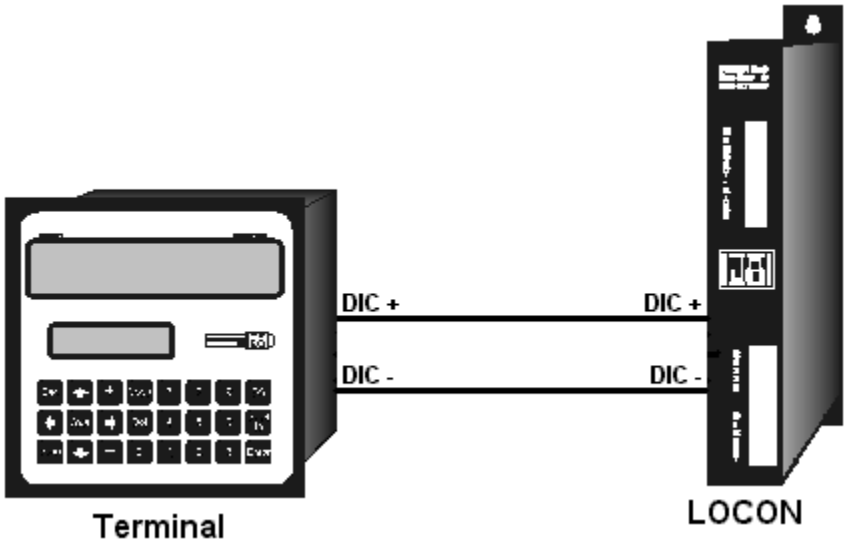
4.4 Comparison DICNET® - RS232

If you intend to set up a permanent link between terminal and one or more cam controls, preference should be given to connection via the DICNET bus and not the RS232 interface since the bus features a higher level of data integrity, i. e. transmission errors which may occur, for instance, as the result of noise pulses are automatically detected and corrected by DICNET up to a certain extent.
Wherever possible, the RS232 interface should be used only for temporary connections (e. g. for connecting a PC).

4.5 Connection examples

4.5.1 DICNET link LOCON - TERM

LOCON and TERM are connected as follows via DICNET:



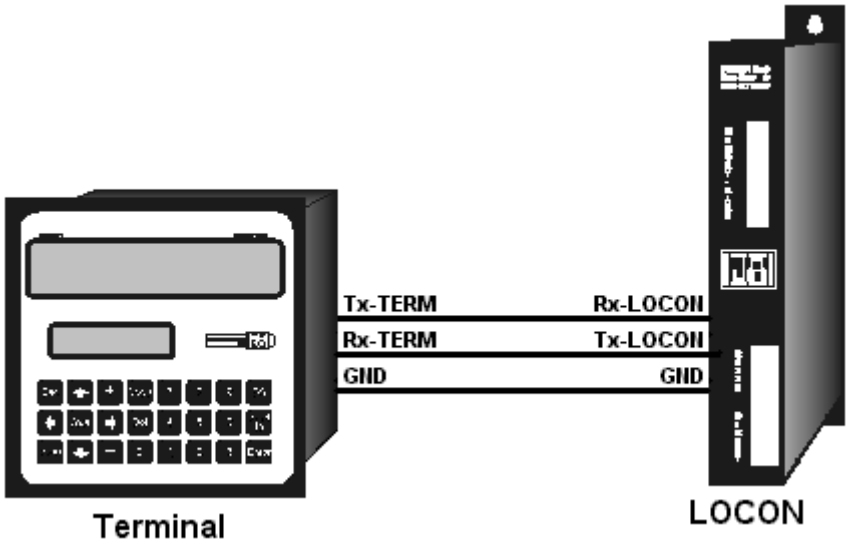
Picture 3: DICNET link terminal - LOCON

The presented devices exemplary stand for Deutschmann terminals and cam controls of the series LOCON / ROTARNOCK respectively.

The two ground potentials do not have to be interconnected. However, you must ensure that the GND potential between the individual DICNET bus users does not differ by more than 7 V. Otherwise, equipotential bonding must be used.
The bus termination resistor must be activated on both units.
Consequently, in the case of simple wiring with a LOCON and an external operator control panel, it is the obvious choice to use the same 24 V supply for both units.

4.5.2 RS232 link LOCON - TERM

On the RS232 version, only a point-to-point connection between LOCON and the external operator control panel is possible.
In this case, the Tx LOCON line must be connected to the Rx TERM line of the operator control unit and vice versa, as can be seen from the illustration below.
The two ground potentials **must** be connected.

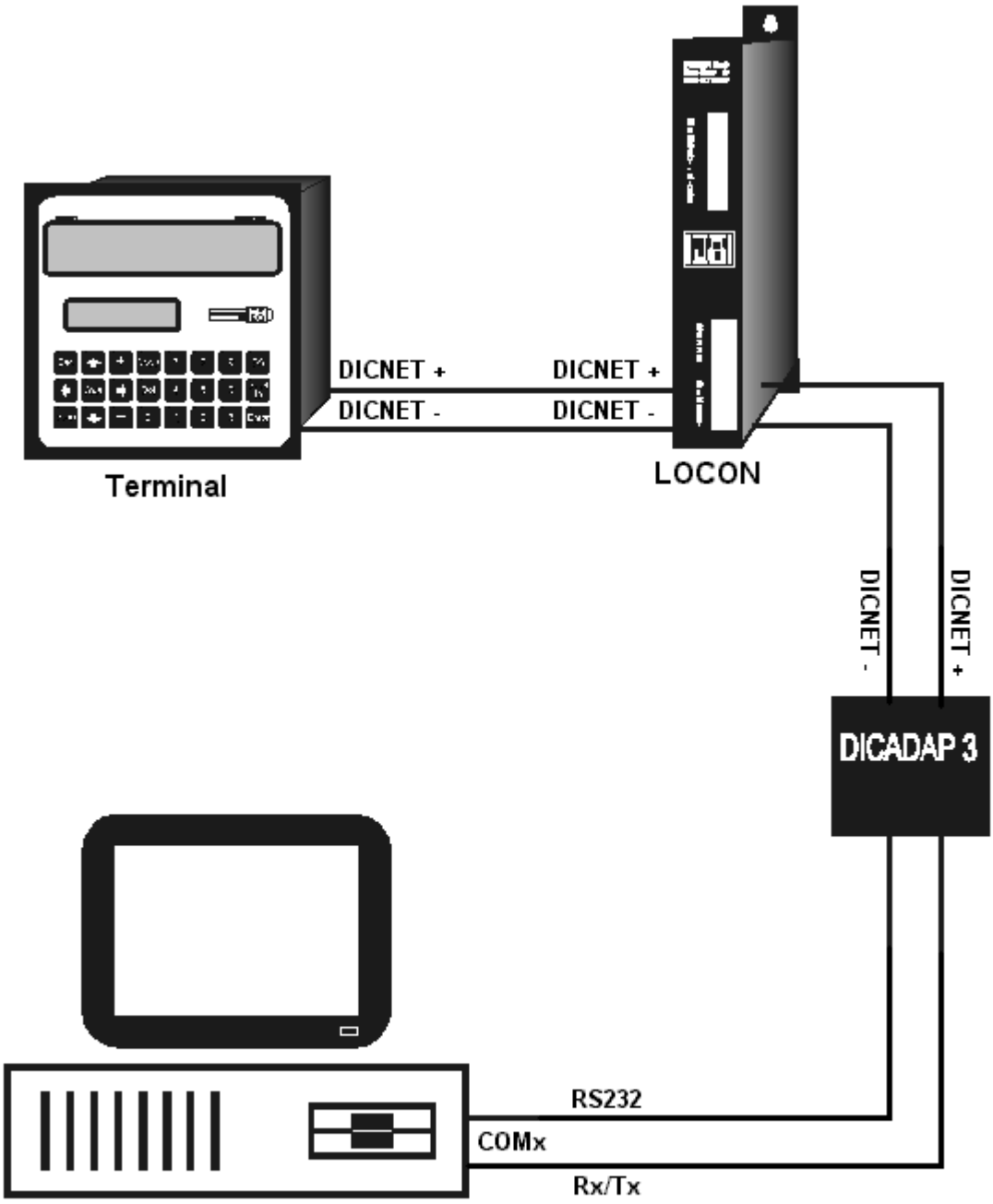


Picture 4: RS232 link Terminal - LOCON

The presented devices exemplary stand for Deutschmann terminals and cam controls of the series LOCON / ROTARNOCK respectively.

4.5.3 DICNET link LOCON - TERM - PC

A PC can be integrated in a DICNET® bus system using a DICNET adapter. The connection to the PC is made at a serial port COMx - see the illustration below.



Picture 5: Link DICNET bus to PC

The presented devices exemplary stand for Deutschmann terminals and cam controls of the series LOCON / ROTARNOCK respectively.

4.5.4 Connecting the encoder

4.5.4.1 SSI-absolute encoder

If LOCON 7/9 is operated with a SSI-encoder, then the 4 data- and clock-lines of the SSI encoder are applied to the pins 1 - 4 of the LOCON 7/9 according to chapter "Pin assignment LOCON 7 and LOCON 9".

4.5.4.2 Incremental encoder (A/B-tracks shifted by 90°)

LOCON 7/9 can be operated by an incremental encoder with any resolution, at which point the limiting values stated in the technical data, have to be kept.
24-Volt-incremental encoders are supported with two tracks A and B (optionally with zero pulse) shifted by 90°-degree centigrade, that according to the chapter connection elements are wired (INK_GEBER_A, INK_GEBER_B) .
With the input "CLEAR+" the count of the LOCON 7/9 can be deleted, where at LOCON 7 you have to pay attention, that the pulse width of the clear-signals is at least 1ms, at LOCON 9 an pulse width of 1µs is enough.
The input "SelectCount" remains not connected, or is connected with GND.

4.5.4.3 Count-/direction signals

Shall LOCON 7/9 work as incremental cam control with count- and direction signals, this mode can be adjusted by means of the input "SelectCount" by connecting with 24V.
With each increasing flank it is counted further to one worth at the input "Count^", where the input "Down" defines the count direction. If this input is not connected, or put to GND it is counted upwards (+1), at a connection of "Down" with 24V it is counted downwards (-1).
With the input "CLEAR+" the count of LOCON 7/9 can be deleted, where you have to pay attention, that the pulse width of the clear-signals is at least 1ms (at LOCON 7) or 1µs (at LOCON 9).
With this mode it is possible to construct a very low-priced complete solution, since for instance an initiator or switch can be inserted as pulse encoder.

The count input urgently has to be debounced, as otherwise every bounce impulse is evaluated as count pulse.

5 External operating unit TERM 5

5.1 Structure of the device

This external control- and display unit consists of a plastic housing with overall dimension W72 x H96 x D18 mm for front sheet installation.

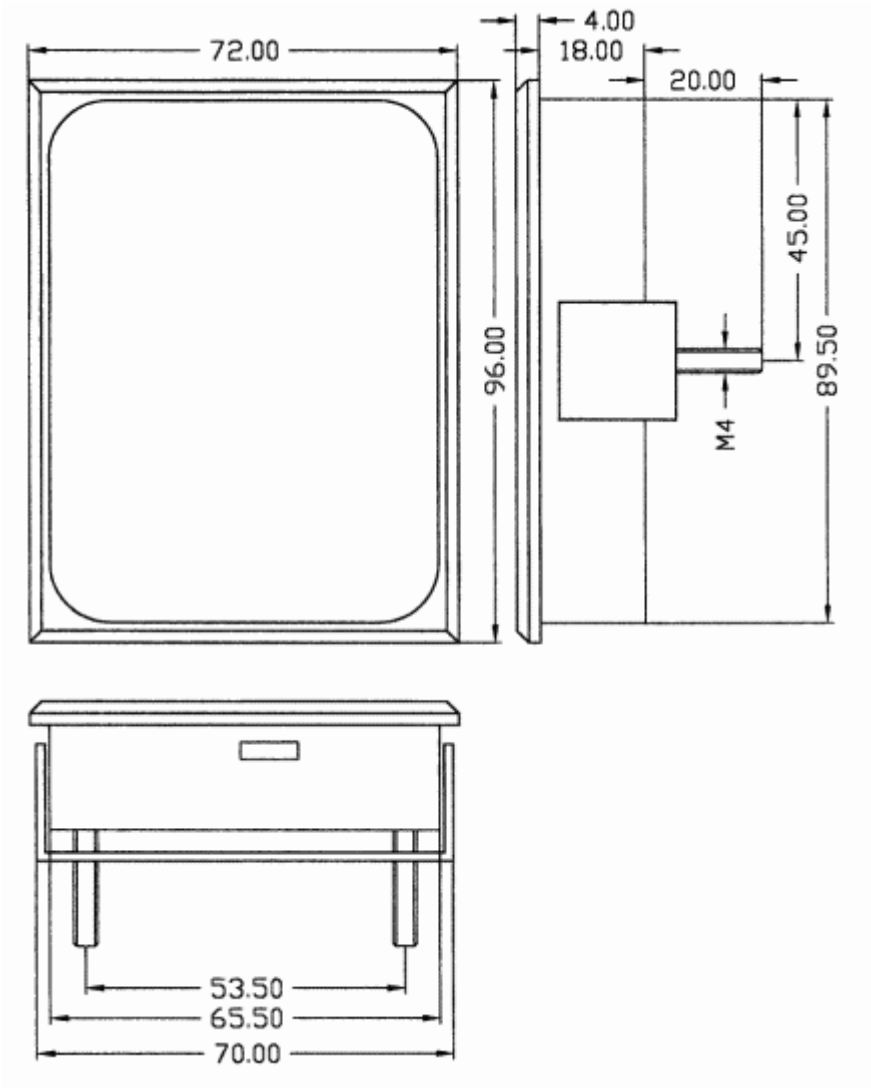
LOCON 7/9 can be programmed via 4 keys, 6 status LEDs, 16 output LEDs and a 6-digit seven-segment display as described in chapter "Programming LOCON 7 and LOCON 9".
The first digit of the seven-segment display presents the number of the active program, the last 4 digits show the current encoder position.
On the 16 LEDs below the seven-segment-display the first 16 outputs of the connected cam controls are displayed with a delay of maximum 500ms.

The connection to the LOCON 7 is made via a serial RS232-connection, to LOCON 9 via DIC-NET.

5.2 View TERM 5/6

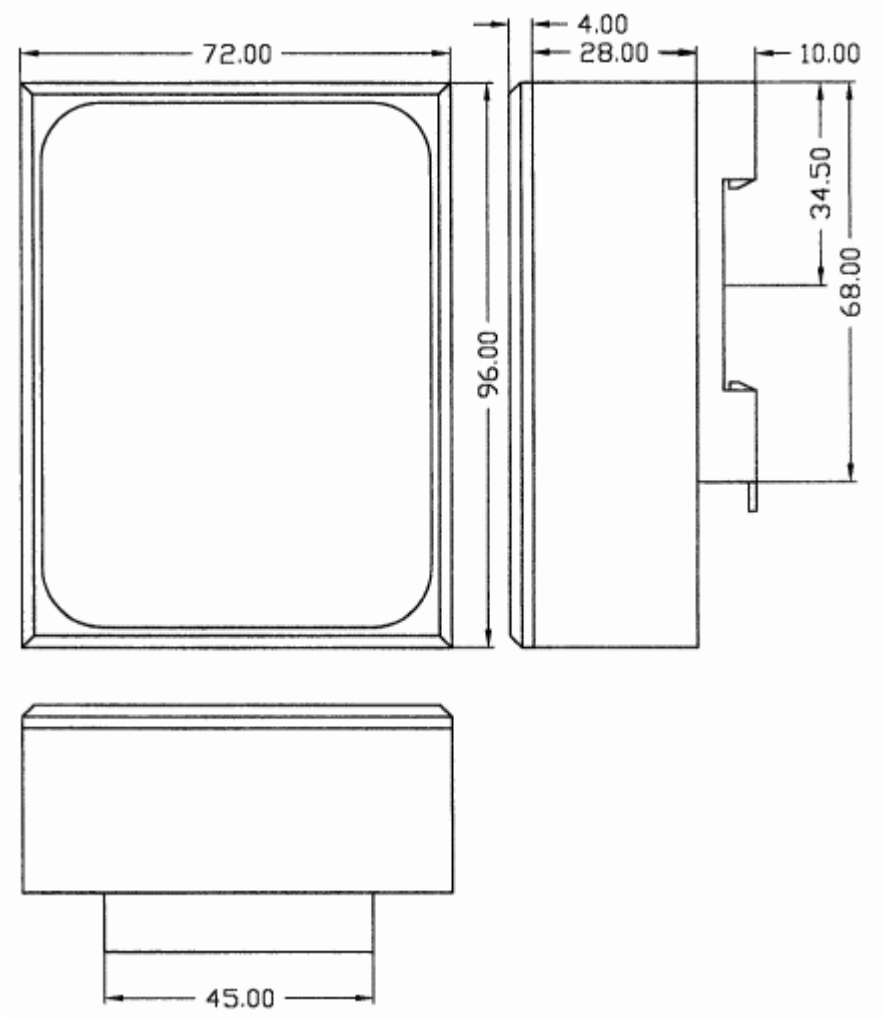
5.3 Technical dimensional drawings

5.3.1 TERM 5 / TERM 6



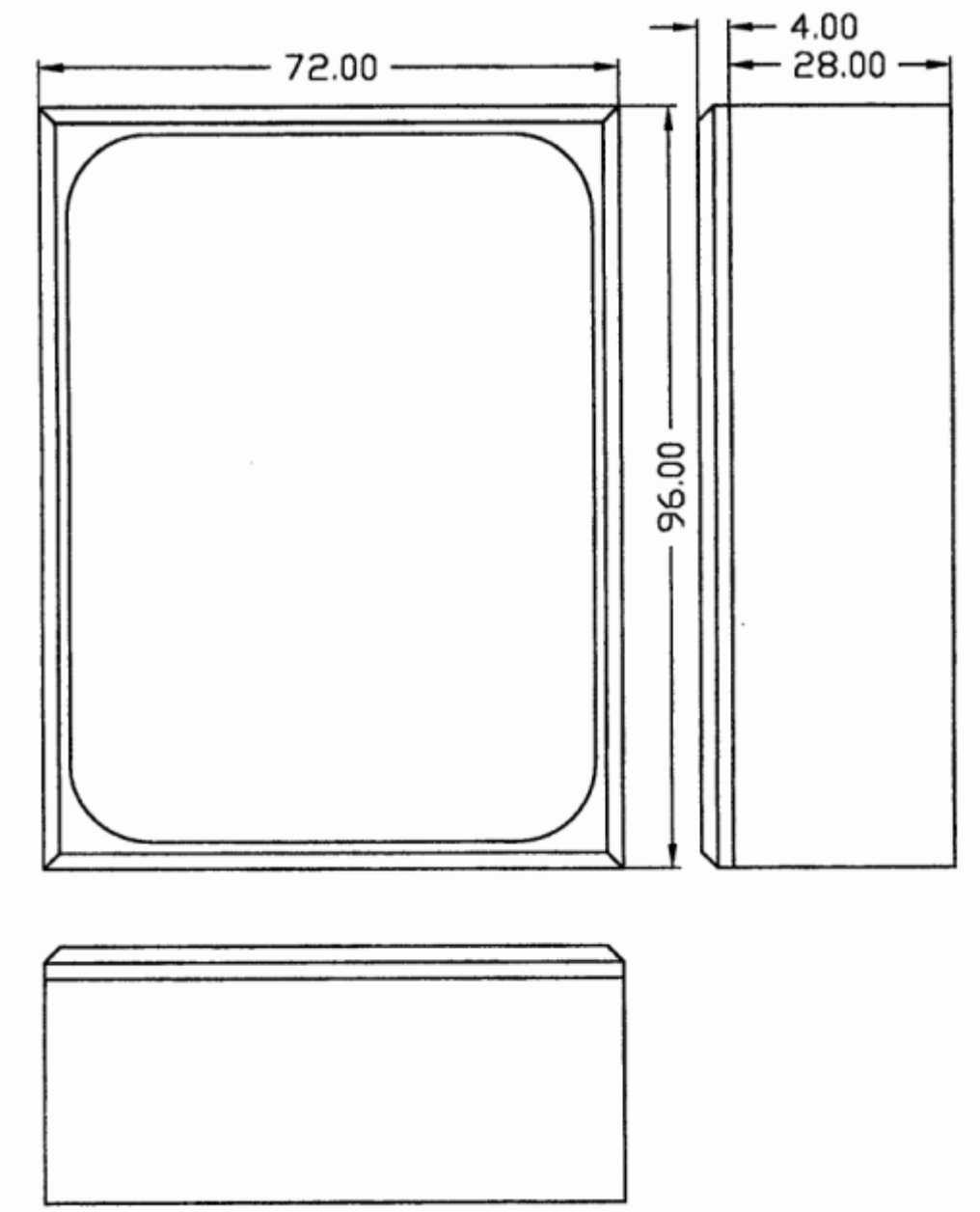
Picture 6: Technical dimensional drawing TERM 5 / TERM 6

5.3.2 TERM 5-H / TERM 6-H



Picture 7: Technical dimensional drawing TERM 5-H / TERM 6-H

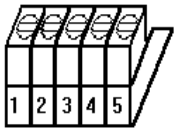
5.3.3 TERM 5-T / TERM 6-T



Picture 8: Technical dimensional drawing TERM 5-T / TERM 6-T

5.4 Pin assignment TERM 5/6

The external control unit is suitable for connection through a 5-pin-screw-plug-connection with the following assignment:



Picture 9: Pin assignment TERM 5 / TERM 6

Pin No.	Significance
1	24 Volt DC
2	GND
3	Rx-TERM (DICNET-)
4	Tx-TERM (DICNET+)
5	GND

5.5 Display element TERM 5

LED Prg.Mode Flashes during programming mode.

LED On Shines when displaying and flashes when programming a cam-turn-on instant.
Shines together with the Off-LED, in case on the program- or output-display (Pxx or Axx on the display) cams exist in this program and output.

LED Off Shines when displaying and flashes when programming a cam-turn-off instant. (see also LED On)

LED Zero Shines when displaying and flashes together with the LED Prg.Mode when programming the zero offset.
Flashes (without LED Prg.Mode) when shifting a complete cam track.
Flashes together with the LED Function when programming the inversion of the rotational direction.

LED Function At LOCON 7 without function, at LOCON 9 idle time indication.

LED Error Flashes in case an error condition appeared. At the same time the corresponding error number is presented on the display, that is described more detailed in the appendix.

LEDs 1-16 Flash in case the corresponding output (1 - 16) is active (24 V applied at the output).

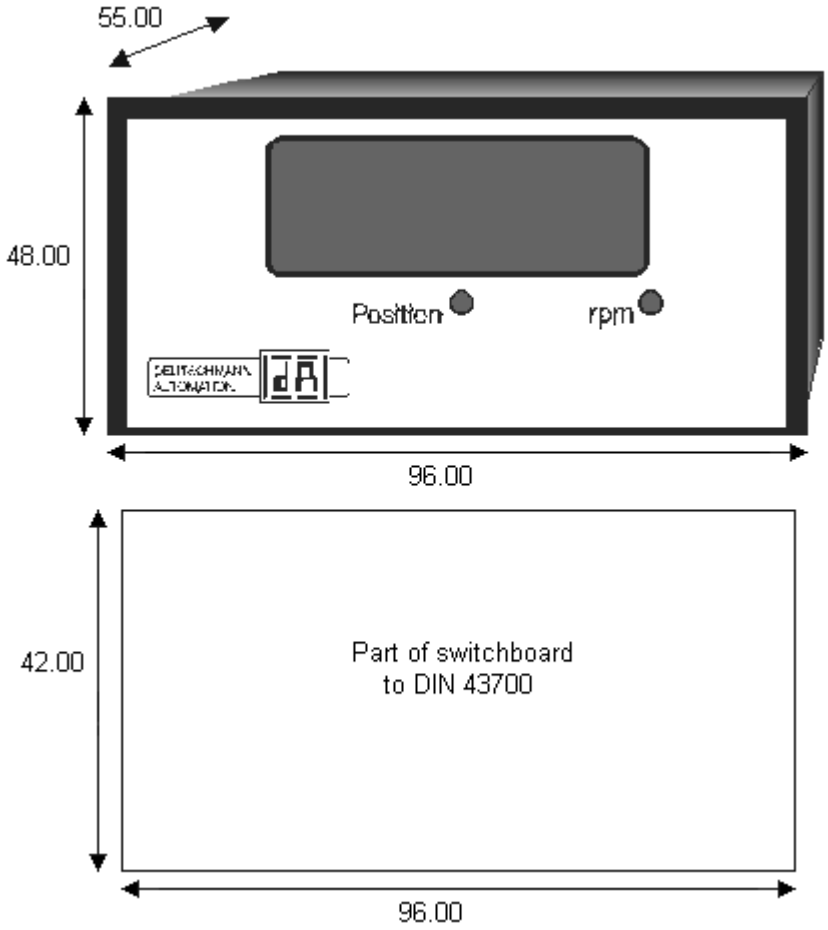
6 External display unit TERM 4

6.1 Assembly of the unit

As an additional position and speed-display TERM 4 is available in the housing W96 x H48 x D55 mm for front sheet installation.
The unit has 4 seven-segment-displays and 2 status LEDs which characterize the position- and speed-display.

The connection to LOCON 7 is made via the RS232-interface.

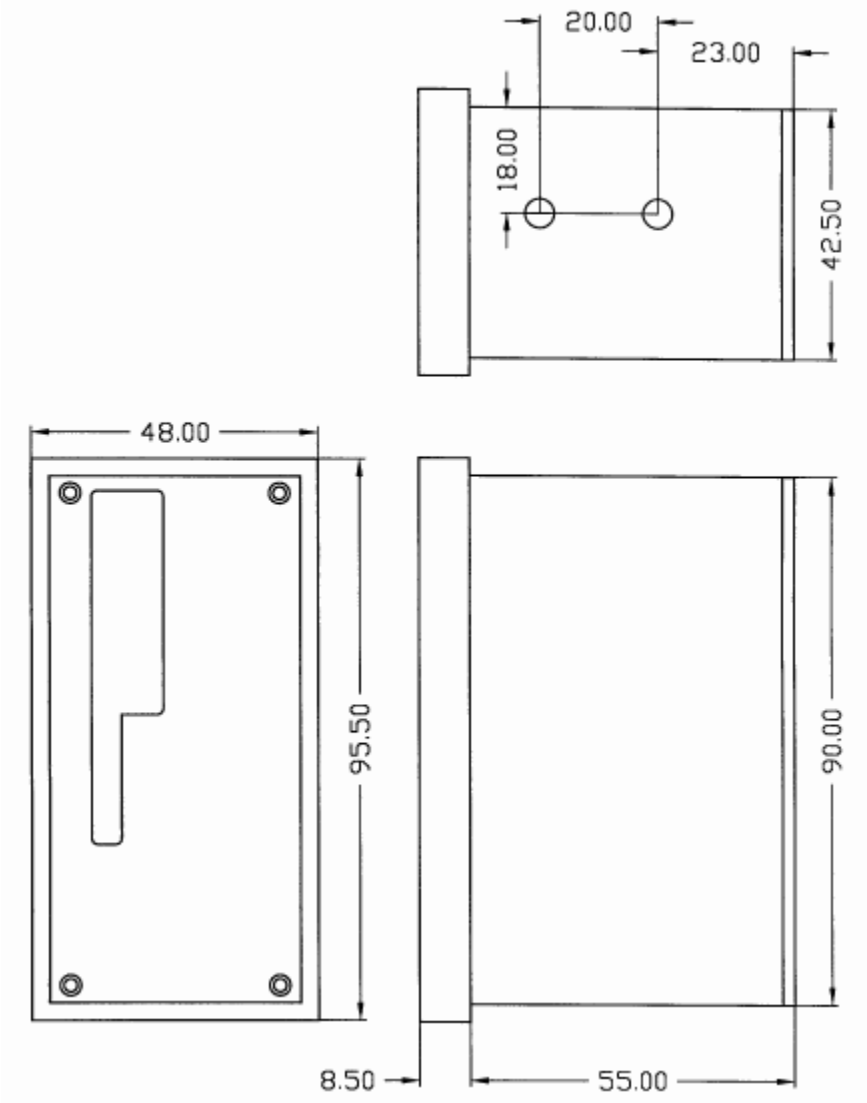
6.2 Dimensional drawing TERM 4



Picture 10: TERM 4

6.3 Technical dimensional drawing

6.3.1 TERM 4



Picture 11: Technical dimensional drawing TERM 4

6.4 Pin assignment TERM 4

The connection is made via a 5 pol. plug (pin assignment identical to that of TERM 5) (see chapter "Pin assignment TERM 5/6" on page 25).

7 Programming LOCON 7 and LOCON 9

7.1 Basics

7.1.1 Backup on PC

The possibility of a backup on a PC is also offered. With WINLOC it is possibe to save programs of LOCON either on harddisk or on a PC's disk and also to load them back.

7.2 Program structure

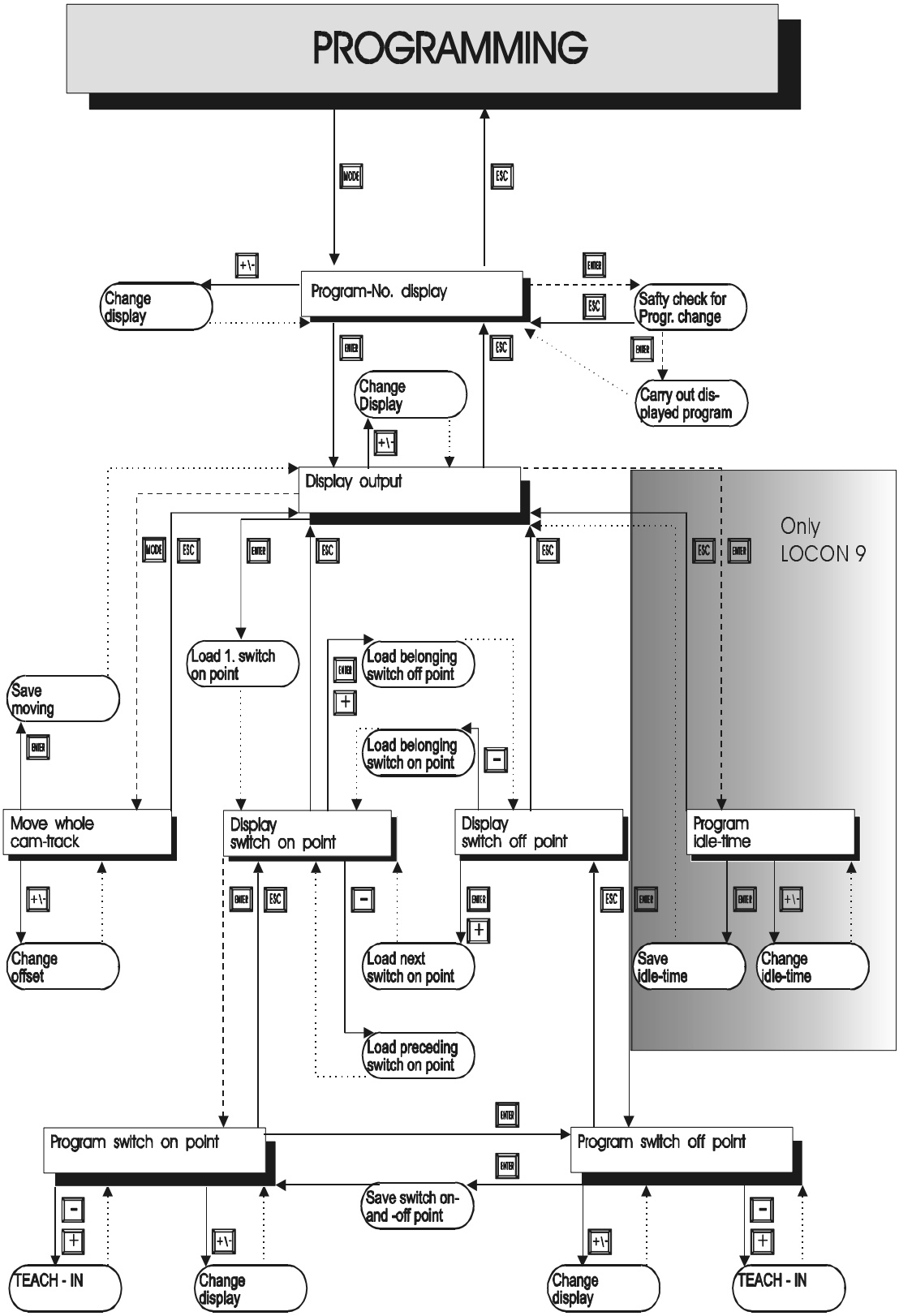
The graphs shown on the following two pages should serve the operators, who have experience in programming cams, as a survey how to program LOCON.
The different states of LOCON are represented by the big boxes; the smaller boxes reflect actions which are caused by pressing a key (represented by arrows).
Generally the following rules apply:

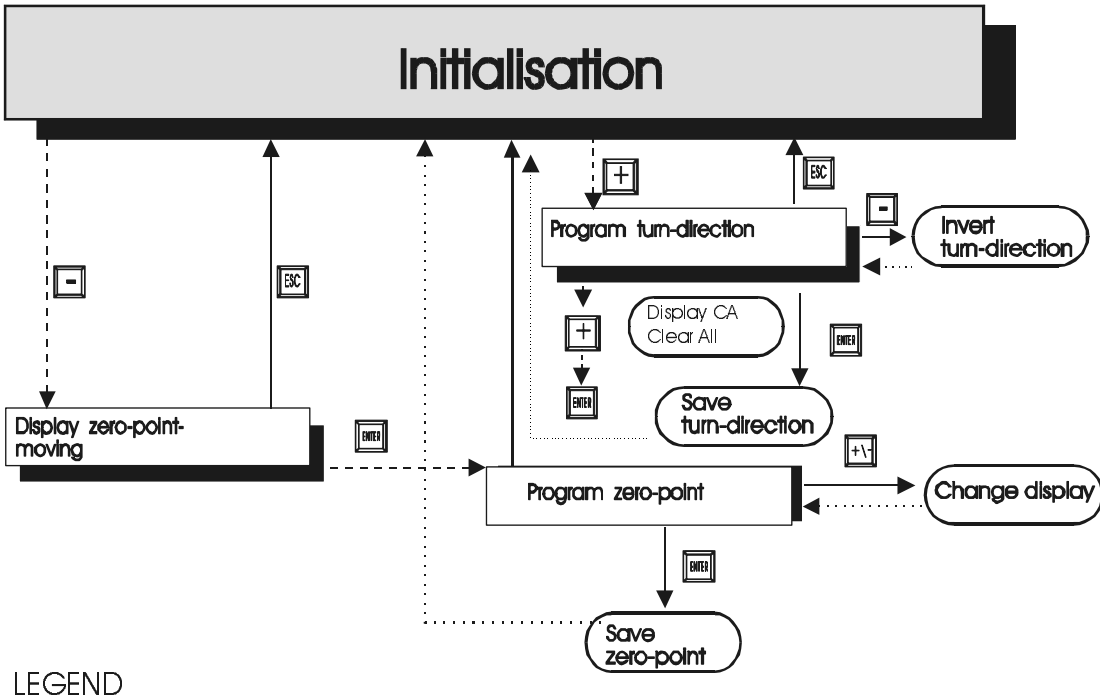
1) With the help of the Enter-key it can be switched to the next menu-point.

2) With the help of the Esc-key the program process is broken off or is returned to the previous menu point.

3) By pressing the Enter-key for a longer period it can be switched from a display-mode to an adequate programming mode.

4) With + and − the displayed value in the program mode can be changed. With it a three-stage autorepeat-function is supported, i. e. one key is pressed steadily, the change of the display follows for a while in one step, then in five steps and in the end in twenty steps. Therefore a fast change of the display in the whole field is guaranteed.


PROGRAMMING
MODE
ESC
+\-
ENTER
Change display
Program-No. display
Safty check for Progr. change
Change Display
Carry out dis-played program
Display output
Only LOCON 9
Load 1. switch on point
Load belonging switch off point
Load belonging switch on point
Save moving
Move whole cam-track
Display switch on point
Display switch off point
Program idle-time
Change offset
Load next switch on point
Load preceding switch on point
Save idle-time
Change idle-time
Program switch on point
Program switch off point
Save switch on- and -off point
TEACH - IN
Change display
Change display
TEACH - IN



7.3 Definitions

Active program — The program that is processed by LOCON, i. e. this program determines how the outputs in dependence on the encoder position are set. After switching on the active program is the one that was processed as active program when switching off the last time.

Normal mode — LOCON is directly in that mode when switching on. Either the encoder position or the speed is displayed. The active program is carried out.

Display mode — Either the switch-on- or the switch-off-point of the programmed cams is displayed. The active program is carried out.

Programming mode — The switch-on- or the switch-off-point, which is just to be programmed, is displayed. At the same time the LED "Prg.Mode" flashes. The active program is carried out. Either the active program or any other program can be programmed.

Blank-cam — A "blank-cam" is displayed by three horizontal dashes (“---“). It always appears, when no cam is programmed at the desired output or if a new cam can be added in the programming-activity.

7.4 Zero offset

The zero offset or zero-point-correction is used to synchronize the mechanical zero-point of a machine with the zero-point of an absolute encoder. It makes it possible that the encoder can be installed in every position; the mechanical zero-point of the machine does not have to correspond with the zero-point of the encoder.
The exact procedure of the zero-point-correction can be taken from the chapters "Reading out the actual zero offset" and "Programming the zero offset".

If LOCON is used with an incremental encoder, the zero-point-correction is not necessary.

7.4.1 Reading out the actual zero offset

The programmed zero offset can be read out in normal mode by pressing the key − (long).
Then the LED "Zero" lights and the difference (zero offset) between the real encoder value and the desired encoder value (position of machine) is displayed.
This zero offset is normally programmed once on the installation of the absolute encoder. It is necessary to compensate the difference between the 0°-position of the machine and the 0°-position of the encoder with the help of software.
This function is left out for incremental encoders!
The procedure of this correction is described more precisely in the following chapter.

7.4.2 Programming the zero offset

In the normal mode the programming begins by pressing the key − (long) and then Enter (long).
Please note that for an easier operation in this mode the zero offset is not displayed, but the desired encoder-position.
The LEDs "Prg.Mode" and "Zero" flash.

In most cases the adjustment is made at the mechanical zero-point of the machine, i. e. the machine runs up to 0°, LOCON is set to "000" with the keys + and − and confirmed with Enter.
If the adjustment at the 0°-point of a machine is not possible, it can be carried out at any other known position. Only the desired position must be input into LOCON.

Leaving this mode is possible either by Enter, then the programmed value is stored, or by Esc, if the value should be rejected.
This function is inapplicable in connection with an incremental encoder!

7.5 Displaying the active program

Pressing the key MODE/ESC in the normal mode causes that the active program appears on the display in form of "Pxx". "xx" represents the corresponding program number.

The program number on the display can be changed with the keys + and −.
If there are cams on the outputs in the displayed program, the LEDs "On" and "Off" light at the same time. Therefore it can be examined very fast, on which program values are programmed.

The normal mode can be reached by pressing the key Esc.

7.6 Changing the active program

Based on the display of the program number (see previous chapter) the active program can be changed.
Therefore that program appears on the display, that should be processed as a new active program.

If this query is also confirmed with Enter (long) the program change takes place.
From that point on the outputs of the LOCON are determined by the new, active program.

7.6.1 External program selection via plug connector

A program change can also be made via the plug connector. For this purpose the desired program number (0..3) is applied at the pins “program selection 1“ and “Program selection 2“ in binary code (see chapter "Connecting the external program selection").

These pins have to stay connected until a new program is supposed to be selected, as with every change of the connection a new program selection is carried out.

The program change is also carried out in the normal mode. The command by hardware, however, is always identified and saved in case LOCON is not in the normal mode that moment.

7.7 Selecting the output number

Should cams be displayed, added or deleted, always the same procedure is carried out:

1) Select the desired program
2) Select the desired output
3) Carry out the manipulations of the cams

The selection of the program occurs according to chapter "Displaying the active program".

From this point on the desired output is selected by pressing the key Enter.

The selected output in form of "Axx" appears on the display. At first the output 1 ("AO1) is always shown {default}.

With the keys + or − the desired output can be adjusted now.
Analogous to the program adjustment the LEDs "On" and "Off" also flash in that mode at the same time, if cams already exist on the displayed output. So the outputs, to which cams are programmed, can be determined very fast within a program.

By renewed pressing the key Enter it is switched to the cam display mode, which is described more detailed in the following chapters.

7.8 Displaying existing cams

With the help of the described procedure in the previous chapter the operator reaches the mode "Display of existing cams".

At first the starting point of the first cam is displayed, that is signalized by a flashing of the LED "On". Is none of the cams programmed, a blank-cam appears instead ("- - -").

By repeatedly pressing the key − counterclockwise, the operator gets all programmed cams displayed, or he can move forward by a repeated pressing of Enter or + and the display changes between the switch-on- or the switch-off-point, that is displayed by the LEDs "On" and "Off".
After displaying the cam with the highest encoder value, the first cam follows again or vice versa, but a blank cam is added in between, because it is necessary for programming new cams, that is described later on.

7.9 Changing existing cams

Should an existing cam be changed, the cam which is to change must be displayed, as it is described in the previous chapters.

After that it is changed to the programming mode by pressing the key Enter (long).
Then the LEDs "Prg.Mode" and "On" or "Off" flash depending if the switch-on- or the switch-off-point of a cam is programmed.

With the keys + and − the desired value can be adjusted. The keys have a graduated autorepeat-function; i. e. the longer the key is pressed, the faster the value of the display increases or decreases.

If the right value is adjusted, it can be taken over with Enter or rejected again with Esc. This automatically leads back to the display mode.

If the value is taken over, the display changes to the next value. That is either the switch-on point of the next cam, if an switch-off point has been programmed, or the switch-off point of the same cam, if an switch-on point has been programmed.
If the change was carried out in the active program, it immediately affects the other outputs.

If no other cams are to be changed, you can return to the display mode with Esc.

7.10 Deleting existing cams

Deleting a cam is the same procedure as changing it, only that the switch-on point is programmed like the switch-off point or vice versa.
If LOCON recognizes that the switch-on- or the switch-off-point are identical, the cam is removed from the program.

7.11 New programming of cams

At first the new programming of a cam is the same procedure as changing it. Always when a blank cam appears on the display, the possibility of a new programming is given by changing with Enter (long) into the programming mode. Now as many cams as desired can be completed in the selected program and output. The program expects the switch-on point at first and then the switch-off point, that is marked by the flashing LEDs "On" or "Off".
The input of the values is carried out analogous to the procedure of changing the cams.

If no more cams are to be completed, it is possible to return to the display mode with the Esc-key.

7.12 Teach-in programming

Instead of a manual programming of the switch-on- and switch-off values it is also possible to use the teach-in-procedure.

Teach-in-procedure means that the machine is run at the switch-on point at first, the adequate encoder value is taken over from LOCON, and then the same procedure is carried out at the switch-off point, but the operator does not have to or input the real encoder value.

Whenever a value must be input, that is obvious if the LEDs "Prg.Mode" and "On" or "Off" are flashing, the actual encoder value can be taken over instead by pressing the keys + and − **at the same time**.

The actual encoder value is displayed, which can be corrected however, if required.
The further procedure is the same as programming or changing cams.

7.13 Shifting all cams on one output

If **all** cams of one output are to be shifted by a certain number of increments, at first the desired output has to be brought on the display, as described in chapter "The program change is also carried out in the normal mode. The command by hardware, however, is always identified and saved in case LOCON is not in the normal mode that moment.".

After that by pressing the key MODE/ESC (long) it is changed into the "shift mode".
Only the LED "Zero" flashes and "000" appears on the display.

Now the increments, by which all cams are to be shifted, can be set with the keys + and −.
If the cam switching points should be changed to a lower value it is necessary to add the encoder resolution to the value which is to be shifted, as a negative input is not possible. This value has to be input.
If for instance the switching points should be set earlier with 10 increments and if a 360-inc.-encoder is connected, this is achieved by entering 350 (360 - 10).

The autorepeat-function is supported as usual.

If the right value is adjusted, the real shift of the cams can be started with Enter or it can be rejected with Esc, that automatically leads back to the display mode in any case.

7.14 Idle time compensation (LOCON 9 only)

Idle time is defined as the time that passes from putting a cam control-output to the real reaction of the connected instrument (e. g. opening a valve).
This idle time is normally fixed.

To compensate this idle time dynamically, a cam control must shift a programmed cam in dependence on the real encoder speed; i. e. a valve that should open at the position 100, must be opened for example at 1m/s at position 95, at 2m/s already at position 90.
This function is called dynamic cam shift or idle time compensation (ITC).

At LOCON 9 idle times can be programmed bitwise, i. e. each output can be programmed with its own idle time.

7.14.1 Program-dependent idle times

It is possible to program different idle times for different programs. To decrease the effort of programming, an idle time which is programmed in the program 0, is interpreted as a default idle time, that is valid for all other programs, provided that it is not programmed explicitly in this program with another value.
If for instance an idle time of 10ms is programmed in the program 0 at the output 1 and one of 20ms is programmed in the program 1 at the output 1, then the idle time of program 0 is valid as a default for all programs. Only in program 1 an idle time of 20ms is executed at the output 1.

ATTENTION: If an idle time was programmed in program 0, this idle time can be changed in other programs, however, it cannot be deleted.

7.14.2 Programming or changing idle times

For programming idle times first of all a program and an output have to be selected (as already described in the previous chapters).
If the desired output appears on the display ("Axx"), the idle time programming is activated by pressing the key Enter (long), provided that the programming release by hardware took place.
Now the LEDs "Function" and "Prg.Mode" flash and the programmed idle time appears on the display.

With the help of the keys + and − this time can be changed now. It must be considered that this change also has a **direct** effect on the outputs.

This state can be left with the keys Enter or Esc, whereas Esc rejects the adjusted value and restores the old value, Enter on the other hand stores the new value.

7.15 Clear all

A complete deletion of all custom-built data (cams, idle time,...) can be carried out through the external operating front or an external TERM 5 as follows:

based on the programming of the rotational direction (see corresponding chapter) by pressing the key + (long) the letters **CA** (for Clear All) appear on the display.

By pressing Enter subsequently the complete deletion is initiated, at which point “---“ is visible on the display during the deletion. After the complete deletion the device is automatically restarted.

7.16 Inverting the rotational direction of the absolute encoder

The rotational direction of the connected encoder can be programmed by software. In the device’s state of delivery the rotational direction is not inverted.
The display and programming of the inversion of the rotational direction takes place as follows:

After pressing the key + (long) in the normal mode the state of the rotational direction is displayed.

The following categorization applies:
0 = rotational direction not inverted (state of delivery)
1 = rotational direction inverted

In this state the LEDs "Zero" and "Function" flash together with the LED "Prg.Mode".

Now the state of inversion of the rotational speed can be changed by pressing the key −.

If the desired value is adjusted, the displayed value is programmed with the key Enter and a return to the normal mode takes place.

If the programming should be broken off, the old value can be restored with the key Esc and a return to the normal mode can take place.

8 Initialization of encoder resolution, counting area, DICNET-ID

(LOCON 9 only)

For LOCON 9 it is possible to parameterize the device number in the net (DICNET-ID), the encoder resolution and in to connection with incremental encoders the counting area. An initialization can be made via TERM 24, TERM 32 or with WINLOC only.

8.1 Parameter's set in factory

		Default	Value range
Device number (DICNET-ID)	:	0	0..15
Encoder resolution (SSI)	:	360	360, 1000, 2n n=0..15
Encoder resolution (incremental)	:	500	1..65535
Counting area (only for inc. version)	:	65536	1..32767 and 65536

8.2 Initialization via TERM 24

In the terminal's configuration menu the corresponding parameters are adjusted to the desired value and confirmed.
Thereupon LOCON 9 carries out a warm start and is operational with the new parameters.

8.3 Initialization via TERM 32

In the terminal's configuration menu the corresponding parameters are adjusted to the desired value and confirmed.
Thereupon LOCON 9 carries out a warm start and is operational with the new parameters.

8.4 Initialization via PC

A connection to LOCON 9 is established with the help of the program WINLOC. Please note that every LOCON 9 is configured to the device number (DICNET-ID) 0 in the state of delivery.
By entering Control-N (simultaneously pressing the keys "Strg" and "N" on the PC) it can be branched to the initialization menu of LOCON 9.
There all parameters are queried interactively. After a change was made LOCON 9 carries out a warm start and reports the new parameters.

9 Commissioning

The commissioning of the LOCON is to be carried out in the following order:

1) Connecting the encoder
2) Connecting the external program selection, if it is required
3) Connecting the CLEAR-signal if using an incremental encoder
4) Connecting the used outputs
5) Connecting the serial interfaces, if required
6) Connecting the 24V supply voltage

The LOCON now conducts the self-test that is described in the following chapter. After this self-test the device is operational, i.e. the program that was active (when it was switched off the last time) is carried out.
At the commissioning the result of the self-test, the hardware configuration and the software revision as well are output to an additionally connected PC.
In case any error messages appeared, which LOCON is able to detected independently, the LED “Error“ flashes and a corresponding error message is presented. The meaning of this number and the required actions are described in the chapter "Error messages".
If a terminal is connected at the time the error appears, the error message is also presented in plain text there.

9.1 Self-test

After the LOCON is switched on it performs a self-test. This test takes a few seconds. Afterwards the device is ready for operation.

The following tests are conducted during the self-test:

- Test of the entire RAM area for defective memory addresses
- Checksum test of the EPROM
- Checksum test and validity test of the EEROM
- Validity test of the cam program

Should errors occur during the self-test, these are presented on the display if possible (see chapter "Error messages").

10 Technical data

10.1 Technical data LOCON 7

Technical data	Basic device	Options
Operating voltage	24 volt DC ±20%, max. 100 mA	Via transfer program on PC
Data protection	EEROM (at least 100 years) no battery required	
Programs	4	
Number of cams	120 cams, optionally distributable to channels and programs Cams are interchangeable linewise	
Zero offset	Programmable over the entire range	
Position recording	360 inc. absolute encoder SSI gray-code (resolution 1°)	Incremental encoder 24V or 24V-metering pulses (initiator) metering frequency max. 10 kHz counting area max. 1024
Encoder voltage	24 volt	
Outputs	8, short-circuit proof, plus-switching 24 volt/0.3A (max. 1A in total)	
Inputs	2 inputs for encoder signals 2 inputs for program selection	For incremental version: 1 input CLEAR+ (1 ms) 1 select-input 2 inputs incremental signals
Cycle time	< 1 ms	
Rotational speed of the encoder shaft	**360 inc. encoder:** Error: 1inc 2inc 3inc 4inc ... --- rev/min: 165 333 500 666 ...	
Programming		Offline via PC online via PC, TERM 5, TERM 24 or TERM 32
Displays	8 output displays 2 displays for external ProgSelection1 SSI-control display 1 error display	External encoder position
Interface	RS232 (V. 24)	
Installation	DIN-rail mounting	
Type of protection	IP24	
Dimensions	24 x 79 x 98 (WxHxD)	

10.2 Technische Daten LOCON 9

Technical data	Basic device	Options
Operating voltage	24 volt DC ±20%, max. 100 mA	Via transfer program on PC
Data protection	EEROM (at least 100 years) no battery required	
Programs	16 (thereof 4 externally dialable)	
Number of cams	1536 cams, optionally distributable to channels and programs cams are interchangeable linewise	
Zero offset	Programmable over the entire range	
Position recording	3SSI absolute encoder up to 13 bit: gray code up to 16 bit: binary coded	Incremental encoder 24V or 24V- metering pulses (initiator) metering frequency max. 10 kHz counting area max. 65536
Encoder voltage	24 volt	
Outputs	8, short-circuit proof, plus-switching 24 volt/0.3A (max. 1A in total)	
Inputs	2 inputs for encoder signals 2 inputs for program selection	For incremental version: 1 input CLEAR+ (1 µs) 1 select-input 2 inputs incremental signals
Cycle time	70 µs	
Rotational speed of the encoder shaft	**E. g. 360 inc. encoder:** Error: 1inc 2inc 3inc 4inc ... --- rev/min: 2380 4760 7140 9520	
Programming		Offline via PC by WINLOC online via TERM 5, TERM 24 or TERM 32
Displays	8 output displays 2 displays for external ProgSelection1 SSI-control display 1 error display	External encoder position
Interface	RS485 (DICNET®)	
Installation	DIN-rail mounting	
Type of protection	IP24	
Dimensions	24 x 79 x 98 (WxHxD)	

10.3 Technical data TERM 4

Characters	TERM 4
Device type	**Display unit**
Connection to	LOCON 1/2 LOCON 7 LOCON 9 LOCON 16/17 LOCON 24 LOCON 32/32PM LOCON 32-HC-4X-INK/32 PM-4X-INK LOCON 32-HC-4X-ABS/32-PM-4X-ABS LOCON 32PM-Matte LOCON 48 LOCON 64 ROTARNOCK 1/2 MULTITURN-ROTARNOCK
Display	4 digit 7-segment display for encoder position/rotational speed LED for encoder position LED for rotational speed
Interface	RS485 DICNET®-1 display to each participant possible RS232 (V.24)
Connections	With screw-plug-connector
Installation	Front panel installation
Type of protection	IP54
Dimensions	48 x 96 x 55 mm (WxHxD)
Switchgear opening	42 x 90 mm
Operating voltage	10 - 30 VDC

10.4 Technical data TERM 5/6

Characters	TERM 5	TERM 6
Device type	**Display unit**	**Display- and operating unit**
Connection to	LOCON 1/2 LOCON 7 LOCON 9 LOCON 16/17 LOCON 32/32PM ROTARNOCK 1/2	LOCON 1/2 LOCON 7 LOCON 9 LOCON 16/17 LOCON 24 LOCON 32/32PM LOCON 32-HC-4X-INK/32PM-4X-INK LOCON 32-HC-4X-ABS/32PM-4X-ABS LOCON 48 LOCON 64 ROTARNOCK 1/2 MULTITURN-ROTARNOCK
Display	6 digit 7-segment display, thereof 4 digits for encoder position/rotational speed 1 digit for device no. (at DICNET®) 1 digit for displaying the executed program (at RS232)	8 digit 7-segment display for encoder position/rotational speed
Interface	RS485 DICNET®-and RS232 (V.24) (switchable)	RS485 DICNET®-and RS232 (V.24) (switchable) up to 3 terminals in one network possible for DICNET-operation
Connections	With screw-plug-connector	With screw-plug-connector
Installation	Front panel installation DIN-rail mounting	Front panel installation DIN-rail mounting portable version
Type of protection	IP54	IP54
Dimensions	72 x 96 x 18 mm (WxHxD) 72 x 96 x 28 mm (WxHxD) DIN-rail version	72 x 96 x 18 mm (WxHxD) 72 x 96 x 28 mm (WxHxD) DIN-rail version
Weight	Appr. 200 g	Appr. 200 g
Switchgear opening	66 x 90 mm	66 x 90 mm
Operating voltage	10 - 30 VDC	10 - 30 VDC

10.5 Specification of the input levels

Logic HIGH: > 16 volt < 10mA (typ. 5mA)
Logic LOW: < 4 volt < 1mA

10.6 Conversion formula rev/min <--> Cycle time

$$\text{Rev.max/min.} = \frac{60{,}000{,}000}{\text{Cycle time [µs] x encoder revolution}}$$

11 Error messages

A LOCON error message can be seen from the fact that an error code is shown on the display. In addition, the optional Run-Control relay drops out if a serious error (1..19, 31, 100..255) has occurred.

All errors must be acknowledged with Esc.

A distinction can be made between the following error types:

11.1 Error number 1..19 (irrecoverable error)

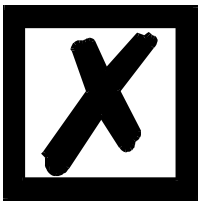
These errors are errors occurring during the self-test routine. If one of the errors 1 to 19 occurs, the unit must be returned to the manufacturer. When returning the unit, please provide the information specified in chapter "Returning a unit".

11.2 Error number 20..99 (warning)

The cam control continues running in the background in the case of all errors of this chapter, i.e. the outputs are still updated as a function of the encoder value in the specified cycle time.

Error No.	Significance	Remarks
20	Error writing to EEPROM	
21	Error saving zero-point offset	
22	Error saving a cam value	
23	Error deleting a data record	
24	Error deleting a program parameter	Parameters can be deleted only in program 0
25	Error copying a program Error shifting a cam track	
26	Time-out accessing LCD	Acknowledge error. If the error occurs again, the unit must be returned specifying the information described in chapter ‘Returning a unit’.
27	Error saving a pattern value	
28	Error programming an idle time	Only in the case of pattern units
29	Error in function CLEAR_CAM	X97 only
30	No programming enable	The program can be modified only if signal ”Prog Enable) is at 24 V on the connector or if parameter ”Lockable outputs” is set appropriately
31	Overload switch-off of the output driver	The output drivers are short-circuit-proof. If LOCON or ROTARNOCK senses an overcurrent for a long period (under certain circumstances, also in the case of incandescent lamps with high power rating), this error message is issued. The corresponding output load must then be reduced and after that the error then be acknowledged. Only the overloaded output is switched off. The other outputs continue to operate.

32	EEPROM full	All data records in the EEPROM are used. Either you must remove cams no longer required or the unit must be equipped with a higher-capacity memory card (LOCON 32 only).
33	Duplicate switch-on point	An attempt has been made to program two cams with the same switch-on point at an output (cam track).
34	Error programming a partial idle time compensation	Unit does not feature the 'Y' partial idle time compensation option
35	Illegal encoder resolution, no power of 2	Program a valid value
36	An attempt has been made to activate the protocol function but no 16k memory card is fitted (LOCON 32 only)	Insert 16k memory card
37	Reserved	
38	Error programming an idle time	On LOCON 17 only - idle times are permitted only for outputs 1 to 8
39	ERROR No ITC No ITC possible	e.g. LOCON 7
40	DICNET® - transmit error Duplicate error on transmit	Duplicate error on transmit
41	DICNET® - receive error	Duplicate error on receive
42	DICNET® - ID error	There is already a user with the same device number (GNR) in the network or the network line is faulty (missing bus termination, line discontinuity or non-twisted lines).
43	DICNET® bus error	
44	Overflow of the serial receive buffer	
45		External fault signal (X26 only)
46	Save blank cam	Data record incomplete
47		Direction-dependent output update illegal
50		Outputs deactivated (brake cam option only)



All outputs are switched briefly to 0 V when error 31 is acknowledged.

11.3 Error number 100..199 (serious error)

All outputs are switched to 0 V until the error has been remedied in the case of errors from this chapter since it is no longer feasible to set the outputs.

Error No.	Significance	Remarks
100	Error in Gray code	The (excess) Gray code read in by the encoder is chekked for plausibility in each cycle. If an illegal code is detected, this error message is issued. If the error occurs only occasionally, this probably involves a fault on the encoder line, and this fault can be remedied by improved cable shielding or different cable routing. Should the error be repeated frequently or be pending constantly, the encoder and the encoder line must be checked and exchanged if necessary. If the error still persists, the unit must be returned (see chapter 'Returning a unit').
101	Checksum error on the memory card or in EEPROM	If a checksum error on the memory card or in the EEPROM is detected on power-up, you will see the corresponding error message. After acknowledgement by the user, the memory is written with the default configuration data and all user data is deleted. You then have the option of reprogramming or, if the old data has been backed up on a PC, of reloading this data.
102	Error initializing the cam array	Illegal cams detected. Carry out a general reset
103	New memory card	
104	Plausibility error (illegal device configuration)	A device configuration which is illegal has been saved (e.g. absolute encoder with 127 increments resolution). Carry out a general reset
105	Encoder error (only in the case of "Special configuration" LOCON 32 option or LOCON 24, 48, 64 units with encoder monitoring option)	An encoder error has been detected. The current encoder value and the last encoder value read in are shown at the top right on the LCD (LOCON 32). LOCON 24, 48, 64, see chapter Options: Encoder monitoring.
108	SSI Time-out error	
111	SSI Gray code error	

11.4 Error number 200-299

The following errors occur only on terminals (or if using cam controls of the LOCON 24, 48, 64 series as a terminal)

Error No.	Significance	Remarks
201	Self-test error	
202	Internal error	
206	Error initializing the RS485 interface	
207	RS232 error	
210	RX overflow error	
211	TX overflow error	
212	TX change ID error	
213	Time-out accessing LCD	Acknowledge the error. If the error occurs again, the unit must be returned, specifying the information described in chapter ‘Returning a unit’
214	Undefined field error	
215	Get key error	
216	LCD XY error	
220	Time-out connecting to cam control	
221	Incorrect data record on transmission to cam control	
222	Checksum error on reception from cam control	
223	Checksum error on transmission to cam control	
224	Unknown command on transmission to cam control	
230	Incorrect configuration data record or not possible to configure the cam control	
231	Incorrect initialisation data record	
240	DICNET® transmit error	
241	DICNET® receive error	
242	Duplicate device number in DIC-NET® or connection problems	Assign a different device number. Check for cable discontinuity, short circuit, non-twisted cable....
243	Too many terminals in network (max. 3 allowed)	Reduce to 3 terminals
244	Max. 1 external terminal in the case of multiple-axis version of the LOCON 32	
251	Internal error	
252	CMD UNKNOWN ERROR	
253	CMD CHECKSUM ERROR	

12 Communication interface

Deutschmann Automation encourages the use of cam controls with remote control and display unit in order to meet market requirements.

Since different combinations of cam control and terminal have been required repeatedly, specific to the particular application, it became necessary to define a standard interface (communication profile) supported by all terminals and cam controls from the Deutschmann Automation-range. This makes it possible for each user to select the most suitable combination for his application.

By making the communication profile an open profile, this means that the user also has the option of communicating with DEUTSCHMANN cam controls and thus using existing information (encoder position, speed, ...) for his own applications or operating the cam control via his own terminal.

For Deutschmann-users the automatic recalculation and assignment of cam tracks via a higher control has already been realized via this communication interface.

On request, we are able to supply information on this interface in the form of the manual "Communication profile.

13 Servicing

Should an error message occur, please first take all measures described in chapter Error messages.

Should questions occur that are not covered by this manual, please contact the responsible sales partner (see internet: http://www.deutschmann.de) or contact us directly.

Please keep the following information ready at hand when you call:

Device designation
Serial number (S/N)
Item No.
Error number and error description (see also following chapter 'Returning a unit')

You can reach us on the following Hotline number. Lines are open from

Monday to Thursday from 8 am to 12 pm and from 1 pm to 5 pm, Friday from 8 am to 12 pm and from 1 pm to 2.30 pm.

Central office & sales department:+49-(0)6434-9433-0
Technical hotline: +49-(0)6434-9433-33

Fax Central office & sales department:+49-(0)6434-9433-40
Fax technical hotline: +49-(0)6434-9433-44

13.1 Returning a unit

If you return a unit to us, we require as comprehensive a description of the error as possible. We require the following information in particular:

- What error number was displayed?
- How is the unit externally wired (encoders, outputs, ..)? Please state all connections of the unit.
- What is the magnitude of the 24 V supply voltage (± 0.5 V) with connected LOCON?
- What were you last doing on the unit (programming, error on power-up, ...)?

The more precise your information and error description, the more precisely we can check the possible causes.

13.2 Internet

The current software WINLOC is available for download from our Internet-homepage (URL). There you can also find topical information on Deutschmann products, instruction manuals and a list of our distribution partners.

URL: www.deutschmann.de

14 Appendix

14.1 Description and connection of the DICNET®-Adapter

14.1.1 DICNET®-Adapter DICADAP 3

The DICNET-Adapter serves to connect a PC to a DICNET-network of the company DEUTSCHMANN AUTOMATION.

It converts both the network protocol as well as the physical RS485-signals, so that a PC with the WINDOWS-software "WINLOC" will be in the position to communicate with those control units from DEUTSCHMANN AUTOMATION, existing in the net through a serial interface (COMx).

"WINLOC" is able to run under WIN 3.1x, WIN95/98 and WIN NT. The basic version is available free of charge.

The DICNET-Adapter is directly connected to a serial interface of the PC through the 9-pin D-SUB plug.

On the other side of the adapter (25-pin D-SUB plug) the DICNET-Bus and the supply voltage, which is allowed to range between 10V and 30V, is fed according to the below pin-assignment.

In case the DICNET-Adapter is connected as the last subscriber in the bus, the internal bus-terminating resistor has to be activated by means of bridges of the PIN's DICNET+ with R+ and DICNET- with R-. (More detailed information to the bus-termination and to the connection to the DICNET can be found in the instruction manual of the used control unit.)

Pin assignment 25-pin:

Pin No.	Name
1-15	Reserved (do not wire)
16	R+
17	DICNET +
18	DICNET -
19	R-
20-23	Reserved (do not wire)
24	+24 V
25	GND

Pin assignment 9-pin:

Pin No.	Name
2	Rx
3	Tx
5	GND
Others	nc