Deutschmann
your ticket to all buses

Instruction manual
LOCON 16 / LOCON 17
TERM 4 / TERM 5 / TERM 6

Manual Art.-No. V3043E

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.

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Bad Camberg, October 2014

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 **<u>important text sections</u>** can be seen from the adjacent pictogram.

You should **<u>always</u>** 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.
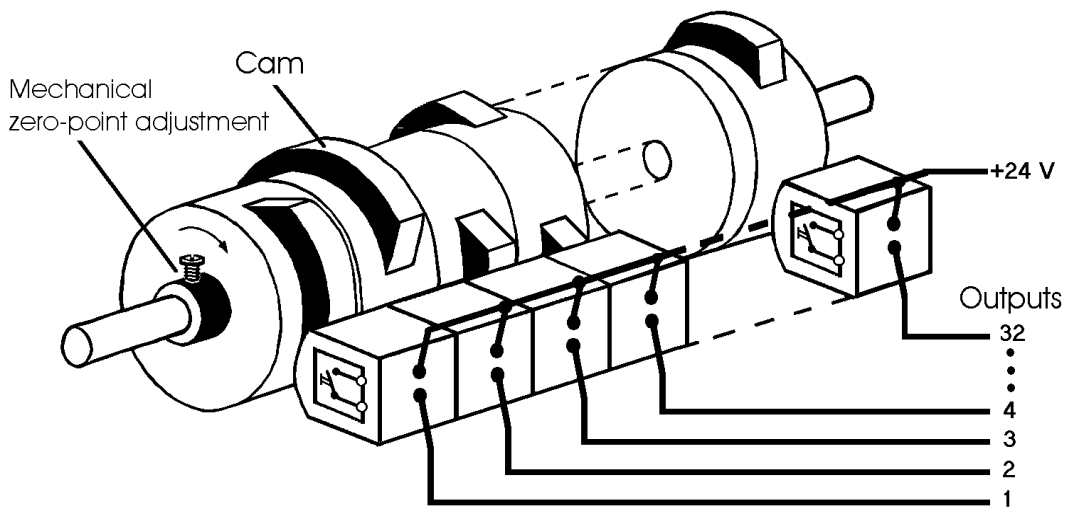
Picture 1: Mechanical cam control

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.
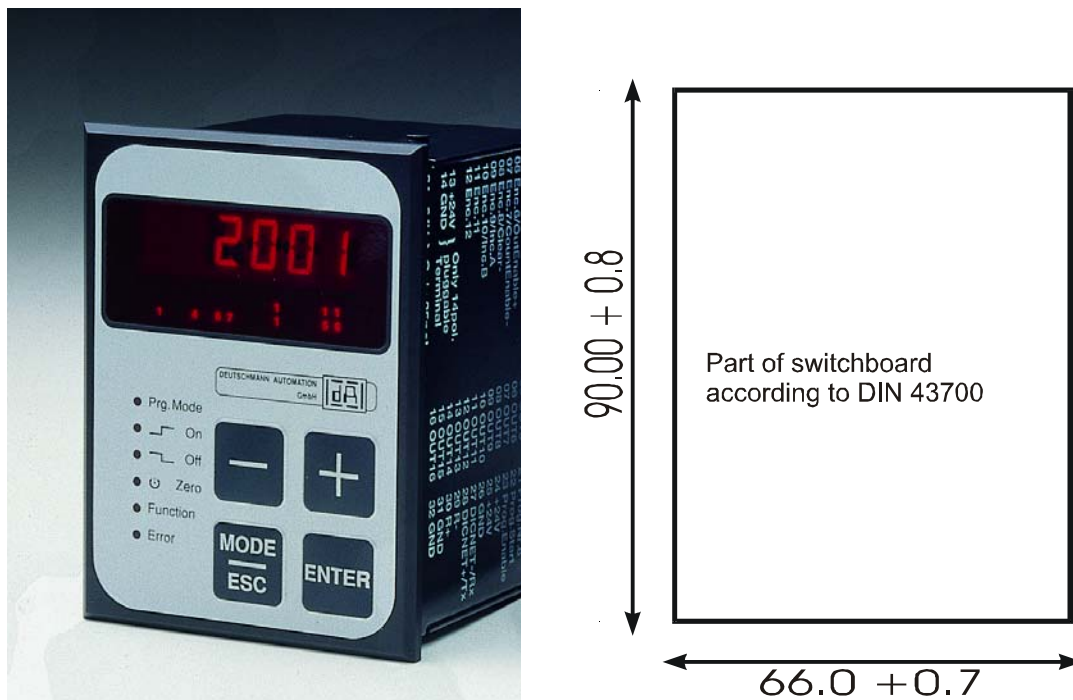
2   EMC Directives for products of Deutschmann Automation

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   Basic device LOCON 16/17
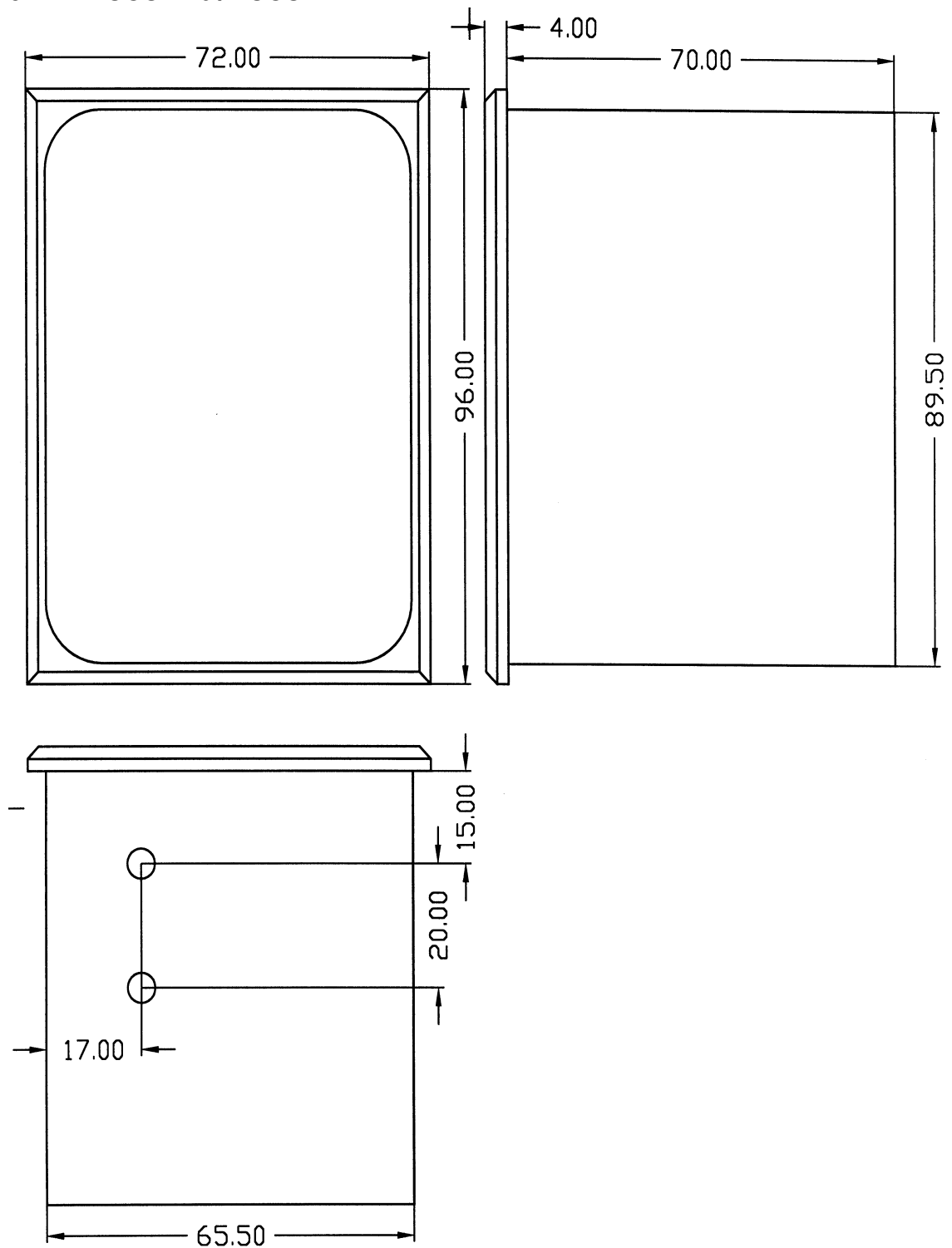
The devices LOCON 16 and LOCON 17 are cam controls with integrated operating front.

Picture 2: Front view LOCON 16 / LOCON 17 and part of switchboard

3.1   Technical dimensional drawings

3.1.1   LOCON 16 / LOCON 17

Picture 3: Technical dimensional drawing LOCON 16 / LOCON 17

3.1.2   LOCON 16PM / LOCON 17PM
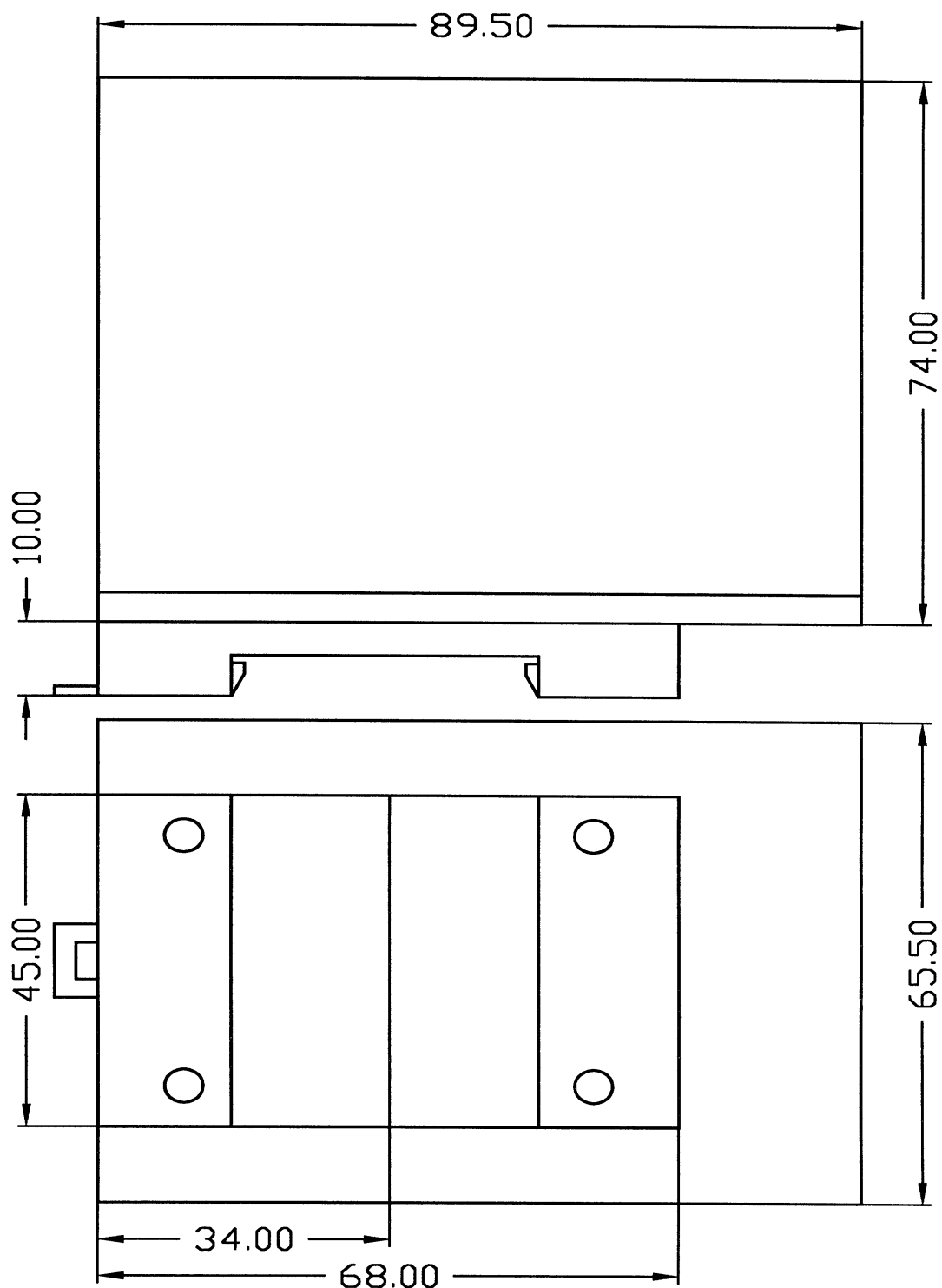
Picture 4: Technical dimensional drawing LOCON 16PM / LOCON 17PM

3.2   Pin assignment LOCON 16 and LOCON 17
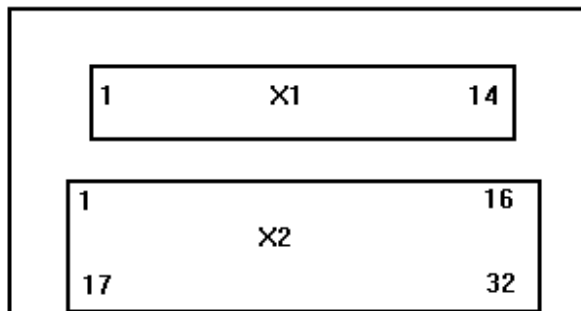
Picture 5: Rear view LOCON 16 / LOCON 17

The screw-plug-connector X2 has 16 pins instead of 15 pins. For questions concerning the pin assignment of previous devices, please contact DEUTSCHMANN AUTOMATION.

X1:

Assignment	D-Sub	Screw-plug-connector
1	Encodertrack 1	Encodertrack 1
...	...	...
12	Encodertrack 12	Encodertrack 12
13		24 V
14		GND (encoder)
24	+24V Power supply encoder (Output)	
25	GND (encoder)	

X2:

Assignment	Screw-plug-connector
1	Output 1
..	...
16	Output 16
17	Reserve (do not wire) output 16
18	ProgNr. 1
19	ProgNr.2
20	ProgNr.4
21	ProgNr. 8
22	Program start
23	Program release
24	+24V - Output
25	+24V Power supply (Input)
26	GND
27	DICNET - (Rx-LOCON)
28	DICNET + (Tx-LOCON)
29	R-
30	R+
31	GND
32	Reserve (do not wire)

3.3   Pin assignment incremental encoder, SSI-encoder X1

Assignment	Incremental-encoder X 1	SSI-encoder X1	RS422-Incremental
1	nc	SSI Dat -	A-
2	nc	SSI Dat +	A+
3	nc	SSICLK +	B+
4	Clear +	SSICLK -	B-
5	StoreCounter	nc	
6	Out Enable	nc	
7	CountEnable	nc	
8	Clear -	nc	
9	Track A	nc	
10	Track B	nc	
11	nc	nc	
12	nc (from S/N 955000 on)	nc	
13			
14			
24	+24V Spannungsversorgung Geber (Output)	+24V Spannungsversorgung Geber (Output)	+24V Spannungsversorgung Geber (Output)
25	GND (encoder)	GND (encoder)	GND (encoder)

3.4   Signal description LOCON 16, 17

Function	Significance
Output 1 ... Output 8	Output block 1 Each output 24V/0.3A positive switching (PNP), short-circuit proof Total current of the output block max. 1A at 25 ° C and full load
Output 9 ... Output 16	Output block 2 Each output 24V/0.3A positive switching (PNP), short-circuit proof Total current of the output block max. 1A at 25 ° C and full load
+24V - Output	24V-output for Prog-Enable and external program selection
+24V - Supply	24V-power supply of the total device incl. output drivers
+24V - Encoder	24V-output voltage to the encoder (max. 300 mA)
GND	Ground potential of the total cam control. All GND-signals are interconnected internally. There is no connection to the housing, that has to be connected to the potential equalization.
Tx-LOCON	RS232-transmission line
Rx-LOCON	RS232-receive line
SSICLK+, SSICLK-	RS422-timing line pair for SSI-connection
SSIDAT+, SSIDAT-	RS422-data line pair for SSI-connection
DSI +, DSI -	RS422-data line pair for DSI-connection
DICNET+, DICNET-	Data line for the networking via the Deutschmann bus-system DICNET® (see also chapter DICNET).
R+, R-	Terminal resistance connections for DICNET. Required when LOCON 32 is operated as first or lasr device in DICNET (see chapter DICNET).
Encodertrack 1 - Encodertrack 12	24V-input (max. 10mA) for encoder lines when using absolute shaft encoders up to 4096 Inf./rev. with parallel output.
InkTrackA	Connection of track A when using an incremental encoder 24V
InkTrackB	Connection of track B when using an incremental encoder 24V
Count^, Down+	In case of 24V at this input, the inputs „Encodertrack9" and „Encodertrack10" will be interpreted as counting input and direction input. With each leading edge to "Count1" an pulse is counted on. If the input "Down+" is at 24V it is counted backwards, otherwise forwards..
Clear-, Clear+	Clear-pulse. As soon as one of the two signals becomes active (0V at Clear-, 24V at Clear+), the count will be set on 0 and it will be on 0 until the clear condition will be disappearing again.
CountEnable-	With 0V or unwired this signal releases the counter. In case this line is wired with 24V, the count is frozen. The speed measurement, and with it the idle time compensation runs on in the meantime. This signal is evaluated with an accuracy of ± 0.5ms.
OutEnable+	When using incremental encoders, with this signal the outputs can be switched on or off. With 0V or unwired the outputs are switched off, with 24V the outputs are set in accordance with the programed. The reaction to a signal change occurs with an accuracy of ± 0.5ms.
ProgNr 1 ... ProgNr 32	The program number is applied at these pins in case of an external program selection. The coding occurs in binary form according to chapter "Coding device numbers".
ProgStart	In case this pin is wired with 24V, the program number is taken over at the ProgNr1 to ProgNr64 (see above).
ProgEnable	In case this pin is wired with 24V, all parameter changes (including change of the configuration) in LOCON are permitted.
nc	Not connected

4   Options

4.1   LOCON 16 and LOCON 17

4.1.1   Counting range shortening (automatic clear)

By default, when using an incremental encoder a run over from the maximum counting value (see technical data) to 0 occurs.
If this reset is supposed to take place earlier, e. g. at a meter reading of 999 back to 0, this reset value can be pointed out to the order with the option "Cn". "n" is equivalent to the value, at which the automatical clear is supposed to take place; in the example "C1000".
The clear-input of hardware is completely independent of the automatical software-clear, and works without any changes.

When using the idle time compensation it considers the shortened counting range and shifts the cams correspondingly.

4.1.2   Function program control (encoder simulation)
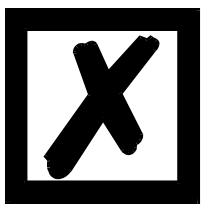
The LOCON can also be configured as program control. In this case it operates like an incremental cam control, at which point however, the meter reading is not changed through an external incremental encoder (see above) but through an internal time base (adjustable from 1 ms to 999 ms).
The time base can be changed as follows:

Press the key ▬ (long) and confirm with Enter (long). Prg-Mode and function flash. Change the

time base with ➕ or ▬ (1-9999) and confirm with Enter (long).

4.1.3   Serial interface

LOCON features a RS232 and a RS485-interface. The interface can be switched manually. The interface switch is to be found under the sticker with the imprint RS232/RS485. In the state of delivery it is set as indicated on the marking of the sticker.The position of the desired interface can be taken from the devices surprint. Please use an appropriate tool to change the position of the microswitch to the left or to the right.

 Please note the signal descriptions!

A support of both interfaces **at the same time** is not possible.

4.1.4   Option screw-plug-connection

As standard the connection for the encoder is made through a 25pin connector.
For LOCON 16 and LOCON 17 it is possible to use a 14pin screw-plug-connector instead.

4.1.5   Storing output names and language (option M)

This standard option allows the storage of an output name with a maximum length of 16 characters and the selected language of an external operating unit. The number of data records amounts to 1936.

4.1.6   Run-control

It's possible to use the output 16 of LOCON as a run-control-signal. This option must be ordered especially and causes, that the output 16 can no longer be connected with cams. Instead this output receives a signal with a frequency, which can vary from 0.8Hz to 1.7Hz; i. e. this output changes its state after 300ms at the earliest or after 625ms at the latest if the cam control works correctly.
Every error leading to an error-display or an uncontrolled system crash of the cam control does not cause a signal change.

4.2   Options LOCON 17

4.2.1   Option H (high-speed)

By this option the cycle times change as follows:

Without idle time:	60 µs
Blockwise idle time:	100 µs (also in case of separate on-off-time)
Bitwise idle time:	250 µs

4.2.2   Option output change dependent on rotational direction

It is possible to make the change (set and reset) of the outputs dependent on the rotational direction of the encoder, e. g. to avoid that, in case of a machine's downtime, at a switch-point of an output, this output switches permanently by encoder-vibrations for some increments.
If for example an output-change is only adjusted in a positive direction of rotation, the outputs are only changed, if the encoder moves to higher position-values.

It must be considered, that after a reversal of rotation an update of the outputs only takes place, if this position is reached again; e. g. while having a positive direction at position 100 the machine comes to a standstill and then swings back to position 90, first an output-change happens at position 100, even if different program changes are programmed between 90 and 100.

This parameter is programmed as follows:

From the display of the end-point of the partial ITC (see chapter instruction manual) the parameter is displayed encoded by pressing the key [−] (long). This parameter determines the rotational direction for the output-change. The following coding applies:

- 0 = always output-change (default)
- 1 = only output-change when having a negative direction of rotation
- 2 = only output-change when having a positive direction of rotation

In this state the LEDs "Function", "On" and "Off" light.

By pressing the key [Esc] you can return to the menu-point display of the end point of the ITC.

If the parameter should be changed, you can switch to the programming-mode by pressing the key **Enter** (long), provided that the programming release by hardware took place.
Then the LEDs "Function", "On", "Off" and "Prg.Mode" flash.

With the keys **+** and **−** the desired value can be adjusted.

Subsequent the programming is either broken off by pressing the key **Esc** and the set value is rejected or by pressing **Enter** the new value is stored permanently in the EEROM.
Anyway a return to the display menu of this parameter takes place.

4.2.3   Option SSI

Additionally to the known options it is possible to run LOCON 17 together with SSI-encoders.
All SSI-encoders with a resolution of up to 4096 are supported. The resolution has to be ordered with the letter "S" in form of "Snnnn".
Please note that the cycle time is extended compared to the "normal version".

5 Special version

5.1 LOCON 17 with option X004 (output-enable-inputs)

5.1.1 Pin assignment LOCON 17-X004

 Picture 6: Rear view LOCON 17

5.1.2 Pin assignment absolute encoder

X1:

Assignment	D- Sub up to 1024-inc. encoder	D-Sub for 2048-inc. encoder
1	Encodertrack 1	Encodertrack 1
..	...	...
10	Encodertrack 10	Encodertrack 10
11	OutEnable 1	Encodertrack 11
12	OutEnable 2	OutEnable 1
13	OutEnable 3	OutEnable 2
14	OutEnable 4	OutEnable 3
24	24V-encoder supply	24V-encoder supply
25	GND (encoder)	GND (encoder)

X2:

Assignment	Screw-plug-connector
1	Output 1
..	..
16	Output 16
17	Output 16
18	ProgNo. 1
19	ProgNo. 2
20	ProgNo. 4
21	ProgNo. 8
22	Program start
23	Program release
24	24 V-supply
25	24 V-supply
26	GND
27	DICNET- (Rx-LOCON)
28	DICNET+(Tx-LOCON)
29	R-
30	R+
31	GND
32	GND

5.1.3   Function description

The software behaves exactly like a LOCON 17 with the extension that the outputs 1 to 4 are enabled through the pins 11 (12) to 14 (15) of the D-Sub plug (the output is always 24V, when the internal cam is switched on **and** the corresponding input is connected with 24V).

This option is only available with D-Sub plug and bitwise idle time compensation.
The maximum possible encoder resolution is 11 bit (2048 increments).

5.2   LOCON 17 with option X016 (brake cam with quadratic ITC)

When using LOCON 17 in presses there is the possibility to run output 16 as brake cam.
In this case the press tappet can be stopped at a point that can be defined as desired **independent of the number of strokes**.
At each number of strokes LOCON 17 calculates the correct lead angle. After the braking command it connects the output 16 accordingly early so that the press tappet is stopped at the desired point.
Here the speed of the press tappet is measured in the field, that is set with the partial idle time compensation (see chapter "Partial idle time compensation").
The option „brake cam" automatically contains the option „partial idle time compensation".

For safety reasons at this option after switching on LOCON 17 no outputs will be activated until ENTER is pressed (via the operating front) as a confirmation. To identify this status error 50 is indicated.
The brake output (output 16) only remains on 0V as long as the brake input (encodertrack12) is connected with 24V. That moment LOCON 17 also connects the brake output with 24V and at this point the press is cleared. If this output is connected with 0V again, LOCON 17stops the press tappet to the next possible instant by switching off output 16 depending on the calculated lead angle. After that output 16 remains on 0V-potential until the brake input at encodertrack12 is connected to 24V again.

The calculation of the lead value is made up of the linear share, including the constant response times and a quadratic share resulting from the kinetic energy of the press.

Consequently the following formula results:

Lead angle = A*n + B*n²

A = Constant linear share
B = Constant quadratic share
n = Number of strokes in 1/min

The constant factors A, B and the brake point (usually OT = 0°) can be defined freely with the program WINLOC via PC. For safety reasons it is not possible to change these parameters with the operating panel.
The procedure of inserting the parameters can also be taken from the program description of „WINLOC".

The constant factors A and B are calculated as follows:

1. The desired brake point is set through WINLOC.
2. With WINLOC the parameters A and B are set to 0 (for programming reasons parameter B can not be set precisely to 0, however this does not affect the measurement).
3. The press is brought to any desired number of strokes and a braking process is initiated. The number of strokes is noted as n1, die angle difference between expected and actual brake angle is quoted as s1.
4. A second braking process with changed number of strokes is carried out and the parameters n2 and s2 are determined correspondingly.
5. The following equations result:

s1 = A*n1 + B*n1²   **s2 = A*n2 + B*n2²**

By solving the equations the demanded parameters A and B can be determined as follows now and they can be programmed with WINLOC.

$$B = \frac{s1*n2 - s2*n1}{n1*n2*(n1-n2)}$$

$$A = \frac{s2 - B*n2^2}{n2}$$

5.3   LOCON 17 with option X021 (high-speed version)

5.3.1   Function description

The software behaves exactly like a LOCON 17 except for the following differences:

- Output 1- 8   : 80µs-cycle time (**2000 rev./min at 360 inc.-encoder) + bitwise ITC**
- Output 9-16   : 1ms-cycle time + no ITC
- Interface   : Only RS232 available (no DICNET)
- Encoder   : Only absolute encoders (no SSI and incremental)
- Options   : All except for 485, C, L, S and U

5.4   LOCON 16/17 with option X038 (security query at ITC)

The device acts like a standard device except for the following difference in operation:

Before entering the programming menu of the idle time compensation (`Enter` (long) when output display) on the display the text "CHG" is presented.

At this point the programming can be aborted by pressing `Esc` or the ITC menu can be reached by pressing the key `Enter` (long).

5.5   LOCON 17 with option X091 (100µs-program control)

5.5.1   Function description

The software behaves exactly like a LOCON 17-T (program control) except for the following differences:

Time base: 0.1...999.9 ms in adjustable in 100µs-steps
Automatic stop at the upper counting limit (4095)
The time base is programmed instead of the zero offset.

5.5.2   Connecting the supply voltage

The supply voltage is 10..30V DC (typ. 24V DC).
Before switching on the supply voltage the corresponding inputs and outputs must be wired, in order to avoid malfunctions.

5.5.3   Connecting inputs and outputs

LOCON has 16 inputs (24V) and 16 24V-outputs.

Absolute shaft encoders or incremental encoders are used as signaling devices of the machines. They are connected to the pins ENCODER-TRACK1 to ENCODER-TRACK9 (360 Inc.-encoder) or ENCODER-TRACK1 to ENCODER-TRACK10 (1000 Inc.-encoder) and INK_TRACK_A, INK_TRACK_B (incremental encoder).
The voltage supply of the encoders occurs through the 24V-encoder supply at the connector strip. It may be loaded with a maximum of 500mA.
For the programming-release 24V must be applied at pin PROG_ENABLE (e. g. by means of a key switch).
The pins PROG_NR1 to PROG_NR8 must only be wired, if an external program change is supposed to happen (for instance via a PLC).
The outputs of LOCON are plus switching 24V, that means an active output has a level of 24V in contrast to GND, a deleted output 0V.
The outputs are short circuit proof and can drive maximum 300mA, whereas 8 correlated outputs of one driver can be operated with a maximum of 1A at 25°C and full load.
If more than 300mA per output become necessary, there is the possibility to couple more outputs (up to 3 outputs each driver). Then 900mA can be driven. If several outputs are coupled, the switch-on points and the switch-off points in the LOCON must be programmed absolutely identically. Otherwise the short circuit control reacts.
In case of a durable short circuit or an overload, the relevant outputs are switched off and a corresponding error message appears on the display.

5.5.4   Connecting the STORE_COUNTER-input

For incremental cam controls this input serves to store the actual encoder position in the EEROM as initialisation value, that means after switching on the LOCON this value is used as encoder starting position.
By activating this signal with a falling off supply voltage the actual value is stored by switching off the LOCON. This value is used as a starting value when you switch on next time.

The signal Store_Counter is negatively edge-triggered, that means a transition from 24V to 0V will activate the memory process.
For a correct storage it must be guaranteed, that after this edge the 24V-input voltage at the LOCON will be **more than 10V for at least 50ms**.
Furthermore it is important that the **Clear-input will be supplied with a minimum of 16V within these 50ms** to avoid a reset to zero before storing the encoder value.

In the worst case the following signal-courses arise:
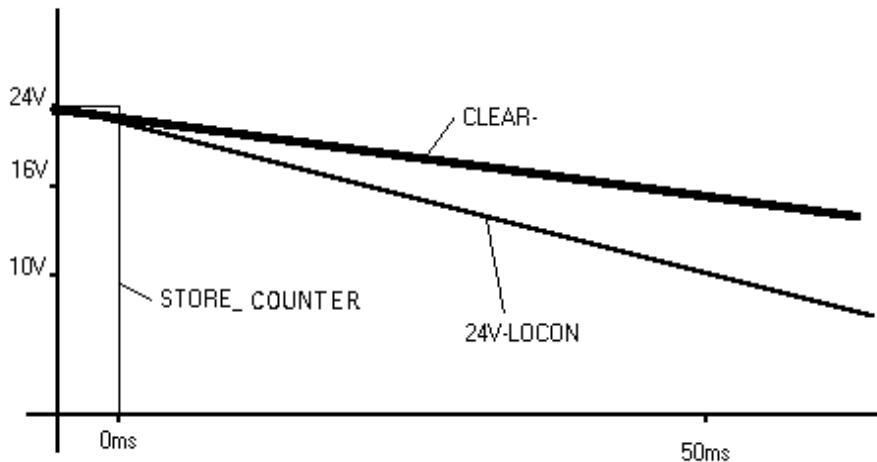
 Picture 7: STORE_COUNTER

5.6   LOCON 16/17 with option X84 (High-speed counter)

In that option LOCON 16/17 behaves functionally as an incremental cam control. But instead of the counter inputs A and B, shifted by 90°, in this variation one input is interpreted as a counter signal and another input as a direction signal according to the following connection:

Screw-plug-connector X1:   Pin 9 direction
                                     Pin 10 counting pulse

It is counted with every falling edge of the counting pulse, namely in ascending order, if the direction input contains 24V It is counted in descending order, if 0V are placed there or if the input is not connected.
The length of the counting pulse must be at least 40 µs, the remaining specifications can be taken from the chapter "Technical data LOCON 16" and "Technical data LOCON 17".

ATTENTION: The counting input is not debounced!

The function of the status signals and the programming can be looked up in the chapters of the incremental cam controls.

5.7   Special versions

Beyond the diverse performance characteristics of the series LOCON 16/17 and TERM 5/6 described in this instruction manual, we also offer - as for all other models as well - customized adaptations as well as special versions. If required please do not hesitate to send your inquiry either to our distribution partner responsible for you or contact us directly.
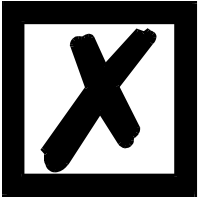
If you are not sure about the device version, resp. the options you are using, please compare the information indicated on the type label to the explanations at the end of this instruction manual, chapter „Order code". For further questions either your distributor or we will be pleased to be at your assistance.

6   Basic device TERM 5/6 (external operating unit)

6.1   Assembly of the instrument

This external control- and display unit consists of a plastic housing with overall dimension W72xH96xD18 mm for front sheet installation and W72xH96xT28 mm for DIN-rail mounting.

It is adjusted for programming cam controls (LOCON, ROTARNOCK) and has the same keys, status LEDs and display possibilities as LOCON 1/2 and LOCON 16/17.
In this respect the programming is just like LOCON 1/2 and LOCON 16/17 and no additional training is required.
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 cam control takes place via a serial wire. According to the standard type a RS485-connection (DICNET) and optionally a RS232-connection (switchable at the device) is supported.
The correct wiring of the instruments among themselves is described in the chapter "Networking terminals with cam controls and PCs".

6.2   View TERM 5/6

 Picture 8: TERM 5 / TERM 6
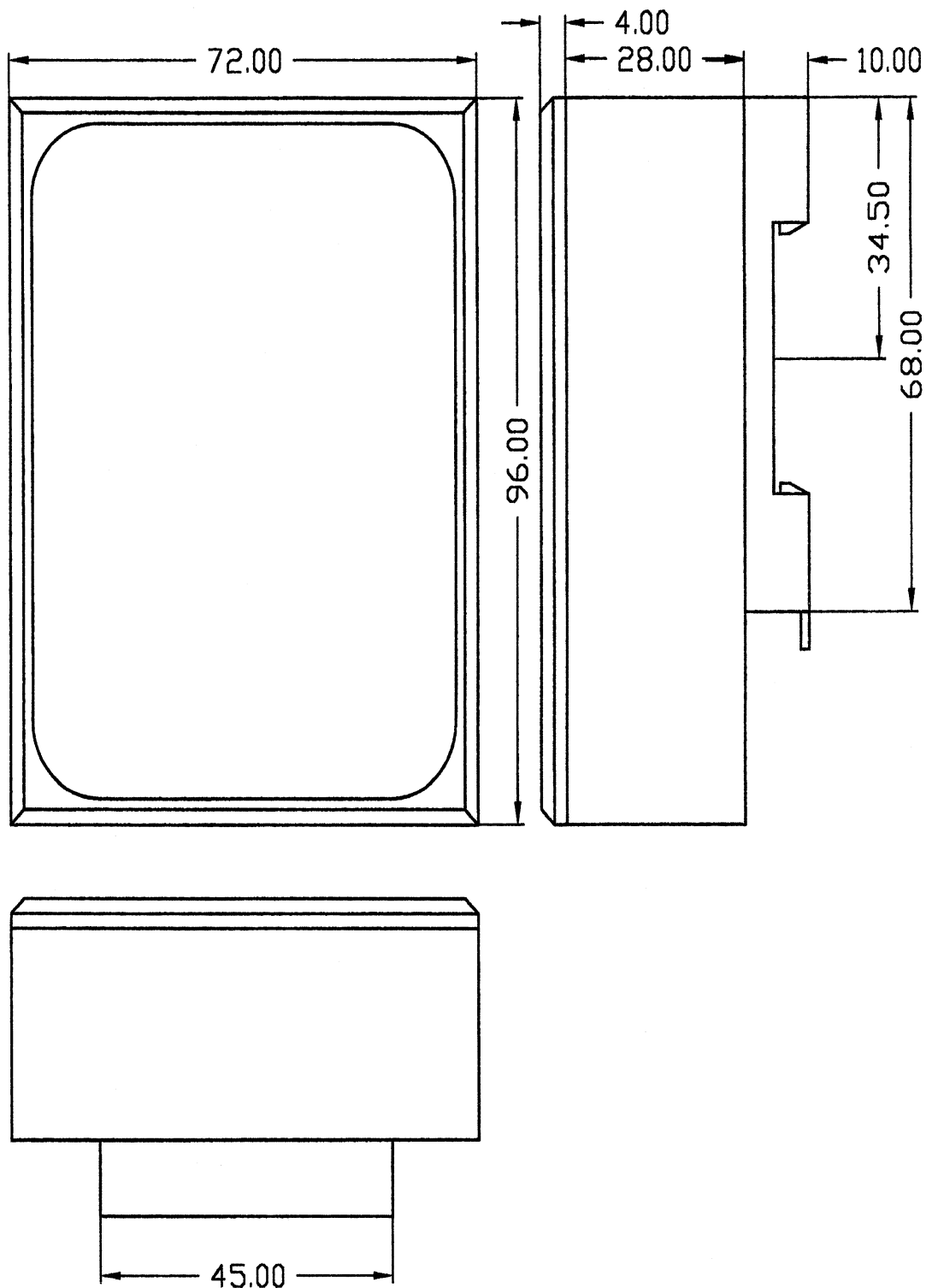
6.3   Technical dimensional drawings

6.3.1   TERM 5 / TERM 6
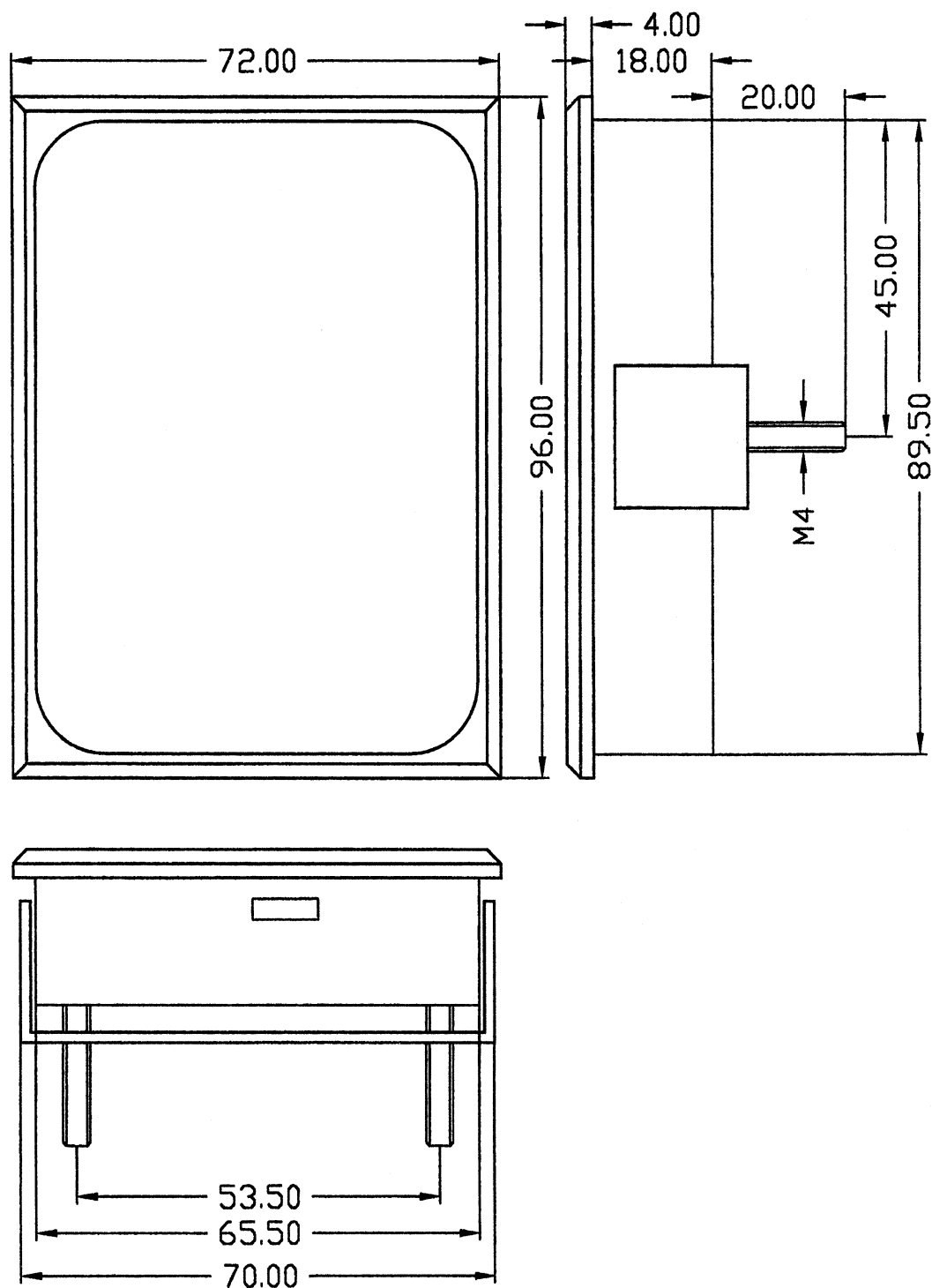
Picture 9: Technical dimensional drawing TERM 5 / TERM 6

6.3.2 TERM 5-H / TERM 6-H

Picture 10: Technical dimensional drawing TERM 5-H / TERM 6-H

6.3.3   TERM 5-T / TERM 6-T
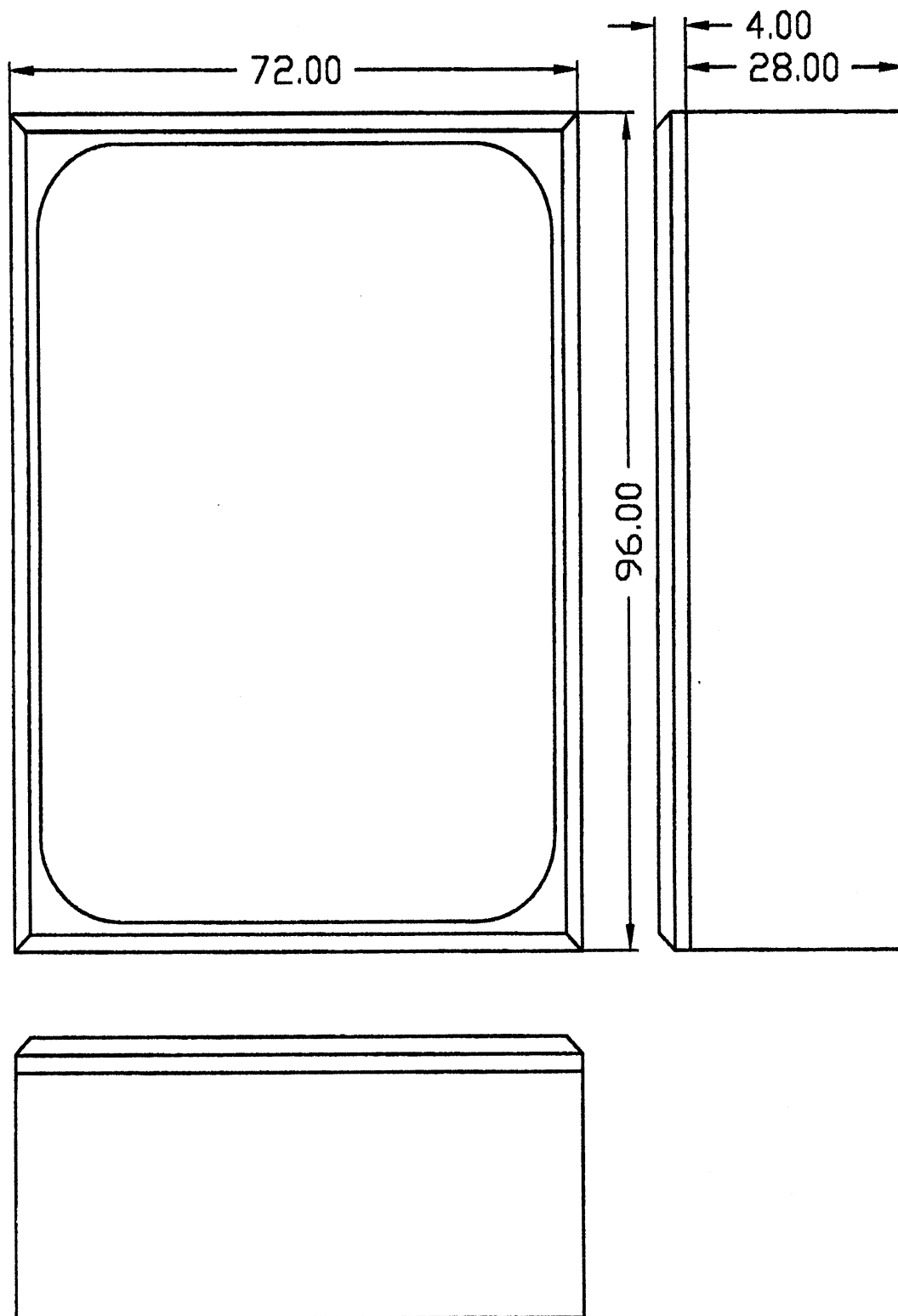
Picture 11: Technical dimensional drawing TERM 5-T / TERM 6-T

6.4   Pin assignment TERM 5/6

The external control unit is suitable for connection through a 5-pin-screw-plug-connection with the following assignment:
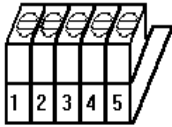
Picture 12: Pin assignment TERM 5 / TERM 6

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

6.4.1   Interface switch-over

The interface switch is to be found under the sticker with the imprint RS232/RS485. In the state of delivery it is set as indicated on the marking of the sticker.The position of the desired interface can be taken from the devices surprint. Please use an appropriate tool to change the position of the microswitch to the left or to the right.

Please note the signal descriptions!

6.5   Programming of several devices with TERM 5/6

TERM 5/6 is network-capable in the version with DICNET-connection, i. e. up to 16 cam controls (LOCON, ROTARNOCK ...) can be connected with TERM 5/6 **at the same time** and they can be programmed by it.
The device number of the device TERM 5/6 is communicating with at the moment appears at the 1. place on the display.

6.5.1   Selecting the device number on TERM 5/6

TERM 5 always communicates with that LOCON whose device number is indicated at the 1. place of the display in hexadecimal spelling (0 to F, see also table in the annex).

After switching on the unit the device number, which is tuned by the rotary switch (0 to F) at the back, is displayed there.
During service this device number can be changed by the keyboard at any time. In standard

mode (see chapter "Definitions") for this purpose the key **Enter** has to be pressed for at least 3 seconds.

Then the displayed ID begins to flash and can be changed with the help of the keys **+** and

– . After adjusting the right value, it is confirmed with **Enter** and from this time on TERM 5/6 communicates with the new selected LOCON, if an instrument with this coding exists in the network.
Should the adjusted value be dismissed and the old ID be restored, this takes place with the key

Esc . In case there is no control system with the chosen ID in DICNET, it appears the display

<p align="center">"- - - - -"</p>

If the TERM 5/6 features the RS232-interface (option), the 1. place shows the actual program, of the connected cam control.

6.6   Display of the executed program via TERM 5/6

When connecting a LOCON with the operating and display unit TERM 5/6 via the RS232-interface, the first place on the left side permanently displays the program that is executed that moment.
This only applies to a RS232-TERM 5/6, as the DICNET-version displays the device number at this place.

6.7   Reading and changing cam control parameters

All cam control parameters that can be reached via the communication profile with GET/SET-PARAMETER can be read and changed via a "menu point" that is integrated in TERM 6.

Starting from the main menu the keys **+** and **–** are pressed for the same time period. Thereupon the function LED shines and a 1 (current parameter number) appears on the display.

Now this number can be changed with **+** and **–** .

If, for instance, the virtual encoder value is to be read / changed, please select (see parameter table in the manual communication profile) the number 19 (corresponds to 13H =

PNR_SCALED_ENCODER_RES). Confirm with **Enter** and the encoder resolution of the con-

nected cam control is displayed (e. g. 1000). To change this value, please press **Enter** again (long). Then the Prog-LED and the Function LED start to flash. Now the value can be changed

with **+** or **–** . Then by pressing **Enter** the new value is loaded into the cam control, the value

is rejected with **Esc** .
Special parameters in X-options can also be handled as described in this chapter.

6.7.1 Possible error messages on the configuration

In case of a wrong application during the configuration might result in error messages:
E34   -> Changing the parameter invalid
E36   -> Parameter not present
E37   -> When programming an angle-time-cam greater than output 16

6.8   Function output change dependent on rotational direction

It is possible to make the change (set and reset) of the outputs dependent on the rotational direction of the encoder, e. g. to avoid that, in case of a machine's downtime, at a switch-point of an output, this output switches permanently by encoder-vibrations for some increments.
If for example an output-change is only adjusted in a positive direction of rotation, the outputs are only changed, if the encoder moves to higher position-values.

It must be considered, that after a reversal of rotation an update of the outputs only takes place, if this position is reached again; e. g. while having a positive direction at position 100 the machine comes to a standstill and then swings back to position 90, first an output-change happens at position 100, even if different program changes are programmed between 90 and 100.

This parameter is programmed as follows:

From the display output indication (see chapter "Programming LOCON ") the parameter is displayed encoded by pressing the key **MODE ESC** and **Enter** (long). This parameter determines the rotational direction for the output-change. The following coding applies:

- 0 = always output-change (default)
- 1 = only output-change when having a positive direction of rotation
- 2 = only output-change when having a negative direction of rotation

In this state the LEDs "Prg.Mode", "On" and "Off" are flashing.

With the keys **+** and **–** the desired value can be adjusted.

Subsequent the programming is either broken off by pressing the key **Esc** and the set value is rejected or by pressing **Enter** the new value is stored permanently in the EEROM.

6.9   Different and common characteristics of TERM 5 and TERM 6

In the previous chapters the devices TERM 5 and TERM 6 were always jointly looked at, even though these are two independent devices that differ in some points.
The main difference is the self-intelligence of the TERM 6, that means it carries out the communication with the user independently and it always exchanges complete data records with the connected cam control. TERM 5, on the other hand, is not active on its own and it forwards information to the cam control, which key is pressed that moment or it receives the information that is to be presented at present from the cam control (LED and display).

Some devices do not support TERM 5 any more, whereas TERM 6 is supported by all cam controls (also old ones).

7   Basic instrument TERM 4 (external display unit)

7.1   Assembly of the unit
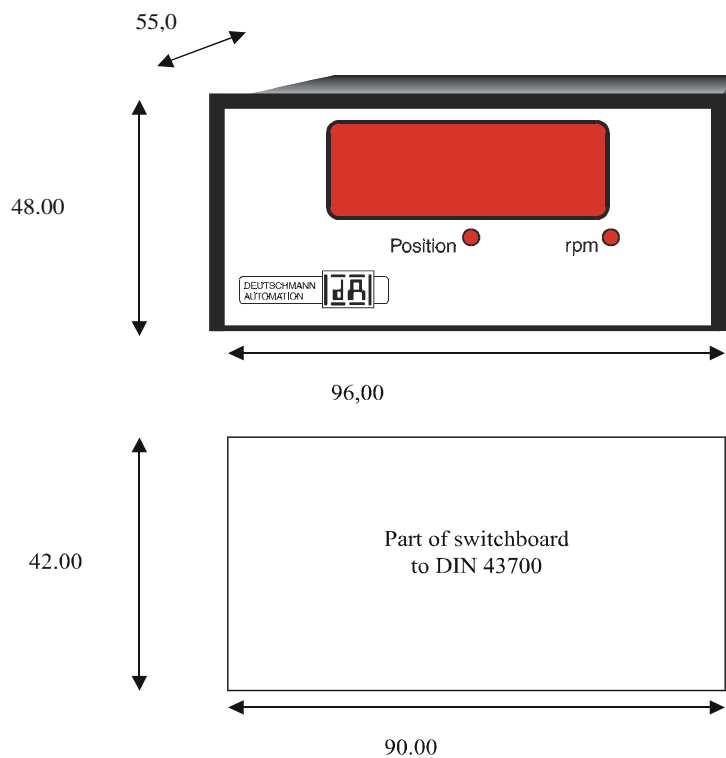
As an additional position and speed-display TERM 4 is available in the housing W96xH48xD55 mm for front sheet installation.
The unit has 4 seven-segment-displays and 2 status LEDs which characterize the position- and speed-display.

At the back next to the plug there is a rotary switch comparable to TERM 5/6, which is necessary in the DICNET-version to adjust the device number of the control system, that data should be displayed by TERM 4. Therefore 16 TERM 4 can be operated in a DICNET at the same time.
The rotary switch of the RS232-variation is without any function.
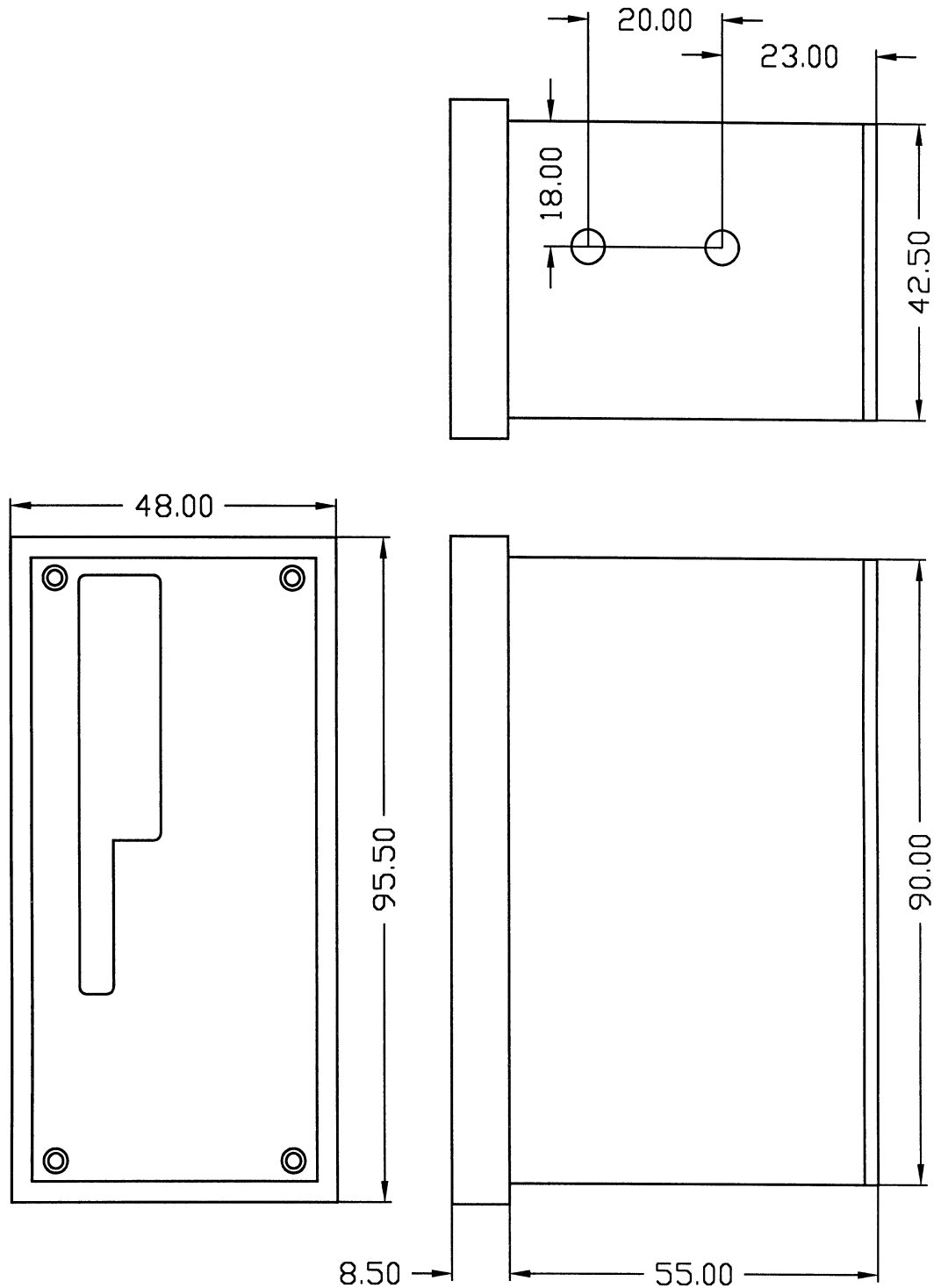
7.2   Dimensional drawing TERM 4

Picture 13: TERM 4

7.3   Technical dimensional drawing

7.3.1   TERM 4

Picture 14: Technical dimensional drawing TERM 4

7.4   Pin assignment TERM 4

The connection is carried out through the 5-pin-plug, identical to the pin assignment of TERM 5 (see chapter 6.4 "Pin assignment TERM 5/6" on page 30).

7.5   Interface switch-over

For more details see chapter "Interface switch-over" on page 30.

8   Networking terminals with cam controls and PCs

The chapter below illustrates certain connection examples between the units both via the DIC-NET bus and 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:

8.1   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.

8.2   RS485 link (DICNET)

A DICNET link is a bus system to which at maximum configuration level 16 cam controls (LOCON 32, LOCON 24 ...), 16 display units (TERM 4), 16 operator terminals (TERM 6, TERM 24 ...) and 1 PC can be connected **simultaneously** via a **twisted two-wire line** which should be shielded.
All "DICNET+" terminals are interconnected and all "DICNET-" terminals are interconnected. The terminals do not need to be reversed as on the RS232 interface.
Likewise, not necessarily there is a connection of the individual device ground potentials as on the RS232 interface; **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.

8.3   Cable type for DICNET®

A shielded, twisted, 2-core cable (twisted pair) is recommended 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 $^*\Omega$ 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 metre from DEUTSCHMANN AUTOMATION.

The minimum wiring with shielding between two bus users is shown in the following illustration:
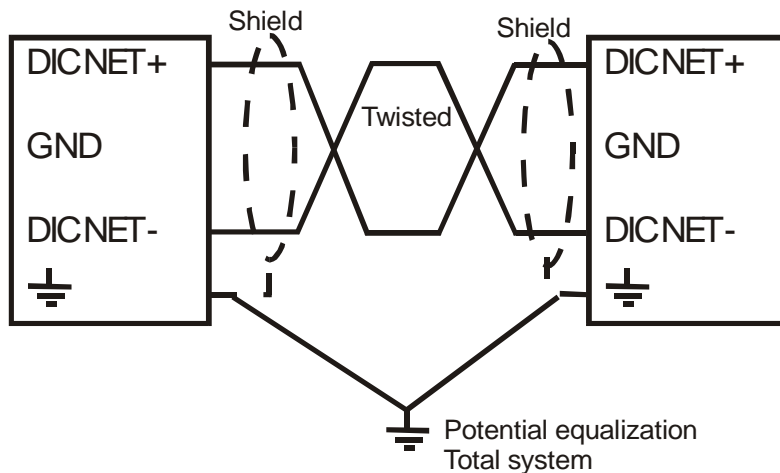
Picture 15: DICNET-wiring

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.

8.3.1   Earthing, shielding

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

8.3.2   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.

8.4   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).

8.5   Connection examples

8.5.1   DICNET link LOCON - TERM

LOCON and TERM are connected as follows via DICNET:
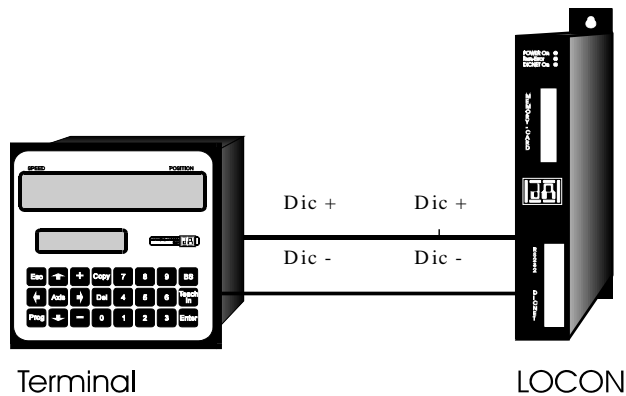
Picture 16: DICNET link terminal - LOCON
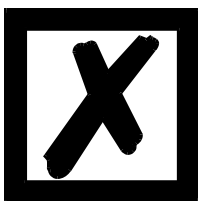
The presented devices exemplary stand for Deutschmann terminals and cam controls of the series LOCON / ROTARNOCK respectively.

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.

8.5.2   RS232 link LOCON - TERM

On the RS232 version, only a point-to-point connection between LOCON and the external opera-
tor 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.
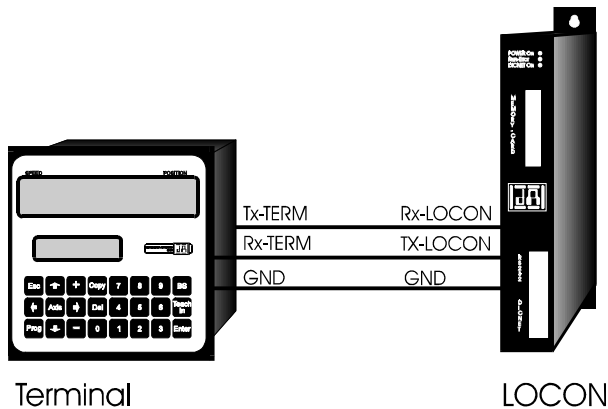
Picture 17: RS232 link Terminal - LOCON
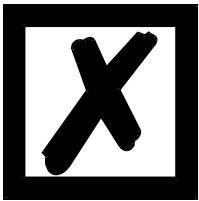
**The presented devices exemplary stand for Deutschmann terminals and
cam controls of the series LOCON / ROTARNOCK respectively.**

8.5.3   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.
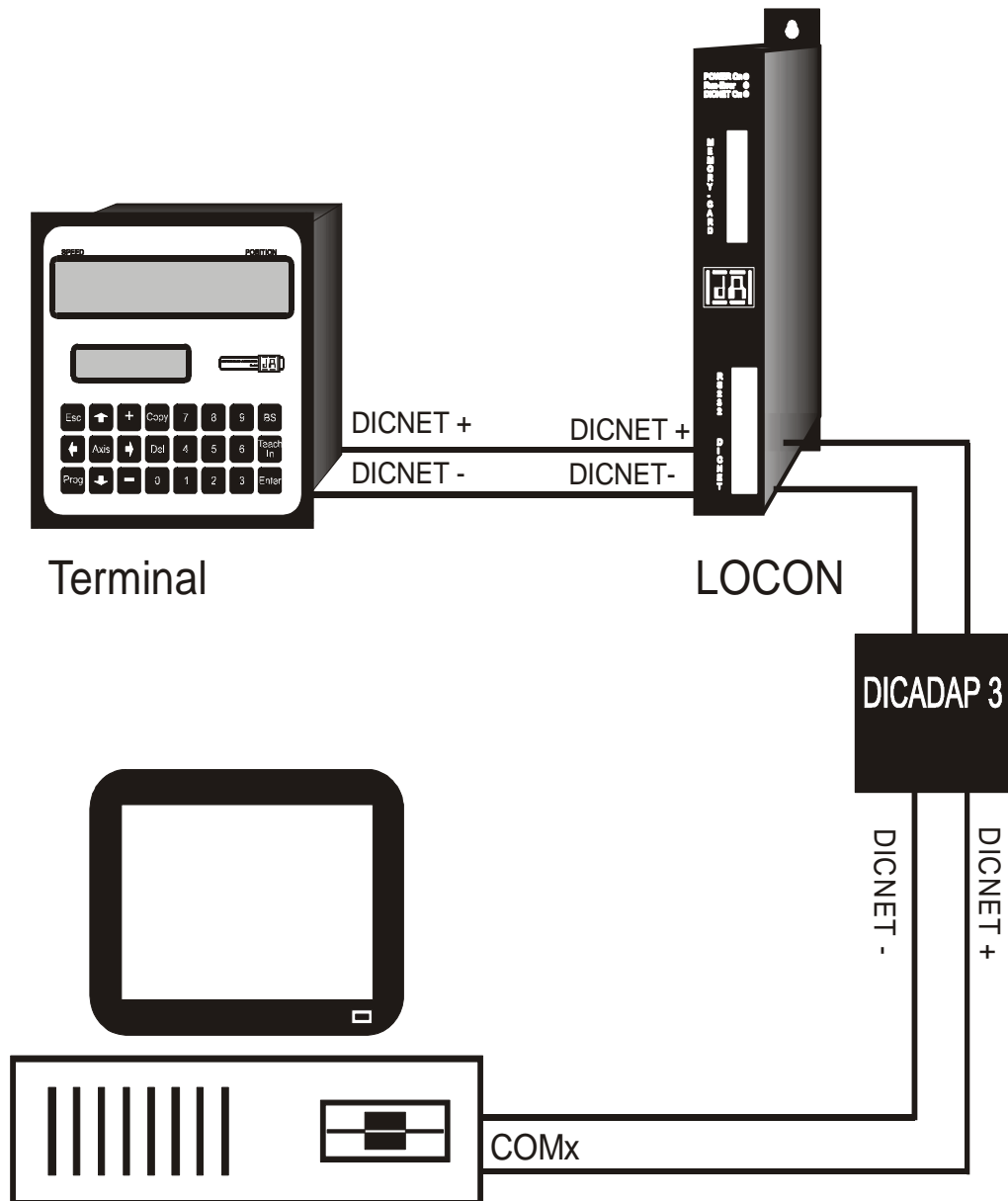
Picture 18: Link DICNET bus to PC

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

9   Programming LOCON

9.1   Basics
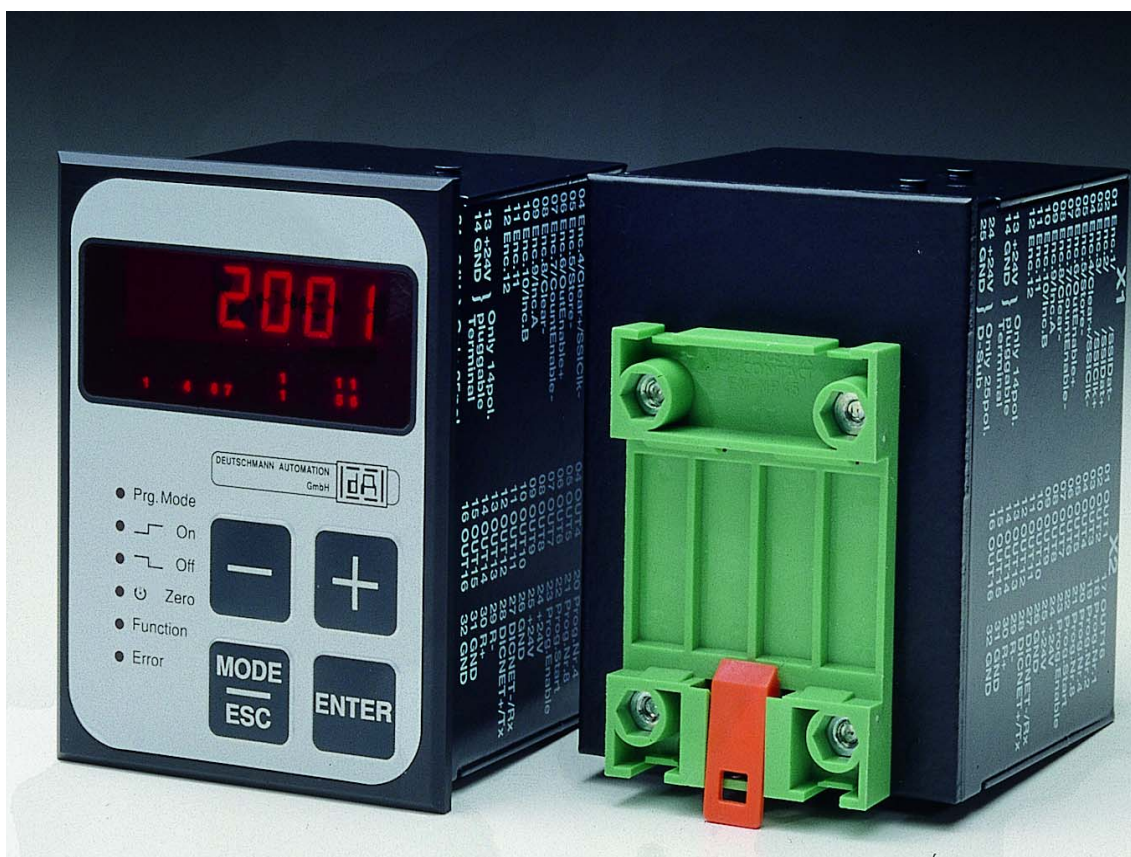
There are several possibilities to program LOCON:

• Input of the switch-on- and switch-off points of the cams through the integrated operation front
• Input of the cams in the TEACH-IN process
• Programming of LOCON offline on a PC with a subsequent download of the program by a serial interface
• Via a fieldbus by using a Fieldbus Gateway

At this point the offline-programming is not described more detailed because it can be taken from the separate program-description "WINLOC".

The other two programming-possibilities are dealt with more detailed in the following chapters. Generally a complete programming of LOCON is possible with the 4 keys, the 7-segment-display and the 6 status LEDs.

9.2   View LOCON 16 / LOCON 17

Picture 19: LOCON 16 / LOCON 17

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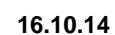
The graphs shown on the following two pages should serve the operators, who have experience in programming cams, as a survey how to program LOCON.
The different states of LOCON are represented by the big boxes; the smaller boxes reflect actions which are caused by pressing a key (represented by arrows).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

Brief Instruction

LOCON 1, LOCON 2, LOCON 16, LOCON 17, TERM 5, TERM 6

Initialisation

Program turn-direction

[+]

[ESC]

[-] → Invert turn-direction

[-]

[ESC]

[+] Display CA Clear All [ENTER]

[ENTER]

Save turn-direction

Display zero-point-moving

[ENTER]

Program zero-point

[+\-] → Change display

[ENTER]

Save zero-point

LOCON 2, 17 / ROTARNOCK 2 ONLY

[-]

[ESC]

Display start-point partially idle-time

[ESC]

[ENTER]

Programm start-point partially idle-time

[+\-] → Change display

[ENTER]

Save start-point

[-]

[ESC]

Display endpoint partially idle-time

[ESC]

[ENTER]

Program endpoint partially idle-time

[+\-] → Change display

[ENTER]

Save endpoint

LEGEND

At the graph are only standardfunctions considered.

All functionkeys are arranged on the right or above.

——————— Keypush normal

- - - - - - - Keypush long

·············· Remove automatically

9.3.1   Definitions

Active program	The program that is finished 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 are 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 program, 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.
Programming release	A change of the program is only possible if a programming release is carried out. For that the pin "PROG_ENABLE" must also have 24V.
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.

9.4   Automatical shifting to the speed display

Instead of the encoder position (optional for LOCON 1) the speed can be displayed in the normal mode. Ordering without any particulars the display takes place in rpm.
The shifting between position- and speed-display is automatically carried out. The position is displayed if the speed falls below 1 rpm; otherwise the speed is displayed.

The speed display indicates an "n" in the second place from the left for the differentiation from position display.

9.5   Zero offset and clear-shift

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.
Instead it is possible at LOCON 2 to program optionally a clear-shift. This clear-shift points out how many increments pass at maximum after a clear-signal, until a reset of the counter should follow.
The exact functioning of this clear-shift can be taken from the following chapters, the programming is the same as of the zero -point-shift and can be looked up in these chapters.

9.5.1   Functioning of an idle time compensated clear-shift

Should a clear-signal cause a reset of the meter reading, if the clear-signal is passive again, after a defined number of increments at the latest, i. e. after a fixed distance, LOCON 2 makes it possible with the help of a clear-shift, that can compensate the idle time.
The length that is to shift at maximum (CV_{Prog}), can be programmed from 0 to 255 in the increments just as you like.
Should the clear-shift be dependent on an idle time, this idle time must be programmed for the output 1. This idle time applies to the cams on the output 0 and to the clear-shift (CV).
The real clear-shift (CV_{Real}) is calculated as follows:

$$CV_{Real} = CV_{Prog} - S_{tot}, \text{ if } S_{tot} <= CV_{Prog}$$

$$CV_{Real} = 0, \text{ if } S_{tot} >= CV_{Prog}$$

S_{tot} is the length, which is covered from output 1 during the idle time.

If, for instance, a shift of 100 increments is programmed and at a meter reading of 123 a clear is sensed, it is ignored as long as after 100 further increments the meter reading 223 is reached, if there's no idle time programmed. With the next counting-pulse the counter is reset to 000.
If a clear-condition already becomes passive before the sequence of 100 programmed increments, e. g. after 20 increments, the reset follows directly with the deactivating of the clear-signal.
After a reset the waiting period of 100 increments starts again.
If an idle time is programmed on the output 1, the clear-shift is reduced according to the formula above.
If the value 0 is programmed as a clear-shift, the counter reset occurs without a time- or course-delay.

The following graph illustrates another example (without idle time compensation) in which the clear-signal is longer than the programmed clear-shift. Then a short clear-shift follows.
The meter reading increases with every falling edge of the counting pulse.
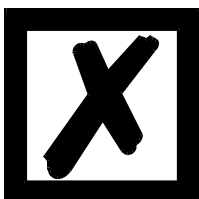
ATTENTION: At least 1 counting pulse has to occur between the falling and the leading edge of clear-, so that clear can be evaluated.
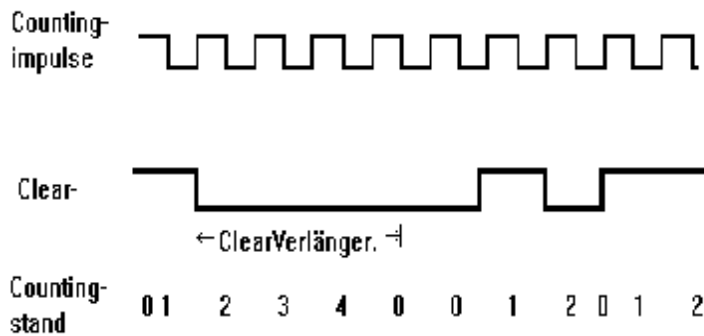
Picture 20: Clear-shift

9.5.2   Reading out the actual zero offset

The programmed zero offset can be read 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.

9.5.3   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 left out in connection with an incremental encoder.

9.6   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. If the displayed program is the active one (it is always at the beginning of the display mode), the middle of the three decimal points lights on the display.

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

9.7   Changing the active program

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

By pressing the key [Enter] (long) a security query takes place (from V 3.33 on) at which point the text „PG_CHG" for „Program change" appears on the seven-segment display.

If this query is also confirmed with [Enter] (long) the program change takes place and the new, active program appears on the display

A break-off of the security query is carried out by pressing the key [Esc]. From that point on the outputs of the LOCON are determined by the new, active program.

A change of the active program (without security query) is also possible via a VG-connection block. A program number as a binary code must be put on the connection block and afterwards a leading edge be produced at the pin "PROG_WECHSEL". The high-level (24 V) must be kept at minimum 200 ms.

Should for example program 7 be activated, the following steps are necessary:

- Program 7 corresponds with the binary code 0111.

- Applying the adequate voltages: PROG_NR8 = 0V0
                                                  PROG_NR4 = 24V 1
                                                  PROG_NR2 = 24V 1
                                                  PROG_NR1 = 24V 1

- Production of the takeover edge: PROG_START = 24V
                                                  Wait 200 ms
                                                  PROG_START = 0V

```
Prog_Nr 1
Prog_Nr 2
Prog_Nr 4
Prog_Nr 8
Prog_Start
                    t1   t2   t3
```

t1 > 1µs
t2 > 1s
t3 > 1µs
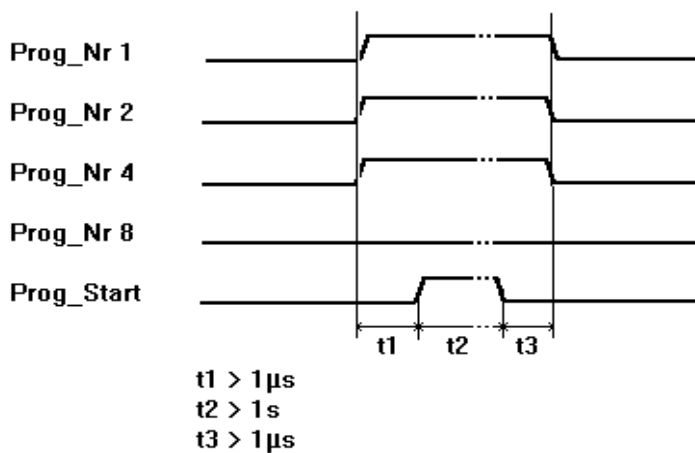
Picture 21: Program change

From software revision V5.4 in the devices LOCON 16, 17 a faster program-changeover routine is used.
This faster routine is always active, when
1. no partial idle time compensation is activated
2. not more than 127 cams exist in any program.
Otherwise the "old" method is used.
The typical changeover time at the "old" method is 750 ms (max. 1 second), at the new method the changeover takes place in max. 280 ms (typical 100 ms).
This time period is extended by max. 200 ms at this new method, when a cam change is carried out before the propram is changed.

At both methods during an up- or download NO program changeover takes place, as otherwise inconsistent data might possibly develop in the EEROM.

9.8 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 dialled 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.
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, or rather the LED "Function", if an idle time is programmed at this 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.

9.9   Displaying existing cams

With the help of the described procedure in the previous chapters 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.

9.10 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 in the programming mode by pressing the key Enter (long) and it is important that the programming release follows by hardware.
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 auto-repeat-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 should be changed, you can return to the display mode with Esc.

9.11 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.

9.12 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 by pressing the

`Esc` -key.

9.13 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.

9.14 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 "Selecting the output number".

After that by pressing the key `MODE ESC` (long) it is changed into the "shift mode". Here it has to be considered that the programming release by hardware took place.
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, because 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.

9.15 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.

9.16 Idle time compensation (ITC)

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 1 idle times can be programmed blockwise only, i. e. an adjusted idle time always applies to a block of 8 outputs, whereas at LOCON 2 idle times can be programmed bit- or blockwise and it is optionally possible to select different switch-on- and switch-off delay-times at a blockwise ITC.

9.16.1 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 but it can not be deleted.

9.16.2 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 now be changed. 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.

9.16.3 Partial idle time compensation

Partial idle time compensation is only available for LOCON 17, provided that the free option Y was ordered.

Partial idle time compensation means that the speed measurement which builds the basis for the ITC, is not realized on the whole encoder field, but only on a part of it.
With it also cams can be shifted dynamically on processes, that do not run with a constant speed on the whole rotation.

9.16.3.1 Display of the starting point of the partial ITC

Based on the display of the zero offset, the starting point of the partial idle time measurement is shown by pressing the key ➖ (long). It is the point, from which the speed measurement for the ITC is carried out.
In the state of delivery it is set to 0.
In this state the LEDs "Function" and "On" flash. Returning to the main menu is possible by pressing the key **Esc**.

9.16.3.2 Programming the starting point of the partial ITC

Based on the display of the starting point (see previous chapter) a change to the programming mode can be achieved by pressing the key **Enter** (long), provided that the programming release by hardware took place.

At that time the LEDs "Function", "On" and "Prg.Mode" flash. With the keys ➕ and ➖ the desired value can be set now. Afterwards the programming is either broken off and the adjusted value is rejected with the key **Esc** or the new value is permanently stored in the EEROM with **Enter**. Anyway a return to the display menu of the starting point occurs.

9.16.3.3 Display of the end point of the partial ITC

Based on the display of the starting point (see above), the end point of the partial idle time measurement is shown by pressing the key ➖ (long). It is the point, to which the speed measurement for the ITC is carried out.
In the LOCON's state of delivery it is set to the maximum encoder value, so that a measurement is always carried out within the complete range. In this state the LEDs "Function" and "On" flash.

Returning to the menu point „Display of the starting point" is possible by pressing the key **Esc**.

9.16.3.4 Programming the end point of the partial ITC

Based on the display of the end point (see previous chapter) a change to the programming mode can be achieved by pressing the key **Enter** (long), provided that the programming release by hardware took place.

At that time the LEDs "Function", "On" and "Prg.Mode" flash. With the keys **+** und **–** the desired value can be set now. Afterwards the programming is either broken off and the adjusted value is rejected with the key **Esc** or the new value is permanently stored in the EEROM with **Enter**. Anyway a return to the display menu of the end point occurs.

9.17 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 the 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, provided that a program release by hardware is available.

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.

9.18 Parameter table LOCON 16/17

Designation	Default	Value range
Initialization parameter		
Counting area	1024 (L16) 4096 (L17)	For incremental encoders
Zero offset	0	
Reversal of rotational direction	0	0 = normal 1 = inverted
Factor Speed indicator	60	(rev./s.)
Configuration parameter		
Encoder resolution	As ordered	Absolute parallel Gray: 360, 512, 720, 1000, 1024,2048, 3600, 4096 SSI Gray: 360, 1024,4096 Incremental: 1024 (16); 4096 (17)
Idle time compensation (ITC)	As ordered	1 = blockwise ITC 2 = bitwise ITC 3 = blockwise, separate switch- on- and switch-off idle time
Device-ID for DICNET (hardware can be configured)	DIP-switch	0..15
Encoder type	As ordered	1 = absolute encoder parallel Gray 2 = incremental encoder 3 = absolute encoder SSI Gray 5 = timer

9.18.1 Parameter description

9.18.1.1 Reversal of rotational direction

The rotational direction of the connected encoder (parallel, incremental or SSI) can be inverted with this parameter.
The reversal of the rotational direction at a configuration via the LCD-display is carried out with the key „±" in the line „fictitious encoder value".

9.18.1.2 Encoder type

This parameter determines the encoder type. At present the following encoders are supported:

• Gray-absolute encoder (parallel) 24V, see parameter table
• Incremental encoder 24V, see parameter table
• Gray-SSI-absolute encoder, see parameter table
• TIMER (value is created internally), see parameter table

9.18.1.3 Encoder resolution

This parameter determines the resolution (inf./rev.) of the encoder.
The available resolutions can be taken from the parameter table.

9.18.1.4 Counting area (for incremental encoders only)

By default when using an incremental encoder at reaching the counting area, a counter overflow takes place. The counting area is adjustable with this parameter. The permissible values can be taken from the parameter table.

9.18.1.5 Kind of idle time compensation

Idle time is the time that passes from setting a cam control-output up to the real reaction of the connected device (i. e. opening a valve).
Generally this idle time is 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).

Idle times can be programmed either blockwise, that means a set idle time is always valid for a block of 8 outputs or bitwise, whereas it is possible to select different switch-on and switch-off delay periods at blockwise ITC.

The adjustment takes place through the following values:

1   =   blockwise idle time compensation
2   =   bitwise idle time compensation
3   =   blockwise idle time compensation with separate switch-on and switch-off times

9.18.1.6 DICNET-device number (GNR)

The device number with which the LOCON logs on the DICNET-bus and with which it is addressed by WINLOC or communicates with TERM 4, is adjustable with this parameter.
This value can not be changed in the menu but the DIP-switch on the back.
This parameter is insignificant if the RS232-interface is used.

9.18.1.7 Zero offset (for absolute encoders only)

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.

LOCON deducts the programmed value of the zero offset from the real encoder value, that means, if the absolute encoder provides value 100 as position and a zero offset of 10 is programmed, LOCON processes the value that way, as if the position 90 is read in.
If a shift to higher values is supposed to happen, the value that is to be shifted has to be deducted from the encoder resolution and it has to be input as zero offset. If in the example above the position 110 is to be processed and an encoder with 1000 inf./rev. is connected, a correction factor of 990 (1000-10) has to be entered.
As in practice in most cases a zero offset takes place at the zero point of the machine, it is sufficient to enter the displayed item value as correction factor (TEACH-IN).

If LOCON is operated with an incremental encoder, the zero point correction is not applicable.

9.18.1.8 Scaling for speed indicator

With this parameter the speed indicator can be adjusted to the given application. A scaling ranking from 0...9999 rev./s is possible.
As a default a value of 60 is preset; that means the speed is indicated in rev./min.

10 Commissioning and self-test

10.1 Commissioning of the terminal

Please follow the procedure below when commissioning the terminal:

1)   Connect the terminal to the required cam control
2)   Connect the 24 V supply voltage

The terminal now conducts the self-test described in the following chapter, checks whether a user with the No. in accordance with the DIP switch setting is connected and then establishes the connection (provided this user is present).
The duration of the power-up phase, until the unit is ready for operation, depends on the number of network users and may take up to 10 seconds.

You will see message "not present" if no user is found with the set No.

10.1.1 Self-test of the terminal

After power-up of the terminal, the terminal conducts a self-test which takes a few seconds. The unit is then ready for operation.

The following tests are conducted during the self-test:

- Test of the entire RAM area or defective memory addresses
- Checksum test of the EPROM
- Display test; all output indicators light

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

10.2 Commissioning of the cam control

The commissioning procedure for the LOCON is as follows:

1)   Connection of the encoder
2)   Connection of the "ProgEnable" input if programming is to be allowed
3)   Connection of the external program selection if required
4)   Connection of the status signals if an incremental encoder is used
5)   Connection of the outputs used
6)   Connection of the serial interface, if required
7)   Connection of the 24 V power supply

The LOCON now conducts the self-test described in the following chapter, then generates the cam tables, after which it is ready for operation, i.e. the program last active (the last time the system was powered down) is executed.
The duration of the power-up phase until the unit is ready for operation depends on the number of programmed cams and may take up to 10 seconds.
A status message together with the software version information is displayed on any optionally connected PC.

If any error conditions which LOCON can detect itself have occurred, a corresponding error number is displayed. Please refer to chapter "Error messages" for the significance of this number and the actions required.

Moreover, the optional Run-Control relay remains in dropped-out condition and the corresponding status LED "Run Error" lights.

10.2.1 Self-test of the cam control

After power-up of the LOCON, the LOCON conducts a self-test which takes a few seconds. The unit is then ready for operation.

The following tests are conducted during this self-test:

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

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

11   Technical data

11.1   Technical data LOCON 16

Characters	Basic equipment	Option
Operating voltage	24 Volt DC ± 20%, max. 0.2A (no load)	
Data protection	EEPROM (at least 100 years); no battery required	Via transfer program on PC
Programs	16	
Number of cams	2000 cams, optionally distributable to channels and programs; cams are interchangeable linewise	
Zero-point offset	Programmable over the entire range	
Position recording	360 inc.-absolute encoder Gray-code parallel 24 V (resolution 1°) 1000 inc.-absolute encoder Gray-code parallel 24 V (resolution 0,36°)	Incremental encoder (max. 10 Khz, max. 1024 positions SSI Timer
Outputs	16, Each output 24V / 0.3A plus switching (PNP), short-circuit proof. Total current of the output block maximum 1A at 25°C and full load	16, short-circuit proof, 24 Volt/0.3A, plus-switching, lockable
Inputs	10 inputs for encoder signs 4 inputs for program selection 1 input program change 1 input program release	For incremental encoders: 2 inputs CLEAR 1 input COUNTER_ENABLE 1 Input OUTPUT_ENABLE 1 Input STORE_COUNTER
Idle time compensation (ITC)	0 ... 999ms (blockwise)	
Cycle time	500µs	
Rotational speed of the encoder shaft	360 inc.-encoder failure: 1inc 2inc 3inc 4inc ... rev./min.: 333 666 1000 1333	1000 inc.-encoder failure: 1inc 2inc 3inc 4inc ... rev./min.: 120 240 360 480
Programming	Via integrated operating panel Teach-In	Offline/online via PC operating panel TERM 5, 6, 24, 32 available without operating front open communication profile
Display	Encoder position	Encoder position/rotational speed RUN-CONTROL
Interface	RS 485 DICNET®-network up to 16 axis RS232 (V.24)	
Connections	Encoder through a 25pin D-Sub, outputs etc.through a screw-plug-connector	All connections through screw-plug-connector
Installation	Front panel installation	DIN-rail mounting (version without control front)
Type of protection	IP54	
Dimensions	72 x 96 x 70 mm (WxHxD)	
Weight	Approximately 450 g	
Switchgear opening	66 x 90 mm	

11.2 Technical data LOCON 17

Characters	Basic equipment	Option
Operating voltage	24 Volt DC ± 20%, max. 0.2A (no load)	
Data protection	EEPROM (at least 100 years); no battery required	Via transfer program on PC
Programs	16	
Number of cams	2000 cams, optionally distributable to channels and programs; cams are inter-changeable linewise	
Zero-point offset	Programmable over the entire range	
Position recording	Absolute encoder Gray-code parallel 24V up to 12 bit (2...4096) 360-inc.- or 1000 inc-absolute encoder Gray-code)	Incremental encoder (max. 100 Khz, max. 4096 positions) SSI Timer
Outputs	16, Each output 24V / 0.3A plus switch-ing (PNP), short-circuit proof. Total cur-rent of the output block maximum 1A at 25°C and full load.	Lockable switching dependent on rotational direc-tion
Inputs	12 inputs for encoder signals 4 input for program selection 1 input program change 1 input program release	For incremental encoders: 1 inputs CLEAR 1 input COUNTER_ENABLE 1 input OUTPUT_ENABLE 1 input STORE_COUNTER
Idle time compensa-tion (ITC)	0 ... 999ms, partial, block- or bitwise	Separate switch-on- and switch-off delay at blockwise idle time compensation
Cycle time	150µs (without ITC) 200µs (with blockwise ITC) 550µs (with bitwise ITC)	High speed (60µs, 100µs, 250µs)
Rotational speed of encoder shaft (Umin^{-1})	360 inc.-encoder: failure: 1inc 2inc 3inc .. without ITC 1110 2220 3330 rev./min. blockw. ITC 833 1666 2450 rev./min. bitwise ITC 303 606 909 rev./min.	1000 inc.-encoder: failure 1inc 2inc 3inc .. without ITC 400 800 1200 rev./min. blockw. ITC 300 600 900 rev.min. bitwise ITC 110 220 330 rev./min.
Programming	Via integrated operating panel Teach-In	Offline/online via PC with operating front TERM 5, 6, 24, 32 available without front panel open communication profile
Display	Encoder position/rotational speed	Run-Control
Interface	RS485 DICNET®-network up to 16 axis RS232 (v.24)	All connections through screw-plug con-nector
Connections	Encoder through a 25pin D-Sub, outputs etc. through screw-plug connector	All connections through screw-plug con-nector
Installation	Front panel installation	DIN-rail mounting (version without oper-ating front)
Type of protection	IP54	
Dimensions	72 x 96 x 70 mm (WxHxD)	
Weight	Approximately 450g	
Switchgear opening	66 x 90 mm	

11.3 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 (BxHxT) 72 x 96 x 28 mm (BxHxT) DIN-rail version	72 x 96 x 18 mm (BxHxT) 72 x 96 x 28 mm (BxHxT) 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

Recommendation for new customers:
For new projects please directly use the more intelligent TERM 6!

11.4 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 (BxHxT)
Switchgear opening	42 x 90 mm
Operating voltage	10 - 30 VDC

11.5 Specification of the RS232-transmission protocol

On request LOCON is in the position to provide information on

● speed
● encoder position
● state of the outputs

via the RS232-interface (9600 baud, 8 data bits, 1 start- and 1 stop bit, no parity bit).
The following 4-byte-order sequence must be sent to LOCON via the RS232-interface (all values binary coded):

24   04   04   Cycle time

The first 3 bytes serve to start a cyclic transmission of the above information, where the 4. byte (cycle-time) gives the time-raster in 10ms-steps. If for instance the sequence 24 04 04 100 is transferred, LOCON sends every second its information via the serial interface.

LOCON sends a data record of 8 bytes cyclically, which is coded as follows:

1. Byte: Identification (always 26)
2. Byte: If > 127, speed follows then, otherwise position
3. Byte: Speed/position (low byte)
4. Byte: Speed/position (high byte)
5. Byte: Status (without meaning)
6. Byte: Output state 9..16
7. Byte: Output state 1..8
8. Byte: Actual program

The information, that is just displayed on the integrated operating front is always sent as 3. and 4. byte (see also chapter "Automatical shifting to the speed display").

12 Technical details

12.1 Specification of the input levels

Logical High:> 16 Volt< 10mA (typ. 5mA)
Logical Low: < 4 Volt< 1mA

12.2 Specification of the output drivers

The used outputs in LOCON are short circuit proof and can drive maximum 300mA per output with a normal ambient temperature. 8 outputs of a driver (1..8 9..16, 17..24, 25..32, 33..40, 41..48, 49..56, 57..64) that belong together can be operated with a maximum of 1A at 25°C and full load.
If more than 300mA per output should be required, it is possible to switch more outputs together (up to 3 outputs per driver). In this case up to 900mA can be driven.
If several outputs are switched together, the switch-on- and switch-off points in LOCON must be programmed absolute identically. Otherwise the short circuit control reacts.

In case of a durable short-circuit or an overload the necessary outputs are switched off, and a corresponding error message is indicated on the display.

When switching inductances (coils, valves) free-wheeling diodes have to be put directly at the inductances (see chapter "EMC Directives for products of Deutschmann Automation").

12.3 Switching accuracy of Deutschmann cam controls

The accuracy of cam controls is influenced by four parameters:

1) Switch delay (SD)

This time is constant and results from the calculating time the cam control requires from reading-in the encoder value up to setting the output driver.

2) Repeat precision (RP)

This tolerance range results from the asynchronous scanning of the encoder. Ideally the encoder is directly scanned after a change, in the worst case the encoder value changes directly after reading-out the cam control.

3) Resolution

This value indicates the length of the shortest cam, which is definitely evaluated by the cam control.

4) Idle time resolution (ITR)

This error appears only, if an idle time is programmed for the adequate output. It's given in ms and represents the scanning time of the encoder speed, which serves as a basis of the ITR.

Generally the SD and the RP are lower than the cycle time of the cam control. That means, the real switch point is between the moment "switch-on point + SD" and "switch-on point + SD + RP", as it is explained in the following graph.

Without idle time compensation (ITC) the resolution is one increment, as long as the maximum encoder speed is not exceeded; i. e. also a 1-increment-long cam is perfectly recognized and set.

By exceeding the encoder speed ($V_{encoder}$) n-times, the resolution increases appropriate to n increments.

By working with idle time compensation the error increases only by one increment, because the correction of ITC, which is caused by the implemented "dynamic brake" at LOCON, comes to maximum $\pm$ 1 increment at each change of the encoder position.

In summary the following formula can be set up:

Without idle time compensation:

Real switch-point = ideal switch-point + SD (const.) + RP

SD   < Cycle time (const. typical cycle time/2)
RP   < Cycle time (varying between 0..cycle time)
Resolution = n increments, when $V_{encoder} < n * V_{encoder\ Max}$

With idle time compensation:

Real switch-point = ideal switch-point + SD (const.) + RP + ITR

SD   < Cycle time (const. typical cycle time/2)
RP   < Cycle time (varying between 0.. cycle time)
ITR   = Resolution of the ITC (typical 1ms)
Resolution = n increments, when $V_{encoder} < n * V_{encoder\ max}$, with $V_{encoder}$ const.
Resolution = n + 1 increments, when $V_{encoder} < n * V_{encoder\ max}$, with $V_{encoder}$ variable

12.3.1 Time diagram
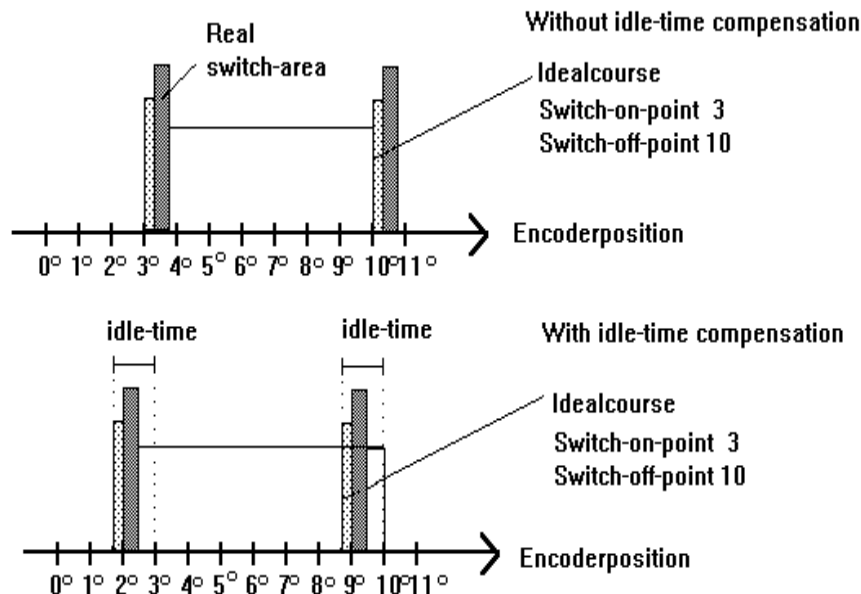
 Picture 22: Time diagram - Idle time compensation

12.4 Environmental specifications of cam controls of the LOCON series

Storage temperature:	-25°C.. + 70°C
Operating temperature:	0°C .. 45°C (without forced convection)
	0°C .. 65°C (with forced convection)
Relative humidity:	Max. 80% no condensation,
	no corrosive atmosphere
Enclosure:	IP 20 (in the case of front-panel installation IP 54 from the front)
Shock:	15 G/11 ms
Vibration:	0.15 mm/10..50 Hz, 1G/50..150 Hz
Weight:	LOCON 16 / LOCON 17 450 g

12.5 Operation mode of the idle time compensation

All mechanical circuit components which are usually connected to a cam control (e.g.: flood-gates, magnetic valves...) feature idle time that means, between accessing the circuit component and the mechanical reflex lies a constant time, the idle time.

The compensation of this idle time depends on the speed of the cam control.
The following processes of idle time compensation are possible:

• path-dependent idle time compensation (standard process in every Deutschmann cam control)
• time-controlled idle time compensation
• direct idle time compensation (without dynamics brake)

Each of the above methods has advantages and disadvantages and is suitable better or worse for a defaulted application.

All methods have in common, that the required idle time value is determined again in every cycle of the cam control in dependence of the current speed. In this case, the idle time value indicates for how many increments the outputs must be activated earlier in order to compensate the idle time of the connected circuit component.

If the machine - at which the cam control is operated - is in an acceleration stage, the current computed required idle time value deviates from the actual idle time value. In this case, the difference between actual and required value only depends on the acceleration. The following methods now differ in the kind and manner when and how the actual idle time value is changed.

12.5.1 Path-dependent idle time compensation

With this method the actual idle time value is adapted for maximal ± 1 increment during every item modification. By that it is guaranteed that no cams are skipped over during the acceleration stage of the machine and that during the braking phase no double cams (see chapter "Time-controlled idle time compensation") occur. The worse dynamics is disadvantageous in the case of this procedure and therefore combined the fact, that with a brake application, that is more rapid as the adjusted idle time, the outputs are frozen on a wrong value in the standstill, as only during a machine movement as well as an item modification a change of the idle time actual value is allowed.

12.5.2 Time-controlled idle time compensation

With this method the actual idle time value is adapted for maximal ± 1 increment in every cycle of the cam control. By that it is guaranteed that no cams are skipped over during the acceleration stage of the machine, but double cams can occur during the braking phase; that means if a complete cam is between the actual encoder position and the encoder position which was slipped by the idle time compensation, the cam appears twice at the output.

12.5.3 Direct idle time compensation

With this method, the required idle time value is undertaken in every cycle as an actual idle time value. Because of this a very high dynamics is achieved but cams can be skipped over during the acceleration and during braking double cams can occur.

12.5.4 Optimization of dynamics

In order to achieve an adaptation of the cam shift to a changed speed (high dynamics) as fast as possible, the cam tracks which are idle time compensated should be placed onto the first outputs (independent of the chosen method of idle time compensation), as - depending on the system - the last compensated output determined the cycle time of the idle time calculation. In this case, the cycle time corresponds to the last compensated output in mS. If the outputs 10,12,14,15 are idle time compensated for example, it results an idle time compensation - cycle time of 15 mS. But if these 4 cam tracks are programmed on the outputs 1..4, a cycle time of 4 mS is achieved.

12.6 DICNET$^{®}$

DICNET$^{®}$ (**D**EUTSCHMANN **I**ndustrial **C**ontroller **Net**) is a multi-master fieldbus whose physical layer complies with the ISO-OSI Layer Model of DIN 19245, part 1, i. e. a connection is established between all users in the network with one RS485 two-wire line.

The physical arrangement is thus a bus system on which the users can be connected and disconnected as required.

Logically, the system comprises a token ring, i. e. only the user granted bus access authorization (token) may send on the bus. If this user has no data for another user, it forwards the token to its neighbor which was determined in a configuration phase.

This principle achieves a deterministic bus cycle time, i.e. the time (worst-case) until a data packet can be sent can be computed precisely.
Automatic reconfiguration occurs when a user is connected or disconnected.

The transmission baud rate is 312.5 kbaud with a length of 11 bits/byte. A maximum of 127 users may be operated on one bus, whereby data packets of maximum 14 bytes per cycle can be sent. An automatic check of the received information is conducted and an error message is issued should a transmission error occur twice.

The maximum extent of the network may not exceed 500 m.
In order to avoid transmission errors, it must be ensured that both ends of the bus are terminated correctly.

12.7 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 has been 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.
Through this it is also possible to make the LOCON capable for fieldbuses with Deutschmann UNIGATES (Profibus, Interbus, CANopen, Ethernet, ...).

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.
Moreover, with Deutschmann UNIGATEs it is possible to make the LOCON-family capable for fieldbuses (Profibus, Interbus, CANopen, Ethernet, ...).
On request, we are able to supply information on this interface in the form of the manual "Communication profile for DEUTSCHMANN AUTOMATION cam controls".

12.8 Coding device numbers

The device number is set in hexadecimal code on the rotary switch.
The following assignment applies:

Display	Device number	Binary coding			
		8	4	2	1
0	0	0	0	0	0
1	1	0	0	0	1
2	2	0	0	1	0
3	3	0	0	1	1
4	4	0	1	0	0
5	5	0	1	0	1
6	6	0	1	1	0
7	7	0	1	1	1
8	8	1	0	0	0
9	9	1	0	0	1

A	10	1	0	1	0
B	11	1	0	1	1
C	12	1	1	0	0
D	13	1	1	0	1
E	14	1	1	1	0
F	15	1	1	1	1

13 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:

## 13.1 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".

13.2 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.

13.3 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 checked 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.
107	DSI Time-out error	
108	SSI Time-out error	
111	SSI Gray code error	

13.4 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	

14 Servicing

Should questions arise that are not covered in this manual you can find further information in our

- FAQ/Wiki area on our homepage www.deutschmann.com or directly in our Wiki on
    www.wiki.deutschmann.de
- Corresponding Manual of the used Cam Control

If your questions are still unanswered please contact the responsible sales partner (see www.deutschmann.com) or contact us directly.

Please note down the following information before calling:

- Device designation
- Serial number (S/N)
- Article number
- Error number and error description

You can reach us during hotline hours which are as follows:

Monday to Thursday from 8 am to midday and from 1 pm to 4 pm, Friday from 8 am to midday (CET).

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Central office and sales department	+49 6434 9433-0
Technical hotline	+49 6434 9433-33
Fax sales department	+49 6434 9433-40
Fax technical hotline	+49 6434 9433-44
E-mail technical Hotline	hotline@deutschmann.de

14.1   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 24V supply voltage (± 0.5V) 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.

Devices, that are sent in without an error description undergo a standard test. You have to bear the costs for that test even though no defect was found.

14.2   Internet

The current software WINLOC32 is available for download from our Internet-homepage www.deutschmann.com. There you can also find topical information on Deutschmann products, instruction manuals and a list of our distribution partners.

15   Appendix

15.1 Description and connection of the DICNET®-Adapter

15.1.1 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