Operating instruction

DigiCal **Digital Thermometer**

DCS 2

Safety notes:

Before operating the equiqment please read carefully all the instructions and safety notes.
If you have any questions please phone us!

Follow the instructions on setting up, operation etc. This is the only way to avoid incorrect operation of the equipment and to ensure full warranty protection.

- Transport the equipment with care!

- Equipment and ist internal parts can be damaged:

  – by dropping

  – by shock.

- Equipment should only be operated by technically qualified personnel!

- Do not start up the equipment if

  – it is damaged or leaking

  – the supply cable is damaged.

- Switch off the equipment and pull out the mains plug for:

  – servicing or repair

  – before moving the equipment!

- Have the equipment serviced or repaired by properly qualified personnel only!

The Operating Instructions include additional safety notes which are identified by a triangle with an exclamation mark. Carefully read the instructions and follow them accurately! Disregarding the instructions may have serious consequences, such as damage to the equipment, damage to property or injury to personnel!

We reserve the right to make technical alterations!

Content

LAUDA

Explanation of signs:

⚠	Danger:	This symbol is used where there may be injury to personnel through incorrect handling.
☞	Note:	Here spezial attention is drawn to some aspect. May include reference to danger.
⇨	Reference:	Refers to additional information in other sections.

DigiCal DCS 2

1. Control and functional elements

DCS 2 front view

| Measuring port for channel 2 | | Temperature-Measuring probe channel 1 (firmly connected) |

| Control panel (Keys) | ON/OFF - switch | Righthand adjustable base |

LAUDA

DCS 2 rear view

| Analogue outlput 0-1V for channel 1 (red=plus) | Analogue output 0-1V for channel 2 (red=plus) |

| RS 232 Interface (9 pins) | Temperature measuring probe channel 1 (firmly connected) | Power supply input |
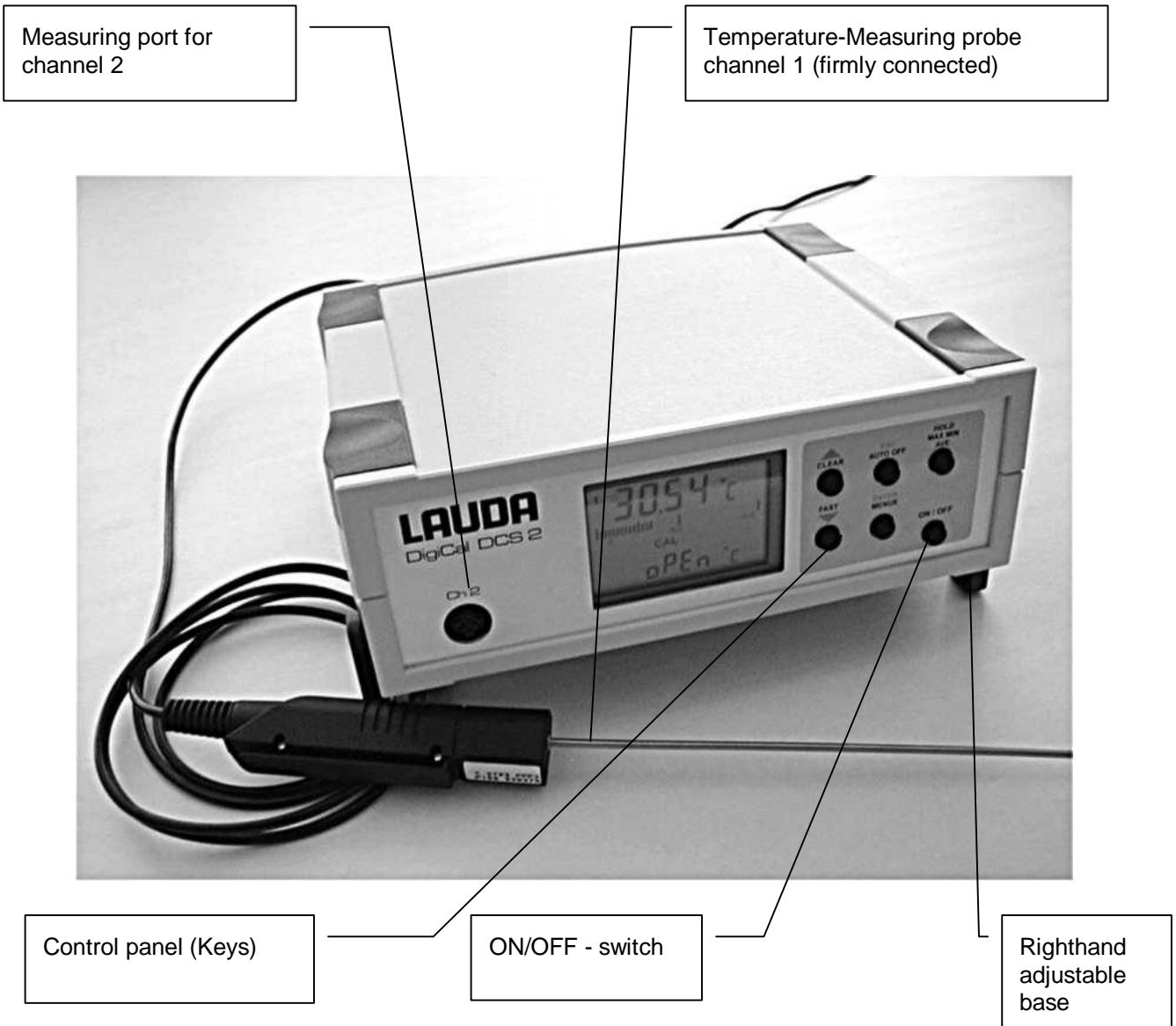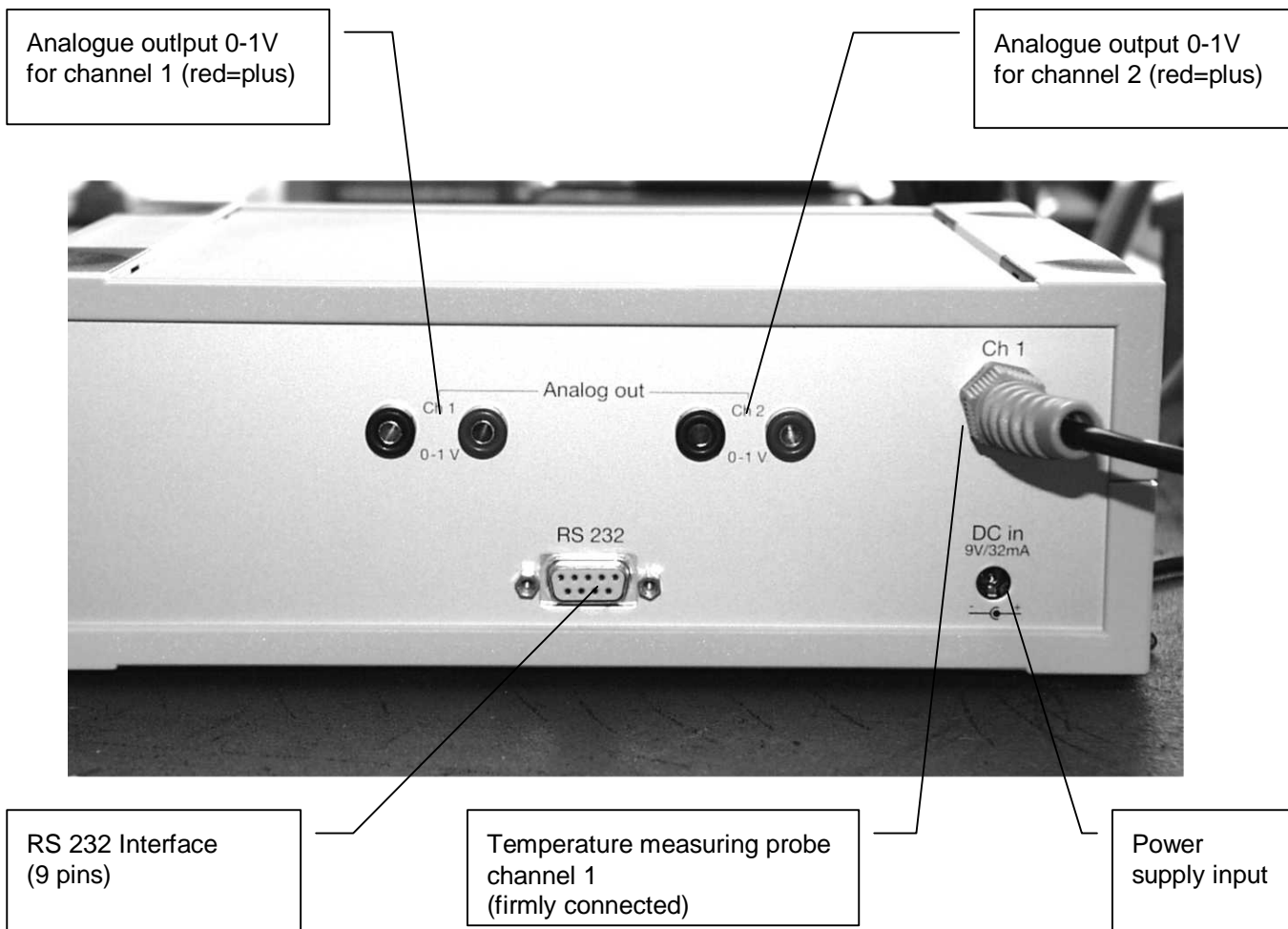
2. Handling / Introduction

2.1 General advice

☞
- For cleaning the instrument please do not use abrasive cleaner but a dry or wet piece of cloth.
- Please store the measuring instrument in a dry and clean place.
- Avoid any force like shocks or pressure to the instrument.
- Do not use force to connect the probe or interface plugs in. The interface plug differs from the probe.

⇒
- If no sensor is connected to the instrument while switching on „*oPEn*" will be indicated on the display (⇨ chapter 4 Error codes)

2.2 Operation

Please kindly check if the provided mains plug unit is working properly with your power supply,. The standard equipment is for 230V; 50/60Hz power supply. If your mains supply a different voltage, you need the universal (all) mains unit (90-260V; 50/60Hz). Please connect first the measuring device with the suitable mains plug unit (see picture on the back side of the device) and then connect the mains plug with the mains supply socket. (⇨ 3 Power supply).

The measuring probe 1 is firmly connected to CH 1.

If you would like to connect a second measuring probe: Plug the second probe into the socket CH 2 of the measuring device. The connection sockets on the housing are marked accordingly a CH 2, RS 232 or Analogue Out.

2.3 Switching on and off

By operating the ON/OFF-key the instrument will be switched on or off.

After switching on the instrument indicates a full segment test for 1,5 sec.

Afterwards the instrument shows the calibration-code and the adjusted measurement category for channel 1 (e.g. [*oFF* for standard distinguishing line and P for Pt100).

In the following the calibration data of the second channel (if available) will be shown.

Fig 1: Example of channel information after switching on:

¹*26FS* P
FFEb
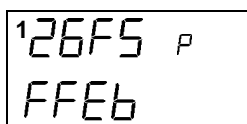
Channel-1 calibration based on the calibration code of the probe..

Now the thermometer starts operating in measurement mode indicating the actual measurement value. All instruments display the measurement value of channel 1 on the top display line (large display line). Underneath the trending bargraph is shown. The second channel of our 2-channel instruments would be displayed on the bottom line (small display line).
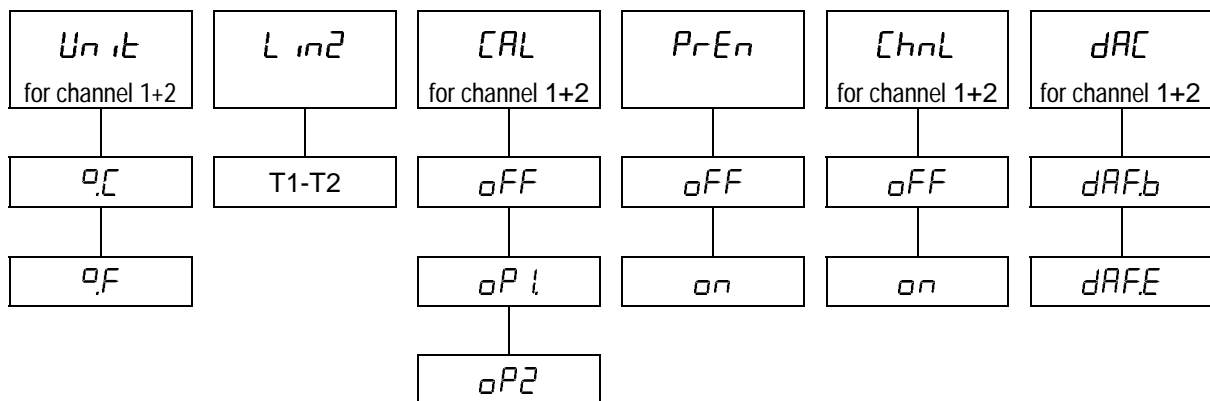
2.4 Menu

The adjustments of the instruments such as like the temperature unit, calibration of probes, deactivation of channels and others are resulting from the structure of the menu.
You will reach into the main menu by pressing [**ENTER/MENUE**]. With the up and down keys [▲▼] you can choose your required menu item.

Push [**ESC**] to be back in the measuring mode.

up and down keys [▲▼]

key [**ESC**]

key [**ENTER/MENUE**]
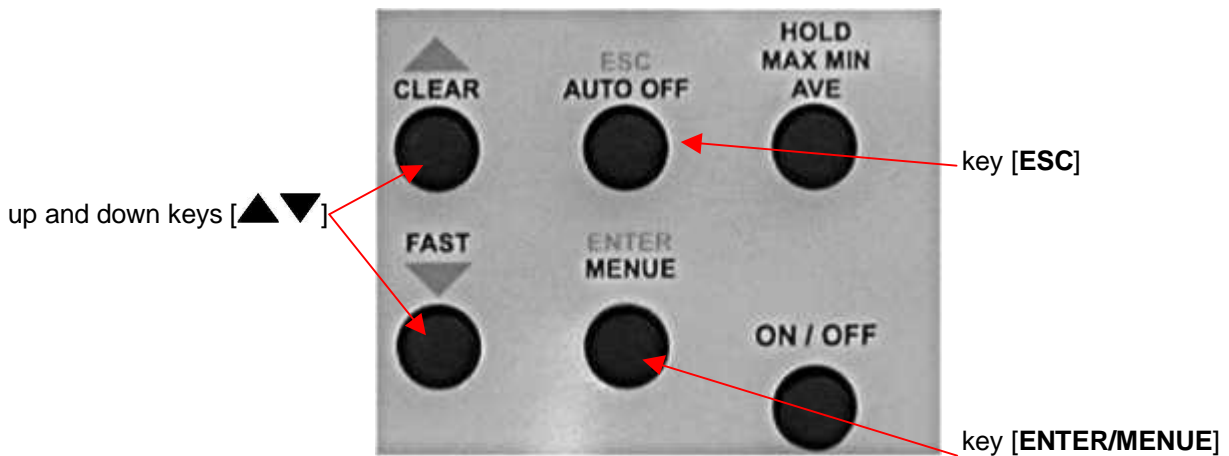
Menu structure

Press the key ▲ accordingly to pass through the menu in the displayed direction. Using the key ▼ it can be started from the opposite direction at dAC .

Unit for channel 1+2	L in2	CAL for channel 1+2	PrEn	ChnL for channel 1+2	dAC for channel 1+2
°C	T1-T2	oFF	oFF	oFF	dAF.b
°F		oP1	on	on	dAF.E
		oP2			

2.4.1 Measuring unit switching °C and °F - $Un\ it$

$Un\ it$ **= Measuring unit**

Measuring unit temperature (°C=Celsius, °F=Fahrenheit).

To change the measuring unit press **[ENTER/MENUE]**. Use the up and down keys [▲ ▼] to select $Un\ it$. Press again **[ENTER/MENUE]**. Of the left corner of the display appears a small **1**, which indicates the selected channel. For changing the channel use the up and down keys [▲ ▼]. Press **[ENTER/MENUE]** to confirm. On the right corner of the display appears °C or °F. Use the up and down keys [▲ ▼] again to adjust the requested measuring unit and press **[ENTER/MENUE]** to confirm.

Press **[ESC]** to get back to the measuring mode.

Display	Keys	Function
$Un\ it$	ENTER/MENUE	
¹$Un\ it$ ₂$Un\ it$	up and down keys [▲ ▼]	select the channel 1 or 2
¹$Un\ it$	ENTER/MENUE	
¹$Un\ it$°C ¹$Un\ it$°F	up and down keys [▲ ▼]	select the measuring unit [C] or [°F]
	ENTER/MENUE	To keep the amended value
	ESC	To escape without retention

2.4.2 Temperature Difference– $L\ in2$

To display the difference between the two temperature channels push **[ENTER/MENUE]**. Use the up and down keys [▲ ▼]to select $L\ in2$. Push again **[ENTER/MENUE]**. On the right corner of the display appears a **T1–T2**. Use the up and down keys [▲ ▼]to adjust the requested selection. Push **[ENTER/MENUE]** to confirm.

Push **[ESC]** to be back in the measuring mode.

☞ Both channel have to be activated for showing the difference temperature.

2.4.3 Calibration function - CAL

☞ Despite high quality manufacturing techniques, each probe is slightly different from specified standards. To eliminate inaccuracies caused by exchanging or ageing of probes, the instrument offer easy calibration functions which guarantee that the system accuracy is always as good as if the instrument was specifically calibrated to the individual probes in our laboratory.

The instruments offer three calibration options:

- $[oP1]$: LAUDA-factory calibration, encoded calibration with optimum accuracy. Probe and electronics are being calibrated at the same time. Therefore the accuracy reaches 0,03°C for temperature range –100°C to +150°C.
  This calibration is stored as $oP1$ calibration code.

  Please note that the accuracy will be 0,05°C in case another probe is connected that was calibrated without the electronics.
  (This probe data can be read as a 2x4 digits code on the handle of the LAUDA DigiCal probes and results from the 2-point-comparison method $oP1$.

- $[oP2]$: Calibration by physical standard references with the best possible system accuracy for a user's calibration (calibration with comparative standards: 1-point, 2-point or 3-point-comparison possible).

- $[oFF]$: Standard characteristic curve with a minimum system accuracy (e.g. Pt100-resistance according DIN IEC 60751).

CAL = **calibration**

Push **[ENTER/MENUE]** to calibrate the instrument with sensor. Use the up and down keys [▲▼] to select CAL. Push again **[ENTER/MENUE]**. On the left corner the display appears a small **1**, which indicates the selected channel. For changing the channel use the up and down keys [▲▼]. Push **[ENTER/MENUE]** to confirm..

Use the up and down keys [▲▼] to select the requested calibration option.

Display	Keys	Function
CAL	ENTER/MENUE	
^1CAL $_2CAL$	up and down keys [▲▼]	select the channel 1 or 2
^1CAL	ENTER/MENUE	
^1CAL $oP1$ $oP2$ $[oFF$	up and down keys [▲▼]	select the calibration mode
	ENTER/MENUE	To keep the amended value
	ESC	To escape without retention

2.4.3.1 Encoded Calibration - $oP1$

☞ This calibrating function is only needed in case you would add another probe to the second measuring channel.

Use the up and down keys [▲ ▼] to select $oP1$. Press **[ENTER/MENUE]** to confirm the requested setting. On the bottom of the display appears a small **1**, followed by a four-digit number (Hex-Code /0..F). The number can be modified with the up key [▲]. For stepping to the next number use the down key [▼]. If the requested number is complete then press **[ENTER/MENUE]** to confirm. Now on the bottom of the display appears a small **2** and after this number a second four-digit number is displayed. For changing the number please follow the manual as before.

Press **[ESC]** to get back to the measuring mode.

Important!

After confirming $oP1$ by pressing **[ENTER/MENUE]** the function $oP1$ (encoded calibration) is activated, even though you leave the menu by pressing the **[ESC]** key
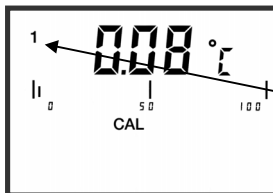
Display-indication with active calibration code $oP1$:

The CAL – segment and the small **1** on the left indicates to the user that $oP1$ is activated.

2.4.3.2   Calibration by physical standard references - $oP2$

Use the up and down keys [▲▼] to select $oP2$. Press **[ENTER/MENUE]** to confirm. On the bottom of the display appears $1\ P$. To select between a 1-Point [$1\ P$], a 2-Point [$2\ P$] or 3-Point [$3\ P$]-calibration use the up and down keys [▲▼].

Example of a 1-Point calibration:

Press **[ENTER/MENUE]** to confirm. On the display appears $6o$. After the displayed measuring value is stabile press **[ENTER/MENUE]**. App. 2 seconds later in the first display line appears $P\ 1$ (measuring value 1); in the second display line appears dP. (standing for decimal point).
Use the up and down keys [▲▼] to select the number of digits after decimal point:

$dP.$ = two decimal digits
$dP\ .$ = one decimal digit (decimal point is jumping one digit to the right)

Press **[ENTER/MENUE]** to confirm. On the second line of the display appears $5\ 1\ \_$. Use the up and down keys [▲▼]to select the requested sign:

$5\ 1\ \_$ = reference standard shows a negative measuring value (below 0.00C°)
$5\ 1\ \_|$ = reference standard shows a positive measuring value (above 0.00C°)

Press **[ENTER/MENUE]** to confirm. On the second line of the display appears $Fd\ 0$. Use the up and down keys [▲▼]to select the requested range:

$Fd\ 0$ = below 100,00°C
$Fd\ 1$ = above 100,00°C

Press **[ENTER/MENUE]** to confirm. Now the display shows $00\ .00$. Please enter here the temperature of your reference. To modify the value use the up key [▲]. For stepping to the next number use the down key [▼].
If the requested value is complete then press **[ENTER/MENUE]**.

Press **[ESC]** to get back to the measuring mode.

Important!

A break of the physical calibration $oP2$ cannot be done by the **[ESC]**-button. Switching off the instrument can only do a break of the physical calibration.
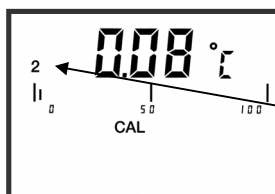
Display-indication with active calibration code $oP2$:

The CAL – segment and the small **2** on the left indicates to the user that $oP2$ is activated.

2.4.3.3   DIN IEC-Calibration DIN IEC 60751 - [oFF

Use the up and down keys [▲▼] to select [oFF. Press **[ENTER/MENUE]** to confirm.

Press **[ESC]** to be back in the measuring mode.

2.4.4 Printer port activation / deactivation - P_rE_n

P_rE_n = **Printer enable**

Press **[ENTER/MENUE]** to activate or deactivate the printer port. Use the up and down keys [▲▼] to select P_rE_n and press **[ENTER/MENUE]**. Use the up and down keys [▲▼] to activate on or deactivate oFF the requested adjustment and press **[ENTER/MENUE]** to confirm.

Press **[ESC]** to get back to the measuring mode.

Display	Keys	Function
P_rE_n	ENTER/MENUE	
P_rE_n on oFF	up and down keys [▲▼]	activation or deactivation
	ENTER/MENUE	To keep the amended value
	ESC	To escape without retention

2.4.5 Selection / Channel activation - $ChnL$

To activate or deactivate a measuring channel press **[ENTER/MENUE]**. Use the up and down keys [▲▼] to select $ChnL$ and press **[ENTER/MENUE]**. On the left corner of the display appears a small **1**, which indicates the selected channel. For changing the channel use the up and down keys [▲▼]. Press **[ENTER/MENUE]** to confirm. The second display line shows on for activation or oFF for deactivation. Use the up and down keys [▲▼] again to activate on or deactivate oFF the requested measuring channel and press **[ENTER/MENUE]** to confirm.

Press **[ESC]** to get back to the measuring mode.

☞
- In case that one channel would not be connected to a probe, the main display would indicate $oPEn$ in the relevant line.
- There must be at least one active channel!

Display	Keys	Function
$ChnL$	ENTER/MENUE	
¹$ChnL$ ₂$ChnL$	up and down keys [▲▼]	select the channel 1 or 2
¹$ChnL$	ENTER/MENUE	
¹$ChnL$ on oFF	up and down keys [▲▼]	activation or deactivation
	ENTER/MENUE	To keep the amended value
	ESC	To escape without retention

2.4.6 Analogue output scaling- $dA\Gamma$

The DCS 2-Measuring instrument contains an analogue output (0-1Volt) for each channel. To get the optimal resolution and accuracy it is possible to scale the analogue output by limiting the measuring range.

Press **[ENTER/MENUE]** to change the measuring range (default_ 0..100). Use the up and down keys [▲ ▼] to select $dA\Gamma$. Press **[ENTER/MENUE]** to confirm.

On the left corner of the display appears a small **1**, which indicates the selected channel. For changing the channel use the up and down keys [▲ ▼] .
Press again **[ENTER/MENUE]** to confirm. On the display appears $dA1b$.
To change between measuring range upper limit and measuring range lower limit use the up and down keys [▲ ▼] .

$dA1b$ = **Lower limit (default 00.00)**
$dA1E$ = **Upper limit (default 100.00)**

Press **[ENTER/MENUE]** to confirm. Use the up and down keys [▲ ▼] to select the number of digits after decimal point:

dP . = two decimal digits
dP . = one decimal digit (decimal point moves one digit to the right)

Press **[ENTER/MENUE]** to confirm. On the second line of the display appears $5 \iota\_ 1$. Use the up and down keys [▲ ▼] to select the requested range:

$5 \iota\_$ = reference standard shows a negative measuring value (below 0,00C°)
$5 \iota\_ 1$ = reference standard shows a positive measuring value (above 0,00C°)

Press **[ENTER/MENUE]** to confirm. On the second line of the display appears $Fd 0$. Use the up and down keys [▲ ▼] to select the requested range:

$Fd 0$ = below 100,00C°
$Fd 1$ = above 100,00C°

Press **[ENTER/MENUE]** to confirm. On the display appears $00 .00$. For changing the value use the up key [▲] . For stepping to the next number use the down key [▼]. If the requested value is complete then press **[ENTER/MENUE]** to confirm.

Press **[ESC]** to return to measuring mode.

For changing the upper measuring range please repeat the above procedure.

☞   The adjustable measuring range limits are corresponding to the selected measuring size.

	DCS 2-menu	Scale	Meas. range °C	Analogue signal
Lower limit	dA1b	00.00	00,00°C	0,00Volt
Upper limit	dA1E	10.00	10,00°C	1,000Volt

2.5   Recalling the memory data (HOLD MAX MIN AVE)

After pressing first time the key **[HOLD MAX MIN AVE]** the actual value will be hold on the top display line (big display). pressing again the key **[HOLD MAX MIN AVE]** the saved maximum-, minimum and average value will be displayed in the bottom display line (small display).

☞
- Note for 2-channel instruments: First the MAX-MIN-AVE-values of channel 1 will be displayed – afterwards the values of the channel 2 will be displayed. Is there only one probe on a 2-channel instrument we suggest to deactivate the channel without probe.
  (⇨ 2.4.5 Selection / Channel activation - Chnl)

- During the recall of the memory data the extremes (MAX MIN) and the average value (AVE) will not be calculated or carried on.

Clearing the memory (MAX MIN AVE)

Press **[CLEAR]** key once to erase the stored maximum, minimum and average from memory. On the display appears CLr.

After erasing the memory the instrument automatically switches back to measuring mode indicating the actual measured value again.

2.6   Measuring rate (FAST-Mode)

Press [FAST/▼] key one to change the measuring rate. Now the measuring rate is app. 4 measurements per second. Press [FAST/▼] key again and the instrument is back in the standard mode (1 measurement per second).

☞
In the fast mode the battery consumption is three times higher than in the standard mode.

2.7   AUTO-OFF-Function

$dAoF$ = **Disable Auto-off**

$EAoF$ = **Enable Auto-off**

Press **[ESC/AUTO-OFF]** key again. On the display appears $dAoF$ Now the Auto-Off-function is deactivated.

Press **[ESC/AUTO-OFF]** key once. On the display appears $EAoF$ Now the instrument switches off automatically after app. 30 minutes.

☞
After switching off and on the instrument, the Auto-Off function is automatically deactivated.

3.   Power supply

For the power supply of the instrument a 9VDC source is required:

- 230V; 50/60Hz,   Ref. No.   EBE 042

- 90-260V; 50-60Hz,   Ref. No.   EBE 043

4.   Error codes

By displaying the following error codes the instrument support the operation of the instrument.

Error	Description
oPEn	no probe or wrong probe is connected
toH ı	"too high" exceeding of the measuring range
toLo	"too low" underflow of the measuring range

5. Technical data

Type:	DigiCal DCS 2
Probe Ports 1 / 2	Pt100
Measuring range	-200...+450°C
Accuracy Pt 100 temperature probe with manufacturer calibration	-200...–100°C: 0.05°C -100...+150°C: 0.03°C +150...+200°C: 0.05°C >200°C: 0.1%
Resolution	-200 bis +200°C with 0.01°C resolution +200 bis +400°C with 0.1°C resolution
Outputs	RS232 Interface (serial Printer can be connected) 2 analogue outputs 0-1 V (11-bit scalable)
Connectors	DIN 8-pole
Allowable operating temp.	0°C ... +40°C
Display	2-line LCD
Housing	plastic (ABS)
Dimensions	200 x 80 x 200 mm (BxHxL)
Weight	950 g
Power supply	Power Supply 230V; 50/60Hz or optional 90-260V; 50/60Hz
DCS 2 Ref. No.	**LMD 018 (230V)** **LMD 919 (90-260V)**

6. RS232 interface protocol

During the data transmission, the availability via PC of the the tension levels for RTS (=+12V) and DTR (= -12V) must be assured by a software's regulation code.

Parameter: **Baudrate**   **2400 Baud**
                 Datenbits   **8**
                 Stopbits   **2**
                 Parität   **None**

To start the data transmission you have to send the following characters. The following index shows you which value can be requested over the interface.

|	DCS 2
Measuring value 1 + 2 autom. recognize	FC (hex)
Enabling the keyboard	0 (hex)

By sending the command FC(hex) you will get the complete data, the instrument lock automatically the keyboard. To release the keyboard you have to send the command 0(hex).

The datas would be sent in the following format.

Datentyp = String

he length of the string depends on the instrument (a two-channel or one-channel instrument).
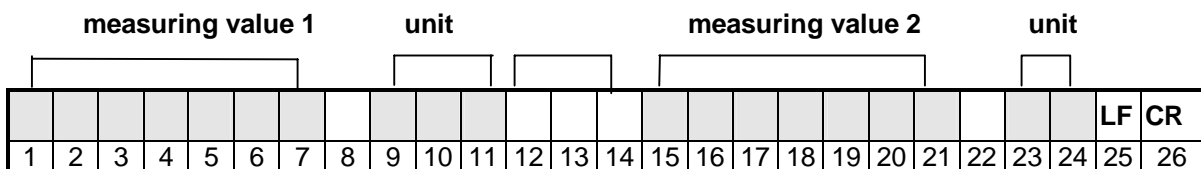

Example: Turbo Pascal Source-Code for initialisation of the RS232 interface

```
PROCEDURE V24oeffnen(com1,com2:Boolean);  { initialisation of RS 232 }
   VAR wert    : Byte;

BEGIN
   IF com1 THEN BEGIN          { initialisation of COM 1  }
   PORT [$3FB]:=128;           { activate baud rate        }
   PORT [$3F8]:= 48;           { baud rate - LSB, 2400 baud }
   PORT [$3F9]:= 0;            { baud rate - MSB           }
   PORT [$3FB]:= 7;            { 8 Bits, No Parity, 2 Stop }
   PORT [$3FC]:= 2;            { DTR = 0, RTS = 1          }
   Wert := PORT [$3F8]         { receiving register empty  }
   END;
END
```

7. Connector layout

7.1 Connector layout Pt100 4-wire

Measuring channel 1 / 2

Pt100 4-Wire

Soldering Side
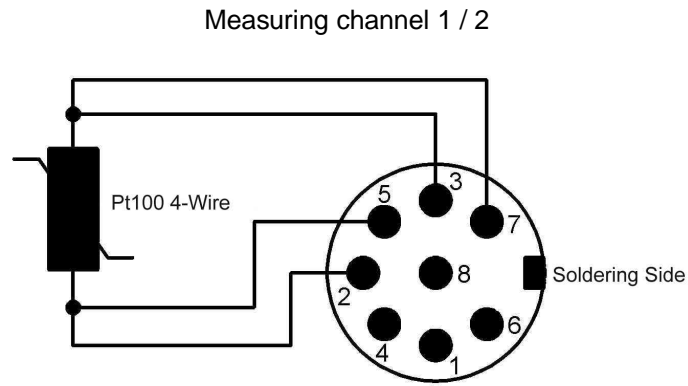
7.2 RS232 PC-adapter cable (Connector layout)

Measuring channel 1 / 2

Soldering side Connector

9 pol. Sub-D plug socket
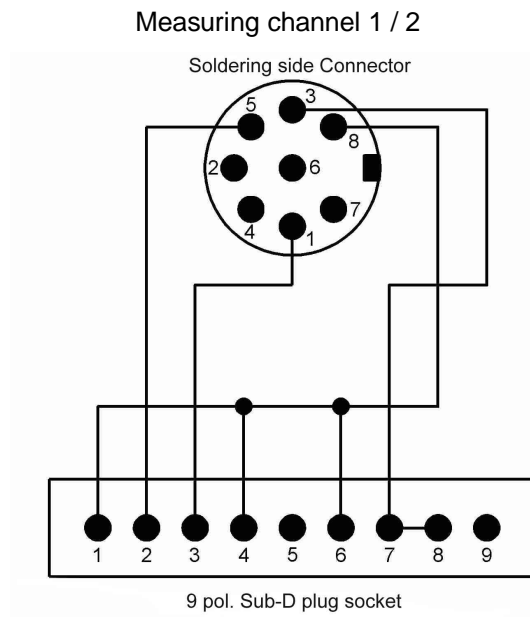
8. Data of probe-calibration

Our quality-probes are the main reason for the precision and quality of your measuring. To facilitate the exchange of a probe without a losing precision, our probes were measured in our company and added with a code that describes the characteristic line of the probe. The probe is labelled obviously with the relevant code.

If you change the probe you have to enter the code into the measuring instrument. . We recommend to write down both values in order to avoid any problems (especially if the probe is positioned at a place difficult to access, or if there are several external probes in use):

Ref.-no: _____
Appellation: _____
Serial number: _____
Calibration data: _____

Ref.-no: _____
Appellation: _____
Serial number: _____
Calibration data: _____

Ref.-no: _____
Appellation: _____
Serial number: _____
Calibration data: _____

Ref.-no: _____
Appellation: _____
Serial number: _____
Calibration data: _____

Ref.-no: _____
Appellation: _____
Serial number: _____
Calibration data: _____

9. Accessories

Accessories	Cat.-no.
Pt 100 sheathed resistance probe with 4-wire connection, class B 1/3 DIN, -200 ... +450°C. The calibration values of this probe are encoded in the LAUDA calibration code. Probes with a 3mm diameter tubing made of stainless steel 300mm long, length of the sensor at the end of the tube < 35mm, plastic handle made of ABS	ETP 065
Factory calibration certificate for the measurement chain with calibration points at 0° and 150°C	LMZ 052
DKD calibration certificate for the measurement chain at 2 selectable calibration temperatures between –40° and +300°C	LMZ 053
PC adapter cable (RS232) with a sub-D-plug for the DCS 2 and a 9-pin sub-D-coupler for the PC	EKS 037
Windows PC Data-Recording-Software: WinTherm Plus on CD-ROM	LSDM2002
Plug In Mains Supply for 90-260VAC, 50-60Hz, including plug adaptors for Euro-plug, USA, UK, Japan	EBE 043

10. Ordering spares

To avoid questions, delay and delivery of incorrect items, please advise always your instruments type and serial number stated on the manufacturer's label.

The capital letter of the serial number (first position) shows the year of manufacture, e.g. B = 2003

We always would appreciate dealing with your queries and comments and receiving your suggestions, experience and criticism.

<div align="center">

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BESTÄTIGUNG / CONFIRMATION / CONFIRMATION

LAUDA

An / To / A:
LAUDA Dr. R. Wobser   •   LAUDA Service Center   •   Fax: +49 (0) 9343 - 503-222

Von / From / De :

Firma / Company / Entreprise: _____

Straße / Street / Rue: _____

Ort / City / Ville: _____

Tel.: _____

Fax: _____

Betreiber / Responsible person / Personne responsable: _____

Hiermit bestätigen wir, daß nachfolgend aufgeführtes LAUDA-Gerät (Daten vom Typenschild):
We herewith confirm that the following LAUDA-equipment (see label):
Par la présente nous confirmons que l'appareil LAUDA (voir plaque signalétique):

Typ / Type / Type :	Serien-Nr. / Serial no. / No. de série:

mit folgendem Medium betrieben wurde
was used with the below mentioned media
a été utilisé avec le liquide suivant

_____

_____

_____

Darüber hinaus bestätigen wir, daß das oben aufgeführte Gerät sorgfältig gereinigt wurde, die Anschlüsse verschlossen sind, und sich weder giftige, aggressive, radioaktive noch andere gefährliche Medien in dem Gerät befinden.

Additionally we confirm that the above mentioned equipment has been cleaned, that all connectors are closed and that there are no poisonous, aggressive, radioactive or other dangerous media inside the equipment.

D'autre part, nous confirmons que l'appareil mentionné ci-dessus a été nettoyé correctement, que les tubulures sont fermées et qu'il n'y a aucun produit toxique, agressif, radioactif ou autre produit nocif ou dangereux dans la cuve.

Stempel Seal / Cachet.	Datum Date / Date	Betreiber Responsible person / Personne responsable