

User Manual  
**Dynamic Load Compensation**  
JOFRA  
**DLC-155/158/159/168/187/250/700**



**User manual**  
**JOFRA DLC-**  
**155/158/159/168/187/250/700**

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## 1.0 General information

This manual is only effective for the following products:

JOFRA DLC-155  
JOFRA DLC-158  
JOFRA DLC-159  
JOFRA DLC-168  
JOFRA DLC-187  
JOFRA DLC-250  
JOFRA DLC-700

The products are manufactured by:



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## 2.0 Introduction

The JOFRA DLC-155, DLC-158, DLC-159, DLC-168, DLC-187, DLC-250 and DLC-700 probes are designed for fast and traceable calibration and temperature measuring with JOFRA RTC-156/157 B/C, JOFRA RTC-158 B/C, JOFRA RTC-159 B/C, JOFRA RTC-168 B/C, JOFRA RTC-187 B/C, JOFRA RTC-250 B/C and JOFRA RTC-700 B/C systems and are ready for use.

Please read this manual carefully before use, to obtain maximum value of your calibration system.



### Warning

- Read this manual before use.
- Do not use in hazardous area.
- Handle carefully.
- Never exceed temperature range

## 3.0 Functionality

### 3.1 Functional description

The probes can be used for temperatures in the range :

- DLC-155 : -60°C to 155°C / -76°F to 311°F
- DLC-158 : -60°C to 155°C / -76°F to 311°F
- DLC-159 : -100°C to 155°C / -148°F to 311°F
- DLC-168 : -60°C to 165°C / -76°F to 329°F
- DLC-187 : -60°C to 180°C / -76°F to 356°F
- DLC-250 : 0°C to 250°C / 32°F to 482°F
- DLC-700 : 0°C to 700°C / 32°F to 1292°F

The JOFRA DLC-155, DLC-158, DLC-159, DLC-187, DLC-250 and DLC-700 probes may be supplied with a certificate for a limited temperature range. The calibration temperature ranges for the DLC sensors are stated on page 19.

## 3.2 Connections

The probes are delivered with a connecting cable.  
The pin-layout is as follows:

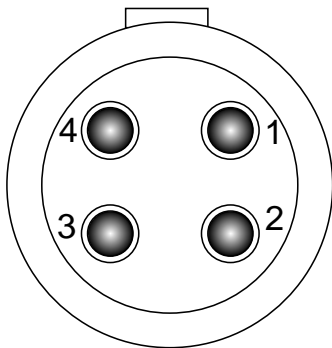
Pin 1 : TC V-

Pin 2 : TC V+

Pin 3 : Memory GND

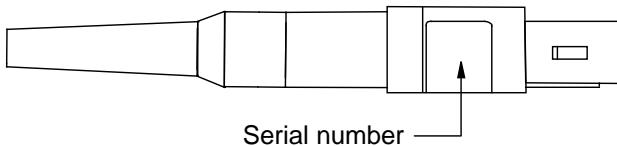
Pin 4 : Memory I/O

The figure below is shown from the connector side of the probe connector.



### 3.3 Serial number

The serial number is placed on the probe as shown on the figure below:





## 4.0 Operation

### 4.1 Operation area

All the probes are intended for use in areas which meet the following:

Ambient temperature

range : -20°C to 70°C (-4°F to 158°F)

Humidity : 0% to 90%

Protection class : IP 50



### **Warning**

Do not use in hazardous areas.

## 5.0 Maintenance

The probe does not require specific maintenance before or after use. The user may carry out the following procedure himself:

- Cleaning the probe : Use alcohol or water and a soft cloth.



### Caution...

- The probe must always be protected against any mechanical damage.
- The probe must never be exposed to mechanical shock effects.
- Avoid thermal shock
- Any bending of the probe may cause permanent damage

## 5.1 Calibration

### Required equipment:

- DLC-probe to be calibrated.
- RTC-calibrator with DLC-input.
- An insert with correct size holes for the DLC-probe and the temperature probe.
- For calibrating DLC-155, DLC-158, DLC-159, DLC-187 and DLC-250: an AMETEK type 127356 temperature probe, order no. 127587 (recommended) or similar with short measuring zone is required.
- For calibrating DLC-700: a STS-200 A 970 temperature probe (recommended) or similar is required.

Calibration setup:

<b>Sensor</b>	<b>DLC-155</b>	<b>DLC-155</b>	<b>DLC-187</b>
<b>Calibrator</b>	<b>RTC-156</b>	<b>RTC-157</b>	<b>RTC-187</b>
<b>Insert*</b>	<b>127312</b>	<b>127312</b>	<b>127312</b>
<b>Temp. probe*</b>	<b>127356</b>	<b>127356</b>	<b>127356</b>
<b>EXCEL spreadsheet**</b>	127588 DLC- 155.XLS	127588 DLC- 155.XLS	129956 DLC- 187.XLS
Recommended calibration temperatures***	-30°C/-22°F	-45°C/-49°F	-45°C/-49°F
	-20°C/-4°F	-20°C/-4°F	-20°C/-4°F
	0°C/32°F	0°C/32°F	0°C/32°F
	50°C/122°F	50°C/122°F	60°C/140°F
	100°C/212°F	100°C/212°F	120°C/248°F
	155°C/311°F	155°C/311°F	180°C/356°F
Lower measuring point	Bottom of insert	Bottom of insert	Bottom of insert
Upper measuring point	60 mm / 2.4" from bottom	60 mm / 2.4" from bottom	60 mm / 2.4" from bottom
Curve fit warning limit	0.01°C/ 0.018°F	0.01°C / 0.018°F	0.01°C / 0.018°F

<b>Sensor</b>	<b>DLC-700</b>
<b>Calibrator</b>	<b>RTC-700</b>
<b>Insert*</b>	<b>127149</b>
<b>Temp. probe*</b>	<b>STS-200 A 970</b>
<b>EXCEL spreadsheet**</b>	127589 DLC-700.XLS
Recommended calibration temperatures***	33°C/91.4°F
	200°C/392°F
	350°C/662°F
	500°C/932°F
	660°C/1220°F
700°C/1292°F	
Lower measuring point	Bottom of insert
Upper measuring point	80 mm / 3.1" from bottom
Curve fit warning limit	0.05°C / 0.09°F

<b>Sensor</b>	<b>DLC-158</b>	<b>DLC-168</b>	<b>DLC-250</b>
<b>Calibrator</b>	<b>RTC-158</b>	<b>RTC-168</b>	<b>RTC-250</b>
<b>Insert*</b>	<b>124897</b>	<b>124897</b>	<b>127759</b>
<b>Temp. probe*</b>	<b>127356</b>	<b>127356</b>	<b>127356</b>
<b>EXCEL spreadsheet**</b>	127884 DLC- 158.XLS	130447 DLC- 168.XLS	127885 DLC- 250.XLS
Recommended calibration temperatures ***	-22°C/-8°F	-30°C/-22°F	28°C/82°F
	-10°C/14°F	-10°C/14°F	50°C/122°F
	0°C/32°F	0°C/32°F	100°C/212°F
	50°C/122°F	50°C/122°F	150°C/302°F
	100°C/212°F	100°C/212°F	200°C/392°F
	155°C/311°F	165°C/329°F	250°C/482°F
Lower measuring point	Bottom of insert	Bottom of insert	Bottom of insert
Upper measuring point	60 mm / 2.4" from bottom	60 mm / 2.4" from bottom	60 mm / 2.4" from bottom
Curve fit warning limit	0.01°C/ 0.018°F	0.01°C/ 0.018°F	0.01°C / 0.018°F

<b>Sensor</b>		<b>DLC-159</b>
<b>Calibrator</b>		<b>RTC-159</b>
<b>Insert*</b>		<b>128477</b>
<b>Temp. probe*</b>		<b>127356</b>
<b>EXCEL spreadsheet**</b>		128583 DLC-159.XLS
Recommended calibration temperatures ***		-100°C/-148°F
		-50°C/-58°F
		0°C/32°F
		50°C/122°F
		100°C/212°F
		155°C/311°F
Lower measuring point		Bottom of insert
Upper measuring point		60 mm / 2.4" from bottom
Curve fit warning limit		0.01°C/ 0.018°F

\* Recommended equipment.

\*\* EXCEL spreadsheet is found on the USB-stick with JOFRACAL.

\*\*\* The temperatures must be entered in Celcius.

## Procedure:

1. Place the DLC-probe in the insert and connect the probe to the DLC-input of the calibrator.
2. Go to the “Sensor setup” menu.
3. Set “Use load compensation” to “YES”. If the reference probe is connected to the “REF” input, set “Sensor type” to “External” and “SET follows TRUE” to “No”. If no reference probe is connected, set “Sensor type” to “Internal”.
4. Enter the DLC-menu.
5. Read the A, B and C-coefficients of the probe and enter the values in the EXCEL spreadsheet.

Microsoft Excel - 12758800 DLC-155.xls

Calibration of DLC-155 sensor

Serial No: 123456-12345

**Step 1**

Coefficient	Current value
A	0,000000E+00
B	1,000000E+00
C	0,000000E+00

**Step 2**

Temperature step	Set temperature °C	Measured value		DLC reading °C
		Lower value	Upper value	
1	-30,000	-30,000	-30,000	0,00E+00
2	-20,000	-20,000	-20,000	0,00E+00
3	0,000	0,000	0,000	0,00E+00
4	50,000	50,000	50,000	0,00E+00
5	100,000	100,000	100,000	0,00E+00
6	155,000	155,000	155,000	0,00E+00

**Step 3**

Coefficient	New value
A	0,000000E+00
B	1,000000E+00
C	0,000000E+00

**Step 4**

Temperature Step	Temperature	Calculated Curve fit
1	-30,000	0,0000
2	-20,000	0,0000
3	0,000	0,0000
4	50,000	0,0000
5	100,000	0,0000
6	155,000	0,0000



The following procedure is repeated for each temperature:

1. Set the SET temperature.
2. Place the reference temperature probe in the bottom of the insert.  
Wait until the temperature have stabilized and the DLC-reading is 0.00°C. If the DLC-reading continuously shows a positive value at -30°C (RTC-156) / -45°C (RTC-157) / -22°C (RTC-158) / -100°C (RTC-159) / -30°C (RTC-168) / -45°C (RTC-187), increase the SET-temperature in steps of 1°C until the DLC-reading displays 0.00°C.
3. Record the temperature of the reference probe in the excel spreadsheet.
4. Move the reference probe to the upper position 60 mm (RTC-156/157/158/159/168/187/250) or 80 mm (RTC-700).
5. Wait until the temperature have stabilized and the DLC-reading is 0.00°C.
6. Record the temperature of the reference probe and the DLC-probe in the excel spreadsheet.
7. Go to next SET-temperature.

After the last STEP is completed:

8. Check that all values in the calculated curve fit are less than the values specified in the table. If this is OK, the new coefficients can be downloaded using the CON050 software.

## 6.0 Technical specifications

### Probe specifications – DLC-155:

Sensor type	:	Differential TC type T
Probe length	:	177 mm (6.96 in)
Temperature range	:	-60°C to 155°C / -76°F to 311°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

### Probe specifications – DLC-158:

Sensor type	:	Differential TC type T
Probe length	:	196 mm (7.72 in)
Temperature range	:	-60°C to 155°C / -76°F to 311°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

### Probe specifications – DLC-168:

Sensor type	:	Differential TC type T
Probe length	:	196 mm (7.72 in)
Temperature range	:	-60°C to 165°C / -76°F to 329°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

### Probe specifications – DLC-159:

Sensor type	:	Differential TC type T
Probe length	:	196 mm (7.72 in)
Temperature range	:	-100°C to 155°C / -148°F to 311°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

### Probe specifications – DLC-187:

Sensor type	:	Differential TC type T
Probe length	:	177 mm (6.96 in)
Temperature range	:	-60°C to 180°C / -76°F to 356°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

### Probe specifications – DLC-250:

Sensor type	:	Differential TC type T
Probe length	:	196 mm (7.72 in)
Temperature range	:	0°C to 250°C / 32°F to 482°F
Diameter	:	OD3 mm
Depth	:	140 mm (5.51 in)
Media compatibility	:	AISI316
Connection	:	Redel plug with build in memory is standard

## Probe specifications – DLC-700:

Sensor type	:	Differential TC type N
Probe length	:	230 mm (9,05 in)
Temperature range	:	0°C to 700°C / 32°F to 1292°F
Diameter	:	OD4 mm
Depth	:	200 mm (7.9 in)
Media compatibility	:	INCONEL 600
Connection	:	Redel plug with build in memory is standard

## Certificate:

If the DLC probes are supplied with a certificate, the calibration is carried out as recommended below according to the ITS 90 temperature scale.

The DLC-155/158 probe is as standard calibrated in the range :

-45°C to 155°C (-49°F to 311°F).

The DLC-159 probe is as standard calibrated in the range :

-100°C to 155°C (-148°F to 311°F).

The DLC-168 probe is as standard calibrated in the range :

-45°C to 165°C (-49°F to 329°F).

The DLC-187 probe is as standard calibrated in the range :

-45°C to 180°C (-49°F to 348°F).

The DLC-250 probe is as standard calibrated in the range :

28°C to 250°C (82°F to 482°F).

The DLC-700 probe is as standard calibrated in the range :

33°C to 700°C (91.4°F to 1292°F).



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