

# User Manual

## Dynamic Load Compensation

### JOFRA DLC-155/158/159/250/700

*...because calibration is  
a matter of confidence*





# User manual

## JOFRA DLC-155/158/159/250/700

© Copyright 2012 AMETEK Denmark A/S



<b>Table of contents:</b>	<b>Page</b>
<b>1.0 General information .....</b>	<b>4</b>
<b>2.0 Introduction.....</b>	<b>5</b>
<b>3.0 Functionality .....</b>	<b>6</b>
3.1 Functional description .....	6
3.2 Connections .....	7
3.3 Serial number.....	8
<b>4.0 Operation .....</b>	<b>9</b>
4.1 Operation area .....	9
<b>5.0 Maintenance.....</b>	<b>10</b>
5.1 Calibration .....	11
<b>6.0 Technical specifications .....</b>	<b>17</b>

## 1.0 General information

This manual is only effective for the following products:

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

The products are manufactured by:



**AMETEK Denmark A/S**  
Gydevang 32-34  
3450 Allerød - Denmark

TEL: +45 48 16 80 00

FAX: +45 48 16 80 80

## 2.0 Introduction

The JOFRA DLC-155, DLC-158, DLC-159, 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-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-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-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:

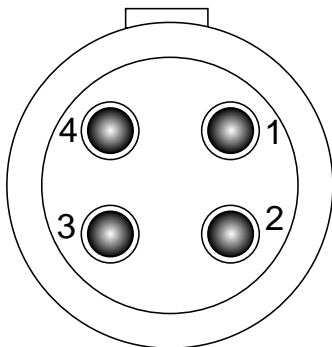
Pin 1 : TC V-

Pin 2 : TC V+

Pin 3 : Memory GND

Pin 4 : Memory I/O

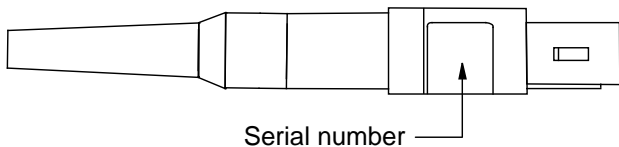
The figure below is shown from the connector side of the probe connector.





### 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 and DLC-250: an AMETEK 127587 temperature probe (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-700</b>
<b>Calibrator</b>	<b>RTC-156</b>	<b>RTC-157</b>	<b>RTC-700</b>
<b>Insert*</b>	<b>127312</b>	<b>127312</b>	<b>127149</b>
<b>Temp. probe*</b>	<b>127587</b>	<b>127587</b>	<b>STS-200 A 970</b>
<b>EXCEL spreadsheet**</b>	127588 DLC- 155.XLS	127588 DLC- 155.XLS	127589 DLC- 700.XLS
Recommended calibration temperatures***	-30°C/-22°F	-45°C/-49°F	33°C/91.4°F
	-20°C/-4°F	-20°C/-4°F	200°C/392°F
	0°C/32°F	0°C/32°F	350°C/662°F
	50°C/122°F	50°C/122°F	500°C/932°F
	100°C/212°F	100°C/212°F	660°C/1220°F
	155°C/311°F	155°C/311°F	700°C/1292°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	80 mm / 3.1" from bottom
Curve fit warning limit	0.01°C/ 0.018°F	0.01°C / 0.018°F	0.05°C / 0.09°F

<b>Sensor</b>	<b>DLC-158</b>	<b>DLC-250</b>
<b>Calibrator</b>	<b>RTC-158</b>	<b>RTC-250</b>
<b>Insert*</b>	<b>124897</b>	<b>127759</b>
<b>Temp. probe*</b>	<b>127587</b>	<b>127587</b>
<b>EXCEL spreadsheet**</b>	127884 DLC-158.XLS	127885 DLC-250.XLS
Recommended calibration temperatures ***	-22°C/-72°F	28°C/82°F
	-10°C/-4°F	50°C/122°F
	0°C/32°F	100°C/212°F
	50°C/122°F	150°C/302°F
	100°C/212°F	200°C/392°F
	155°C/311°F	250°C/482°F
Lower measuring point	Bottom of insert	Bottom of insert
Upper measuring point	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

<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>127587</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

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 Lower value	Measured value Upper value	DLC reading °C
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), 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-156/157/158/159/250) 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-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-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-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).

#### **AMETEK Calibration Instruments**

is one of the world's leading manufacturers and developers of calibration instruments for temperature, pressure and process signals as well as for temperature sensors both from a commercial and a technological point of view.

#### **JOFRA Temperature Instruments**

Portable precision thermometers. Dry-block and liquid bath calibrators: 5 series, with more than 25 models and temperature ranges from -90° to 1205°C / -130° to 2200°F.

All featuring speed, portability, accuracy and advanced documenting functions with JOFRACAL calibration software.

#### **JOFRA Pressure Instruments**

Convenient electronic systems ranging from -25 mbar to 1000 bar (0.4 to 15,000 psi) - multiple choices of pressure ranges, pumps and accuracies, fully temperature-compensated for problem-free and accurate field use.

#### **JOFRA Signal Instruments**

Process signal measurement and simulation for easy control loop calibration and measurement tasks - from handheld field instruments to laboratory reference level bench top instruments.

#### **JOFRA / JF Marine Instruments**

A complete range of calibration equipment for temperature, pressure and signal, approved for marine use.

#### **FP Temperature Sensors**

A complete range of temperature sensors for industrial and marine use.

#### **M&G Pressure Testers**

Pneumatic floating-ball or hydraulic piston dead weight testers with accuracies to 0.015% of reading.

#### **M&G Pumps**

Pressure generators from small pneumatic "bicycle" style pumps to hydraulic pumps generating up to 1,000 bar (15,000 psi).



## **TEST & CALIBRATION INSTRUMENTS**

### **UK**

**AMETEK Calibration Instruments**  
Tel +44 (0)1243 833 302  
jofra@ametek.co.uk

### **France**

**AMETEK S.A.S.**  
Tel +33 (0)1 30 68 89 40  
general.lloyd-instruments@ametek.fr

### **Germany**

**AMETEK GmbH**  
Tel +49 (0)2159 9136 510  
info.mct-de@ametek.de

### **Denmark**

**AMETEK Denmark**  
Tel +45 4816 8000  
jofra@ametek.com

### **USA**

**AMETEK Mansfield & Green**  
Tel +1 (800) 527 9999  
cal.info@ametek.com

### **India**

**AMETEK Instruments India Pvt Ltd.**  
Tel +91 22 2836 4750  
jofra@ametek.com

**www.jofra.com**

### **Singapore**

**AMETEK Singapore Pte Ltd**  
Tel +65 6484 2388  
jofra@ametek.com

### **China**

**AMETEK Inc. - Shanghai**  
Tel +86 21 5868 5111

**AMETEK Inc. - Beijing**  
Tel +86 10 8526 2111

**AMETEK Inc. - Guangzhou**  
Tel +86 20 8363 4768  
jofra.sales@ametek.com.cn