

## Iron<sup>2+/3+</sup>

### Principle

Iron(II) ions form an orange-red complex with 1.10-phenanthroline. Any iron(III) ions are reduced to iron(II) ions.

### Range of Application

Drinking water, raw water, swimming-bath water, waste water, process control

### Storage Information

The test reagents are stable at +2 to +8°C up to the expiry date given on the package.

### Interferences

The ions listed in the table have been individually checked up to the given concentrations. Cumulative effects and the influence of other ions have not been determined by us. There is no interference from:

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**1000 mg/L:** Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>

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**500 mg/L:** K<sup>+</sup>, Na<sup>+</sup>, Ca<sup>2+</sup>, NH<sub>4</sub><sup>+</sup>

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**100 mg/L:** Ag<sup>+</sup>

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**70 mg/L:** Cd<sup>2+</sup>

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**50 mg/L:** NO<sub>3</sub><sup>-</sup>, Co<sup>2+</sup>, Zn<sup>2+</sup>, Pb<sup>2+</sup>, CO<sub>3</sub><sup>2-</sup>, Hg<sup>2+</sup>, Cr<sup>3+</sup>, Cr<sup>6+</sup>

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**25 mg/L:** Ni<sup>2+</sup>

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**10 mg/L:** Cu<sup>2+</sup>

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**5 mg/L:** Sn<sup>2+</sup>

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The sample should be colourless and free of turbidities. Slight colourations can be taken into account with the help of a sample-specific blank reading. Turbidities are eliminated by filtration through a membrane filter (LCW 904).

The measurement results must be subjected to plausibility checks (dilute and/or spike the water sample).

### pH/Temperature/Time

The pH of the water sample must be between pH 3 and pH 9. The colour reaction of the iron<sup>2+/3+</sup> analysis is strongly temperature-dependent. The sample and sample cuvette should therefore have a working temperature of 20°C.

**The reaction times must be strictly observed.**

### Safety Advice

On grounds of quality and reliability, the analysis should be carried out only with original HACH LANGE accessories.

### CADAS 100 (LPG 185 / ≥ LPG 210)

If this test is not already stored in your instrument please ask your HACH LANGE Agency for programming instructions.

**Procedure** **LCK 320**

**Applies to all types of photometer**

**Iron<sup>2+/3+</sup>** **Edition 97/06**

<b>Fe (II)/(III)-Determination</b>	
Pipette into the cuvette test	
Water sample	2 mL
Close cuvette and invert a few times until the freeze-dried contents are completely dissolved. After <b>5 min</b> invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.	

**Data table** **LCK 320**

<b>LP2W</b>	<b>97/06</b>
<b>Fe II/III</b> • F <sub>1</sub> = 0 • F <sub>2</sub> = 4.54 • K = -0.032	
<b>CADAS 30/50</b>	<b>97/06</b>
<b>Fe II</b> • λ: 485 nm • Pro.: 1 • F <sub>1</sub> = 0 • F <sub>2</sub> = 4.75 • K = -0.212	
<b>Fe II/III/tot</b> • λ: 485 nm • Pro.: 11 • F <sub>1</sub> = 4.75 • F <sub>2</sub> = 0 • F <sub>3</sub> = 4.75 • F <sub>4</sub> = 0 K <sub>1</sub> = -0.212 • K <sub>2</sub> = -0.212	
<b>CADAS 30S/50S</b>	<b>97/06</b>
<b>Fe II</b> • λ: 485 nm • Pro.: 1 • F <sub>1</sub> = 0 • F <sub>2</sub> = 4.75 • K = -0.212	
<b>Fe II/III/tot</b> • λ: 485 nm • Pro.: 12 • F <sub>1</sub> = 4.749 • F <sub>2</sub> = 0 • F <sub>3</sub> = 4.749 • F <sub>4</sub> = 0 K <sub>1</sub> = -0.212 • K <sub>2</sub> = -0.212	
<b>ISIS 6000/9000</b>	<b>97/06</b>
<b>Fe II</b> • λ: 500 nm • Pro.: 1 • F <sub>1</sub> = 0 • F <sub>2</sub> = 4.57 • K = -0.215	
<b>Fe II/III/tot</b> • λ: 500 nm • Pro.: 11 • F <sub>1</sub> = 4.57 • F <sub>2</sub> = 0 • F <sub>3</sub> = 4.57 • F <sub>4</sub> = 0 • K <sub>1</sub> = -0.215 • K <sub>2</sub> = -0.215	
<b>CADAS 100 / LPG 185</b>	<b>97/06</b>
<b>Fe II</b> • λ: 485 nm • F <sub>1</sub> = 4.8 • F <sub>2</sub> = -0.067	
<b>Fe II/III/tot</b> • λ: 485 nm • F <sub>1</sub> = 4.8 • F <sub>2</sub> = -0.067 • F <sub>3</sub> = 4.8 • F <sub>4</sub> = -0.067 • F <sub>5</sub> = -1 • F <sub>6</sub> = 1	
<b>CADAS 100 / ≥ LPG 210</b>	<b>97/06</b>
<b>Fe II</b> • λ: 485 nm • F <sub>1</sub> = 4.8 • K = -0.067	
<b>Fe II/III/tot</b> • λ: 485 nm • F <sub>1</sub> = 4.8 • F <sub>2</sub> = -0.067 • F <sub>3</sub> = 4.8 • F <sub>4</sub> = -0.067	

**LASA 1 / plus** **LCK 320**

**Iron<sup>2+</sup>** **Edition 97/06**

**Evaluation**

**Fe (II)-Determination**

1. Press "Mode" key and check program control number:  
**\_\_ : 38**
2. Insert program filter **480 nm**.
3. Select test with "Mode" key.
4. Insert sample cuvette.

Parameter	Display	Meas. range
Iron II (Fe II)	Fe II LCK 320	0.2 – 6.0 mg/L

**LASA 1 / plus** **LCK 320**

**Iron<sup>3+</sup>** **Edition 97/06**

**Evaluation**

**Fe (III)-Determination**

1. Press "Mode" key and check program control number:  
**\_\_ : 38**
2. Insert program filter **480 nm**.
3. Select test with "Mode" key.
4. Insert sample cuvette.
5. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

6. Insert sample cuvette again.  
20 sec display = **Fe II**  
20 sec display = **Fetot (Fe total)**  
20 sec display = **Felll**  
or by pressing the key \* the results for **Fe II**,  
**Fetot (Fe total)** and **Felll** can be called up immediately one after another.

Parameter	Display	Meas. range
Iron II (Fe II)	Fe III LCK 320	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Insert sample cuvette.
2. Select evaluation for Iron II (Fe II).

Parameter	Meas. range
Iron II (Fe II)	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Insert sample cuvette.
2. Select evaluation for Iron III (Fe III).
3. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

4. Insert sample cuvette again.

## CADAS 30/50, ISIS 9000:

The results for **Fe II**, **Fe tot (Fe total)** and **Fe III** can be called up by pressing the key under the symbol " → ".

Parameter	Meas. range
Iron II (Fe II)	0.2 – 6.0 mg/L
Iron total (Fe tot)	0.2 – 6.0 mg/L
Iron III (Fe III)	0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Check program control number:  
 \_\_ : **38 (CADAS 200)**  
 \_\_ : **38 (ISIS 6000)** ⇒ Select »CUVETTE TEST« mode.
2. Select test number (see below) and evaluation for Iron II (Fe II).
3. Control number must be **2**.
4. Insert sample cuvette and press green key.

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Check program control number:  
 \_\_ : **38 (CADAS 200)**  
 \_\_ : **38 (ISIS 6000)** ⇒ Select »CUVETTE TEST« mode.
2. Select test number (see below) and evaluation for Iron III (Fe III).
3. Control number must be **2**.
4. Insert sample cuvette and press green key.
5. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

6. Insert sample cuvette again and press green key.

## CADAS 200:

The result is displayed in **Iron II**, **Iron tot.** and **Iron III**.

## ISIS 6000:

The results for **Fe II**, **Fe tot (Fe total)** and **Fe III** can be called up by pressing the key under the symbol " → ".

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Select »TEST« mode.
2. Select symbol (see below).
3. Check factors and measuring wavelength in memory »Mem«.
4. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
5. Insert sample cuvette and press "MESS" (measure) key.

Parameter	Symbol	Meas. range
Iron II (Fe II)	\$ 320 A	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Select »TEST« mode.
2. Select symbol (see below).
3. Select symbol » > «.
4. Check factors and measuring wavelength in memory »Mem«.
5. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
6. Insert sample cuvette and press "MESS" (measure) key.
7. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

8. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
9. Insert sample cuvette and press "MESS" (measure) key.

The result is printed out in **Fe (II), Fe tot** and **Fe (III)**.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Symbol	Meas. range
Iron II (Fe II)	\$ 320 B	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Select »TEST« mode.
2. Select symbol (see below).
3. Control number must be **5**.
4. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
5. Insert sample cuvette and press "MESS" (measure) key.

Parameter	Symbol	Meas. range
Iron II (Fe II)	320 A	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Select »TEST« mode.
2. Select symbol (see below).
3. Control number must be **2**.
4. Insert blank-value cuvette (water sample) and press "NULL" (zero) key.
5. Insert sample cuvette and press "MESS" (measure) key.
6. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

7. Insert sample cuvette again and press "MESS" (measure) key.

The result is printed out in **Fe (II), Fe tot** and **Fe (III)**.

If more than one sample is to be measured start the next evaluation at point 5.

Parameter	Symbol	Meas. range
Iron II (Fe II)	320 B	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Press any key.
2. Check program control number: \_\_ : **38**
3. Select test with ↑ or ↓ key.
4. Insert sample cuvette.

Parameter	Display	Meas. range
Iron II (Fe II)	Fe II LCK 320	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Press any key.
2. Check program control number: \_\_ : **38**
3. Select test with ↑ or ↓ key.
4. Insert sample cuvette.
5. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

6. Insert sample cuvette again.
  - 20 sec display = **Fe 2 (Fe II)**
  - 20 sec display = **Fe t (Fe total)**
  - 20 sec display = **Fe 3 (Fe III)**
 or by pressing the key ↓ the results for **Fe 2, Fe t and Fe 3** can be called up immediately one after another.

Parameter	Display	Meas. range
Iron II (Fe II)	Fe III LCK 320	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Insert filter **480 nm**.
2. Select »Dr. Lange« mode.
3. Select test number (see below) and evaluation for Iron II (Fe II).
4. Control number must be **2**.
5. Insert sample cuvette and press green key.

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Insert filter **480 nm**.
2. Select »Dr. Lange« mode.
3. Select test number (see below) and evaluation for Iron III (Fe III).
4. Control number must be **2**.
5. Insert sample cuvette and press green key.
6. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

7. Insert sample cuvette again and press green key.

The result is displayed in **Fell, Fetot ( Fe total) and Felll**.

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Insert filter **500 nm**.
2. Enter factor (see below) and store ↑.
3. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
4. Insert sample cuvette and press "Ergebnis mit Faktor" (result with factor) key.

**Subtract 0.032 mg/L from the displayed result.**

Parameter	Factor	Meas. range
Iron	4.54	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Insert filter **500 nm**.
2. Enter factor (see below) and store ↑.
3. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
4. Insert sample cuvette and press "Ergebnis mit Faktor" (result with factor) key.

**Subtract 0.032 mg/L from the displayed result.**

Make a note of the result – **Fe (II)**.

5. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

6. Insert sample cuvette again and press "Ergebnis mit Faktor" (result with factor) key.

**Subtract 0.032 mg/L from the displayed result.**

Make a note of the result – **Fe<sub>tot</sub>**.

**Calculation of the Fe (III)-concentration:**

$$Fe_{tot} - Fe(II) = \text{mg/L Fe (III)}$$

Parameter	Factor	Meas. range
Iron	4.54	0.2 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Insert program filter **500 nm**.
2. Press "Tests" key until display (see below) appears.
3. Control number must be **9**.
4. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
5. Insert sample cuvette and press "Ergebnis" (result) key.

Parameter	Display	Meas. range
Iron	Iron LCK 320	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Insert program filter **500 nm**.
2. Press "Tests" key until display (see below) appears.
3. Control number must be **9**.
4. Insert blank-value cuvette (water sample) and press "Null" (zero) key.
5. Insert sample cuvette and press "Ergebnis" (result) key. Make a note of the result – **Fe (II)**.
6. Remove sample cuvette.

Screw a **DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

7. Insert sample cuvette again and press "Ergebnis" (result) key. Make a note of the result – **Fe<sub>tot</sub>**.

**Calculation of the Fe (III)-concentration:**

$$Fe_{tot} - Fe(II) = \text{mg/L Fe (III)}$$

Parameter	Display	Meas. range
Iron	Iron LCK 320	0.2 – 6.0 mg/L

Iron<sup>2+</sup>

Edition 97/06

## Evaluation

## Fe (II)-Determination

1. Select »Barcode Programs«.
2. Select test number (see below) and evaluation for Iron II (Fe II).
3. Control number must be **2**.
4. Insert sample cuvette and press »Read«.

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L

Iron<sup>3+</sup>

Edition 97/06

## Evaluation

## Fe (III)-Determination

1. Select »Barcode Programs«.
2. Select test number (see below) and evaluation for Iron III (Fe III).
3. Control number must be **2**.
4. Insert sample cuvette and press »Read 1«.
5. Remove sample cuvette.

Screw **a DosiCap A** (LCK 320 A) onto the same cuvette. Invert a few times. After **5 min** invert a few times more, then thoroughly clean the outside of the cuvette and evaluate.

6. Insert sample cuvette again and press »Read 2«.

The result is displayed in **Fell**, **Fetot ( Fe total)** and **Felll**.

Parameter	Test-No.	Meas. range
Iron II (Fe II)	320	0.2 – 6.0 mg/L
Iron total (Fe tot)		0.2 – 6.0 mg/L
Iron III (Fe III)		0 – 6.0 mg/L