Introduction
Besides the taste, the quality of a vinegar depends on various factors such as pH and total titratable acidity. As this determination is run by titration with a strong basic solution (NaOH 1 or 0.5 M), the end point titration is between pH 8.0 and pH 8.8 depending on the manufacturing conditions.

Principle
The end point titration for this application note, based on experiments at pH 8.2, is very easy to run. Vinegar is diluted before analysis with freshly distilled water; the titrant is NaOH 1M or 0.5 M. The result is expressed in g/100 ml (or %) of CH₃COOH (MW=60 g/mol)

Electrode and reagents
pHC2401-8 Combined pH Electrode
NaOH 0.5 or 1 eq/l solution in distilled water
Distilled water
IUPAC Series pH standards
pH 4.005 (part no. S11M002) or pH 7.00 (part no. S11M004) and pH 10.012 (part no. S11M007).

End Point titration settings
- Burette volume: 25 ml
- Stirring speed: 400 rpm
- Working mode: pH
- Number of end points: 1
- End point: 8.20 pH
- Stirring delay: 30 seconds
- Minimum speed: 0.2 ml/min
- Maximum speed: 10 ml/min
- Proportional band: 3.00 pH
- End point delay: 5 seconds
- Sample unit: ml
- Sample amount: 10
- Titrant: Increasing pH
- Result: g/l

Procedure
As the end point of the titration depends on the vinegar, refer to your local procedure or determine the end point value by means of a manual titration (manual dosing).

Calibrate the pHC2401-8 electrode using 2 of the 3 above-mentioned IUPAC standards.

Prepare the burette with the 1M or 0.5M NaOH titrant.

Add 50 ml of freshly distilled water. Dip electrode and delivery tip in the solution.

Start method by pressing the RUN key.

Results
Expressed as g/100 ml (or %) of CH₃COOH

\[ R = \frac{V(titr) \times C(titr) \times 60 \times 100}{V(smp) \times 1000} \]

- \( V(titr) = \) total volume of titrant to reach the end point in ml
- \( C(titr) = \) Titrant concentration in eq/l (currently 0.1)
- \( V(smp) = \) sample volume in ml 60 = molecular weight of CH₃COOH

For a result in %
Enter
A first result unit as g/l
The actual sample amount in the SAMPLE screen
The titrant concentration in the TITRANT screen
1 Titrant and 1 Sample in the COEFFICIENTS display
60 as molecular weight

As the Titration Manager cannot give a result as a % if the sample unit is a volumetric unit, use the equation feature:

- Equation number: 1
- Equation result: % CH₃COOH
- Equation formula: \( R1 / 10 \)

R1 is the titration result calculated in g/l.

For 5 determinations
Mean (as g/100 ml of CH₃COOH): 7.2 g/100 ml
Standard deviation: 0.058 g/100 ml
Rel. standard deviation: 0.8%

Working Range
Irrespective of manufacturing differences, commercially available vinegars generally have a total titratable acidity of between 4 and 8%. For a 10 ml sample amount, this corresponds to 0.4 to 0.8 g of acetic acid and 1 ml of NaOH 1M corresponds to 0.06 g of CH₃COOH.
Notes
Differences in standards or procedures may lead the end point to be fixed at a pH higher than 9.5. In this case, use the pH2011-8 Combined pH Electrode (part no. E16M317) instead of the pH2401-8.