# INSTRUMENT CALIBRATION FOR STATUS AND TREND NETWORK PROJECTS

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# PRESENTATION OUTLINE

1. Definitions.
2. General requirements.
3. Detailed requirements.
    a) Listed by parameter.
4. Troubleshooting.

# DEFINITIONS

## Page 17 of the Sampling Manual

**Instrument Calibration for Status and Trend Network Projects**

# DEFINITIONS

**Initial Calibration (IC):**
The instrument or meter electronics are adjusted to a theoretical value or a known value of a calibration standard.

**Initial Calibration Verification (ICV):**
The instrument or meter calibration is checked, directly following the initial calibration, by measuring a calibration standard of known value as if it were a sample. The measured result is compared to the calibration acceptance criteria.

# DEFINITIONS

**Continuing Calibration Verification (CCV):**
The instrument or meter calibration is checked or verified by measuring a calibration standard of known value as if it were a sample. The measured result is compared to the calibration acceptance criteria.

**Acceptance Criteria:**
The numerical limits within which calibration verifications are acceptable.

# GENERAL REQUIREMENTS

## Instrument Calibration for Status and Trend Network Projects

# BRACKETING REQUIREMENTS

**Chronologically:**
Need verification before collecting field data and verification after collecting field data.

**Quantitatively:**
Standards used for calibration and verification must encompass range of values observed in field.

All field data must be bracketed by passing calibration or verification data.

# SPECIFIC CONDUCTANCE EXAMPLE

## BRACKET SAMPLES BY STANDARD RANGE AND TIME

7:30 Calibrate (1000 µmhos/cm)

↓

7:35 ICV (100 µmhos/cm)

↓

10:00 Sample Collection (1525 µmhos/cm)

↓

15:30 End of Day CCV (5000 µmhos/cm)

# DOCUMENTATION

Calibration log required for all calibrations and verifications.

- Standard operating procedure (SOP) reference.
- Meter identification (ID).
- Date/Time of each calibration or verification.
- Information about standards.
- Instrument reading.
- Result.
  - Pass or Fail.
- Name of person performing each activity.

**CALIBRATION AND VERIFICATION LOG** (FDEP SOP FT 1000-FT 1500, FD 1000-FD 4000)

*Boldly "X" this box if there are qualified data on this page.*

Meter ID: _____ RQ- _____ Project: _____

**Notes:** (1) Always wait for meter to stabilize before recording any readings.
(2) Report all digits displayed. Do not round before reporting measurements. (See special instructions for depth).
(3) For Calibrations, record calibrated meter reading. Do not record initial meter reading before calibration.

**Temperature (Quarterly) FT 1400** Date of Last Temperature Verification _____

| DO DEP SOP FT 1500 | Name | Date | Time CT-ET | Temp °C | Baro-meter mmHg | D.O. Chart mg/L | Meter D.O. mg/L | % DO | Probe Charge | Probe Gain | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calibr. | | | | | | | | | | | P / F | L / F |
| ICV | | | | | | | | | | | P / F | L / F |
| CCV | | | | | | | | | | | P / F | L / F |
| CCV | | | | | | | | | | | P / F | L / F |

DO Acceptance criteria from Table ± 0.3 mg/L. **Rapid-Pulse Sensors:** DO Gain Range 0.7 to 1.4; DO Charge Range 25-75.
**Optical:** DO gain range 0.85 to 1.15 (Pro DSS 0.75 to 1.50); DO charge N/A. **Steady-state & Galvanic Sensors:** DO Gain & Charge N/A.

| Spec. Cond. FT 1200 | Name | Date | Time CT-ET | Lot # | Expir. Date | Standard µmhos/cm | Meter Reading µmhos/cm | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|
| Calibr. | | | | | | | | P / F | L / F |
| ICV | | | | | | | | P / F | L / F |
| CCV | | | | | | | | P / F | L / F |
| CCV | | | | | | | | P / F | L / F |

Conductivity Acceptance criteria ± 5%

| pH DEP SOP FT 1100 | Name | Date | Time CT-ET | Lot # | Expir. Date | pH Buffer SU | Temp °C | Meter reading SU | mV | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calibr. | | | | | | 7. | | | | P / F | L / F |
| Calibr. | | | | | | 4. | | | | P / F | L / F |
| Calibr. | | | | | | 10. | | | | P / F | L / F |
| ICV | | | | | | | | | | P / F | L / F |
| CCV | | | | | | | | | | P / F | L / F |
| CCV | | | | | | | | | | P / F | L / F |

pH Acceptance criteria ± 0.2 SU; mV pH 7 Range 0 ± 50; mV pH 4 Range +180 ± 50; mV pH 10 Range -180 ± 50;
If mV are recorded: slope from 7 to 10 _____, slope from 4 to 7 _____ (both must be between 165 and 180 mV)

**Does meter have a depth sensor that will be used to measure total depth & sample depth? YES / NO / NA** (not surf. water project)
If **YES**, complete daily Calibr. & ICV below and list date of last quarterly depth verification: _____
If **NO**, what will be used? (circle one) **Secchi Disk Line / Sonar** Unique ID: _____; Date of last verification: _____

| Depth Sensor (Daily Calibration & ICV) | Name | Date | Time CT-ET | Calibrated Value (0.00 or Offset), meters | ICV Value, meters | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|
| Pressure mode in air | | | | | | P / F | L / F |

Report two decimal places. Round numbers ≤ 4 down, ≥ 5 up. ICV acceptance criteria ± 5 % or ± 0.05m, whichever is greater.

**COMMENTS:**

Form effective August 1, 2018

# DOCUMENTATION

- When documenting a date, always include month, day and year.
  - In MM/DD/YYYY format.
- Complete all required fields for each calibration log entry.
  - Acceptable to use arrows/ditto marks.

| Spec. Cond. FT 1200 | Name | Date | Time CT-ET | Lot # | Expir. Date | Standard µmhos/cm | Meter Reading µmhos/cm | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|
| Calibr. | JANE DOE | 3/23/2022 | 07:45 | C3PO | 04/30/2023 | 1000 | 1005 | P / F | L / F |
| ICV | JANE DOE | 3/23/2022 | 08:05 | R2D2 | 05/31/2023 | 100 | 101 | P / F | L / F |
| CCV | JANE DOE | 3/23/2022 | 13:55 | OBE1 | 06/30/2023 | 5000 | 5015 | P / F | L / F |
| CCV | JANE DOE | 3/23/2022 | 14:00 | R2D2 | 05/31/2023 | 100 | 102 | P / F | L / F |

Conductivity Acceptance criteria ± 5%

| Spec. Cond. FT 1200 | Name | Date | Time CT-ET | Lot # | Expir. Date | Standard µmhos/cm | Meter Reading µmhos/cm | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|
| Calibr. | JANE DOE | 3/23/2022 | 07:45 | C3PO | 04/30/2023 | 1000 | 1005 | P / F | L / F |
| ICV | " | " | 08:05 | R2D2 | 05/31/2023 | 100 | 101 | P / F | L / F |
| CCV | " | " | 13:55 | OBE1 | 06/30/2023 | 5000 | 5015 | P / F | L / F |
| CCV | " | " | 14:00 | R2D2 | 05/31/2023 | 100 | 102 | P / F | L / F |

Conductivity Acceptance criteria ± 5%

# STANDARDS

- Do not reuse standards.
  - Use a fresh aliquot of standard for each activity (IC, ICV and CCV).
- Do not use expired standards.
  - Unless they have been previously verified against other (non – expired standards).
    - Contact Quality Assurance (QA) Officer for requirements.

# DETAILED REQUIREMENTS

## Instrument Calibration for Status and Trend Network Projects

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| pH | All Displayed | Daily IC, ICV, CCV | ± 0.2 SU |
| Specific Conductance | All Displayed | Daily IC, ICV, CCV | ± 5% |
| Dissolved Oxygen | All Displayed | Daily IC, ICV, CCV | ± 0.3 mg/L |
| Temperature | All Displayed | Quarterly CCV | ± 0.5 °C |
| Turbidity | All Displayed | Daily CCV;<br>Quarterly IC, ICV, secondary standard verification; | 0.1 - 10 NTU: ± 10%;<br>11-40 NTU: ± 8%;<br>41-100 NTU: ± 6.5%;<br>> 100 NTU: ± 5% |
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

SU = Standard Units.
NTU = Nephelometric Turbidity units.

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| pH | All Displayed | Daily IC, ICV, CCV | ± 0.2 SU |
| Specific Conductance | All Displayed | Daily IC, ICV, CCV | ± 5% |
| Dissolved Oxygen | All Displayed | Daily IC, ICV, CCV | ± 0.3 mg/L |
| Temperature | All Displayed | Quarterly CCV | ± 0.5 °C |
| Turbidity | All Displayed | Daily CCV;<br>Quarterly IC, ICV, secondary standard verification; | 0.1 - 10 NTU: ± 10%;<br>11-40 NTU: ± 8%;<br>41-100 NTU: ± 6.5%;<br>> 100 NTU: ± 5% |
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

# DAILY CALIBRATION PROCEDURES

## DISSOLVED OXYGEN, SPECIFIC CONDUCATANCE AND PH

**Required.**

- IC at beginning of day.
- ICV immediately following IC.
- CCV at end of day.

**Recommended.**

- Mid-day CCV at sample site.
  - Required if end of day CCV routinely fails.

# pH

- Check pH millivolts at least weekly.
  - Daily check recommended.
- Always begin three-point calibration with pH 7.0 buffer.
- Rinse well with de-ionized (DI) water (required) and fresh buffer (recommended) before each calibration or verification activity.
- Select buffers to bracket values measured in the field.
  - May need buffers < 4.0 or > 10.0.
- pH of buffer solutions varies with temperature.
  - If using adjusted calibration values, you need to adjust expected value for verifications.

# pH

Document temperature – adjusted pH buffer value (from container / reference chart) when using a meter with auto buffer recognition and populated temperature – adjusted pH calibration values.

| pH DEP SOP FT 1100 | Name | Date | Time CT-ET | Lot # | Expir. Date | pH Buffer SU | Temp °C | Meter reading SU | mV | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calibr. | JANE DOE | 3/23/2022 | 6:45 | 8675309 | 1/31/2023 | 7.03 | 18.0 | 7.03 | -37.9 | (P) / F | (L) / F |
| Calibr. | JANE DOE | 3/23/2022 | 6:47 | 7765577 | 1/31/2023 | 4.00 | 18.0 | 4.00 | 138.7 | (P) / F | (L) / F |
| Calibr. | JANE DOE | 3/23/2022 | 6:49 | 6488888 | 1/31/2023 | 10.08 | 18.0 | 10.08 | -204.5 | (P) / F | (L) / F |
| ICV | JANE DOE | 3/23/2022 | 6:53 | 7765577 | 1/31/2023 | 4.00 | 18.3 | 4.02 | | (P) / F | (L) / F |
| CCV | JANE DOE | 3/23/2022 | 14:10 | 6488888 | 1/31/2023 | 10.12 | 15.0 | 10.30 | | (P) / F | L / (F) |
| CCV | | | | | | | | | | P / F | L / F |

pH Acceptance criteria ± 0.2 SU; mV pH 7 Range 0 ± 50; mV pH 4 Range +180 ± 50; mV pH 10 Range -180 ± 50;
If mV are recorded: slope from 7 to 10 166.6, slope from 4 to 7 176.6 (both must be between 165 and 180 mV)

# SPECIFIC CONDUCTANCE


- Always use Potassium Chloride (KCl) standards.
- Rinse well with DI and fresh standard before each calibration point or reading.
- Select standards to bracket values measured in the field.
- If observed field values are lower than 100 µmhos/cm, you must use the 100 µmhos/cm standard for CCV.
- You do not need to use standards lower than 100 µmhos/cm.
- For all YSI models, manually enter standard value during calibration.
  - No auto-recognition of standards.

# SPECIFIC CONDUCTANCE

## If all field measurements < 100 µmhos/cm

| Spec. Cond. FT 1200 | Name | Date | Time CT-ET | Lot # | Expir. Date | Standard µmhos/cm | Meter Reading µmhos/cm | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|
| Calibr. | JANE DOE | 3/23/2022 | 07:45 | C3PO | 04/30/2023 | 1000 | 1005 | P / F | L / F |
| ICV | JANE DOE | 3/23/2022 | 08:05 | R2D2 | 05/31/2023 | 100 | 101 | P / F | L / F |
| CCV | JANE DOE | 3/23/2022 | 13:55 | R2D2 | 05/31/2023 | 100 | 102 | P / F | L / F |
| CCV | | | | | | | | P / F | L / F |

Conductivity Acceptance criteria ± 5%

## If field measurements have wide range:
## Some > 1000 µmhos/cm and some < 100 µmhos/cm

| Spec. Cond. FT 1200 | Name | Date | Time CT-ET | Lot # | Expir. Date | Standard µmhos/cm | Meter Reading µmhos/cm | Pass / Fail | Lab / Field |
|---|---|---|---|---|---|---|---|---|---|
| Calibr. | JANE DOE | 3/23/2022 | 07:45 | C3PO | 04/30/2023 | 1000 | 1005 | P / F | L / F |
| ICV | JANE DOE | 3/23/2022 | 08:05 | R2D2 | 05/31/2023 | 100 | 101 | P / F | L / F |
| CCV | JANE DOE | 3/23/2022 | 13:55 | OBE1 | 06/30/2023 | 5000 | 5015 | P / F | L / F |
| CCV | JANE DOE | 3/23/2022 | 14:00 | R2D2 | 05/31/2023 | 100 | 102 | P / F | L / F |

Conductivity Acceptance criteria ± 5%

# DISSOLVED OXYGEN

- Calibrate with water – saturated air or air – saturated water methods.
- Temperature sensitive.
  - Use room temperature water.
  - Allow meter temperature and dissolved oxygen (DO) to stabilize before calibrating.
- Inspect probe for damage daily.
- Check DO gain and charge at least weekly.
  - Gain checked for both membrane and optical.
  - Charge checked for membrane probes.
- Verify annually if an internal barometer is part of the multiprobe device.

# DO

For each calibration or verification, document:

- Barometer value (760 mm Hg or internal barometer reading).
- Temperature (°C).
- DO mg/L.
- DO percent saturation.

Compare DO mg/L meter reading to “Solubility of Oxygen in Water” reference table value for matching temperature and barometric pressure.

**Solubility of oxygen in fresh water at various temperatures and pressures. (Solubility shown in milligrams per liter.)**

Values based on published equations by Benson and Krause (1980 and 1984). Results from DOTABLES program at https://water.usgs.gov/software/DOTABLES/.

| | Barometric Pressure (mm Hg) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp. (°C) | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 |
| 19.0 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.4 | 9.4 |
| 19.1 | 9.1 | 9.1 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 |
| 19.2 | 9.1 | 9.1 | 9.1 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 |
| 19.3 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 |

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| pH | All Displayed | Daily IC, ICV, CCV | ± 0.2 SU |
| Specific Conductance | All Displayed | Daily IC, ICV, CCV | ± 5% |
| Dissolved Oxygen | All Displayed | Daily IC, ICV, CCV | ± 0.3 mg/L |
| Temperature | All Displayed | Quarterly CCV | ± 0.5 °C |
| Turbidity | All Displayed | Daily CCV;<br>Quarterly IC, ICV, secondary standard verification; | 0.1 - 10 NTU: ± 10%;<br>11-40 NTU: ± 8%;<br>41-100 NTU: ± 6.5%;<br>> 100 NTU: ± 5% |
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

# TEMPERATURE

- Perform quarterly CCV.
- Compare meter reading to National Institute of Standards and Technology (NIST) traceable thermometer reading.
- Perform verification at two different temperatures.
  - Ice bath and warm water bath.
- Time reports as Eastern Time Zone (ETZ) or Central Time Zone (CTZ).

**Quarterly Temperature Verification Log - DEP Regional Operation Centers**

DEP SOP FT 1400. Acceptance Criteria for Temp. ± 0.5°C.
Record all digits displayed for temperature readings. Do not round before reporting measurements.
CCV = Continuing Calibration Verification. Target temperature for cold CCV is 0 - 10 (°C). Target temperature for hot CCV is 30 - 40 (°C).

**Time Zone** (circle one): **ETZ / CTZ**

| Field Meter ID | Field Meter Serial Number | NIST Reference Device ID | Activity Date | Cold CCV Time | Cold CCV Field Meter Temp (°C) | Cold CCV NIST Temp (°C) | Cold CCV Result (circle one) | Hot CCV Time | Hot CCV Field Meter Temp (°C) | Hot CCV NIST Temp (°C) | Hot CCV Result (circle one) | Activity Performed By (Staff Name) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |
| | | | | | | | P / F | | | | P / F | | |

Form effective date: September 6, 2024

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| pH | All Displayed | Daily IC, ICV, CCV | ± 0.2 SU |
| Specific Conductance | All Displayed | Daily IC, ICV, CCV | ± 5% |
| Dissolved Oxygen | All Displayed | Daily IC, ICV, CCV | ± 0.3 mg/L |
| Temperature | All Displayed | Quarterly CCV | ± 0.5 °C |
| Turbidity | All Displayed | Daily CCV;<br>Quarterly IC, ICV, secondary standard verification; | 0.1 - 10 NTU: ± 10%;<br>11-40 NTU: ± 8%;<br>41-100 NTU: ± 6.5%;<br>> 100 NTU: ± 5% |
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

# TURBIDITY

## FOR GROUNDWATER PROJECTS ONLY


- Place meter on level surface.
- Check cuvette for scratches.
- Dry cuvette with lint – free wipe.
- Handle cuvette carefully.
  - No fingerprints or dirt on glass.
- Ensure cuvette orientation is correct when inserting into meter.

# TURBIDITY

## FOR GROUNDWATER PROJECTS ONLY

- Use portable turbidimeter with tungsten filament light source.
  - Hach 2100P or Hach 2100Q.
- Two types of standards:
  - Primary formazin.
    - Required.
    - Requires agitation before use.
    - Temperature sensitive.
      - Use between 0°Celsius (C) and 25°C.
  - Secondary gel.
    - Optional.
    - Used for CCVs only.
    - Values are assigned by instrument user after each meter calibration.
    - Assigned values are instrument and calibration – specific.
    - If meter is recalibrated, must also redo verification of secondary gel standards.
    - Do not require agitation and are less temperature sensitive.

# TURBIDITY

## FOR GROUNDWATER PROJECTS ONLY

**Quarterly Requirements.**

- IC using at least two primary formazin standards.
- ICV immediately after IC using at least one primary formazin standard.
- If using secondary gel standards, verify all secondary gel standards immediately after ICV.
  - Read each gel standard and assign current reading as the standard's value.

**Daily Requirements.**

- CCV using at least one secondary gel standard or primary formazin standard.

**For all verifications (ICV and CCVs).**

- Do not use turbidity–free water or < 0.1 NTU standard.

# DOCUMENTATION

## TURBIDITY CALIBRATION LOG

Quarterly Activities

Daily Activities

**Turbidity Calibration Log (DEP SOPs FT1000 & FT1600)**
**Regional Operations Centers**

Meter ID:_____ Date of Last Calibration:_____ Project Name:_____

**Quarterly Calibration**

Sampler Name:_____ Date:_____ Time:_____ ETZ / CTZ *(circle one)*

| Standard Value *(Use Primary Formazin Standards)* | Exp. Date | Lot # | Type of Information Displayed During Calibraiton? *(circle one)* | Value Displayed NTU | Calibration Pass / Fail *(circle one)* |
|---|---|---|---|---|---|
| NTU | | | Meter Reading / Next Value | | P / F |
| NTU | | | Meter Reading / Next Value | | P / F |
| NTU | | | Meter Reading / Next Value | | P / F |
| NTU | | | Meter Reading / Next Value | | P / F |

**Initial Calibration Verification (ICV)** *(Only perform ICV immediately after quarterly calibr. Do not use < 0.1 NTU standard for ICV.)*

Sampler Name:_____ Date:_____ Time:_____ ETZ / CTZ *(circle one)*

| Standard Value *(Use A Primary Formazin Standard)* | Exp. Date | Lot # | Meter Reading NTU | Pass / Fail *(circle one)* |
|---|---|---|---|---|
| NTU | | | | P / F |

**Secondary Gel Standard Quarterly Verification** *(perform gel standard verificaiton immediately after quarterly calib. and ICV)*

Sampler Name:_____ Date:_____ Time:_____ ETZ / CTZ *(circle one)*

| Standard Value Range NTU | Previous Value Assigned NTU | Exp. Date | Lot # | Meter Reading NTU *(new value assigned)* | Acceptable Range, NTU *(Calculate using new value assigned & acceptance criteria*)* |
|---|---|---|---|---|---|
| 0 – 10 | | | | | |
| 10 – 100 | | | | | |
| 100 - 1000 | | | | | |

**Daily Continuing Calibration Verification (CCV)** *(required every day that meter is used)*

| Date | Time (24hr) CT-ET | Sampler Name | Standard Type *(circle one)* | Standard Value NTU | Exp. Date | Lot # | Meter Reading NTU | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |
| | | | Formazin / Gel | | | | | P / F |

**Comments:**

*Acceptance Criteria: 0.1-10 NTU → ± 10 %; 11-40 NTU → ± 8 %; 41-100 NTU → ± 6.5 %; >100 NTU → ± 5 %;
Acceptable ranges for common standards: 20 NTU (18.4 - 21.6 NTU); 100 NTU (93.5 – 106.5 NTU); 800 NTU (760 - 840 NTU)

Form Effective October 1, 2017

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| pH | All Displayed | Daily IC, ICV, CCV | ± 0.2 SU |
| Specific Conductance | All Displayed | Daily IC, ICV, CCV | ± 5% |
| Dissolved Oxygen | All Displayed | Daily IC, ICV, CCV | ± 0.3 mg/L |
| Temperature | All Displayed | Quarterly CCV | ± 0.5 °C |
| Turbidity | All Displayed | Daily CCV;<br>Quarterly IC, ICV, secondary standard verification; | 0.1 - 10 NTU: ± 10%;<br>11-40 NTU: ± 8%;<br>41-100 NTU: ± 6.5%;<br>> 100 NTU: ± 5% |
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

# DEPTH

## SURFACE WATER PROJECTS ONLY

| Parameter | Number of Decimal Places To Record | Calibration / Verification Frequency | Acceptance Criteria |
|---|---|---|---|
| Depth | Cal. / Ver.:<br>2 for electronic devices;<br>1 for manual devices<br>Field Meas.:<br>2 if total depth < 0.6 m;<br>1 if total depth ≥ 0.6 m | Daily: IC, ICV for Sondes.<br>Quarterly: Verify Sondes & Electronic Devices.<br>Every 6 months: Inspect Manual Devices. | ICV: ± 5% or ± 0.05 m, whichever is greater;<br>Electronic Device Check: ± 10%;<br>Line Increments: ± 10%;<br>Total Length of Lines: ± 5%; |

# DEPTH

## SURFACE WATER PROJECTS ONLY

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## Rounding Rule.

- Numbers ≤ 4 are rounded down.
  - E.g. 3.14 becomes 3.1.
- Numbers ≥ 5 are rounded up.
  - E.g. 6.89 becomes 6.9.

# DEPTH

## SURFACE WATER PROJECTS ONLY

**Daily Requirement**

- Zero depth sensor on field multi – parameter meters (if applicable) and perform ICV.
- Acceptance criteria ± 5 percent or ± 0.05 m, whichever is greater.

Source: Yellow Springs Instruments

# DEPTH

## SURFACE WATER PROJECTS ONLY

**Quarterly Requirements.**

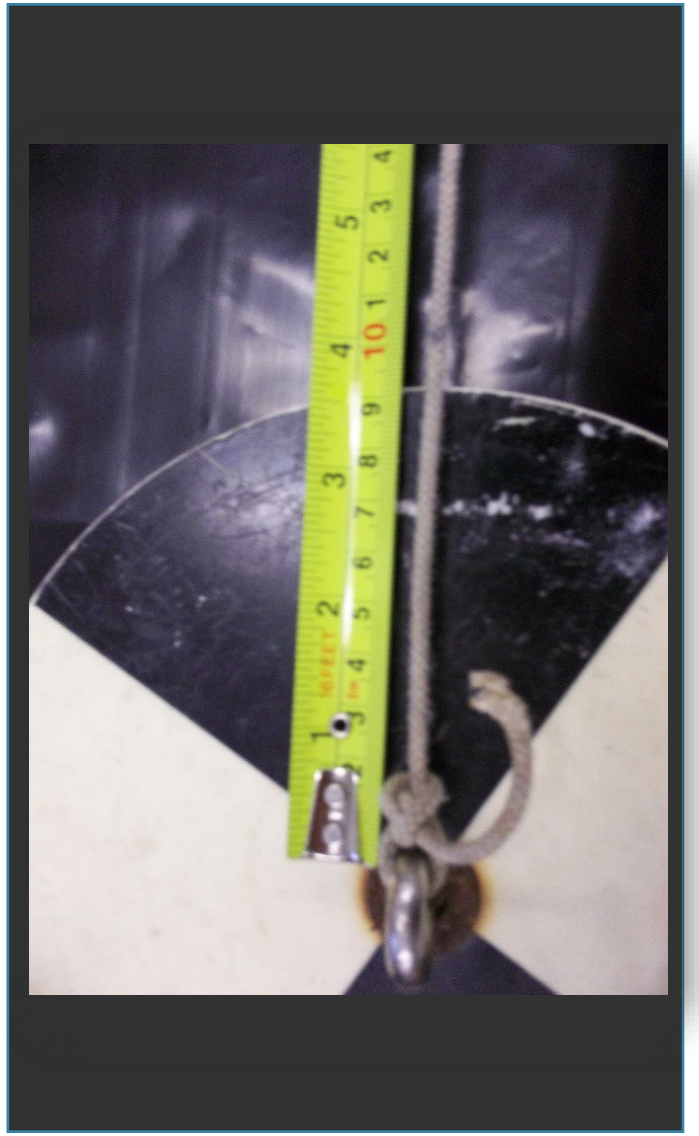
- Check all electronic devices used for depth measurement.
- Compare reading to a reference device.
  - Graduated bucket, metal measuring tape, verified Secchi disk line.
- Acceptance criteria ± 10 percent.

# DEPTH

## SURFACE WATER PROJECTS ONLY

Every six months.

- Compare all lines used for depth measurements to a reference device.
- Redo markings as needed.
- Check incremental marking.
  - Acceptance criteria ± 10%.
- Check total length.
  - Check up to greatest anticipated depth in field.
  - Acceptance criteria ± 5%.



# DEPTH
## QUARTERLY VERIFICATION LOG

### Depth Verification
### Regional Operation Centers

SOP - S&T Sampling Manual and ROC Training Manual.
Report two decimal places for electronic devices. Report one decimal place for manual devices.
Numbers ≤4, are rounded down; numbers ≥ 5 are rounded up.

**QUARTERLY VERIFICATION OF ELECTRONIC DEVICES (SONDE, SONAR DEVICE, ETC.)**

**Meter / Device ID#:**_____ **Date of Last Verification:** _____

**Date:** _____ **Time:** _____ **ETZ / CTZ** **Verification Location:** _____

**Person Performing Verification:** _____

**Reference Device: Graduated Bucket / Metal Measuring Tape / Meter Stick / Other** _____

**Depth measurements: Reference Device:** _____ **m ; Device Being Tested:** _____ **m**

**Result: Pass / Fail** (acceptance Criteria 10%)

**6 MONTH VERIFICATION OF MANUAL DEVICES (SECCHI DISK, WEIGHTED LINE, ETC.)**

**Secchi/Weighted Line ID#:**_____ **Date of Last Verification:** _____

**Date:** _____ **Time:** _____ **ETZ / CTZ** **Verification Location:** _____**Lab**_____

**Person Performing Verification:** _____

**Reference Device: Metal Measuring Tape / Meter Stick / Other** _____

**Incremental markings of 0.1 m checked: YES / NO** **Result: Pass / Fail** (acceptable criteria 10%)

**Total length of line (up to anticipated depth encountered in field) checked: YES / NO**

**Total Length: indicated by line markings** _____ **m ; measured by reference device** _____ **m**

**Result: Pass / Fail** (acceptable criteria of 5%) **Markings redone: YES / NO**

# DEPTH

## SURFACE WATER PROJECTS ONLY

- When comparing depth measuring device to reference device, document reading from both devices.
  - Quarterly verifications for electron devices.
  - Six-month verifications of manual device total length.

**6 MONTH VERIFICATION OF MANUAL DEVICES (SECCHI DISK, WEIGHTED LINE, ETC.)**

Secchi/Weighted Line ID#:_____ Date of Last Verification: _____

Date: _____ Time: _____ ETZ / CTZ Verification Location: ____Lab____

Person Performing Verification: _____

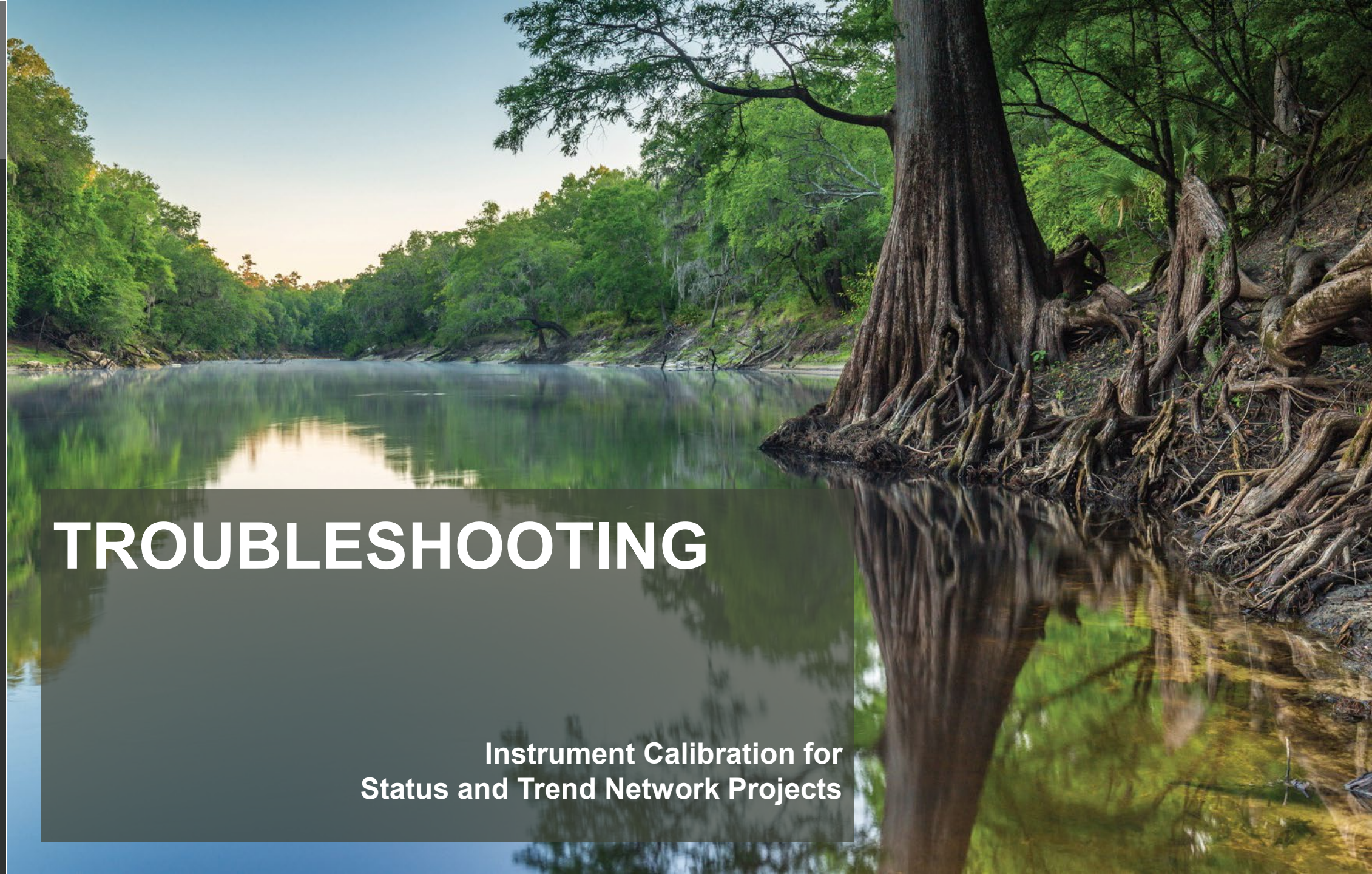
Reference Device: Metal Measuring Tape / Meter Stick / Other _____

Incremental markings of 0.1 m checked: YES / NO Result: Pass / Fail (acceptable criteria 10%)

Total length of line (up to anticipated depth encountered in field) checked: YES / NO

Total Length: indicated by line markings 6.0 m ; measured by reference device 6.1 m

Result: Pass / Fail (acceptable criteria of 5%) Markings redone: YES / NO



# TROUBLESHOOTING

**Instrument Calibration for**
**Status and Trend Network Projects**

# TROUBLESHOOTING

**Calibration or ICV Fails.**

- Perform maintenance/cleaning and attempt IC again.
- Do not use meter for data collection until issue is resolved.

**CCV Fails.**

- Rinse probe with standard and attempt CCV again.
- If failure still present, affect field data must be “J” qualified.
    - Add a comment describing the problem.

**Bracketing Requirements not Met.**

- Affected field data must be “J” qualified.
    - Add a comment describing the problem.

# THANK YOU

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FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION