

- **Dual input gives two measurements in one instrument**
  - cost effective
- **Reagentless operation**
  - significant savings in operational expenditure costs
- **Automatic cleaning**
  - maintains the integrity of the measurement with minimal intervention
- **Annual replacement of wiper blades is only planned maintenance**
  - virtually zero maintenance
- **Dual wavelength measurement compensates for both turbidity and organics content**
  - no expensive filtration required
- **Long lamp life**
  - up to 10 years operation keeping cost of ownership to a minimum
- **Automatic on-line diagnostics**
  - maintains the integrity of the measurement



A robust, easy-to-use range of continuous on-line monitors

## AV400 Series Nitrate Monitor

The AV450 and AV455 Nitrate Monitors are designed for use on potable water treatment plants to determine the quality of the final treated water. They can also be used for blending of high and low nitrate waters and borehole water. The monitor provides continuous analysis with the minimum of manual intervention and extremely low running costs – no expensive chemical reagents are required.

The flow-through system is supplied complete with inlet isolating valve, drain and a wall-mount bracket as standard.

## Dual-Wavelength Measurement

In addition to the measurement of nitrate at 220nm another measurement at a different wavelength compensates for interference from both turbidity up to 100NTU or Dissolved Organics (as Humic Acids) up to 20mg<sup>l</sup><sup>-1</sup>. This sophisticated advanced technology ensures a superior compensation providing greater security of performance in applications when there are widely fluctuating sample conditions. It also removes the need for expensive and maintenance-prone filtration systems, significantly reducing maintenance demands and simplifying the measurement.

## Reagentless Operation

The monitor is a straight-through system requiring no consumable reagents or pump tubes, keeping the cost of ownership to an absolute minimum.

## Maintenance

Minimal maintenance is required due to the simplicity of the monitor. Apart from periodic validation of the calibration of the monitor and annual replacement of the wiper blades, there is no need for manual intervention.

## Calibration

Calibration is a simple procedure using high-quality demineralized water for zero and sodium nitrate as the standard solution to adjust the span.

The monitor design ensures that the system is extremely stable and calibration needs to be performed only once or twice a year.

## Installation of the Sensor

A wall-mount bracket is supplied as standard to enable the flow-through sensor to be mounted on the back-plate.



Adding Demineralized Water

## Alarms

Three alarms are supplied as standard. These can be configured as high or low programmable alarms or as a status alarm.

## Light Source

The light source is monitored continuously for correct operation and is operated at a fraction of the normal frequency of the operating voltage intended by the manufacturer. Only 13% of the rated lamp life is used in 10 years. This results in a very stable light source, keeping operating costs to a minimum.

## Auto-Cleaning

Optical cleaning is a key feature, ensuring optimum performance with the minimum of manual intervention. The cleaning interval is programmable to accommodate varying sample conditions.



Auto-cleaning Mechanism

**AV400 Series Transmitter**

The transmitter incorporates the latest technology to provide a highly reliable, yet flexible, feature-packed device designed to satisfy a diverse range of process monitoring and control applications. On dual-input monitors both measured parameters are displayed simultaneously.

**High Functionality as Standard**

All versions are supplied with two fully isolated current outputs as standard. Both outputs can be ranged independently on single input versions. Each one can be assigned to either sensor input on dual input versions.

Three programmable relay set points are available that can also be assigned as required.

Innovative features such as a power saving display and a diagnostic current output option all contribute to a low cost of ownership.



Dual Nitrate Display

**Significantly Reduced Maintenance Costs**

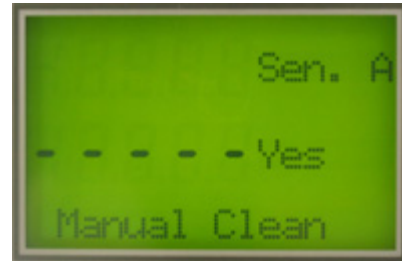
The transmitters are supplied as standard for 85 to 265V AC operation. There are no inner switches to be set.

The transmitters can also be provided for 9 to 36V DC operation that reduces maintenance costs significantly by removing the need for costly, annual safety tests to ensure compliance with safety procedures.

**Energy Saving Display**

The backlit display has been designed to operate in all types of environments and shows both the measured parameter(s) and, on a separate 16-character display line, diagnostic and computed information.

For conservation of energy, the backlight can be set to switch off automatically after 60s of inactivity.



Backlight Can Be Set To Switch-off When Inactive

**Easy Access Installation Terminals**

Easy access to the terminations ensures rapid and cost-effective installation. The wall-/pipe-mount version has been designed to ensure that cable connection is simple and convenient. Ingress protection of the electronics section is retained even when the terminal compartment is opened.



AV400 Termination Chamber Makes Access Easy

## Applications

There are a number of applications within Potable Water Treatment where the AV450 Series UV Nitrate monitor can be used.

### Intake Protection

Monitoring the nitrate levels at the point of abstraction, from either river or bore hole sources, enables the plant to control the nitrate throughout the plant.

### Nitrate Reduction

Complete removal of nitrate is not a practical and cost effective option. Reducing the nitrate levels to below the consent limits is the preferred method.

The consent limits for nitrates are:

EU and WHO  $-50\text{mg l}^{-1}$  as  $\text{NO}_3^-$

US  $-10\text{mg l}^{-1}$  as N ( $45\text{mg l}^{-1}$   $\text{NO}_3^-$ )

De-nitrification is the process of reducing the nitrate levels.

A mixture of physical and chemical processes are used for de-nitrification.

Four de-nitrification methods in common use, making use of reliable on-line monitoring, are:

### 1. Blending

This method is really nitrate reduction.

Water with a low nitrate level from another source is added to the raw water to bring the nitrate level down below the maximum value.

Nitrate monitoring is required to control the blending process.

### 2. Ion-exchange

The process involves drawing-off a percentage of the water, passing it through an ion-exchange bed that removes the nitrate and returning the water back into the main stream. By adjusting the ratio of the two streams, the nitrate level in the final blended water is reduced to the required level.

Monitoring the outlet of the ion-exchange bed enables automatic control of the regeneration process (also monitored here) and the blended water enables accurate control of the final nitrate concentration going to distribution.

See diagram opposite.

**3. Reverse Osmosis.**

In reverse osmosis processes, raw water is forced through thin film membranes of synthetic polymeric material. Dissolved and suspended solids do not permeate the membrane. Treating only part of the total water flow and blending this back into the main flow achieves the reduction of nitrate concentration of borehole water. See diagram below.

**4. Biological.**

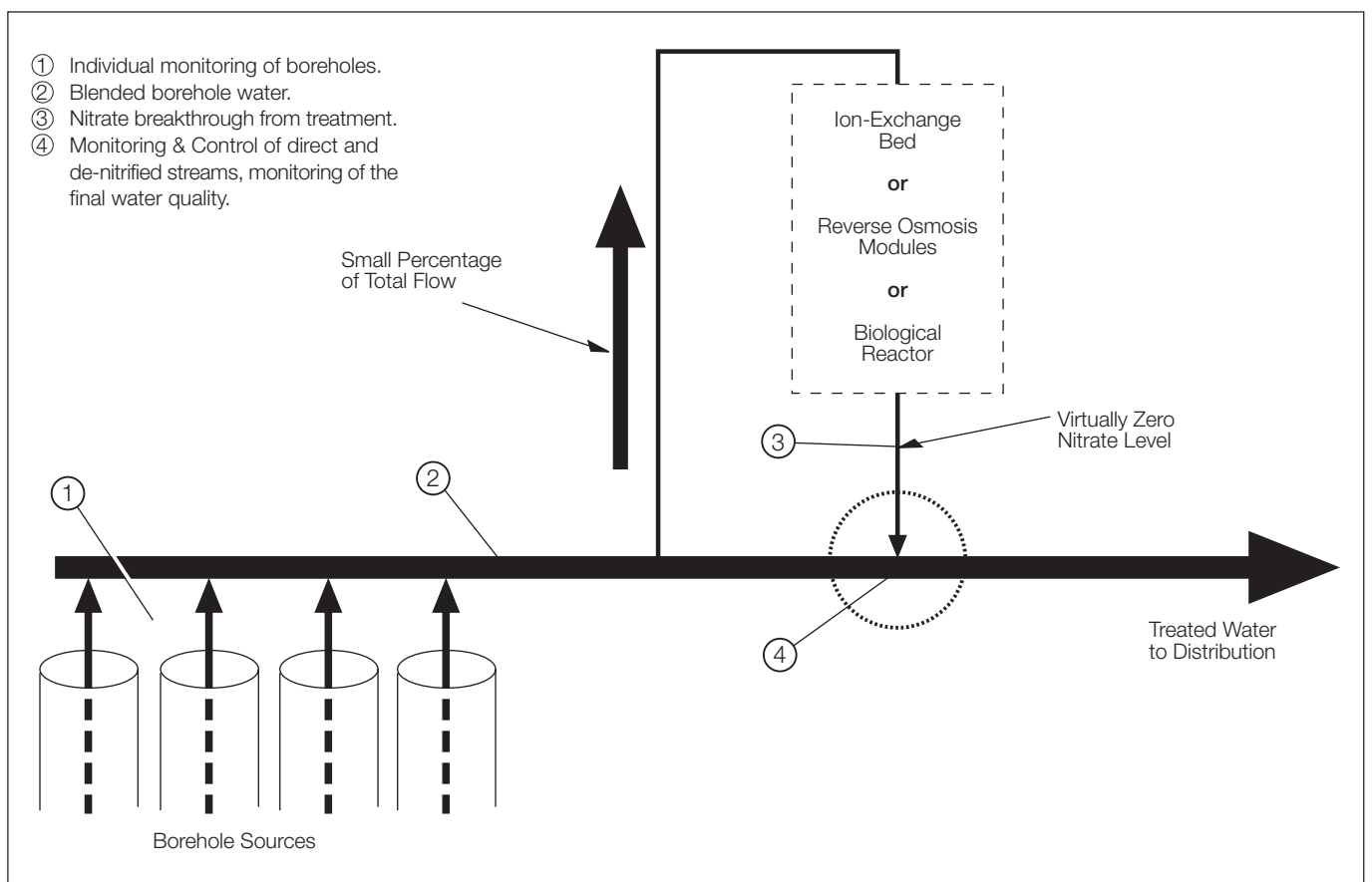
Biological de-nitrification relies on the ability of certain naturally occurring bacteria that use nitrate for respiration which, in the absence of dissolved oxygen, convert the nitrate to nitrogen gas.



The biological reactor is operated under anaerobic conditions, the essential nutrient is provided by the addition of phosphate and carbon in form of methanol, ethanol, or acetic acid. The sludge is removed by conventional coagulation followed by sand filtration.

Again, a percentage of the water is treated and returned to the main stream. By adjusting the ratio of the two streams the nitrate in the final blended water is reduced to the required value.

See diagram below.



Typical Nitrate Reduction Processes

## Specification

### General

#### Sensor range

AV450/455 operating ranges:

As NO<sub>3</sub> 0 to 100mg<sup>-1</sup>

As N 0 to 20mg<sup>-1</sup>

#### Accuracy

As NO<sub>3</sub> ±2% of reading or 0.5mg<sup>-1</sup>, whichever is the greater

As N ±2% of reading or 0.15mg<sup>-1</sup>, whichever is the greater

#### Reproducibility

As NO<sub>3</sub> ±0.5mg<sup>-1</sup>

As N ±0.15mg<sup>-1</sup>

#### Interference compensation

Turbidity <100NTU

or

Dissolved Organics as Humic Acid <20mg<sup>-1</sup>

#### Maximum current output scale expansion

As NO<sub>3</sub> minimum range 0 to 20mg<sup>-1</sup>

As N minimum range 0 to 4mg<sup>-1</sup>

#### Response time

Normally three minutes for 90% step change depending on damping factor

#### Lamp life

Rated by the manufacturer at 1.2 x 10<sup>9</sup> flashes (10 years continuous operation at the rate of one flash at 2s intervals [typical] equates to 13% of the rated lamp life)

#### Internal wiper cleaning system

Programmable, operation frequency 15, 30, 45 and 60 minutes, 2, 4, 6, 12 and 24 hours

#### Maximum distance between transmitter and sensor

750mm (29.5 in.)

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### Sample

#### Flow rate

0.5 to 5l min<sup>-1</sup> (free of air bubbles).

A higher minimum flow rate is required at high turbidity levels

#### Temperature

0 to 40°C (32 to 104°F)

#### Pressure

The sensor should be operated at atmospheric pressure but can withstand 3bar (43.5 psi) max.

### Display

#### Type

Dual 4<sup>1</sup>/<sub>2</sub>-digit, 7-segment backlit LCD

#### Information

16-character, single line dot matrix

#### Resolution

As NO<sub>3</sub> 0.1mg<sup>-1</sup>

As N 0.01mg<sup>-1</sup>

#### Energy saving function

Backlit LCD configurable as ON or Auto Off after 60s

#### Logbook

Electronic record of major events and calibration data

#### Real-time clock

Records time for logbook and auto cleaning

#### Diagnostics

Out of sample

Lamp disabled

Loss of signal

Electronic failure

#### Languages

English

French

German

Italian

Spanish

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### Outputs

#### Current Outputs

##### Number of signals

2 fully isolated current outputs supplied as standard, configurable to one or both sensor outputs

Current outputs also programmable to any value between 0 and 22mA to indicate system failure

##### Output current

0 to 10mA, 0 to 20mA or 4 to 20mA

##### Maximum load resistance

750 $\Omega$  at 20mA

##### Accuracy

±0.25% FSD ±5% of reading

##### Resolution

0.1% at 10mA, 0.05 at 20mA

##### Serial communication

PROFIBUS DP

## Relay outputs

### Number of relays

Three supplied as standard,  
configurable to one or both sensor inputs or status

### Set point adjustment

Fully programmable as normal or failsafe, high/low or status

### Hysteresis

Programmable 0 to 5% in 0.1% increments

### Delay

Programmable 0 to 100 minutes in 1 minute intervals

### Relay contacts

Single-pole changeover

Rating 5A 250V max. non-inductive

### Insulation

2kV RMS contacts to earth (ground)

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## Power supply

### Voltage requirements

85 to 260V AC 50/60 Hz

Optional 9 to 36V DC

### Power consumption

<24VA

### Insulation

Mains to earth (line to ground) 2kV RMS

## Mechanical Data

### Transmitter

IP66/NEMA4X

Dimensions 192mm (7.56 in.) high x 230mm (9.06 in.) wide x  
94mm (3.7 in.) deep

Weight 1kg (2.2 lb)

### Sensor

Low Range Dimensions 327mm (12.87 in.) wide  
x 410mm (16.14 in.) high x 162mm (6.38 in) deep

High Range Dimensions 405mm (15.94 in.) wide  
x 373mm (14.68 in.) high x 136mm (5.35 in) deep

Weight 6kg (13.2 lb)

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## Environmental Data

### Operating temperature limits

0 to 50°C (32 to 122°F)

### Storage temperature limits

-25 to 75°C (-13 to 167°F)

### Operating humidity limits

Up to 95%RH non-condensing

### EMC emissions and immunity

Meets requirements of:

EN61326 (for an industrial environment)

EN50081-2

EN50082-2

### Safety

EN61010-1

Overvoltage Class II on inputs and outputs

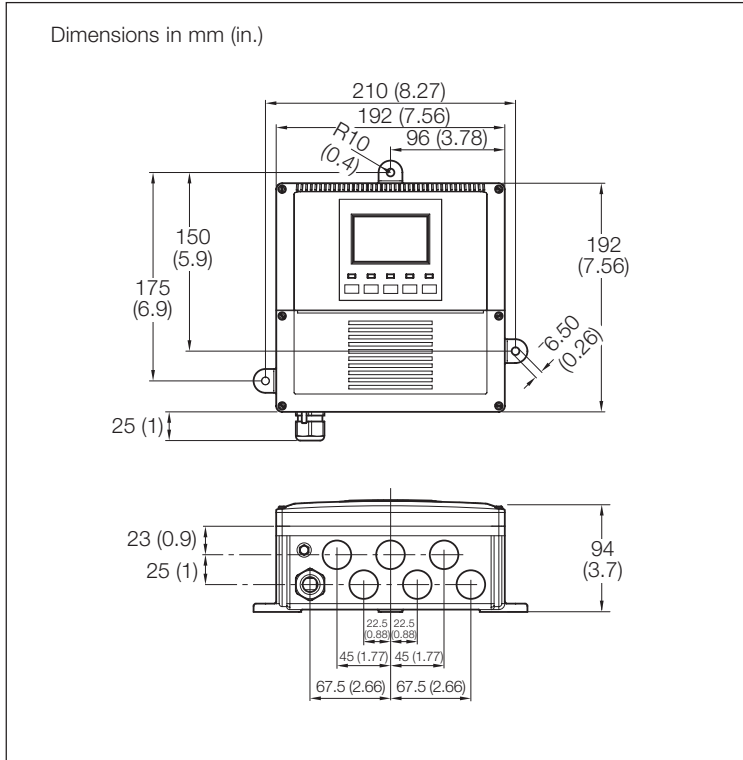
Pollution Category 2

### Cable entry types

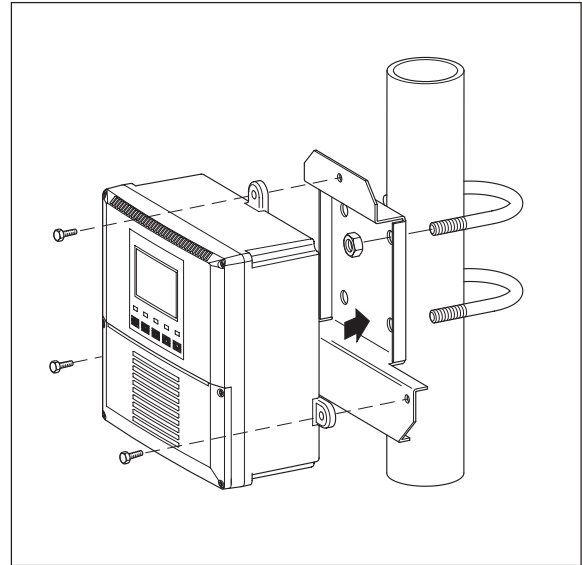
Standard 5 or 7 x M20 cable glands

N. American 7 x knockouts suitable for 1/2 in. Hubble gland

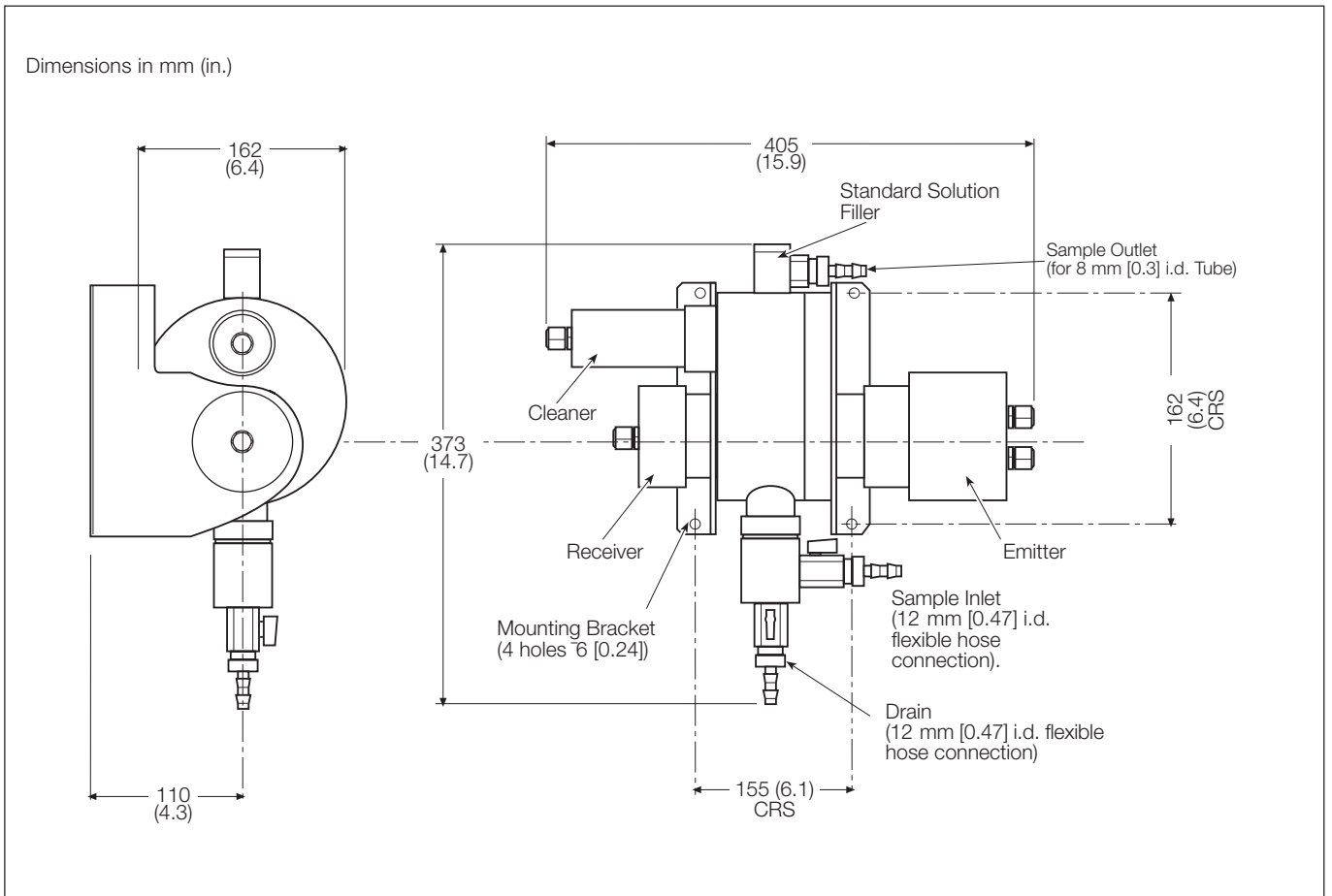
### Overall Dimensions



Transmitter

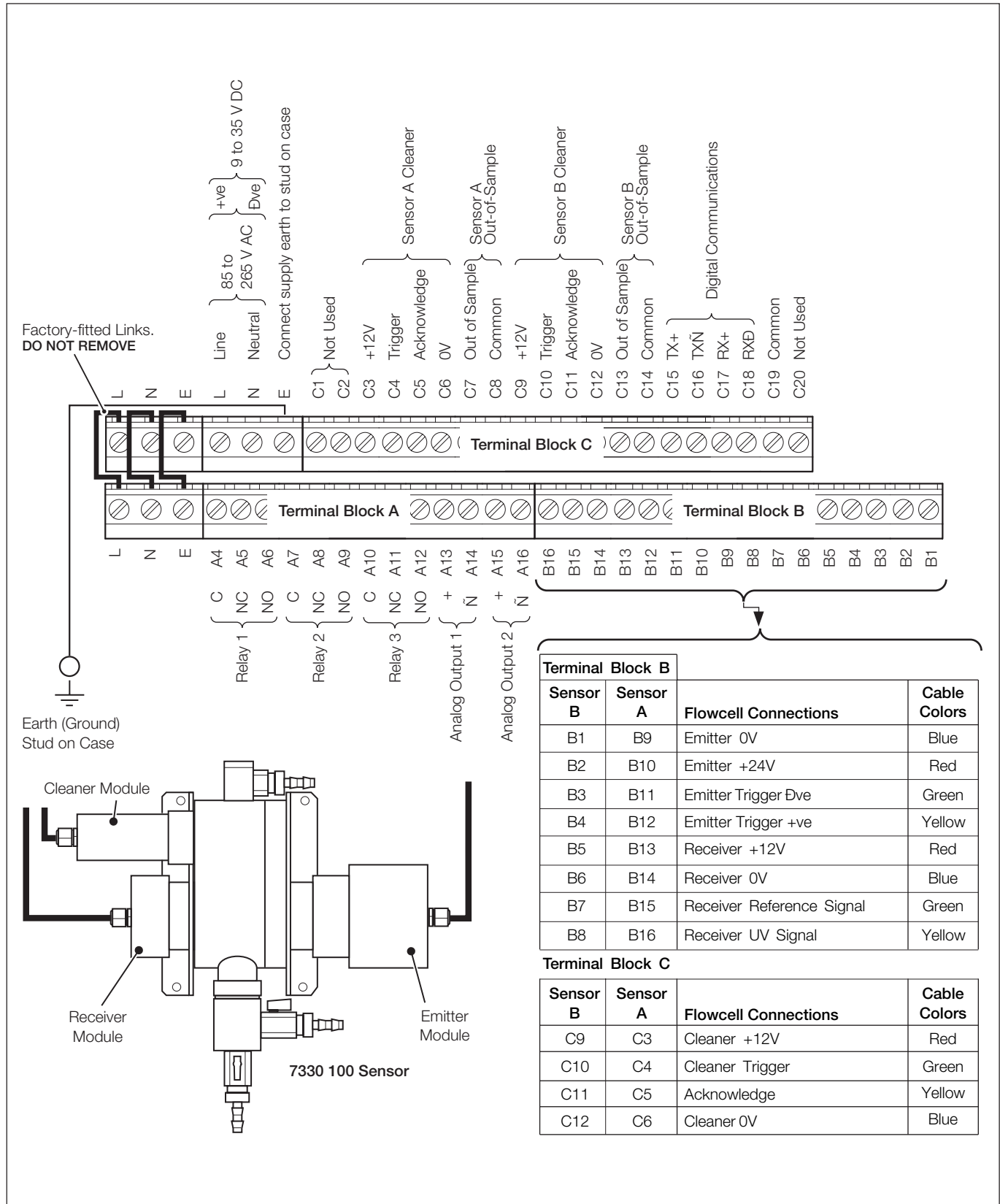


Pipe-mount Details



Sensor Model 7330-100

Electrical Connections



Electrical Connections

Ordering Information

<b>Single &amp; Dual UV Nitrate Monitors for Potable Water Treatment AV450 &amp; AV455</b>	AV4	X	X	/X	X	X	0	X
<b>Primary Process Variable (PV 1)</b>								
Nitrate		5						
<b>Primary Process Variable (PV 2)</b>								
None			0					
Nitrate			5					
<b>Transmitter Enclosure Types</b>								
<b>Wall IP66/NEMA4X – General</b>								
Wall-mount				/1				
Wall-mount complete with pipe-mount bracket				/2				
<b>Wall IP66/NEMA4X – N. American</b>								
Wall-mount				/6				
Wall-mount complete with pipe-mount bracket				/7				
<b>Serial Communications</b>								
None					0			
PROFIBUS (pending)					2			
<b>Power Supply</b>								
85 to 276V AC, 45 to 65Hz						0		
9 to 36V DC						1		
Reserved								0
<b>Manual</b>								
English								1
French								2
Italian								3
German								4
Spanish								5

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