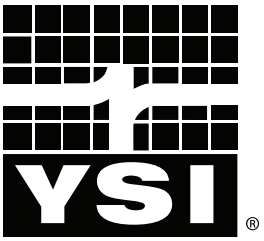
YSI Incorporated



5400 MultiDO

Monitor, Control, & Alarm Instrument

User Manual

Item # 605877
Rev A
Drawing # A605877
October 2010

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1 Introduction

-5400 Product Description
-User's Manual Guide
-Specifications

Introduction

Thank you for purchasing the YSI 5400. The YSI 5400 is a fully programmable aquatic control monitor with alarming capability. A key feature of the 5400 monitor is the ability to independently operate four dissolved oxygen (DO) inputs and six auxiliary (Aux) inputs. This allows control of multiple water systems from one 5400 controller. Peripheral devices wired to the 5400 respond to user-defined configurations to ensure that stable water conditions are maintained. The 5400's on-site and remote access capability are suitable for a variety of applications.

5400 features:

- four (4) independent DO systems
- six (6) independent Aux I/O systems - (digital, analog (0-1VDC, 0-5VDC, 4-20mA, and/or temperature)
- eight (8) onboard relays - 240VAC@5AMPs; 110VAC@10AMPs
- universal AC power with power fail alarm (only available on AC instruments)
- optional DC power with low battery alarm
- four (4) ten event daily timers
- four (4) feed timers
- two (2) 32-bit processors
- non-volatile memory of sensor, event, and calibration data logs
- 1000 data set memory for sensor data
- field upgradable software and firmware
- backlit LCD with timer function - input and output data displayed continuously
- menu-driven programming with four (4) softkeys
- networking capability - connect up to (32) 5400s and/or 5200As on one network via RS485 protocol
- optional AquaManager® PC software* serves as monitor management tool via direct (RS232) or TCP/IP connection
- email alarming via TCP/IP or local AquaManager connection
- NEMA 4X, IP65 enclosure

See *Product Specifications this chapter* for complete details on all 5400 features.

*AquaManager displays real time data from monitors and provides data logging, graphing, autopolling, mapping, and system configuration control from a PC. AquaManager is a valuable tool for remote and local access applications.

Product Description

The 5400 system manages aquatic environments by automating control and alarm devices to maintain stable water conditions.

A 5400 system is configurable by the user; therefore, each system setup is unique to the application. An example of a 5400 system could include*:

- 5400 instrument(s)
- 5400 components such as power, communication, and network devices
- input peripheral devices (i.e. float switch, probe assembly)
- output peripheral devices (i.e. aerator)
- 5400 user-defined configuration
- AquaManager PC interface (optional)

*All of the items listed are not included with the purchase of a 5400 instrument.

Input devices send data to the 5400. This data is processed based on the 5400 configuration. For example, a DO sensor (input) reports a 5.4 mg/L value and relay #3 (output) is configured to activate an aerator when value is ≤ 5.5 mg/L. The aerator wired to relay #3 will energize until the 5400 receives a DO sensor reading ≥ set point value.

Figure 1.1 shows the 5400 front panel and enclosure. The front panel includes an LCD which continuously displays current system conditions. Front Panel Keys are used to navigate screens and program configurations. Compression fittings located at the bottom of the enclosure provide liquid-tight connections for wiring peripheral devices and 5400 components.

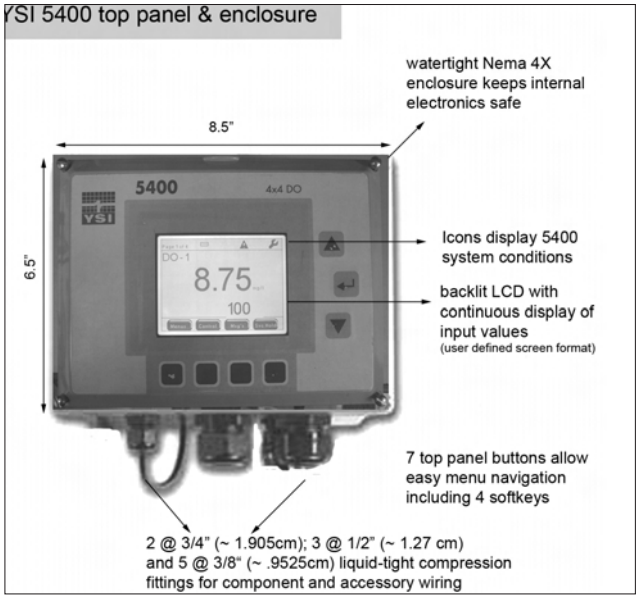

Figure 1.1

Preview of User Manual

This manual includes information on installing, configuring, operating, and maintaining a 5400 system.

Read Chapter 2 *"Safety Information"* before installing or configuring a 5400 system.

Chapter 3 *"Installation"* provides information on how to install the 5400, 5400 components, and peripheral devices. Only *qualified* people should install a 5400 system. Do not attempt to install or configure this device if you are not *qualified* to do so. If information is not clear, DO NOT PROCEED until clarification can be obtained. All wiring involving connections to main power must be performed by a qualified licensed electrician and must conform to all locally applicable electrical codes.

Chapter 4 *"Configuring 5400 Systems"* provides information on configuring 5400 instruments.

Chapter 5 *"AquaManager"* provides general information regarding the PC software program. The AquaManager program includes an extensive on-line help system which contains detailed information that is not provided in this manual.

This icon is used throughout the manual to indicate helpful information for AquaManager users.

Chapter 6 "*Maintenance*" provides information on maintaining the 5400 system including monitor and sensor service.

"Notes" at the end of each manual section provide additional information to help clarify certain 5400 operations and features.

The appendices include Unpacking & Inspection, Troubleshooting, Menu Maps, Declaration of Conformity, Warranty information, and SMS Messaging.

An index is provided starting on page 218.

Product Specifications

To ensure accurate and reliable performance, operate the 5400 system according to the specifications provided in the following tables. Damage and/or incorrect operation could result if these specifications are not followed.

Product specifications are subject to change without notice. Visit www.ysi.com to view the most recent product specifications.

Environmental Specifications

Environmental Category	Operating Range
Temperature	-15 to 70˚C (5 to 158˚F)
Enclosure Rating	NEMA 4X (direct exposure to outside conditions) IP65
Compression Fitting Rating	IP 68/NEMA 6 (liquid tight)
Electrical Safety	IEC compliant*
Other	RoHS compliant

**See Appendix 4 Declaration of Conformity - page 208.*

Input System Specifications

Aux Systems	There are 6 Aux input systems that allow digital or analog (0-1.0VDC, 0-5.0VDC, or 4-20mA) configuration. In addition, four of the Aux systems can be configured as temperature systems see *Temperature Systems* - page 15.

Aux System Type	Digital	Analog
Range	dry contact open/close	0 -1.0 VDC, 0-5.0 VDC, or 4-20mA
Accuracy	n/a	0-1.0VDC: ± 3% ± 10 mV 0-5.0VDC: ± 3% ±15 mV 4-20 mA: ± 3% ±100µA
Resolution	n/a	user selectable (0), (0 .0), or (0.00)

DO Systems	There are 4 independent DO systems. Each DO system has 2 control ↑ranges, 2 control↓ ranges, and high and low alarming.

Sensor Type	Polarographic (mA)	Galvanic (mV)
Membrane Type	Teflon (TE), 2 mil (gray) Polyethylene (PE), 2 mil (blue)	Teflon (TE), 2 mil (gray)
Range	0 to 500% air saturation 0 to 60 mg/L	0 to 500% air saturation 0 to 60 mg/L
Accuracy	±2% or ± 0.2 mg/L, whichever is greater for 0-200% ±6% of reading for 200-500%	±2% or ± 0.2 mg/L, whichever is greater for 0-200% ±6% of reading for 200-500%
Resolution	0.1% (0.0-99.9%); 1% (> 99.9) 0.01 mg/L (0-10 mg/L); 0.1 mg/L (10-60 mg/L)	0.1% (0.0-99.9%); 1% (> 99.9) 0.01 mg/L (0-10 mg/L); 0.1 mg/L (10-60 mg/L)
Response Time	95% of reading in 17 seconds for 2.0 mil PE membrane; 95% of reading in 36 seconds for 2.0 mil Teflon membrane. Allow approximately 10-15 minutes after 5400 is powered on, or after the DO sensor is serviced, for the polarographic sensor to stabilize.	95% of reading in 36 seconds for 2.0 mil Teflon membrane.
Cable lengths	4, 10, 20 m (special order up to 100m)	4, 10, 20 m (special order up to 100m)

Flow requirements	minimum flow rate of 3 inches per second or 7.62 cm/second for 2.0 mil PE membrane; 6 inches per second or 15.24 cm/second for 2.0 mil Teflon membrane	6 inches per second or 15.24 cm/second for 2.0 mil Teflon membrane
Other	manual salinity compensation for DO mg/L readings	manual salinity compensation for DO mg/L readings

Temperature Systems	There are 4 independent temperature systems. Auxiliary inputs 3, 4, 5, & 6 can be configured as temperature systems. Each temperature system has 1 control ↑range, 1 control ↓ range, and high and low alarming. Temperature systems can be configured as the temperature source for DO measurements or as stand alone systems.
Sensor type	10,000 ohm @ 25°C thermistor
Range	0-45°C; 32-113°F
Accuracy	± 0.2°C
Resolution	0.1°C

Component and System (non input) Specifications

Hardware		
System	System Feature	Specification
Display/LEDs	backlit graphic LCD (320X240) with timer	readings updated 2 times a second
	diagnostic troubleshooting LEDs	
Outputs	8 on-board relays	240VAC@ 5AMPs switching capacity; 110VAC@10AMPS; type: SPDT
Timer Systems	4 timers	10 daily events per timer system
	4 feed timers	includes sensor & FCR control

Component and System (non input) Specifications continued

Power: There are two 5400 versions available. The DC version can only be powered by DC power. The AC version can be powered by AC or DC power.		
Power for DC Version:	external 12VDC power source	9-16.5VDC; 800 mA
Power for AC Version:	internal AC switching power supply	100-240VAC; 50-60Hz; 300 mA
Both AC and DC versions:	lithium battery (for real time clock)	2032 lithium ion
Electronics	ARM7 embedded microprocessor	
	DSP (digital signal processing)	Digital processing of 5400 information ensures accurate and repeatable readings.
Firmware		
	Feature	Specification
	Flash Memory	Firmware field upgradable with local PC connection
	Data Logging	non-volatile data log memory
		storage of 3750 records
		sensor log (1000 records)
		event log (1250 records)
		calibration log (500 records)
		Configuration log (1000 records)
	Security	password protection
	Data filtering	reads 2-3 times per second; readings are averaged
Communication		
	Feature	Specification
	RS232	up to 100 ft (30m)
OR	Optional serial to ethernet device	remote TCP/IP PC access and/or email alarming

Instrument to Instrument Networking		
	Feature	Specification
	Network 2 to 32 isolated 5400 and/or 5200A instruments	RS485 up to 4000 ft (1220m) entire network distance
AquaManager		
	Feature	Other PC Requirements
	Runs on Windows 2000/XP/ Vista/Windows 7 operating systems	PC capable of running Windows 2000 VGA display card CD-ROM Drive Total RAM Installed 16 Megs or greater 100 MB free hard-disk space

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2 Safety

-IMPORTANT safety information. Read this chapter before installing 5400 components and peripheral devices.

THIS IS IMPORTANT

Take time to be safe when working on electrical circuits and equipment. It could save your life. Avoid unsafe acts and conditions. Do not operate or install the 5400 before reading this chapter. Installing the 5400 involves wiring high voltage equipment. Follow all provided safety information. Installation must be performed by someone who understand the dangers of, and is qualified to, wire electrical devices. If information or instructions are not clear, DO NOT PROCEED until clarification can be obtained.

ALWAYS:

Follow basic safety rules when working with or near high voltage circuits. The 5400 is a high voltage instrument using 110v. Peripheral devices may also be high voltage devices.

Consider the result of each act. Keep away from live circuits. Do not change parts or make adjustments inside the equipment with high voltages on.

Do not service alone.

Do not tamper with interlocks. Safety devices such as interlocks, overload relays, and fuses should never be altered or disconnected except for replacement. Safety protection devices should never be changed or modified without a clear understanding of what effect the modification will have on the system.

Do not ground yourself.

Do not energize equipment if there is any evidence of water leakage.

Warnings and Cautions

Safety information is presented in this manual in one of two ways:

- WARNING - RISK OF ELECTRIC SHOCK This symbol identifies installation and operation procedures that can result in personal injury or death if safety information is not followed.

- AVERTISSEMENT – RISQUE DE CHOC ÉLECTRIQUE. Ce symbole identifie les procédures d'installation et d'opération pouvant entraîner des blessures ou la mort si les consignes de sécurité ne sont pas suivies.

- CAUTION - RISK OF DANGER This symbol identifies installation and operation procedures that can result in personal injury or damage to equipment if safety information is not followed.

These symbols ( ) ( ) appear in the left margin of the page to highlight safety information as it applies to a particular installation or operation step.

A complete list of all safety cautions is provided below. Warnings are provided in both English and French.

Install and use the 5400 only in accordance with information documented in this manual.

Warnings

WARNINGS are used when personal injury or death can result when safety information is not followed.

WARNING: All wiring involving connections to mains power must be performed by a qualified licensed electrician, and must conform to all locally applicable electrical codes.

AVERTISSEMENT: tous les câblages comportant une connexion à l'alimentation secteur doivent être réalisés par un électricien qualifié et doivent être conformes aux codes électriques applicables.

WARNING: Do not make connections while power is applied. Turn off power and assure power "Lockout" before installing or servicing to avoid contact with electrically powered circuits. This includes working on devices connected to the relay outputs and auxiliary input systems. **Disconnect external power to the 5400 before connecting or disconnecting components and/or peripheral devices.**

AVERTISSEMENT : n'effectuez aucune connexion alors que le circuit est sous tension. Coupez l'alimentation et assurez l'interdiction du courant avant toute installation ou tâche d'entretien afin d'éviter d'entrer en contact avec des circuits sous tension. Cela comprend tout travail sur des appareils connectés à des sorties de relais et des systèmes d'entrée auxiliaires. **Déconnectez l'alimentation externe du modèle 5400 avant de connecter ou de déconnecter des composants et/ou des appareils périphériques.**

WARNING: A switch or circuit breaker shall be included in the building where the 5400 is installed. The disconnecting device should be in close proximity to

the equipment and within easy reach of the operator. The disconnecting device shall be marked for the equipment.

AVERTISSEMENT : un commutateur ou disjoncteur doit être installé dans le bâtiment où le modèle 5400 est installé. Le dispositif de déconnexion doit se trouver à proximité de l'équipement et à portée de l'opérateur. Le dispositif de déconnexion doit indiquer l'équipement auquel il se rapporte.

WARNING: The covers of fuse boxes and junction boxes should be kept securely closed except when service is being done.

AVERTISSEMENT : le couvercle des boîtes à fusibles et des boîtes de dérivation doit être maintenu fermé sauf lors des tâches d'entretien.

WARNING: Electric sparks and chemical exposure are potential dangers when working with batteries. Use necessary precautions and follow all manufacturer's directions.

AVERTISSEMENT : l'exposition à des étincelles ou produits chimiques est un danger potentiel inhérent à tout travail sur des batteries. Observez les précautions nécessaires et suivez les consignes du fabricant.

WARNING: Ground the 5400. *See Ground 5400 - page 42*. The sensitivity and stability of the 5400 will be impaired if the 5400 is not grounded. To avoid possible electrical shock or damage to the equipment, connect earth ground to the 5400 I/O control board. In addition to grounding the 5400, all tanks should be electrically grounded using a ground probe.

AVERTISSEMENT : mettez le modèle 5400 à la terre. Voir Mise à la terre du modèle 5400. La sensibilité et la stabilité du modèle 5400 seront affectées s'il n'est pas mis à la terre. Pour éviter toute possibilité de choc électrique ou d'endommagement de l'équipement, connectez le fil de terre à la carte d'E/S du modèle 5400. En plus de la mise à la terre du modèle 5400, tous les réservoirs doivent être mis à la terre.

WARNING: Do not overload relays. Verify that the surge current at startup does not exceed the relay load ratings. Be familiar with all safety information regarding installing and servicing peripheral devices.

AVERTISSEMENT : ne surchargez pas les relais. Vérifiez que la surtension de démarrage ne dépasse pas la capacité de charge nominale du relais. Prenez connaissance de toutes les consignes de sécurité concernant l'installation et l'entretien des appareils périphériques.

WARNING: The 5400 is not fused. Fuses used in any peripheral equipment should be removed and replaced only after the circuit has been de-energized. When a fuse blows, it should be replaced only with a fuse of the same current and voltage ratings. Circuits should be carefully checked before fuse replacement. A burned out fuse is often the result of circuit fault.

AVERTISSEMENT : le modèle 5400 ne contient pas de fusible. Les fusibles utilisés par les équipements périphériques doivent être retirés et remplacés uniquement après que le circuit a été mis hors tension. Lorsqu'un fusible est grillé, il doit être remplacé uniquement par un fusible d'une tension et d'un ampérage nominaux identiques. Les circuits doivent être soigneusement vérifiés avant le remplacement d'un fusible. Un fusible grillé est souvent le résultat d'une défaillance de circuit.

WARNING: Do not apply power to the 5400 until all electrical connections are verified and secured.

AVERTISSEMENT : ne mettez pas le modèle 5400 sous tension tant que les connexions électriques n'ont pas été vérifiées et sécurisées.

Cautions

CAUTIONS are used when personal injury or damage to equipment can result if safety information is not followed.

CAUTION: The 5400 utilizes sensitive solid state devices that can be damaged by static shock. Installers must observe accepted ESD (Electro-Static Discharge) procedures while connecting wires to the 5400 control board.

CAUTION: Sensors are powered by the 5400 instrument and use a "floating" ground reference. This requires that the probe not be individually grounded.

CAUTION: Power supply voltage above 16.5 VDC may permanently damage the 5400. *See Wire DC Power - page 45.*

CAUTION: Surge protectors are strongly recommended to protect from secondary surges and lightning. Surge suppression devices should be located on the AC line supplying power to the 5400 and any signal lines connecting the 5400. *See Lightning and Surge Protection - page 65.*

CAUTION: It is essential that all sensor wiring be run in a separate cable or conduit from power wiring.

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3 Installation & Wiring

-Installing & wiring 5400 components and peripheral devices

Hardware Installation

Correctly install 5400 system components to ensure accurate data collection and reliable operation. First, determine what monitor, control, and alarm functions the 5400 system will perform. Because system components are wired to the 5400 instrument, it is important to determine where and how components will be installed and configured. Preparing a system schematic (figure 3.1) is helpful.

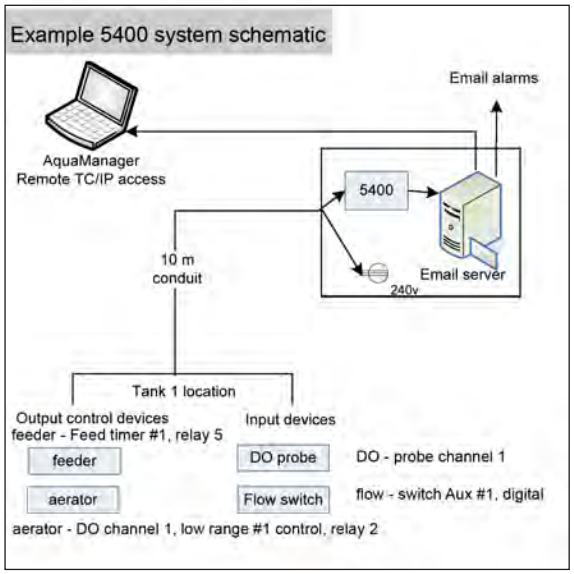


Figure 3.1

Hardware installation steps (not all steps required for all applications):

Step 1 - install 5400 instrument
Step 2 - locate and install sensor(s)
Step 3 - ground 5400
Step 4 - wire power
Step 5 - wire sensors(s)
Step 6 - wire relays (output devices)
Step 7 - wire aux input devices (excluding temperature probes)
Step 8 - wire a network of 2 - 32 instruments
Step 9 - install and wire communication equipment

See *Chapter 4 Configuring 5400 Systems - page 68* for directions on programming 5400 systems.

Tools and supplies needed for hardware installation:

- Phillips-head screwdriver to remove 5400 fro panel to access I/O board and lower board assembly
- necessary tools for cutting mounting holes in mounting brackets (rail mount) and/or control panel (panel mount)
- 5/32" Allen wrench (panel mount only)
- electric drill and bits for mounting 5400 (panel or rail) and for drilling rubber grommets in bulkhead fittings
- small flat-head screwdriver to terminate wires on I/O board pluggable terminal strips
- wrench to tighten bulkhead fittings following system component wiring
- tweezers to replace the membrane gasket on the YSI 5422 sensor
- wire strippers
- distilled water for DO membrane installation
- contactors may be required for relay wiring; see *contactor wiring* - page 52

Optional accessories for hardware installation:

- surface mount hardware (included)
- rail mount hardware
- panel mount hardware
- weather shield hardware
- serial to ethernet device
- wiring for network wiring
- wiring not supplied with components and/or peripheral devices

Step 1 Install 5400

Select a mounting location and method to mount the 5400.

Location Considerations

The 5400 must be located:

- above any level where water damage can occur
- away from extremely high or low temperature sources
- away from vibrating surfaces
- at least two 2 feet (~.7 m) from any high voltage conduit
- away from electromagnetic, radio, AC motor, transformer, or antennas
- so the front panel can be fully opened and serviced
- so system component wires are run as specified in this manual and according to local applicable electrical code

Mount the 5400

Select surface, rail, or panel mount option. Install the weather shield for outdoor installations.

Surface Mount

Mount 5400 to any flat surface using mounting brackets. Mounting brackets and screws are included with the 5400.

1. Fasten the mounting brackets to the back of the 5400 with the mounting screws - figure 3.2.
2. Tighten the screws, securing the brackets to the back of the 5400 enclosure.
3. Fasten the 5400 mounting brackets to the mounting surface with the mounting screws provided - figure 3.2. Make sure screws adequately secure 5400 to surface.
4. Tighten the screws, securing the 5400 to the surface.

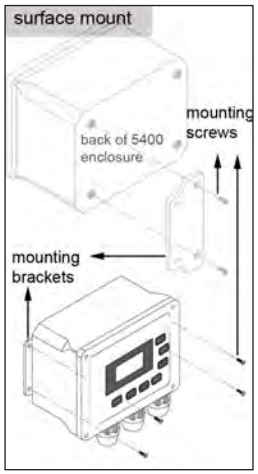


Figure 3.2

Rail Mount

Mount 5400 to handrail or pipe 1 to 1.5" (2.5 to 3.8cm) in diameter. The rail mount kit (YSI model number 6509) includes u-bolts, a pre-drilled metal plate, washers, and nuts.

1. Drill holes in the mounting brackets to fit the u-bolts. Use the pre-drilled metal plate as a template.
2. Fasten the mounting brackets to the back of the 5400 with the mounting screws as shown in figure 3.2.
3. Tighten the screws, securing the brackets to the 5400.
4. Place the u-bolts around the rail securing the 5400 to the pipe or rail by feeding through the pre-drilled holes on the mounting brackets as shown in figure 3.3.
5. Secure the metal plate over the u-bolts and around the rail or pipe using washers and nuts provided.
6. Tighten the screws, securing the 5400 to the rail.

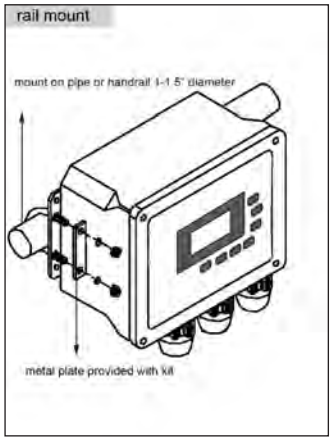


Figure 3.3

Panel Mount

Panel mount the 5400 if the 5400's front panel is to be mounted on a control panel or any vertical surface where only the front panel will be accessible from the mounting surface. The panel mount kit (YSI model number 6510) includes the standoffs and frame necessary to mount the 5400 to any panel 9.5" l x 7.5" w (~24x19cm). The space behind the panel must be at least 5.5" (14cm) deep.

WARNING: Disconnect external power to the unit before opening the front panel.

AVERTISSEMENT: déconnectez l'alimentation externe de l'unité avant d'ouvrir le panneau avant.

1. See *Open Front Panel to Access I/O Board* - page 40 to remove front panel from enclosure.

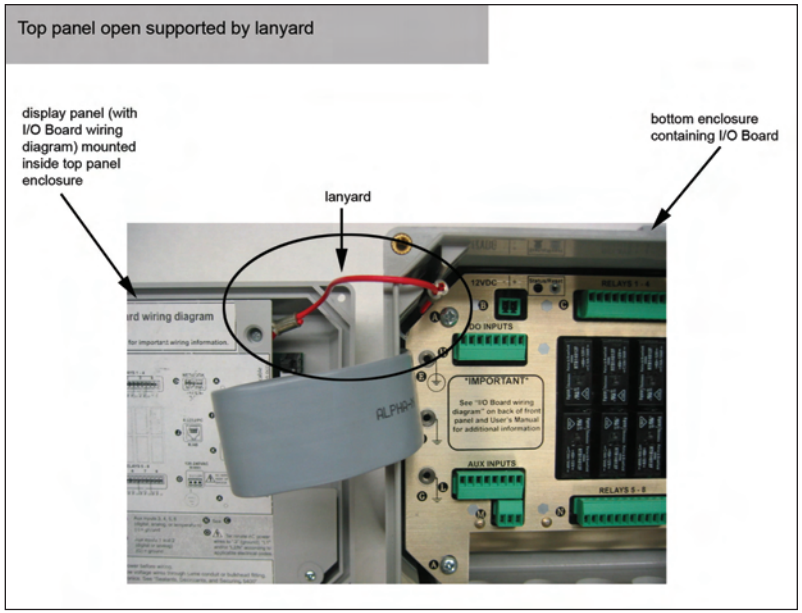


Figure 3.4

2. Disconnect front panel ribbon cable by pressing the two IDC header connectors located on the front panel out (away from the IDC header) - figure 3.5.

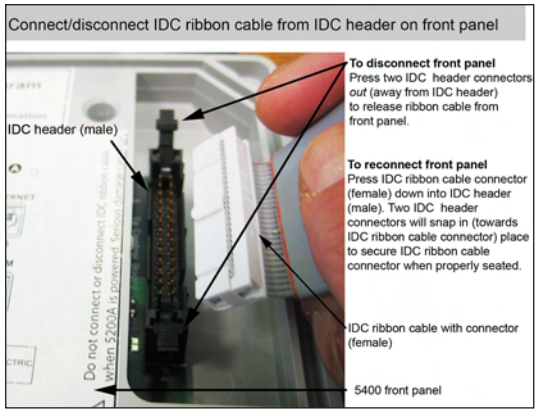


Figure 3.5

3. Remove and retain four screws that secure display board into top panel enclosure - figure 3.6. (Display board is mounted on panel attached to 5400 top panel. I/O Board wiring diagram is located on the display board panel.)

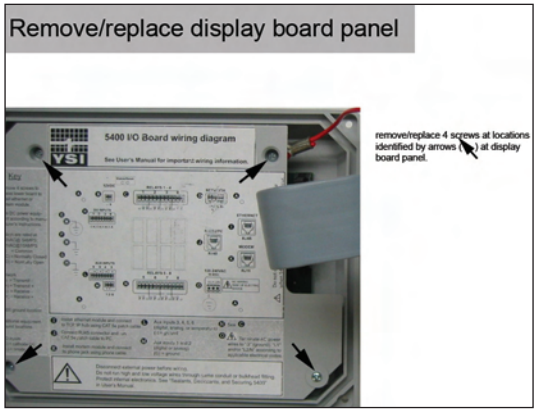


Figure 3.6

4. Carefully lift out the display board and remove the lanyard from the display board panel - figure 3.7. Set display board panel and top panel aside.

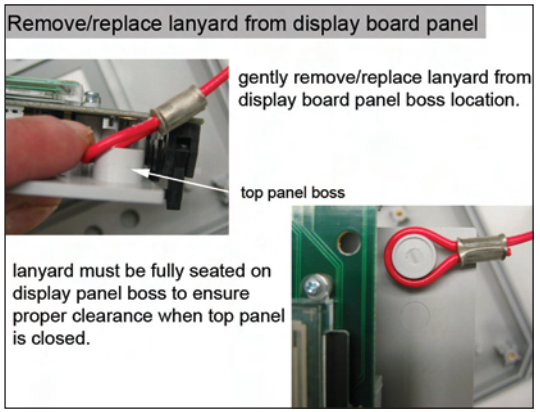


Figure 3.7

5. Fasten the mounting brackets to the back of the 5400 enclosure with the mounting screws - figure 3.2, page 28.
6. Tighten the screws, securing the brackets to the 5400.
7. Drill hole in panel for 5400 enclosure (dimensions provided with kit).
8. Place standoffs between 5400 mounting brackets and panel surface - figure 3.8.

9. Secure 5400 to panel with frame using washers and bolts provided.

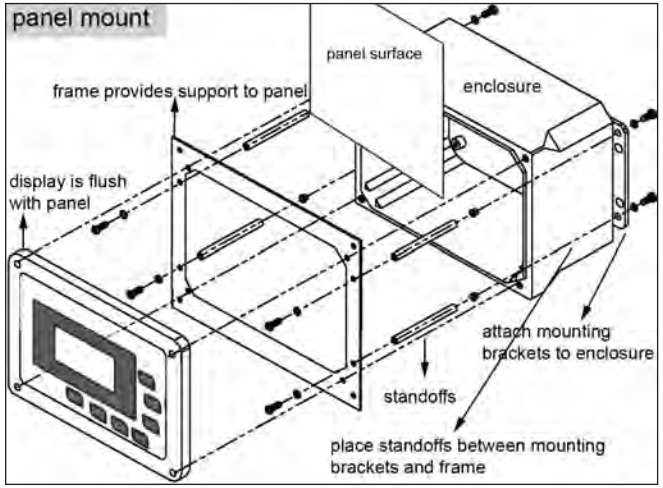


Figure 3.8

10. Reattach lanyard by placing lanyard at proper location of display board panel. Make sure lanyard is fully seated on display panel boss to ensure proper clearance when front panel is closed- figure 3.7.
11. Replace four screws to reattach display board panel to front panel enclosure - figure 3.6.
12. Connect 5400 display board to ribbon cable - figure 3.5.
13. Secure the 5400 front panel to the frame using mounting screws. Follow procedures provided at *Close Front Panel* - page 40 to secure 5400 and protect internal electronics.
14. Tighten the screws, securing the 5400 to the panel.

Install the Weather Shield

Install the weather shield for outdoor installations. The weather shield can be used with either a surface or rail mount. The weather shield kit (model number 6505) includes a weather shield, u-bolts, pre-drilled metal plate, washers, and nuts.

1. First complete steps 1-2 under Surface Mount or steps 1-3 under Rail Mount depending on the type of installation. Note: You may need to modify the pre-drilled holes in the weather shield depending on the mounting location.
2. At step 3 (surface mount) or step 4 (rail mount), attach the weather shield with the metal plate installed securely to the surface or rail. Figure 3.9 shows the weather shield installed for a rail mounted 5400.

3. Tighten the screws, securing the weather shield.

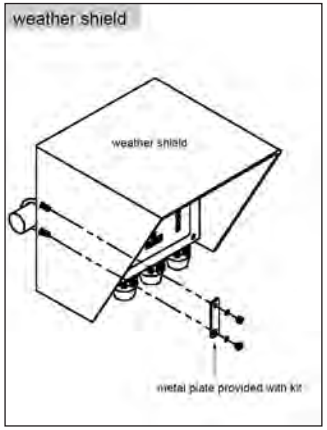


Figure 3.9

Step 2 Locate and Install Sensor(s)

The 5400 can be configured with 1, 2, 3, or 4 dissolved oxygen (DO) sensors and 1, 2, 3, or 4 temperature sensors. Temperature sensors are configured as auxiliary (Aux) inputs 3, 4, 5, and/or 6. Select a YSI 5422 DO (polarographic)/temperature, a YSI 5421 DO (galvanic)/temperature, and/or a YSI 5420 DO (galvanic) sensor assembly. All DO sensors require a properly installed membrane. The 5422 DO (polarographic) sensor can use either a blue (PE 2.0 mil) or gray (Teflon 2.0mil) membrane. The Galvanic sensor can only use a probe-specific Teflon membrane. Temperature sensor(s) must be a thermistor with 10K at 25˚C. See *Appendix 6 Alpha A Curve* - page 214.

For accurate DO measurements, ensure that the temperature reading for each DO channel is representative of the temperature at that DO sensor's location. This is important when using the same temperature input source for multiple DO sensors. Example - if the temperature source for DO1 and DO2 is the temperature sensor connected to Aux 3 at the DO1 sensor location, it is important that the temperature at the DO2 sensor location is the same as at DO1 sensor location.

See *Chapter 4 Sensor Setup* - page 127, for information on configuring 5400 sensor systems. User defined sensor configuration items include:

- Display format (i.e. units of measure. For example, mg/L or % saturation, °C or °F)
- Temperature source (aux input 3, 4, 5, or 6, or user defined)

- Salinity input value (user entered salinity value of the water being monitored)
- Elevation monitoring system
- Setpoint, control, and alarm values and ranges
- Control and alarm relay assignments

Location Considerations

Readings gathered at the sensor location(s) are data logged and processed by the 5400 instrument. Output control and alarm devices are configured to respond to sensor values. Therefore, it is essential to have accurate readings at the sensor location. Locate sensors according to the below specifications.

Locate sensor end of probe assembly:

- **in a location that represents the entire system**
- where the water flow is at least 3 inches per second (7.6 cm/sec) if using the 2.0 mil PE membrane or at least 6 inches per second (15.24 cm/sec) for 2.0 mil Teflon membrane
- in a location that is free from debris (e.g. algae); ideally at a 45˚ angle from vertical position and directed with the flow - figure 3.10

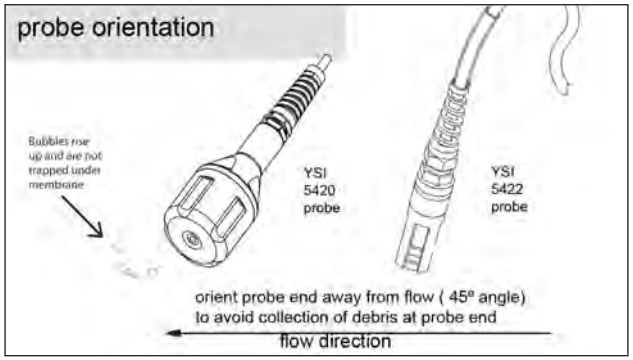


Figure 3.10

- in a well mixed, free-flowing area; midstream and mid-depth typically gives representative readings; the probe assembly and cable are fully submersible up to the cable connector
- submersed at all times so liquid level fluctuations do not expose the sensors to the atmosphere
- so the sensor/probe cabling is not routed near rotating machinery and/or equipment involving electrical switching or regulation

- so that the sensor assembly and cabling are located away from sources of electrical interference such as UV sterilizers, florescent lighting, ballasts, pumps, any high voltage peripheral devices, etc.

⚠ CAUTION: run high and low voltage cabling through separate bulkhead and conduit

- where regular maintenance, including calibration can easily be done. Calibrations are performed using the 5400 front panel.

Note:
- The YSI 5422 DO sensor is field replaceable and can be replaced without replacing the probe cabling. The 5420 and 5421 DO sensors are not replaceable. If a 5420 or 5421 sensor requires replacement, the entire probe/cable assembly will have to be replaced.

In addition to the above considerations, locate the temperature sensor(s):

- in a location that accurately reflects the temperature of the DO sensor it is monitoring.

YSI 5422 Polarographic DO/Temperature Probe Assembly

The YSI 5422 probe assembly includes a polarographic DO and temperature sensor. Install the DO sensor on the cable. The DO sensor is shipped with a red protective cap. Remove the red cap and install a new membrane with fresh electrolyte onto the DO sensor prior to use. Complete instructions are provided with the sensor and membrane kit.

Figure 3.11 shows the external parts of the YSI 5422 probe assembly.

After installing the probe in its monitoring location, see *Wire Sensors* - page 47 for wiring directions.

Probes should be serviced on a regular basis. See *DO Probe Maintenance* - page 6. Allow approximately 10 to 15 minutes after the 5400 is powered on, or after servicing the DO sensor, for the polarographic sensor to stabilize.

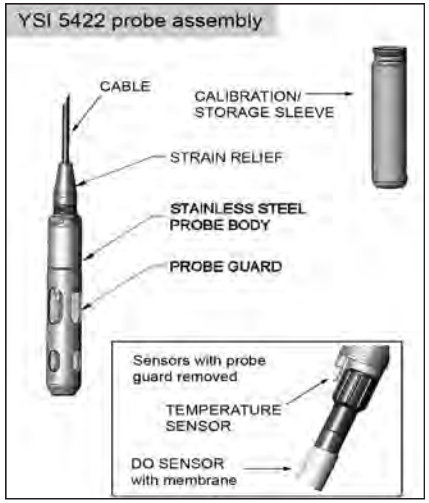


Figure 3.11

YSI 5420 (Galvanic DO) and YSI 5421 (Galvanic DO/Temperature) probe assembly

The YSI 5420 probe/cable assembly includes a galvanic DO sensor. The YSI 5421 includes a galvanic DO and temperature sensor. The DO sensor on both of these cables is shipped with a dry membrane. A new membrane with fresh electrolyte must be installed on the DO sensor prior to use. Complete instructions are provided with the sensor and membrane kit.

Figure 3.12 shows the external parts of the YSI 5420 probe/cable assembly.

After installing the probe in its monitoring location, see *Wire Sensors* - page 47 for wiring directions.

Probes should be serviced on a regular basis. See *DO Probe Maintenance* - page 6.

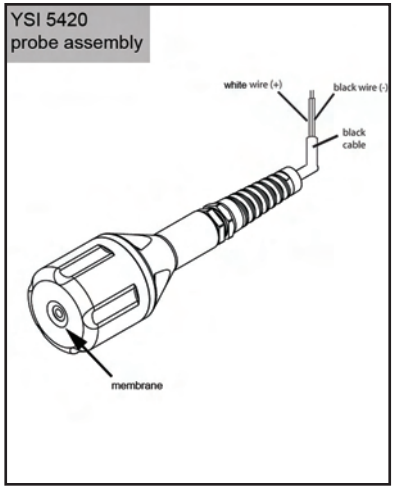


Figure 3.12

Install Temperature Sensors

The 5400 system will support 4 Temperature/Aux Analog inputs. Temperature sensors are included on YSI 5421 and 5422 probe/cable assemblies. Alternate temperature sensors can be used but must be thermistors with 10K at 25˚C . See *Appendix 6 Alpha Curve* - page 214.

After installing the temperature in its monitoring location, see *Wire Temperature Sensors* - page 50.

Probes should be serviced on a regular basis. See *Probe Maintenance* - page 6.

Wiring Information

System components must be wired correctly to ensure reliable performance and accurate data collection. Directions are provided on the following pages for wiring all components and peripheral devices.

PCBs

There are four printed circuit boards (PCBs) inside the 5400 enclosure. They are:

- Display board (mounted in the front panel)
- I/O board (visible when front panel is removed)

- DO daughter board mounted to the I/O Board
- Control board (connected to the under side of the I/O Board)

Notes:

- I/O board and control board (including DO daughter board) are attached to a metal plate and are referred to as the "lower board assembly". See *Control Board* - page 41.
- No 5400 components or peripheral devices are wired to the display or DO daughter board.

Most components including: power, ground, Aux input, network, relay output, and RS232 communication components are terminated on the I/O board. The optional serial to ethernet device is installed on the control board. The front panel must be removed when wiring 5400 components and peripheral devices. See Accessing the I/O Board - page 40. It is recommended that some system configuration and testing be done in conjunction with hardware installation. This will ensure that the 5400 system is wired correctly. Necessary configuration information (from Chapter 4 - *"Configuration"*) is referenced in the applicable test system procedure.

WARNING: Follow all safety information and local electrical codes when wiring 5400 system components and peripheral devices**.** Proper wire gauge should be determined based on voltages and wire/cable length. Incorrect wiring can result in damage to you or equipment. Ground loops can also result due to improper wiring.

AVERTISSEMENT : suivez toutes les consignes de sécurité et les codes électriques en vigueur lors du câblage des composants du système 5400 et des appareils périphériques. Le calibre correct des câbles doit être déterminé en fonction des tensions et de la longueur des câbles/fils. Un câblage incorrect peut entraîner des blessures et endommager l'équipement. Des boucles de mise à la terre peuvent également être provoquées par un câblage incorrect.

5400 Bulkhead Fittings

Five bulkhead fittings [5@ 3/8"(.9525cm), 2 @ 3/4" (1.905cm), and 3@ 1/2" (1.27cm)] located at the bottom of the 5400 enclosure provide watertight connections for 5400 system component wiring. Rubber grommets must be "pushed out" of the compression fitting housing and drilled for wiring installation. The drill bit diameter should be slightly smaller than the wire diameter so that a watertight seal can be made. Rubber grommets can be frozen (put in a freezer for 1 hour) and then easily drilled to the required diameter. Some pre-drilled rubber grommets are supplied with the 5400.

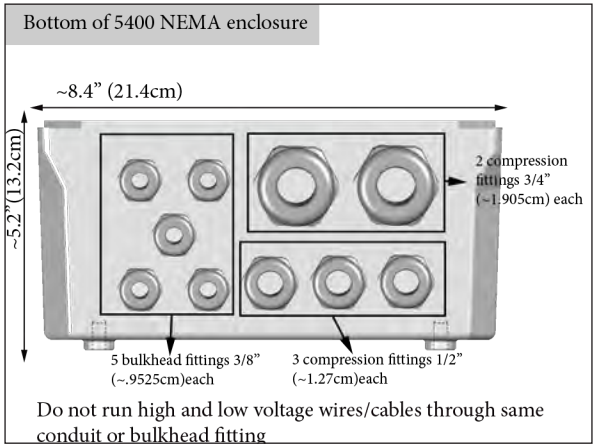


Figure 3.13

Accessing the I/O Board

The I/O board is accessible when the 5400 front panel is removed. The letters on the metal plate attached to the I/O board identify pluggable terminal strips on the I/O board. Letters on the metal plate correspond to the wiring diagram located on the inside of the top panel - figure 3.14. A ribbon cable connects the display board (mounted in the top panel) to the I/O board. When the 5400 top panel is removed, a lanyard protects against stress on the ribbon cable. See *Open Top Panel to Access I/O Board - page 40.*

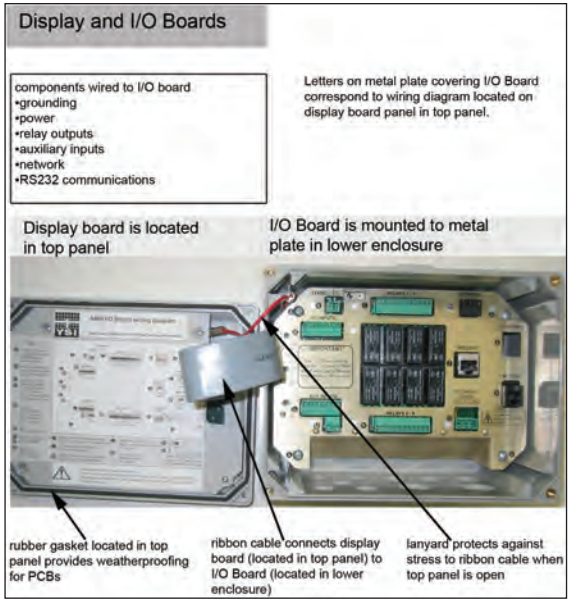


Figure 3.14

Open Front Panel to Access I/O Board

WARNING: Disconnect external power to the unit before doing any wiring.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Loosen the 4 mounting screws connecting the front panel to back enclosure. Captive screws remain in front panel after loosening.
2. Carefully lift the 5400 front panel from the back enclosure. The front panel should be placed to the left of enclosure. Allow the lanyard to hold the weight of the front panel. The rubber gasket seated in the front panel should remain in the front panel lid.

Close Front Panel

1. Tighten bulkhead fittings after connecting all 5400 wiring. (Hand tighten fittings around rubber grommet. Tighten bulkhead fittings into 5400 enclosure with wrench being careful to not overtighten.)
2. Follow information in *Sealants, Desiccants and Securing the Monitor Section* - page 66 to safeguard against damage to internal electronic components.
3. Make certain the gasket in front panel lid is in place and not twisted or damaged.
4. Replace front panel making sure that ribbon cable is not trapped in the gasket channel before inserting mounting screws.
5. Tighten mounting screws, making sure not to cross thread. The screws are stainless steel, and the receiving threads are brass. Do not over-tighten!

WARNING: The 5400 utilizes sensitive solid-state devices that can be damaged by static shock. Installers must observe accepted ESD (Electro-Static Discharge) procedures while connecting cabling to the 5400 I/O plate or to any other internal component or damage may result.

AVERTISSEMENT : le modèle 5400 utilise des appareils transistorisés sensibles pouvant être endommagés par des décharges d'électricité statique. Les installateurs doivent observer les procédures de protection acceptées contre les décharges électrostatiques lors du câblage à la carte d'E/S du modèle 5400 ou à tout autre composant interne afin d'éviter tout risque de dommage.

Control Board

The control board is mounted underneath the I/O Board. The serial to ethernet device and lithium battery are installed on the control board. Complete installation instructions, including accessing control board, are provided with the optional serial to ethernet device. Figure 3.15 shows the control board and I/O Board removed from the 5400 enclosure.

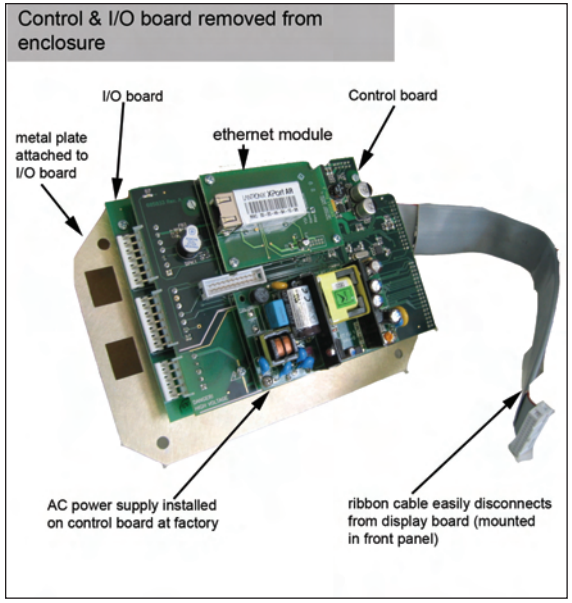


Figure 3.15

Step 3 Ground 5400

WARNING: Ground the 5400 to avoid possible electrical shock or damage to the equipment.

AVERTISSEMENT : mettez le modèle 5400 à la terre afin d'éviter tout risque de choc électrique ou d'endommagement de l'équipement.

Ground the 5400 at location Ⓔ on I/O Board - figure 3.16. Other 5400 system components can be grounded at locations Ⓕ and Ⓖ. Titanium ground rods can also be used to ground peripheral equipment.

In addition to grounding the 5400, all tanks should be electrically grounded via a ground probe.

Directions to Ground 5400

WARNING: Disconnect external power to the unit before wiring.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Perform steps 1 - 2 of 5400 installation.
2. Open front panel - page 40.
3. Remove screw from location Ⓔ.
4. Feed ground wire through drilled hole in rubber grommet and to location Ⓔ on metal plate covering I/O Board. Ground wire gauge must conform to all locally applicable electrical codes.

CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

5. Terminate ground wire by returning screw at Ⓔ over terminal connection of ground wire.

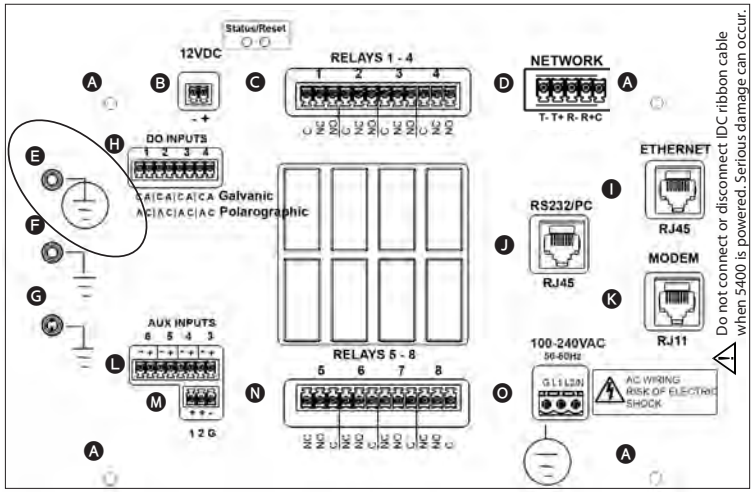


Figure 3.16

6. Terminate other end of the earth ground wire to a cold water pipe, steel rod, copper pipe, or earth ground.
7. Complete other wiring to configure 5400 system.
8. Close front panel - page 40.

Step 4 Wire Power

The 5400 is available as an AC or DC instrument. The DC version can only be powered by DC power. The AC version can be powered by either AC or DC power. If an AC version is properly wired and configured for both AC and DC power, and

AC power fails, the power switches to 12VDC. If DC voltage drops below a user defined safe operating range, an alarm occurs.

⚠ CAUTION: At 120VAC, the 5400 draws 25 watts (~0.2 amps). Use wiring suitable for that load following all safety information and local electrical codes.

Back up power is recommended when operating with AC power. Backup power can be supplied by 12VDC or UPS battery source.

Wire AC Power

The AC power option includes an integrated universal (worldwide) AC switching power supply allowing AC power from any AC receptacle 100-240VAC. AC power wires are terminated at location ⓞ on I/O Board - 3.17.

Directions to Wire AC Power

⚠ WARNING: Disconnect external power to the unit before wiring.

⚠ AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Perform steps 1-3 of 5400 installation.
2. Open front panel - page 40
3. Feed AC power cable through drilled hole in rubber grommet to location ⓞ. The terminal strip is removable.

⚠ CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Terminate AC power wires to pins "G" (ground), "L1", and/or "L2/N" according to applicable local electrical codes. Use minimum 18 gauge 3 wire power cord.

⚠ CAUTION: It is recommended to power only the 5400 instrument with the power cord to prevent exceeding the current draw of the AC power supply.

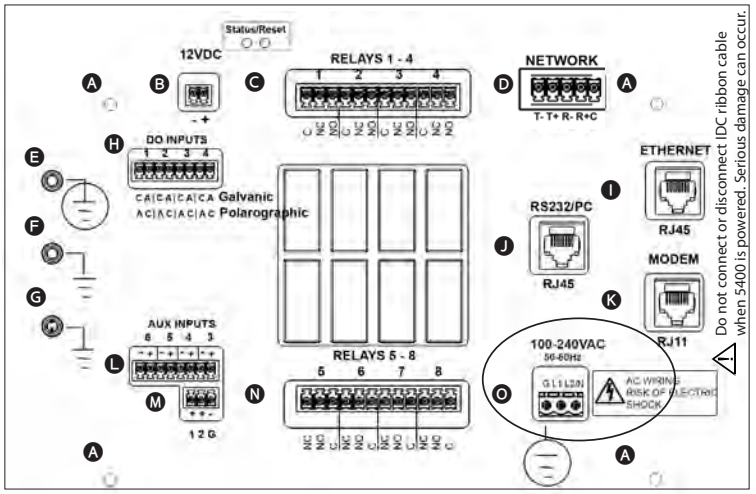


Figure 3.17

5. Complete other wiring to 5400.
6. Close front panel - page 40.
7. Test AC power.

Test AC Power

Turn on main power. The enabled system values display on the Run Screen after initial YSI splash screen. If applicable, install and configure DC power backup on this page. Verify AC power at the **Menus → System →Version** menu - page 125.

See *power fail menu* - page 117 for AC power event log information.

Wire DC Power and Backup Power

The 5400 may be powered by most regulated 9.0-16.5 VDC source that provides 800mA of current and is isolated from mains supply by double or reinforced insulation. The DC power source is user supplied and could be lead acid, gel cell, or UPS (with 12VDC transformer) external batteries. DC power wires are terminated at location ⓑ on the I/O Board - 3.18.

Notes:

- The 5400 does not charge batteries. Quality assurance maintenance procedures should be established if batteries are to be fully powered when used as

back-up power source.
- Power supply voltage above 16.5 VDC may permanently damage the 5400.
- When back up voltage falls below 9.0 volts, the 5400 ceases to operate properly.
- Some switching DC power supplies not supplied by YSI may result in noisy readings.

Directions to Wire DC Power/DC Backup Power

WARNING: Disconnect external power to the unit before wiring. Follow all manufacturer's safety and installation instructions when providing power to the 5400 via a DC power supply.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer le câblage. Suivez toutes les consignes de sécurité et d'installation du fabricant lorsque vous fournissez de l'alimentation au modèle 5400 par un bloc d'alimentation à courant continu.

1. Perform steps 1-3 of 5400 installation.
2. Open front panel - page 40.
3. Feed DC power cable through drilled hole in rubber grommet to location Ⓑ. Terminal strip is removable.

CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Terminate DC power wires to pins (-) and (+) according to manufacturer instructions and any applicable local electrical codes.

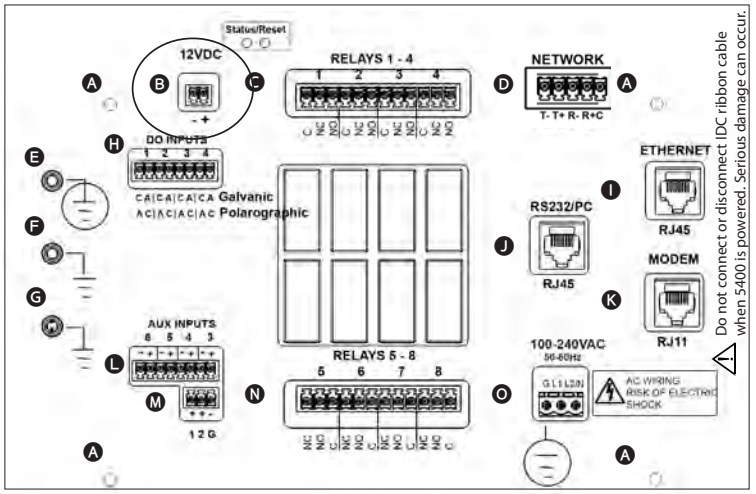


Figure 3.18

5. Complete other wiring to 5400.
6. Close front panel - page 40
7. Test DC power.

Test DC Power

Connect DC power cable to power source. The enabled system values will display on Run Screen after initial YSI splash screen. Verify DC power at the **Menus** → **System** →**Version** menu - page 125.

See *Power Fail Menu* - page 117 for DC low battery trigger monitor and alarm information.

Note:
- The 5400 will not power up if DC power supply wires are terminated incorrectly.

Step 5 Wire Sensor(s)

Up to four DO sensors and four temperature sensors can be wired to the 5400. All sensors are wired to the I/O Board - figure 3.19. YSI probe assembly 5422 has one polarographic DO sensor and one temperature sensor. YSI probe assembly 5421 has one galvanic DO sensor and one temperature sensor. YSI probe assembly 5420 has one galvanic DO sensor. The probe assemblies are shipped bare wire. YSI 5421

and 5422 probe assemblies have five wires. Two wires are for the DO sensor and are terminated at location H on the I/O board. Two wires are for the temperature sensor and are terminated at location L on the I/O board. The fifth wire is a ground and is not used. The YSI 5420 probe assembly has two wires for the DO sensor. Follow the wiring instructions below to ensure proper sensor operation.

Note:

- The ground wire (clear in color) should not be used and can be cut back to the black cable sheathing.

Wire DO Sensors

Directions to Wire DO Sensor(s)

WARNING: Disconnect external power to the unit before wiring.

1. Perform steps 1 - 4 of 5400 installation.
2. Open front panel - page 40
3. Feed DO cable through drilled hole in rubber grommet to location ❽. The terminal strip is removable.

⚠ CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Terminate the DO sensor wires for the DO1, DO2, DO3, and/or DO4 system. Wire the DO sensor cathode wire to (+) terminals and the DO sensor anode wire to (-) terminals. Follow the coloring scheme described below when wiring the DO sensor.
   - YSI 5422 polarographic DO sensor wires are green and white.
     -Terminate green wire to "A Polarographic".
     -Terminate white wire to "C Polarographic".
   - YSI 5420 & 5421 galvanic DO sensor wires are white and black.
     -Terminate white wire to "C Galvanic".
     -Terminate black wire to "A Galvanic".
5. Wire temperature sensors if temperature is to be monitored, controlled, and/or alarmed. Temperature sensors are wired as auxiliary inputs. See *Temperature Sensor(s) - page 50*

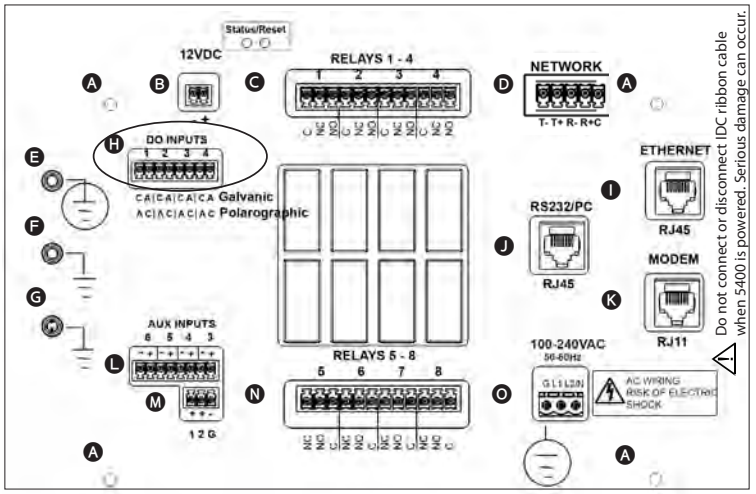


Figure 3.19

6. Complete other wiring to configure 5400 system.
7. Close Front panel -page 40.
8. Test DO sensor.

⚠ CAUTION: Do not ground the probe body.

Test DO/Temperature Sensors

Apply power to 5400. See *DO Sensor Setup* - page 139, to configure DO sensor inputs. See *Temperature Setup* - page138. Calibrate the DO sensor, see DO calibration - page 78. Verify changes in sensor values occur when the sensor is placed in environments of different oxygen concentration and temperature. For example, the DO reading in saturated air for calibration versus the DO reading when the sensor is placed in a zero oxygen environment (mix 1 gram sodium sulfite in 0.5 liter of water).

Wire Temperature Sensor(s)

The 5400 system will support four Temperature/Aux Analog inputs. Temperature sensors should have 2 wires and are terminated at location ❿ on I/O Board - figure 3.20. Temperature sensor(s) must be thermistors with 10K at 25˚C, see *Appendix 6 Alpha A Curve* - page 214

Directions to Wire Temperature Sensor(s)

WARNING: Disconnect external power to the unit before wiring.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Mount and install 5400 and probes.
2. Open front panel - page 40.
3. Feed temperature probe cable through drilled hole in rubber grommet to location L. The terminal strip is removable.

CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Terminate temperature sensor wires to Aux 3, Aux 4, Aux 5, and/or Aux 6 system. There is no polarity for temperature sensor wire; therefore, (+) and (-) terminals are interchangeable. Make sure the temperature sensor wires are wired to the (+) and (-) terminals for the Aux system (3, 4, 5, 6) you are configuring.

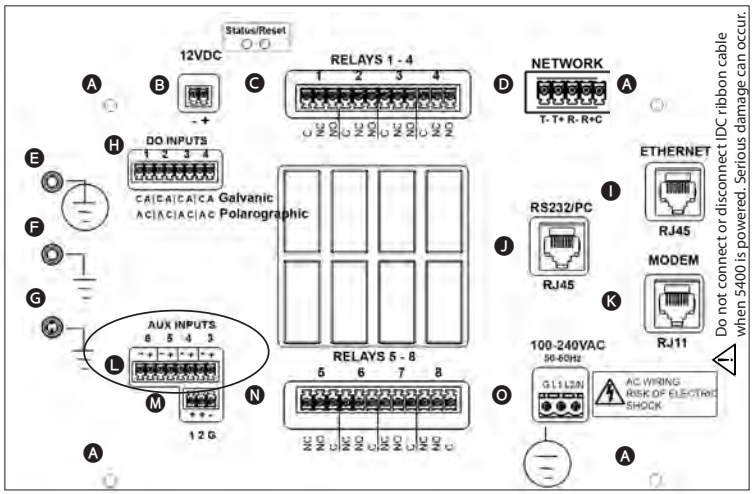


Figure 3.20

5. Complete other wiring to configure 5400 system.
6. Close front panel - page 40
7. Test temperature sensor.

Note:

- Temperature sensors wired to Aux 3, Aux 4, Aux 5, and Aux 6 are displayed on the 5400 by default as Temp 1, Temp 2, Temp 3, and Temp 4 respectively. For instructions on changing the default display settings, see section *Name Devices/Sensors* in Chapter 4 *Configuring the 5400*.

Test Temperature Sensor

Apply power to 5400. See *Configure Aux Temperature* - page 101 to configure temperature sensor input. Place the temperature sensor in solutions of varying temperature and verify the sensor readings with another temperature sensor.

Step 6 Wire Relay outputs

The 5400 has eight (8) on board non-fused relays rated at 240VAC@5AMPs (110VAC@10AMPs) of switching capacity. Relays energize and de-energize peripheral control, alarm and/or timer devices. Terminate relay device wires to Normally Open (NO), Normally Closed (NC), and Common (C) sockets as required for the application. (See 5400 I/O Board wiring diagram on inside of front panel for identification of relay number and pin position.) Relays 1-4 are terminated at location C on I/O Board. Relays 5-8 are terminated at location N on I/O Board - 3.21.

CAUTION: Do not overload relay(s). Check manufacturer specifications for inductive current/amp at power up. Use a contactor if necessary - figure 3.22.

Directions to Wire Relay Outputs

WARNING: Disconnect external power to the unit before wiring. If any of the relay contacts are connected to a "hazardous-live" circuit, ALL contacts on ALL relays must be considered "hazardous live" and appropriately protected from user contact outside the 5400 enclosure.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer le câblage. Si un contact de relai quelconque est connecté à un circuit sous tension dangereuse, TOUS les contacts de TOUS les relais doivent être considérés comme étant sous tension dangereuse et doivent être protégés de façon adéquate de tout contact de l'utilisateur hors du boîtier du modèle 5400.

1. Perform steps 1-4 of 5400 installation and step 5 as required for application.
2. Open front panel -page 40.

3. Feed relay device wires through drilled hole in rubber grommet and to locations C and/or N. The terminal strip is removable.

⚠ CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Terminate relay device wires to the relay number (1-8) that will be configured for device. Wire devices to NC or NO and C pins depending on device configuration.

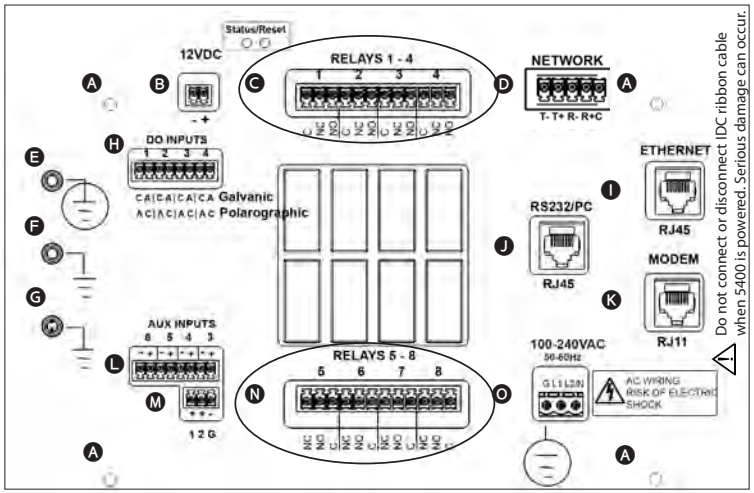


Figure 3.21

5. Complete other wiring to 5400.
6. Close front panel -page 40
7. Test relays.

Wiring a Contactor

The eight onboard relays are rated at 240VAC@5AMPs (110VAC@10AMPs) switching capacity. Contactors should be used for devices drawing current loads higher than relay specification. See figure 3.22 for contactor wiring.

Note:
- Contactor must meet the electrical requirements of the load.

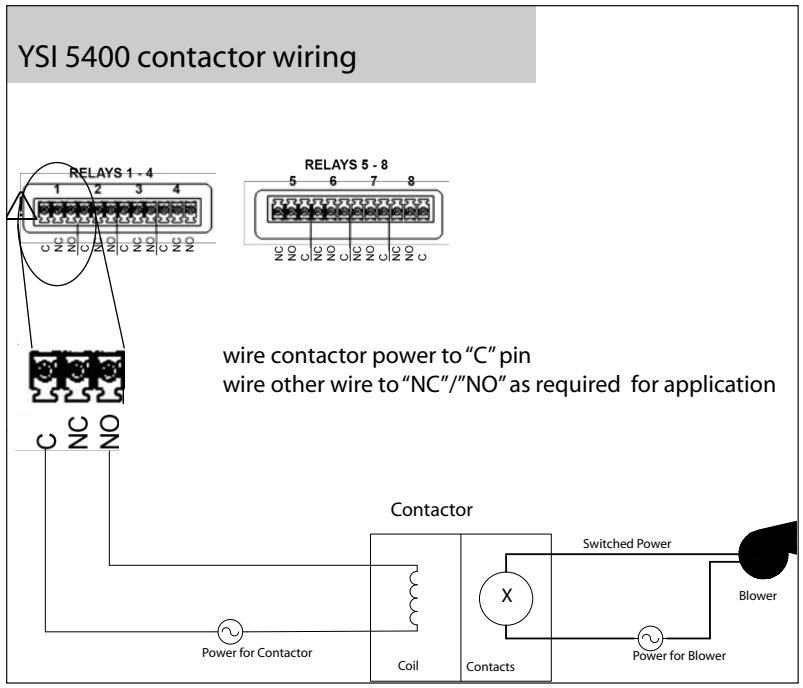


Figure 3.22

Test Relay Outputs:

Apply power to 5400. Verify device activates at relay test. See *Relay Test* - page 123.

Note:
Entering the relay test menu turns off any active relays and disables any sensor, aux, and timer system relays from energizing regardless of value or condition. Systems are not reset when the Relay Test menu is exited. To reset systems after exiting the Relay Test menu, **power cycle the 5400**.

Step 7 Wire Aux Inputs (Non Temperature)

The 5400 has six (6) auxiliary inputs. All 6 auxiliary inputs can be used for digital (open/closed dry contacts) or analog (0-1VDC; 0-5VDC, or 4-20ma) inputs. Auxiliary inputs 3, 4, 5, and 6 can be configured for a temperature sensor. See *Temperature Probes* - page 50 for wiring directions. Aux inputs can be used for a variety of

applications including: level switch, pressure switch, and/or an external instrument with an analog recorder output. Aux input wires are terminated at location Ⓛ and/or Ⓜ on I/O Board - figure 3.23. (See 5400 I/O Board wiring diagram on inside of front panel for identification of aux system number and pin position.) See Digital Input example - figure 3.24, and Analog Input example - figure 3.25.

Notes:

- All aux inputs have input protection, the maximum input voltage should not exceed 6 VDC.
- Analog systems will not monitor and/or alarm properly if the device that is installed and configured operates outside the configured analog range.
- For proper digital input operation, use low impedance switches and wiring. The total resistance should not exceed 200 Ω (ohms).

Directions to Wire Aux Inputs (Non Temperature Inputs)

⚠ WARNING: Disconnect external power to the unit before wiring.

⚠ AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Perform steps 1-4 of 5400 installation and steps 5 -6 as required for the application.
2. Open front panel - page 40 .
3. Feed auxiliary device cable(s) through drilled hole in rubber grommet to locations Ⓛ and/or Ⓜ. The terminal strip is removable.

⚠ CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. For Aux 3, 4, 5, & 6 use the terminal strip located at Ⓛ, using (+) terminal for one wire and (-) for ground wire. For Aux 1 and 2, use terminal strip located at Ⓜ. "G" pin is the common ground for Aux 1 and 2.

See Digital Input example - figure 3.24 and Analog Input example - figure 3.25.

⚠ CAUTION: The auxiliary inputs are not isolated. Devices connected must be electrically isolated from ground and the water.

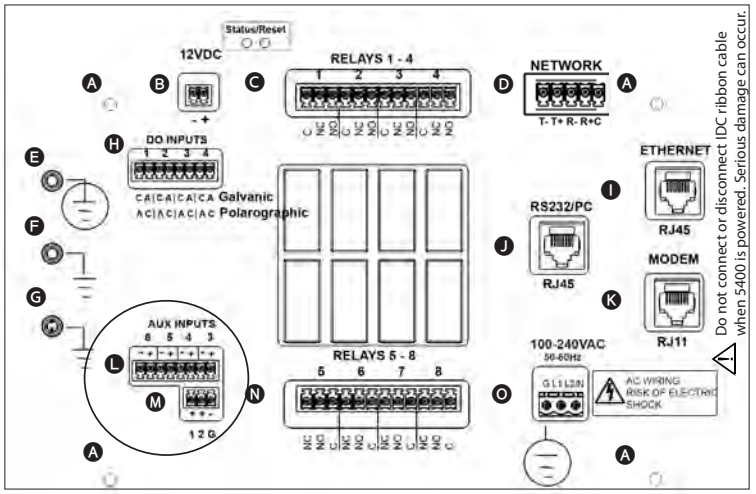


Figure 3.23

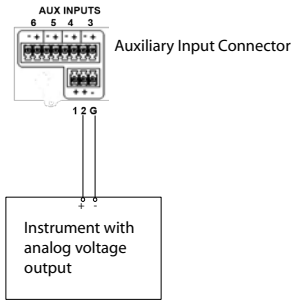
5. Complete other wiring to 5400.
6. Close front panel - page 40.
7. Test aux systems.

Test Auxiliary Input Devices

Apply power to 5400. See *Aux Setup* - beginning on page 132 for configuration information. Verify display, control, and/or alarm functionality based on user defined configuration.

Wire Aux Digital Input

1. Install aux digital device according to manufacturer's instructions.
2. Connect switch wires to Aux Input 1 - 6. Connect ground wire to (G) at location Ⓜ for aux 1 and 2 or to (-) at Ⓛ for aux 3, 4, 5, or 6. Connect the other wire to (+) Ⓛ and to 1 or 2 at Ⓜ.

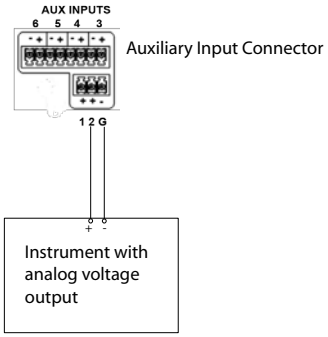


⚠ CAUTION: Do not input external voltage.

Figure 3.24

Wire Aux Analog Input

1. Install analog instrument according to manufacturer's instructions.
2. Connect analog instrument wires to Aux Input 1 - 6. Connect ground wire to the (G) at Ⓜ for aux 1 and 2 or to (-) at Ⓛ for aux 3, 4, 5, or 6. Connect the other wire to 1 or 2 at Ⓜ for aux 1 and 2 or to (+) at Ⓛ for aux 3, 4, 5, or 6.



⚠ CAUTION: Observe correct polarity on analog input.

Figure 3.25

Step 8 Wire Network

Multiple 5400 and 5200A instruments can be networked using the RS485 network ports. A node network consists of one master and up to 31 slaves. On a network, the master is the point of access for the AquaManager PC software program. In addition, the master sends all serial to ethernet device emails. Communication hardware (RS232 or serial to ethernet device) is installed on the master instrument (node) only.

RS485 network wiring can span distances up to 4000 feet (1220m). This maximum distance (4000 ft) is for the total network distance, not the distance between networked units (*see Notes below). RS485 ports are optically isolated for safety, to reduce noise, and to help eliminate ground loops. No further isolation is required.

Network traffic refers to the constant communication between the master and all slaves on the network. Example - slave node 3 is configured to generate an alarm if the temperature drops below 70°F. The master node is configured to send email alarms via TCP/IP using the serial to ethernet device. The master node sends an email alarm when slave node 3 reports a temperature value below 70° F (for longer than the alarm hold off time) to the master.

AquaManager is a valuable tool for monitoring and controlling node networks.

Notes:

- *Use an RS485 Line Extender/Booster for distances over 4000' (1220m). Communication failures may occur without it. Mount the booster in an area where it is protected from moisture.
- Multiple networks connected to a PC via RS232 require separate PC COM ports for simultaneous AquaManager mapping and autopolling.
- Legacy 5200s can not be on the same network as 5200As and/or 5400s. However, Legacy 5200s can communicate with AquaManager and Legacy 5200 data will be stored in the same database as 5200A and 5400 data.
- Network traffic speed operates at ~ 230 KB and is not user selectable.
- Remove network terminal strip from any networked slave that is not powered. Network rewiring is required if a stub (*see note below) is created when a slave is taken off the network. See valid network configuration - see figure 3.30.

Note:

- * A stub is created when the last wired network terminal strip is not connected to a network slave - figure 3.26.

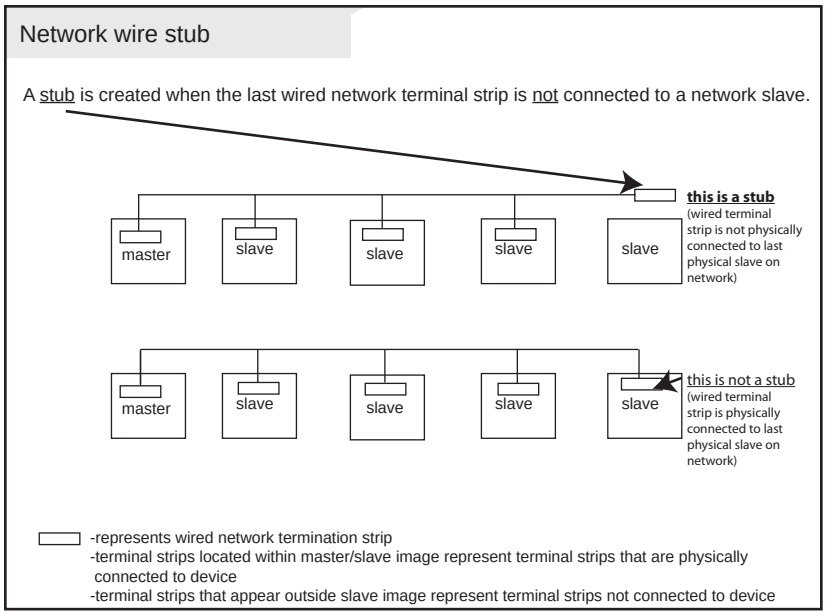


Figure 3.26

Directions to Wire Network

Network wiring consists of **two pair of twisted pair cable plus a communications com wire**. Category 5 ethernet cable is recommended. Network wires are terminated at location Ⓓ on I/O Board - figure 3.27.

WARNING: Disconnect external power to the unit before wiring.

AVERTISSEMENT : déconnectez l'alimentation externe de l'unité avant d'effectuer un câblage quelconque.

1. Perform steps 1-4 of 5400 installation and steps 5 -7 as required for the application.
2. Open front panel -page 40.
3. Strip five wires to terminate at network termination strip. Use appropriate wire stripper to avoid wire nicks.
4. Feed networking cable through drilled hole in rubber grommet and to location Ⓓ. The terminal strip is removable.

Note:

- It is essential that wires be terminated cleanly. Nicks (stray wires, not cleanly terminated) can result in unreliable network communication.

CAUTION: Run high and low voltage wires/cables through separate bulkhead and conduit.

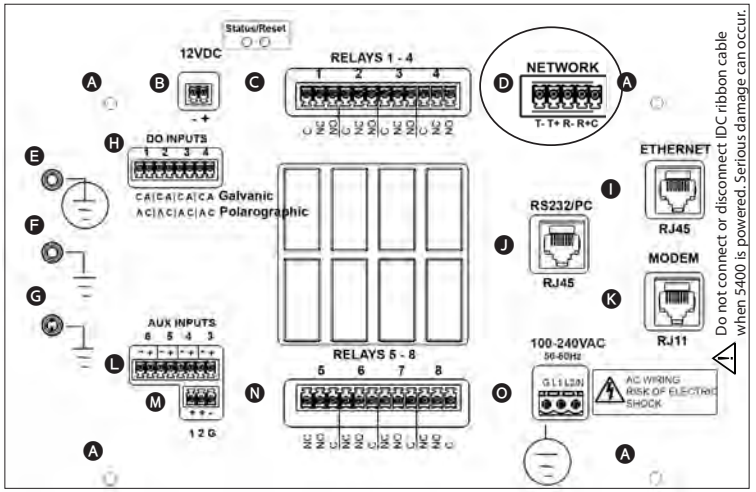


Figure 3.27

5. Terminate wires as described using category 5 cable: (color scheme may be different than described below.)
   - Pair #1 wires: solid blue and white with blue stripe
   - Pair #2 wires: solid orange and white with orange stripe
   - 1 wire green
   - Secure unused wires to avoid potential for shorting

Wire the master as follows:

Wire Color	Terminal
solid orange	T(-)
white with orange stripe	T (+)
solid blue	R (-)
white with blue stripe	R (+)
green	Communications Common (C)

Wire all slaves as follows:

Wire Color	Terminal
solid blue	T(-)
white with blue stripe	T (+)

solid orange	R (-)
white with orange stripe	R (+)
green	Communications Common (C)

Figure 3.28 is a wiring diagram for the most common 5400 network configuration where a master 5400 is the first physical device in the network. Additional network diagrams are provided after step 8.

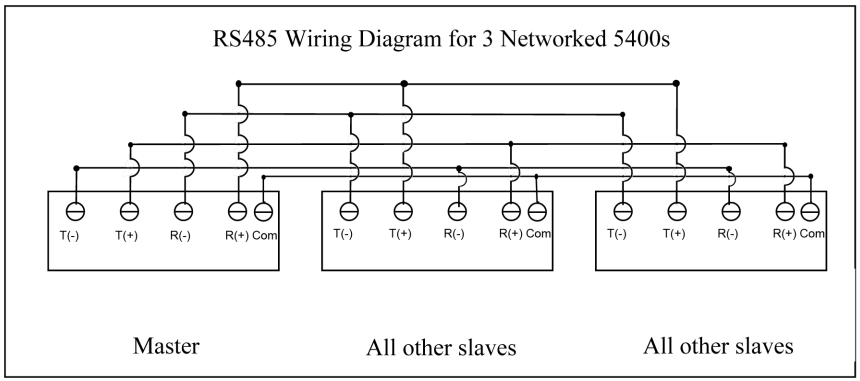


Figure 3.28

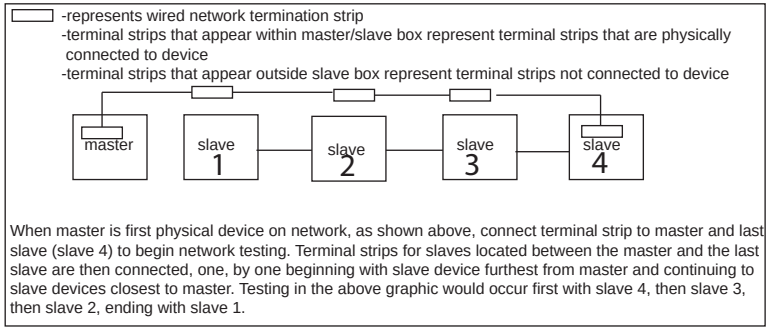
6. **Wire all network terminal strips prior to network testing but only connect a network terminal strip to the first and last devices on the network** (*see note below). Configure network menu and follow testing procedure as described starting on page 92. Slave devices are tested one by one as they are added to the network. Network testing cannot be done if stubs exist (** see note below).

Notes:

- *If the master is not the first physical device on the network, place network terminal strip on the master and on the first and last physical devices on the network. (In this case two slaves will need to be tested at the same time.) - figure 3.29.
- **A stub is created when the last wired network terminal strip is not connected to a network slave - figure 3.26.

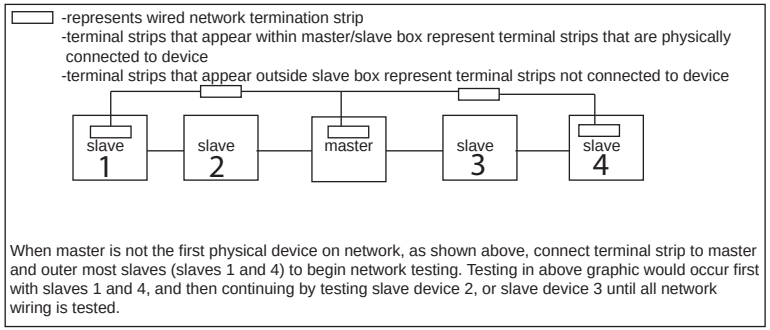
Testing network configurations

Follow wiring instructions below to avoid testing network wiring with stubs.



When master is first physical device on network, as shown above, connect terminal strip to master and last slave (slave 4) to begin network testing. Terminal strips for slaves located between the master and the last slave are then connected, one, by one beginning with slave device furthest from master and continuing to slave devices closest to master. Testing in the above graphic would occur first with slave 4, then slave 3, then slave 2, ending with slave 1.

use above network wiring testing method when master is first physical device on network



When master is not the first physical device on network, as shown above, connect terminal strip to master and outer most slaves (slaves 1 and 4) to begin network testing. Testing in above graphic would occur first with slaves 1 and 4, and then continuing by testing slave device 2, or slave device 3 until all network wiring is tested.

use above network wiring testing method when master is not first physical device on network

Figure 3.29

7. Close front panel -page 40.

5400 networks must be configured point to point (instrument to instrument). Network wiring cannot contain loops, stars, or stubs - figure 3.30.

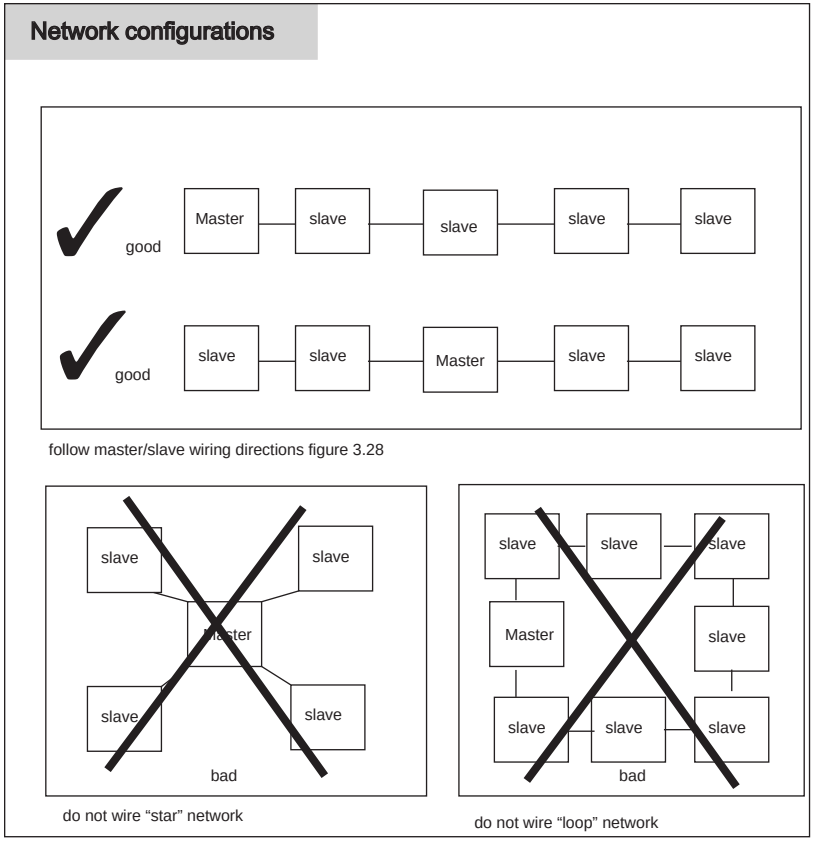


Figure 3.30

Test Network Wiring and Configuration

Apply power to only the master and last slave device on the network. If the master is not the first physical device on the network, apply power to the master and the first and last physical slave devices on the network. See *Network* beginning on page 92.

Step 9 Wire and Install Communication Equipment

Communication equipment must be installed in order to communicate, either locally or remotely, with the 5400. The communication connection can be made locally

(RS232) or remotely with a serial to ethernet device. **Only 1 connection method can be used at a time.** AquaManager supports both connection methods.

Notes:

- Firmware can only be uploaded to an instrument using a local RS232 connection. See *Downloader* - page 109.
- On a network, install and configure RS232 or the serial to ethernet device (hardware and wiring) on the master node only.

Email Alarming

Email alarming can be configured in 1 of 2 ways:

- from PC running AutoPoll Program that is included with AquaManager software (PC must have internet connection). This is referred to as *AquaManager email*.
- via a serial to ethernet* device with TCP/IP connection at the master 5400. This is referred to as *5400 email*.

*Serial to ethernet connection requires access to an SMTP server accessible by the local network.

RS232 Communication

Use Category 5e patch cable from RS232 port at location ❶ - figure 3.31 of I/O Board to PC using RJ45 to DB9 adapter.

Directions to Wire Direct RS232 PC Connection

WARNING: Disconnect external power to the unit before wiring.

AVERTISSEMENT : déconnectez l’alimentation externe de l’unité avant d’effectuer un câblage quelconque.

1. Perform steps 1-4 of 5400 installation and steps 5 -8 as required for the application.
2. Open front panel - page 40.
3. Feed direct connect cable through drilled hole of rubber grommet and to location ❶.

CAUTION: Run high and low voltage cables through separate bulkhead and conduit.

4. Connect one end of communication cable to RJ45 at location J. Connect other end to RS232 PC com port using RJ45 to DB9 adapter figure 3.31.

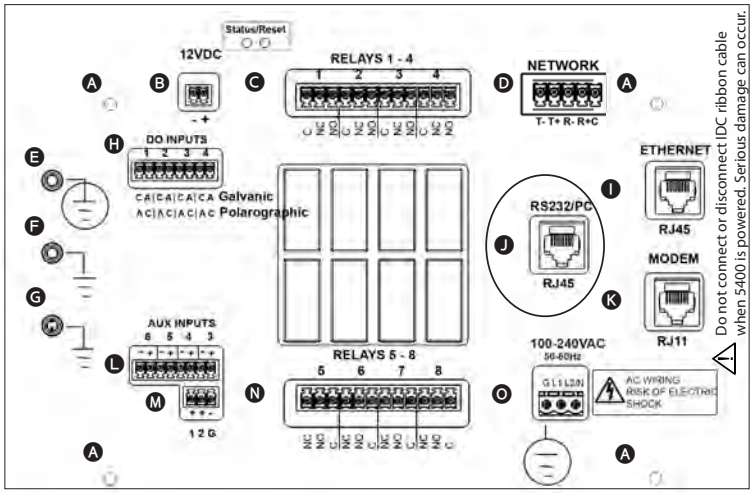


figure 3.31

5. Complete other wiring to configure 5400 system.
6. Close front panel - page 40.
7. Test RS232 communication.

Notes:

- When using a USB-Serial Adapter, verify that the port number assigned during driver installation is the same port configured when using AquaManager and/or the Firmware Updater.
- When making RS232 cable runs greater than 100 feet (30.5 m), use an RS232 Line Extender/Booster. Mount the booster in an area where it is protected from moisture.
- Proper PC com port number must be configured when using AquaManager or Firmware Updater programs.

Test RS232 Communications

Apply power to 5400. Insert node into AquaManager program. Poll node. If wired correctly. AquaManager will obtain 5400 configuration and logs.

Ethernet (TCP/IP) Module Communication

The optional serial to ethernet device must be installed on the 5400 control board when using TCP/IP for communication. Complete installation instructions are provided with the optional serial to ethernet device.
Notes:

- See *Menus* → *System* → *Communications* → *Ethernet* **beginning on - \ for configuration information.**
- An SMTP server accessible by the local network must be provided for ethernet connection.

Consult the network administrator to verify compatibility for ethernet configuration.

Lightning and Surge Protection

AC line voltage surge suppressors protect field equipment on any AC line to ground from damage due to electrical transients induced in the interconnecting power lines from lightning discharges and other high voltage surges. Surge protection devices are strongly recommended to protect your equipment from secondary surges and lightning on outdoor installations. Follow the recommendations provided when choosing and incorporating surge protection devices into your operation:

Recommendations:

- Surge suppression devices should be located on the AC line supplying power to the 5400 and any signal lines connecting the 5400.
- The unit should include noise filtering, common mode, and normal mode suppression and nanosecond reaction time.
- Surge suppressors should be internally fused to remove the load if the unit is overloaded or the internal protection fails.
- Signal line suppressors protect low voltage signals and relay outputs from damage due to electrical transients induced in the signal lines from lightning discharges or nearby electrical devices.
- Signal line suppressors should be installed at each end of an analog loop.
- Relay outputs should be protected at the receiver end.
- Signal line suppressors should consist of a three-element gas tube followed by metal oxide varistors and suppressor diodes.
- The protective elements should be matched such that high-energy surge voltages trigger the gas surge arrester, while low energy or surge voltages affect the MOV's and suppressor diodes.
- Lightning protection devices should be located as close to the 5400 as pos-

sible and wired in accordance with the National Electric Code in approved watertight enclosures.

⚠ CAUTION: This or any other installation procedure cannot protect against a direct lightning strike. YSI Incorporated cannot accept liability for damage due to lightning or secondary surges.

Sealants, Desiccants, and Securing 5400

Environmental conditions can promote the formation of condensation in and around the 5400. It is very important to follow the steps below to prevent damage to the electronic components and extend the life of the 5400 system.

1. Place solid rubber grommets in bulkhead fittings that have no electrical connections.
2. If using optional conduit fittings (YSI p/n 065926UL) in place of bulkhead fittings, industrial encapsulant (YSI p/n 065921 conduit sealer) must be used to prevent moisture from entering the 5400 enclosure. Apply the sealant after all wiring and connections are complete. Failure to use industrial encapsulant may result in damage to the 5400.
3. Desiccant pack must be replaced whenever the 5400 enclosure is opened (Desiccant pack, YSI p/n 006506). Desiccant absorbs moisture captured within the enclosure.
4. Ensure that the rubber gasket is seated between front panel and enclosure whenever enclosure is closed.
5. Replace front panel making sure that ribbon cable is not trapped in the gasket channel before inserting mounting screws.
6. Tighten mounting screws, making sure not to cross thread. The screws are stainless steel and the receiving threads are brass. Do not over-tighten!

WARNING: The 5400 utilizes sensitive solid-state devices that can be damaged by static shock. Installers must observe accepted ESD (Electro-Static Discharge) procedures while connecting cabling to the 5400 I/O plate or any other internal component or damage may result.

AVERTISSEMENT : le modèle 5400 utilise des appareils transistorisés sensibles pouvant être endommagés par des décharges d'électricité statique. Les installateurs doivent observer les procédures de protection acceptées contre les décharges électrostatiques lors du câblage à la carte d'E/S du modèle 5400 ou à tout autre composant interne afin d'éviter tout risque de dommage.

4 Configuring 5400 Systems

-Front panel keys
-Run Screen
-Navigating menus
-Menu structure
-Configuring 5400 systems

5400 Configuration and Monitoring

This chapter provides information on the 5400's front panel, navigating menus, and menu functions.

The front panel - figure 4.1, is the front component of the 5400 enclosure. The front panel contains the 5400 display and seven keys. Use the keys to navigate menus and instrument system information.

This icon indicates helpful information for AquaManager users and is used throughout this chapter. AquaManager provides access to 5400 system information from a PC. Most 5400 configuration and monitoring can be done using AquaManager. See *Chapter 5 AquaManager* - page 160.

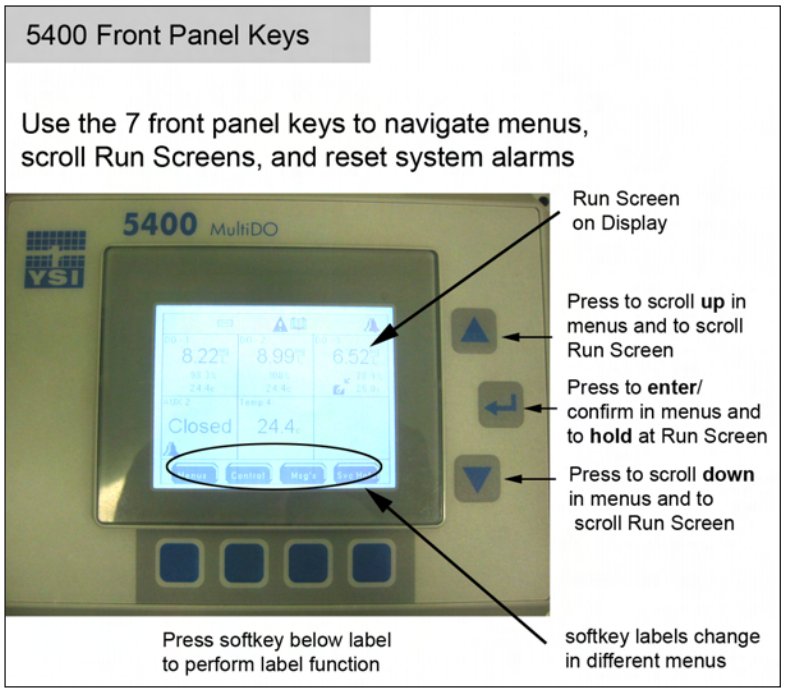


Figure 4.1

Front Panel Keys

There are seven (7) 5400 front panel keys - figure 4.1. Use ▲ and ▼ keys to scroll and highlight menu lists and to scroll through multiple Run Screens. Use ↵ key to select and enter highlighted submenu item and to hold one of multiple run screens from scrolling. Hold is not an option when there is only one run screen. Run screens can be scrolled when held by pressing ▲ and ▼ keys.

Notes:

- Press and hold ▲ and ▼ longer than one second for continuous scrolling.
- Use ▲ and ▼ to scroll and view additional menu items when a scroll bar appears to right of screen.
- Pressing any of the four bottom keys resets any active alarm system. See *General Alarm - page 113.*

Softkeys

Softkey labels appear on the bottom of the display and identify the function of the buttons below them. Softkey labels change in different menus. Softkey labels and corresponding softkey functions are listed in table 4.1.

Note:

- Not all menus and screens display four softkey labels. If there is no softkey label, that softkey has no functionality.

Softkey label	Function
Menus	Access to Main Menu including: calibration submenu system submenu sensor setup submenu timers submenus
Control	Display active non timer control & alarm system(s)
Msg's	Access to Msg's (Messages) Menu including: sensor logs event logs calibration logs
Svc Hold	Activate Service Hold
Exit Menu	Exit menu return to Run Screen saving menu configuration changes.
Cancel	Exit menu (to previous menu) without saving configuration changes.

Softkey label	Function
Back	Back to previous menu. Changes to configurations are saved at return to Run Screen.
Next	Prompt to take next action. i.e. enter user value at calibration menus.
Save	Save alpha and numeric configurations and calibrations.
Disabled Enabled	Disable/Enable menu option. i.e. buzzer.
< >	Scroll left and right in alpha and numeric keypad screens.
OK	To acknowledge and save sensor calibration.
Yes No	Prompt to confirm "Are you sure?" message when performing certain functions. i.e. reset to factory and clear data log menus.
Open Closed	Digital input control configuration from Sensor Setup Menu.

table 4.1

Run Screen

The Run Screen displays measurements and inputs from enabled sensors and conditions - figure 4.2. At power up, the Run Screen is displayed immediately after the YSI splash screen (the YSI splash screen appears for approximately 2 seconds). Icons displayed at the Run Screen represent individual and systemwide conditions. See *Run Screen Icons* - page 71.

Run Screen and sensor display formats are user selectable. See *Display Format* - page 107, and *Sensor Setup Menus* - page 127.

Notes:

- **The Run Screen must be displayed during normal operation.**
- **All alarm functions (5400 email alarms, energizing of enabled alarm relays, alarm icons, and buzzer) are suspended when in 5400 instrument menus.** Alarm systems are reset when menus are exited to Run Screen.
- Always manually poll the 5400 after uploading configuration changes and verify the uploaded information is retained. When configuration changes are uploaded using AquaManager at the same time configuration changes are being made at the instrument, the AquaManager uploads may not be saved depending on the timing of keystrokes at the 5400.

- **The Run Screen must be displayed during normal operation.** If the 5400 is not at the run screen during AquaManager uploading, pressing Exit Menu at the 5400 will only save certain configuration changes.
- At power up, 5400 systems have a 30 second hold off allowing sensor values to stabilize before enabling any control and/or alarm devices.

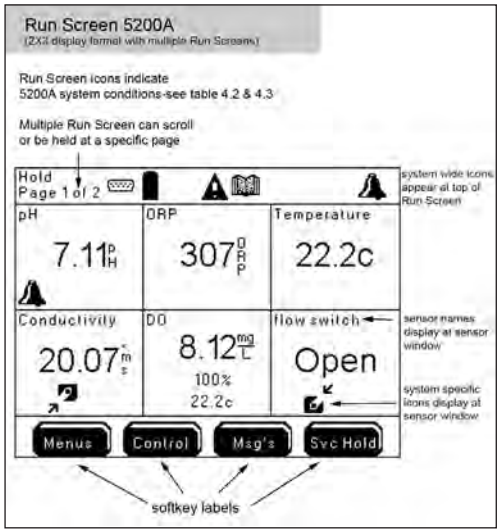


Figure 4.2

Run Screen Icons

Icons identify control, alarm, timer, power, service, and communication information. Icons along the top of the Run Screen indicate 5400 systemwide conditions - table 4.2. Icons displayed within a sensor window indicate condition(s) specific to that system - table 4.3.

Notes:

- Control icons display when the control relay(s) is active.
- General alarm icon, buzzer, 5400 emails, and enabled alarm relay(s) [sensor and general alarm] remain active until one of the bottom four 5400 front panel keys is pressed, regardless if the alarm condition no longer exists.
- Relays, and corresponding icons, that de-energize for Svr Hold, calibration, and/or factory resets are restored after 30 seconds of completing Svr hold, calibration, and/or factory resets. For exceptions, see menu specific information in this chapter.
- With alarms enabled, alarm icons appear at the systemwide location and

individual system location regardless if a relay is assigned to the sensor alarm or general alarm system.

ICONS (systemwide)	Meaning	Notes
	RS232 communication	blinking icon indicates "force serial port" is enabled
	TCP/IP communication ethernet module installed	
	operating in acceptable DC power range	
	DC power is ≤ low battery trigger	
	5400 is password protected	
	sensor (data) logs have information	Msg's to view logs
	one or more control systems is active	Control to view active systems
	feed timer is active	
	one or more 10 event timer is active	
	probe timer needs to be reset	
	General Alarm is active	

table 4.2

ICONS (Sensor & Aux)	Meaning	Notes
	sensor system is in alarm	
	low range control relay is energized (to raise sensor value)	control icons do not appear for aux systems
	high range control relay is energized (to lower sensor value)	control icons do not appear for aux systems
	DO low range 2 control relay is energized (to raise sensor value)	
	DO high range 2 control relay is energized (to lower sensor value)	

table 4.3

Menus

5400 firmware is structured using menus that enable you to easily configure and view system status, messages, and logs. The menu structure and screen formats are very intuitive. Menus are structured in hierarchical fashion. See *Appendix 3 "Menu Maps"* - beginning on page 187. Example - figure 4.3 illustrates the menu path to configure data logging interval.

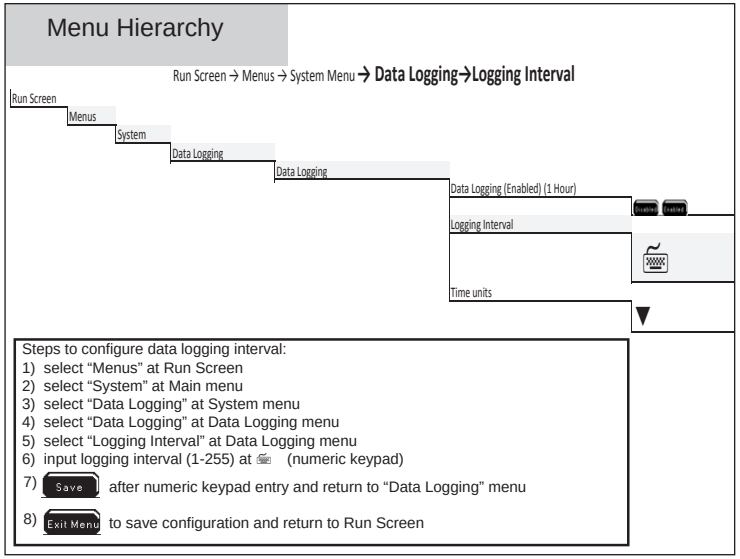


Figure 4.3

Submenu Screen Types

The 5400 includes numeric, alpha/numeric, and pull-down submenus - 4.4. See *Front panel keys* page 68, to navigate, enter, configure, and view submenus.

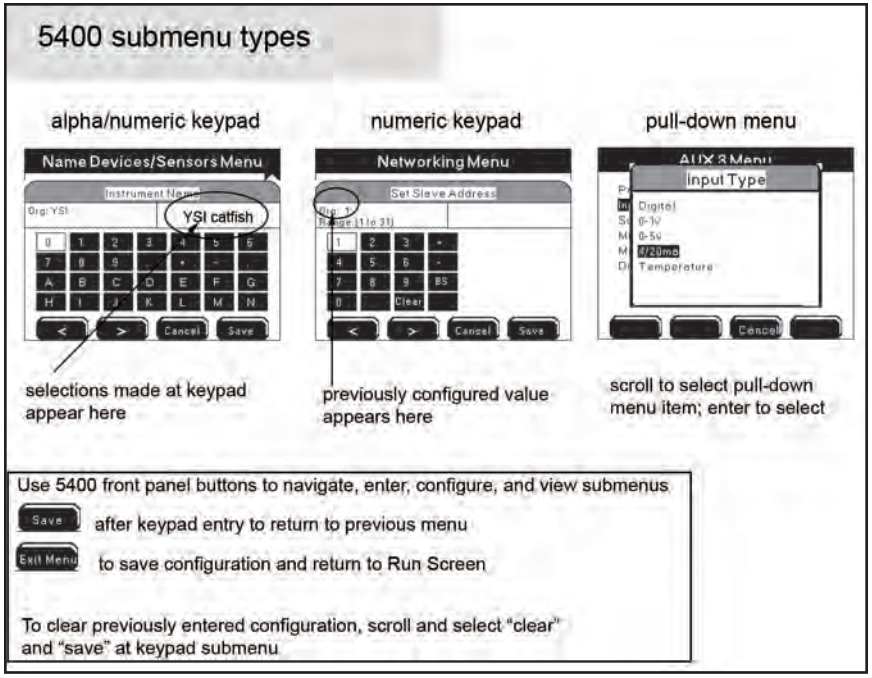


Figure 4.4

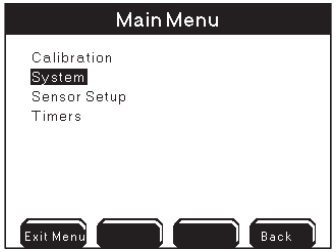
This symbol indicates that alpha/numeric or numeric keypad entry is required. This symbol is used in the menu map appendix starting on page187 and in directions for menu configuration (this chapter). Use ▲ ▼ front panel keys to scroll and ↵ to select entries.

The remainder of this chapter provides information on 5400 menus and submenus and their function. Menu structure and information is provided in hierarchical order starting with the Menus menu. Information on Control, Msg's, and Svc Hold menus is provided after the Menus menu sections.

Main Menu

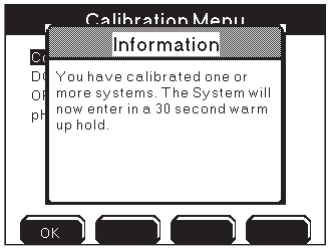
Press Menus at the Run Screen to enter the Main Menu.

All system configuration is done through this menu. The four Main Menu submenus are Calibration, System, Sensor Setup, and Timers.



Calibration Menu

DO sensors(s) must be user calibrated to ensure accurate measurements. Calibrate DO sensors at the Calibration Menu. Entering the Calibration Menu de-energizes control and alarm relays for the DO system being calibrated de-energize. Energized DO control relays for systems not being calibrated remain energized including any/all temperature systems regardless if they are the configured temperature (temp) source for the DO sensor being calibrated. If necessary, disable any temperature relays for the associated DO sensor in the Sensor Setup menu. There is a 30 second hold off period for control and alarm relays after pressing Cancel or Exit Menu at the calibration menu. The hold off period allows sensors time to stabilize before processing readings for controlling and alarming purposes.



Notes:

- Active Aux and Timer relays do not de-energize at calibration menu.
- A "Check probe" error message during calibration means that the sensor is unable to calibrate within the 5400's specifications. This may indicate improper sensor wiring (see page 47), the need to service the sensor, or a failed sensor.
- Temperature sensors do not require calibration nor is it available.
- Energized alarm relays for all systems de-energize when a front panel key is pressed to enter the calibration menu. Alarm systems are not reset until Exit Menu is pressed to return the instrument to the run screen.

Getting Ready to Calibrate

Calibrate DO sensor(s) by performing a one point calibration. Calibration can be done in % Saturation (Sat) or mg/L. Calibrating in %Sat automatically calibrates mg/L and vice versa so it is only necessary to calibrate one or the other, not both. For both ease and accuracy, YSI recommends calibrating in %Sat. Salinity compensation for the mg/L readings is obtained from the user entered ppt value. This value can be entered and modified in the DO sensor setup menu.

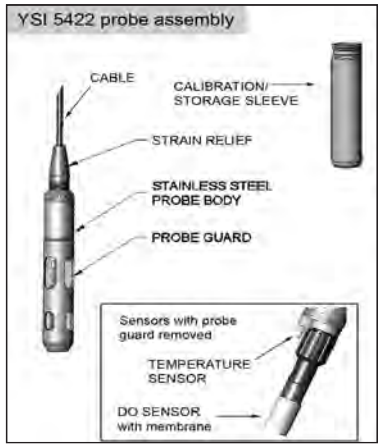


Figure 4.6

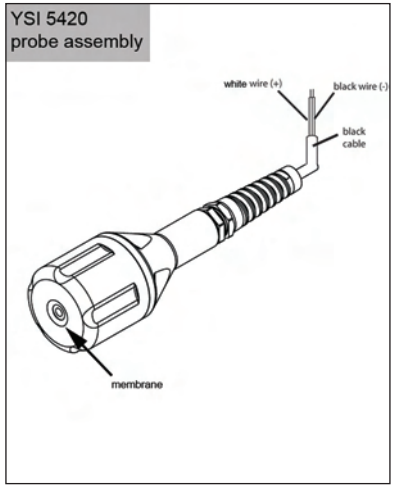


Figure 4.5

Notes:

- A sensor must be enabled in order to calibrate it.
- For the YSI 5422 cable/probe assembly only, keep the sensor guard installed during the calibration to protect the membrane from possible physical damage - figure 4.6.
- When calibrating to mg/L, use a ring stand and clamp to secure the sensor in the calibration water sample.
- Older sensors may take longer to calibrate than new ones because the sensor readings may take longer to stabilize.

Calibration Log

Calibration data is stored in the 5400 calibration log. A calibration data record includes sensor information, the time and date of the calibration, and the calibration method. Press Msg's at the Run Screen to view the calibration log - page 153.

Notes:

- Use AquaManager to view and save calibration data on a PC. In addition to the calibration log information listed above, AquaManager calibration logs also include user inputs 1 and 2.
- Information from cancelled calibrations is not stored.

DO

Menus → Calibration→ DO

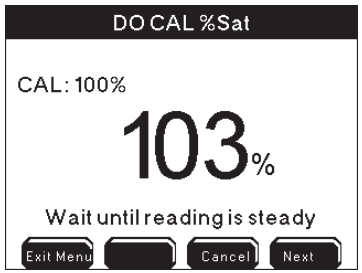
Directions to Calibrate DO Sensor %Sat

1. If you have not already done so, locate and install the sensor if using a YSI 5422, see probe installation instructions included with the sensor.
2. Next, install a new membrane, see instructions included with membrane kit and wire the DO probe page 47.
3. Verify that the sensor type and membrane type are configured correctly in the DO Sensor Setup menu on the instrument.
4. Read *Getting Ready to Calibrate* - page 77.
5. If using the 5422 polarographic sensor, wait at least 10-15 minutes after the 5400 is powered on, or after the DO sensor is serviced, before calibrating. This allows enough time for the DO sensor to stabilize.
6. Verify that the configured salinity (ppt) value in the DO Sensor Setup menu is correct. The entered salinity value should equal the salinity of the water being monitored (not the calibration solution). If necessary, enter the correct the salinity value (ppt).
   Menus → Sensor Setup→ DO→ppt
7. Verify that the local elevation in the DO Sensor Setup menu is correct. If necessary, enter the correct elevation.
   Menus → Sensor Setup→ DO→Elevation
8. Create a 100% water-saturated air environment for the DO sensor:

   <u>For a YSI 5422 polarographic sensor:</u>
   - Moisten the sponge in the gray calibration/storage sleeve with a small amount of clean water. Do not use too much water! The idea is to create a 100% humid environment.
   - With the sensor guard installed, place the cal/storage sleeve over the sensor guard. Make sure that the DO sensor is not immersed in water and that there are no water droplets on the membrane.

   <u>For a YSI 5520 and 5521 galvanic sensor, there are two options for the %Sat calibration environment:</u>
   - For highest accuracy, place the sensor in a cup that contains a small amount of clean water. Place the sensor in the cup so the probe body rests on the sides of the cup but does not touch the water, see picture below. The idea is to create a 100% humid environment. Make sure that the DO sensor is not immersed in water and that there are no water droplets on the membrane.

   <u>OR</u>
   - Alternatively, you may choose to calibrate the galvanic sensor in air by exposing it to air and removing any water droplets from the membrane with a lint free cloth - figure 4.5, page77. While this method is acceptable, it may introduce a small amount of error to the DO readings. For highest accuracy, calibrate in a 100% water-saturated air environment following the directions listed previously.
9. If the temperature source for the DO sensor being calibrated is not coming from a temperature sensor located on the DO sensor's probe assembly, make sure that the temperature value being reported by the source is equivalent to the temperature at the DO sensor's calibration location.
   Menus → Sensor Setup→ DO→Temp Source (User Defined)
10. Enter DO calibration menu
    Menus → Calibration→ DO→Sat
11. Allow approximately 10 minutes for the air in the calibration envriron-ment to become completely water saturated and for the temperature to equilibrate.



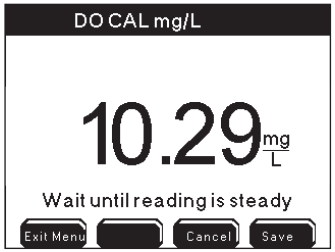
12. After 10 minutes, verify that the DO reading shows no significant change for approximately 30 seconds. Then press Next to complete calibration OR press Cancel to abort the calibration without saving.
13. Press OK to save calibration and return to Run Screen.
14. Remove the probe from its calibration chamber.
15. Rinse sensor in tap or purified water and place the probe assembly back in its monitoring location.

Directions to Calibrate DO Sensor mg/L

A large bucket can be used when calibrating the DO mg/L reading. Be sure to provide sample flow across the membrane by physically stirring the probe or using a stirrer such as a stir bar. The DO sensor requires a sample flow rate of at least 3 inches (~7.62 cm) per second if using the 2.0 mil PE membrane (blue) and at least 6 inches (~15.24 cm) per second if using the 2.0 mil Teflon membrane (gray).

1. If you have not already done so, locate and install the sensor, install a new membrane - page 33, page35, page36 and wire the DO probe page 47.
2. Verify that the sensor type and membrane type are configured correctly in the DO Sensor Setup menu on the instrument.
3. Read *Getting Ready to Calibrate* - page 77.
4. If using the 5422 polarographic sensor, wait at least 10-15 minutes after the 5200A is powered on, or after the DO sensor is serviced, before calibrating. This allows enough time for the DO sensor to stabilize.
5. Verify that the configured salinity (ppt) value in the DO Sensor Setup menu is correct. The entered salinity value should equal the salinity of the water being monitored (not the calibration solution). If necessary, enter the correct the salinity value (ppt).
   Menus → Sensor Setup→ DO→ppt
6. Place the DO probe in a water sample with a known DO concentration (the DO mg/L value can be determined from another recently calibrated DO instrument or from a Winkler titration).

7. If the temperature source for the DO sensor being calibrated is not coming from a temperature sensor located on the DO sensor's probe assembly, make sure that the temperature value being reported by the source is equivalent to the temperature at the DO sensor's calibration location.
   Menus → Sensor Setup→ DO→Temp Source (User Defined)
8. Enter DO calibration menu
   Menus → Calibration→ DO→mg/l
9. Allow the probe to stabilize for approximately one minute.



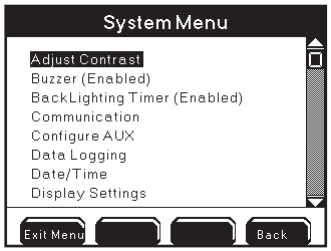
10. After one minute, verify that the DO value shows no significant change for approximately 30 seconds. Then, press Next to complete the calibration OR press Cancel to escape calibration and return to calibration menu without saving.
11. Using the arrow keys to select numbers on the numeric keypad, enter the known DO value in mg/L. Press ↵ to confirm each number selection.
12. Press Save to confirm the entered value OR press Cancel to abort the calibration without saving any changes.
13. Press OK to save the calibration and return to the Run Screen.
14. Rinse sensor in tap or purified water and place the probe assembly back in its monitoring location.
15. Rinse sensor in tap or purified water and place probe assembly in system stream.

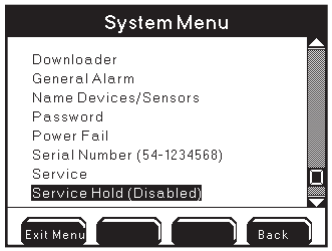
Note:
- Elevation is not required for mg/L Calibration.

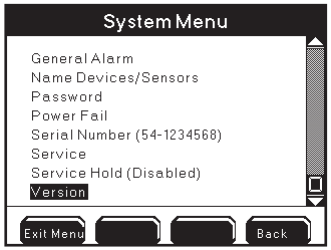
System Menu

Menus → System

The System Menu contains 17 submenus. Use System submenus to configure non-sensor and non-timer systems. System submenus are shown below. Press Menus at the Run Screen to enter the Main Menu. Use ▲ ▼ to scroll and highlight a System submenu. Press ↵ to select and enter a highlighted menu. Configuration changes are saved when Exit Menu is pressed.







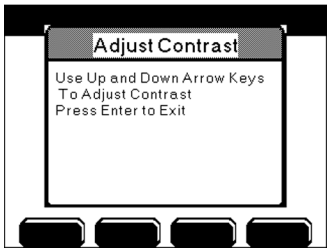
Notes:

- See *Appendix 3 "Menu Maps"* for system defaults and ranges (where applicable) - starting on **page 187.**
- Menu configurations are saved to the instrument only after Exit Menu is pressed and not when the change is made in the menu. If Exit Menu is not pressed, the changes made to the configuration will not be saved. Exception - Date and time and clear data logs are updated immediately to the system; however, YSI recommends pressing Exit Menu in this instance as well in order to save any other changes that may have been made to the configuration.

Adjust Contrast

Menus → System → Adjust Contrast

Use the Adjust Contrast menu to lighten or darken the display contrast.



1. Enter Adjust Contrast Menu:
   Menus → System → Adjust Contrast
2. Use ▲ or ▼ to darken/lighten display.
3. Press ↵ to confirm new display contrast.
4. Press Exit Menu to save configuration and return to Run Screen.

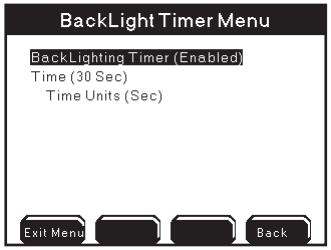
Notes:

- The display contrast will adjust automatically based on the 5400's internal temperature.
- Contrast adjustment cannot be performed using AquaManager.

BackLight Timer

Menus → System → BackLight Timer

When the backlight timer is enabled, the backlight will turn on when any front panel key is pressed and then turn off after the user configured time. If the backlight timer is disabled, the display backlight will not turn off.



1. Enter BackLight Timer menu
   Menus → System →BackLight Timer
2. Use ▲ and ▼ to scroll and highlight submenus.
3. Press ↵ to select the submenu you wish to change.

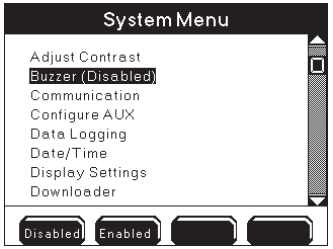
4. Enable and configure submenus.
5. After making desired changes, press Exit Menu to save configuration and return to Run Screen.

Buzzer

Menus → System → Buzzer

The 5400 has an audible buzzer that sounds when a general alarm condition occurs. The buzzer sounds after the alarm hold off period. The General Alarm must be enabled for the buzzer to sound. Use the Buzzer Menu to enable or disable the audible alarm.

When enabled, the buzzer will sound until one of the four bottom softkeys on the 5400 front panel is pressed. From the Run Screen, press one of the following softkeys Menus Control Msg's Svc Hold to reset the General Alarm. Resetting the General Alarm silences the buzzer, de-energizes any alarm relay(s), and stops any pending 5400 email alarm messages. See *General Alarm - page 113 and Sensor Setup - page 127 menus* for additional information.

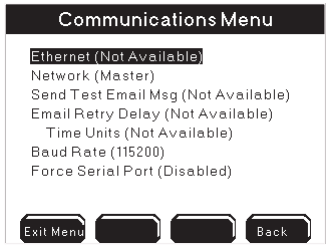


1. Enter Buzzer Menu
   Menus → System → Buzzer
2. Press Disabled or Enabled to turn the buzzer either off or on.
3. Press Exit Menu to save configuration and return to Run Screen.

Communication

Menus → System → Communications

Select the communication method for AquaManager and/or 5400 email alarming. Only 1 communication method can be used at a time. Hardware changes are required when the communication method is changed. See *Wire Communication Equipment* starting on page 62. Configure remote ethernet communication, network settings, and RS232 settings in the Communications menu.



Note:

- AquaManager supports both communication methods.

Email Alarming

Email alarming can be configured in 1 of 2 ways:

1. A *5400 email* is sent from the 5400 serial to ethernet device - See *Ethernet* starting on page 87 for additional information.
2. An *AquaManager email* is sent from the PC running the AquaManager application. AquaManager Autopoller must be running. See *Chapter 5 AquaManager - page 160 and AquaManager online help* for additional AquaManager email alarming information.

*Ethernet connection requires access to an SMTP server accessible by the local network.

EMAIL ALARMING DISCLAIMER - There are many factors that can affect delivery of an email in a timely fashion. Certain SMTP email servers are more reliable than others. No email alarm message has guaranteed delivery. Use multiple email addresses and email forwarding as safe guards. Mechanisms, such as spam filters used by service providers, evolve constantly and can result in non-delivery. Verify with the service provider and/or network administrator to confirm that the 5400 communication configuration ensures the most reliable delivery of alarm emails.

Below is a 5400 DO Alarm Low email sent from a serial to ethernet device. As shown in the example, all of the alarm information is listed in the subject line. The user-configured device name is 'YSI Environmental'. The DO system does not have a user-configured name; therefore, the default system name, 'DO - 3', is included in the subject line.

From: myname@xxx-xxxx.com
Sent: Mon, May 11, 2010 10:24 am
To: myname@xxx-xxxx.com
CC: hot49@xxxx.com
Subject: 05/11/2010 10:23:29 AM YSI Environmental DO - 3 Alarm Low 77%Sat

Notes on 5400 Alarm Emails:

- 5400 emails contain date, time, device name, system name, alarm condition, and the sensor reading in the Subject line of the email. When instrument and sensor names are not user configured, the email includes the serial number and default system name, i.e. "DO - 3".
- On a network, user configured instrument and sensor system names appear in the alarm emails for the master only. Slave alarm emails will report the 5400 serial number and the default system names regardless if the names are user configured.
- Aux digital closed alarm is reported as 0.00; aux digital open alarm is reported as 1.00.
- Aux analog alarm emails are reported in 0.00 resolution regardless of the display format resolution.
- Aux temperature systems do not report a value. The email message will report alarm high or alarm low.
- See *General Alarm*- page 113 and *Set Points* - page 128 for important alarm configuration information.
- Emails are retransmitted based on the Email Retry Delay configuration see page 95.
- Separate emails are sent for each system in alarm.
- 5400 DO email alarms provide the %Sat value and do not provide mg/L value.
- 5400 emails that say "Alarm Both" mean that both a high and low alarm condition have existed and the alarm has not been cleared by pressing a front panel key.
- 5400 alarm emails are not transmitted during a service hold.
- 5400 slave emails are sent to the configured email addresses in the master.
- At power up, the serial to ethernet device may take up to 2 minutes to initialize before sending alarm emails (if alarm condition exists).
- On a network, multiple alarm conditions may exist but only one alarm email is sent. Master alarm emails have priority over slave alarms. When multiple slave alarm conditions exist, it's possible that only one of many 5400 slave alarms will be sent. Therefore, it is critical that all alarm emails are addressed locally by the user.

Below is an example of a 5400 DO Alarm Low email sent from AquaManager. All of the information is in the body of the email and not the subject line.

YSI5400 Alarm
ysi environmental (node name in tree)
54-2345567
DO2 Low Alarm: 77

Notes AquaManager alarm emails:

- AquaManager emails are retransmitted based on the Email Retry Delay configuration see page 95.
- Multiple system alarms are included in one AquaManager email.
- AquaManager DO email alarms provide the %Sat value and not the mg/L value.
- For the AquaManager alarm email to function properly, it may be necessary to send a test email to each email address configured in the Email Alarm List in the Node Properties window. Test emails can be sent in the AquaManager Properties window under the Autopoller tab.

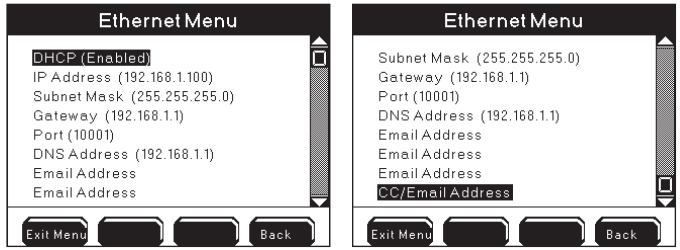
Ethernet

Menus → System → Communications → Ethernet

The serial to ethernet device (TCP/IP connections) must be configured for 5400 email alarming and/or remote access from AquaManager. Device speed and format are self configured at power up. If the serial to ethernet device is not installed or is not installed properly, the ethernet menu will display (Not Available).

Notes:

- 5400 email alarming from ethernet module requires access to an SMTP server accessible by the local network.
- Do not reconfigure internal serial to ethernet device settings.

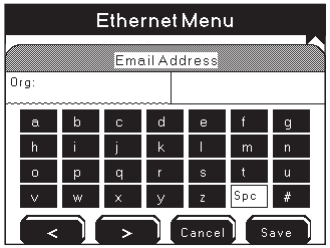


1. Install serial to ethernet device - page 65.
2. The Ethernet icon displays at the Run Screen when the serial to ethernet device is properly installed.

3. Enter Ethernet menu
   Menus → System → Communications → Ethernet
4. Use ▲ and ▼ to scroll and highlight submenus.
5. Press ↵ to select submenu.
6. Configure submenus as needed.
7. Press Exit Menu to save configuration and return to Run Screen.

Notes:

- The CC/Email address must be configured when using 5400 email alarming. Specific alarm system information will not be sent if the CC/Email address menu is not configured with a valid email address.
- If Autopoller is being used for AquaManager email alarming on a TCP/IP connection, it is strongly recommended that the 5400 email alarming using the serial to ethernet device be disabled. When the ethernet device sends email alarms, all Autopoller SMS communication is suspended. This could potentially delay any AquaManager alarm emails from being sent.
- To disable the serial to ethernet device from sending alarms, clear all four email addresses from the *Communication → Ethernet* menus. Clear the email addresses by using the "Spc" (space) key on the numeric keypad. Save change at numeric keypad and press Exit Menu to save configuration and return to Run Screen.



DHCP

Enable DHCP if you are using the serial to ethernet device only for 5400 email alarming and not for AquaManager remote TCP/IP access.

Notes:

- When DHCP is enabled, the 5400 IP address is not updated at the IP address menu.
- With DHCP is enabled, the serial to ethernet device acquires SMTP and DNS addresses during initialization.
- AquaManager requires a static IP address; therefore, DHCP must be disabled when using AquaManager. Consult the network administrator to obtain a static IP address.
- Power cycle the 5400 whenever DHCP is enabled.

IP Address

Menus → System → Communications → Ethernet → IP Address

The IP address can only be configured when DHCP is disabled.

Notes:

- AquaManager users should program the Gateway address either by force serial port in the AquaManager Communication menu or locally at the 5400. Poll node using RS232 communication to upload configuration information including: static IP, port, subnet, and gateway addresses.
- When DHCP is enabled, the IP address is not updated at the IP address menu.
- Power cycle the 5400 whenever a new IP address is configured.

Subnet Mask

Menus → System → Communications → Ethernet → Subnet Mask

A Subnet mask address can only be configured when DHCP is disabled. The subnet mask number helps to define the relationship between the host (computers, routers, switches, etc.) and the rest of the network. Consult the network administrator when configuring this menu.

Notes:

- When DHCP is enabled, the Subnet Mask address is not updated at the Subnet Mask menu.
- AquaManager users should program the Subnet mask either by force serial port in the AquaManager Communication menu or locally at the 5400. Poll node using RS232 communication to upload configuration information including: static IP, port, subnet, and gateway addresses.

Gateway

Menus → System → Communications → Ethernet → Gateway

The Gateway address can only be configured when DHCP is disabled. A gateway IP refers to a device on a network which sends local network traffic to other networks. Consult the network administrator when configuring this menu.

Notes:

- When DHCP is enabled, the Gateway address is not updated at the Gateway menu.

- AquaManager users should program the Gateway address either by force serial port in the AquaManager Communication menu or locally at the 5400. Poll node using RS232 communication to upload configuration information including: static IP, port, subnet, and gateway addresses.

Port

Menus → System → Communications → Ethernet → Port

The default port number for the ethernet module is 10001. Consult the network administrator when configuring this menu.

Note:

- AquaManager users should program the port number either by force serial port in the AquaManager Communication menu or locally at the 5400. Poll node using RS232 communication to upload configuration information including: static IP, port, subnet, and gateway addresses.

DNS Address

Menus → System → Communications → Ethernet → DNS

Domain Name Service (DNS) numbers are IP addresses that a workstation or server uses to refer to specific servers that resolve domain names to IP addresses.

Notes:

- With DHCP is enabled, the serial to ethernet device will acquire SMTP and DNS addresses during initialization.
- When DHCP is enabled, the DNS address is not updated at the IP address menu.

Email Addresses

Menus → System → Communications → Ethernet → Email Address
→ Email Address
→ Email Address
→ CC/Email Address

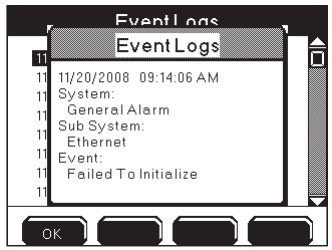
Up to four email addresses can be configured for *5400 emails.* At a minimum, the first email address and the CC/email address must be configured. **If the CC/email address is not configured, 5400 email alarms will contain no alarm information.** The email '**from**' address will be the email address entered in the first *Email Address* menu.

Notes:

- See *Send Test Email Msg* - page 94 to verify proper configuration of ethernet menus.
- On a network, both master and slave alarm emails are sent to the configured email addresses in the master.
- Test the alarm email delivery by creating an alarm condition at the 5400 and verify the email(s) is received.
- The CC/Email address must be configured when using 5400 email alarming. Specific alarm system information will not be sent if the CC/Email address menu is not configured with a valid email address.
- Use AquaManager to easily configure email addresses using the PC keyboard. See AquaManager on line help.
- If Autopoller is being used for AquaManager email alarming on a TCP/IP connection, it is strongly recommended that the 5400 email alarming using the serial to ethernet device be disabled. When the ethernet device sends email alarms, all Autopoller SMS communication is suspended. This could potentially delay any AquaManager alarm emails from being sent.
- To disable the serial to ethernet device from sending alarms, clear all four email addresses from the *Communication → Ethernet* menus. Clear the email addresses by using the "Spc" (space) key on the numeric keypad. Save change at numeric keypad and press Exit Menu to save configuration and return to Run Screen.

Ethernet Module Error Message

At power up, the serial to ethernet device will generate an error message if it cannot properly handshake with the 5400 hardware. If this error occurs, communication (AquaManager and 5400 alarm emails) will not work via TCP/IP. The error could be a result of incorrect serial to ethernet device installation or a faulty ethernet device. The error message will appear in the event log.



SMS Messaging with Ethernet Module

SMS (Short Message Service) or text messaging is a service for sending messages to your cell phone or mobile device. To use SMS messaging, enter the email address in the **Menus → System → Communications→ Ethernet →Email address.** See *Appendix 6 SMS* - page 213 for a list of cellular and mobile companies that support sending text messages.

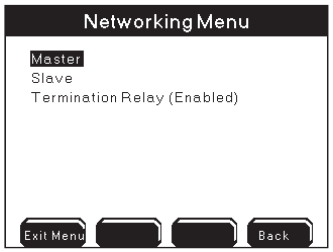
Node Network

Menus → System → Communications → Network

A node network includes multiple 5200A and/or 5400 instruments. The devices are physically hardwired together using RS485 protocol. Node networks are configured with one master node and up to 31 slave nodes. The master continuously queries enabled slaves on the network. The master is the access point for the entire network. This includes AquaManager communication and sending of 5200A/5400 alarm emails. Slave nodes must be configured with a slave address.

Note:

- Multiple node networks communicating via direct connect (RS232) require separate PC COM ports for simultaneous AquaManager mapping and auto-polling.



1. Wire 5400 network - page 57.
2. Enter Network menu
   Menus → System → Communications → Network
3. Press ▲ and ▼ to scroll and highlight submenus.
4. **For master node:** Press ↵ at master submenu.
5. **For all slave nodes:** Press ↵ at slave submenu. Configure a slave address.

Note:

The slave address appears as the slave subnode at node properties.

6. Disable the Termination Relay on all devices except the first and last device on the network. **Menus → System → Communications → Network → Termination Relay.**
7. Verify that the Termination Relay is enabled on the first and last device on the network.

8. **For master node:** Press ↵ at master submenu. At assign slaves menu, select the slave address configured in step 5 above. Press enter. **Enable one slave at a time using Disabled Enabled softkeys. See Testing Network - page 62 for the required testing network wiring.**

9. Press Exit Menu to save configuration and return to Run Screen.
10. Each slave must be tested one by one. Insert network termination strip and apply power to the master and the last physical device on the network. If the master is not the first or last physical device on the network, apply power and insert network terminal strip on the master and on the first and last physical devices on the network. Refer to network wiring instructions for detailed testing information beginning on page 57. Testing for proper wiring and configuration can be done of two ways:

    A. After performing step 9, wait at least 30 seconds and then reenter the Communication Master submenu. If serial number of the slave is displayed next to the slave address number, the communication network is wired and configured correctly.

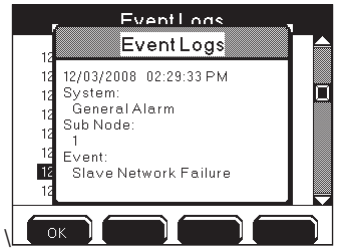
OR

B. After performing step 9, wait at least 30 seconds and then poll the slave node using Aqua Manager. If the serial number of the slave is displayed next to the slave number, the communication network is wired and configured correctly.

11. Apply power. Insert network termination strip to 5200A/5400 units as described in network wiring instructions beginning on page 57. Repeat network configuration directions starting at step 8 until network wiring for master and all slaves has been tested.

Notes:

- An Event and General Alarm (if enabled) will occur if, after ten queries, an enabled slave does not respond to the Master.



- Configuring a 5400 as a Master overrides any slave configuration that had been previously saved.
- Slave alarms (slave alarm at master and 5400 email alarms) will not occur if slave node serial number is not recognized at master node at steps 10. A or 10. B above.

Termination Relay

Menus → System → Communications → Network →Termination Relay

The termination relay must be enabled on the first and last 5400 on a network. All other devices should have the termination relay disabled.

Note:

- Install one 120Ω (ohm) resistor between T(+) and T(-) and one 120Ω (ohm) resistor between R(+) and R(-) on the master 5200. Resistors were included with the 5200.

Send Test Email Msg

Menus → System → Communications → Send Test Email Msg

Send a test email to verify proper configuration of ethernet menus. Test emails are only transmitted from configured master 5400s.

Note:

- Exit to Run Screen is required before the test email is sent.

Example of a 5400 test email sent from ethernet device:

From: myname@xxx-xxxx.com
Sent: Wed, Feb 04, 2010 3:49 pm
To: myname@xxx-xxxx.com
CC: sweet49@xxxx.com
Subject: 02/04/10 03:50:05 PM YSI5400 Email Alarm Test Message

Email Retry Delay

Menus → System → Communications → Email Retry Delay

Configure the Email Retry Delay for the time interval that emails should be retransmitted after the initial alarm email is sent. The initial alarm email is sent immediately after the general alarm hold off time or after the aux hold off time. Emails will be retransmitted until one of the front panel softkeys is pressed, regardless if the alarm condition still exists.

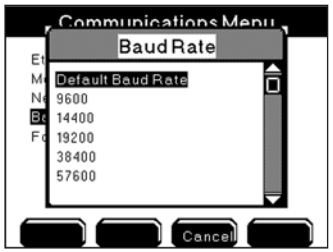
Notes:

- On a network, emails are retransmitted according to the slave retry delay configuration of the slave in alarm and not the master's email retry delay configuration. Please note, a slave Email Retry Delay menu will display (Not available) because of its slave configuration; however, this feature is available and has a default value of 15 minutes that can be configured by the user.
- The Retry Delay should be configured at intervals ≥ 15 minutes.
- AquaManager alarm emails are retransmitted based on 5400 slave(s) and master email retry delay configuration.

Baud Rate RS232

Menus → System → Communications → Baud Rate

Configure the Baud rate (for RS232 connections only) in the 5400 to match the baud rate configured in AquaManager. Use the default rate of 115200 for fastest communication speed.

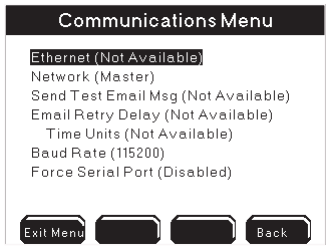


1. Enter Network menu
   Menus → System → Communications → Network →Baud Rate
2. Press ▲ or ▼ to scroll and highlight a selection.
3. Press ↵ to confirm selection.
4. Press Exit Menu to save configuration and return to Run Screen.

Force Serial Port

Menus → System → Communications → Force Serial Port

Enable the Force Serial Port when the 5400 is communicating via RS232 (direct) to a PC and when the 5400 has a serial to ethernet device.



1. Wire RS232 connection - page 63.
2. Enter Network menu
   Menus → System → Communications → Force Serial Port
3. Use the Disabled Enabled softkeys to configure off or on.
4. Press Exit Menu to save configuration and return to Run Screen.

Notes:
- RS232 connection is required to upload firmware using the Firmware Updater.
- The RS232 icon blinks at the Run Screen when in Force Serial Port mode.

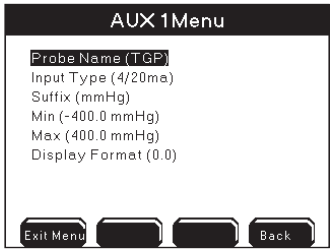
Non-Networked (Stand Alone) 5400s

Non-networked (stand alone) 5400s must have the termination relay enabled. In addition, non-networked (stand alone) 5400s must be configured as a master in the System Communication menu with no slave nodes enabled.

Configure AUX

Menus → System → Configure Aux 1-6

The 5400 has six auxiliary (Aux) inputs. Aux inputs 1, 2, 3, 4, 5, and 6 can be configured for digital or analog (0-1V,DC 0-5VDC, or 4-20 mA) inputs. In addition, Aux 3, 4, 5, and 6 can be configured with a temperature sensor. Configure suffix, minimum (Min), maximum (Max), and display format menus for the analog inputs. Non temperature aux input's control/alarm on condition, control/alarm relay, and hold off time are configured in the **Sensor Setup Menus → Sensor Setup Aux 1-6** menus. Temperature aux input's set points, control, alarm, and relays are configured in the **Sensor Setup Menus → Sensor Setup Aux 3-6** menus.



Probe Name

Menus → System → Configure Aux →Aux 1-6→Probe Name

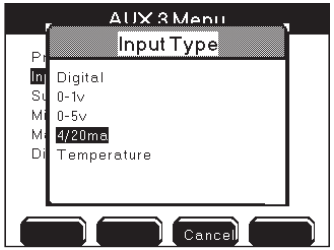
Use the alpha/numeric keypad to name aux inputs. Configured name(s) appear throughout menus and at Run Screen - figure 4.7, page 100.

Note:
- Aux names can also be configured at Menus → System → Name Devices/ Sensors.

Input Type

Menus → System → Configure Aux →Aux 1-6→Input Type

Select the input type for the device(s) wired to aux system(s). Aux Sensor Setup menu selections are based on the aux input type configured at system menu.



Digital

Menus → System → Configure Aux →Aux 1-6→Input Type→Digital

Use digital input when wiring an external device to control or alarm when the contacts of an external switch open or close. A common application would be to detect high or low water levels using a float switch.

Notes:
- Suffix, Min, Max, and Display Format are not available for digital inputs.
- In the 5400 sensor log, aux digital "closed" is logged as Aux 0.00. Aux digital "open" is logged as Aux 1.00.

1. Wire aux digital devices - page 53.
2. Enter Aux menu
   Menus → System → Configure Aux →Aux 1-6
3. Use ▲ and ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Configure digital input type and name.
6. Press Exit Menu to save configuration and return to Run Screen.
7. Go to Sensor Setup Menus → Sensor Setup Aux 1-2 - page 132 to enable and configure control/alarm on condition, control/alarm relay, and hold off time.
8. Press Exit Menu to save configuration.

Analog Non Temperature

0-1VDC and 0-5VDC and 4-20 mA

Menus → System → Configure Aux →Aux 3-6→Input Type →**0-1V**
→**0-5V**
→**4/20ma**

Select the analog input type based on the signal being sent from the device.

Notes:
- It is normal to hear an on-board relay "click" when switching to or from the 4-20ma aux input type.
- Analog systems will not monitor, control, or alarm properly if a device that operates outside the configured analog range is installed and configured.

Suffix

Menus → System → Configure Aux →Aux 1-6→Suffix

Enter the Suffix (up to 4 characters) to describe the input type or units. The suffix is displayed at the Run Screen. The suffix is typically used to describe the input signal type.

Example - when using a total dissolved gas pressure sensor "mmHg" could be used as a suffix for measuring TGP (total dissolved gas pressure) - figure 4.7, page 100.

Min and Max values

Menus → System → Configure Aux →Aux 1-2 →**Min**
→**Max**

Min and Max values are user defined. The range is -10000 to 10000. Min and Max values are used for scaling the input value received from an analog aux input. The min and max values may be configured to correspond to the minimum input level (i.e. 0VDC or 4mA) and maximum input level (i.e. 1VDC, 5VDC, or 20mA). The Min value must be less than Max value.

Example - when using a total dissolved gas pressure sensor (0-5VDC input type) enter -400 for min value. The 5400 will display "-400" when the input value is 0VDC. Set the max value to correspond to the maximum input value as +400. The 5400 will display "400" when input value is 5VDC.

Notes:
- The 5400 will monitor and data log based on the "min" and "max" voltage or current signal.
- To enter negative values, type the whole number then select "-" on the numeric keypad.
- Whenever min and/or max values are changed, go to **Menus → System → Sensor Setup → Aux 1-6 → Control Low and Control High** menu to verify control/alarm values are correct for the application.

Display Format

Menus → System → Configure Aux →Aux 1-6→Display Format

Configure the Display format (0, 0.0, or 0.00) based on the resolution to be displayed at the Run Screen.

Example - when using a total dissolved gas pressure sensor, configure the display format as 0.0 - figure 4.7, on this page.

In the below screen shot, the Run Screen is displaying aux name "TGP," suffix "mmHg," with display format "0.0". The display value represents an input of 1.875 volts with 0-5VDC analog aux configuration. The min value = "-400". The max value = "+400." The control/alarm low is "-50." Alarms are enabled for this aux input.

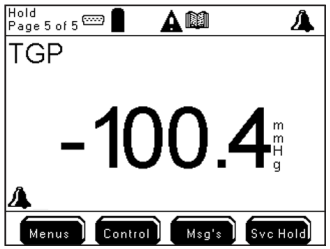


figure 4.7

Notes:

- Values are displayed based on the display format resolution. Example - if the display format is 0.0 and the min value configured is 1.88, then 1.9 will be the value displayed in the min value menu.
- 5400 aux sensor logs record 0.00 resolution regardless of the selected resolution in the aux analog display format configuration.

1. Wire aux analog devices - page 53.
2. Enter Aux menu
   Menus → System → Configure Aux →Aux 1-6
3. Use ▲ and ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Press Exit Menu to save configuration.
6. Go to Sensor Setup Menus → Sensor Setup Aux 1-2 - page 132 to enable and configure set points, control, alarm, relays, and hold off time.
7. Press Exit Menu to save configuration.

Note:

- The alarm low value must be ≥ the min value. The alarm high value must be ≤ the max value.

Analog Temperature (Available Aux 3, 4, 5, 6)

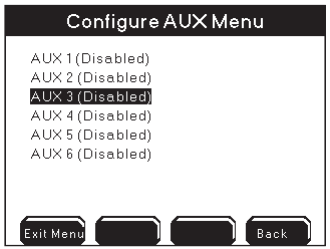
Menus → System → Configure Aux →Aux 3-6→Input Type→Temperature

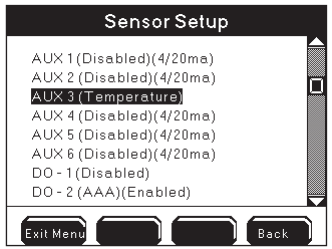
Subject: 02/04/10 03:50:05 PM YSI5400 Email Alarm Test Message
A temperature sensor can be configured as an Aux input on Aux systems 3, 4, 5, and 6. Temperature sensors can be configured in conjunction with one of the DO (dissolved oxygen) systems or as an independent temperature system at any location.

1. Wire temperature sensors - page 50.
2. Enter Aux menu
   Menus → System → Configure Aux →Aux 3-6
3. Use ▲ ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Configure temperature input type and name.
6. Press Exit Menu to save settings and return to Run Screen.
7. Go to Sensor Setup Menus → Sensor Setup Aux 3-6 - page 127 to enable and configure set points, control, alarm, and relays.
8. Press Exit Menu to save settings and return to Run Screen.

Notes:

- The Configure Aux menu will display temperature configured channels as "disabled". This is because aux systems configured as temperature channels no longer function as analog aux channels, but rather function as a sensor system.
- The Sensor Setup menu - page 138 is automatically enabled when an aux channel is configured for temperature.

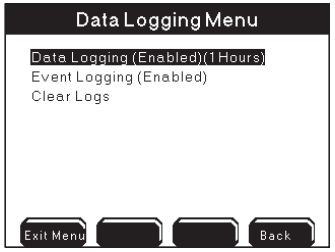




Data Logging

Menus → System →Data Logging

The 5400 saves information in the calibration, sensor, and event logs. Press Msg's at the Run Screen to view the 25 most recent records for each log. The 5400 sensor log can stores 1000 records. The calibration log can store 500 records. The event log can store 1250 records. Once a 5400 log is full, it will begin overwriting the oldest records with new records (data wrapping).



Notes:

- Use AquaManager to store and analyze 5400 logs. To avoid gaps in data, use polling intervals based on the user defined data logging configuration. Set the data log interval so that analyzing the data is meaningful.
- AquaManager users can view Configuration events in the Configuration log. Configuration events are created when certain 5400 configuration changes are made. The configuration log is not accessible at the 5400. See *AquaManager Online Help* for additional information.

Data Logging

Menus → System →Data Logging→Data Logging

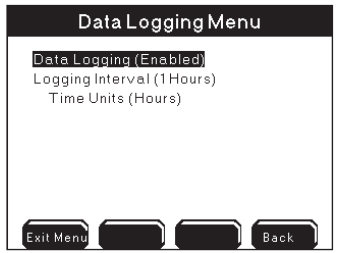
The 5400 sensor log stores records for sensors and aux systems. Sensor logs are time and date stamped based on the user configured logging interval (1-255 minutes/ hours).

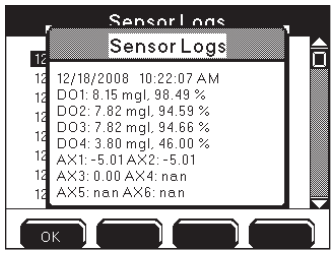
1. Enter Data Logging menu
   Menus → System →Data Logging→Data Logging
2. Use ▲ ▼ to scroll and highlight submenus.
3. Press ↵ to select.
4. Enable and configure submenus.
5. Press Exit Menu to save setting and return to Run Screen.

Press Msg's to view the 25 most recent sensor logs

Notes:

- Temperature values are stored in °C regardless of display format.
- Aux digital "closed" is logged as Aux 0.00. Aux digital "open" is logged as Aux 1.00.
- The 5400 sensor log records 0.00 resolution for aux analog inputs regardless of the selected display format.
- DO values are stored in mg/l & %Sat regardless of selected display format.
- Sensor logs record the default system name and not the user configured system name.
- Aux temperature values are not accessible at the 5400. Temperature values can only be obtained using AquaManager. Values will be shown in the AquaManager data log in °C regardless of the selected display format. Temperature values are only available and stored for temperature systems assigned to a DO system.
- Changes to the data logging interval take effect after the expiration of the interval being changed. Example - if the interval is changed from one hour to one minute, one minute logging will begin after the expiration of the current one hour interval. Power cycle the 5400 to make a change to the data logging interval occur immediately.
- **Menu configurations are saved to the system by pressing Exit Menu to return to the Run Screen and not when the change is made in the menu. Exception - Date and time and clear data logs are updated immediately to the system, not when Exit Menu is pressed**.
- The sensor log contains values for all sensor and aux systems regardless if the system is disabled.
- 5400 sensor log values for disabled systems and systems without sensors are not valid.





In the above sensor log screen shot Aux 3 is assigned as temperature for DO 1. DO 4 and Aux 1, 2, 4, 5, & 6 are disabled.

Event Logging

Menus → System → Data Logging → Event Logging

Control, Alarm, and Timer relays assigned to 5400 systems create events when they turn on and off. In addition, AC power failures, ethernet device error messages, and slave network failures are create events. These events are stored in the Event Log. Event logs identify the 5400 system, are time and date stamped, and record relay the action ("on" or "off").

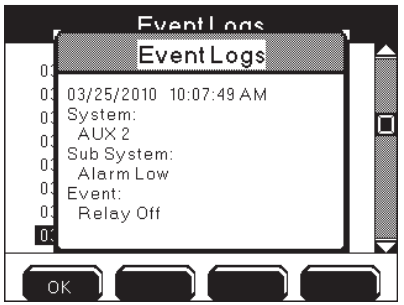
1. Enter Event Logging menu
   Menus → System → Data Logging → Event Logging
2. Use ▲ ▼ to scroll and highlight submenus.
3. Press ↵ to select.
4. Press Disabled Enabled to turn off or on.
5. Press Exit Menu to save setting and return to Run Screen.

Press Msg's to view 25 most recent event logs.

Press Control to view active ("on") non timer events. *See Control Menu* - page152 for additional information.

Notes:

- The General Alarm does not create an event whether a general alarm relay is enabled or not.
- Events are not recorded when relays de-energize due to system-wide events. System-wide events include calibration, Svr Hold, factory resets, power cycle, 30 second sensor system reset, relay test, and disabling systems.
- Event logs record the default system name not user configured system name.
- Event logs do not record relay number or user configured relay name.
- Aux analog (non temperature) events will always display "alarm" regardless if alarms are enabled, see below screen shot on left.
- Aux digital events will never display "alarm" regardless if alarms are enabled, see below screen shot on right.

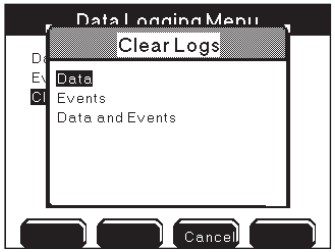


Clear Logs

Menus → System → Data Logging → Clear Logs

Use the Clear Log option to permanently delete all event and/or sensor log records from the 5400.

Before permanently deleting sensor and event logs, poll all data using AquaManager. AquaManager will store all logs in PC database.



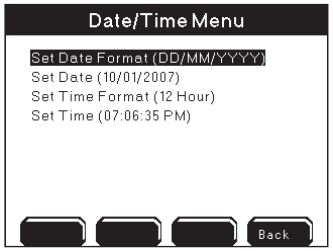
1. Enter Clear Log menu
   Menus → System → Data Logging → Clear Logs
2. Use ▲ and ▼ to scroll submenu.
3. Press ↵ to select.
4. The instrument will prompt, "Are You Sure?" Press one of the following softkeys to confirm: Yes No Cancel.
5. Selecting "Yes" automatically deletes logs and then returns to the Run Screen after approximately three seconds.
6. Selecting "No" or "Cancel" does not delete logs and returns to the Data Logging menu.
7. Press Exit Menu to save setting and return to Run Screen.

Notes:
- Logs cannot be deleted from the 5400 instrument using AquaManager.
- Calibration and Configuration logs cannot be cleared from 5400.

Date/Time

Menus → System → Date/Time

It is important to configure the correct date and time in the 5400. Four 10-event daily timers and four feed timer run based on the 5400 date and time. Logs record events based on the 5400 clock. Date and time display formats are user defined.



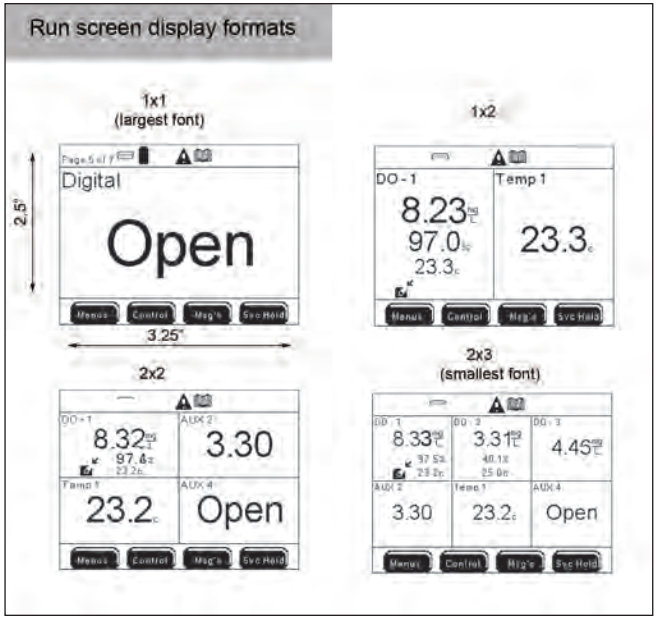
1. Enter Date/Time menu
   Menus → System → Date/Time
2. Verify 5400 current date and time.
3. If necessary, use ▲ and ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Configure submenus.
6. Press Exit Menu to save setting and return to Run Screen or press Back to System menu.

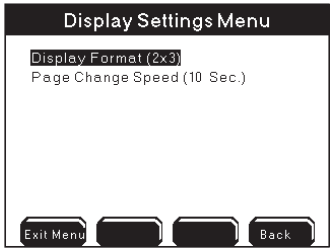
Notes:
- Changes to Date and Time menus take place immediately and are saved prior to Exit Menu.
- Configured date and time formats are carried throughout menus and logs.
- Any active (with energized relay) timer system, including 10-event daily timers, feed timers, and/or dosing timers, are NOT recalculated when the 5400 time and/or date is changed. Once a timer relay has been energized, it runs for the duration and does not reset based on changes to the 5400 date and time. Example - timer 1, event 1 is configured to come on at 9:00am for 10 minutes. Timer relay energizes at 9:00am. At 9:05am the 5400 time is changed to 10:05am (for daylight savings adjustment). The timer relay will de-energize after five additional minutes. The 5400 time will be 10:10am. The event log will reflect the configured 5400 time when the event occurred. In this example, 9:00am for the start and 10:10am for the end.
- The time must be manually changed for daylight savings time adjustments. Daylight savings note: Sensor data log records are not overwritten when the clock is changed unless the instrument is power cycled after changing the data and time. Example - the data log interval is set to 15 minutes. Current instrument time is 6:00 am. The clock is adjusted to 5:00 am for daylight savings time. The 5400 sensor log contains four 15 minute interval records from 5:00 am to 6:00 am from prior to time change. Sensor data logs are not overwritten with new values for the repeat of 5:00 am to 6:00 am 15 minute intervals unless the instrument is power cycled.
- Menu configurations are saved to the system by pressing Exit Menu to return to the Run Screen and not when the change is made in the menu. Exception - Date and time and clear data logs are updated immediately to the system, not when Exit Menu is pressed.

Display Settings

Menus → System → Display Settings

Sensor and Aux conditions are displayed at the Run Screen. Use the Display Settings menu to configure how many systems display on one page at the Run Screen. Up to six systems can be displayed on one Run Screen page. Multiple Run Screen pages scroll at user configured speed (1-65535 seconds).





1. Enter Display Settings menu
   Menus → System → Display Settings →Display Format
2. Use ▲ and ▼ to scroll and highlight submenus.
3. Press ↵ to select.
4. Exit Menu to save configuration and return to Run Screen Back.

Notes:

- At 1x2 & 2x2 display settings, analog aux values over 7 digits will overlap on to the adjoining sensor window. Adjust aux display format to lower resolution.
- Because of font limitations, 1X2 and 2X3 display formats do not show all 20 characters of a 20 character name. Typically only 13 characters are displayed.

Updating 5400 Firmware

Like all microprocessor based instruments, it may be necessary to upload revisions to 5400 firmware. Download new firmware using the Firmware Updater utility in AquaManager. A serial RS232 connection is necessary to run the Downloader program.

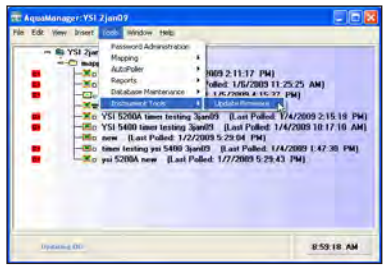
The instrument firmware may become corrupted if any of the following occurs during a 5400 firmware update:

- Firmware Updater utility is closed;
- AquaManager is closed;
- RS232 cable is removed from 5200A or PC com port;
- power is disconnected from 5200A.

If the 5400 firmware becomes corrupted and is not updated properly, the instrument will need to be returned to YSI.

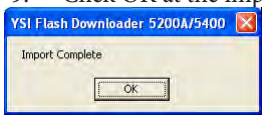
Firmware Updater Directions

1. Wire RS232 connection. See *RS232 Communication* - page 63. (Disregard if already using RS232 connection.)
   Note:
   Connect RS232 directly into slaves in order to upload firmware to slaves. Disable slaves at the master to avoid slave failure alarms when uploading - **Menus → System → Communications → Network →Master.**
2. Enable the Force Serial Port on 5400s wired and configured with an ethernet device - page 96.
3. Verify that the baud rate in 5400 Communications menu is configured to 115200.
4. From the AquaManager Explorer window, access the Firmware Updater utility from the pull down menu: Tools→ Instrument tools→Update Firmware.

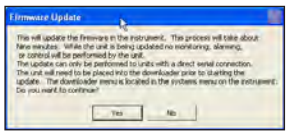


5. Configure PC com port number (1-8) in Firmware Updater program.
   Note:
   - When using USB-Serial Adapter, verify that the port number assigned during driver installation is the same port configured when using AquaManager Firmware Updater.

6. Access the YSI web site Downloads page at www.ysi.com to get the latest version of the 5400 firmware code.
7. Locate the YSI 5400 Firmware and save the file to a temporary directory on your computer.
8. Within the lower left box of the Firmware Updater Utility window, browse to locate the firmware file on local PC and then import it into the utility.
9. Click OK at the import complete confirmation window.

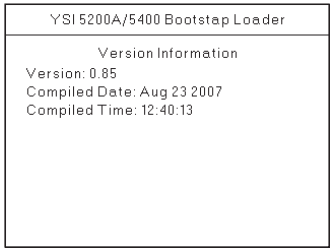


10. Select "Program Device". The following Firmware Updater message appears.



11. Select "Yes" and the following screens will appear.

On instrument:



On PC:

12. The 5400 will reboot (power cycle) when firmware upload is complete.

13. Select "ok" when this window appears
14. Verify version information to confirm downloaded code:
    Menus → System → Version
15. If applicable, disable Force Serial Port configuration.

Notes:

- During upload, 5400 systems are placed into Service Hold which de-energizes any active systems including energized relays. See *SVR Hold Menu* - page 124 for additional information. No "off" event is created for system relays that de-energize when 5400 is placed in downloader. Systems are reset when power is cycled after downloader.
- All logs and unit configuration are retained when 5400 firmware is updated.
- Display board code loads first, followed by control board code. The display board screen flickers when display board code is loading. The display stops flickering when the control board code is loading. The Firmware Updater

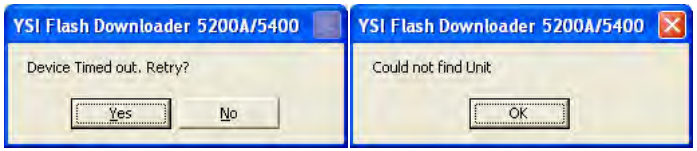
progress bar will complete two full scrolls during firmware updating.

- Total download time is approximately nine minutes; eight minutes to upload display board firmware and about one minute to upload control board firmware.
- Autopoll must be shut down when firmware is uploaded to 5400.

Firmware Updater Messages

The Firmware Updater program may respond with one of the following messages to indicate that the upload did not occur.

"Timed out" or "Could not find Unit" messages indicate a communication problem between PC and 5400. Reconfirm Communication menu configuration, com port settings, and RS232 connections. (A power cycle will be required to access the Communications menu.) Place 5400 in downloader mode again and select "yes" to retry at Firmware Updater error message window. If the upload is still unsuccessful, it is possible that the 5400 is not in downloader mode. See *Force Downloader* - on this page.



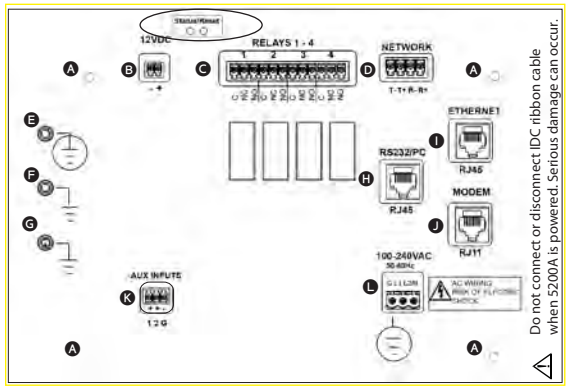
"Unit is Up-To-Date" indicates that the 5400 has most recent firmware and upload is not necessary.

Force Downloader

A status LED on the I/O Board must be visible to determine if the 5400 is in downloader mode. The status LED flashes about 10 times in 5 seconds when in downloader mode. When not in downloader mode, the status LED flashes more quickly about 15 flashes in 5 seconds. The led at the "status/reset" location of the I/O Board indicates the current status of 5400 boards.

Directions to Force 5400 into Downloader

1. WARNING: Disconnect external power to 5400. (AVERTISSEMENT : déconnectez l'alimentation externe de l'unité.)
2. Open front panel - page 40 .
3. Depress reset button on I/O board (see figure below) and hold down the enter key on the front panel. Use a paper clip or other sturdy piece of wire to access the reset button through the I/O metal plate. Ensure that you are only touching the reset button on the I/O board and the enter key, then turn power on. The Downloader (bootstrap loader) screen should appear on the instrument.



4. Proceed with uploading firmware with Firmware Updater utility. *See Downloader - page 109.*

General Alarm

Menus → System → General Alarm

The General Alarm triggers the buzzer, general alarm relay, general alarm icon, and 5400 emails. Sensor alarms, aux alarms, slave failure (networks), and low battery alarms trigger the General Alarm when enabled. **If individual system alarms are not enabled, the General Alarm will not trigger.**

The General Alarm (buzzer, relay, emails, icon) remains active until one of the four softkeys Menus Control Msg's Svc Hold on the front panel is pressed. Pressing one of the four softkeys while in the Run Screen stops the buzzer, de-energizes the General Alarm relay, stops 5400 emails, and removes the General Alarm icon. Pressing one of these keys also resets the sensor and aux alarm systems. If the alarm condition still exists after Alarm Hold period(s), the General Alarm triggers again. Low bat-

tery and slave failure alarms are not reset when softkeys are pressed.
Sensor alarm values set the acceptable control range. When a sensor reports a value ≤ low alarm value or ≥ high alarm value, the alarm system becomes active after the alarm hold off period. See *Set Points, Control, and Alarms* - page 128 for additional information. If an alarm system is active and alarm relay is enabled, the alarm relay energizes. See *Aux Setup* page132 for important aux control and alarm system information.

Notes:

- **The Run Screen must be displayed during normal operation. All alarm functions (5400 email alarms, energizing of enabled alarm relays, alarm icons, and buzzer) are suspended in 5400 menus. Alarm systems are reset when menus are exited to Run Screen.**
- The General Alarm system is disabled during system-wide events such as service hold and downloader.
- Sensor and Aux alarms must be enabled to trigger the General Alarm.

Alarm Hold Off

Menus → System → General Alarm → Alarm Hold Off→Time Units

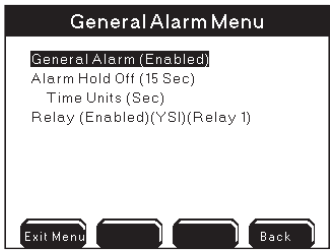
General Alarm Hold Off is the length of time the alarm condition must exist before the General Alarm system becomes active.
Notes:

- To avoid alarms for spurious events set the Alarm Hold Off > than 0.
- Aux system alarms are triggered after the Aux hold off time, and not after the General Alarm hold off time.
- Low battery alarm has a five (5) second hold off that is not user selectable.

Relay

Menus → System → General Alarm → Relay

The General Alarm relay can be wired and configured for any output device to energize when the General Alarm system is active.



Note:

- The General Alarm does not create an event log or control message regardless if a General Alarm relay is enabled.

1. Wire General Alarm devices - page 51.
2. Enter General Alarm Menu
   Menus → System → General Alarm
3. Use ▲ ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Enable and configure submenus.
6. Press Exit Menu to save configuration and return to Run Screen.
7. Configure alarm, control values, and assign relays at Sensor Setup menus. **Menus → Sensor Setup - page 132.**

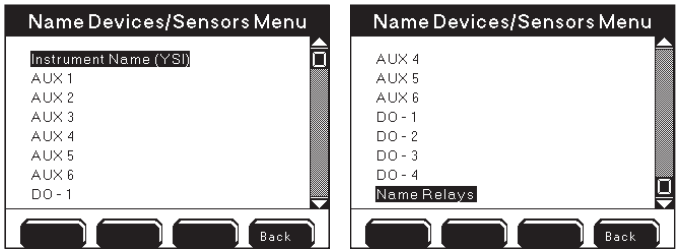
Name Devices/Sensors

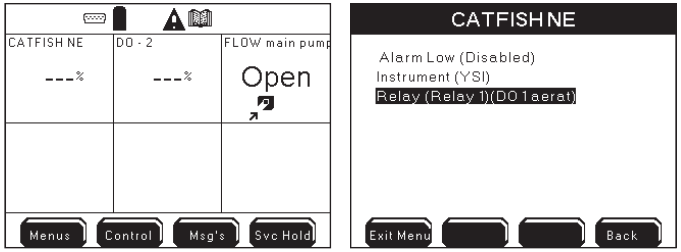
Menus → System → Name Devices/Sensors

Names can be user configured for the 5400 instrument, sensor, and aux systems, and relays. System names are displayed at Run Screen, configuration, and control messages menus. Relay and instrument names are displayed at configuration menus. Default names are displayed when names are not user configured. 5400 default system names are: DO1, DO2, DO3, DO4, Aux 1, Aux 2, Aux 3, Aux 4, Aux 5, Aux 6, relay 1, relay 2, relay 3, and relay 4. Default names for Aux 2, 3, 4, 5, and 6 assigned as temperature systems are Temp 1, Temp 2, Temp 3, and Temp 4.

Names can contain up to 20 characters.

Use AquaManager to easily configure names using the PC keyboard. See *AquaManager On Line* help.





1. Enter Name Devices/Sensors menu
   Menus → System → Name Devices/Sensors
2. Use ▲ ▼ to scroll and highlight submenus.
3. Press ↵ to select.
4. Use keypad to configure name.
5. Press Exit Menu to save configuration and return to Run Screen.

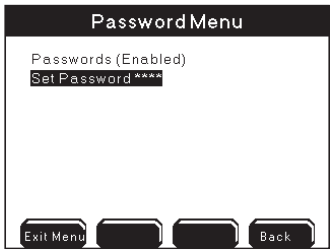
Notes:

- User configured Aux system names only appear for aux non-temperature systems. "Temp 1," "Temp 2", "Temp 3", and "Temp 4" appear for aux 2, 3, 4, 5, and 6 when configured as temperature systems regardless if the aux channel has a user configured name.
- AquaManager users - Names uploaded in the temperature system name field within the temperature system tab are displayed at the run screen, configuration menus, and control messages menus.
- Instrument, Aux & Sensor Names are not cleared at Reset to factory menus.
- Relays names are cleared at "reset relays", "reset all systems", and "reset to factory/reset all" service menus.
- The 5400 default system name is displayed at event, sensor, and calibration logs, regardless if system name is user configured.
- Press "Clear" at keypad and then press Save to clear user configured names.
- Non temperature aux system names can also be configured at: **Menus → System → Configure Aux →Aux 1-6→Probe Name**
- Because of font limitations, 1X2 and 2X3 display formats do not show all 20 characters of a 20 character name. Typically only 13 characters are displayed.
- The instrument name is not shown at Run Screen. The instrument name is shown at relay enable menus.
- Certain menus (i.e. configure aux) display up to 18 characters of the device name. "..." is shown at the menu if the name exceeds 18 characters.

Password

Menus → System → Password

Enable and set the password in the password menu. Once the password is enabled and saved, 5400 system menus are not accessible without first entering the correct password at the Run Screen. The password can contain up to 12 characters.



1. Enter Password menu
   Menus → System → Password
2. Use ▲ and ▼ to scroll and highlight submenus.
3. Press ↵ to select.
4. Enable and configure submenus.
5. Press Exit Menu to save configuration and return to Run Screen.

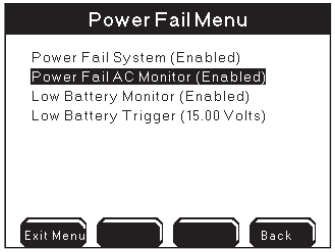
Notes:

- Svc Hold is not password protected.
- displays at Run Screen when password is enabled.

Power Fail Menu

Menus → System → Power Fail

In the event of AC power failure, an AC version instrument's power switches to DC if properly wired. The switch from AC to DC power is automatic and does not require 5400 configuration. Enable *Power Fail AC Monitor* to generate event when AC power fails and is restored.



Disabling the *Power Fail System* will disable AC power events and disable the General Alarm in the event of low battery for DC power. ***Disable Power Fail AC Monitor* when powering 5400 by a DC power source.**

Enable *Low Battery Monitor* to trigger General Alarm in the event DC voltage is ≤ to low battery trigger. The Low Battery Alarm Hold Off time is five (5) seconds and cannot be user configured. Once the low battery general alarm has been acknowledged by pressing one of the 4 softkeys, it is not reset. See *General Alarm* - page 113.

1. Verify AC and DC power supplies are properly wired and powered - page 43.
2. Enter Power Fail Alarm menu and submenus
   Menus → System → Power Fail
3. Use ▲ ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Enable and configure submenus
6. Press Exit Menu to save configuration and return to Run Screen.

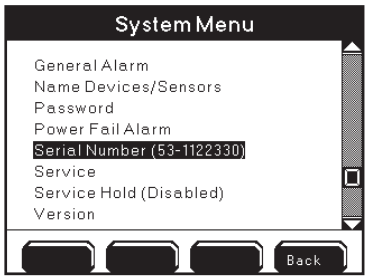
Notes:

- Press Msg's to view AC power fail events.
- icon at Run Screen indicates that the 5400 DC power is ≥ Low Battery Trigger value with Low Battery Monitor enabled.
- icon at Run Screen indicates DC voltage ≤ the Low Battery Trigger when Low Battery Monitor is enabled.
- Low battery alarm is not reset when front panel softkey is pressed.
- AC power fail does not generate a general alarm.

Serial Number

Menus → System → Serial Number

The serial number is displayed at the serial number menu. The serial number is required when contacting YSI customer service. The serial number is also necessary to configure AquaManager. 5400 serial numbers begin with "54-"followed by seven digits. Serial numbers are generated at the factory and cannot be changed by the user.



Service

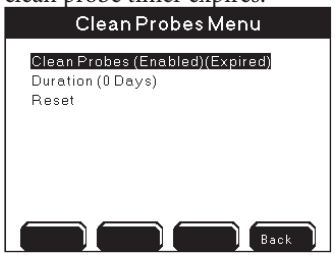
Menus → System → Service

The Service menu includes submenus to configure and Reset Clean Probe timer, Reset Systems to factory defaults, and test Relay(s).

Reset Clean Probes

Menus → System → Service→ Reset Clean Probes

Enable clean probe timer, configure the duration, and reset clean probe days remaining from Reset Clean Probe menu. Selecting reset at this menu resets clean probe timer to the user configured value. icon displays at Run Screen when the clean probe timer expires.



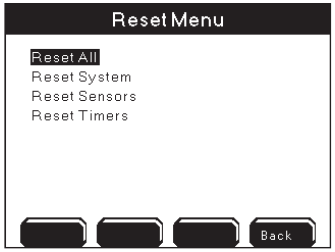
Reset Clean Probe timer at the Msg's menu or at the Reset Clean Probes menu.

When prompted "Are you sure?", select "Yes" to reset the clean probe timer to the user configured number of days.

Reset To Factory

Menus → System → Service→ Reset To Factory

The Reset to Factory menu allows resetting of some or all of 5400 systems to factory defaults. Example - if Clean Probe Timer is user configured to 60 days, performing a factory reset will reset the Clean Probe Timer to 90 days which is the factory default setting and not the user configured value. See *Appendix B Menu Maps* - starting on page 187 for factory default settings for all systems.



Notes:

- "Reset All" and "Reset All Systems" resets time format to 12 hour and date format to MMDDYYYY.
- It is strongly recommended that user configuration be maintained in a log by the user.
- Instrument, aux, sensor, and suffix names are not reset at any reset to factory menus. Relay names are reset at "reset relays" and "reset all" menus.
- Control icons and control menu messages are displayed for 30 seconds after pressing Exit Menu from reset to factory menus for any system that was active (energized relay) prior to factory reset.

Reset All

Menus → System → Service→ Reset To Factory→ Reset All

Resets all systems, sensors, and timers to factory defaults.

1. Use ▲ and ▼ to scroll and highlight submenus.
2. Press ↵ to select.
3. When prompted, "Are you sure?", select one of the following to confirm, Yes No Cancel
4. Press Exit Menu to save configuration and return to Run Screen.

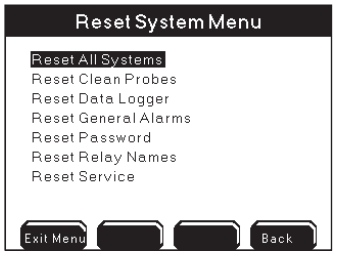
Notes:

- Display contrast, backlight timer, and buzzer can only be reset to factory defaults through this menu.
- Sensors will need calibrated after performing a factory Reset All and/or Reset Sensor.

Reset System

Menus → System → Service→ Reset To Factory→ Reset System

Specific systems or all systems in the Reset System menu can be reset to factory defaults.

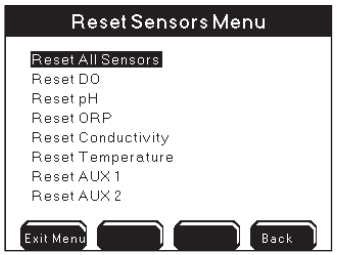


1. Use ▲ and ▼ to scroll and highlight submenus.
2. Press ↵ to select.
3. When prompted, "Are you sure?", select one of the following to confirm, Yes No Cancel
4. Press Exit Menu to save configuration and return to Run Screen.

Reset Sensors

Menus → System → Service→ Reset To Factory→ Reset Sensors

Specific sensors, aux system, or all sensor and aux systems listed in the Reset Sensors menu can be reset to factory default.



1. Use ▲ and ▼ to scroll and highlight submenus.
2. Press ↵ to select.
3. When prompted, "Are you sure?", select one of the following to confirm, Yes No Cancel

4. Press Exit Menu to save configuration and return to Run Screen.

Note:
- Perform a sensor calibration after resetting a sensor to factory default.

Reset Timers

Menus → System → Service→ Reset To Factory→ Reset Timers

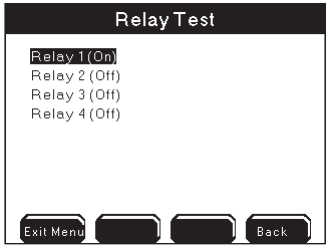
A specific timer, feed timer, or all timers listed in the Reset Timers menu can be reset to factory defaults.

1. Use ▲ and ▼ to scroll and highlight submenus.
2. Press ↵ to select.
3. When prompted, "Are you sure?", select one of the following to confirm, Yes No Cancel
4. Press Exit Menu to save configuration and return to Run Screen.

Relay Test

Menus → System → Service→ Relay Test

Use the Relay Test menu to verify peripheral devices are wired correctly. Entering this menu turns off any active relays and disables any sensor, aux, and timer system relays from energizing regardless of value or condition. Systems are not reset when the Relay Test menu is exited. To reset systems after exiting the Relay Test menu, power cycle the 5400. Example - an energized conductivity low control relay (normal mode) is de-energized when entering the Relay Test menu. If the conductivity value is in control low range when the Relay Test menu is exited, the relay will not re-energize until the system has a change of condition. The conductivity system must reach setpoint and then fall in low control range again before the control low relay is energized. It is strongly recommended to turn the power off, then on, at the 5400 after exiting the Relay Test menu.



1. Press ↵ to toggle relay on.
2. Press ↵ to toggle relay off.
3. Press Exit Menu to save configuration and return to Run Screen.

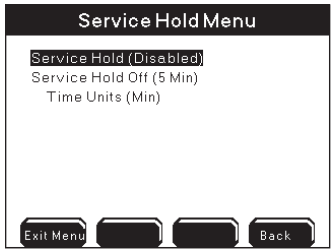
Note:

- Timer and control icon(s) remain at the Run Screen until the system is reset. Example - the timer icon remains at systemwide location until the end of the timer cycle that was stopped when the relay test menu was entered even though the relay is not energized. To reset systems after exiting the Relay Test menu, power cycle the 5400.

Service Hold

Menus → System → Service Hold

Pressing Svc Hold at the Run Screen puts the 5400 into Service Hold. The Service Hold time is user selectable (1-255 sec, min, or hours). Service Hold turns off any active relays and disables any sensor, aux, and timer system relays from energizing regardless of value or condition. 5400 alarm emails are not sent during service hold. After the service hold time expires or is cancelled, the sensor systems are reset after 30 seconds. Timer systems are not reset. See *Service Hold Menu* - on this page for additional information.



1. Use ▲ and ▼ to scroll and highlight submenus.

2. Press ↵ to select.
3. Enable and configure submenus.
4. Press Exit Menu to save configuration and return to Run Screen.

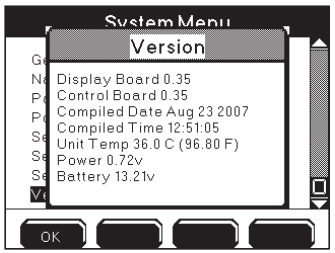
Version

Menus → System →Version

The Version menu contains information about the 5400 including: display and control board firmware code version, control board temperature, and AC and DC voltage.

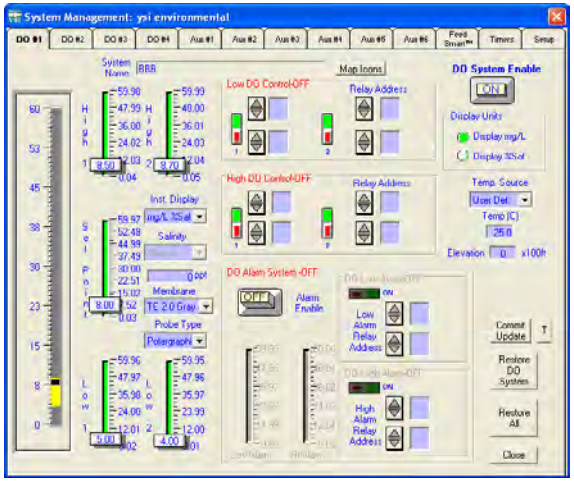
Notes:

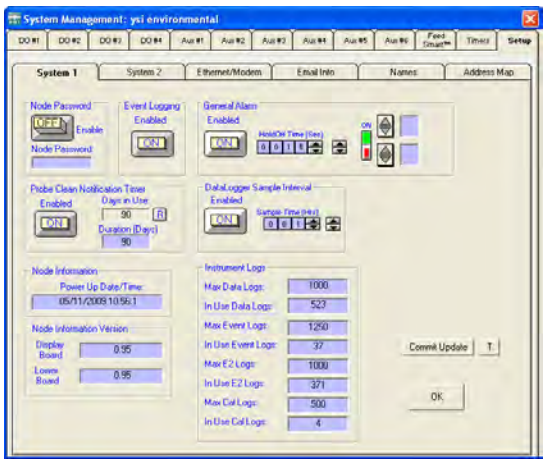
- Firmware version information is required when contacting YSI support.
- The clock chip temperature range starts at 0ºC. Values < 0ºC are not valid numbers.
- Firmware date and time compilation are displayed below the version number information.
- The normal operating range temperature will be a few degrees above ambient.
- AC powered units will run at a higher temperature than DC powered units.
- To view current AC and DC power values Exit Menu to return to the Run Screen and then return to menu. Power information does not refresh when version menu is open.



AquaManager and the System Menu

AquaManager users can configure most 5400 system menus from a PC. After polling the 5400, use “Systems Management” from the node window to view and upload 5400 configuration. System menus are configured at the Setup and Input tabs.





Notes:

- Always manually poll the 5400 after uploading configuration changes and verify uploaded information is retained. When configuration changes are uploaded using AquaManager at the same time configuration changes are being made by a user in the menus on a 5400 instrument, the AquaManager uploads may not be saved depending on the timing of keystrokes at the 5400.
- **The Run Screen must be displayed during normal operation.** If the 5400 is not at the run screen during AquaManager uploading, pressing Exit Menu at the 5400 will only save certain configuration changes.

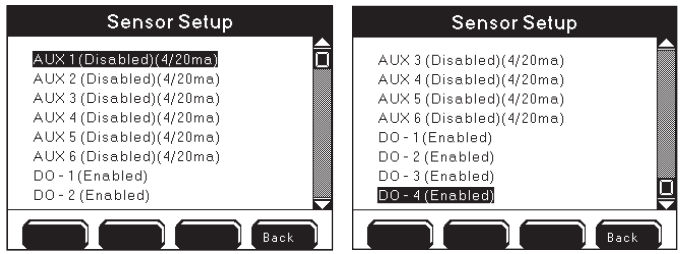
See *Chapter 5 AquaManager* - page 160 and *AquaManager online help* for additional information.

Sensor Setup

Menus → Sensor Setup → Aux 1-6
→ DO 1-4

Aux, DO, and temperature system set points, control, alarm, and relays are configured in the Sensor Setup menu. Configure control and alarm values based on conditions to maintain desirable water quality for your water system.

Aux non temperature systems operate differently than aux temperature and DO sensor systems. See information beginning on page 132 regarding aux systems setup.



Values and conditions at sensor and aux device locations are processed by the 5400. Systems (alarm and/or control) become active and inactive based on user configuration. Eight onboard relays can be assigned for control and alarm devices. Enabled relays energize when a control or alarm system is active. Example - DO sensor (input) reports a 5.4 mg/L value and relay #3 (output) is enabled for DO range low 2 when value is ≤ 5.5 mg/L. An aerator is wired to relay #3. The aerator wired to relay #3 energizes until the 5400 receives a DO sensor reading ≥ set point value.

Notes:

- **For normal operation, the 5400 must be at the Run Screen. Alarm functionality (email alarms, activation of assigned alarm relays, alarm icons, and buzzer) is suspended when 5400 is not at Run Screen.**
- **Sensor system must be enabled in order to display values at Run Screen. Control and/or alarm relays will not energize regardless of value if the sensor system is disabled.**
- There is a 30 second delay at power up before control, timer, and alarm systems become active.
- There is a 30 second sensor system hold off when sensor configuration is changed. See *30 Second Sensor System Hold Off* - page 131.

- Calibrate sensor prior to use. See *Calibration* - page 77.
- "Over" and "Under" readings are displayed at the run screen when DO sensor is measuring outside it's operating range - see *DO range specification* - page 14. DO control and alarm functions including relays are suspended when a sensor is reading "Over" or "Under."
- "Over" and "Under" are not displayed for aux temperature systems when temperature values are outside the temperature operating range - see *Temperature Range Specification* - page 15. Temperature system controls and alarms will not operate correctly when values are outside the temperature operating range.
- DO "Over" and "Under" readings most likely indicate that the sensor needs serviced or replaced, or a bad probe/cable connection.
- See *Menu maps* - page 187 for system defaults and ranges.
- One relay can be assigned to multiple systems. It is essential that the relay configuration be verified in order to avoid conflict of operation of wired relay devices. Assigning one relay to multiple systems can result in invalid operation of 5400 if set points and alarm values are not properly setup.

Set Points, Controls, and Alarms

Understanding how Set Point, Control, Alarm, and Alarm Hold Off values are processed by the 5400 is necessary to properly configure the instrument.

Set Points

Configure the Set point (DO and temperature systems) to the ideal value the system sensor should operate at.

Control Values

Range low and Range high values set the acceptable sensor reading range for the water system. Control system(s) do not become active when value(s) are within acceptable control range. See figure 4.8 - page 130. Enabled control relays energize when the sensor reports a value ≤ the range low control value or ≥ range high control value. Control relays are typically wired to devices used to raise or lower water conditions to meet control ranges for a particular sensor reading, i.e. DO. Control relays remain energized until the sensor reports a value ≤ low control set point or ≥ high control set point value. Exception - See timed mode for temperature high control.

Sensor low control range starts at -1 significant digit below set point value. High control range starts at +1 significant digit above set point value.

Notes:

- DO systems have two control ranges. They are referred to as range Range Low 1 & 2 and Range High 1 & 2.

- Control systems remain active when the user is in 5400 menus.
- Control icons display at the Run Screen when relays are energized - see *Icons* - page 71.
- Press Control at Run Screen to display active sensor and aux system relays.
- Press Msg's at Run Screen to display events created by control and alarm relays - see *Event Log* - page 104.
- Control relays are not energized if the 5400 DO sensor value reads "Over" or "Under."
- "Over" and "Under" are not displayed for aux temperature systems when temperature values are outside the temperature operating range - see *temperature range specification* - page 15. Temperature system controls will not operate correctly when values are outside the temperature operating range.
- *See Wire Relays* - page51 for information on wiring control output devices.

Alarm Values

Alarm values set the acceptable control range. Alarm system(s) do not become active when values are within acceptable control range. See figure 4.8 - page 130. Alarm system(s) becomes active when value is ≤ low alarm value or ≥ high alarm value. Enabled alarm relays energize if alarm condition exists for the general alarm hold off time. Alarm relays are energized until one of the four softkeys Menus Control Msg's Svc Hold is pressed regardless of sensor value. Pressing one of four softkeys resets the alarm system. Alarm systems become active again if, after the alarm hold off period has passed, the alarm condition still exists. Alarm hold off is configured in the General Alarm menu.

When the General Alarm is enabled, (with or without enabled relay), the general alarm system becomes active when any system alarm is active. See *General Alarm* - page 113.

Sensor low alarm range starts at -1 significant digit below low control value. High alarm range starts at +1 significant digit above high control value.

Notes:

- **It is important to keep the 5400 at the Run Screen during normal operation. Alarm functionality (email alarms, activation of enabled alarm relays, alarm icons, and buzzer) is suspended when 5400 is not at Run Screen.**
- Alarm icon(s) display at the Run Screen when alarm condition(s) exists for longer than the general alarm hold off time. *See Icons* - page 71.
- Press Control at Run Screen to display active sensor and aux system relays.
- Msg's to display events created by control and alarm relays - see *Event Log* - page 104.

- Alarm relays are not energized if the 5400 DO sensor value reads “Over” or “Under.”
- “Over” and “Under” are not displayed for aux temperature systems when temperature values are outside the temperature range specification - see *temperature range specification* - page 15. Temperature system alarms will not operate correctly when values are outside the temperature range specification.
- *See Wire Relays* - page 51 for information on wiring alarm output devices.

Figure4.8 shows how the 5400 operates based on a sensor setup configuration example. DO range low 1 and range low 2 devices will energize at ≤ 5.0 and ≤4.0 respectively. The alarm low system becomes active at ≤3.5.

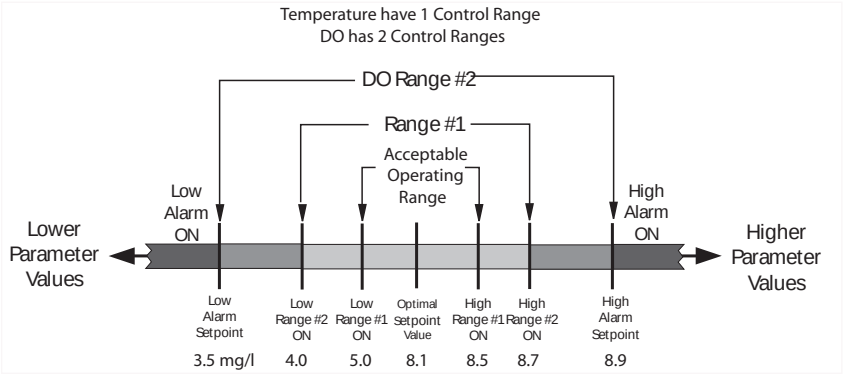


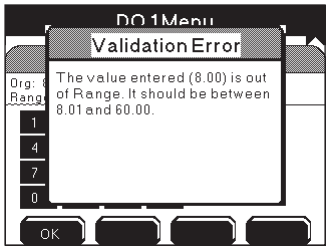
Figure 4.8

Validation Error and Autofix

When an invalid value is entered at the numeric keypad a Validation Error window displays. An invalid value is either a value outside the range of the sensor system or a value that breaches other settings within the sensor system. Autofix occurs when a high or low control value is entered that breaches the set point value. See the following examples
Low range control value must be < set point low value. High range control value must be > set point high value. Low alarm value must be < low control value. High alarm value must be > high control value.

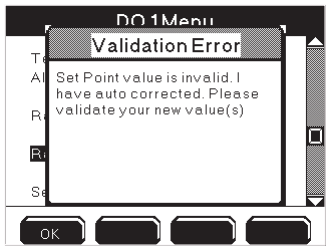
Example 1 - entering “63” for DO set point results in validation error because the valid range for the DO sensor system is 0.00 to 60.0 mg/l. User must configure value within valid range. In addition, the value cannot breach respective control and alarm system values.

Example 2 - configuring set point value of 8.00 mg/L with range low value of 8.00 mg/l results in validation error. Valid set point range is displayed at validation error display. Press OK to return to numeric keypad to enter valid value.



Autofix occurs when a high or low control value is entered that breaches the set point value. Autofix changes the high or low control value by one least significant digit away from the set point value. The set point value is never adjusted.

Example 3 - Entering 8.00 mg/L as the range low value when the set point value is 8.00 mg/L results in an auto fix of the control value. The invalid control value is displayed at the sensor setup menu. Pressing Exit Menu is not an option after saving a value at numeric keypad. Press Back from the sensor setup menu to continue with the autofix. A validation error window is displayed to show that the autofix has occurred. Press OK to return to sensor setup menu. Verify that the autofixed values are configured for user’s specific application and reconfigure as necessary. Press Exit Menu to save configuration and return to Run Screen.



30 Second Aux and Sensor System Hold Off

Exiting aux and sensor menus after making certain configuration changes places the system in a 30 second hold. During the 30 second sensor hold, control and alarm systems are not active. System(s) becomes active, if, after 30 seconds, the values are reported in control or alarm range. This 30 second hold off allows sensors time to

stabilize before control and/or alarm systems become active.

Example - DO sensor menu is entered and the control high set point value is changed while a control relay is energized. When Exit Menu is pressed to return to the Run Screen, the DO control relay de-energizes regardless of sensor value. The control relay re-energizes if, after the 30 second hold, the value is still in control range.

Reconfiguration of the following does not place the system in 30 second hold off:

- All systems - enable/disable alarms;
- DO systems - display format, probe type, membrane type, ppt, elevation, temp source, temp display format, low alarm set point;
- Temperature system - display format, chiller on time, chiller on time units, chiller hold off time, chiller hold off time units , set points, enable/disable control relays.

Notes:

- Configuration changes place only the system that has been reconfigured on 30 second hold.
- No "off" event log is created when energized system relays de-energize due to 30 second sensor hold off.
- Control icons and control messages continue to display during the 30 second sensor system hold at the Run Screen regardless if relays are energized.
- Enabling certain control/alarm functions when system value is in control/alarm range requires that the 5400 be power cycled in order to reset the system to properly control/alarm for current condition.

Non Temperature Aux Setup

Menus → Sensor Setup → Aux 1-6

Aux systems control/alarm on (digital), control/alarm high, control/alarm low (analog), hold off, and relay settings are configured in the Sensor Setup menu. Before configuring Aux Sensor Setup menus, configure the Aux input type at the system menu. See *Configure Aux* - page 97 **Menus → System → Aux Configuration 1-6 menu.** Aux Sensor Setup menu selections are based on Aux input type configured at system menu.

Notes:

- **For normal operation the 5400 must be at the Run Screen. Alarm functionality (email alarms, activation of assigned alarm relays, alarm icons, and buzzer) is suspended when 5400 is not at Run Screen.**
- There is a 30 second delay at power up before control, timer, and alarm systems become active.

- There is a 30 second sensor system hold off when a sensor configuration is changed. See *30 second sensor system hold off* - page 131
- See *Menu maps* - page 187 for system defaults and ranges.

Aux Relay

Aux systems work differently than other sensors in regard to control and alarm functionality because only one relay can be assigned to aux systems. In addition, there is no set point for non temperature analog aux systems. Eight onboard relays can be assigned for either aux control or alarm devices.

Notes:

- The Control menu will display energized aux relay only when alarms are enabled.
- An alarm icon is displayed at the Run Screen only when alarms are enabled. If alarms are disabled and an aux relay is energized, there is no icon at the aux system on the Run Screen.
- One relay can be assigned to multiple 5400 systems. It is essential that the relay configuration be verified in order to avoid conflict of operation of wired relay devices. If not configured properly, assigning one relay to multiple systems can result in invalid operation of 5400.
- Event logs are created when an aux relay energizes and de-energizes regardless if alarms are enabled.
- Aux alarms must be enabled to trigger General Alarm.
- General Alarm may still be active even though aux system is no longer in alarm. See aux relay information below and *General Alarm* - page 113.

Aux Hold Off

Aux Hold Off (user configured) is the length of time the control or alarm condition must exist before the Aux relay energizes.

Notes:

- To avoid control or alarm for spurious events , configure the Alarm Hold Off > than 0.
- If General Alarm is enabled, it is triggered after the Aux hold off time and not the general alarm hold off time.

Digital

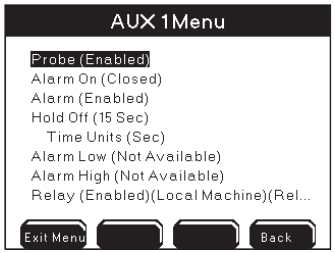
Configure digital control/alarm (open/closed), relay, alarms, and hold off in the Aux 1 - Aux 6 Sensor Setup Menu. Use digital input type for triggering relay to energize based on either a switch open or switch closed condition. Enabled relay will energize based on the condition configured in the control/alarm on menu.

Aux Relay Digital

When enabled, Aux digital relay energizes when configured control/alarm on condition occurs. Aux relay energizes after configured aux hold off time. When alarms are disabled and as long as control/alarm on condition exists, the relay remains energized including when menus are entered. Relay de-energizes when the non control/alarm condition is processed by the 5400 regardless if alarms are enabled. If alarms are enabled, the relay also de-energizes when one of the four front panel softkeys Menus Control Msg's Svc Hold is pressed. Pressing one of four softkeys resets the alarm system. The Alarm system becomes active again if, after the aux hold off period, the alarm condition still exists.

Aux digital events (event log) are identified by aux number, input type (digital), relay condition (on/off), and do not identify digital condition (open, or closed). Aux digital events are not identified as control or alarm events regardless if alarms are enabled.

Configure Aux 1-6 digital input type:



Directions to Configure Aux (digital)

1. Wire Aux digital devices - page 53.
2. Configure "digital" at **Menus → System → Configure Aux →Input Type**
3. Enter Aux 1-6 in Sensor Setup menu
   Menus → System → Sensor Setup → Aux 1-6
4. Use ▲ ▼ to scroll and highlight submenus.
5. Press ↵ to select.
6. Enable and configure submenus.
7. Press Exit Menu to save configuration and return to Run Screen.

Notes:

- At sensor log Aux (1:1.00) is reporting open condition. Aux (1: 0.00) is reporting closed condition.
- When in menus, an aux digital relay will energize when alarms are enabled if in menus longer than the aux alarm hold off time and the control/alarm condition is processed from an existing non control/alarm condition. The general alarm will not trigger until the user exits to run screen, the control/alarm condition is reset by processing a non control/alarm condition, AND then a control/alarm condition is reproduced.
- Do not enable aux digital alarms when the sensor is in the control/alarm condition. Enabling aux digital alarms when sensor is in control/alarm condition can result in aux system not properly processing existing alarm condition.

Analog (0-1VDC, 0-5VDC, and 4-20mA)

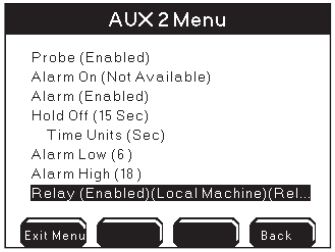
Configure control/alarm low, control/alarm high values, relay, alarms, and hold off time in the Sensor Setup Menu.

Aux Relay Analog

When enabled, the Aux analog relay energizes when either the control/alarm high **OR** the control/alarm low value is processed by the 5400. The aux relay energizes after the configured aux hold off time. When alarms are disabled and as long as a value ≤ the control/alarm low value OR a value ≥ the control/alarm high value is processed by the 5400, the relay remains energized including when menus are entered. The relay de-energizes when a value > control/alarm low value OR a value < control/alarm high value is processed by the 5400 regardless if alarms are enabled. If alarms are enabled, the relay also de-energizes when one of the four front panel softkeys Menus Control Msg's Svc Hold is pressed. Pressing one of the softkeys resets the alarm system. The Alarm system becomes active again if, after the aux hold off period, the alarm condition still exists.

Non temperature aux analog events (event logs) are identified by aux number, relay state (on/off) and report "alarm high", or "alarm low" condition regardless if alarms are enabled.

AquaManager identifies Aux analog events as control or alarm based on node configuration.



Directions to Configure Aux (analog)

1. Wire Aux analog devices - page 53.
2. Select "0-1v", "0-5v", or "4/20ma" input type at **Menus → System → Configure Aux →Input Type**
3. Enter Aux 1-6 in Sensor Setup menu
   Menus → System → Sensor Setup→Aux 1-6
4. Use ▲ ▼ to scroll and highlight submenus.
5. Press ↵ to select.
6. Configure submenus.
7. Press Exit Menu to save configuration and return to Run Screen.

Notes:

- Control/alarm high value must be ≤ Max value. Control/alarm low value must be ≥ Min value. Min & Max values are configured in **Menus → System → Configure Aux →Aux 1-6→Min/Max** menu.
- Do not enable aux analog alarms when the sensor is in the control/alarm condition. Enabling aux analog alarms when sensor is in control/alarm condition can result in aux system not properly processing existing alarm condition.

Aux 3-6 (Temperature)

Menus → Sensor Setup→Aux 3-6

See *Set Points, Control, and Alarms* - page 128 before configuring temperature system. Since most heaters and chillers have their own thermostats, their thermostats can be used as a backup temperature control system. Set the heater thermostat control several degrees above the desired temperature and the chiller thermostat control several degrees below the desired temperature.

Range High Timed and Normal Control

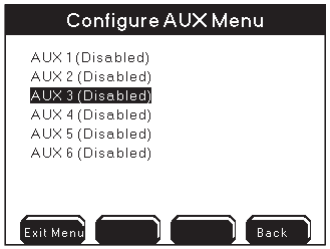
Temperature high control can operate in two different modes: normal or timed. Temperature low control operates in normal mode only. In the normal mode, the control relay is energized until the set point value is reached. For normal control, configure chiller on time to 0. The chiller off time will be ignored.

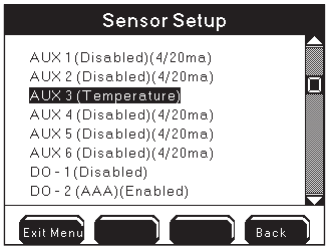
In temperature high control timed mode, the control relay is energized for the chiller on time, regardless if the sensor value has returned to the set point value. Chiller off time is user selectable. To avoid chiller compressor damage, configure the chiller hold off time to a value of eight (8) minutes or more. After the chiller on time expires, the control relay de-energizes for the configured chiller off time. After the chiller off time expires, the control relay will reenergize if the value is still in control range. A chiller off time must be configured in the timed mode or the control relay will never de-energize.

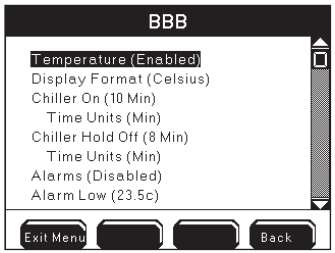
Notes:

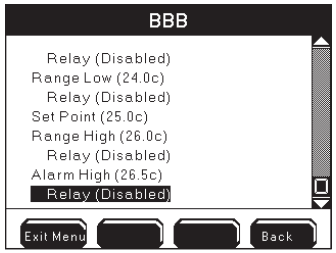
- The Configure Aux menu will display temperature configured channels as "disabled". This is because aux systems configured as temperature channels no longer function as analog aux channels, but rather function as a sensor system.
- The Sensor Setup menu - page 138 is automatically enabled when an aux channel is configured for temperature.
- Aux temperature readings are not accessible at the 5400. Temperature readings can only be obtained using AquaManager. Readings will be shown in the AquaManager datalog in either °C or °F based on the user configured temperature display format.
- The Celsius temperature set point, control, and alarm values are configured to the 10ths place. Fahrenheit values are configured to the 100ths place; however, fahrenheit display values and temperature system operation are based on values truncated to the 10ths digit.
- *See 30 Second Sensor Hold Off* - page131.
- Active sensor control timers are reset after systemwide events. Systemwide events de-energize relays. Example - chiller on time is configured for an eight (8) minute on time. Energized chiller (control down) relay de-energizes when 5400 goes into Svr Hold. The chiller on relay had been energized for three (3) minutes before the Svr Hold occurred. The Svr Hold time is one (1) minute. If the sensor is reporting control low condition after the service hold time period, the chiller on time will be for eight (8) minutes and not the remaining five (5) minutes of the chiller on time prior to entering Svr Hold.
- Temperature display format (°C or °F) is user selectable. Changing the temperature units automatically adjusts set points to new temperature units.
- Temperature readings are stored in the sensor data log in °C regardless of display format.

- Temperature values affect DO readings. It is important that the temperature sensor is reporting accurately.
- Control down relay (chiller) energizes for original "on time" if chiller "on time" is reconfigured when relay is energized.
- When disabling an aux 3-6 that has been assigned to a DO channel as the temperature source, be sure to reconfigure the user defined temp source or enable another aux temperature source for that DO system.









Directions to Configure Temperature System

1. Wire temperature sensor to 5400 I/O Board - page 47.
2. Configure "temperature" input type at
   Menus → System → Configure Aux →Input Type
3. Enter Aux 3-6 in Sensor Setup menu to configure temperature sensor setup
   Menus → System → Sensor Setup→Aux 3-6
4. Use ▲ ▼ to scroll and highlight submenus.
5. Press ↵ to select.
6. Configure submenus.
7. Press Exit Menu to save settings and return to Run Screen.

DO 1-4

Menus → Sensor Setup→DO 1-4

See *Set Points, Control, and Alarms* - page 128 before configuring the DO system.

Salinity and Temperature Compensation for DO Measurements

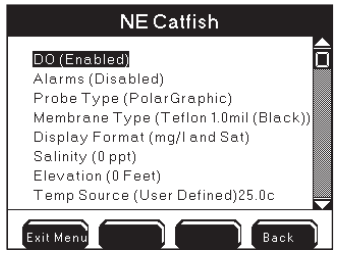
In order to report accurate DO values, the salinity and temperature of the water system must be known and compensated for. Each DO channel uses the temperature value from the configured temperature sensor or from a user defined value entered in the DO temperature source menu. For accurate DO mg/L readings, the salinity value of the water being monitored should be entered as a ppt (parts per thousand) value in the DO salinity menu.

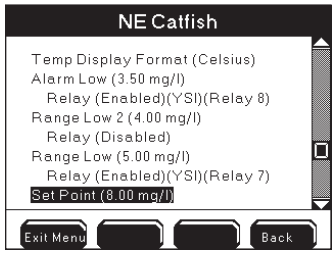
Notes:

- Changes to salinity affect DO mg/L value.
- Changes to salinity do not affect DO % sat values.
- It is necessary to assign a temperature source or enter a user defined value for each enabled DO system. Verify that the configured temperature value or assigned temperature sensor is accurate for the water system being monitored.

Two Range Controls for DO

Each 5400 DO sensor input has two low and two high control ranges. This dual range allows for more control over oxygen levels in the water system. Example - DO range low control one becomes active causing the air injection system wired/configured to relay #1 to energize. DO levels continue to fall, activating range low control two. The pure oxygen injection system wired/configured to relay #2 to energize.



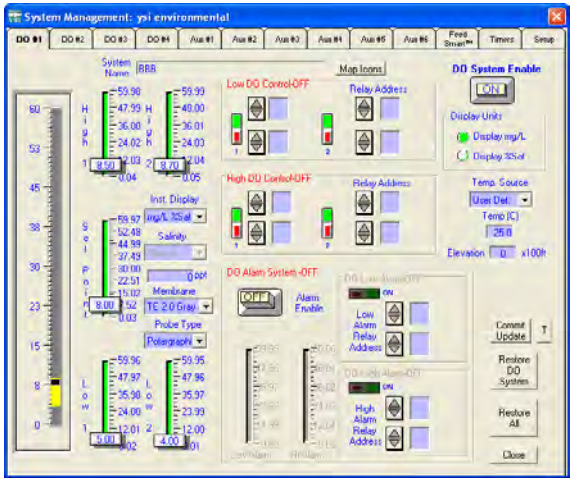


Directions to Configure DO Systems

1. Install and wire DO probe(s) and membrane - page 47.
2. Enter DO 1-4 Sensor Setup menu and submenus to set up
   Menus → System → Sensor Setup→DO 1-4
3. Use ▲ ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Configure submenus.
   Note:
   - Verify temperature source or user defined temperature value accurately reports the temperature for the DO sensor location - page 33.
6. Press Exit Menu to save settings and return to Run Screen.

AquaManager and the Sensor Setup Menu

All Sensor Setup menus can be configured using AquaManager. After polling the 5400 node, use "Systems Management" to view and upload 5400 configuration.



Notes

- Always manually poll the 5400 after uploading configuration changes and verify that the uploaded information is retained. When configuration changes are uploaded using AquaManager at the same time configuration changes are being made by a user in the menus on the 5400, AquaManager uploads may not be saved depending on the timing of keystrokes at the 5400.
- **The Run Screen must be displayed during normal operation.** If the 5400 is not at the run screen during AquaManager uploading, pressing Exit Menu at the 5400 will only save certain configuration changes.

See *Chapter 5 AquaManager* - page 160 and *AquaManager online help* for additional information.

Timers

The 5400 has four daily ten event timers. Timers can be configured to control various hardware devices. In addition, there are four Feed Smart™ feed timers.

Notes:

- **Timer system must be enabled in order to energize the configured timer relay.**
- If a timer is active (relay energized), the timer is NOT recalculated when the 5400 time and/or date is changed. Once a timer has been turned on, it runs for it's configured duration and does not reset it's run time based on changes made to 5400 time. Example - Timer 1, event 1 is configured to come on at

9:00am for 10 minutes. Timer relay energizes at 9:00am. At 9:05am, the 5400 unit time is changed to 10:05am (for daylight savings adjustment). The timer relay will de-energize after five additional minutes. Unit time will be 10:10am. The event log will reflect the unit time when the event occurred. In this example, 9:00am for the start time and 10:10am for the end time.

- If a timer is active (relay energized) and 5400 is put on service hold, the relay will not reenergize after service hold expires regardless if timer time has not expired. There is only one "on" time for all timers. Turn the 5400 off, then on, to reset the timer system. A timer relay will energize for the configured time duration and not for the remainder of time prior to service hold. Example - timer relay 1 is configured to start at 11:00 am for one hour. Service hold is enabled and configured for 5 minutes. The timer relay energizes at 11:00 am. At 11:15 am, the 5400 is put into service hold. Timer relay 1 de-energizes. At 11:20 am, the service hold time expires. The 5400 is power cycled and the timer relay energizes after 30 seconds. The timer relay de-energizes at 12:20 pm and not at 12:00 pm which would have been the original off time if the unit had not been placed in service hold.
- Energized timer relays de-energize at downloader. The relay will reenergize after a power cycle following the downloader if the timer system is still active. Timer relay will energize for entire configured duration time and not for the remainder of time prior to being placed in downloader. There is only one "on" time for all timers. Example - timer relay 1 is configured to start at 11:00 am for one hour. The timer relay energizes at 11:00 am. At 11:15 am the 5400 is put into downloader. Timer 1 relay de-energizes. Timer 1 relay re-energizes 30 seconds after a power cycle following the downloader (at approximately 11:24 am). The timer relay de-energizes at 12:24 pm and not at 12:00 pm which would have been the original off time if the unit had not been placed in downloader.
- If power fails when a timer is energized and the power is restored when the timer system is still active, the timer relay will energize for the timer duration and not for the remaining original timer cycle. Example - timer one is configured to start at 10:40 for one hour. The power fails at 11:30. Power is restored at 11:35. The timer will energize for one hour, not the remaining 5 minutes of the original timer cycle.
- When the timer relay is energized after the timer duration is changed, the timer relay de-energizes and reenergizes for the newly configured duration and not for the remaining original timer duration. Example - timer one is configured to turn on at 8:30 am for 10 minute duration. Timer one relay energizes at 8:30 am. At 8:35 am, timer one duration is changed to 20 minute. Timer one relay de-energizes at 8:35 am and re-energizes for the newly configured 20 minute duration.
- When the timer start time and duration are reconfigured and fall within the current 5400 unit time, the relay energizes for the entire duration. Example

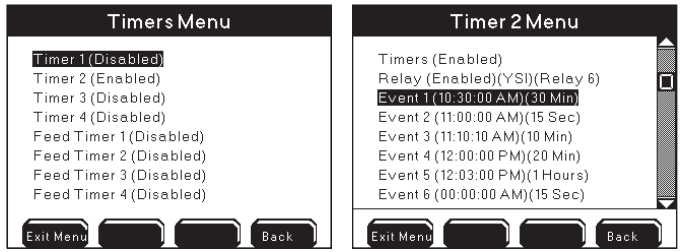
- The 5400 unit time is 8:30 am. Timer one is configured to turn on at 8:00 am for one hour. The timer relay will energize at exit to run screen and will remain energized for one hour. The 5400 does not use the system clock to calculate duration in this case. The following day, the relay will energize at 8:00 am, and de-energize at 9:00 am.
- There is a 30 second delay at power up before timers become active.
- Timer relay off times drift by < .2%. when duration is longer than 5 minutes. The drift increases the relay 'on' time.

Timers 1-4

Menus → Timers→Timer 1-4

Configure up to 40 daily timer events using the 10 events of Daily Timer systems 1-4. Timer events occur on a daily basis until either the start time is cleared, the timer system is disabled, or the relay is disabled. Timer icon displays at Run Screen when timer relay is active. See *Icons* - page 71.

Configure Timer 1-4:



1. Install and wire timer devices - page 51.
2. Enter Timer 1-4 menu
   Menus →Timers
3. Use ▲ and ▼ to scroll and highlight submenus.
4. Press ↵ to select.
5. Enable and configure submenus.
6. Press Exit Menu to save configuration and return to Run Screen.

Notes:

- Press Msg's to display timer events.
- Timer events with overlapping times occur as follows. Example - event 1 starts at 10:15 for 25 minutes, event 2 starts at 10:25 for 25 minutes; relay turns on at

10:15, relay turns off at 10:25, relay turns on at 10:25, relay turns off at 10:50.
- Configure "0" duration time to disable any of the 10 timer events.
- Timers configured over 86399 seconds (seconds in a day) are not valid.

Feed Smart[tm] Timers 1-4

Menus → Timers→Feed Smart[tm] Timer 1-4

The 5400 has four feed timers. In order to configure feed timer(s) correctly, it is important to understand how the 5400 operates based on the feed timer configuration. The Feed Smart[tm] Timer system must be calibrated prior to use. For proper operation, the Feed Timer System requires the user to enter the total amount of food to be dispensed, number of feedings to dispense the food, and a defined time period within which the feedings will occur.
The Feed Timer can be set to operate for any or all days of the week and includes continuous or timed feeding modes, FCR (feed conversion ratio), and sensor options.

The following definitions are used in regard to the Feed Smart[tm] Timer system:
- feed cycle - amount of time that all feeds occur in:
    - continuous - feedings occur 24 hours/day
    - timed - length of time between start and end time
- feed duration - length of time feeder relay is energized;
- feed interval - length of time between feedings.

Optional Sensor control reduces the amount of food dispensed if DO or temperature measurements are "out of range" per user defined configuration. The FCR (feed conversion ratio) feature automatically computes and increases the daily amount of food dispensed per FCR configuration.

Notes:
- It is important that the 5400 be configured with valid data. The feeder system will not operate properly if, for example, the daily weight of food is greater than can be dispensed in the defined feed cycle.
- Disable the feed timer system when changing configuration and/or when performing a calibration. Enable the feed timer system after configuration changes and/or calibration has been done. The feed timer system recalculates duration and interval times based on the new configuration. Press Exit Menu after disabling the feed timer system and before making configuration/calibration changes.

Feed Mode

Continuous

Menus → Timers→Feed Smart Timer→Feeder→Feed Mode →Continuous

When the feed timer is configured for continuous feed mode, feedings occur throughout the day. Feed duration and interval are determined by the daily total weight of food, number of feedings, and test calibration data. Optional Sensor control and FCR configuration can also effect feed duration.

Example of Feed Timer Configuration and Test Calibration Data:			
Feed Mode			**test calibration data**
Continuous (86500 seconds in 24 hours), feed timer sensor control is disabled	**daily weight** 500 units	**daily feedings** 100	10 units per 30 seconds
The 5200A determines feed duration and feed interval for the above feed cycle as follows:			
units fed per feeding:	500 ÷ 100 = 5 units per feed		
feed time duration for each feeding:	if 10 units feed in 30 seconds, then 5 units will feed in 15 seconds 30x5 ÷ 10 = 15		
determine total time feed relay will be energized over 24 hour period:	15 units X 100 feeds = 1500 seconds		
determine feed interval:	86500 - 1500 = 84900 ÷ = 100 (number of feeds) = 849 seconds¸ 60 = 14.15 minutes, or 14 minutes and 9		

Notes:
- Once Continuous feed has been configured, the 5400 determines any remaining feeds for the 24 hour period ending at 23:59. In continuous feed mode, the feed cycle always begins at 00:00 (midnight). Start and End time fields are not available for Continuous feed mode.
- In continuous feed mode, feeding(s) will end after the last completed feeding that ends prior to 11:59 pm (23:59) of an enabled day when crossing midnight to a disabled day. Feeding(s) will resume at 12:00 am (00:00) for the next enabled day.

Timed

Menus →Timers→Feed Smart Timer→Feeder→Feed Mode →Timed

Feedings occur only during the start and end times on "enabled" days of the week. In timed mode, the 1st feeding occurs at the start time of the feed cycle. The last feeding completes by the end time. Feed duration and interval are determined by the daily total weight of food, number of feedings, and test calibration data. Optional Sensor control and FCR configuration also effect feed duration.

Example of Feed Timer Configuration and Test Calibration Data:			
Feed Mode			**test calibration data**
Timed, Start Time: 8 am, End Time: 10A	**daily weight**	**daily feedings**	10 units per 30
feed timer sensor control is disabled	500 units	**5**	seconds
The 5200A determines feed duration and feed interval for the above feed cycle as follows:			
units fed per feeding:	500 ÷ 5 = 100 units per feed		
feed time duration for each feeding:	if 10 units feed in 30 seconds, then 100 units will feed in 300 seconds 30x10 = 300		
Total feed duration over 2 hour period	300 seconds X 5 feeds = 1500 seconds		
determine feed interval:	7200 seconds (seconds in 2 hours) - 1500 (feed duration seconds for 2 hour) = 1140 seconds ÷ 60 = 19 minute intervals		

Notes:

- If a timed feed cycle includes feed times that cross midnight, the feed cycle ends prior to 11:59 pm (23:59) of the enabled day when crossing midnight to a disabled day. Feeding(s) will resume on next enabled day. Example - if Tues through Sat are enabled days and the start time is configured for 10:00 pm (23:00) and the end time is configured for 01:00. On a Saturday, the feed cycle would start at 10:00 pm (23:00). The last feed occurs by 11:59 pm (23:59) on Saturday since Sunday is a disabled day. The next feed occurs at 12:00 am (0:00) on Tuesday. This feed cycle would end at 01:00 on Tuesday. No feeding occurs Monday, because Monday is a disabled day.
- The Feed timer will not operate properly if the start date is set prior to January 1, 2007.

Daily Weight

Menus →Timers→Feed Smart™ Timer→Feeder→Daily Weight

The daily feed amount is the total weight of food that will be dispensed over the feeding cycle. The value is user selectable from 1 to 100000. The Feed Timer system divides the total daily feed amount by the number of daily feedings and uses the calibration/test data to determine feed duration and interval times.

Daily Feedings

Menus →Timers→Feed Smart™ Timer→Feeder→Daily Feedings

Configure the number of feedings to occur in feed cycle. The value is user selectable 1–255.

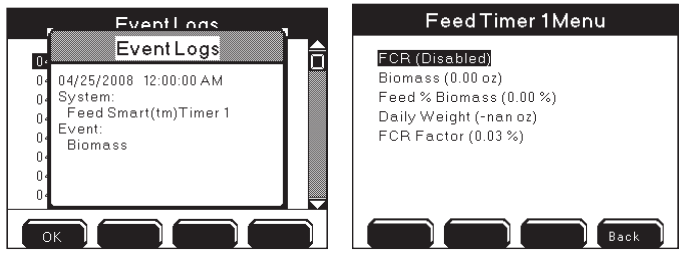
FCR

Menus →Timers→Feed Smart™ Timer→Feeder→FCR

The optional FCR (feed conversion ratio) feature automatically increases the amount of food dispensed over a feed cycle. The increase in the amount of food is based on the user configured increase in biomass over a 24 hour period. Biomass and daily (feed) weight amounts are adjusted by the 5400 prior to the 1st feed "on" time of a scheduled feed cycle occurring after midnight.

Notes:

- With FCR enabled and properly configured an event occurs when the 5400 time crosses midnight. See below.



Biomass

Menus →Timers→Feed Smart™ Timer→Feeder→FCR→Biomass

Enter the total weight of livestock being fed at the time FCR is enabled. The value is user selectable 1 to 100000.

Feed % (of) Biomass

Menus →Timers→Feed Smart Timer→Feeder→FCR→Feed % Biomass

Enter the percentage of the total livestock weight (biomass) that will be used to determine the daily feed weight. The value is user selectable 0.0–99.9%.

Daily (Feed) Weight

Menus →Timers→Feed Smart Timer→Feeder→FCR→Daily Weight

Configure the initial daily feed weight by multiplying the biomass amount by the Feed % Biomass percentage (the 5400 will not calculate the initial amount). Example—if the biomass is 1000 and the feed % biomass is 3%, the initial daily feed weight amount is 30. On each following day, the 5400 will use the biomass value along with the feed % biomass to calculate the new daily feed weight amount.

Note:

- The initial daily weight value must be calculated as described above. Configuring an invalid initial daily weight will result in incorrect biomass and daily weight calculations when the 5400 crosses midnight.

FCR Factor

Menus →Timers→Feed Smart Timer→Feeder→FCR→FCR Factor

Enter the ratio of the amount of food required versus the corresponding increase in fish weight (biomass). This value is used to automatically increase the biomass amount—as shown in the example below.

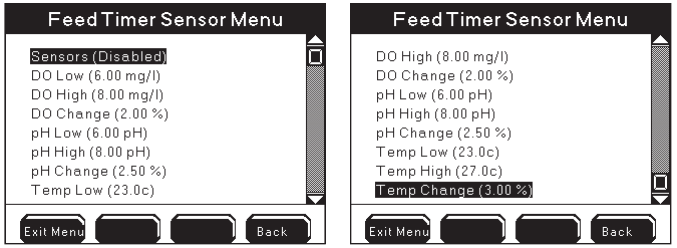
FCR example

	Day 1	Day2	Day 3	Day 4	Day 5	Day 6	Day 7
Biomass	1000	1020	1040	1061	1082	1104	1126
Feed % Biomass	3%	3%	3%	3%	3%	3%	3%
Daily Feed Amount	30	30.6	31.2	31.8	32.5	33.1	33.8
FCR Factor	1.5	1.5	1.5	1.5	1.5	1.5	1.5
1/FCRX Feed Amount	20	20.4	20.8	21.2	21.6	22.1	22.5
New Biomass	1020	1040	1061	1082	1104	1126	1149

Sensors

Menus →Timers→Feed Smart Timer→Feeder→Sensors
→Disabled/Enabled
→DO Low/High/DO % Change
→pH Low/High/pH % Change
→Temp Low/High/Temp % Change

Changes in water conditions affect the amount of food fish eat which in turn affects fish growth. With the sensor feature enabled, the feed timer system will verify that DO and temperature values are within user configured ranges. This verification is done immediately prior to starting each feed duration in a feed cycle. If values are reported that fall outside acceptable configured ranges, the feed timer relay energizes for a shorter period (user configured percentage) thereby reducing the amount of food that is dispensed. Feed timer sensor ranges are independent of sensor setup configuration ranges. For timed feed cycles, feed interval for the entire feed cycle is determined by the duration of the first feed.



Example - The feed timer is configured as follows: sensor temperature low value is 25.1°C, feed timer temperature change is 9%, timed feed mode, six feeds, daily weight 2 units start time 8A, end time 9A, six 9.999 second feeds of .3333 units each to occur at 9 minute 50 second intervals without sensor reduction. Prior to 8A feed cycle, the start temperature value is reading 24.9°C. Feed duration of 9.999 seconds will be reduced by approximately 1 second (9%) because of the "out of range" temperature value.

DO Low/Temp Low

Enter the lower limit of the sensor range where no feed reduction will take place.

DO High/Temp High

Enter the high limit of the sensor range where no feed reduction will take place.

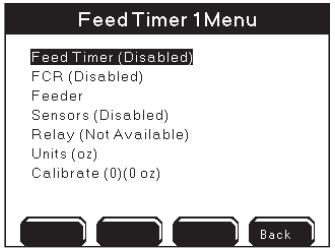
DO Change/Temp Change

Enter the percent reduction in feed weight that will occur for "out of range" enabled feed timer sensors. Results from all out of range sensors are added. To disable a sensor value from affecting feed duration configure 0.0% as the % change for that sensor.

Calibrate

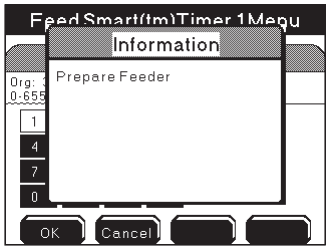
Menus →Timers→Feed Smart™ Timer→Feeder→Calibrate

Calibrating the feeder is essential for proper operation of the feed timer system. Feed timer calibration is required to establish the amount of food dispensed over a certain period of time. The 5400 will base feed cycle duration times on the last saved calibration value.



Calibrate Feed Smart[tm] Timer

1. Install and wire feed timer device - page 51.
2. Enable Feed Timer.
   Menus → Timers→Feed Smart[tm] Timer →Feed Timer →Enabled
3. Assign feed timer relay.
   Menus → Timers→Feed Smart[tm] Timer →Relay
4. Calibrate feeder.
   Menus → Timers→Feed Smart[tm] Timer →Calibrate
5. At numeric keypad, enter test run time the feeder relay will energize.



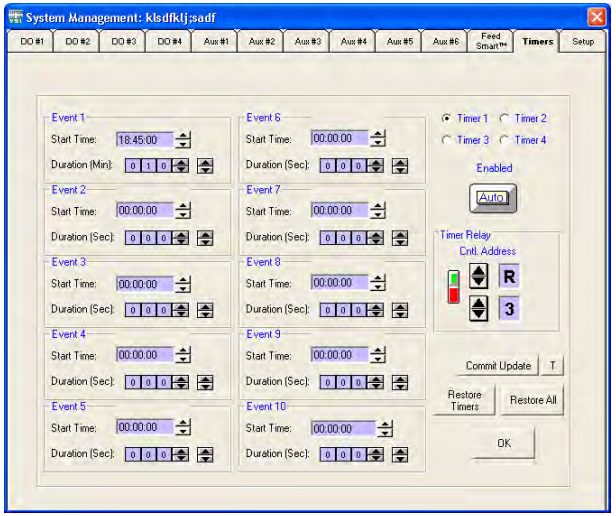
6. Press OK for feed timer relay to energize for configured run test time. Countdown of relay "on" time is displayed.
7. When run time expires, the relay de-energizes. Enter the amount of food dispensed at the Measured Weight screen.
8. Press Exit Menu to save settings and return to Run Screen.

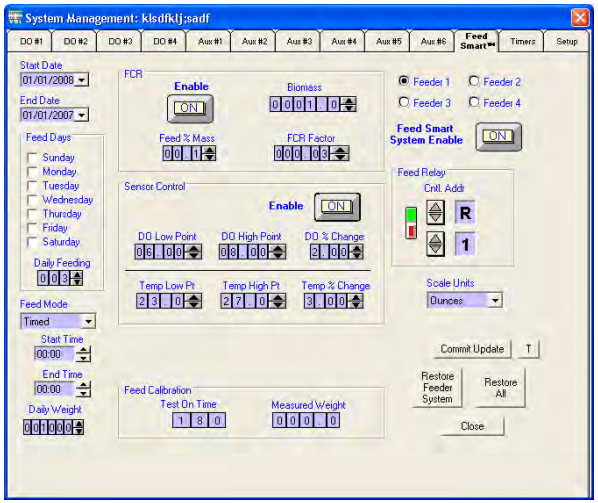
Notes:

- Since feeders and food size vary, run several calibrations and enter the average weight at the last calibration. If feeder or feed type is changed, recalibrate the feeder.
- If no test/calibration has been performed or if the results have not been saved, the 5400 will be unable to perform any feeding(s) because there will be no reference to determine the rate at which feeding(s) will occur.
- Stored calibration data is available from the AquaManager program.
- If feed timer units change, the feeder must be recalibrated.
- If an incorrect value is entered and saved, another calibration must be performed.
- Disable feed timer system when performing feed timer calibration, de-energizing any active feed timer relay.
- After calibration is complete, press Exit Menu to Run Screen. The Feed timer system resets based on new calibration configuration.
- Feed Timer calibration cannot be done using AquaManager.

AquaManager and the Timer Menu

Most Timer menus can be configured using AquaManager. After polling the 5400 node, use "Systems Management" to view and upload 5400 configurations. Select the Timers/Feeder tabs to view and change configuration.





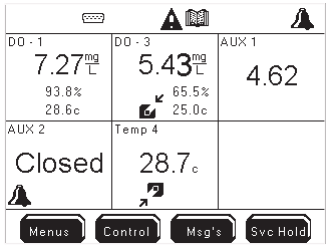
Notes

- Always manually poll the 5400 after uploading configuration changes and verify that the uploaded information is retained. When configuration changes are uploaded using AquaManager at the same time configuration changes are being made by a user in the menus at the 5400, AquaManager uploads may not be saved depending on the timing of keystrokes at the 5400.
- **The Run Screen must be displayed during normal operation.** If the 5400 is not at the run screen during AquaManager uploading, pressing Exit Menu at the 5400 will only save certain configuration changes.

See *Chapter 5 AquaManager* - page 160 and *AquaManager Online Help* for additional information.

Control Menu

Press Control at the Run Screen to display a list of energized sensor and aux 5400 system relays. The Control menu identifies the active sensor or aux system and control and/or alarm condition. See *Set Points, Controls, and Alarms* - page 128 for additional information.



Notes:

- Press Msg's to display time stamped detail of control and alarm relay(s).
- Alarm message appears at the Control menu for aux and sensor systems when alarms are enabled regardless if an alarm relay is assigned.
- Active timer (10 event timer and feed timer) systems are not displayed at control menu.
- General alarm systems are not displayed at the Control menu regardless if general alarm relay is enabled.
- Use ▲ ▼ to scroll list when scroll bar appears at menu.

When no 5400 control or alarm system(s) are active, the below screen is displayed.

Msg's Menu

Calibration, Sensor, and Event logs contain 5400 system information. The 5400 Sensor log stores 1000 records. The Calibration log stores 500 records. The Event log stores 1250 records. Once the log memory is full, the oldest records are overwritten with more recent records. The number shown in ( ) at the Msg's menu reflects the total number of records in the log. The 25 most recent records for each log are displayed at the Msg's menu. Use ▲ ▼ to scroll and press ↵ to view time stamped detail record.

Use AquaManager to capture all records from 5400 logs and store them to a PC database. Polling times should be determined by logging intervals. Example - if the sensor log is recording values every minute and the sensor log holds 1000 records, polling should occur at least every 27 hours. This would allow for all records to be saved to the PC before being overwritten on the 5400. Set the data log interval so that analyzing data based on the configured interval will be helpful. Poll at intervals that don't result in gaps in data.

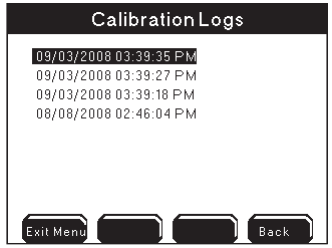
A Reset Clean Probe message will appear at the Msg's Menu if the clean probe timer expires. Selecting "Yes" at "Are you sure?" resets the clean probe timer to the user configured number of days.

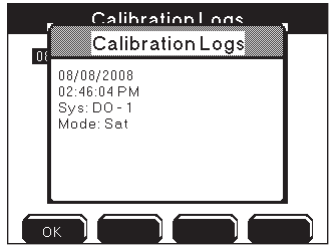
Note:

- User configured sensor and relay names do not appear in log menus.

Calibration Logs

Calibration logs store sensor calibration data. Calibration logs are date and time stamped and contain sensor and calibration information for completed calibrations.

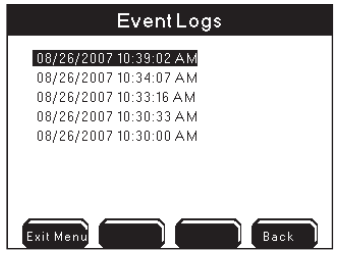


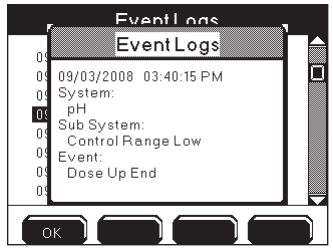


Certain calibration data is not available at the 5400. Use AquaManager to view and save calibration data to a PC. In addition to sensor system, time, date, and calibration method, AquaManager calibration logs include user input 1, user input 2, and the original and new slope/offset information when applicable.

Event Logs

Control, Alarm, and Timer relays assigned to 5400 systems create events when they energize and de-energize. In addition, AC power fail and ethernet failure to initialize errors create events. These events are recorded in the Event log. Events identify the 5400 system, are time stamped, and record relay on and off times. The General Alarm does not create an event or control message unless a General Alarm relay is enabled.



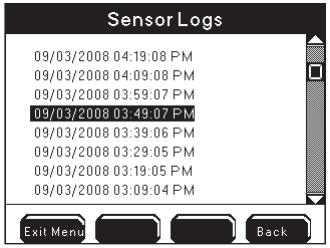


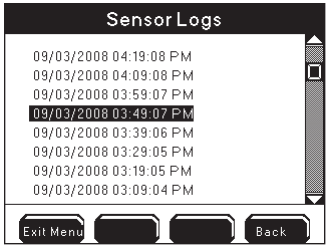
Note:

- Enable event logging in the System menu. *See Event Logging* - page 104 for additional information.

Sensor Logs

Enabled systems record sensor data based on data logging menu configuration. Sensor logs identify sensor system, are date and time stamped, and record sensor value at user configured intervals.





Notes:

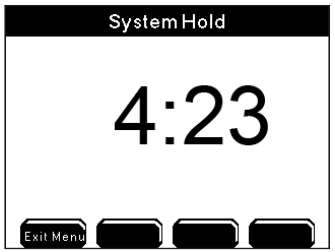
- Data logging must be enabled in the System Menu. *See Data Logging* - page 102 for additional information.

Svr Hold Menu

When servicing sensors or doing tank maintenance, it may be necessary to shut off all systems (including relays) because sensor values will not be accurate. Press Svc Hold at Run Screen to enter Service Hold menu. When in Service hold, all relays are de-energized until the Service Hold time expires. The Service Hold time is user selectable. Enable and configure service hold time at **Menus → System→Service Hold.** After service hold time expires or is cancelled, sensor and aux systems are reset causing relays to energize/de-energize based on the system value/condition. Timer systems are not reset. To reset timer systems, turn power off and then on at the 5400.

Press Exit Menu to exit Service Hold. Go to *Menus → System → Service Hold* to enable and configure service hold time - page 124.

The Run Screen displays a clock count down of the Service Hold remaining time.



Notes:

- If a timer is active (relay energized) at service hold, the relay will not reenergize after service hold expires regardless if timer time has not expired. There is only one "on" time for all timer systems.
- Entering Downloader mode places 5400 into Service Hold.
- AquaManager polling, autopoller (including mapping), and email alarms continue to function during Service Hold. Stop or pause the AquaManager Autopoller during a Service Hold to avoid seeing erroneous data in AquaManager and to avoid receiving alarm emails during sensor service.
- 5400 alarm emails are not sent during service hold.

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5 AquaManager

-Installing
-Registration

Installing AquaManager

AquaManager provides data logging, graphing, autopolling, mapping, system configuration control, and displays near real-time sensor and aux input values* at the desktop PC. AquaManager is a valuable tool for remote and local access applications. An extensive online Help system is provided with AquaManager.

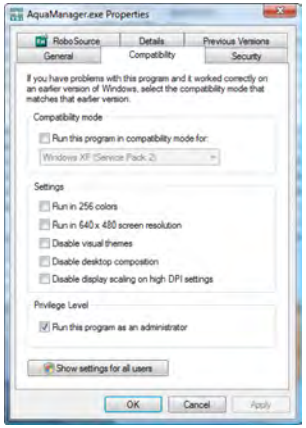
*Near real-time - The AquaManager map is updated several times a minute as AquaManager constantly communicates with the nodes during Autopolling using SMS commands. This results in displaying near real-time sensor and aux input values on the map.

One copy of AquaManager per machine is required.

PC requirements and features

System requirements:

- PC capable of running Windows 2000
- Microsoft Windows 2000/XP/Vista/7 compatible
- VGA display card
- CD-ROM Drive
- Total RAM installed 16 Megs or greater
- 100 MB of free hard-disk space
- Internet Explorer 7.0, or higher
- Adobe Flash 10B or higher
- Administrator privileges on PC where application is being installed
- In addition Vista users must enable UAC properties prior to AquaManager registration. Go to AquaManager.exe file properties in the program file folder and check the box 'Run with Administrator Privileges'.



Recommendations:

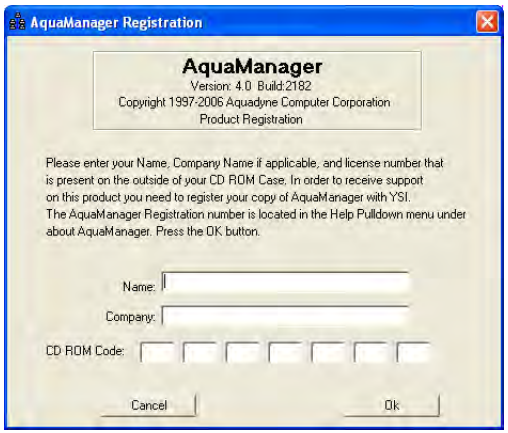
- Total RAM installed 64 Megs or greater
- 300 MB of free hard-disk space
- latest versions of Microsoft including O/S and Internet Explorer.

Software Installation

1. Run AquaManager.exe on the CDROM and follow the instructions in the installation setup.
2. Refer to the README.txt file on the CDROM for additional information on installation and use of AquaManager application.

Getting started

Open application and register. The registration number code is located on the back of CD case.



See *AquaManager Online Help* for detailed application configuration information. Before the node can be accessed using AquaManager, perform the following:

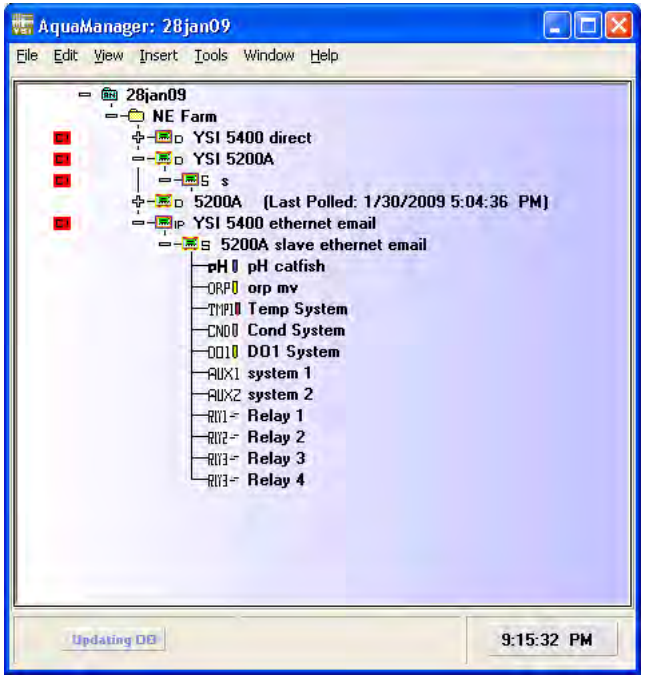
1. Create, or Open network;
2. Insert group;
3. Insert node(s);
   A. Determine communication method;
   B. Obtain 5200A and/or 5400 serial number(s);
4. Poll node to obtain current node configuration;
5. Complete configuration of node and Aquamanager features for your application.

AquaManager Windows

Use the Explorer and Node Screens to access configuration forms. Certain configuration forms can be assessed in multiple ways. Access to configuration forms is provided below.

Explorer Window

The Explorer Screen is displayed when AquaManager is launched. At the Explorer Screen, the network tree is displayed. The tree includes network, group, and node folder(s), along with node systems that are used for mapping. The tree is represented in hierarchical format.



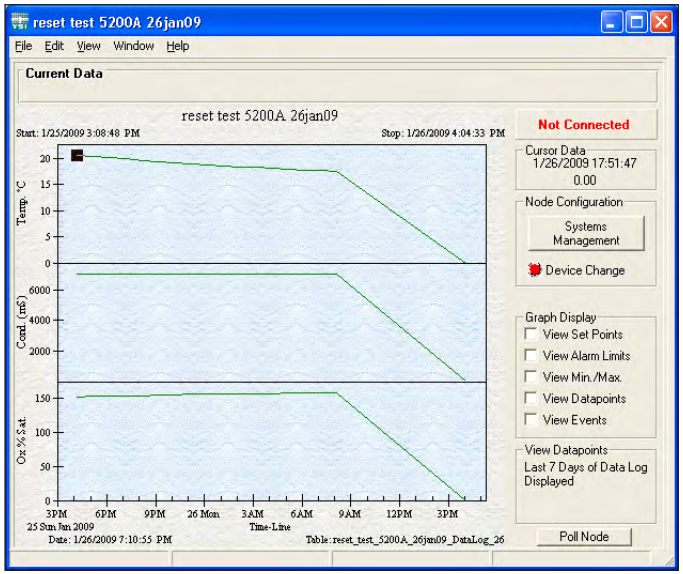
The following configuration and tasks are performed from the Explorer Screen:

- create, open, and export networks
- insert and configure nodes and groups
- edit and view map
- configure system wide properties
- print tree and printer setup
- exit program
- cut, copy, and find node(s)

- delete node or group
- sort nodes in group
- expand and collapse tree view
- access network log files
- insert manual event and manual data into node
- password administration
- launch autopoller
- generate reports
- manual database maintenance
- launch update firmware utility
- configure window display format
- access AquaManager Help
- check for AquaManager software updates
- AquaManager about information

Node (Graph) Window

Double click on a node in tree at the Explorer Screen to open a Node window. A graph is displayed based on the sensor log data received from the last poll. Use graph management and Node Window options to configure the graph display.



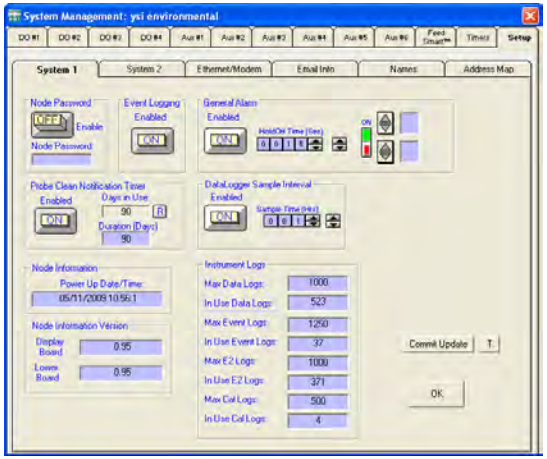
The following configuration and tasks are performed from the Node Window:

- view and configure node properties

- print graph and printer setup
- close node window
- copy graph to clipboard
- insert manual event
- graph management
- customize graph settings
- clear graph overlays
- view data, calibration, event, & configuration event logs
- restore Node Window size to include access to systems management and poll node buttons
- Systems Management access - viewing and uploading configuration to 5400
- Graph Display options
- Manually poll node button
- Current data is displayed at the top of the graph during a manual poll

Systems Management

To open Systems Management, click on the Systems Management button located to the right of the graph in the Node Window. Use the tabs to view and upload a configuration to node. The node configuration displayed is based on last poll.



The following configuration and tasks are performed from Systems Management forms:

- view and configure node sensor and aux systems
- view and configure node timer and feed timer systems
- view and configure most node systems (5400 system menu)
- configure node mapping icons

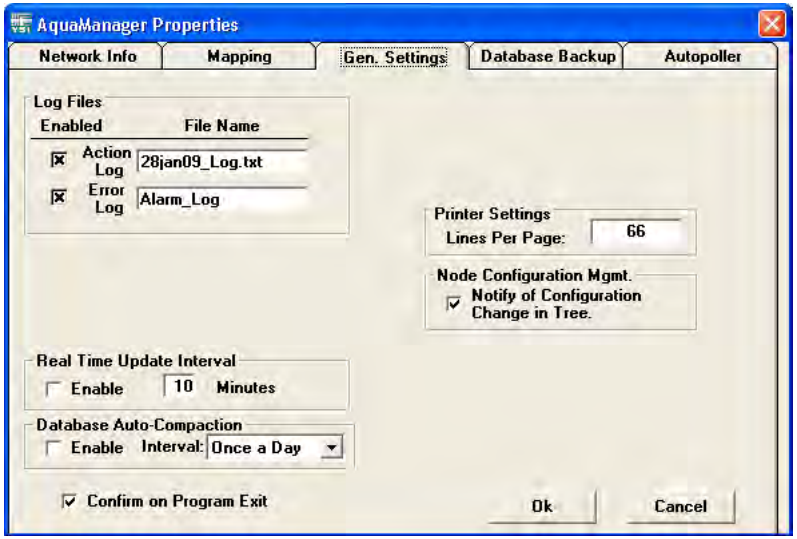
Note:

- Always manually poll the 5400 after uploading configuration changes and verify that the uploaded information is retained. When configuration changes are uploaded using AquaManager at the same time configuration changes are being made by a user in the menus at the 5400, AquaManager uploads may not be saved depending on the timing of keystrokes at the 5400.
- **The Run Screen must be displayed during normal operation.** If the 5400 is not at the run screen during AquaManager uploading, pressing Exit Menu at the 5400 will only save certain configuration changes.

Database Management

For optimal operation and safeguarding, compact and back up the AquaManager database. Uncompacted Access database(s) may become > 1GB when polling large networks and/or large data logs. Compact the database from the Explorer Window Tools>Database Maintenance>Compact Database or from the System Wide Properties>Gen. Settings tab.

Configure an automatic weekly backup from the System Wide Properties>Database Backup tab.



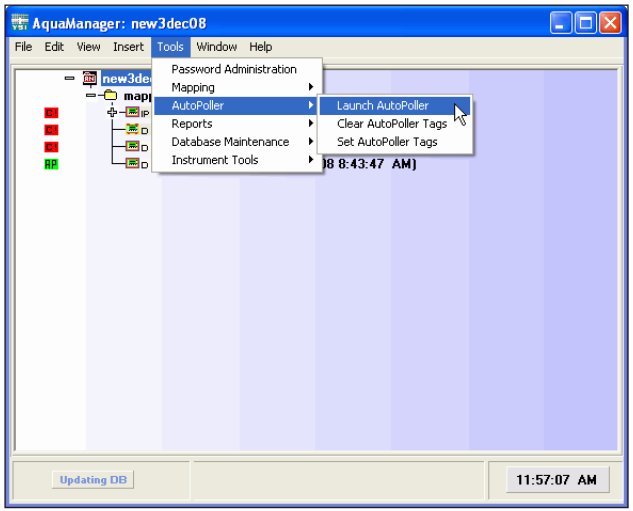
Note:

- Database Auto-Compaction must be enabled in order to access the Backup enable box.

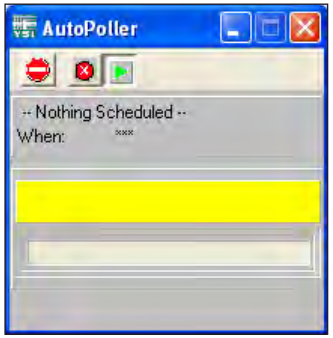
Autopoller

Autopoller is designed to poll node(s) at an interval specified by the user. When the node(s) is polled, new log records and the configuration are saved to the AquaManager database. Autopoll must be running for the AquaManager email and mapping functions to operate.

Launch Autopoll at the Explorer Window>Tools>Launch Autopoller.



An Autopoller Window opens when Autopoller is launched.



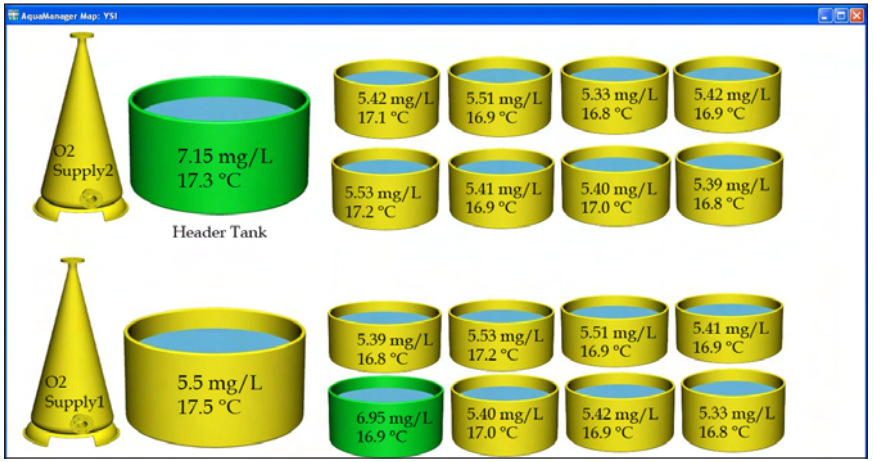
Mapping

Create a network map to display current conditions* for 5200A and 5400 nodes at the AquaManager PC. Map icons are configured to represent nodes, node systems, and relays. Map icon images change based on system condition(s). For example, one icon is displayed when DO-1 is in acceptable operating range, a second icon is displayed when DO-1 system is in control range (when enabled), and a third icon is displayed when DO-1 system is in alarm range. This provides a quick visual of system conditions at the PC.

*Near real-time - Map is updated several times a minute as AquaManager constantly communicates with nodes during Autopolling.

Node mapping is available for direct and TCP/IP node communication types.

The following figure is an example of an AquaManager map.



AquaManager Alarm Emails

The PC running AquaManager can be configured to send an alarm email when data received from the node is in alarm range. The alarm range or condition is based on the node configuration. The node configuration is stored in the network database and is verified and updated at each Autopoll SMS communication interval. Autopoller must be running for AquaManager to generate alarm emails. Run Autopoller 24/7 to ensure that alarm emails are sent.

For the AquaManager alarm email to function properly, it may be necessary to send

a test email to each email address configured in the Email Alarm List in the Node Properties window. Test emails can be sent in the AquaManager Properties window under the Autopoller tab.

6 Maintenance

-Sensor Calibration Checks
-Sensor Maintenance
-Sensor Storage
-Charging DC batteries
-AquaManager database

Maintenance

It is important to remember that the quality of data is dependent on three factors directly related to the probe:

- General maintenance at the physical deployment site of the probe.
- A well-defined quality assurance program that is carried out on a regular basis to ensure that the sensors are performing properly.
- Proper periodic calibration and maintenance of the specific sensors.

This chapter is designed to provide help in these important areas by providing maintenance tips, help in implementing a quality assurance protocol, and suggested service methods and intervals for the sensors.

Probe Maintenance at the Deployment Site

Algae and Debris

A common problem most likely to be encountered with regard to the overall probe deployment is fouling from algae (and other debris). Algae will inevitably collect on any object immersed in water and, unless periodically removed, it can inhibit the sensor's measurement. Once algae build-up occurs on the sensors and/or probe guard, it isolates the sensor's environment from the sample stream. To avoid or minimize this problem, it is necessary to periodically remove the algae from the probe guard and sensors.

Minimizing the Effect of Algae and Debris

The collection of algae on the probe and the frequency of cleaning can be minimized by deploying the probe so that it is angled with (rather than against) the current of the stream. This deployment method will maximize the chances of the algae being swept free of the probe rather than collecting on it.

Remember that no matter what precautions are taken, debris will still collect on the probe and the fouling will have to be removed by periodic cleaning. Cleaning will be easier if the probe mounting method allows for easy removal and replacement of the probe. A little extra time spent on implementing a good mounting arrangement using the optional probe mounting kits will save a lot of time in subsequent cleaning operations.

The frequency with which you will have to remove fouling from the probe varies with the type of water being monitored and the physical deployment of the probe. The need for cleaning can usually be ascertained by visual inspection. You can do no harm by excess cleaning so it is best to remove and clean the probe if any significant fouling is suspected.

Calibration Checks

The sensors are of high quality and should exhibit excellent performance in excess of the warranty period. However, the dissolved oxygen sensors will inevitably show some drift during deployment due to physical changes of the electrodes, minor fouling of the sensor surfaces, or both of these factors. Noisy dissolved oxygen readings can signal the need for specific maintenance procedures. With these factors in mind, it is imperative that you establish and carry out regular quality checks of the sensor readings to ensure that they are within their specifications. The quality checks can help determine when sensor maintenance or calibration is required.

Recommended Quality Assurance Protocol

This product has been designed and tested to provide trouble free service. However, as with all microprocessor based products, there is potential for failure which could cause loss of control functions. Proper QC (Quality Control) procedures can reduce the potential for failure.

It is recommended that you carry out the following quality assurance program weekly during the initial use of the 5400 system. After several weeks of this program, you should be able to ascertain if this frequency is appropriate for your application. If only minimal drift is observed, then the frequency of quality checks can be decreased. The procedure is relatively simple and should take only about 20 minutes to complete.

1. Take the following items to the deployment site:
   - Bucket of clean water
   - The calibration/storage cap (supplied with the 5422 probe)
2. Place the 5400 in Service Hold mode.
3. Remove the probe from the sample stream.
4. Remove the probe guard from the 5422 probe.
5. Manually remove any debris from the sensors and then rinse the sensor carefully in a bucket of clean water, being very careful not to damage the sensor or membrane.
6. Inspect the dissolved oxygen membrane for obvious holes or tears. Do not remove the membrane at this time.
7. Replace the probe guard on the 5422 probe.
8. Place the sensor in its calibration environment, i.e. 100% water-saturated air. This can be accomplished by placing the 5422 sensor in the calibration/storage sleeve containing a moist sponge. For the 5420 or 5421 sensor, place the sensor in a cup containing a small amount (~1/8 inch (3 mm)) of water. Make sure that the dissolved oxygen sensor is

not immersed in the water and that there are no water droplets on the membrane.

9. Wait about 5 minutes for temperature equilibration and then record the dissolved oxygen reading in percent air saturation as shown on the 5400 display.
10. If the dissolved oxygen readings show minimal calibration drift (i.e., within about 5% of the correct value) and the readings are stable, proceed to Step #12. If excessive drift is noted or the readings are jumpy, replace the membrane as described in the instruction sheet included in the Membrane Kit.
11. After replacing the membrane, calibrate the DO sensor.
12. Place the probe back in the sample stream and continue monitoring.
13. Test all control and alarm relays for proper operation.

Alternative Quality Assurance Protocol (quick check and adjustment)

An alternative protocol, complementary to the quality assurance program described above, can be carried out by comparing the current dissolved oxygen reading shown on the 5400 with those taken by a recently calibrated hand held instrument. For dissolved oxygen, the probe of a handheld DO instrument can be placed in the stream near the 5400 probe. If a comparison of the readings from the recently calibrated DO instrument and the 5400 indicates calibration drift, the 5400 can be recalibrated. Note - this comparison should only be used to determine if a calibration is necessary once the 5400 probe has been cleaned of all algae and other debris. If a gross variation is observed between the two instruments (> 1 mg/L), it is likely that maintenance is required on the 5200 DO sensor.

Sensor Care and Maintenance

Periodic DO sensor electrode cleaning and membrane changes are required.

DO Sensor

The DO sensor requires periodic membrane changes and electrode cleaning. For best results, YSI recommends that the electrolyte solution and the membrane cap be changed at least once every 30–90. Refer to the instruction sheet included with the membrane kit for specific instructions on changing a membrane.

Notes

- Membrane life depends on usage. Membranes will last a long time if installed

properly and treated with care. Erratic readings are a result of loose, wrinkled, damaged, or fouled membranes, or from large (more than 1/8" diameter) air bubbles in the electrolyte solution. If erratic readings or evidence of membrane damage occurs, replace the membrane and the electrolyte solution.

- If the membrane is coated with oxygen consuming (e.g. bacteria) or oxygen producing organisms (e.g. algae), erroneous readings may occur.
- Chlorine, sulfur dioxide, nitric oxide, and nitrous oxide can affect readings by behaving like oxygen at the sensor. If you suspect erroneous readings, it may be necessary to determine if these gases are the cause.

YSI 5422 Electrode Maintenance

The gold cathode and silver anode require cleaning about once or twice per year. Perform the following cleaning procedures if, after a DO membrane change, the DO readings are erratic and/or a good calibration can not be performed.

Silver Anode Cleaning

After extended use, a thick layer of AgCl builds up on the silver anode reducing the sensitivity of the sensor. The anode must be cleaned about once or twice per year (depending on use) to remove this layer and restore proper performance.

The cleaning can be chemical and/or mechanical:

Chemical Cleaning: Remove the membrane cap and soak the electrodes in a 14% ammonium hydroxide solution for 2 to 3 minutes, followed by a thorough rinsing with clean water. The anode should then be thoroughly wiped with a wet, lint free cloth to remove the residual layer from the anode.

Mechanical Cleaning: Sand off the dark layer from the silver anode with 400 grit wet/dry sandpaper. Wrap the sandpaper around the anode and twist the sensor. Rinse the anode with clean water after sanding, followed by wiping thoroughly with a wet lint free cloth.

Note - After cleaning, install a new membrane cap with fresh electrolyte and then perform a calibration. Refer to the instruction sheet included with the Membrane kit for instruction on how to replace a membrane.

Turn the instrument on and allow the system to stabilize for at least 30 minutes. If, after several hours, you are still unable to calibrate, contact YSI Customer Service.

Gold Cathode Cleaning

For correct sensor operation, the gold cathode must be textured properly. It can become tarnished or plated with silver after extended use. The gold cathode can be cleaned by using 400 grit wet/dry sand paper. This should be done about once or twice per year.

Using the sand paper provided in the YSI 5238 Probe Reconditioning Kit, wet sand the gold with a twisting motion about 3 times or until all silver deposits are removed and the gold appears to have a matte finish. Rinse the cathode with clean water after sanding, followed by wiping thoroughly with a wet, lint free cloth. If the cathode remains tarnished, contact YSI Customer Service.

Note - After cleaning, install a new membrane cap with fresh electrolyte and then perform a calibration. Refer to the instruction sheet included with the Membrane kit for instruction on how to replace a membrane.

YSI 5420 and 5421 Sensor Maintenance

Perform the following to periodically clean the 5420 and 5421 electrodes.

1. Unscrew the lower body from the upper body.

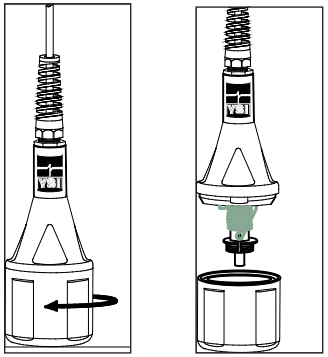


Figure 6.1

2. Safely dispose of the electrolyte that is a special molarity, reagent grade Sodium Chloride solution (salt water).
3. Using the Membrane Tool, unscrew the Membrane Lock in the lower body.

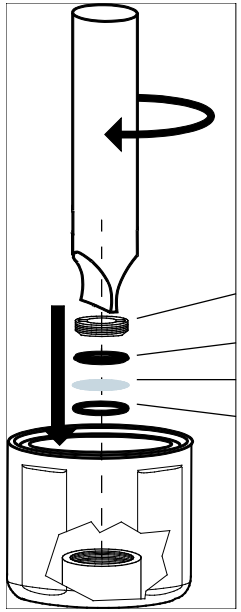


Figure 6.2

4. Remove and dispose of the membrane and its O-Ring as shown above.
5. Using a toothbrush, dish washing powder, and clean water, clean the cathode, anode, and plastic between them. Rinse all components thoroughly.
6. In order, install a new O-Ring into the lower body, then a new membrane, and then the spacer. Using the Membrane Tool, screw the Membrane Lock on top of the spacer as shown in the figure on previous page.
7. Inspect the membrane for wrinkles. Replace if it is wrinkled.
8. Pour some water into the lower body and look for leakage around the membrane. Replace the membrane if there is leakage. If no leakage, dispose of the water.
9. Fill the lower body to its rim with fresh electrolyte as shown.
10. Screw the lower body onto the upper body. Excess electrolyte will leak out at the joint between the sensor's lower and upper body.

Note - Perform a calibration after cleaning and installing a new membrane with fresh electrolyte.

Recommended Cleaning of the 5400 and Accessories

Clean the 5400 monitor and accessories as needed. Dampen a cloth with warm water and wipe the outside of the unit. You may use mild detergent with water if necessary. Do not use acid-based, alkali-based, or other organic solvent-based solvents (e.g., acetone, alcohol, etc.).

Storage

Proper storage between periods of usage will not only extend the life of the sensors, but will also ensure that the unit will be ready to use as quickly as possible for your next application.

Short Term Storage

Short term storage is defined as a period of time < 30 days. For short term storage, it is important to keep the sensor in a moist environment without actually immersing it in liquid.

For short term storage, place the 5422 in the calibration/storage sleeve containing a moist sponge. For the 5420 or 5421 sensor, place the sensor in a cup containing a small amount (~1/8 inch (3 mm)) of water.

Long Term Storage

Long term storage is defined as a period of time > 30 days.

The DO sensor should be stored dry with a dry membrane installed to protect it dust, dirt, and grit.

1. Remove the used membrane.
2. Rinse the DO sensor with distilled or deionized water.
3. Dry the DO sensor and install a new, dry membrane cap.

Sensor Replacement

The 5422 DO sensor is user replaceable. Refer to the instruction sheet provided with the replacement sensor for detailed instructions.

Charging DC batteries

The 5400 does not charge batteries. Quality assurance maintenance procedures should be established if batteries are to be fully powered when used as back-up power source.

AquaManager Database Maintenance

See *AquaManager Database Maintenance* - page 165 and *AquaManager online Help* for additional information.

Replacement Parts & Accessories

See www.YSI.com for replacement part and accessory information and Appendix 5 of this manual - page 210.

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Appendices

Appendix 1 - Unpacking and Inspection

Inspect the outside of the shipping carton for damage. If damage is detected, contact the carrier immediately. Remove the instrument from the shipping container. Be careful not to discard any parts or supplies. Confirm that all items on the packing list are present. Inspect all assemblies and components for damage. Save the original packing carton. Carriers typically require proof of damage due to mishandling.

The following components are included with the purchase of the 5400 instrument:

5400 instrument
006515 Flange Mounting Kit
006506 Desiccant Kit
605877 Instruction Manual
605230 Compression Plugs, 2 each
605229 Compression Plugs, 2 each
605804 Compression Plugs, 4 each
605898 Compression Plugs, 3 each
655384 Dual Male RJ-45 Cable Assembly
655383 Adapter, DB-9 to RJ-45
605880 AC Power Cord, 155 VAC U.S. Plug (AC version only)
605944UL Pluggable Socket Connector for AC Power, 3 pole (AC version only)
506939UL Pluggable Socket Connector for 12 VDC Power, 2 pole
605941UL Pluggable Socket Connector for RS-485, 5 pole
605943UL Pluggable Socket Connector for relays, 12 pole, 2 each
605940UL Pluggable Socket Connector for Auxiliary Inputs, 3 Pole
605942UL Pluggable Socket Connector for DO and AUX inputs, 8 Pole, 2 each

If any parts are damaged or missing, contact YSI or your YSI representative immediately.

Appendix 2 - Troubleshooting

Sensor Troubleshooting

- When troubleshooting sensors, disable the control/alarm relays.
- Verify 5400 wiring and configuration.

Issue	possible cause	possible solution
inaccurate or fluctuating sensor values	improper placement of probe assembly	See *Location Considerations - Step 2 Locate and Install Probe Assembly* - page 34.
	improper placement of 5400	See *Location considerations - Step 1 Install 5400* - page 27
	bad sensor bad DO membrane	recalibrate, change membrane, clean sensor, test sensor outside system stream in solution of known value, replace sensor
	sensor out of calibration	See *Calibration* - page 76..
	DO elevation configuration incorrect	Correct DO elevation at Menus → System → Sensor Setup→DO→Elevation menu
	DO values are affected by temperature. If DO values are incorrect, verify that the temperature source is accurate and reporting correct values or that the user defined temperature value is correct for the DO sensor location. If the temperature sensor is reporting incorrect values, the DO mg/L values are not reliable.	See *DO and temperature* - page139.
DO-galvanic or polarographic inaccurate values	DO sensor wires are terminated incorrectly	see *Wire DO sensors* -page 48.
	probe assembly ground wire or temp sensor wires (if not in use) are causing interference)	cut back unused wires to cable sheathing to avoid shorting

Sensor Troubleshooting continued

Issue	possible cause	possible solution
"over/under" sensor readings	bad sensor bad membrane	clean sensor, replace membrane, calibrate sensor, test sensor outside system stream in solution of known value, replace sensor
no sensor value on screen	sensor not enabled	See *Sensor Setup* - page 127.
	display setting configuration set for multiple Run Screens	See *Display Setting* - page107
"check probe" message at sensor calibration	improper placement of probe assembly, incorrect sensor wire connection(s), improper placement of 5400, bad sensor, and/or bad membrane	See *Location Considerations Probe Assembly* - page 34 See *Connect Probe Assembly* - page 47. See *Location Considerations 5400* - page 27. clean sensor, calibrate, test sensor outside system stream in solution of known value, replace membrane and/or replace sensor if necessary
Analog aux value is overlapping to adjoining sensor window	1X1 & 2X2 display format setting cannot display values over 7 digits in aux sensor window	Adjust aux display format to lower resolution i.e. from 0.00 format to 0 format. See also *Notes: Display Screen Limitations* - page 108.

Relay (Outputs) Troubleshooting

- Disable control, alarm, and timer relays when troubleshooting relay outputs.
- Verify 5400 wiring and configuration.

Issue	possible cause	possible solution
relay does not energize	incorrect sensor configuration	See *Set Points, Controls, and Alarm* - page 128. relay not enabled
	incorrect timer configuration	See *Timers* - page 141.
	30 second delay at power up and/or sensor configuration change	30 seconds delay - see page 127 and page131.
	peripheral device is wired incorrectly	See *Wire Relays* - page 51. The device is incorrectly wired to NO or NC pins.
	relays are not enabled for control/alarm/timer system	Verify menu configuration (relay enable) for control/alarm/timer system. See sensor system enable - page127. See timer system enable -page141.
temp (high) does not de-energize when set point value is read	sensor is configured for timed control	Verify setpoint and control configuration values - *on page 128*

Email Alarm Troubleshooting

Issue	possible cause	possible solution
no 5400 email alarm message received	5400 display is not at Run Screen - all alarming is suspended when in menus	exit to run screen to reset alarm email alarm system
	Serial to ethernet device did not initialize properly. Check the event log for "unable to initialize error".	disconnect power to 5400, verify installation of serial to ethernet device on lower board and repower
	faulty ethernet serial to ethernet device	replace serial to ethernet device

Email Alarm Troubleshooting continued

Issue	possible cause	possible solution
	Are the alarms enabled in sensor menu? Is the general alarm enabled?	see *Sensor Setup Alarms Values* - page 129. see *General Alarm* - page 113.
no email alarm received for slave alarm condition	Are slaves enabled on network?	enable slaves at **Menus → System → Communications → Network →Master**
no test email alarm message received	exit to run screen from communication menu not done	exit to run screen to process test email request

Network Troubleshooting

Issue	possible cause	possible solution
no communication to networked unit(s)	Are master/slave menus properly configured?	See *Networking* - page 92.
	Is termination relay enabled in 1st & last 5400 on network?	See *Termination Relay* - page 94.
	Is proper communication method configured and wired properly?	See *Networking* - page 92. See *Wire Communication Equipmen*t - page 62.
	Are slaves enabled and recognized at master?	enable slaves at **Menus → System → Communications → Network →Master**
	more than one device is configured as a master	**verify configuration at Menus → System → Communications → Network →Master/Slave menus on all nodes.**
slow network performance	nicked wires; improper wiring	**Verify network wiring - See** *Wire Network* **- page 57**

5400 Systems Troubleshooting

Issue	possible cause	possible solution
time and date lost at power up	bad lithium battery	replace lithium battery
no events in event log	event logging not enabled	See *Event Logging* - page104.
no data in data log	data log interval time has not passed	See *Data Logging* - page 102.
cannot view specific data log records at 5400	Data log record has older date and time-stamp than the 25 most current data log records available at 5400 sensor log.	See *Data Logging* - page 102.

Firmware Updater Troubleshooting

Issue	possible cause	possible solution
Device "timed out" error	incorrect configuration in 5400 communication menu	See Device Timed Out error - page 112
	incorrect wiring of RS232 connection	See Device Timed Out error - page 112
5400 does not go into downloader mode when "program device" is selected at Firmware Updater		Manually put 5400 in downloader and retry firmware updater upload. **Menus → System → Downloader**
		See *Force downloader* - page 112.
unit does not upload new code at downloader	unit is not in downloader mode	See *Downloader* - page 109.
	RS232 connection is incorrect	See *Wire Communications - RS232* - page 63.

Feed Timer Troubleshooting

Issue	Understanding how the 5400 calculates sensor reduction time
Sensor reduction % is not accurate based on display sensor value(s).	The 5400 displays temperature sensor values to the 10ths and DO values to 100ths. In reality the 5400 temperature and DO sensor system values are stored at a much greater resolution (out to 64 bits). It is the stored values, not the displayed values, that are used to calculate the feed timer sensor reduction.

AquaManager Troubleshooting

Refer to AquaManager online Help for all AquaManager operation and troubleshooting information.

Appendix 3 - Menu Maps

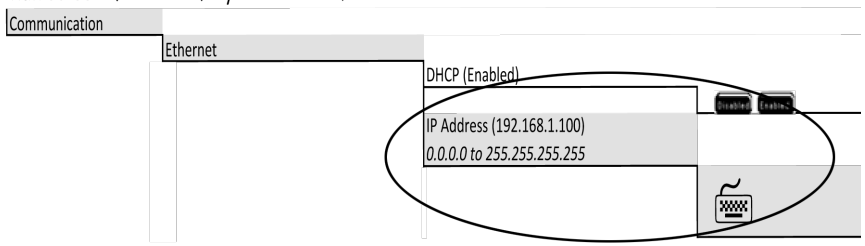
This Appendix contains the menu structure for the 5400. The menu maps contain all submenus, factory defaults, and user selectable ranges of the 5400 firmware. Menu maps are presented in hierarchal format. All menus are accessed by pressing Menus at the Run Screen. Menu maps are provided in the following order:

1. Calibration menu
2. System menu
3. Sensor Setup menu
4. Timers menu

The example below shows how to navigate the menu maps in this manual.

1. Find the menu you want to configure. For example, IP address for the serial to ethernet device.
2. Follow the path highlighted at the top of menu. Then, follow the path under and to the right of the menu heading to access submenu.

Run Screen → Menus → System Menu → Communication



Key strokes to enter IP address as depicted above.

1. From the Run Screen, press the softkey below Menus label.
2. Enter the System menu.
3. Enter the Communication menu.
4. Enter the Ethernet menu.
5. Enter the IP Address menu - a numeric keypad is displayed.
6. Configure the IP address using numeric keypad.

Menu Map Key

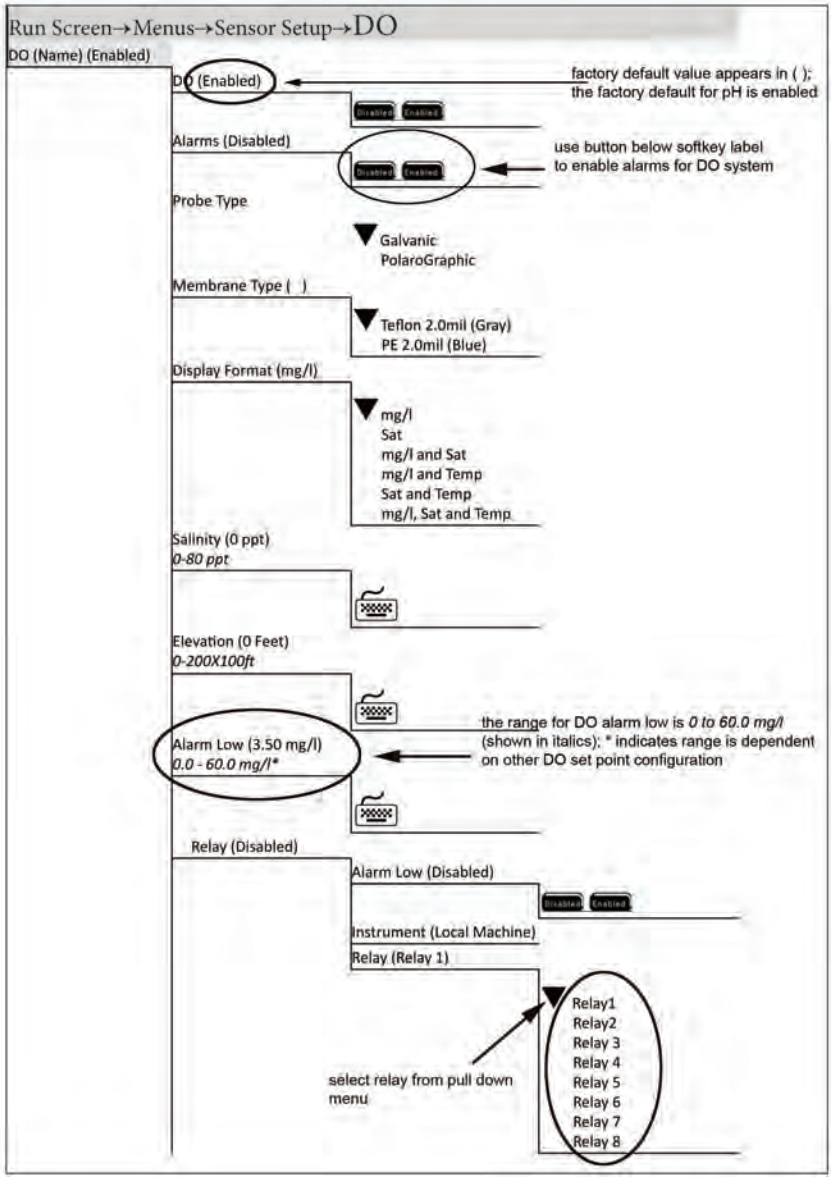
The following conventions are used in menu maps:

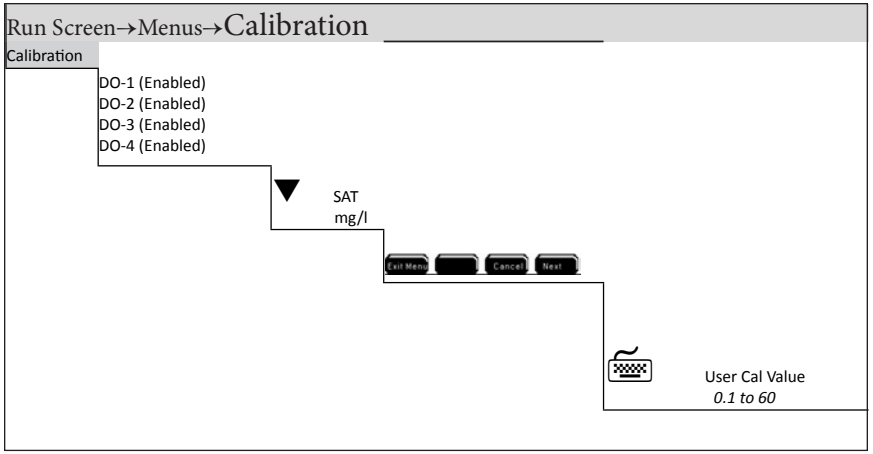
- Factory defaults are contained in ( ). If blank, no default value is loaded for this menu. In certain menus, the user configuration will appear in () once the menu is configured.
- System range (if applicable) are in *italics*. "*" displayed after the range indicates that the range is based on another system configuration i.e. set point submenus.
- (Not Available) indicates hardware is not installed.

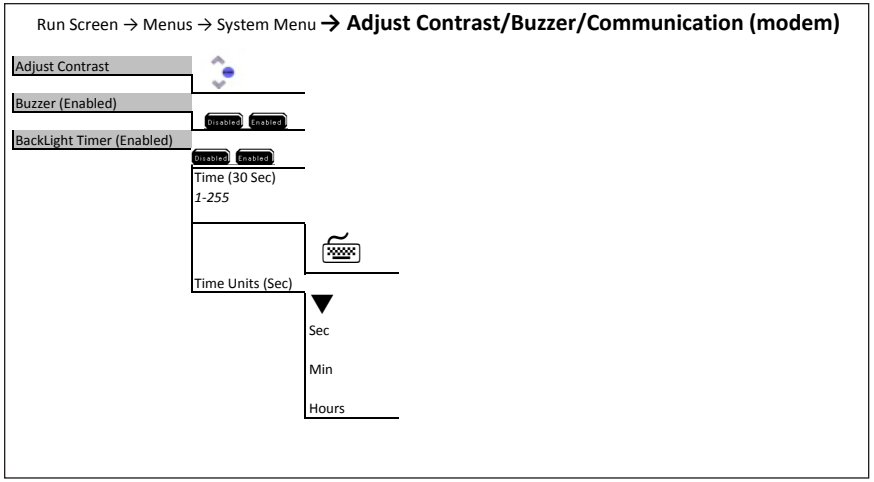
The following graphics are used in menu maps:

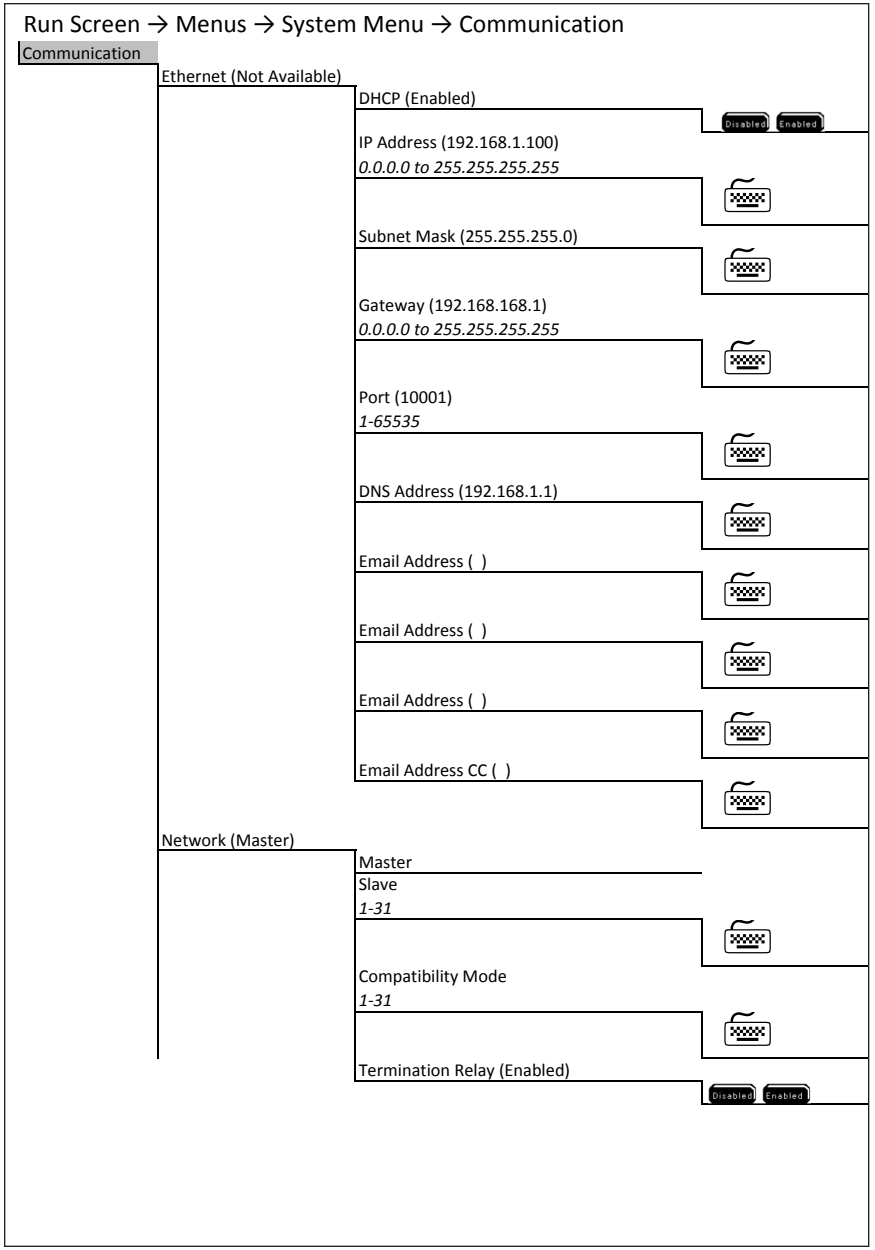
- - Input is required at numeric or alpha/numeric keypad.
- Disabled Enabled - One of these softkey entries is required.
- ▼ - Make a selection from a pull down menu.
- - Use three front panel key to proceed; (only used at adjust contrast menu).

The menu map on the following page depicts how the menu map conventions and graphics are used for configuring the DO alarm low value and enabling the DO system alarms.









continued next page

Send Test Email Msg (Not Available)

"Email test has been placed in the queue"

Email Retry Delay (Not Available) (15)

1-255

Time Units (Not Available)

Sec
Min
Hours

Baud Rate (115200)

Default Baud Rate
9600
14400
19200
38400
57600
115200

Force Serial Port (Disabled)

Disabled Enabled

Run Screen → Menus → System → Configure Aux

Configure AUX

Aux 1 - 2 (Disabled) (Name)

Probe Name ( )

Input Type (4/20ma)

Digital
0-v
0-5v
4/20ma

Suffix ( )

Min (0)
-10000 to 10000

Max (20)
-10000 to 10000

Display Format (0)

0
0.0
0.00

Aux 3 - 6 (Disabled) (Name)

Probe Name ( )

Input Type (4/20ma)

Digital
0-v
0-5v
4/20ma

Suffix ( )

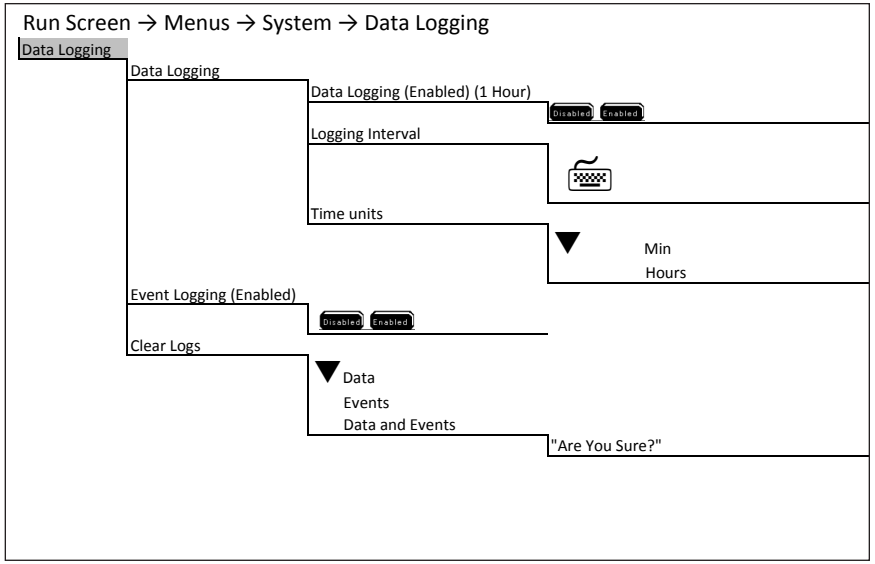
Min (0)
-10000 to 10000

Max (20)
-10000 to 10000

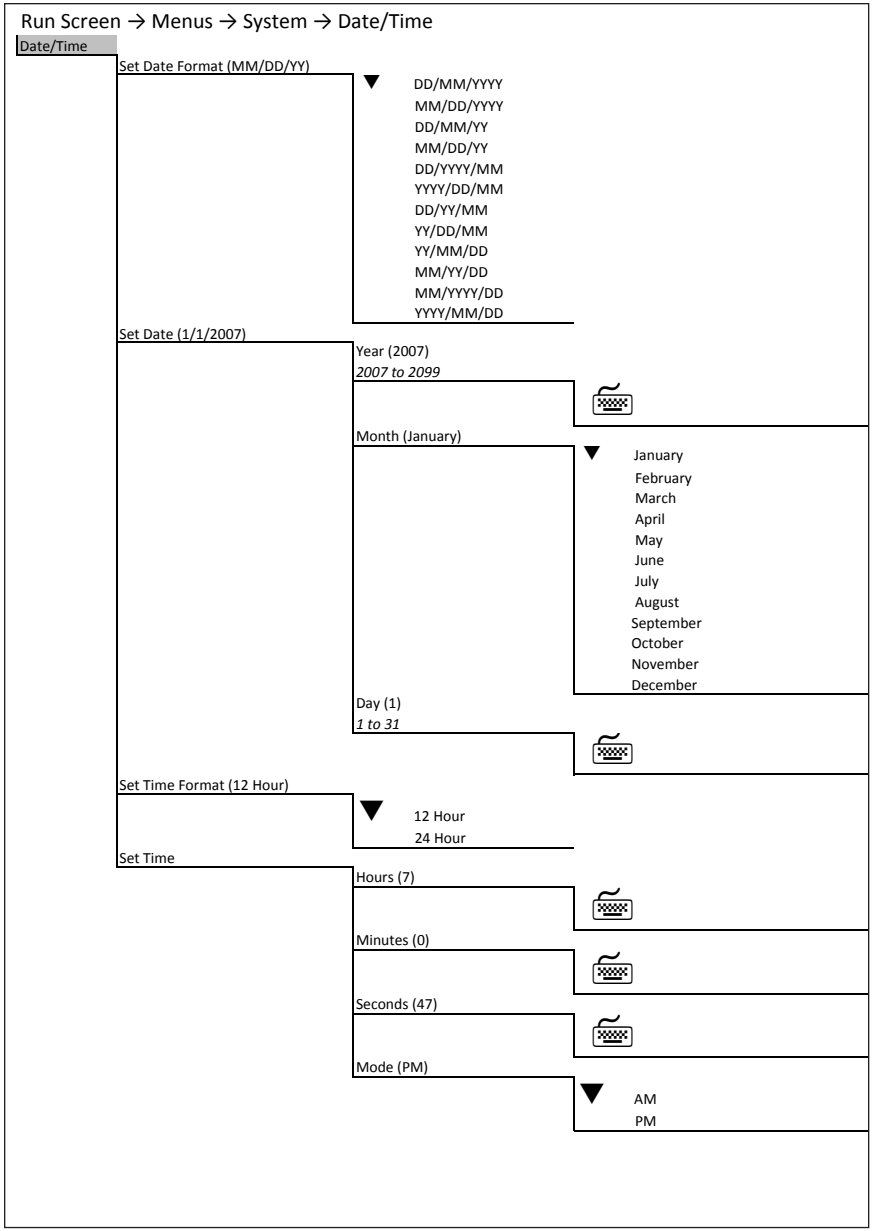
Display Format (0)

0
0.0
0.00

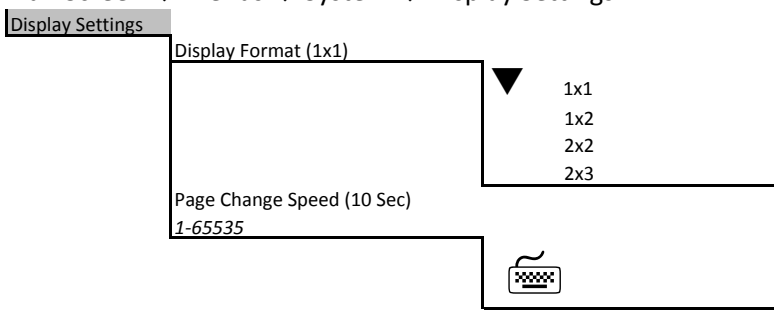
Run Screen → Menus → System → Data Logging



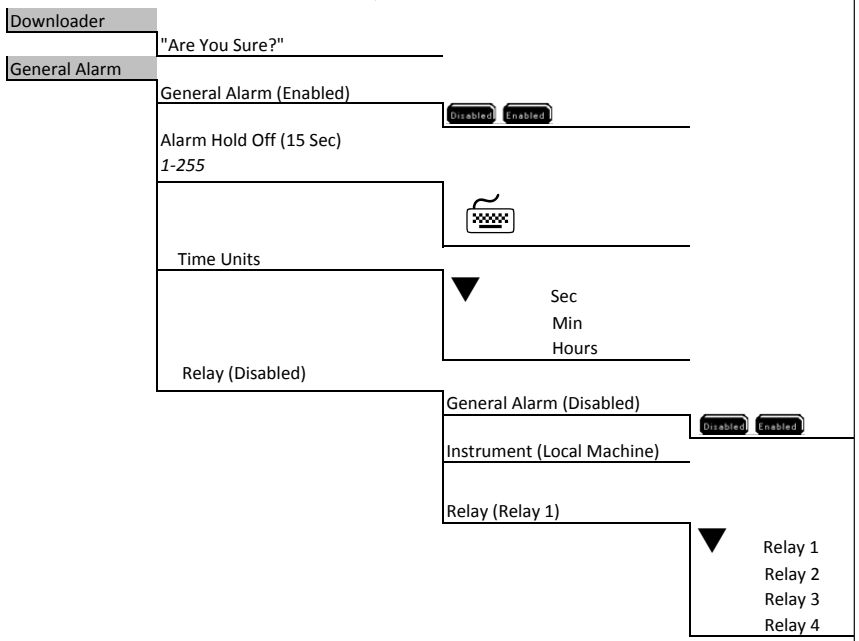
Run Screen → Menus → System → Date/Time



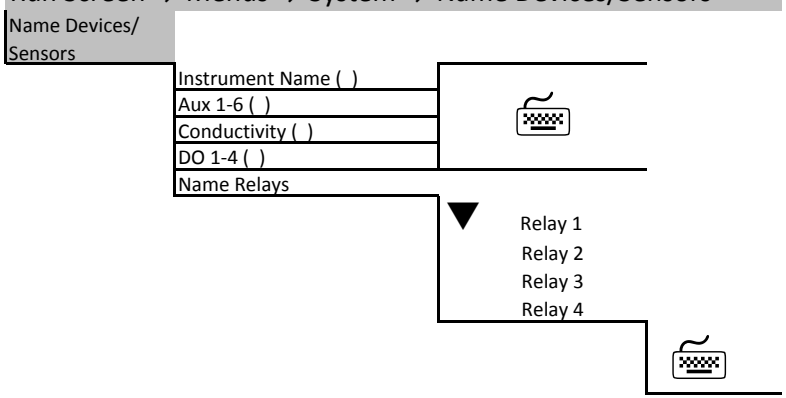
Run Screen → Menus → System → Display Settings



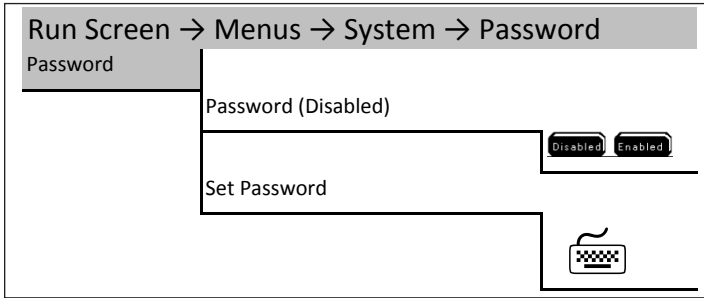
Run Screen → Menus → System → Downloader → General Alarm



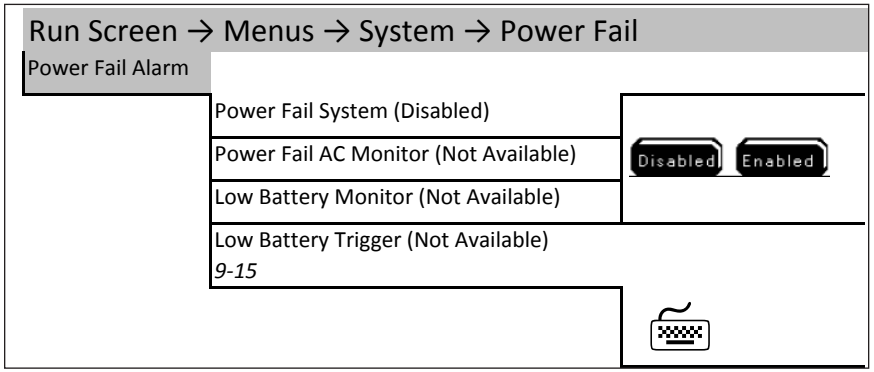
Run Screen → Menus → System → Name Devices/Sensors



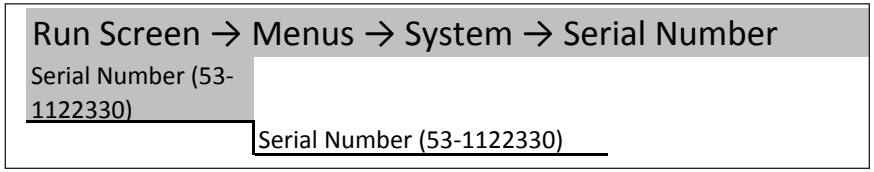
Run Screen → Menus → System → Password



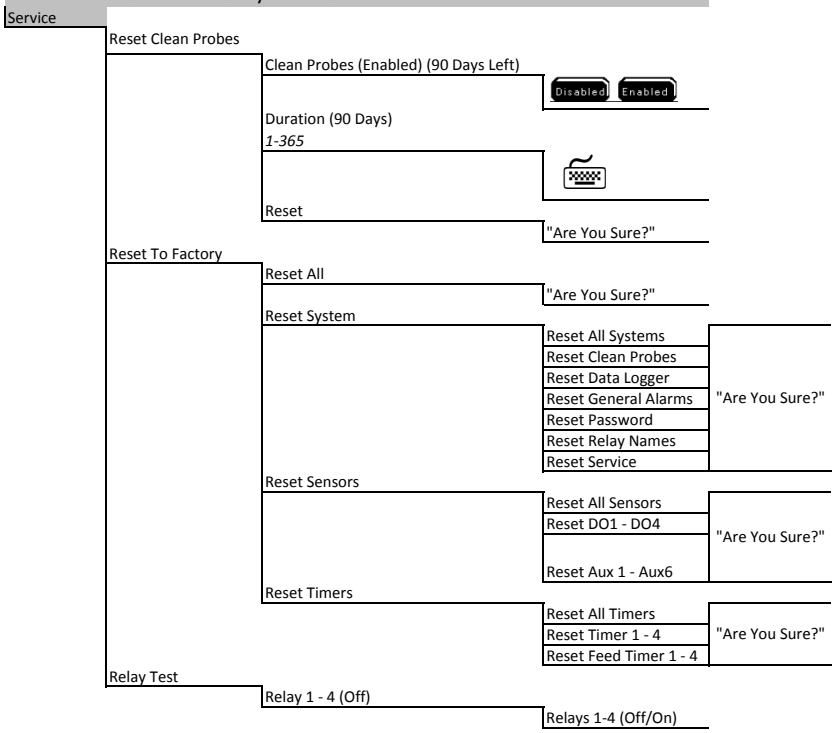
Run Screen → Menus → System → Power Fail



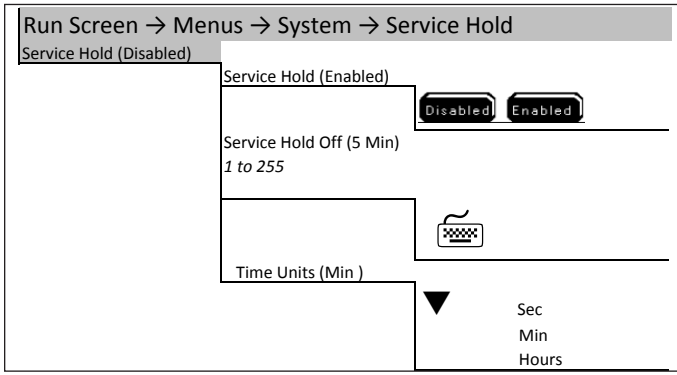
Run Screen → Menus → System → Serial Number



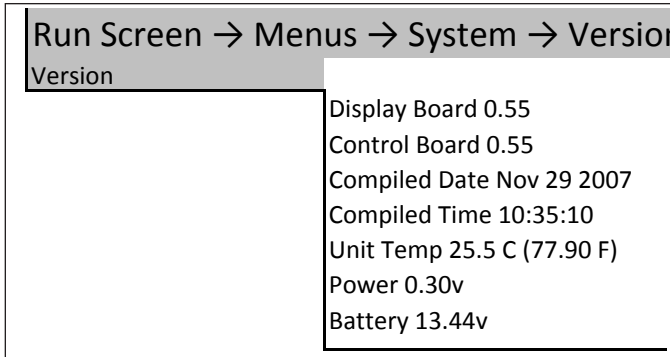
Run Screen → Menus → System → Service



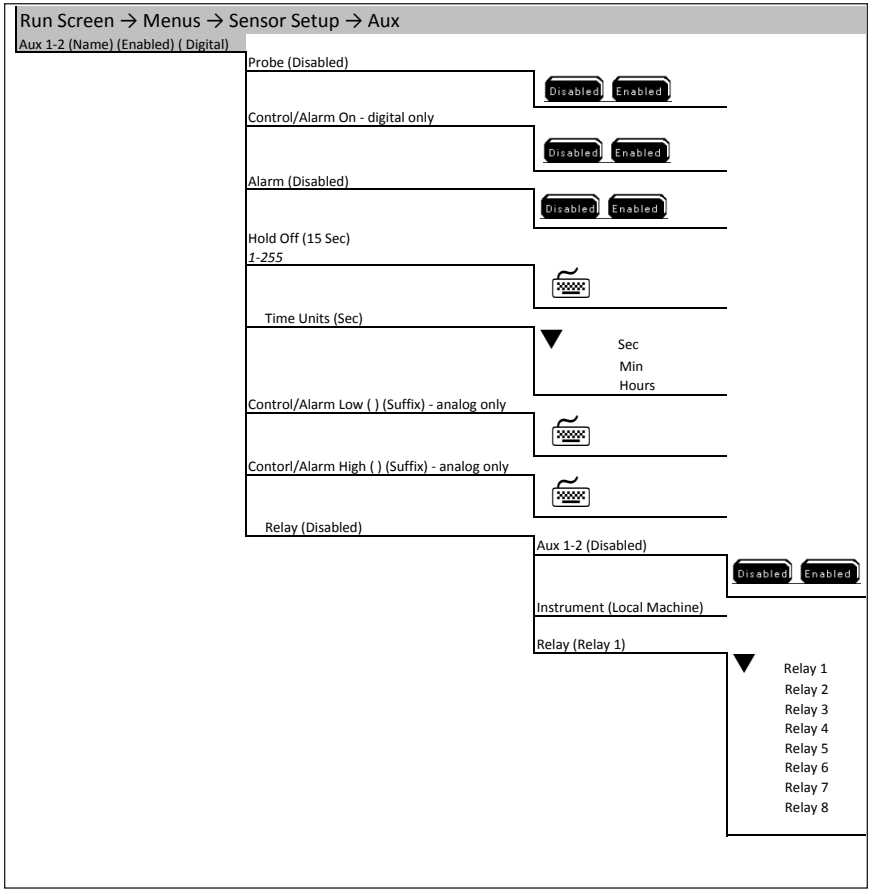
Run Screen → Menus → System → Service Hold

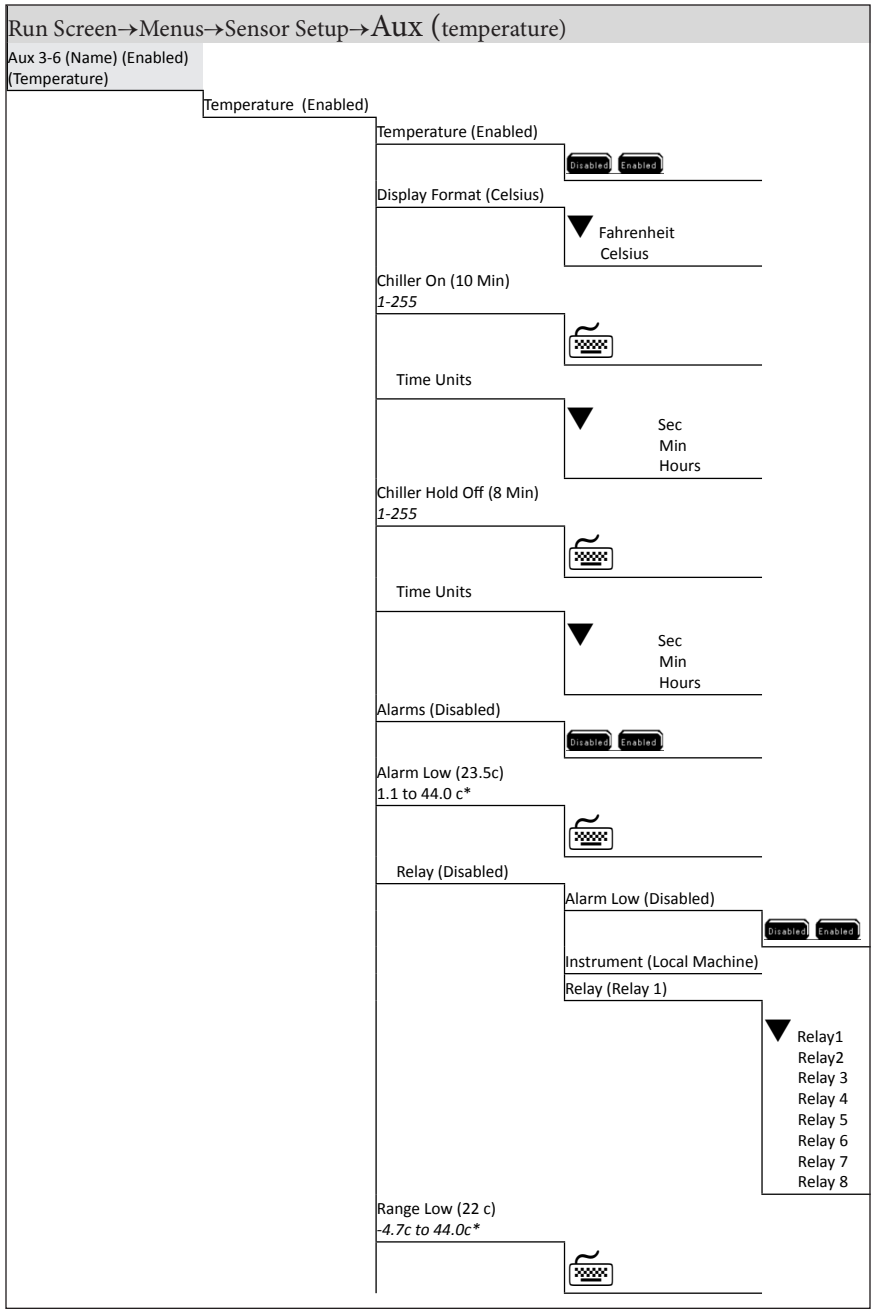


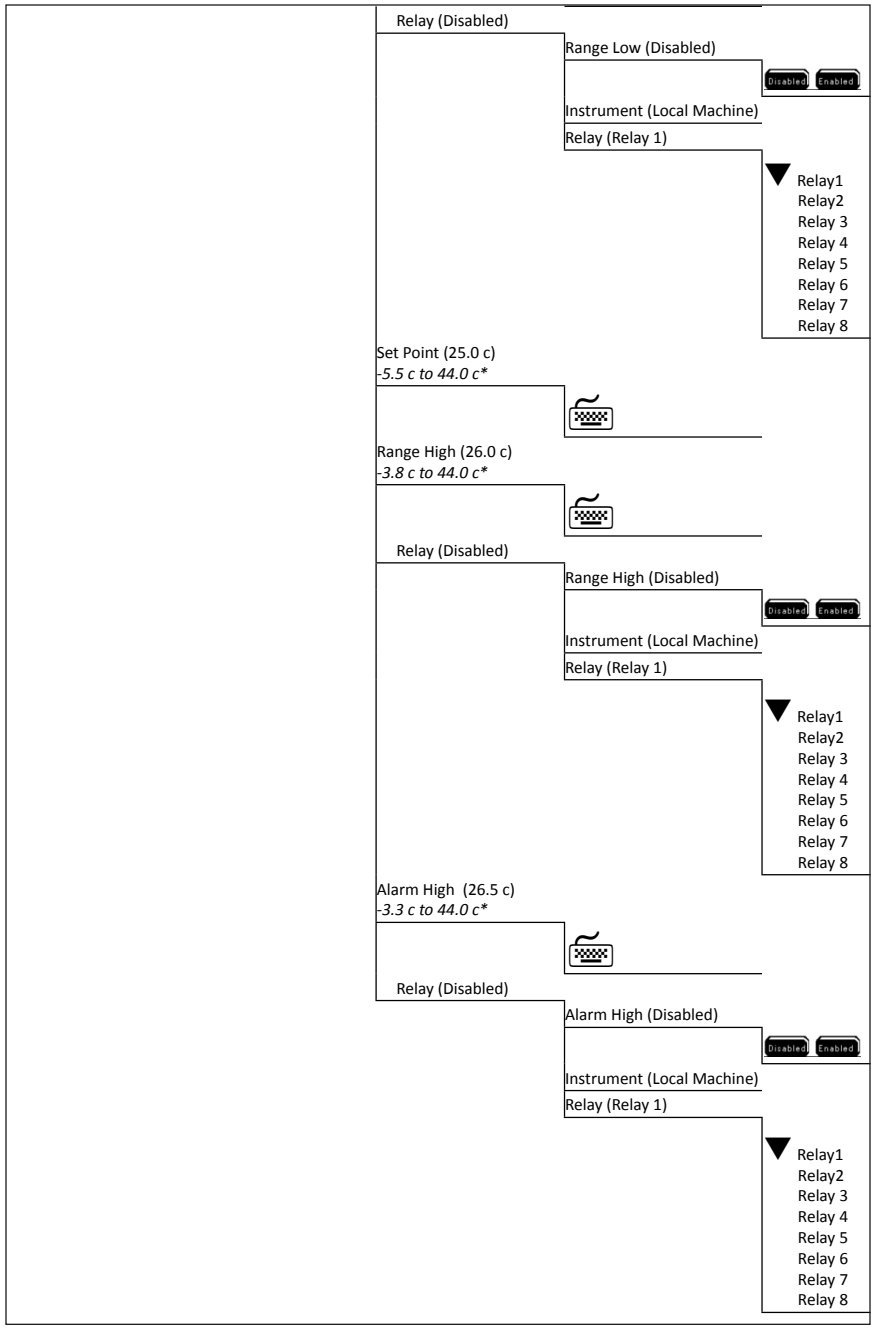
Run Screen → Menus → System → Version

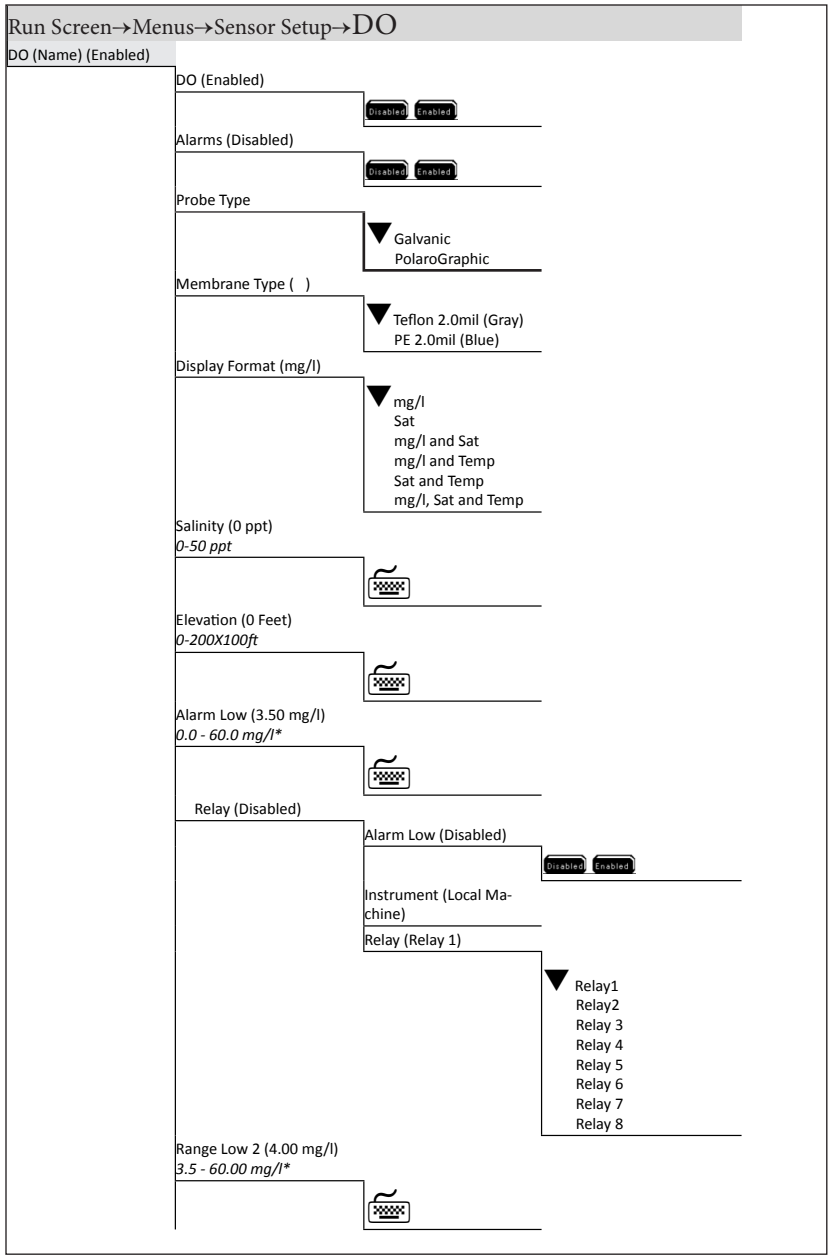


Run Screen → Menus → Sensor Setup → Aux

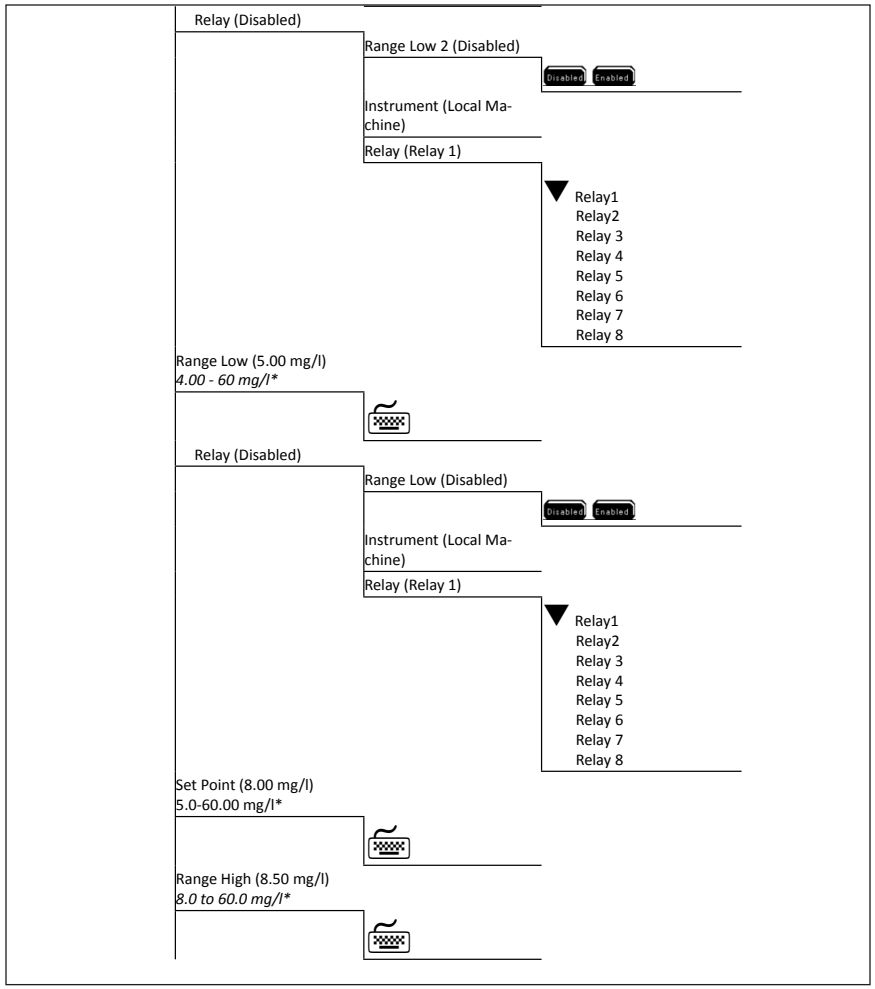



Run Screen→Menus→Sensor Setup→Aux (temperature)
Aux 3-6 (Name) (Enabled)
(Temperature)
Temperature (Enabled)
Temperature (Enabled)
Disabled
Enabled
Display Format (Celsius)
Fahrenheit
Celsius
Chiller On (10 Min)
1-255
Time Units
Sec
Min
Hours
Chiller Hold Off (8 Min)
1-255
Time Units
Sec
Min
Hours
Alarms (Disabled)
Disabled
Enabled
Alarm Low (23.5c)
1.1 to 44.0 c*
Relay (Disabled)
Alarm Low (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8
Range Low (22 c)
-4.7c to 44.0c*
continued next page

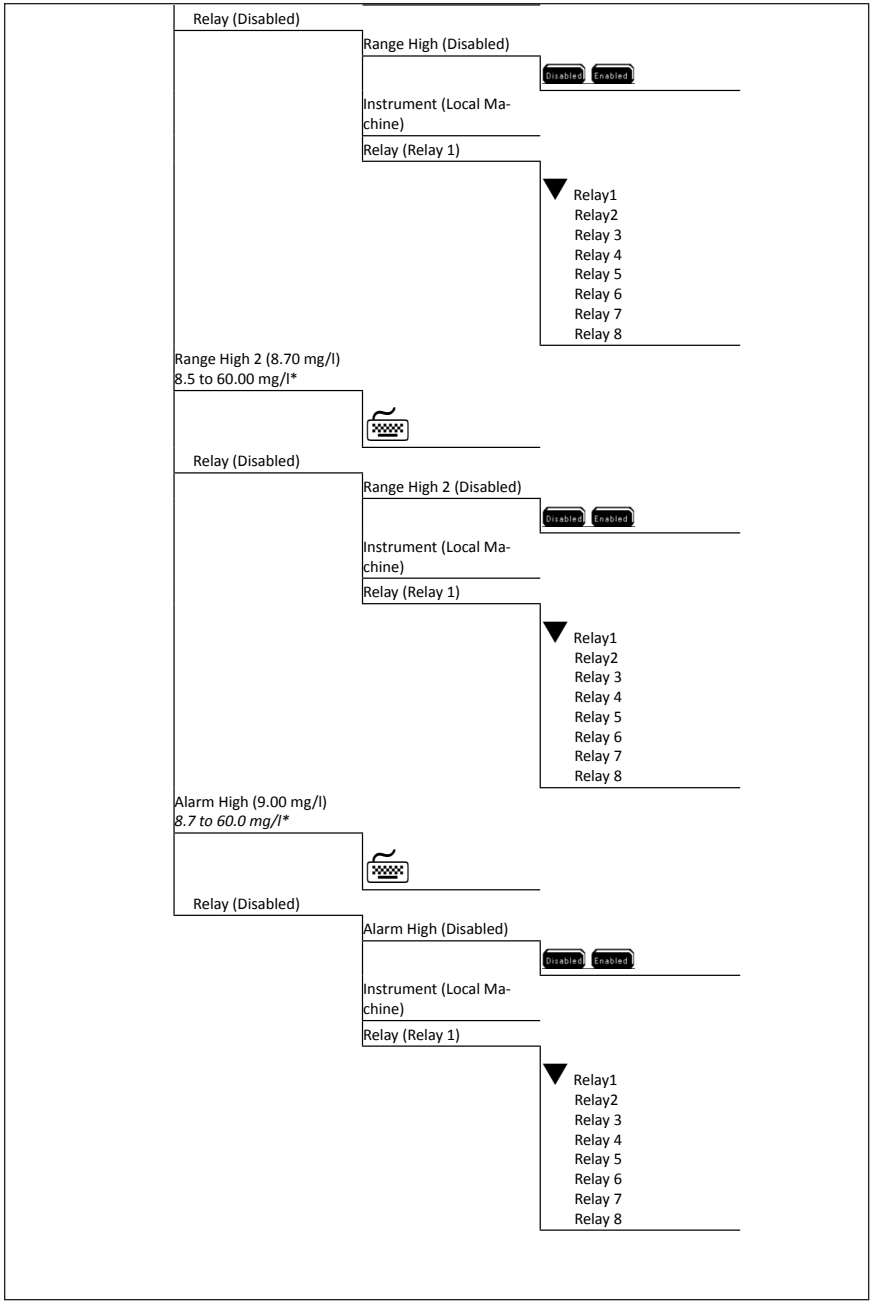

Relay (Disabled)
Range Low (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8
Set Point (25.0 c)
-5.5 c to 44.0 c*
Range High (26.0 c)
-3.8 c to 44.0 c*
Relay (Disabled)
Range High (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8
Alarm High (26.5 c)
-3.3 c to 44.0 c*
Relay (Disabled)
Alarm High (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8

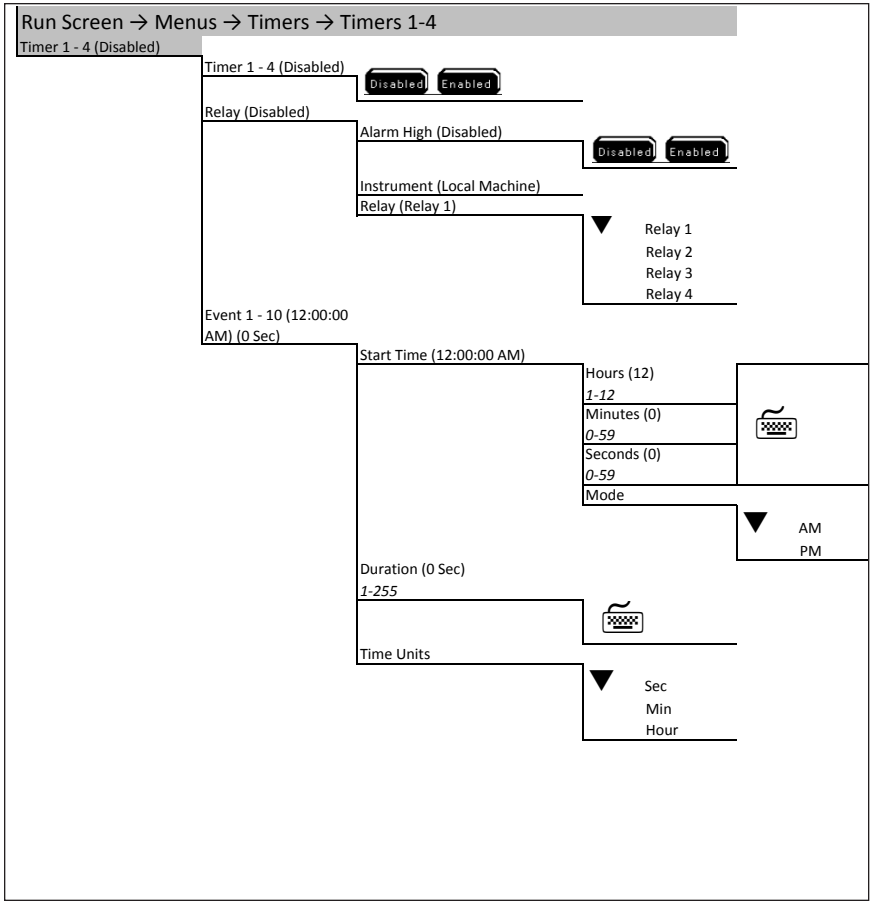


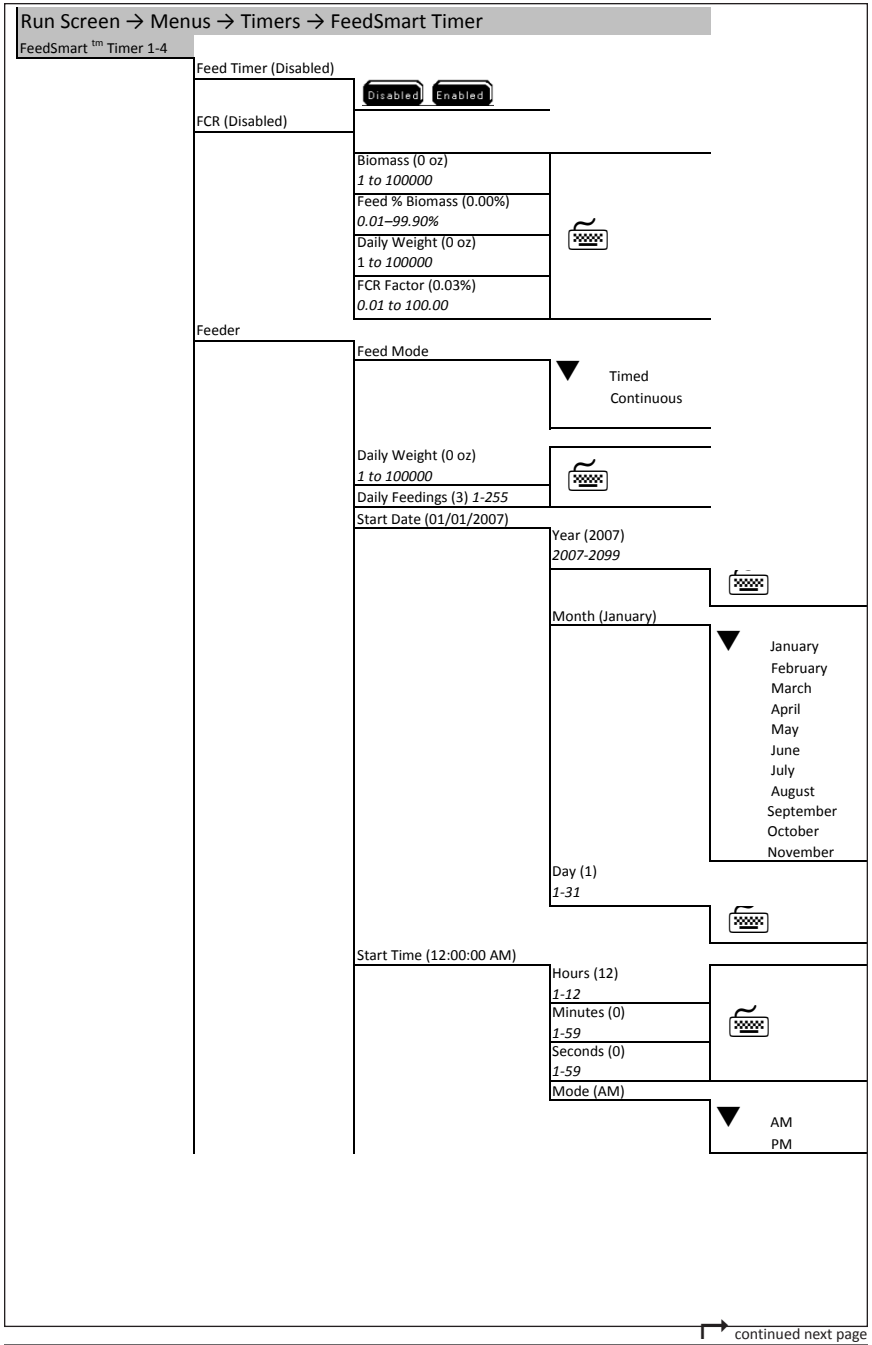
continued next page

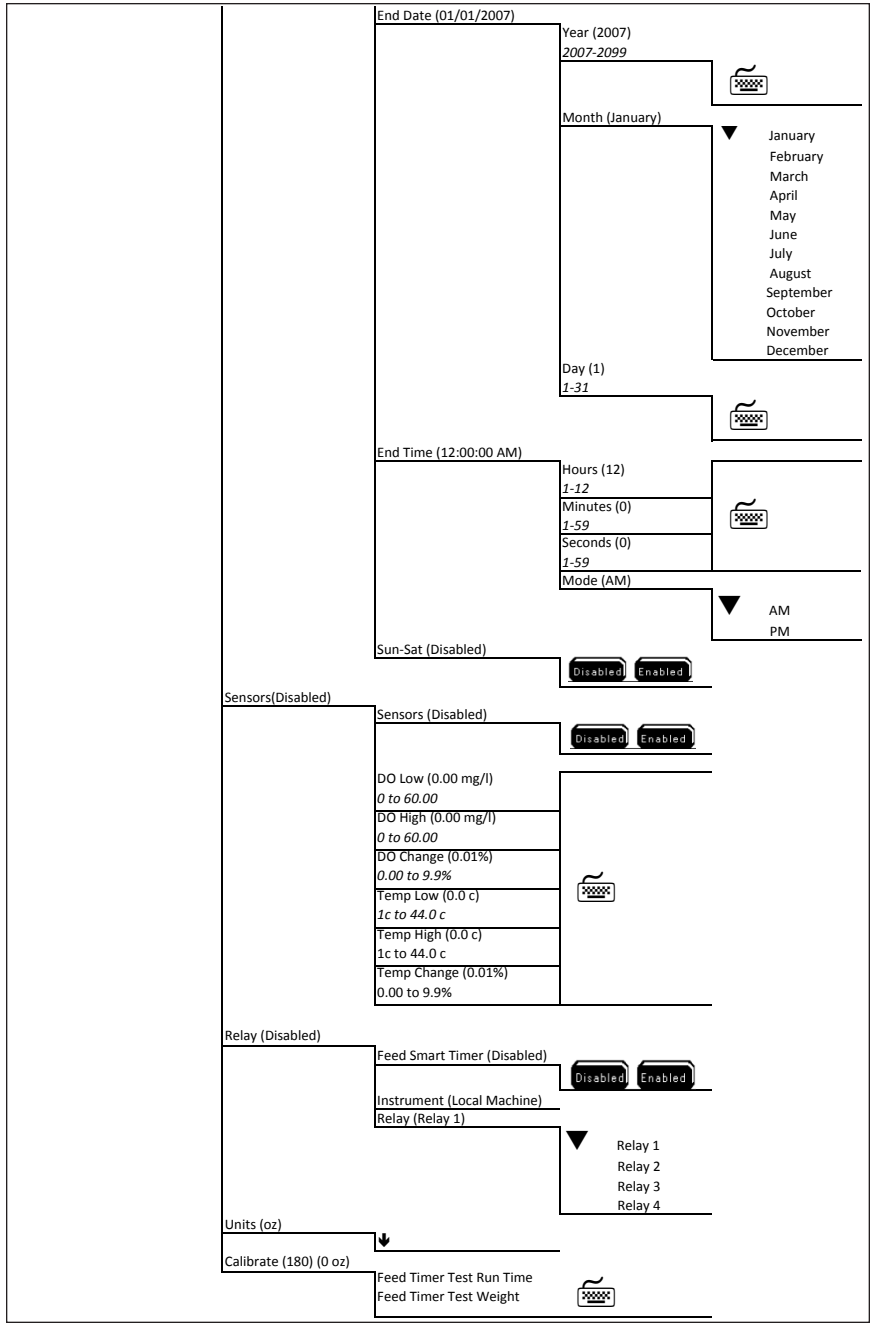


continued next page


Relay (Disabled)
Range High (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8
Range High 2 (8.70 mg/l)
8.5 to 60.00 mg/l*
Relay (Disabled)
Range High 2 (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8
Alarm High (9.00 mg/l)
8.7 to 60.0 mg/l*
Relay (Disabled)
Alarm High (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay1
Relay2
Relay 3
Relay 4
Relay 5
Relay 6
Relay 7
Relay 8


Run Screen → Menus → Timers → Timers 1-4
Timer 1 - 4 (Disabled)
Timer 1 - 4 (Disabled)
Disabled
Enabled
Relay (Disabled)
Alarm High (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay 1
Relay 2
Relay 3
Relay 4
Event 1 - 10 (12:00:00 AM) (0 Sec)
Start Time (12:00:00 AM)
Hours (12)
1-12
Minutes (0)
0-59
Seconds (0)
0-59
Mode
AM
PM
Duration (0 Sec)
1-255
Time Units
Sec
Min
Hour


Run Screen → Menus → Timers → FeedSmart Timer
FeedSmart tm Timer 1-4
Feed Timer (Disabled)
Disabled
Enabled
FCR (Disabled)
Biomass (0 oz)
1 to 100000
Feed % Biomass (0.00%)
0.01–99.90%
Daily Weight (0 oz)
1 to 100000
FCR Factor (0.03%)
0.01 to 100.00
Feeder
Feed Mode
Timed
Continuous
Daily Weight (0 oz)
1 to 100000
Daily Feedings (3) 1-255
Start Date (01/01/2007)
Year (2007)
2007-2099
Month (January)
January
February
March
April
May
June
July
August
September
October
November
Day (1)
1-31
Start Time (12:00:00 AM)
Hours (12)
1-12
Minutes (0)
1-59
Seconds (0)
1-59
Mode (AM)
AM
PM
continued next page


End Date (01/01/2007)
Year (2007)
2007-2099
Month (January)
January
February
March
April
May
June
July
August
September
October
November
December
Day (1)
1-31
End Time (12:00:00 AM)
Hours (12)
1-12
Minutes (0)
1-59
Seconds (0)
1-59
Mode (AM)
AM
PM
Sun-Sat (Disabled)
Disabled
Enabled
Sensors(Disabled)
Sensors (Disabled)
Disabled
Enabled
DO Low (0.00 mg/l)
0 to 60.00
DO High (0.00 mg/l)
0 to 60.00
DO Change (0.01%)
0.00 to 9.9%
Temp Low (0.0 c)
1c to 44.0 c
Temp High (0.0 c)
1c to 44.0 c
Temp Change (0.01%)
0.00 to 9.9%
Relay (Disabled)
Feed Smart Timer (Disabled)
Disabled
Enabled
Instrument (Local Machine)
Relay (Relay 1)
Relay 1
Relay 2
Relay 3
Relay 4
Units (oz)
Calibrate (180) (0 oz)
Feed Timer Test Run Time
Feed Timer Test Weight

Appendix 4 - Declaration of Conformity

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s).

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Multi-parameter Monitoring and Control Instrument
Model Numbers:	5400
Conforms to the following:	
Directives:	RoHS 2002/95/EC WEEE 2002/96/EC
Harmonized Standards:	IEC61010-1:2001 EN61326-1:2006 EN61000-3-2:2000/A-2-2005 EN61000-3-3:1995/A1-2001, A2-2005 CISPR11
Authorized EU Representative	YSI Hydrodata Ltd 2 Focal Point, Lacerta Court, Works Road Letchworth, Hertfordshire, SG6 1FJ UK

Signed: Lisa M. Abel Date: 21 May 2010
Title: Director of Quality

FCC Required Notice

The Federal Communications Commission defines this product as a computing device and requires the following notice.

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A or Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commission, helpful: “How to Identify and Resolve Radio-TV Interference Problems”. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No.0004-000-00345-4.

Appendix 5 Parts and Accessories

Replacement Part	Part Number and Description
Galvanic probe/cable assemblies cable lengths available: 4m, 10m, 20m, 30m, and custom to 100 m	
	p/n 5420 DO (galvanic) p/n 5421 DO (galvanic) and temperature
Polarographic probe/cable assemblies cable lengths available: 4m, 10m, 20m, 30m, and custom to 100 m	
	p/n 5422 - cable, includes DO (polarographic) and temperature.
Polarographic replacement sensor	
	p/n 605203 - installs on 5422 cables
DO Membranes for Galvanic DO Sensor	
2 mil Teflon	5405-5 membrane kit contains: -5 membrane -electrolyte solution
2 mil Teflon	5405-25 membrane kit contains: -25 membranes -electrolyte solution
Electrolyte solution	5406, 1 pint
DO Membranes and electrolyte solution for Polarographic sensor	
2 mil PE (blue)	605307 membrane kit contains: -6 cap membranes -electrolyte solution -sanding disk -3 gaskets
2 mil Teflon (gray)	605204 membrane kit contains: -6 cap membranes -Probe electrolyte -sanding disk -3 gaskets
Installation Mounting kits	
Panel mount kit	006510 - for mounting 5200A instrument to a panel.
Rail mount kit	006509 - for mounting a 5200A instrument to a rail.
Weather shield kit	006505

Replacement Part	Part Number and Description
Other	
AC Power cord, 115 VAC, USA plug	605880, for AC version only, included with AC version
Adapter, DB-9 to RJ-45	655383, included with instrument
AquaManager Software, single and network use	655363
Compression Plugs, Large	605230, 2 each included with instrument
Compression Plugs, Large	605229, 2 each included with instrument
Compression Plugs, Medium	605898, 3 each included with instrument
Compression Plugs, Small	605804, 4 each included with instrument
Conduit fittings	065926UL - For optional conduit mount, industrial encapsulant required
Conduit Sealer	065921, industrial encapsulant require for above item
Desiccant pack replacement	006506, included with instrument
DO (Galvanic) sensor reconditioning kit	5407
DO (Polarographic) sensor reconditioning kit	052380, includes 400 grit sanding discs and sanding tool.
Dual Male, RJ-45 Cable Assembly	655384, included with instrument
Flange Mounting Kit	006515, included with instrument
Grounding Screws	605889, included with instrument
Pluggable Socket Connector for AC power, 3 pole	605944UL, for AC version only, included with AC version
Pluggable Socket Connector for Auxiliary Inputs, 3 pole	605940UL, included with instrument
Pluggable Socket Connector for Aux and DO inputs, 8 pole	605942UL, included with instrument
Pluggable Socket Connector for relays, 12 pole	605943UL, 2 each included with instrument
Pluggable Socket Connector for RS-485, 5 pole	605941UL, included with instrument
Pluggable Socket Connector for 12 VDC power, 2 pole	506939UL, included with instrument
RS-232 Opto Isolator, DB-9 to RJ-45	605285

Replacement Part	Part Number and Description
Serial to Ethernet device kit	5402
User Manual	605878, included with instrument
12-volt power supply, 115 VAC input	605227UL
12-volt power supply, 230 VAC input	655478UL
230 VAC power cord, European (AC version only)	606100
230 VAC power cord, UK (AC version only)	606101
230 VAC power cord, Australia (AC version only)	606102

Appendix 6 - SMS messaging

SMS (Short Message Service) or text messaging is a service for sending messages to your Cell phone or Pager (mobile device). Using the optional xPort Ethernet solution, you can redirect your alarm messages to your mobile device.

Under the Service->Communications->Ethernet menu you will find a menu item called Email Address. Using the format from your carrier, see list below, replace your email address with this information. Example: Your Cell phone number is 858-555-1212 and your carrier is Sprint PCS, your email address would be 8585551212@messaging.sprintpcs.com. Note the maximum size of your email address or cell phone information is 49 characters. This should be large enough to cover most email addresses.

Below is a list of major USA Cellular and Pager companies that support sending Text messages to a Cell Phone or pager device via email (xPort Ethernet solution). If your carrier is international or is not listed here, please visit http://www.notepage.net/smtp.htm for a more comprehensive list or contact your service provider for information on how to send a SMS or Email message to your mobile device.

Company Name	SMTP Format
Alltel	[10-digit phone number]@message.alltel.com
AT&T (formerly Cingular)	[10-digit phone number]@txt.att.net
Boost Mobile	[10-digit phone number]@myboostmobile.com
Nextel (now Sprint Nextel)	[10-digit telephone number]@messaging.nextel.com
Sprint PCS (now Sprint Nextel)	[10-digit phone number]@messaging.sprintpcs.com [10-digit phone number]@pm.sprint.com (MMS)
T-Mobile	[10-digit phone number]@tmomail.net
US Cellular	[10-digit phone number]email.uscc.net (SMS) [10-digit phone number]@mms.uscc.net (MMS)
Verizon	[10-digit phone number]@vtext.com [10-digit phone number]@vzwpix.com (MMS)
Virgin Mobile USA	[10-digit phone number]@vmobl.com

Appendix 7 - Alpha “A” curve

ALPHA "A" CURVE

Resistance-Temperature Conversion Table

Temp °C	Resistance	Temp °C	Resistance	Temp °C	Resistance	Temp °C	Resistance
-40	336600.0000	8	21920.0000	56	2878.00000	104	605.000000
-39	315000.0000	9	20880.0000	57	2774.00000	105	588.000000
-38	295000.0000	10	19900.0000	58	2674.00000	106	571.400000
-37	276400.0000	11	18970.0000	59	2580.00000	107	555.600000
-36	259000.0000	12	18090.0000	60	2488.00000	108	540.200000
-35	242800.0000	13	17260.0000	61	2400.00000	109	525.200000
-34	227800.0000	14	16460.0000	62	2316.00000	110	510.800000
-33	213800.0000	15	15710.0000	63	2234.00000	111	496.800000
-32	200600.0000	16	15000.0000	64	2158.00000	112	483.200000
-31	188400.0000	17	14320.0000	65	2082.00000	113	470.200000
-30	177000.0000	18	13680.0000	66	2012.00000	114	457.400000
-29	166400.0000	19	13070.0000	67	1942.00000	115	445.200000
-28	156500.0000	20	12490.0000	68	1876.00000	116	433.400000
-27	147200.0000	21	11940.0000	69	1813.00000	117	421.800000
-26	138500.0000	22	11420.0000	70	1751.00000	118	410.600000
-25	130400.0000	23	10920.0000	71	1693.00000	119	399.800000
-24	122900.0000	24	10450.0000	72	1637.00000	120	389.400000
-23	115800.0000	25	10000.0000	73	1582.00000	121	379.200000
-22	109100.0000	26	9574.00000	74	1530.00000	122	369.400000
-21	102900.0000	27	9166.00000	75	1480.00000	123	359.800000
-20	97120.0000	28	8778.00000	76	1432.00000	124	350.600000
-19	91660.0000	29	8408.00000	77	1385.00000	125	341.600000
-18	86540.0000	30	8058.00000	78	1341.00000	126	332.800000
-17	81720.0000	31	7722.00000	79	1298.00000	127	324.400000
-16	77220.0000	32	7404.00000	80	1256.00000	128	316.200000
-15	72980.0000	33	7098.00000	81	1216.00000	129	308.200000
-14	69000.0000	34	6808.00000	82	1178.00000	130	300.600000
-13	65260.0000	35	6532.00000	83	1141.00000	131	293.000000
-12	61760.0000	36	6268.00000	84	1105.00000	132	285.800000
-11	58460.0000	37	6016.00000	85	1071.00000	133	278.800000
-10	55340.0000	38	5776.00000	86	1038.00000	134	272.000000
-9	52420.0000	39	5546.00000	87	1006.00000	135	265.200000
-8	49660.0000	40	5326.00000	88	975.00000	136	258.800000
-7	47080.0000	41	5118.00000	89	945.200000	137	252.600000
-6	44640.0000	42	4918.00000	90	916.400000	138	246.400000
-5	42340.0000	43	4726.00000	91	888.800000	139	240.600000
-4	40160.0000	44	4544.00000	92	862.000000	140	234.800000
-3	38120.0000	45	4368.00000	93	836.400000	141	229.200000
-2	36200.0000	46	4202.00000	94	811.400000	142	223.800000
-1	34380.0000	47	4042.00000	95	787.400000	143	218.400000
0	32660.0000	48	3888.00000	96	764.200000	144	213.400000
1	31040.0000	49	3742.00000	97	741.800000	145	208.400000
2	29500.0000	50	3602.00000	98	720.200000	146	203.600000
3	28060.0000	51	3468.00000	99	699.400000	147	198.800000
4	26680.0000	52	3340.00000	100	679.200000	148	194.200000
5	25400.0000	53	3216.00000	101	659.600000	149	189.700000
6	24180.0000	54	3098.00000	102	640.800000	150	185.400000
7	23020.0000	55	2986.00000	103	622.600000		

Appendix 8 - Warranty

The YSI 5400 instrument is warranted by YSI for two years from date of purchase by the end user against defects in materials and workmanship (excluding components and materials for the YSI 5400 which are separately warranted below). All YSI cables, probe modules, and sensors for the YSI 5400 are warranted by YSI for one year from date of purchase by the end user against defects in material and workmanship. Within the applicable warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI customer service in Yellow Springs, Ohio at +1 937 767-7241. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement. The end user making a claim under any of these warranties is responsible for all product removal and reinstallation costs related to any product repair or replacement under any such warranty.

Limitation of Warranty

This warranty does not apply to any YSI product damage or failure caused by:

1. failure to install, operate or use the product in accordance with YSI’s written instructions;
2. abuse or misuse of the product;
3. failure to maintain the product in accordance with YSI’s written instructions or standard industry procedure;
4. any improper, incorrect or substandard repairs to the product not performed by YSI;
5. use by anyone (other than YSI) of any defective or improper component or part in servicing or repairing the product;
6. modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI’S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM OR CAUSED BY ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

Appendix 9 - Contact Us

Ordering and Technical Support

Please visit www.ysi.com for a list of YSI's locations worldwide along with additional contact information.

YSI, Inc. Corporate Headquarters:

Telephone:	800 897 4151 (US) +1 937 767 7241 (Globally) Monday through Friday, 8:00 AM to 5:00 ET
Fax:	+1 937 767 9353 (orders) +1 937 767 1058 (technical support)
Email:	environmental@ysi.com
Mail:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Web Site:	www.ysi.com

When placing an order please have the following available:
1.) YSI account number (if available)
2.) Name and phone number
3.) Purchase Order or Credit Card
4.) Model Number or brief description
5.) Billing and shipping addresses
6.) Quantity

Service Information

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at +1 937-767-7241.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support" tab, then the Product Return Form button..

Appendix 10 - Recycling

Recycling

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of material going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

Battery Disposal

The circuit board in this instrument contains a manganese dioxide lithium "coin cell" battery that must be in place for continuity of power to memory devices on the board. This battery is not user serviceable or replaceable. When appropriate, an authorized YSI service center will remove this battery and properly dispose of it, per service and repair policies

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