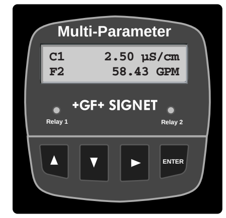
‡ SIGNET
# 8900 Multi-Parameter Controller



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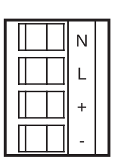
Important Safety Information

- **Read and understand instruction manual before using this product.**
- **This unit is designed to be connected to equipment which can be hazardous to persons and property if used incorrectly. Read and understand all associated equipment manuals and safety warnings before using with this product.**
- **Do not remove rear panel slot shields if the modules are not installed.**
- **Remove power to unit before wiring input and output connections.**
- **Wiring connections to this product should only be performed by qualified personnel.**
- **Do not exceed published specifications in the use of this product.**
- **In case of communication error or loss of source signal:**
  - **Relays will be deactivated.**
  - **Current outputs will go to 22.1 mA.**
  - **Voltage outputs will go to 0 V.**

Power Connection



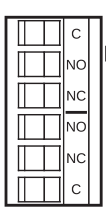
100 - 240VAC ~
50-60Hz, 24VA MAX

11 - 24 VDC ⎓
0.7 A MAX.

CAUTION

DO NOT attempt to connect both AC and DC at the same time

3-8900.620

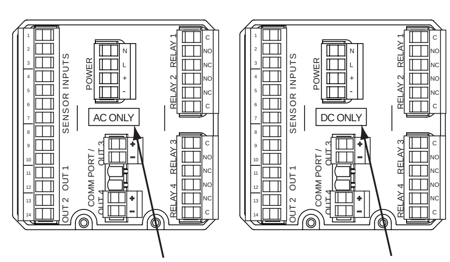


Mechanical Relays
Rating:
5A 250 VAC ~
5A 30 VDC ⎓

Solid State Relays
Rating:
50 mA 30V ≃

WARNING!

IMPORTANT SAFETY INFORMATION



For additional operator safety, an adhesive power indication label (AC ONLY or DC ONLY) is packaged with each Power Module and should be applied to the 8900 rear panel as illustrated.

1. Description

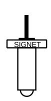
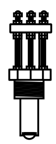
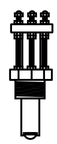
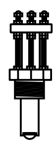
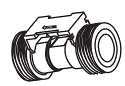
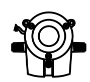
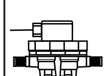
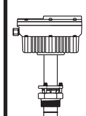
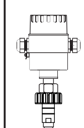
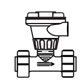
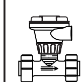
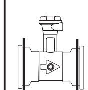
The 8900 Multi-Parameter Controller takes the concept of modularity to the extreme. Two base units, one with back-lit LCD and the other with vacuum fluorescent display can be configured by the user in the field. Ultimate flexibility is achieved via plug-in modules for either two or four input channels, universal AC line voltage or 12 to 24 VDC power, up to four analog outputs, and up to four relays. The controller will support up to four additional relays, for a total of eight, by way of external relay modules. Absolute input versatility allows mixing and matching of up to four sensors with S³L™ output including pH, ORP, conductivity/resistivity, pressure, temperature, and level. Up to two of the possible four input channels may be used for any combination of the many +GF+ SIGNET flow sensors with frequency output. See **Section 2 Compatibility** for sensor models and other devices available for use with this controller.

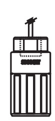
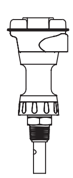
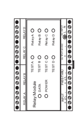
2. Compatibility

Model numbers of sensors and external relays compatible with the 8900 are identified in the tables below.

Legend	
Freq.	Compatible with the 8900; signal type is Frequency
S³L	Compatible with the 8900; signal type is S ³L
nc	Not compatible with the 8900

Flow Sensors

Paddlewheel						Turbine, Mini & Micro Flow			Insertion Mag		Vortex		
515	525	2517	2536	2540	2541	2100	2000	2507	2550	2560	7000	7001	7002
Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	nc	Freq.	nc	Freq.
													

pH & ORP Sensors			Cond/Res Sensors		Pressure Sensors	Temp. Sensors	Other
2750 Sensor with DryLoc Electrodes	2720 Preamplifier with Twist-Lock Electrodes	2721 Preamplifier	2850 Sensor with DryLoc Electrodes	281x to 282x and 2839-1X to 2842-1x	2450	2350	8059 External Relay Modules
S³L	nc	nc	S³L	nc	S³L	S³L	S³L
							

- For two channel systems, mix and match up to two of any of these sensors.
- For four channel systems, mix and match up to four sensors with S³L output. Up to two of the four channels may be used for frequency inputs.
- It is not necessary to select sensor types or external relays prior to purchasing 8900 Base Units. All 8900 systems are completely "field commissionable".
- The optional external relays connect via S³L to the I/O Module, but do NOT consume a sensor input channel.
- pH and conductivity sensors include temperature sensors. These "secondary" measurements are treated by the 8900 as separate sensors with respect to display, output and relay functionality, but they do NOT consume separate input channels.

3. System Overview

The most basic 8900 system consists of a Base Unit, an I/O Module and a Power Module. Outputs and relays are optional. Each item is ordered separately. The variety of configurations attainable from this modularity is extraordinary.
See **Section 5 Installation & Basic Functionality**, and **Ordering Information** for more details.

a. Base Unit, required; choose one (1) either back-lit LCD or Vacuum Fluorescent display.

b. Rear panel shown installed with shields in place for the optional modules. No plug-in modules are installed in this view.

c. Slot for the required I/O Module. Choose one (1) for either two or four input channels. This module is also used for optional Analog Outputs 1 & 2.

d. Slot for the required Power Module. Choose one (1) to power the unit with either universal AC line voltage or 12 to 24 VDC.

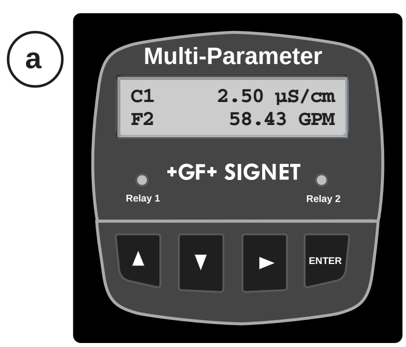
e. Slot for an optional Output Module. Choose Analog Outputs 3 & 4, or RS232, or neither.

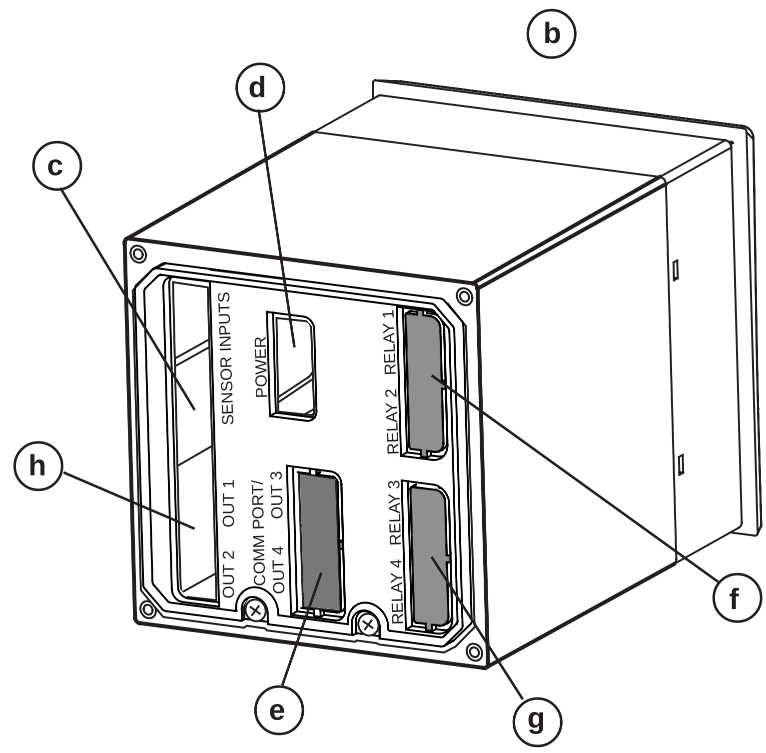
f. Slot for an optional Relay Module. Choose Relays 1 & 2, or not.

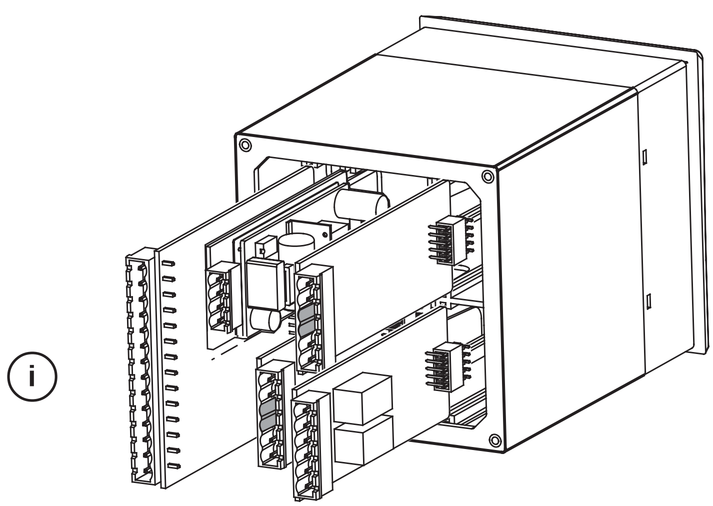
g. Slot for another optional Relay Module. Choose Relays 3 & 4, or not.

h. External Relay Modules connect via S^3L™ to the I/O Module and are optional.

i. Plug-in modules slide into the base unit on rails and are then held securely in place by the rear panel. Changes and upgrades can be made in the field at any time.

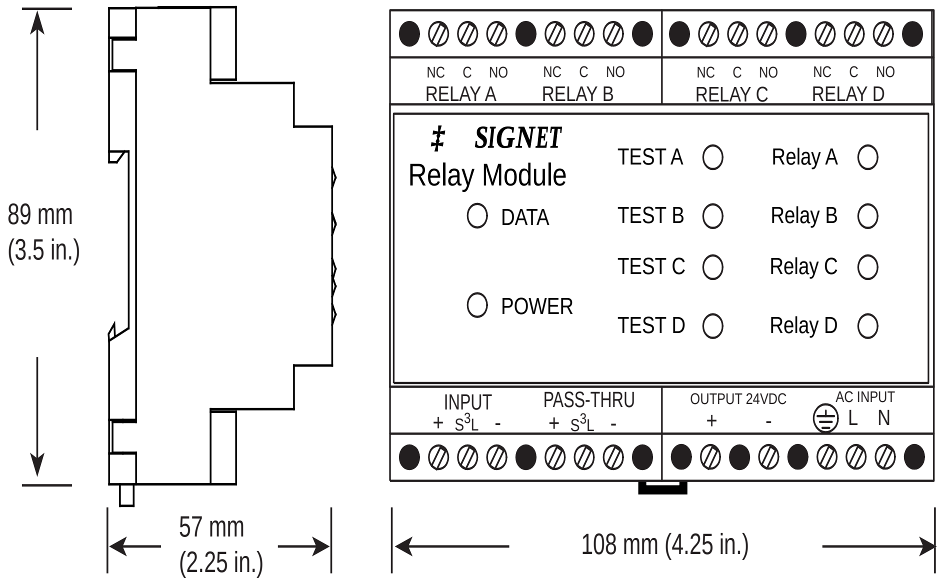






4. Specifications

Dimensions



General:
Configurability: Modular (completely field-commissionable)
Number of input channels: 2 or 4
Compatible sensor models: See **Section 2. Compatibility**

Input signal types:

S^3L™:	Serial ASCII, TTL level 9600 bps
Frequency:	Range: 0 to 1500 Hz Accuracy: 0.5% of reading

Measurement types:	Flow, pH, ORP, Conductivity/ Resistivity, Pressure, Temperature, Level
Derived measurements:	Sum, Difference, Ratio, % Recovery, % Reject, % Passage

Number of relays supported:
Avail. in pairs: 0, 2, 4, 6 or 8
(Dry-contact and/or Solid State)

Number of analog outputs:
Avail. in pairs: 0, 2 or 4
(active and/or passive
4 to 20 mA; and/or 0 to 5/10 VDC)

Enclosure and Display

Enclosure Rating:	NEMA 4X/IP65 (front face only)
Case Material:	PBT
Panel Gasket:	Silicone Sponge
Window:	Self-healing polyurethane-coated polycarbonate
Keypad:	4-buttons, highly tactile and audible Injection-molded silicone rubber seal
Display:	Alphanumeric 2 x 16 Back-lit LCD or Vacuum Fluorescent versions
Update rate:	1 second
Accuracy:	Sensor dependent
Vacuum Fluorescent Brightness:	4 intensity levels
LCD Contrast:	4 settings

Display ranges:
(Refer to Sensor Specifications for actual measurement limits)

pH:	0.00 to 15.00 pH
pH Temp.:	-40 to 150°C (-40 to 302°F)
ORP:	-9999 to +9999 mV
Flow Rate:	0.0000 to 999999 units per second, minute, hour or day
Totalizer:	0.00 to 99999999 units
Conductivity:	0.0000 to 999990 µS, mS, PPM & PPB (TDS), kΩ, MΩ
Cond. Temp.:	-99.9 to 250°C (-148 to 482°F)
Temperature:	-99.9 to 999.9°C (-148 to 999.9°F)
Pressure:	-99.99 to 9999 psi, kPa, bar
Level:	-99999 to 99999 m, cm, ft, in, %

Volume: -99999 to 999999 cm^3, m^3, in^3, ft^3, gal, L, lb, kg, %

Electrical:
Power Requirements (AC or DC via Power Modules)

Universal AC:	120 to 240 VAC ±10%, 50-60 Hz, 24 VA max.
DC:	11 to 24 VDC ±10%, unregulated, 0.7A max.

Output Power to Sensors:
5VDC up to 40 mA total

Terminal type: Screw clamp, removable via plug-in modules

Analog Outputs (via I/O Modules and Output Modules)
Any and all analog outputs are freely assignable to any channel.
4 to 20 mA Output:
Endpoints are adjustable and reversible:
Min. default: 4.0 mA; adjustable from 3.8 to 5.0 mA
Max. default: 20.00 mA; adjustable from 19.0 to 21.0 mA
Test mode: Produces an adjustable 4 to 20 mA signal for functional verification of each output circuit
Isolation: Up to 48 V AC/DC
Error condition: 22.1 mA (default state if output source not configured)
Update rate: 100 mS
Accuracy: ±32 µA over entire operating temperature range
Resolution: 6 µA
Power Supply Rejection: ±1 µA/V
Short circuit and reverse polarity protected

Passive 4 to 20 mA:
Voltage: ` 12 to 24 VDC +/- 10%
Max. Impedance: 250 ohms @ 12 VDC
500 ohms @ 18 VDC
750 ohms @ 24 VDC
Active 4 to 20 mA:
Max Impedance: 650 ohms

0 to 5/10 VDC Output:
Output range: 0 to 5 VDC or 0 to 10 VDC, software selectable
Endpoints are adjustable and reversible:
Min. default: 0 VDC; programmable from 0 to 0.5 VDC
Max. default: 5 VDC; programmable from 4.5 to 5.5 VDC, or 9.5 to 10.5 VDC
Output load: 10 kΩ minimum
Test mode: Produces an adjustable signal for functional verification of each output circuit
Isolation: Up to 48 V AC/DC
Error condition: 0 VDC (default state if output source not configured)
Update rate: 100 mS
Accuracy: ±20 mV over entire operating temperature range
Resolution: 5 mV
Power Supply Rejection: 0.5 mV/V

Relay Modules
Any and all relays are freely assignable to any channel.
Internal relay modes of operation:
Off, Low, High, Window, Pulse, PWM, USP
External relay modes of operation: Off, Low, High, Window, USP
Hysteresis: User adjustable
Time Delay: 0 to 6400 seconds

Solid State Relays (non-mechanical switches)
Normally open/closed operation: Software selectable
Max. pulse rate: 600 pulses per minute (volumetric pulse & PWM modes)
400 pulses per minute (prop. pulse mode)
Max. voltage rating: 30 VDC or 42 VAC p-p
Current rating: 50 mA DC or 50 mA AC RMS
On-state impedance: 30 ohms or less
Off-state leakage: 400 nA or less, AC or DC
Isolation: Up to 48 V AC/DC
Transient protection: Embedded, up to 48 V over-voltage

Dry-contact Relays (mechanical contacts)
Type: SPDT
Form: C
Max. pulse rate: 600 pulses per minute (volumetric pulse & PWM modes)
400 pulses per minute (prop. pulse mode)
Max. voltage rating: 30 VDC or 250 VAC
Current rating: 5 A

RS232 Communication Module
Connector: Female DB-9
Utilization: Clone Mode, initially (fully functional RS232 output is pending)

Environmental
Ambient operating temperature:
Back-lit LCD: -10 to 55°C (14 to 131°F)
Vacuum Fluorescent Display: -10 to 50°C (14 to 122°F)
Storage Temp.: -15 to 80°C (5 to 176°F)
Relative Humidity: 0 to 95%, non-condensing
Maximum Altitude: 2,000m (6,560 ft.)
4,000m (13,123 ft.); use only DC power supply and, if applicable, solid state relays to maintain UL safety standard up to this altitude

Standards and Approvals
UL 3101-1
CSA Standard C22.2
CE rating for heavy industry
Immunity: EN61326-1 and EN 61326-2
Emissions: EN55011, Class A and Class B
Low Voltage Directive: EN61010
Manufactured under ISO 9001 and ISO 14001

Shipping Weights

Base Unit	1.00 kg (2.25 lb.)
Power Module	0.12 kg (0.25 lb.)
I/O Module	0.12 kg (0.25 lb.)
Output Module	0.12 kg (0.25 lb.)
Relay Module	0.12 kg (0.25 lb.)
RS232 Communication Module	0.12 kg (0.25 lb.)

5. Installation and Basic Functionality

This section lists all items included with individual 8900 system components, describes installation detail for plug-in modules and base units, and provides information and instruction on the basic functionality of the plug-in modules.

5.1 Unpacking

Base units, plug-in modules, accessories and spare parts are sold, packaged and shipped separately from the factory. Unpack all components carefully. The following items accompany every 8900 base unit:

- 8900 Base Unit (back-lit LCD or Vacuum Fluorescent display)
- Front Face Panel Gasket (pre-installed on base unit)
- Quick-clip panel mounting bracket
- Adhesive Template for panel cutout
- Instruction Manual, Paper copy – English (paper copies of other languages sold separately)
- CD-ROM containing instruction manuals in English, French, German, Spanish, Italian and Portuguese; +GF+ SIGNET briefcase website (www.gfsignet.com); PowerPoint presentation; other useful information.

For future reference, for each installation, it is recommended to record the part number and serial number of each of the components listed here:

Facility Tag Number or System ID (user assigned):________________________

Base unit	3-8900- _______	S/N____________________	Relay Module	3-8900.403-____	S/N____________________
I/O Module	3-8900.401-____	S/N____________________	Ext Relay Module	3-8059-________	S/N__________________
Power Module	3-8900.402-____	S/N____________________	Output Module	3-8900.405-____	S/N____________________
Relay Module	3-8900.403-____	S/N____________________	Comm Module	3-8900.404-____	S/N____________________

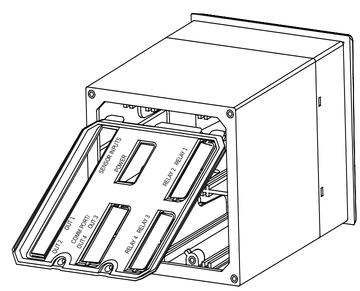
5.2 Tools and Equipment Required:

- Philips screwdriver (medium tip)
- Standard screwdriver (small/medium tip)
- Diagonal cutters (small)
- File (fine)
- ¼ DIN punch or jigsaw suitable for cutting panel opening to within 1 mm (0.020 in.) tolerance.

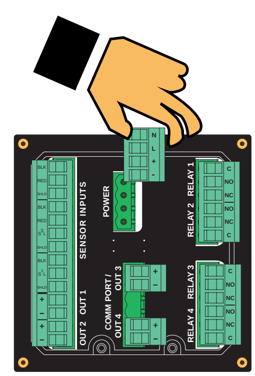
5.3 Plug-in Modules

- If the 8900 Base Unit will be mounted in a panel, plug-in modules may be installed either before or after the base unit is mounted. If the 8900 Base Unit will be mounted using the accessory Wall Mount Bracket, first install plug-in modules.
- Plug-in modules are packaged in anti-static bags and contain individual instruction sheets and removable terminals for convenient wiring. Minimize handling of plug-in modules to reduce the probability of damage due to static discharge.
- I/O Modules and Power Modules also include adhesive labels to be applied to the outside of the 8900 enclosure in specific locations as illustrated in **sections 5.3.1 and 5.3.2**.

- The rear panel of the 8900 must be removed prior to installing or removing plug-in modules. And if plug-in modules are already installed, the terminals must be removed prior to removing the rear panel! It may be helpful to use a standard screwdriver to gently pry removable terminals away from the receptacle on the plug-in modules.
- Use a Philips screwdriver to loosen the two captive screws at the bottom of the panel. Pinch one of the screws and **swing the panel up approximately 90°**, using the tab hinge at the top of the panel, and pull it straight away from the base unit. Reverse this step to reinstall the panel after the plug-in modules are installed.

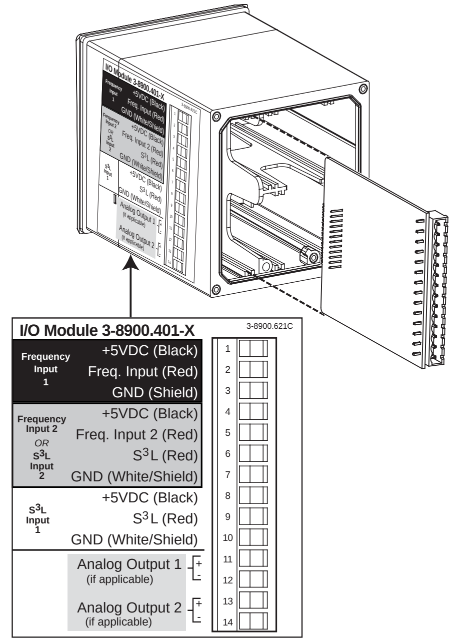


- Remove terminals from the receptacle of each plug-in module prior to installation.
- Identify the appropriate slot per the illustrations below, then use the guide rails and slide the plug-in modules all the way into the base unit until the self-aligning electrical connections "click" to a positive seat.
- Use diagonal cutters to remove slot shields from the rear panel for optional plug-in modules as required. Only remove shields for slots to be used (UL safety requirement).
- Smooth any protruding edges with a file.
- Reinstall the rear panel; it will hold the modules securely in place.



5.3.1 I/O Module, required; install one (1)

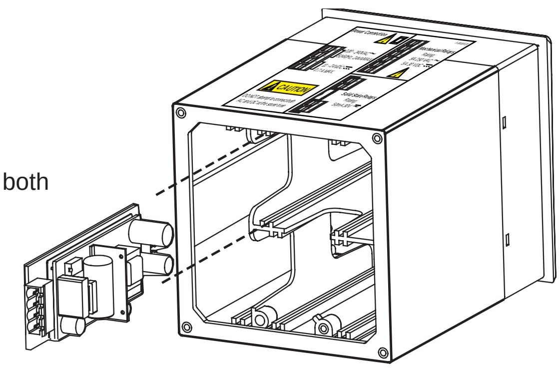
Mfr. Part No.	Description
3-8900.401-1	Two inputs, no outputs
3-8900.401-2	Two inputs, two passive 4 to 20 mA outputs
3-8900.401-3	Two inputs, two active 4 to 20 mA outputs
3-8900.401-4	Two inputs, two 0 to 5/10 VDC outputs
3-8900.401-5	Four inputs, no outputs
3-8900.401-6	Four inputs, two passive 4 to 20 mA outputs
3-8900.401-7	Four inputs, two active 4 to 20 mA outputs
3-8900.401-8	Four inputs, two 0 to 5/10 VDC outputs



- These modules determine the maximum number of sensor input channels available for the instrument. Unwanted or unused channels can remain completely hidden for uncluttered single or three-channel operation.
- Optional analog outputs are contained on the I/O Module, and will always be identified as Outputs 1 & 2 in the 8900 menus. Any and all analog outputs are freely assignable to any channel. All analog outputs available from the 8900 are isolated.
- An adhesive terminal designation label is included with each I/O Module and should be applied to the side of the 8900 base unit as illustrated, or to a more convenient surface for quick and easy access.

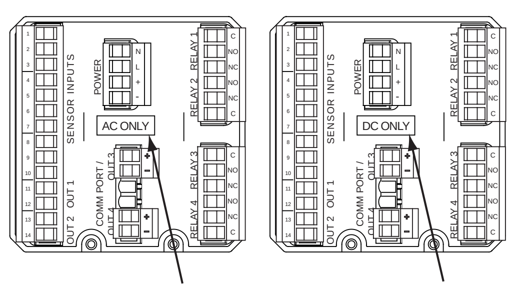
5.3.2 Power Module, required; install one (1)

Mfr. Part No.	Description
3-8900.402-1	85 to 264 VAC, 50/60 Hz
3-8900.402-2	12 to 24 VDC +/-10%



- Each 8900 Base Unit may be powered with either AC or DC voltage, but not both simultaneously (no "uninterruptible" power option).
- The AC Power Module is universal; no jumper selection is required.

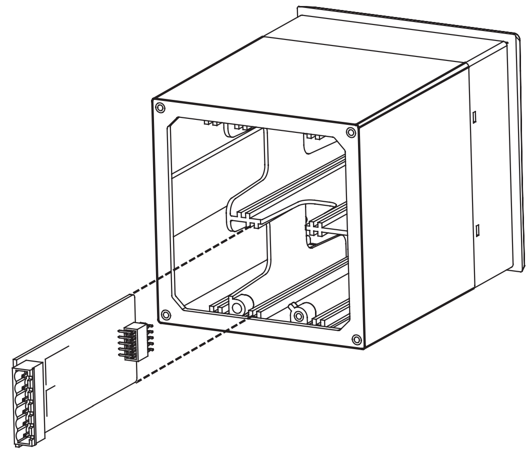
IMPORTANT SAFETY INFORMATION



For additional operator safety, an adhesive power indication label (**AC ONLY** or **DC ONLY**) is packaged with each Power Module and should be applied to the 8900 rear panel as illustrated.

5.3.3 Output Module, optional; install zero (0) or one (1)

Mfr. Part No.	Description
3-8900.405-1	Two passive 4 to 20 mA outputs
3-8900.405-2	Two active 4 to 20 mA outputs
3-8900.405-3	Two 0 to 5/10 VDC outputs
3-8900.404-1	RS232 Communication Module (see NOTE below)

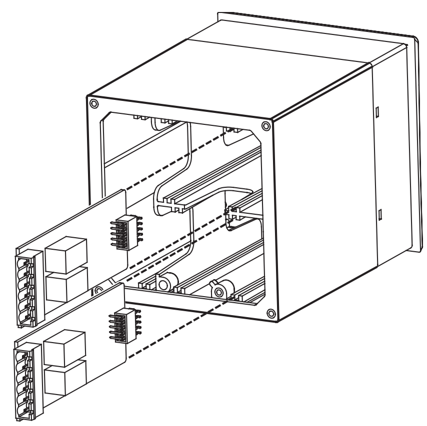


- Optional analog Outputs 1 & 2 are obtained via the I/O Module, but are not required to be installed in order to use the optional analog output modules listed immediately above.
- However, the analog outputs obtained via these separate modules will always be identified as Outputs 3 & 4 in the 8900 menus. The slot on the rear panel is labeled accordingly.
- It is perfectly acceptable to mix and match analog output types between those contained on the I/O Module and those obtained via these separate modules.
- Any and all analog outputs are freely assignable to any channel.
- All analog outputs available from the 8900 are isolated.
- Passive outputs throttle current in loops powered by a supply external to the 8900.
- Active outputs throttle current in loops powered by the 8900; no external power source is required.
- Voltage outputs are independently software selectable for operation from 0 to 5 or 0 to 10 VDC.
- NOTE: Upon initial introduction of the 8900 product series, the RS232 Communication Module will be limited to Clone Mode functionality. This feature requires the accessory DB-9 Crossover Cable and allows an 8900 instrument to adopt all software settings of another 8900 instrument. Both instruments must have RS232 Communication Modules installed.
- Fully functional RS232 output is pending.

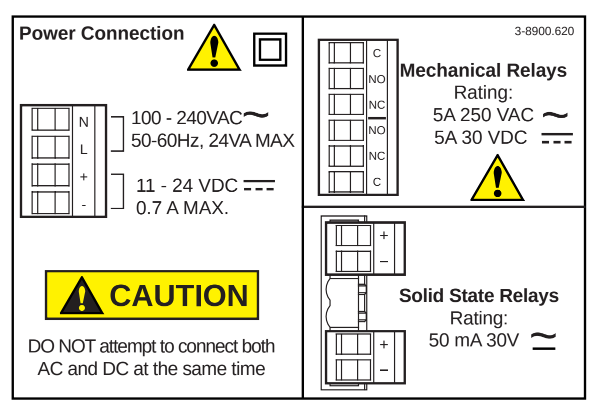
Mfr. Part No.	Description
3-8900.390	DB-9 Crossover Cable

5.3.4 Relay Module, optional; install zero (0), one (1) or two (2)

Mfr. Part No.	Description
3-8900.403-1	Two dry-contact relays
3-8900.403-2	Two solid-state relays



- Up to two sets of two relays may be installed directly into the 8900. The modules are completely independent of one another, so it is not necessary for Relays 1 & 2 to be installed in order to use Relays 3 & 4.
- However, in accordance with the labeling on the rear panel, relays installed directly into the 8900 via these plug-in modules will always be identified in the 8900 menus as Relays 1 & 2 and 3 & 4, respectively.
- The red LED relay status indicators on the front panel of the 8900 are hardwired to Relays 1 & 2. If the slot for Relays 1 & 2 is vacant, the red LEDs will be inoperative. Status of all relays is available at all times in a single screen in View mode.
- It is perfectly acceptable to mix and match the relay types installed directly in the 8900, as well as between internal and external modules.
- Any and all relays are freely assignable to any channel. Hysteresis and time delay are adjustable for each relay.
- Dry-contact relays are electromechanical switches that "click" during operation. They are suitable for many general-purpose applications, AC or DC, including AC loads up to 250 V.
- Solid-state relays are electronic switches that operate silently and may be used with AC or DC loads, but have lower current handling capability and voltage ratings than Dry-contact relays. Solid-state relays will outlast Dry-contact relays in pulsing applications.
- Switching active loads (most commonly inductive) can cause contact arcing sufficient to damage both types of relays. The RC Filter Kit or "snubber" is available as an accessory to reduce or eliminate these damaging effects.



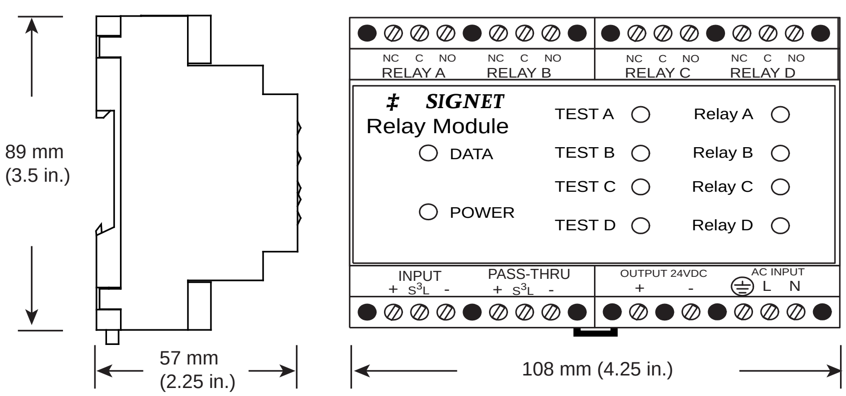
Mfr. Part No.	Description
3-8050.396	RC Filter Kit

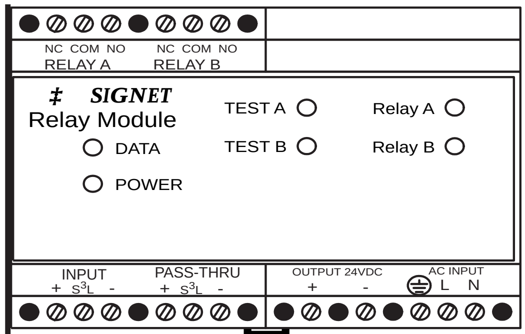
5.3.5 External Relay Module, optional; install zero (0) or one (1)

Mfr. Part No.	Description
3-8059-2	Two external dry-contact relays
3-8059-2AC	Two external dry-contact relays w/ power supply
3-8059-4	Four external dry-contact relays
3-8059-4AC	Four external dry-contact relays w/ power supply

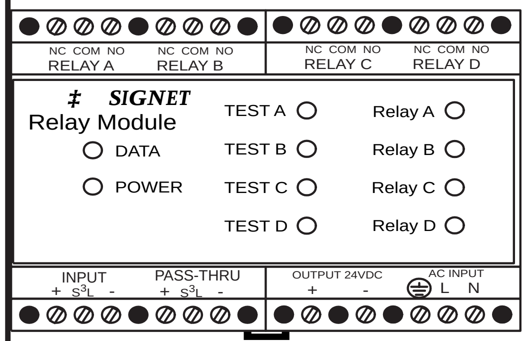
- The 8900 will support up to eight (8) relays, though only four actually fit directly inside its compact $^1/_4$ DIN enclosure! 8059 External Relay Modules of either two or four relays may be connected to the 8900 via S^{3}L at the I/O Module (this does NOT consume a sensor input channel).
- External relays are completely independent of internal relays, so it is not necessary for Relays 1 & 2 or 3 & 4 to be installed in order to use the external relays. In the 8900 menus, external relays will always be identified as Relays A, B, C and D.
- 8059 versions with power supply are powered by universal AC line voltage and may be used to power the 8900 with 24 VDC. Also, S^{3}L pass-thru terminals on the 8059 can help to reduce sensor wiring congestion at the 8900. See Section 6 Wiring and/or the 8059 instruction manual for more details.
- External Relays mount on DIN rail inside a panel and can be tested remotely from the 8900, or locally with switches built-in for convenience. They also include LED relay status indicators, but the status of these and all relays is available at all times in a single screen in the 8900 View mode.
- Any and all relays are freely assignable to any channel. Hysteresis and time delay are adjustable for each relay.
- It is perfectly acceptable to mix and match relay types between internal and external modules. However, NOTE: The 8900 only allows external relays to be used in modes Off, Low, Hi, Window and USP.
- 8059 External Relay Modules contain dry-contact relays only. These electromechanical switches “click” during operation and are suitable for many general-purpose applications, AC or DC, including AC loads up to 250 V.
- Switching active loads (most commonly inductive) can cause contact arcing sufficient to damage relays. The RC Filter Kit or “snubber” is available as an accessory to reduce or eliminate these damaging effects.

Mfr. Part No.	Description
3-8050.396	RC Filter Kit
6205-0002	DIN Rail, 1m
6205-0003	End Clips, DIN Rail

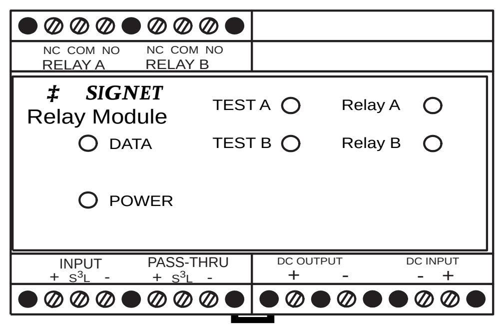




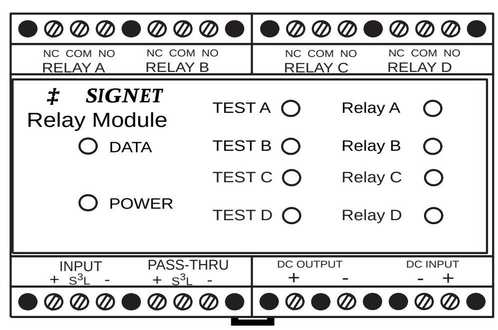
8059-2AC



8059-4AC



8059-2

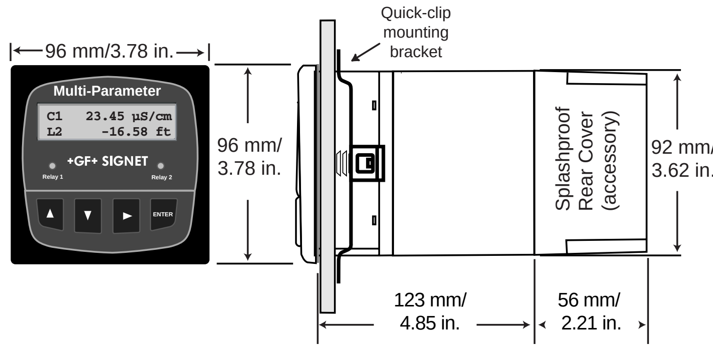


8059-4

5.4 Mounting the Base Unit

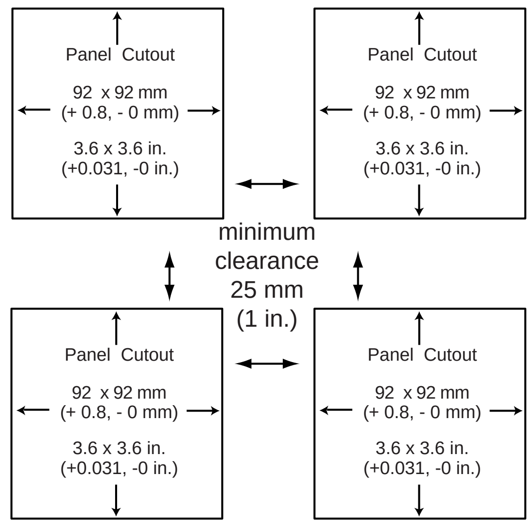
The 8900 may be mounted in a panel, on a wall, or on virtually any surface including shelves, racks and pipes. All methods of mounting the 8900 make use of the +GF+ SIGNET Quick-clip for holding the instrument securely in place. This unique clip eliminates the hassle of locating and drilling holes for mounting screws.

If the 8900 will be mounted in a panel, plug-in modules may be installed either before or after the base unit is mounted. If an accessory Wall Mount Bracket will be used, first install plug-in modules.



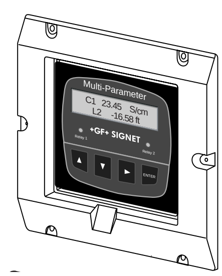
5.4.1 Panel Mounting

- The 8900 enclosure conforms to the ¹/₄ DIN standard, which requires a panel opening of 92 mm x 92 mm (3.6 x 3.6 in.).
- ¹/₄ DIN punches are available and recommended for creating clean, precise openings quickly and easily in most instrument panels.
- Alternatively, a jigsaw or other cutting tool may be used. An adhesive template is provided to help guide the cutting process.
- Recommended minimum clearance on all sides between instruments and panel edges is 25 mm (1 in.) as illustrated.
- Use an appropriate file as necessary to shape and size the opening, and to remove burrs.

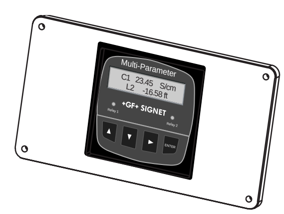


- Two panel adapter accessories are available for installing the 8900 into panels with existing cutouts larger than the ¹/₄ DIN standard.

3-5000.399 Panel adapter,
5 in. x 5 in. to ¹/₄ DIN



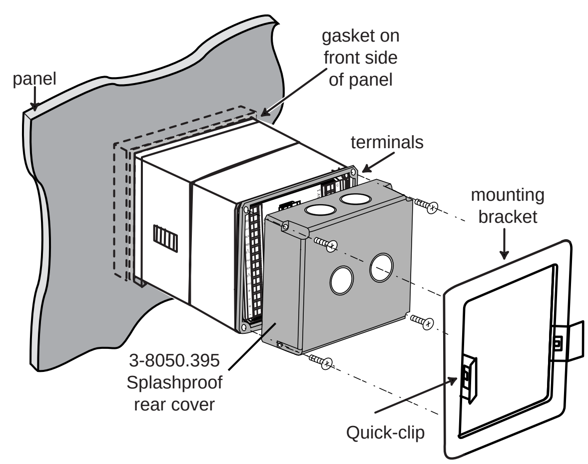
3-8050.392 Panel adapter,
¹/₂ DIN to ¹/₄ DIN



To install 8900 in a panel:

1. Slide the 8900 into the opening from the front of the panel. Ensure the Front Face Panel Gasket is properly seated against the panel and around the instrument case.
2. Slide the Quick-clip mounting bracket over the back of the instrument as illustrated. The Quick-clips will snap into engagement with the molded latches on the side of the instrument. Press the bracket against the inside of the panel to secure the instrument firmly in place.

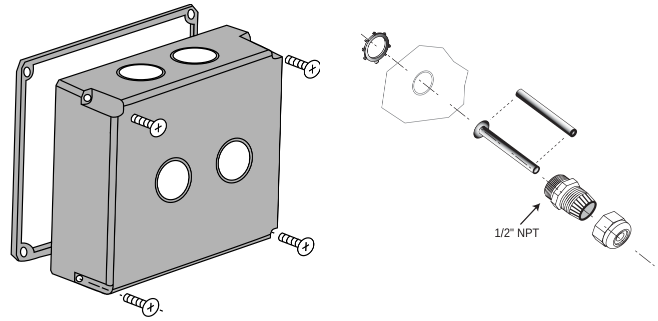
- To remove, press the Quick-clips outward while pulling the bracket away from the instrument panel. DO NOT ALLOW THE INSTRUMENT TO FALL FORWARD OUT OF THE PANEL OPENING! It may be necessary/helpful to temporarily secure the instrument from the front with tape, etc.



5.4.2 Mounting Accessories

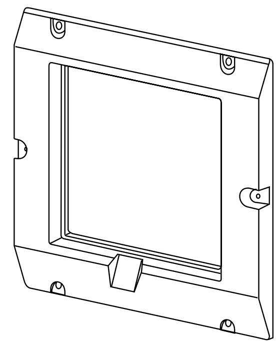
Refer to **section 5.4.1** regarding the use of the Quick-clip for securing the 8900 instrument in panel adapters or brackets.

Mfr. Part No. | **Description**
3-8050.395 | Splashproof rear cover



- Use in conjunction with liquid tight connector kits to seal wiring ports.
- Protects rear of instrument and terminals from moisture intrusion and corrosion.
- Suitable for indoor and outdoor installations.
- 3-9000.392 Liquid tight connector kit, NPT (3 connectors)
- 3-9000.392-1 Liquid tight connector kit, NPT (1 connector)
- 3-9000.392-2 Liquid tight connector kit, PG13.5 (1 connector)

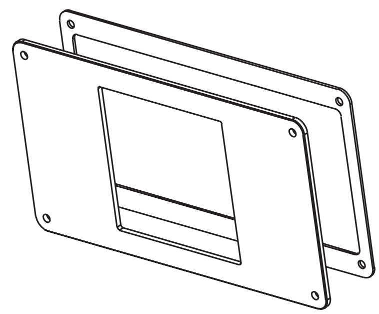
Mfr. Part No. | **Description**
3-5000.399 | Panel adapter, 5 x 5 in. to ¼ DIN



- Converts 127 x 127 mm (5 x 5 in.) panel cutouts to ¼ DIN
- Primarily used when replacing retired 500-series

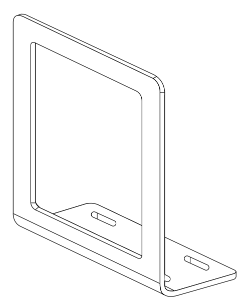
  +GF+ SIGNET instruments with modern ¼ DIN instruments
- Injection molded black plastic (Acetal)
- Neoprene gasket and machine screw hardware included

Mfr. Part No. | **Description**
3-8050.392 | Panel adapter, ½ DIN to ¼ DIN



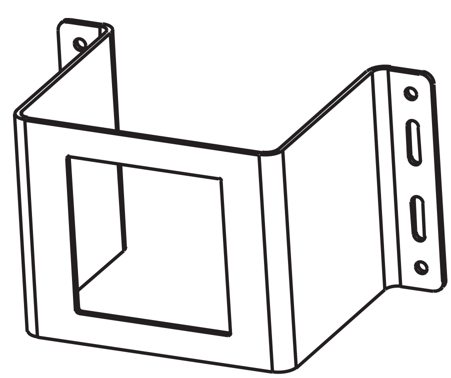
- Converts existing panel cutouts, up to 96 x 192 mm (3.8 x 7.6 in.), to ¼ DIN (92 x 92 mm)
- Powder coated aluminum, black, 3.2 mm (0.125 in.) thick
- Neoprene gasket and machine screw hardware included

Mfr. Part No. | **Description**
3-5000.598 | Shelf/pipe mount bracket, ¼ DIN instrument



- Use for surface mount installations under a shelf, or on a counter or rack.
- Powder coated aluminum, black, 3.2 mm (0.125 in.) thick
- Nylon straps or other suitable fasteners may be used to secure this bracket to a pipe.

Mfr. Part No. | **Description**
3-0000.596-1 | ¼ DIN wall mount bracket, 6.5 in. depth



- Use to mount the 8900 (without a splashproof rear cover) to a solid wall or bulkhead.
- Powder coated aluminum, black, 3.2 mm (0.125 in.) thick

Mfr. Part No. | **Description**
3-0000.596-2 | ¼ DIN wall mount bracket, 9.0 in. depth

- Use to mount the 8900 (with a Splashproof rear cover) to a solid wall or bulkhead.
- Powder coated aluminum, black, 3.2 mm (0.125 in.) thick

6. Wiring

All wiring connections to the 8900 are made via the removable terminals of the plug-in modules. This section contains instructions and diagrams for wiring each type of module. Several helpful tables, explanations and recommendations are also provided. In general:

- Do not allow any AC leads that may be connected to the Power Module, or to optional internal relays, to come in contact with low voltage wiring.
- Terminals accept 12 to 24 AWG wire.
- Strip 10 to 12 mm (0.4 to 0.5 in.) of insulation from wire tips and tin bare ends to eliminate fraying.
- Use ferrules when connecting more than one wire to a single terminal of a module or a junction box.
- Insert wire tip or ferrule completely into the terminal and secure with the screw until finger tight.

6.1 I/O Module (3-8900.401-X)

- The I/O Module provides the terminals for sensor inputs, optional external relays, and optional Analog Outputs 1 & 2.
- These modules (3-8900.401-X) support frequency and S^{3}L™ sensor input signal types. External relays are controlled via S^{3}L and connect to the I/O Module just as if they were S^{3}L sensors. External relays do NOT consume a sensor input channel.
- Refer to **Section 6.3: Output Module** for wiring optional Analog Outputs 1 & 2.

6.1.1 What is S^{3}L™?

S^{3}L™ is a +GF+ SIGNET trademark meaning **S**ignet **S**ensor **S**erial **L**ink. It is a serial communication system that provides a common digital interface between +GF+ SIGNET sensors, instruments, and other devices. Two very practical benefits of S^{3}L are explained below. Visit www.gfsignet.com for more details.

1. Digital networks like S^{3}L™ have better noise immunity and pose fewer ground loop problems compared to analog methods of signal transmission. This can be extremely important when measurement systems must be installed in close proximity to notorious sources of EMI such as high-power lines, three-phase transformers, motor starters, generators, etc.

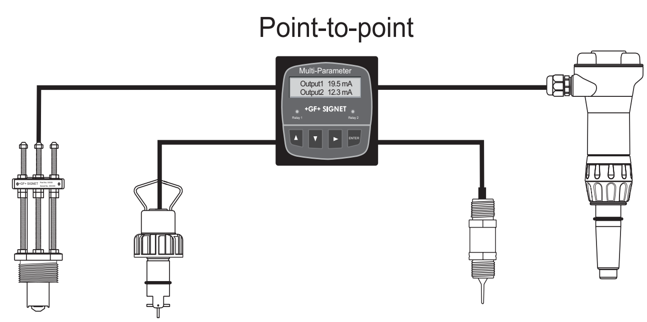
2. In an S^{3}L network, measurement data and other information are exchanged in "packets" marked by individual device identification codes. This means that if multiple S^{3}L devices will be used with an 8900, then the interconnecting wiring may be shared in Multi-drop and/or Daisy-chain topologies. When compared to traditional point-to-point wiring, these topologies may reduce total wire and conduit requirements significantly.

6.1.2 Wiring Topologies

Several options for the physical routing of wire and conduit used to connect sensors and external relays to I/O Modules (3-8900.401-X) are described in this section. Diagrams are provided to convey the basic idea of each topology. These configurations plus variations and many possible combinations exemplify the extraordinary versatility of the 8900 system. Consult the tables in **Section 6.1.3: Maximum Cable Lengths** to determine the total maximum allowable cable length for any installation.

6.1.2.1 Point-to-point

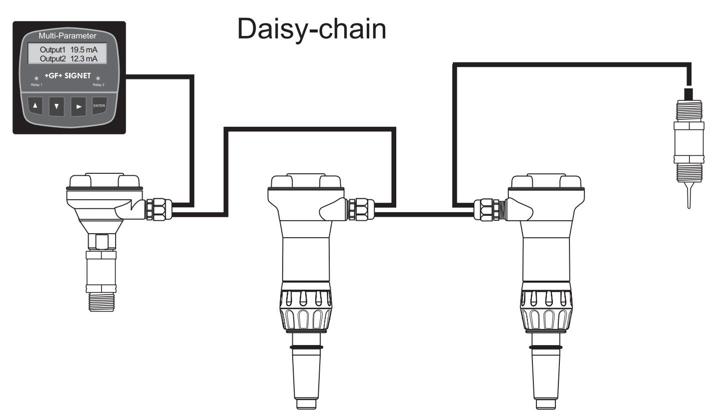
This familiar topology is characterized by the direct wiring of individual devices to an I/O Module.



- All frequency inputs MUST be wired in this fashion.
- S^{3}L devices may also be connected point-to-point, and/or by the other topologies described below.
- Integral junction boxes are built-in to some sensors for convenience. Other very useful versions with either ³/₄ in. NPT or Universal mount are available as accessories for all other sensors.

6.1.2.2 Daisy-chain

This topology is characterized by the sequential connection of one S^{3}L device to another, and may allow significant reductions in total wire and conduit when compared to point-to-point configurations.

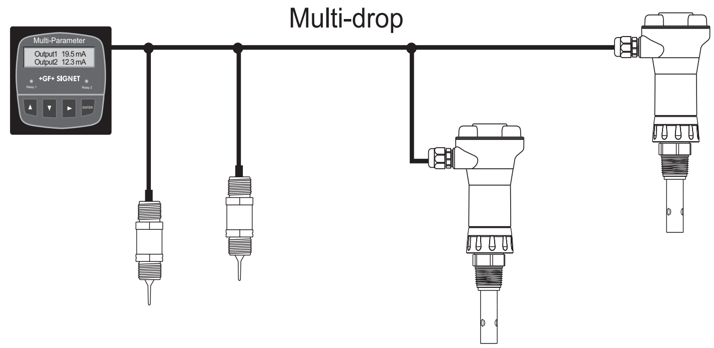


- Suitable for S^{3}L devices only.
- Consider this topology especially if multiple sensors will be installed in relative proximity to one another. A single run of cable may then connect all the sensors to the 8900.
- Integral junction boxes are built-in to some sensors for convenience. Other very useful versions with either ³/₄ in. NPT or Universal mount are available as accessories for all other sensors.
- All +GF+ SIGNET junction boxes provide dual conduit ports to simplify this wiring scheme.

6.1.2.3 Multi-drop

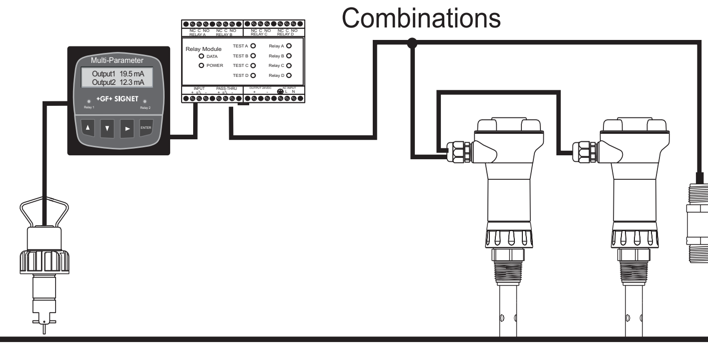
This topology is characterized by a single run of cable to which sensor branches are connected via junction boxes. Substantial reductions in total wire and conduit compared to point-to-point and daisy-chain configurations may be possible.

- Suitable for S³L™ devices only.
- Consider this topology especially if a multiple sensor deployment includes significant vertical as well as horizontal wire distances (that is, if sensor wiring must span walkways, driveways, or multiple floors of a building, etc.).
- +GF+ SIGNET junction boxes can be useful in making the 3-way junctions necessary in this configuration.
- Another variation of this topology can be used to reduce congestion at the I/O Module resulting from some point-to-point wiring configurations. Consolidate S³L signal lines with a terminal strip just prior to connecting to the I/O Module.



6.1.2.4 Combinations

The basic topologies described above may be combined to suit specific installation requirements in systems containing multiple S³L devices. All three configurations are featured in the example here.



6.1.2.5 Accessory Junction Boxes

Various junction boxes are available to facilitate the wiring configurations described above, and to achieve and maintain reliable sensor connections even in harsh industrial environments.

Mfr. Part No.	Code	Description
3-8050-1	159 000 753	Universal Mount Junction Box
3-8050-1CR	159 000 889	Universal Mount Junction Box w/Ranges (for use with 2850)
3-8050-2	159 000 754	Universal Mount Junction Box w/EasyCal (for use with 2750)
3-8050-2CR	159 000 802	Universal Mount Junction Box w/EasyCal (for use with 2850)
3-8052-1	159 000 755	3/4 in. NPT Mount Junction Box
3-8052-1CR	159 000 890	3/4 in. NPT Mount Junction Box w/Ranges (for use with 2850)
3-8052-2	159 000 756	3/4 in. NPT Mount Junction Box w/EasyCal (for use with 2750)
3-8052-2CR	159 000 803	3/4 in. NPT Mount Junction Box w/EasyCal (for use with 2850)

6.1.3 Maximum Cable Lengths

The I/O Module (3-8900.401-x) supports frequency and S³L signal types. These signal types are fundamentally different from one another, and the rules governing maximum cable lengths also differ, so the two types must be treated separately. Refer to the following two sections as necessary to determine the cable length limitations of any system.

6.1.3.1 Signal Type: Frequency

The maximum allowable cable length for flow sensors with frequency output is dependent upon the output signal strength of the sensors themselves, and the degree to which the signals are susceptible to EMI or "noise". This is largely a function of whether the sensors are self-powered, or powered by an external source.

All of the sensors in the table below are compatible with the 8900. The three models limited to 60 m (200 ft.) are self-powered sensors. The 8900 automatically provides power to the others via the I/O Module (normal sensor wiring).

These maximum recommended cable lengths apply to individual sensors and are completely independent of one another. Additionally, these cable lengths have no relevance to any S³L devices that may also be connected to the I/O Module.

+GF+ SIGNET Flow sensor models with frequency output												
Maximum cable length	**515**	**525**	**2000**	**2100**	**2507**	**2517**	**2536**	**2540**	**2541**	**2550**	**7000**	**7002**
60 m (200 ft.)	X	X				X						
305 m (1000 ft.)			X	X	X		X	X	X	X	X	X

6.1.3.2 Signal Type: S^{3}L™

The total maximum allowable cable length for all S^{3}L devices in a system is primarily dependent upon the connecting instrument, not the sensors or external relays themselves. From an instrument's EMI filtering capability, and its capacity to provide power to these devices, maximum cable length guidelines can be established. For the 8900, these guidelines are defined here.

Maximum total cable length from S^{3}L Devices to 8900

	Total Current Consumption of S^{3}L^a Devices					
Wire Size (AWG)	**1 mA**	**2 mA**	**4 mA**	**10 mA**	**20 mA**	**40 mA**
24	1800 ft	900 ft	450 ft	180 ft	90 ft	40 ft
22	2850 ft	*1420 ft*	710 ft	280 ft	140 ft	70 ft
20	n/a	2290 ft	*1140 ft*	450 ft	220 ft	110 ft
18	n/a	n/a	1810 ft	720 ft	360 ft	180 ft
16	n/a	n/a	2840 ft	*1130 ft*	560 ft	280 ft
14	n/a	n/a	n/a	1850 ft	*920 ft*	460 ft
12	n/a	n/a	n/a	2940 ft	*1470 ft*	730 ft

Cable capacitance <50 pf/ft (practically all cables)

Cable capacitance <30 pf/ft

Cable capacitance <15 pf/ft

In order to use this table, the total maximum current consumption of all the S^{3}L devices in the system must be known. Refer to the current consumption table and add the appropriate mA values to find the total.

Round up to the nearest column heading in the cable length table, or extrapolate between columns to approximate the maximum allowable cable length for all S^{3}L devices in the system (regardless of topology). Notice the influence of wire size and capacitance on maximum allowable cable lengths. Proper cable selection is imperative, especially when long runs are required in an installation.

Maximum Current Consumption for S^{3}L Devices

S3L Device	Current Consumption per Device
2350 Temperature Sensor	1 mA
2450 Pressure Sensor	1 mA
2750 pH and ORP Sensors	3 mA
2850 Conductivity Sensor	2 mA
8059 External Relay Module *	1 mA

* The S^{3}L communication link between the 8900 and the 8059 is powered by the 8900 and consumes 1 mA maximum. However, the 8059 External Relay Module always requires a separate power source for its operation.

The Maximum Current table above applies only to S^{3}L devices powered by the 8900 (normal sensor wiring). If an auxiliary power source more local to the sensor is used, then wire size may be reduced and S^{3}L wiring distances may be substantially increased. Contact your local +GF+ sales office for more information.

6.1.4 I/O Module (3-8900.401-X) Wiring Diagrams

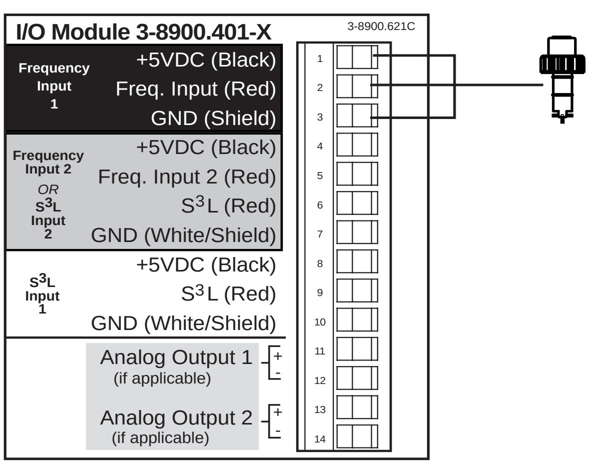
Determine the number of frequency inputs and the number of separate S^{3}L™ digital signal lines to be wired directly to the I/O Module, then use the table below and the corresponding wiring diagram(s) for instruction.

Number of Frequency Inputs	Number of Separate S^{3}L^a Signal Lines	Wiring Diagram(s)	Note(s)
1	0	A	
2	0	B	1
0	1	C	
1	1	A & C	
2	1	B & C	1
0	2	D	2, 3, 5
1	2	A & D	2, 3, 5
2	2	E	1, 3, 5
0	3	F	2, 3, 4, 5
1	3	A & F	2, 3, 4, 5
2	3	G	1, 3, 4, 5, 6
0	4	H	2, 3, 4, 5
1	4	A & H	2, 3, 4, 5, 6
0	5	I	2, 3, 4, 5, 6

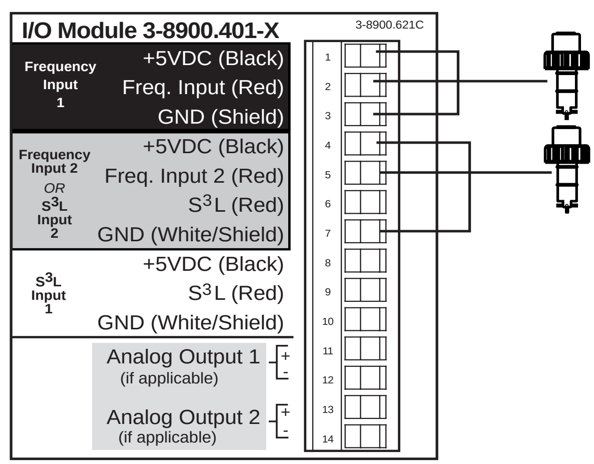
Notes:

1) If two frequency inputs are required, then the terminals for Frequency Inputs 1 and 2 must be used. In such cases, any and all S^{3}L devices must be connected via S^{3}L Input (terminals 8, 9 and 10).
2. Multiple S^{3}L devices may be connected to a single S^{3}L input (terminals 8, 9 and 10 for example). However, for best EMI filtering in point-to-point wiring topologies involving more than one S^{3}L device, use S^{3}L Inputs 1 and 2 if possible.
3) Consider daisy-chain or multi-drop wiring topology for S^{3}L devices. This will reduce the number of separate digital signal lines to be connected to the I/O Module.
4) In point-to-point wiring topologies involving more than two S^{3}L devices it will be necessary to connect more than one S^{3}L device to a single set of terminals. In such cases, for best EMI filtering, combine the wiring of sensors that are located nearest to one another in the installation.
5) Ferrules are recommended when connecting multiple S^{3}L devices to a single set of terminals.
6) This combination is only possible if one of the S^{3}L devices is the 8059 External Relay Module.

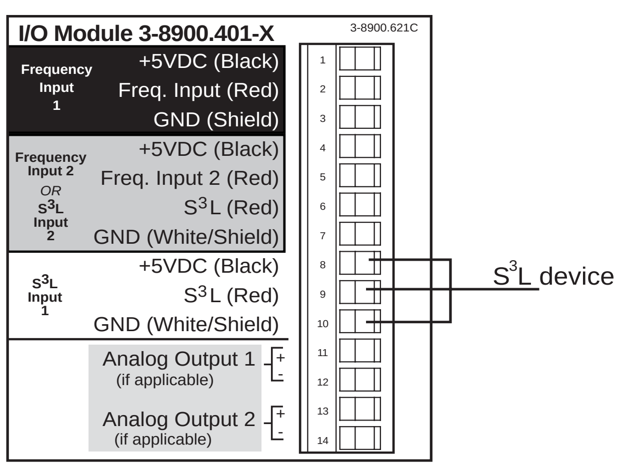
A



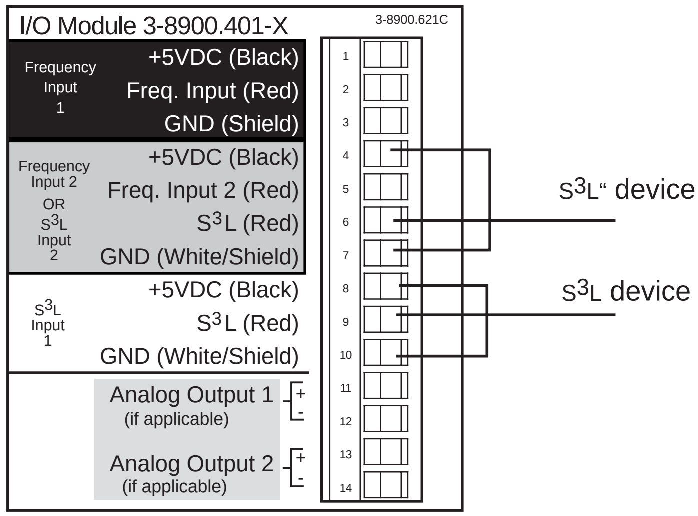
B



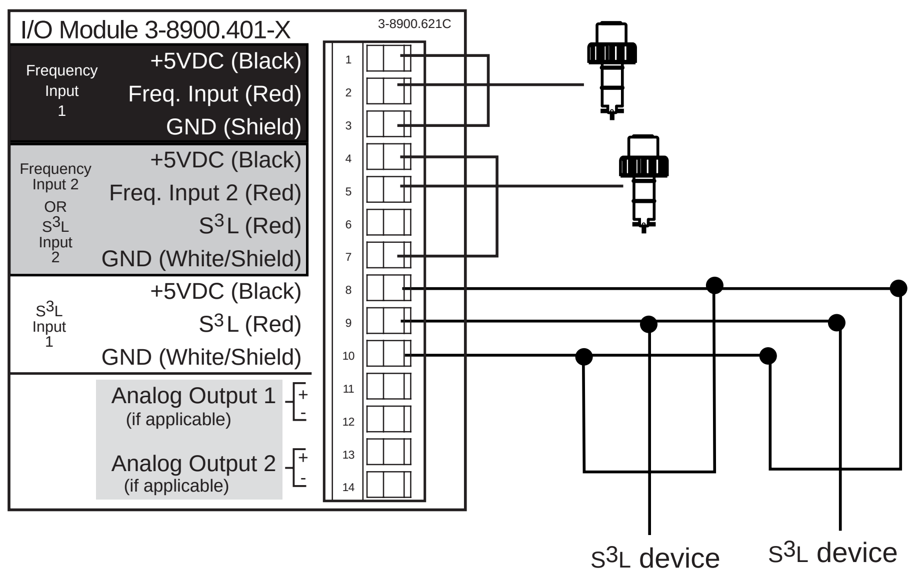
C



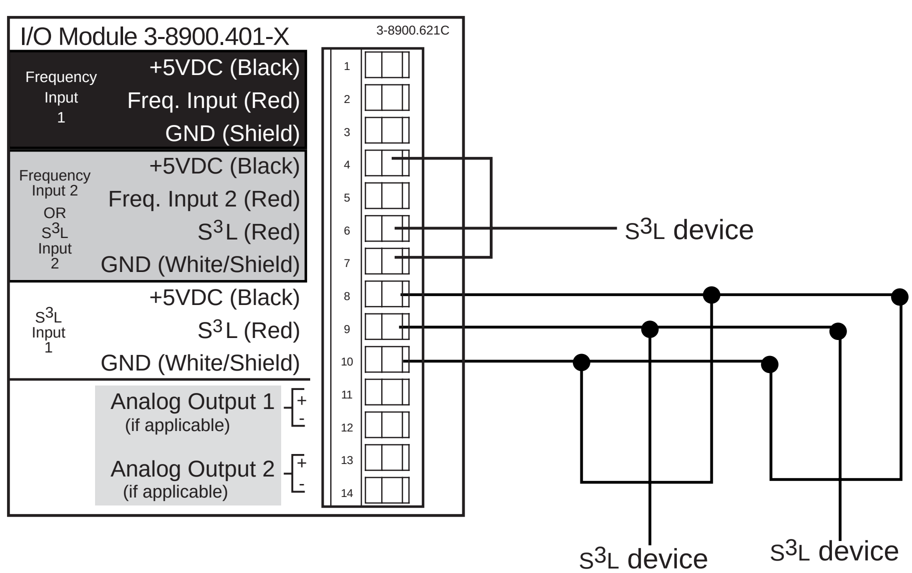
D


I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
1 2 3 4 5 6 7 8 9 10 11 12 13 14
S3L“ device
S3L device

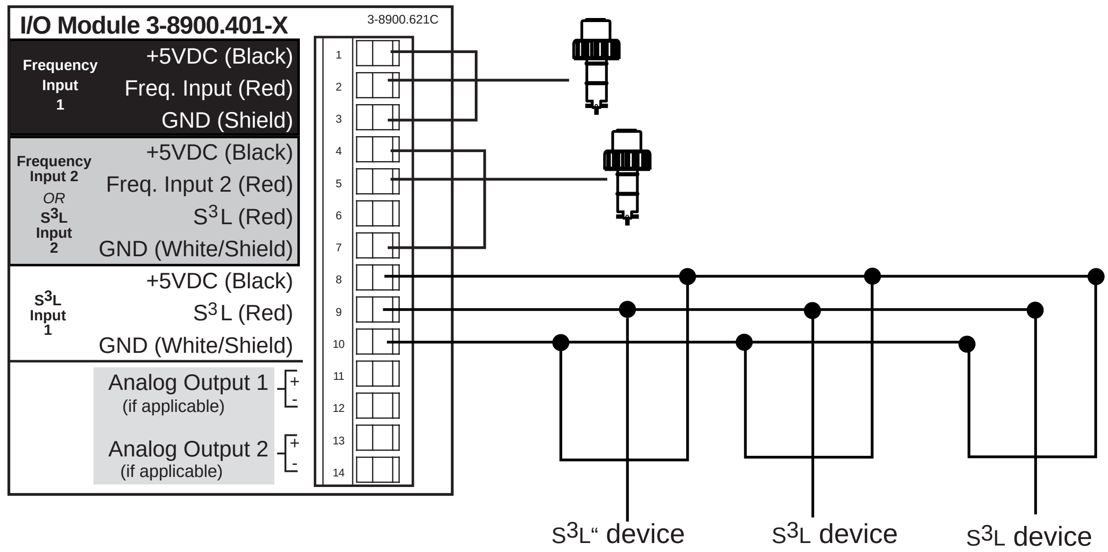
E


I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
1 2 3 4 5 6 7 8 9 10 11 12 13 14
S3L device
S3L device

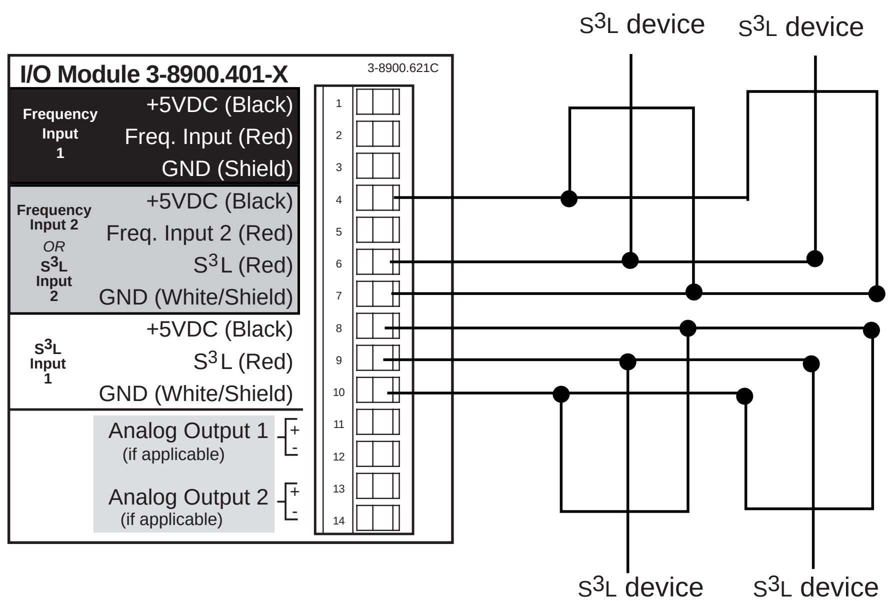
F


I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
1 2 3 4 5 6 7 8 9 10 11 12 13 14
S3L device
S3L device
S3L device

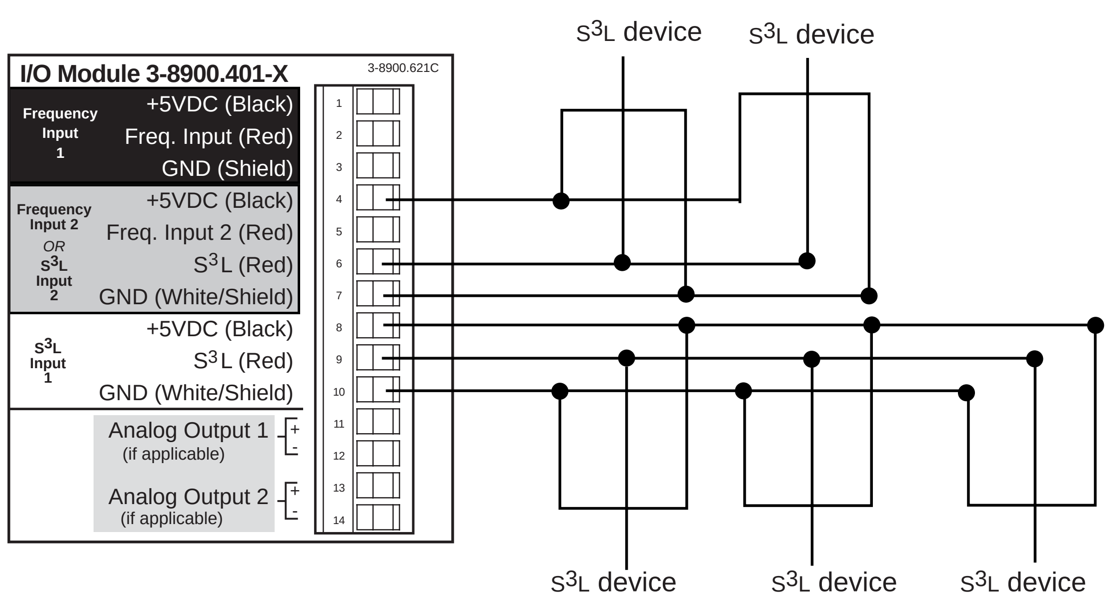
G


I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
S3L" device
S3L device
S3L device

H

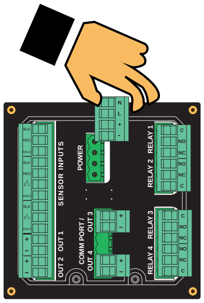

S3L device
S3L device
I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
S3L device
S3L device

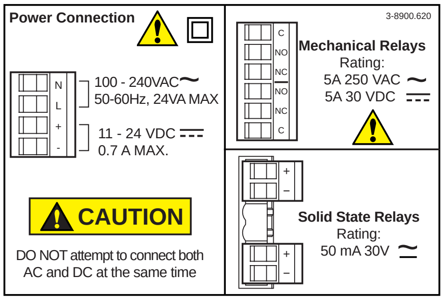
I

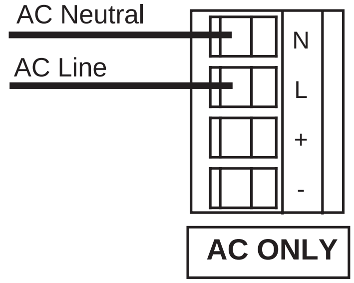

S3L device
S3L device
I/O Module 3-8900.401-X
3-8900.621C
Frequency Input 1
+5VDC (Black)
Freq. Input (Red)
GND (Shield)
Frequency Input 2 OR S3L Input 2
+5VDC (Black)
Freq. Input 2 (Red)
S3L (Red)
GND (White/Shield)
S3L Input 1
+5VDC (Black)
S3L (Red)
GND (White/Shield)
Analog Output 1 (if applicable)
Analog Output 2 (if applicable)
S3L device
S3L device
S3L device

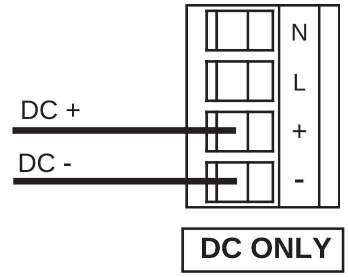
6.2 Power Module (3-8900.402-X)

- Exceeding voltage ratings may damage the unit and pose a shock hazard.
- To simultaneously connect AC and DC to these power modules will not cause damage to the unit, however invalidates the double insulation rating and UL safety standards.





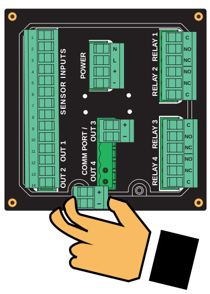


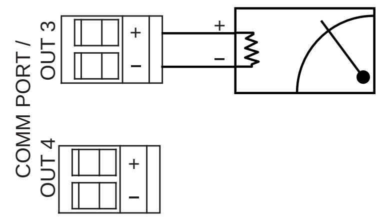


6.3 Output Module (3-8900.405-X)

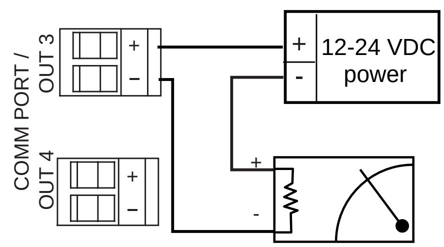
The 8900 will support up to four analog outputs.

- Analog outputs 3 & 4 are obtained via these separate plug-in modules.
- Analog outputs 1 & 2 are located on selected I/O Modules and are also wired as shown here.

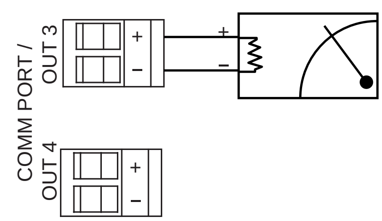




Active 4-20 mA Loop wiring



Passive 4-20 mA Loop wiring



0-5 VDC Output wiring

- Active 4-20 mA Loop Output Module
  The DC power required for the loop is supplied by the 8900.
  No additional power source is needed.

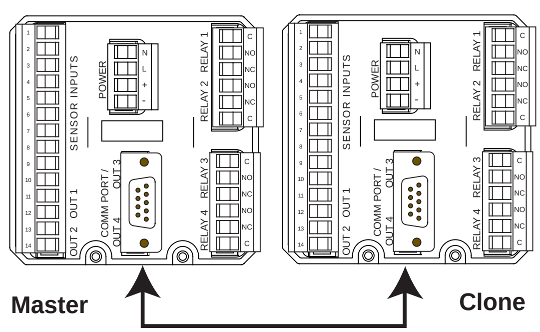
- Passive 4-20 mA Loop Output Module
  The DC power required for the loop must be provided by an external source.

- 0-5 or 0-10 VDC Output Module
  The 8900 provides power for the 0-5 or 0-10 VDC output.

6.4 RS232 Communication Module (3-8900.404-1)

Upon initial introduction of the 8900 product series, the RS232 Communication Module will be limited to Clone Mode functionality. This feature requires the accessory DB-9 Crossover Cable and allows an 8900 instrument to adopt all software settings of another 8900 instrument. Both instruments must have RS232 Communication Modules installed. Fully functional RS232 output is pending.

Mfr. Part No.	Description
3-8900.390	DB-9 Crossover Cable



DB-9 Crossover Cable (3-8900.390)

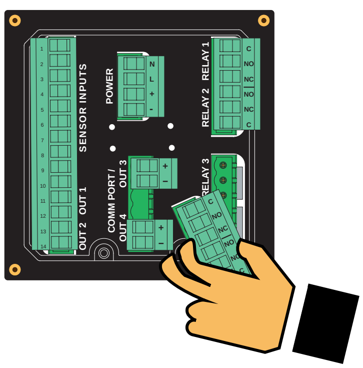
6.5 Relay Module (3-8900.403-X)

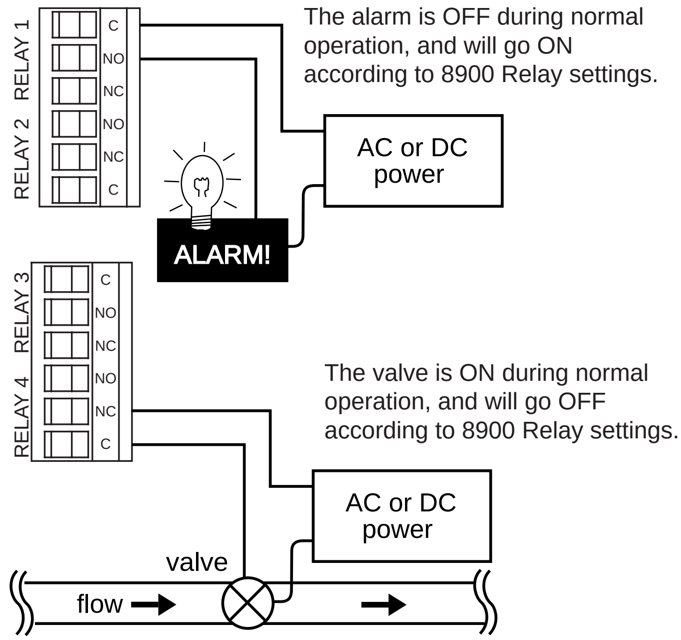
Solid State Relays (non-mechanical switches)

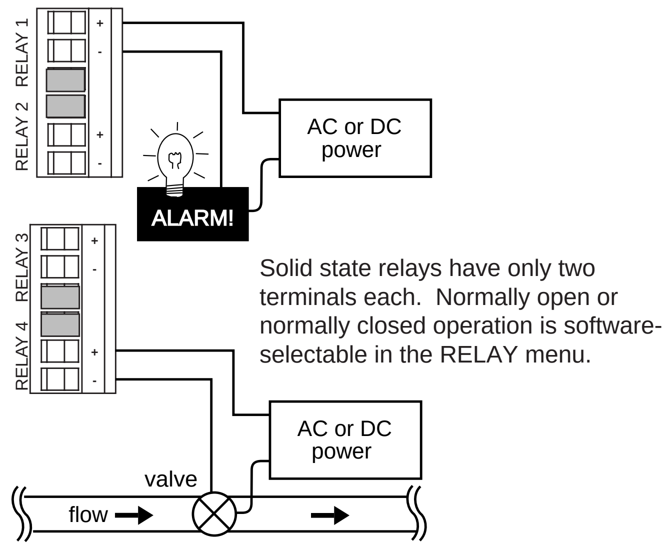
Normally open/closed operation:	Software selectable
Max. pulse rate:	600 pulses per minute (volumetric pulse & PWM modes) 400 pulses per minute (prop. pulse mode)
Max. voltage rating:	30 VDC or 42 VAC p-p
Current rating:	50 mA DC or 50 mA AC RMS
On-state impedance:	30 ohms or less
Off-state leakage:	400 nA or less, AC or DC
Isolation:	Up to 48 VDC, or 48 VAC p-p
Transient protection:	Embedded, up to 48 V over-voltage

Dry-contact Relays (mechanical contacts)

Type:	SPDT
Form:	C
Max. pulse rate:	600 pulses per minute (volumetric pulse & PWM modes) 400 pulses per minute (prop. pulse mode)
Max. voltage rating:	30 VDC or 250 VAC
Current rating:	5 A

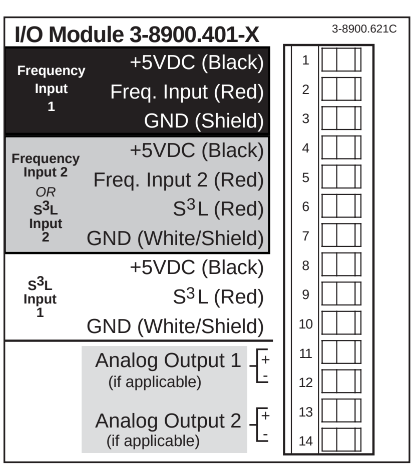


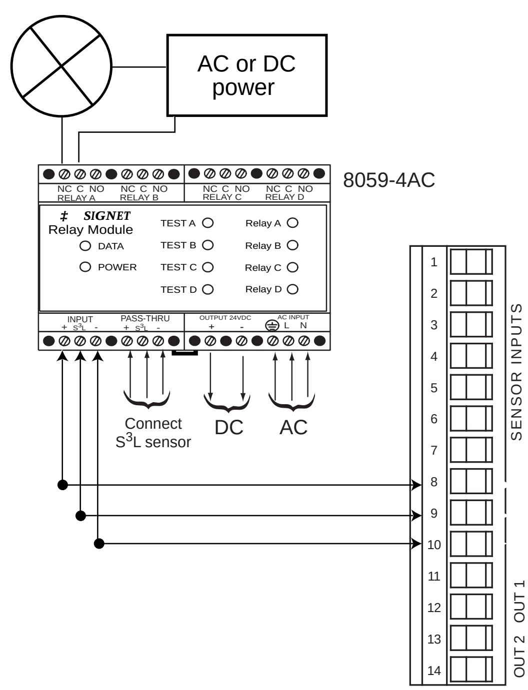




6.6 External Relay Module

- 8059 external relay modules provide either 2 or 4 additional dry-contact relays.
- External modules are controlled via the S³L™ serial bus.
- See **section 5.3.5 External relay module** and/or the 8059 instruction manual for more information.



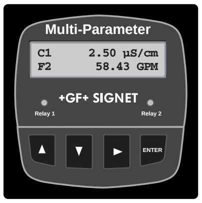


7. Operational Overview

The 8900 Multi-Parameter Controller belongs to the ProcessPro family of instruments. Each member of this family features a digital display and a four-button keypad for system set-up and general operation. These instruments are strongly similar to one another in many other ways also, including software, though some differences do exist. This section contains a description of keypad functions, a general operation flowchart, and View mode details for the 8900.

7.1 Keypad Functions

The four buttons of the keypad are used to navigate display modes according to the descriptions in this table. Notice that the function of each button may change depending on the display mode.

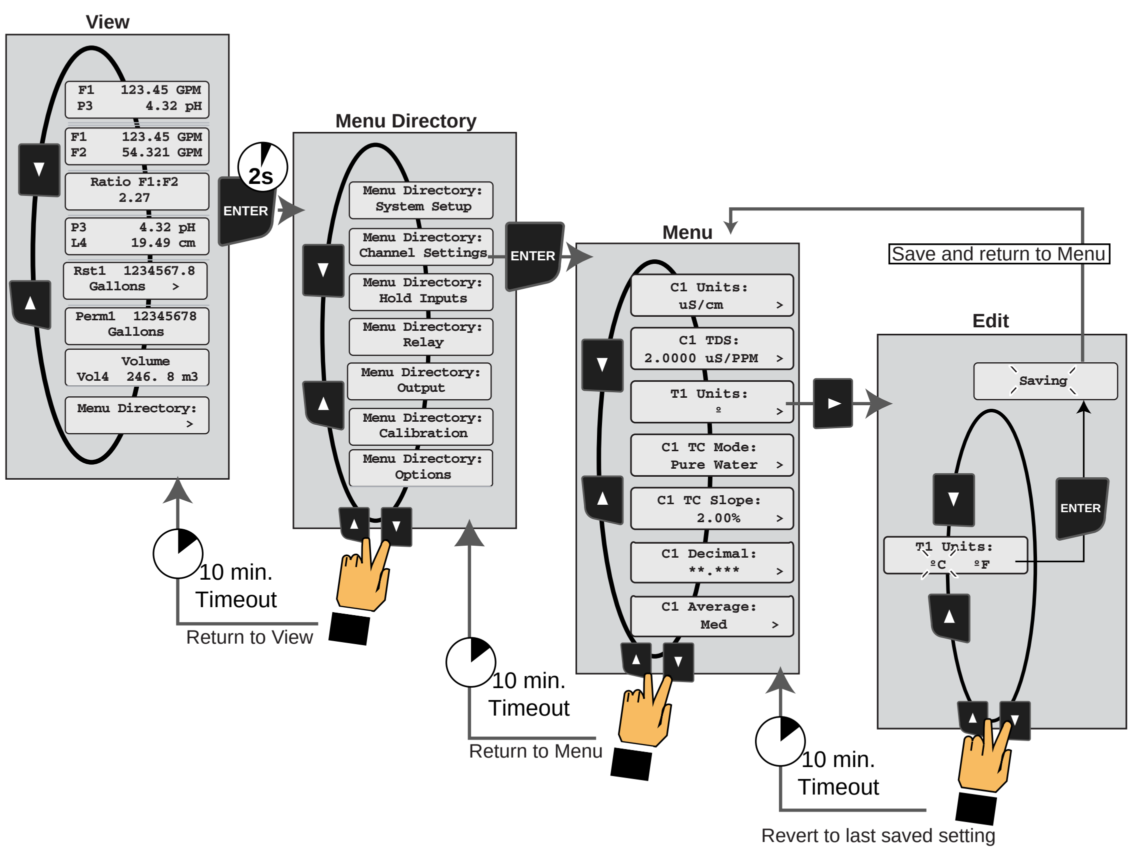


Display Mode	▲ ▼	►	ENTER	▲ ▼ Pressed simultaneously
View	Scroll through items in View	Select items marked with ►	Go to Menu Directory	No function
Menu Directory	Scroll through items in Menu Directory	Scroll DOWN through items in Menu Directory	Select menu	Return to View
Menu	Scroll through items in Menu	Select menu item for editing	No function	Return to Menu Directory
Edit	Scroll through flashing items, or edit flashing character	Scroll DOWN/RIGHT through flashing items, or advance flashing cursor "_"	Save new setting	Escape to menu item without saving new setting
	Function			

7.2 General Operation Flowchart

The four display modes of the 8900 are layered as shown in the flowchart below. Keypad symbols illustrate basic navigation within and between these modes.

- **View:** This is the default mode upon supplying power to the instrument. After system set-up is complete, all measurement values for each channel, plus the status of any analog outputs and relays will be available.
  See **section 7.3: View Mode** and **section 8: Menus** for details.
- **Menu Directory:** There are two ways to access the Menu Directory from View. The Menu Directory provides access to seven separate menus for set-up and operation.
  1. Scroll to the Menu Directory item and press the Right-arrow button.
  2. From any item in View, press and hold the ENTER button for 2 seconds.
- **Menu:** The current setting for each item in a Menu can be viewed and selected for editing from this mode.
- **Edit:** Access to this mode is password protected. Use the Standard password (UP-UP-UP-DOWN), or create a custom Enhanced password (see **section 8.8.1: Password** for details). Entering the correct password one time allows access to all editable items in all menus, until a return to View mode.



7.3 View Mode

Most of the items in View mode appear only after Channel Types and Measurement Display Screens are assigned via the System Setup menu. Since these two items determine much of the content of View, they will be described in this section.
Refer to **section 8.2 System Setup** for more information about these items, and before attempting to make measurements.

7.3.1 Channel Types

- A measurement type (flow, pH, ORP, conductivity, pressure, temperature or level) must be associated with a channel before any measurement values will appear in View. These assignments occur in Channel Types of the System Setup menu.
- Select “None” for Channel Type to hide a channel completely from View and from the other display modes.
- After Channel Types are assigned, the user determines the way in which measurements will appear in View. This does not occur automatically; see **section 7.3.2 Measurement Display Screens** and **section 8.1 System Setup** for details.
- If flow, pH or ORP measurement types are assigned to a channel, then the following information WILL automatically appear in View in a format that cannot be modified:

\- For each channel assigned to flow, two display screens will be added to View; one for a permanent totalizer (Perm~), and another for a resettable totalizer (Rst~):

```
Perm1 1234567.8
    Gallons
```

```
Rst2 1234567.8
    Gallons   ▶
```

\- For each channel assigned to pH or ORP, one display screen showing the raw mV input from the sensor will be added to View:

```
pH4 Input:
 -6.027 mV
```

```
ORP3 Input:
  763 mV
```

7.3.2 Measurement Display Screens

- The 8900 has a two-line display screen, like all the other ProcessPro instruments, but 8900 users choose to display either one or two measurements per screen.
- In fact, four measurement display screens are independently configurable for single-measurement format, or dual-measurement format, according to user preference. These selections occur in Measurement Display Screens of the System Setup menu.
- However, Channel Types must be assigned before Measurement Display Screens can be assigned. The measurements available for display are entirely dependent on channel type assignments.
- From the Options menu, users may also choose to enable Auto Scroll for these four screens.

Measurement Type	Abbreviation	Unit(s) of Measure
Flow (rate)	F~	units per s, m, h, d
pH	pH~	pH
ORP	ORP~	mV
Conductivity	C~	uS/cm, mS/cm, PPM & PPB (TDS), kΩ, MΩ
Pressure	P~	psi, kPa, bar, cm, m, in., ft.
Temperature	T~	°C, °F
Volume (level)	V~	cm^3, m^3, in^3, ft^3, gal, L, lb, kg

- For single-measurement display format, assign the measurement to one of the lines of the screen and set the other line to "None". The measurement’s full name will appear on the first line, and the abbreviation with channel number, the measurement value, and the unit of measure will appear on the second line:

```
  Measurement
Abbrev Val Unit
```

```
      Flow
F1     127.4 GPM
```

- For dual-measurement display format, assign each measurement to the desired line of the screen. The measurement abbreviation with channel number, the measurement value, and the unit of measure will appear on each line:

```
Abbrev Val Unit
Abbrev Val Unit
```

```
pH2        7.1 pH
C3    4.55 uS/cm
```

- Units of measure are assigned in the Channel Settings menu.
- If both lines of a display screen are set to "None", then the display screen will be hidden from View.
- The default setting for both lines of each measurement display screen is "None", so these screens will remain hidden until assigned in System Setup.
- All items in View, except Measurement Display Screens and Derived Measurement Displays, have a 10-minute timeout back to the first measurement display screen. If all four configurable screens are hidden, then the timeout will go to the first screen that would normally follow (depends on installed options and setup details).

7.3.3 Derived Functions

- Whenever two or more measurements of the same type are present in the 8900 setup, the following derived functions become available for like pairs: Sum, Difference, Ratio, %Recovery (flow), %Reject and %Passage (conductivity). These assignments occur in Function Type of the Options menu.

- The 8900 allows up to three derived functions to be used for display and control at any one time. An example of the display for derived functions is shown here. This format cannot be modified.

```
Reject C3→C4
    99.1%
```

7.3.4 Analog Output Values

- The 8900 supports up to four analog outputs. If installed, output values will be displayed automatically, in pairs, in a format that cannot be modified.
- Outputs will remain in error condition (as shown in this example) until properly assigned in the Output menu, or until a true error affecting output source is remedied.
- There is a 10 minute timeout from this item back to the first measurement display screen.

```
Output1 22.10 mA
Output2 22.10 mA
```

7.3.5 Relay Status Indicators

- The 8900 supports up to eight (8) relays; four internal, and four external. The four internal relays are numbered 1 through 4, and the four external relays are labeled A through D. In the Activated Relays screen, underscores ("_") are used to indicate relaxed or inactive relays.

```
Activated Relays
 _ _ _ _ _ _ _ _
```

- If a relay is activated, then its number or letter will replace the corresponding underscore. In the example below, relays 1 & 2 and A & B are activated:

```
Activated Relays
 1 2 _ _ A B _ _
```

- Relays that are not installed or connected will always be represented by the underscore.
- Relays will remain or become inactive (error condition) until properly assigned in the Relay menu, or until a true error affecting relay source is remedied.
- There is a 10 minute timeout from this item back to the first measurement display screen.

7.3.6 Memo

- The second line of this screen is alphanumerically editable, up to 15 characters, via the Memo item in the Options menu.
- Use this field to record important dates such as system commissioning or scheduled maintenance, or the telephone number of your local +GF+ sales representative.
- There is a 10 minute timeout from this item back to the first measurement display screen.

```
     Memo:
 gfsignet.com
```

7.3.7 System Configuration

- Selecting this item will initiate an auto-scrolling inventory of the plug-in modules installed in the unit.

```
System Config:
              >
```

- The order in which items appear is as follows:

```
Sensor Inputs:
# of channels
```

```
Outputs 1 & 2:
type or "None"
```

```
Power:
VAC or VDC
```

```
Comm/Out 3 & 4:
type or "None"
```

```
Relays 1 & 2:
type or "None"
```

```
External Relays:
detected or not
```

```
Outputs 1 & 2:
type or "None"
```

- To advance more quickly to the next screen, press any button during the auto-scrolling sequence.
- There is a 10 minute timeout from this item back to the first measurement display screen.

7.3.8 Menu Directory

- Select this item to exit View and go to the Menu Directory.
- The Menu Directory may also be reached from any item in View by pressing and holding the ENTER button for two seconds.
- The Menu Directory provides access to the seven separate menus of the 8900: System Setup, Channel Settings, Hold Inputs, Relay, Output, Calibration, and Options.
- The content and utility of each of these menus is described in **section 8: Menus**.
- There is a 10 minute timeout from this item back to the first measurement display screen.

```
Menu Directory:
               >
```

```
Menu Directory:
System Setup
```

8. Menus

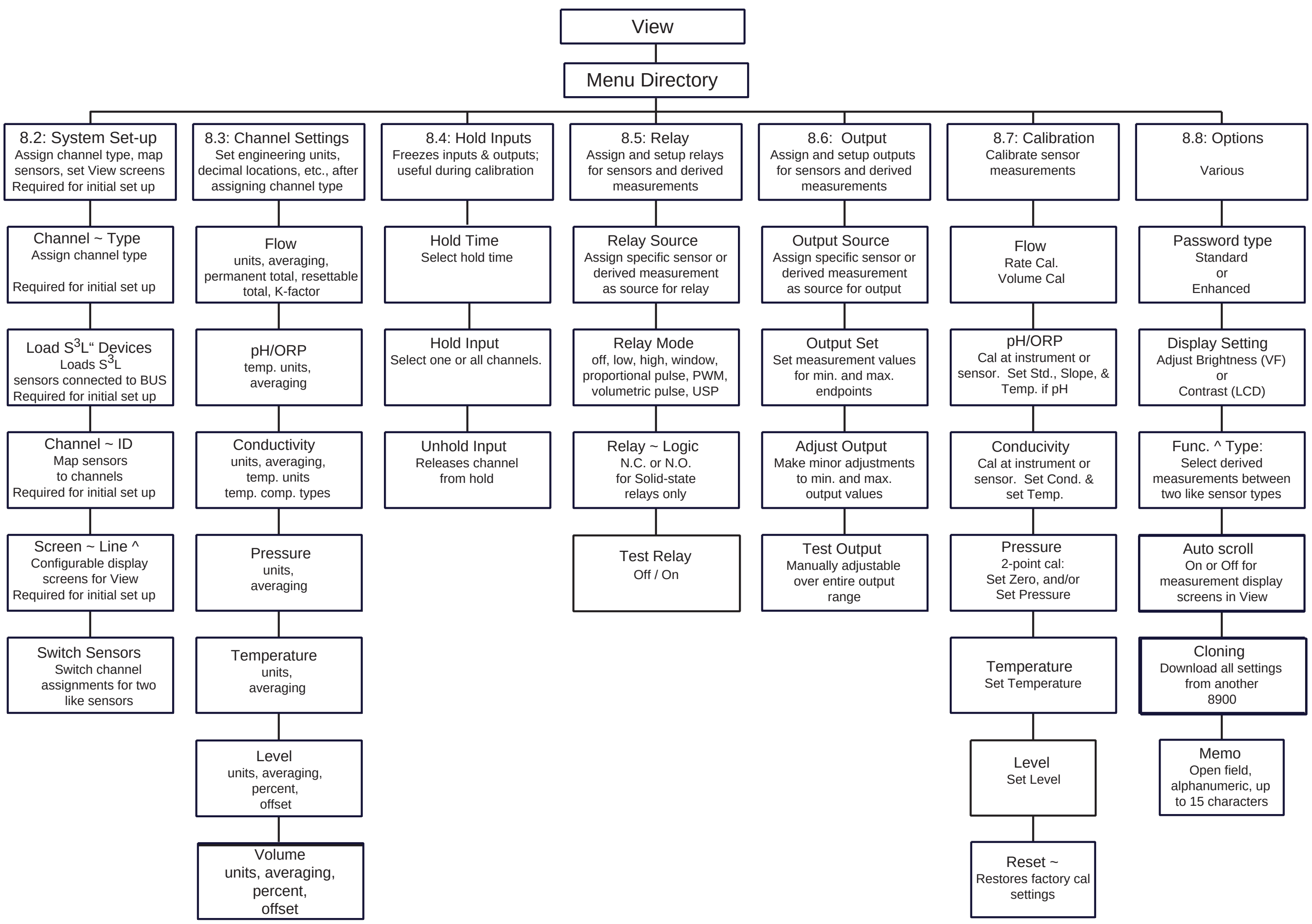
The 8900 is a multi-channel, multi-parameter controller based on a concept of extreme modularity. The number of possible hardware and measurement combinations attainable from this system is staggering. However, intelligent software assures that each individual configuration will not be burdened with unnecessary complexity.

When power is applied to the 8900 it automatically recognizes the types of plug-in modules installed and adjusts menu content accordingly. For example, there will be no reference to channels 3 and 4, in any of the menus, if an I/O Module containing only two inputs is installed. Likewise, Relay and Output menus automatically tailor themselves to each optional module, and will expand or contract to the number installed. Menus are further refined by selections made during System Setup, particularly Channel Type assignment(s).

To help produce a highly intuitive structure, each menu is a functional division of the whole system. This section begins with general guidelines for getting started toward making measurements with the 8900, then provides detailed descriptions and instructions for using each menu to achieve the functionality required of specific applications.

8.1 General Guideline

To begin making measurements: install plug-in modules, connect sensors, apply power, complete the items in System Setup, and exit to View to monitor measurements. Go to other menus as applicable to customize instrument settings.



8.1.1 Pre-configuration Guidelines

To pre-configure a unit for a given application, before actually deploying it to the field for sensor connection and commissioning for instance, follow these guidelines:

1. Install plug-in modules and apply power to the unit.
2. Go to the Channel Type item in the System Setup menu and assign measurement types to channels.
3. Exit System Setup and go to the Channel Settings menu. Make adjustments to default settings as required.
4. Exit Channel Settings and go to the Relay menu, if applicable (if not, go to step 5). Menu items for external relays A through D are always present in the Relay menu. Menu items for internal relays 1 through 4 will only appear if installed. Make adjustments to default settings as required.
5. Exit Channel Settings or Relay and go to the Output menu, if applicable (if not, go to step 6). Menu items for outputs will only appear if installed. Make adjustments to default settings as required.
6. Exit Channel Settings or Output and go to the Options menu. Make adjustments to default settings as required.
7. Exit Options and go back to the System Setup menu. Scroll to Measurement Display Screens (Screen # Line #) and setup measurement display preferences for View mode.
8. Exit System Setup and Menu Directory. Scroll through items in View to assure proper setup.

   Note: "CHK SENSOR" is normal when:

   a. sensors are not connected, or
   b. S^3L devices have not been loaded, or
   c. channel ID has not been assigned.

   Note: b. and c. can only be remedied after sensors are connected.
9. Remove power from the unit. All settings will be saved indefinitely in the non-volatile memory.
10. 8900 systems may be transported from one location to another with plug-in modules installed.

8.1.2 Making Measurements after Pre-configuration

To proceed to making measurements with a unit that has been pre-configured as described above, follow these guidelines:

1. Remove power from the unit (if applied), connect sensors, and then apply power to unit.
2. Go to the System Setup menu to Load S^3L Devices and/or assign Channel # ID.
3. Exit to View to monitor measurements.

8.2 System Setup

In terms of getting started and making measurements, System Setup is the most important menu in the 8900. And, the first and most important item in this menu is the Channel Type selection. Accessibility or content of virtually all items in every menu is reliant upon the association of measurement types with channels. This is the purpose of the Channel Type selection and until it occurs, no additional setup can be accomplished.

After channel types are assigned, relevant items in other menus become available for adjustment from default settings. To proceed to making measurements, the remaining items in System Setup must be completed.

```
Channel 1 Type:
  Conductivity >
```

- Select a measurement type to be assigned to this channel:
  None, Flow, pH, ORP, Conductivity, Pressure, Temperature or Level.
- Select "None" to hide a channel completely from View and other display modes.
- Making changes to a Channel Type will reset selections for that channel to default settings in all other menus. To change a channel type by mistake will waste previous setup efforts, so two warning messages and the question “Are You Sure?” are posed each time a change is made to Channel Type.

```
    Load S3L
    Devices:   >
```

- Scans the S^3L network and loads all connected S^3L devices.
- Stores sensor ID numbers for subsequent channel assignment.
- S^3L sensor ID numbers = the last ten digits of the sensor serial number.
- Perform this step upon initial setup, whenever changes are made to Channel Types, or when sensors or external relay modules are added to, or removed from, the S^3L network.

```
Channel 1 ID:
  3456789012   >
```

- Select a specific S^3L sensor (from the ID numbers loaded in the previous step) to be assigned to this channel.
- Only the ID numbers of sensors matching the measurement type assigned to this channel will be available for selection.
- If the same measurement type is assigned to more than one channel, sensor ID numbers are used to differentiate between them.
- If Channel Type = Flow, then this function is used to map Frequency Input 1 or 2 to this channel.
- Perform this step upon initial setup, whenever changes are made to Channel Types, or when sensors are added to, or removed from, the system.

```
Screen 1 Line 1:
Temperature T1 >
```

- Four measurement display screens with two lines each may be configured for View.
- Select the measurement types to be displayed, the sequence in which they will appear, and single or dual-display format.
- For single-display format, set one of the lines of a screen to “None”.
- See **section 7.3.2 Measurement Display Screens** for additional information.

```
Switch Sensors
   (CAUTION!)  >
```

- Appears only if the same measurement type is assigned to more than one channel.
- This function reverses the channel assignment of any two sensors of the same type.
- The CAUTION is that all instrument settings will remain with the channel, and only the sensor channel assignments will be switched.
  Use this function to quickly resolve situations in which customized instrument settings are associated with the wrong sensor in the installation.

8.3 Channel Settings

8.3.1 Channel Settings: If Channel Type = Flow:

```
F1 Units:
GPM          >
```

Set the units of measure for this flow channel.
The last character sets the timebase:
Select **S** (seconds) **M** (minutes) **H** (hours) **D** (days)

```
F1 K-Factor:
60.000       >
```

Set K-factor (pulses per unit volume) from Flow Sensor manual:
Minimum: 0.0001 Maximum: 99999. (Cannot be zero)

```
F1 Decimal:
**.***       >
```

Select decimal resolution for Flow Rate display:
XXXXX. XXXX.X XXX.XX XX.XXX X.XXXX

```
Tot1 Unit:
Gallons      >
```

This setting identifies the Totalizer units. It has no effect on any calculation.
Up to eight (8) alphanumeric characters, upper & lower case, serve as a label only.

```
Tot1 Factor:
60.000       >
```

Tot~ Factor: Sets the volume of each count of the Totalizer as a multiple of the volume unit of the K-factor: If K-factor = pulses per gallon, and Tot~ Factor is set to 1.000, then Totalizer counts once per gallon; if Tot~ Factor is set to 10.00, then Totalizer counts once for every 10 gallons, etc.
Minimum: 0.0001 Maximum: 99999. (Cannot be zero)

```
Tot1 Decimal:
******.**    >
```

Select decimal resolution for Totalizer displays:
XXXXXXXX. XXXXXXX.X XXXXXX.XX

```
Tot1 Reset:
Lock Off     >
```

Lock On: EDIT code required to reset the Resettable totalizer to zero.
Lock Off: No EDIT code required to reset the Resettable totalizer to zero.

```
F1 Average:
Med          >
```

Dampens display, output and relay response rates for this channel.
Off: Near instantaneous updates
Low: 4 s **Med**: 8 s **Hi**: 32 s

8.3.2 Channel Settings: If Channel Type = pH

T1 Units: °C >	Select the unit of measure for the temperature sensor inside the pH electrode: **°C** or **°F**
pH1 Average: Med >	Dampens display, output and relay response rates for this channel. **Off**: Near instantaneous updates **Low**: 4 s **Med**: 8 s **Hi**: 32 s

8.3.3 Channel Settings: If Channel Type = ORP

ORP1 Average: Med >	Dampens display, output and relay response rates for this channel. **Off**: Near instantaneous updates **Low**: 4 s **Med**: 8 s **Hi**: 32 s

8.3.4 Channel Settings: If Channel Type = Conductivity

C1 Units: uS/cm >	Select the unit of measure for this conductivity channel: **uS/cm** **mS/cm** **kΩ • cm** **MΩ • cm** **PPM or PPB (of TDS)**
C1 TDS: 2.0000 uS/PPM >	If units for this channel are PPM or PPB: set the ratio of µS per PPM. **Minimum 0.01 µS per PPM** **maximum 99999.9 µS per PPM**
T1 Units: °C >	Select the unit of measure for the temperature sensor inside the conductivity electrode: **·C** **·F**
C1 TC Mode: Pure Water >	Select method of temperature compensation: **None** required for USP **Linear** best for water with conductivity of more than 0.2 µS/cm (5.0 Mý resistivity) **Pure Water** best for water with conductivity of less than 0.2 µS/cm (5.0 Mý resistivity)
C1 TC Slope: 2.00 % >	Nominal setting is 2% change in conductivity for each 1º C shift from 25ºC. **Maximum setting is 9.99% per °C**
C1 Decimal: **.*** >	Select decimal location for this conductivity display: **XXXXX.** **XXXX.X** **XXX.XX** **XX.XXX** **X.XXXX**
C1 Average: Med >	Dampens display, output and relay response rates for this channel. **Off**: Near instantaneous updates **Low**: 4 s **Med**: 8 s **Hi**: 32 s

8.3.5 Channel Settings: If Channel Type = Pressure

```
P1 Units:
  psi      >
```

Select the unit of measure for this pressure channel : **psi** **bar** **kPa**

```
P1 Decimal:
 **.***    >
```

Select decimal location for this pressure display:
XXXXX. **XXXX.X** **XXX.XX** **XX.XXX**

```
P1 Average:
  Med      >
```

Dampens display, output and relay response rates for this channel.
Off: Near instantaneous updates
Low: 4 s **Med**: 8 s **Hi**: 32 s

8.3.6 Channel Settings: If Channel Type = Temperature

```
T1 Units:
  °C       >
```

Select the unit of measure for this temperature channel: **·C or ·F**

```
T1 Average:
  Med      >
```

Dampens display, output and relay response rates for this channel.
Off: Near instantaneous updates
Low: 4 s **Med**: 8 s **Hi**: 32 s

8.3.7 Channel Settings: If Channel Type = Level

```
L1 Units:
   ft        >
```

Select the unit of measure for this Level channel: **cm** **m** **in** **ft**

```
Show L1 in %:
     No      >
```

Yes: Level measurement will be displayed as a percentage of full scale.
No: Level measurement will be displayed in unit of measure selected in previous setting.

```
L1 100%=
0.00 ft      >
```

If level measurement will be displayed as a percentage, set the full scale value (100%) in units of measure.

```
L1 Decimal:
  **.***     >
```

Select the decimal location for this Level display.
XXXXX. XXXX.X XXX.XX XX.XXX X.XXXX

```
Sensor 1 Offset:
 +XXX.XX   ft  >
```

Enter the distance (in units of measure) from the sensor to the zero reference point.
See Appendix for additional information.

Note: The following channel settings for Volume may be ignored if not applicable to the application.

```
V1 Units:
   ft3       >
```

Select the unit of measure for Volume displays from this level sensor:
cm^3 m^3 in^3 ft^3 gal lit lb kg

```
Show V1 in %:
     No      >
```

Yes: Volumetric measurements will be displayed as a percentage of full scale.
No: Volumetric measurements will be displayed as units selected in previous setting.

```
V1 100% =:
0.0000 gal   >
```

If Volume measurement will be displayed a percentage, set the full scale value (100%) in units of measure.

```
Spec Gravity L1:
   1.0000    >
```

If a pressure sensor is used for Level measurement, enter the specific gravity of the fluid.

8.3.8 Channel Settings: If Channel Type = Level (continued)

```
  V1 Shape:
Vert Cylinder  >
```

Select the shape of the vessel where the level sensor is located.
Vert Cylinder   Horiz Cylinder   Rectangular   Custom

```
 V1 Diameter:
 10.000  ft   >
```

If Vert Cylinder or Horiz Cylinder is selected, enter the diameter of the cylinder.
0.0000 to 99999.

```
 V1 Length:
 5.0000  ft   >
```

If Horiz Cylinder or Rectangular shape is selected, enter the length of the vessel.
0.0000 to 99999.

```
 V1 Width:
 2.0000  ft   >
```

If Rectangular shape is selected, enter the width of the vessel.
0.0000 to 99999.

```
 V1 Cal Points:
      10      >
```

If **Custom** shape is selected, enter the number of measurement points to be used to charactrize the vessel shape.
Minimum 2 points, maximum 20 points. A larger number of points improves accuracy.

```
L1 Measurement:
     Manual   >
```

```
Pt01: -1234.5 ft
V1: +5432.1 gal>
```

Manual: Enter Level and Volume for each custom point. These points are typically determined by calculation.

Automatic: Enter Volume only for each custom point. Use this method if the volume associated with each level can be easily measured.

```
 V1 Decimal:
   **.***     >
```

Select the decimal location for the Volume display. Must be consistent with the range:
XXXXX.   XXXX.X   XXX.XX   XX.XXX   X.XXXX

```
  L1 Average:
    Med       >
```

Dampens display, output and relay response rates for this channel.
Off: Near instantaneous updates
Low: 4 s   **Med**: 8 s   **Hi**: 32 s

8.4 Hold Inputs

```
 Hold time: min
 5 10 30 60  ∞
```

Set the duration the channel should be held:
5   10   30   60   (infinite time, until manually released)

```
 Hold Input:
 Conductivity C1>
```

Holds status of input, output and relay functions (flow totalizers will continue counting, however). Useful during calibration to avoid false alarms and unwanted engagement of control equipment.

```
 Un-Hold Input:
 Conductivity C1>
```

Manually release the channel on hold. (Appears only when a channel is held)

8.5 Relay

The following table contains modes of operation for internal and external relays, by measurement and function type, supported by the 8900:

			Internal Relays							
			External Relays							
		Mode:	Off	Low	High	Window	USP	Prop. Pulse*	PWM	Vol. Pulse
	Source									
Measurement	Flow		X	X	X	X		X	X	X
Measurement	pH		X	X	X	X		X	X	
Measurement	ORP		X	X	X	X		X	X	
Measurement	Conductivity		X	X	X	X	X	X	X	
Measurement	Pressure		X	X	X	X				
Measurement	Temperature		X	X	X	X		X	X	
Measurement	Level		X	X	X	X		X	X	
Function	Sum		X	X	X	X		X	X	
Function	Difference		X	X	X	X		X	X	
Function	Ratio		X	X	X	X		X	X	
Function	% Reject		X	X	X	X		X	X	
Function	% Passage		X	X	X	X		X	X	
Function	% Recover		X	X	X	X		X	X	

* Maximum pulse rate: 400 pulses per minute

See Appendix E for more information about relay mode functionality.

```
Relay 1 Source:
     Flow F1   >
```

Select measurement type or derived function to be assigned to this relay.

```
Relay 1 Mode:
      Low      >
```

Select the mode of operation for this relay:
Off, Low, High, Window, Prop Pulse, PWM, Volumetric Pulse, USP

```
Relay 1 SetPnt:
   10.0 GPM    >
```

If relay mode is Low or High: Enter the relay setpoint.

```
Relay 1 Rng: min
  +25.000 GPM  >
```

If relay mode is Prop Pulse, PWM or Window: Enter the low-end setpoint.

```
Relay 1 Rng: max
  +45.000 GPM  >
```

If relay mode is Prop Pulse, PWM or Window: Enter the high-end setpoint.

```
Relay 1 Period:
   5.0 secs    >
```

If relay mode is PWM, set the pulse period. **Minimum 0.1 s, maximum 3240 s (54 minutes)**

```
Relay 1 Hys:
   5.0 GPM    >
```

If relay mode is High, Low, Window or USP: Enter hysteresis.

```
Relay 1 Delay:
   1.0 sec    >
```

If relay mode is High, Low, Window or USP: Enter the trigger time delay. The relay will activate only if the process value exceeds the setpoint for this period of time.
Minimum 0.1 s, maximum 6400 s (106.67 minutes)

```
Relay 1 maxRate:
 120 pls/min  >
```

If relay mode is Pulse: Set the maximum pulse rate. (**1 to 400 pulses per minute.**)

```
Relay 1 Volume:
100.00 Gallons >
```

If relay mode is Vol Pulse (Flow): Set the volume represented by one pulse.

```
Relay 1 P.Width:
    0.1 secs  >
```

If Relay mode is pulse: Set the duration of the relay pulse.
Minimum 0.1 s, maximum 3240 s (54 minutes)

```
Relay 1 Logic:
     N.O.     >
```

For solid state relays only:

N.C. = Normally Closed
N.O. = Normally Open

```
Test Relay 1:
              >
```

Manually toggle relay to test operation.

8.6 Output

Output 1 Source: Flow 1 >	Select measurement type or derived function to be assigned to this output.
Output 1 Range: 0-5Vdc >	If Voltage output card is installed: Select **0-to-5 VDC** or **0-to-10 VDC.**
Output 1 0Vdc: +25.000 GPM >	If Voltage output card is installed: Enter the low-end setpoint = 0 VDC.
Output 1 5Vdc: +25.000 GPM >	If Voltage output card is installed: Enter the high-end setpoint = 5 or 10 VDC.
Adjust 1 Low: 0 V >	Adjust the output voltage at low-end setpoint: 0 to 0.5 VDC.
Adjust 1 High: 5 V >	Adjust the output voltage at high-end setpoint: 4.5 to 5.5 VDC or 9.5 to 10.5 VDC.
Output 1 4mA: +25.000 GPM >	If Current output card is installed: Set the low-end setpoint = 4 mA.
Output 1 20mA +25.000 GPM >	If Current output card is installed: Set the high-end setpoint = 20 mA.
Adjust 1 Low: 4.00 mA >	Adjust the output current at low-end setpoint: 3.8 to 5.0 mA.
Adjust 1 High: 20.00 mA >	Adjust the output current at high-end setpoint: 19.0 to 21.0 mA.
Test Output 1: >	Manually adjust analog output to test operation. If 4-20 mA, test limits are **3.8 mA to 21.0 mA**. If 0-5 VDC, test limits are **0.00 to 5.50 VDC**. If 0-10 VDC, test limits are **0.00 to 10.50 VDC**.

8.7 Calibration

8.7.1 Calibration: If Channel type = Flow

F1 Cal Method: Volume >	**Rate:** Select rate-based method of calibration. **Volumetric:** Select volumetric method of calibration.
Volumetric Cal F1: >	Select to perform volumetric calibration.
Press <ENTER> to Start Cal	Press ENTER to start the volumetric calibration period. The 8900 starts counting pulses from the flow sensor.
Press <ENTER> to Stop Cal	Press ENTER to stop the volumetric calibration period. The 8900 stops counting pulses from the flow sensor.
Enter Volume: 0000.0 GPM	Enter the volume of fluid known to have flowed past the sensor during the volumetric calibration period. This will modify the existing Flow K-factor.
New K-Factor: 123.456	Successful volumetric calibration. Press ENTER to accept the new K-factor or press UP-DOWN keys simultaneously to escape without saving and return to Enter Volume.
Error: K-Factor Out Of Range	The calculated K-factor is less than 0.0001 or greater than 99999. Returns to Enter Volume.
Error: No Flow Detected	Indicates that the flow sensor is not generating any pulses, or pulses are not detected by the 8900. Returns to Volumetric Cal.
F1 Rate Cal: >	Select to match the dynamic momentary flow rate as indicated by an external reference. Entering a rate will modify the existing K-factor.

8.7.2 Calibration: If Channel type = pH

pH1 Cal at: Sensor >	SENSOR: Select to perform calibration at the sensor via 2750 EasyCal. INSTRUMENT: Select to perform calibration at the 8900 via the steps below. If Cal at Instrument is selected, the following menu items appear:
Set pH1 Std: >	Place sensor in any pH buffer. Allow sufficient time for sensor output to stabilize, then enter value. Maximum offset allowed: ±1.3 pH.
Set pH1 Slope: >	Place sensor in any buffer that is different by at least 2 pH units from Std value, then enter value. Maximum offset allowed: ±1.3 pH.
Set Temperature T1: >	Adjust the temperature measurement from the pH sensor to match a reliable reference. Maximum offset allowed is ± 20°C
Reset pH1 to Factory Cal: >	If pH~ Cal at Instrument is selected, reset Standard, Slope and Temperature to factory calibration.

8.7.3 Calibration: If Channel type = ORP

ORP1 Cal at: Sensor >	SENSOR: Select to perform calibration at the sensor via 2750 EasyCal. INSTRUMENT: Select to perform calibration at the 8900 via the steps below. If Cal at Instrument is selected, the following menu items appear:
Set ORP1 Std: >	Place sensor in any ORP test solution. Allow sufficient time for sensor output to stabilize, then enter value. Maximum offset allowed: ±2900 mV.
Set ORP1 Slope: >	Place sensor in any buffer that is different by at least 30 mV from Std value, then enter value. Maximum offset allowed: ±2900 mV.
Reset ORP1 to Factory Cal: >	If ORP~ Cal at Instrument is selected, reset Standard and Slope to factory calibration.

8.7.4 Calibration: If Channel type = Conductivity

C1 Cal at: Sensor >	SENSOR: Select to perform calibration at the sensor via 2850 EasyCal. INSTRUMENT: Select to perform calibration at the 8900 via the steps below. If Cal at Instrument is selected, the following menu items appear:
Set Conductivity C1: >	Place sensor in any conductivity test solution. Allow sufficient time for sensor output to stabilize, then enter value.
Set Temperature T1: >	Adjust the temperature measurement from the conductivity sensor to match a reliable reference. Maximum offset allowed is ± 20°C
Reset C1 to Factory Cal: >	If C~ Cal at Instrument is selected, reset Conductivity and Temperature to factory calibration.

8.7.5 Calibration: If Channel type = Pressure

Set Zero P2: >	Select YES to set reading to zero at ambient atmospheric pressure. Maximum offset allowed is ± 2.75 psi.
Set Pressure P2: >	Adjust the pressure to match a reliable reference. Must be • 3 psi above zero point. Maximum offset allowed is ± 2.75 psi.
Reset P2 to Factory Cal: >	Reset the pressure calibration to factory setting.

8.7.6 Calibration: If Channel type = Temperature

Set Temperature T2: >	Adjust the temperature to match a reliable reference. Maximum offset allowed is ± 20°C.
Reset T2 to Factory Cal: >	Reset Temperature to factory calibration.

8.7.7 Calibration: If Channel type = Level

Set Level L1: >	Enter the level value (in inches) based on an external measurement.
Reset L1 to Factory Cal: >	Reset level calibration to factory setting.

8.8 Options

Display	Description
Password Type: Standard	The standard password is "UP-UP-UP-DOWN" Select Enhanced password to set a custom 4-digit code.
Select Enhanced Password:	If "Enhanced" password is selected, set any 4-digit numerical code: 0000 (default) to 9999. If the enhanced password is forgotten, see **section 8.8.2.1** below.
Contrast: 3 >	Adjust LCD contrast: 4 settings.
Brightness: 2 >	Adjust vacuum fluorescent brightness: 4 intensity levels.
Auto Scroll: Off >	Enable Auto Scroll for measurement Display screens in View.
Scroll Time: 4 secs >	Set the scroll time interval for each measurement display screen. **Minimum 1 second, maximum 99 seconds**. Press any key to interrupt autoscroll for 20 seconds, or the scroll time, whichever is greater.
Func. 1 Type: Ratio >	If two or more measurements of the same type are present, select a functional relationship between them: **Sum** **Difference** **Ratio** **% Reject** **% Passage** **% Recovery (A, B, or C)** **None**
Func. 1 Source: ORP1-ORP2 >	Select the two measurements to be used for this function.
Clone Instrument: >	Select "YES" to download all settings from another 8900. Both units must be equipped with the same plug-in modules, including the RS232 Comm Module. The DB-9 crossover cable accessory is required for this operation.
Memo: gfsignet.com >	Enter notes such as: next commissioning date, scheduled service, +GF+ Sales rep telephone number, etc.

8.8.1 Standard password
The standard password is the UP-UP-UP-DOWN keys, pressed in sequence.

8.8.2 Enhanced password
The enhanced password default setting is 0-0-0-0, adjustable to any 4-digit numerical code up to 9999.

8.8.2.1 Enhanced password Reset Procedure:
The following procedure will reset the Enhance Password to the factory default code of (0-0-0-0).
Note: For your security, this is intended to be difficult. Technical Tip: Do not forget the enhanced password!

1. Disconnect power.
2. Remove the I/O Module (remove terminals from this and all other plug-in modules installed, then the rear cover).
3. Cycle power to the unit (apply power for at least 15 seconds, then disconnect power again)
4. Install the I/O Module, the rear panel, and terminals as applicable.
5. Reconnect power to the unit.

Notes

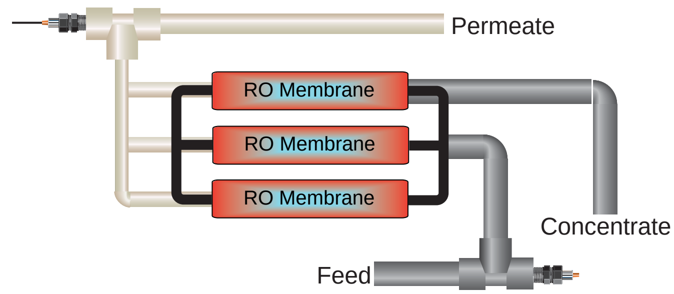
Appendix A: Derived Functions

When two or more measurements of the same type are present, the 8900 can calculate several derived functions from like pairs. Up to three derived Functions can be defined and used as the source for display and output functions.

- Flow, Temperature, Pressure, and Level channels must have matching units. (flow channels must also have same timebase)
- Conductivity channels will automatically scale to µS/cm before the function calculation is made.
- **Three derived measurements can be applied to any set of sensors, regardless of type.**
  - Ratio: Measurement 1 ÷ Measurement 2
  - Difference: Measurement 1 - Measurement 2
  - Sum: Measurement 1 + Measurement 2

% Passage and % Reject

- % Passage and % Reject are derived from conductivity measurements only, specifically for use in reverse osmosis systems.
- % Passage is the amount of contaminates remaining in the product water compared to the level of contaminates in the feed water. For example, if the feed water measures 100 µS and the product water measures 5 µS, the % Passage is (5 ÷ 100) x 100, or 5%.
- % Reject is the amount of contaminates rejected to the concentrate water compared to the amount of contaminates in the feed water. For example, if the % Passage is 5%, the % Reject is 95%.
- Decreasing Reject values and increasing Passage values usually indicate a problem with the RO membrane.

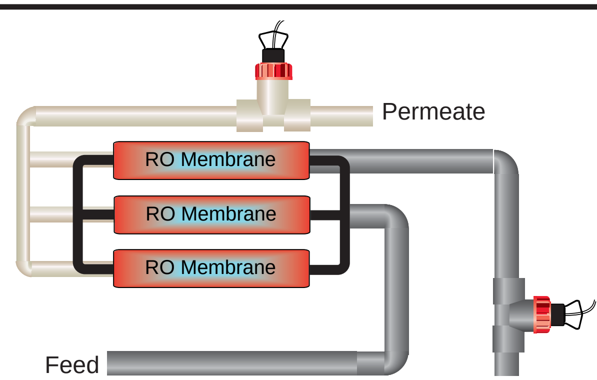


% Passage: **(Permeate ÷ Feed) x 100**

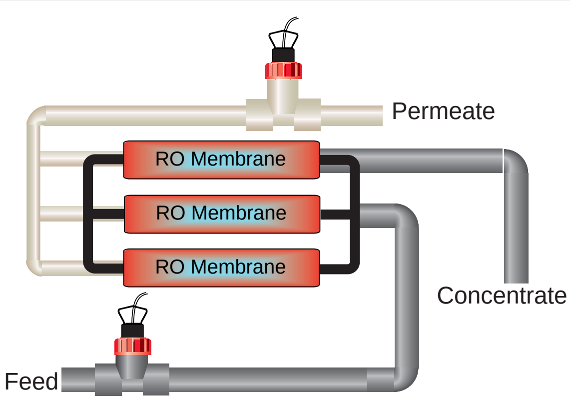
% Reject: **[1 - (Permeate ÷ Feed)] x 100**

% Recovery

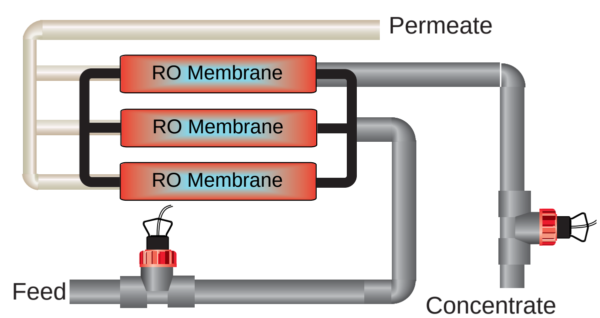
- % Recovery is a derived measurement based on flow rate only. In a reverse osmosis system, % Recovery is flow rate in the permeate (product) compared to the flow rate of the incoming feed water.
- To measure % Recovery, the 8900 must have two flow sensors connected. They may be located in the Feed line, the Concentrate line or the Permeate line.
- The 8900 provides 3 different methods for calculating Recovery to accomodate any configuration.
- Both flow sensors must use the same timebase and units of measure.



% Recovery B: Permeate ÷ **(**Permeate **+ Concentrate) x 100**
In the Setup menu, select the option that represents
Concentrate ∅ Permeate



% Recovery A: **(**Permeate ÷ **Feed)** x 100
In the Setup menu, select the option that represents
Feed ∅ Permeate



% Recovery C: **[(**Feed **- Concentrate)** ÷ Feed**] x 100**
In the Setup menu, select the option that represents
Concentrate ∅ Feed

Appendix B: Level System Configuration

The +GF+ SIGNET 2450 Pressure sensor can be used to calculate level values. The following information is required for this mode:

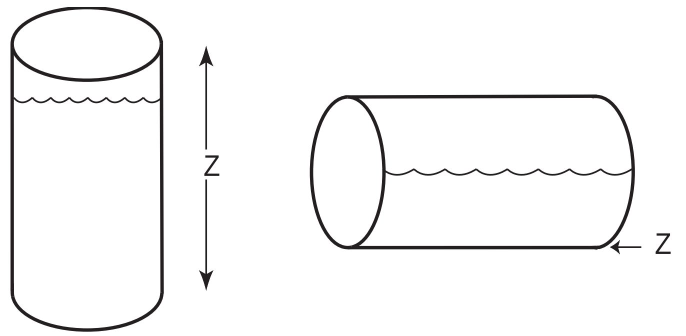
1. Determine where you want the level measurement to start. This is the Zero reference point (Z).
   Review the diagrams for your sensor type to help select the best option.
2. Determine where you will mount the sensor. This is $\mathbf{S_{Loc}}$.
   Consult the Sensor manual for information regarding the best location for the sensor.
3. Measure the distance between Z and S_{Loc}. This is **O(ffset).**
4. Enter the Offset into the Calibrate menu.

Zero reference point (Z):
Definition:
The point in the vessel where you want the 8900 to display zero (0 ft., 0 gal. etc).
- If Z is located below the fluid surface, the 8900 will display a positive level measurement.
- If Z is located above the fluid surface, the 8900 will display a negative level measurement.

Sensor Location point ($\mathbf{S_{Loc}}$):
Definition:
The point on the level sensor where the measurement is taken.
- Pressure sensors measure from the centerline of the diaphragm.

Offset (O):
Definition:
The distance from the zero reference point (Z) to the sensor location point (S_{loc}).
- Enter a positive value in the Calibrate menu if the sensor is located above Z (zero reference point).
- Enter a negative value in the Calibrate menu if the sensor is located below Z (zero reference point).
- Enter 0 in the Calibrate menu if the sensor is located at Z (zero reference point).

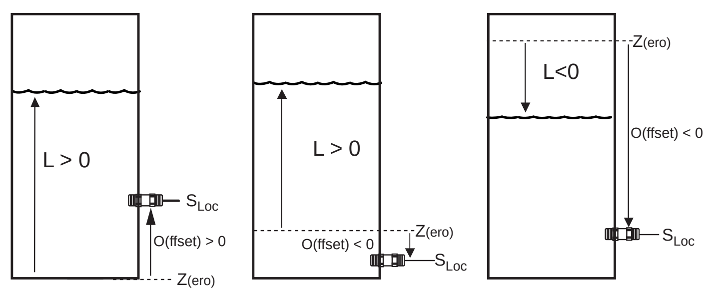
Level (L):
Definition:
- The distance from Z (zero reference point) to surface of fluid.



For most vessels, the zero reference point may be designated as any height in the vessel.

For horizontal cylinders only, the zero reference point MUST be the lowest point in the vessel.

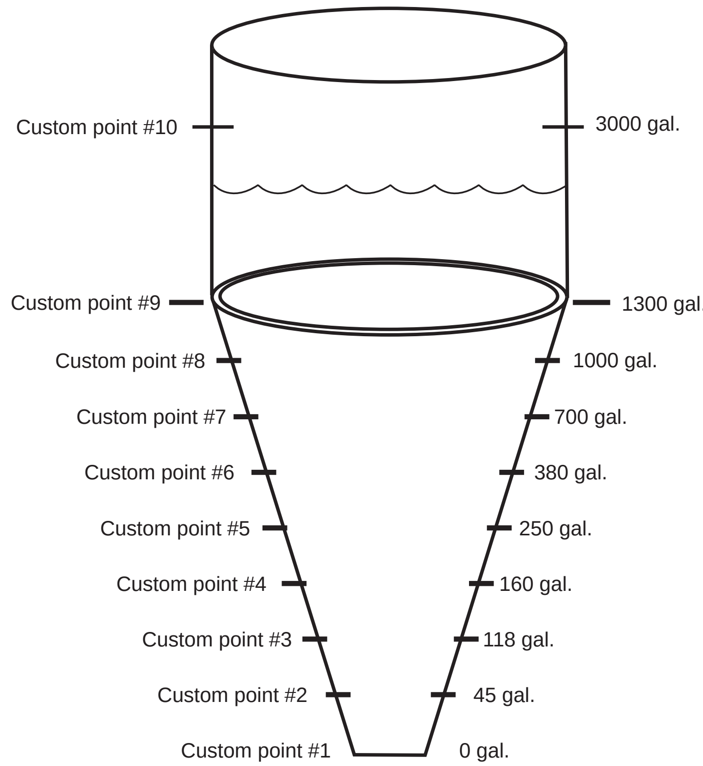
2450 Pressure Sensor Location and Offset



Level and Volume conversion in custom shaped vessels

If you select Custom Shape in the Options menu, you can define from 2 to 20 Custom Points to establish the relationship of level to volume in the vessel.

- Select Manual level Measurement mode to edit both level and volume data (dry configuration).
- Select Automatic level Measurement mode to accept the sensor measurement of the Level, while you assign a volumetric value to each custom point (wet configuration).
- Enter from 2 to 20 custom points to link level and volume values.
- The first custom point must be the lowest fluid level in the vessel.
- Each successive point must be greater than the preceding point.
- The last point must be equal to or greater than the highest fluid level in the vessel.
- A custom point should be located at all transition points in the vessel shape (for example, at custom point #9, where the shape changes from a cylinder to a cone).
- The more complex sections should be defined with more points. Notice that the conical section of the illustration has been defined by custom points 1 through 9.
- Simpler sections require fewer defining points. Note that the cylinder requires only custom points 9 and 10.



Custom vessel:
The 8900 performs linear interpolation between adjacent points.

Technical Reference for Level measurement

Level, volume and mass calculations performed by the 8900 include:

Pressure to level conversion:

Level = P ÷ (SG • $D_{(water)}$)

where P = Pressure
SG = Specific Gravity of fluid
$D_{(water)}$ = Density of water

With pressure in psi: Level (meters) = (0.703069 • P / SG)
with pressure in bar: Level (meters) = 1.019715 • P / SG)

Mass conversion

$$m = D_{(water)} \cdot SG \cdot V$$

where m = mass of fluid
$D_{(water)}$ = Density of water = 1000 kg/m^3
SG = Specific Gravity of fluid
V = Volume of fluid (m^3)

m (kg) = 1000 • SG • V

Volume calculations

Vertical cylinder: V = þ • d^2 • h/4

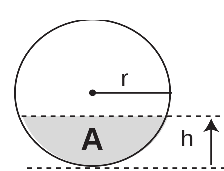
where d = diameter of cylinder
h = height of fluid

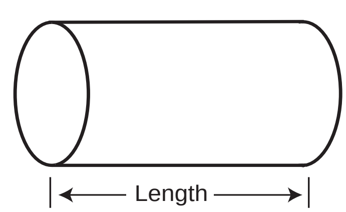
Rectangular vessel: V = w • l • h

where w = width
l = length

Horizontal cylinder: V = A • L

where A = area of segment
L = Length of vessel





Temperature Effects

Conductivity measurement is highly dependent on temperature. The basic rule is that higher temperatures result in greater conductance (less resistance).
Temperature effects are expressed as the percentage of conductivity change (in µS) per °C. The conductivity value is generally referenced to 25 ºC. The 8900 has three temperature compensation options:

None
USP standards for pharmaceutical waters require that the measurement be made without temperature compensation. USP limits are discussed on page 7.

Pure Water (Standard Compensation)
This selection is used for measurements of very clean water, less than 0.2 µS. Temperature effects are not linear in this range, so the temperature coefficient is not easily determined. This selection is recommended for all Resistivity applications measuring from 5 Mý to 18Mý. This selection conforms to ASTM standard D1125 and D5391.

Linear
This selection allows you to calculate a custom temperature compensation value for Conductivity measurements in the range of 0.2 µS and greater (Resistivity applications measuring less than 5 Mý). The procedure is outlined in the section on the right.

TDS Factor

Some industries need to display a conductivity value as Total Dissolved Solids (TDS), measured in units of parts per million (PPM) or parts per billion (PPB).

- 1 PPM is equivalent to 1 mg per liter.
- 1 PPB is equivalent to 1 µg per liter.
- The 8900 calculates PPM or PPB by dividing the µS value by a TDS Factor that you define.
- TDS factors can vary widely, ranging from 1.50 to 2.50 µS per PPM. Methods for establishing a TDS factor are beyond the scope of this manual.
- The 8900 will accept TDS factor values from 0.01 to 99999.9 µS per PPM.
  (factory preset = 2.00 µS per PPM)

NOTE: The 8900 TDS factor must be set in PPM.

TDS Factor = Conductivity (µS) ÷Total dissolved solids (PPM)
PPM = Solution conductivity (µS) ÷ TDS Factor

Example:

- Solution conductivity = 150 µS
- TDS = 80 PPM
- TDS Factor =150 µS ÷ 80 PPM = **1.88 µS per PPM**

Calculating a Linear Temperature Coefficient

1. Set TC Mode to NONE (see SETUP menu).
2. Heat a sample solution close to the maximum process temperature. Place sensor in the sample solution and allow several minutes for stabilization. Record the 8900 temperature and conductivity values in the spaces provided:

   Displayed temperature: T1 = _______ °C

   Displayed conductivity: C1 = _______ °C

3. Cool the sample solution close to the minimum process temperature. Place sensor in the sample solution allowing several minutes for stabilization. Record displayed temperature and conductivity values in the spaces provided:

   Displayed temperature: T2 = _______ °C

   Displayed conductivity: C2 = _______ °C

   (A 10% change in conductivity between steps 2 and 3 is recommended.)

4. Substitute recorded readings (steps 2 and 3) into the following formula:

$$\text{TC Slope} = \frac{100 \times (C1 - C2)}{(C2 \times (T1 - 25)) - (C1 \times (T2 - 25))}$$

Example: A sample solution has a conductivity of 205 µS @ 48°C. After cooling the solution, the conductivity was measured at 150 µS @ 23 °C. (C1 = 205, T1 = 48, C2 = 150, T2 = 23)

The TC is calculated as follows:

$$\text{TC Slope} = \frac{100 \times (205 - 150)}{(150 \times (48 - 25)) - (205 \times (23 - 25))} = \frac{5500}{3860} = 1.42\%/°C$$

Conductivity Calibrate Procedure

Wet Calibration with NIST Traceable Solutions:

- When using NIST traceable standards, review the temperature information provided with the test solution.
- Prevent contamination of the test solution.
- The sensor must be at the temperature specified on the test solution label.
- Remove the sensor from the system and rinse in a small amount of test solution.
- Place the sensor into the test solution. Gently stir/shake the electrode to dislodge any air bubbles on the electrode.
- Place a reference thermometer into the same solution.
- Allow sufficient time for the temperature to stabilize.
- Set Temp: Adjust the temperature value based on the reference thermometer.
- Set Cond: Adjust the conductivity value based on the test solution value.
- Verify the linearity of the 8900 by placing the sensor into a second test solution of a different value.
- If the 8900 does not display the correct value (Temperature ± 0.5 ºC, Conductivity ± 2% of reading), service is required.

Appendix D: USP Limits

USP (United States Pharmacopoeia) has defined a set of conductivity values (limits) to be used for pharmaceutical water monitoring. This standard requires non-temperature compensated conductivity measurement be used to warn if the conductance approaches the USP limit. The limits vary according to the temperature of the sample.
The 8900 has the USP limits stored in memory. It will automatically determine the proper USP limit based on the measured temperature.

Using the USP function

USP setpoints are defined as a percentage below the USP limit, so a USP alarm is always a HIGH alarm. The 8900 can be set to warn you if the conductivity approaches within a set percentage of the USP limit.

The following settings and conditions are required for a USP relay function:

1. In the Setup menu:
- RELAY MODE must be set to USP.
- RELAY SOURCE must be a Conductivity channel
- SOURCE UNITS must be set to µS.

2. In the OPTIONS menu:
- The TC Mode of the USP channel must be set to **None**.

(Service tip: If a relay is constantly on when it should be off, check the relay settings listed above.)

Example:
- The USP setpoint is 40%.
- The water temperature is 19 ºC, so the USP limit is 1.0 µS.
- The relay will be activated when the conductivity value reaches 0.6 µS, or 40% below the 1.0 USP limit.
- If the water temperature drifts to more than 20ºC, the 8900 will automatically adjust the USP limit to 1.1.
- The relay will now be activated when the conductivity value reaches 40% below 1.1 µS, or 0.66 µS.

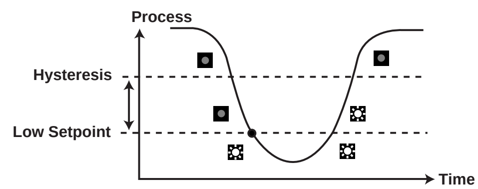
When the temperature range is:	The USP limit (µS) is:
0 to < 5 ºC	0.6
5 to < 10 ºC	0.8
10 to < 15 ºC	0.9
15 to < 20 ºC	1
20 to < 25 ºC	1.1
25 to < 30 ºC	1.3
30 to < 35 ºC	1.4
35 to < 40 ºC	1.5
40 to < 45 ºC	1.7
50 to < 55 ºC	1.8
55 to < 60 ºC	2.1
60 to < 65 ºC	2.2
65 to < 70 ºC	2.4
70 to < 75 ºC	2.5
75 to < 80 ºC	2.7
80 to < 85 ºC	2.7
85 to < 90 ºC	2.7
90 to < 95 ºC	2.7
95 to < 100 ºC	2.9
100 to < 105 ºC	3.1

Appendix E: Relay mode descriptions

Off:	Disables the relay
Low:	Relay activates when process value falls below setpoint.
High:	Relay activates when process value rises above setpoint.
Window:	Relay activates when process value moves above or below a fixed window of values.
Proportional Pulse:	Relay pulses at a rate defined by min and max process value settings. (Max rate 400 pulses per minute.)
Pulse Width Modulation:	Varies the relay duty cycle between minimum and maximum setpoints. Not applicable to flow and pressure.
Volumetric Pulse:	A pulse is generated when a specified volume of fluid is registered. For flow inputs only.
USP:	Relay activates when process value rises above USP defined conductivity and temperature limits. For conductivity inputs only.

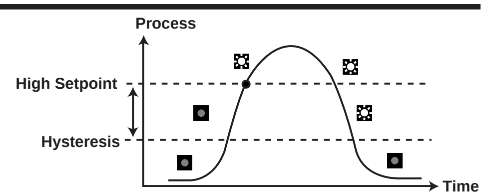
Low

- Relay is activated when the process variable is less than the setpoint.
- The relay is deactivated when the process variable becomes greater than the sum of the setpoint and the hysteresis.



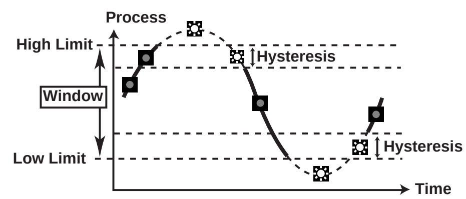
High

- Relay is activated when process variable is greater than the setpoint.
- The relay is deactivated when the process variable becomes less than the sum of the setpoint and the hysteresis.



Window

- In Window mode, a single relay is activated when the process variable moves above or below a fixed window of values.
- The relay is deactivated when the process variable moves inside the window by more than the hysteresis value.

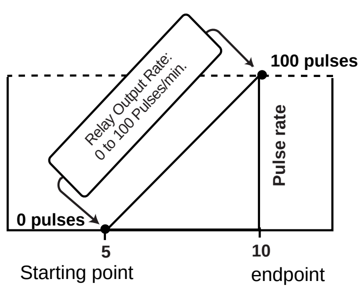


Proportional Pulsing

- Proportional Pulse mode varies the frequency of pulses in direct proportion to minimum and maximum setpoints.
- The 8900 does not allow use of this mode for Pressure applications.

Example:

- The output will be 0 pulses/min. at process values less than 5.0.
- The output will be 50 pulses/min. when the process value is 7.5.
- The output will be 100 pulses/min. at process values above 10.

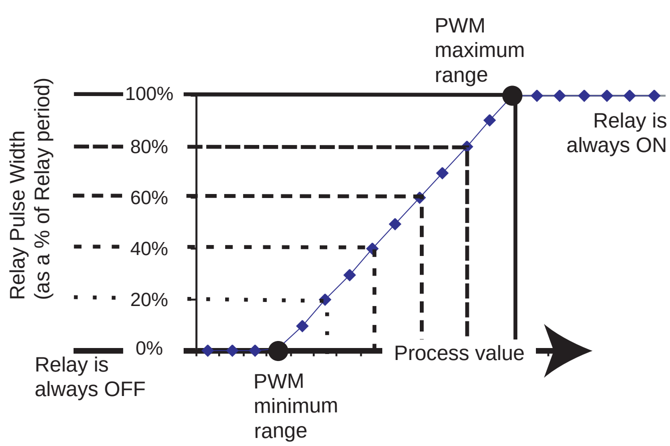


Pulse Width Modulation

- PWM automatically varies the ratio of ON time to OFF time proportional to minimum and maximum range settings.
- The relay period is the sum of the time a relay is ON and the time it is OFF.
- Relay pulse width is the time the relay is ON.
- The 8900 must be programmed with the relay period, and with the low and high setpoints.
- The 8900 does not allow use of this mode for Pressure applications.

Example:

- The pulse width will be 0% of the relay period (relay always OFF) when the process value is less than the minimum range.
- The pulse width will be 100% of the relay period (relay always ON) when the process value is greater than the maximum range.
- The pulse width will be 60% of the relay period when the process value is at 60% of the span between the minimum and maximum range.



Appendix F: 8900 display messages

Display Message	Explanation
Press <ENTER>To Stop Cal	This will stop the flow counting for volumetric cal
Enter Volume:	Enter a volume to calculate flow K-Factor
New K-Factor:	New K-Factor is calculated in flow vol. Cal
Channel Data Will be RESET!	Used when changing instrument types
Check Relay and Output Sources	Used when changing instrument types
Error: No Flow Detected	If no flow detected while performing a vol. Cal for flow
Error: K-Factor Out of Range	If calc. K-Factor bad while performing a vol. Cal for flow
Instrument Types Must be Selected	If entering Setup, Hold Input, or Cal menu before instrument types are selected
Must Have 2 or Less Flow Inputs	If two flow inputs are already chosen
Lost Signal	If an ultra sonic sensor outputs an out of range value
CHK SENSOR	If a sensor cannot be detected
Too Much Error CHECK SENSOR	Self explanatory
Value must be 6400 or less	If relay delay is set to a value greater than 6400
Value must be Greater than 0	If Specific Gravity or Auto Scroll time is set to zero
Must Have MoreThan 1 Point	If number of custom volume points is set to 0 or 1
Must Have 20 or Less Points	If number of custom volume points is greater than 20
WARNING: Table Must be Modified	If number of custom volume points id changed
Channel ~ CustomTable Error	If custom volume points are not monotonic and rising
Must be > Than Previous Point	If custom volume point is set to a value less than the previous point
No Relay Cards Installed	Self explanatory
No Output Cards Installed	Self explanatory
Channel Type Must be Selected	Self explanatory
Memory Error Load Defaults?	If setup data locations in the EEPROM are corrupted they can be re-loaded
Input Module Not Found	Self explanatory
Input/Out 1&2 Module Defective	Self explanatory
Comm/Out 3&4 Module Defective	Self explanatory
Cal Point Too Close to Zero	pres: Set pressure val too close to zero
Standard Too Close to Slope	pH/ORP: Attempt to cal w/pts too close to each other
Found New S3L Device(s)	Shows up on power up if new sensors were detected
Value Must Be 3240 or Less	If PWM period is greater than 3240 secs
Value Must be 0.1 or Higher	If PWM period is less that 0.1 secs
Value Must Be 400 or less	If Relay maxRate if greater than 400
Value Must Be1 or Higher	If Relay maxRate is less than 1
Value Must Be 1000.0 Or Less	If relay p.width is greater than 1000.0
All Settings Will Change!	If “Yes” is chosen to clone
Are You Sure? Press <ENTER>	<ENTER> starts clone process
Requesting Data From Host	Self Explanatory
Error: Invalid Host Version	If the two units have incompatible software versions
Error: No Data From Host	If no data or inclomplete data is received
Error: Data Transfer Failed	Transfer failed because of corrupt data
Transfer Complete	If clone process is successful
8900 Restarting	After a successful clone process
- - - - -	Overrange

Ordering Information

Mfr. Part No.	Code	Description
Base Unit, required; choose one		
3-8900	159 000 868	Base unit with back-lit LCD
3-8900-VF	159 000 869	Base unit with vacuum fluorescent display
I/O Module, required; choose one		
3-8900.401-1	159 000 870	Two inputs, no outputs
3-8900.401-2	159 000 871	Two inputs, two passive 4 to 20mA outputs
3-8900.401-3	159 000 872	Two inputs, two active 4 to 20mA outputs
3-8900.401-4	159 000 873	Two inputs, two 0 to 5/10 VDC outputs
3-8900.401-5	159 000 874	Four inputs, no outputs
3-8900.401-6	159 000 875	Four inputs, two passive 4 to 20mA outputs
3-8900.401-7	159 000 876	Four inputs, two active 4 to 20mA outputs
3-8900.401-8	159 000 877	Four inputs, two 0 to 5/10 VDC outputs
Power Module, required; choose one		
3-8900.402-1	159 000 878	85 to 264 VAC power
3-8900.402-2	159 000 879	12 to 24 VDC power
Relay Module, optional; choose zero, one or two		
3-8900.403-1	159 000 880	Two dry-contact relays
3-8900.403-2	159 000 881	Two solid-state relays
External Relay Module, optional; choose zero or one		
3-8059-2	159 000 770	Two external dry-contact relays
3-8059-2AC	159 000 771	Two external dry-contact relays w ith power supply
3-8059-4	159 000 772	Four external dry-contact relays
3-8059-4AC	159 000 773	Four external dry-contact relays with power supply
Additional Outputs, optional; choose zero or one		
3-8900.405-1	159 000 883	Two passive 4 to 20mA outputs
3-8900.405-2	159 000 884	Two active 4 to 20mA outputs
3-8900.405-3	159 000 885	Two 0 to 5/10 VDC outputs
3-8900.404-1	159 000 882	RS232 communication module

Accessories

Mfr. Part No.	Code	Description
3-8050-1	159 000 753	Universal Mount Junction Box
3-8050-1CR	159 000 889	Universal Mount Junction Box w/Ranges (for use with 2850)
3-8050-2	159 000 754	Universal Mount Junction Box w/EasyCal (for use with 2750)
3-8050-2CR	159 000 802	Universal Mount Junction Box w/EasyCal (for use with 2850)
3-8050.392	159 000 640	Panel adapter, 1/2 DIN to 1/4 DIN
3-8050.395	159 000 186	Splashproof rear cover
3-8050.396	159 000 617	RC Filter kit (for relay use, 2 pieces)
3-8052-1	159 000 755	3/4 in. NPT Mount Junction Box
3-8052-1CR	159 000 890	3/4 in. NPT Mount Junction Box w/Ranges (for use with 2850)
3-8052-2	159 000 756	3/4 in. NPT Mount Junction Box w/EasyCal (for use with 2750)
3-8052-2CR	159 000 803	3/4 in. NPT Mount Junction Box w/EasyCal (for use with 2850)
3-0000.596-1	159 000 892	1/4 DIN wall mount bracket, 6.5 in. (use if no rear cover is installed)
3-0000.596-2	159 000 893	1/4 DIN wall mount bracket, 9 in. (use if rear cover is installed)
3-5000.399	198 840 224	Panel adapter, 5 x 5 in. to 1/4 DIN
3-5000.598	198 840 225	Shelf/Pipe mount bracket
3-8900.390	159 000 891	DB-9 crossover cable (for clone mode)
3-9000.392	159 000 368	Liquid tight connector kit, (3 pieces)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)

Spare Parts

Mfr. Part No.	Code	Description
3-8900.614	159 000 902	14-terminal plug (for I/O Module)
3-8900.604	159 000 903	4-terminal plug (for Power Module)
3-8900.606	159 000 905	6-terminal plug (for Dry-contact Relays)
3-8900.602	159 000 904	2-terminal plug, 2 ea. (for SSR & Outputs 3 & 4)
3-8900.391	159 000 918	Rear Panel w/ Captive Screws
3-8900.561	159 000 919	Front Face Panel Gasket

‡ SIGNET

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3-8900.090-1 (B-11/03) English

Printed in U.S.A. on recycled paper