

User Manual

***Models N701 and N701H
Zero Air Generators***

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SAFETY MESSAGES

Important safety messages are provided throughout this manual for the purpose of avoiding personal injury or instrument damage. Please read these messages carefully. Each safety message is associated with a safety alert symbol, and placed throughout this manual and inside the instrument. It is imperative that you pay close attention to these messages, the descriptions for which are defined as follows:



WARNING: Electrical Shock Hazard



HAZARD: Strong oxidizer



GENERAL WARNING/CAUTION: Read the accompanying message for specific information.



CAUTION: Hot Surface Warning



Do Not Touch. Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.



Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.



Electrical Ground: This symbol inside the instrument marks the central safety grounding point for the instrument.

CAUTION



This instrument should only be used for the purpose and in the manner described in this manual. If you use this instrument in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

For Technical Assistance regarding the use and maintenance of this instrument or any other Teledyne API product, contact Teledyne API's Technical Support Department:

Telephone: 800-324-5190
Email: api-techsupport@teledyne.com

or access any of the service options on our website at <http://www.teledyne-api.com/>



CONSIGNES DE SÉCURITÉ

Des consignes de sécurité importantes sont fournies tout au long du présent manuel dans le but d'éviter des blessures corporelles ou d'endommager les instruments. Veuillez lire attentivement ces consignes. Chaque consigne de sécurité est représentée par un pictogramme d'alerte de sécurité; ces pictogrammes se retrouvent dans ce manuel et à l'intérieur des instruments. Les symboles correspondent aux consignes suivantes :



AVERTISSEMENT : Risque de choc électrique



DANGER : Oxydant puissant



AVERTISSEMENT GÉNÉRAL / MISE EN GARDE : Lire la consigne complémentaire pour des renseignements spécifiques



MISE EN GARDE : Surface chaude



Ne pas toucher : Toucher à certaines parties de l'instrument sans protection ou sans les outils appropriés pourrait entraîner des dommages aux pièces ou à l'instrument.



Pictogramme « technicien » : Toutes les opérations portant ce symbole doivent être effectuées uniquement par du personnel de maintenance qualifié.



Mise à la terre : Ce symbole à l'intérieur de l'instrument détermine le point central de la mise à la terre sécuritaire de l'instrument.

MISE EN GARDE



Cet instrument doit être utilisé aux fins décrites et de la manière décrite dans ce manuel. Si vous utilisez cet instrument d'une autre manière que celle pour laquelle il a été prévu, l'instrument pourrait se comporter de façon imprévisible et entraîner des conséquences dangereuses.

WARRANTY

WARRANTY POLICY (02024J)

Teledyne API (TAPI), a business unit of Teledyne Instruments, Inc., provides that:

Prior to shipment, TAPI equipment is thoroughly inspected and tested. Should equipment failure occur, TAPI assures its customers that prompt service and support will be available. (For the instrument-specific warranty period, please refer to the “Limited Warranty” section in the Terms and Conditions of Sale on our website: www.teledyne-api.com.)

COVERAGE

After the warranty period and throughout the equipment lifetime, TAPI stands ready to provide on-site or in-plant service at reasonable rates similar to those of other manufacturers in the industry. All maintenance and the first level of field troubleshooting are to be performed by the customer.

NON-TAPI MANUFACTURED EQUIPMENT

Equipment provided but not manufactured by TAPI is warranted and will be repaired to the extent and according to the current terms and conditions of the respective equipment manufacturer’s warranty.

Product Return

All units or components returned to Teledyne API should be properly packed for handling and returned freight prepaid to the nearest designated Service Center. After the repair, the equipment will be returned, freight prepaid.

The complete Terms and Conditions of Sale can be reviewed on our website.



CAUTION – Avoid Warranty Invalidation

Failure to comply with proper anti-Electro-Static Discharge (ESD) handling and packing instructions and Return Merchandise Authorization (RMA) procedures when returning parts for repair or calibration may void your warranty. For anti-ESD handling and packing instructions please refer to the manual, Fundamentals of ESD, PN 04786, in its “Packing Components for Return to Teledyne API’s Customer Service” section. The manual can be downloaded from our website at <http://www.teledyne-api.com>. RMA procedures can also be found on our website.



ABOUT THIS MANUAL

Support manuals, such as Fundamentals of Electro-Static Discharge (ESD), PN 04786, and NumaView™ Remote, PN 04892, are available on the TAPI website <http://www.teledyne-api.com>.

Note

We recommend that all users read this manual in its entirety before operating the instrument.

CONVENTIONS USED

In addition to the safety symbols as presented in the *Safety Messages* page, this manual provides *special notices* related to the careful and effective use of the instrument and related, pertinent information.

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY

This special notice provides information to avoid damage to your instrument and possibly invalidate the warranty.

Important

IMPACT ON READINGS OR DATA

Provides information about that which could either affect accuracy of instrument readings or cause loss of data.

Note

Provides information pertinent to the proper care, operation or maintenance of the instrument or its parts.

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1 INTRODUCTION

The Models N701 and N701H Zero Air Generators (“N701/H” in this manual refers to both) are an excellent source of clean, dry air for dilution calibrators. They also may be used as a source of purge air for permeation tube ovens or burner air for FID analyzers. Serial and Ethernet connectivity are available (option in the N701; standard in the N701H) for remote monitoring through MODBUS® protocol.

The regenerative, heatless dryer removes water and produces gas with a Dewpoint of less than -40°C independent of the inlet Dewpoint and assists in the removal of other gases, greatly increasing the life of the chemical scrubbers.

Inlet air is pulled into the pump and routed through a pre-cooler and water trap to remove moisture. The air then passes through the Regenerative Dryer for final drying and then to the storage tank.

Tank pressure is monitored and maintained at a preset level by cycling the pump automatically as needed, thereby extending both the pump and the scrubber life. Outlet air then passes through a filter to assure a clean, dry, analytical zero air supply.

These models are an ideal accessory to the Model N700 family of calibrators as a zero air source for analyzers.

1.1 FEATURES

- Regenerative, heatless dryer for maintenance-free water removal independent of inlet dewpoint
- Long life scrubbers (option or standard, depending on model) for SO_2 , NO , NO_2 , O_3 , H_2S , CO^1 , and Hydrocarbons (HC)¹
- Automatic water drain
- Automatic pump control based on flow demand
- May be used to provide combustion air for FID
- Source of purge air for permeation tube ovens
- Source of Zero air for Ozone Generators
- Digital Communication through MODBUS®
- Remote Stand-by Operation

¹ Carbon (CO) and HC/CO scrubbers are options for the N701.



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2 SPECIFICATIONS AND APPROVALS

2.1 SPECIFICATIONS

Table 2-1. Specifications

Parameter	Specification		
	N701	N701H	
Output	18 SLPM at 30 psig	30 SLPM at 30 psig; 10 SLPM @ 60 psig	
Max delivery pressure	35 psig	35 psig	
	(50 psig for calibrators with special features that include restricted output).		
Dewpoint	-20°C up to 15 SLPM -10°C above 15 SLPM	-40°C	
Dryer	Regenerative heatless dryer with lifetime of greater than 5 years		
Output Concentration	SO ₂ and H ₂ S < 0.1 ppb	SO ₂ and H ₂ S < 0.025 ppb	
	NO < 0.1 ppb	NO < 0.025 ppb	
	NO ₂ < 0.1 ppb	NO ₂ < 0.025 ppb	
	O ₃ < 0.4 ppb	O ₃ < 0.3 ppb	
	CO < 20 ppb ¹	CO < 10 ppb	
	HC < 5 ppb ¹	HC < 0.25 ppb	
Compressor	Internal long-life, oil-less piston pump		
Power ²		N701 Typical Power Consumption ²	N701H Typical Power Consumption ²
	115 V~ 60 Hz, 7.0 A 220 – 240 V~ 50 Hz, 5.0 A	230W (309 W) ¹ 324W (357 W) ¹	427 W 402 W
Weight	56 lbs. (25.4kg) (64 lbs. (29kg)) ¹	69 lbs. (31.3kg)	
Mounting	Bench type (standard), Rack mount (optional)		
Dimensions	8.75" H x 17"W x 28"D (22.2 cm x 43.2 cm x 71.12 cm)		
Operating Temp	5-40°C		
Environmental Conditions	Installation Category (Over Voltage Category) II Pollution Degree 2 Intended for Indoor Use Only at Altitudes ≤ 2000m Maximum Relative Humidity: 95%		

¹ with HC Scrubber or HC/CO option

² Power Consumption measured at 10LPM for N701 and 20LPM for N701H. Individual results may differ due to flow demand, altitude and temperature.



2.2 APPROVALS AND CERTIFICATIONS

2.2.1 SAFETY

IEC/EN 61010-1:2010 (3rd Edition), Safety requirements for electrical equipment for measurement, control and laboratory use.

CE: 2014/35/EU, Low-Voltage Directive

2.2.2 EMC

IEC/EN 61326-1, Class A Emissions/Industrial Immunity

EN55011 (CISPR 11), Group 1, Class A Emissions

FCC 47 CFR Part 15B, Class A Emissions

CE: 2014/30/EU, Electromagnetic Compatibility Directive



3 GETTING STARTED

This section provides instructions on the proper installation and power up of the N701/H.

3.1 UNPACKING



CAUTION

To avoid personal injury, always use two persons to lift and carry the N701/H.

1. Verify that there is no shipping damage. If there are signs of damage, immediately advise the shipper, then Teledyne API.
2. Remove the N701/H from its shipping carton.
3. Remove the cover and check for damage inside.
4. Ensure electrical cables and pneumatic tubing did not come loose during shipment.
5. Check the line voltage and frequency label on the rear panel to ensure that it matches the local power source.

3.2 INSTALLATION

The basic N701/H has rubber feet for counter-top use. If the rack mount option was included in the order, the N701/H is supplied with slides and angles for mounting in a standard 19" RETMA rack.

In order to ensure safe operation of the N701/H, the following steps must be taken prior to installation for proper venting, access, weight support, and operation:

1. At least 6" (150 mm) clearance at the rear of the instrument.
2. At least 3" (75 mm) at each side.
3. Adequate support for the weight (Table 2-1).
4. Access at the rear for making the pneumatic and electrical connections.
5. Access at the front.
6. Operate the N701/H with the cover on.

3.3 INSTRUMENT LAYOUT

Figure 3-1 and Figure 3-2 illustrate the instrument's front and rear panels. The internal layout for N701 is shown in Figure 3-3 and for N701H in Figure 3-4.

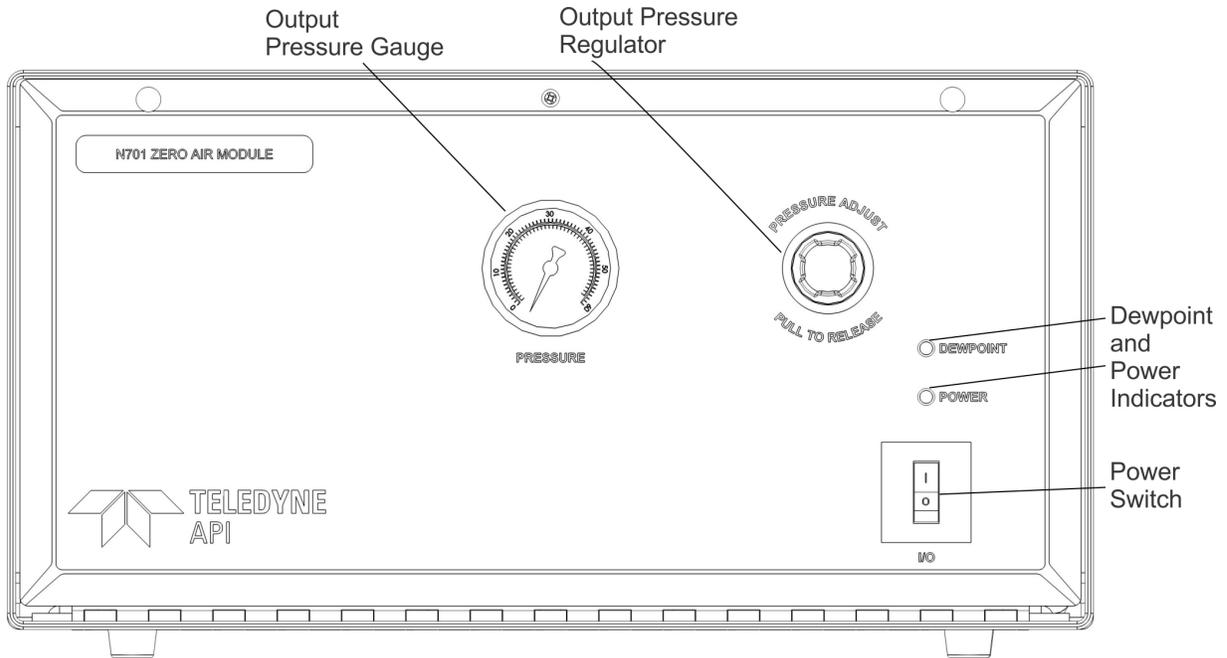


Figure 3-1. Front Panel (N701 label shown)

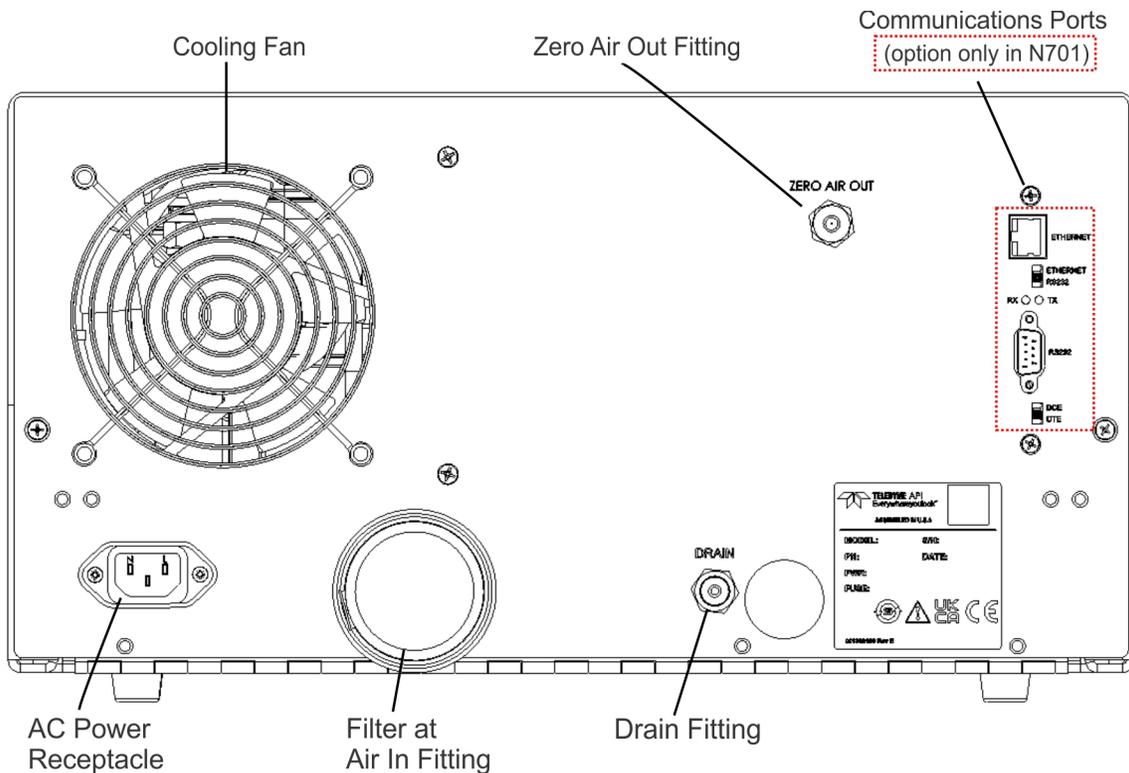


Figure 3-2. Rear Panel

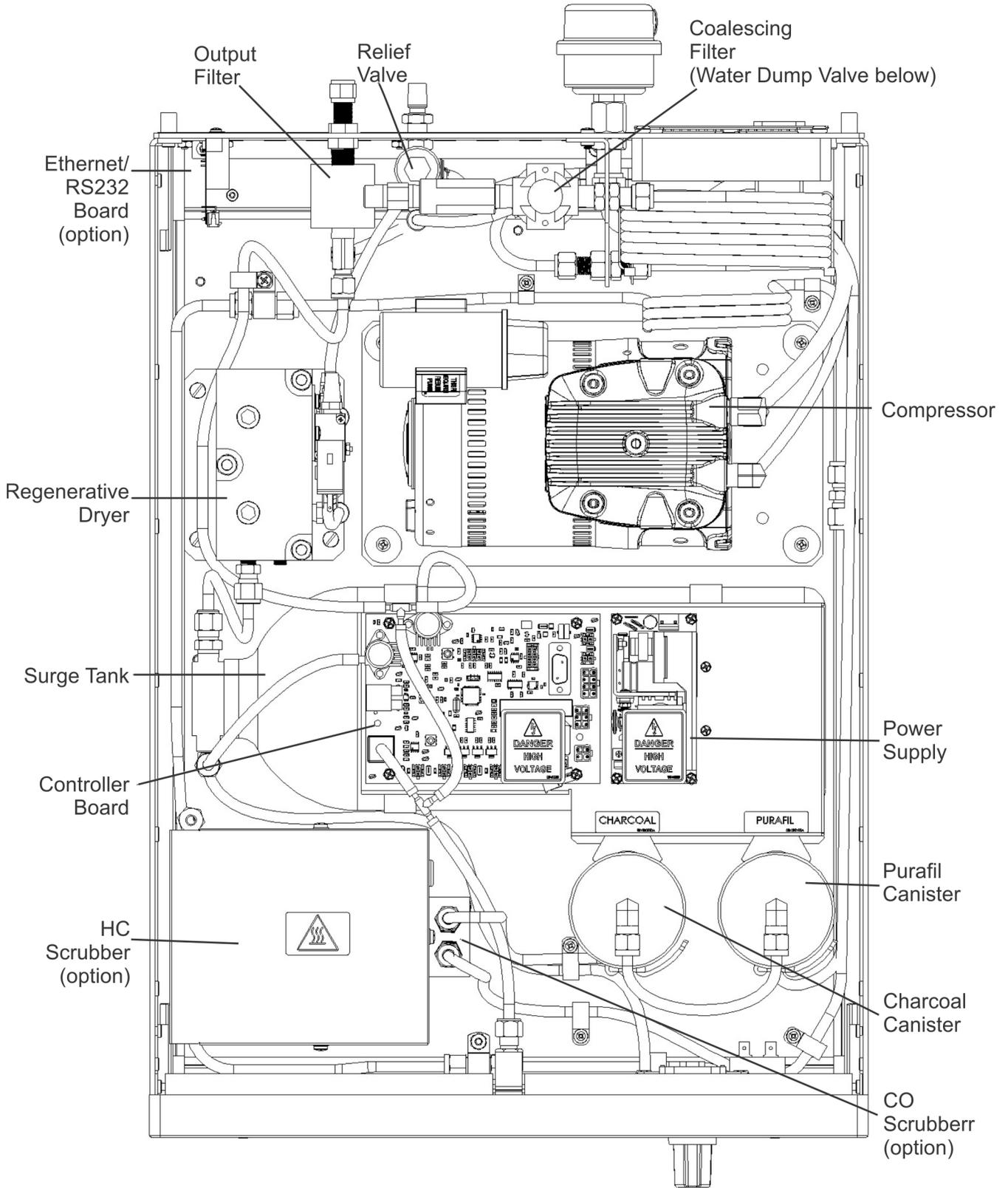


Figure 3-3. N701 Internal Layout (with options)

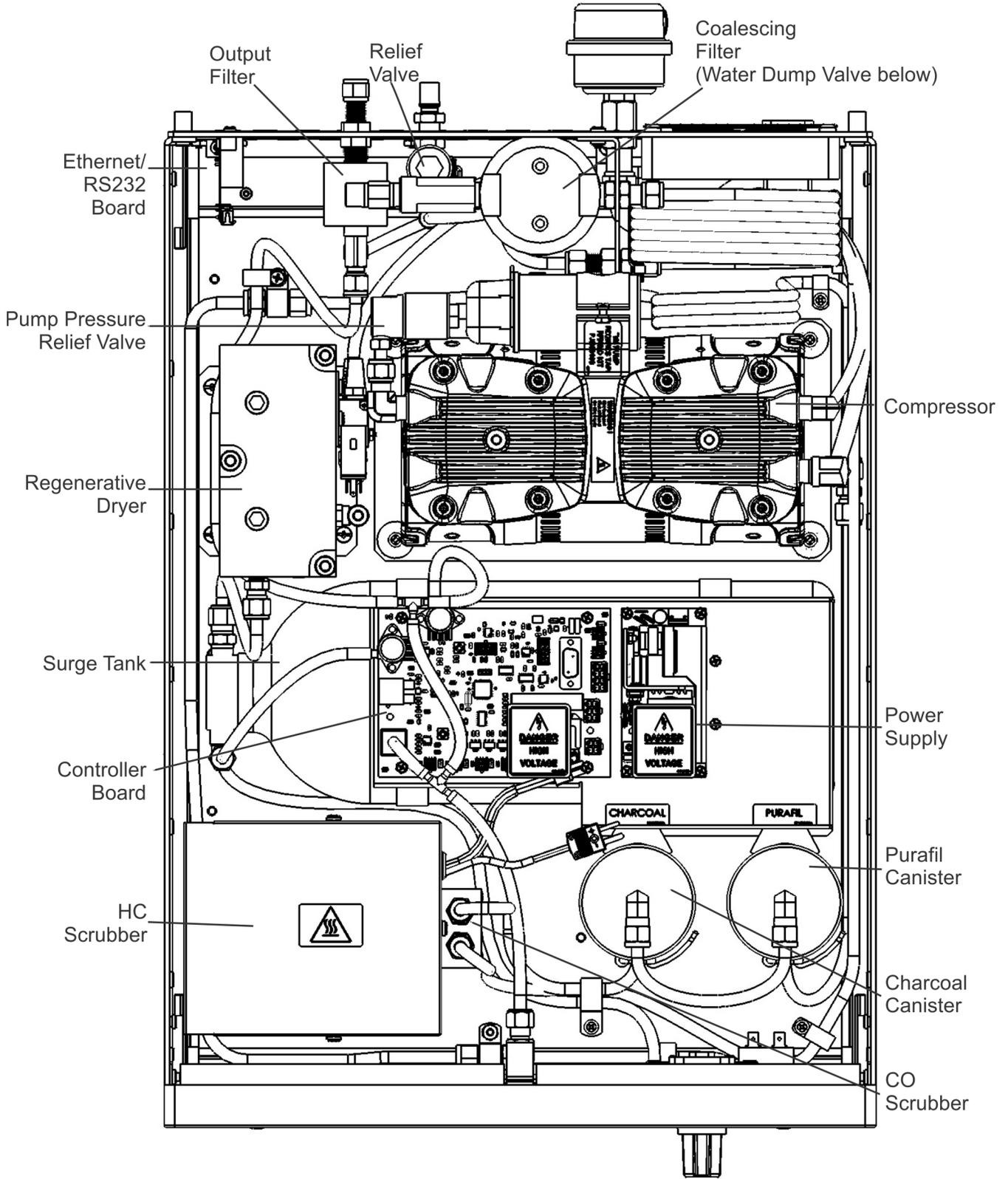


Figure 3-4. N701H Internal Layout



3.4 CONNECTIONS AND SETUP

All connections, electric and pneumatic, are made at the rear panel (Figure 3-2).

3.4.1 ELECTRICAL CONNECTIONS

Note

To maintain compliance with EMC standards, it is required that the cable length be no greater than 3 meters for all I/O connections, which include the power cord and communications cables.



WARNING

ELECTRICAL SHOCK HAZARD

- High Voltages are present inside the instrument.
- Ensure that the power cord being used is capable of carrying the power rating of the instrument (see Specifications Table 2-1)
- Power connection must have a functioning ground connection.
- Ensure that installation provides access to disconnect power from the instrument.
- Do not defeat the ground wire on power plug.
- Turn off power before disconnecting or connecting electrical subassemblies.
- Do not operate with cover off.

Attach power cord to AC receptacle of instrument, and plug it into a power outlet capable of carrying at least the rated current at your AC voltage range; also ensure that it is equipped with a functioning earth ground.

3.4.1.1 COMMUNICATIONS CONNECTIONS

Ethernet and RS-232 communications are available in the N701 as an option and standard in the N701H, but only one or the other may be used at one time. Both use the standardized MODBUS® protocol. (For details on the MODBUS TCP/IP specification, please see <http://www.modbus.org>). A rear panel slide switch, located between the two connectors must be set to select either Ethernet or RS-232 for the intended mode of communication (See Ethernet/RS232 Selector Switch in Figure 3-2).

RS-232

For RS-232 communication connect an RS-232 cable (see Communication Cables in Table 1-1) from the rear panel to the device to be used. Section 5.1 provides configuration instructions.

ETHERNET

For Ethernet communication connect an Ethernet cable (see Communication Cables in Table 1-1) from the analyzer's Ethernet port to a Local Area Network (LAN) or Internet port. Section 5.2 provides configuration instructions.



3.4.2 PNEUMATIC CONNECTIONS

Make the following pneumatic connections (refer to Figure 3-2):

AIR IN
(1/4" female
pipe thread)

Screw the inlet filter into the "AIR IN" port. Hand tight is OK.

Note

Operation without the filter will cause premature pump wear.

DRAIN
(1/4" swage-type
bulkhead union)

Connect a 1/4" diameter tubing to the DRAIN fitting to avoid the occasional spurts of water on the instrument rack.

Connect the other end of the tubing to a drain or, alternatively, the water can be collected in a tray or bucket and dispersed by normal evaporation.

ZERO AIR OUT
(1/4" swage type
bulkhead union)

Connect the AIR OUT port of the N701/H to the INLET fitting of the Model 700 Calibrator with *clean* 1/4" TFE tubing

Keep this line as short as possible to minimize pressure drops.



3.5 POWER-UP

Turn on the front panel POWER SWITCH.

- The front panel POWER indicator LED should light.
- The cooling fan should start immediately.
- The compressor should start after a few second's delay. The delay is to allow the control board to initialize and boot up.
- After 30 to 60 seconds, the front panel pressure gauge should read 30 psig.
- The N701/H is now producing clean dry air.

Note

If the N701/H has been unused for several days, it may take 30-60 minutes to achieve final purity and dryness.

Note

The N701 has a 20 LPM output restriction, and the N701H has a 30 LPM output restriction. The instrument must be connected to a Model 700 or similar calibrator to restrict the zero air flow for lesser flow rates.

3.5.1 COMPRESSOR FUNCTION

Because the N701/H supplies zero air on demand, pressure in the storage tank will build until the “cut-out” level is achieved, thus turning off the compressor. In order for the compressor to turn on, the storage tank pressure must drop below the “cut in” level.

This function maintains a steady supply of zero air.

3.5.2 SHUT DOWN PROCEDURE FOR STORAGE OR TRANSPORTATION

If the N701/H will not be used for an extended period of time or will be transported, follow this procedure for proper shut down:

1. Cycle power off and back on.
2. Wait for the compressor to come back on.
3. The water drain valve will switch into the open position and vent any accumulated water through the water drain. (Standing H₂O will cause corrosion)
4. Turn the N701/H off.

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY

This special notice provides information to avoid damage to your instrument and possibly invalidate the warranty.



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4 OPERATION

4.1 OVERVIEW

Refer to Figure 3-3 for internal components and to Figure 4-1 for pneumatic flow.

The N701/H dries and scrubs ambient air to produce zero air.

The compressor draws air in from the rear panel bulkhead union and inlet filter. At the compressor outlet, the air is under pressure and hot from the compression. The relative humidity is high as a result of the high pressure.

The air is conducted through the cooling coil where heat is removed by transfer to the cooling fan air. With the high pressure and the temperature reduced to ambient level, the relative humidity is at its highest. At this point, the air is usually supersaturated.

From the coil, the wet air passes through a coalescing filter where the excess water is separated and settles in the bottom of the filter. The controller periodically opens the solenoid drain valve allowing the water to be expelled through a rear panel bulkhead union (drain).

The partially dried air enters the Regenerative Dryer which removes essentially all the remaining water and a portion of the other contaminants. The pressure relief valve may open occasionally and can be loud but this is a normal part of the operation for the N701/H.

The dry air then passes through a check-valve to the storage tank. A pressure switch turns off the compressor when the pressure in the tank reaches a set high value, and turns on the compressor when the pressure reaches a set low value. Thus, when air demand is low, the compressor is turned off and the tank fulfills the demand. The pressure in the tank varies from approximately 45 psig to approximately 80 psig depending on the demand and the restricted output. Some special calibrators with restricted output are set to 50 psig. As the air leaves the tank, its pressure is controlled by an air pressure regulator mounted on the front panel. This maintains a constant pressure at the calibrator inlet and is displayed by the pressure gauge on the front panel or by a remote computer using MODBUS protocol (Section 5.3).



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For a final clean-up, the dry, regulated air enters the specific scrubbers as follows:

1. The Hydrocarbon scrubber (option in the N701, which includes the CO scrubber) where Hydrocarbons and CO are catalytically converted to CO₂ and water.
2. The NO scrubber where NO is oxidized to NO₂.
3. The activated charcoal scrubber where the NO₂ is absorbed.
4. The CO scrubber (option in the N701), where CO is catalytically oxidized to CO₂.
5. The clean dry air passes through a fine particulate outlet filter and leaves the N701/H through the rear panel bulkhead union (Zero Air Out).

When air usage is high, the compressor may run continuously. When air usage is low, the pressure switch turns the compressor off until the storage tank pressure drops to 45 psig, and then turns the compressor on again.

Note

It is not necessary to turn off the N701/H when the air usage is low.

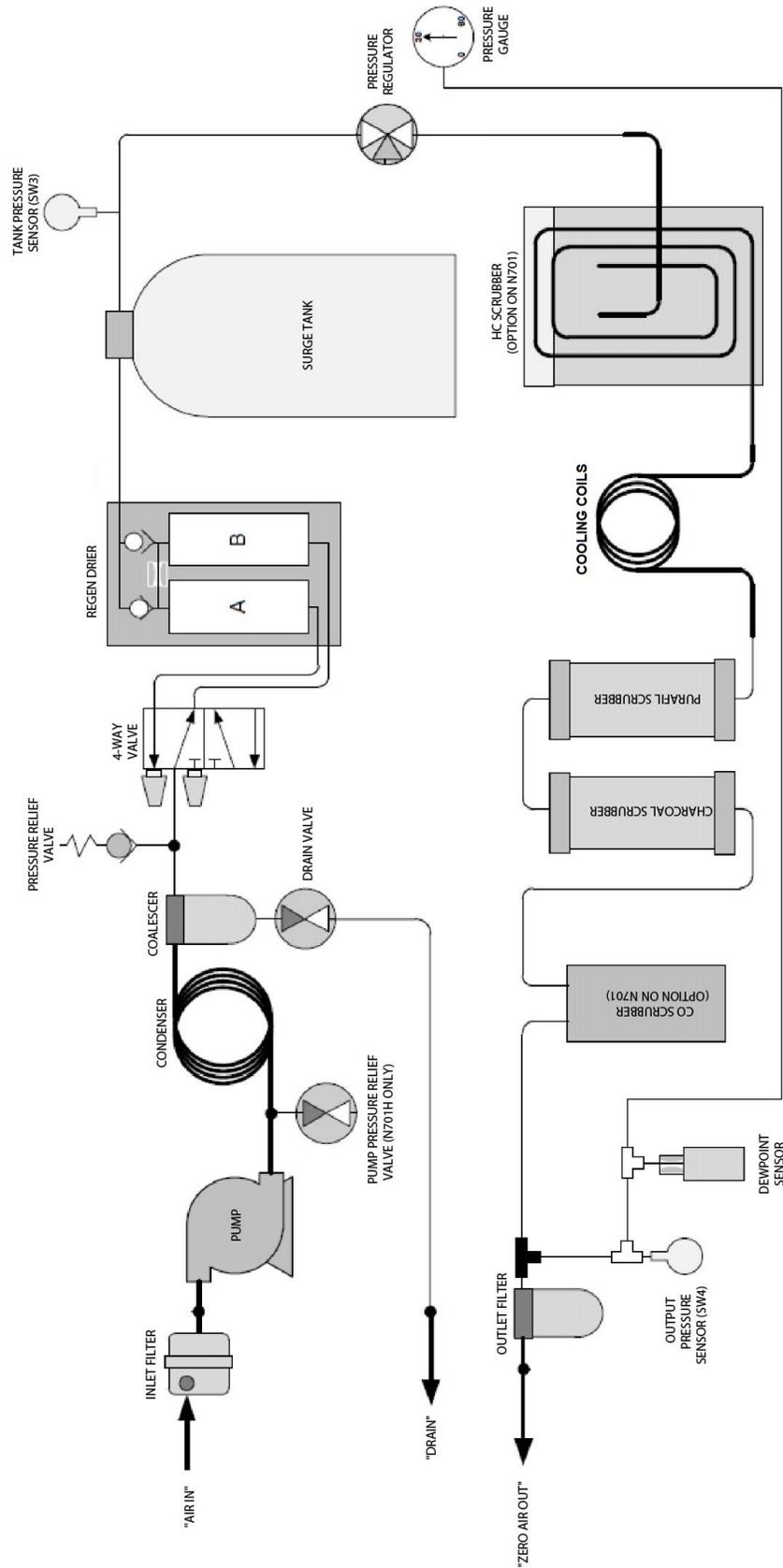


Figure 4-1. Pneumatic Diagram



4.2 COMPONENTS

This section describes the main components of the instrument and their functions.

4.2.1 COMPRESSOR

The compressor is a dual-cylinder oscillating piston type driven by a split capacitor AC motor. The compressor is dry; that is, there are no lubricants which can contaminate the compressed air. The pistons are sealed by flexible TFE piston rings, and after a short run-in period to seat the rings, should last for years. There are no diaphragms.

The compressor is mounted on a sub-plate which is supported on four tuned vibration isolators.

4.2.2 COOLING COIL

The cooling coil consists of several turns of copper tubing coiled to form a cylinder through which the cooling fan blows outside air to cool the hot compressed gas, and allow the water vapor to condense.

4.2.3 WATER TRAP

The water trap is a coalescing type. Supersaturated air enters the trap and is rapidly swirled causing the water droplets to deposit on a membrane where the drops coalesce and gather in a puddle at the bottom of the filter bowl.

4.2.4 WATER DRAIN VALVE

Accumulated water is drained from the filter through a stainless steel solenoid-operated valve. The valve is sequenced by the controller to open and drain the accumulated water.



CAUTION

The water/air spray leaving the rear panel drain fitting spurts at a high velocity and **MUST** be conducted away from any sensitive components.

The operation cycle has been preset at the factory and is not adjustable.

4.2.5 PRESSURE RELIEF VALVE

The pressure relief valve is a safety device designed to limit the maximum pressure to which the N701/H can be subjected. It is set to open at approximately 100 psig. This can be quite loud when the valve opens and sounds like steam escaping.



CAUTION – SAFETY HAZARD

DO NOT ADJUST THE RELIEF VALVE!

(Contact TAPI Technical Support if there is any concern about proper function).



4.2.6 REGENERATIVE DRYER

The Regenerative Dryer consists primarily of two parallel columns of molecular sieve, in which alternately one column is scrubbing the air while the other is being regenerated.

The Regenerative Dryer needs no warm-up and operates at full efficiency as soon as the N701/H is turned on. The molecular sieve has a typical life expectancy of greater than 5 years.

When the N701/H is turned on, a four-way solenoid-operated valve directs high pressure air to one of the two columns and vents the other column to atmosphere. Virtually all the water in the high-pressure air is trapped by the molecular sieve. A portion of the dried air is expanded to atmospheric pressure in the outlet shuttle valve and passes in reverse through the second column. By expanding the air, the volume increases and the relative humidity decreases, thus enabling a small amount of dry purge air to evaporate the entrained water in the second column. The wet purge air leaving the column is exhausted inside the N701/H. The rapid air movement inside the N701/H chassis ensures that the small amount of water involved is safely vented to the atmosphere. The majority of the dry air from the first column is conducted to the storage tank.

The controller toggles the four-way valve at a predetermined interval and the columns alternate their function. This cycling rate has been selected to provide the optimum balance of scrubbing efficiency and air usage and is not adjustable.

A built-in check valve on the dryer is to isolate the air in the storage tank from the components upstream. Thus, when the compressor turns off, the air in the storage tank will be retained and not lost through the drier purge air path or back through the compressor.

4.2.7 STORAGE TANK

The storage tank serves two functions. As its name implies, it stores air so that when the demand is low, the compressor can be turned off to conserve energy, allowing the storage tank to supply the air requirements. The tank also serves as “filter capacitor”, preventing pulses generated by the drier cycles or water drain valve from reaching the output port on the rear panel.

The air in the tank has been dried so there is no need for a tank drain and no concern about internal corrosion.

The tank is a commercial gas storage cylinder, rated at 1800 psi, and is not modified or altered in any way that can harm its integrity.

4.2.8 PRESSURE SENSORS

The Tank Pressure sensor senses the pressure in the storage tank and controls the compressor through the control board.



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It is set at the factory to turn off (cut out) the compressor and turn on (cut in) the compressor at predetermined pressures for optimal performance.

The Output Pressure sensor monitors the output pressure of the N701/N701H and displays its value through a MODBUS register (Section 5.4).

4.2.9 PRESSURE REGULATOR

The N701/H pressure regulator serves as a stabilizer to minimize compressor-induced pressure surges or pressure variations with flow to a calibrator, such as the Teledyne API Model N700. The pressure regulator is set at 30 psig at the factory except for specially modified units. Should adjustment be desired, the regulator is accessible on the front panel. The adjustment knob has a push-pull locking ring which should be reengaged after making an adjustment to prevent the knob from turning under vibration.

When the N701/H is used with the Teledyne API Model N700 Calibrator, the pressure should be between 28 and 32 psig.

WARNING



The N701/H nominal delivery pressure is 30 psig. Only specially modified units will require that the delivery pressure be set higher.

On these specially modified units never set the delivery pressure higher than 50 psig. To do so may cause damage to the N701/H and injury to the operator.

4.2.10 PRESSURE GAUGE

The front panel-mounted pressure gauge shows approximately the regulated air pressure available to a calibrator. The gauge will usually indicate 30 psig. If the flow is very low, as in a standby condition, the gauge may read slightly higher. It will move to the correct reading when the air flow is increased. When the demand on air increases dramatically, the pressure may drop below 30 psig. At maximum air flow, 30 SLPM, you may notice that the pressure drops to 29 psig for a standard operation.



4.2.11 HYDROCARBON SCRUBBER (STANDARD ON N701H, OPTION ON N701)

The High Purity Hydrocarbon Scrubber option (which includes the CO Scrubber) catalytically converts hydrocarbons to carbon dioxide and water. The scrubber consists of a cylindrical cartridge which contains a preheat chamber and the pelletized precious-metal catalyst. The canister is heated by a band heater with an integral type-K thermocouple and is housed in a stainless steel casing with appropriate thermal insulation. The cartridge temperature is controlled by the instrument's controller. The controller reads the thermocouple voltage, compensates for cold-junction temperature and modulates the heater to maintain a constant cartridge temperature.

The operating temperature of the cartridge is 300°C. The temperature can be verified by measuring the thermocouple voltage at the two terminal blocks of J12 (labeled "Thermal Couple" in Figure 4-2). At 300°C, the thermocouple voltage is 11.2 mV in an ambient temperature of 25°C (11.4 mV at 20° and 11.0 mV at 30°). While the controller compensates for cold-junction temperature in controlling the heater, the thermocouple voltage at the terminal block is not compensated, so allowance must be made for ambient temperature when converting the voltage to cartridge temperature.



CAUTION – VERY HOT!

The air leaving the scrubber is at 300°C (575°F).
This copper coil and the casing can be very hot.

The catalyst is proprietary. It theoretically should never need changing. However, if contamination is suspected, we recommend that the scrubber be replaced (Section 6.8).

4.2.12 CO SCRUBBER (STANDARD ON N701H, OPTION ON N701)

The CO scrubber catalytically oxidizes CO to CO₂. The catalyst is proprietary and operates at a slightly elevated temperature; theoretically, it should never need changing. However, it may become contaminated or poisoned over time so we recommend that it be replaced (Section 6.7) if contamination is suspected or sooner if the level of CO in the air is high.

4.2.13 NO SCRUBBER

The NO scrubber uses Purafil® to oxidize NO to NO₂. Purafil® has a finite life and we recommend that it be replaced (Section 6.5) annually or sooner if the level of NO in the air is high.

4.2.14 CHARCOAL SCRUBBER

Activated charcoal removes NO₂, O₃, SO₂ and H₂S. The charcoal should be replaced (Section 6.4) annually or sooner if there are high atmospheric levels of these contaminants, or if the calibrator zero air shows signs of a positive drift.



4.2.15 FINAL FILTER

The final filter (labeled “Output Filter” in Figure 3-3), inside the rear panel retains any particulates released by the N701/H. The filter rating is 0.01 micron. If the filter becomes restricted, it should be disassembled and cleaned, or the element be replaced (TAPI Part Number FL57).

4.2.16 CONTROLLER



WARNING – Electrical Shock Hazard!
Dangerous voltages exist on the control board.

All functions of the N701/H are managed by the Control board (Figure 4-2). The Control board provides connections for all switched and non-switched AC and DC components, AC/DC input, front panel indicators, communications board and the front panel power switch/circuit breaker.

Switched DC components include the Regenerative Dryer valve, water drain valve, and the relief valve. **Switched AC components** include the pump and HC Scrubber. Provision for 120V/240V AC power is via a jumper plug (J5).

Non-switched components include the CO scrubber and fan.

All electrical connections are made by quick release connectors to aid in servicing. Additionally, the tank pressure, output pressure and Dewpoint connections are made to the control board with flexible tubing. Refer to Figure 4-2 for the layout and to Appendix B for the interconnect drawing.

The N701/H Control PCB is microcontroller based, and provides the following functions:

- Cycles the four-way valve of the Regenerative Dryer.
- Cycles the water drain solenoid valve.
- Starts and stops the compressor in response to the pressure sensor. This function includes cycling the Regenerative Dryer four-way valve and momentarily opening the water drain solenoid valve before starting the compressor. This momentarily reduces the pressure at the compressor outlet to facilitate compressor starting.
- MODBUS® communication via the Rear Panel Connectors to remotely display instrument’s parameters.
- Monitors and regulates the HC Scrubber Temperature.

LED D13 (Figure 4-2) flashes at 1 second intervals as an indication that the controller is functioning, and a watchdog timer is enabled to prevent any power line disturbances from halting the processor.

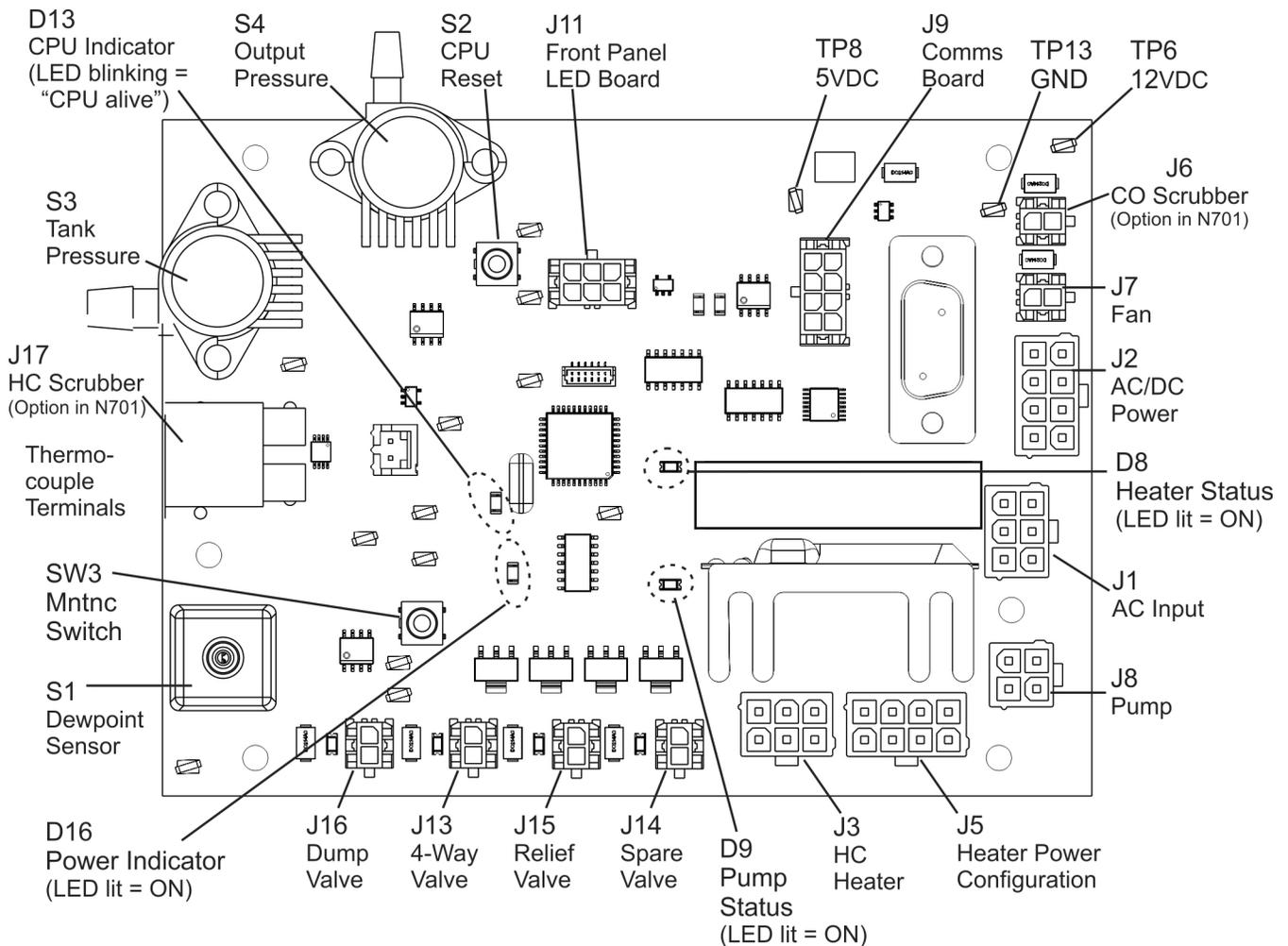


Figure 4-2. Control Board Layout

4.2.17 DEWPOINT SENSOR

The dewpoint sensor ensures that the Regenerative Dryer maintains an acceptable dewpoint. This will increase the life of the chemical scrubbers. When the dewpoint rises above -20°C, the green LED (dewpoint indicator) on the front panel will light.



4.2.18 FRONT PANEL INDICATOR LIGHTS

Multicolor indicator lights for both the power state and Dewpoint state relay diagnostic information and instrument mode to the user.

Power Indicator	Dewpoint Indicator	Description
Green	Green	Power ON, Dewpoint GOOD < -20.0°C
Green	Yellow	Power ON, Dewpoint CAUTION
Green	Red-Flashing	Power ON, Dewpoint BAD > -16.0°C
Green	Red	Power ON, Dewpoint FAULT
Alternating Yellow-Green	Any Color	Maintenance Mode. 24hr Dewpoint Fault Override.
Alternating Yellow-Green	Off	User Enabled Pump Standby Mode
Red-Flashing	Yellow	Box Temperature Fault. Pump and Hydrocarbon heater shutdown.
Red-Flashing	Red	Dewpoint Fault. Dewpoint has exceeded critical set point. Pump shutdown.

4.2.19 COMMUNICATIONS BOARD

RS232 and Ethernet (option in the N701) connectors are located on the rear panel. A selector switch is installed between them to connect either Ethernet (10 Mbit) or RS232, but not both simultaneously. Also, when the RS232 port is used, a switch is available to select between DTC/DCE (Section 5.1.1). Connectivity LEDs will light to confirm that RS232 and/or Ethernet cables are connected; indication of activity is described in Section 5.



5 COMMUNICATIONS SETUP & OPERATION

This section provides RS232 and Ethernet communications (N701 option) configuration instructions.

The rear panel communications board allows connection between a computer or a digital data acquisition system. The communications port uses either MODBUS RTU for the RS232 port or MODBUS TCP/IP for the Ethernet port which allows communication between a wide variety of devices and networks.

Note that when one communications port is in use, the other is disabled. For RS-232 communications (Section 5.1), set the rear panel **Ethernet RS232 Selector Switch** (Figure 3-2) to **RS232**, or for Ethernet communications (Section 5.2), set the switch to **ETHERNET**.

5.1 RS232 COMMUNICATIONS

RS232 protocol requires that communications be set up for either Data Terminal Equipment (DTE) or Data Communication Equipment (DCE), described next.

5.1.1 DATA TERMINAL / COMMUNICATION EQUIPMENT (DTE DEC)

RS-232 was developed for allowing communications between data terminal equipment (DTE) and data communication equipment (DCE). Basic terminals always fall into the DTE category, whereas modems are always considered DCE devices. The difference between the two is the pin assignment of the Data Receive and Data Transmit functions.

- DTE devices receive data on pin 2 and transmit data on pin 3.
- DCE devices receive data on pin 3 and transmit data on pin 2.

To set the instrument for use with terminals (DTE), modems (DCE) and computers (which can be either), use the switch labeled DCE DTE mounted below the RS232 ports on the rear panel to select one of these two data devices. This switch exchanges the Receive and Transmit lines on RS-232 emulating a cross-over or null-modem cable.



5.1.2 RS-232 CONFIGURATION

1. Connect one the RS-232 cable from the RS232 port on the rear panel to either a computer or a modem.

Note

Cables that appear to be compatible because of matching connectors may incorporate internal wiring that makes the link inoperable. Check cables acquired from sources other than Teledyne API for pin assignments before using.

2. Slide the rear panel Ethernet RS-232 switch down toward the RS232 port.
3. Check the activity indicators labeled Rx and Tx above the RS232 port: both the red and the green LED should be lit.
 - If the LEDs are not lit, change the DTE DCE switch to its other mode.
 - If both LEDs are still not lit, ensure that the cable is properly constructed.

Received from the factory, the unit is set up to emulate an RS-232 DCE device as follows:

- **RS-232:** RS-232 (fixed) DB-9 male connector
- **Baud rate:** 57600 bits per second
- **Data Bits:** 8 data bits with 1 stop bit
- **Parity:** Even

5.2 ETHERNET

When using the Ethernet interface, the instrument can be connected to any standard 10BaseT or 100BaseT Ethernet network via low-cost network hubs, switches or routers. Ethernet is DHCP-enabled by default (Section 5.2.2), allowing the instrument to be connected to a network or router with a DHCP server, which automatically assigns an IP address for the instrument. This configuration is useful for quickly getting an instrument up and running on a network. However, because DHCP can reset the IP address automatically, it is recommended that the manual method be used for Ethernet configuration (Section 5.2.1) so that the IP address remains static.

The Ethernet connector has two LEDs that are on the connector itself, indicating its current operating status.

Table 5-1. Ethernet Status Indicators

LED	FUNCTION
amber (activity)	Flickers during any activity on the LAN.
green (link)	Solid lit when connection to the LAN is valid.



5.2.1 CONFIGURING ETHERNET COMMUNICATION MANUALLY (STATIC IP ADDRESS)

For applications where the IP Address must remain constant, a static IP Address can be manually assigned to the instrument. The interface operates with MODBUS protocol.

1. Connect a cable from the analyzer's Ethernet port to a Local Area Network (LAN) or Internet port.
2. Slide the rear panel Ethernet RS-232 selector switch up toward the Ethernet port.
3. Install Windows software application, *DeviceInstaller*, to configure the Ethernet module. This application is available for download at:
<http://www.teledyne-api.com/software/>.

4. Click **Start->Programs->Lantronix DeviceInstaller->DeviceInstaller**. If your PC has more than one network adapter, a message displays. Select an adapter and click **OK**.

Note: If the unit already has an IP address (e.g., DHCP has assigned an IP address), click the **Search** icon and select the unit from the list of Lantronix device servers on the local network.

5. Click the **Assign IP** icon.
6. If prompted, enter the hardware address (on the product label) and click **Next**.
7. Select **Assign a specific IP address** and click **Next**.
8. Enter the **IP address**. The Subnet mask displays automatically based on the IP address; if desired, you may change it. On a local network, you can leave the Default gateway blank (all zeros). Port should be 502. Click **Next**.
9. Click the **Assign** button and wait several seconds until a confirmation message displays. Click **Finish**.
10. Select the device from the main window list and click **Ping** from the **Tools** menu. The Ping Device dialog box shows the IP address of the selected device.
11. From the **Tools** menu, click the **Ping** button. The results display in the Status window. Click the **Clear Status** button to clear the window so you can ping the device again.

Note: If you do not receive "Reply" messages, make sure the unit is properly attached to the network and that the IP address assigned is valid for the particular network segment you are working with. If you are not sure, check with your systems administrator.

12. Click the **Close** button to close the dialog box and return to the main window.



5.2.2 CONFIGURING ETHERNET COMMUNICATION USING DYNAMIC HOST CONFIGURATION PROTOCOL (DHCP)

The DeviceInstaller software application (downloadable from <http://www.teledyne-api.com/software/>) can be used to search a network for instruments and determine the IP Address assigned by a DHCP server.

1. Click **Start->Programs->Lantronix DeviceInstaller->DeviceInstaller**. If your PC has more than one network adapter, a message displays. Select an adapter and click **OK**.
2. Click the **Search** icon. After a moment a list of instruments on the network will be displayed. The instrument should be listed as an **XPORT-IAP** type device.
3. Double-click on the device in the right-hand section of the DeviceInstaller window; a list of configuration parameters will be shown, including the IP Address. If multiple devices are shown, the correct one can be determined by matching the Hardware Address shown with the address printed on the label of the Ethernet module in the instrument. Remove the instrument cover or lower the rear panel to find this address.

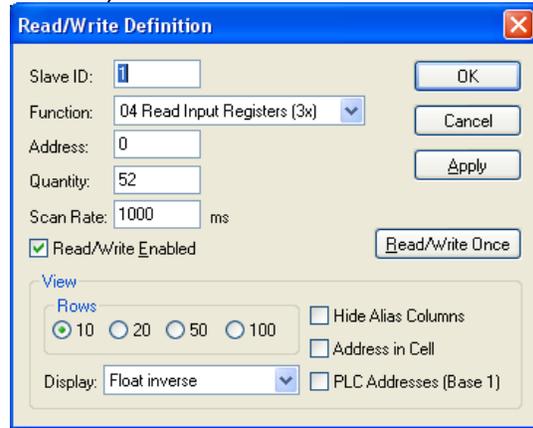
5.3 COMMUNICATIONS PROTOCOL: MODBUS

The following set of instructions assumes that the user is familiar with MODBUS communications, and provides minimal information to get started. For additional instruction, please refer to the Teledyne API MODBUS manual, PN 06276 (available on TAPI website). Also refer to www.modbus.org for MODBUS communication protocols. Section 5.4 provides MODBUS registers for this instrument.

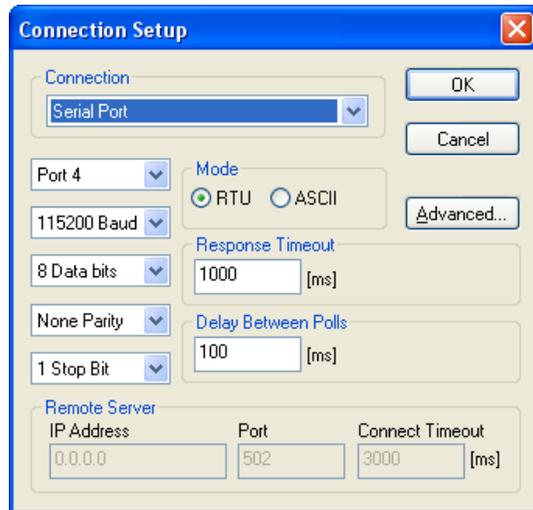
Minimum Requirements

- MODBUS-compatible software (TAPI uses MODBUS Poll for testing; see www.modbustools.com)
- Personal computer
- Communications cable (Ethernet or RS232)

Read/Write Definition window:



Example Connection Setup window:



5.4 MODBUS REGISTERS

Table 5-2. N701, N701H MODBUS Register Map

MODBUS Register Addr. (dec, 0-based)	Description	Data Type	Units
MODBUS Coil Registers			
0	System Reset Warning	single-bit; read/write	
1	Remote Pump Disable	single-bit; read/write	
2	Pump Service Timer Reset	single-bit; read/write	
3	Latch System Reset Warning	single-bit; read/write	
4	CPU Restart	single-bit; read/write	
5	Maintenance Mode Enable	Single-bit; read/write	
MODBUS Discrete Inputs			
0	Pump Service Reminder Warning	single-bit; read-only	
1	Dewpoint Warning	single-bit; read-only	
2	HC Scrubber Temp Warning	single-bit; read-only	
3	Low Output Pressure Warning	single-bit; read-only	
4	Dewpoint Shut Down Warning	single-bit; read-only	
5	Box Temperature Shut Down Warning	single-bit; read-only	
6	Maintenance Mode Warning	single-bit; read-only	
MODBUS Holding Registers			
0	MODBUS Slave Address	Unsigned Int; read/write	1-247
MODBUS Input Registers			
0	Tank Pressure	32-bit IEEE 754 Format; read-only	PSI
2	Output Pressure	32-bit IEEE 754 Format; read-only	PSI
4	HC Scrubber Temperature	32-bit IEEE 754 Format; read-only	°C
6	Box Temperature	32-bit IEEE 754 Format; read-only	°C
8	Pump Duty Cycle	32-bit IEEE 754 Format; read-only	Fraction (1.0 = 100%)
10	HC Heater Duty Cycle	32-bit IEEE 754 Format; read-only	Fraction (1.0 = 100%)
12	Pump Service Interval Remaining Timer	32-bit IEEE 754 Format; read-only	Hrs.
14	4096 mV Reference Voltage	32-bit IEEE 754 Format; read-only	mV
30	Model Number	Inverse Long; read-only	
32	Serial Number	Inverse Long; read-only	
34	Software Part Number	Inverse Long; read-only	
36	Software Version	32-bit IEEE 754 Format; read-only	

5.4.1 NOTES ON MODBUS REGISTERS

5.4.1.1 SYSTEM RESET WARNING

The System Reset Warning register notifies the user of an intentional or unintentional CPU reset condition. When the instrument restarts, the register will read 1; to clear the register, write 0 to it or allow it to reset to 0 automatically after the warm-up period. However, if the Latch System Reset Warning register value reads 1, then the software will not clear the warning automatically, and the System Reset Warning will require manual reset (write 0 to the register).

5.4.1.2 REMOTE PUMP DISABLE

The Remote Pump Disable register allows the instrument to enter standby mode when a 1 is written into the register. In this mode the pump is disabled but the Hydrocarbon heater or CO Scrubber heater remains operational to decrease the time needed for operational warm-up. To exit standby mode and resume operation, write a 0 into the register.

5.4.1.3 PUMP SERVICE TIMER RESET

The Pump Service Timer Reset register operates together with two other registers, the Pump Service Interval Remaining Timer (in Holding Register) and the Pump Service Reminder Warning (in Discrete Input Register), in order to ensure the pump is serviced according to maintenance requirements. The Pump Service Interval Remaining Timer counts down the number of operational hours remaining before the next service is due. The Pump Service Reminder Warning is activated when the time runs out, showing a value of 1 in the register. To reset the warning and timer, write a 1 to the Pump Service Timer Reset register. The software will rewrite the warning register to a 0, which clears the warning and restarts the timer.

5.4.1.4 MODBUS SLAVE ADDRESS

The MODBUS Slave Address register assigns an address to the instrument (default 1), and is used when multiple instruments are connected to the same serial line. It accepts an address of 1 to 247. The instrument does not need to be reset after changing this address value; the change is immediate. If the instrument is connected through the Ethernet, connection it is recommended that this address register be set to 1.

5.4.1.5 MAINTENANCE MODE ENABLE

The Maintenance Mode Enable register allows the unit to be placed into Maintenance Mode remotely. (See Section 6.6 for a description of Maintenance Mode). Writing this register to 1 will start Maintenance Mode. The register will be written to 0 by the software after the change is acknowledged. The MODBUS Discrete Inputs register at address 6 will be 1 while the unit is in Maintenance Mode. After the Maintenance Mode timer elapses the software will write this register to 0.



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6 MAINTENANCE

6.1 SCHEDULE



CAUTION

The operations outlined in this section are to be performed by qualified maintenance personnel only.

Before any maintenance cycle the power on/off and drain any water that may be present (refer to instructions for “Shut Down Procedure for Storage or Transportation ” in Section 3.5.2). Table 6-1 presents the maintenance schedule.

Table 6-1. Maintenance Schedule

Date Instrument was received:						
Item	Charcoal Scrubber	NO-NO ₂ Scrubber (Purafil)	CO Scrubber (N701 option only)	HC Scrubber (N701 option only)	Regenerative Dryer	Particulate Filter (“Air In” on Rear Panel)
Frequency	Annually	Annually	When Contaminated	When Contaminated	When Contaminated	Annually
Refer to Section	6.4	6.5	6.7	6.8	6.9	6.13
Month	January					
	February					
	March					
	April					
	May					
	June					
	July					
	August					
	September					
	October					
	November					
	December					

6.2 CLEANING

1. Occasionally, depending upon the local conditions, check the inside of the N701/H for excessive dirt or dust.
2. Particularly, check the cooling fan, cooling coil and compressor fan inlet.
3. Remove any dirt or dust with a vacuum cleaner.
Do not use an air jet. This will only redistribute the dirt and will not remove it.



WARNING – Electrical Shock Hazard!

There are high voltages present while the N701/H is plugged in.

6.3 CHECKING TUBING INTEGRITY

1. Under the vibration of the compressor, it is possible for some parts of the TFE tubing to abrade against nearby objects. This is most likely to occur with the tubing directly attached to the compressor.
2. Check to see if any signs of abrasion are present, and, if so, re-dress the tubing.
3. If any section of tubing appears to be heavily abraded, remove and replace it.



CAUTION

Do not loosen any tubing connection while the N701/H is running.



CAUTION

Before working on the N701/H plumbing turn off the N701/H, wait for the pressure gauge to read zero. (This may require that you loosen the rear panel bulkhead union to allow the air to bleed away.)



WARNING

Even though the front panel power switch is off, there is line voltage present at the power entry terminals AND power switch terminals. For added safety, remove the power cord from the rear panel receptacle.

6.4 REPLACING THE CHARCOAL SCRUBBER

Before emptying the used charcoal, wearing a dust mask is recommended as a preventive measure since it is possible that some charcoal dust may rise when emptying and refilling the canister.

1. Turn off the N701/H and wait for the pressure to go to zero.
2. Open the front panel, or remove the top cover.
3. Remove the 1/4" tubing connected to the top of the scrubber canister.
4. Release the fastening strap to free the canister.
5. Remove the 1/4" tubing connected to the bottom of the canister.
6. Unscrew the cap of the canister.



7. Remove the pad from the top of the canister.
8. Pour out the charcoal and dispose of it properly.
9. Refill the canister with fresh charcoal, up to 3/8" to 1/4" from the top. Rap the sides of the canister gently to settle the charcoal and add more as necessary.
10. Replace the pad on top of the charcoal.
11. Wipe any charcoal dust from the top edge of the canister. This is the surface which seals against the gasket.
12. Check that the gasket is in place in the cap.
13. Replace the cap and tighten it "hand-tight".
14. Reconnect the lower 1/4" tube connection.
15. Reattach the canister with the fastening strap.
16. Reconnect the upper 1/4" tube.
17. Enable "maintenance mode" (Section 6.6) which will bypass the Dewpoint warnings during scrubber drying.
18. After the compressor is turned on, it may be wise to check the scrubber for leaks using a commercial soap solution leak finder.
19. Place the instrument in Maintenance Mode to dry out scrubber (Section 6.6).

6.5 REPLACING THE NO - NO₂ SCRUBBER

This procedure is identical to the charcoal scrubber replacement procedure (above) except that the canister should be refilled with Purafil®.

Note

After replacing the material in these scrubbers it can take up to 48 hours for the material to dry out before the N701/H is functioning optimally.

6.6 MAINTENANCE MODE

When changing the media of the Charcoal Scrubber (Section 6.4) and the NO-NO₂ Scrubber (Section 6.5), the new media will contain some moisture due to humidity in the ambient air and will consequently trigger a Dewpoint fault condition. Placing the N701/H in Maintenance Mode will override the fault for 24 hours, allowing time to thoroughly dry the new media before resuming normal operation. (In high humidity environments this may take longer).

To place the instrument in Maintenance Mode, press and briefly hold the Maintenance Switch (SW3, Figure 4-2).



6.7 REPLACING THE CO SCRUBBER (OPTION IN N701)

The CO scrubber is attached to the HC scrubber housing. This is not a heated scrubber. It is secured with four screws through the body of the scrubber into the bracket.

1. Turn off power and unplug the N701/H.



CAUTION

The scrubber will be hot.

2. With a wrench, remove the inlet and outlet tubing and the two unions from the top of the scrubber cartridge.
3. Remove the four screws to remove the scrubber.
4. Pick out the retaining screens.
5. Shake out the catalyst beads and dispose. No special disposal methods required.
6. Pour in new catalyst to 1/2" from the top of the bores. Tap the cartridge sides gently to settle the beads and top up to the 1/2" level.
7. Replace the retainer screens.
8. Replace the TFE tape on the two unions and replace the unions in the cartridge.
9. Reassemble the scrubber, replace it in the chassis and reconnect the tubing and receptacle.
10. Turn on the N701/H and leak check using soap solution.



6.8 REPLACING THE HYDROCARBON (HC) SCRUBBER (N701 OPTION ONLY)

1. Turn off power and unplug the instrument's power cord.
2. Disconnect the HC scrubber power at the Controller (Figure 4-2).
3. Unplug the thermocouple from the control board.



CAUTION

Wait for the scrubber to cool. The scrubber casing and the copper cooling coil will be very hot.

4. Remove the heat shield from the HC scrubber.
5. Disconnect the pneumatic connections at the CHARCOAL SCRUBBER INLET AND AT THE REAR END OF THE COPPER COOLING COIL, using 1/2" and 9/16" wrenches.
6. Remove the four screws holding the scrubber, under the chassis.
7. Lift out the scrubber.
8. Install a new Teledyne API-supplied scrubber (these are purged at the factory).
9. Screw it down.
10. Attach and tighten the pneumatic connections.



CAUTION

Ensure that the copper cooling coil is not touching any wire or cable.

11. Plug the scrubber into the control board.



CAUTION

Be sure to use a Teledyne API-supplied, purged scrubber. Otherwise, downstream components may be damaged. An unpurged hydrocarbon scrubber produces a lot of water when first turned on.

12. Plug the thermocouple into the control board.
13. Turn on the N701/H.
14. Connect a millivolt meter to J17 (labeled "Thermal Couple" in Figure 4-2) on the temperature controller.
Observe that the Heater Relay LED (D8) starts blinking at 11.2 mV (300°C) and that the thermocouple voltage holds steady.
15. When all traces of water have disappeared from the N701/H output, the output may be reconnected to the analyzers.



6.9 SERVICING THE REGENERATIVE DRYER

It is unlikely that the Regenerative Dryer should ever need service. Should the molecular sieve become contaminated by oil or other external contaminants, the scrubber will need to be cleaned and recharged. Refer to Figure 6-1.

Although the molecular sieve is not toxic, wearing a mask is recommended as a preventive measure against inhaling dust that may rise during the emptying and refilling process.

1. Turn off the N701/H, and turn on again and remove any water in bowl.
2. Unplug the instrument from electrical service.
3. Allow the pressure to bleed to zero.
4. Remove the two pneumatic connections and the electrical connection from the 4-way manifold.
5. Remove the dryer from the chassis by unscrewing the four captive screws in the dryer base.
6. Remove the 4-way valve bracket from the upper manifold and let the valve hang loose attached to the lower manifold.
7. Remove the three nuts on top of the upper manifold.
8. Remove the upper manifold.
9. Remove the two columns.
10. Remove the retainer pads from the two columns and dump the molecular sieve into a suitable waste receptacle.
11. Wipe out the inside of the columns with a clean dry rag.
12. Examine the surface and ports in the upper and lower manifolds. If there is an accumulation of dirt or corrosion, disassemble the manifolds and clean them. If not, proceed with step 13.
13. Place two new clean retainer pads in each end of each column. Push the pads 1/8" into the column.
14. Pour new clean molecular sieve into each column, up to 1/4" from the top. Rap the side gently, (with a screw-driver handle, for instance) to settle the molecular sieve, and then top up to the 1/4" mark again.
15. Place two new clean retainer pads on top of the molecular sieve. Push the pad 1/8" into the column.
16. Change the four o-rings in the circular grooves in the upper and lower manifolds.
17. Place the bottom of the columns with two pads in the circular grooves in the lower manifold. Ensure that they are in the grooves and not caught up on the edge.
18. Wipe the ends of the columns. These are the surfaces which seal against the o-rings.



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19. Place the upper manifold (new if replacing the shuttle valve, Section 6.11) on top of the two columns. Ensure that the columns are in the grooves. (Wiggle the columns sideways to ensure that the columns are seated in the grooves.)
 20. Replace the nuts and lock-washers on the three tie rods **BUT DO NOT TIGHTEN THEM**.
 21. Push down hard in the center of the upper manifold with one hand and finger-tighten the nuts until you feel a soft resistance.
 22. With a wrench, tighten each nut in turn, 1/2 turn at a time. This will ensure that all the nuts are tightened evenly. If the nuts are tightened unevenly, the column o-rings may not seal and you may cause damage to the sealing surfaces.
 23. Examine the fit of the columns in the manifold groove one more time.
 24. Re-attach the 4-way valve bracket.
 25. Replace the dryer in the N701/H chassis and tighten the four captive screws.
 26. Reconnect the two pneumatic fittings and the valve power cord.
 27. Plug in and turn on the N701/H.
 28. Using soap solution, check the dryer for leaks.
- If no leaks are detected, the N701/H is ready for operation.

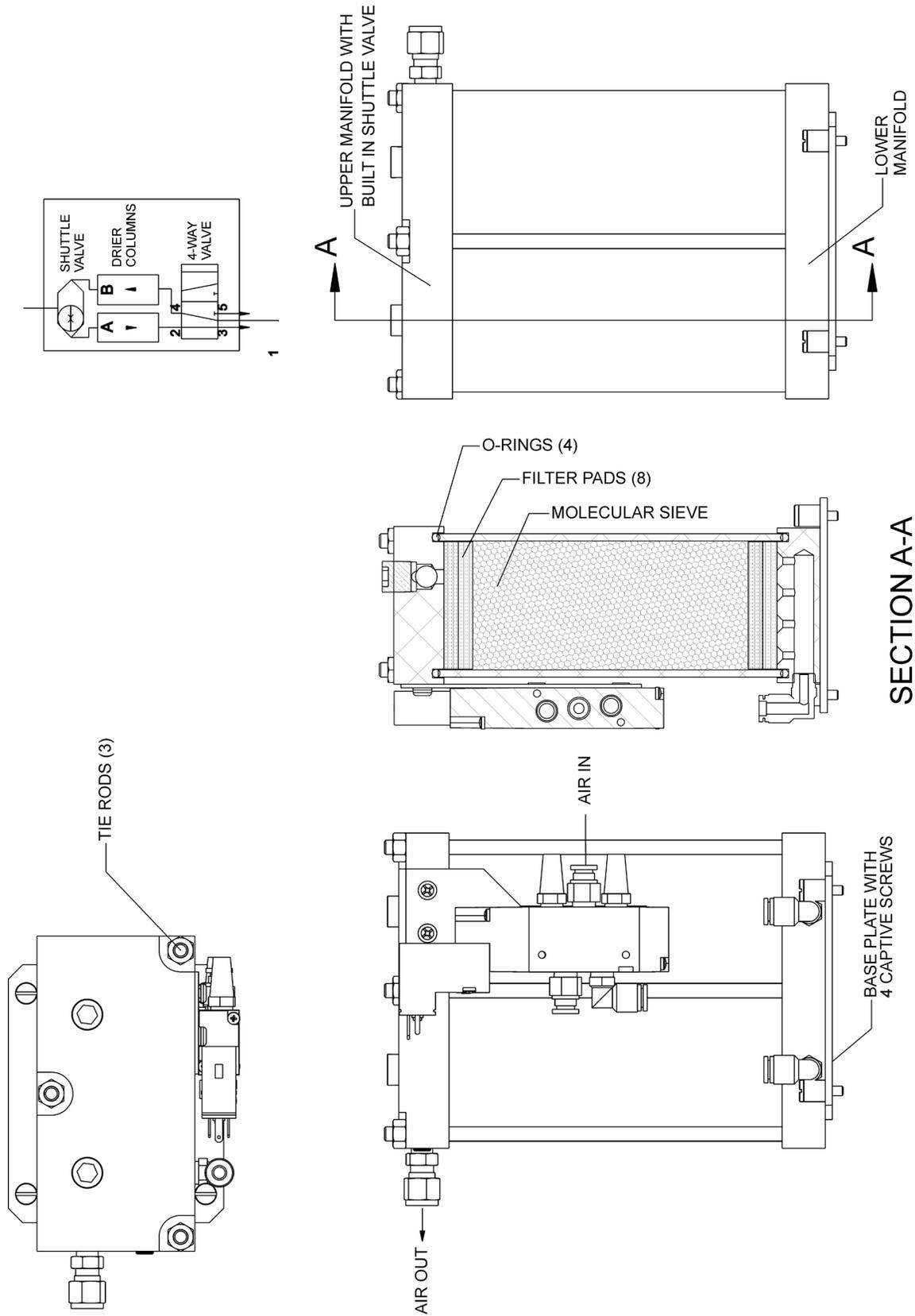


Figure 6-1. Regenerative Dryer



6.10 CHANGING THE REGENERATIVE DRYER'S 4-WAY VALVE

1. Remove the Regenerative Dryer from the chassis as described in Section 6.9 above.
2. Disconnect the two tubing connections and the electrical connection to the 4-way valve.
3. Remove the 4-way valve bracket from the regenerative upper manifold.
4. Remove the 4-way valve from the bracket.
5. Attach a new valve, complete with tube fittings and muffler(s).
6. Attach the bracket to the upper manifold.
7. Connect the electric cable and two pneumatic fittings.
8. Re-install the dryer in the N701/H chassis and tighten the four captive base screws.

6.11 REPLACING THE REGENERATIVE DRYER'S SHUTTLE VALVE

It is not necessary to remove the Regenerative Dryer from the N701/H chassis.

The Shuttle Valve is integral to upper manifold assembly. To replace the Shuttle Valve, replace the upper manifold assembly. Refer to Section 6.9 steps 1, 2, 3, 5, 6, 7, 8 & 19 through 28.

6.12 LEAK CHECK



WARNING – Electrical Shock Hazard

Unplug power cord prior to starting the leak check procedure.

1. Power off the unit and unplug the power cord.
2. Cap the exhaust on the rear panel and the regenerative dryer.
3. Disconnect the line from the T-connector threaded into the outlet filter to the Dewpoint sensor, and cap that fitting as well.
4. Plug in the power cord, power on the unit, and allow it to run until the pump shuts off on its own (now it's pressurized).
5. Turn off the power switch and wait five minutes. The reading on the front panel pressure gauge should not change.

Note

This procedure checks the majority of the components and fittings. If you believe that there is still a leak, please contact Technical Support.



6.13 PARTICULATE FILTER ELEMENT REPLACEMENT

Replace the particulate filter located at the “Air In” inlet on the rear panel (refer to Figure 3-2) as follows:

1. Remove the particulate filter cap by turning it counter-clockwise.
2. Remove the used filter element and replace with a new filter element (TAPI Part Number FL15).
3. Replace the particulate filter cap and turn it clockwise to secure in place.

7 TROUBLESHOOTING

This section presents possible problems and their causes and solutions.



CAUTION – Avoid Warranty Invalidation

Failure to comply with proper anti-Electro-Static Discharge (ESD) handling may void your warranty. For anti-ESD handling instructions please refer to the manual, Fundamentals of ESD, PN 04786, which can be downloaded from our website at <http://www.teledyne-api.com>.

Table 7-1. Troubleshooting Guidance

Problem	Probable Cause	Corrective Action
Power light does not come on.	Unplugged power cord.	Plug in power cord at both ends.
	Failed Control Board	Check for 5 VDC at TP8 on the control board (see Figure 4-2).
	Tripped power switch/circuit breaker.	Reset the power switch/circuit breaker.
	VDC power supply failed.	Replace power supply (see Figure 3-3 for location).
Compressor does not start (after 10 seconds).	Tank pressure is above the cut-out pressure.	No action. Pressure will drop as air is used.
	AIR IN filter is plugged.	Replace the filter (Section 6.13).
	Compressor fan is jammed.	Check for any mechanical obstruction.
	Pump is not connected to controller.	Connect the pump to the controller (see Figure 4-2).
	Pump is in Stand-by Mode	Remove from Stand-by Mode (see Section 5-7)
Compressor stops and does not restart.	Pump relay (K4) is open.	Replace the controller (Section 4.2.17).
	Tank pressure has not subsided to the pressure switch cut-in setting.	No action. Wait for the pressure to subside.
Compressor does not stop when the demand is.	Internal leak.	Check for leaks. (Section 6.12).
	Pump has low output pressure.	Rebuild pump (see sticker on pump for rebuild kit PN).



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Problem	Probable Cause	Corrective Action
Instrument vibrates excessively.	Compressor shock isolator screws are loose.	Tighten the screws.
	Screws securing the compressor to the base plate are loose.	Tighten the screws.
	The tubing attached to the compressor is vibrating against a component.	Adjust the placement of the tubing.
	Air demand too high. Maximum air flow is 30 SLPM (unless customized at factory).	No action. Pressure will drop as air is used.
Pressure does not increase to 30 psig.	Air Inlet impeded.	Check for impediment and remove object.
	Pressure regulator is set too low.	Adjust the pressure via the front panel control.
	Air leakage.	Check for leaks (Section 6.12).
	Air demand is too high.	Lower the flow demand.
Output pressure surges.	Scrubbers may be contaminated.	Replace the scrubbers (Sections 6.4, 6.5, 6.7, 6.8).
Output air is not "Zero".	4-way valve is jammed; only one column is being used.	Check to ensure the valve is plugged in (Figure 4-2); replace the valve (Section 6.10).
Output air is not dry.	Shuttle valve is jammed.	Replace the upper manifold assembly (Section 6.9, steps 1 thru 8, and step 19).
	Molecular sieve is contaminated.	Replace the molecular sieve (Section 6.9).

7.1 TECHNICAL SUPPORT CONTACT

Our Technical Support Department may be reached as follows:

Phone: +1 800-324-5190 (toll free) or +1 858-657-9800

Email. api-techsupport@teledyne.com



APPENDIX - INTERCONNECTS

