SEREN

INDUSTRIAL POWER SYSTEMS INC.

ATS-SERIES
AUTOMATIC IMPEDANCE MATCHING NETWORK

OPERATOR'S MANUAL

Revision: 2.01
Standard Configuration

Document Number 6200160000

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Introduction

Thank you for purchasing your new SEREN IPS product. The ATS-Series Automatic Impedance Matching Networks have been designed to provide the best value, ease of operation, and reliability for plasma and non-plasma processing systems. This manual covers specifications, installation, and operation of the ATS-Series Automatic Impedance Matching Network.

Automatic Impedance Matching Networks are often custom-configured for the application; therefore only generic versions of the ATS-Series products are discussed in this manual. Custom matching networks usually differ in mechanical configuration and tuning range. The operation of a custom-configured matching network is, in most cases, the same as a generic unit. Consult your local Seren IPS representative or the factory for detailed specifications of custom-configured matching networks.

Information

To obtain answers for any questions you might have regarding your plasma or processing system, please contact your system vendor first. Your system vendor knows the intimate details of how your equipment interfaces and operates with the ATS-Series Matching Network and can efficiently resolve system related problems.

For questions directly related to the ATS-Series Matching Network, you may call us, Monday through Friday, 8:00am to 5:00pm, United States Eastern Time, at:

1-856-205-1131

Service

For Matching Networks purchased with a processing system, or covered under a service contract from your system vendor, please contact the system vendor to arrange for service.

For after-market or end user customers, a SEREN IPS customer service representative will arrange for service. Call us, Monday through Friday, 8:00am to 5:00pm, United States Eastern Time, at:

1-856-205-1131

Please note: Equipment returned to us without prior authorization or without a Return Materials Authorization (RMA) number visible on the outside of the package will be refused.

How to Contact Us

Our address, telephone, and fax numbers are listed below.

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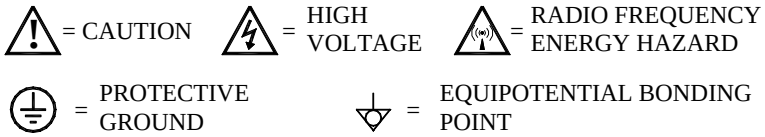
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Safety Notes

The ATS-Series Automatic Impedance Matching Networks have been designed and tested to meet strict safety requirements. These include independent lab examination and approval, and compliance to established standards. Please read the following instructions carefully before operating the ATS-Series Matching Network and refer to them as needed to ensure the continued safe operation of the ATS-Series Matching Network.

Follow all warnings and instructions marked on or supplied with the product.

Symbology:



Unplug or disconnect this equipment from the Radio Frequency and DC power sources before cleaning, re-configuring or performing maintenance operations.

Do not use this equipment near water, wet locations, or outdoors.

Do not place this equipment on an unstable cart, stand, or table. The ATS-Series Automatic Impedance Matching Network may fall, causing personal injury or damage to the Matching Network.

To avoid electric shock, this unit must be connected to the power source in compliance with the National Electrical Code ANSI C1 and/or any other codes applicable to the user. Improper installation may result in a shock or fire hazard.

It is the responsibility of the installer to provide a proper protective ground from the ATS-Series Matching Network to earth ground, in accordance with local and national electrical codes, and any other codes applicable to the user.

The ATS-Series Matching Network should be operated from the type of power source indicated by the ratings plate. If you are not sure of the type of power available, consult the system integrator, an electrician, or your local power company.

Do not allow anything to rest on the power cable, RF cables, or other interconnecting cables. Do not locate the ATS-Series Matching Network where persons will step on the power, RF, or interconnecting cables.

Slots and Openings in the equipment's chassis are provided for ventilation. To ensure reliable operation of the ATS-Series Automatic Impedance Matching Network, these openings must not be blocked, covered, or restricted. Restricting the air inlets or exhaust will cause the unit to overheat. Sustained over temperature conditions may degrade or damage the unit.

Never push objects of any kind into the slots and openings of the ATS-Series Matching Network enclosure. They may touch dangerous voltage points or short out parts, which could result in a fire or electric shock.

Never spill liquid of any kind on or into the ATS-Series Matching Network.

Never remove covers or guards that require a tool for removal. There are no operator serviceable areas within these covers. Refer servicing to qualified service personnel.



CAUTION!



ELECTRICAL SHOCK HAZARD PRESENT INSIDE UNIT AND AT THE RF INPUT AND RF OUTPUT CONNECTORS/CONNECTIONS.
DO NOT REMOVE COVERS.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

ATS-Series Automatic Impedance Matching Network Features

The ATS-Series Automatic Impedance Matching Network is a self-contained product. It is designed for direct integration into a processing system as a component of an RF power delivery system for plasma or other processing applications. The ATS-Series Matching Networks are powered from the processing system, and are remotely controlled and monitored by the system through digital and analog interfaces. An *optional* Remote Display Panel is available for direct control of the ATS-Series Matching Networks, for set-up and programming or operation without a system controller.

Interface cables, Interconnect cables, Remote Display Panel, and other accessories are sold separately.

ATS-Series Automatic Impedance Matching Networks typically consist of two variable capacitors and a single fixed inductor. The matching network circuit topology is typically an "L" type. The type "L" circuit configuration provides a wide tuning range and low insertion loss, delivering maximum power transfer to the load. Stepper motors, operated by an internal controller, drive the variable capacitors within the ATS-Series Automatic Matching Network.

In the manual mode of operation, the variable capacitors can be positioned using by control signals from the digital or analog interfaces, or by the MIN/MAX switches on the *optional* Remote Display panel. The operator can control the direction of stepper motor rotation, thus allowing the operator to manually tune the network to match the load impedance.

In the automatic mode of operation, the ATS-Series Matching Network's internal sensor, called the Phase and Magnitude detector, generates an error signal. The matching network's internal controller reacts to the error signal and drives the stepper motors, automatically tuning the network to the appropriate load impedance.

Other ATS-Series Matching Network features:

- Compact package with internal controller
- Powered by 24VDC (customer supplied power source)
- Stepper Motor Design
- Scalable RF and DC Probe
- Programmable capacitor position presets
- Programmable capacitor position limits
- Digital monitoring and control via serial interface or *optional* DeviceNet™ interface
- RS-232, RS-422, and RS-485 serial interface protocols supported
- Analog remote control via system interface connector
- Custom configurations available – consult factory.
- Air-Cooled (convection), Air-Cooled (fan), and Water-Cooled configurations available – consult factory.

- Impedance matching (tuning) range can be tailored to fit the application – consult factory.
- Limit Condition Back-out: The ATS-Series internal controller reverses the matching network's motors when a position limit condition has been reached, allowing the matching network to re-tune, thus minimizing "stuck" network conditions. The limit condition back-out feature can be enabled/disabled as needed.
- *Optional* Remote Display Panel available, with bright, easy to read 4 Line Vacuum Fluorescent Display, capable of displaying matching network status, RF or DC Probe Voltage, Phase and Magnitude error signals, and has controls for capacitor positioning, mode selection, and configuring operational parameters.
- Matching network capacitors can be manually positioned from the *optional* Remote Display panel controls while unit is in "Automatic" mode.
- *Optional* RF Current Probe available.
- *Optional* Power Sensor available.

Installation

Unpacking:

Remove the ATS-Series Matching Network from its carton and packing materials. Examine the unit for physical damage. If physical damage is evident, notify both the carrier and Seren IPS, Inc.. Contact the Seren IPS Inc. service department or a Seren IPS Inc. service representative for assistance.

Supplied Accessories:

Description	Quantity	Seren Part Number
Product Information CD-ROM	1	6800000000

For generic ATS-Series Automatic Impedance Matching Networks, model-specific supplied accessories are listed in the Technical Data section of this manual. Consult a local Seren IPS Inc. representative or the factory for details regarding custom configured ATS-Series matching networks.

Recommended mounting:

The ATS-Series Automatic Impedance Matching Network is designed for direct integration into plasma or material processing systems. An ATS-Series Matching Network is typically bolted to a plasma chamber or processing system frame. Placement on a tabletop or other surface is possible, but not recommended and the installer must take measures to ensure adequate safety and RF grounding (equipotential bonding). Improper installation and inadequate grounding can cause poor performance, shock, RF burn, EMC compliance issues, and electrocution hazards. The user is responsible for providing mounting hardware and ensuring the installation and/or application is EMC-compliant.

Mount the ATS-Series Matching Network on the plasma chamber or processing apparatus or as close as possible to the plasma chamber or processing apparatus. Ensure vent holes are not blocked or obstructed. Ensure there is a proper RF ground (equipotential bond) connection between the plasma chamber or processing apparatus and the matching network chassis.

Equipotential Bonding (grounding) of the ATS-Series Matching Network

A solid Radio Frequency (RF) electrical bond between the matching network's chassis and the plasma chamber or processing apparatus chassis is essential for proper operation and safety. A poor bond may result in erratic matching network performance, EMC compliance issues, an electrical shock hazard or RF burn hazard.



ENSURE THE ATS-SERIES MATCHING NETWORK CHASSIS IS DIRECTLY BOLTED/ELECTRICALLY BONDED TO THE PLASMA CHAMBER OR PROCESSING APPARATUS. A POOR ELECTRICAL BOND MAY RESULT IN EMC COMPLIANCE ISSUES, ELECTRICAL SHOCK HAZARD, OR RF BURN HAZARD.

Equipotential bonding straps can be constructed of 0.020" thick to 0.031" thick by 2" (or wider) Copper strap, preferably silver-plated to enhance conductivity and prevent the copper from oxidizing (tarnished copper is not a good RF conductor). Connect the bonding strap from the ATS-Series Matching Network's chassis to the plasma chamber or processing apparatus chassis.

Bonding straps should be short in length and as wide as possible. Due to the operating frequency, the majority of the RF current flows on the surface of the bonding strap (called the Skin Effect). The more surface area, the better the RF bonding connection. If a single bonding (ground) point is not available, a star-bonding (ground) configuration is recommended.

Do not daisy chain Equipotential Bonding connections.

Power Source for the ATS-Series Automatic Matching Networks

The ATS-Series Automatic Matching Network requires a regulated +24VDC power source, capable of delivering a minimum of 3 Amperes. The system integrator/user is responsible for providing a suitable power supply and power supply wiring.

If more than one ATS-Series Matching network is used in a system and a common +24VDC power supply is used, the +24VDC power supply must be capable of delivering +24VDC at 3 Amperes *for each* ATS-Series Matching Network (3A for 1 matching network, 6A for 2 matching networks, 9A for 3 matching networks, etc.) If you need additional assistance, consult a local Seren IPS representative or the factory.

Connecting the ATS-Series Automatic Matching Network's RF Output

For units *without* output connectors:

Directly connect the matching network's RF output to the plasma chamber or processing apparatus via a "hard line" connection. The user/installer must determine the appropriate connection method and locate a place to cut a hole in one of the matching network's panels. Typically, the user will pass a copper strap through a hole in a panel and connect to the RF output side of the Tune (series) capacitor. Keep the connection length as short as possible.

For units *with* output connectors:

Connect the matching network's RF Output connector(s) to the plasma chamber or processing apparatus via a coaxial cable (or multiple coaxial cables for units with more than 1 RF output connector). Keep the length of the coaxial cable connections as short as possible (under 3 feet). Multiple coaxial cables must be identical in length.

The plasma chamber or processing apparatus can present low-impedance, high current and/or high impedance, high voltage loads to the ATS-Series Automatic Matching Network's output. RG-393/U or RG-225/U coaxial output cable is recommended for its high-voltage and high temperature properties. Depending on the application, non-Teflon dielectric coaxial cable types may melt or internally arc.

Some configurations of the ATS-Series Automatic Matching Network utilize a pair of connectors for RF output. By using two output connections in parallel, the RF output current is divided, reducing heating of the connection(s) to the plasma reactor or load.

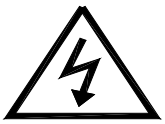
Connecting the ATS-Series Automatic Matching Network's RF Input

Connect the matching network's RF Input connector to the RF power source's (RF Generator's) RF output connector with a suitable coaxial cable. Depending on the power level and frequency, coaxial cable types RG-213/U, RG-218/U, RG-393/U, are commonly used. If you are unsure about which coaxial cable is appropriate for your application, contact a local Seren IPS Inc. representative or the factory for assistance.

The RF input cable is, electrically, a component of the matching network. The RF input cable length can affect the matching network's performance and ability to tune. A ¼ wavelength cable (at the operating frequency) is recommended for initial system set-up, and is often sufficient for most applications (1/4-wavelength @ 13.56MHz is 12-foot / 3.66m). Optimum cable length for the application must be empirically determined.



CAUTION: Do not apply RF power to the ATS-Series matching network without connecting a suitable load to the RF Output connector. Operating without a suitable load may damage the matching network void the warranty.



WARNING: Do not apply RF power to the ATS-Series matching network without connecting a suitable load to the RF Output connector. Operating without a suitable load connected to the RF Output connector may create a Shock, Electrocution, or RF Energy Burn Hazard

Water Connections to the ATS-Series Automatic Matching Network

(water-cooled units only)

Water-cooled matching networks require connection to an external, user-supplied water chiller or water re-circulation system. Unless otherwise specified, coolant water connections for water-cooled ATS-Series matching networks are industrial compression-type fluid fittings (Swagelok™ / Parker A-Lok™ compatible). Refer to the Technical Data section for model-specific details.

Coolant Water Supply Lines *(water-cooled units only)*

To ensure sufficient coolant water flow, the coolant water supply and return lines must have sufficient inside diameter (ID). If the inside diameter of the coolant supply and return lines is too small, the matching network may be damaged from insufficient cooling. Recommended coolant line parameters are listed in the table below:

Tube Fitting Size	Tubing OD (Outside Diameter)	Tubing Wall Thickness	Tubing ID (Inside Diameter)
1/4"	1/4" (0.250")	0.031"	0.188"
3/8"	3/8" (0.375")	0.062"	0.250"



DO NOT connect the matching network's coolant lines in series or "daisy-chain" with other water-cooled equipment. Other water-cooled equipment may have restricted water paths, resulting in insufficient water flow through the matching network.

Connect the water supply lines directly to the system water supply manifold. If the coolant lines are routed near hot system components, the use of FEP Teflon tubing is strongly recommended.

Important Note For Water-Cooled Matching Networks

Proper coolant water resistivity is crucial for heat extraction and system performance. If the system water resistivity is too low, the water may conduct RF energy from the reactor or the matching network's internal inductor (if inductor is water-cooled) to ground. This RF energy "leak" is an additional load to the RF delivery system and makes the matching network appear less efficient, resulting in an apparent power loss and is nominally identified by Low DC Developed Bias Voltage. Recommended minimum water Specific Resistivity is 500,000 Ohms per centimeter at 25°C.

System Interfacing and Control Connections

ATS-Series Matching Networks are designed for interfacing and integration with a processing system. There are three (3) standard connectors and one optional connector dedicated to system interfacing. With the use of the *optional* Remote Display Panel, the ATS-Series matching can also be operated as "stand-alone" unit.

There are many possible interface schemes – a full discussion of interface schemes is beyond the scope of this document. Contact the Seren IPS Inc. customer service department if you require assistance with interface connection details.

Detailed connector pin lists and signal descriptions are provided in the **Controls and Connections** section. Refer to the **Typical Connections** section for detailed generic analog interface connection schemes. Generic system configurations are diagrammed in the **Typical Configurations** section. A brief summary of the connectors is listed below.

"INTERFACE" Connector

Provides analog status signals and allows an external system controller to position the matching network's capacitors via analog signals.

"CONTROL" Connector

Facilitates computer control & monitoring of ATS-Series Matching Network functions via RS-232, RS-422, RS-485, and Modbus protocols

"DEVICENET" Connector (optional)

Facilitates computer control and monitoring of ATS-Series Matching Network functions via the *optional* DEVICENET communications interface.

"PROFIBUS" Connector (optional)

Facilitates computer control and monitoring of ATS-Series Matching Network functions via the *optional* PROFIBUS communications interface.

"ETHERNET" Connector (optional)

Facilitates computer control and monitoring of ATS-Series Matching Network functions via the *optional* ETHERNET communications interface.

"PROBE" Connector

Provides analog signals (DC Bias and RF Probe) for monitoring by the processing system or, by interconnection to the RF power supply, for use as a feedback signal for regulating the RF power supply's output.

"DISPLAY" Connector

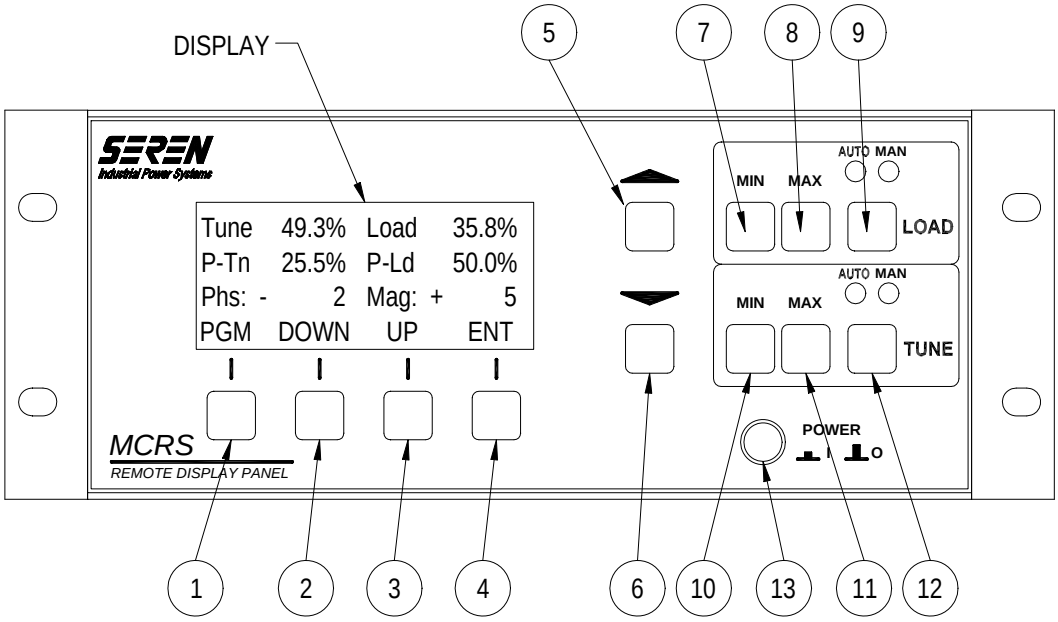
Connects to an *optional* Remote Display Panel for manual or "stand-alone" operation of the ATS-Series Automatic Impedance Matching Network. The DISPLAY connector supports only control signals; it ***does not*** provide power for the Remote Display Panel. The Remote Display Panel obtains power from its AC Mains power connection.

An optional 910036XXXX series display cable is required to connect to the Remote Display Panel to the ATS-Series Matching Network. Several cable lengths are available – consult your local Seren IPS Inc. representative or the factory for display cable options and availability.

MCRS Remote Display Panel *(optional accessory)*

ATS-Series Automatic Impedance Matching Networks can be connected to an *optional* MCRS remote display panel. The MCRS remote display panel provides a stand-alone user interface for programming, configuration, and manual operation of the ATS-Series matching network.

The MCRS remote display panel includes a 4-line display, status LEDs, power switch, and various buttons used for control and configuration. The top line of the display always shows the Tune and Load capacitor positions. The bottom line of the display indicates the functions of the four softkeys used for configuration. The middle lines of the display can be configured to show information such as Phase and Magnitude error signals, probe voltages, and preset values.

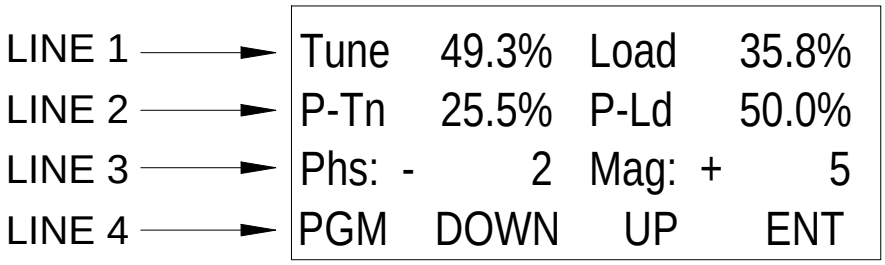


MCRS Remote Display Panel Buttons		
Item	**Name**	**Description**
1	Program/Run	Toggles the ATS-Series matching network's internal controller between the RUN mode and PROGRAM mode. In Program mode, display line 3 changes to show Programmable Menu Entry Options. The button legend changes from "PGM" to "RUN" when in the Program mode.
2	Down	Moves down the programming menu
3	Up	Moves up the programming menu
4	Enter	Programs (saves) changes made to a parameter
5	Value Up	Changes Parameter Value - Increment
6	Value Down	Changes Parameter Value - Decrement
7	Load Min	Manually positions Load cap towards minimum capacitance
8	Load Max	Manually positions Load cap towards maximum capacitance
9	Load Mode	Selects Load capacitor automatic or manual mode

MCRS Remote Display Panel Buttons		
Item	**Name**	**Description**
10	Tune Min	Manually moves Tune cap to minimum capacitance
11	Tune Max	Manually moves Tune cap to maximum capacitance
12	Tune Mode	Selects Tune capacitor automatic or manual mode
13	Power Switch	Enable/Disables power for the MCRS Remote Display Panel (Does not enable/disable power to the ATS-Series matching network)

MCRS Display

The MCRS display indicates the current matching network capacitor positions, user-configurable display items, and provides legends for the keypad. Two of the four display lines are user configurable. There are three (3) display items available for the user configurable display lines, but only two (2) display items can be shown at one time.



MCRS Display Lines	
Line	**Description**
1	Tune and Load Capacitor positions 0.0 to 100%.
2	User Configurable Display Line Displays Tune Capacitor Preset Point, Load Capacitor Preset Point (User enabled or disabled) Displays Phase and MAGnitude error signal Voltage (User enabled or disabled) Displays DC Voltage Probe or RF Voltage Probe output (User enabled or disabled)
3	User Configurable Display Line In RUN mode: Displays Tune Capacitor Preset Point, Load Capacitor Preset Point (User enabled or disabled) Displays Phase and MAGnitude error signal Voltage (User enabled or disabled) Displays DC Voltage Probe or RF Voltage Probe output (User enabled or disabled) In PROGRAM mode: Displays a programmable parameter and its current setting.
4	Keypad Menu – button legends change depending on mode

Operation

The ATS-Series Automatic Impedance Matching Network is designed for OEM integration into a processing system, and is primarily intended for operation by the system controller.

Reading the Remote Display Panel Operation, Program Mode, and Programmable Parameter sections will give insight and understanding of the features and capabilities of ATS-Series Matching Network. Understanding of the aforementioned sections is important because nearly every feature and parameter that can be controlled or monitored by the Remote Display Panel can also be digitally accessed via the Serial communications interface or one of the optional communications interfaces.

The ATS-Series Matching Networks can also be controlled via the Analog Interface. The Analog Interface provides access to basic operational controls of the ATS-Series matching network through a user-supplied programmable controller or custom control panel. Analog Interface operation is discussed in detail in the Analog Control section of this manual.

Remote Display Panel Operation

Remote display panel operation of the ATS-Series Automatic Impedance Matching Network is simple. This section describes the use and operation of the *optional* remote display panel controls in a "how to…" manner. Refer to the MCRS Remote Display Panel section for item references.

Power On/Off

Ensure power is supplied to the ATS-Series matching network. Press the POWER button (item 13) to enable the remote display panel power – the remote panel's display will illuminate and momentarily display the power-on message and copyright. Press the POWER button again to disable the remote display panel's mains power.

If the remote display panel is not connected to an ATS-Series matching network or the ATS-Series matching network is not powered, the display will read "Connecting…..".



The Power On/Off button only controls the MCRS Remote Display Panel – it does not control power to the ATS-Series Automatic Impedance Matching Network.

Run Mode, Automatic and Manual Control

The RUN mode is the normal operational state of the ATS-Series matching network. Tune and Load capacitor operational modes can be selected and the capacitors can be manually positioned.

To Select CAPACITOR MODE:

The ATS-Series matching network has two (2) capacitor control modes: Automatic (AUTO) and Manual (MAN). The Load and Tune capacitor control modes are independent of each other.

The Automatic mode responds to an error signal from the matching network's Phase and Magnitude sensor, automatically adjusting the associated matching network capacitor to minimize reflected power to the RF generator. The MIN and MAX capacitor positioning buttons are active in Automatic mode – this is useful for system set-up.

The automatic mode will only respond when an RF signal is applied to the matching network.

The Manual mode disables automatic operation of the respective matching network capacitor. The MIN and MAX capacitor positioning buttons may be used to manually position the matching network capacitor.

LOAD:
To change the mode of the Load capacitor, press the LOAD mode select button (item 9) on the front panel. The indicator lamp above the button will change to show the current operational mode.

TUNE:
To change the mode of the Tune capacitor, press the TUNE mode select button (item 12) on the front panel. The indicator lamp above the button will change to show the current operational mode.

Note: The mode selection is saved when the ATS-Series matching network is powered down – it will power-up in the same mode.

Manually Positioning Matching Network Capacitors:

Use the MIN and MAX Positioning Buttons. The Load and Tune capacitor positioning buttons operate independently of each other and are active in the AUTOmatic and MANual modes.

The LOAD capacitor MIN button (item 7) moves the LOAD capacitor towards minimum capacitance. Depress the button until the desired position is reached and then release – the capacitor will stop.

The LOAD capacitor MAX button (item 8) moves the LOAD capacitor towards maximum capacitance. Depress the button until the desired position is reached and then release – the capacitor will stop.

The TUNE capacitor MIN button (item 10) moves the TUNE capacitor towards minimum capacitance. Depress the button until the desired position is reached and then release – the capacitor will stop.

The TUNE capacitor MAX button (item 11) moves the TUNE capacitor towards maximum capacitance. Depress the button until the desired position is reached and then release – the capacitor will stop.

Program Mode

The Program mode allows the user to examine and edit the programmable parameters (configuration settings) of the ATS-Series matching network.

In the discussions below, it is assumed that the *optional* MCRS Remote Display Panel accessory is used to navigate and view the Programming Menu. Note: Nearly all of the ATS-Series Matching Network's configurable parameters are also accessible via standard Serial communication interfaces or via optional DeviceNet, PROFIBUS, or Ethernet communication interfaces.

To enter the Program mode, press the "PGM" button (program/run button – item 1 on the remote display panel). The button legend will change to RUN. In Program mode, the ATS-Series matching network will continue to operate while allowing the use of the DOWN and UP buttons to examine and edit the programmable parameter settings. The programmable parameters are presented one-at-a-time on line 3 of the display, as the DOWN or UP buttons are pressed

Configuring Programmable Parameters

The ATS-Series Automatic Impedance Matching Network's programmable parameters allow you to select options to fit your application needs. A summary of the programmable parameters is listed in the table below, followed by detailed descriptions of each parameter.

Navigating the Programming Menu

TO ENTER the programming mode, press the "PGM" button (Program/Run button – item 1) on the remote display panel. The legend above the button will change from "PGM" to "RUN".

TO EXIT the programming mode, press the "RUN" button (Program/Run button – item 1) on the remote display panel. The legend above the button will change from "RUN" to "PGM".

Pressing the "DOWN" button (item 2) moves down the list of programmable parameters.

Pressing the "UP" button (item 3) moves up the list of programmable parameters.

While a particular programmable parameter is displayed, its setting or value can be changed using the UP ARROW or DOWN ARROW buttons (items 5 and 6 respectively) on the remote display panel. When a setting is changed, the change takes place immediately, however the change is not retained if the ATS-Series matching network is powered off unless the "ENT" button (item 4) is pressed.



If you edit a programmable parameter's value or setting and wish the change to remain in effect after a power-down/power-up cycle, be sure to press the "ENT" button.

Pressing the "ENT" button (item 4) saves the currently displayed programmable parameter setting. When the "ENT" button is pressed, the ENT legend will blink to acknowledge the setting has been saved. The programmable parameter's setting is saved in the ATS-Series matching network's memory and is recalled upon power-on

PROGRAMMABLE PARAMAETER REFERENCE CHART

Factory settings are noted in the option column by an asterisk (*) or the term "Default:".

ATS-Series Automatic Impedance Matching Networks are designed for embedded applications within processing systems. Nearly all of the ATS-Series Matching Network's configurable parameters are accessible via standard Serial communication interfaces or via optional DeviceNet, PROFIBUS, or Ethernet communication interfaces. In most applications, the system controller operates the ATS-Series matching network.

"Stand-alone" operation is possible with the *optional* MCRS Remote Display Panel accessory and a user-supplied 24VDC power supply.

In the event a system controller is not available or a service operator wishes to directly control the ATS-Series matching network or access its configurable parameters, an *optional* MCRS Remote Display Panel accessory may be used.

In the discussions below, it is assumed that the *optional* MCRS Remote Display Panel accessory is used to navigate and view the Programming Menu.

Navigating the Programming Menu

TO ENTER the programming mode, press the "PGM" button (Program/Run button – item 1) on the front panel. The legend above the button will change from "PGM" to "RUN".

TO EXIT the programming mode, press the "RUN" button (Program/Run button – item 1) on the front panel. The legend above the button will change from "RUN" to "PGM".

Pressing the "DOWN" button (item 2) moves down the programming menu levels.

Pressing the "UP" button (item 3) moves up the programming menu levels.

Pressing the "ENT" button (item 4) saves the programmable parameter selection. Pressing either the "UP" or "DOWN" buttons selects the next programmable parameter but does not save the parameter selection in the RF Power Supply's memory. If changes are made and the "ENT" button *is not* pressed, the changes will not be preserved after a power-off/power-on cycle

Pressing the VALUE UP button ("up" arrow - item 5) increments the parameter value.

Pressing the VALUE DOWN button ("down" arrow - item 6) decrements the parameter value.

The saved programmable parameters are recalled upon power-on.

PROGRAMMABLE PARAMETER REFERENCE CHART		
PARAMETER	**DISPLAY LINE 3**	**OPTION**
Auxiliary (Aux) Capacitor Position (Presented only if Aux capacitor is installed)	AUX POS XX.X%	0.0% to 100.0% Default: 50.0%
Auxiliary (Aux) Capacitor Mode (Presented only if Aux capacitor is installed)	AUX MODE: MANUAL	MANUAL* AUTO
Set Strike Preset	RECORD STRIKE PRESET or WAITING FOR DC BIAS	<ENT>
Move to selected Preset Position	GOTO PRESET 1	PRESET 1* PRESET 2
Load Capacitor Preset Position 1	LOAD PRESET 1 XXX.X%	0.0% to 100.0% Default: 50.0%
Tune Capacitor Preset Position 1	TUNE PRESET 1 XXX.X%	0.0% to 100.0% Default: 50.0%
Auxiliary (Aux) Capacitor Position Preset 1 (Presented only if Aux capacitor is installed)	AUX PRESET 1 XXX.X%	0.0% to 100.0% Default: 50.0%
Load Capacitor Preset Position 2	LOAD PRESET 2 XXX.X%	0.0% to 100.0% Default: 50.0%
Tune Capacitor Preset Position 2	TUNE PRESET 2 XXX.X%	0.0% to 100.0% Default: 50.0%
Auxiliary (Aux) Capacitor Position Preset 2 (Presented only if Aux capacitor is installed)	AUX PRESET 2 XXX.X%	0.0% to 100.0% Default: 50.0%
Preset Source	PRESETS: OFF	OFF * INTERNAL ANALOG
Preset Trigger Mode Enable/Disable	RF-OFF TRIGGER: OFF	OFF* ON

PROGRAMMABLE PARAMETER REFERENCE CHART		
PARAMETER	**DISPLAY LINE 3**	**OPTION**
Analog Interface Control Enable/Disable	ANALOG CONTROL OFF	OFF * ON
Feedback Source (Probe) Select	DCV PROBE SELECTED	DCV PROBE* RFV PROBE CUR PROBE
DC Voltage Probe Attenuation Factor (XXXX:1)	DC PROBE ATTEN XXXX	1 to 4095 Default: 200
RF Voltage Probe Attenuation Factor (XXXX:1)	RF PROBE ATTEN XXXX	1 to 4095 Default: 200
Current Probe Attenuation Factor (XXXX:1)	I PROBE ATTEN XXXX	1 to 1000 Default: 100
Display Line 2 Information Select	LINE 2 INFO NONE	None* Phs/Mag PRESETS PROBES PWRSENS
Display Line 2 - Information Select (Presented only if Power Sensor option is installed) (Firmware Version X.X and later)	Frq 13.56M Phs -14.2	FREQ/PHASE VOLT/CURR DELIV/REACT FWD/REF IMP-R/IMP-X GAMMA/VSWR VPK/IPK
Display Line 3 Information Select	LINE 3 INFO NONE	NONE* Phs/Mag PRESETS PROBES PWRSENS
Display Line 3 Information Select (Presented only if Power Sensor option is installed) (Firmware Version X.X and later)	Frq 13.56M Phs -14.2	FREQ/PHASE VOLT/CURR DELIV/REACT FWD/REF IMP-R/IMP-X GAMMA/VSWR VPK/IPK
RF On/Off Detect Threshold – Phase Error	RFON THR PHS XXXXmV	0 to 5000mV Default: 40mV

PROGRAMMABLE PARAMETER REFERENCE CHART		
PARAMETER	**DISPLAY LINE 3**	**OPTION**
RF On/Off Detect Threshold - Magnitude Error	RFON THR MAG XXXXmV	0 to 5000mV Default: 20mV
RF On/Off Detect Threshold - Power Sense	RFON THR PWR XXXXmV	0 to 5000mV Default: 15mV
RF On/Off Detect Threshold – RF Probe	RFON THR RFV XXXXXV	0 to 20000V Default: 10V
RF-Off Delay (Firmware Version 3.5A and later)	RF-OFF DELAY 50ms	0 to 20000ms Default: 50ms
Load Capacitor Position High Limit	LOAD LIMIT HI XXX.X%	2.0-100.0% Default: 80.0%
Load Capacitor Position Low Limit	LOAD LIMIT LO XX.X%	0.0-98.0% Default: 2.0%
Tune Capacitor Position High Limit	TUNE LIMIT HI XXX.X%	2.0-100.0% Default 80.0%
Tune Capacitor Position Low Limit	TUNE LIMIT LO XX.X%	0.0-98.0% Default: 2.0%
Load Capacitor Deadband	LOAD DEADBAND XXXX mV	0mV to 1250mV Default: 15mV
Load Capacitor High-Speed Threshold (Firmware Version 3.5A and later)	LD SPEED THR XXXXmV	0mV to 1250mV Default: 200mV
Load Capacitor Motion Slowdown Delay (Firmware Version 3.5A and later)	LOAD SLOWDOWN XXXmS	0mS to 100mS Default: 8mS (Air) 1mS (Vac)
Tune Capacitor Deadband	TUNE DEADBAND XXXX mV	0mV to 1250mV Default: 15mV
Tune Capacitor High-Speed Threshold (Firmware Version 3.5A and later)	TN SPEED THR XXXXmV	0mV to 1250mV Default: 200mV
Tune Capacitor Motion Slowdown Delay (Firmware Version 3.5A and later)	TUNE SLOWDOWN XXXmS	0mS to 100mS Default: 8mS (Air) 1mS (Vac)
Express Tuning Delay	RF ON->GoPres2 XXXmS	0ms to 9999mS Default: 0mS (off)

PROGRAMMABLE PARAMETER REFERENCE CHART		
PARAMETER	**DISPLAY LINE 3**	**OPTION**
Auto Load Delay	AUTO-LD DELAY XXXXmS	0 to 9999mS Default: 0
Auto Tune Delay	AUTO-TN DELAY XXXXmS	0 to 9999mS Default: 0
Express Tuning	RFon->GoPres2 (off) RFon->GoPres2 XXXXmS	RFon->GoPres2 (off)* 0 to 9999mS
BACKOUT Feature Mode	BACKOUT: OFF	OFF * PRESET 2 REVERSE ALG
BACKOUT Delay	BACKOUT DELAY XXXXmS	50mS to 5000mS Default: 1000mS
Communication Protocol Select (MODBUS supported with firmware version 4.2A and later)	RS232	PROFIBUS DEVICENET MODBUS 2W RTU MODBUS 4W RTU RS485-2 RS485-4 RS422 RS232*
Address ID number Applies to all Communication Protocols.	ADDRESS # XXX	0 to 247 Default: Varies, protocol-dependant
Data Rate DeviceNet Protocol: 500, 250, 125 KBPS RS232, RS422, RS485, and MODBUS Protocols: 115200, 57600, 38400, 19200, 9600 4800, 2400 BAUD PROFIBUS Protocol: Data Rate is automatically determined	DATA RATE XXX KBPS XXXXX BAUD	500 KBPS* 250 KBPS 125 KBPS 115200 BAUD 57600 BAUD 38400 BAUD 19200 BAUD* 9600 BAUD 4800 BAUD 2400 BAUD
DeviceNet Assembly Set (Presented if DeviceNet protocol is selected)	DN Data XX out XX in	DN Data 10 out 18 in* DN Data 6 out 12 in DN Data 9 out 14 in
Communications ECHO (RS232 and RS-485 Protocols)	ECHO: DISABLED	Disabled* Enabled

PROGRAMMABLE PARAMETER REFERENCE CHART		
PARAMETER	**DISPLAY LINE 3**	**OPTION**
Modbus Type (Presented if Modbus Protocol is selected)	MULTIPLE ADDR: NO	NO* YES
Analog Interface Voltage Range	ANALOG RANGE 5V	5V * 10V
Save Programmable Parameter Configuration Settings to Internal Flash Memory	SAVE CONFIG TO FLASH	Press the "ENT" button to save
Phase/Mag Error Signal Offset Zero (IMPORTANT! See parameter details for procedure.)	PHS/MAG ZERO	Press the "ENT" button to zero-out Phase/Mag Signals
Save Phase/Mag Null Data (Used with Alternate Phase/Mag Null Feature.) IMPORTANT! See Alternate Phase/Mag Null parameter details for procedure.	SAVE P/M NULL (ENT)	Press the "ENT" button to store Phase/Mag null data.
Alternate Phase/Mag Null (Useful for Pulsing Applications) IMPORTANT! See parameter details for procedure.	USE ALT P/M NULL: X	N (No)* Y (Yes)
Automatic Capacitor Maintenance Motion (Firmware version 3.8A and later)	CAP MAINT OFF	OFF* 0>100 0>100>0
Last Tune Time timer (Feature available with firmware version 4.6B and later)	Tuning Time XXXXX ms	Where XXXXX is the elapsed time of the last tune cycle, in milli-seconds. See parameter details.
Factory Settings – Enter Pass-Code. No User Adjustments	SERVICE CODE: XXXXXX	XXXXXX

PROGRAMMABLE PARAMETER DETAILS:

Programmable parameters are discussed in detail below.

All programmable parameters are shown, including parameters for optional features and configurations which may or may not be installed.

Optional configuration and feature information is typically listed on the test data sheet supplied with the ATS-Series matching network.

If you are unsure of your matching network's configuration, contact Seren IPS customer service or an authorized Seren IPS service depot for assistance. Be prepared to supply the matching network's model number, serial number, and 10-digit part number.

ATS-Series Automatic Impedance Matching Networks are designed for embedded applications within processing systems. Nearly all of the ATS-Series Matching Network's configurable parameters are accessible via standard Serial communication interfaces or via optional DeviceNet, PROFIBUS, or Ethernet communication interfaces.

In the discussions below, it is assumed that the optional MCRS Remote Display Panel accessory is used to navigate and view the Programming menu.

Where applicable, related programmable parameters and serial commands are listed.

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Auxiliary (Aux) Capacitor Position	Presented/available only if the matching network is configured/constructed with an auxiliary variable capacitor. Used to manually position the internal Auxiliary Capacitor. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Used in conjunction with Auxiliary (Aux) Capacitor mode parameter. If the Aux Capacitor Mode parameter is set to "manual", the VALUE UP button (item 5) or VALUE DOWN button (item 6) can be used to manually position the Auxiliary (Aux) Capacitor. Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed Auxiliary (Aux) Capacitor "manual" position value is saved in non-volatile storage. Factory Default setting: 50.0%. Related Parameter: Auxiliary (Aux) Capacitor Mode Related Serial Command: MVAUX, CPAP

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Auxiliary (Aux) Capacitor Mode	Presented/available only if the matching network is configured/constructed with an auxiliary variable capacitor. Available selections are: AUTO MANUAL Factory default setting: MANUAL Operational Notes: 1. When set to "MANUAL", the Auxiliary (Aux) Capacitor is moved to the Auxiliary (Aux) Capacitor Position parameter value and remains at the specified position until the Auxiliary (Aux) Capacitor Position value is changed. The Auxiliary (Aux) Capacitor responds to commands to move to the PRESET 1 or PRESET2 positions. 2. When set to "AUTO", the Auxiliary (Aux) Capacitor responds moves to the PRESET1 position when RF is "OFF", and moves to the PRESET 2 position if RF is "ON". Related Parameter: Auxiliary (Aux) Capacitor Position Related Serial Command: MAUX, AAUX, QAMA
Set Strike Preset	Used in conjunction with LOAD and TUNE presets. Detects the point where DC bias is first developed ("strike point") and records the current capacitor positions for use with the preset feature. 1. Configure the matching network and RF power supply and initiate sequence to ignite a plasma. The third line of the *optional* Remote Display Panel displays: "WAITING FOR DC BIAS" 2. As a plasma is developed and DC Bias is detected (the "strike point"), the ATS-Series matching network records the strike point. The third line of the *optional* Remote Display Panel changes to "ENT SAVES STRK PRES" 3. Press the Enter "ENT" button (item 4) on the Remote Display Panel to save the Load and Tune capacitor positions at the strike point into memory as Preset 1 parameters. Related Parameters: Preset Source, Preset Trigger, Load Preset 1, Tune Preset 1

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Move to Selected Preset Positions	The ATS-Series matching network can store two (2) sets of Tune and Load capacitor preset positions. When using an *optional* Remote Display Panel while in programming mode, the operator can automatically jump to a desired preset. Available Selections are: GOTO PRESET 1 (ENT) GOTO PRESET 2 (ENT) Factory default setting: PRESET 1 Use the VALUE UP button (item 5) or VALUE DOWN button (item 6) to select the desired PRESET and press the "ENT" button – the Tune, Load, and Aux (if equipped) capacitors will be automatically moved to their respective preset positions. Operational Note: The ATS-Series matching network's TUNE, LOAD, and AUX (if equipped with auxiliary capacitor) capacitors will be positioned to the selected preset regardless of the capacitor mode (AUTO or MANUAL). Related Parameters: Load Capacitor Preset 1, Tune Capacitor Preset 1, Auxiliary (Aux) Capacitor Preset 1, Load Capacitor Preset 2 Tune Capacitor Preset 2, Auxiliary (Aux) Capacitor Preset 2 Auxiliary (Aux) Capacitor Mode Related Serial Command: MPL, MPLS, MPT, MPTS, MPA, MPAS, P2L, P2T, P2A, GOTO, GOP2
Load Capacitor Preset Position 1	Sets the internal Load Capacitor Preset Position 1. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Preset Source, Preset Trigger Mode Enable/Disable, Move To Selected Preset Position Related Serial Command: MPL, MPLS, QPL, QP1L, GOTO
Tune Capacitor Preset Position 1	Sets the internal Tune Capacitor Preset Position 1. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Preset Source, Preset Trigger Mode Enable/Disable Move To Selected Preset Position Related Serial Command: MPT, MPTS, QPT, QP1T, GOTO

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Auxiliary (Aux) Capacitor Preset Position 1	Presented/available only if the matching network is configured/constructed with an auxiliary variable capacitor. Sets the internal Auxiliary (Aux) Capacitor Preset Position 1. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Preset Source, Preset Trigger Mode Enable/Disable Move To Selected Preset Position, Auxiliary (Aux) Capacitor Mode Related Serial Command: MPA, MPAS, QP1A, GOTO
Load Capacitor Preset Position 2	Sets the internal Load Capacitor Preset Position 2. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Move To Selected Preset Position, Backout Feature Mode Related Serial Command: P2L, QP2L, GOP2
Tune Capacitor Preset Position 2	Sets the internal Tune Capacitor Preset Position 2. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Move To Selected Preset Position, Backout Feature Mode Related Serial Command: P2T, QP2T, GOP2
Auxiliary (Aux) Capacitor Preset Position 2	Presented/available only if the matching network is configured/constructed with an auxiliary variable capacitor. Sets the internal Auxiliary (Aux) Capacitor Preset Position 2. Settable position range is from 0.0% (minimum) to 100.0% (maximum). Factory default setting: 50.0%. Related Parameters: Move To Selected Preset Position Related Serial Command: P2A, QP2A, GOP2

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Preset Source Selection	Enables/Disables presets and selects the preset position source. Applicable to Preset 1 positions onlt. Available selections are: PRESETS: OFF PRESETS: INTERNAL PRESETS: ANALOG Factory default setting: PRESETS OFF PRESETS OFF: Automatic preset function is disabled. Presets function will not respond to any trigger source. PRESETS INTERNAL: Preset function is enabled. Selects the Load Capacitor Preset 1, Tune Capacitor Preset 1, and Auxiliary Capacitor Preset 1 (if equipped) values internally stored in ATS-Series matching network as the preset source. The Load and Tune capacitors are automatically positioned to the stored preset values when a preset trigger event occurs. The Auxiliary capacitor (if equipped) may or may not be automatically positioned to its Preset 1 value, depending on the value of the Auxiliary Capacitor Mode parameter. PRESETS ANALOG: Preset function is enabled. Selects the Load and Tune Capacitor Preset values applied to the ATS-Series matching network's "ANALOG INTERFACE" connector. The Load and Tune Capacitors are automatically positioned to the preset position values present at the "ANALOG INTERFACE" connector when a preset trigger event occurs. The Preset Source and Preset 1 values can be set via remote communication or from the *optional* Remote Display Panel. Operational Notes: 1. When using the optional Remote Display Panel, the ATS-Series matching network will respond to the manual GOTO PRESET (X) parameter, even if the PRESETS parameter is set to "OFF". 2. The ATS-Series matching network will respond to the GOTO and GOP2 serial commands, even if the PRESETS parameter is set to "OFF". 3. Only capacitors in AUTO mode can respond to preset trigger events. When a capacitor is in MANUAL mode, preset trigger events are ignored. If a capacitor is switched from MANUAL mode to AUTO mode while a preset is active, the capacitor will be positioned to the preset value. 4. Preset Trigger Events: Automatic RF On/Off Detection (see Preset Trigger Mode), Analog Preset Trigger Related Parameters: Load Capacitor Preset Position 1, Tune Capacitor Preset Position 1, Auxiliary (Aux) Capacitor Preset Position 1, Auxiliary (Aux) Capacitor Mode, Preset Trigger Mode, Analog Interface Control Enable/Disable Related Serial Commands: OFF, INT, EXT, GOTO, QPMD

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Preset Trigger Mode Enable/Disable	Enables/Disables Preset RF-Off Trigger mode. Applies to internal Preset 1 and Analog presets. Note: A Preset Source must be selected in order to use presets. Available selections are: RF-OFF TRIGGER: OFF RF-OFF TRIGGER: ON Factory default setting: RF-OFF TRIGGER: OFF RF-OFF TRIGGER: OFF In AUTO mode, the Load, Tune and Auxiliary (if equipped) capacitors ***do not*** automatically move to the Preset 1 positions or the Analog Preset positions when RF is off. When RF is "ON", the ATS-Series matching network's internal controls automatically adjust the Load and Tune capacitors to minimize reflected power. In MANUAL mode, the Load, Tune, and Auxiliary (if equipped) capacitors ***do not*** automatically move to the Preset 1 positions or the Analog Preset positions when RF is off. When RF is "ON", the ATS-Series matching network's internal controls ***do not*** automatically adjust the Load and Tune capacitors to minimize reflected power. RF-OFF TRIGGER: ON In AUTO mode, the Load, Tune and Auxiliary (if equiped) capacitors automatically move to the Preset 1 positions or the Analog Preset positions when RF is off. When RF is "ON", the ATS-Series matching network's internal controls automatically adjust the Load and Tune capacitors to minimize reflected power, and (if equipped) the Auxiliary capacitor moves to its PRESET 2 position. In MANUAL mode, the Load, Tune, and Auxiliary (if equipped) capacitors ***do not*** automatically move to the Preset 1 positions or the Analog Preset positions when RF is off. When RF is "ON", the ATS-Series matching network's internal controls ***do not*** automatically adjust the Load and Tune capacitors to minimize reflected power How The Preset Trigger Works: The ATS-Series matching network determines if RF is on or off by using its internal Phase and Magnitude detectors and its internal RF Probe. The RF "ON" sensitivity can be adjusted using the RF-ON THRESHOLD-RF PROBE, RF-ON THRESHOLD – PHASE ERROR, RF-ON THRESHOLD-MAG ERROR, RF-ON THRESHOLD-POWER SENSE, and RF-OFF DELAY parameters. The ATS-Series matching network assumes RF is "OFF" if the Phase Error signal *and* the Magnitude Error signal *and* the RF Probe signal and the Power Sense signal are equal to or less than the threshold value for the time period specified by the RF-OFF DELAY parameter. If one or more of the threshold values is exceeded, the ATS-Series matching network assumes that RF is "ON". The preset trigger can mode can be set via remote communication or by the *optional* Remote Display Panel. Related Parameters: Load Capacitor Preset 1 Position, Tune Capacitor Preset 1 Position, Preset Source, RF-On/Off Threshold-RF Probe, RF-On/Off Threshold-Phase Error, RF-On/Off Threshold-Magnitude Error, RF On/Off Threshold-Power Sense, Preset Source Selection, RF-Off Delay Related Serial Commands: TRGX, TRGR, QTRG

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Analog Interface Control Enable/Disable	Enables/disables response to Analog Control signal inputs from the Analog Interface connector. Applies to all analog interface control signal inputs except the analog preset voltage inputs. Available selections are: ANALOG CONTROL OFF ANALOG CONTROL ON Factory default setting: ANALOG CONTROL OFF ANALOG CONTROL OFF: Analog Interface connector Auto/Manual mode select, preset enable, load capacitor positioning, and tune capacitor positioning signals are ignored. If an *optional* Remote Display Panel is connected, the Auto/Manual mode select buttons and capacitor position buttons are active. ANALOG CONTROL ON: Analog Interface connector Auto/Manual mode select, preset enable, load capacitor positioning, and tune capacitor positioning signals are active. If an *optional* Remote Display Panel is connected, the Auto/Manual mode select buttons and capacitor position buttons are disabled. Operational Notes: 1. To use Analog Control, an interface connection from the ATS-Series matching network's "ANALOG INTERFACE" connector to the user's system or user-supplied external controls is required. 2. The analog preset voltage inputs are active at all times. The preset value used when a preset trigger event occurs is controlled by the Preset Source Selection parameter. 3. If you wish to directly control capacitor preset activation via the Analog Interface connector's preset trigger signals, it may be advisable to set the Preset Trigger Mode to "RF-OFF TRIGGER: OFF" (disables automatic RF On/Off detection - see Preset Trigger Mode parameter details) or adjust the RF-On detection thresholds. If the Preset Trigger Mode is set to "RF-OFF TRIGGER: ON", the capacitors will be automatically positioned to the preset values when RF is off, regardless of the analog preset trigger signal state. 4. When Analog Control is "ON" and an Analog Interface Preset Trigger signal is activated, the corresponding capacitor will be positioned to the selected preset value (internal or analog). The capacitor will be held at the preset position until the Analog Interface Preset Trigger signal is de-activated. 5. In AUTO mode, when Analog Control is "ON" and an Analog Interface Preset Trigger signal is activated, and RF is "ON", the corresponding capacitor will move to the preset position and remain at the preset position until the Analog Interface Preset Trigger signal is de-activated. When the Analog Interface Preset Trigger is de-activated automatic tuning is resumed. Analog Interface control mode can be set via remote communication or by the *optional* Remote Display Panel. Related Parameters: Preset Source Selection, Preset Trigger Mode Related Serial Commands: AIY, AIN, QAI

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Feedback Source (Probe) Select	Selects the matching network voltage probe signal, DC Voltage Probe or RF Voltage Probe, to be routed to pin 4 of the PROBE connector and Pin 22 of the ANALOG INTERFACE connector. The probe signal can be used as a remote feedback source for an RF power supply or a monitoring point for process applications. Available Selections are: DCV PROBE SELECTED RFV PROBE SELECTED CUR PROBE SELECTED (available with firmware Ver X.XX and later) Factory default setting: DCV PROBE (DC Voltage Probe). <u>DCV PROBE SELECTED:</u> The voltage signal from the ATS-Series matching network's internal DC Voltage Probe is routed to pin 4 of the PROBE connector and pin 22 of the ANALOG INTERFACE connector. The DC Probe Attenuation Factor is applied to this signal. Assuming a 200:1 DC Probe attenuation factor, a 200V reading on the Remote Display Panel would result in a 1.0VDC output at the PROBE and ANALOG INTERFACE connectors. <u>RFV PROBE SELECTED:</u> The voltage signal from the ATS-Series matching network's internal RF Voltage Probe is routed to pin 4 of the PROBE connector and pin 22 of the ANALOG INTERFACE connector. The RF Probe Attenuation Factor is applied to this signal. Assuming a 200:1 RF Probe attenuation factor, a 200V reading on the Remote Display Panel would result in a 1.0VDC output at the PROBE and ANALOG INTERFACE connectors. <u>CUR PROBE SELECTED:</u> The voltage signal from the ATS-Series matching network's internal Current Probe is routed to pin 4 of the PROBE connector and pin 22 of the ANALOG INTERFACE connector. The Current Attenuation Factor is applied to this signal. Assuming a 100:1 Current Probe attenuation factor, a 100A reading on the Remote Display Panel would result in a 1.0VDC output at the PROBE and ANALOG INTERFACE connectors. <u>Operational Notes:</u> 1. Your matching network's configuration may have any combination of DC, RF, and Current Probes, or no probes installed. 2. To use the PROBE output as an external feedback source for an RF Power Supply, an interface connection between the ATS-Series matching network and the RF Power Supply is required. The Feedback Source (Probe) Select can be set via remote communication or the *optional* Remote Display Panel. <u>Related Parameters:</u> DC Voltage Probe Attenuation Factor, RF Voltage Probe Attenuation Factor Current Probe Attenuation Factor, Display Line 2 Information Select, Display Line 3 Information Select <u>Related Serial Commands:</u> PRB0, PRB1, PRB2, QPRB

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
DC Voltage Probe Attenuation Factor	Sets the DC Voltage probe's attenuation factor, in the form of XXXX: 1. Set the attenuation factor to match the matching network's DC Voltage Probe attenuation factor. Attenuation factor range is 1:1 to 4095:1 Factory default setting: 200:1 Note: The standard DC Voltage Probe attenuation factor for Seren IPS Inc. ATS-Series matching networks is 200:1. DC Voltage probes are standard on Seren ATS-Series matching networks. Custom-configured matching networks may vary. The DC Voltage Probe Attenuation Factor can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Feedback Source (Probe) Select Display Line 2 Information Select, Display Line 3 Information Select Related Serial Commands: PADC, QPAD, QDP
RF Voltage Probe Attenuation Factor	Sets the RF Voltage probe's attenuation factor, in the form of XXXX: 1. Set the attenuation factor to match the matching network's RF Voltage Probe attenuation factor. Attenuation factor range is 1:1 to 4095:1. Factory default setting: 200:1 Notes: 1. The standard RF Voltage Probe attenuation factor for Seren IPS Inc. ATS-Series matching networks is 200:1. Custom-configured matching networks may vary. 2. The *optional* Auxiliary RF Voltage Probe, if equipped, uses the same attenuation factor as the standard RF Voltage Probe. The RF Voltage Probe Attenuation Factor can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Feedback Source (Probe) Select Display Line 2 Information Select, Display Line 3 Information Select RF On/Off Detect Threshold – RF Probe Related Serial Commands: PARF, QPAR, QRP, QXP

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Current Probe Attenuation Factor	Sets the Current probe's attenuation factor, in the form of XXXX: 1. Set the attenuation factor to match the matching network's Current Probe attenuation factor. Attenuation factor range is 1:1 to 1000:1. Factory default setting: 100:1 **Note:** The standard RF Current Probe attenuation factor for Seren IPS Inc. ATS-Series matching networks is 100:1. Custom-configured matching networks may vary. The Current Probe Attenuation Factor can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Feedback Source (Probe) Select Display Line 2 Information Select, Display Line 3 Information Select Related Serial Commands: PAI, QPAI, QIP

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Display Line 2 Information Selection	Selects the information to display on line two (2) of the *optional* Remote Display Panel. Available selections are: LINE 2 INFO: None LINE 2 INFO: Phs/Mag LINE 2 INFO: Presets LINE 2 INFO: Probes LINE 2 INFO: PwrSense Factory default setting: LINE 2 INFO: None LINE 2 INFO: None Display line 2 is blank. LINE 2 INFO: Phs/Mag Line 2 displays the Phase and Magnitude error voltages, in milli-Volts (mV). Example: Phs: - 2 Mag: - 3 LINE 2 INFO: Presets Line 2 displays the current values of Preset 1 (Load and Tune capacitors) Example: P-Tn50.0% P-Ld50.0% LINE 2 INFO: Probes Line 2 displays the current values of the DC Probe (in Volts), RF Probe (in Volts), and Current Probe (in Amps) Note: DC, RF, and Current probe attenuation factors are applied. Example: D 194 R 673 I 3.54 LINE 2 INFO: PwrSense Line 2 displays the raw Power Sense Signal voltage, in milli-Volts (mV) Example: Power Sense 131mV The following selections are available if an *optional* Power Sensor is installed: LINE 2 INFO: Freq/Phase LINE 2 INFO: Volt/Curr LINE 2 INFO: Deliv/React LINE 2 INFO: Fwd/Ref LINE 2 INFO: Imp-R/Imp-X LINE 2 INFO: Gamma/VSWR LINE 2 INFO: Vpk/Ipk LINE 2 INFO: Freq/Phase Line 2 displays RF Frequency (in Hertz) and Phase (in degrees) Example: Freq: 13.56M Phs -14.2 LINE 2 INFO: Volt/Curr Line 2 displays RMS Voltage (in Volts) and RMS Current (in Amps): Example: Vlt 223 Curr 4.47 LINE 2 INFO: Deliv/React Line 2 displays Delivered Power and Reactive Power, in Watts: Example: Dlv 966 React 10

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Display Line 2 Information Selection (continued)	LINE 2 INFO: Fwd/Ref Line displays Forward power and Reflected power, in Watts: Example: Fwd 996 Ref 0 LINE 2 INFO: Imp-R/Imp-X Line 2 displays Real Impedance (in Ohms) and Reactive Impedance Example: Zr 50.0 Zx- 0.5 LINE 2 INFO: Gamma/VSWR Line 2 displays Gamma and VSWR: Example: Gam 0.01 VSWR 1.01 LINE 2 INFO: Vpk/Ipk Line 2 displays Peak Voltage (in Volts) and Peak Current (in Amps) Example: Vpk 317 Ipk 6.41 Related Parameters: DC Probe Attenuation Factor, RF Probe Attenuation Factor, Current Probe Attenuation Factor Related Serial Commands: [NONE]
Display Line 3 Information Selection	Selects the information to display on line three (3) of the *optional* Remote Display Panel. Available selections are: LINE 3 INFO: None LINE 3 INFO: Phs/Mag LINE 3 INFO: Presets LINE 3 INFO: Probes LINE 3 INFO: PwrSense Factory default setting: LINE 3 INFO: None LINE 3 INFO: None Display line 3 is blank. LINE 3 INFO: Phs/Mag Line 3 displays the Phase and Magnitude error voltages, in milli-Volts (mV). Example: Phs: - 2 Mag: - 3 LINE 3 INFO: Presets Line 3 displays the current values of Preset 1 (Load and Tune capacitors) Example: P-Tn50.0% P-Ld50.0% LINE 3 INFO: Probes Line 3 displays the current values of the DC Probe (in Volts), RF Probe (in Volts), and Current Probe (in Amps) Note: DC, RF, and Current probe attenuation factors are applied. Example: D 194 R 673 I 3.54 LINE 3 INFO: PwrSense Line 3 displays the raw Power Sense Signal voltage, in milli-Volts (mV) Example: Power Sense 131mV

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Display Line 3 Information Selection (continued)	The following selections are available if an *optional* Power Sensor is installed: LINE 3 INFO: Freq/Phase LINE 3 INFO: Volt/Curr LINE 3 INFO: Deliv/React LINE 3 INFO: Fwd/Ref LINE 3 INFO: Imp-R/Imp-X LINE 3 INFO: Gamma/VSWR LINE 3 INFO: Vpk/Ipk LINE 3 INFO: Freq/Phase Line 3 displays RF Frequency (in Hertz) and Phase (in degrees) Example: Freq: 13.56M Phs -14.2 LINE 3 INFO: Volt/Curr Line 3 displays RMS Voltage (in Volts) and RMS Current (in Amps): Example: Vlt 223 Curr 4.47 LINE 3 INFO: Deliv/React Line 3 displays Delivered Power and Reactive Power, in Watts: Example: Dlv 966 React 10 LINE 3 INFO: Fwd/Ref Line displays Forward power and Reflected power, in Watts: Example: Fwd 996 Ref 0 LINE 3 INFO: Imp-R/Imp-X Line 3 displays Real Impedance (in Ohms) and Reactive Impedance Example: Zr 50.0 Zx- 0.5 LINE 3 INFO: Gamma/VSWR Line 3 displays Gamma and VSWR: Example: Gam 0.01 VSWR 1.01 LINE 3 INFO: Vpk/Ipk Line 3 displays Peak Voltage (in Volts) and Peak Current (in Amps) Example: Vpk 317 Ipk 6.41 Related Parameters: DC Probe Attenuation Factor, RF Probe Attenuation Factor, Current Probe Attenuation Factor Related Serial Commands: [NONE]

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
RF-On/Off Detect Threshold – Phase Error	Sets the RF-ON/OFF detect threshold for the internal Phase Error Detector signal. If the absolute value of the Phase Error signal exceeds this value, the ATS-Series matching network assumes the RF Power Supply is in the "RF ON" state. Threshold range is 0mV to 5000mV Factory default setting: 40mV Used in conjunction with the RF-OFF Delay parameter to determine if RF power is on or off for automatic Capacitor Preset Trigger and Express Tuning features. Operational Note: If *one or more* RF On/Off threshold signal values is exceeded, the matching network assumes the RF Power Supply is in the "RF ON" state. If *all* the RF On/Off Threshold signals are below their threshold values, the matching network assumes the RF Power Supply is in the "RF OFF" state. The RF-On/Off Detect Threshold – Phase Error parameter can be set via remote communication or the *optional* Remote Display Panel. Related parameters: Preset Trigger Mode Enable/Disable RF-Off Delay, Express Tuning Related Serial Commands: THPH, QTHP
RF-On/Off Detect Threshold – Magnitude Error	Sets the RF-ON/OFF threshold for the internal Magnitude Error Detector signal. If the absolute value of the Phase Error signal exceeds this value, the ATS-Series matching network assumes the RF Power Supply is in the "RF ON" state. Threshold range is 0mV to 5000mV Factory default setting: 20mV Used in conjunction with the RF-OFF Delay parameter to determine if RF power is on or off for automatic Capacitor Preset Trigger and Express Tuning features. Operational Note: If *one or more* RF On/Off threshold signal values is exceeded, the matching network assumes the RF Power Supply is in the "RF ON" state. If *all* the RF On/Off Threshold signals are below their threshold values, the matching network assumes the RF Power Supply is in the "RF OFF" state. The RF-On/Off Detect Threshold – Magnitude Error parameter can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Preset Trigger Mode Enable/Disable, RF-Off Delay, Express Tuning Related Serial Commands: THMG, QTHM

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
RF-On/Off Detect Threshold – Power Sense	Sets the RF-ON/OFF threshold for the internal Power Sense signal. If the value of the Power Sense signal exceeds this value, the ATS-Series matching network assumes the RF Power Supply is in the "RF ON" state. Threshold range is 0mV to 5000mV Factory default setting: 15mV Used in conjunction with the RF-OFF Delay parameter to determine if RF power is on or off for automatic Capacitor Preset Trigger and Express Tuning features. Operational Note: If *one or more* RF On/Off threshold signal values is exceeded, the matching network assumes the RF Power Supply is in the "RF ON" state. If *all* the RF On/Off Threshold signals are below their threshold values, the matching network assumes the RF Power Supply is in the "RF OFF" state. The RF-On/Off Detect Threshold – Power Sense parameter can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Preset Trigger Mode Enable/Disable RF-Off Delay, Express Tuning Related Serial Commands: THPS, QTHS
RF-On/Off Detect Threshold – RF Probe	Sets the RF-ON/OFF detection threshold for the internal RF Voltage Probe. If the RF Probe Voltage exceeds this value, the ATS-Series matching network assumes the RF Power Supply is in the "RF ON" state. Threshold range is 0V to 20000V Factory default setting: 10V Used in conjunction with the RF-OFF delay to determine if RF power is on or off for automatic Capacitor Preset Trigger and Express Tuning features. Operational Notes: 1. The threshold value represents the voltage from the RF Voltage Probe *after* the RF Voltage Probe Attenuation Factor has been applied. 2. If the ATS-Series matching network is not equipped with an RF Voltage Probe, set the RF Probe Voltage Attenuation Factor parameter value to "1" and set the RF RF On/Off Detect Threshold-RF Probe parameter value to "10V". This will avoid false RF On/Off detections. 3. If *one or more* RF On/Off threshold signal values is exceeded, the matching network assumes the RF Power Supply is in the "RF ON" state. If *all* the RF On/Off Threshold signals are below their threshold values, the matching network assumes the RF Power Supply is in the "RF OFF" state. The RF-On/Off Detect Threshold – RF Probe parameter can be set via remote communication or the *optional* Remote Display Panel. Related parameters: Preset Trigger Mode Enable/Disable, RF Voltage Probe Attenuation Factor, RF-Off Delay Express Tuning Related Serial Commands: THRF, QTHR

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
RF-Off Delay	RF-Off detection time delay period. **All** of the RF On/Off Detect signals (Phase Error, Magnitude Error, Power Sense, and RF Probe) must be below their respective threshold values for the specified RF-Off delay time period before the ATS-Series matching network recognizes/determines that an RF-OFF condition exists. Note: Feature available with firmware version 3.5A and later Delay range: 0mS to 20000mS Factory Default Setting: 50mS Related parameters: Preset Trigger Mode Enable/Disable, RF On/Off Detect Threshold-Phase Error, RF On/Off Detect Threshold-Magnitude Error, RF On/Off Detect Threshold-RF Probe, RF On/Off Detect Threshold-Power Sense, Related Serial Commands: RFODLY, QRFOD
Load Capacitor Position High Limit	Sets the Load Capacitor's maximum position limit to a value less than the absolute maximum. The Load Capacitor's motor will stop when this limit is reached, regardless of the Magnitude error signal, preset parameter value, Analog Interface preset signal, Analog Interface Move Load Capacitor signal, remote command, or *optional* Remote Display Panel positioning controls. Limit Range is 2.0% to 100.0%. Factory default setting: 80%. Operational Note: The Load Capacitor Position High Limit must be greater then the Load Capacitor Position Low Limit. If the High limit is less than the Low limit, capacitor travel will be limited to a 2% window (not damaging, but not very useful). The Load Capacitor Position High Limit can be set via remote communication or the *optional* Remote Display Panel. Related Serial Command: LLH, QLLH
Load Capacitor Position Low Limit	Sets the Load Capacitor's minimum position limit to a value greater than the absolute minimum. The Load Capacitor's motor will stop when this limit is reached, regardless of the Magnitude error signal, preset parameter value, Analog Interface preset signal, Analog Interface Move Load Capacitor signal, remote command, or *optional* Remote Display Panel positioning controls. Limit Range is 0.0% to 98.0%. Factory default setting: 5%. Operational Note: The Load Capacitor Position Low Limit must be less than the Load Capacitor Position High Limit. If the Low limit is greater than the High limit, capacitor travel will be limited to a 2% window (not damaging, but not very useful). The Load Capacitor Position Low Limit can be set via remote communication or the *optional* Remote Display Panel. Related Serial Command: LLL, QLLL

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Tune Capacitor Position High Limit	Sets the Tune Capacitor's maximum position limit to a value less than the absolute maximum. The Tune Capacitor's motor will stop when this limit is reached, regardless of the Phase error signal, preset parameter value, Analog Interface preset signal, Analog Interface Move Load Capacitor signal, remote command, or *optional* Remote Display Panel positioning controls. Limit Range is 2.0% to 100.0%. Factory default setting: 80%. Operational Note: The Tune Capacitor Position High Limit must be greater then the Tune Capacitor Position Low Limit. If the High limit is less than the Low limit, capacitor travel will be limited to a 2% window (not damaging, but not very useful). The Tune Capacitor Position High Limit can be set via remote communication or the *optional* Remote Display Panel. Related Serial Command: TLH, QTLH
Tune Capacitor Position Low Limit	Sets the Tune Capacitor's minimum position limit to a value greater than the absolute minimum. The Tune Capacitor's motor will stop when this limit is reached, regardless of the Phase error signal, preset parameter value, Analog Interface preset signal, Analog Interface Move Load Capacitor signal, remote command, or *optional* Remote Display Panel positioning controls. Limit Range is 0.0% to 98.0%. Factory default setting: 5%. Operational Note: The Tune Capacitor Position Low Limit must be less than the Tune Capacitor Position High Limit. If the Low limit is greater than the High limit, capacitor travel will be limited to a 2% window (not damaging, but not very useful). The Tune Capacitor Position Low Limit can be set via remote communication or the *optional* Remote Display Panel. Related Serial Command: TLL, QTLL

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Load Capacitor Deadband	The Load Capacitor Deadband is a threshold that determines how much Magnitude (Mag) error signal must be measured before the Load capacitor is moved in AUTO mode. This setting allows the system operator to define when a match condition is "good enough", thus preventing the matching network from continuously "hunting" for a better match point. If the Magnitude error signal exceeds the deadband setting, the Load capacitor is moved. If the error signal is less than the deadband setting, the Load capacitor will not be moved. Deadband Range: 0mV to 1250mV Factory default setting: 15mV **Example:** If the Load Capacitor Deadband is set to 20mV, the Load capacitor will move until the Magnitude error signal falls below +/-20mV. Operational Note: If the Load Capacitor Deadband value is set to zero (0mV), the Magnitude error signal is ignored and the Load capacitor is not moved. The Load Capacitor Deadband can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Load Gain (Firmware Versions 3.4X and earlier) Load High-Speed Threshold (Firmware Versions 3.5A & later) Load Motion Slowdown (Firmware Versions 3.5A & later) Related Serial Commands: DBL, QDBL

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Load Capacitor High-Speed Threshold	This feature, combined with the Load Capacitor Motion Slowdown feature helps to prevent over-shoot of the match point while utilizing high motor speed to enhance matching time. The Load Capacitor High-Speed Threshold parameter determines how much Magnitude (Mag) error signal must be measured before the Load capacitor moves at high speed in AUTO mode. When the Magnitude error signal level is between the Load Capacitor Deadband parameter's value and the Load Capacitor High-Speed Threshold value, the Load capacitor moves at low speed. When the Magnitude error signal exceeds the Load Capacitor High-Speed Threshold value, the Load capacitor moves at high speed. Threshold Range: 0mV to 1250mV Factory default setting: 200mV Operational Note: To completely disable Load capacitor high speed motion, set the Load Capacitor High-Speed Threshold parameter value to zero (0mV). Note: Feature available with firmware versions 3.5A and later. Related Parameters: Load Capacitor Motion Slowdown Delay Load Capacitor Deadband Related Serial Commands: LSPD, QLSPD
Load Capacitor Motion Slowdown Delay	The Load Capacitor Motion Slowdown Delay parameter allows a time delay to be inserted between each step of the stepper motor used to move the Load capacitor. This is useful in applications where the normal capacitor motion in AUTO mode may be too fast. This feature may be particularly useful when the RF Power Supply is used in pulse mode with a low pulse rate (less than 100 pulses/second), or when the plasma (or other load) has a high Q factor. Range: 0 to 100mS, in 1mS Steps Factory default setting: 1mS (Vacuum variable capacitor) 8mS (Air variable capacitor) Operational Notes: 1. For vacuum variable capacitors, the normal delay between steps is 1mS. A Motion Slowdown Delay parameter setting of 3mS will slow a vacuum capacitor down by a factor of four (4). 2. For air variable capacitors, the normal delay between steps is 8mS. A Motion Slowdown Delay parameter setting of 8mS will slow an air capacitor down by a factor of two (2). Note: Feature available with firmware versions 3.5A and later. Related Parameters: Load Capacitor High-Speed Threshold, Load Capacitor Deadband Related Serial Commands: LSLO, QLSLO

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Tune Capacitor Deadband	The Tune Capacitor Deadband is a threshold that determines how much Phase error signal must be measured before the Tune capacitor is moved in AUTO mode. This setting allows the system operator to define when a match condition is "good enough", thus preventing the matching network from continuously "hunting" for a better match point. If the Phase error signal exceeds the deadband setting, the Tune capacitor is moved. If the error signal is less than the deadband setting, the Tune capacitor will not be moved. Deadband Range: 0mV to 1250mV Factory default setting: 15mV **Example:** If the Tune Capacitor Deadband is set to 20mV, the Tune capacitor will move until the Phase error signal falls below +/-20mV. Operational Note: If the Tune Capacitor Deadbeand is set to zero (0mV), the Phase error signal is ignored and the Tune capacitor is not moved. The Tune Capacitor Deadband can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Tune Gain (Firmware Versions 3.4X and earlier) Tune High-Speed Threshold (Firmware Versions 3.5A & later) Tune Motion Slowdown (Firmware Versions 3.5A & later) Related Serial Commands: DBT, QDBT

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Tune Capacitor High-Speed Threshold	This feature, combined with the Tune Capacitor Motion Slowdown feature helps to prevent over-shoot of the match point while utilizing high motor speed to enhance matching time. The Tune Capacitor High-Speed Threshold parameter determines how much Phase (Phs) error signal must be measured before the Tune capacitor moves at high speed in AUTO mode. When the Phase error signal level is between the Tune Capacitor Deadband parameter's value and the Tune Capacitor High-Speed Threshold value, the Tune capacitor moves at low speed. When the Phase error signal exceeds the Tune Capacitor High-Speed Threshold value, the Tune capacitor moves at high speed. Threshold Range: 0mV to 1250mV Factory default setting: 200mV Operational Note: To completely disable Tune capacitor high speed motion, set the Tune Capacitor High-Speed Threshold parameter value to zero (0mV). Note: Feature available with firmware versions 3.5A and later. Related Parameters: Tune Capacitor Motion Slowdown Delay Tune Capacitor Deadband Related Serial Commands: TSPD, QTSPD
Tune Capacitor Motion Slowdown Delay	The Tune Capacitor Motion Slowdown Delay parameter allows a time delay to be inserted between each step of the stepper motor used to move the Tune capacitor. This is useful in applications where the normal capacitor motion in AUTO mode may be too fast. This feature may be particularly useful when the RF Power Supply is used in pulse mode with a low pulse rate (less than 100 pulses/second), or when the plasma (or other load) has a high Q factor. Range: 0 to 100mS, in 1mS Steps Factory default setting: 1mS (Vacuum variable capacitor) 8mS (Air variable capacitor) Operational Notes: 1. For vacuum variable capacitors, the normal delay between steps is 1mS. A Motion Slowdown Delay parameter setting of 3mS will slow a vacuum capacitor down by a factor of four (4). 2. For air variable capacitors, the normal delay between steps is 8mS. A Motion Slowdown Delay parameter setting of 8mS will slow an air capacitor down by a factor of two (2). Note: Feature available with firmware versions 3.5A and later. Related Parameters: Tune Capacitor High-Speed Threshold, Tune Capacitor Deadband Related Serial Commands: TSLO, QTSLO

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Express Tuning	With the Express Tuning feature is enabled, all capacitors (including the Auxiliary capacitor, if equipped) are automatically moved to the Preset 2 positions after a specified delay when an RF-On condition is detected, before attempting to automatically match the load using the Phase and Magnitude error signals. The RF-On condition is detected using the Phase Error, Magnitude Error, Power Sense, and RF Probe signals. The matching network assumes an RF-On state exists if one or more of the RF On/Off Threshold parameter values is exceeded. Express Tuning Delay Range: 0mS (off) to 9999mS Factory default setting: 0mS (off) To enable Express Tuning, set a non-zero value for the Express Tuning delay (time between RF-On Detection event and the move to the Preset 2 positions event). **Example:** RFon->GoPres2 500mS With the delay set to 500mS, the matching sequence is as follows: 1. RF-On 2. Wait 500ms (do not auto-tune) 3. Move capacitors to preset 2 positions 4. Begin normal automatic tuning To disable Express Tuning, set the Express Tuning Delay to 0mS (off) Related Parameters: RF On/Off Detect Threshold-Phase Error RF On/Off Detect Threshold-Magnitude Error RF On/Off Detect Threshold-Power Sense RF On/Off Detect Threshold-RF Probe Load Capacitor Preset Position 2 Tune Capacitor Preset Position 2 Auxiliary Capacitor Preset Position 2 (if equipped) Related Serial Commands: TRAJ, QTRAJ,

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Auto Load Delay	The Auto Load Delay parameter sets the amount of time the Load capacitor is prevented from automatically moving after an RF-ON condition has been detected. In some applications, in AUTO mode, it may be beneficial to the process to let the Tune capacitor operate for a brief period before allowing the Load capacitor to move/tune. Setting the Auto Load Delay parameter to 0 disables the delay. Auto Load Delay Range: 0 to 9999mS Factory default setting: 0mS (Disabled) Operational Note: The ATS-Series matching network assumes RF is "OFF" if the Phase Error signal *and* the Magnitude Error signal *and* the Power Sense signal *and* the RF Probe signal are equal to or less than their respective threshold values. If one or more of the four threshold values is exceeded, the ATS-Series matching network assumes that RF is "ON". The Auto Load Delay can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: RF On/Off Detect Threshold – RF Probe RF On/Off Detect Threshold – Phase Error RF On/Off Detect Threshold - Magnitude Error Related Serial Commands: DLY, QDLY
Auto Tune Delay	The Auto Tune Delay parameter sets the amount of time the Tune capacitor is prevented from automatically moving after an RF-ON condition has been detected. In some applications, in AUTO mode, it may be beneficial to the process to let the Load capacitor operate for a brief period before allowing the Tune capacitor to move/tune. Setting the Auto Tune Delay parameter to 0 disables the delay. Auto Tune Delay Range: 0 to 9999mS Factory default setting: 0mS (Disabled) Operational Note: The ATS-Series matching network assumes RF is "OFF" if the Phase Error signal *and* the Magnitude Error signal *and* the power Sense signal *and* the RF Probe signal are equal to or less than their respective threshold values. If one or more of the four threshold values is exceeded, the ATS-Series matching network assumes that RF is "ON". The Auto Tune Delay can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: RF On/Off Detect Threshold – RF Probe RF On/Off Detect Threshold – Phase Error RF On/Off Detect Threshold - Magnitude Error Related Serial Commands: DLT, QDLT

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
BACKOUT Feature Mode	Enables or disables the ATS-Series matching network's Backout feature. In some cases, depending on load conditions, the Phase and Magnitude error signals can cause the capacitors to move to their extreme positions and then keep them there, essentially "stuck". The Backout feature provides an automatic means for the matching network to recover from a "stuck" condition. This feature is useful for processing systems or plasmas that are difficult to start or ignite. Operational Notes: 1. The Backout feature, when enabled, only responds when the capacitors are in AUTO mode *and* an RF-ON condition is detected *and* the capacitors are "stuck" for more than the time specified by the Backout Delay parameter. 2. When installing ATS-Series matching network on a new system, or when calibrating a matching network, it is recommended the BACKOUT feature be set to "OFF" (disabled). Enabling the BACKOUT feature during set-up may lead to "oscillation" of the capacitors, making set-up very difficult. Available selections are: BACKOUT: OFF BACKOUT: PRESET 2 BACKOUT: REVERSE ALG Factory default setting: OFF BACKOUT: OFF Selected The Backout feature is completely disabled. If the Phase and Magnitude error signals drive the capacitors to their end-stops, they will remain there until the load conditions change or an operator, system controller, or remote command intervenes. BACKOUT: PRESET 2 Selected Responds by moving the Load and Tune capacitors to the PRESET 2 positions and then resumes automatic tuning. BACKOUT: REVERSE ALG Selected Responds by running the normal auto-match algorithm in reverse (reverse tuning) until the Phase and Magnitude error signals are both less than their respective Deadband parameter values. The Backout Feature parameter can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Backout Delay RF On/Off Detect Threshold – RF Probe RF On/Off Detect Threshold – Phase Error RF On/Off Detect Threshold - Magnitude Error RF On/Off Detect Threshold - Power Sense Load Capacitor Preset Position 2, Tune Capacitor Preset Position 2 Related Serial Commands: BAK, QBAK, BOD
BACKOUT Delay	The BACKOUT Delay is the time the ATS-Series matching network allows a capacitor to stay at an extreme position before the Backout function, if enabled, is triggered. BACKOUT Delay range: 50mS to 5000mS Factory default setting: 1000mS Related Parameters: BACKOUT Mode Related Serial Commands: BOD, QBD

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Communications Protocol Select	Selects the communications interface protocol. Available selections: RS232 (Single-ended, point-to-point, full-duplex) RS422 (Balanced, multi-point, receive/listen only) RS485-4 (RS-485 4-Wire - Balanced, multi-point, full-duplex) RS485-2 (RS-485 2-Wire - Balanced, multi-point, half-duplex) MODBUS 4W RTU (Balanced, multi-point, full-duplex) MODBUS 2W RTU (Balanced, multi-point, half-duplex) DEVICENET (requires *optional* factory-installed DeviceNet Interface) PROFIBUS (requires *optional* factory-installed PROFIBUS Interface) Factory default setting: RS232 Operational Notes: 1. When RS232 communications protocol is selected, the Address ID Number is ignored. 2. Modbus multiple address protocol (three slave IDs implementation / MC2-Emulation) available with firmware version 4.2A and later. 2. Modbus single address protocol (one slave ID / ATS-Specific implementation) available with firmware version 4.6A and later 3. Currently, the ATS match network cannot be configured for Modbus control via serial commands (RS-232/422/485), and it is not possible to change to serial control via Modbus command. Changing to Modbus or changing from Modbus to another protocol requires the *optional* MCRS remote display panel. 4. Connections for RS485, RS422, RS232, and Modbus communications are made via the "CONTROL" connector. Refer to the Controls And Connections section for interface wiring details. 5. Connections for *optional* DEVICENET communications are made via an optional "DEVICENET" connector. Refer to the Controls And Connections section for DEVICENET interface wiring details. 6. Connections for optional PROFIBUS communications are made via an optional "PROFIBUS" connector. Refer to the Controls And Connections section for PROFIBUS interface wiring details The Communications Protocol Select parameter can be set via remote communication or the *optional* Remote Display Panel. Related Parameters: Address ID Number Data Rate Communications ECHO DeviceNet Assembly Set Modbus Type Related Serial Commands: SMD, QSMD, SAD, QSAD, DNDF, QDNDF, DNDR, QDNDR, ECHO, NOECHO, MBTP, OMBT

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Address ID Number	Selects the Address ID Number for RS-232, RS-422, RS-485, Modbus, PROFIBUS, and DEVICENET communication protocols. "ADDRESS # XXX" will be displayed on the *optional* Remote Display Panel, where "XXX" is the address value. Address ranges: RS422, RS485: 0 to 99 MODBUS: 1 to 250 DeviceNet: 0 to 64 PROFIBUS: 0 to 126 Factory default settings: RS-232, RS-422, RS-485, Modbus, PROFIBUS: 99 DeviceNet: 63 <u>Operational Notes:</u> 1. When RS232 protocol is selected, the Address ID Number is ignored. If a command is preceded by an address, the address portion of the command is ignored and the ATS-Series matching network automatically responds to the command. 2. If the Address ID Number is set to 99, the ATS-Series matching network will assume that addressing is not used and will respond to every command. 3. If the Address ID Number is less than 99, the ATS-Series matching network will expect each command to be preceded by an address, and will respond only to commands that are preceded by an address that matches its Address ID Number setting. 4. When using RS422 and RS-485 protocols, the ATS-Series matching network will always respond to address 99. This is useful if the ATS-Series matching network's address is unknown or forgotten and an *optional* Remote Display Panel is not available. The Address ID Number parameter can be set via remote communication or the *optional* Remote Display Panel. <u>Related Parameters:</u> Communications Protocol Select Data Rate Communications ECHO <u>Related Serial Commands</u>: SAD, QSAD

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Data Rate	Selects the Data Rate for RS-232, RS-422, RS-485, Modbus and DEVICENET communication protocols. Available data rates displayed *optional* Remote Display Panel depend on the currently selected communications protocol. Available Data Rates for DEVICENET protocol: 500KBPS 250KBPS 125KBPS **Note:** DeviceNet data rate selections are visible only when DeviceNet protocol is selected. On larger ATS-Series matching networks (networks large enough to accommodate DeviceNet controls) the DeviceNet data rate is set via the data rate switch. With the *optional* DeviceNet interface is installed, the DeviceNet interface reads the data rate switch, sets the data rate, and displays the data rate on the *optional* Remote Display Panel. When the *optional* DeviceNet interface is not installed, the data rate can be adjusted via the *optional* Remote Display Panel, but it is ignored. On "mini"-package ATS-Series matching networks (models ATS-xM) with DeviceNet installed, the matching network is too small to permit DeviceNet controls, therefore the data rate can be adjusted via the *optional* Remote Display Panel or serial command. Available Data Rates for RS-232, RS-422, RS-485 and Modbus protocols: 115200 BAUD 57600 BAUD 38400 BAUD 19200 BAUD 9600 BAUD 4800 BAUD 2400 BAUD **Note:** RS-232, RS-422, RS-485, and Modbus protocol data rate selections are visible on the *optional* Remote Display Panel only when RS-232, RS-422, RS-485, or Modbus communication protocols are selected. Factory Default Setting: DEVICENET: 500KBPS RS232, RS422, and RS485: 19200 BAUD ProfiBus: Data Rate is auto-negotiated. Related Parameters: Communications Protocol Select Address ID Number Communications ECHO Related Serial Commands: BAUD, DNDR, QDNDR

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
DeviceNet Assembly Set	Selects the DeviceNet Assembly Set. Presented if DeviceNet protocol is selected. The Assembly Set parameter specifies the data format used for DeviceNet communications. Refer to the DeviceNet Communications section for a detailed operational description. Available settings: DN Data 10 out 18 in DN Data 6 out 12 in DN Data 9 out 14 in Factory default setting: DN Data 10 out 18 in Setting Descriptions: DN Data 10 out 18 in: Default Assembly Set for the ATS-Series matching network. Master sends 10 bytes (assembly ID 64hex). The ATS-Series matching network returns 18 bytes (Assembly ID 65hex) DN Data 6 out 12 in: Emulates the Seren IPS Inc. MC2 Matching Network Controller with DeviceNet interface. Master sends 6 bytes (Assembly ID 66hex). The ATS-Series matching network returns 12 bytes (Assembly ID 67hex) DN Data 9 out 14 in: Alternate Assembly Set. Master sends 9 bytes (Assembly ID 68hex). The ATS-Series matching network returns 14 bytes (Assembly ID 69hex) Related Parameters: Communications Protocol Select Related Serial Commands: DNDF, QDNDF
Communications ECHO	Enables and Disables echoing of serial characters back to the originating communications device. Parameter presented only if RS232, RS485-2, or RS485-4, communications protocols are selected. ECHO should normally be enabled only if RS-232 protocol is selected. If RS-485 protocol is selected, ECHO should only be enabled if the Address ID Number is set to "99". Communications ECHO is not applicable to Modbus, PROFIBUS, or DeviceNet communications protocols. Available settings: ECHO: ENABLED ECHO: DISBLED Factory default setting: ECHO: DISABLED Communications ECHO mode can be set by remote communication or by the *optional* Remote Display Panel. Related Parameters: Communications Protocol Select Address ID Number Data Rate Related Serial Commands: ECHO, NOECHO

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Modbus Type	Configures the Modbus implementation type. As of firmware version 4.6A, the ATS-Series matching networks support two Modbus implementations: ATS-Specific, and MC2-Emulation. Parameter presented only if MODBUS 4W RTU or MODBUS 2W RTU communications protocols are selected. Firmware versions 4.2A to 4.5X only support the Modbus Multiple Address implementation (MC2-Emulation) and therefore do not support/display this parameter. Available Settings: MULTIPLE ADDR: NO MULTIPLE ADDR: YES Factory default setting: NO MULTIPLE ADDR: NO (ATS-Specific Implementation) If the ATS-Specific implementation is selected (single slave ID), the ATS-Series matching network behaves like a typical Modbus slave in that it responds to one Modbus slave ID. MULTIPLE ADDR: YES (MC2 Emulation Implementation) If the MC2-Emulation implementation is selected (multiple slave IDs), the ATS-Series matching network responds to three (3) consecutive Modbus slave IDs (like a Seren IPS Inc. model MC2 Matching Network Controller). The Modbus Type can be set by remote communication or by the *optional* Remote Display Panel. Related Parameters: Communications Protocol Select Related Serial Commands: MBTP, QMBT
Analog Interface Voltage Range	Configures the voltage range for the Analog Interface connector's capacitor preset inputs and capacitor position outputs. Available settings: ANALOG RANGE 5V ANALOG RANGE 10V Factory default setting: 5V ANALOG RANGE 5V: Sets the Load and Tune capacitor preset inputs voltage range to 0-5VDC. Sets the Load and Tune capacitor position outputs voltage range to 0-5VDC. Example: 50.0% capacitor position = 2.50VDC ANALOG RANGE 10V: Sets the Load and Tune capacitor preset inputs voltage range to 0-10VDC. Sets the Load and Tune capacitor position outputs voltage range to 0-10VDC. Example: 50.0% capacitor position = 5.00VDC The Analog Interface Voltage Range can be set by remote communication or by the *optional* Remote Display Panel. Related Parameters: Analog Interface Control Enable/Disable Preset Source Selection, Preset Trigger Mode Enable/Disable Related Serial Commands: RNG5, RNG10, QRNG

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Save Configuration To Flash Memory	Forces saving of configuration parameters stored in battery-backed memory to Flash memory. When a configuration parameter is edited and saved (by remote communication or by pressing the "ENT" button on the optional Remote Display Panel), the parameter is saved to the ATS-Series matching network's battery-backed memory. If desired, all settings can be saved to Flash memory, which retains data without the need for a battery. Enter the programming mode and press the DOWN button (item 2) on the *optional* Remote Display Panel until display line 3 reads: SAVE CONFIG TO FLASH Press the ENT button (item 4) on the *optional* Remote Display Panel to save all settings to Flash Memory. When the operation is complete, line 3 will show: - - - CONFIG SAVED - - - Press the RUN button (item 1) on the optional Remote Display Panel to resume normal operation. Configuration settings can be saved to Flash memory via remote communication or the *optional* Remote Display Panel. <u>Operational Notes:</u> 1. This feature is provided for systems integrators. All programmable parameters are normally stored in the unit's battery-backed memory and retained after power down/power up cycles. If a systems integrator makes changes from the factory pre-programmed parameter values to suit their system or process, it is good practice to save the parameters into flash memory. If the battery for the battery-backed memory ever needs to be changed, the system integrator's parameters will be retained. Normal battery life expectancy is 7 to 10 years. 2. It is neither advisable nor required for a system operator to save the configuration to flash memory every time a parameter setting is adjusted. Excessive use of this feature may cause premature wear-out of the flash memory. <u>Related Serial Commands</u>: FLSH

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Phase/Mag Error Signal Offset Zero	This feature provides a means to null or "zero-out" small amounts of offset error in the Phase and Magnitude (Mag) error signals that may be displayed/reported when the RF power supply is off or disconnected from the ATS-Series matching network. Note: ATS-Series matching networks manufactured on or about June 2011 or later incorporate control boards with circuitry that makes this adjustment procedure unnecessary. This feature is still supported for firmware updates on older units. Units with the new circuitry will not display this feature option on the optional Remote Display Panel, but it is accessible by serial command. Technical Background: ATS-Series matching networks include circuitry to detect a mis-match condition. The detection circuitry produces two error signals, called Phase Error and Magnitude (or Mag) Error, which are used for tuning. With RF power applied, the Phase Error signal drives the tune capacitor, the Magnitude (Mag) Error signal drives the Load capacitor. When the Phase and/or Magnitude error signals are non-zero, the matching network's circuits adjust the tune and load capacitor positions until Phase and Magnitude error signals are zero (or within their deadband limits), then continuously adjust the capacitors to maintain the error signals at zero (or within their deadband limits). When RF power is not applied (i.e. the RF Power Supply is Off), the reported Phase and Mag Error signals should be no more than a few milli-Volts. If the error signals are more than a few milli-Volts, a measurement offset exists. For optimal operation, any Phase and/or Magnitude offset error should be eliminated. This measurement offset error is checked for and eliminated (or "zeroed-out") during factory calibration. It is possible the Phase and Magnitude offset error may change over time. If the reported Phase and Magnitude error signals are more than a few milli-Volts when RF power is Off, this feature can be used to reset or "zero-out" the measurement offset error. **If you are unsure about using this feature or have technical concerns, Stop/Do Not continue**. Contact Seren IPS technical support or an authorized Seren IPS Service Depot for assistance. Procedure: 1. Disable/turn off the RF Power supply, and any other RF power sources that may be present if the matching network is installed on a processing system. If possible, disconnect the matching network's RF output from the system/load. 2. Navigate the programming menu, and set either the Display Line 2 or Display Line 3 parameter to "Phs/Mag", to display the Phase (Phs) and Magnitude (Mag) error signal values.

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Phase/Mag Error Signal Offset Zero (continued)	3. If the Phase or Magnitude (or both) error signal values are more than "4" (the value is in milli-Volts), resetting or "zeroing" the offset is advisable. 4. Navigate the programming menu to the PHS/MAG ZERO option. 5. Press the ENT softkey (item 4). Display line 3 will change to show the following: -- PHS/MAG ZEROED -- (or execute the AZERO serial command). 6. Confirm the reported Phase and Magnitude signals are "4" or less. 7. Navigate the programming menu to the SAVE CONFIG TO FLASH parameter entry. Press the ENT softkey (item 4) to save changes to flash memory. 8. Re-connect the matching network to the load and RF Power Supply. 9. Apply RF power and allow the matching network to tune. Depending on the size of the offset error, the matching network's Phase and Magnitude potentiometers may need to be adjusted to achieve an optimal match point. For detailed instructions, refer to the Phase and Magnitude Sensor Adjustment Procedure in the Problem Solving section of this manual. Related Serial Commands: AZERO
Save Phase/Mag Null Data IMPORTANT! See Alternate Phase/Mag Null parameter details for procedure.	Saves the current Phase and Magnitude sensor values as "Alternate Null" values. Used with Alternate Phase/Mag Null feature. IMPORTANT! See Alternate Phase/Mag Null parameter details for procedure. Notes: 1. Feature available with firmware version 4.5A and later. 2. Feature is not available if the control board in the ATS match network was manufactured before June 2011. Pressing the "ENT" softkey (item 4) saves the current Phase and Magnitude sensor values as Alternate Null values. Related Parameters: Alternate Phase/Mag Null Related Serial Commands: ANUL, QNUL

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Alternate Phase/Mag Null	Alternate Phase and Magnitude Null Feature In some applications when pulsed RF power is used, the Phase and Magnitude ("Mag") error values corresponding to minimal reflected power are not the same as if continuous-wave power is used. To compensate for this condition, the ATS-Series matching network can be configured to use an Alternate Null in pulsed power applications so the Phase and Mag error signals will be lowest when minimal reflected power is achieved. Notes: 1. Feature available with firmware version 4.5A and later. 2. Feature is not available if the control board in the ATS match network was manufactured before June 2011. 3. Configuration of the Alternate Phase/Mag Null feature is possible via serial command, but may be easier to accomplish using the *optional* MCRS Remote Display Panel. 4. DO NOT use for non-pulsing/Continuous Wave (CW) applications. Use of the Alternate Phase/Mag Null feature in CW applications will cause tuning errors. Configuration of the Alternate Phase/Mag Null is as follows: Procedure: 1. Disable/turn off the RF Power supply, and any other RF power sources that may be present. 2. Navigate the programming menu until the display's third line shows: USE ALT P/M NULL: 3. If the third display line shows USE ALT P/M NULL: N , skip to step 5. 4. If the third display line shows USE ALT P/M NULL: Y , press the VALUE DOWN button (item 6) to change the line to USE ALT P/M NULL: N . Press the ENT button (item 4). This disables the Alternate Phase/Mag Null Feature. 5. Press the UP button (item 3) once, so the third display line reads: SAVE P/M NULL (ENT) 6. Turn on/enable the RF power supply and apply pulsed RF power. Allow the matching network to tune. 7. Set the Load and Tune capacitors to manual mode. Manually move/position the matching network's capacitors to achieve minimal reflected power. 8. Press the ENT button (item 4) to store the alternate Phase/Mag Null. The third display line will show -- ALT NULL SAVED -- 9. Press the DOWN button (item 2) once. The third display line should read: USE ALT P/M NULL: N 10. Press the VALUE UP button (item 5) once. The third display line will show USE ALT P/M NULL: Y 11. Press the ENT button (item 4). This activates the Alternate Phase/Mag Null feature. 12. Set the Load and Tune capacitors to automatic mode. End of procedure. Related Parameters: Save Phase/Mag Null Data Related Serial Commands: ANUL, UNUL, XNUL,QNUL, SNUL

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Automatic Capacitor Maintenance Motion	Enables/Disables Automatic Capacitor Maintenance Motion and selects the type of maintenance motion. The Automatic Capacitor Maintenance Motion feature automatically moves the capacitors through their entire range of travel to evenly re-distribute the lubricant inside the capacitor over the entire length of the capacitor's internal screw-drive mechanism. Periodic capacitor maintenance motion is recommended to prevent premature wear-out of the capacitor's internal drive mechanism. When enabled, the selected Automatic Capacitor Maintenance Motion occurs upon power-up or when initiated by remote command. For production systems, time should be periodically allotted for the system to execute the matching network's Automatic Capacitor Maintenance Motion function (Serial Command: GMNT). Available Settings: Cap Maint OFF Cap Maint 0>100 Cap Maint 0>100>0 Factory default setting: OFF **Note:** Feature available with firmware version 3.8A and later. Cap Maint OFF: The Automatic Capacitor Maintenance Motion feature is disabled. Cap Maint 0>100: The Automatic Capacitor Maintenance Motion feature is enabled. Upon power-up or when initiated by remote command, the Load and Tune capacitors are moved to the 0% position, then moved from 0% to 100%, then are automatically positioned at the Capacitor High Limit position. The Auxiliary (Aux) capacitor, if equipped, will be moved in the same manner as the Load and Tune capacitors, then will be positioned at the 100% position (Aux capacitor does not have a High Limit Position parameter) . If the capacitors are in AUTO mode and presets are enabled, the capacitors will then move to the preset positions. Cap Maint 0>100>0: The Automatic Capacitor Maintenance Motion feature is enabled. Upon power-up or when initiated by remote command, the Load and Tune capacitors are moved to the 0% position, then moved from 0% to 100%, then moved back to the 0% position, then are automatically positioned at the Capacitor Low Limit position. The Auxiliary (Aux) capacitor, if equipped, will be moved in the same manner as the Load and Tune capacitors, then will be positioned at the 0% position (Aux capacitor does not have a Low Limit Position parameter) If the capacitors are in AUTO mode and presets are enabled, the capacitors will then move to the preset positions. Related Parameters: Load Capacitor Position Low Limit Load Capacitor Position High Limit Tune Capacitor Position Low Limit Tune Capacitor Position High Limit Related Serial Commands: CMNT, QMNT, GMNT

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Last Tune Time timer	Automatically measures the elapsed time of the last tuning cycle, in milliseconds. Range: 0 to 60000 milliseconds. The value of Last Tune Time can be reported or reset by using the optional remote display panel or by serial command. Feature available with firmware version 4.6B and later. The tuning cycle elapsed time measurement begins when an RF-ON condition is detected and stops when ***all*** of the following conditions are met: a) The RF-ON state is in effect (RF-ON is detected). b) Either the Phase Error signal has been above the Tune Capacitor Deadband value or the Magnitude Error signal has been above the Load Capacitor Deadband value at some point since the RF-ON condition was detected. c) All of the programmable tuning delay intervals have passed, including the Express Tuning delay, Tune Capacitor delay, and Load Capacitor Delay. d) The Tune ***and*** Load capacitors have stopped moving / are stationary. e) The Phase Error Signal is at or below the Tune Capacitor Deadband parameter setting. f) The Magnitude Error Signal is at or below the Load Capacitor Deadband parameter setting. Operational Notes: 1. When RF-ON state transitions from RF-OFF to RF-ON (RF-ON is detected), any previously measured Last Tune Time value is set to zero (0) and the timer is started. 2. If the Last Tune Time is zero (0) [displayed as "Tuning Time -----" on the optional remote display panel], one or more of the following conditions is indicated: a. The matching network has not completed a tuning process. b. Tuning is in process. c. The Last Tuning Time timer has been intentionally reset. 3. If the Last Tune Time is greater than zero (0) and not more than 1 minute, the tuning time is displayed in milliseconds on the optional remote display panel or reported in milliseconds in response to the QTNTM serial command. 4. If the Last Tune Time is greater than 60000 milliseconds (1 minute), the optional remote panel display will indicate "Tuning Time >1min". Serial command QTNTM will return a value of "60001" 5. Pressing the "ENT" button resets the Last Tune Time timer, causing the display to show "Tuning Time -----" Related Parameters: RF-On/Off Detect Threshold - Magnitude Error Auto Tune Delay, Auto Load Delay, Express Tuning, Tune Capacitor Deadband, Load Capacitor Deadband Related Serial Commands: QTNTM, RTNTM

PROGRAMMABLE PARAMETER DETAILS	
PARAMETER	**PARAMETER DETAIL**
Factory Settings	Used by factory technicians to calibrate the ATS-Series matching network. There are no user adjustments. The version of the installed firmware is briefly displayed, then the SERVICE CODE: input line is displayed. Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to set the desired SERVICE CODE value. Press the Enter "ENT" button (item 4) on the front panel. If the displayed SERVICE CODE value is correct, factory settings are available by using the UP or DOWN buttons, or press the RUN button (item 1) to resume normal operation.

Serial Communications

The Seren IPS Inc. model ATS-Series Automatic Impedance Matching Network supports several serial communications modes and interfaces. The communications mode and corresponding interface is configurable from the communications interface or the *optional* Remote Display Panel. Available communications modes are: RS-232, RS-422, RS-485 4 Wire, RS-485 2 Wire, Modbus 4W RTU, Modbus 2W RTU, DeviceNet, and PROFIBUS. ***DeviceNet and PROFIBUS are optional interfaces***, and are not field-installable.

This section describes the usage and commands applicable to RS232, RS422, RS485-4 and RS-485-2 serial protocols. Modbus, DeviceNet, and PROFIBUS communications are discussed in its own respective sections. Selecting and configuring the serial interface is discussed later in this section.

The serial interface connector (labeled "CONTROL"), is used for RS232, RS422, RS485-4, RS485-2, Modbus 4W RTU, and Modbus 2W RTU communications. The serial interface connector pin list and pin functions are discussed in detail in the Controls And Connections section. Modbus communications uses the same physical layer as RS485-2 and RS485-4, but the protocol is different.

RS232, RS422, RS485-4, and RS485-2 modes share a common command set. The differences between the serial interface modes are related to the physical connection type and usage. The serial modes and connections are described in the chart below.

IMPORTANT NOTE:

When communicating via the serial interface, the *optional* Remote Display Panel controls (if panel is connected) remain active. Programmable parameters may be set via the *optional* Remote Display Panel, the Load and Tune capacitors may be positioned via the *optional* Remote Display Panel, and the Load and Tune capacitor position control mode may be changed via the *optional* Remote Display Panel.

General Note:

Throughout this document, Hexadecimal numbers are preceded by "0x"
Example: 80 (decimal) = 0x50 (hexadecimal)

The following serial communication parameters are fixed and cannot be configured	
Parity:	NONE
Handshaking	NONE
Data Bits:	8
Stop Bits:	1

Serial Interface Modes and Connections	
Mode	**Description**
RS232	Single-Ended, point-to-point, Full Duplex. Suitable for short distances (less than 30 meters) Control Connector — Signal Function Pin 2 — Transmit Data (data out) Pin 3 — Receive Data (data in) Pin 9 — Common (ground)
RS422	Balanced, multi-point, receive only. Suitable for longer distances (up to 1000 meters at 9600 BAUD) Control Connector — Signal Function Pin 5 — Receive Data + (data in) Pin 6 — Receive Data – (data in) Pin 9 — Ground
RS485-4	Balanced, multipoint addressable, up to 32 nodes. 4-Wire. Full Duplex. Suitable for longer distances (up to 1000 meters at 9600 BAUD) Control Connector — Signal Function Pin 5 — Receive Data + (in) Pin 6 — Receive Data – (in) Pin 7 — Transmit Data + (out) Pin 8 — Transmit Data – (out) Pin 9 — Ground
RS485-2	Balanced, multipoint addressable, up to 32 nodes. 2-Wire. Half Duplex. Suitable for longer distances (up to 1000 meters at 9600 BAUD) Control Connector — Signal Function Pin 7 — Transmit / Receive Data + (data out/data in) Pin 8 — Transmit / Receive Data – (data out/data in) Pin 9 — Ground

Serial Interface Address

When any of the multipoint communication modes (RS-422, RS485-4, RS485-2) is used, each slave device (such as the ATS-Series matching network) is assigned a unique address so that only one device at a time will respond to commands. The ATS-Series matching network's address can be configured via the communications interface or the optional Remote Display Panel. The address can range from 0 to 99.

If the ATS-Series matching network's address is below 99, the ATS-Series matching network will expect each command to be preceded by an address, and it will respond only to commands that follow an address that matches its address setting.

If the ATS-Series matching network's address is 99, the ATS-Series matching network will assume that addressing is not used and will respond to every command. The factory default address for RS-422 and RS-485 serial communications mode is "99"

When addressing is used, each command must be preceded by a device's address, sent as follows:

@<address high digit><address low digit><CR>

Where: @ = the "at" character, ASCII value 0x40
<CR> = the "carriage return" character, ASCII value 0x0D
The address must always be sent as two decimal digits. For 4, send 04

After the address is sent, the ATS-Series matching network will acknowledge by sending an "A" character. After that, the ATS-Series matching network expects one of the serial commands described in the serial command chart. An example of a serial communications exchange is shown below.

Example 1: For an ATS-Series matching network with an address of "46", set the load capacitor for manual operation.

Command	Response	Comments
@46<CR>	A	Send address 46, receive "A" as acknowledgment
MLD<CR>	<CR>	Send "load = manual" command

Example 2: For an ATS-Series matching network's with an address of "3", read the tune capacitor position.

Command	Response	Comments
@03<CR>	A	Send address 03 (must send 2 digits), receive "A" as acknowledgment
TPS?<CR>	44<CR>	Send "report tune position" command, receive position "44"

Serial Commands

RS-232, RS-422, RS-485-4 and RS-485-2 modes share a common command set. The commands are listed in the Serial Command Reference chart in a "how to" fashion. In the Serial Command Detail chart, serial commands are listed alphabetically and described in depth.

All of the following commands must be terminated with a CR (carriage return) character, ASCII value 0x0D. For commands that expect an input value, send the value first, then send a space, then send the command.

The ATS-Series matching network serial commands are not case-sensitive, however for compatibility with other Seren IPS equipment, it is advised that all commands be sent in uppercase (capital) letters. If an invalid command is sent, the ATS-Series matching network will respond with "N<CR>".

References in the Description/Comment column regarding LED lights and displayed text refer to events on the *optional* Remote Display Panel, if it is connected to the ATS-Series matching network. The ATS-Series matching network does not require the *optional* Remote Display Panel in order to operate.

Symbology: @ = the "at" character, ASCII value 0x40

<CR> = the "carriage return" character, ASCII value 0x0D

<sp> = the "space" character, ASCII value 0x20

All examples are given with character echo disabled.

Serial Command Reference chart:

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Load capacitor position control mode to manual	MLD<CR>	Load "AUTO" LED extinguishes, Load "MAN" LED illuminates. Response: <CR>
Set the Load capacitor position control mode to automatic	ALD<CR>	Load "MAN" LED extinguishes, Load "AUTO" led illuminates. Response: <CR>
Set the Tune capacitor position control mode to manual	MTN<CR>	Tune "AUTO" LED extinguishes, Tune "MAN" LED illuminates. Response: <CR>
Set the Tune capacitor position control mode to automatic	ATN<CR>	Tune "MAN" LED extinguishes, Tune "AUTO" LED illuminates. Response: <CR>

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Auxiliary (Aux) capacitor position control mode to manual	MAUX<CR>	Response: <CR>
Set the Auxiliary (Aux) capacitor position control mode to automatic	AAUX<CR>	Response: <CR>
Read the Load capacitor's Auto/Manual status	QAML<CR>	Reports the current Auto/Manual control status of the Load capacitor Response: X<CR> Where "X" is "A" for automatic, "M" for manual.
Read the Tune capacitor's Auto/Manual status	QAMT<CR>	Reports the current Auto/Manual control status of the Tune capacitor Response: X<CR> Where "X" is "A" for automatic, "M" for manual.
Read the Auxiliary (Aux) capacitor's Auto/Manual status	QAMA<CR>	Reports the current Auto/Manual control status of the Auxiliary (Aux) capacitor Response: X<CR> Where "X" is "A" for automatic, "M" for manual.
Read the Load capacitor position	LPS?<CR>	Reports the current Load capacitor position LPS (without the question mark) is also accepted Response: XXX<CR> Where "XXX" is the Load capacitor position, in percent.
Read the Load capacitor position (percent x10)	CPLP<CR>	Reports the current Load capacitor position, in percent x10 Response: XXXX<CR> Where XXXX is the Load capacitor in percent x10 (453<CR> = 45.3%)
Read the Tune capacitor position	TPS?<CR>	Reports the current Tune capacitor position TPS (without the question mark) is also accepted Response: XXX<CR> Where "XXX" is the Tune capacitor position, in percent.
Read the Tune capacitor position (percent x10)	CPTP<CR>	Reports the current Tune capacitor position, in percent x10 Response: XXXX<CR> Where XXXX is the Tune capacitor in percent x10 (512<CR> = 51.2%)

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the Auxiliary (Aux) capacitor position (percent x10)	CPAP<CR>	Reports the current Auxiliary (Aux) capacitor position, in percent x10 Response: XXXX<CR> Where XXXX is the Tune capacitor in percent x10 (880<CR> = 88.0%)
Move the Load capacitor	XX<sp>MVLD<CR>	Moves the Load capacitor to a specific position. Where "XX" is the desired Load capacitor position, in percent x10. 2 to 4 digits, range: 0.0% to 100.0%. (Example: 453 MVLD<CR> = 45.3%) Response: <CR>
Move the Tune capacitor	XX<sp>MVTN<CR>	Moves the Tune capacitor to a specific position. Where "XX" is the desired Load capacitor position, in percent x10. 2 to 4 digits, range: 0.0% to 100.0%. (Example: 512 MVTN<CR> = 51.2%) Response: <CR>
Move the Auxiliary (Aux) capacitor	XX<sp>MVAUX<CR>	Moves the Auxiliary (Aux) capacitor to a specific position. Where "XX" is the desired Auxiliary (Aux) capacitor position, in percent x10. 2 to 4 digits, range: 0.0% to 100.0%. (Example: 880 MVAUX<CR> = 88.0%) Response: <CR>
Set the Load Capacitor Preset 1 position	XX<sp>MPL<CR>	Where "XX" is the desired Load capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value *is not* saved to non-volatile memory. Response: <CR>
Set the Load Capacitor Preset 1 position and save value to non-volatile memory.	XX<sp>MPLS<CR>	Where "XX" is the desired Load capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>
Read the current Load Capacitor Preset 1 position (Percent)	QPL<CR>	Reports the current Load capacitor Preset 1 position value. Response: XXX<CR> Where "XXX" is the preset position, in percent.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the current Load Capacitor Preset 1 position (Percent x10)	QP1L<CR>	Reports the current Load capacitor Preset 1 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set Load Capacitor Preset 2 position and save value to non-volatile memory	XX<sp>P2L<CR>	Where "XX" is the desired Load capacitor Preset 2 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>
Read the current Load Capacitor Preset 2 position (Percent x10)	QP2L<CR>	Reports the current Load capacitor Preset 2 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set the Tune Capacitor Preset 1 position	XX<sp>MPT<CR>	Where "XX" is the desired Tune capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value *is not* saved to non-volatile memory. Response: <CR>
Set the Tune Capacitor Preset 1 position and save value to non-volatile memory	XX<sp>MPTS<CR>	Where "XX" is the desired Tune capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>
Read the current Tune Capacitor Preset 1 position (Percent)	QPT<CR>	Reports the current Tune capacitor Preset 1 position value. Response: XXX<CR> Where "XXX" is the preset position, in percent.
Read the current Tune capacitor Preset 1 position (Percent x10)	QP1T<CR>	Reports the current Tune capacitor Preset 1 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set Tune Capacitor Preset 2 position and save value to non-volatile memory	XX<sp>P2T<CR>	Where "XX" is the desired Tune capacitor Preset 2 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the current Tune Capacitor Preset 2 position (Percent x10)	QP2T<CR>	Reports the current Tune capacitor Preset 2 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set the Auxiliary (Aux) Capacitor Preset 1 position	XX<sp>MPA<CR>	Where "XX" is the desired Auxiliary (Aux) capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value ***is not*** saved to non-volatile memory. Response: <CR>
Set the Auxiliary (Aux) Capacitor Preset 1 position and save value to non-volatile memory	XX<sp>MPAS<CR>	Where "XX" is the desired Auxiliary (Aux) capacitor Preset 1 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>
Read the current Auxiliary (Aux) capacitor Preset 1 position (Percent x10)	QP1A<CR>	Reports the current Auxiliary (Aux) capacitor Preset 1 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set Auxiliary (Aux) Capacitor Preset 2 position and save value to non-volatile memory	XX<sp>P2A<CR>	Where "XX" is the desired Tune capacitor Preset 2 position, in percent. 2 to 5 digits, range: 0.0% to 100.0%. Preset value is saved to non-volatile memory. Response: <CR>
Read the current Auxiliary (Aux) capacitor Preset 2 position (Percent x10)	QP2A<CR>	Reports the current Auxiliary (Aux) capacitor Preset 2 position value. Response: XXXX<CR> Where "XXXX" is the preset position, in percent x10.
Set preset mode to "off"	OFF<CR>	Disables preset mode. Response: <CR>
Enable presets and set preset source to "internal"	INT<CR>	Enables preset mode ***and*** instructs the ATS-Series matching network to use the Load and Tune Preset 1 values for preset position. Response: <CR>
Enable presets and set preset source to "external"	EXT<CR>	Enables preset mode ***and*** instructs the ATS-Series matching network to use the Load and Tune preset signals present at the ANALOG INTERFACE connector. Response: <CR>

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the current Preset mode	QPMD<CR>	Reports the current Preset Mode. Response: X<CR>, Where X = 0 = OFF, Where X = 1 = INTERNAL Where X = 2 = ANALOG
Enable RF-OFF preset trigger mode	TRGR<CR>	Instructs the ATS-Series matching network to automatically move the Load and Tune capacitors to the selected preset positions when the ATS-Series matching network detects the RF power supply is in an RF OFF state. Response: <CR>
Disable RF-OFF preset trigger mode	TRGX<CR>	The ATS-Series matching network will not move the Load and Tune capacitors to the selected preset positions when the ATS-Series matching network detects the RF power supply in an RF OFF state. Response: <CR>
Read the current RF-OFF preset trigger mode.	QTRG<CR>	Reports the current RF-OFF Preset Trigger Mode Response: X<CR> Where X = 0: RF-OFF Trigger feature disabled. Where X = 1: RF-OFF Trigger feature is enabled.
Set the Phase Error RF-ON detection threshold	XX<sp>THPH<CR>	Where XX is the Phase Error signal threshold value, 1 to 4 characters, in milli-Volts Value Range: 0 to 4999
Read the Phase Error RF-ON detection threshold	QTHP<CR>	Reports the current Phase Error RFON detection threshold value. 1 to 4 characters. Response: X<CR> Where X = the Phase Error RF ON threshold value, in milli-Volts.
Set the Magnitude Error RF-ON detection threshold	XX<sp>THMG<CR>	Where XX is the Magnitude Error signal threshold value, 1 to 4 characters, in milli-Volts Value Range: 0 to 4999
Read the Magnitude Error RF-ON detection threshold	QTHM<CR>	Reports the current Magnitude Error RFON detection threshold value. 1 to 4 characters. Response: X<CR> Where X = the Magnitude Error RF ON threshold value, in milli-Volts

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Power Sense RF-ON detection threshold	XX<sp>THPS<CR>	Where XX is the Power Sense signal threshold value, 1 to 4 characters, in milli-Volts Value Range: 0 to 5000
Read the Power Sense RF-ON detection threshold.	QTHS<CR>	Reports the current Power Sense RFON detection threshold value. 1to 4 characters. Response: X<CR> Where X = the Power Sense threshold value, in milli-Volts
Set the RF Voltage Probe RF-ON detection	XX<sp>THRF<CR>	Where XX is the RF Voltage Probe signal value, 1 to 5 characters, in milli-Volts Value Range: 0 to 19999
Read the RF Voltage Probe RF-ON detection	QTHR<CR>	Reports the current RF Voltage Probe RFON detection threshold value. 1 to 4 characters. Response: X<CR> Where X = the Power Sense threshold value, in milli-Volts
Set the RF-OFF delay	XX<sp> RFODLY<CR>	Where XX is the RF-OFF delay time parameter value, 1 to 5 characters, in milli-Seconds. Value Range: 0 to 20000
Read the RF-OFF delay	QRFOD<CR>	Reports the current RF-OFF delay time parameter value. 1 to 5 characters. Response: X<CR> Where X = the RF-OFF delay time, in milli-Seconds
Move all Capacitors to their Preset 1 position	GOTO<CR>	Automatically moves the capacitors to the Preset 1 position. Response: <CR>
Move all Capacitors to their Preset 2 position	GOP2	Automatically moves the capacitors to the Preset 2 position. Response: <CR>
Read the Phase error signal	PHS<CR>	Reports the current Phase error signal voltage. Response: -XX<CR> Where "-XX" is the Phase error voltage in milli-volts (mV). Note: Negative polarity is prefixed with a "-" sign, positive polarity is unsigned.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the Magnitude error signal	MAG<CR>	Reports the current Magnitude error signal voltage. Response: -XX<CR> Where "-XX" is the Magnitude error voltage in milli-volts (mV). Note: Negative polarity is prefixed with a "-" sign, positive polarity is unsigned.
Read the internal Power Sensor signal	QPSNS<CR>	Reports the current Power Sensor signal voltage. Response: XX<CR> Where XX is the Power Sensor signal voltage, 1 to 5 characters, in milli-Volts.
Select the DC probe	PRB0<CR>	Routes the ATS-Series matching network's DC Probe signal to the PROBE and ANALOG INTERFACE connectors Probe Output pin. Response: <CR>
Select the RF Probe	PRB1<CR>	Routes the ATS-Series matching network's RF Probe signal to the PROBE and ANALOG INTERFACE connectors Probe Output pin. Response: <CR>
Select the Current Probe	PRB2<CR>	Routes the ATS-Series matching network's Current Probe signal to the PROBE and ANALOG INTERFACE connectors Probe Output pin. Response: <CR>
Report the selected Probe	QPRB<CR>	Reports the currently selected Probe. Response: X<CR> Where X = 0: DC Probe Where X = 1: RF Probe Where X = 2: Current Probe
Read the Voltage probe	V?<CR>	Reports the currently selected probe voltage. Response: XXX<CR> Where "XXX" is the probe voltage, in Volts. Note: Same as the "0?" command

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the Voltage probe	0?<CR>	Reports the currently selected probe voltage. Response: XXX<CR> Where "XXX" is the probe voltage, in Volts. Note: Same as the "V?" command
Read the DC Probe Voltage	QDP<CR>	Reports the DC Probe Voltage. Response: XXX<CR> Where "XXX" is the DC Probe voltage, in Volts.
Read the RF Probe Voltage	QRP<CR>	Reports the RF Probe Voltage. Response: XXX<CR> Where "XXX" is the RF Probe voltage, in Volts
Read the Current Probe Current	QIP<CR>	Reports the Current Probe Current. Response: XXXX<CR> Where "XXXX" is the Current Probe Current, in Amps
Read Auxiliary Current Probe Current	QAP<CR>	Reports the Auxiliary Current Probe Current. Response: XXXX<CR> Where "XXXX" is the Auxiliary Current Probe Current, in Amps Note: OEM option. See command details.
Read the Auxiliary RF Probe Voltage	QXP<CR>	Reports the Auxiliary RF Probe Voltage. Response: XXX<CR> Where "XXX" is the Auxiliary RF Probe voltage, in Volts Note: OEM option. See command details.
Set the DC Probe Attenuation Factor	XXXX_PADC<CR>	Where "XXXX" is the desired attenuation factor, XXXX: 1. Range: 1:1 to 4095:1 Response: <CR>
Read the DC Probe Attenuation Factor	QPAD<CR>	Reports the DC Probe attenuation factor. Response: XXXX<CR> Where XXXX is 1 to 4 characters.
Set the RF Probe Attenuation Factor	XXXX_PARF<CR>	Where "XXXX" is the desired attenuation factor, XXXX: 1. Range: 1:1 to 4095:1 Response: <CR>
Read the RF Probe Attenuation Factor	QPAR<CR>	Reports the RF Probe attenuation factor. Response: XXXX<CR> Where XXXX is 1 to 4 characters.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Current Probe Attenuation Factor	XXXX_PAI<CR>	Where "XXXX" is the desired attenuation factor, XXXX: 1. Range: 1:1 to 1000:1 Response: <CR>
Read the Current Probe Attenuation Factor	QPAI<CR>	Reports the Current Probe attenuation factor. Response: XXXX<CR> Where XXXX is 1 to 4 characters.
Read one (1) measurement set from Power Sensor	QVIP<CR>	Report one (1) measurement set from Power Sensor - Voltage, Current, Phase, etc. - see command detail. Response: 118-Character string followed by <CR>. See command detail. Note: Power Sensor is optional equipment.
Repeatedly read measurement sets from Power Sensor (stream measurement sets)	VIPL<CR>	Report four (4) measurement sets from Power Sensor per second until stopped (Voltage, Current, Phase, etc. - see command detail) Response: Repeating 118-Character strings, each followed by <CR>. See command detail. Note: Power Sensor is optional equipment.
Read RMS voltage of fundamental frequency	QVIVR<CR>	Reports the RMS voltage of the fundamental frequency. Response: XXXX<CR> Where "XXXX" is the RMS voltage of the fundamental frequency, in Volts. Note: Power Sensor is optional equipment.
Read RMS current of fundamental frequency	QVIIR<CR>	Reports the RMS current of the fundamental frequency. Response: XXXX<CR> Where "XXXX" is the RMS current of the fundamental frequency, in Amps Note: Power Sensor is optional equipment.
Read Peak Voltage from Power Sensor	QVIVP<CR>	Reports the Peak Voltage from the Power Sensor. Response: XXXX<CR> Where "XXXX" is the peak voltage, in Volts. Note: Power Sensor is optional equipment.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read Peak Current from Power Sensor	QVIIR<CR>	Reports the Peak current from the Power Sensor. Response: XXXX<CR> Where "XXXX" is the peak current, in Amps. Note: Power Sensor is optional equipment.
Set the Load Capacitor Position Limit – High Value	XXXX<sp>LLH<CR>	Where "XXXX" is the desired High value, 1 to 5 digits, in percent. Range: 2.0 to 100.0 Response: <CR>
Read the Load Capacitor Position Limit – High Value	QLLH<CR>	Reports the Load Capacitor Position Limit – High Value, in percent. Response: XXXX<cr> Where "XXXX" is the High Limit value, in percent.
Set the Load Capacitor Position Limit – Low Value	XXXX<sp>LLL<CR>	Where "XXXX" is the desired Low value, 1 to 5 digits, in percent. Range: 0.0 to 98.0 Response: <CR>
Read the Load Capacitor Position Limit – Low Value	QLLL<CR>	Reports the Load Capacitor Position Limit – Low Value, in percent. Response: XXXX<cr> Where "XXXX" is the low Limit value, in percent.
Set the Tune Capacitor Position Limit – High Value	XXXX<sp>TLH<CR>	Where "XXXX" is the desired High value, 1 to 5 digits, in percent. Range: 2.0 to 100.0 Response: <CR>
Read the Tune Capacitor Position Limit – High Value	QTLH<CR>	Reports the Tune Capacitor Position Limit – High Value, in percent. Response: XXXX<cr> Where "XXXX" is the High Limit value, in percent.
Set the Tune Capacitor Position Limit – Low Value	XXXX<sp>TLL<CR>	Where "XXXX" is the desired Low value, 1 to 4 digits, in percent. Range: 0.0 to 98.0 Response: <CR>
Read the Tune Capacitor Position Limit – Low Value	QTLL<CR>	Reports the Tune Capacitor Position Limit – Low Value, in percent. Response: XXXX<cr> Where "XXXX" is the low Limit value, in percent.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Load Capacitor Deadband	XXXX<sp>DBL<CR>	Where "XXXX" is the Load capacitor deadband threshold, in milli-volts, 1 to 4 digits, Range: 0 to 1250 Response: <CR>
Read the Load Capacitor Deadband parameter	QDBL<CR>	Reports the Load Capacitor deadband parameter value. Response: XXXX<CR> Where "XXXX" is the Load capacitor deadband value in milli-Volts, 1 to 4 digits.
Set the Tune Capacitor Deadband	XXXX<sp>DBT<CR>	Where "XXXX" is the Tune capacitor deadband threshold, in milli-volts, 1 to 4 digits, Range: 0 to 1250 Response: <CR>
Read the Tune Capacitor Deadband parameter	QDBT<CR>	Reports the Tune Capacitor deadband parameter value. Response: XXXX<CR> Where "XXXX" is the Tune capacitor deadband value in milli-Volts, 1 to 4 digits.
Set the Load Capacitor High-Speed Threshold value (Firmware 3.5A and later)	XXXX<sp>LSPD<CR>	Where "XXXX" is the Load Capacitor High-Speed Threshold parameter value, 1 to 4 digits, in milli-Volts. Range: 0 to 1250 Response: <CR>
Read the Load Capacitor High-Speed Threshold value (Firmware 3.5A and later)	QLSPD<CR>	Reports the current Load Capacitor High-Speed Threshold parameter value. Response: XXXX<CR> Where "XXXX" is the Load Capacitor High-Speed Threshold parameter value, in milli-Volts, 1 to 4 digits.
Set the Tune Capacitor High-Speed Threshold value (Firmware 3.5A and later)	XXXX<sp>TSPD<CR>	Where "XXXX" is the Tune Capacitor High-Speed Threshold parameter value, 1 to 4 digits, in milli-Volts. Range: 0 to 1250 Response: <CR>
Read the Tune Capacitor High-Speed Threshold value (Firmware 3.5A and later)	QTSPD<CR>	Reports the current Tune Capacitor High-Speed Threshold parameter value. Response: XXXX<CR> Where "XXXX" is the Load Capacitor High-Speed Threshold parameter value, in milli-Volts, 1 to 4 digits.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Load Capacitor Motion Slowdown value (Firmware 3.5A and later)	XXX<sp>LSLO<CR>	Where "XXX" is the Load Capacitor Motion Slowdown parameter value, 1 to 3 digits, in milli-Seconds. Range: 0 to 100 Response: <CR>
Read the Load Capacitor Motion Slowdown value (Firmware 3.5A and later)	QLSLO<CR>	Reports the current Load Capacitor Motion Slowdown parameter value. Response: XXX<CR> Where "XXX" is the current parameter value, in milli-seconds, 1 to 3 digits.
Set the Tune Capacitor Motion Slowdown value (Firmware 3.5A and later)	TSLO<CR>	Where "XXX" is the Tune Capacitor Motion Slowdown parameter value, 1 to 3 digits, in milli-Seconds. Range: 0 to 100 Response: <CR>
Read the Tune Capacitor Motion Slowdown value (Firmware 3.5A and later)	QTSLO<CR>	Reports the current Tune Capacitor Motion Slowdown parameter value. Response: XXX<CR> Where "XXX" is the current parameter value, in milli-seconds, 1 to 3 digits.
Set the Express Tuning Delay value	XXXX<sp>TRAJ<CR>	Where "XXXX" is the Express Tuning Delay parameter value, in milli-Seconds. 1 to 4 digits, Range: 0 to 9999. Note: setting value to "0" disables feature.
Read the Express Tuning Delay value	QTRAJ<CR>	Reports the current Express Tuning delay parameter value. Response: XXXX<CR> Where "XXXX" is the Express Tuning Delay parameter value, in milli-Seconds, 1 to 4 digits
Set the Load Capacitor Auto-Tuning Delay	XXXX<sp>DLY<CR>	Where "XXXX" is the Auto Load Delay parameter value, in milli-seconds, 1 to 4 digits. Range: 0 to 9999 Response: <CR>
Read the Load Capacitor Auto-Tuning Delay	QDLY<CR>	Reports the Load Capacitor Auto-Tuning Delay parameter value. Response: XXXX<CR> Where "XXXX" is the Load Capacitor Auto-Tuning Delay parameter value, in milli-Seconds.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Tune Capacitor Auto-Tuning Delay	XXXX<sp>DLT<CR>	Where "XXXX" is the Auto Load Delay parameter value, in milli-seconds, 1 to 4 digits. Range: 0 to 9999 Response: <CR>
Read the Tune Capacitor Auto-Tuning Delay	QDLT<CR>	Reports the Tune Capacitor Auto-Tuning Delay parameter value. Response: XXXX<CR> Where "XXXX" is the Tune Capacitor Auto-Tuning Delay parameter value, in milli-Seconds.
Set the Backout Feature Mode	X<sp>BAK<CR>	Where "X" is the desired mode of operation. Range 0 to 2: 0 = Off 1 = Preset 2 2 = Reverse Algorithm Response: <CR>
Read the current Backout Feature mode	QBAK<CR>	Reports the current Backout Feature mode. Response: X<CR> Where "X" = 0: Off Where "X" = 1: Preset 2 Where "X" = 2: Reverse Algorithm
Set the Backout Delay parameter value	XX<sp>BOD<CR>	Sets the Backout Feature's delay time parameter, in milli-seconds. 2 to 4 characters, Range: 50mS to 5000mS. Response: <CR>
Read the Backout Delay parameter value	QBD<CR>	Reports the current Backout Feature Delay parameter value. Response: XX<CR> Where "XX" is the Backout Delay time value, in milli-seconds, 2 to 4 characters.
Set the Analog Interface Voltage Range to 5V	RNG5<CR>	Sets the Analog Interface's voltage range to 0-5VDC Response: <CR>
Set the Analog Interface Voltage Range to 10V	RNG10<CR>	Sets the Analog Interface's voltage range to 0-10VDC Response: <CR>
Read the Analog Interface Voltage Range	QRNG<CR>	Reports the current Analog Interface Voltage Range parameter value Response: X<CR> Where "X" = 0: Range = 0-5V Where "X" = 1: Range = 0-10V

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Enable Analog Interface Control	AIY<CR>	Analog Interface capacitor positioning, preset enable, and Auto/Manual mode select signals are active. Response: <CR>
Disable Analog Interface Control	AIN<CR>	Analog Interface capacitor positioning, preset enable, and Auto/Manual mode select signals are ignored. Response: <CR>
Read the Analog Interface Control mode	QAI<CR>	Reports the current Analog Interface Control mode. Response: X<CR> Where "X" = 0: Analog Control Disabled Where "X" = 1: Analog Control Enabled
Set the Communications Protocol	X<sp>SMD<CR>	Where "X" is the desired communications protocol. Range 0 to 7: 0 = RS-232 1 = RS-422 2 = RS-485-4 (4-Wire, Full Duplex) 3 = RS-485-2 (2-Wire, Half Duplex) 4 = MODBUS 4W RTU * (Modbus 4-Wire) 5 = MODBUS 2W RTU * (Modbus 2-wire) 6 = DeviceNet 7 = PROFIBUS Response: <CR> *Note: Modbus not settable via serial command. Refer to SMD command details for information.
Read the current Communications Protocol	QSMD<CR>	Response: X<CR> Where "X" is a 1-character code for the current communications protocol: 0 = RS-232 1 = RS-422 2 = RS-485-4 (4-Wire, Full Duplex) 3 = RS-485-2 (2-Wire, Half Duplex) 4 = MODBUS 4W RTU (Modbus 4-Wire) 5 = MODBUS 2W RTU (Modbus 2-wire) 6 = DeviceNet 7 = PROFIBUS

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Set the Address ID Number	XXX<sp>SAD<CR>	Where "XXX" is the desired Address ID Number, 1 to 3 digits. Range: 0 to 247. (See discussion of communications modes for address range details) Response: <CR>
Read the Address ID Number	QSAD<CR>	Response: XXX<CR> Where "XXX" is the Address ID Number. 1 to 3 Digits, Range 0 to 247
Set the Serial Data Rate (RS232/422/485, Modbus)	X<sp>BAUD<CR>	Where "X" is a 1-character code for the desired Serial Data rate: 0 = 2400 BAUD 1 = 4800 BAUD 2 = 9600 BAUD 3 = 19200 BAUD 4 = 38400 BAUD 5 = 57600 BAUD 6 = 115200 BAUD Response: <CR>
Enable character echo	ECHO<CR>	Response: <CR>
Disable character echo	NOECHO<CR>	Response: <CR>
Set the DeviceNet Data Rate	X<sp>DNDR<CR>	Where "X" is a 1-character code for the desired DeviceNet data rate. Range: 0 to 2: 0 = 125Kbps 1 = 250Kbps 2 = 500Kbps Response: <CR>
Read the DeviceNet Data Rate	QDNDR<CR>	Response: X<CR> Where "X" is a 1-character code for the current DeviceNet Data Rate: 0 = 125Kbps 1 = 250Kbps 2 = 500Kbps
Set the DeviceNet Assembly Set (Data Format)	X<sp>DNDF<CR>	Where "X" is a 1-character code for the desired DeviceNet Assembly Set (Data Format). Range: 0 to 2 0 = Master sends 10 bytes ATS-Series network returns 18 bytes 1 = Master sends 6 bytes ATS-Series network returns 12 bytes 2 = Master sends 9 bytes ATS-Series network returns 14 bytes Response: <CR>

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Read the DeviceNet Assembly set (Data Format)	QDNDF<CR>	Response: X<CR> Where "X" is a 1-character code for the current DeviceNet Assembly set: 0 = Master sends 10 bytes ATS-Series network returns 18 bytes 1 = Master sends 6 bytes ATS-Series network returns 12 bytes 2 = Master sends 9 bytes ATS-Series network returns 14 bytes
Set the Modbus Implementation Type (Firmware 4.6A and later)	X<sp>MBTP<CR>	Where "X" is a 1-character code for the desired Modbus implementation type: 0 = Single ID ATS-Specific Implementation 1 = Multiple ID MC2-Emulation Implementation Response: <CR>
Query the Modbus Implementation type (Firmware 4.6A and later)	QMBT<CR>	Response: X<CR> Where "X" is a 1-character code for the desired Modbus implementation type: 0 = Single ID ATS-Specific Implementation 1 = Multiple ID MC2-Emulation Implementation
Save configuration settings to Flash memory	FLSH<CR>	Forces saving of configuration parameters stored in battery-backed memory to Flash memory. Response: <CR>
Ignore commands from Fieldbus	FBIGNORE<CR>	If connected to a Fieldbus (DeviceNet, PROFIBUS), causes the matching network to ignore commands sent by the Fieldbus master. Response: <CR>
Obey commands from Fieldbus	FBNORM<CR>	If connected to a Fieldbus (DeviceNet, PROFIBUS), causes the matching network to obey commands sent by the Fieldbus master. (Cancels the effect of the FBIGNORE command) Response: <CR>

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Query the presence of an Auxiliary (Aux) capacitor	QACI<CR>	Response: X<CR> Where "X" is a 1-digit code for the presence of the Auxiliary (Aux) capacitor: 0 = Aux capacitor NOT installed 1 = Aux capacitor is installed
Query the Load capacitor type	QTYPL<CR>	Response: X<CR> Where "X" is a 1-digit code for the Load capacitor type: 0 = Vacuum Variable Capacitor 1 = Air Variable Capacitor
Query the Tune capacitor type	QTYPT<CR>	Response: X<CR> Where "X" is a 1-digit code for the Tune capacitor type: 0 = Vacuum Variable Capacitor 1 = Air Variable Capacitor
Query the Auxiliary (Aux) capacitor type	QTYPA<CR>	Response: X<CR> Where "X" is a 1-digit code for the Auxiliary (Aux) capacitor type: 0 = Vacuum Variable Capacitor 1 = Air Variable Capacitor
Null or "zero-out" Phase/Mag offset error	AZERO<CR>	Response <CR> Note: Ensure RF is "OFF" before executing command. See Phase/Mag Error Signal Offset Zero details and procedure in the Programmable Parameters section **before** using.
Enable/Disable Automatic Capacitor Maintenance Motion and set motion mode (Firmware version 3.8A and later)	X<sp>CMNT<CR>	Where "X" is a 1-character code for the maintenance motion mode: 0 = Capacitor Maintenance Motion OFF 1 = Motion On, 0% to 100% 2 = Motion On, 0% to 100% to 0% Response: <CR>
Read the current Automatic Capacitor Maintenance Motion mode (Firmware version 3.8A and later)	QMNT<CR>	Response: X<CR> Where "X" is a 1-digit code for the current Automatic Capacitor Maintenance Motion mode: 0 = Capacitor Maintenance Motion OFF 1 = Motion On, 0% to 100% 2 = Motion On, 0% to 100% to 0%

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Initiate a Capacitor Maintenance Motion cycle (Firmware version 3.8A and later)	GMNT<CR>	Response: <CR> Note: Ensure RF is "OFF" before executing command. Refer to the Automatic Capacitor Maintenance Mode feature details in the Programmable Parameters Detail section.
Measure and store the current Phase/Mag sensor values. (Firmware version 4.5A and later)	ANUL<CR>	Response: <CR> Note: Part of Alternate Phase/Mag Null feature for pulsed RF power applications. Refer to the Alternate Phase/Mag Null feature description in the Programmable Parameters section for procedural information.
Enable the Alternate Phase/Mag Null feature. (Firmware version 4.5A and later)	UNUL<CR>	Response: <CR> Note: Part of Alternate Phase/Mag Null feature for pulsed RF power applications. Refer to the Alternate Phase/Mag Null feature description in the Programmable Parameters section for procedural information.
Disable the Alternate Phase/Mag Null feature. (Firmware version 4.5A and later)	XNUL<CR>	Response: <CR>
Query the stored Alternate Phase/Mag Null values (Firmware version 4.5A and later)	QNUL<CR>	Response: XXXX<sp>YYYY<sp><CR> Where: XXXX is the Phase value in Analog-to-Digital (A/D) converter counts, noted in signed 16-bit Hexadecimal format. YYYY is the Magnitude value in Analog-to-Digital (A/D) converter counts, noted in signed 16-bit Hexadecimal format..
Set the stored Alternate Phase/Mag Null values (Firmware version 4.5A and later)	SNUL<sp>X<sp>Y<CR>	Response:<CR> Where: X is the Phase value in Analog-to-Digital (A/D) converter counts , noted in signed 16-bit Hexadecimal format. Y is the Magnitude value in Analog-to-Digital (A/D) converter counts, noted in signed 16-bit Hexadecimal format. Refer to the Alternate Phase/Mag Null feature description in the Programmable Parameters section for procedural information.

SERIAL COMMAND REFERENCE		
To	**Send**	**Description/Comment**
Query the last Tuning Time timer. (Firmware version 4.6B and later)	QTNTM<CR>	Response: XXXXX<CR> Where XXXXX is the Last Tune time, in milliseconds, 1 to 5 digits. A value of zero (0) indicates: a. The matching network has not completed a tuning process b. Tuning is in process c. The Last Tuning Time timer has been intentionally reset A value of 60001 indicates the tuning time was more than 1 minute. Refer to the Last Tune Time parameter in the Programmable Parameters section for detailed operational information
Reset the last Tune Time timer. (Firmware version 4.6B and later)	RTNTM<CR>	Response: <CR> Resets the last Tune Time timer to zero (0) milliseconds.

Serial Command Details:

All of the following commands must be terminated with a CR (carriage return) character, ASCII value 0x0D. For commands that expect an input value(unless otherwise noted) send the value first, then send a space, then send the command.

Symbology: @ = the "at" character, ASCII value 0x40

<CR> = the "carriage return" character, ASCII value 0x0D

<sp> = the "space" character, ASCII value 0x20

All examples are given with character echo disabled.

General Note:

Throughout this document, Hexadecimal numbers are preceded by "0x"
Example: 80 (decimal) = 0x50 (hexadecimal)

The ATS-Series matching network serial commands are not case-sensitive, however for compatibility with other Seren IPS equipment, it is advised that all commands be sent in uppercase (capital) letters. If an invalid command is sent, the ATS-Series matching network will respond with "N<CR>".

References in the Command Details column regarding LED lights and displayed text refer to events on the *optional* Remote Display Panel, if it is connected to the ATS-Series matching network. The ATS-Series matching network does not require the *optional* Remote Display Panel in order to operate.

For detailed operational information regarding a function or a programmable parameter that is modified or controlled by a serial command, refer to the Related Programmable Parameter's description in the Programmable Parameter Details section of this manual.

Serial Command Detail chart:

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
0?	Query the currently selected probe's voltage. Responds with the value of the currently selected probe (DC Voltage, RF Voltage or Current), with the corresponding Probe Attenuation factor applied. Unit of measure is Volts for DC or RF probes, Amps for Current probe. Note: The "0?" command is the same as the "V?" command. Related Serial Commands: PRB0, PRB1, PRB2, V?, PADC, PARF, PAI Related Programmable Parameters: Feedback Source (Probe) Select DC Voltage Probe Attenuation Factor RF Voltage Probe Attenuation Factor Current Probe Attenuation Factor In the example below, assume the Probe Voltage reading is 250V: ASCII / HEX BYTES Command: 0?<CR> / 30 3F 0D Response: 250<CR> / 32 35 30 0D
AAUX	Set the Auxiliary (Aux) capacitor position control mode to "automatic". Applicable to matching networks configured/constructed with an auxiliary variable capacitor. Matching networks constructed without an auxiliary variable capacitor will accept and respond to this command, but the command has no effect on operation. The ATS-Series matching network responds to commands to move the Auxiliary (Aux) capacitor to the PRESET1 or PRESET 2 positions. The Auxiliary (Aux) capacitor position control mode can be set via remote command or the *optional* Remote Display Panel. Related Programmable Parameters: Auxiliary (Aux) Capacitor Mode Related Serial Commands: MAUX, QAMA, GOTO, GOP2 Command example: ASCII / HEX BYTES Command: AAUX<CR> / 41 41 55 58 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

AIN

Disables Analog Interface control.

Analog Interface connector Auto/Manual mode select, preset enable, Load capacitor positioning, and Tune capacitor positioning signals are ignored. If an optional Remote Display panel is connected to the ATS-Series matching network, the Auto/Manual mode select buttons and capacitor positioning buttons are active.

Related Serial Commands: AIY

Related Programmable Parameters: Analog Interface Control Enable/Disable

Command example:

	ASCII	HEX BYTES
Command:	AIN<CR>	41 49 59 0D
Response:	<CR>	0D

AIY

Enables Analog Interface control.

Analog Interface connector Auto/Manual mode select, preset enable, Load capacitor positioning, and Tune capacitor positioning signals are active. If an optional Remote Display panel is connected to the ATS-Series matching network, the Auto/Manual mode select buttons and capacitor positioning buttons are disabled.

Related Serial Commands: AIN

Related Programmable Parameters: Analog Interface Control Enable/Disable

Command example:

	ASCII	HEX BYTES
Command:	AIY<CR>	41 49 4E 0D
Response:	<CR>	0D

ALD

Set the Load capacitor position control mode to "automatic".

The Load "MAN" LED extinguishes, and the Load "AUTO" LED illuminates. The ATS-Series matching network responds to the internal Magnitude error signal and automatically positions the Load capacitor.

The Tune capacitor position control mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: MLD, GOTO, QAML

Related Programmable Parameters: [none]

Command example:

	ASCII	HEX BYTES
Command:	ALD<CR>	41 4C 44 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

ANUL

Measure and save the current Phase and Mag (Magnitude) error signals for use with Alternate Phase/Mag Null feature.

Notes:

1. Useful when using pulsed RF power.
2. Feature available with firmware version 4.5A and later.
3. Feature is not available if the control board in the ATS match network was manufactured before June 2011.
4. Configuration of the Alternate Phase/Mag Null feature is possible via serial command, but may be easier to accomplish using the *optional* MCRS Remote Display Panel.
5. See Alternate Phase/Mag Null feature in the Programmable Parameters section for procedural details.

Related Serial Commands: QNUL, SNUL, UNUL, XNUL

Related Programmable Parameter:
Save Phase/Mag Null Data, Alternate Phase/Mag Null

Command Example:

	ASCII	HEX BYTES
Command:	ANUL<CR>	41 4E 55 4C 0D
Response:	<CR>	0D

ATN

Set the Tune capacitor position control mode to "automatic".

The Tune "MAN" LED extinguishes, and the Tune "AUTO" LED illuminates. The ATS-Series matching network responds to the internal Phase error signal and automatically positions the tune capacitor.

The Tune capacitor position control mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: MTN, GOTO, QAMT

Related Programmable Parameters: [None]

Command Example:

	ASCII	HEX BYTES
Command:	ATN<CR>	41 54 4E 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

AZERO

Nulls or or "zeros-out" small amounts of offset error in the Phase and Magnitude (Mag) error signals that may be displayed/reported when the RF power supply is off or disconnected from the ATS-Series matching network.

Notes:

1. **If you are unsure about using this feature or have technical concerns, Stop/Do Not Continue**. Contact Seren IPS technical support or an authorized Seren IPS Service Depot for assistance.
2. ATS-Series matching networks manufactured on or about June 2011 or later incorporate control boards with circuitry that makes this adjustment procedure unnecessary. This feature is still supported for firmware updates on older units. Units with the new circuitry will not display this feature option on the optional Remote Display Panel, but it is accessible by serial command.
3. **DO NOT** execute this command if RF power is present or "on".
4. Refer to Phase/Mag Error Signal Offset Zero in the Programmable Parameter Details section for in-depth technical information.

Procedure:

1. Disable/turn off the RF Power supply, and any other RF power sources that may be present if the matching network is installed on a processing system. If possible, disconnect the matching network's RF output from the system/load.
2. Read the Phase error sensor value by executing the "PHS" command. Read the Magnitude error sensor value by executing the "MAG" command.
3. If the Phase or Magnitude (or both) error signal values are more than "4" (the value is in milli-Volts), resetting or "zeroing" the offset is advisable.
4. Execute the "AZERO" command.
5. Re-read the Phase and Magnitude error sensor values.
6. Confirm the reported Phase and Magnitude signals are "4" or less.
7. Ensure the offset correction is stored by executing the "FLSH" command.
9. Apply RF power and allow the matching network to tune. Depending on the size of the offset error, the matching network's Phase and Magnitude potentiometers may need to be adjusted to achieve an optimal match point. For detailed instructions, refer to the Phase and Magnitude Sensor Adjustment Procedure in the Problem Solving section of this manual.

Nulling of the Phase and Magnitude offset errors can be initiated by remote command and for units built before June 2011, also via the *optional* Remote Display Panel.

Related Programmable Parameter: Phase/Mag Error Signal Offset Zero

Related Serial Commands: [none]

Command Example:

	ASCII	HEX BYTES
Command:	AZERO<CR>	41 5A 45 52 4F 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

BAK

Enables/Disables the Backout Feature and sets operational mode.

Parameter Mode range: 0 to 2

Parameter Modes:

0 = Backout Feature Off
1 = Preset 2
2 = Reverse Algorithm

The Backout Feature Mode can be set via remote command or the *optional* Remote Display Panel.

Command Syntax: X<sp>BAK<CR>

Related Serial Commands: QBAK, BOD, P2L, P2T

Related Programmable Parameters:

Backout Feature Mode, Backout Delay,
RF On/Off Detect Threshold – RF Probe
RF On/Off Detect Threshold – Phase Error,
RF On/Off Detect Threshold - Magnitude Error
RF On/Off Detect Threshold - Power Sense
Load Capacitor Preset Position 2, Tune Capacitor Preset Position 2

In the example below, the Backout Feature is set to use Reverse Algorithm tuning:

	ASCII	HEX BYTES
Command:	2<sp>BAK<CR>	32 20 42 41 4B 0D
Response:	<CR>	0D

BAUD

Sets the Serial Data rate (RS-232/422/485 and Modbus)

A 1-character code is used to indicate the desired Serial Data rate
Range: 0 to 6, where:

0 = 2400 BAUD
1 = 4800 BAUD
2 = 9600 BAUD
3 = 19200 BAUD
4 = 38400 BAUD
5 = 57600 BAUD
6 = 115200 BAUD

The Serial Data Rate parameter can be set by via remote command or the *optional* Remote Display Panel.

Command Syntax: X<sp>BAUD<CR>

Related Programmable Parameters: Data Rate

Related Serial Commands: [none]

In the example below, the Serial Data Rate is set to 19200 baud:

	ASCII	HEX BYTES
Command:	3<sp>BAUD<CR>	33 20 42 41 55 44 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

BOD

Sets the time, in milliseconds (mS), the ATS-Series matching network allows a capacitor to stay at an extreme position before the Backout function, if enabled, is triggered.

Range: 50 to 5000, 2 to 4 digits, whole numbers (integers) only.

The Backout delay parameter can be set via remote command or the *optional* Remote Display Panel.

Command Syntax: XX<sp>BOD<CR>

Related Serial Commands: BAK

Related Programmable Parameters: BACKOUT Delay, BACKOUT Feature Mode

In the example below, the Backout Delay is set to 1000mS:

	ASCII	HEX BYTES
Command:	1000<sp>BOD<CR>	31 30 30 30 20 42 4F 44 0D
Response:	<CR>	0D

CMNT

Sets the Automatic Capacitor Maintenance Motion Mode

Feature available with Firmware version 3.8A and later.

Range: 0 to 2, 1 digit, whole numbers (integers) only.

0 = Capacitor Maintenance Motion OFF
1 = Motion On, 0% to 100%
2 = Motion On, 0% to 100% to 0%

The Automatic Capacitor Maintenance Motion Mode parameter can be set by via remote command or the *optional* Remote Display Panel.

Command Syntax: X<sp>CMNT<CR>

Related Serial Commands: QMNT, GMNT

Related Programmable Parameters: Automatic Capacitor Maintenance Motion

In the example below, the Automatic Capacitor Maintenance Motion Mode is set to: 0% to 100% to 0%

	ASCII	HEX BYTES
Command:	2<sp> CMNT<CR>	32 20 43 4D 4E 54 0D
Response:	<CR>	0D

CPAP

Reports the current Auxiliary (Aux) capacitor position, in Percent x10.

Related Serial Commands: MVAUX

Related Programmable Parameters:
Auxiliary (Aux) Capacitor Position, Auxiliary (Aux) Capacitor Mode

In the example below, the Auxiliary (Aux) capacitor position is 30.0%

	ASCII	HEX BYTES
Command:	CPAP<CR>	43 50 41 50 0D
Response:	300<CR>	33 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

CPLP

Reports the current Load capacitor position, in Percent x10.

Related Serial Commands: MVLD, LPS, LPS?
Related Programmable Parameters: [None]

In the example below, the Load capacitor position is 43.50%

	ASCII	HEX BYTES
Command:	CPLP<CR>	43 50 4C 50 0D
Response:	435<CR>	34 33 35 0D

CPTP

Reports the current Tune capacitor position, in Percent x10.

Related Serial Commands: MVTN, TPS, TPS?
Related Programmable Parameters: [None]

In the example below, the Tune capacitor position is 75.3%

	ASCII	HEX BYTES
Command:	CPTP<CR>	43 50 54 50 0D
Response:	753<CR>	37 35 33 0D

DBL

Sets the Load Capacitor Deadband parameter value, in milli-volts (mV)
Range: 0 to 1250, 1 to 4 digits, whole numbers (integers) only.

The Load Capacitor Deadband parameter value can be set by via remote command or the *optional* Remote Display Panel.

Command Syntax: X<sp>DBL<CR>

Related Serial Command: QDBL
Related Programmable Parameters: Load Capacitor Deadband

In the example below, the Load Capacitor Deadband is set to 80mV:

	ASCII	HEX BYTES
Command:	80<sp>DBL<CR>	38 30 20 44 42 4C 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
DBT	Sets the Tune Capacitor Deadband parameter value, in milli-volts (mV) Range: 0 to 1250, 1 to 4 digits, whole numbers (integers) only. The Tune Capacitor Deadband parameter value can be set by via remote command or the *optional* Remote Display Panel. Command Syntax: X<sp>DBT<CR> Related Serial Command: QDBT Related Programmable Parameters: Tune Capacitor Deadband In the example below, the Tune Capacitor Deadband is set to 120mV: ASCII / HEX BYTES Command: 120<sp>DBT<CR> / 31 32 30 20 44 42 54 0D Response: <CR> / 0D
DLY	Sets the Auto Load Delay parameter value, in milli-seconds (mS) Range: 0 to 9999, 1 to 4 digits, whole numbers (integers) only. Refer to Auto Lead Delay in the Programmable Parameter Details section for feature functional description. Setting the Auto Load Delay parameter to 0 disables the delay. Factory Default Setting: 0 (Disabled) Command Syntax: X<sp>DLY<CR> Related Programmable Parameters: Auto Load Delay Related Serial Command: QDLY In the example below, the Auto Load Delay is set to 2000 mS: ASCII / HEX BYTES Command: 2000<sp>DLY<CR> / 32 30 30 30 20 44 4C 59 0D Response: <CR> / 0D
DLT	Sets the Auto Tune Delay parameter value, in milli-seconds (mS) Range: 0 to 9999, 1 to 4 digits, whole numbers (integers) only. Refer to Auto Tune Delay in the Programmable Parameter Details section for feature functional description. Setting the Auto Tune Delay parameter to 0 disables the delay. Factory Default Setting: 0 (Disabled) Command Syntax: X<sp>DLT<CR> Related Programmable Parameters: Auto Load Delay Related Serial Command: QDLT In the example below, the Auto Tune Delay is set to 2000 mS ASCII / HEX BYTES Command: 2000<sp>DLT<CR> / 30 30 30 30 20 44 4C 54 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
DNDF	Select the DeviceNet Assembly Set (Data Format). The Assembly Set parameter specifies the data format used for DeviceNet communications. Refer to the DeviceNet Communications section for detailed data format descriptions. Parameter Mode range: 0 to 2 Parameter Modes: 0 = DN Data 10 out 18 in: Default Assembly Set for the ATS-Series matching network. Master sends 10 bytes (assembly ID 64hex). The ATS-Series matching network returns 18 bytes (Assembly ID 65hex) 1 = DN Data 6 out 12 in: Emulates the Seren IPS Inc. MC2 Matching Network Controller with DeviceNet interface. Master sends 6 bytes (Assembly ID 66hex). The ATS-Series matching network returns 12 bytes (Assembly ID 67hex) 2 = DN Data 9 out 14 in: Alternate Assembly Set. Master sends 9 bytes (Assembly ID 68hex). The ATS-Series matching network returns 14 bytes (Assembly ID 69hex) Factory default setting: 0 Command Syntax: X<sp>DNDF<CR> Related Serial Command: QDNDF Related Programmable Parameters: Communications Protocol Select DeviceNet Assembly Set In the example below, the Assembly Set is configured for the default set (mode 0). ASCII / HEX BYTES Command: 0<sp>DNDF<CR> / 30 20 44 4E 44 46 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
DNDR	Select the DeviceNet Data Communications Rate. Parameter Mode range: 0 to 2 Parameter Modes: 0 = 125Kbps 1 = 250Kbps 2 = 500Kbps Operational Note: On larger ATS-Series matching networks (networks large enough to accommodate DeviceNet controls) the DeviceNet data rate is set via the data rate switch. The DeviceNet interface reads the data rate switch, and sets the data rate. Data rate settings made by the optional Remote Display panel or by serial command are ignored. If using the optional Remote Display Panel, it is good practice to set the data rate to match the data rate switch. On ATS-Series matching networks too small to permit DeviceNet controls, the DeviceNet data rate is configured by the *optional* Remote Display Panel or serial command. Command Syntax: X<sp>DNDR<CR> Factory default setting: 2 (500Kbps) Related Serial Command: QDNDR Related Programmable Parameters: Communications Protocol Select Data Rate In the example below, the DeviceNet data rate is set to 500Kbps ASCII — HEX BYTES Command: 2<sp>DNDR<CR> — 32 20 44 4E 44 52 0D Response: <CR> — 0D
ECHO	Enable character echo, RS-232 and RS-485 protocols. Enables the echoing of command characters back to the sending source. Character echo is often enabled when communicating with the ATS-Series matching network via a data terminal or a personal computer running terminal emulation software. Echo is mainly used for RS-232 protocol. If RS-485 protocol is selected, ECHO should only be enabled if the Address ID Number is set to "99". ECHO is not applicable to Modbus, PROFIBUS, or DeviceNet communications protocols. Character ECHO mode can be set via remote command or the *optional* Remote Display Panel. Related Serial Commands: NOECHO Related Programmable parameters: Communications ECHO Command example: ASCII — HEX BYTES Command: ECHO<CR> — 45 43 48 4F 0D Response: <CR> — 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

EXT

Set preset source to "Analog".

Enables preset mode ***and*** instructs the ATS-Series matching network to use the Load, Tune, and Auxiliary (Aux) preset signals present at the "Analog Interface" connector.

The preset mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: INT, OFF, TRGX, TRGR, AIY, AIN

Related Programmable Parameters:
Preset Source, Preset Trigger Mode Enable/Disable,
Analog Interface Control Enable/Disable

Command example:

	ASCII	HEX BYTES
Command:	EXT<CR>	45 58 54 0D
Response:	<CR>	0D

FBIGNORE

If connected to a Fieldbus (DeviceNet, PROFIBUS), causes the matching network to ignore commands sent by the Fieldbus master, however the matching network will continue to report status in the data sent to the Fieldbus master. The matching network will ignore continue to ignore Fieldbus commands until the FBNORM command is received or the unit is powered-off and then powered back on.

Operational Note: After a power-down/power-up cycle, the matching network is automatically set to obey Fieldbus commands.

Related Serial Command: FBNORM

Command example:

	ASCII	HEX BYTES
Command:	FBIGNORE<CR>	46 42 49 47 4E 4F 52 45 0D
Response:	<CR>	0D

FBNORM

If connected to a Fieldbus (DeviceNet, PROFIBUS), causes the matching network to obey commands sent by the Fieldbus master. (Cancels the effect of the FBIGNORE command).

Operational Note: After a power-down/power-up cycle, the matching network is automatically set to obey Fieldbus commands.

Related Serial Command: FBIGNORE

Command example:

	ASCII	HEX BYTES
Command:	FBNORM<CR>	46 42 4E 4F 52 4D 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
FLSH	Saves current settings to Flash memory Forces saving of configuration parameters stored in battery-backed memory to Flash memory. Operational Note: It is neither advisable nor required to save the configuration to Flash memory every time a parameter setting is adjusted. Excessive use of this feature mau cause premature wear-out of the Flash memory. See the Programmable Parameter Details section for additional information. Related Programmable Parameter: Save Configuration To Flash Memory Command example: ASCII / HEX BYTES Command: FLSH<CR> / 46 4C 53 48 0D Response: <CR> / 0D
GMNT	Initiate a Capacitor Maintenance Motion cycle. Operational Note: Ensure RF is "OFF" before executing command. Refer to the Automatic Capacitor Maintenance Motion feature description in the Programmable Parameter Details section for operation information. Feature available with firmware version 3.8A and later. Related Serial Commands: CMNT, QMNT Related Programmable Parameters: Automatic Capacitor Maintenance Motion Command Example: ASCII / HEX BYTES Command: GMNT<CR> / 47 4D 4E 54 0D Response: <CR> / 0D
GOP2	Go To the PRESET 2 position. Moves all (Load, Tune, and Auxiliary (Aux)) capacitors to their respective PRESET 2 positions. Related Serial Commands: P2A, P2L, P2T Related Programmable Parameters: Load Capacitor Preset Position 2 , Tune Capacitor Preset Position 2 Auxiliary (Aux) Capacitor Preset Position 2 Command Example: ASCII / HEX BYTES Command: GOP2<CR> / 47 4F 50 32 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
GOTO	Go To the PRESET 1 position. Moves all (Load, Tune, and Auxiliary (Aux)) capacitors to their respective PRESET 1 positions, internal or external, as specified by the Preset Source parameter or by the INT/EXT remote commands. Related Serial Commands: AAUX, ATN, ALD, INT, EXT, OFF, MPA, MPAS, MPL, MPLS, MPT, MPTS Related Programmable Parameters: Load Capacitor Preset Position 1 Tune Capacitor Preset Position 1 Auxiliary (Aux) Capacitor Preset Position 1 Preset Source Command Example: ASCII / HEX BYTES Command: GOTO<CR> / 47 4F 54 4F 0D Response: <CR> / 0D
INT	Set preset mode to "internal". Enables preset mode ***and*** instructs the ATS-Series matching network to use the current Load and Tune Preset 1 values. The preset mode can be set by via remote command or the *optional* Remote Display Panel. Related Serial Commands: EXT, OFF, TRGX, TRGR, AIY, AIN, MPA, MPAS, MPL, MPLS, MPT, MPTS Related Programmable Parameters: Preset Source, Preset Trigger Mode Enable/Disable, Load Capacitor Preset Position 1, Tune Capacitor Preset Position 1 Auxiliary (Aux) Capacitor Preset 1 Command example: ASCII / HEX BYTES Command: INT<CR> / 46 4E 54 0D Response: <CR> / 0D
LLH	Sets the Load Capacitor Position High Limit parameter value, in percent. High Limit range: 2.0 to 100, 1 to 3 digits, whole numbers (integers) only. Operational Note: The Load Capacitor Position High Limit must be greater than the Load Capacitor Position Low Limit. Command Syntax: X<sp>LLH<CR> Related Programmable Parameter: Load Capacitor Position High Limit Related Serial Command: QLLH In the example below, the Load Capacitor High Limit is set to 80% ASCII / HEX BYTES Command: 80<sp>LLH<CR> / 38 30 20 4C 4C 48 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
LLL	Sets the Load Capacitor Position Low Limit parameter value, in percent. High Limit range: 0 to 98, 1 to 2 digits, whole numbers (integers) only. Operational Note: The Load Capacitor Position Low Limit must be less than the Load Capacitor Position High Limit. Command Syntax: X<sp>LL<CR> Related Programmable Parameter: Load Capacitor Position Low Limit Related Serial Command: QLLL In the example below, the Load Capacitor High Limit is set to 20% ASCII / HEX BYTES Command: 20<sp>LLL<CR> / 32 30 20 4C 4C 4C 0D Response: <CR> / 0D
LPS? or LPS	Query the current Load capacitor position. Reports the current Load capacitor position, in percent, range 0% to 100% In the example below, the Load capacitor position is 43% ASCII / HEX BYTES Command: LPS?<CR> / 4C 50 53 3F 0D Response: 43<CR> / 34 33 0D
LSLO	Set the Load Capacitor Motion Slowdown Delay parameter value, in milliseconds (mS). Range: 0 to 100, 1 to 3 digits, whole numbers (integers) only. Note: Feature available with firmware versions 3.5A and later. See Load Capacitor Motion Slowdown Delay in the Programmable Parameter Details section for function description. Command Syntax: X<sp>LSLO<CR> Related Programmable Parameter: Load Capacitor Motion Slowdown Delay Related Serial Command: QLSLO In the example below, the Load Capacitor Slowdown Delay parameter is set to 3mS ASCII / HEX BYTES Command: 3<sp>LSLO<CR> / 33 20 4C 53 4C 4F 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
LSPD	Sets the Load Capacitor High-Speed Threshold parameter value, in milli-Volts (mV) Range: 0 to 1250, 1 to 4 digits, whle numbers (integers) only. Note: Feature available with firmware versions 3.5A and later. See Load Capacitor High-Speed Threshold in the Programmable Parameter Details section for function description. Command Syntax: X<sp>LSPD<CR> Related Programmable Parameter: Load Capacitor High-Speed Threshold Related Serial Command: QLSPD In the example below, the Load Capacitor High-Speed Threshold parameter value is set to 200mV ASCII — HEX BYTES Command: 200<sp>LSPD<CR> — 32 30 30 20 4C 53 50 44 0D Response: <CR> — 0D
MAG	Query the current Magnitude error signal voltage. Reports the current Magnitude error signal voltage, in milli-Volts (mV). Negative polarity is prefixed with a "-" sign (0x2D), positive polarity is unsigned. In the example below, assume the Magnitude error signal is 137 mV ASCII — HEX BYTES Command: MAG<CR> — 4D 41 47 0D Response: 137<CR> — 31 33 37 0D
MAUX	Set the Auxiliary (Aux) capacitor position control mode to "manual". Applicable to matching networks configured/constructed with an auxiliary variable capacitor. Matching networks constructed without an auxiliary variable capacitor will accept and respond to this command, but the command has no effect on operation.. The Auxiliary (Aux) Capacitor is moved to the Auxiliary (Aux) Capacitor Position parameter value and remains at the specified position until the Auxiliary (Aux) Capacitor Position value is changed. The Auxiliary (Aux) Capacitor *does not* respond to commands to move to the PRESET 1 position. The Auxiliary (Aux) Capacitor responds to commands to move to the PRESET 2 position. The Auxiliary (Aux) capacitor position control mode can be set via remote command or the *optional* Remote Display Panel. Related Programmable Parameters: Auxiliary (Aux) Capacitor Mode Related Serial Commands: MAUX, QAMA, GOTO, GOP2 Command Example: ASCII — HEX BYTES Command: MAUX<CR> — 4D 41 55 58 0D Response: <CR> — 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MBTP

Set the Modbus Communications Implementation Type.

Note: Feature available with firmware version 4.6A and later. See the Modbus Communications section for detailed description.

Command syntax: X<sp>MBPT<CR>

Where: "X" is the desired Modbus Implementation Type code:
0 = ATS-Specific Implementation (Single ID)
1 = MC2-Emulation Implementation (Multiple ID)

The Modbus Communications Implementation type can be set via remote command or the *optional* Remote Display Panel.

Related Programmable Parameters: Modbus Type, Communications Protocol Select
Related Serial Commands: QMBT

Command Example: Set Modbus Implementation Type to Single ID

	ASCII	HEX BYTES
Command:	0<sp>MBTP<CR>	30 20 4D 42 54 50 0D
Response:	<CR>	0D

MLD

Set the Load capacitor position control mode to "manual".

The Load "AUTO" LED extinguishes, and the Load "MAN" LED illuminates. The ATS-Series matching network ignores the internal Magnitude error signal and ***does not*** automatically position the Load capacitor.

The Load capacitor position control mode can be set via remote command or the *optional* Remote Display Panel (using Load Auto/Manual button)

Related Serial Commands: ALD, GOTO

Command example:

	ASCII	HEX BYTES
Command:	MLD<CR>	4D 4C 44 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MPA

Modify the internal Auxiliary (Aux) Capacitor Preset Position 1 parameter value.

The Auxiliary (Aux) Capacitor Preset Position 1 value is modified by the MPA command, but the modified Preset Position 1 value ***is not*** saved to non-volatile memory.

The internal Auxiliary (Aux) Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPL<CR>

Where: "X" is the desired Auxiliary (Aux) Capacitor Preset Position 1 value, in percent. 1 to 5 digits, Range: 0.0 to 100.0

Related Serial Commands: QP1A, MPAS, GOTO

Related Programmable Parameters: Auxiliary (Aux) Capacitor Preset Position 1, Preset Source

In the example below, the Load Capacitor Preset Position 1 value is set to 34%

	ASCII	HEX BYTES
Command:	34<sp>MPA<CR>	33 34 20 4D 50 41 0D
Response:	<CR>	0D

MPAS

Modify the internal Auxiliary (Aux) Capacitor Preset Position 1 parameter value and save to non-volatile memory.

The Auxiliary (Aux) Capacitor Preset Position 1 value is modified by the MPAS command ***and*** saved to non-volatile memory.

The internal Auxiliary (Aux) Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPL<CR>

Where: "X" is the desired Auxiliary (Aux) Capacitor Preset Position 1 value, in percent. 1 to 5 digits, Range: 0.0 to 100.0

Related Serial Commands: QP1A, MPA, GOTO

Related Programmable Parameters: Auxiliary (Aux) Capacitor Preset Position 1, Preset Source

In the example below, the Load Capacitor Preset Position 1 value is set to 34.2% and saved to non-volatile memory

	ASCII	HEX BYTES
Command:	34.2<sp>MPAS<CR>	33 34 2E 32 20 4D 50 41 53 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MPL

Modify the internal Load Capacitor Preset Position 1 parameter value.

The Load Capacitor Preset Position 1 value is modified by the MPL command, but the modified value *is not* saved to non-volatile memory.

The internal Load Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPL<CR>

Where: "X" is the desired Load Capacitor Preset Position 1 value, in percent.
1 to 5 digits, Range: 0.0 to 100

Related Serial Commands: QPL, QP1L, MPLS, GOTO

Related Programmable Parameters: Load Capacitor Preset Position 1, Preset Source

In the example below, the Load Capacitor Preset Position 1 value is set to 56%

	ASCII	HEX BYTES
Command:	56<sp>MPL<CR>	35 36 20 4D 50 4C 0D
Response:	<CR>	0D

MPLS

Modify the internal Load Capacitor Preset Position 1 parameter value *and* save to non-volatile memory.

The internal Load Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPLS<CR>

Where: "X" is the desired Load Capacitor Preset Position 1 value, in percent.
1 to 5 digits, range: 0.0 to 100

Related Serial Commands: QPL, QP1L, MPL, GOTO

Related Programmable Parameters: Load Capacitor Preset Position 1, Preset Source

In the example below, the Load Capacitor Preset Position 1 value is set to 56.4%

	ASCII	HEX BYTES
Command:	56.4<sp>MPL<CR>	35 36 2E 34 20 4D 50 4C 53 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MPT

Modify the internal Tune Capacitor Preset Position 1 parameter value.

The Tune Capacitor Preset Position 1 value is modified by the MPT command, but the modified value *is not* saved to non-volatile memory.

The internal Tune Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPT<CR>

Where: "X" is the desired Tune capacitor preset position, in percent.
1 to 5 digits, range: 0.0 to 100.0

Related Serial Commands: QPT, QP1T, MPTS, GOTO

Related Programmable Parameter: Tune Capacitor Preset Position 1, Preset Source

In the example below, the Tune capacitor preset position is set to 22%

	ASCII	HEX BYTES
Command:	22<sp>MPT<CR>	32 32 20 4D 50 54 0D
Response:	<CR>	0D

MPTS

Modify the internal Tune Capacitor Preset Position 1 parameter value *and* save to non-volatile memory.

The internal Tune Capacitor Preset Position 1 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MPTS<CR>

Where: "X" is the desired Tune capacitor preset position, in percent.
1 to 5 digits, range: 0.0 to 100.0

Related Serial Commands: MPTS, GOTO

Related Programmable Parameter: Tune Capacitor Preset Position 1, Preset Source

In the example below, the Tune capacitor preset position is set to 22.7%

	ASCII	HEX BYTES
Command:	22.7<sp>MPTS<CR>	32 32 2E 37 20 4D 50 54 53 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MTN

Set the Tune capacitor position control mode to "manual".

The Tune "AUTO" LED extinguishes, and the Tune "MAN" LED illuminates. The ATS-Series matching network ignores the internal Phase error signal and *does not* automatically position the tune capacitor.

The Tune capacitor position control mode can be set via remote command or the *optional* Remote Display Panel (using Tune Auto/Manual button).

Related Serial Commands: ATN, GOTO

Command example:

	ASCII	HEX BYTES
Command:	MTN<CR>	4D 54 4E 0D
Response:	<CR>	0D

MVAUX

Move the Auxiliary (Aux) Capacitor to a specified position.

The Auxiliary (Aux) Capacitor position value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>MVAUX<CR>

Where: "X" is the desired Auxiliary (Aux) capacitor position, in Percent x10.
1 to 4 digits whole numbers (integers) only,
Range: 0 to 1000

Related Serial Commands: CPAP, QACI

Related Programmable Parameter: Auxiliary (Aux) Capacitor Position

In the example below, the Auxiliary (Aux) capacitor position is moved to 65.3%

	ASCII	HEX BYTES
Command:	653<sp>MVAUX<CR>	36 35 33 20 4D 56 41 55 58 0D
Response:	<CR>	0D

MVLD

Move the Load Capacitor to a specified position.

The Load Capacitor position can be set via remote command or the *optional* Remote Display Panel (using Load Min/Max buttons).

Command syntax: X<sp>MVLD<CR>

Where: "X" is the desired Load capacitor position, in Percent x10.
1 to 4 digits, whole numbers (integers) only,
Range: 0 to 1000

Related Serial Commands: CPLP, LPS, LPS?

In the example below, the Load capacitor is moved to 50.0%

	ASCII	HEX BYTES
Command:	500<sp>MVLD<CR>	35 30 30 20 4D 56 4C 44 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

MVTN

Move the Tune Capacitor to a specified position.

The Tune Capacitor position can be set via remote command or the *optional* Remote Display Panel (using Tune Min/Max buttons).

Command syntax: X<sp>MVLD<CR>

Where: "X" is the desired Tune capacitor position, in Percent x10.
1 to 4 digits, whole numbers (integers) only,
Range: 0 to 1000

Related Serial Commands: CPTP, TPS, TPS?

In the example below, the Tune capacitor is moved to 44.8%

	ASCII	HEX BYTES
Command:	448<sp>MVTN<CR>	34 34 38 20 4D 56 54 4E 0D
Response:	<CR>	0D

NOECHO

Disable character echo.

Disables the echoing of command characters back to the sending source. When communicating with the ATS-Series matching network via a system controller computer or a PLC, character echo is usually not required and is set to "disabled".

Character ECHO mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Command: ECHO

Related Programmable Parameters: Communications Echo

Command example:

	ASCII	HEX BYTES
Command:	NOECHO<CR>	4E 4F 45 43 48 4F 0D
Response:	<CR>	0D

OFF

Set Preset mode to "off".

Disables preset mode. When preset mode is set to off, the ATS-Series matching network will not respond to any preset trigger event.

The preset mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: QPMD, INT, EXT, TRGR, TRGX,

Related Programmable Parameters:
Preset Source, Preset Trigger Mode Enable/Disable

Command example:

	ASCII	HEX BYTES
Command:	OFF<CR>	4F 46 46 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

P2A

Modify the internal Auxiliary (Aux) Capacitor Preset Position 2 value ***and*** save to non-volatile memory.

The internal Auxiliary(Aux) Capacitor Preset Position 2 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>P2A<CR>

Where: "X" is the desired Auxiliary (Aux) capacitor preset position, in percent.
1 to 5 characters, Range: 0 to 100.0

Related Serial Commands: QP2A

Related Programmable Parameters: Auxiliary (Aux) Capacitor Preset Position 2

In the example below, the Auxiliary (Aux) Capacitor Preset Position 2 value is set to 34%

	ASCII	HEX BYTES
Command:	34<sp>P2A<CR>	33 34 20 50 32 41 0D
Response:	<CR>	0D

In the example below, the Auxiliary (Aux) Capacitor Preset Position 2 value is set to 34.2%

	ASCII	HEX BYTES
Command:	34.2<sp>P2A<CR>	33 34 2E 32 20 50 32 41 0D
Response:	<CR>	0D

P2L

Modify the internal Load Capacitor Preset Position 2 value ***and*** save to non-volatile memory.

The internal Load Capacitor Preset Position 2 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>P2L<CR>

Where: "X" is the desired Load capacitor preset position, in percent.
1 to 5 characters, Range: 0 to 100.0

Related Serial Commands: QP2L

Related Programmable Parameters: Load Capacitor Preset Position 2

In the example below, the Load Capacitor Preset Position 2 value is set to 56%

	ASCII	HEX BYTES
Command:	56<sp>P2L<CR>	35 36 20 50 32 4C 0D
Response:	<CR>	0D

In the example below, the Load Capacitor Preset Position 2 value is set to 56.2%

	ASCII	HEX BYTES
Command:	56.2<sp>P2L<CR>	35 36 2E 32 20 50 32 4C 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

P2T

Modify the internal Tune Capacitor Preset Position 2 value ***and*** save to non-volatile memory.

The internal Tune Capacitor Preset Position 2 value can be set via remote command or the *optional* Remote Display Panel.

Command syntax: X<sp>P2T<CR>

Where: "X" is the desired Tune capacitor preset position, in percent.
1 to 5 characters, range: 0 to 100.0

Related Serial Commands: QP2T

Related Programmable Parameter: Tune Capacitor Preset Position 2

In the example below, the Tune Capacitor Preset Position 2 is set to 22%

	ASCII	HEX BYTES
Command:	22<sp>P2T<CR>	32 32 20 50 32 54 0D
Response:	<CR>	0D

In the example below, the Tune Capacitor Preset Position 2 is set to 22.1%

	ASCII	HEX BYTES
Command:	22.1<sp>P2T<CR>	32 32 2E 31 20 50 32 54 0D
Response:	<CR>	0D

PADC

Set the DC Voltage Probe's Attenuation Factor, in the form of XXXX:1; where "XXXX" is a whole number (integer), 1 to 4 digits.

Attenuation factor range is 1:1 to 4095:1

The DC Voltage Probe Attenuation Factor can be set via remote command or *optional* Remote Display Panel.

Command syntax: X<sp>PADC<CR>

Where: "X" is the desired DC Voltage Probe attenuation factor.
1 to 4 characters, range 1 to 4095.

Related Serial Commands: QPAD, 0?, V?, PRB0

Related Programmable Parameters:
RF Voltage Probe Attenuation Factor
Feedback Source (Probe) Select

In the example below, the DC Voltage Probe attenuation factor is set to 1000:1

	ASCII	HEX BYTES
Command:	1000<sp>PADC<CR>	31 30 30 30 20 50 41 44 43 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
PAI	Set the Current Probe's attenuation factor, in the form of XXXX:1; where "XXXX" is a whole number (integer), 1 to 4 digits. Attenuation factor range is 1:1 to 1000:1 The Current Probe Attenuation Factor can be set via remote command or *optional* Remote Display Panel. Command syntax: X<sp>PAI<CR> Where: "X" is the desired Current Probe attenuation factor. 1 to 4 characters, range 1 to 1000. Related Serial Commands: QPAI, QIP, 0?, V?, PRB2 Related Programmable Parameters: Current Probe Attenuation Factor Feedback Source (Probe) Select In the example below, the Current Probe attenuation factor is set to 100:1 ASCII / HEX BYTES Command: 100<sp>PAI<CR> / 31 30 30 20 50 41 49 0D Response: <CR> / 0D
PARF	Set the RF Voltage Probe attenuation factor (standard RF Voltage Probe and optional Auxiliary RF Voltage Probe), in the form of XXXX:1; where "XXXX" is a whole number (integer), 1 to 4 digits. Attenuation factor range is 1:1 to 4095:1 Command syntax: X<sp>PARFI<CR> Where: "X" is the desired RF Voltage Probe attenuation factor. 1 to 4 characters, range 1 to 4095. The RF Voltage Probe Attenuation Factor can be set via remote command or *optional* Remote Display Panel. Related Serial Commands: QPAR, 0?, V?, PRB1, QXP Related Programmable Parameters: RF Voltage Probe Attenuation Factor Feedback Source (Probe) Select In the example below, the RF Voltage Probe attenuation factor is set to 200:1 ASCII / HEX BYTES Command: 200<sp>PARF<CR> / 32 30 30 20 50 41 52 46 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
PHS	Query the current Phase error signal voltage. Reports the current Phase error signal voltage, in milli-Volts (mV). Negative polarity is prefixed with a "-" sign (0x2D), positive polarity is unsigned. In the example below, the Phase error signal is -44 mV ASCII / HEX BYTES Command: PHS<CR> / 50 48 53 0D Response: -44<CR> / 2D 34 34 0D
PRB0	Select the DC Probe. Selects and routes the DC PROBE signal to the SELECTED PROBE output pin of the ATS-Series matching network's PROBE and ANALOG INTERFACE connectors. The DC Probe can be selected/routed via remote command or the *optional* Remote Display Panel. Related Serial Commands: QPRB, 0?, PRB1, PRB2, V?, PADC, QDP Related Programmable Parameters: Feedback Source (Probe) Select, DC Probe Attenuation Factor Command example: ASCII / HEX BYTES Command: PRB0<CR> / 50 52 42 30 0D Response: <CR> / 0D
PRB1	Select the RF Probe. Selects and routes the RF PROBE signal to the SELECTED PROBE output pin of the ATS-Series matching network's PROBE and ANALOG INTERFACE connectors. The RF Probe can be selected/routed via remote command or the *optional* Remote Display Panel. Related Serial Commands: QPRB, 0?, PRB0, PRB2, V?, PARF, QPAR Related Programmable Parameters: Feedback Source (Probe) Select, RF Probe Attenuation Factor Command example: ASCII / HEX BYTES Command: PRB1<CR> / 50 52 42 31 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

PRB2

Select the Current Probe.

Selects and routes the CURRENT PROBE signal to the SELECTED PROBE output pin of the ATS-Series matching network's PROBE and ANALOG INTERFACE connectors.

The RF Probe can be selected/routed via remote command or the *optional* Remote Display Panel.

Related Serial Commands: QPRB, 0?, PRB0, PRB1, V?, PA, QPAI, QIP

Related Programmable Parameters:
Feedback Source (Probe) Select, RF Probe Attenuation Factor

Command example:

	ASCII	HEX BYTES
Command:	PRB2<CR>	50 52 42 32 0D
Response:	<CR>	0D

QACI

Query the installation status of the Auxiliary (Aux) Capacitor.

Responds with "0" for Auxiliary (Aux) Capacitor ***not*** installed
Responds with "1" for Auxiliary (Aux) Capacitor installed

Related Serial Commands: QTYPA

Related Programmable Parameters:
Auxiliary (Aux) Capacitor Position, Auxiliary (Aux) Capacitor Mode

In the following example, the matching network is equipped/configured with an Auxiliary (Aux) capacitor.

	ASCII	HEX BYTES
Command:	QACI<CR>	51 41 43 49 0D
Response:	1<CR>	31 0D

QAI

Query the current Analog Interface Control status.

Responds with "0" for Analog Interface Control disabled (off).
Responds with "1" for Analog Interface Control enabled (on).

Related Serial Commands: AIY, AIN

Related Programmable Parameters: Analog Interface Control Enable/Disable

In the following example, Analog Interface Control is disabled:

	ASCII	HEX BYTES
Command:	QAI<CR>	51 41 49 0D
Response:	0<CR>	30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QAMA	Query the control status of the Auxiliary (Aux) capacitor. Responds with "A" for automatic. Responds with "M" for manual. Related Serial Commands: MAUX, AAUX Related Programmable Parameters: Auxiliary (Aux) Capacitor Mode In the following example, the Auxiliary (Aux) capacitor mode is "manual". ASCII / HEX BYTES Command: QAMA<CR> / 51 41 4D 41 0D Response: M<CR> / 4D 0D
QAML	Query the control status of the Load capacitor. Responds with "A" for automatic. Responds with "M" for manual. Related Serial Commands: MLD, ALD In the following example, the Load capacitor mode is "automatic". ASCII / HEX BYTES Command: QAML<CR> / 51 41 4D 4C 0D Response: A<CR> / 41 0D
QAMT	Query the control status of the Tune capacitor. Responds with "A" for automatic. Responds with "M" for manual. Related Serial Commands: MLD, ALD In the following example, the Tune capacitor mode is "manual". ASCII / HEX BYTES Command: QAMT<CR> / 51 41 4D 54 0D Response: M<CR> / 4D 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QAP

Query Auxiliary Current Probe Current

Reports the Auxiliary Current Probe current with attenuation factor applied, in Amps (A)

Notes:

1. Auxiliary Current probe is optional. If installed, the Auxiliary Current Probe replaces the DC probe. The Auxiliary Current probe uses the DC Probe Attenuation Factor parameter value.
2. Feature available with firmware version 4.1C and later.

Related Serial Commands: PADC, QPAD

Related Programmable Parameters: DC Voltage Probe Attenuation Factor

In the following example, the Auxiliary Current probe current is 5.22A

	ASCII	HEX BYTES
Command:	QAP<CR>	51 41 50 0D
Response:	5.22<CR>	35 2E 32 32 0D

QBAK

Query the BACKOUT feature mode.

Responds with "0" for Disabled (off)
Responds with "1" for PRESET2
Responds with "2" for REVERSE ALGORITHM

Related Serial Commands: BAK

Related Programmable Parameters: Backout Feature Mode

In the following example, the BACKOUT feature mode is "REVERSE ALGORITHM"

	ASCII	HEX BYTES
Command:	QBAK<CR>	51 42 41 4B 0D
Response:	2<CR>	32 0D

QBD

Query the BACKOUT feature delay time.

Reports the BACKOUT Delay parameter value, in milliseconds (mS). 2 to 4 characters.

Related Serial Commands: BOD, BAK

Related Programmable Parameters: BACKOUT Delay, BACKOUT Feature Mode

In the following command example, the Backout delay time is 1000milli-seconds (mS) (1 Second):

	ASCII	HEX BYTES
Command:	QBD<CR>	51 42 44 0D
Response:	1000<CR>	31 30 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QDBL	Query the Load Capacitor Deadband Reports the Load Capacitor Deadband parameter value, in milli-Volts (mV) Related Serial Commands: DBL Related Programmable Parameters: Load Capacitor Deadband In the following example, the Load Capacitor Deadband parameter value is 80mV ASCII / HEX BYTES Command: QDBL<CR> / 51 44 42 4C 0D Response: 80<CR> / 38 30 0D
QDBT	Query the Tune Capacitor Deadband Reports the Tune Capacitor Deadband parameter value, in milli-Volts (mV) Related Serial Commands: DBT Related Programmable Parameters: Tune Capacitor Deadband In the following example, the Tune Capacitor Deadband parameter value is 120mV ASCII / HEX BYTES Command: QDBL<CR> / 51 44 42 54 0D Response: 120<CR> / 31 32 30 0D
QDLY	Query the Auto Load Delay parameter value Reports the Auto Load Delay parameter value, in milliseconds (mS) Related Serial Commands: DLY Related Programmable Parameters: Auto Load Delay In the following example, the Auto Load Delay parameter value is 2000mS: ASCII / HEX BYTES Command: QDLY<CR> / 51 44 4C 59 0D Response: 2000<CR> / 32 30 30 30 0D
QDLT	Query the Auto Tune Delay parameter value Reports the Auto Tune Delay parameter value, in milliseconds (mS) Related Serial Commands: DLT Related Programmable Parameters: Auto Tune Delay In the following example, the Auto Tune Delay parameter value is 2000mS: ASCII / HEX BYTES Command: QDLT<CR> / 51 44 4C 54 0D Response: 2000<CR> / 32 30 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QDNDF	Query the current DeviceNet Assembly Set (data format) type. Responds with "0" for 10-out/18-in Responds with "1" for 6-out/12-in Responds with "2" for 9-out/14-in Related Serial Commands: DNDF Related Programmable Parameters: DeviceNet Assembly Set In the following example, the DeviceNet Data Format is 10-out/18-in ASCII / HEX BYTES Command: QDNDF<CR> / 51 44 4E 44 46 0D Response: 0<CR> / 30 0D
QDNDR	Query the current DeviceNet Data Rate Responds with "0" for 125kbps Responds with "1" for 250kbps Responds with "2" for 500kbps Related Serial Commands: DNDR Related Programmable Parameters: Data Rate In the following example, the current DeviceNet Data rate is 500kbps ASCII / HEX BYTES Command: QDNDR<CR> / 51 44 4E 44 52 0D Response: 2<CR> / 32 0D
QDP	Query the DC Probe Voltage Reports the DC Probe Voltage, in Volts, with the DC Probe attenuation factor applied. Related Serial Commands: PADC, QPAD Related Programmable Parameters: DC Voltage Probe Attenuation Factor In the following example, the DC Probe Voltage is 200V. ASCII / HEX BYTES Command: QDP<CR> / 51 44 50 0D Response: 200<CR> / 32 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QIP	Query the Current Probe current. Reports the Current Probe current, in Amps, with the current probe attenuation factor applied. Related Serial Commands: PAI, QPAI Related Programmable Parameters: Current Probe Attenuation Factor In the following example, the Current Probe current is 3.21A ASCII / HEX BYTES Command: QIP<CR> / 51 49 50 0D Response: 3.21<CR> / 33 2E 32 31 0D
QLLH	Query the Load Capacitor Position High Limit parameter value. Reports the current Load Capacitor Position High Limit parameter value, in percent (decimals not supported - rounded to the nearest integer). Related Serial Commands: LLH Related Programmable Parameters: Load Capacitor Position High Limit In the following example, the Load Capacitor High Limit parameter is set to 95.6% ASCII / HEX BYTES Command: QLLH<CR> / 51 4C 4C 48 0D Response: 95<CR> / 39 35 0D
QLLL	Query the Load Capacitor Position Low Limit parameter value. Reports the current Load Capacitor Position Low Limit parameter value, in percent (decimals not supported - rounded to the nearest integer). Related Serial Commands: LLL Related Programmable Parameters: Load Capacitor Position Low Limit In the following example, the Load Capacitor Low Limit parameter is set to 20.3% ASCII / HEX BYTES Command: QLLL<CR> / 51 4C 4C 4C 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QLSLO	Query the current Load Capacitor Motion Slowdown Delay parameter value. Reports the Load Capacitor Motion Slowdown Delay parameter value in milliseconds (mS) Related Serial Commands: LSLO Related Programmable Parameters: Load Capacitor Motion Slowdown Delay In the following example, the Load Capacitor Motion Slowdown Delay parameter value is 3mS: ASCII / HEX BYTES Command: QLSLO<CR> / 51 4C 53 4C 4F 0D Response: 3<CR> / 33 0D
QLSPD	Query the current Load Capacitor High-Speed Threshold parameter value. Reports the Load Capacitor High-Speed Threshold parameter value, in milli-Volts (mV) Note: Feature and command applicable to firmware version 3.5A and later. Related Serial Commands: LSPD Related Programmable Parameters: Load Capacitor High-Speed Threshold In the following example, the Load Capacitor High-Speed Threshold is 200mV: ASCII / HEX BYTES Command: QLSPD<CR> / 51 4C 53 50 44 0D Response: 200<CR> / 32 30 30 0D
QMBT	Query the Modbus Communications Implementation Type. Note: Feature available with firmware version 4.6A and later. See the Modbus Communications section for detailed description. Command syntax: QMBT<CR> Response: X<CR> Where: "X" is the Modbus Implementation Type code: 0 = ATS-Specific Implementation (Single ID) 1 = MC2-Emulation Implementation (Multiple ID) Related Programmable Parameters: Modbus Type, Communications Protocol Select Related Serial Commands: MBTP In the following example, the Modbus Implementation Type is "Multiple ID" ASCII / HEX BYTES Command: QMBT<CR> / 51 4D 42 54 0D Response: 1<CR> / 31 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QMNT

Query the current Automatic Capacitor Maintenance Motion mode.

Responds with "0" for disabled (off).
Responds with "1" for 0%-to-100%
Responds with "2" for 0%-to-100%-to-0%

Note: Feature available with firmware version 3.8A and later.

Related Serial Commands: CMNT GMNT

Related Programmable Parameters: Automatic Capacitor Maintenance Motion

In the following example, the Automatic Capacitor Maintenance Motion mode is disabled (off):

	ASCII	HEX BYTES
Command:	QMNT<CR>	51 4D 4E 54 0D
Response:	0<CR>	30 0D

QNUL

Query the stored Alternate Phase/Mag values. Used with the Alternate Phase/Mag Null feature for pulsed RF power applications.

Notes:

1. Feature available with firmware version 4.5A and later.
2. Feature is not available if the control board in the ATS match network was manufactured before June 2011.

Command syntax: QNUL<CR>

Command response: XXXX<sp>YYYY<sp><CR>

Where:

XXXX is a signed integer in 16-bit Hexadecimal format, representing the stored Alternate Phase Null value in milli-Volts (mV). Leading zeros are not suppressed.

YYYY is a signed integer in 16-bit hexadecimal format, representing the stored Alternate Magnitude Null value in milli-Volts (mV). Leading zeros are not suppressed.

<sp> (The space character - 0x20) is the value terminator/delimiter.

Related Programmable Parameters:
Alternate Phase/Mag Null, Save Phase/Mag Null Data

Related Serial Commands: ANUL, SNUL

In the following command example, the stored alternate null values are:
+16 mV Phase, -16 mV Mag:

	ASCII	HEX BYTES
Command:	QNUL<CR>	51 4E 55 4C 0D
Response:	0010<sp>FFF0<sp><CR>	30 30 31 30 20 46 46 46 30 20 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QPL

Query the current Load Capacitor Preset 1 value.

Reports the currently selected Load capacitor's preset value, in percent (decimals not supported - rounded to nearest integer)

Notes:

1. If the Preset Source Select parameter value is set to "OFF" or "INTERNAL" the QPL command reports the current value of the Load Capacitor Preset Position 1 parameter.
2. If the Preset Source Select parameter value is set to "ANALOG", the QPL command reports the current value of the Analog Interface connector's Load Capacitor Preset input signal.

Related Serial Commands: OFF, INT, EXT, MPL, MPLS, Q1PL

Related Programmable Parameters:
Preset Source Selection, Load Capacitor Preset Position 1

The following example assumes the currently selected Load capacitor preset value is 33.6%:

	ASCII	HEX BYTES
Command:	QPL<CR>	51 50 4C 0D
Response:	33<CR>	33 33 0D

QPMD

Query the current Preset Source Selection Mode (applicable to Preset 1 positions only)

Responds with "0" for Presets: Off (disabled)
Responds with "1" for Presets: Internal
Responds with "2" for Presets: Analog

Related Serial Commands: OFF, INT, EXT, GOTO

Related Programmable Parameters: Preset Source Selection

In the following example, the current preset mode is INTERNAL:

	ASCII	HEX BYTES
Command:	QPMD<CR>	51 50 4D 440D
Response:	1<CR>	31 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QPT

Query the current Tune Capacitor Preset 1 value.

Reports the currently selected Tune Capacitor preset value, in percent (decimals not supported - rounded to nearest integer)

Notes:

1. If the Preset Source Select parameter value is set to "OFF" or "INTERNAL" the QPT command reports the current value of the Tune Capacitor Preset Position 1 parameter.
2. If the Preset Source Select parameter value is set to "ANALOG", the QPT command reports the current value of the Analog Interface connector's Tune Capacitor Preset input signal.

Related Serial Commands: OFF, INT, EXT, MPT, MPTS, QP1T

Related Programmable Parameters:
Preset Source Selection, Tune Capacitor Preset Position 1

The following example assumes the currently selected Load capacitor preset value is 66.7%:

	ASCII	HEX BYTES
Command:	QPT<CR>	51 50 54 0D
Response:	67<CR>	36 37 0D

QP1A

Query the current Auxiliary (Aux) Capacitor Preset 1position value.

Reports the current Auxiliary (Aux) Capacitor Preset 1 position value in Percent x10

Notes:

1. If the Preset Source Select parameter value is set to "OFF" or "INTERNAL" the QP1A command reports the current value of the Auxiliary (Aux) Capacitor Preset Position 1 parameter.
2. If the Preset Source Select parameter value is set to "ANALOG", the QP1A command reports the current value of the Analog Interface connector's Auxiliary (Aux) Capacitor Preset input signal.

Related Serial Commands: MPA, MPAS, GOTO

Related Programmable Parameters:
Auxiliary (Aux) Capacitor Preset Position 1, Preset Source Selection

In the following example, the Auxiliary (Aux) Capacitor Preset 1 position value is 25.0%

	ASCII	HEX BYTES
Command:	QP1A<CR>	51 50 32 41 0D
Response:	250<CR>	32 35 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QP1L

Query the current Load Capacitor Preset 1 position value.

Reports the current Load Capacitor Preset 1 position value in Percent x10

Notes:

1. If the Preset Source Select parameter value is set to "OFF" or "INTERNAL" the QP1L command reports the current value of the Load Capacitor Preset Position 1 parameter.
2. If the Preset Source Select parameter value is set to "ANALOG", the QP1L command reports the current value of the Analog Interface connector's Load Capacitor Preset input signal.

Related Serial Commands: MPL, MPLS, QPT, GOTO

Related Programmable Parameters:

Load Capacitor Preset Position 1, Preset Source Select

In the following example, the Load Capacitor Preset 1 position value is 33.3%

	ASCII	HEX BYTES
Command:	QP1L<CR>	51 50 31 4C 0D
Response:	333<CR>	33 33 33 0D

QP1T

Query the current Tune Capacitor Preset 1 position value.

Reports the current Tune Capacitor Preset 1 position value in Percent x10

Notes:

1. If the Preset Source Select parameter value is set to "OFF" or "INTERNAL" the QP1T command reports the current value of the Tune Capacitor Preset Position 1 parameter.
2. If the Preset Source Select parameter value is set to "ANALOG", the QP1T command reports the current value of the Analog Interface connector's Tune Capacitor Preset input signal.

Related Serial Commands: MPL, MPLS, QPL, GOTO

Related Programmable Parameters:

Tune Capacitor Preset Position 1, Preset Source Select

In the following example, the Tune Capacitor Preset 1 position value is 66.2

	ASCII	HEX BYTES
Command:	QP1L<CR>	51 50 31 540D
Response:	662<CR>	36 36 32 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QP2A	Query the current Auxiliary (Aux) Capacitor Preset Position 2 value. Reports the Auxiliary (Aux) Capacitor Preset Position 2 value, in Percent x10 Related Serial Commands: P2A, GOP2 Related Programmable Parameters: Auxiliary (Aux) Capacitor Preset Position 2 In the following example, the Auxiliary (Aux) Capacitor Preset Position 2 value is 25.0% ASCII — HEX BYTES Command: QP2A<CR> — 51 50 32 41 0D Response: 250<CR> — 32 35 30 0D
QP2L	Query the current Load Capacitor Preset Position 2 value. Reports the Load Capacitor Preset Position 2 value, in Percent x10 Related Serial Commands: P2L, GOP2 Related Programmable Parameters: Load Capacitor Preset Position 2 In the following example, the Load Capacitor Preset Position 2 value is 33.3% ASCII — HEX BYTES Command: QP2L<CR> — 51 50 32 4C 0D Response: 333<CR> — 33 33 33 0D
QP2T	Query the current Tune Capacitor Preset Position 2 value. Reports the Tune Capacitor Preset Position 2 value, in Percent x10 Related Serial Commands: P2T, GOP2 Related Programmable Parameters: Tune Capacitor Preset Position 2 In the following example, the Tune Capacitor Preset Position 2 value is 66.2% ASCII — HEX BYTES Command: QP2T<CR> — 51 50 32 54 0D Response: 662<CR> — 36 36 32 0D
QPAD	Query the DC Probe Attenuation Factor parameter value. Related Serial Commands: PADC, QDP Related Programmable Parameters: DC Probe Attenuation Factor In the following example, the DC Probe Attenuation Factor parameter value is 1000 ASCII — HEX BYTES Command: QPAD<CR> — 51 50 41 44 0D Response: 1000<CR> — 31 30 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QPAI

Query the Current Probe Attenuation Factor parameter value.

Related Serial Commands: PAI, QIP
Related Programmable Parameters: Current Probe Attenuation Factor

In the following example, the Current Probe Attenuation Factor parameter value is 100

	ASCII	HEX BYTES
Command:	QPAI<CR>	51 50 41 49 0D
Response:	100<CR>	31 30 30 0D

QPAR

Query the RF Probe Attenuation Factor parameter value

Related Serial Commands: PARF, QRP, QXP
Related Programmable Parameters:

In the following example, the RF Probe Attenuation Factor parameter value is 200:

	ASCII	HEX BYTES
Command:	QPAR<CR>	51 50 41 52 0D
Response:	200<CR>	32 30 30 0D

QPRB

Query the Selected Probe.

Responds with a numeric code indicating the selected probe:

"0" for DC Voltage Probe
"1" for RF Voltage Probe
"2" for Current Probe

Related Serial Commands: PRB0, PRB1, PRB2
Related Programmable Parameters: Feedback Source Select

In the following example, the DC Probe is selected:

	ASCII	HEX BYTES
Command:	QPRB<CR>	51 50 52 42 0D
Response:	0<CR>	30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QPSNS

Query the Internal Power Sense signal reading.

Reports the Internal Power Sense signal's current value, in milli-Volts (mV).

Note: The internal Power Sense signal is derived from the Phase and Magnitude detector and provides a relative indication of the presence of RF power for the Automatic Capacitor Preset Trigger and Express Tuning features. The internal Power Sense *is not* a calibrated instrument for measuring RF power.

Related Programmable Parameters: RF On/Off Detect Threshold - Power Sense

In the following example, the Internal Power Sense signal value is 67mV:

	ASCII	HEX BYTES
Command:	QPSNS<CR>	51 50 53 4E 53 0D
Response:	67<CR>	36 37 0D

QRFOD

Query the current RF-Off Delay time parameter value.

Reports the current RF-Off Delay time parameter value, in milliseconds (mS)

Note: Feature available with firmware version 3.5A and later.

Related Serial Commands: RFODLY

Related Programmable Parameters: RF-Off Delay

In the following example, the RF-Off Delay parameter value is 40mS:

	ASCII	HEX BYTES
Command:	QRFOD<CR>	51 52 46 4F 44 0D
Response:	40<CR>	34 30 0D

QRNG

Queries the current Analog Interface Voltage Range parameter value.

Responds with "0" for 0-5V range
Responds with "1" for 0-10V range.

Related Serial Commands: RNG5, RNG10

Related Programmable Parameters: Analog Interface Voltage Range

In the following example, the Analog Interface Voltage Range is 0-5V:

	ASCII	HEX BYTES
Command:	QRNG<CR>	51 52 4E 47 0D
Response:	0<CR>	30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QRP

Queries the RF Probe Voltage.

Reports the RF Probe Voltage, in Volts, with the RF Probe attenuation factor applied.

Related Serial Commands: PARF, QPAR

Related Programmable Parameters: RF Probe Attenuation Factor

In the following example, the RF Probe voltage is 1000V

	ASCII	HEX BYTES
Command:	QRP<CR>	51 52 50 0D
Response:	1000<CR>	31 30 30 30 0D

QSAD

Query the current Address ID Number (Serial Address)

Reports the current Address ID Number (Serial Address). Applicable to RS232, RS422, RS485, DeviceNet, MODBUS and PROFIBUS communications interfaces.

Related Serial Commands: SAD

Related Programmable Parameters: Address ID Number

In the following example, the Address ID Number (Serial Address) is 10

	ASCII	HEX BYTES
Command:	QSAD<CR>	51 53 41 44 0D
Response:	10<CR>	31 30 0D

QSMD

Query the current communications mode/communications protocol.

Reports the current communications mode/protocol via a 1-digit code:

0 = RS-232
1 = RS-422
2 = RS-485-4 (4-Wire, Full Duplex)
3 = RS-485-2 (2-Wire, Half Duplex)
4 = MODBUS 4W RTU (Modbus 4-Wire, Full Duplex)
5 = MODBUS 2W RTU (Modbus 2-Wire, Half Duplex)
6 = DeviceNet
7 = PROFIBUS

Related Serial Commands: SMD,.SAD, QSAD, DNDF, QDNDF, DNDR, QDNDR

Related Programmable Parameters: Communications Protocol Select

In the following example, the current communications mode/protocol is RS-232:

	ASCII	HEX BYTES
Command:	QSMD<CR>	51 53 4D 44 0D
Response:	0<CR>	30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QTHM	Query the RF-On/Off Detect Threshold Magnitude Error parameter value. Reports the current RF-On/Off Detect Threshold Magnitude Error value, in milli-Volts (mV). Related Serial Commands: THMG Related Programmable Parameters: RF-On/Off Detect Threshold - Magnitude Error In the following example, the RF-On/Off Detect Threshold (Magnitude Error) value is 50mV: ASCII / HEX BYTES Command: QTHM<CR> / 51 54 48 4D 0D Response: 50<CR> / 35 30 0D
QTHP	Query the RF-On/Off Detect Threshold Phase Error parameter value. Reports the current RF-On/Off Detect Threshold Phase Error value, in milli-Volts (mV). Related Serial Commands: THPH Related Programmable Parameters: RF-On/Off Detect Threshold - Phase Error In the following example, the RF-On/Off Detect Threshold (Phase Error) value is 40mV ASCII / HEX BYTES Command: QTHP<CR> / 51 54 48 50 0D Response: 40<CR> / 34 30 0D
QTHR	Query the RF-On/Off Detect Threshold RF Voltage Probe parameter value. Reports the current RF-On/Off Detect Threshold RF Voltage Probe value, in Volts (V). Related Serial Commands: THRF Related Programmable Parameters: RF-On/Off Detect Threshold - RF Probe In the following example, the RF-On/Off Detect Threshold (Phase Error) value is 100V ASCII / HEX BYTES Command: QTHR<CR> / 51 54 48 52 0D Response: 100<CR> / 31 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QTHS	Query the RF-On/Off Detect Threshold RF Power Sense parameter value. Reports the current RF-On/Off Detect Threshold RF Power Sense value, in milli-Volts (mV). Related Serial Commands: THPS Related Programmable Parameters: RF-On/Off Detect Threshold - RF Power Sense In the following example, the the RF-On/Off Detect Threshold (Power Sensor) is 100mV. ASCII / HEX BYTES Command: QTHS<CR> / 51 54 48 53 0D Response: 100<CR> / 31 30 30 OD
QTLH	Query the Tune Capacitor Position High Limit parameter value. Reports the current Tune Capacitor Position High Limit parameter value, in percent. One to three digits, whole numbers (integers) only - decimals not supported - rounded to the nearest integer. Related Serial Commands: TLH Related Programmable Parameters: Tune Capacitor Position High Limit In the following example, the Tune Capacitor Position High Limit is 85.2% ASCII / HEX BYTES Command: QTLH<CR> / 51 54 4C 48 0D Response: 85<CR> / 38 35 0D
QTLL	Query the Tune Capacitor Position Low Limit parameter value Reports the current Tune Capacitor Position Low Limit parameter value, in percent. One to three digits, whole numbers (integers) only - decimals not supported - rounded to the nearest integer. Related Serial Commands: TLL Related Programmable Parameters: Tune Capacitor Position Low Limit In the following example, the Tune Capacitor Position Low Limit is 15%: ASCII / HEX BYTES Command: QTLH<CR> / 51 54 4C 4C 0D Response: 15<CR> / 31 35 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QTNTM

Query the Last Tune Time timer.

Reports the elapsed time of the last tuning cycle, in milliseconds. 1 to 5 digits.

A value of zero (0) indicates any one of the following conditions:

a. The matching network has not completed a tuning process.
b. Tuning is in process.
c. The Last Tuning Time timer has been intentionally reset.

A value of "60001" indicates the elapsed time of the last tuning cycle was more than 1 minute.

Notes:

1. There are specific conditions defining a tuning cycle. Refer to the Last Tune Time parameter in the Programmable Parameters section for detailed functional description.
2. Feature available with Firmware Version 4.6B and later.

Related Serial Commands: RTNTM

Related Programmable Parameters: Last Tune Time

In the following example, the Last Tune Time timer result is 2500 milliseconds (2.5 seconds)

	ASCII	HEX BYTES
Command:	QTNTM<CR>	51 54 4E 54 4D 0D
Response:	2500<CR>	32 35 30 30 0D

QTRAJ

Query the current Express Tuning Delay time parameter value.

Reports the current Express Tuning time delay value, in milli-Seconds (mS).

Note: If the Express Tuning Delay time parameter value is zero (0), the Express Tuning feature is disabled.

Related Serial Commands: TRAJ

Related Programmable Parameters: Express Tuning

In the following example, Express Tuning is enabled and the Express Tuning Delay time is 500mS.

	ASCII	HEX BYTES
Command:	QTRAJ<CR>	51 54 52 41 4A 0D
Response:	500<CR>	35 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QTRG	Query the Preset RF-Off Trigger feature's operational status. Reports a 1-digit status code: "0" = Enabled/On "1" = Disabled/Off Related Serial Commands: TRGX, TRGR Related Programmable Parameters: Preset Trigger Mode Enable/Disable In the following example, the Preset RF-Off Trigger is enabled ASCII — HEX BYTES Command: QTRG<CR> — 51 54 42 47 0D Response: 0<CR> — 30 0D
QTSLO	Query the Tune Capacitor Motion Slowdown Delay parameter value. Reports the current Tune Capacitor Motion Slowdown Delay parameter value, in milli-Seconds (mS). Related Serial Commands: TSLO Related Programmable Parameters: Tune Capacitor Motion Slowdown Delay In the following example, the Tune Capacitor Motion Slowdown Delay is 3mS ASCII — HEX BYTES Command: QTSLO<CR> — 51 54 53 4C 4F 0D Response: <CR> — 0D
QTSPD	Queries the Tune Capacitor High-Speed Threshold parameter value. Reports the current Tune Capacitor High-Speed Threshold value, in milli-Volts (mV). Related Serial Commands: TSPD Related Programmable Parameters: Tune Capacitor High-Speed Threshold In the following example, the Tune Capacitor High-Speed Threshold is 200mV: ASCII — HEX BYTES Command: QTSPD<CR> — 51 54 53 50 44 0D Response: 200<CR> — 32 30 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QTYPA	Queries the Auxiliary Capacitor type. Reports a 1-digit code indicating the Auxiliary Capacitor type: "0" = Vacuum Variable Capacitor "1" = Air Variable Capacitor Related Serial Commands: None Related Programmable Parameters: None In the following example, the Auxiliary Capacitor is a Vacuum Variable type ASCII / HEX BYTES Command: QTYPA<CR> / 51 54 59 50 41 0D Response: 0<CR> / 30 0D
QTYPL	Queries the Load Capacitor type. Reports a 1-digit code indicating the Load Capacitor type: "0" = Vacuum Variable Capacitor "1" = Air Variable Capacitor Related Serial Commands: None Related Programmable Parameters: None In the following example, the Load Capacitor is a Vacuum Variable type ASCII / HEX BYTES Command: QTYPL<CR> / 51 54 59 50 4C 0D Response: 0<CR> / 30 0D
QTYPT	Queries the Tune Capacitor type. Reports a 1-digit code indicating the Tune Capacitor type: "0" = Vacuum Variable Capacitor "1" = Air Variable Capacitor Related Serial Commands: None Related Programmable Parameters: None In the following example, the Tune Capacitor is an Air Variable type ASCII / HEX BYTES Command: QTYPT<CR> / 51 54 59 50 54 0D Response: 1<CR> / 31 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QVIIP	Query *optional* internal Power Sensor - Peak Current. Reports the Peak RF Current, in Amperes (Amps). Notes: 1. If the *optional* Power Sensor is not installed, the command returns a value of 0.00. 2. Feature available with firmware version 4.4C and later. Related Serial Commands: None. Related Programmable Parameters: Display Line 2 Information Selection, Display Line 3 Information Selection In the following example, the Peak RF Current is 6.45A ASCII / HEX BYTES Command: QVIIP<CR> / 51 56 49 49 50 0D Response: 6.45<CR> / 36 2E 34 35 0D
QVIIR	Query *optional* internal Power Sensor for RMS Current of the fundamental RF frequency. Reports the RMS current of the fundamental RF frequency, in Amperes (Amps). Notes: 1. If the *optional* Power Sensor is not installed, the command returns a value of zero (0.00). 2. Feature available with firmware version 4.4C and later. Related Serial Commands: None. Related Programmable Parameters: Display Line 2 Information Selection, Display Line 3 Information Selection In the following example, the RMS current of the fundamental RF frequency is 4.49A: ASCII / HEX BYTES Command: QVIIR<CR> / 51 56 49 49 52 0D Response: 4.49<CR> / 34 2E 34 39 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

QVIP

Query for one measurement set from the ***optional*** Power Sensor (voltage, current, phase, etc.)

This command reports a set of measurements made by the optional Power Sensor. All measurements made by the power sensor are returned in one (1) string of 118 characters, ending in <CR> (117 characters + <CR>).

The values in the string are right-justified so that the last character in each value is always in the same place in the string. Leading spaces are added to each value so that each value is represented by the same number of characters. There is at least one leading space within character groups 2 through 14, acting as a delimiter. Character group 1 (frequency) may or may not have leading spaces, depending on the frequency.

Notes:

1. If the ***optional*** Power Sensor is not installed, the values for each measurement are zero (0), except for VSWR, which returns "1.000".
2. Feature available with firmware version 4.4A and later.

Related Serial Commands: VIPL

Related Programmable Parameters:
Display Line 2 Information Selection, Display Line 3 Information Selection

Command Example:

	ASCII	HEX BYTES
Command:	QVIP<CR>	51 56 49 50 0D
Response:	(see sample string below, characters numbered left-to-right)	

13559.74	224.11	4.489	0.57	1006	10	1006	0	49.93	-0.50	0.005	1.010	318.86	6.450

Group No.	Characters	Measurement
1	1 to 8	Fundamental Frequency, in KHZ, 2 decimal places
2	9 to 17	RMS Voltage at fundamental frequency, in Volts, 2 decimal places
3	18 to 26	RMS Current at fundamental frequency, in Amps, 3 decimal places
4	27 to 35	Phase, in Degrees, 2 decimal places
5	36 to 42	Delivered Power in Watts, integer only
6	43 to 49	Reactive Power in Watts, integer only
7	50 to 56	Forward Power in Watts, integer only
8	57 to 63	Reflected Power in Watts, integer only
9	64 to 72	Impedance - R (Real/Resistive component) in Ohms, 2 decimal places
10	73 to 81	Impedance - X (Imaginary/Reactance component), 2 decimal places
11	82 to 90	Gamma, 3 decimal places
12	91 to 99	VSWR, as in X.XXX:1, 3 decimal places
13	100 to 108	Volts Peak
14	109 to 117	Amps Peak

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QVIVP	Query the ***optional*** Power Sensor for Peak Voltage measurement. Reports the current Peak Voltage measurement value, in Volts (V). Notes: 1. If the ***optional*** Power Sensor is not installed, the command returns a value of zero (0). 2. Feature available with firmware version 4.4C and later. Related Serial Commands: QVIP Related Programmable Parameters: Display Line 2 Information Selection, Display Line 3 Information Selection In the following example, the Peak Voltage measurement is 319V: ASCII — HEX BYTES Command: QVIVP<CR> — 51 56 49 56 50 0D Response: 319<CR> — 33 31 39 0D
QVIVR	Query the ***optional*** Power Sensor for the RMS Voltage of the fundamental RF frequency. Reports the current RMS Voltage of the fundamental RF frequency, in Volts (V). Notes: 1. If the ***optional*** Power Sensor is not installed, the command returns a value of zero (0). 2. Feature available with firmware version 4.4C and later. Related Serial Commands: QVIP Related Programmable Parameters: Display Line 2 Information Selection, Display Line 3 Information Selection In the following example, the RMS voltage of the fundamental frequency is 224V ASCII — HEX BYTES Command: QVIVR<CR> — 51 56 49 56 52 0D Response: 224<CR> — 32 32 34 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
QXP	Query the Auxiliary RF Probe voltage. Reports the current Auxiliary RF Probe voltage measurement, in Volts (V). Notes: 1. The Auxiliary RF Probe is an ***optional*** feature, and therefore ***is not present*** in most ATS-Series matching networks. 2. The Auxiliary RF Probe uses the same attenuation factor as the standard RF Voltage Probe. 3. Feature available with firmware version 4.1C and later. Related Serial Commands: PARF, QPAR Related Programmable Parameters: RF Voltage Probe Attenuation Factor In the following example, the Auxiliary RF Probe Voltage is 2000V ASCII / HEX BYTES Command: QXP<CR> / 51 58 500D Response: 2000<CR> / 32 30 30 30 0D
RFODLY	Set the RF-Off Delay parameter value. Delay range: 0mS to 20000mS The RF-Off Delay period range can be set via remote command or the *optional* Remote Display Panel. Related Serial Commands: QRFOD Related Programmable Parameters: RF-Off Delay In the following example, the RF-Off Delay is set to 50mS ASCII / HEX BYTES Command: 50<sp>RFODLY<CR> / 35 30 20 52 46 4F 44 4C 59 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

RNG5

Sets the Analog Interface Voltage Range parameter to 0-5V

Configures the Analog Interface connector's capacitor preset inputs and capacitor position outputs for 0-to-5VDC operation.

The Analog Interface Voltage range can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: RNG10, QRNG

Related Programmable Parameters: Analog Interface Voltage Range

Command example:

	ASCII	HEX BYTES
Command:	RNG5<CR>	52 4E 47 35 0D
Response:	<CR>	0D

RNG10

Sets the Analog Interface Voltage Range parameter to 0-10V

Configures the Analog Interface connector's capacitor preset inputs and capacitor position outputs for 0-to-10VDC operation.

The Analog Interface Voltage range can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: RNG5, QRNG

Related Programmable Parameters: Analog Interface Voltage Range

Command example:

	ASCII	HEX BYTES
Command:	RNG10<CR>	52 4E 47 31 30 0D
Response:	<CR>	0D

RTNTM

Sets/Resets the Last Tune Time value to zero (0)

Related Serial Commands: QTNTM

Related Programmable Parameters: Last Tune Time

Command example:

	ASCII	HEX BYTES
Command:	RTNTM<CR>	52 54 4E 54 4D 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

SAD

Sets the communications Address ID number.

Configures the Address ID Number for RS-232, RS-422, RS-485 and DeviceNet communications protocols.

Address Range:
RS-232, RS-422, RS-485: 0 - 99
Modbus: 1 - 247
DeviceNet: 0 - 64
PROFIBUS: 0 to 126

The Address ID Number can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: SMD, DNDR, DNDF

Related Programmable Parameters:
Address ID Number
Communications Protocol Select
Data Rate
DeviceNet Assembly Set

In the example below, the communications Address ID Number is set to 10:

	ASCII	HEX BYTES
Command:	10<sp>SAD<CR>	31 30 20 53 41 44 0D
Response:	<CR>	0D

Operational Notes:

If the current Address ID Number is unknown, use address 99. The ATS-Series matching network always responds to address 99.

To reset an ATS-Series matching Network with an unknown Address ID Number, use the following steps:

1. If multiple networks or a mix of equipment is connected using RS-422 or RS-485 multi-drop communications, isolate the matching network from the rest of the system.
2. Address the unit as Address ID Number "99"
3. Use the "SAD" command to set the desired Address ID Number.

In the example below, an unknown address is set to "10" (RS422 or RS485 protocol):

Command	Response	Comment
@99<CR>	A	Send to address 99, receive "A" as acknowledgement
10<sp>SAD<CR>	<CR>	Set the address to "10"

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
SMD	Sets the communications protocol parameter. Selects RS-232, RS-422, RS485-4, RS-485-2, Modbus, DeviceNet, or PROFIBUS communications protocol. Parameter Mode range: 0 to 7 Parameter Modes: 0 = RS-232 (Full Duplex) 1 = RS-422 (Listen Only) 2 = RS-485-4 (4-Wire, Full Duplex) 3 = RS-485-2 (2-Wire, Half Duplex) 4 = Modbus 4W RTU (Modbus 4-Wire, Full Duplex) Note 4 5 = Modbus 2W RTU (Modbus 2-Wire, Half Duplex) Note 4 6 = DeviceNet 7 = PROFIBUS Notes: 1. DeviceNet and PROFIBUS are *optional* hardware interfaces and are not field-installable. 2. Modbus communications (Multiple ID / MC2-Emulation) available with Firmware Version 4.5A and later. 3. Modbus communications (Single ID / ATS-Specific) available with firmware version 4.6A and later. 4. Selection of Modbus protocols via serial command is not currently implemented. Parameter Mode codes for Modbus 4W RTU and Modbus 2W RTU are provided, are accepted, and then ignored. An *optional* Remote Display Panel is needed to set the communications protocol to Modbus or to change from Modbus to other protocols. The communications protocol can be set via remote command (Note 4) or the *optional* Remote Display Panel. Related Serial Commands: QSMD, SAD, QSAD, DNDF, QDNDF, DNDR, QDNDR Related Programmable Parameters: Communications Protocol Select, Address ID Number, Data Rate, DeviceNet Assembly Set, Communications Echo, Modbus Type In the example below, the communications protocol is set to RS-485-4: ASCII — HEX BYTES Command: 2<sp>SMD<CR> — 32 20 53 4D 44 0D Response: <CR> — 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
SNUL	Set/Assign the stored Alternate Phase/Mag values. Used with the Alternate Phase/Mag Null feature for pulsed RF power applications. Notes: 1. Feature available with firmware version 4.5A and later. 2. Feature is not available if the control board in the ATS match network was manufactured before June 2011. Command Syntax: SNUL XXXX<sp>YYYY<CR> Where: XXXX is a signed integer in 16-bit Hexadecimal format, representing the stored Alternate Phase Null value in Analog-to-Digital (A/D) converter counts. Leading zeros are accepted but are not required. YYYY is a signed integer in 16-bit hexadecimal format, representing the stored Alternate Magnitude Null value in Analog-to-Digital (A/D) converter counts. Leading zeros are accepted but are not required. <sp> (The space character - 0x20) is the value terminator/delimiter. Command Response: <CR> Related Programmable Parameters: Alternate Phase/Mag Null, Save Phase/Mag Null Data Related Serial Commands: ANUL, QNUL In the following command example, the alternate null values to be stored are: -10 mV Phase, +20 mV Mag: Command: ASCII: SNUL<sp>FFF6<sp>0014<CR> HEX BYTES: 53 4E 55 4C 20 46 46 46 36 20 30 30 32 30 0D Response: ASCII: <CR> HEX BYTES: 0D
THMG	Sets the RF-On Detection Threshold – Magnitude Error parameter value, in milli-volts (mV). Threshold value range: 0 to 5000, whole numbers (integers) only The RF-On Detection Threshold-Magnitude Error parameter value can be set via remote command or the *optional* Remote Display Panel. Related Serial Commands: QTHM, TRGR, TRGX, QTRG Related Programmable Parameters: RF-On Detection Threshold – Magnitude Error Preset Trigger Mode Enable/Disable In the example below, the RF-On Detection Threshold – Magnitude Error parameter value is set to 50mV. ASCII / HEX BYTES Command: 50<sp>THMG<CR> / 35 30 20 54 48 4D 47 0D Response: <CR> / 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

THPH

Sets the RF-On Detection Threshold – Phase Error parameter value, in milli-volts (mV).

Threshold value range: 0 to 5000, whole numbers (integers) only

The RF-On Detection Threshold–Phase Error parameter value can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: QTHP, TRGR, TRGX, QTRG

Related Programmable Parameters:
RF-On Detection Threshold – Phase Error
Preset Trigger Mode Enable/Disable

In the example below, the RF-On Detection Threshold – Phase Error parameter value is set to 40mV.

	ASCII	HEX BYTES
Command:	40<sp>THPH<CR>	34 30 20 54 48 50 48 0D
Response:	<CR>	0D

THPS

Sets the RF-On Detection Threshold – Power Sensor parameter value, in milli-volts (mV).

Threshold value range: 0 to 5000, whole numbers (integers) only

The RF-On Detection Threshold–Power Sense parameter value can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: QTHS, TRGR, TRGX, QTRG

Related Programmable Parameters:
RF-On Detection Threshold – Power Sensor
Preset Trigger Mode Enable/Disable

In the example below, the RF-On Detection Threshold – Power Sensor parameter value is set to 100mV.

	ASCII	HEX BYTES
Command:	100<sp>THPS<CR>	31 30 30 20 54 48 50 53 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

THRF

Sets the RF-On Detection Threshold – RF Voltage Probe parameter value, in volts (V).

The RF Voltage Probe Attenuation factor is applied to the ATS-Series matching network's internal RF Probe.

Threshold value range: 0 to 20000, whole numbers (integers) only

The RF-On Detection Threshold–Phase Error parameter value can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: QTHR, TRGR, TRGX, QTRG, PARF

Related Programmable Parameters:
- RF-On Detection Threshold – RF Voltage Probe
- Preset Trigger Mode Enable/Disable
- RF Voltage Probe Attenuation Factor

In the example below, the RF-On Detection Threshold – RF Voltage Probe parameter value is set to 100V.

	ASCII	HEX BYTES
Command:	100<sp>THRF<CR>	31 30 30 20 54 48 52 46 0D
Response:	<CR>	0D

TLH

Sets the Tune Capacitor Position High Limit, in percent.

High Limit range: 2 to 100, 1 to 3 digits, whole numbers (integers) only.

Operational Note: The Tune Capacitor Position High Limit must be greater than the Tune Capacitor Position Low Limit.

Related Serial Commands: QTLH

Related Programmable Parameter: Tune Capacitor Position High Limit

In the example below, the Tune Capacitor High Limit is set to 85%

	ASCII	HEX BYTES
Command:	85<sp>TLH<CR>	38 35 20 54 4C 48 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
TLL	Sets the Tune Capacitor Position Low Limit, in percent. High Limit range: 0 to 98, 1 to 2 digits, whole numbers (integers) only. Operational Note: The Tune Capacitor Position Low Limit must be less than the Tune Capacitor Position High Limit. Related Serial Commands: QTLL Related Programmable Parameter: Tune Capacitor Position Low Limit In the example below, the Tune Capacitor High Limit is set to 15% ASCII — HEX BYTES Command: 15<sp>TLL<CR> — 31 35 20 54 4C 4C 0D Response: <CR> — 0D
TPS? or TPS	Query the current Tune capacitor position. Reports the current Tune capacitor position, in percent, range 0 to 100, 1 to 3 digits. In the example below, the Tune capacitor position is 75% ASCII — HEX BYTES Command: TPS?<CR> — 54 50 53 3F 0D Response: 75<CR> — 37 35 0D
TRAJ	Set the Express Tuning Delay parameter value, in milli-seconds (mS); Enable/Disable Express Tuning. Express Tuning Delay range: 0 to 9999, 1 to 4 digits, whole numbers (integers) only. Note: A non-zero value enables Express Tuning, setting the value to zero (0) disables Express Tuning. Related Serial Commands: QTRAJ Related Programmable Parameters: Express Tuning, RF On/Off Detect Threshold-Phase Error RF On/Off Detect Threshold-Magnitude Error, RF On/Off Detect Threshold-Power Sense RF On/Off Detect Threshold-RF Probe Load Capacitor Preset Position 2 Tune Capacitor Preset Position 2 Auxiliary Capacitor Preset Position 2 (if equipped) In the example below, the Express Tuning Delay parameter value is set to 500mS ASCII — HEX BYTES Command: 500<sp>TRAJ<CR> — 35 30 30 20 54 52 41 4A 0D Response: <CR> — 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

TRGR

Enables RF-On/Off Detection and RF-OFF Preset Trigger.

Instructs the ATS-Series matching network to position the Load and Tune capacitors to the selected preset (Preset Position 1 or Analog Preset) values when an RF "OFF" condition is detected. When RF is "ON", the ATS-Series matching network's internal controls automatically adjust the Tune and Load capacitors to minimize reflected power.

Note: The Load and Tune capacitor must be set to "AUTO" mode for presets to operate.

The preset trigger mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: TRGX, QTRG, OFF, INT, EXT, QPMD, MPL, MPLS, MPT, MPTS, THRF, THPH, THMG, THPS

Related Programmable Parameters:
Preset Source, Preset Trigger Mode Enable/Disable
Load Capacitor Preset Position 1, Tune Capacitor Preset Position 1
RF-On Threshold – Magnitude Error, RF-On Threshold – Phase Error
RF-On Threshold – RF Probe, RF-On Threshold - Power Sense,
RF Voltage Probe Attenuation Factor

Command example:

	ASCII	HEX BYTES
Command:	TRGR<CR>	54 52 47 52 0D
Response:	<CR>	0D

TRGX

Disables RF-On/Off Detection and RF-OFF Preset Trigger.

The ATS-Series matching network ***will not*** position the Load and Tune capacitors to the selected preset (Preset Position 1 or Analog Preset) values when an RF "OFF" condition is detected. When RF is "ON", the ATS-Series matching network's internal controls automatically adjust the Tune and Load capacitors to minimize reflected power.

The preset trigger mode can be set via remote command or the *optional* Remote Display Panel.

Related Serial Commands: TRGR, QTRG, OFF, INT, EXT, QPMD
Related Programmable Parameters: Preset Trigger Mode Enable/Disable

Command example:

	ASCII	HEX BYTES
Command:	TRGX<CR>	54 52 47 58 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

TSLO

Set the Tune Capacitor Motion Slowdown Delay parameter value, in milliseconds (mS).

Range: 0 to 100, 1 to 3 digits, whole numbers (integers) only.

Note: Feature available with firmware versions 3.5A and later. See Tune Capacitor Motion Slowdown Delay in the Programmable Parameter Details section for function description.

Command Syntax: X<sp>TSLO<CR>

Where "X" is the desired Tune Capacitor Motion Slowdown Delay value, in milli-seconds. 0 to 100, 1 to 3 digits, whole numbers (integers) only.

Related Programmable Parameter: Tune Capacitor Motion Slowdown Delay

Related Serial Command: QTSLO

In the example below, the Tune Capacitor Motion Slowdown Delay parameter is set to 3mS:

	ASCII	HEX BYTES
Command:	3<sp>TSLO<CR>	33 20 54 53 4C 4F 0D
Response:	<CR>	0D

TSPD

Sets the Tune Capacitor High-Speed Threshold parameter value, in milli-Volts (mV)

Range: 0 to 1250, 1 to 4 digits, whole numbers (integers) only.

Note: Feature available with firmware versions 3.5A and later. See Tune Capacitor High-Speed Threshold in the Programmable Parameter Details section for function description.

Command Syntax: X<sp>TSPD<CR>

Where "X" is the desired Tune Capacitor High-Speed Threshold value, in milli-Volts. 0 to 1250, 1 to 4 digits, whole numbers (integers) only.

Related Programmable Parameter: Tune Capacitor High-Speed Threshold

Related Serial Command: QTSPD

In the example below, the Load Capacitor High-Speed Threshold parameter value is set to 200mV:

	ASCII	HEX BYTES
Command:	200<sp>TSPD<CR>	32 30 30 20 54 53 50 44 0D
Response:	<CR>	0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**

UNUL

Enable the Alternate Phase/Mag Null feature.

Notes:

1. Useful for pulsed RF power applications.
2. DO NOT use for non-pulsing/Continuous Wave (CW) applications. Use of the Alternate Phase/Mag Null feature in CW applications will cause tuning errors.
3. Feature available with firmware version 4.5A and later.
4. Feature is not available if the control board in the ATS match network was manufactured before June 2011.
5. Configuration of the Alternate Phase/Mag Null feature is possible via serial command, but may be easier to accomplish using the *optional* MCRS Remote Display Panel.
6. See Alternate Phase/Mag Null feature in the Programmable Parameters section for procedural details.

Related Serial Commands: XNUL, ANUL, QNUL, SNUL,

Related Programmable Parameters:
Save Phase/Mag Null Data, Alternate Phase/Mag Null

Command Example:

	ASCII	HEX BYTES
Command:	UNUL<CR>	55 4E 55 4C 0D
Response:	<CR>	0D

V?

Query the currently selected probe's voltage.

Responds with the value of the currently selected probe (DC Voltage, RF Voltage, or Current), with the corresponding Probe Attenuation factor applied. Unit of measure is Volts for DC or RF probes, Amps for Current probe.

Note: The "V?" command is the same as the "0?" command.

Related Serial Commands: PRB0, PRB1, PRB2, 0?, PADC, PARF, PAI

Related Programmable Parameters:
Feedback Source (Probe) Select
DC Voltage Probe Attenuation Factor
RF Voltage Probe Attenuation Factor
Current Probe Attenuation Factor

In the example below, the Probe Voltage reading is 250V:

	ASCII	HEX BYTES
Command:	0?<CR>	30 3F 0D
Response:	250<CR>	32 35 30 0D

SERIAL COMMAND DETAILS	
COMMAND	**COMMAND DETAIL**
VIPL	Reports four (4) Power Sensor measurement sets per second from the ***optional*** Power Sensor (voltage, current, phase, etc.), until stopped. After this command is received by the ATS-Series matching network, one Power Sensor measurement set is transmitted every 250mS until a character is sent to the matching network. Each measurement set is a 118-character string, formatted as described under the QVIP command. Notes: 1. If the ***optional*** Power Sensor is not installed, one empty character set is sent, and the ATS-Series matching network waits for another character (or command) to be sent to terminate the VIPL command. 2. Feature available with firmware version 4.4A and later. Related Serial Commands: QVIP Related Programmable Parameters: Display Line 2 Information Selection, Display Line 3 Information Selection Command example: ASCII / HEX BYTES Command: VIPL<CR> / 56 49 50 4C 0D Response: {118-Character String}
XNUL	Disable the Alternate Phase/Mag Null feature. Notes: 1. Feature available with firmware version 4.5A and later. 2. Feature is not available if the control board in the ATS match network was manufactured before June 2011. 3. Configuration of the Alternate Phase/Mag Null feature is possible via serial command, but may be easier to accomplish using the *optional* MCRS Remote Display Panel. 4. See Alternate Phase/Mag Null feature in the Programmable Parameters section for procedural details. Related Serial Commands: XNUL, ANUL, QNUL, SNUL, Related Programmable Parameters: Alternate Phase/Mag Null Command Example: ASCII / HEX BYTES Command: XNUL<CR> / 58 4E 55 4C 0D Response: <CR> / 0D

Configuring the ATS-Series Matching Network for Serial Communications

How to configure the ATS-Series Automatic Impedance Matching Network for serial communications is described in a step-by-step manner below. The example assumes the *optional* Remote Display Panel is used to configure the ATS-Series matching network. The matching network can also be configured in a similar manner using serial commands issued from a data terminal or a personal computer with terminal emulation software.

The serial interface wiring depends on the selected serial communications mode. Refer to the **Serial Interface Modes and Connections** chart and the **CONTROL** connector pin list in the Controls and Connections section for serial interface wiring details.

Note: DeviceNet is an *optional* communications interface.

The following serial communication parameters are fixed and cannot be configured	
Parity:	NONE
Data Bits:	8
Stop Bits:	1
Handshaking:	NONE

Serial Communication Configuration Steps	
STEP	**ACTION**
1.	Enter programming menu - press the PRG button (item 1) on the *optional* Remote Display Panel.
2.	Press the DOWN button (item 2) on the *optional* Remote Display Panel until the third display line indicates one of the following communications protocols: RS232 RS422 RS485-4 RS485-2 MODBUS 4W RTU MODBUS 2W RTU DEVICENET PROFIBUS
3.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel select the desired communications protocol.
4.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed serial communications protocol selection is saved in non-volatile memory.

<table>
<tr><th colspan="3">Serial Communication Configuration Steps</th></tr>
<tr><th>STEP</th><th colspan="2">ACTION</th></tr>
<tr><td>5.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should look like:
ADDRESS # XX
(Where "XX" = the current serial address, "0" to "99")
<u>Note:</u> Ensure the address is valid for the selected communications protocol.</td></tr>
<tr><td>6.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired serial address.</td></tr>
<tr><td>7.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed serial communications address selection is saved in non-volatile memory.</td></tr>
<tr><td rowspan="3">8.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display one of the following data rates:</td></tr>
<tr><td>500KBPS
250KBPS
125KBPS</td><td>Data rates for DeviceNet.
(Displayed if DeviceNet protocol is selected.)</td></tr>
<tr><td>115200 BAUD
57600 BAUD
38400 BAUD
19200 BAUD
9600 BAUD
4800 BAUD
2400 BAUD</td><td>Data rates for RS-232,RS-422, RS-485, and Modbus.
(Displayed if DeviceNet or PROFIBUS protocol is not selected.)

Note: PROFIBUS data rate is automatically negotiated between the ATS-Series matching network and the host controller.</td></tr>
<tr><td>9.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired data rate.</td></tr>
<tr><td>10.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed serial communications data rate selection is saved in non-volatile memory.</td></tr>
<tr><td>11.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display one of the following echo modes:
ECHO: DISABLED
ECHO: ENABLED</td></tr>
<tr><td>12.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired echo mode.</td></tr>
<tr><td>13.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed serial communications echo mode selection is saved in non-volatile memory.</td></tr>
<tr><td>14.</td><td colspan="2">Press the RUN button. Serial communications configuration is complete.</td></tr>
</table>

Ethernet Communications *(optional)*

Starting with firmware version 3.6A, the ATS-Series matching networks support Ethernet communication using the TCP/IP protocol. Ethernet communication is available only on ATS-series matching networks that are ordered with the optional Ethernet communications interface. The Ethernet communications interface option *is not* field-installable. The Ethernet interface can be configured in one of two ways (specified at time of order):

1.) Primary interface.

In this configuration, the Ethernet interface is intended to provide the primary control interface for the ATS-Series matching network. The Serial Communications port is also available.

2.) Secondary interface.

In this configuration, the Ethernet interface replaces the Serial Communications port. This allows another interface, such as PROFIBUS or DeviceNet, to be installed as the primary control interface, with Ethernet available for monitoring.

With the Ethernet communications option installed, the ATS-Series matching network accepts a TCP/IP connection to Port 10001 and responds to the same character-based commands that are available using the Serial Communications port.

About Ethernet Configuration Settings

Before the ATS-Series matching network can be used on an Ethernet network, three configuration settings must be selected:

1) IP address (Internet Protocol address)
2) Subnet mask
3) Gateway address

The **IP address** is a 32-bit number that identifies a device connected to the network. The number is represented by four "octets" separated by decimal points.

Example: 192.64.32.235.

Each octet can range in value from 0 to 255. An IP address can be thought of as having two parts: a network identifier and a device identifier. On a typical small network, the first three octets of any IP Address are the same for all devices on that network, and the last octet is unique for each device.

Example: In a network with four computers, the IP addresses may be:
192.206.151.101, 192.206.151.102, 192.206.151.103, and 192.206.151.104

The **Subnet mask** setting is used by the networking software in each device to determine if an IP address is local (the same first octets used in all IP addresses on the network) or remote. The Subnet mask looks like an IP address with the first octets set to 255 and the remaining octets set to 0. For the typical small network that uses the first three octets of each

IP address as the network identifier, the Subnet mask would be 255.255.255.0. For a larger network that uses the first two octets of each IP address as the network identifier, the Subnet mask would be 255.255.0.0. Octets set to 255 correspond to the network identifier portion of each IP address.

Most devices have one physical network connection, and can only communicate directly with other devices on the local network. If communication between networks is necessary, one device must have two network connections: one for the local network, and one for another network. The device with two connections is called a Gateway. When a device needs to send data to another network, the device sends the data through the Gateway, which directs the data to its intended destination. Any device that needs to communicate outside the local network must have the correct **Gateway address** setting, which is the IP address of the Gateway as it appears on the local network.

Hardware (MAC) Address

In addition to the IP address, each Ethernet device has a Hardware address that cannot be changed. The Hardware address is also referred to as the MAC address or Ethernet address. The Hardware address for each Ethernet-equipped ATS-Series matching network appears on a label attached to the outside of the chassis. The hardware address may be needed for configuration.

Configuring Ethernet Communications (DeviceInstaller Software)

The ATS-Series matching network's Ethernet interface uses an Ethernet-to-serial adapter. The adapter accepts TCP/IP network connections and manages data flow between the matching network's internal control board and the Ethernet network. The ATS match's internal control board sees the Ethernet Adapter as a serial port, and is not aware of the details of network protocols and settings. Ethernet communications parameters (IP Address, Subnet Mask, and Gateway Address) cannot be set using a MCRS Remote Display Panel (optional accessory), or by Serial Interface commands.

The IP address, Subnet mask, and Gateway address are set by connecting the Ethernet-equipped ATS matching network to an Ethernet network and running the DeviceInstaller software. The DeviceInstaller software is included on the CD-ROM shipped with the ATS-Series matching network (Folder: \Match_Network_ATS-Series\Ethernet_Utility).

To install the DeviceInstaller software, load the CD-ROM into a PC (Windows XP Service Pack 3 or later operating system) and run the DeviceInstallerSetup.exe program. If the installation wizard asks for a selection of installation type, select Typical.

To set the IP address and other Ethernet settings for an ATS matching network, proceed as follows:

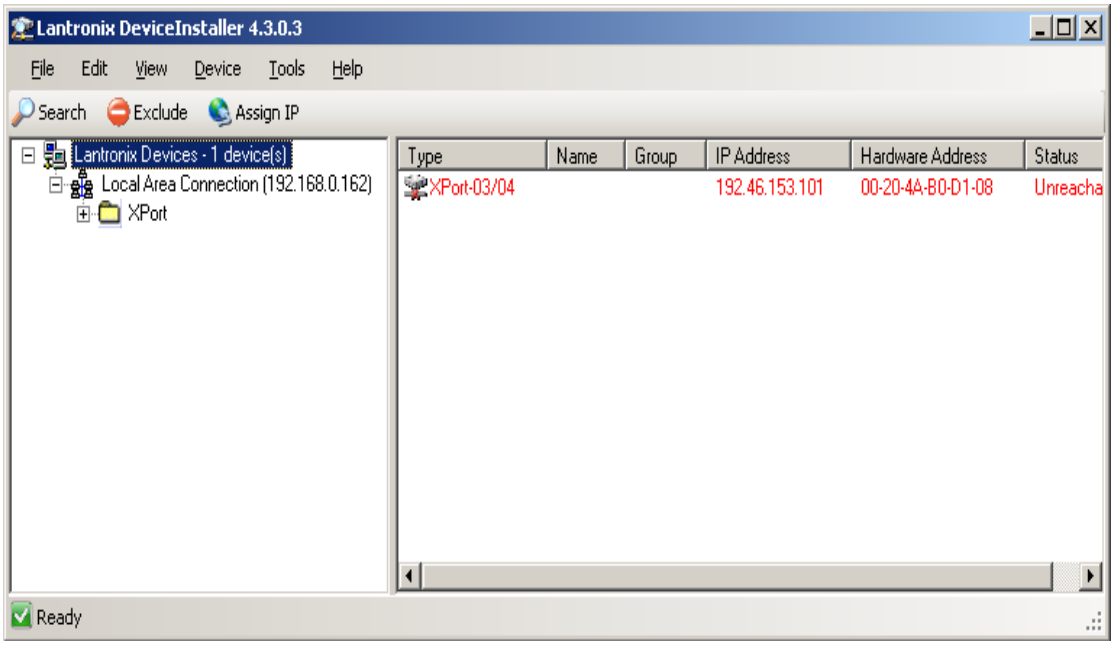
1. Connect the ATS matching network to the Ethernet network using an RJ-45 Category 6 rated patch cord (user supplied).

2. Turn on the ATS matching network by applying 24VDC to the 24V IN connector.

3. Run the DeviceInstaller software.

   Click **Start→Programs→Lantronix→DeviceInstaller→DeviceInstaller**.

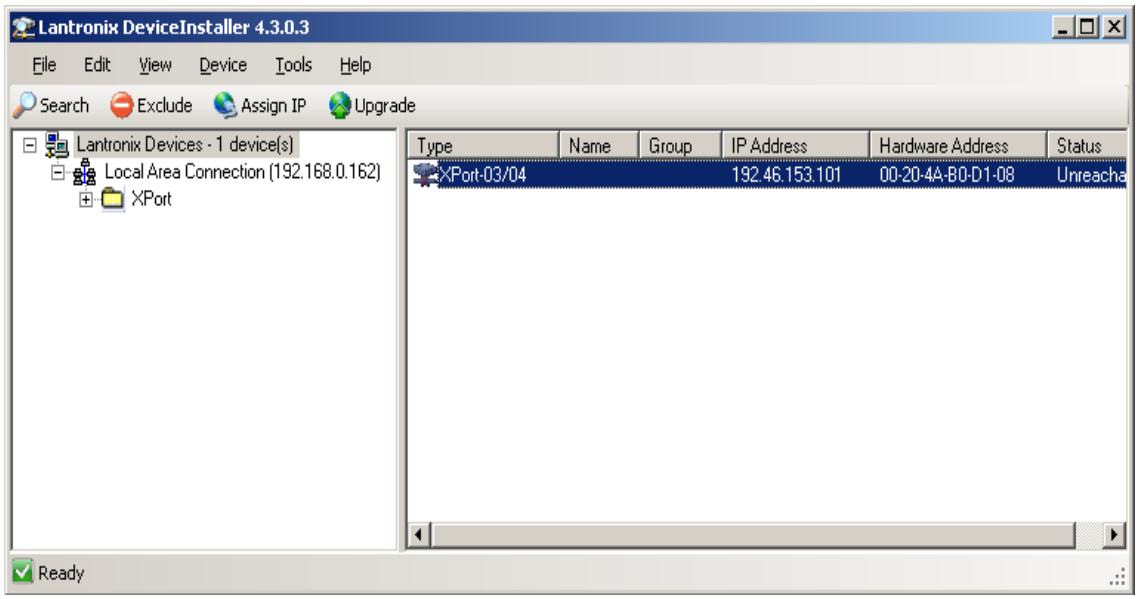
   The startup screen should look something like this:



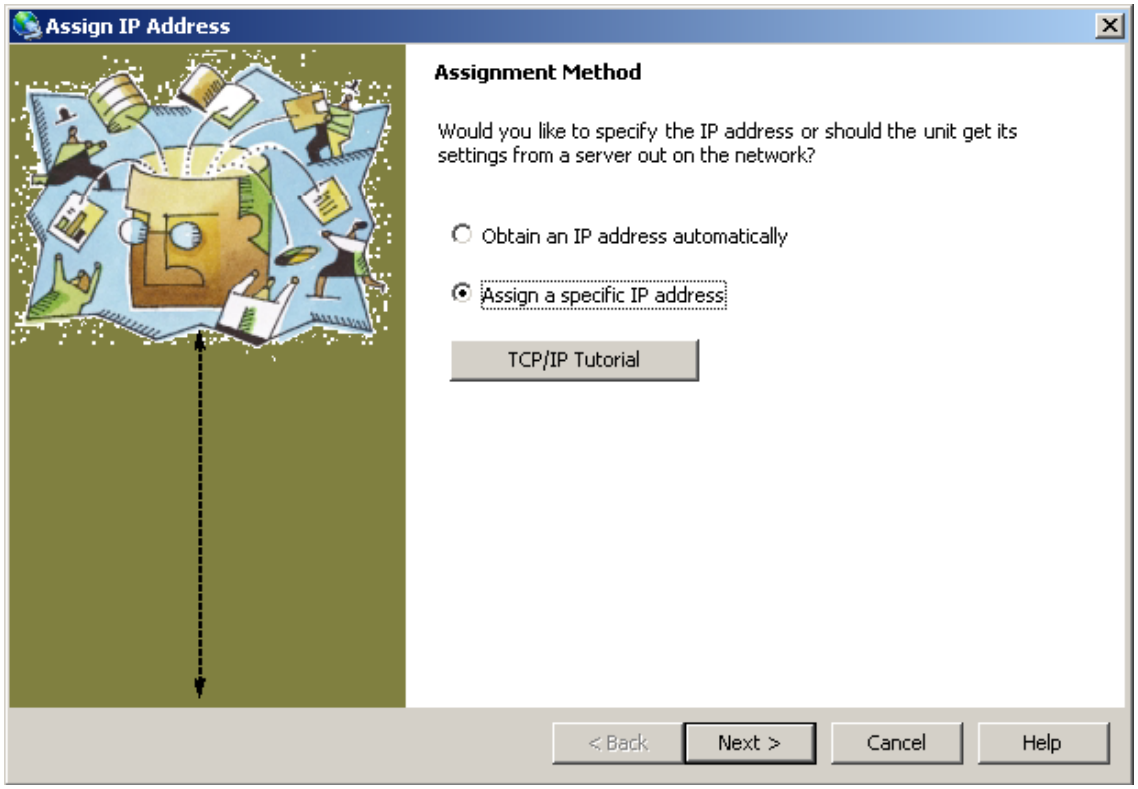
The DeviceInstaller utility software searches the local network and shows a list of all "XPort" Ethernet adapters it finds. In the example above, one ATS unit was found, with Hardware address 00-20-4A-B0-D1-08 and IP address 192.46.153.101.

The Type is shown as "XPort-03/04" because "XPort" is the type of Ethernet adapter used in the ATS matching network. The status is shown as "unreachable" because the first octets of IP address 192.46.153.101 do not match the first octets of the computer's IP address (shown as Local Area Connection 192.168.9.162 in the left portion of the DeviceInstaller screen).

4. Click on the Hardware address for the ATS matching network (00-20-4A-B0-D1-08). The screen should appear as follows:

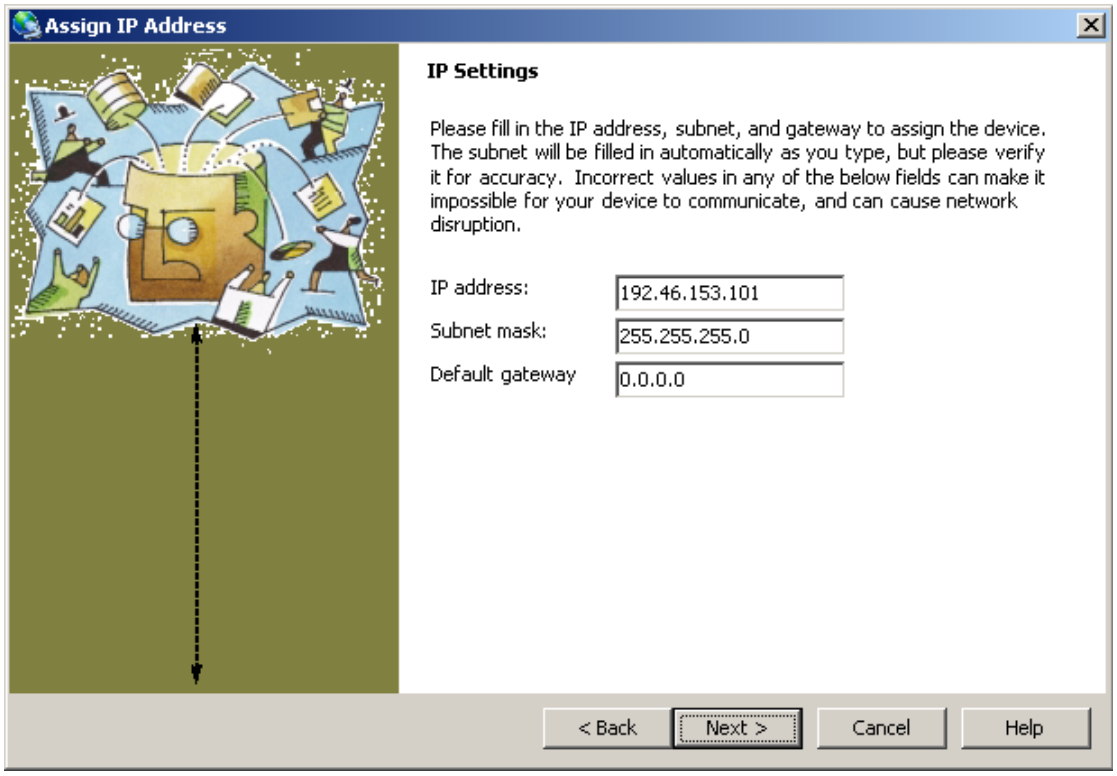


5. Click on **Assign IP**. A dialog box appears:



6. Select **Assign a specific IP address**, then click **Next**:

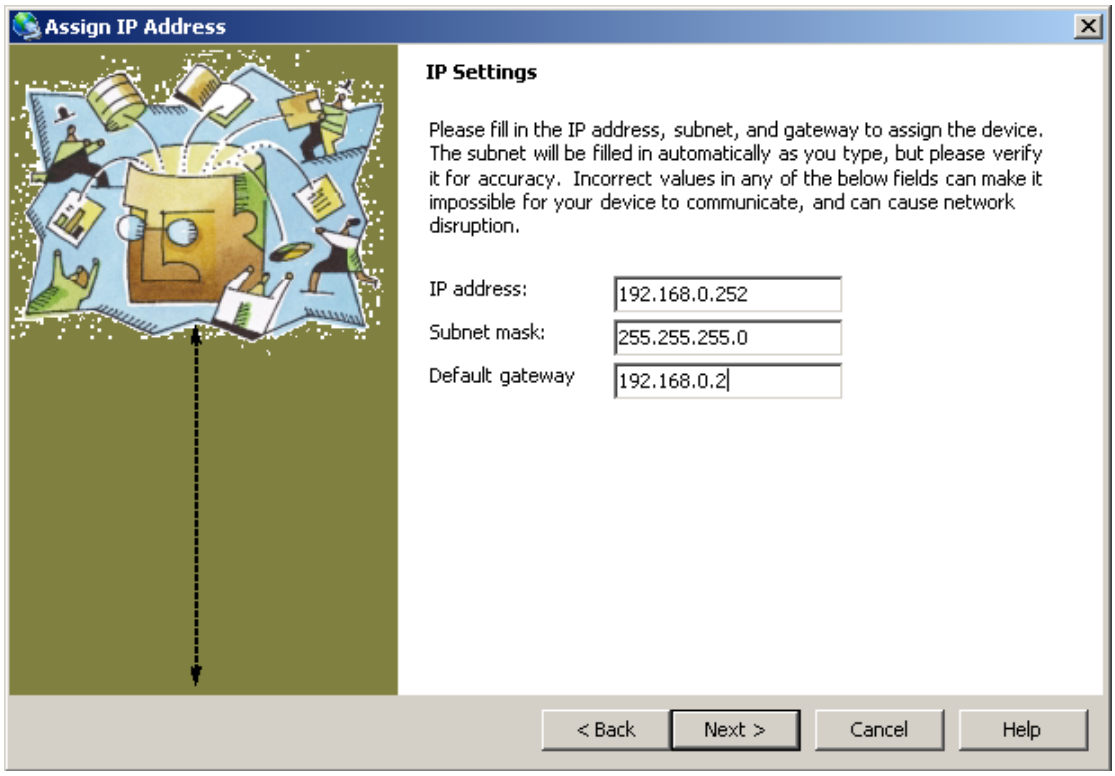
7. A new dialog box appears:



For the purpose of this discussion, assume the IP address should be 192.168.0.252, the Subnet mask should be 255.255.255.0, and the Gateway address should be 192.168.0.2.

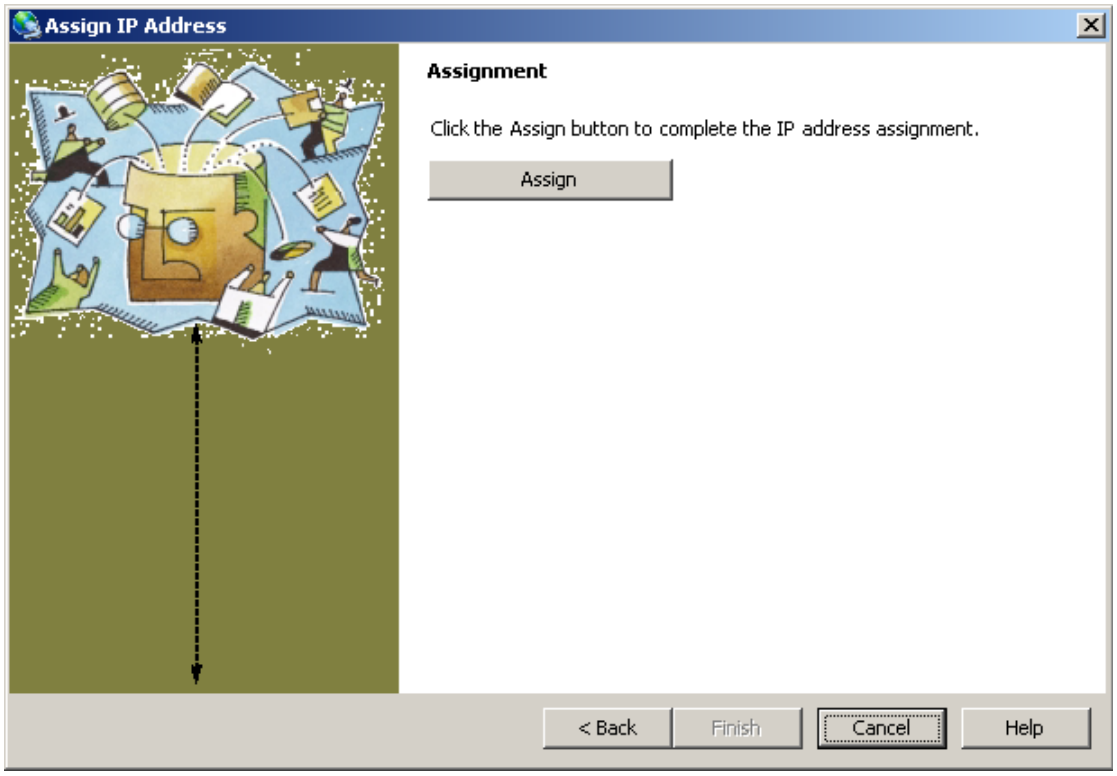
Actual settings appropriate to your system can be configured later, using the same method.

8. Fill in the IP address, Subnet mask, and Gateway address (Default gateway). The dialog box should look like this:



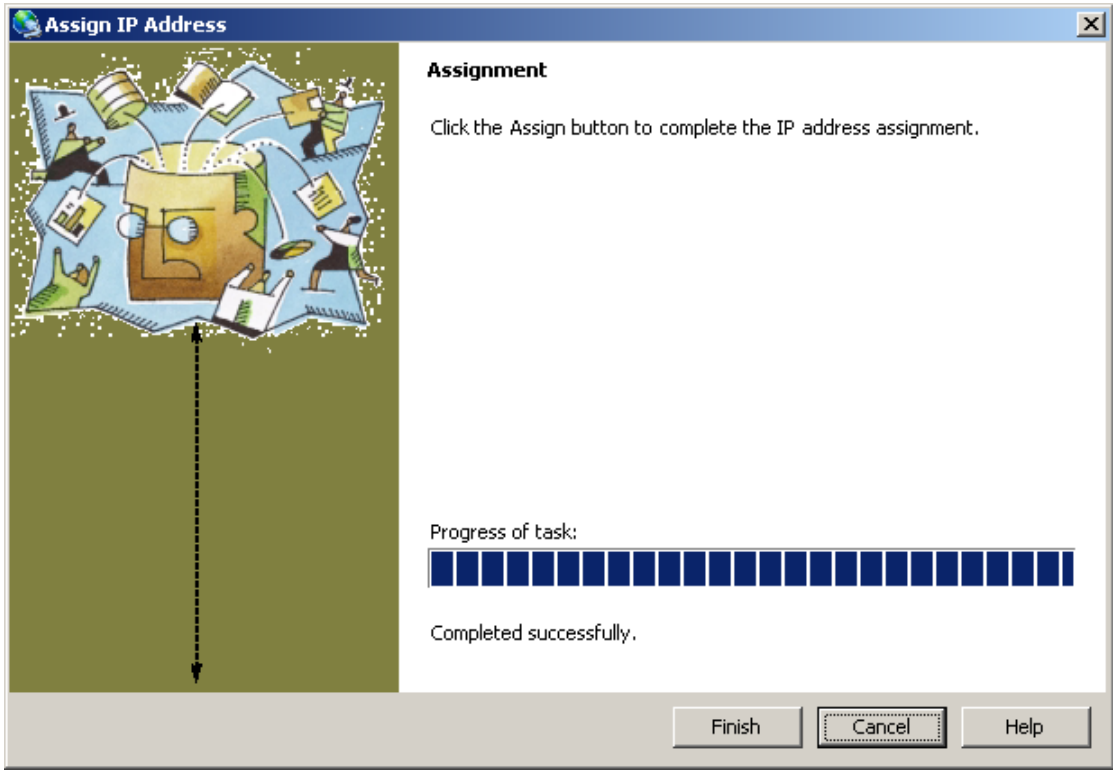
9. Click **Next**. A new dialog box appears.

10. At this dialog box, click the **Assign** button.

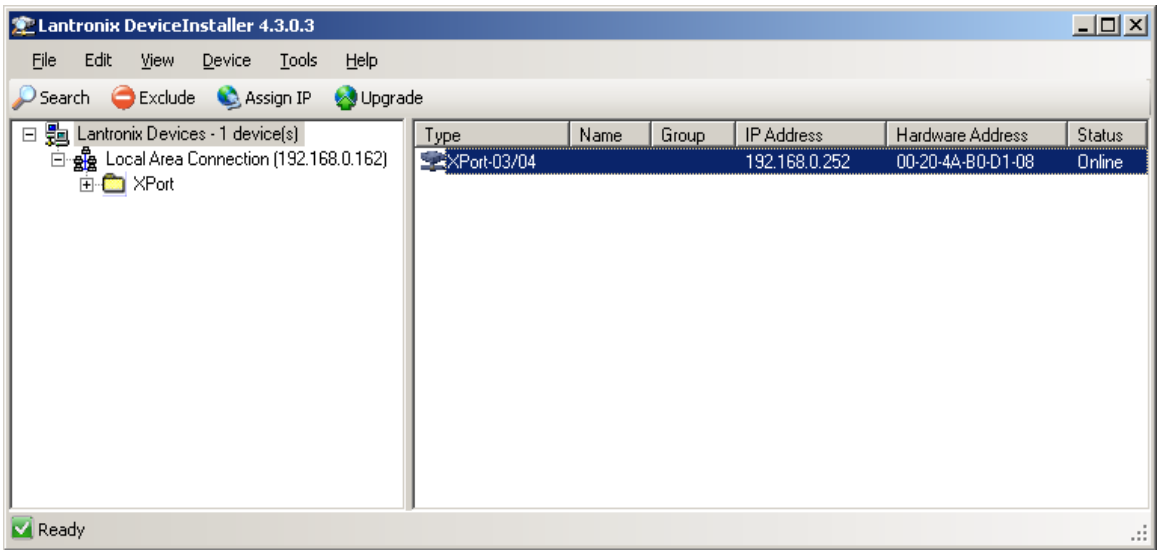


The dialog box will change to show a progress bar.

11. When the configuration is complete, the dialog box appears as follows:



12. Click **Finish**. The main DeviceInstaller screen should now show the ATS matching network with the new IP address.



13. Exit the DeviceInstaller utility. This completes the configuration of the ATS matching network's Ethernet interface.

Ethernet Operation

Connection

With the optional Ethernet interface installed, the ATS matching network unit will accept a TCP/IP connection to port 10001. Only one TCP/IP connection at a time will be accepted. The Ethernet interface will automatically negotiate the data rate, either 10Mbit or 100MBit.

The ATS matching network's Ethernet interface operates as a slave only and will not actively initiate a TCP/IP connection.

Command Set

Once the TCP/IP connection is established, the ATS matching network will respond to the serial commands as described in the SERIAL COMMANDS section.

Disconnection

An active TCP/IP connection can be terminated by:

1. The standard TCP/IP disconnection sequence initiated by the master that established the connection.

2. Letting the connection remain idle until the Ethernet card's disconnection timer runs out (1 minute).

Modbus Communications

Overview

Modbus is a data communication protocol that allows several Slave devices connected to an RS-485 bus to be controlled by a Master. Each Slave device has a unique ID or address that the Master uses to direct communication with each individual Slave. Configuration and status data within each Slave is accessed by the Master using a combination of addressable registers and single-bit quantities. The organization of a Slave's data as it appears to the Master is defined by the manufacturer of the Slave device.

The Modbus specification can be downloaded from www.modbus.org.

This section describes Seren IPS Inc.'s Modbus implementation for ATS-Series automatic matching networks. The two separate Modbus implementations are available, referred to as the ATS-Specific and MC2-Emulation implementations:

ATS-Specific Implementation

- The ATS behaves as a single Modbus Slave with one Slave ID or Address.
- Most ATS setup parameters and status values are available through various Modbus registers
- The serial interface is set for EVEN PARITY.
- Available with firmware version 4.6A and later

MC2-Emulation Implementation

- The ATS behaves as three Modbus Slaves with consecutive addresses.
- The available Modbus registers are the same as for the Seren IPS Inc. MC2 Matching Network Controller.
- The serial interface is set for NO PARITY.
- Available with firmware version 4.2A and later.

ATS-Series matching networks support connection to either a 4-wire or 2-wire RS-485 bus for Modbus communication.

Transmission Mode

The Modbus specification describes two modes of data transmission over serial lines: ASCII and RTU. The ATS-Series matching network supports only the RTU mode.

Decimal and Hexadecimal Data

Throughout this document, numeric values preceded by "0x" are hexadecimal. Unless otherwise noted, all other values are decimal.

Configuring the ATS-Series Matching Network for Modbus Communications

Remote Panel Method

Configuring the ATS-Series Automatic Impedance Matching Network for Modbus communications is described in a step-by-step manner below. This example assumes the *optional* Remote Display Panel is used to configure the ATS-Series matching network.

Note: The ATS-Series matching network currently cannot be configured for Modbus communications using RS-232 serial commands - the ability to do so is not currently implemented. Also, once Modbus communications is selected/enabled, the Serial Interface connector (RS-232 or Modbus protocol) cannot be used to change the serial mode/protocol. The optional Remote Display Panel is needed to select Modbus protocol and to change from Modbus protocol to other protocols/interfaces, as the current implementation of Modbus protocol does not provide commands to select other communications protocols.

Refer to the Serial connector pin list in the Controls and Connections section for RS-422/RS-485/ Modbus interface wiring details.

Modbus Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
1.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the Serial/Modbus cable from the SERIAL connector.
2.	Connect/enable the power to the ATS-Series matching network.
5.	Enter the programming menu - press the PRG button (item 1) on the *optional* Remote Display Panel.
6.	Press the DOWN button (item 2) on the *optional* Remote Display Panel until the third display line indicates one of the following communications protocols: RS232 RS422 RS485-4 RS485-2 MODBUS 4W RTU MODBUS 2W RTU DEVICENET PROFIBUS
7.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select "MODBUS 4W RTU" or "MODBUS 2W RTU" communications protocol, as needed.
8.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed communications protocol selection is saved in non-volatile memory.

<table>
<tr><th colspan="3">Modbus Communication Configuration Steps – Remote Panel Method</th></tr>
<tr><th>STEP</th><th colspan="2">ACTION</th></tr>
<tr><td>9.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should look like:
ADDRESS # XX
(Where "XX" = the current address, "0" to "99")
<u>Address Selection Notes:</u>
a. Ensure the address is valid for the selected communications protocol. Valid Modbus Slave ID (address) range is "0" to "250"
b. If the MC2-Emulation implementation is selected (see below), this Slave ID will be the first of three consecutive Slave IDs the ATS-Series matching network will respond to. The maximum recommended Slave ID (address) setting for MC2-Emulation is "248". With the Slave ID (address) set to "248", the unit will respond to IDs of "248", "249", and "250".</td></tr>
<tr><td>10.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired Modbus Slave ID (address).</td></tr>
<tr><td>11.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed Modbus Slave ID (address) selection is saved in non-volatile memory.</td></tr>
<tr><td>12.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display one of the following data rates:
2400 BAUD
4800 BAUD
9600 BAUD
19200 BAUD
38400 BAUD
57600 BAUD
115200 BAUD</td></tr>
<tr><td>13.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired data rate.</td></tr>
<tr><td>14.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed communications data rate selection is saved in non-volatile storage.</td></tr>
<tr><td rowspan="3">15.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display one of the following Modbus implementations.</td></tr>
<tr><td>MULTIPLE ADDR: NO</td><td>ATS-Specific implementation - single Slave ID
(This is the default Modbus implementation setting.)</td></tr>
<tr><td>MULTIPLE ADDR: YES</td><td>MC2-Emulation - three consecutive Slave IDs
(Emulates Seren IPS Inc. model MC2 Matching Network Controller Modbus Implementation).</td></tr>
</table>

Modbus Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
16.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select the desired Modbus implementation.
17.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed Modbus implementation selection is saved in non-volatile storage.
18.	Press the RUN button.
19.	Disable/disconnect power to the ATS-Series matching network.
20.	Connect the Modbus cable to the SERIAL connector. (See the Controls and Connections section for Serial connector pin list and RS-422/RS-485/Modbus wiring)
21.	Enable/connect power to the ATS-Series matching network.

Modbus Data Types

The Modbus specification lists four types of data:

Type	Description
Discrete input	1-bit, read-only
Coils	1-bit, read/write
Input Register	16-bit integer, read-only
Holding Register	16-bit integer, read/write

The ATS-Series matching network's Modbus implementations only supports Holding Registers, some of which are considered read-only.

Floating Point (MC2-Emulation Implementation Only)

If the MC2-Emulation implementation is selected, each configuration or status value can be accessed as either an integer or as an IEEE-754 floating point number. All integer values are stored in 16-bit Holding Registers using the addresses shown in the Modbus Register Map below. All floating point values are stored in 32-bit Holding Registers using the addresses shown in the Modbus Register Map below.

Register Addressing

The Modbus RTU protocol allows a device to have up to 65536 Holding Registers, numbered from zero to 65535. The Modbus Register Map below uses the 0-to-65535 numbering method. Some Modbus Master software is written so that Holding Registers are numbered from 1 to 65536. If such software is used, it will be necessary to specify Holding Registers by adding 1 to the register addresses shown in the Register Map.

Modbus Register Map - ATS-Specific Implementation

Register Address		Direction	ATS Value	Range Of Value	Notes
100	(0x0064)	Read/Write	Control Bits		(1)
101	(0x0065)	Read/Write	Tune Preset 1	0 - 1000 (0.0% - 100.0%)	(2)
102	(0x0066)	Read/Write	Load Preset 1	0 - 1000 (0.0% - 100.0%)	(2)
103	(0x0067)	Read/Write	Aux Preset 1	0 - 1000 (0.0% - 100.0%)	(2)
104	(0x0068)	Read/Write	Tune Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
105	(0x0069)	Read/Write	Load Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
106	(0x006A)	Read/Write	Aux Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
107	(0x006B)	Read/Write	Tune Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
108	(0x006C)	Read/Write	Load Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
109	(0x006D)	Read/Write	Aux Preset 2	0 - 1000 (0.0% - 100.0%)	(2)
110	(0x006E)	Read/Write	Motion Control Bits		(3)
111	(0x006F)	Read/Write	Tune High Limit	20 - 1000 (2.0% - 100.0%)	(2)
112	(0x0070)	Read/Write	Tune Low Limit	0 - 980 (0.0% - 98.0%)	(2)
113	(0x0071)	Read/Write	Load High Limit	20 - 1000 (2.0% - 100.0%)	(2)
114	(0x0072)	Read/Write	Load Low Limit	0 - 980 (0.0% - 98.0%)	(2)
115	(0x0073)	Read/Write	RF-On Thresh, Phase	0 - 5000 mV	
116	(0x0074)	Read/Write	RF-On Thresh, Mag	0 - 5000 mV	
117	(0x0075)	Read/Write	RF-On Thresh, Power	0 - 5000 mV	
118	(0x0076)	Read/Write	RF-On Thresh, RF Probe	0 - 20000 V	
119	(0x0077)	Read/Write	RF-Off Delay	0 - 20000 mS	
120	(0x0078)	Read/Write	Tune Deadband	0 - 1250 mV	
121	(0x0079)	Read/Write	Tune High Speed Thresh	0 - 1250 mV	
122	(0x007A)	Read/Write	Tune Slowdown	0 - 100 mS	
123	(0x007B)	Read/Write	Load Deadband	0 - 1250 mV	
124	(0x007C)	Read/Write	Load High Speed Thresh	0 - 1250 mV	
125	(0x007D)	Read/Write	Load Slowdown	0 - 100 mS	
126	(0x007E)	Read/Write	Express Tuning Delay	0 - 9999 mS	
127	(0x007F)	Read/Write	Auto Delay, Tune	0 - 9999 mS	
128	(0x0080)	Read/Write	Auto Delay, Load	0 - 9999 mS	
129	(0x0081)	Read/Write	Backout Delay	50 - 5000 mS	
130 - 149	(0x0082 - 0x0095)	Reserved: write accepted but ignored, read always 0			
150	(0x0096)	Read-only	Tune cap position	0 - 1000 (0.0% - 100.0%)	(2)
151	(0x0097)	Read-only	Load cap position	0 - 1000 (0.0% - 100.0%)	(2)
152	(0x0098)	Read-only	Aux cap position	0 - 1000 (0.0% - 100.0%)	(2)
153	(0x0099)	Read-only	Phase error	-2500 to 2500 mV	
154	(0x009A)	Read-only	Magnitude error	-2500 to 2500 mV	
155	(0x009B)	Read-only	DC Probe reading, 1 V resolution, max depends on attenuation		
156	(0x009C)	Read-only	RF Probe reading, 1 V resolution, max depends on attenuation		
157	(0x009D)	Read-only	Current Probe reading, 0.01 A resolution, max depends on attenuation		
158	(0x009E)	Read-only	Aux RF Probe reading, 1 V resolution, max depends on attenuation		
159	(0x009F)	Read-only	Aux Current Probe reading, 0.01 A resolution, max depends on attenuation		

Modbus Register Map - ATS-Specific Implementation (continued)

Note 1 - Control Bits

The bits within the Control Bits register are used for various configuration settings.

Bit	15	14	13	12	11, 10	9, 8	7	6	5	4	3	2	1, 0
Func	rsvd	rsvd	rsvd	Aux Here	Backout Mode	Probe Selection	Anlg Rng	Aux Md	Load Md	Tune Md	Anlg Enab	Trig Md	Preset Mode

Bit(s)	Function	Data
15, 14, 13	Reserved	Always read as 0
12	Aux Here	0 = Aux Cap not installed, 1 = Aux Cap installed (read-only)
11, 10	Backout Mode	0 = None, 1 = Preset 2, 2 = Reverse Algorithm
9, 8	Probe Select	0 = DC Probe, 1 = RF Probe, 2 = Current Probe
7	Analog Range	0 = 5V, 1=10V
6	Aux Cap Mode	0 = Auto, 1=Manual
5	Load Cap Mode	0 = Auto, 1=Manual
4	Tune Cap Mode	0 = Auto, 1=Manual
3	Analog Enabled	0 = Analog Port Disabled, 1 = Analog Port Enabled
2	Trigger Mode	0 = Internal Trigger (RF-On), 1 = External Trigger
1, 0	Preset Mode	0 = Off, 1 = Internal, 2 = External

Note 2 - Capacitor Position

Capacitor position is specified and indicated by an integer representing a capacitor position with 0.1% resolution, 0.0% to 100.0%. For example, an integer value of 250 would represent 25.0%.

Note 3 - Motion Control Bits

The bits within the Motion Control Bits register are used to cause one or more capacitors to move.

Bit	15 - 7	6	5	4	3	2	1	0
Func	Reserved	Aux Targ	Load Targ	Tune Targ	Reserved	Reserved	GO P2	GO P1

Bit(s)	Function	Data
15 - 7	Reserved	Always read as 0
6	Aux Target Trigger	0-to-1 transition moves Aux cap to Aux Target (register 109)
5	Load Target Trigger	0-to-1 transition moves Load cap to Load Target (register 108)
4	Tube Target Triger	0-to-1 transition moves Tune cap to Tune Target (register 107)
3,2	Reserved	Always read as 0
1	Go To Preset 2	0-to-1 transition moves caps to Preset 2 positions
0	Go To Preset 1	0-to-1 transition moves caps to Preset 1 positions

Modbus Register Map - MC2-Emulation Implementation

ATS Value	Direction	Virtual Device	Modbus Registers		
			#	Integer	Floating Pt
Tune Cap Position (Note 1)	Read	1st Slave ID	(1)	0x01	0x8002
Tune Cap Preset (Note 4)	Read/Write	1st Slave ID	(2)	0x02	0x8004
Output Percentage, Tune Cap	Read	1st Slave ID	(3)	0x03	0x8006
Tune Cap Position (Note 1)	Read	1st Slave ID	(5)	0x05	0x800A
Proportional	Reads 0	1st Slave ID	(6)	0x06	0x800C
Integral	Reads 0	1st Slave ID	(8)	0x08	0x8010
Derivative	Reads 0	1st Slave ID	(9)	0x09	0x8012
Tune Cap Preset (Note 4)	Read/Write	1st Slave ID	(24)	0x18	0x8030
Ramp Rate	Reads 0	1st Slave ID	(35)	0x23	0x8046
Tune Cap Max (Note 1)	Read/Write	1st Slave ID	(111)	0x6F	0x80DE
Tune Cap Min (Note 1)	Read/Write	1st Slave ID	(112)	0x70	0x80E0
Tune Cap Man/Auto (Note 2)	Read/Write	1st Slave ID	(126)	0x7E	0x80FC
Phase (Note 3)	Read	1st Slave ID	(127)	0x7F	0x80FE
Load Cap Position (Note 1)	Read	2nd Slave ID	(1)	0x01	0x8002
Load Cap Preset (Note 4)	Read/Write	2nd Slave ID	(2)	0x02	0x8004
Output Percentage, Load Cap	Read	2nd Slave ID	(3)	0x03	0x8006
Load Cap Position (Note 1)	Read	2nd Slave ID	(5)	0x05	0x800A
Proportional	Reads 0	2nd Slave ID	(6)	0x06	0x800C
Integral	Reads 0	2nd Slave ID	(8)	0x08	0x8010
Derivative	Reads 0	2nd Slave ID	(9)	0x09	0x8012
Load Cap Preset (Note 4)	Read/Write	2nd Slave ID	(24)	0x18	0x8030
Ramp Rate	Reads 0	2nd Slave ID	(35)	0x23	0x8046
Load Cap Max (Note 1)	Read/Write	2nd Slave ID	(111)	0x6F	0x80DE
Load Cap Min (Note 1)	Read/Write	2nd Slave ID	(112)	0x70	0x80E0
Load Cap Man/Auto (Note 2)	Read/Write	2nd Slave ID	(126)	0x7E	0x80FC
Magnitude (Note 3)	Read	2nd Slave ID	(127)	0x7F	0x80FE
RF Voltage	Read	3rd Slave ID	(1)	0x01	0x8002
Target Setpoint	Reads 0	3rd Slave ID	(2)	0x02	0x8004
Output Percentage	Reads 0	3rd Slave ID	(3)	0x03	0x8006
Working Setpoint	Reads 0	3rd Slave ID	(5)	0x05	0x800A
Proportional	Reads 0	3rd Slave ID	(6)	0x06	0x800C
Integral	Reads 0	3rd Slave ID	(8)	0x08	0x8010
Derivative	Reads 0	3rd Slave ID	(9)	0x09	0x8012
DC Bias Voltage	Read	3rd Slave ID	(16)	0x10	0x8020
Target Setpoint	Reads 0	3rd Slave ID	(24)	0x18	0x8030
Ramp Rate	Reads 0	3rd Slave ID	(35)	0x23	0x8046
Load Cap Max	Reads 0	3rd Slave ID	(111)	0x6F	0x80DE
Load Cap Min	Reads 0	3rd Slave ID	(112)	0x70	0x80E0

Modbus Register Map - MC2-Emulation Implementation (continued)

Note 1: All cap positions are in percent. Position settings should be between 2% and 98% inclusive

Note 2: For man/auto settings, 0=auto and 1=manual.

Note 3: Phase and magnitude values are signed.

Note 4: If a preset value is changed while in manual mode, the capacitor position will change.

PROFIBUS Communications *(optional)*

The Seren IPS Inc. ATS-Series Automatic Impedance Matching Network supports several serial communications modes and interfaces. The communications mode is configured from the *optional* MCRS Remote Display Panel accessory programming menu or RS-232 Serial Interface commands. Available communications modes are: RS-232, RS-422, RS-485 4 Wire, RS-485 2 Wire, Modbus 4W RTU, Modbus 2W RTU, PROFIBUS, and DeviceNet.

PROFIBUS is an optional interface, and is not field-installable.

This section describes the usage and commands applicable to PROFIBUS. RS-232, RS-422, and RS-485 serial, Modbus, and DeviceNet protocols are discussed in their own respective sections of this manual.

The PROFIBUS interface connector is detailed in the Controls And Connections section.

In the following discussion:
The term "SLAVE" refers to the ATS-Series Matching Network.
The term "MASTER" refers to the user's (or system) PROFIBUS controller (user-supplied)

Hardware:

PROFIBUS Physical layer:	Siemens SPC3 with isolated driver/receiver.
Configuration switches:	None. PROFIBUS station ID is set via serial command or from the *optional* MCRS Remote Display Panel accessory. Baud rate is automatically detected.
Status Indicators:	None. PROFIBUS station ID and status is shown on the *optional* MCRS Remote Display Panel accessory while RF is off.
Connector Style:	9-Pin Female "D" connector

Software:

Communications Model:	PROFIBUS DP. Modular slave, 1 module max.
Device ID Number:	0ACB
GSD File Name:	SERN0ACB.GSD

(The GSD file and supporting files are located on the Seren IPS Product Information CD-ROM supplied with the ATS-Series Matching Network, in the \Match_Network_ATS-Series\ATS-Series_PROFIBUS_Info folder.)

Resources:

PROFIBUS and PROFINET International (PI) web site:	http://www.profibus.com
PROFIBUS/PROFINET North America web site:	http://us.profinet.com
PLC Academy web site:	http://www.plcacademy.com/

PROFIBUS Commands

Data Exchange: Master-to-Slave

BYTE	7	6	5	4	3	2	1	0
0	Load Target (high byte)							
1	Load Target (low byte)							
2	Tune Target (high byte)							
3	Tune Target (low byte)							
4	Auxiliary Cap Target (high byte)							
5	Auxiliary Cap Target (low byte)							
6	0	AltNull	0	GoTarget	GoPres2	GoPres1	SetPres2	SetPres1
7	DataValid	ProbeSel	LoadMd	TuneMd	Strike	TrigMd	Preset Control	

PROFIBUS Command Data Structure	
Data Field	Description
Bytes 0,1	Load Cap Target. Value in percent x 10, min = 0, max = 1000
Bytes 2,3	Tune Cap Target. Value in percent x 10, min = 0, max = 1000
Bytes 4,5	Auxiliary Cap Target. Value in percent x 10, min = 0, max = 1000
Byte 6 bit 0	Set Preset 1. Transition from 0 to 1 saves specified Target positions as Preset 1
Byte 6 bit 1	Set Preset 2. Transition from 0 to 1 saves specified Target positions as Preset 2
Byte 6 bit 2	Go To Preset 1 Positions. Transition from 0 to 1 moves caps to Preset 1 positions
Byte 6 bit 3	Go To Preset 2 Positions. Transition from 0 to 1 moves caps to Preset 2 positions
Byte 6 bit 4	Go To Target Positions. Transition from 0 to 1 moves caps to Target positions
Byte 6 bit 5	Reserved. Data ignored.
Byte 6 bit 6	Alternate Null. 0=Alternate Null deactivated. 1=Alternate Null activated.
Byte 6 bit 7	Reserved. Data ignored.
Byte 7 bit 7	Data valid. 0 = Data is not valid, slave will ignore all settings. 1 = Data is valid
Byte 7 bit 6	Probe select. 0 = RF probe selected, 1 = Current probe selected (see Slave to Master data)
Byte 7 bit 5	Load Capacitor Mode. 0 = Automatic. 1 = Manual
Byte 7 bit 4	Tune Capacitor Mode. 0 = Automatic. 1 = Manual
Byte 7 bit 3	Strike. Transition from 0 to 1 causes current cap positions to be saved as Preset 1.
Byte 7 bit 2	Trigger Mode. 0 = RF On/Off. 1 = External.
Byte 7 bits 1,0	Preset Control. 0 = Off. 1 = Internal. 2 = External

Data Exchange: Slave-To-Master

BYTE	7	6	5	4	3	2	1	0
0	Load Cap Position (high byte)							
1	Load Cap Position (low byte)							
2	Tune Cap Position (high byte)							
3	Tune Cap Position (low byte)							
4	Auxiliary Cap Position (high byte)							
5	Auxiliary Cap Position (low byte)							
6	RF ON	AltNull	0	0	0	0	0	0
7	DataValid	ProbeSel	LoadMd	TuneMd	0	Trigger	Preset Control	
8	Magnitude (high byte)							
9	Magnitude (low byte)							
10	Phase (high byte)							
11	Phase (low byte)							
12	DC Probe Voltage (high byte)							
13	DC Probe Voltage (low byte)							
14	RF Probe or Current Probe Reading (high byte)							
15	RF Probe or Current Probe Reading (low byte)							

PROFIBUS Reply Data Structure	
Data Field	Description
Bytes 0,1	Load Cap Position. Value in percent x 10, min = 0, max = 1000
Bytes 2,3	Tune Cap Position. Value in percent x 10, min = 0, max = 1000
Bytes 4,5	Auxilliary Cap Position. Value in percent x 10, min = 0, max = 1000
Byte 6 bit 7	RF On Status. 0 = RF-off condition detected. 1 = RF-on condition detected
Byte 6 bit 6	Alternate Null. 0=Alternate Null deactivated. 1=Alternate Null activated.
Byte 6 bits 5-0	Reserved. Always "0"
Byte 7 bit 7	DataValid. 0 = Data is not valid, master should ignore all values. 1 = Data is valid
Byte 7 bit 6.	Probe select. 0 = RF probe reading in bytes 14,15. 1 = Current probe reading in bytes 14,15
Byte 7 bit 5	Load Mode. 0 = Auto Load. 1 = Manual Load
Byte 7 bit 4	Tune Mode. 0 = Auto Tune. 1 = Manual Tune
Byte 7 bit 3	Reserved. Always "0"
Byte 7 bit 2	Trigger Mode. 0 = RF On/Off. 1 = External
Byte 7 bits 1,0	Preset Control. 0 = Off. 1 = Internal. 2 = External

PROFIBUS Reply Data Structure	
Data Field	Description
Bytes 8,9	Magnitude error signal. Signed integer, value in milli-Volts
Bytes 10,11	Phase error signal. Signed integer, value in milli-Volts
Bytes 12,13	DC Probe Voltage, value in Volts
Bytes 14,15	Reading from the probe selected according to Byte 7 bit 6 in the Master-to-Slave data. RF Probe reading: value in Volts. Current probe reading: value in Amps x 10 (example: 67 = 6.7 Amps).

Configuring the ATS-Series Matching Network for PROFIBUS Communications

PROFIBUS Setup - Remote Panel Method

Configuring the ATS-Series Automatic Impedance Matching Network for PROFIBUS communications is described in a step-by-step manner below. This example assumes the *optional* Remote Display Panel is used to configure the ATS-Series matching network. The matching network can also be configured in a similar manner using serial commands issued from a data terminal or a personal computer with terminal emulation software.

Refer to the PROFIBUS connector pin list in the Controls and Connections section for PROFIBUS interface wiring details.

Note: PROFIBUS is an *optional* communications interface.

PROFIBUS Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
1.	Disable RF power to the ATS-Series Matching Network.
2.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the PROFIBUS cable from the PROFIBUS connector.
3.	Connect/enable the power to the ATS-Series matching network.
4.	Enter the programming menu - press the PRG button (item 1) on the *optional* Remote Display Panel.

PROFIBUS Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
5.	Press the DOWN button (item 2) on the *optional* Remote Display Panel until the third display line indicates one of the following communications protocols: RS232 RS422 RS485-4 RS485-2 MODBUS 4W RTU MODBUS 2W RTU DEVICENET PROFIBUS
6	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select "PROFIBUS" communications protocol.
7.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed communications protocol selection is saved in non-volatile memory.
8.	Press the DOWN button (item 2) on the *optional* Remote Display Panel once. The display's third line should look like: ADDRESS # XXX (Where "XX" = the current address, "0" to "126") Note: Ensure the address is valid for the selected communications protocol. Valid PROFIBUS address range is "0" to "126"
9.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select the desired PROFIBUS address.
10.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed PROFIBUS address selection is saved in non-volatile memory.
11.	Press the UP button (item 3) on the *optional* Remote Display Panel once. The display's third line should display PROFIBUS
12.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel.
13.	Disconnect/disable the power to the ATS-Series Matching Network.
14.	Re-connect/re-enable the power to the ATS-Series Matching Network.

PROFIBUS Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
15.	With RF Power to the ATS-Series Matching Network OFF, observe the third display line. PROFIBUS status is displayed. Examples: PB 10 Awaiting Prm PB 10 Awaiting Cfg PB 10 Data Exchange PB 10 CHECK I/O CARD "PB" indicates PROFIBUS. The number following "PB" is the PROFIBUS station address. Range is 0 to 126. Status Messages: Awaiting Prm — The slave is waiting for Parameter data Awaiting Cfg — The slave is waiting for Config data Data Exchange — The slave is in Data Exchange mode CHECK I/O CARD — The slave unit's PROFIBUS I/O card is not responding.
16.	PROFIBUS setup complete.

PROFIBUS Setup - RS-232 Serial Interface Method

The RS-232 port (CONTROL connector) can be used to select PROFIBUS control and to specify the station (SLAVE) address.

Configuring the ATS-Series Automatic Impedance Matching Network for PROFIBUS communications is described in a step-by-step manner below. This example assumes a data terminal or personal computer with terminal emulation software and a RS-232 serial port is used to configure the ATS-Series matching network. The matching network can also be configured using the *optional* Remote Display Panel.

Refer to the CONTROL connector pin list in the Controls and Connections section for serial interface wiring details. Refer to the Serial Communications section for detailed information on serial commands and serial command syntax. In the instructions below, the carriage return character, <CR>, is generated by pressing the "enter" key on the data terminal or personal computer, the space character ,<sp>, is generated by pressing the space bar.

Note: PROFIBUS is an ***optional*** communications interface.

PROFIBUS Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
1.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the PROFIBUS cable from the unit's PROFIBUS connector.
2.	Connect/enable the power to the ATS-Series matching network.
3.	Connect the ATS-Series matching network's "CONTROL" connector (serial port) to a RS-232 serial port on a data terminal or a computer running a terminal emulation application such as HyperTerminal. Configure the data terminal/terminal emulation software to match the ATS-Series matching network's serial communication parameters (baud rate, data bits, stop bits, parity, and hand-shaking). Factory default RS-232 serial communication parameters: 19200 baud, 8 data bits, 1 stop bit, parity =NONE, handshaking = NONE
4.	To make sure the following command is processed regardless of the current serial address/station address, send the following serial command: @99<CR>
5.	Enable character echo, making typed commands visible on the terminal. Send the following serial command: ECHO<CR>
6.	To select PROFIBUS control, send the following serial command: 7<sp>SMD<CR>

PROFIBUS Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
7.	To set the PROFIBUS station address, send the following serial command: XXX<sp>SAD<CR> Where "XXX" is the desired PROFIBUS station address, 1 to 3 characters in length. Note: PROFIBUS address range: 0 to 126. Factory default: 10.
8.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the RS-232 cable from the CONTROL connector.
9.	Connect the PROFIBUS cable to the PROFIBUS connector.
10.	Connect/enable the power to the ATS-Series matching network.
11.	PROFIBUS configuration complete.

DeviceNet ™ Communications

The Seren IPS Inc. ATS-Series Automatic Impedance Matching Network supports several serial communications modes and interfaces. The communications mode is configured from the optional MCRS Remote Display Panel accessory programming menu. Available communications modes are: RS-232, RS-422, RS-485 4 Wire, RS-485 2 Wire, Modbus 4W RTU, Modbus 2W RTU, PROFIBUS, and DeviceNet. ***DeviceNet is an optional interface***, and is not field-installable.

This section describes the usage and commands applicable to DeviceNet. RS-232, RS-422, and RS-485 serial, Modbus, and PROFIBUS protocols are discussed in their own respective sections of this manual.

The DeviceNet interface connector, configuration switches, and status indicators are detailed in the Controls And Connections section.

DeviceNet Communications Model:

Group 2 Only Server
Predefined Master/Slave Connection Set supported

DeviceNet Connections:

Connection Instance 1: Explicit
Connection Instance 2: Polled I/O

DeviceNet Specifications:

Vendor ID: 946 (3B2 hex)
Product Code: 302
Product Name: "Seren IPS ATS "
Message Body Format: DeviceNet 8/8
Minimum Time Between I/O Poll Commands: 20ms

Hardware:

DeviceNet Physical Layer:	Philips PCA82C250 CAN controller, optically isolated
Configuration Switches:	Rotary - Communications Rate, MAC ID
Status Indicators:	Network Status LED, Module Status LED
Connector Style:	5-pin Micro, Male, Sealed

Applicable Documents:

Title: DeviceNet Specification Volume I: DeviceNet Communication Model and Protocol
Version: Release 2.0, Errata 5 March 31, 2002
Source: ODVA

Title: DeviceNet Specification Volume II: DeviceNet Device Profiles and Object Library
Version: Release 2.0, Errata 5 March 31, 2002
Source: ODVA

Title: Interface Guidelines for DeviceNet Devices On Semiconductor Manufacturing Tools
Version: Revision: 2.5 09-Sept-2005
Source: ODVA Semiconductor Special Interest Group (SIG)

DeviceNet Electronic Data Sheet (EDS):

An EDS is available. An EDS file is located on the product information CD-ROM supplied with this product. EDS files are also available from Seren IPS representatives or Seren IPS technical support.

DeviceNet Product Codes and Product Names

Each model in the ATS-Series of matching networks has its own Product Code and Product Name. The Product Code is a 16-bit integer, and the Product Name is a 16-character ASCII string. These parameters are included in the Identity Object and can be obtained via DeviceNet using the Get Attribute Single request.

DeviceNet Product Codes and Product Names		
Product Code	**Product Name**	**Comment**
302	"Seren IPS ATS "	Generic ATS, model unspecified
303	"Seren ATS Custom"	Custom order, not a standard model
304	"Seren ATS3 "	
305	"Seren ATS3M "	
306	"Seren ATS6 "	
307	"Seren ATS6M "	
308	"Seren ATS10 "	
309	"Seren ATS10M "	
310	"Seren ATS20 "	
311	"Seren ATS30 "	
312	"Seren ATS50 "	
313	"Seren ATS150 "	
314	"Seren ATS Dual "	
351	"Seren ATS6D "	
316	"Seren ATS10/20D "	
317	"Seren ATS30/40D "	
318	"Seren ATS30M "	
319	"Seren ATS50/75 "	
320	"Seren ATS50/125 "	
321	"Seren ATS50/140 "	
322	"Seren ATS50M "	
323	"Seren ATS100/125"	
324	"Seren ATS100/140"	
325	"Seren ATS100/160"	

DeviceNet Product Codes and Product Names		
Product Code	**Product Name**	**Comment**
326	"Seren ATS150/140"	
327	"Seren ATS150/160"	
328	"Seren ATS150/180"	
329	"Seren ATS150/250"	
330	"Seren ATS300 "	

DeviceNet Product Serial Number Reporting

The product serial number assigned at the factory consists of the model type designation followed by a 4-digit number. For example, an ATS10 may have a serial number of ATS10-0117.

When the serial number is reported via DeviceNet, it is a 32-bit integer which, when shown as a decimal value, consists of the Product Code and the last 4 digits of the factory serial number.

For example, if the factory serial number is ATS10-0117, the DeviceNet-reported serial number is 3080117

ATS-Series Matching Network DeviceNet Operation:

When the ATS-Series matching network is powered up, it runs through a self-test, sends two "Duplicate MAC ID check" messages, and waits for a Master to establish a connection. To set up a connection, a Master should send "Allocate Master/Slave Connection Set" followed by "Set Single Attribute - Expected Packet Rate". After the connection is established, the Master may issue I/O Poll Command messages and the ATS-Series matching network will respond with I/O Poll Response messages.

In the following examples, the Master's MAC ID is 01, and the Slave's (ATS-Series matching network) MAC ID is 3F. Values are in hexadecimal.

Example 1: Allocate Master/Slave Connection Set

CAN ID:	5FE	Group 2, Destination MAC ID 3F, Message ID 6
Data Byte Count:	6	
Data:	01	Message header - source ID = 01
	4B	Service code = Allocate M/S Connection Set
	03	Class ID = DeviceNet
	01	Instance ID = 01
	03	Allocation choice = Polled + Explicit
	01	Allocator's MAC ID = 01

Example 2: Set Expected Packet Rate for the I/O Poll Connection

CAN ID:	5FC	Group 2, Destination MAC ID 3F, Message ID 4
Data Byte Count:	7	
Data:	01	Message header - source ID = 01
	10	Service code = Set Attribute Single
	05	Class ID = Connection
	02	Instance ID = I/O Poll
	09	Attribute = Expected Packet Rate
	00	Value LSB
	04	Value MSB (Value = 0400 = 1024_{10} ms)

I/O Poll Command/Response Assembly Data Formats

While the ATS-Series matching network is connected to the Master and I/O Polling is in progress, the Master periodically sends a data packet to the ATS-Series matching network and the ATS-Series matching network sends a data packet in response. In DeviceNet terminology, each data packet is called an "assembly". The direction of data transfer is always with respect to the Master, so that "out" means "from Master to Slave" and "in" means "from Slave to Master".

The format of the data within each assembly depends on which "Assembly Set" is selected. The ATS-Series matching networks support three Assembly Sets, each with different sizes and capabilities, depending on the application. This section describes each Assembly Set in detail.

The desired Assembly Set can be selected via DeviceNet by sending a Set Attribute Single explicit message to set the Consumed Connection Path of the I/O Poll Connection:

Assembly Set 1:	Set Attribute Single 20 04 24 64 30 03
Assembly Set 2:	Set Attribute Single 20 04 24 66 30 03
Assembly Set 3:	Set Attribute Single 20 04 24 68 30 03

When an Assembly Set is selected, the setting is retained while the ATS-Series matching network is powered off, so that it will not be necessary to re-select the Assembly Set each time the ATS-Series matching network is powered on.

The desired Assembly Set can also be selected using the *optional* MCRS Remote Display Panel or from the serial communications interface using RS-232 as described in the Configuring the ATS-Series Matching Network for DeviceNet Communications section of this manual.

DeviceNet Commands:

I/O Poll Command Format - Assembly ID 64hex

Assembly ID 64hex: From: Master To: Slave

BYTE	7	6	5	4	3	2	1	0
0	Load Preset LSB							
1	Load Preset MSB							
2	Tune Preset LSB							
3	Tune Preset MSB							
4	Aux Preset LSB							
5	Aux Preset MSB							
6	AuxRF		LoadMd	TuneMd		TrigMd	Preset Control	
7	GoTo	Strike	GoToAux			(reserved)	(reserved)	IGNORE
8	(reserved)							
9	(reserved)							

DeviceNet I/O Poll Command Data Structure	
Data Field	Description
Bytes 0, 1	Load Capacitor Preset, Value in (Percent * 10)
Bytes.2, 3	Tune Capacitor Preset, Value in (Percent * 10)
Bytes 4, 5	Auxiliary Capacitor Preset, Value in (Percent * 10)
Byte 6 bit 7	Select either Magnitude Error or Auxiliary (Aux) RF Probe report 0 = Magnitude Error, 1 = Auxiliary (Aux) RF Probe
Byte 6 bit 5	Load Capacitor Tuning Mode 0 = Automatic, 1 = Manual
Byte 6bit 4	Tune Capacitor Tuning Mode 0 = Automatic, 1 = Manual
Byte 6 bit 2	Trigger Mode 0 = RF On/Off, 1 = Externall
Byte 6 bits 1,0	Preset Control 0 = Off, 1 = Internal, 2 = External
Byte 7 bit 7	Move Load and Tune Capacitors to PRESET1 positions Transition from 0 to 1 causes capacitors to move to the Load and Tune preset positions
Byte 7 bit 6	Strike Transition from 0 to 1 causes the current Load and Tune capacitor positions to be saved as PRESET1
Byte 7 bit 5	Move Auxiliary Capacitor to Preset position Transition from 0 to 1 causes Auxiliary capacitor to move to the Preset position
Byte 5 bit 0	IGNORE 0 = Normal, 1 = Ignore While set, the ATS-Series matching network will ignore all other settings

I/O Poll Response Format - Assembly ID 65hex

Assembly ID 65hex: Slave to Master

BYTE	7	6	5	4	3	2	1	0
0	Load Position LSB							
1	Load Position MSB							
2	Tune Position LSB							
3	Tune Position MSB							
4	Aux Position LSB							
5	Aux Position MSB							
6	AuxRF		LoadMd	TuneMd		Trigger	Preset Control	
7	MovingLT		MovingA				Fault	IGNORE
8	Magnitude or Aux RF Probe LSB (see byte 6)							
9	Magnitude or Aux RF Probe MSB (see byte 6)							
10	Phase LSB							
11	Phase MSB							
12	DC Probe Voltage or Aux Current Probe LSB							
13	DC Probe Voltage or Aux Current Probe MSB							
14	RF Probe Voltage LSB							
15	RF Probe Voltage MSB							
16	Current Probe LSB							
17	Current Probe MSB							

DeviceNet I/O Poll Response Data Structure, Assembly ID 65hex	
Data Field	Description
Bytes 0, 1	Load Capacitor Position, Value in (Percent * 10)
Bytes 2, 3	Tune Capacitor Position, Value in (Percent * 10)
Bytes 4, 5	Auxiliary Capacitor Position, Value in (Percent * 10)
Byte 6 bit 7	Indicates whether Magnitude Error or Aux RF Probe is reported in bytes 8 and 9 0 = Magnitude Error Signal, 1 = Aux RF Probe
Byte 6 bit 5	Load Capacitor Tuning Mode 0 = Automatic, 1 = Manual
Byte 6 bit 4	Tune Capacitor Mode 0 = Automatic, 1 = Manual

DeviceNet I/O Poll Response Data Structure, Assembly ID 65hex	
Data Field	Description
Byte 6 bit 2	Trigger Mode 0 = RF On/Off, 1 = External
Byte 6 bits 1,0	Preset Control 0 = Off, 1 = Internal, 2 = External
Byte 7 bit 7	Load/Tune capacitors moving to preset positions 0 = Not Moving, 1 = Moving
Byte 7 bit 5	Auxiliary capacitor moving to preset position 0 = Not Moving, 1 = Moving
Byte 7 bit 1	Fault 0 = OK, 1 = Fault The FAULT bit is set if the DeviceNet interface card in the ATS-Series matching network looses communication with the matching network's main CPU.
Byte 7 bit 0	IGNORE 0 = Normal, 1 = Ignore While set, the ATS-Series Matching Network will ignore all other settings.
Bytes 8, 9	Magnitude Error, Value in millivolts, signed integer, or Aux RF Probe Value in Volts (see Byte 6, bit 7) Note: The Aux RF Probe is present only in units that have been modified/configured to include additional Aux RF Probe circuitry.
Bytes 10, 11	Phase Error, Value in millivolts, signed integer
Bytes 12, 13	DC Probe Voltage, Value in Volts, or Auxiliary Current Probe, Value in Amps*10 Note: The Aux Current Probe is present only in units that have been modified to change the DC Probe circuit into a second current probe circuit.
Bytes 14, 15	RF Probe Voltage, Value in Volts
Bytes 16, 17	Current Probe, Value in Amps*10

I/O Poll Command Format - Assembly ID 66hex

Assembly ID 66hex: Master to Slave

BYTE	7	6	5	4	3	2	1	0
0	Load Preset							
1	Tune Preset							
2	Not Used							
3	Not Used							
4			LoadMd	TuneMd		TrigMd	Preset Control	
5	GoTo	Strike						IGNORE

DeviceNet I/O Poll Command Data Structure, Assembly ID 66hex	
Data Field	Description
Byte 0	Load Capacitor Preset, Value in Percent, Min = 2, Max = 98
Byte 1	Tune Capacitor Preset, Value in Percent, Min = 2, Max = 98
Byte 4, bit 5	Load Capacitor Mode 0 = Automatic, 1 = Manual
Byte 4, bit 4	Tune Capacitor Mode 0 = Automatic, 1 = Manual
Byte 4, bit 2	Trigger Mode 0 = RF On/Off, 1 = External
Byte 4, bits 1, 0	Preset Control 0 = Off, 1 = Internal, 2 = External
Byte 5, bit 7	Move Load /Tune Capacitors To Preset1 Positions Transition from 0 to 1 causes move to Load and Tune preset positions
Byte 5, bit 6	Strike Transition from 0 to 1 causes the current Load and Tune capacitor positions to be saved as PRESET1
Byte 5, bit 0	IGNORE 0 = Normal, 1 = Ignore While set, the ATS-Series matching network will ignore all other settings

I/O Poll Response Format - Assembly ID 67hex

Assembly ID 67hex: Slave to Master

BYTE	7	6	5	4	3	2	1	0
0	Load Preset							
1	Tune Preset							
2	Probe Voltage LSB							
3	Probe Voltage MSB							
4			LoadMd	TuneMd		Trigger	Preset Control	
5							Fault	IGNORE
6	Magnitude LSB							
7	Magnitude MSB							
8	Phase LSB							
9	Phase MSB							
10	Load Position							
11	Tune Position							

DeviceNet I/O Poll Response Data Structure, Assembly ID 67hex	
Data Field	Description
Byte 0	Load Capacitor Preset, Value in Percent
Byte 1	Tune Capacitor Preset, Value in Percent
Bytes 2, 3	Probe Voltage, Value in Volts DC or RF probe as selected by remote command or optional MCRS Remote Display Panel
Byte 4, bit 5	Load Capacitor Mode 0 = Automatic, 1 = Manual
Byte 4, bit 4	Tune Capacitor Mode 0 = Automatic, 1 = Manual
Byte 4, bit 2	Preset Trigger Mode 0 = RF On/Off, 1 = External
Byte 4, bits 1,0	Preset Control 0 = Off, 1 = Internal, 2 = External
Byte 5, bit 1	Fault (0=OK, 1=Fault) The FAULT bit is set if the DeviceNet interface card in the ATS-Series matching network looses communication with the matching network's main CPU.
Byte 5, bit 0	Ignore 0 = Normal, 1 = Ignore If set, ignore all other data reported by the ATS-Series Matching Network
Bytes 6, 7	Magnitude Error, Value in millivolts, signed integer)
Bytes 8, 9	Phase Error, Value in millivolts, signed integer)
Byte 10	Current Load Capacitor Position, Value in Percent
Byte 11	Current Tune Capacitor Position, Value in Percent

I/O Poll Command Format - Assembly ID 68hex

Assembly ID 68hex: Master to Slave

BYTE	7	6	5	4	3	2	1	0
0	Series (Tune) Setpoint LSB							
1	Series (Tune) Setpoint MSB							
2	Shunt (Load) Setpoint LSB							
3	Shunt (Load) Setpoint MSB							
4	RF Power Split (Auxiliary) Setpoint LSB							
5	RF Power Split (Auxiliary) Setpoint MSB							
6	Reserved							
7	Reserved							
8	Reset			IGNORE		PS Preset	Preset	Mode

DeviceNet I/O Poll Command Data Structure, Assembly ID 68hex	
Data Field	Description
Bytes 0, 1	Series (Tune) Capacitor Preset, Value in (Percent * 10)
Bytes 2, 3	Shunt (Load) Capacitor Preset, Value in (Percent * 10)
Bytes 4, 5	RF Power Split (Auxiliary) Capacitor Setpoint, Value in (Percent * 10)
Bytes 6, 7,	Reserved
Byte 8, bit 7	Reset 0 = Normal, 1 = Reset
Byte 8, bit 4	Ignore 0 = Normal, 1 = Ignore While set, the ATS-Series matching network will ignore all other settings
Byte 8, bit 2	Move Power Split (Auxiliary) Capacitor to setpoint Transition from 0 to 1 transition initiates move
Byte 8, bit 1	Move Series/Shunt Capacitors to preset positions Transition from 0 to 1 transition initiates move
Byte 8, bit 0	Tuning Mode Select 0 = Manual, 1 = Automatic

I/O Poll Response Format - Assembly ID 69hex

Assembly ID 69hex: Slave to Master

BYTE	7	6	5	4	3	2	1	0
0	Series (Tune) Position LSB							
1	Series (Tune) Position MSB							
2	Shunt (Load) Position LSB							
3	Shunt (Load) Position MSB							
4	DC Probe Voltage LSB							
5	DC Probe Voltage MSB							
6	RF Probe Voltage LSB							
7	RF Probe Voltage MSB							
8						Alarm 1	Alarm 0	Mode
9	Reserved							
10	Power Split (Auxiliary) Capacitor Position LSB							
11	Power Split (Auxiliary) Capacitor Position MSB							
12	Power Split Ratio LSB							
13	Power Split Ratio MSB							

DeviceNet I/O Poll Response Data Structure, Assembly ID 69hex	
Data Field	Description
Bytes 0, 1	Series (Tune) Capacitor Position, Value in (Percent * 10)
Bytes 2, 3	Shunt (Load) Capacitor Position, Value in (Percent * 10)
Bytes 4, 5	DC Probe Voltage, Value in Volts
Bytes 6, 7	RF Probe Voltage, Value in Volts
Byte 8, bit 2	Alarm1: Power Split Alarm 0 = Alarm, 1 = OK
Byte 8, bit 1	Alarm0: Matching Network Alarm 0= Alarm, 1 = OK The Alarm0 bit is set to 0 if the DeviceNet interface card looses communication with the ATS-Series matching network's main CPU.
Byte 8, bit 0	Tuning Mode 0 = Manual, 1 = Automatic
Bytes 10. 11	Power Split (Auxiliary) Capacitor Position, Value in (Percent * 10)
Bytes 12, 13	Power Split Ratio

Configuring the ATS-Series Matching Network for DeviceNet Communications

DeviceNet Setup - Remote Panel Method

Configuring the ATS-Series Automatic Impedance Matching Network for DeviceNet communications is described in a step-by-step manner below. This example assumes the *optional* Remote Display Panel is used to configure the ATS-Series matching network. The matching network can also be configured in a similar manner using serial commands issued from a data terminal or a personal computer with terminal emulation software.

Refer to the DeviceNet connector pin list and DeviceNet switches and indicators in the Controls and Connections section for DeviceNet interface wiring details.

Note: DeviceNet is an *optional* communications interface.

DeviceNet Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
1.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the DeviceNet cable from the DeviceNet connector.
2.	If the ATS-Series matching network does not have DeviceNet switches and indicator LEDs, proceed to step 4.
3.	If the ATS-Series matching network has DeviceNet switches and indicator LEDs: a. Set the RATE switch to the desired data rate 1 = 125Kb, 2 = 250Kb, 5 = 500Kb, P = set by programming menu b. Set the DeviceNet address, "00" to "63", using the MSD and LSD switches. MSD = Most Significant Digit (10's column) LSD = Least Significant Digit (1's column) Factory default setting is "63"
4.	Connect/enable the power to the ATS-Series matching network.
5.	Enter the programming menu - press the PRG button (item 1) on the *optional* Remote Display Panel.
6.	Press the DOWN button (item 2) on the *optional* Remote Display Panel until the third display line indicates one of the following communications protocols: RS232 RS422 RS485-4 RS485-2 MODBUS 4W RTU MODBUS 2W RTU DEVICENET PROFIBUS

<table>
<tr><th colspan="3">DeviceNet Communication Configuration Steps – Remote Panel Method</th></tr>
<tr><th>STEP</th><th colspan="2">ACTION</th></tr>
<tr><td>7.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select "DEVICENET" communications protocol.</td></tr>
<tr><td>8.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed communications protocol selection is saved in non-volatile memory.</td></tr>
<tr><td>9.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should look like:
ADDRESS # XX
(Where "XX" = the current address, "0" to "99")
<u>Note:</u> Ensure the address is valid for the selected communications protocol. Valid DeviceNet address range is "0" to "64"
<u>Address Selection Notes:</u>
a. If the DeviceNet address switches are available (availability of DeviceNet interface controls and status indicators depends on matching network physical size and configuration), any address selection made via the programming menu (optional remote display panel) or remote command will be ignored.
b. It is strongly recommended that the programming menu's address selection parameter be set to match the DeviceNet address switch settings.</td></tr>
<tr><td>10.</td><td colspan="2">Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the optional Remote Display Panel to select the desired DeviceNet address.</td></tr>
<tr><td>11.</td><td colspan="2">Press the Enter "ENT" button (item 4) on the optional Remote Display Panel. The displayed DeviceNet address selection is saved in non-volatile memory.</td></tr>
<tr><td rowspan="2">12.</td><td colspan="2">Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display one of the following data rates:</td></tr>
<tr><td>500KBPS
250KBPS
125KBPS</td><td>Data rates for DeviceNet.
Displayed if DeviceNet protocol is selected.
<u>Data Rate Selection Notes:</u>
a. If a rear panel DeviceNet RATE switch is present, the DeviceNet data rate is determined by the RATE switch. The RATE switch setting overrides the display panel setting.
b. Set the rear panel RATE switch for the desired DeviceNet data rate:
5 = 500KBPS
2 = 250KBPS
1 = 125KBPS
c. It is strongly recommended that the programming menu data rate parameter be set to match the rear panel DeviceNet RATE switch setting.</td></tr>
</table>

DeviceNet Communication Configuration Steps – Remote Panel Method		
STEP	**ACTION**	
13.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select the desired DeviceNet data rate.	
14.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed DeviceNet communications data rate selection is saved in non-volatile storage.	
15.	Press the DOWN button (item 2) on the optional Remote Display Panel once. The display's third line should display on of the following Assembly Sets	
	DN Data 10 out 18 in	This is the default Assembly Set for the ATS-Series matching network. Master sends 10 bytes (Assembly ID 64hex) The ATS network returns 18 bytes (Assembly ID 65hex)
	DN Data 6 out 12 in	This Assembly Set emulates the Seren IPS Inc. MC2 Matching Network Controller with DeviceNet interface. Master sends 6 bytes (Assembly ID 66hex) The ATS network returns 12 bytes (Assembly ID 67hex)
	DN Data 9 out 14 in	This is an alternate Assembly Set Master sends 9 bytes (Assembly ID 68hex) The ATS network returns 14 bytes (Assembly ID 69hex)
16.	Use the VALUE UP button (item 5) or the VALUE DOWN button (item 6) on the *optional* Remote Display Panel to select the desired DeviceNet Assembly Set.	
17.	Press the Enter "ENT" button (item 4) on the *optional* Remote Display Panel. The displayed DeviceNet communications Assembly Set selection is saved in non-volatile storage.	
18.	Press the RUN button.	
19.	Disable/disconnect power to the ATS-Series matching network.	
20.	Connect the DeviceNet cable to the DeviceNet connector.	
21.	Enable/connect power to the ATS-Series matching network.	

DeviceNet Communication Configuration Steps – Remote Panel Method	
STEP	**ACTION**
22.	If the ATS-Series matching network has DeviceNet status indicator LEDs, they should light up in the following sequence: NET and MOD both flash green briefly (normal turn-on behavior) NET off MOD green NET off MOD red NET green MOD green NET red MOD green NET off MOD off NET amber MOD amber NET off MOD off
23.	Once the power-on sequence is complete, the MOD indicator should stay solid (steady) green. The NET indicator should either be flashing green (waiting for a connection) or solid (steady) green (connection established). If the NET indicator is red, check the following: a. Ensure power is available on the DeviceNet network. b. Ensure the DeviceNet network is properly terminated. c. Ensure the ATS-Series matching network's address is valid. d. Ensure the ATS-Series matching network's data rate is set to match the DeviceNet network data rate. e. Ensure the ATS-Series matching network's address is not the same as another device on the network. If the MOD indicator is red: Check the Communications Protocol parameter selection (Via programming menu or serial command) - ensure the Communications Protocol is set to "DEVICENET". If the DeviceNet status indicators remain amber color: Check the Communications Protocol selection (via programming menu or remote command) – ensure the communications protocol is set to "DEVICENET"
24.	DeviceNet setup complete

DeviceNet Setup - RS-232 Serial Interface Method

Configuring the ATS-Series Automatic Impedance Matching Network for DeviceNet communications is described in a step-by-step manner below. This example assumes a data terminal or personal computer with terminal emulation software and a RS-232 serial port is used to configure the ATS-Series matching network. The matching network can also be configured using the *optional* Remote Display Panel.

Refer to the CONTROL connector pin list in the Controls and Connections section for serial interface wiring details. Refer to the Serial Communications section for detailed information on serial commands and serial command syntax. In the instructions below, the carriage return character, <CR>, is generated by pressing the "enter" key on the data terminal or personal computer, the space character ,<sp>, is generated by pressing the space bar.

Note: DeviceNet is an *optional* communications interface

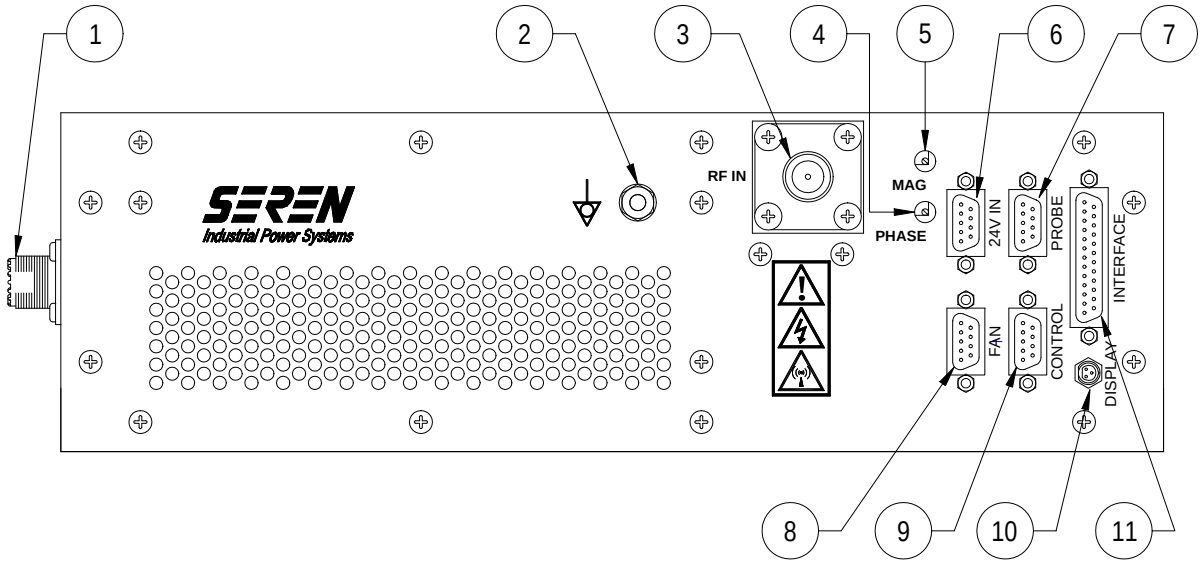
DeviceNet Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
1.	Disconnect/disable the power to the ATS-Series Matching Network. Disconnect the DeviceNet cable from the unit's DeviceNet connector.
2.	If the ATS-Series matching network does not have DeviceNet switches and indicator LEDs (DeviceNet controls) proceed to step 4.
3.	If the ATS-Series matching network has DeviceNet switches and indicator LEDs: a. Set the RATE switch to the desired data rate 1 = 125Kb, 2 = 250Kb, 5 = 500Kb, P = set by programming menu Factory default setting is "5" b. Set the desired DeviceNet address, "00" to "63", using the MSD and LSD switches. MSD = Most Significant Digit (10's column) LSD = Least Significant Digit (1's column) Factory default setting is "63"
4.	Connect/enable the power to the ATS-Series matching network. Connect the ATS-Series matching network's "CONTROL" connector (serial port) to a RS-232 serial port on a data terminal or a computer running a terminal emulation application such as HyperTerminal. Configure the data terminal/terminal emulation software to match the ATS-Series matching network's serial communication parameters (baud rate, data bits, stop bits, parity, and hand-shaking). Factory default RS-232 serial communication parameters: 19200 baud, 8 data bits, 1 stop bit, parity =NONE, handshaking = NONE
5.	Enable character echo, making typed commands visible on the terminal. Send the following serial command: ECHO<CR>

DeviceNet Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
6.	Select RS-232 control. Send the following serial command: 0<sp>SMD<CR>
7.	Set the DeviceNet address. a. If the ATS-Series matching network *is* equipped with DeviceNet controls, set the DeviceNet address to match the address switch settings in step 3b, using the command below: XX<sp>SAD<CR> Where "XX" is the DeviceNet address indicated by the switch settings. b. If the ATS-Series Matching network is not equipped with DeviceNet controls, set the DeviceNet address as desired with the command below: XX <sp>SAD<CR> Where "XX" is the desired DeviceNet address. Note: DeviceNet address range: 0 to 63. Factory default: 63.
8.	Set the DeviceNet Data Rate. a. If the ATS-Series matching network *is* equipped with DeviceNet controls, set the DeviceNet data rate to match the rate switch setting in step 3a, using the command below: X<sp>DNDR<CR> Where "X" is the DeviceNet data rate indicated by the switch settings: "0" for 125kbps, "1" for 250kbps, or "2" for 500kbps. b. If the ATS-Series Matching network is not equipped with DeviceNet controls, set the DeviceNet data rate as desired with the command below: X<sp>DNDR<CR> Where "X" is the desired DeviceNet Data Rate:. "0" = 125kbps, "1" = 250kbps, "2" = 500kbps

DeviceNet Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
9.	Configure the ATS-Series matching network for the desired DeviceNet Assembly Set (data format). Details of DeviceNet data formats are discussed in other sections of this manual. Send the command: X<sp>DNDF<CR> Where "X" = 0, 1, or 2 as follows: 0 = Master sends 10 bytes (assembly ID 64hex). The ATS-Series matching network returns 18 bytes (Assembly ID 65hex) (Default Assembly Set) 1 = Master sends 6 bytes (Assembly ID 66hex). The ATS-Series matching network returns 12 bytes (Assembly ID 67hex) (Emulates the Seren IPS Inc. MC2 Matching Network Controller) 2 = Master sends 9 bytes (Assembly ID 68hex). The ATS-Series matching network returns 14 bytes (Assembly ID 69hex) (Alternate Assembly Set)
10.	Select DeviceNet control. Send the command: 6<sp>SMD<CR>
11.	Disconnect/disable the power to the ATS-Series Matching Network. Connect the DeviceNet cable to the DeviceNet connector.
12.	Connect/enable the power to the ATS-Series matching network.
13.	If the ATS-Series matching network has DeviceNet status indicator LEDs, they should light up in the following sequence: NET and MOD both flash green briefly (normal turn-on behavior) NET off MOD green NET off MOD red NET green MOD green NET red MOD green NET off MOD off NET amber MOD amber NET off MOD off

DeviceNet Communication Configuration Steps – RS-232 Serial Interface Method	
STEP	**ACTION**
14.	Once the power-on sequence is complete, the MOD indicator should stay off. The NET indicator should either be flashing green (waiting for a connection) or solid (steady) green (connection established). If the NET indicator is red, check the following: a. Ensure power is available on the DeviceNet network. b. Ensure the DeviceNet network is properly terminated. c. Ensure the ATS-Series matching network's address is valid. d. Ensure the ATS-Series matching network's data rate is set to match the DeviceNet network data rate. c. Ensure the ATS-Series matching network's address is not the same as another device on the network. If the MOD indicator is red: Check the Communications Protocol parameter selection (via programming menu or serial command) - ensure the Communications Protocol is set to "DEVICENET". If the both DeviceNet status indicators remain amber color: Check the Communications Protocol parameter selection (via programming menu or remote command) – ensure the Communications Protocol is set to "DEVICENET"
15.	DeviceNet configuration complete.

Controls and Connections



Side View, ATS3 Matching Network, Typical Configuration
Ethernet, PROFIBUS, and DeviceNet options *not installed*
Other models/configurations may differ in size and location of connectors

1. RF Output Connector

The RF output connector varies depending on model type and configuration ordered. The RF output connector location may also vary depending on model type and configuration ordered. Consult the factory for available output connection options.

The ATS-Series matching networks may be configured with:

1. No output connector - the systems integrator/user is responsible for making the RF output connection to internal components.
2. One or more industry-standard coaxial output connectors (Types C, N, HN, UHF, 7/16 DIN)
3. Stud Terminals
4. High-Current Posts and Sockets
5. Connecting Straps
6. Custom output connector(s)

If the ATS-Series matching network is configured with an industry-standard coaxial output connector (Types C, N, HN, UHF, 7/16 DIN), the center pin is "RF" hot, internally connected to the Tune (series) capacitor. The threaded shell is RF Return, connected to the ATS-Series matching network's chassis.

2. Equipotential Bonding Terminal

10-32 x 1" long stud, supplied with 2 washers and a hex nut. Directly connected to the ATS-Series matching network's chassis. Connect to the plasma chamber frame ground or system frame ground and the RF Generator's Equipotential bonding terminal or chassis with a 2" or wider piece of silver plated copper strap. Keep strap connections as short as possible. Used to minimize RF circulating currents within a processing system.

3. RF Input Connector

Coaxial RF Connector. Center pin is RF 'Hot", internally connected to the load capacitor and the series inductor. The threaded shell is RF Return, connected to the ATS-Series matching network chassis. The actual connector type depends on the model type, power rating, and configuration of the matching network. The table below lists typically available connectors for various models.

Model:	**RF Input Connector**
ATS3, ATS6, ATS10	Type N Female
ATS20	Type N Female, Type HN Female
ATS30	Type HN Female, 7/16 DIN Female
ATS50	7/16 DIN Female, Type LC Female
ATS100	7/16 DIN Female, Type LC Female
ATS150	Type LC Female, 1-5/8" EIA Flange
ATS300	1-5/8" EIA Flange

4. Phase Error Sensor Null Adjustment Potentiometer

Used to align the ATS-Series Automatic Matching Network during system set-up. Associated with controlling the operation of the Tune (series) capacitor in automatic operating mode. See Troubleshooting instructions for details

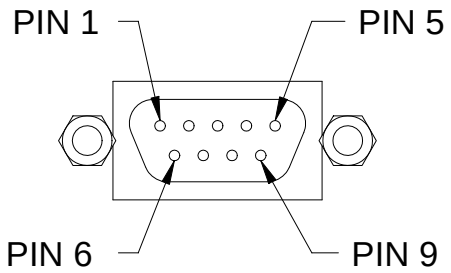
5. Magnitude Error Sensor Null Adjustment Potentiometer

Used to align the ATS-Series Automatic Matching Network during system set-up. Associated with controlling the operation of the Load (shunt) capacitor in automatic operating mode. See Troubleshooting instructions for details

6. 24VDC Power Input Connector

+24VDC power input to the ATS-Series matching network. Connects to System/User supplied external power source.

Connector Type: 9-Pin Male "D" Connector.



24V CONNECTOR

24V Connector Pin List		
Pin	**Signal**	**Description**
1	+24	+24VDC Power Input. Internally connected to pins 2, 6, and 7
2	+24	+24VDC Power Input. Internally connected to pins 1, 6, and 7
3	-	No Connection
4	GND	24VDC Return. Internally connected to chassis ground.
5	GND	24VDC Return. Internally connected to chassis ground.
6	+24	+24VDC Power Input. Internally connected to pins 1, 2, and 7
7	+24	+24VDC Power Input. Internally connected to pins 1, 2, and 6
8	GND	24VDC Return. Internally connected to chassis ground.
9	GND	24VDC Return. Internally connected to chassis ground.

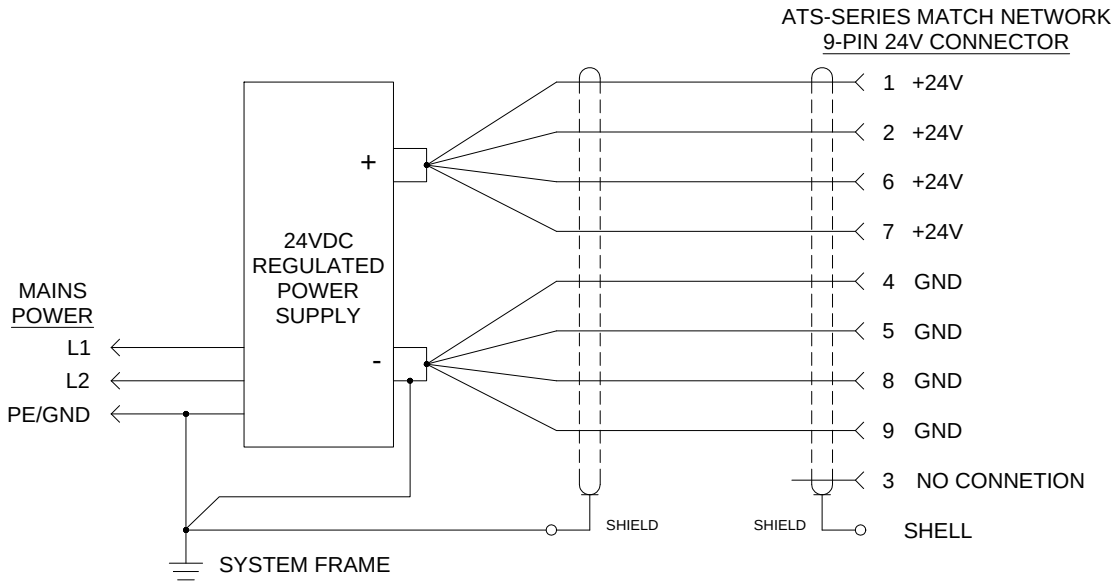
Power Requirements and Recommended Power Supply

Seren IPS recommends the use of a regulated 24VDC power supply capable of delivering 24VDC +/-1VDC at 3.0A, continuous duty. The 24VDC power supply is provided by the systems integrator / user.

Nominal Current Load: 1A
Peak/Maximum Current Requirement: 3A

Recommended Power Wiring:

Seren IPS recommends connecting to all power pins with individual wires, 22AWG for cable runs up to 12 feet. For cable runs over 12 feet, 18 AWG wire is preferred. The use of multiple wires is intended to keep voltage drop to a minimum and ensure there is enough current available for transient load changes. The use of shielded cable is recommended for systems where Electro-Magnetic Compatibility (EMC/Emissions) is a concern. Detailed discussions of EMC concerns and methods are beyond the scope of this document.

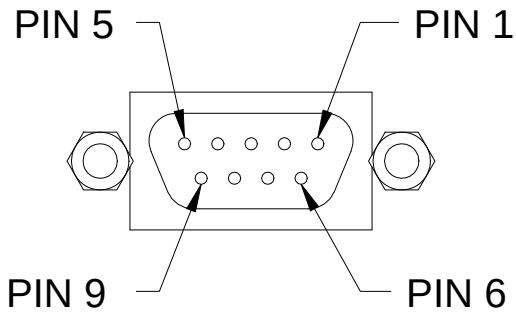


CONNECTION TO POWER SOURCE / POWER WIRING

7. Probe Connector

Provides analog signal outputs (DC Bias and RF Probe) for monitoring by the processing system or, by interconnection to the RF power supply, for use as a feedback signal for regulating the RF power supply's output.

Connector Type: 9 Pin "D" Female



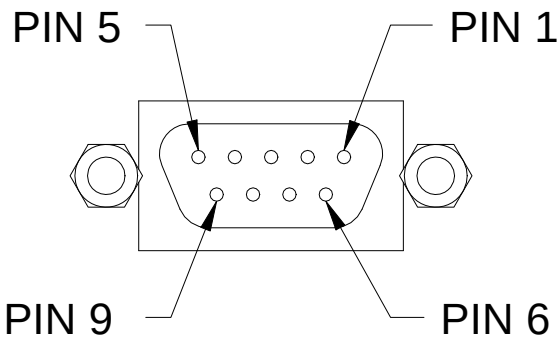
PROBE CONNECTOR

PROBE Connector Pin List		
Pin	**Signal**	**Description**
1	-	No Connection
2	DCP	DC Voltage Probe Output, Analog, 0 to 10VDC. The DC Voltage Probe attenuation factor is not applied to this signal.
3	RFP	RF Voltage Probe Output, Analog, 0 to 10VDC. The RF Voltage Probe attenuation factor is not applied to this signal.
4	PROBE	Selected Probe Output, Analog, 0 to 10VDC. The Probe source is selected via the PRB0 or PRB1 serial commands or by using the *optional* Remote Display Panel Feedback Source (Probe) Select parameter. Probe attenuation factors are not applied to this signal.
5	-	No Connection
6	GND	Internally connected to chassis ground
7	GND	Internally connected to chassis ground
8	GND	Internally connected to chassis ground
9	GND	Internally connected to chassis ground

8. Fan Connector *(optional)*

Provides power to *optional* externally mounted cooling fan(s), if installed. Power rating, internal components, and application determine the need for an external fan.

Connector Type: 9 Pin "D" Female



FAN CONNECTOR

FAN Connector Pin List		
Pin	**Signal**	**Description**
1	FAN+	+24VDC nominal, current-limited output.
2	GND	Internally connected to chassis ground.
3	-	Reserved
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	-	Reserved
8	-	Reserved
9	-	Reserved

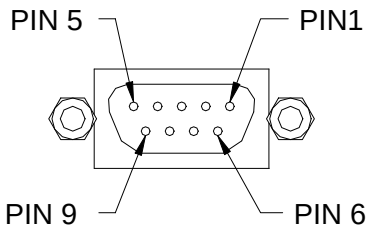
9. Control (Serial) Connector

For remote computer control, configuration, and monitoring of the ATS-Series matching network.

Supported serial interface protocols: RS-232, RS-422 2-Wire, RS-422 4 Wire, RS-485 2-Wire, RS-485 4 Wire, Modbus 4-Wire RTU, and Modbus 2-Wire RTU. Serial interface protocol type and data rate can be selected via remote command or the *optional* Remote Display Panel programming menu.

Fixed Serial Parameters: Parity: None
Number of data bits: 8
Number of stop bits: 1

Connector Type: 9 pin "D" female



Control Connector

For serial operation details, see the Serial Commands section of this manual.

SERIAL RS232 Connector Pin List		
Pin	**Signal**	**Description**
1	No Connection	No Connection
2	TXB-232	RS-232 Transmit Data Output (internally connected to pin 4)
3	RXB-232	RS-232 Receive Data Input
4	TXB-232	RS-232 Transmit Data Output (internally connected to pin 2) [2]
5	+RCV	RS-422/485–4 +RCV
6	-RCV	RS-422/485-4 -RCV
7	+XMIT	RS-422/485-4 +XMIT (RS-485-2 +RCV/XMIT)
8	-XMIT	RS-422/485-4 –XMIT (RS-485-2 -RCV/XMIT) [2]
9	COMMON	Common Return (internally connected to chassis ground)

Notes:

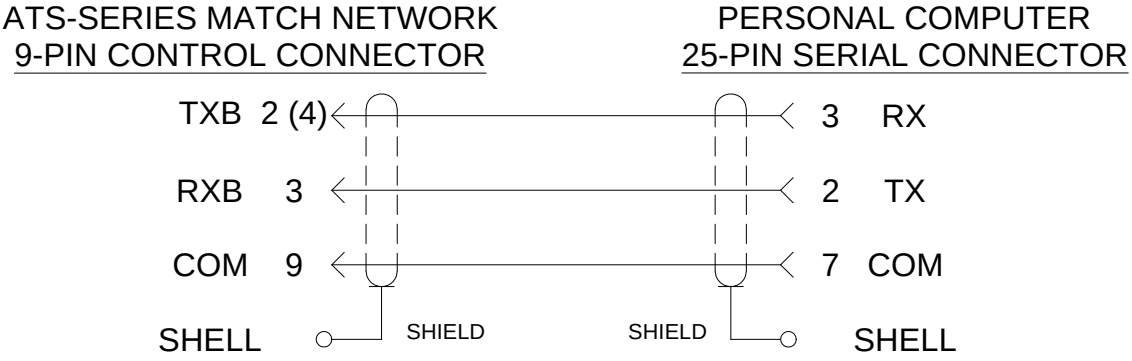
1. To accommodate multiple topologies and protocols, the Seren IPS ATS-Series matching network uses a non-standard serial connector pin arrangement.
2. Standard configuration shown. Control connector pin list may be custom configured for non-standard applications. RS-422/485 functionality may not be available for non-standard configurations. Consult factory for details.

RS-232 Serial Interface Wiring

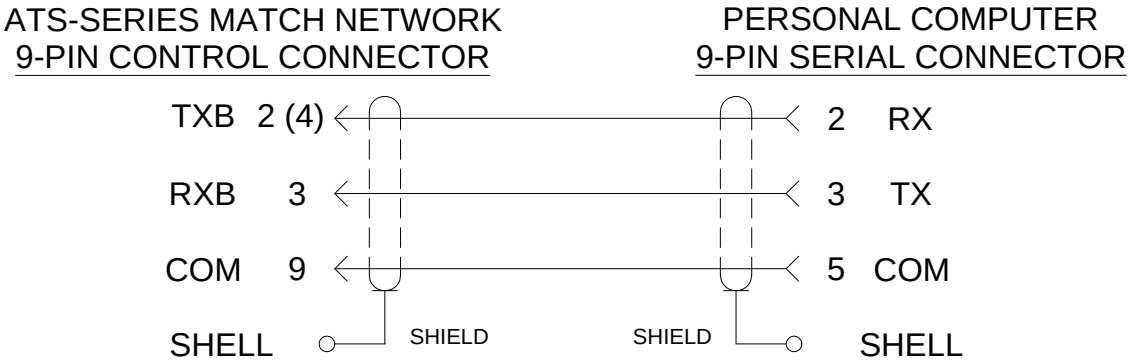
To accommodate multiple topologies and protocols, the Seren IPS ATS-Series matching network uses a non-standard serial connector pin arrangement. A generic "straight through" or "null modem" serial cable *will not work* properly for RS-232 connections between the ATS-Series matching network and a personal computer serial port.

Wiring for RS-232 serial interface connections to a personal computer is shown below. The user may construct a serial interface cable using the diagrams below or purchase a serial interface cable by contacting a Seren IPS representative or the factory.

The use of shielded cable for serial interface connections is strongly recommended. Maximum cable length for RS-232 is 30 meters at 9600 baud.



RS-232 Serial Interface Connections to Personal Computer, DB25 Connector



RS-232 Serial Interface Connections to Personal Computer, DB9 Connector

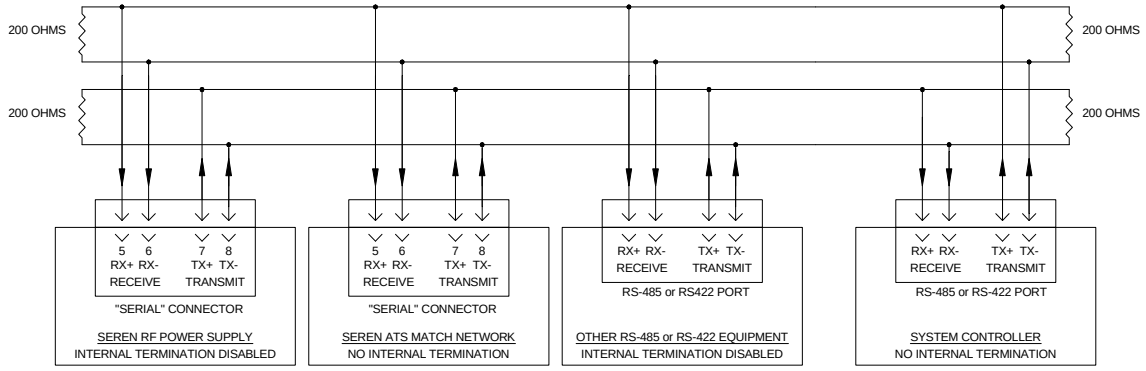
Seren Part Numbers for Serial Interface Cables (PC with DB9 Connector):

9100460072 CBL ASM: INTERFACE RS232 TO SEREN EQUIP DB9M/F 6'
9100460144 CBL ASM: INTERFACE RS232 TO SEREN EQUIP DB9M/F 12'
9100460288 CBL ASM: INTERFACE RS232 TO SEREN EQUIP DB9M/F 24'

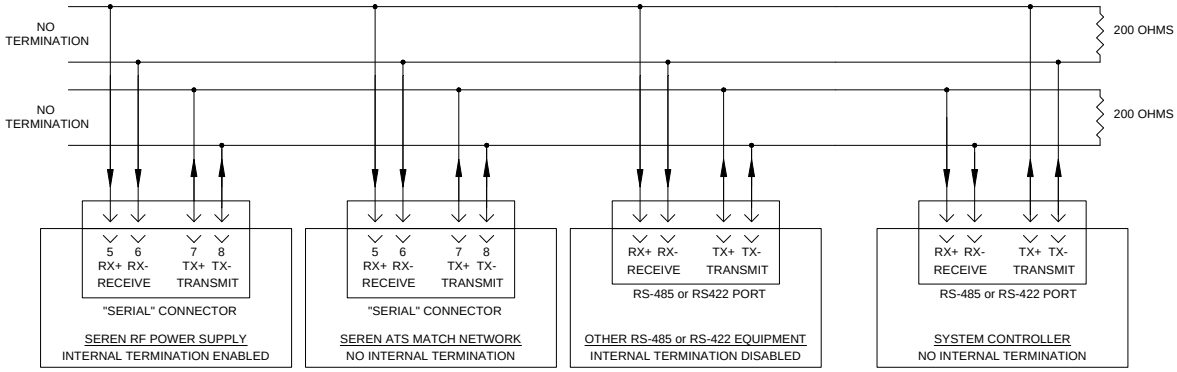
Serial Interface Wiring: 4-Wire RS-485, RS-422, and Modbus

Typical wiring for 4-Wire RS-485, RS-422, and MODBUS serial interface connections are shown below. Not all hardware manufacturers implement the industry-recommended connector pin-outs for RS-485/RS-422/MODBUS communications, so it is strongly advised that you consult the documentation provided with your RS-485/RS-422/MODBUS serial interface hardware, the Serial Interface Connector Pin List of the Seren product(s), and the serial interface pin list(s) of other devices to determine the proper wiring method for your hardware.

Seren IPS strongly recommends the use of low-capacitance shielded cable when making serial interface connections. The use of unshielded cable may result in data errors and other serial communication problems. Maximum cable length for RS485, RS-422, and Modbus is 1000 meters at 9600 baud.



Typical 4-Wire RS-485 / RS-422 / MODBUS Connections
Seren RF Power Supply with internal termination Disabled



Typical 4-Wire RS-485 / RS-422 / MODBUS Connections
Seren RF Power Supply with internal termination Enabled

Serial Bus Protocols:

All devices on the serial bus must be configured for the same protocol, RS-485 *or* RS-422 *or* MODBUS. *Do not mix protocols* on the serial bus.

Termination:

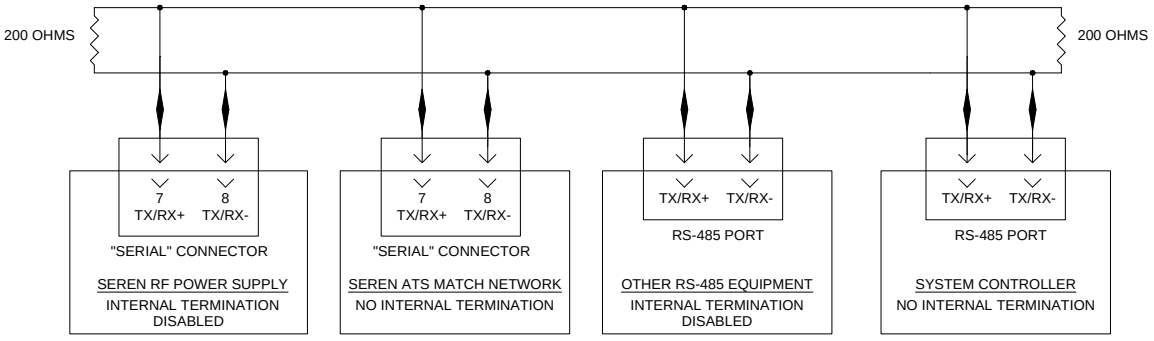
Seren IPS ATS-Series matching networks do not have internal termination resistors for the serial bus. The system integrator must supply termination resistors at the end of the serial bus.

If the system's RS-485/RS-422/MODBUS interface *does not* have built-in termination, the 200 Ohm termination resistors shown in the connection diagram above must be connected.

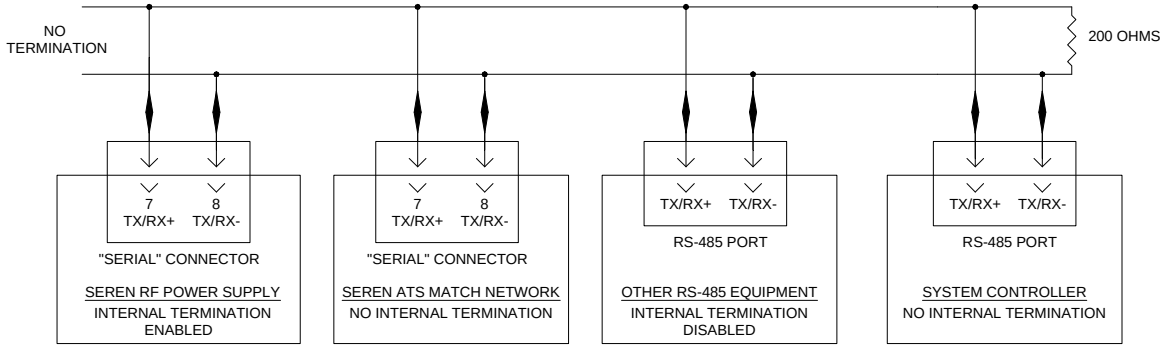
Serial Interface Wiring: 2-Wire RS-485 and Modbus

Typical wiring for 2-Wire RS-485 and MODBUS serial interface connections are shown below. Not all hardware manufacturers implement the industry-recommended connector pin-outs for RS-485/MODBUS communications, so it is strongly advised that you consult the documentation provided with your RS-485/MODBUS serial interface hardware, the Serial Interface Connector Pin List of the Seren product(s), and the serial interface pin list(s) of other devices to determine the proper wiring method for your hardware.

Seren IPS strongly recommends the use of low-capacitance shielded cable when making serial interface connections. The use of unshielded cable may result in data errors and other serial communication problems. Maximum cable length for RS-485 and Modbus is 1000 meters at 9600 baud.



Typical 2-Wire RS-485 Connections
Seren RF Power Supply with internal termination Disabled



Typical 2-Wire RS-485 Connections
Seren RF Power Supply with internal termination Enabled

Protocols:

All devices on the serial bus must be configured for RS-485 *or* MODBUS protocol. *Do not mix protocols* on the serial bus.

Termination:

Seren IPS ATS-Series matching networks do not have internal termination resistors for the serial bus. The system integrator must supply termination resistors at the end of the serial bus.

If the system's RS-485/RS-422/MODBUS interface *does not* have built-in termination, the 200 Ohm termination resistors shown in the connection diagram above must be connected.

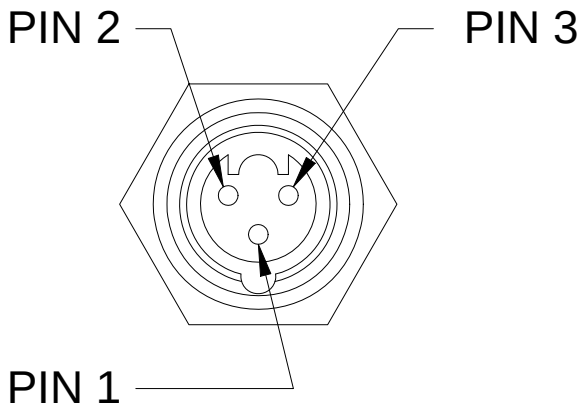
10. Display Connector

Connects to the *optional* Remote Display Panel. The Remote Display Panel provides a means to control the ATS-Series matching network and access operating parameters without the use of a system controller or personal computer. The ATS-Series matching network does not require the *optional* Remote Display Panel to operate.

The Display Connector only provides data signals to and from the *optional* Remote Display Panel – it does not provide power to operate the Remote Display Panel.

The *optional* Remote Display Panel can be connected to or disconnected from the ATS-Series matching network at any time, with power on or off.

Connector Type: 3-Pin Mini Circular Female, Locking
Mating Connector: 3-Pin Mini Circular Male, Locking, Neutrik type NSC3M



DISPLAY CONNECTOR

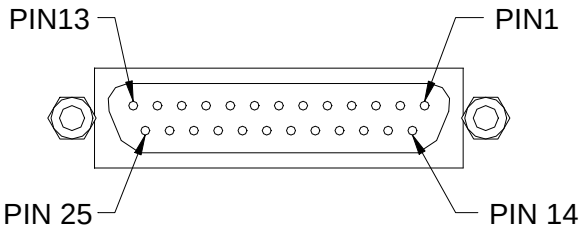
DISPLAY Connector Pin List		
Pin	**Signal**	**Description**
1	GND	Common. Internally connected to chassis ground
2	XMIT	Transmit Data Output
3	RCV	Receive Data Input

11. Interface Connector

Analog control signals for system interfacing. Basic operation of the ATS-Series matching network can be accomplished by connecting a programmable controller or custom control panel to the Interface connector.

Use shielded cable for making connections to system controller or external equipment.

Connector Type: 25 pin "D" female



Interface Connector
25 Pin "D" Female

All input signals, except the preset voltage inputs (pins 8, 10, and 12) and manual capacitor positioning inputs (pins 16, 17, 18, and 19), are ignored if the Analog Interface Control Enable/Disable programmable parameter is set to "ANALOG CONTROL OFF". Related Serial Commands: AIN, AIY. Analog output signals and Logic output signals are always active.

All Interface signals are referenced to the ATS-Series matching network's "Signal Ground".

INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
1	PRELOAD	Load capacitor preset trigger input. TTL/HCMOS compatible logic input, active low, internally pulled up to +5V. Apply a logic low signal for a minimum of 500 milli-seconds to trigger move-to-preset operation.
2	PRELOAD-ON	Load capacitor preset active output signal. TTL/HCMOS compatible logic output, active low. Internally pulled up to +5VDC. Logic low when the Load capacitor is being moved to the preset position, logic high when the load capacitor is not being pre-set.
3	PRETUNE-ON	Tune capacitor preset active output signal. TTL/HCMOS compatible logic output, active low. Internally pulled up to +5VDC. Logic low when the Tune capacitor is being moved to the preset position, logic high when the Tune capacitor is not being pre-set.

INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
4	PRETUNE	Tune capacitor preset trigger input. TTL/HCMOS compatible logic input, active low, internally pulled up to +5V. Apply a logic low signal for a minimum of 500 milli-seconds to trigger move-to-preset operation.
5	PREAUX	Auxiliary capacitor preset trigger input. TTL/HCMOS compatible logic input, active low, internally pulled up to +5V. Apply a logic low signal for a minimum of 500 milli-seconds to trigger move-to-preset operation. Note: Auxiliary capacitor not used/not present on most ATS-Series matching network models. May be used on some custom OEM configurations. Consult factory for details.
6	PREAUX-ON	Auxiliary capacitor preset active output signal. TTL/HCMOS compatible logic output, active low. Internally pulled up to +5VDC. Logic low when the Auxiliary capacitor is being moved to the preset position, logic high when the Auxiliary capacitor is not being pre-set. Note: Auxiliary capacitor not used/not present on most ATS-Series matching network models. May be used on some custom OEM configurations. Consult factory for details.
7	FAIL	General-purpose fault condition signal output. TTL/HCMOS compatible logic output, active high. Output state is logic high if a fault condition is detected; output state is logic low if there is no fault condition (normal).
8	AUXPSETV	Auxiliary capacitor position preset voltage input. Analog input. Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to +10.00VDC , selectable. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Related Programmable Parameters: Analog Interface Voltage Range Related Serial Commands: RNG5, RNG10. Note: Auxiliary capacitor not used/not present on most ATS-Series matching network models. May be used on some custom OEM configurations. Consult factory for details.

INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
9	AUXMETER	Auxiliary capacitor position output signal. Analog output. Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to 10.00VDC, selectable. Linearly proportional 0 to 100% of Auxiliary capacitor position. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Related Programmable Parameters: Analog Interface Voltage Range Related Serial Commands: RNG5, RNG10. Note: Auxiliary capacitor not used/not present on most ATS-Series matching network models. May be used on some custom OEM configurations. Consult factory for details.
10	LOADMETER	Load capacitor position output signal. Analog output. Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to 10.00VDC, selectable. Linearly proportional 0 to 100% of Load capacitor position. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Related Programmable Parameters: Analog Interface Voltage Range Related Serial Commands: RNG5, RNG10.
11	TUNEPSETV	Tune capacitor position preset voltage input. Analog input. The TUNEPSETV signal is ignored unless Preset Source Parameter is set to "PRESETS: ANALOG" Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to +10.00VDC , selectable. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Operational Note: If no signal is connected to the TUNEPSETV input and the Preset Source Parameter is set to "PRESETS: ANALOG", a default preset value will be used. The default preset value is typically 50%. Related Programmable Parameters: Analog Interface Voltage Range Preset Source Selection Related Serial Commands: RNG5, RNG10, OFF, INT, EXT.

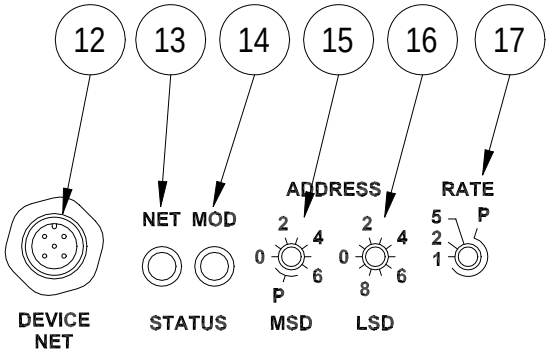
INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
12	LOADPSETV	Load capacitor position preset voltage input. Analog input. The LOADPSETV signal is ignored unless Preset Source Parameter is set to "PRESETS: ANALOG". Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to +10.00VDC , selectable. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Operational Note: If no signal is connected to the TUNEPSETV input and the Preset Source Parameter is set to "PRESETS: ANALOG", a default preset value will be used. The default preset value is typically 50%. Related Programmable Parameters: Analog Interface Voltage Range Preset Source Selection Related Serial Commands: RNG5, RNG10, OFF, INT, EXT
13	GND	Signal ground. Internally connected to chassis ground.
14	TUNEMODE	Tune capacitor automatic/manual mode select. TTL/HCMOS compatible logic input, internally pulled up to +5V. Logic high = automatic tuning mode, logic low = manual tuning mode (automatic tuning disabled).
15	LOADMODE	Load capacitor automatic/manual mode select. TTL/HCMOS compatible logic input, internally pulled up to +5V. Logic high = automatic tuning mode, logic low = manual tuning mode (automatic tuning disabled).
16	TUNEPOS+	Tune capacitor manual position – increase capacitance. TTL/HCMOS compatible logic input, internally pulled up to +5V. A logic low signal applied to TUNEPOS+ moves the Tune capacitor towards maximum capacitance. If a logic high signal or open circuit/no connection is applied, there is no capacitor movement.
17	TUNEPOS-	Tune capacitor manual position – decrease capacitance. TTL/HCMOS compatible logic input, internally pulled up to +5V. A logic low signal applied to TUNEPOS- moves the Tune capacitor towards minimum capacitance. If a logic high signal or open circuit/no connection is applied, there is no capacitor movement.

INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
18	LOADPOS+	Load capacitor manual position – increase capacitance. TTL/HCMOS compatible logic input, internally pulled up to +5V. A logic low signal applied to LOADPOS+ moves the Load capacitor moves towards maximum capacitance. If a logic high signal or open circuit/no connection is applied, there is no capacitor movement.
19	LOADPOS-	Load capacitor manual position – decrease capacitance. TTL/HCMOS compatible logic input, internally pulled up to +5V. A logic low signal applied to LOADPOS- moves the Load capacitor towards minimum capacitance. If a logic high signal or open circuit/no connection is applied, there is no capacitor movement.
20	DCV	DC Voltage Probe output. Analog output, range: 0 to +10VDC. Buffered signal from the ATS-Series matching network's internal DC Voltage Probe. May be used as a remote feedback source for an RF power supply or a monitoring point for process applications. Note: DC Probe Attenuation Factor is not applied to this signal.
21	TUNEMETER	Tune capacitor position output signal. Analog output. Range (selectable): 0.00VDC to +5.00VDC or 0.00VDC to 10.00VDC, selectable. Linearly proportional 0 to 100% of Tune capacitor position. 0.00VDC = minimum capacitance; +5.00VDC (5V range) or +10.00VDC (10V Range) = maximum capacitance. Related Programming Parameters: Analog Interface Voltage Range Related Serial Commands: RNG5, RNG10.
22	PROBE	Selected Probe output. Analog output, range: 0 to +10VDC Buffered signal from the ATS-Series matching network's internal DC Voltage Probe or internal RF Voltage probe, as selected by the Feedback Source (Probe) Select programmable parameter or PRB0/PRB1 serial commands. The selected Probe signal may be used as a remote feedback source for an RF power supply or a monitoring point for process applications. Note: Probe attenuation factor is not applied to this signal. Related Programming Parameters: Feedback Source (Probe) Select Related Serial Commands: PRB0, PRB1.

INTERFACE Connector Pin List		
Pin	**Signal**	**Description**
23	RFV	RF Voltage Probe output. Analog output, 0 to +10VDC. Buffered signal from the ATS-Series matching network's internal RF Voltage Probe. May be used as a remote feedback source for an RF power supply or a monitoring point for process applications. Note: RF Probe Attenuation Factor is not applied to this signal.
24	GND	Signal ground. Internally connected to chassis ground.
25	GND	Signal ground. Internally connected to chassis ground.

DeviceNet Interface Controls and Connector (optional, not shown in illustration)

ATS-Series matching networks equipped with an optional DeviceNet™ interface may or may not have the DeviceNet controls and status indicators. The availability and location of the controls and status indicators depends on the physical size of the ATS-Series matching network and the configuration ordered. Consult your local Seren IPS representative or the factory for configuration-specific details.

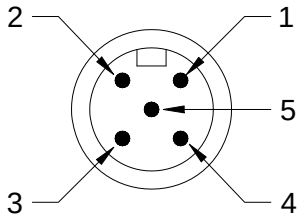


Typical DeviceNet Connector and Controls

12. DeviceNet Interface Connector (optional, not shown in illustration)

Permits remote computer control and monitoring of the matching network's parameters over the user's DeviceNet network. Use shielded cable to make DeviceNet interface connections.

Connector type: DeviceNet 5 pin Male micro-circular connector.



DeviceNet Connector

DeviceNet Connector Pin List		
Pin	**Signal**	**Description**
1	DRAIN	Shield drain connection. Internally connected to chassis ground
2	V+	DeviceNet termination power positive
3	V-	DeviceNet termination power negative
4	CAN_H	DeviceNet/CAN Bus data +
5	CAN_L	DeviceNet/CAN Bus data -

13. DeviceNet NET Status Indicator (optional)

After flashing during the power-up sequence, the Network (NET) status indicator shows the DeviceNet connection status, per the chart below: Additional details are explained in the DeviceNet communications section.

NET indicator	Status
Flashing Green	Waiting for connection
Solid Green	Connection Established
Solid Red	Problem with connection – check the following: 1. Ensure power is available on the DeviceNet Network. 2. Verify the DeviceNet network is properly terminated. 3. Verify the ATS-Series Matching Network's address is valid (0 to 63) 4. Ensure the ATS-Series Matching Network's data rate is appropriate for the DeviceNet network

14. DeviceNet MOD Status Indicator (optional)

After flashing during the power-up and connection sequence, the Module (MOD) status indicator should remain off. Additional details are explained in the DeviceNet communications section.

15. DeviceNet Address MSD Select Switch (Most Significant Digit) (optional)

Selects the most significant digit of the 2-digit DeviceNet address ("tens" column). Selection range is 0 to 6, and "P". The "P" position should not be used.

It is good practice to ensure the programmable parameter address is set to the same value indicated by the DeviceNet Address Select switches.

16. DeviceNet Address LSD Select Switch (Least Significant Digit) (optional)

Selects the least significant digit of the 2-digit DeviceNet address ("ones" column). Selection range is 0 to 9.

It is strongly recommended that the programmable parameter DeviceNet address be set to the same value indicated by the DeviceNet Address Select switches.

17. DeviceNet Data Rate Select Switch (optional)

Selects the DeviceNet network data rate. Data rate selections are listed below.

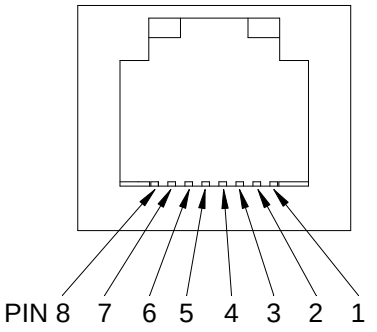
It is strongly recommended that the programmable parameter DeviceNet data rate is set to the same value indicated by the DeviceNet RATE select switch.

RATE Switch Setting	DeviceNet Data Rate
1	125 KBPS
2	250 KBPS
5	500 KBPS
P	Not supported, do not use.

18. Ethernet Communications Connector (optional, not shown in illustration)

Facilitates computer control and monitoring of the ATS-Series automatic matching network over the user's ETHERNET network. Use of Category 5 or better shielded cable to make ETHERNET interface connections is strongly recommended.

Connector Type: 8-Pin RJ-45 Female
Data Rate: 10Mbps (10Base-T) or 100Mbps (100Base-TX), auto-sensing



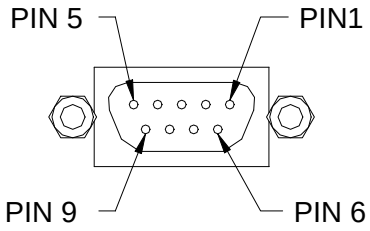
ETHERNET CONNECTOR

Ethernet Connector Pin List	
Pin	**Description**
1	Transmit Data +
2	Transmit Data -
3	Receive Data +
4	No Connection / Not used
5	No Connection / Not used
6	Receive Data +
7	No Connection / Not used
8	No Connection / Not used

19. PROFIBUS Communications Connector (optional, not shown in illustration)

Facilitates remote computer control and monitoring of the matching network's parameters over the user's PROFIBUS network. Use ProfiBus-specific shielded cable, wiring devices, and wiring practices to make PROFIBUS interface connections.

Connector type: 9-pin "D" female.



PROFIBUS Connector

PROFIBUS Connector Pin List		
Pin	**Signal**	**Description**
1	No Connection	No Connection
2	No Connection	No Connection
3	RxD/TxD-P	Data receive and transmit, positive
4	CNTR-P	Direction Control
5	DGND	Reference potential for +5V and data (isolated)
6	VP	+5VDC Termination Voltage (active termination)
7	No Connection	No Connection
8	RxD/TxD-N	Data receive and transmit, negative
9	No Connection	No Connection

PROFIBUS Interface Wiring

A technical discussion of PROFIBUS communications networking and interface wiring is beyond the scope of this document. Please refer to the PROFIBUS and PROFINET International (PI) web site (http://www.profibus.com) for general information. Technical information can be found at http://www.profibus.com/download.

Other useful resource links:

PROFIBUS/PROFINET North America: http://us.profinet.com
PLC Academy: http://www.plcacademy.com/profibus-cable-connector-termination/

TYPICAL INTERFACE CONNECTIONS

Analog Control via the Interface Connector

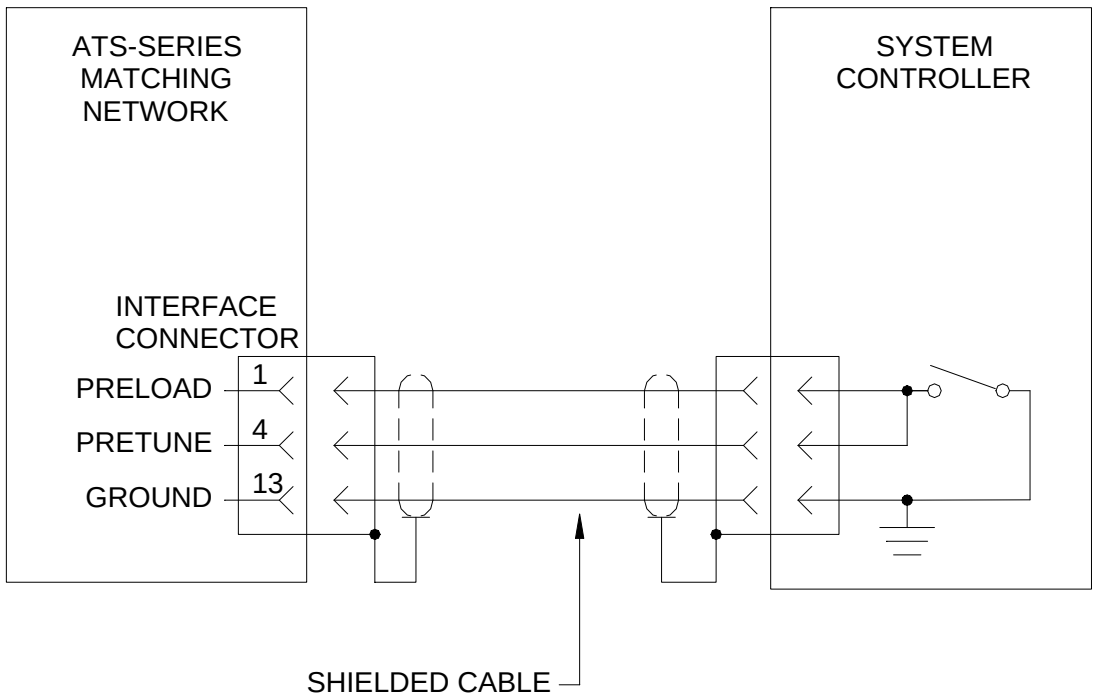
There are many possible analog control wiring schemes. The basic schemes shown below can be combined to make more sophisticated analog control schemes. Refer to the Interface connector pin list in the Controls and Connections section for signal details. Use shielded cable for all interconnections.

Basic Preset Operation

Simultaneously presets the ATS-Series matching network's Load and Tune capacitors to the internally stored positions (Programmable Parameters: Load Capacitor Preset Position 1; Tune Capacitor Preset Parameter 1;).

Apply a TTL logic LOW to the Interface Connector pins 1 and 4. Allow sufficient time for the capacitors to reach their preset point, then apply a TTL logic HIGH (or open circuit) to pins 1 and 4. Once the capacitors are positioned, enable RF power.

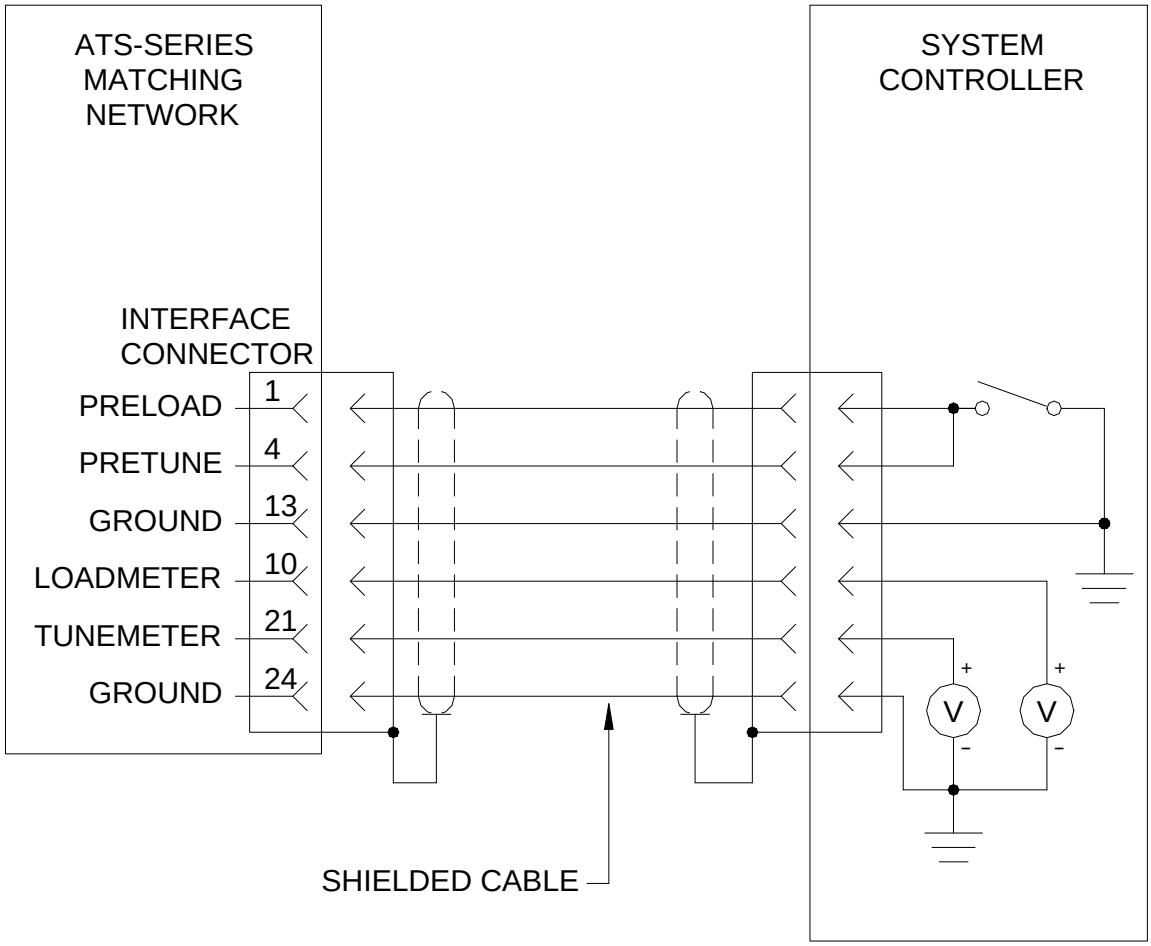
Requires setting of the ***Preset Source Selection*** programmable parameter to "PRESETS: INTERNAL" and the ***Analog Interface Control Enable/Disable*** programmable parameter to "ANALOG CONTROL ON".



Basic Preset

Basic Preset With Feedback

Operates the same as the Basic Preset Scheme above, but the system controller can monitor capacitor positions during preset and normal operation.



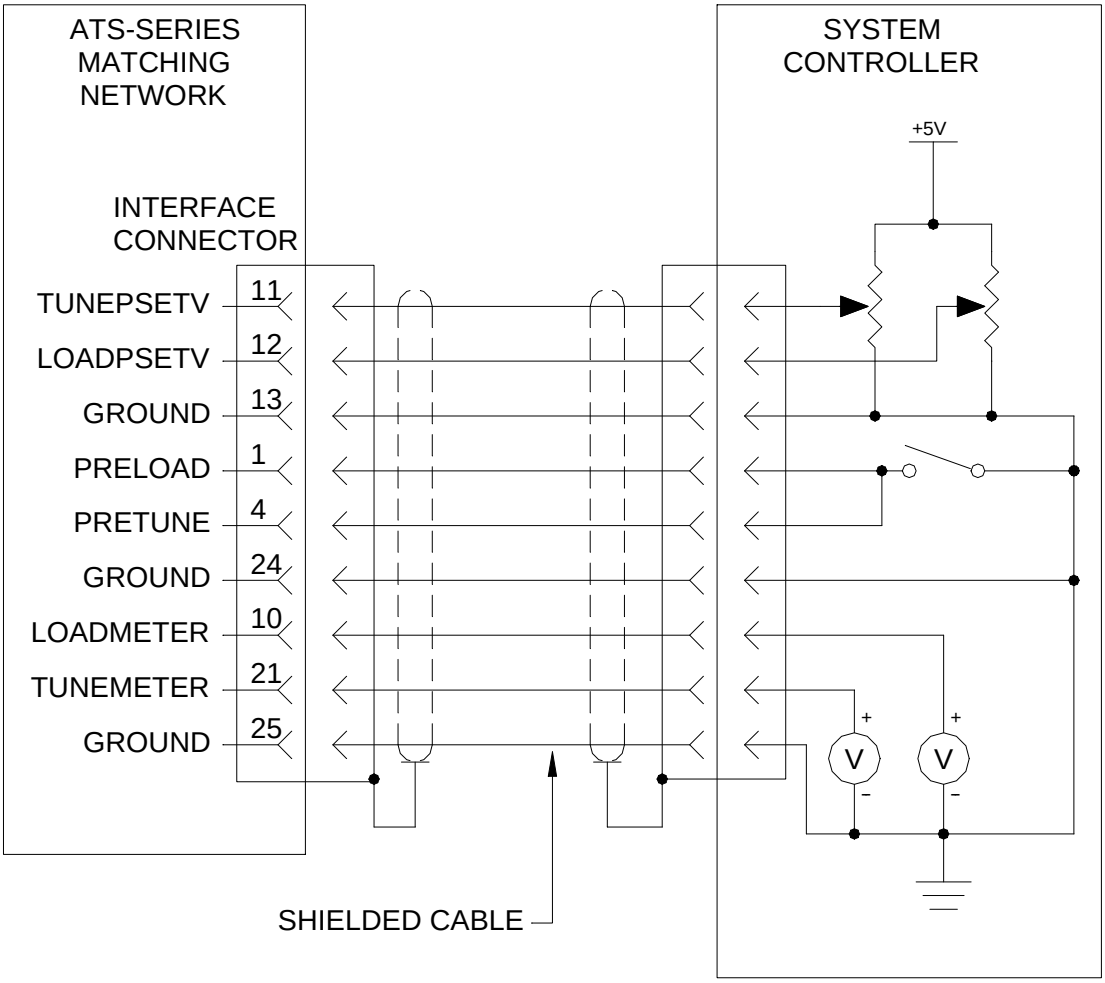
Basic Preset with Feedback

External Preset Operation

Simultaneously presets the matching network's Load and Tune capacitors to the positions requested by the system controller.

Apply a TTL logic LOW to pins 1 and 4 of the Interface Connector. Allow sufficient time for the capacitors to reach their preset point, or monitor the capacitor position signals TUNEMETER and LOADMETER until the capacitors to reach their requested positions, then apply a TTL logic level HIGH (or open circuit) to pins 1 and 4. Once the capacitors are positioned, enable RF power.

Requires setting of the ***Preset Source Selection*** programmable parameter to "PRESETS: ANALOG" and the ***Analog Interface Control Enable/Disable*** programmable parameter to "ANALOG CONTROL ON".



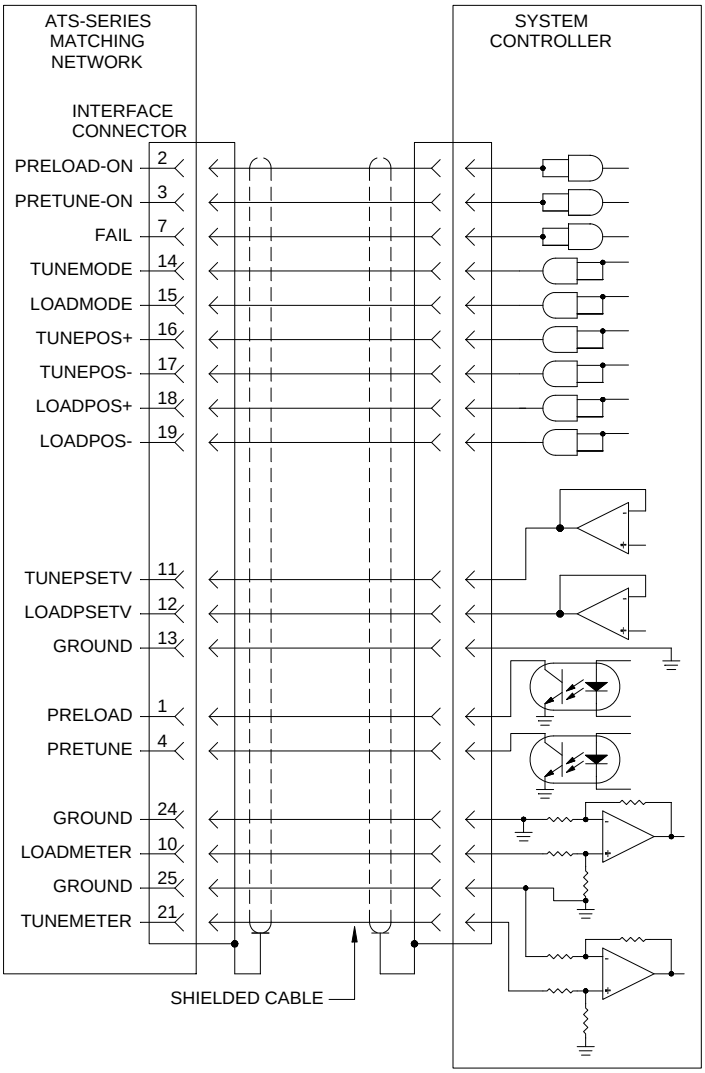
External Preset

Full Analog Control

The system controller can individually preset the matching network's Load and Tune capacitors, monitor the capacitor positions and monitor all status signals.

Make connections to the Interface Control Connector as shown below. Apply preset voltages to pins 11 and 12 and apply a TTL logic LOW state to pin 1 and/or pin 4. Allow sufficient time for the capacitors to reach their preset point, or monitor the capacitor position signals TUNEMETER (pin 21) and LOADMETER (pin 10) until the capacitors to reach their requested positions, then apply a TTL logic HIGH signal to pins 1 and 4. Once the capacitors are positioned, enable RF power.

Requires setting of the ***Preset Source Selection*** programmable parameter to "PRESETS: ANALOG" and the ***Analog Interface Control Enable/Disable*** programmable parameter to "ANALOG CONTROL ON".



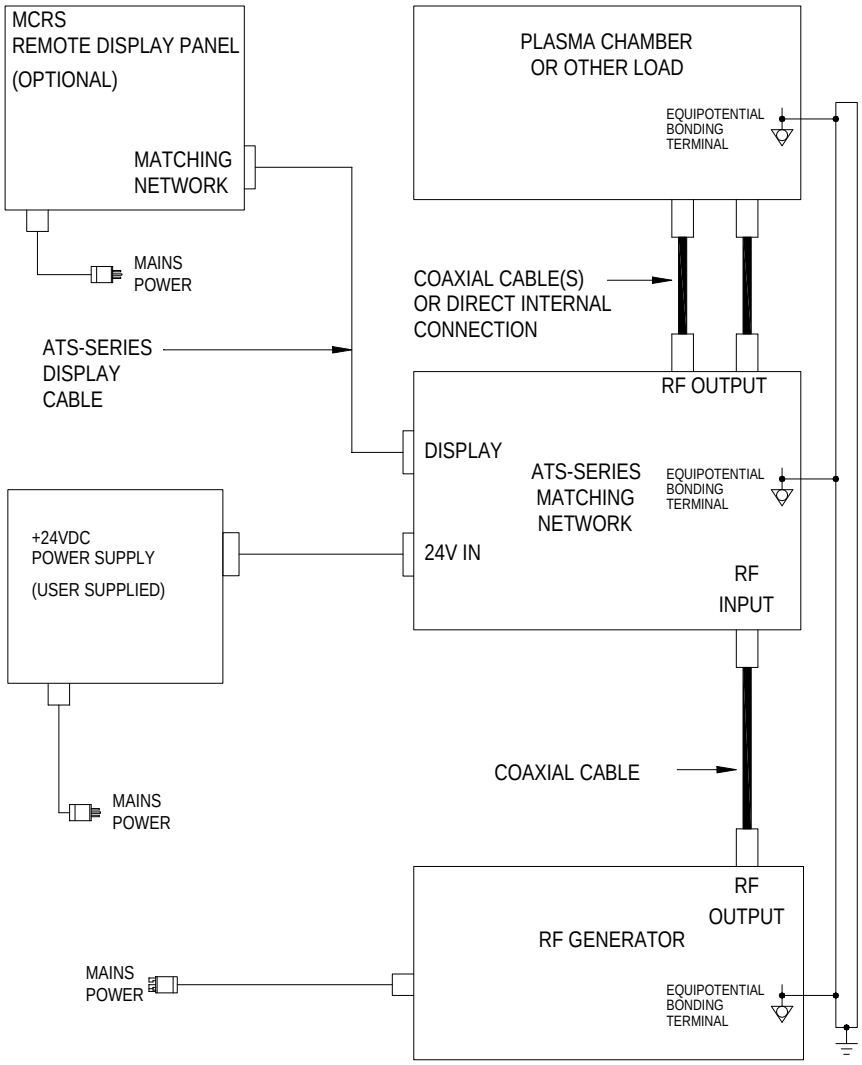
Full Analog Control

Typical System Configurations

Popular system configurations are depicted in this manual. Other configurations and wiring schemes are possible. For assistance with system wiring schemes, contact the customer service department or a Seren IPS Inc. service depot. Coaxial cables, control cables, RF generators, Remote Display Panel, +24VDC Power Supply, and system equipment are not supplied with the ATS-Series matching network.

1. Basic Configuration

   The basic configuration consists of the ATS-Series matching network, an RF Power source (generator), and a load. There are no control connections between the ATS-Series matching network, the RF Power source, and the load/processing system. In this configuration, the ATS-Series matching network operates independently from the RF power source and load/processing system. The *optional* Remote Display Panel is used for configuring and monitoring the ATS-Series matching network.

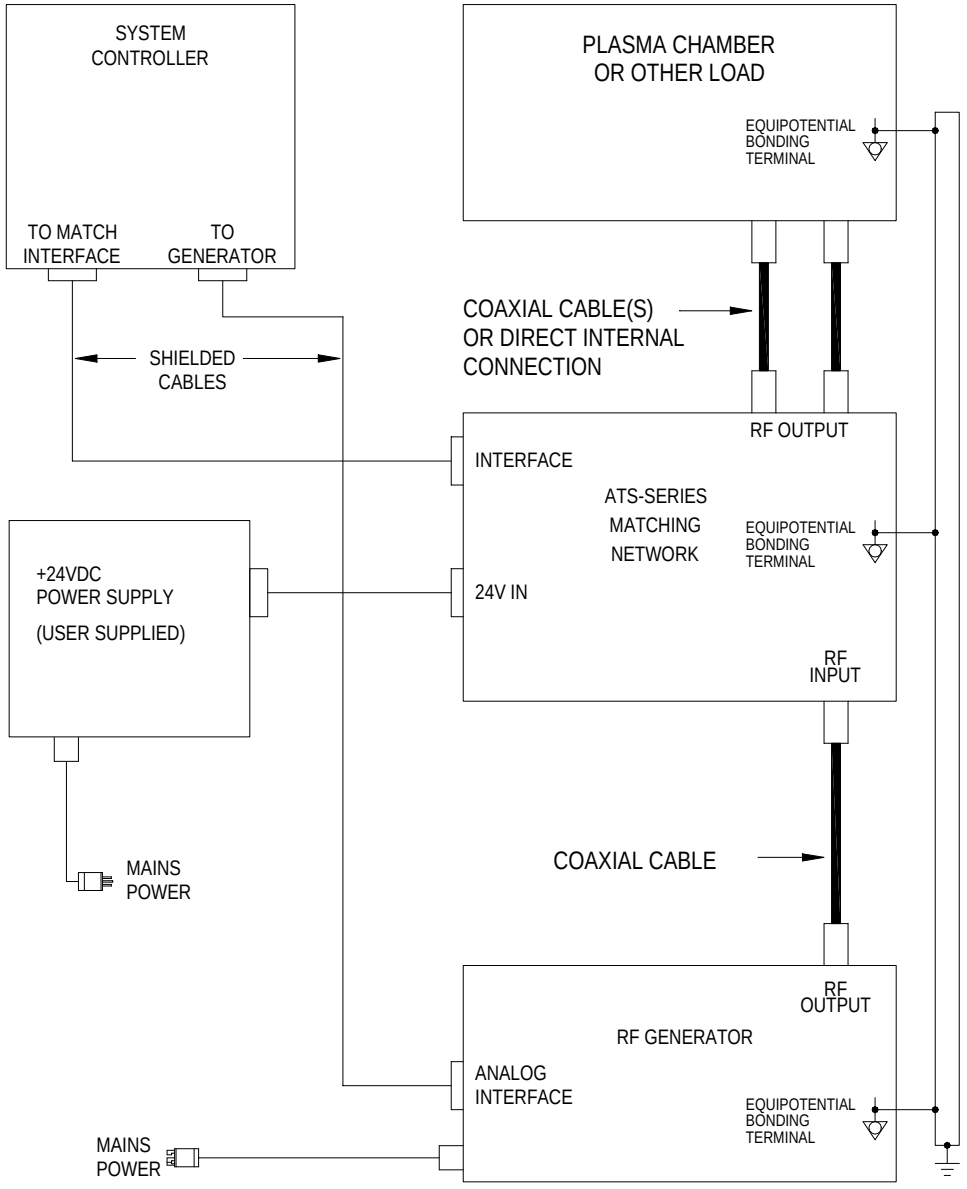


Basic Configuration

2. Basic Analog System

The Basic Analog System configuration consists of an ATS-Series matching network, an RF Power source (generator), system controller, and a load. The system controller interfaces to the ATS-Series matching network and the RF generator. There are no control connections between the ATS-Series matching network and the RF Power source.

In this configuration, the ATS-Series matching network operates independently from the RF power source. The system controller controls the operation of the ATS-Series matching network and the RF generator. Voltage control (a DC Probe or RF Probe within the matching network provides a feedback signal to the generator's power regulation circuits) of the RF generator is not used.



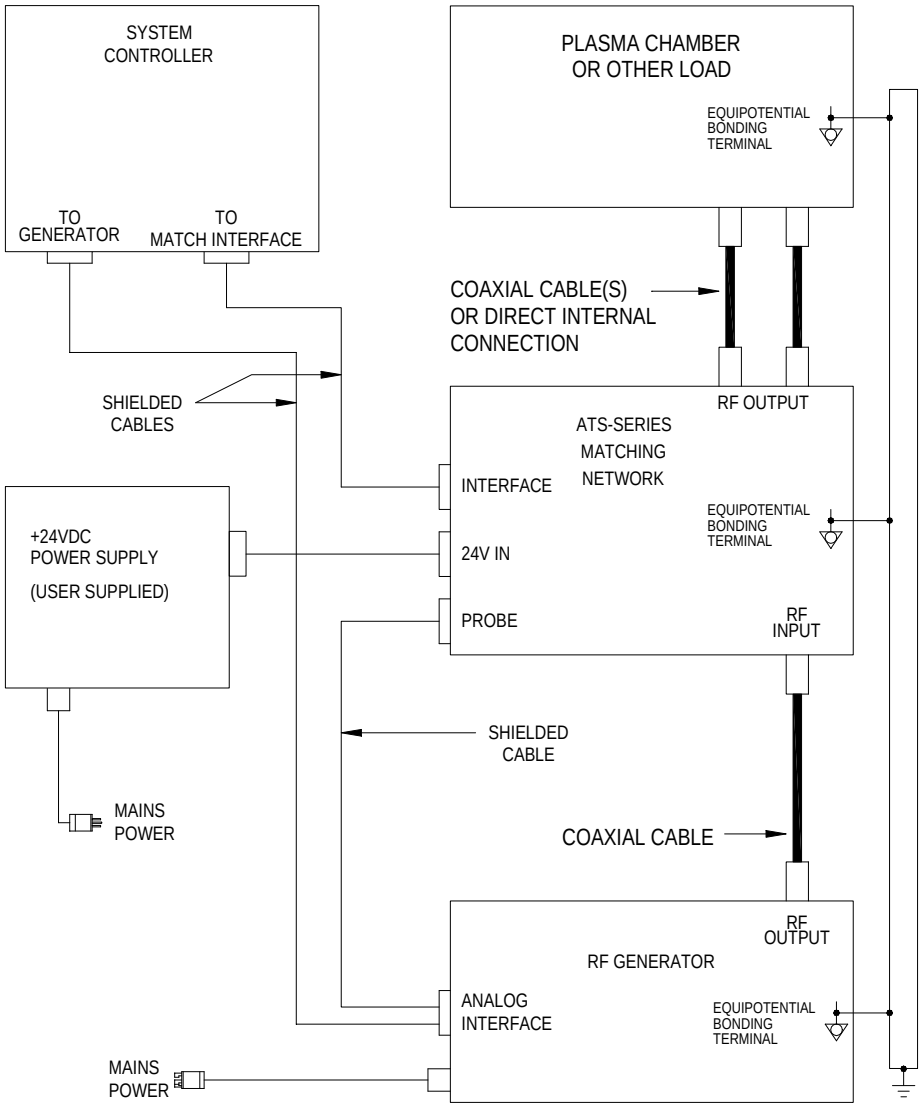
Basic Analog System Configuration

3. Full Analog System

The Full Analog System configuration consists of an ATS-Series matching network, an RF Power source (generator), system controller, and a load. The system controller interfaces to the ATS-Series matching network and the RF generator with shielded analog control cables.

In this configuration, the ATS-Series matching network operates independently from the RF power source. The system controller controls the operation of the ATS-Series Matching Network and the RF generator. A voltage control signal (a DC Probe or RF Probe within the matching network provides a feedback signal to the generator's power regulation circuits) from the matching network is routed to the RF generator.

The system controller controls the RF generator and the ATS-Series matching network.

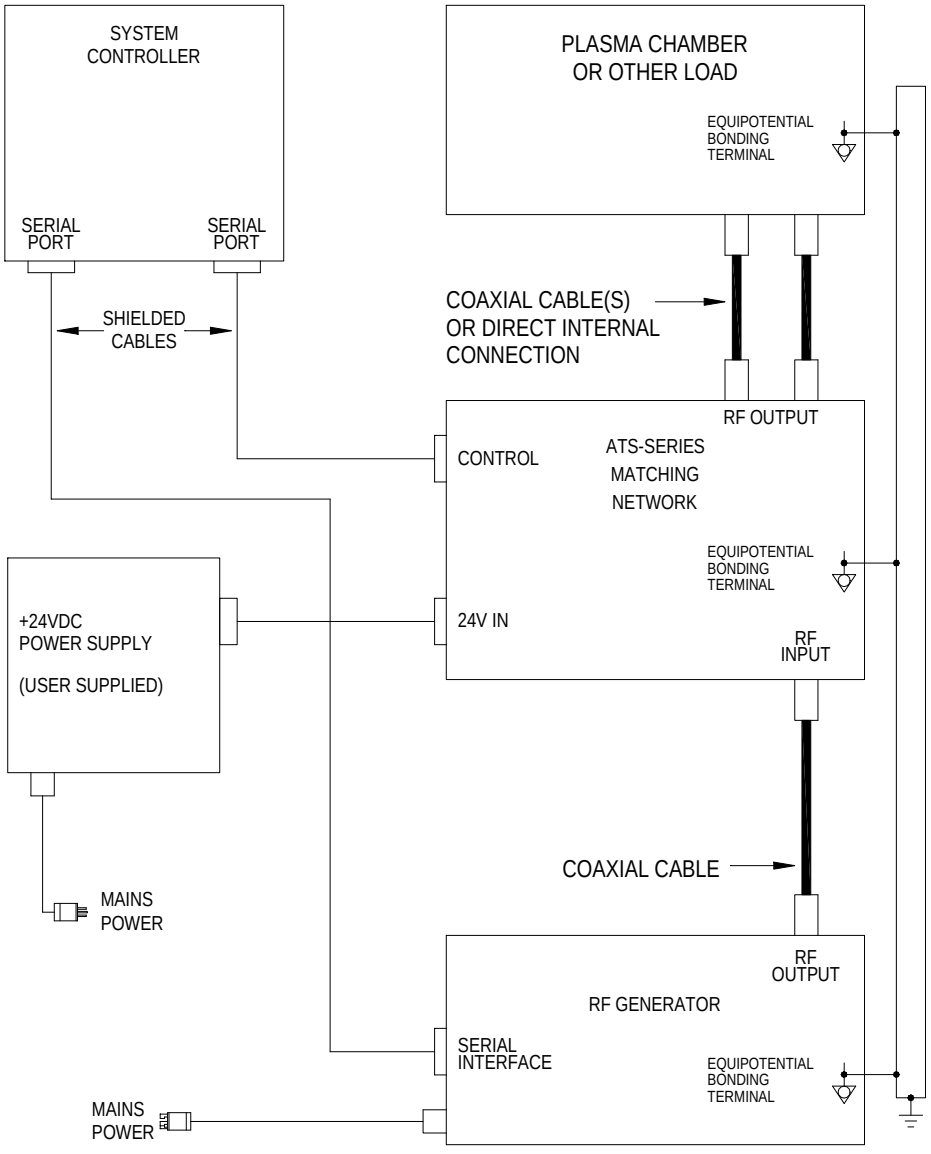


Full Analog System with Voltage Control

4. Basic Serial System

The Basic Serial System configuration consists of the AT-Series matching network, an RF Power source (generator), system controller, and a load. The system controller interfaces to the ATS-Series Automatic Impedance Matching Network and the RF generator using RS232 serial interfaces. There are no control connections between the ATS-Series matching network and the RF Power source.

In this configuration, the ATS-Series matching network operates independently from the RF power source. The system controller controls the operation of the ATS-Series matching network and the RF generator. Voltage control of the generator (a DC Probe or RF Probe within the matching network provides a feedback signal to the generator's power regulation circuits) is not used.

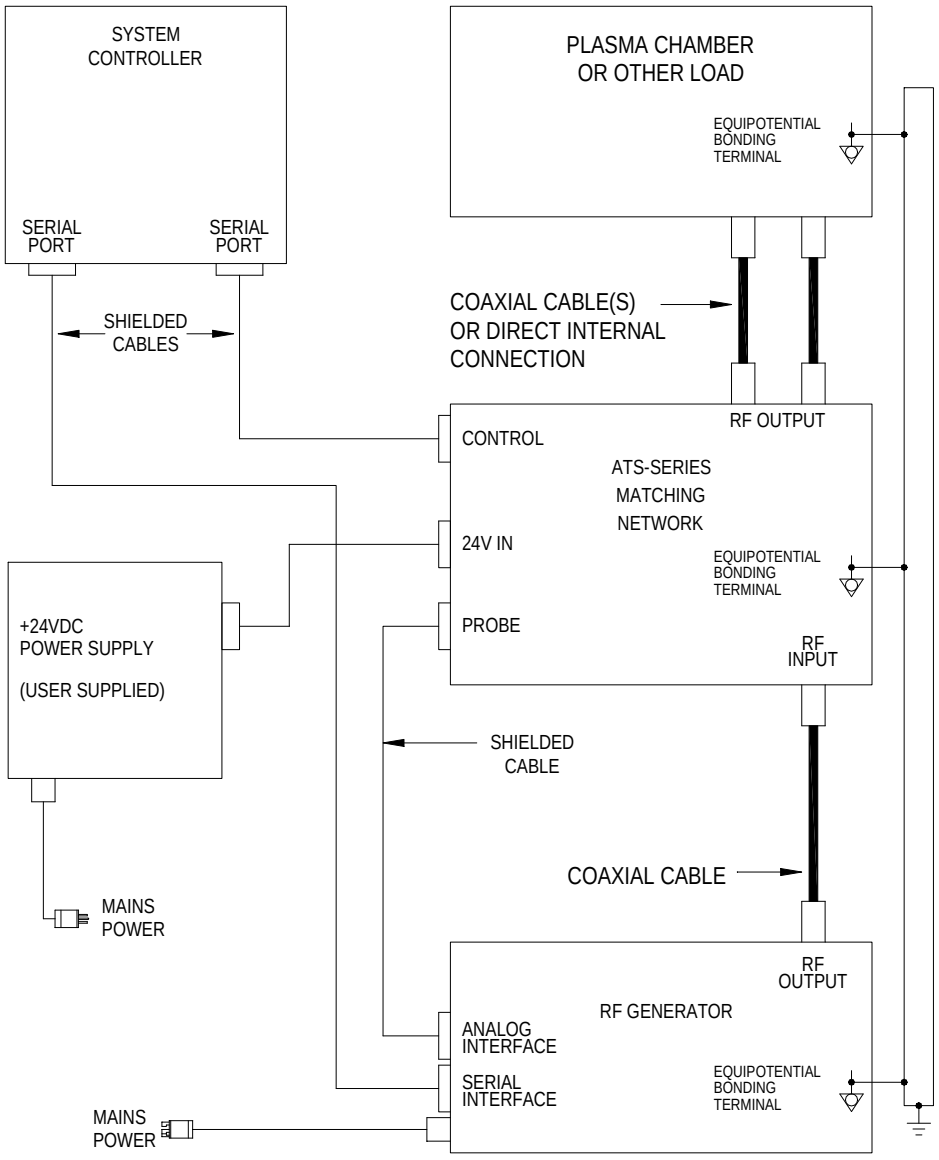


Basic Serial System

5. Serial System With Voltage Control

The Serial System with Voltage Control consists of an ATS-Series matching network, RF Power source (generator), system controller, and a load. The system controller interfaces to the ATS-Series matching network and the RF generator using RS232 serial interfaces. The DC Probe signal (feedback signal) is connected directly to the RF Power source.

In this configuration, the ATS-Series matching network operates independently from the RF power source. The system controller controls the operation of the ATS-Series matching network and the RF generator. Voltage control of the RF generator (a DC Probe or RF Probe within the matching network provides a feedback signal to the generator's power regulation circuits) is used.

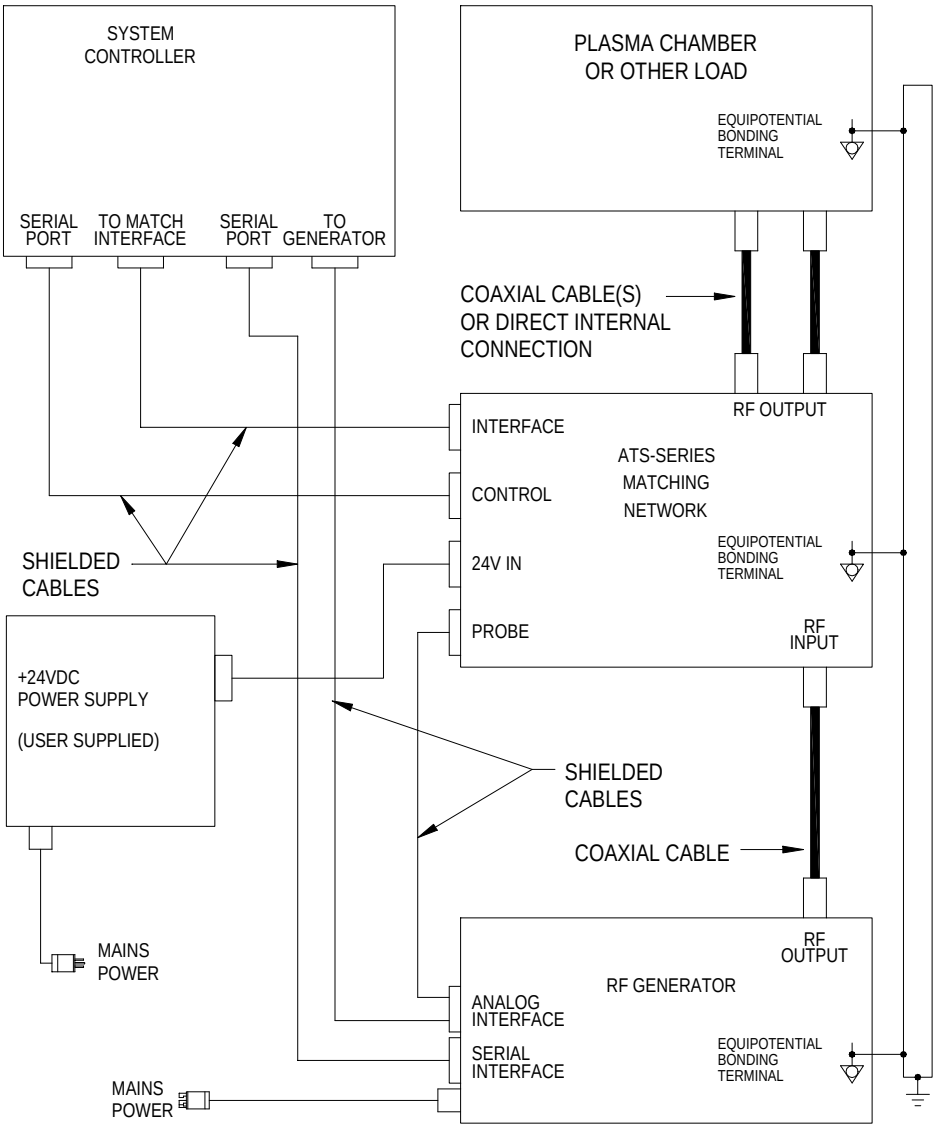


Serial System with Voltage Control

6. Fully Configured System

The Fully Configured System consists of an ATS-Series matching network, RF Power source (generator), system controller, and a load. The system controller interfaces to the ATS-Series matching network and the RF generator using Serial *and* Analog Control interfaces. The ATS-Series matching network's DC Probe signal (feedback signal) is routed to the RF Power source.

In this configuration, the ATS-Series matching network operates independently from the RF power source. The system controller controls the operation of the ATS-Series matching network and the RF generator. Voltage control of the generator (a DC Probe or RF Probe within the matching network provides a feedback signal to the generator's power regulation circuits) is used.



Fully Configured System

Maintenance

The ATS-Series matching networks are designed to be maintenance free. There are no user maintainable assemblies inside the unit. ATS-Series matching networks are designed for use in a clean environment. Periodically check the air vents and cooling fan(s) for accumulation of dust and debris. Clean the air vents with a vacuum cleaner if they appear dirty or clogged.



Restricting the air vents or installing the ATS-Series matching network in a dusty environment may impact the long-term reliability of the matching network.

Cleaning:

DO NOT clean the ATS-Series matching network while RF power is applied to the matching network or when the unit is connected to system power. The exterior of the ATS-Series matching network may be cleaned with a soft cloth, dampened with soap and water or a mild solvent, such as alcohol.

Problem Solving

Problem Solving Chart

The following chart lists some conditions that may occur and the recommended solutions. Follow the suggested solutions until the problem is corrected. If the problem persists, please contact Seren IPS Inc. customer service or a Seren IPS Inc. service representative.

ATS-Series Matching Network Problem Solving Chart	
Condition	**Suggested Solution**
When power is first applied to the ATS-Series matching network, there is a brief "humming" or "buzzing" sound.	This is normal. The ATS-Series matching network is initializing.
The matching network motors do not turn	Verify the 24V power cable is properly mated to the Matching network's "24V IN" connector. Make sure AC Mains power is applied to the system's 24VDC power source.
The matching network does not tune when RF Power is applied to the matching network	Check the ATS-Series matching network's load and tune capacitor's mode settings. Ensure both the Load and Tune capacitors are set to the "AUTO" (automatic) mode
The Load and/or Tune capacitor travels to a limit and "chatters" or "oscillates" in automatic mode when RF power is applied	The "chatter" is caused by the capacitor(s) being driven to the end-of-travel limit by the automatic mode and the "BACKOUT" feature is pushing the capacitor away form the end-of-travel limit. Temporarily switch the capacitor in question to "MAN" (manual) mode to confirm – the "chatter" should stop. The matching network's range configuration may need adjustment. See the "Matching Network Range Configuration" heading in the Problem Solving section
The Load and/or Tune capacitor travels to an end limit, Reflected power cannot be manually tuned to Zero (0) Watts.	The matching network's range configuration may need adjustment. See the "Matching Network Range Configuration" heading in the Problem Solving section

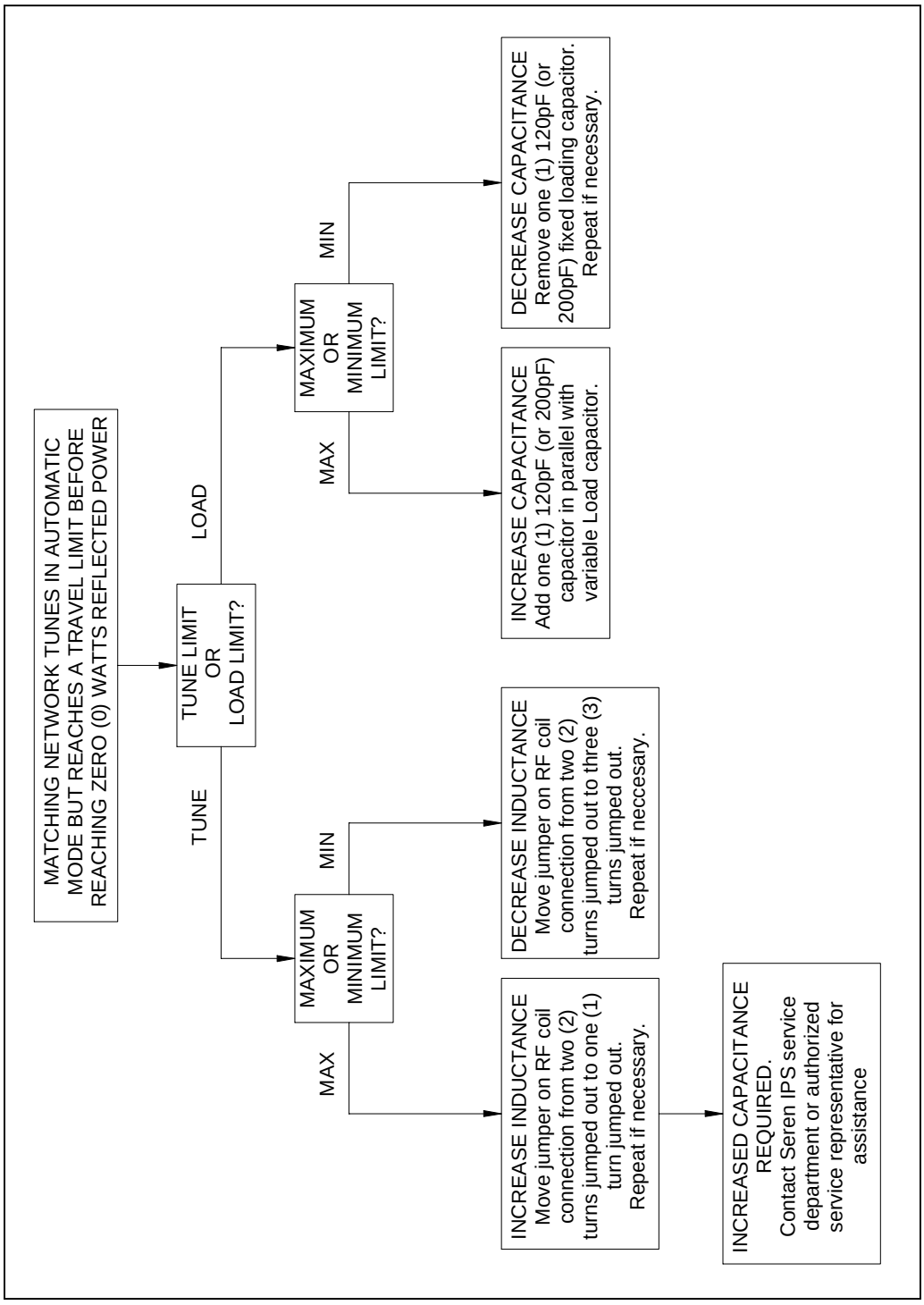
ATS-Series Matching Network Problem Solving Chart	
Condition	**Suggested Solution**
The matching network tunes automatically, but reflected power is not Zero (0) Watts. Reflected power is less than 10 Watts and can be tuned to Zero (0) Watts in manual mode.	On some systems, a perfect match (0W reflected power) may not be possible or a slight mis-match (1W to 5W of reflected power) may be considered tolerable due to process variations or a multi-process system configuration. If needed, the Phase and Magnitude sensor may be adjusted. Refer to the "Phase And Magnitude Sensor Adjustment Procedure" heading in the Problem Solving section.
The matching network tunes automatically, but reflected power is not Zero (0) Watts. Reflected power is greater than 10 Watts and can be tuned to Zero (0) Watts in manual mode.	The Phase and Magnitude sensor may require adjustment. Refer to the "Phase And Magnitude Sensor Adjustment Procedure" heading in the Problem Solving section.
Cannot communicate with the ATS-Series matching network via serial commands	1. Several programmable parameter settings affect serial communications. Ensure the following programming menu parameters are set appropriately for your serial communications method: Communications Protocol Address ID Number Data Rate Communications ECHO 2. Ensure the system controller or data terminal emulation software is set for: No Parity, 8 Data Bits, 1 Stop Bit 3. Check the serial interface wiring. The ATS-Series matching network uses a non-standard serial interface connector, and serial interface wiring depends on the serial communications protocol selected. Refer to the Serial Communications section for wiring details by protocol; refer to the Controls and Connections section for the serial connector pin list. 4. If DeviceNet communication protocol is selected, commands sent via the serial interface are ignored. 5. Ensure the serial cable from the system is connected to the matching network's "CONTROL" connector. 6. The ATS-Series matching network always responds to Address ID number 99. Try communicating with the matching network at Address ID 99 while adjusting the data rate on your terminal or terminal emulation software.

ATS-Series Matching Network Problem Solving Chart	
Condition	**Suggested Solution**
Cannot communicate with the ATS-Series matching network via DeviceNet	1. Several programmable parameters settings affect DeviceNet communications. Ensure the following programming menu parameters are set appropriately for your DeviceNet communications method: Ensure the ATS-Series matching network's Communications Protocol is set to "DEVICENET". Ensure the ATS-Series matching network's Address ID number is between "00" and "63" – check Address ID switches (if present) ***and*** programmable parameter settings. Ensure the selected Data Rate is correct for the DeviceNet network. 2. Ensure the DeviceNet cable is connected to the rear panel DEVICENET connector. 3. Ensure proper power is available on the DeviceNet network. 4. Ensure the DeviceNet network is properly terminated. 5. Ensure no duplicate address ID's exist on the DeviceNet network.
Cannot communicate with the ATS-Series matching network via DeviceNet, The rear panel NET LED indicator is RED	1. Ensure the Address ID number is between "00" and "63" – check rear panel switches ***and*** front panel programmable parameter settings. 2. Ensure the selected Data Rate is correct for the DeviceNet network. 3. Ensure there is proper power available on the DeviceNet network. 4. Ensure the DeviceNet network is properly terminated.
Cannot communicate with the ATS-Series matching network via DeviceNet, The rear panel NET LED ***and*** MOD LED indicators are AMBER	The ATS-Series matching network's communications mode ***is not*** set to "DEVICENET". Set the communications protocol programmable parameter to "DEVICENET".
The rear panel NET LED indicator is flashing GREEN (DeviceNet equipped ATS-Series matching networks only)	There is no fault with the ATS-Series matching network. The ATS-Series matching network is waiting for a DeviceNet host to establish a connection.

ATS-Series Matching Network Problem Solving Chart	
Condition	**Suggested Solution**
Cannot communicate with the ATS-Series matching network via Modbus:	1. The ATS-Series matching network's communications mode *is not* set to "MODBUS". Set the communications protocol programmable parameter to "MODBUS 4W RTU" or "MODBUS 2W RTU", as needed.. 2. Check the ADDRESS ID setting. Ensure it is set to the appropriate value. 3. Check the DATA RATE. Ensure all devices on the bus are set for the same data rate. 4. Check the Modbus Communications type. Set for Multiple Address (MC2 Emulation) Implementation or ATS-Specific Implementation, as needed. 5. Ensure Modbus network wiring is properly connected and terminated (termination resistors).
Cannot communicate with the ATS-Series matching network via Ethernet:	1. Ensure all Ethernet cables are properly connected and any Ethernet hubs/switches in the network path are powered and operating properly. 2. Ensure the ATS-Series matching network's Ethernet Address, Subnet Mask, and Gateway Address settings are correct/appropriate for the connected network. See the Ethernet Communications section for detailed information. 3. Ensure the systems's Ethernet communications program is configured to communicate with the ATS-Series matching network on TCP/IP Port 10001.
Cannot communicate with the ATS-Series matching network via PROFIBUS: "CHECK I/O CARD" is displayed on the third line of the optional Remote Display Panel when RF Power is OFF	The ATS-Series matching network's CPU is unable to communicate with the PROFIBUS interface adapter. Power down/disable power to the ATS-Series matching network, then power-up/re-apply power. If the CHECK I/O CARD message persists, contact Seren IPS technical support for assistance.

Matching Network Range Configuration

Unless otherwise specified at the time of order, Seren IPS Inc. Automatic Matching Networks are shipped with a "generic" range configuration. On some systems, the generic range configuration may be insufficient to obtain a matched condition (0 Watts Reflected power). Refer to the chart below to adjust the matching network's range.



Phase and Magnitude Sensor Adjustment Procedure:

If your Seren IPS Inc. AT-Series matching network can optimally match to your plasma chamber in manual mode, but not in automatic mode, or your matching network's hardware configuration required changes to meet your process requirements, adjustment of the Phase and Magnitude error sensor may have to be performed. Use the following procedure to adjust the Phase and Magnitude Error Sensor.

Required test equipment: Seren IPS Inc. model MCRS Remote Display Panel.

1. Using the Remote Display Panel, set the Load and Tune capacitor modes to "MAN" (manual)
2. Set the RF Generator's power setpoint to 250 Watts and enable the RF output.
3. Manually adjust the matching network's Load and Tune capacitors for minimum reflected power at the RF Generator.
4. Configure line 3 of the Remote Display Panel to display the PHASE and MAG error signals. Refer to Programmable Parameter section for "how-to" information.
5. Adjust the ATS-Series matching network's "PHASE" potentiometer for a "PH" (Phase) reading of 0.0mV +/- 5mV on line 3 of the Remote Display Panel.
6. Adjust the ATS-Series matching network's "MAG" potentiometer for a "MAG" reading of 0.0mVD +/- 5.0mV on line 3 of the Remote Display Panel.
7. Set the Load and Tune capacitor modes to "AUTO" (automatic) and confirm the matching network tunes to zero (0) Watts reflected.
8. Increase the RF Generator's output power to the matching networks' rated input power (or maximum power if less than the matching network's rated input power) and confirm the matching network tunes to zero (0) Watts reflected.
9. Repeat steps 2 through 8.
10. Disconnect the Remote Display Panel.
11. Disable the RF generator's RF output.
12. End Of Procedure

Technical Data

Common Specifications:

Specifications common to all ATS-Series matching networks are listed below. Model-specific specifications are listed in the next section.

ATS-Series Common Specifications		
Input Power:	Voltage: 24.0VDC +/- 1.2VDC, Regulated (user-supplied)	
	Nominal Current: 1.0A	
	Peak Current: 3.0A	
	Over-current Protection: Provided by systems integrator/user	
	Power Connector: 9-Pin Male D-Sub type	
	Note: Power source and power wiring must be capable of delivering 24VDC at 3.0A, continuous duty, to the ATS-Series matching network.	
Controller:	Internal	
Interfaces & Connections:	24V IN (Power)	9 Pin Male D-Sub Connector
	Control (Serial):	9 Pin Female D-Sub Connector
	Interface (Analog):	25 Pin Female D-Sub Connector
	Probe (Analog):	9 Pin Female D-Sub Connector
	Fan (optional):	9 Pin Female D-Sub Connector
	Display:	3 Pin Micro-circular connector, latching
	DeviceNet (optional):	5-pin Male Micro-circular connector, with screw-on locking
	Ethernet (optional):	8-pin Type RJ45 Female Connector
	PROFIBUS (optional):	9 Pin Female D-Sub Connector
Environmental:	Operating Temperature, Ambient: 0 to +40°C Operating Relative Humidity: 10% to 80%, non-condensing	
Cooling:	Convection, forced air (fan), and/or water-cooling, depending on model type and configuration/application.	
Coolant Water: (Water-Cooled Units Only)	Inlet Temperature:	+15°C minimum to +40°C maximum temperature, +22°C to +28°C recommended

ATS-Series Common Specifications		
Coolant Water Purity: (Water-Cooled Units Only)	pH: Between 7 and 9 Total Chlorine: <20ppm Total Nitrate: <10ppm Total Sulfate: <100ppm Total Dissolved Solids: <250ppm Total Hardness expressed as Calcium Carbonate equivalent: <250ppm Specific Resistivity: >500,000 Ohms/cm @ +25°C Note: **DO NOT** use de-ionized (D-I) water as a coolant. Using de-ionized water will deteriorate the water fittings and cause water leaks.	
Coolant Water Flow Rate (Water-cooled Units Only)	See Model-Specific Specifications section	
Matching Network Motor Type:	DC Stepper	
DeviceNet Applicable Documents:	Title:	DeviceNet Specification Volume 1: DeviceNet Communication Model and Protocol
	Version:	Release 2.0, Errata5 March 31 2002
	Source:	ODVA
	Title:	DeviceNet Specification Volume II: DeviceNet Device Profiles and Object Library
	Version:	Release 2.0, Errata 5 March 31, 2002
	Source:	ODVA
	Title:	Interface Guidelines for DeviceNet Devices On Semiconductor Manufacturing Tools
	Version:	Revision: 2.5 09-Sept-2005
	Source:	ODVA Semiconductor Special Interest Group (SIG)
DeviceNet Physical Layer:	Philips PCA82C250 CAN Controller, Optically Isolated	
DeviceNet Communications Model:	Group 2 Only Server	
DeviceNet Connections:	Connection Instance 1: Explicit Connection Instance 2: Polled I/O	
DeviceNet Specifications:	Vendor ID: 946 (3B2 hex) Product Code: 302 Product Name: "Seren IPS ATS " Message Body Format: DeviceNet 8/8 Minimum Time Between I/O Poll Commands: 20ms	

ATS-Series Common Specifications		
Agency Compliance:	Safety	IEC/EN 61010-1:2005 UL 61010-1: 2004 R10.08 CE Marked
	EMC	Not tested for EMC compliance, as the ATS-Series matching networks are embedded components intended for integration into the user's application or system. Care has been taken and best practices have been used in the design and methods used to assemble the ATS-Series matching network to minimize EMC issues. Physical mounting, electrical connections (control and RF input/output), equipotential bonding (RF grounding), water connections (if water-cooled), cabling, post-factory user modifications, user configurations, and application all impact EMC compliance. EMC compliance must be determined in-application.

Model-Specific Specifications:

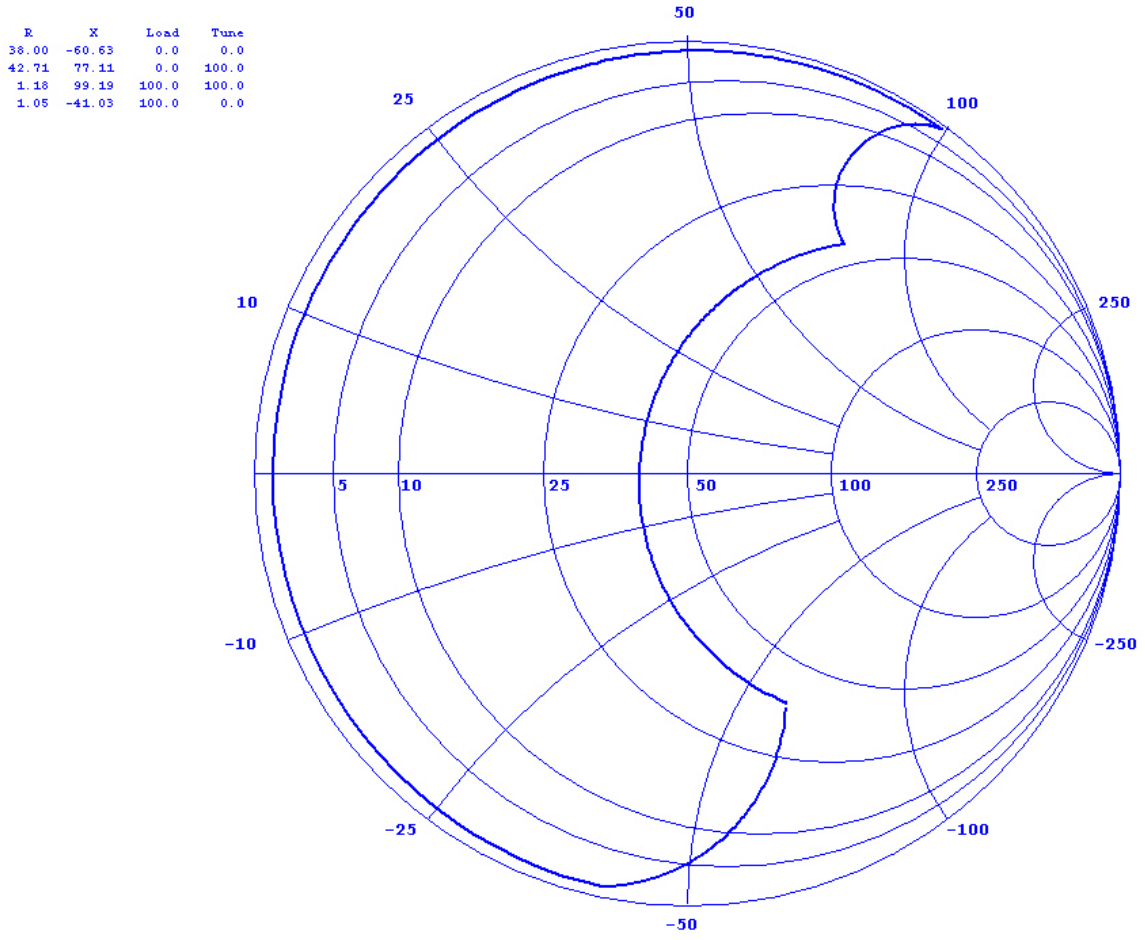
Specifications listed are for generic ATS-Series matching network configurations. Depending on the application and/or configuration, your ATS-Series matching network may differ from the generic model type. Consult your local Seren IPS Inc. representative or the factory for detailed specifications of custom-configured matching networks.

ATS-3 Automatic Matching Network Specifications:

ATS-3 Matching Network Specifications (Generic Configuration)	
RF Input Power:	300 Watts Nominal, application dependant 2.5KV Peak, 20A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Dual (2x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connections) Custom (Consult factory)
Cooling:	Standard: Convection Optional: Forced Air (Fan)
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 17-178pF Load Capacitor Type: Air Dielectric RF Coil: 6 Turn, Tapped "L" Configuration, Sputter Application Load Capacitor Range (Variable): 30-1713pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 17-178pF Load Capacitor Type: Air Dielectric RF Coil: 6 Turn, Tapped

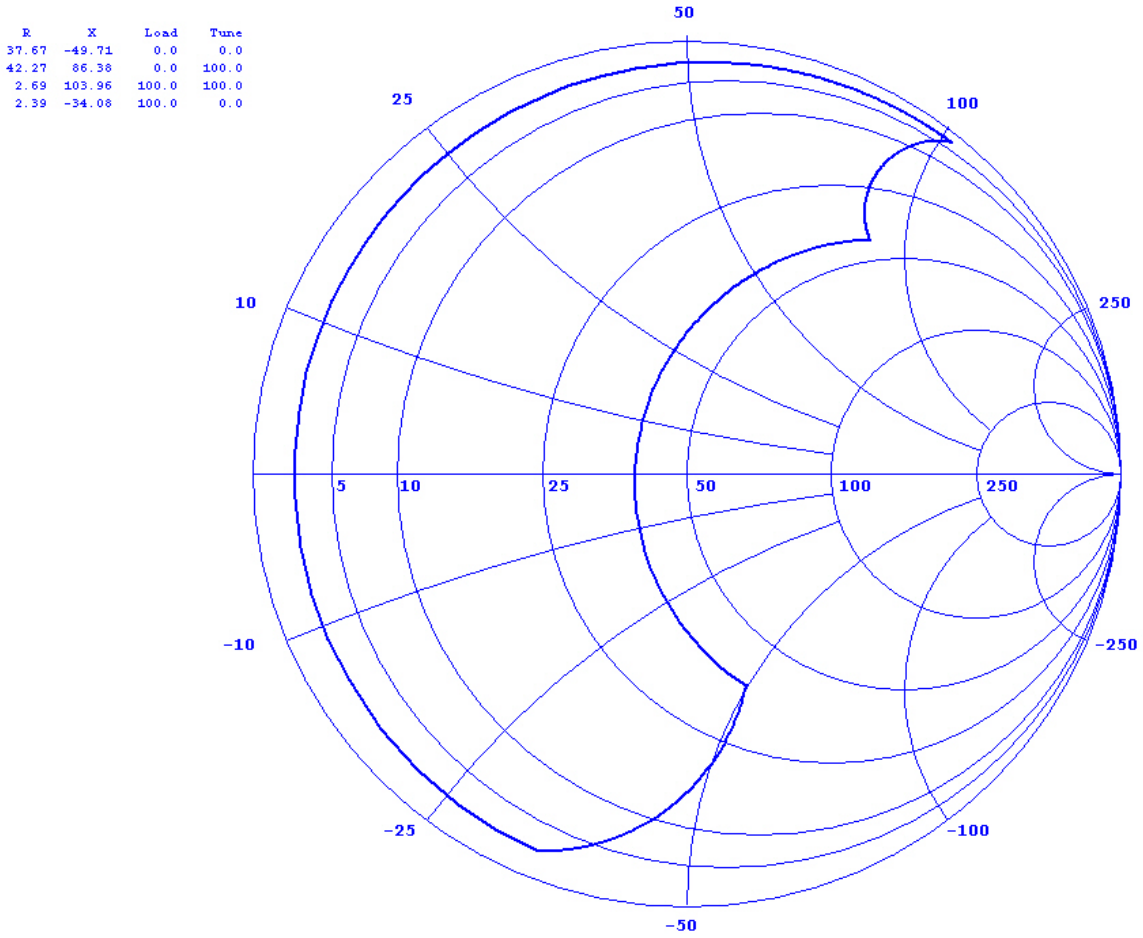
ATS-3 Matching Network Specifications (Generic Configuration)	
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	5.00 [127] High x 9.00 [228.6] Wide x 16.13 [409.7] Deep
Weight:	10.0 lbs [4.53Kg]
Mounting:	Customer Supplied

ATS-3 Tuning Range, Generic Sputter Configuration



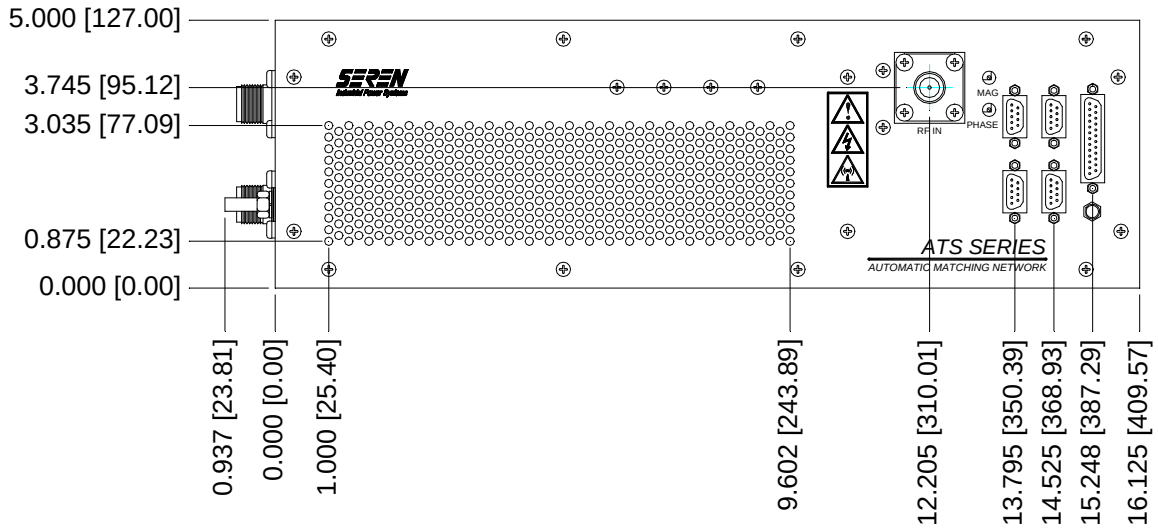
ATS-3 Matching Network Specifications (Generic Configuration)

ATS-3 Tuning Range, Generic Non-Sputter Configuration

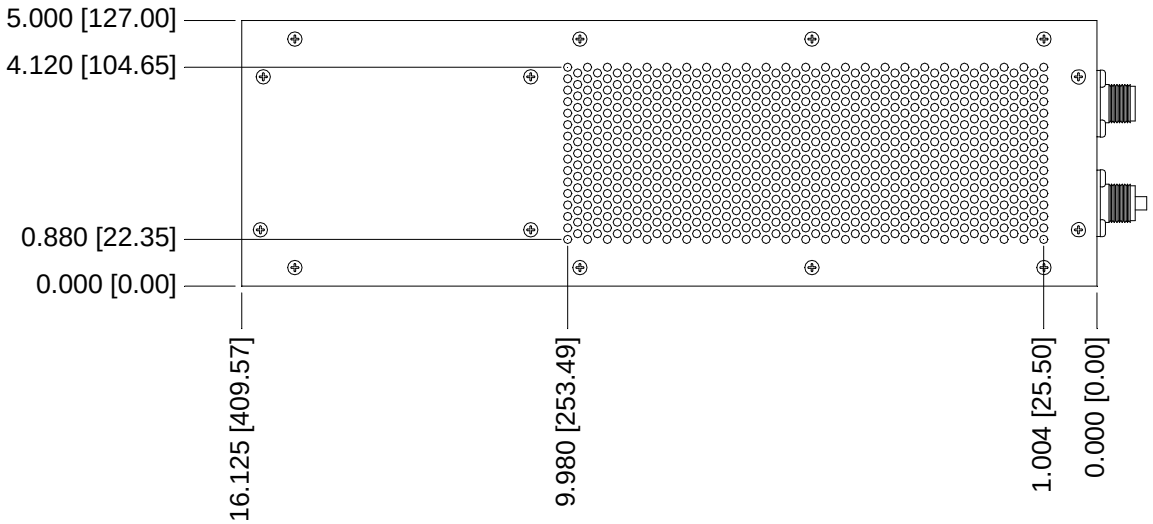


ATS-3 Matching Network Specifications (Generic Configuration)

ATS-3 Physical Dimensions:



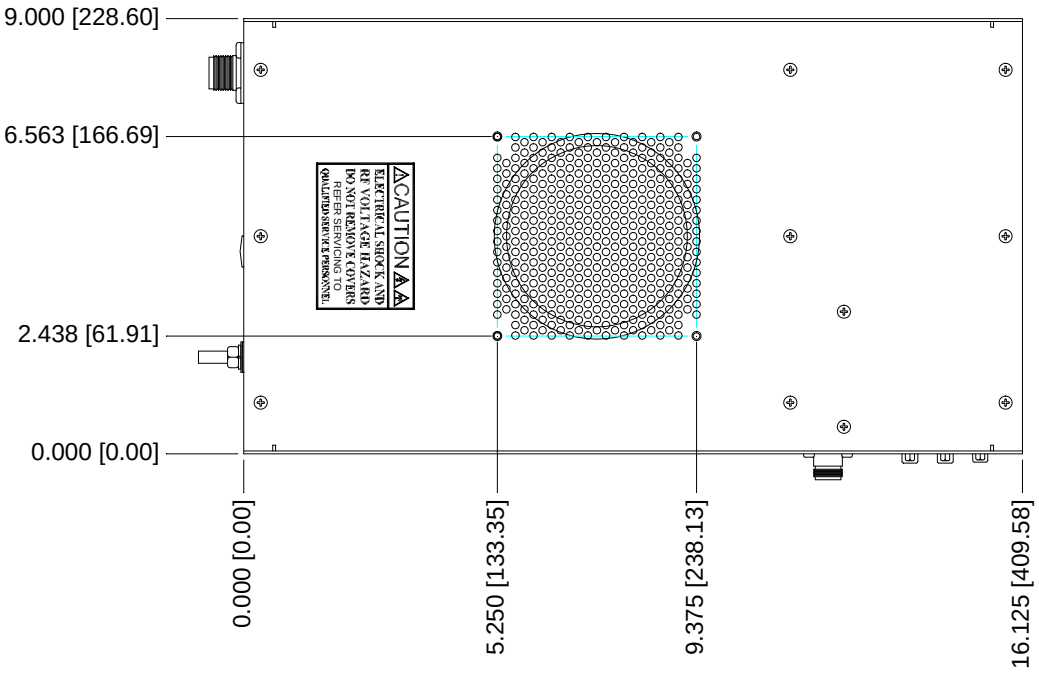
ATS-3 Left Side View



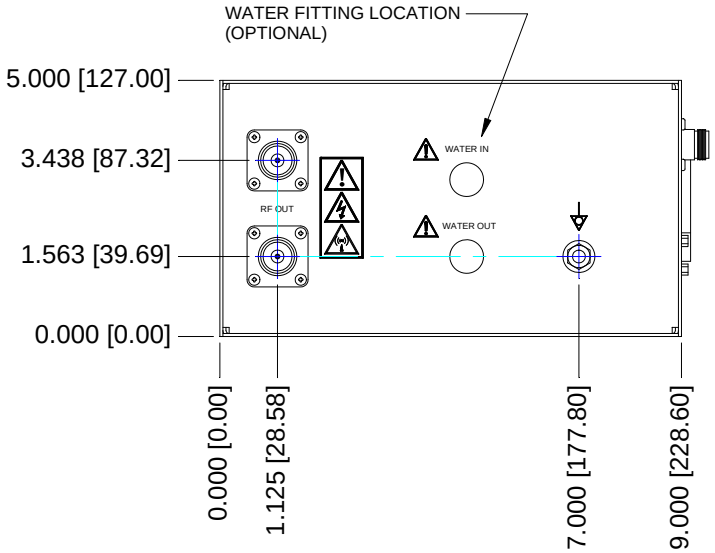
ATS-3 Right Side View

ATS-3 Matching Network Specifications (Generic Configuration)

ATS-3 Physical Dimensions (continued):



ATS-3 Top View



ATS-3 Rear View

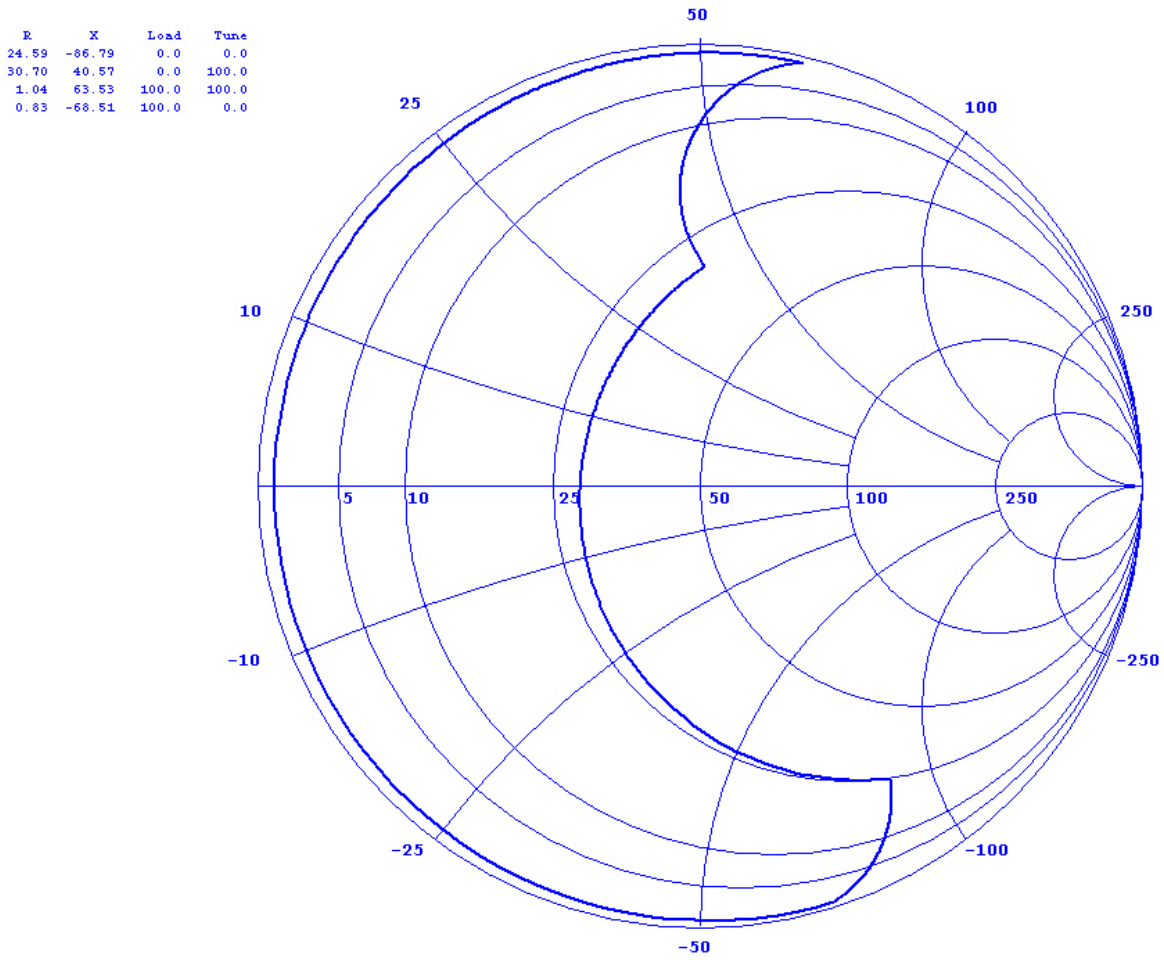
ATS-3M Automatic Matching Network "Mini" Package Specifications:

ATS-3M Matching Network "Mini" Package Specifications (Generic Configuration)	
RF Input Power:	300 Watts Nominal, application dependant 2.5KV Peak, 20A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Single (1x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connections) Custom (Consult factory)
Cooling:	Standard: Forced Air (Fan, 33CFM)
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 17-178pF Load Capacitor Type: Air Dielectric RF Coil: 5 Turn "L" Configuration, Sputter Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 17-178pF Load Capacitor Type: Air Dielectric RF Coil: 5 Turn
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1

ATS-3M Matching Network "Mini" Package Specifications (Generic Configuration)

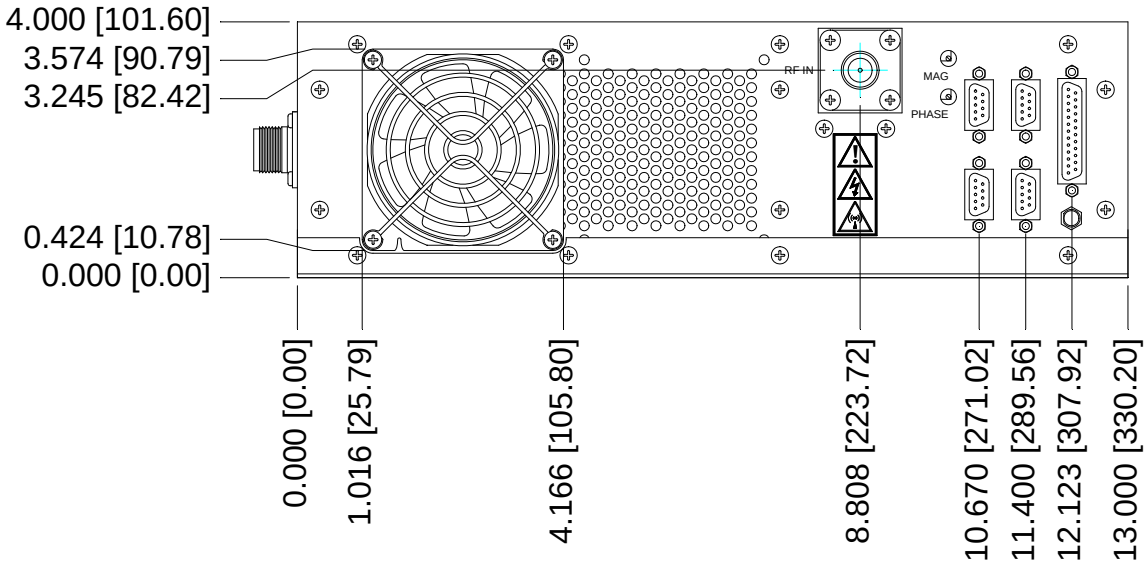
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	4.00 [101.6]H x 8.00 [203.2]W x 13.00 [330.2]D
Weight:	10.0 lbs [4.53Kg]
Mounting:	Customer Supplied

ATS-3M Tuning Range, Generic Configuration:

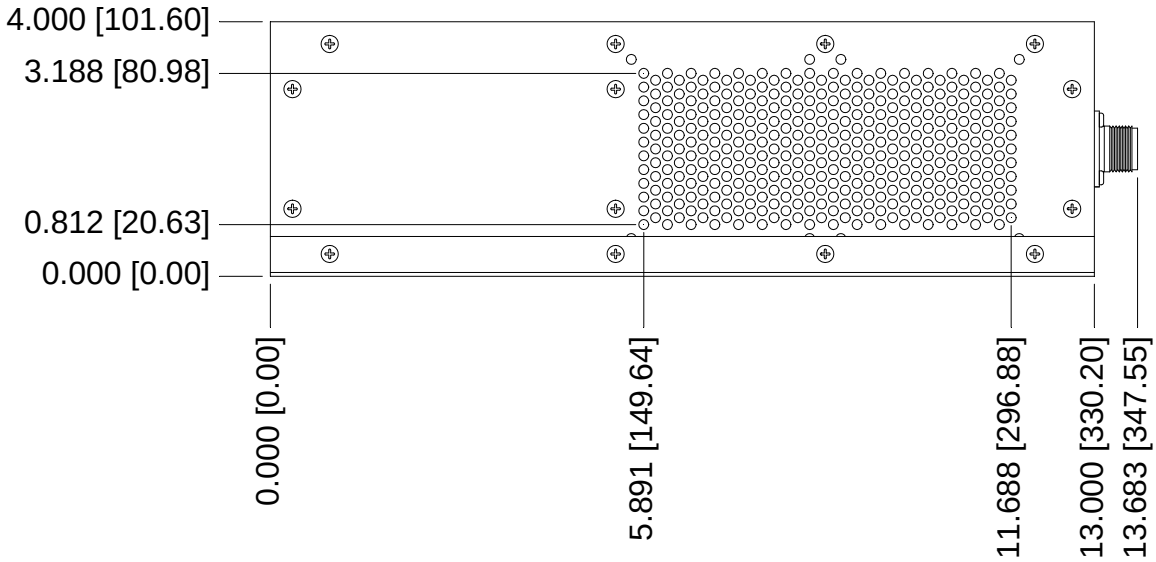


ATS-3M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-3M Physical Dimensions:



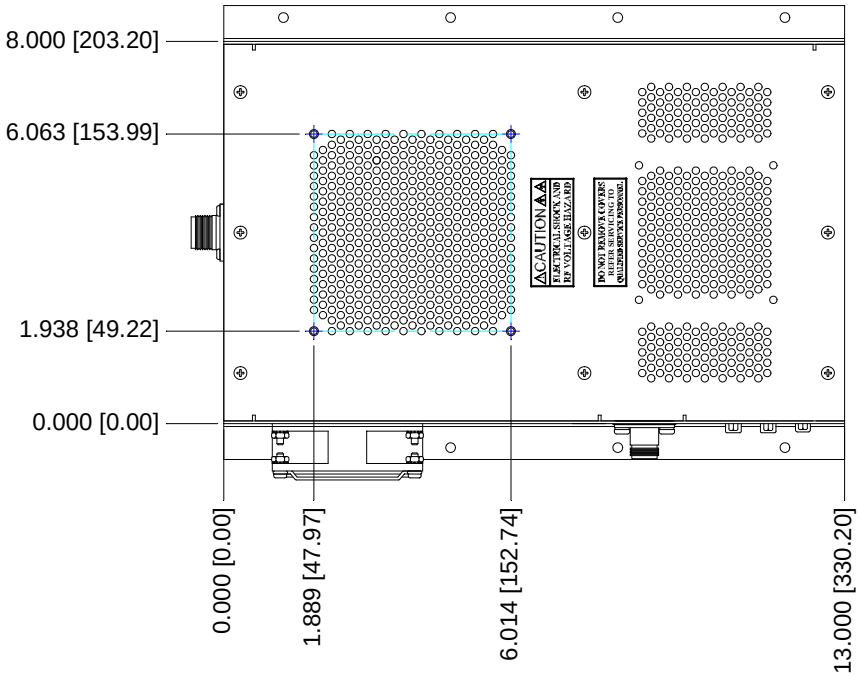
ATS-3M Left Side View



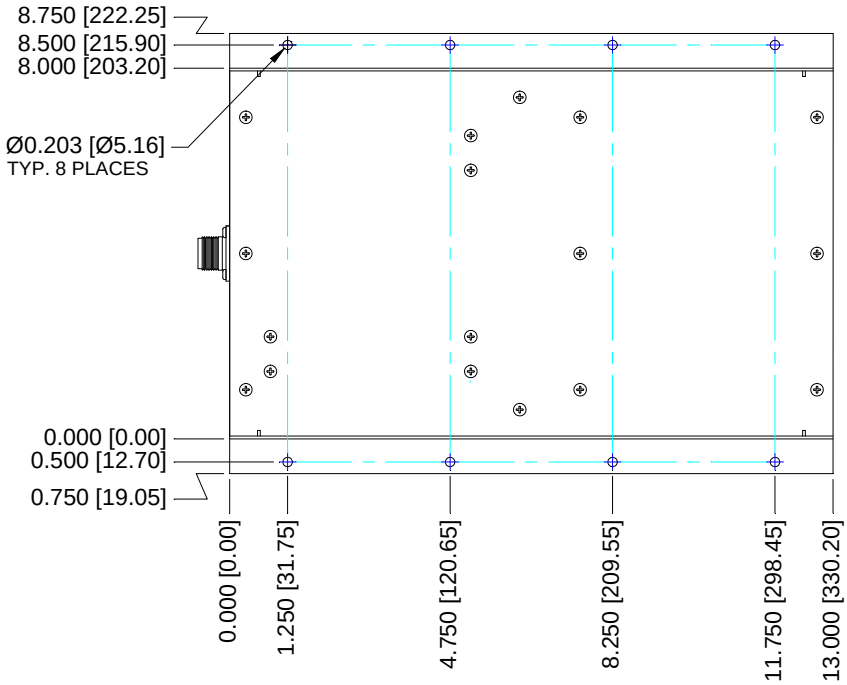
ATS-3M Right Side View

ATS-3M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-3M Physical Dimensions (continued):



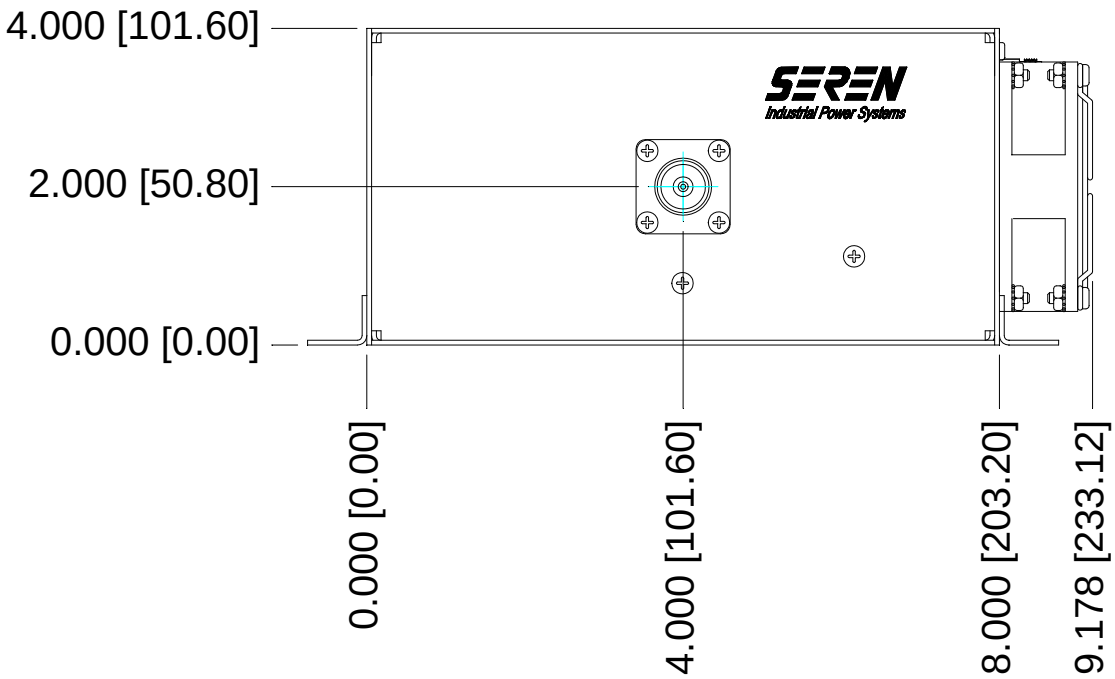
ATS-3M Top View



ATS-3M Bottom View

ATS-3M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-3M Physical Dimensions (continued):



ATS-3M Rear View

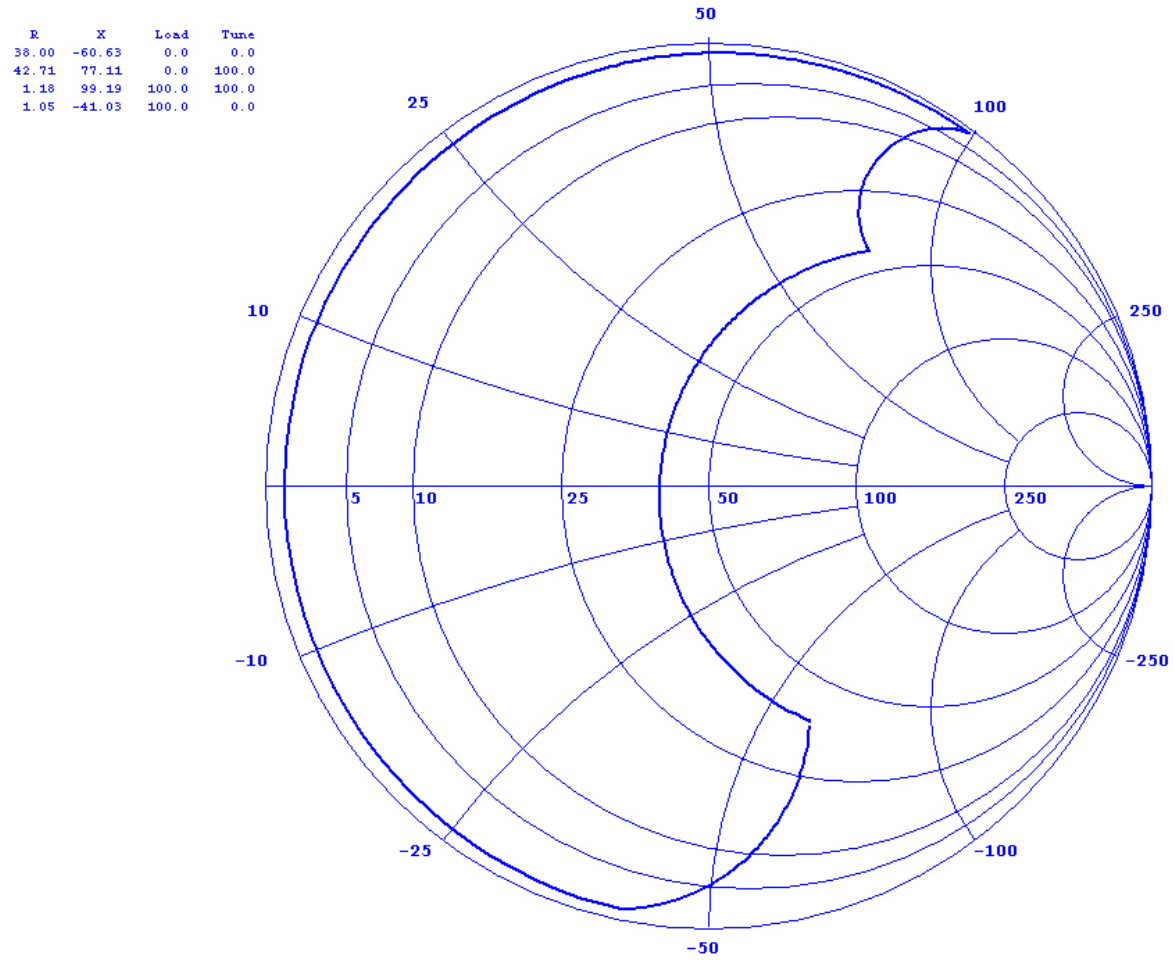
ATS-6 Automatic Matching Network Specifications

ATS-6 Matching Network Specifications (Generic Configuration)	
RF Input Power:	600 Watts Nominal, application dependant 4.5KV Peak, 35A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Dual (2x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connection) Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan), Optional: Water
Coolant Water Connection:	(Optional) ¼" OD Tube, Swagelok Compression Type
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 6 Turn, Tapped "L" Configuration, Sputter Application Load Capacitor Range (Variable): 30-1713pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 5-100pF Load Capacitor Type: Vacuum Dielectric RF Coil: 6 Turn, Tapped

ATS-6 Matching Network Specifications (Generic Configuration)

DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	5.00 [127] High x 9.00 [228.6] Wide x 16.13 [409.7] Deep
Weight:	10.0 lbs [4.53Kg]
Mounting:	Customer Supplied

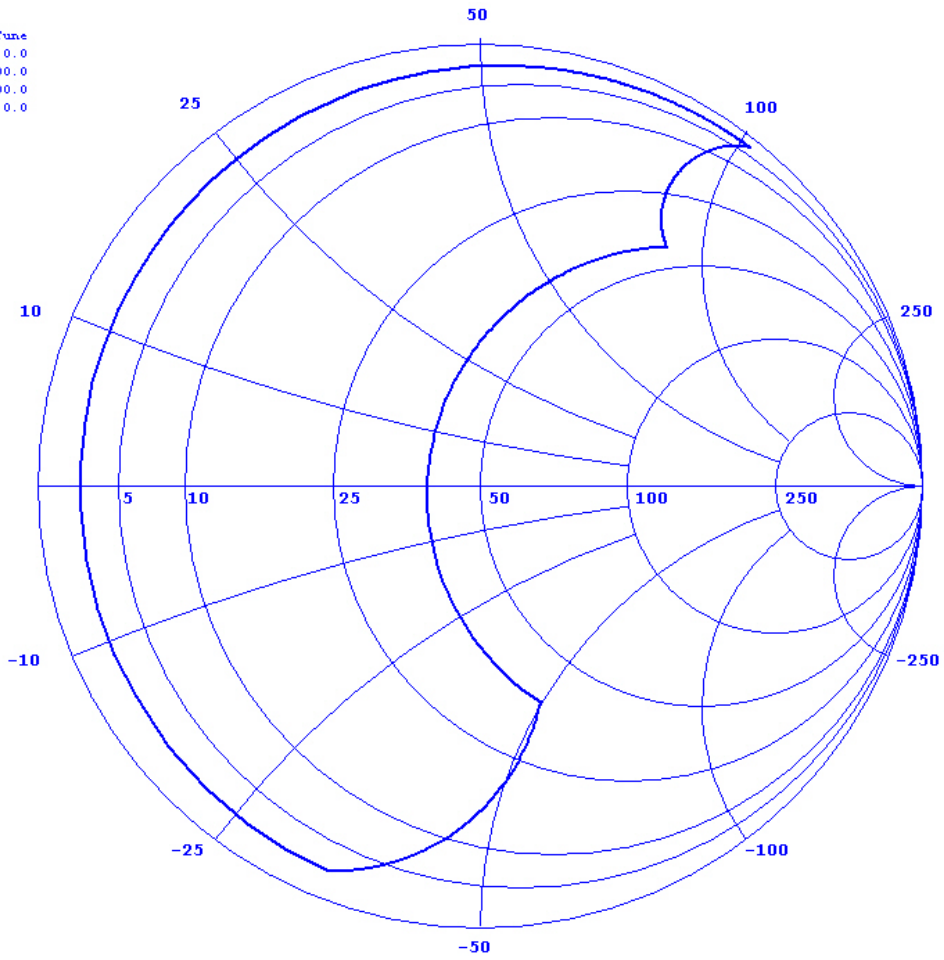
ATS-6 Tuning Range, Generic Sputter Configuration



ATS-6 Matching Network Specifications (Generic Configuration)

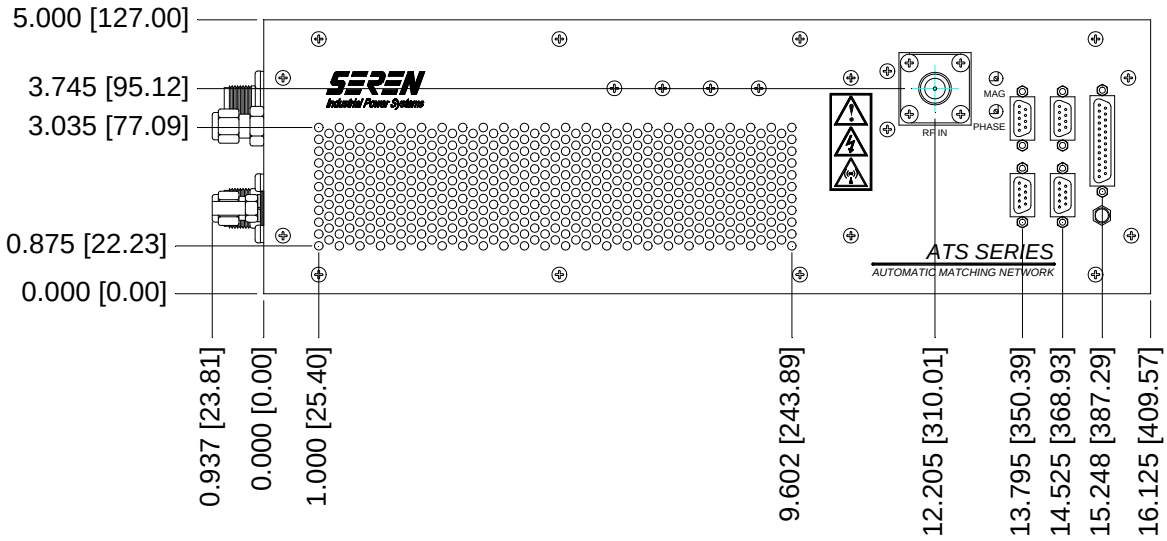
ATS-6 Tuning Range, Generic Non-Sputter Configuration

R	X	Load	Tune
37.67	-49.71	0.0	0.0
42.27	86.38	0.0	100.0
2.69	103.96	100.0	100.0
2.39	-34.08	100.0	0.0

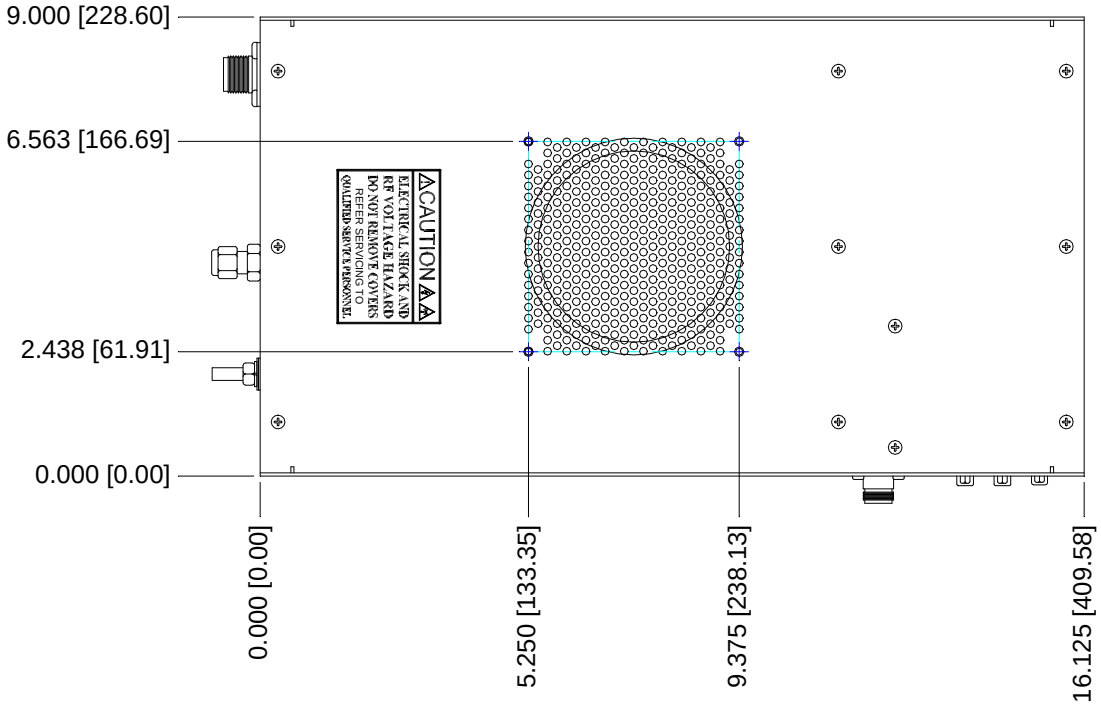


ATS-6 Matching Network Specifications (Generic Configuration)

ATS-6 Physical Dimensions:



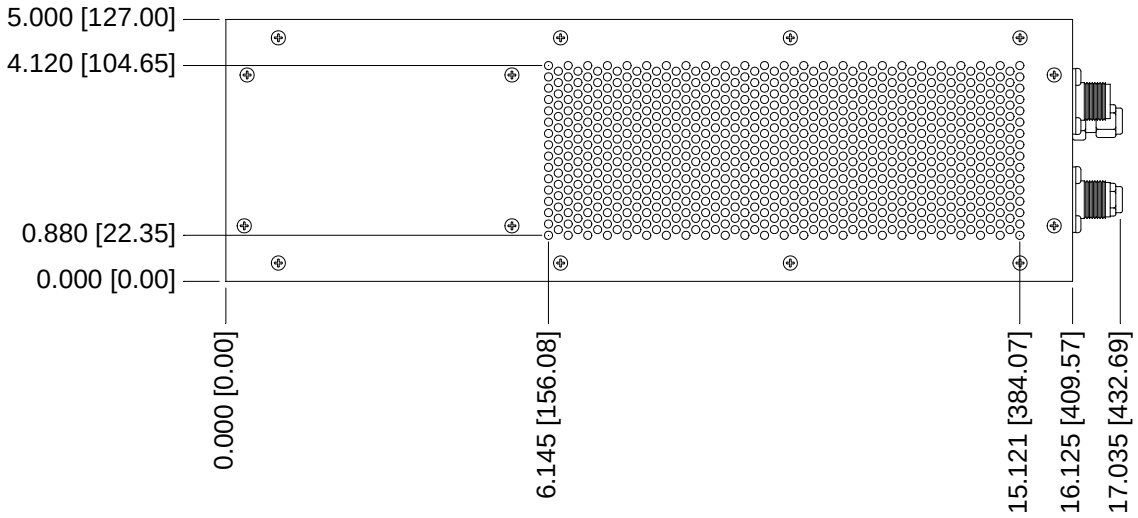
ATS-6 Left Side View



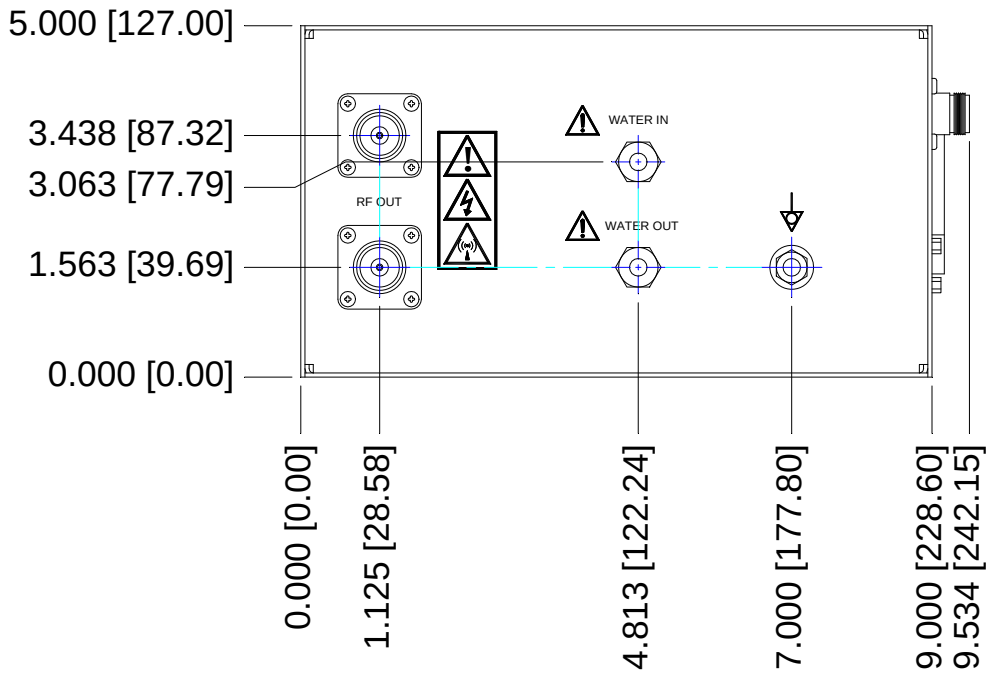
ATS-6 Top View

ATS-6 Matching Network Specifications (Generic Configuration)

ATS-6 Physical Dimensions (continued):



ATS-6 Right Side View



ATS-6 Rear View

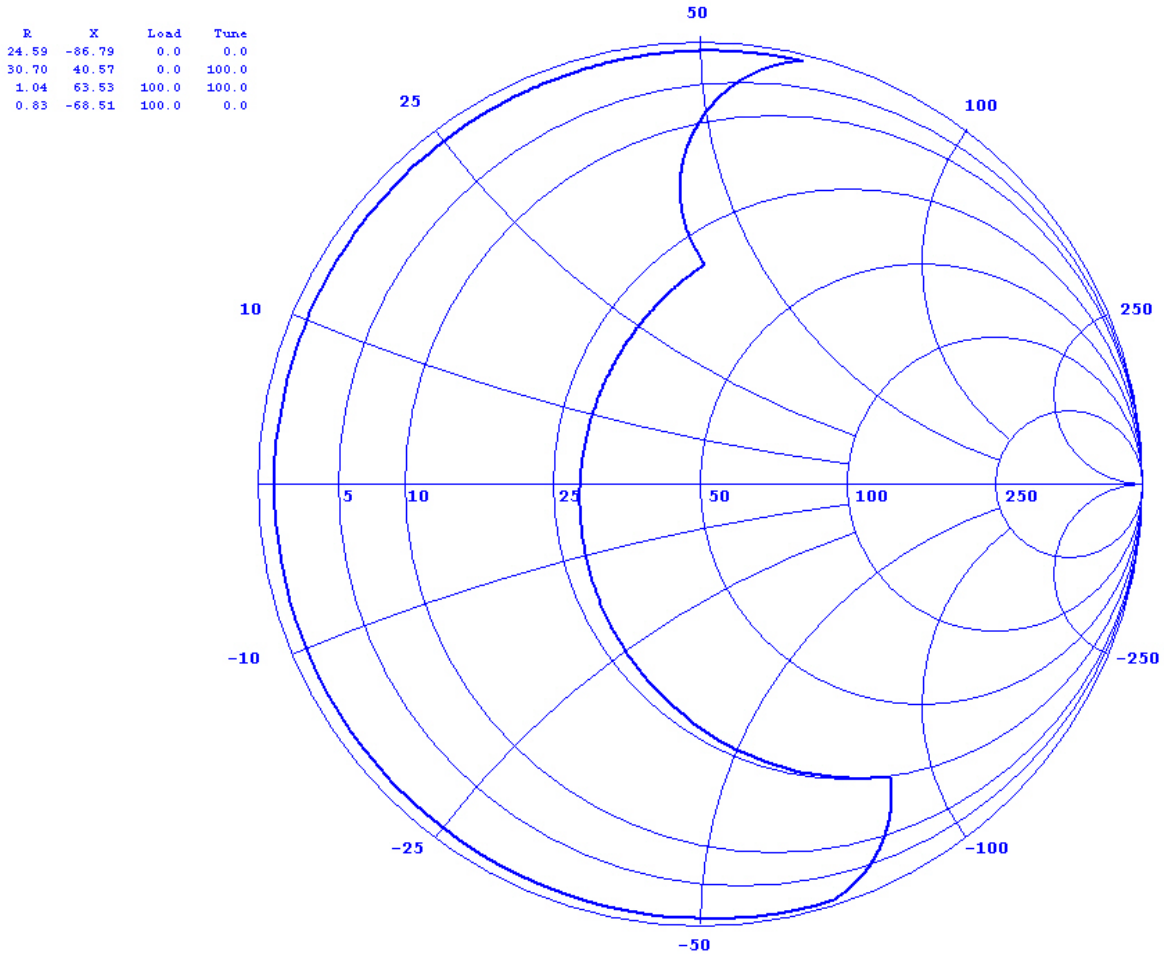
ATS-6M Automatic Matching Network "Mini" Package Specifications:

ATS-6M Matching Network "Mini" Package Specifications (Generic Configuration)	
RF Input Power:	600 Watts Nominal, application dependant 4.5KV Peak, 35A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Single (1x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connection) Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan, 33CFM)
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 5 Turn "L" Configuration, Sputter Application Load Capacitor Range (Variable): 30-1039pF Load Capacitor Type: Air Dielectric Fixed Load Capacitance: 3x 120pF Tune Capacitor Range (Variable): 5-100pF Load Capacitor Type: Vacuum Dielectric RF Coil: 5 Turn
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1

ATS-6M Matching Network "Mini" Package Specifications (Generic Configuration)

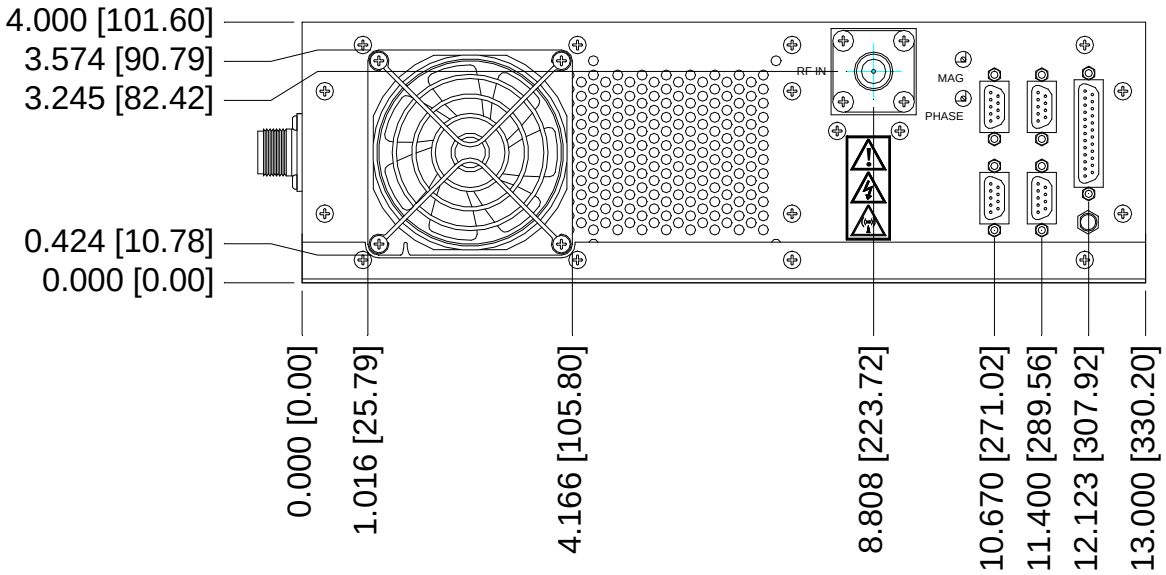
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	4.00 [101.6]H x 8.00 [203.2]W x 13.00 [330.2]D
Weight:	10.0 lbs [4.53Kg]
Mounting:	Customer Supplied

ATS-6M Tuning Range, Generic Configuration:

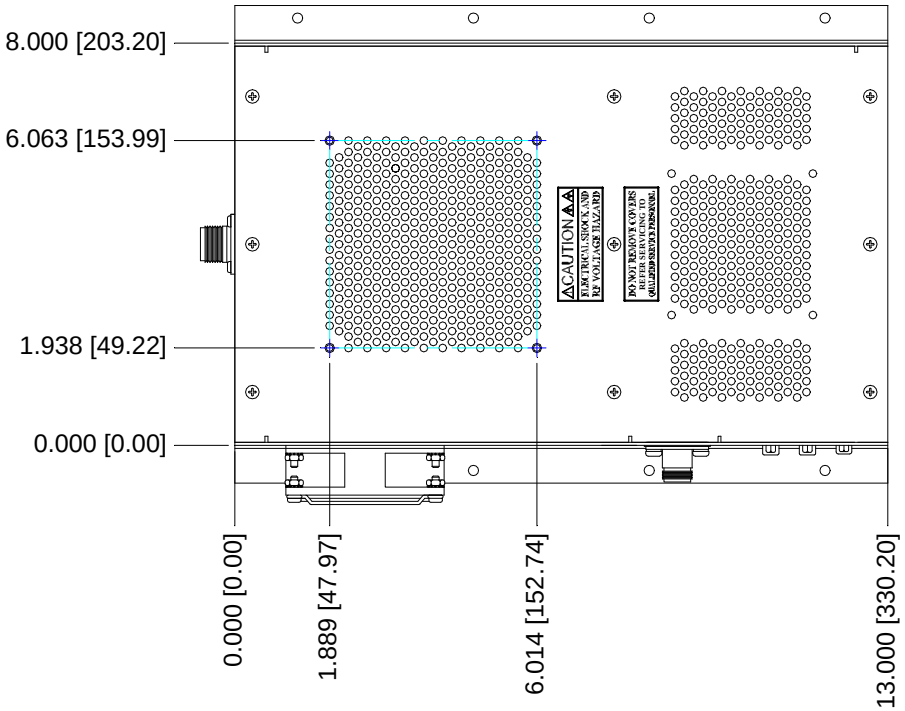


ATS-6M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-6M Physical Dimensions:



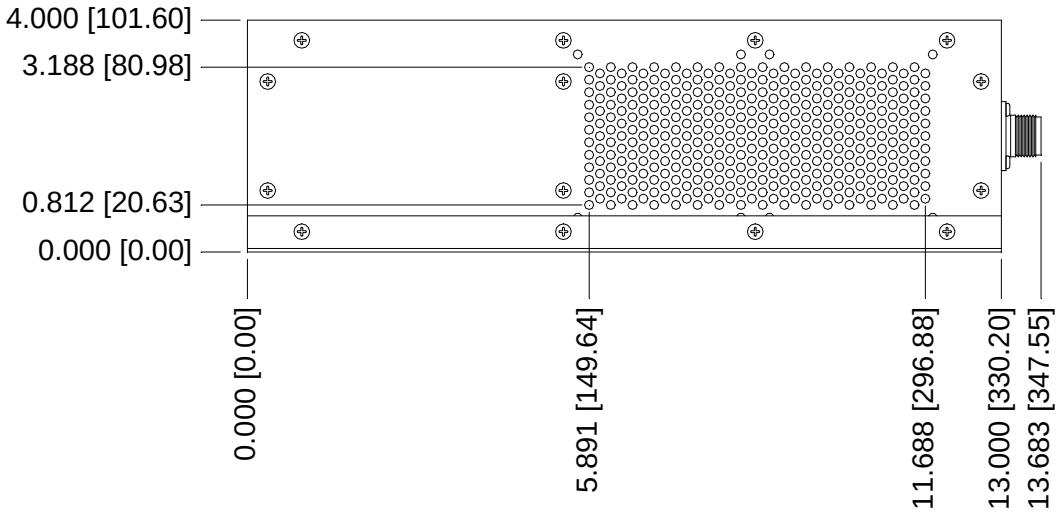
ATS-6M Left Side View



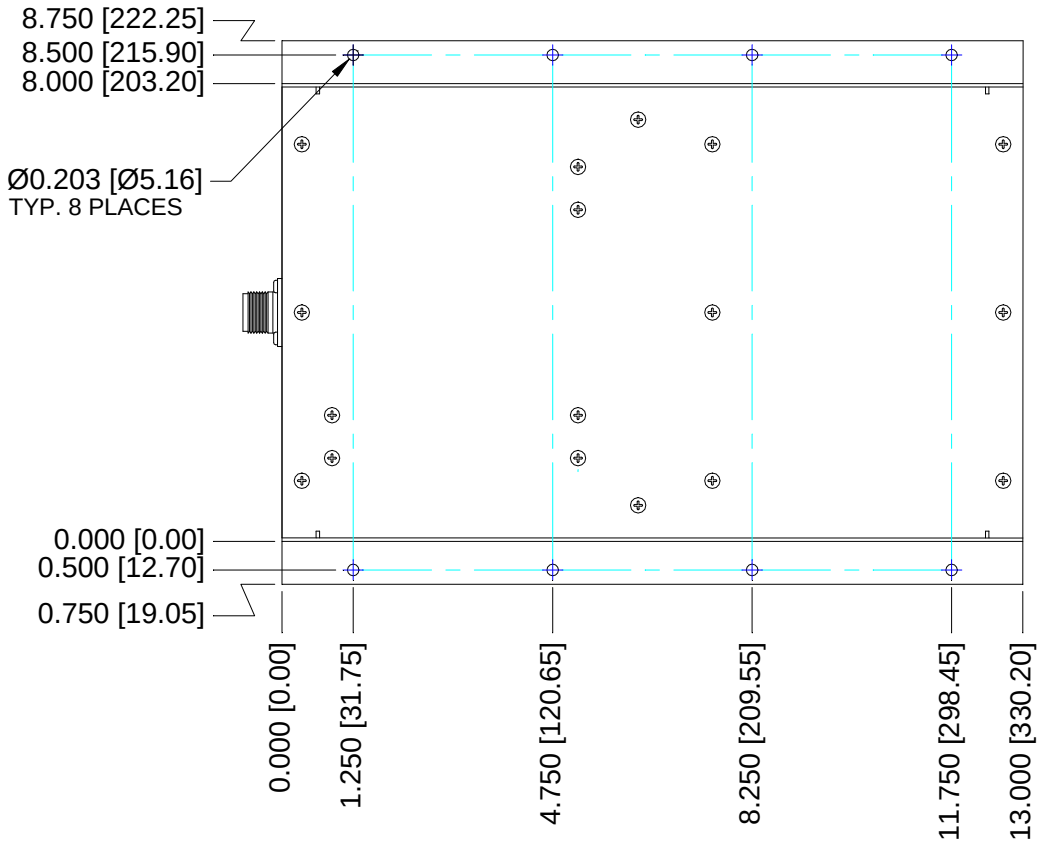
ATS-6M Top View

ATS-6M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-6M Physical Dimensions (continued):



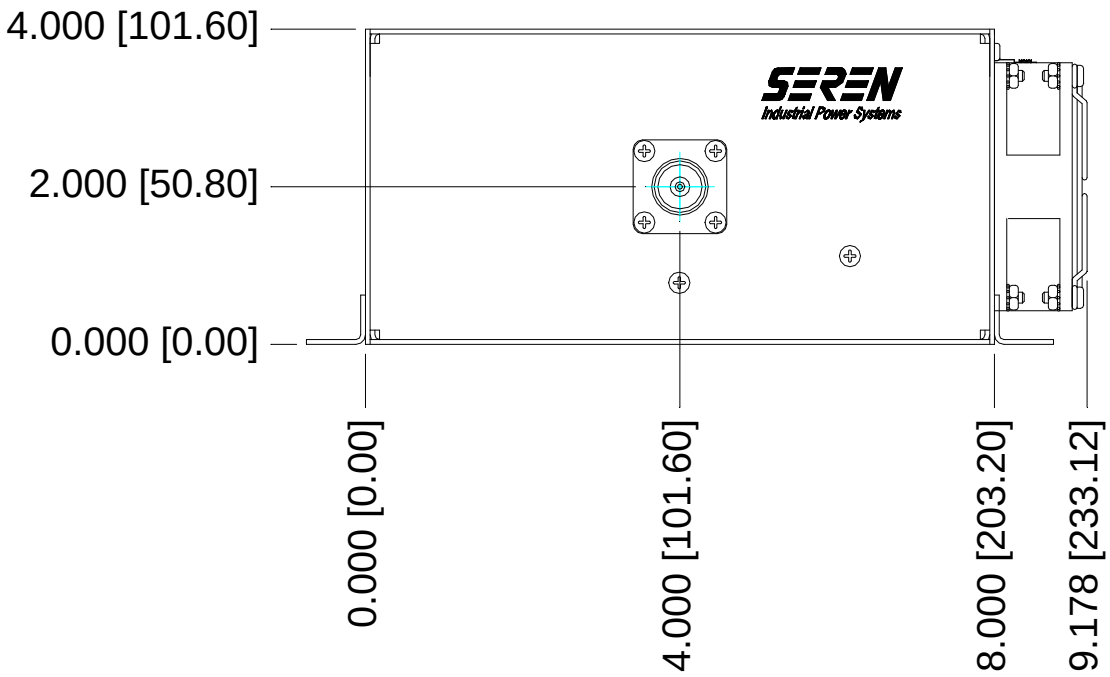
ATS-6M Right Side View



ATS-6M Bottom View

ATS-6M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-6M Physical Dimensions (continued):



ATS-6M Rear View

ATS-10 Automatic Matching Network Specifications

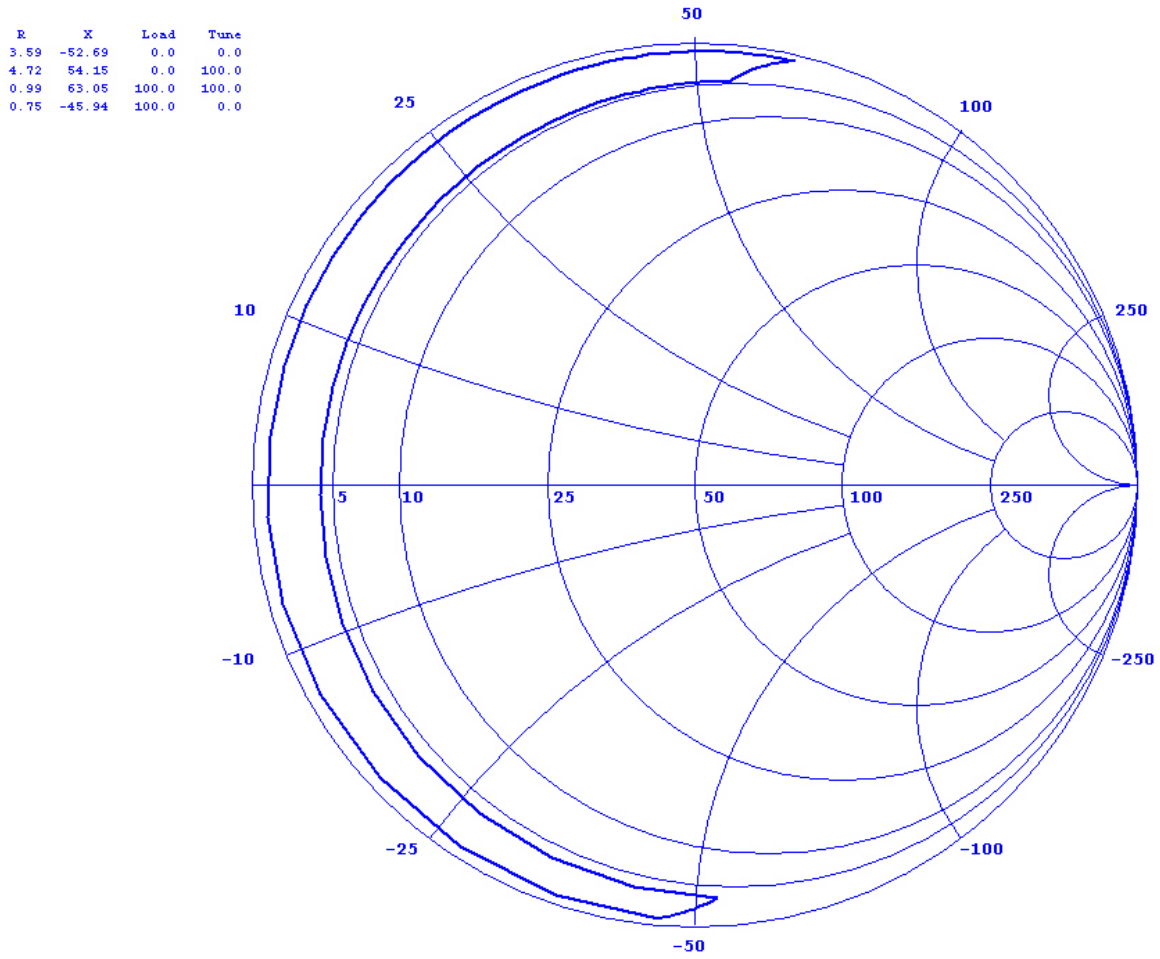
ATS-10 Matching Network Specifications (Generic Configuration)	
RF Input Power:	1000 Watts Nominal, application dependant 4.5KV Peak, 45A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Dual (2x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connection) Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan, 110CFM) Optional: Water (application dependant)
Coolant Water Connection:	(Optional) ¼" OD Tube, Swagelok Compression Type
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 100-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 4x 200pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 5 Turn
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	6.00 [152.4]H x 13.13 [333.5]W x 13.38 [339.9]D

ATS-10 Matching Network Specifications (Generic Configuration)

Weight: 20.0 lbs [9.07Kg]

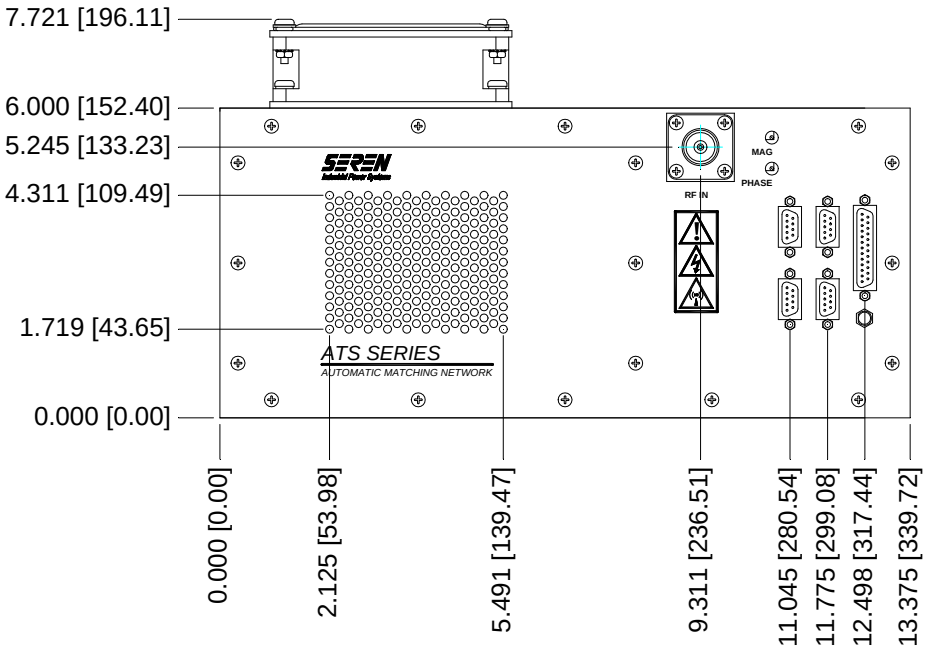
Mounting: Customer Supplied

ATS-10 Tuning Range, Generic Configuration

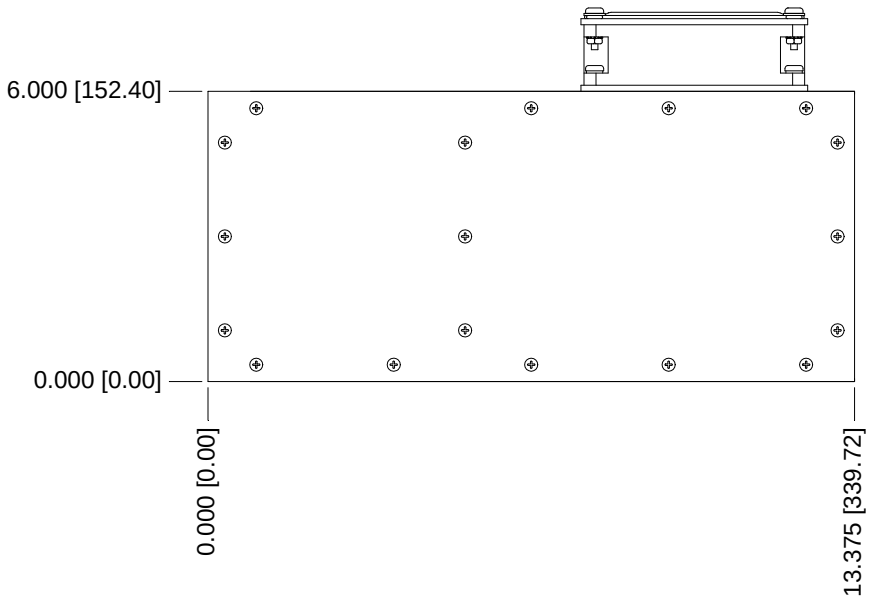


ATS-10 Matching Network Specifications (Generic Configuration)

ATS-10 Physical Dimensions:



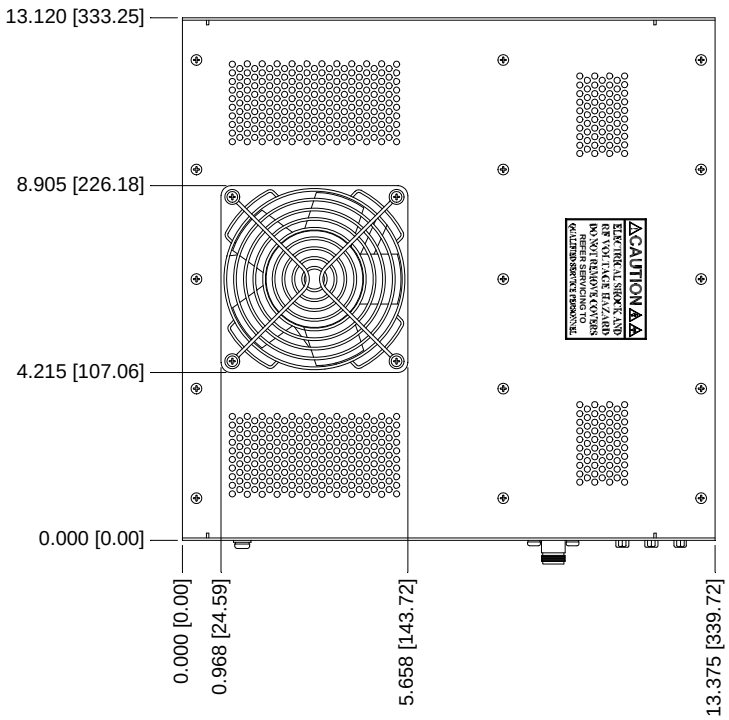
ATS-10 Left Side View



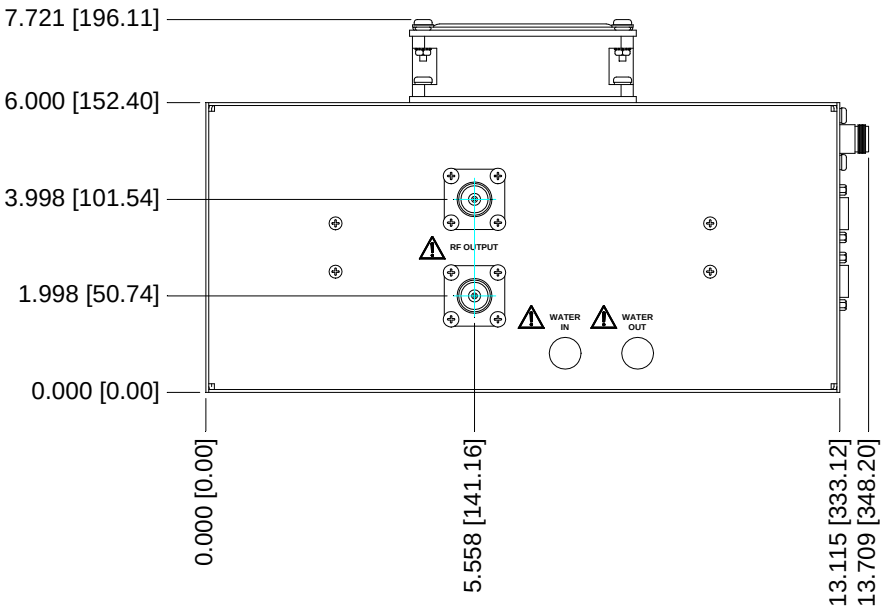
ATS-10 Right Side View

ATS-10 Matching Network Specifications (Generic Configuration)

ATS-10 Physical Dimensions (continued):



ATS-10 Top View



ATS-10 Rear View

ATS-10M Automatic Matching Network "Mini" Package Specifications

ATS-10M Matching Network "Mini" Package Specifications (Generic Configuration)

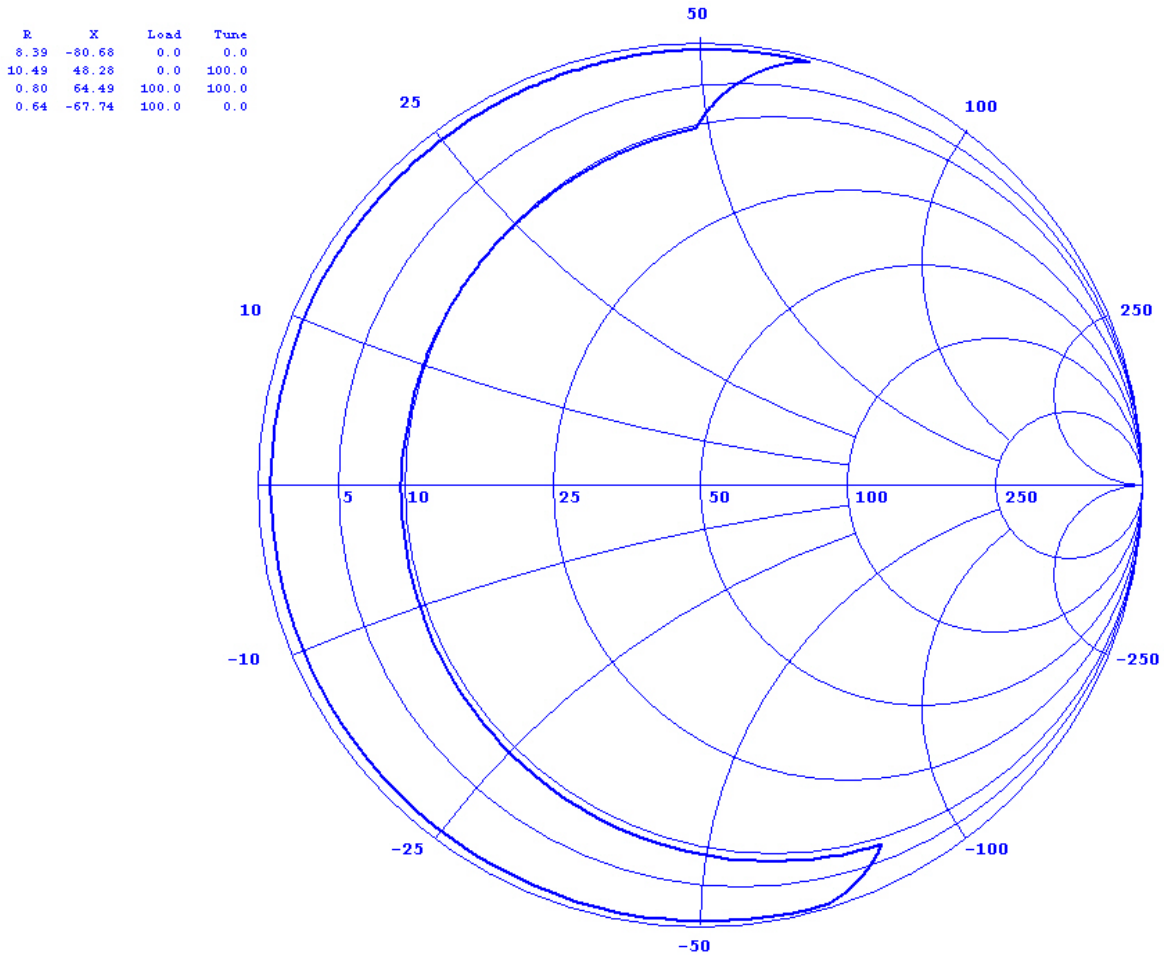
RF Input Power:	1000 Watts Nominal, application dependant 4.5KV Peak, 45A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Type "N" Female
RF Output Connection:	Standard: Single (1x) Type HN Female Optional: Type "C" Female Type "UHF" Female Type 7/16 DIN Female Stud Terminal None (System integrator makes connection) Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan, 33CFM)
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 100-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 2x 240pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 5 Turn
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	4.00 [101.6]H x 8.00 [203.2]W x 13.00 [330.2]D

ATS-10M Matching Network "Mini" Package Specifications (Generic Configuration)

Weight: 20.0 lbs [9.07Kg]

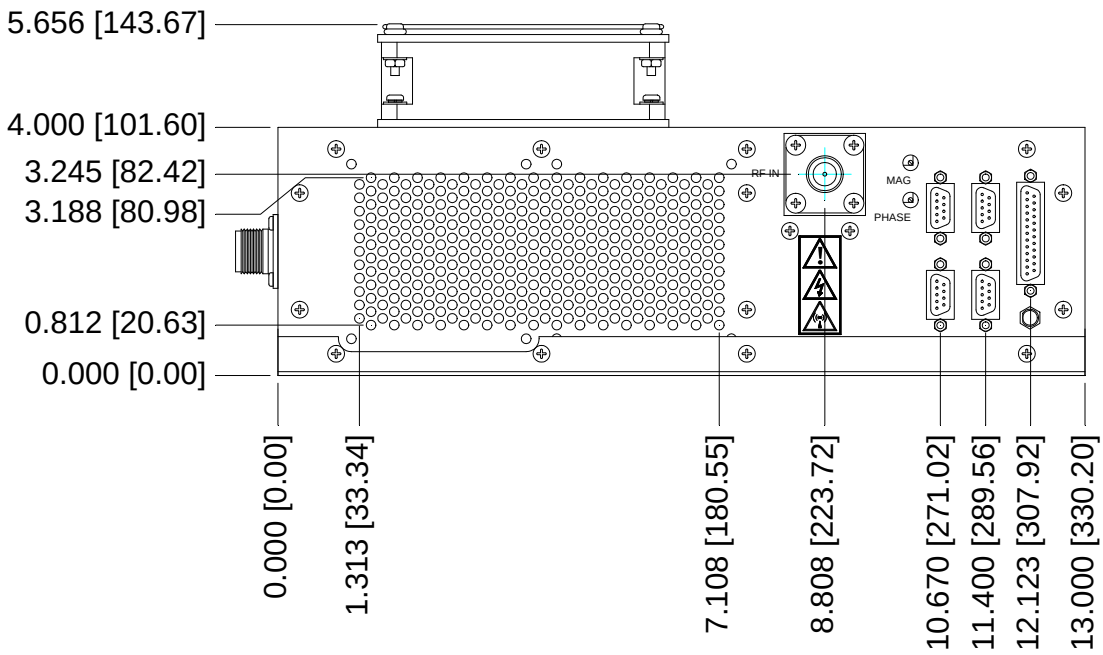
Mounting: Customer Supplied

ATS-10M Tuning Range, Generic Configuration:

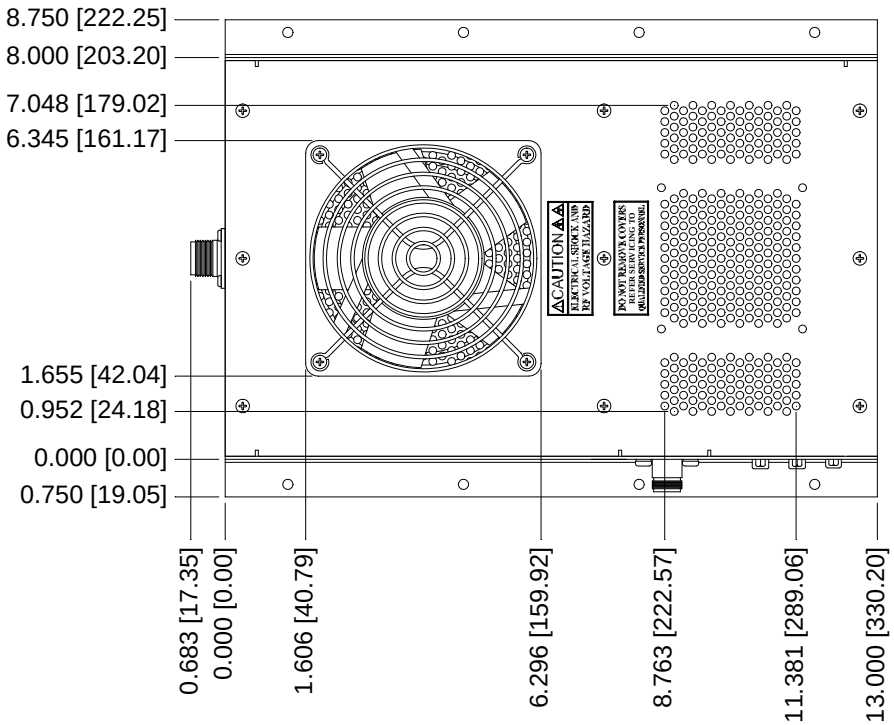


ATS-10M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-10M Physical Dimensions:



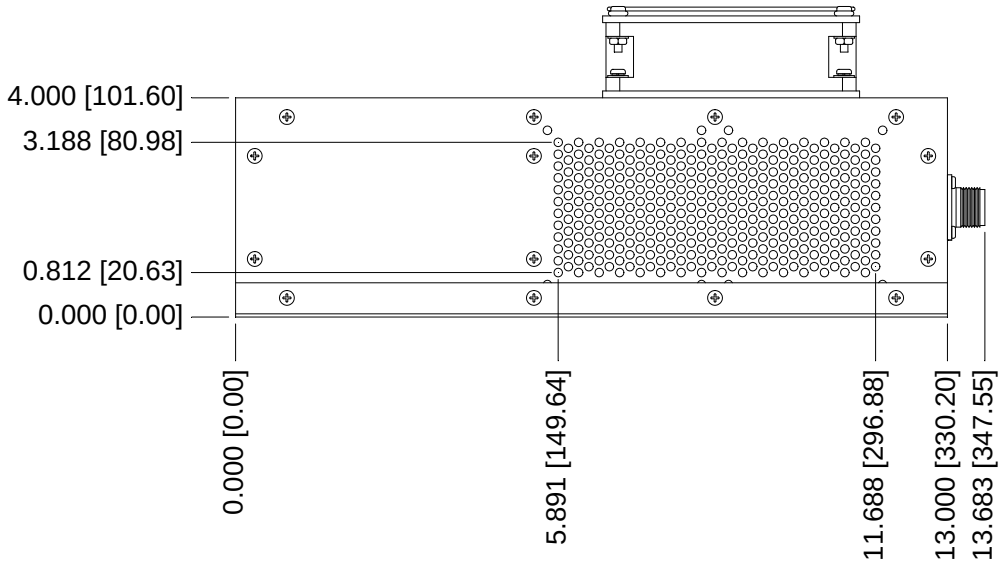
ATS-10M Left Side View



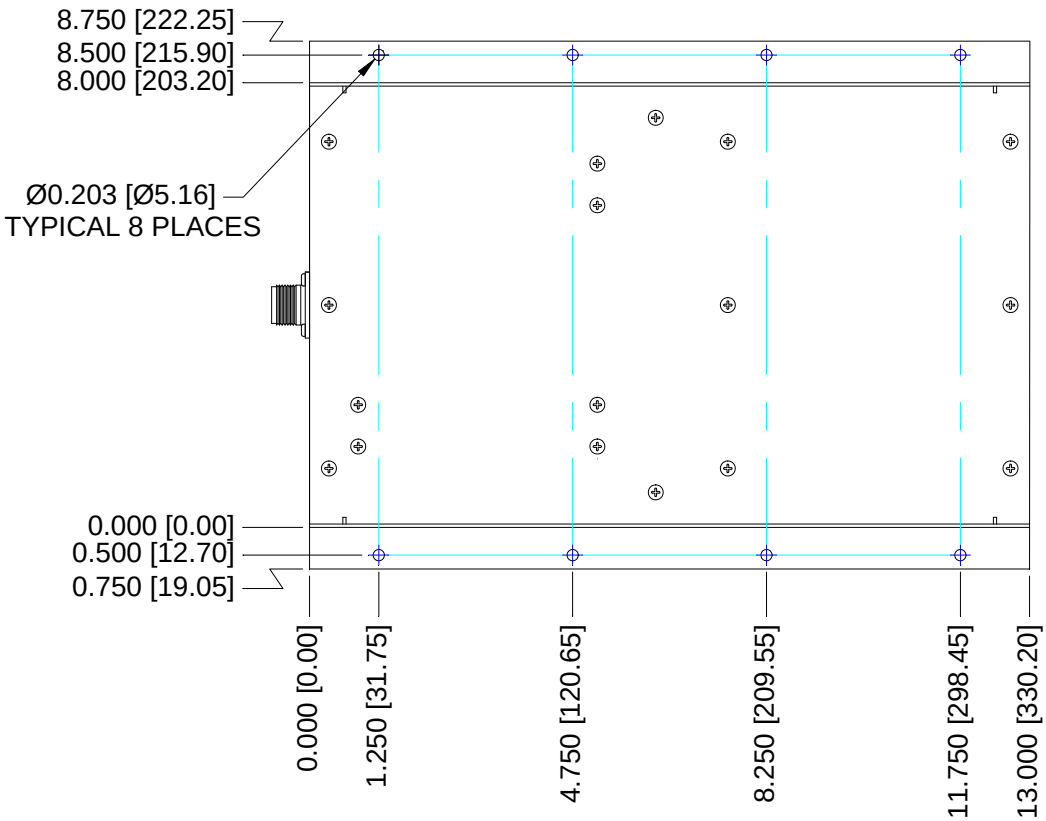
ATS-10M Top View

ATS-10M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-10M Physical Dimensions (continued):



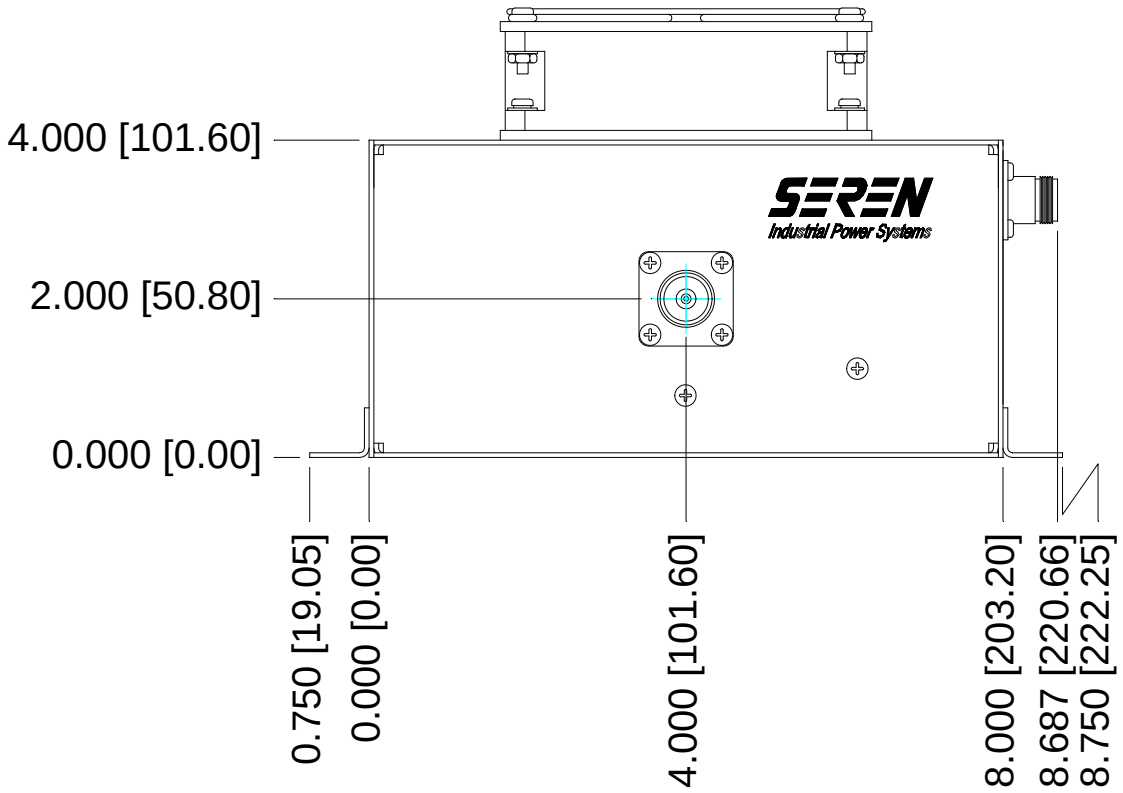
ATS-10M Right Side View



ATS-10M Bottom View

ATS-10M Matching Network "Mini" Package Specifications (Generic Configuration)

ATS-10M Physical Dimensions (continued):



ATS-10M Rear View

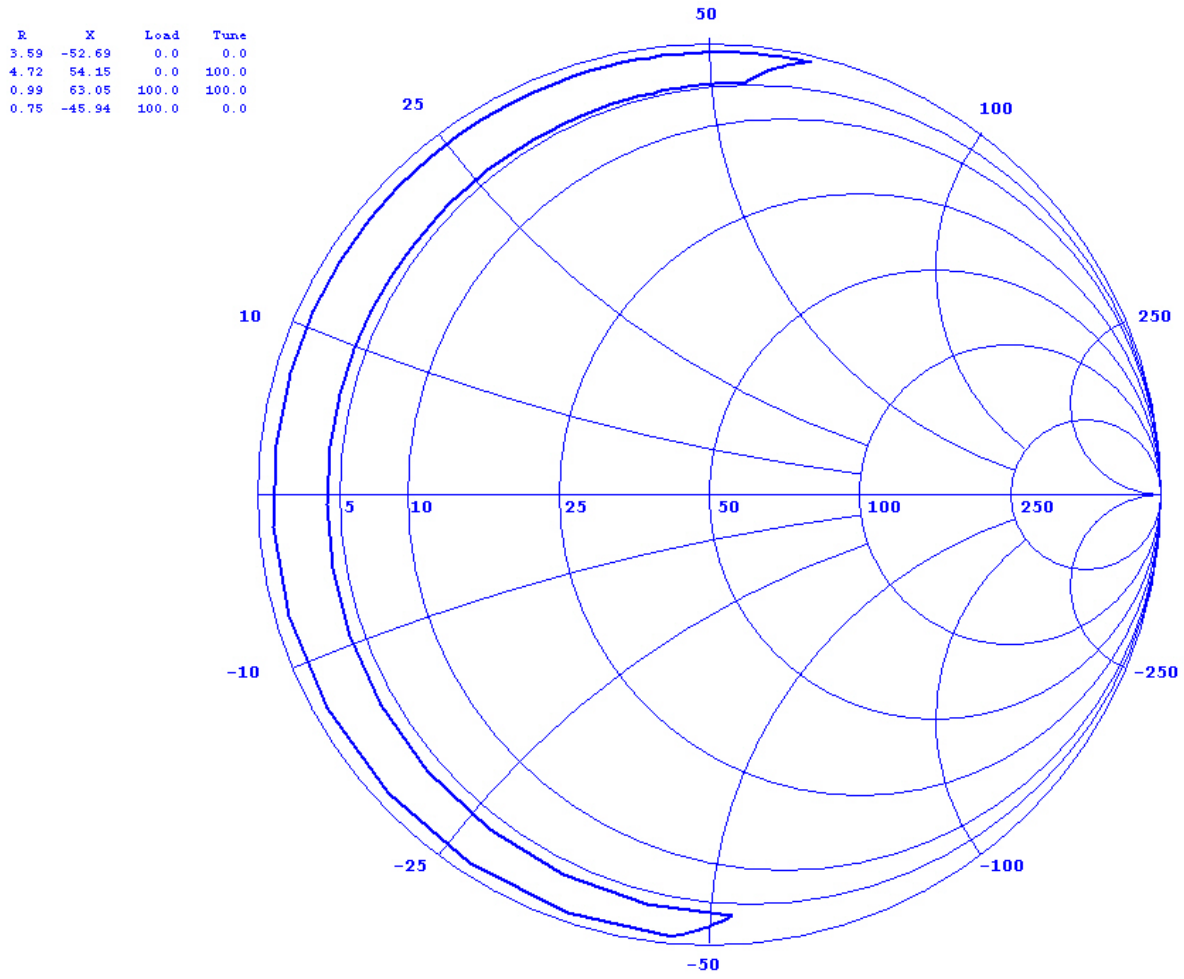
ATS-20 Automatic Matching Network Specifications

ATS-20 Matching Network Specifications (Generic Configuration)	
RF Input Power:	2000 Watts Nominal, application dependant 7.2KV Peak, 55A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: Type "N" Female Optional: Type "HN" Female
RF Output Connection:	Standard: None (System integrator makes connection) Optional: Type "C" Female Type 7/16 DIN Female Type HN Female Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan, 110CFM) Optional: Water (Application-dependant. Cooling fan may or may not be supplied, depending on application/part number specific configuration - consult factory.)
Coolant Water Connection:	(Optional) ¼" OD Tube, Swagelok Compression Type
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 100-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 4x 200pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 5 Turn, Convection Cooled (Water-cooled optional, application dependant) "Inverted L" configuration available – consult factory.
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1

ATS-20 Matching Network Specifications (Generic Configuration)

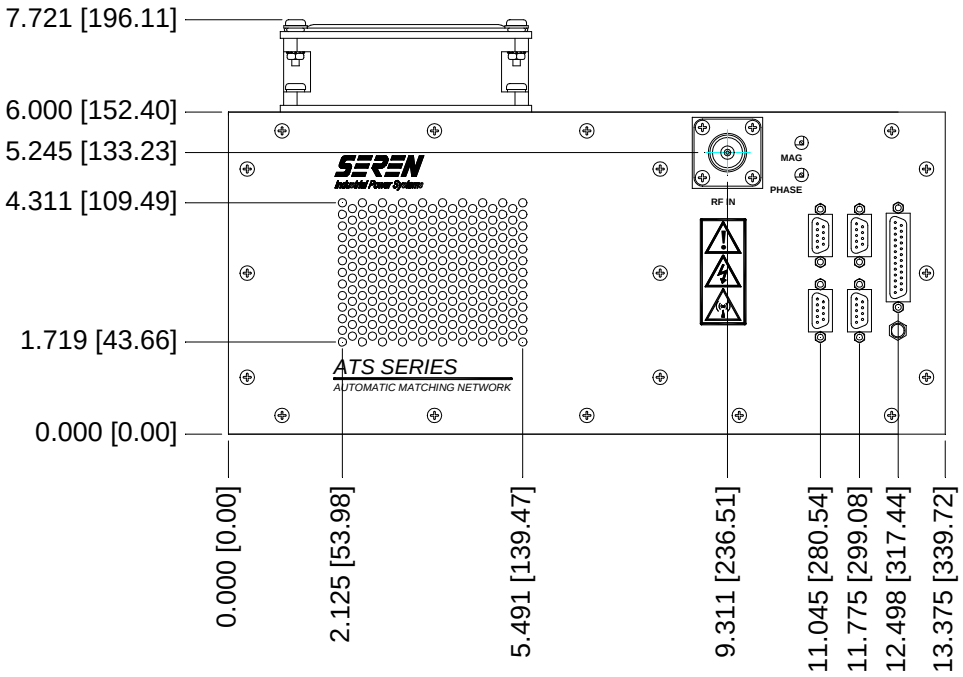
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1
Physical Dimensions: inch [mm]	6.00 [152.4]H x 13.13 [333.5]W x 13.38 [337.2] Deep
Weight:	21.0 lbs [9.52Kg]
Mounting:	Customer Supplied

ATS-20 Tuning Range, Generic Configuration

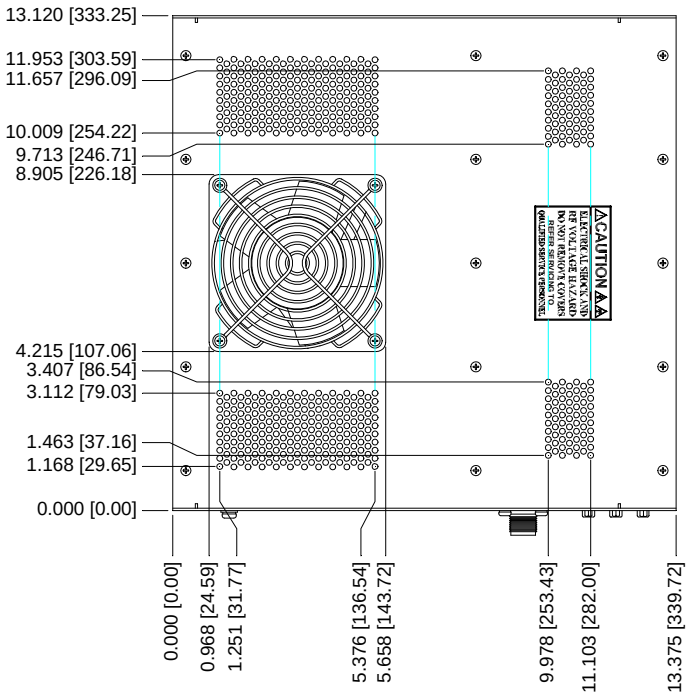


ATS-20 Matching Network Specifications (Generic Configuration)

ATS-20 Physical Dimensions:



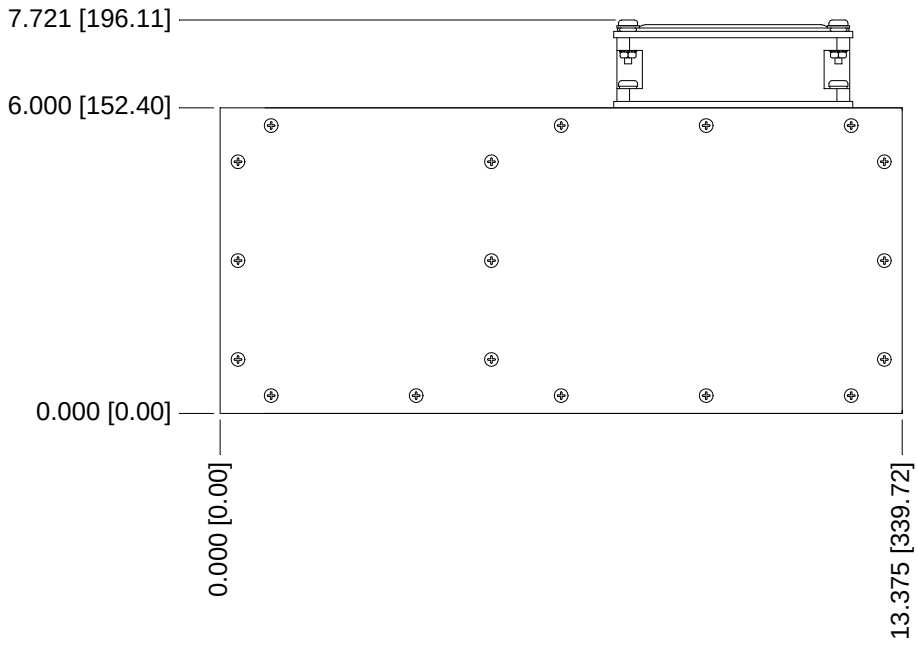
ATS-20 Left Side View



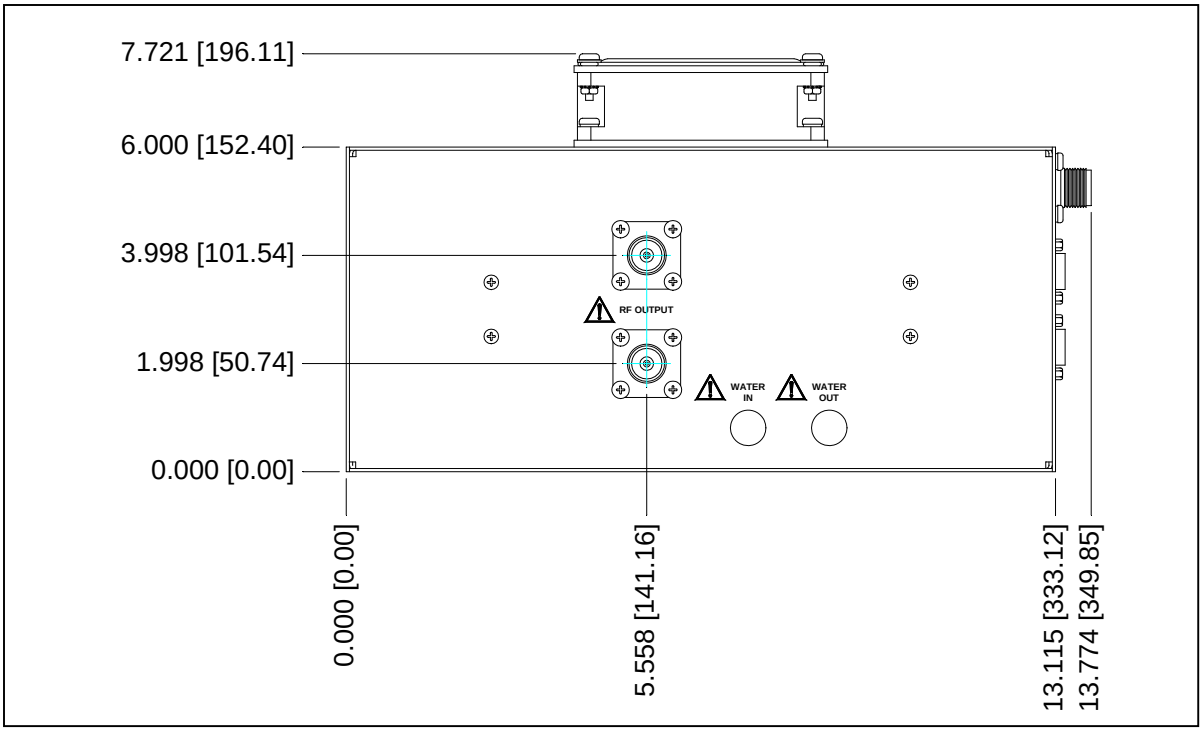
ATS-20 Top View

ATS-20 Matching Network Specifications (Generic Configuration)

ATS-20 Physical Dimensions (continued):



ATS-20 Right Side View



ATS-20 Rear View

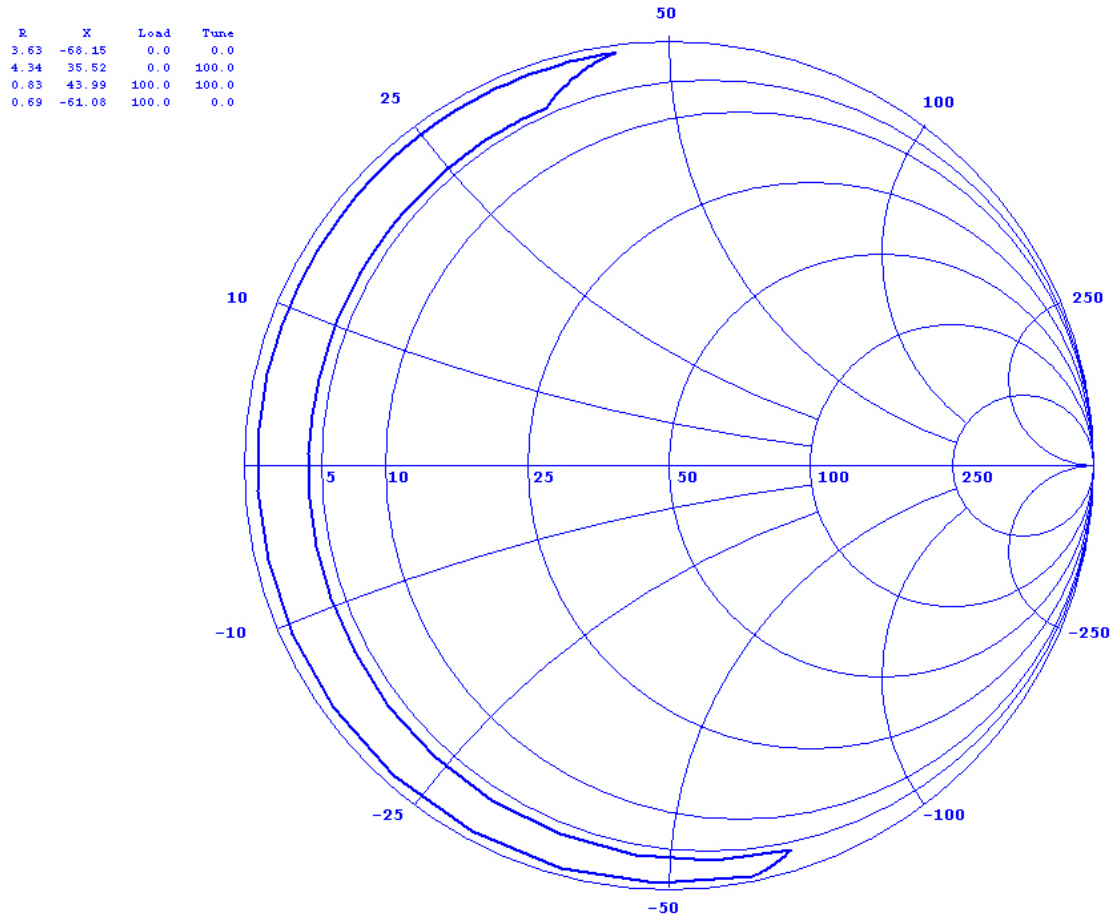
ATS-30 Automatic Matching Network Specifications

ATS-30 Matching Network Specifications (Generic Configuration)	
RF Input Power:	3000 Watts Nominal, application dependant 7.2KV Peak, 65A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: Type "HN" Female Optional: Type 7/16 DIN Female
RF Output Connection:	Standard: None (System integrator makes connection) Optional: Type "C" Female Type 7/16 DIN Female Type "HN" Female Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Forced Air (Fan, 110CFM) Optional: Water (application dependant)
Coolant Water Connection:	(Optional) ¼" OD Tube, Swagelok Compression Type
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 100-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 2x 240pF Tune Capacitor Range (Variable): 50-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 3 Turn, Convection Cooled (Water-cooled optional, application dependant) "Inverted L" configuration available – consult factory.
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1

ATS-30 Matching Network Specifications (Generic Configuration)

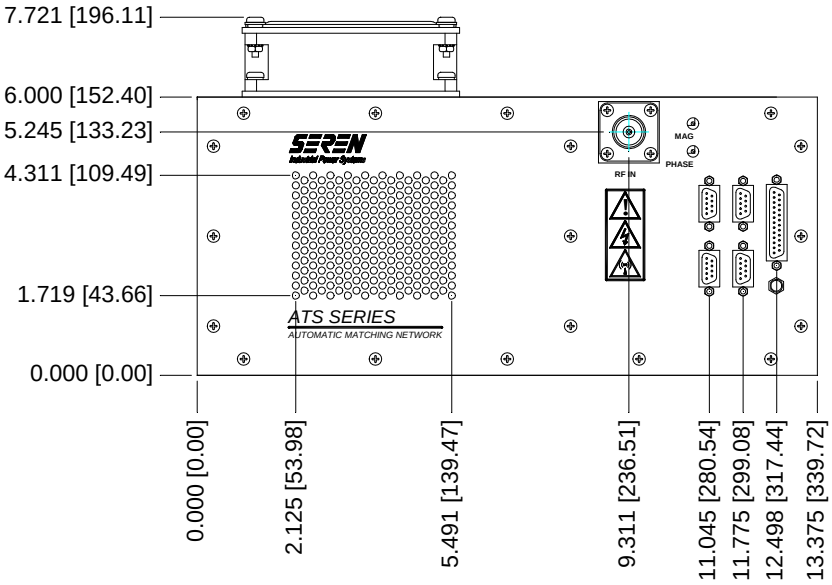
Physical Dimensions: inch [mm]	6.00 [152.4]H x 13.13 [333.5]W x 13.38 [339.9]D
Weight:	21.0 lbs [9.52Kg]
Mounting:	Customer Supplied

ATS-30 Tuning Range, Generic Configuration

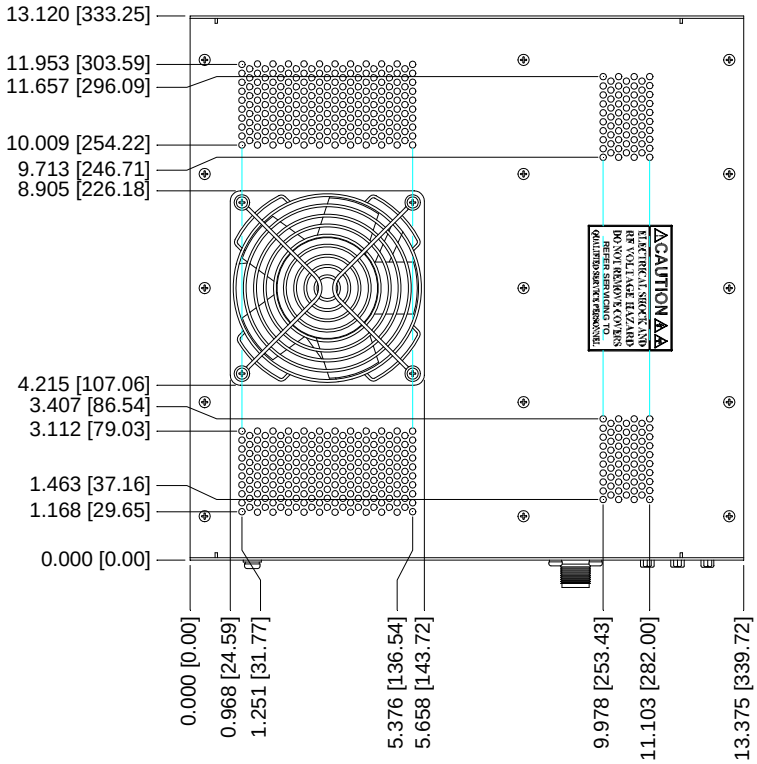


ATS-30 Matching Network Specifications (Generic Configuration)

ATS-30 Physical Dimensions:



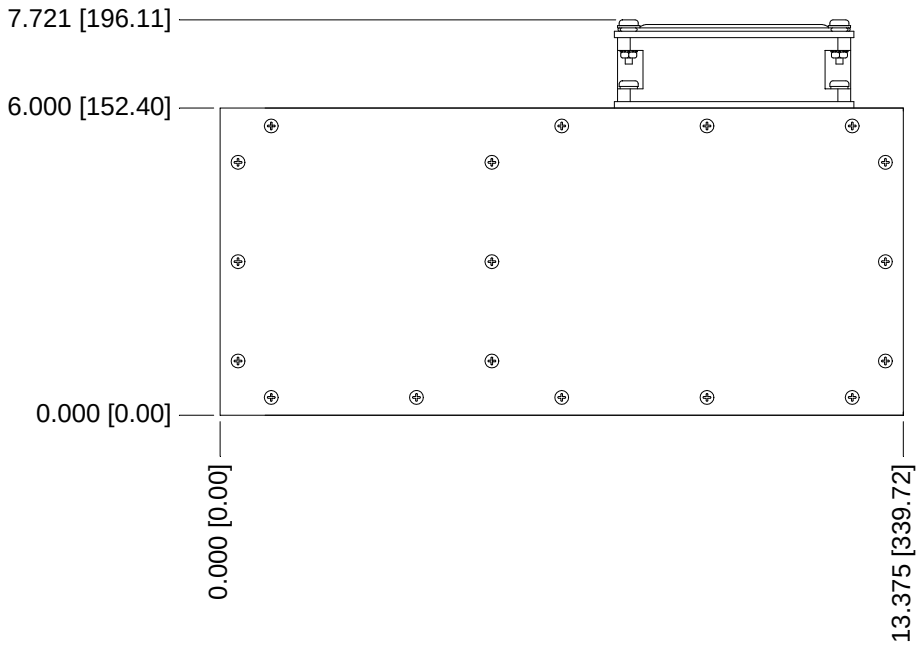
ATS-30 Left Side View



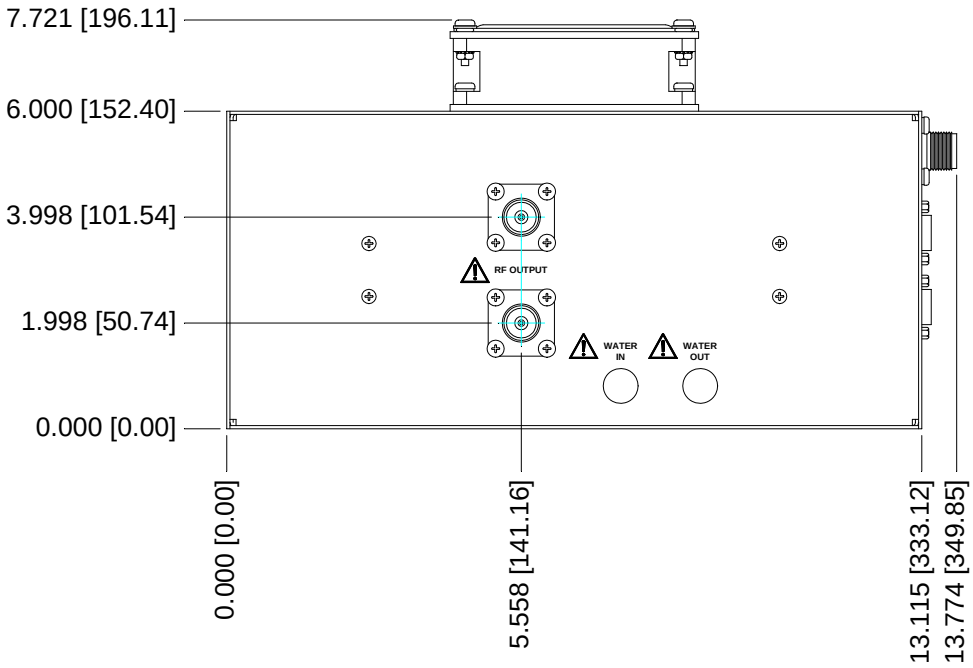
ATS-30 Top View

ATS-30 Matching Network Specifications (Generic Configuration)

ATS-30 Physical Dimensions (continued):



ATS-30 Right Side View



ATS-30 Rear View

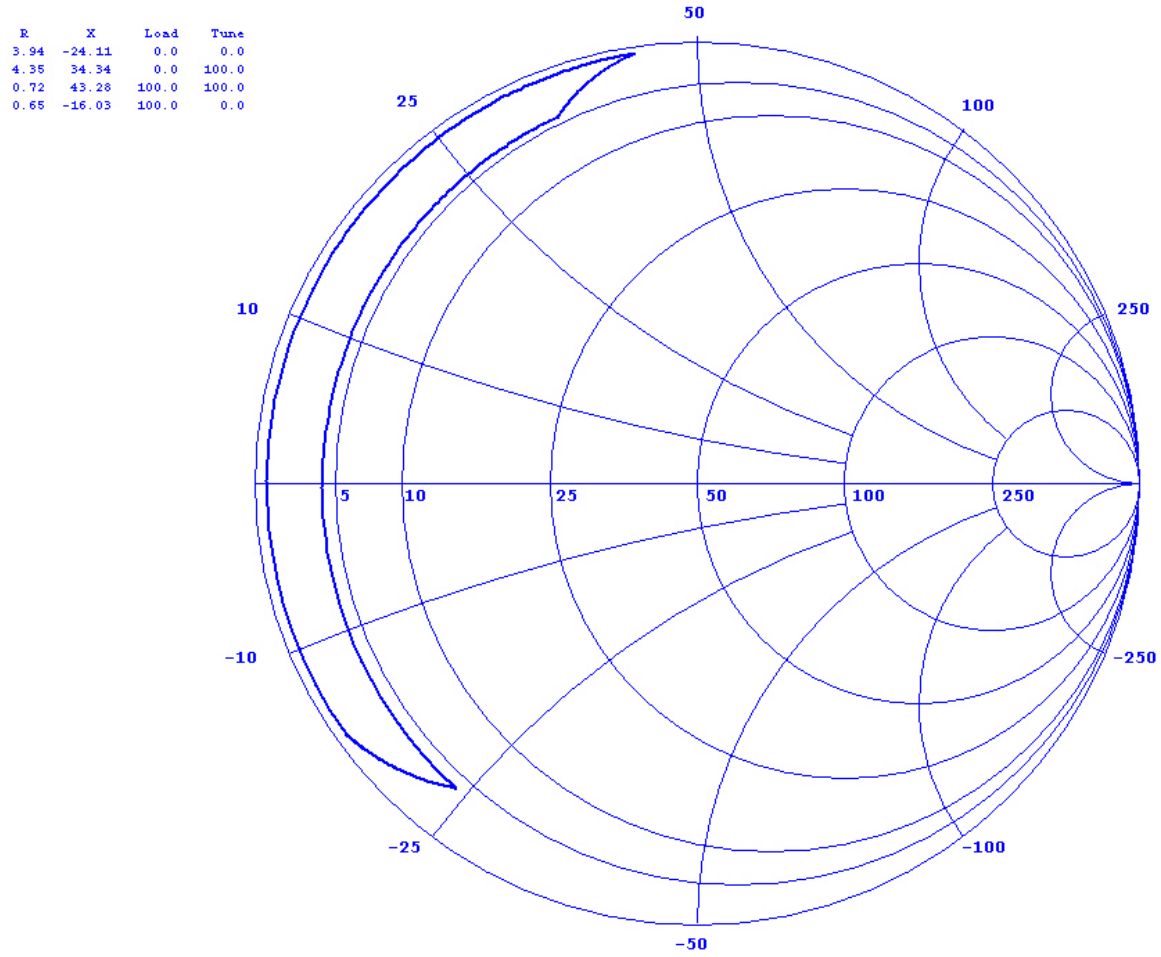
ATS-50/75 Automatic Matching Network Specifications

ATS-50/75 Matching Network Specifications (Generic Configuration)	
RF Input Power:	5000 Watts Nominal, application dependant 9.0KV Peak, 75A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: Type 7/16 DIN Female Optional: Type "LC" Female
RF Output Connection:	Standard: None (System integrator makes connection) Optional: Type 7/16 DIN Female Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Water and Forced Air (Fan, 110CFM)
Coolant Water Connection:	¼" OD Tube, Swagelok Compression Type
Coolant Water Flow Rate:	5 Gallons/Hour (GPH) minimum
Coolant Water Pressure:	80 PSI maximum
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 7-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 4x 200pF Tune Capacitor Range (Variable): 12-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 3 Turn, Water-Cooled
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1

ATS-50/75 Matching Network Specifications (Generic Configuration)

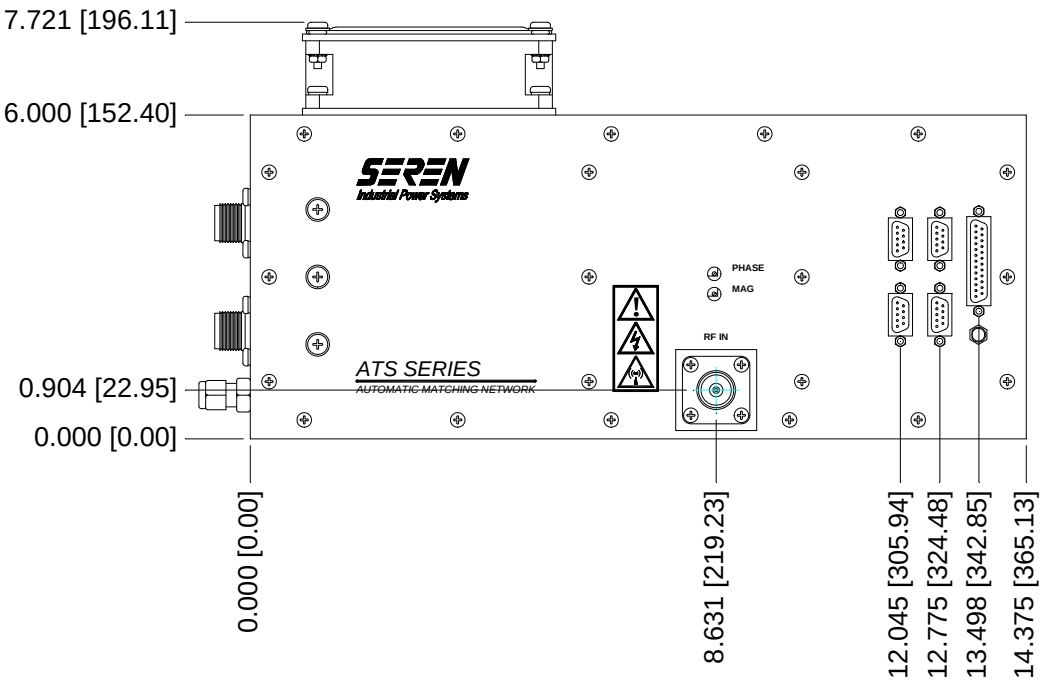
Physical Dimensions: inch [mm]	6.00 [152.4]H x 13.13 [333.5]W x 14.38 [365.25]D
Weight:	23.0 lbs [10.43Kg]
Mounting:	Customer Supplied

ATS-50/75 Tuning Range, Generic Configuration

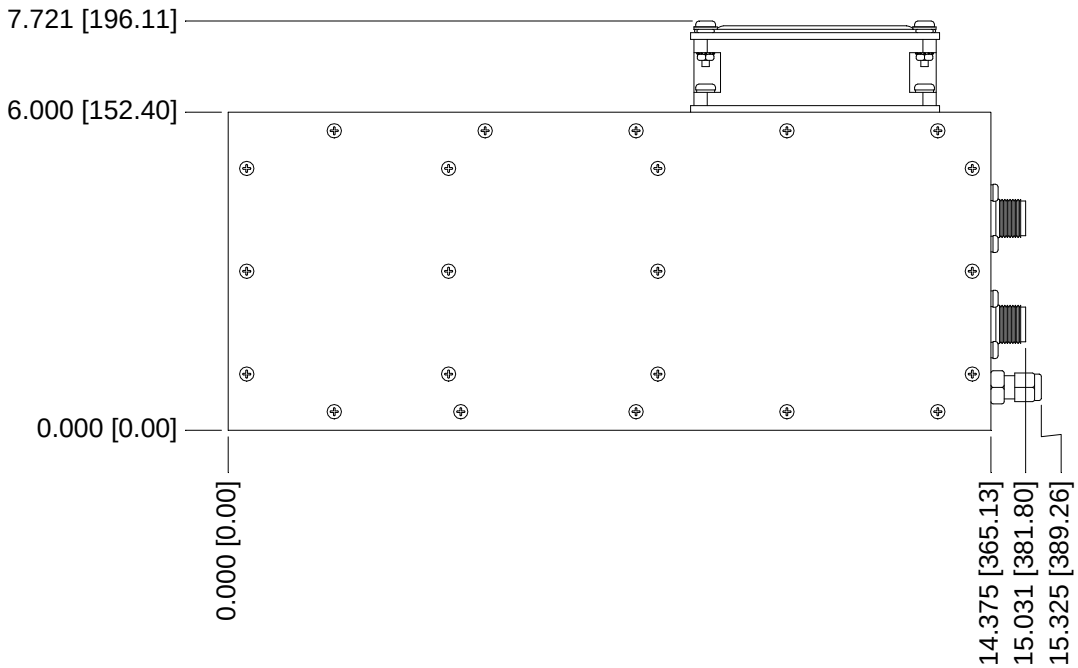


ATS-50/75 Matching Network Specifications (Generic Configuration)

ATS-50/75 Physical Dimensions:



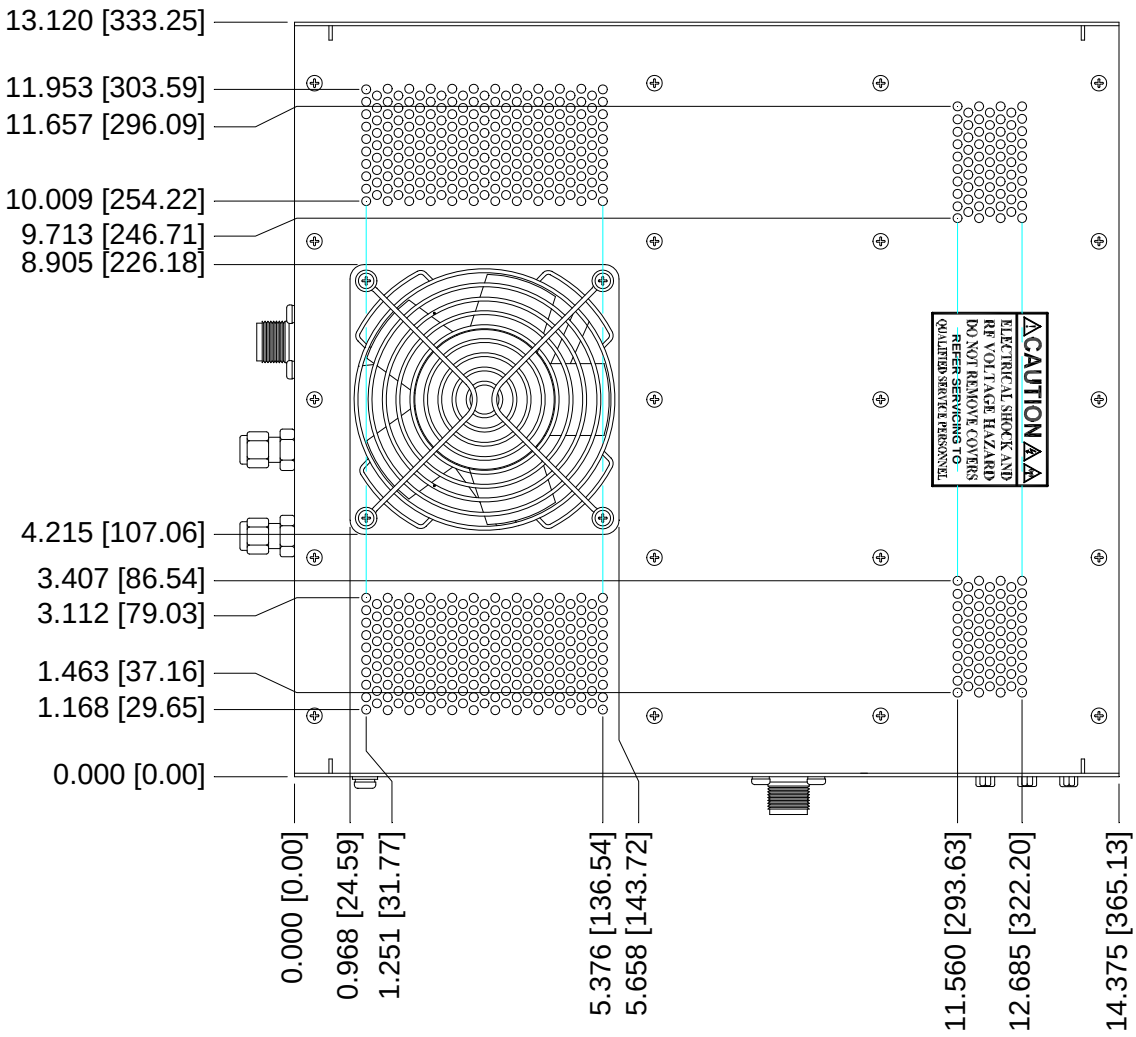
ATS-50/75 Left Side View



ATS-50/75 Right Side View

ATS-50/75 Matching Network Specifications (Generic Configuration)

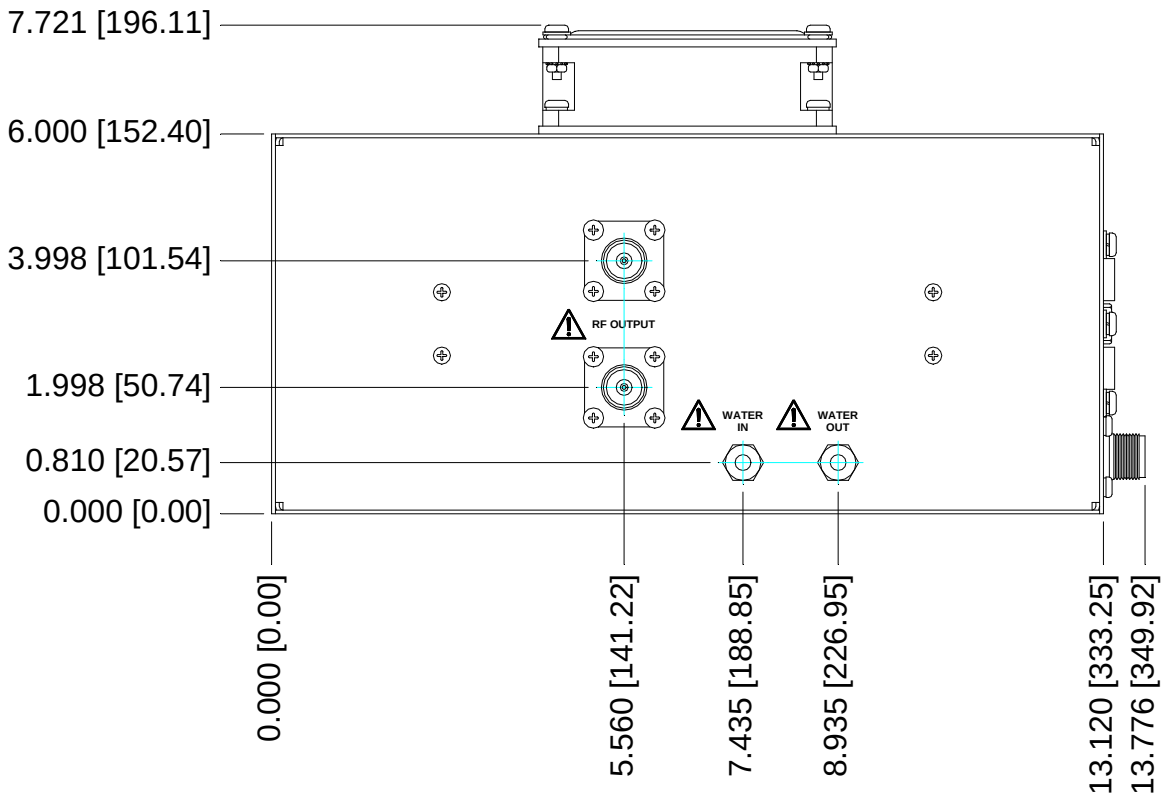
ATS-50/75 Physical Dimensions (continued):



ATS-50/75 Top View

ATS-50/75 Matching Network Specifications (Generic Configuration)

ATS-50/75 Physical Dimensions (continued):



ATS-50/75 Rear View

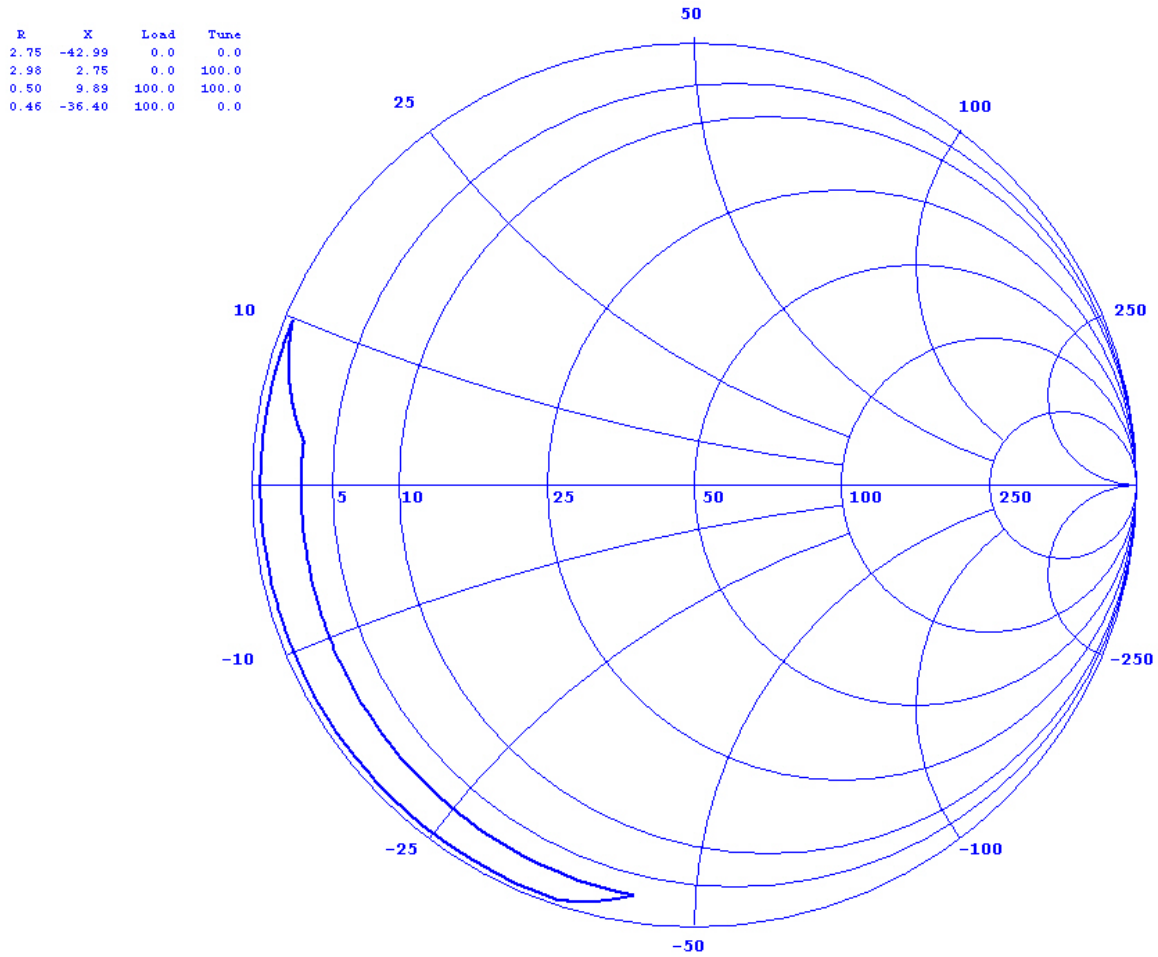
ATS-50/140 Automatic Matching Network Specifications

ATS-50/140 Matching Network Specifications (Generic Configuration)	
RF Input Power:	5000 Watts Nominal, application dependant 9.0KV Peak, 140A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: Type 7/16 DIN Female Optional: Type "LC" Female, 1-5/8" EIA Flange
RF Output Connection:	Standard: None (System integrator makes connection) Optional: Type 7/16 DIN Female Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Water and Forced Air (Fan, 110CFM)
Coolant Water Connection:	Standard: 3/8" OD Tube, Swagelok Compression Type
Coolant Water Flow Rate:	5 Gallons/Hour (GPH) minimum
Coolant Water Pressure:	80 PSI maximum
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 25-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 4x 200pF Tune Capacitor Range (Variable): 25-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 3 Turn, Water-Cooled
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1

ATS-50/140 Matching Network Specifications (Generic Configuration)

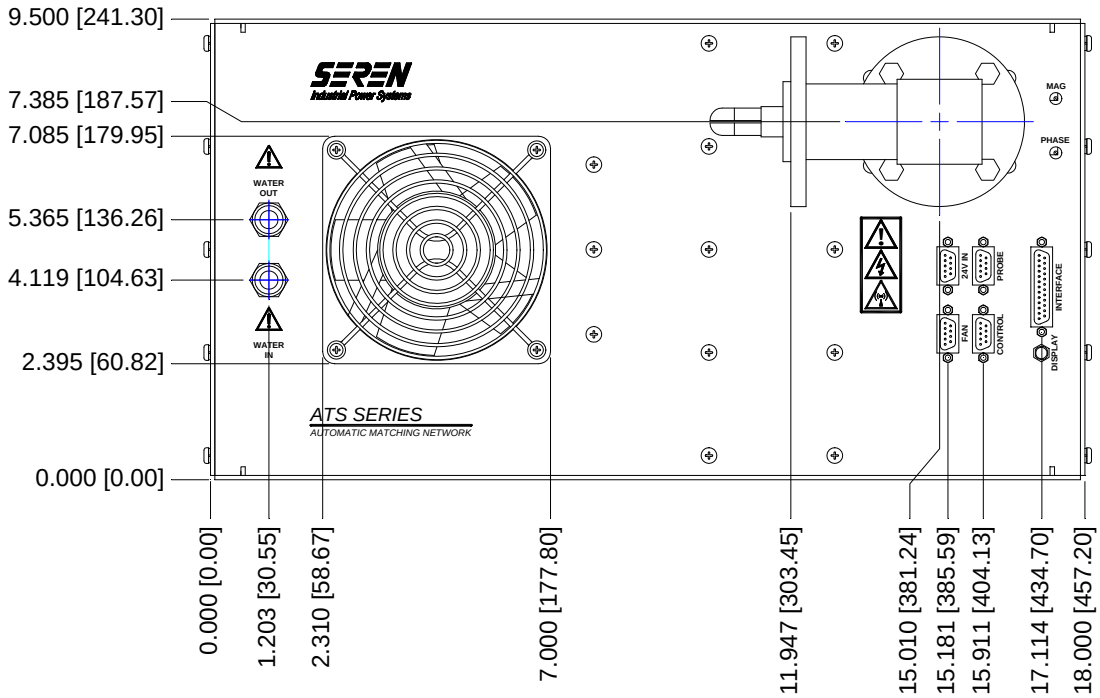
Physical Dimensions: inch [mm]	16.13 [409.7]L x 18.00 [457.2]W x 9.50 [241.3]D
Weight:	23.0 lbs [10.43Kg]
Mounting:	Customer Supplied

ATS-50/140 Tuning Range, Generic Configuration:

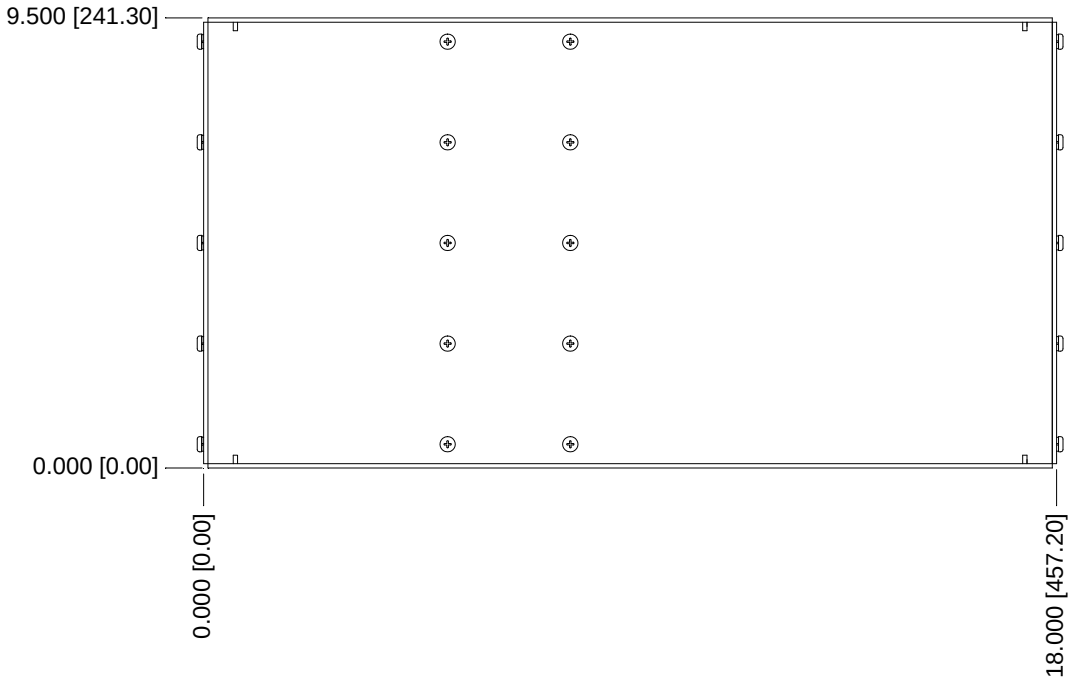


ATS-50/140 Matching Network Specifications (Generic Configuration)

ATS-50/140 Physical Dimensions:



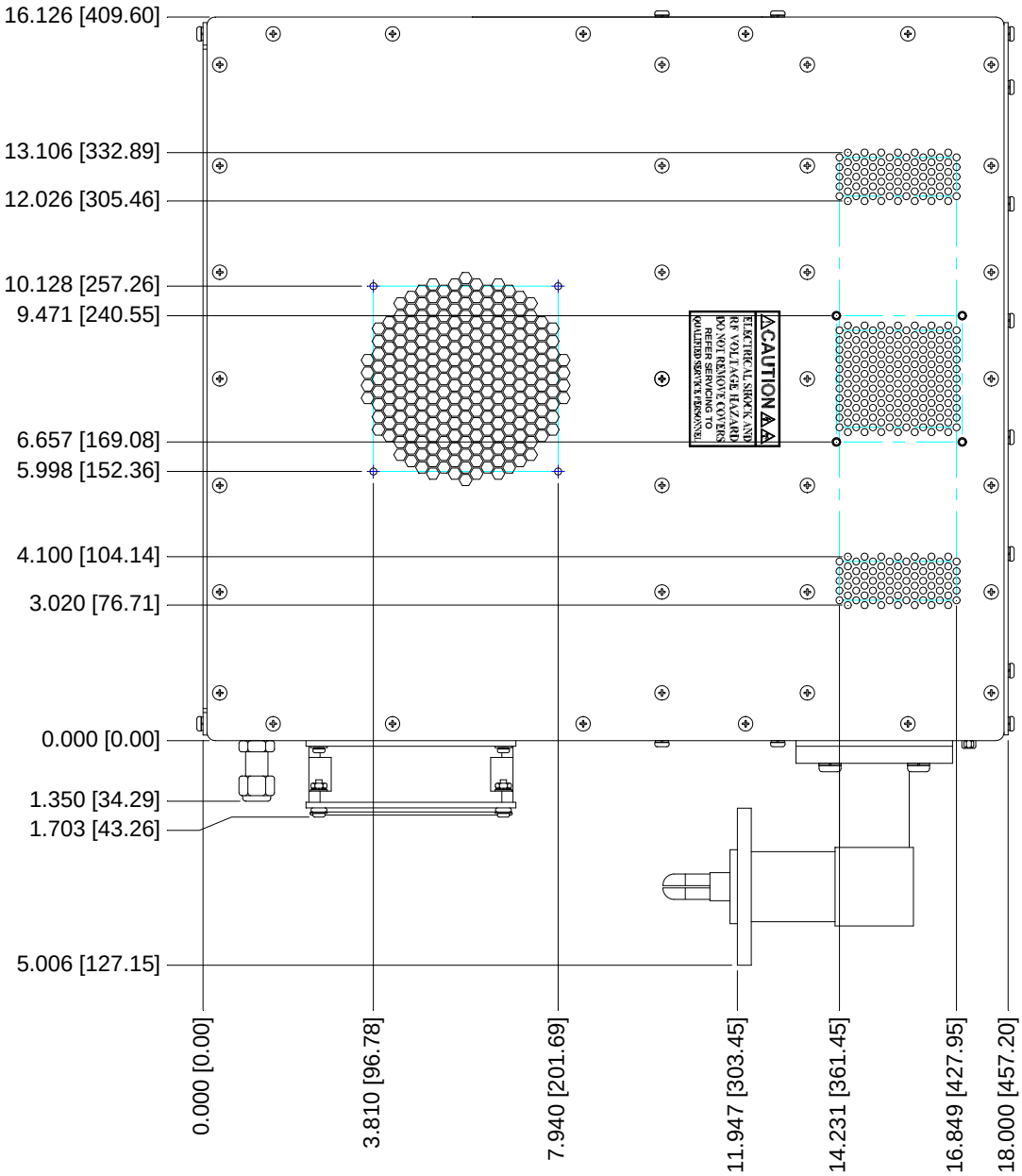
ATS-50/140 Left Side View



ATS-50/140 Right Side View

ATS-50/140 Matching Network Specifications (Generic Configuration)

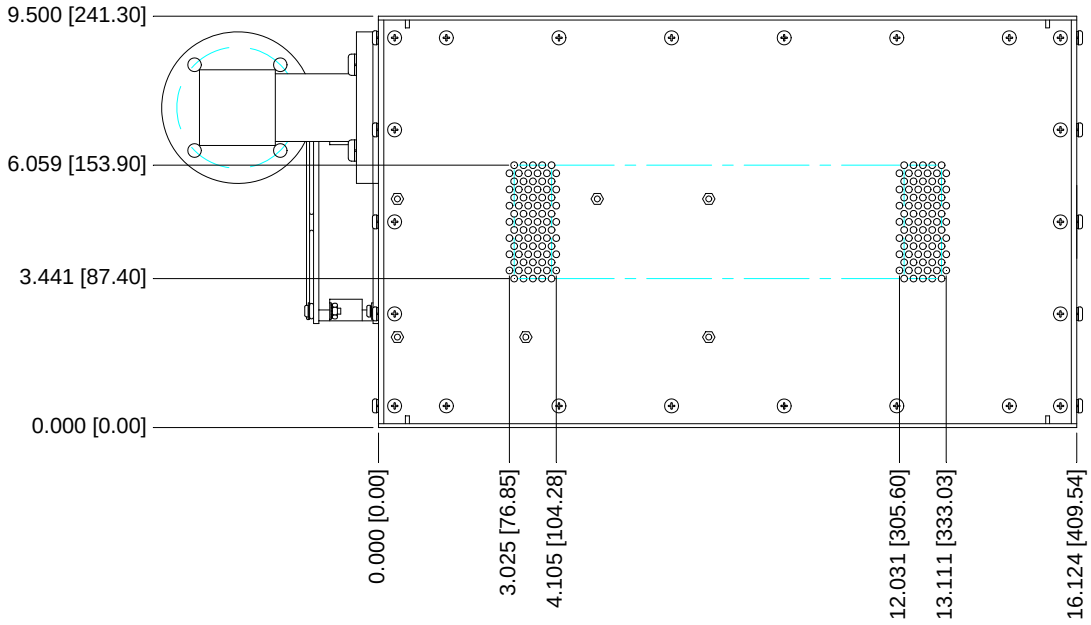
ATS-50/140 Physical Dimensions (continued):



ATS-50/140 Top View

ATS-50/140 Matching Network Specifications (Generic Configuration)

ATS-50/140 Physical Dimensions (continued):



ATS-50/140 Front View



ATS-50/140 Rear View

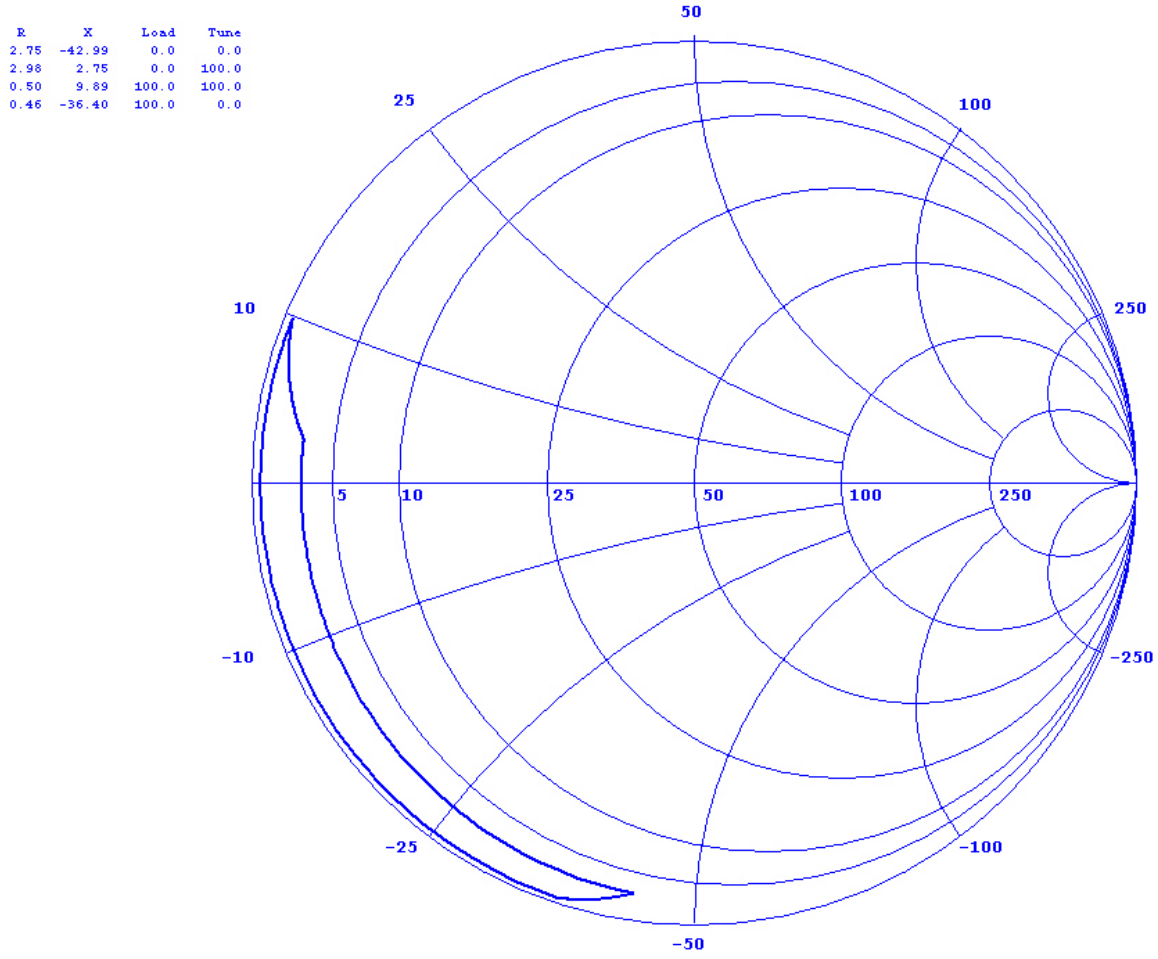
ATS-150/160 Automatic Matching Network Specifications

ATS-150/160 Matching Network Specifications (Generic Configuration)	
RF Input Power:	15000 Watts Nominal, application dependant 9.0KV Peak, 160A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: 1-5/8" EIA Flange
RF Output Connection:	Standard: None (System integrator makes connection) Optional: 1-5/8" EIA Flange Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Water and Forced Air (Fan, 110CFM)
Coolant Water Connection:	Standard: 3/8" OD Tube, Swagelok Compression Type
Coolant Water Flow Rate:	5 Gallons/Hour (GPH) minimum
Coolant Water Pressure:	80 PSI maximum
Matching Elements:	"L" Configuration, Generic Application Load Capacitor Range (Variable): 25-1000pF Load Capacitor Type: Vacuum Dielectric Fixed Load Capacitance: 4x 200pF Tune Capacitor Range (Variable): 25-500pF Load Capacitor Type: Vacuum Dielectric RF Coil: 3 Turn, Water-Cooled
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 200:1

ATS-150/160 Matching Network Specifications (Generic Configuration)

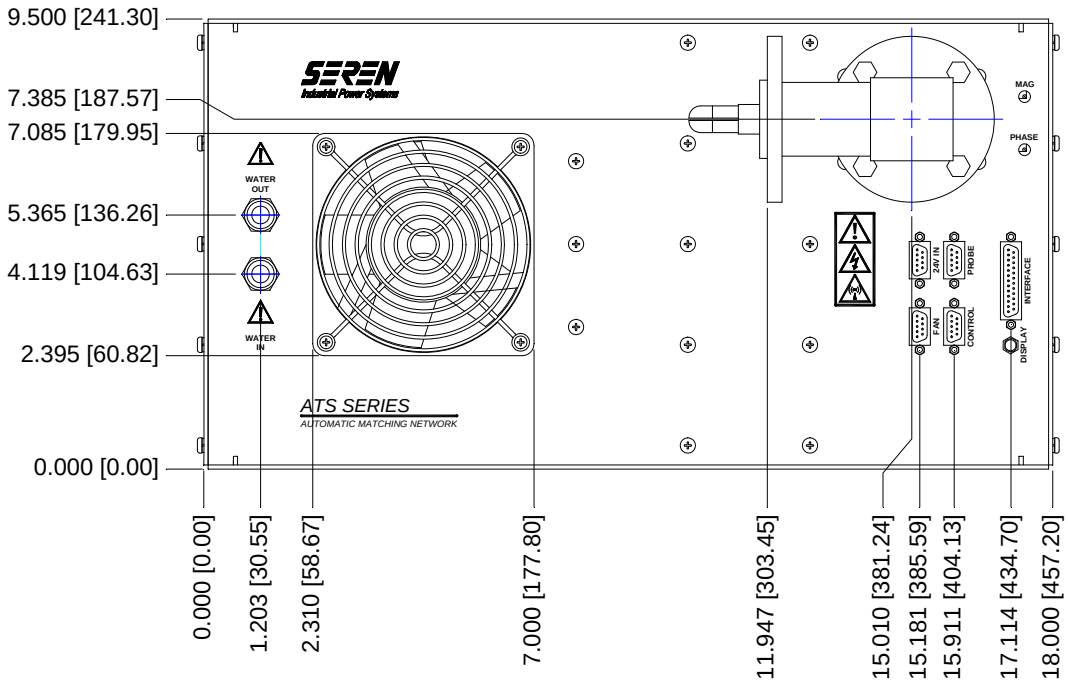
Physical Dimensions: inch [mm]	16.13 [409.7]L x 18.00 [457.2]W x 9.50 [241.3]D
Weight:	26.0 lbs [10.43Kg]
Mounting:	Customer Supplied

ATS-150/160 Tuning Range, Generic Configuration:

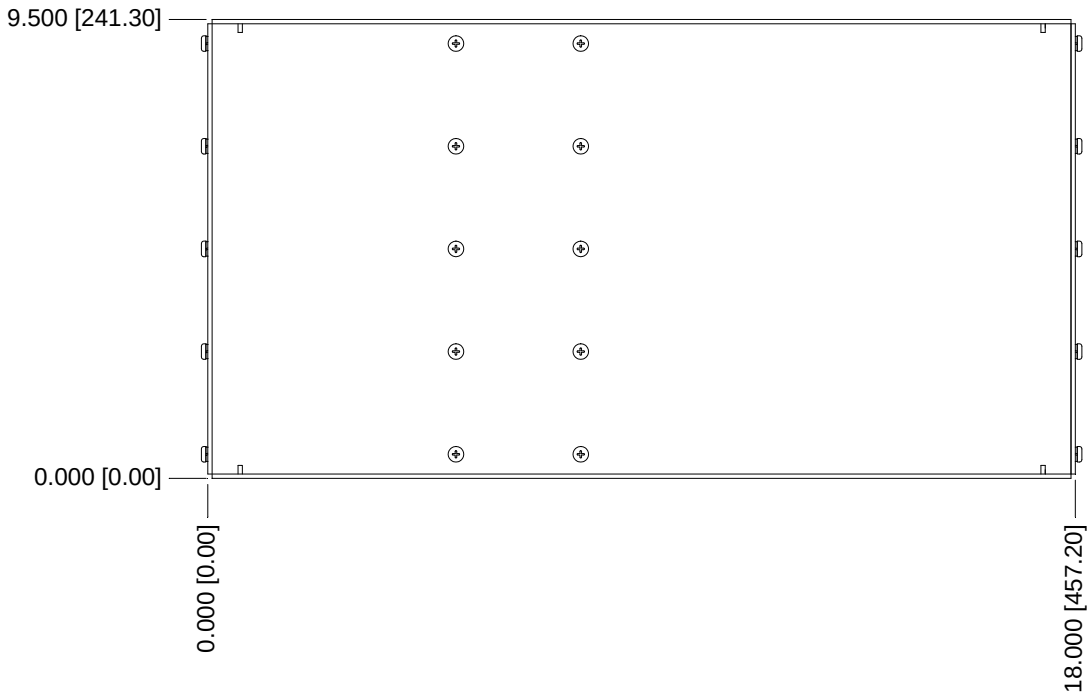


ATS-150/160 Matching Network Specifications (Generic Configuration)

ATS-150/160 Physical Dimensions:



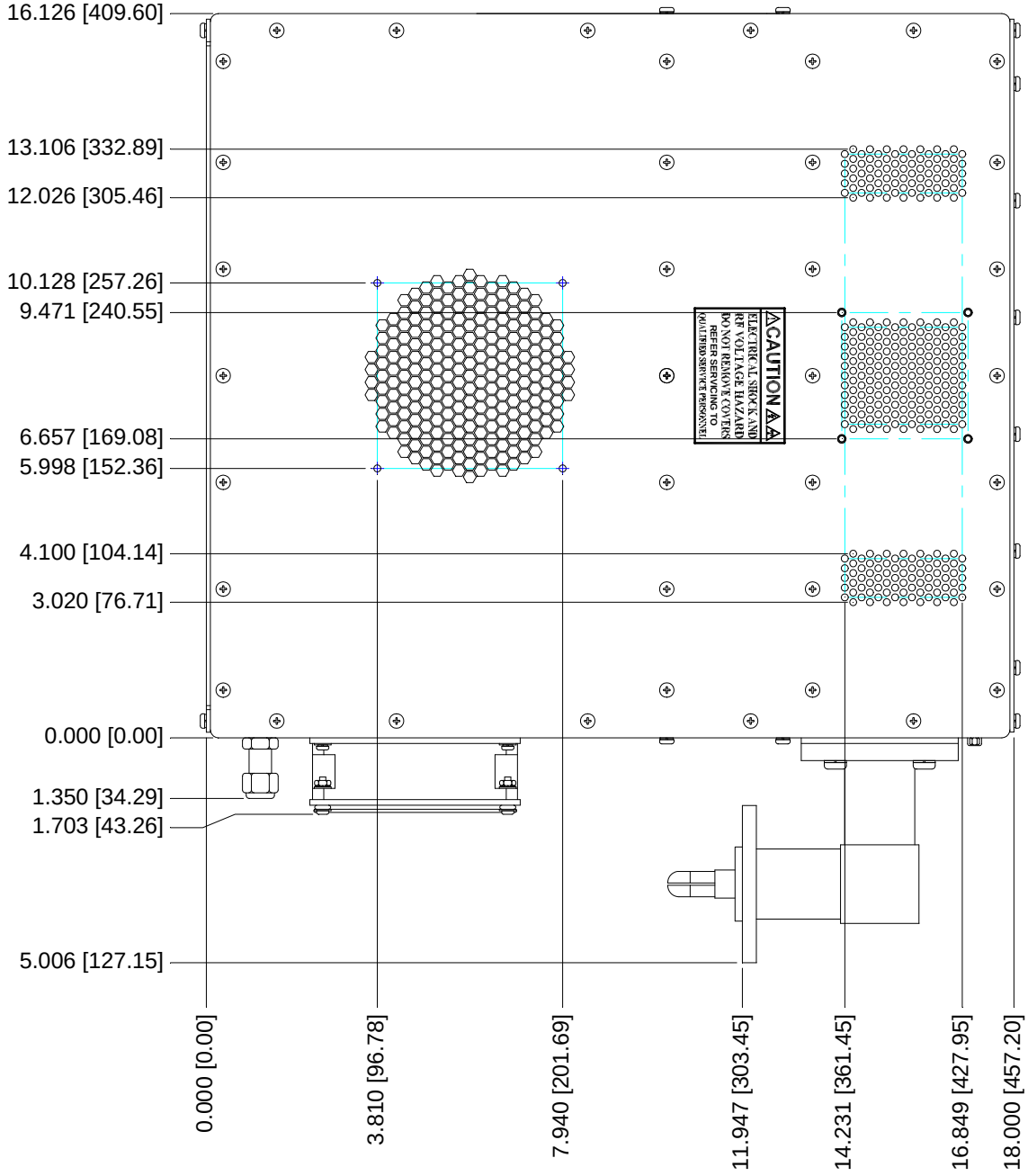
ATS-150/160 Left Side View



ATS-150/160 Right Side View

ATS-150/160 Matching Network Specifications (Generic Configuration)

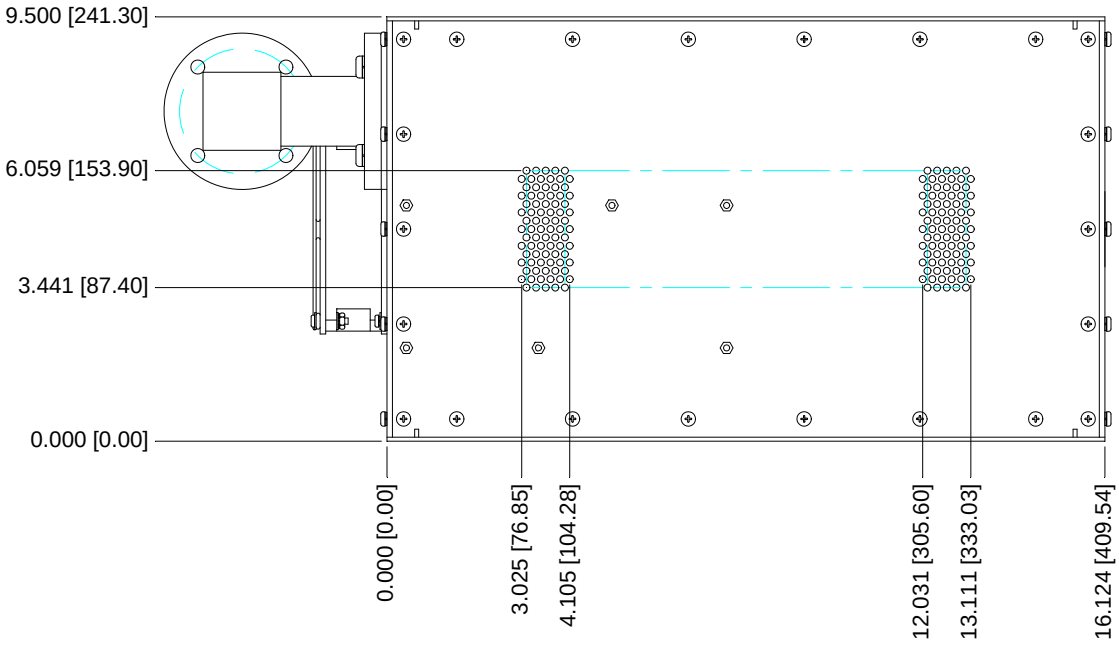
ATS-150/160 Physical Dimensions (continued):



ATS-150/160 Top View

ATS-150/160 Matching Network Specifications (Generic Configuration)

ATS-150/160 Physical Dimensions (continued):



ATS-150/160 Front View



ATS-150-160 Rear View

ATS-150/250 Automatic Matching Network Specifications

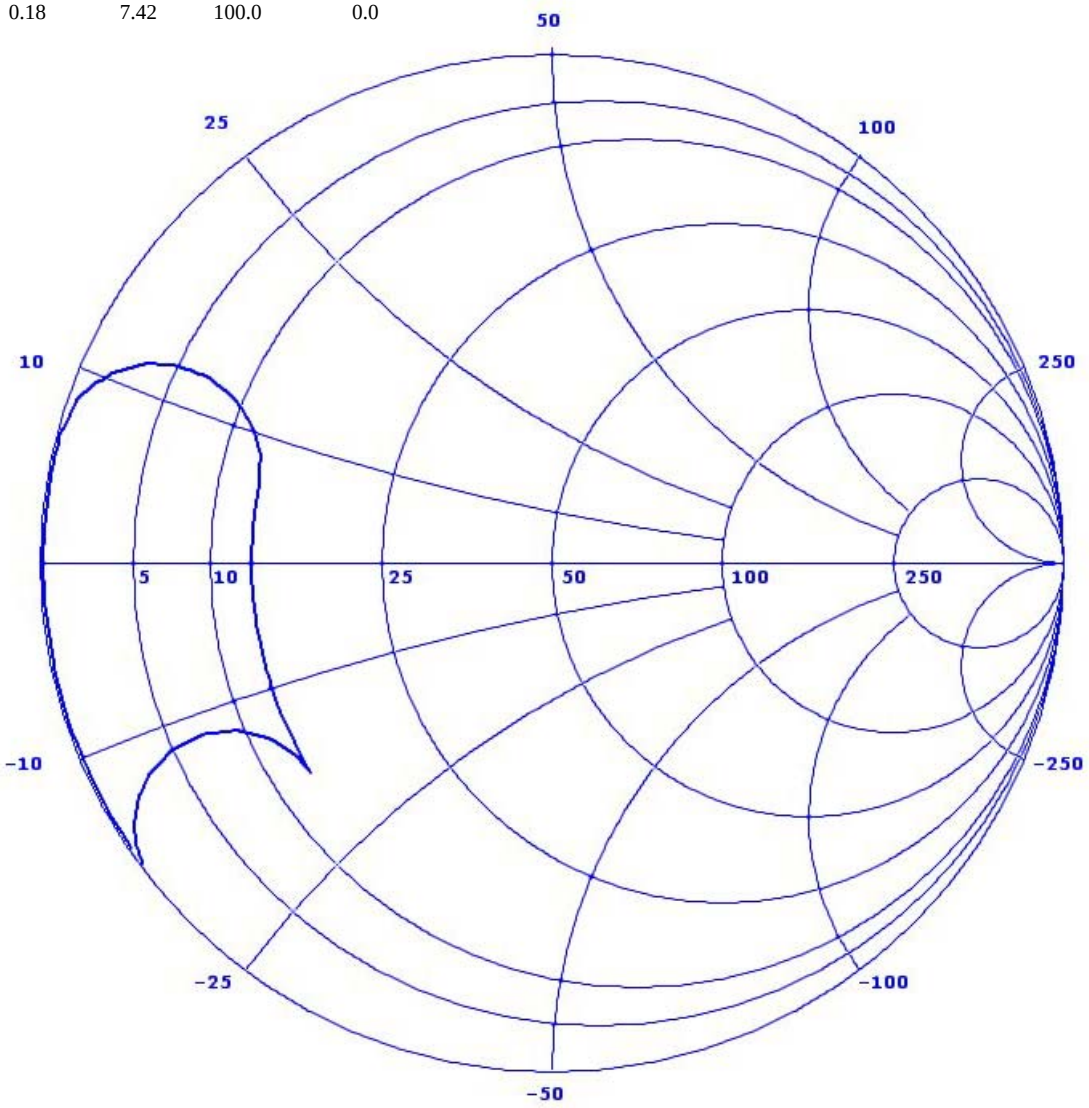
ATS-150/250 Matching Network Specifications (OEM Configuration)	
RF Input Power:	15000 Watts Nominal, application dependant 9.0KV Peak, 250A Maximum
Frequency:	13.56MHZ Standard, Other frequencies available.
RF Input Connection:	Standard: 1-5/8" Flange Optional: Type LC Female
RF Output Connection:	Standard: None (System integrator makes connection) Optional: 1-5/8" EIA Flange Stud Terminal Custom (Consult Factory)
Cooling:	Standard: Water
Coolant Water Connection:	Standard: 3/8" OD Tube, Swagelok Compression Type
Coolant Water Flow Rate:	5 Gallons/Hour (GPH) minimum
Coolant Water Pressure:	80 PSI maximum
Matching Elements:	"T" Configuration, OEM Application Input (Series) Capacitor Range (Variable): 23-130pF Input (Series) Capacitor Type: Vacuum Output (Series) Capacitor Range (Variable): 170-600pF Output (Series) Capacitor Type: Vacuum Output (Series) Capacitor Padder (Fixed): 100pF Output (Series) Capacitor Padder Type: Vacuum Inductor: 2.5 Turn, Water-Cooled
DC Voltage Probe:	Supplied with internal DC Voltage probe, Attenuation Factor: 200:1
RF Voltage Probe:	Supplied with internal RF Voltage probe, Attenuation Factor: 1000:1
RF Current Probe:	Output Range: 0 – 10VDC Output Scaling: 25A/V (0-10VDC = 0 - 250A)
Interlocks:	DC Applied, Ready, Water Flow, Current Overload

ATS-150/250 Matching Network Specifications (OEM Configuration)

Physical Dimensions: inch [mm]	17.91 [454.9]L x 19.69 [500.1]W x 9.50 [241.3]D
Weight:	28.0 lbs [12.69Kg]
Mounting:	Customer Supplied

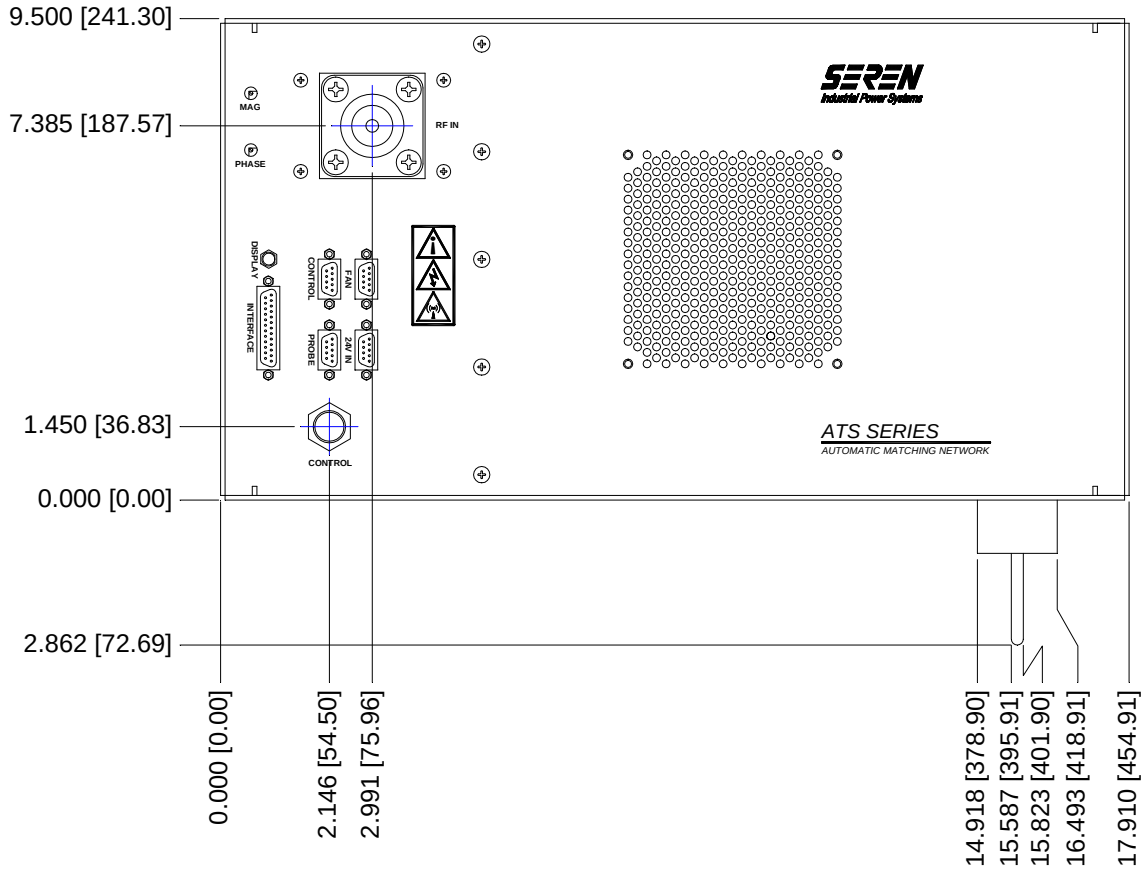
ATS-150/250 Tuning Range, OEM Configuration:

R	X	Load	Tune
0.18	-16.38	0.0	0.0
13.06	-17.70	0.0	100.0
13.06	6.21	100.0	100.0
0.18	7.42	100.0	0.0



ATS-150/250 Matching Network Specifications (OEM Configuration)

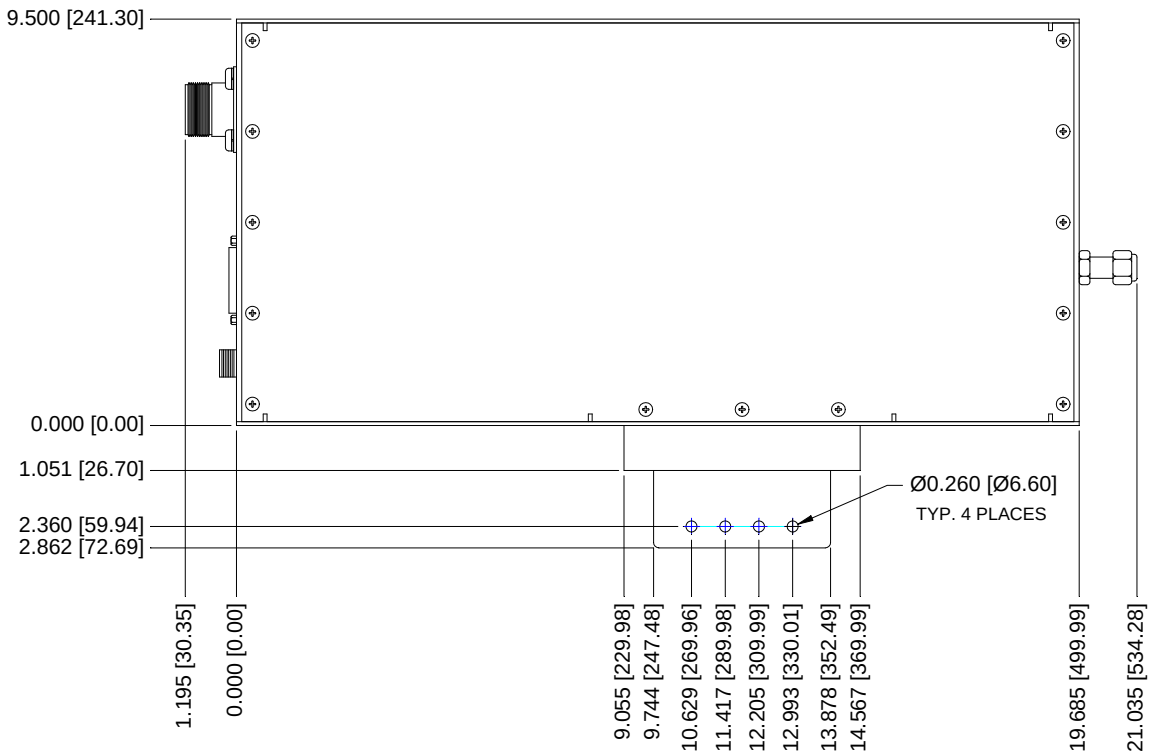
ATS-150/250 OEM Physical Dimensions:



Front View, ATS-150/250, OEM, LC Input, Custom Output

ATS-150/250 Matching Network Specifications (OEM Configuration)

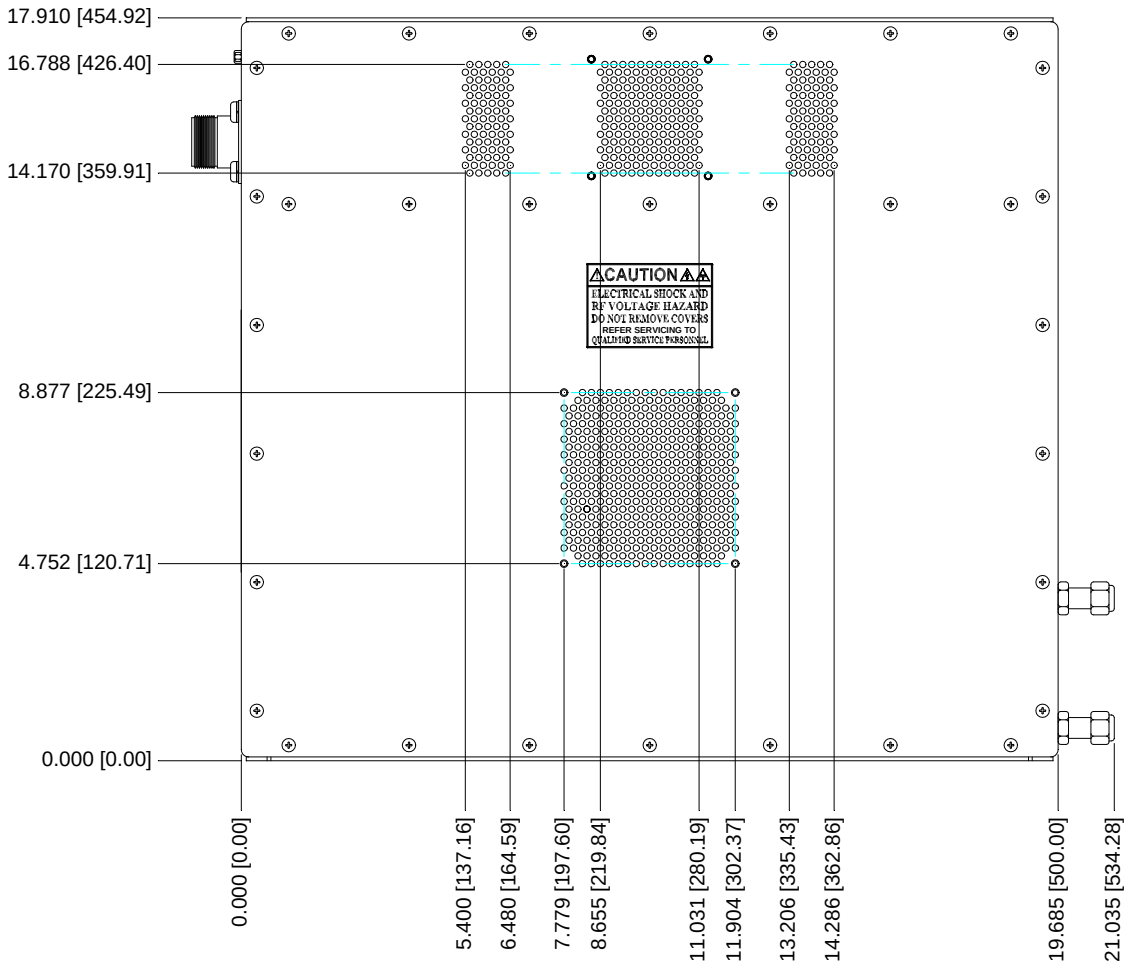
ATS-150/250 OEM Physical Dimensions (continued):



Side View, ATS-150/250, OEM, LC Input, Custom Output

ATS-150/250 Matching Network Specifications (OEM Configuration)

ATS-150/250 OEM Physical Dimensions (continued):



Top View, ATS-150/250, OEM, LC Input, Custom Output

Agency Approvals

Declaration of Conformity

In accordance with ISO/IEC Guide 22

ATS-Series Automatic Impedance Matching Network Product Family

Supplier:	Seren IPS Inc.
Address:	1670 Gallagher Drive Vineland, NJ, 08360 USA
European Representative:	RF Industries Ltd. Nork Works Nork Gardens, Banstead, Surrey, SM7 1NZ United Kingdom
Product:	**ATS-Series Automatic Impedance Matching Networks**

The product described above is in conformity with Essential Health and Safety Requirements of the Low Voltage Directive (LVD - 73/23/EEC) as amended.

Low Voltage Directive 73/23/EEC

EN 61010-1 July 2005 Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Issued: Vineland, NJ, U.S.A. April 21, 2011

Lawrence A. Hooper — April 21, 2011

Lawrence A. Hooper
Director of Engineering

Date

SEREN 1 Year Limited Warranty

SEREN IPS Inc. products are warranted to the original purchaser against defects in material and workmanship for a period of one year from the date of delivery.

SEREN IPS Inc. will repair or replace, at its option, all defective products returned freight prepaid during the warranty period, without charge, provided that there is no evidence the product has been mishandled, abused, or misapplied. Our liability under this warranty is limited to servicing, repairing, or replacing any defective products for a period of one year after delivery to the original purchaser.

If warranty service is required, the equipment must be returned, transportation charges prepaid, to our factory or authorized service depot. In the case of misuse, abnormal operating conditions, or other non-warranty work, a repair cost estimate will be submitted for approval before work is started.

WHAT THE WARRANTY DOES NOT COVER:

This warranty covers only defects in materials and workmanship provided by SEREN I.P.S. and does not cover equipment damage or malfunction from misuse, abuse, accident, act of God, non-SEREN I.P.S. modification or upgrade. Improper return shipping, packaging, or shipping damage is not covered. SEREN I.P.S. will not be liable for any incidental or consequential damages resulting from your use or inability to use your matching network.

IF YOU HAVE A PROBLEM

The first step is to contact your system vendor. Consult with your system vendor to determine the nature of the problem. Your system vendor knows the intimate details of how your processing system interfaces and operates with the ATS-Series Automatic Impedance Matching Network and can efficiently resolve system related problems.

If it is determined that the ATS-Series Matching Network has a problem, contact our customer service department at **1-856-205-1131**. Before you call, please be ready to provide the model of your matching network, Seren IPS part number, serial number, date of manufacture, a description of the problem, and the model and manufacturer of the processing system it is used on.

HOW IS WARRANTY SERVICE OBTAINED?

Our customer service representative will explain how to obtain service under this warranty. Please save the original packing materials in order to facilitate shipment.

Glossary of Terms

A	Amperes, a measurement unit of current
AC	Alternating Current
Chamber	Industry term for a vacuum chamber used in plasma processing equipment.
D-Sub	Industry term for D-Subminiature connector
DC	Direct Current
Equipotential Bond Equipotential Bonding	Equipotential bonding (often referred to as grounding) is used to control RF circulating currents within a system. For regulatory purposes, it is not a "Protective Earth" or "Safety Ground", even though it may be bonded to the "Protective Earth" or "Safety Ground" within the equipment or user's facility.
KHz	Kilo Hertz, a measurement unit of frequency (1000 Hertz)
KVA	Kilo Volt-Amperes
LED	Light-emitting diode. Used an indicator lamp to show status.
Load Capacitor	Industry term for a shunt capacitor in an "L" type impedance matching network. Can be fixed or variable type.
Matchbox	Industry term for an impedance matching network
MHz	Mega Hertz, a measurement unit of frequency (1,000,000 Hertz)
mV	Milli-Volts, a measurement unit of Voltage, equal to 1/1000 of a Volt.
Non-Volatile Storage	Also know as non-volatile memory. Computer memory that retains its data after power has been removed.
RF Generator	Industry term for Radio Frequency Power Supply
RF	Radio Frequency
Strike Preset	A pre-determined (usually empirically) starting positions for the matching network's capacitors – an aid for plasma ignition.
TTL	Transistor-Transistor Logic
Tune Capacitor	Industry term for the series capacitor in an "L" type impedance matching network. Can be fixed or variable type.
Tuner	Industry term for an impedance matching network
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
W	Watts

Revision History:

Revision	Date	Revision Description
0.01	7/2/09	Preliminary
0.02	7/13/09	First review update.
0.03	9/25/09	Added "Mini" package models, engineering review update.
0.04	9/30/09	Added dimension drawings.
0.05	10/2/09	Updated output connectors on "mini" networks, corrected AT20M input connectors, added CFM information for fans.
0.06	12/10/09	Updated DeviceNet information.
1.00	12/11/09	Issued.
1.01	4/21/11	Added Model ATS-150/250, Added CE Declaration Of Conformity.
1.02	12/23/14	Corrected coolant water Specific Resistivity specification, page 122
2.00	3/18/16	Revised minimum DC power supply current requirement, all models. Added optional water cooling info to models ATS20, ATS30. Deleted references to model ATS20M (not produced). Deleted references to obsoleted Load Gain and Tune Gain programmable parameters. Added/updated programming menu entries & features, serial commands, MC2-Comapatible Modbus and ATS-Specific Modbus communications, PROFIBUS and DeviceNet communications.
2.01	3/30/17	Added EMC compliance statement to common technical specifications, updated Recommended Mounting and Equipotential Bonding topics in Installation section.

Notes: