Redundancy Controller

RMC-RRS011-HE01

Operation Manual

W A V E S T R E A M

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Document Number: 90-005-0030_E

Conventions

	**D A N G E R** **Hazard.** Immediate hazard, which if not avoided WILL result in severe injury or death to personnel or destruction of the equipment.

	**W A R N I N G** **Hazard.** Potentially immediate hazard, which COULD result in severe injury or death to personnel or destruction of the equipment.

	**C A U T I O N** **Hazard.** Immediate hazards, which COULD result in minor or moderate injury to personnel or damage to the equipment. Also indicates unsafe practices.

N o t e

Items that are important for safe and correct equipment operation.

Proposition 65 Warning

	**W A R N I N G** This product contains chemicals known to the State of California to cause cancer and/or birth defects or other reproductive harm.

Technical Support

Contact Technical Support via email at support@wavestream.com.

Notices

Warranty

The Wavestream Corporation Warranty is defined in the TERMS AND CONDITIONS OF SALE that accompanied the quotation and purchase order for this product. To return the unit to Wavestream for repair, contact your customer service representative at Wavestream Corporation. If the unit was purchased from a distributor follow the distributor's Return Materials Authorization (RMA) process.

Always include the model number and serial number in all correspondence.

The warranty does not apply to any defect, failure, or damage caused by improper use or inadequate or improper maintenance and care.

Notwithstanding the Warranty defined in the Terms and Conditions of Sale, Wavestream Corporation is not obligated to furnish service under this warranty.

- To repair damage resulting from attempts by personnel (other than Wavestream Corporation's personnel) to repair, or service the product.
- To repair damage or malfunction caused by the use of non-standard ancillary equipment.
- To service a product that has not been previously approved in writing by Wavestream Corporation.

Note

Opening or removing any component or sealed area will immediately void the warranty.

Regulatory Compliance

CE Declaration of Conformity

CE

We, Wavestream Corporation, declare under sole responsibility that the unit manufactured for

Wavestream Corporation
545 West Terrace Drive
San Dimas, California 91773

to which this declaration relates, is in conformity with the requirements of the following CE Directives:

Council Directive 89/ 336/ EEC (92/ 31/ EEC)

On the approximation of the laws of the Member States relating to electromagnetic compatibility is based on compliance with the following harmonized standards:

EN 55022 Conducted and Radiated Emissions
EN 61000 Immunity
EN 60950 Safety
EN 61000-3-2 Harmonic Current Emissions

Safety	EN 60950
Electromagnetic Emissions	EN 61000-6-4; test method per EN 55022 class A (for industrial)
Electromagnetic Immunity	EN 61000-4-2, 4-3, 4-6, 4-8, 4-11

Table of Contents

Introduction

Wavestream's Redundancy Controller provides intelligent control of Wavestream amplifiers in a 1:1 configuration along with corresponding receive paths. The compact (1U) rack-mount chassis has a 4-line, backlit LCD display and status LEDs, menu navigation keys, 1:1 string switching or independent TX and RX switching, integrated waveguide switch control, alarm interface with flexible input and output alarm processing and Ethernet interface for NMS (Network Management Systems) integration.

Key Features:

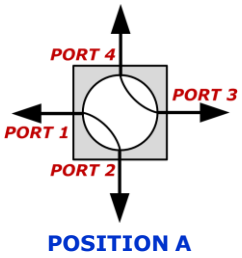
- Control of Wavestream Amplifiers/BUCS in a 1:1 configuration
- Control of non-Wavestream Amplifiers with discrete inputs in a 1:1 configuration
- Automatic switchover on amplifier failure with support for manual override
- User selectable switching mode
- Manual switch operation, does not affect automatic fail-over switch operation
- Auto sensing of switch position
- Receive waveguide switch toggles in response to an alarm condition on pin 1 or pin2 of connector J2
- Remote monitor and control interface via Ethernet Console A port
- Firmware upgrade port via the USB Console B port

About This Manual

This operation manual provides information and instructions for installation and operation of Wavestream equipment. It should be used by trained field technicians, or system engineers, responsible for satellite and broadcast networks.

This manual refers to a waveguide switch as a baseball switch. A baseball switch is an industry standard name for a certain type of waveguide switch.

For manual updates contact Wavestream support.



Safety

Because the RMC can be used in close proximity to amplifiers, caution must be exercised when working close to amplifiers and waveguides

The equipment contains delicate electronics and electrical components. Carefully read and follow all safety, use, and operating instructions before operating the equipment. Retain these instructions for future reference.

Safety Precautions

D A N G E R

Shock Hazard.

Do not open the unit. High voltages are present inside the unit. Service may only be performed by Wavestream.

There are no user serviceable parts. Do not attempt to service this product yourself. Any attempt to do so void any and all warranties.

W A R N I N G

High Power RF Hazard.

Do not operate unless RF output waveguides are properly connected to the rest of the system or to a high power load.

W A R N I N G

Grounding.

To protect against voltage surges and built-up static charges, install the unit using appropriate grounding methods in compliance with grounding standards for electrical and radio equipment according to the electrical codes in the country of installation.

C A U T I O N

Electrostatic sensitive.

There are devices in the unit that are easily damaged by ESD. Take standard ESD precautions.

Operation Precaution

C A U T I O N

Connect to feed and antenna before applying power.

Do not apply power until the SSPAs or BUCs are appropriately connected to the feed and antenna system.

Specifications

Performance

Switch operation	Manual or automatic, user selectable
Muting	Wavestream SSPAs/BUCs: automatic muting of transmission when baseball switch switches between units.
Switching time	Less than 1 second
Supported units	Wavestream: 8-40 W Ku-Band SSPA / BUC 100 W Ku-Band SSPA / BUC 200 W Ku-Band SSPA / BUC 600 W C-Band SSPA / BUC Non-Wavestream: Any SSPA or TWTA with discrete system status line

Monitor & Control

Monitor & Control	Ethernet
Status LEDs	Indicates Tx active, summary fault, serial link, 10 MHz lock
Display interface	Quick status review, setup, manual control

Power

Prime power, AC	90 - 264 VAC, 50-60 Hz

Environmental

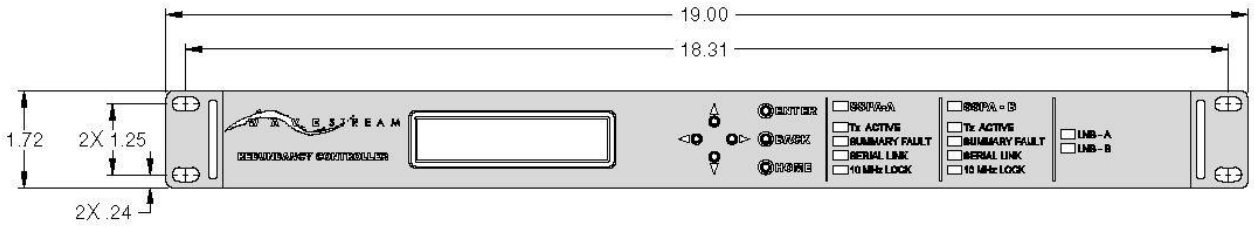
Ambient temperature	Operating: -0°C to +50° C (-32° F to +122° F) Non-operating: -40° C to +70° C (-40° F to +158° F)
Relative humidity	0 – 95% noncondensing
Altitude	10,000 feet above mean sea level

Physical

Size	19” W [rack mount] x 1.72” H [1U standard] x 9.64”D [from front panel]
Weight	4.2 lbs (1.568 kg)

Dimensions

Front View



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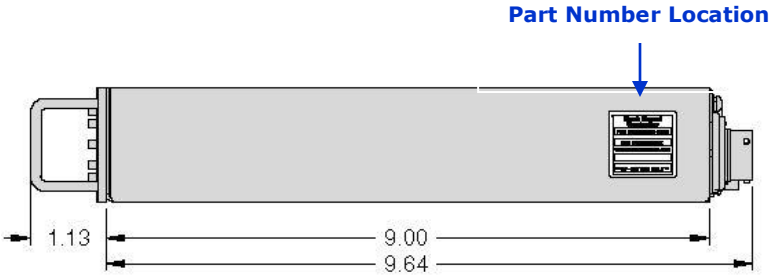
Side View



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Equipment

The following components and cables are shipped with the unit.

- Documentation
- Wavestream CD with computer GUI

Customer Provided Interfaces

The customer must provide the interface and cables that will be used.

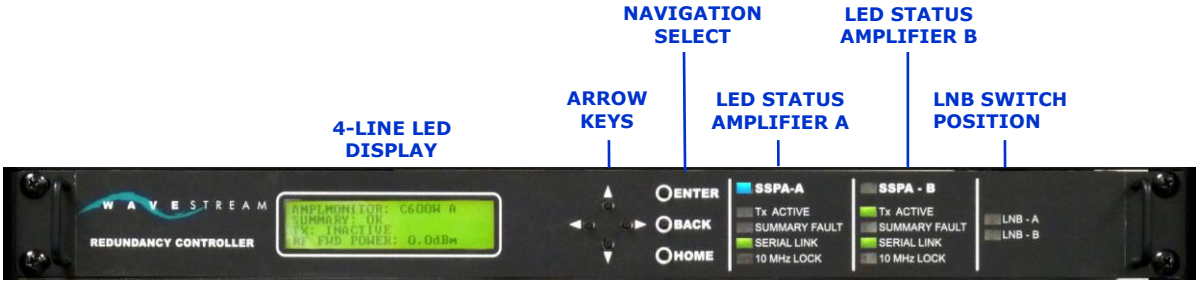
- TX / RX 9-pin interface cable
- SSPA-A / SSPA-B M&C cable
- 15-pin discrete output / alarms cable
- Ethernet cable (optional)
- USB (optional for firmware upgrade)
- AC power cable

Technical Support

Technical support is available by email at support@wavestream.com.

System Description

Front Panel Display

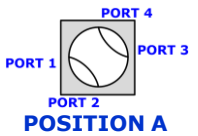


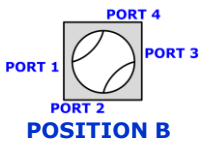
RMC

4-line LED display	24-character display for status monitoring and system control.
Navigation select	Press to navigate quickly through the menus.
Enter	Selects the highlighted sub control option.
Back	Returns to the previous screen.
Home	Returns to the home/monitor screen of the menu or sub menu.
Arrow keys	Navigate through menu options and functions.
LED Status A/B	

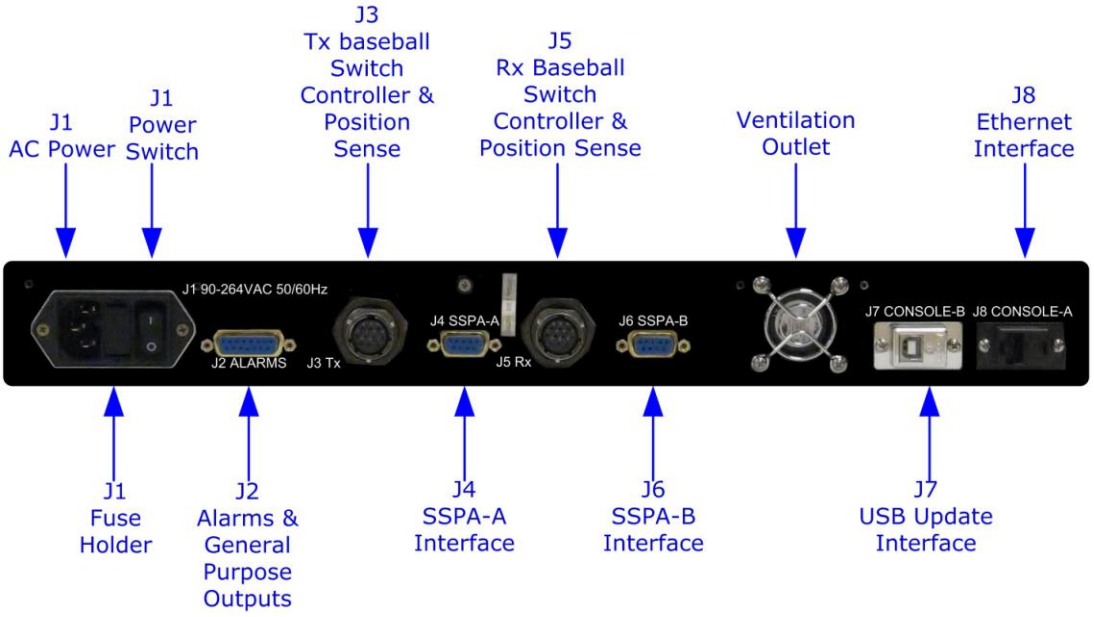
T7

SSPA-A:	Blue LED on = Tx waveguide switch is in position A. Off = waveguide switch is not connected or in position B.
SSPA-B	Blue LED on = Tx waveguide switch is in position B. Off = waveguide switch is not connected or in position A.
Tx ACTIVE:	Green LED on = SSPA is Tx Enabled. Off = SSPA is not Tx Enabled.
SUM FAULT:	Red LED on = SSPA has incurred a system fault. Off = no system fault is sensed.
SERIAL LINK:	Green LED on = a serial link to Wavestream SSPA/BUC is established. Off = the system status is ok or the RMC is connected to a non-Wavestream SSPA.
10MHz LOCK:	Green LED on = a 10 MHz Reference signal is supplied to the SSPA. Red LED on = a 10 MHz Reference signal is not supplied to the SSPA. Off = front panel LEDs have been disabled.
LNB switch position	Indicates the position of the RX waveguide
LNB-A:	Blue LED on = Rx waveguide switch is in position A. Off = waveguide switch is not connected or in position B.
LNB-B:	Blue LED on = Rx waveguide switch is in position B Off = waveguide switch is not connected or in position A.





Back



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	Port Name	Description	Connector On the Unit	Mating Connector
J1	90-264 VAC 50/60 Hz	Primary power, 110 W @ 120 VAC	C13 power plug	
	Fuse	5x20mm 1A slow blow long time lag fuse		
	Power switch	Enables/disables unit power		
J2	Alarms	Alarms, general purpose outputs	15-pin, female ITT Cannon DAMAM15S	15-pin, male ITT Cannon M24308/4-2
J3	Tx	Tx Waveguide Switch Controller & Position Sense	10-pin circular ITT Cannon KPSE07E-12-10S	10-pin circular male ITT Cannon KPT06U12-10P
J4	SSPA-A	SSPA-A M&C interface	M&C interface 9-pin, female	D-sub 9-pin, male ITT Cannon DEMAM9P
J5	Rx	Rx waveguide switch controller & position sense	10-pin circular, ITT-Cannon KPSE07E12-10S	10-pin circular male ITT Cannon KPT06U12-10P
J6	SSPA-B	SSPA-B M&C interface	9-pin, female	D-sub 9-pin, male ITT Cannon DEMAM9P
J7	Console-B	USB update console B		USB, type B connector
J8	Console-A	Ethernet console A 10 MHz reference		RJ-45 (Cat 5e) connector

Interface cables are customer provided. The following sections provide pin out and signal information for each connector, use this information to build the interface cables.

N o t e

If a cable will be 6 feet or longer, Wavestream recommends use of multi-conductor shielded cable to reduce noise pickup.

Connect the shield to the case.

J1 – AC Input Power

Pin	Description	
T3	AC line	[bottom pin]
T2	AC neutral	[top pin]
T1	Ground	[center pin]

J2 – Alarms and General Purpose Outputs

Pins 1-11 are TTL logic. Must use when connecting to non-Wavestream SSPAs for control of discrete inputs.

Pin #	Description	
	Wavestream SSPA / BUCs	Non-Wavestream SSPA
1	General input LNB-A fault	Amplifier-A summary fault
2	General input LNB-B fault	Amplifier-B summary fault
3	General input 2	General input 2
4	General input 3	General input 3
5	General output 0	RF Inhibit A
6	General output 1	RF Inhibit B
7	General output 2	General output 2
8	General output 3	General output 3
9	Signal ground	Signal ground
10	Signal ground	Signal ground
11	/INHIBIT	/INHIBIT
12	/SUMFAULT	/SUMFAULT
13	SUMFAULT	SUMFAULT
14	N/C	N/C
15	N/C	N/C

SUMFAULT / /SUMFAULT [pins 12 / 13]

When the system incurs a fault, the states of the pins are as shown below.

J2 / Pin state		Ok	Fault	No Power
Pin 12	/SUMFAULT	Open	Short	Short
Pin 13	SUMFAULT	Short	Open	Open

N o t e

/SUM FAULT and SUMFAULT are rated up to 47 VDC at 1A.

J3 – Tx Waveguide Switch Controller & Position Sense

See Ethernet for Ethernet units.

W A R N I N G

Wiring.

Incorrect cable wiring can permanently damage this unit.

The serial transmit / receive signals are not crossed inside the unit.

To communicate with the unit over a serial connection, cross the signals externally.

Pin	Signal	Signal Type	Notes
A	Relay Driver 1A		Twist with pin B and A
B	Relay Ground		
C	Relay Driver 1B		Twist with pin C and B
D	Relay Position Sense 1A		Twist with pin E and D
E	Signal Ground		
F	Relay Position Sense 1B		Twist with pin F and E
G	N/C		
H	N/C		
J	N/C		
K	N/C		

J4 – Wavestream SSPS-A Interface

Pin	Description	Notes
1	N/C	
2	RS485 Rx-	Twist with pin 7
3	RS485 Tx+	Twist with Pin 8
4	Signal Ground	
5	N/C	
6	Signal Ground	
7	RS485 Rx+	Twist with pin 2
8	RS485 Tx-	Twist with pin 3
9	N/C	

J5 – Rx Waveguide Switch Controller & Position Sense

Pin	Description	Notes
A	Relay Driver 2 A	Twist with pin B
B	Relay Ground	Twist with pin A and C
C	Relay Driver 2 B	Twist with pin B
D	Relay Position Sense 2 A	Twist with pin E
E	Signal Ground	Twist with pin D and F
F	Relay Position Sense 2 B	Twist with pin D
G	N/C	
H	N/C	
J	N/C	
K	N/C	

J6 – Wavestream SSPA-B Interface

Pin	Description	Notes
1	N/C	
2	RS485 Rx-	Twist with pin 7
3	RS485 Tx+	Twist with pin 8
4	Signal Ground	
5	N/C	
6	Signal Ground	
7	RS485 Rx+	Twist with pin 2
8	RS485 Tx-	Twist with pin 3
9	N/C	

J7 – USB Update Console B Port

Use a cable with a USB, type B connector.

Pin	Description
1	+5 V
2	USBD-
3	USBD+
4	Ground

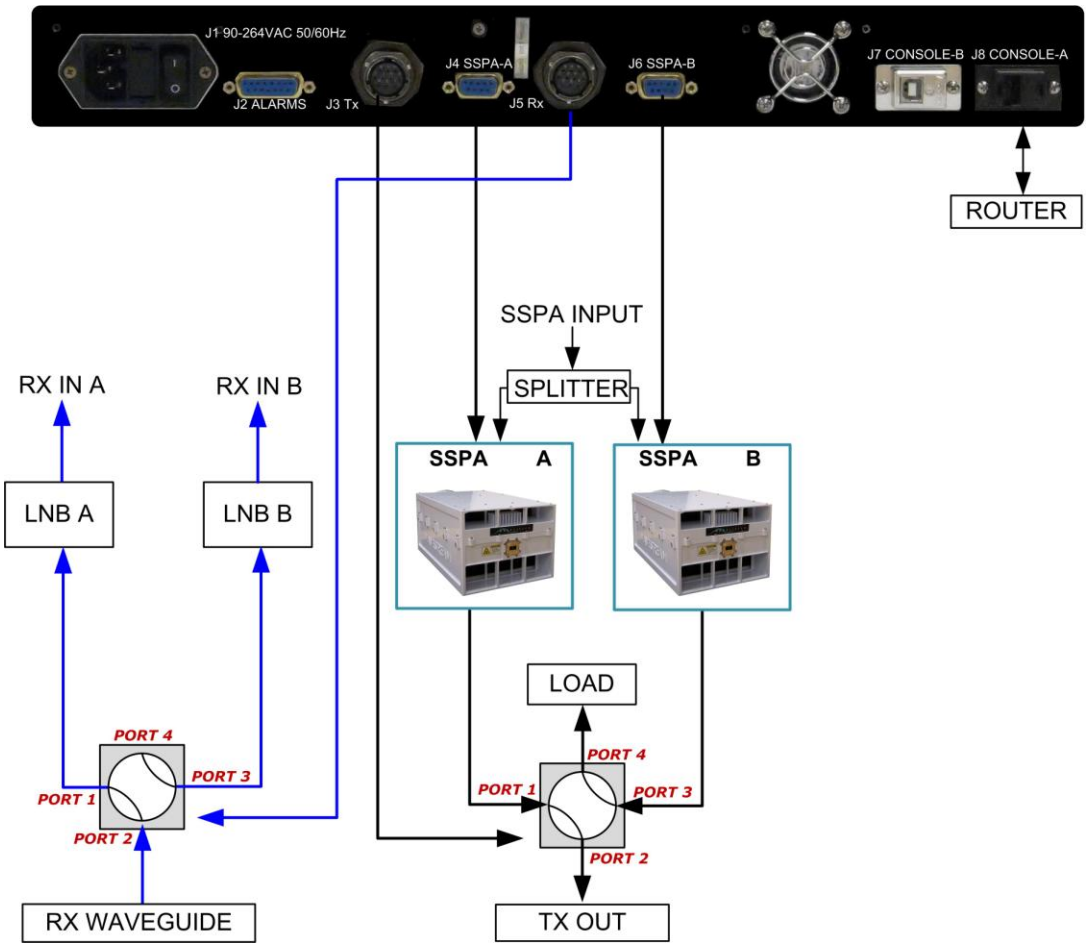
J8 – Ethernet Console A Port

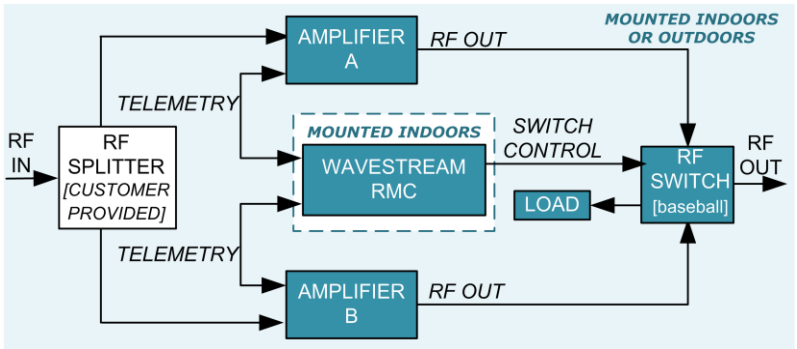
Use Standard CAT 5e Cable.

Pin	Description	Notes
1	ENET TX+	
2	ENET TX-	
3	ENET RX+	
4	N/C	
5	N/C	
6	ENET RX-	
7	N/C	
8	N/C	

Installation and Configuration

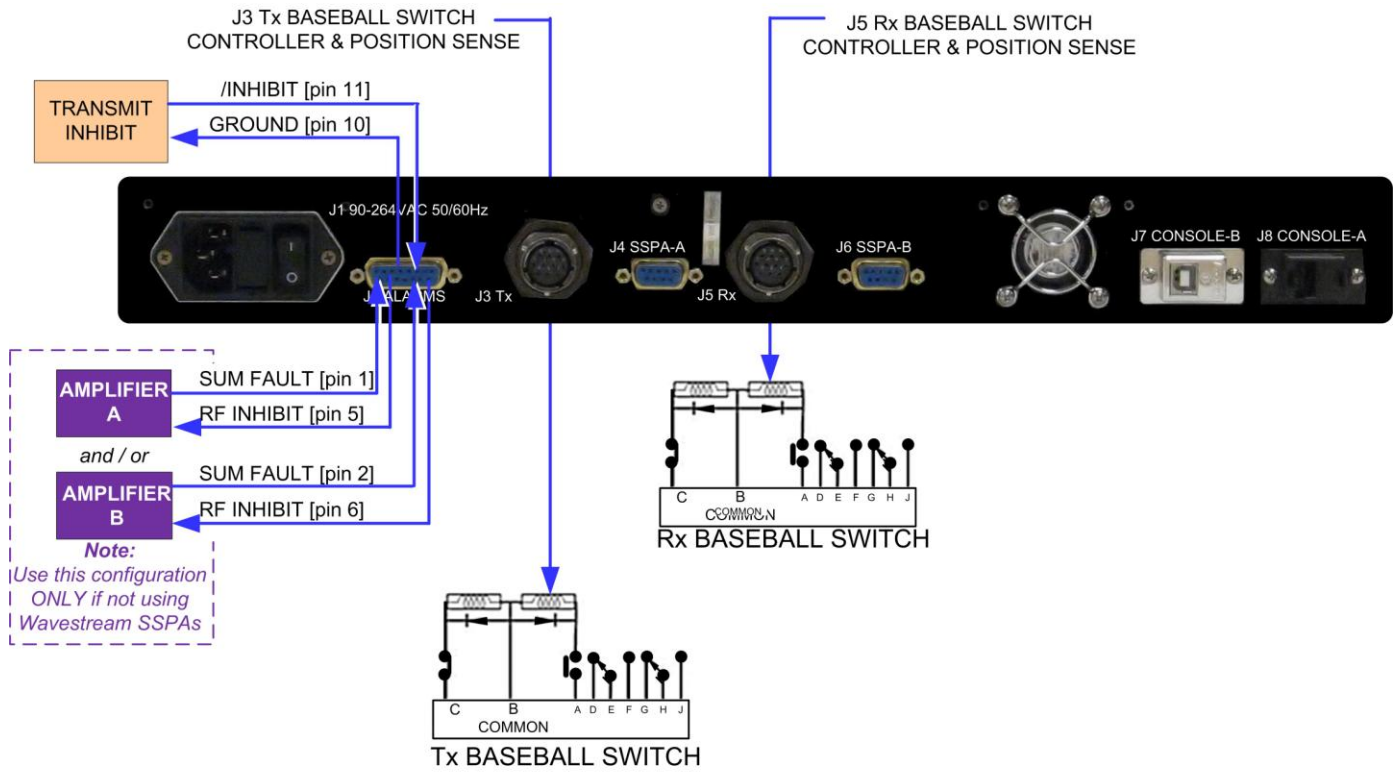
Wavestream's RMC Controller automatically or manually switches to a secondary SSPA (Solid State Power Amplifier) when system configuration requires redundancy. The controller can be manually configured and controlled from the front panel or remotely configured and controlled with Wavestream provided software via the Ethernet console port. The receive waveguide switch can follow the transmit switch on failure (requires external alarm input on J2) or be switched independently. The following basic diagram shows one of many possible configurations to achieve power amplifier redundancy.





Waveguide Connection Diagram

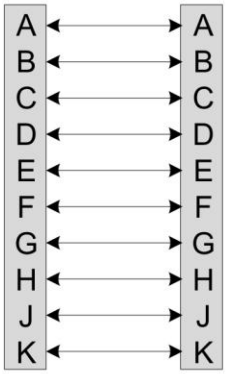
Use this configuration when a non-Wavestream switch is being used in the system. The switch must be a 24 VDC drive switch.



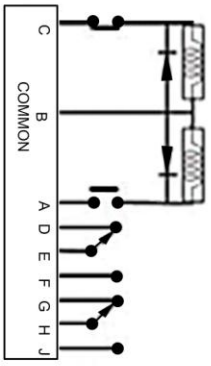
PINOUT

PIN	DESCRIPTION
A	RELAY_DR_1A
B	GND
C	RELAY_DR_1B
D	RELAY_SENSE_1A
E	GND
F	RELAY_SENSE_1B
G	N/A
H	N/A
J	N/A
K	N/A

CABLE



TX OR TX BASEBALL SWITCH



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Preparation

Required Tools / Supplies

- Torque driver
- Cable manufacturing tools

Installation Precautions / Prerequisites

⚠ C A U T I O N

Moisture sensitive.

The unit is not weatherized. Install in a weatherized location using good commercial practice and UV-rated materials.

Inspection and Unpacking

- Keep the shipping box and all packing materials for future use, including return of the unit for repair.
- Inspect the unit for any visible damage. If the unit is damaged, follow the warranty RMA instructions.
- Remove any foreign objects such as packing material.
- Verify that the connector pins are intact and ready for connection.

Installation

⚠ C A U T I O N

Airflow.

The slots and openings provide forced air convection ventilation and air flow.

Do not block these openings.

When mounting the unit in a closed area, such as a building or radome, ensure that proper ventilation is provided. The internal operating temperature should not exceed the maximum rated temperature.

- Install the unit according to standard practice. The RMC can be mounted in a standard 19" rack mount cabinet.
- Position the RMC in the appropriate rack position (it fits into a 1U space).
- Secure the RMC to the rack with two 10-32 screws installed on each side of the RMC front panel. Torque to 25-28 inch pounds.

⚠ W A R N I N G

High Power RF Hazard.

Do not energize the SSPAs / BUCs until all RF output waveguides are properly connected to the rest of the system or to a high power load..

Do not open the RMC. Never put any object through the slots or openings as this could result in touching dangerous voltage points, short-circuiting parts, electric shock, fire or electrostatic discharge.

Power and Grounding

The unit requires 90-264 VAC, 50-60 Hz autosensing power.

- Ensure that the unit is protected against voltage surges and built-up static charges.

⚠ W A R N I N G

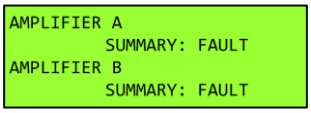
Grounding.

To protect against voltage surges and built-up static charges, install the unit with appropriate grounding methods in compliance with grounding standards for electrical and radio equipment according to the electrical codes in the country of installation.

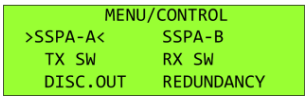
- To ensure continuous RMC operation use an Uninterruptible Power Source (UPS) for protection from primary power line anomalies.
- Plug in the AC power cord.
- Do NOT apply power yet to the system.

RMC Self Test

1. Before connecting any amplifiers, ensure that all connections are removed.
2. Apply AC power to the RMC, turn **on** the ON/OFF switch on the RMC back panel.
3. The RMC displays the Wavestream graphic while the self test runs.
4. At the completion of the self test, all of the LEDs will flash and stay on for 2-3 seconds, then flash again.
5. The RMC defaults to displaying FAULT status when serial communications is missing.



6. Both of the **SUM FAULT** red fault LEDs will turn on.
7. Press the **ENTER** button to access **MENU/CONTROL**.



8. Press the up and down arrows to exercise the display and verify that the scrolling and select functions are working properly.
9. Press the ON/OFF switch on the RMC back panel to **off**.

Non-Wavestream SSPAs

This procedure assumes that there are two operating SSPAs and that the waveguide switches are already installed.

1. Perform a continuity check on all cables prior to installation.
   - Ensure that cable for J2 is correctly wired. Refer to J2 Alarms and General Purpose Outputs for the pin out.
   - Verify that pins 1 and 2 and 5 and 6 are correctly wired.
   - Install the cables J2 through J8 into the back of the RMC as applicable.

Wavestream SSPAs / BUCs

This procedure assumes that there are two operating Wavestream SSPAs / BUCs and that the waveguide switches are already installed.

W A R N I N G

Wiring.

Incorrect cable wiring can permanently damage this unit.

N o t e

If a cable will be 6 feet or longer, Wavestream recommends use of multi-conductor shielded cable to reduce noise pickup.

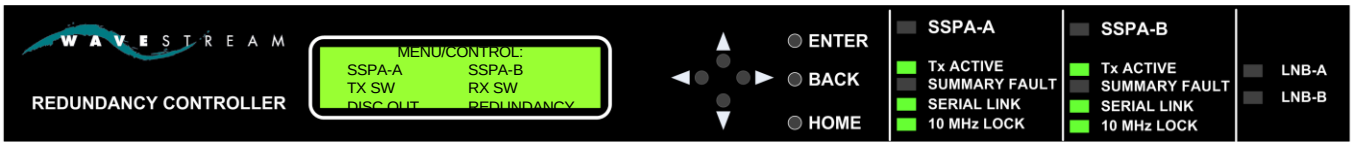
Connect the shield to the case.

- Perform a continuity check on all cables prior to installation.
- Install the cables J2 through J8 into the back of the RMC as applicable.

Connect Cables

1. Route the cables out of the cabinet. Be careful not to strain the connectors on the back of the RMC. Use cable ties and strain reliefs to secure the cables.
2. Connect the cables to the SSPAs and waveguide switches.
3. Connect the J2 alarm and general output cable.
4. Connect the Ethernet cable to the computer system if applicable.

Operation



Menu Map

MONITOR: Ku100W A
SUMMARY: OK
TX: ACTIVE
RF FWD POWER: 48.5dBm

Press ENTER

MENU/CONTROL:
SSPA-A SSPA-B
TX SW RX SW
DISC.OUT REDUNDANCY

SSPA-A and SSPA-B
- FRONT PANEL LEDS
  - SSPA A/B: SETTINGS: CH LEDS
    PRESENT STATE ENABLED / DISABLED
    PANEL LEDS ENABLE
    PANEL LEDS DISABLE
- TX ON/OFF
  - SSPA A/B: SETTINGS: TX
    TX ENABLE
    TX DISABLE
- SET ATTENUATION
  - SSPA A/B: SETTINGS:ATTEN
    RF ATTENUATION: 0.0dB
    ATTENUATION +2
    ATTENUATION -2
- SAVE UNIT SETTINGS
  - SSPA A/B: SETTINGS:SAVE
    PRESS ENTER TO SAVE
    TURN ON TX:INACTIVE
    TURN ON RF ATTEN:0.0dB
    - SSPA A/B: SETTINGS:SAVE
      PRESS ENTER TO SAVE
      TURN ON RF ATTEN: 0.0dB
      TURN ON LED:DISABLED
- UNIT INFORMATION
  - SERIAL#:
    WSxxx
    MODEL #:
    XX XXXW BUC/SSPA
    UNIT FIRMWARE VER:
    XX.X

TW SW
- TX SWITCH CONTROL
  ACTIVE: NO SW / TXA / TXB
  POSITION A
  POSITION B

DISC OUT
- DISCRETE OUTPUT SETTINGS
  OUTPUT 0 / 1 / 2 / 3: CLEAR / SET
  CLEAR
  SET

Note: there are 4 discrete output settings.

RX SW
- RX SWITCH CONTROL
  ACTIVE: NO SW / RXA / RXB
  POSITION A
  POSITION B

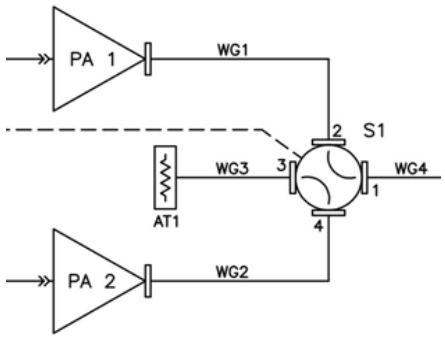
REDUNDANCY
- REDUNDANCY SETTING
  ACTIVE: 1:1 D-REDUNDANCY
  1:1 SIMPLEX REDUNDANCY
  1:1 DUPLEX REDUNDANCY
  - REDUNDANCY SETTING
    ACTIVE: 1:1 D-REDUNDANCY
    OFF
    1:1 SIMPLEX REDUNDANCY

Menu Definitions

MONITOR	Identifies the SSPA [A or B] being monitored and brief status information. If the SSPA is muted INHIBITED will be displayed.
Summary	[*OK/Fault*] Summary fault status.
Tx	[*Active/Inactive*] Status of transmit.
RF Fwd Power	Provides the RF forward power in dBm.
MENU/CONTROL	Lists submenus that may be accessed. Press Enter to access it.
SSPA-A	Selects SSPA-A submenu.
SSPA-B	Selects SSPA-B submenu
TX SW	Select which position the TX switch will be active: A=1 and 2, 3 and 4 B=1 and 4, 2 and 3
RX SW	Select which position the RX switch will be active: A=1 and 2, 3 and 4 B=1 and 4, 2 and 3
DISC. OUT	Configure discrete outputs. For non-Wavestream units, these pins must be connected; otherwise the unit will not be muted during transition.
SSPA-A/B	Lists submenus that may be accessed
Front Panel LEDS	Enable/disable the front panel LEDs.
TX On/Off	Enable/disable TX. This function is also available through the GUI.
Set Attenuation	Select value to increase or decrease the attenuation on the unit.
Save Unit Settings	After any changes, always SAVE the settings. Otherwise when the unit is power cycled it will revert to the previously saved settings.
Unit Information	Provides the serial number and model number of the unit.
TX SW	Lists transmit switch selections.
Position A	Select and press Enter to set the TX switch to position A [1 and 2, 3 and 4].
Position B	Select and press Enter to set the TX switch to position B [1 and 4, 2 and 3].
RX SW	Lists receive switch selections.
Position A	Select and press Enter to set the RX switch to position A [1 and 2, 3 and 4].
Position B	Select and press Enter to set the RW switch to position B [1 and 4, 2 and 3].
DISC OUT	Sets (5 V) or clears (0 V) the discrete outputs on J2.
Output 0:	[*Clear/Set*] Clear (0 V) this output Set (5 V) this output
Output 1:	[*Clear/Set*] Clear (0 V) this output Set (5 V) this output
Output 2:	[*Clear/Set*] user defined Clear (0 V) this output Set (5 V) this output
Output 3:	[*Clear/Set*] user defined Clear (0 V) this output Set (5 V) this output

Redundancy Select the redundancy that the units are configured for

1:1 simplex redundancy [*OFF/ON*] Default is on.
If the primary unit goes into summary fault mode, the RMC automatically switches transmit to the secondary unit. Rx is not automatically switched.

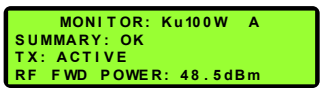


1:1 duplex redundancy [*OFF/ON*] Default is off. If the primary unit goes into summary fault mode, the RMC automatically switches transmit and receive to the secondary unit.

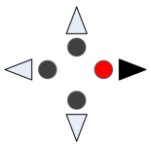
RMC Front Panel Status and Control

Use the RMC front panel or the GUI to configure and control the RMC.

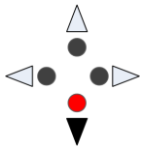
Power Up and Status



- At power on the RMC displays the Monitor or Home display.
- If SSPA unit A is connected correctly, the Summary status is displayed.



- Press the right arrow to display the status of unit B.
- Press the right arrow again to display the status of unit A.

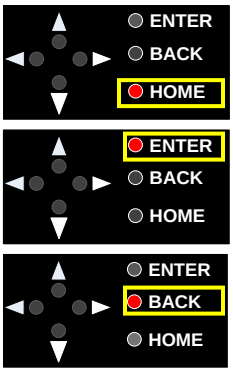


- Press the down arrow to step down, line by line through the status of the SSPA-A or SSPA-B.
- Pressing the up arrow steps the display back up through the status.
- Status information includes:

System Summary Status
Tx Status
RF Forward Power Status [dBm]
RF Forward Power Status [W]
Step Attenuator Setting [dB]
System Temperature [C]
10MHz Reference Signal Status
Ext Tx Enable Status
Software Tx Enable Status
Unit Led Enable Status
Unit Fan Speed Status
Unit Gate Status
Unit Drain Voltage Status
Unit Drain Current Status
Alarm 0 In Status
Alarm 1 In Status
Alarm 2 In Status
Alarm 3 In Status
General Purpose Output 0 Status
General Purpose Output 1 Status
General Purpose Output 2 Status
General Purpose Output 3 Status

- If a unit is not connected, **FAULT** will be displayed when you press the right arrow to display the status.

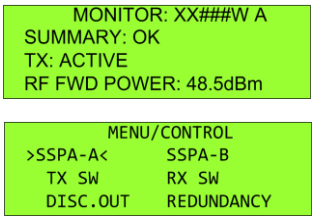
Quick Navigation



1. Press **Home** to return to the Monitor/Home position
2. Press **Enter** to access the Menu/Control.
3. Use the arrow keys to select a submenu, press **Enter** to access it.
4. Press **BACK** to return the menu screen that was just displayed.

Change the SSPA-A/B Settings

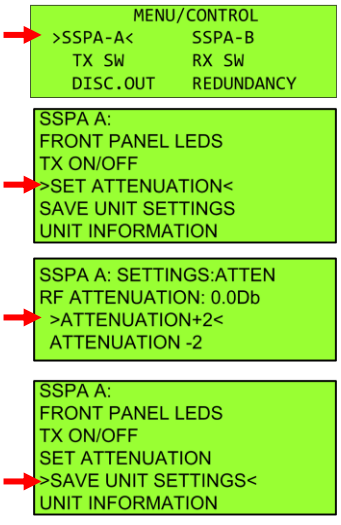
Select SSPA-A or SSPA-B



1. From the Monitor/Home position press **Enter** to access Menu/Control.
2. Use the arrow keys to select a submenu.
   > < around a line indicates which choice will be selected.
   In this example SSPA-A will be selected when you press **Enter**.

Example:

Change parameter(s). For example to decrease the attenuation:



1. Press **Home,** select **SSPA-A**, and press **Enter**.
2. Select **SET ATTENUATION**. Press **Enter**.
3. Use the arrow keys to select increase/decrease the attenuation. Press **Enter** for your selection (for this example increase the attenuation by +2.
4. Press the **Home** key to return to the SSPA-A Home menu. Use the arrow keys to select **SAVE UNIT SETTINGS**. Press **Enter.**
   - Your changes will be saved. *NOTE: if you do not save your settings then whenever the unit is power cycled it will revert to the original settings*.

General Purpose Output Settings [DISC OUT]

Use this menu to set (5 V) or clear (0V) the external outputs on the J2 connector.

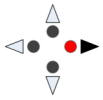
	Wavestream	Non-Wavestream
In0	No Connect or External Fault A	Amplifier A Status[High = Fault, Low = Ok]
In1	No Connect or External Fault B	Amplifier B Status[High = Fault, Low = Ok]
In2	General Input 2	General Input 2
In3	General Input 3	General Input 3
Out0	No Connect	Amplifier A Inhibit
Out1	No Connect	Amplifier B Inhibit
Out2	General Output 2	General Output 2
Out3	General Output 3	General Output 3

For non-Wavestream SSPAs these pins must be connected and set to mute the unit during transition. Wavestream units are automatically muted when the baseball switch transitions from one SSPA to another.

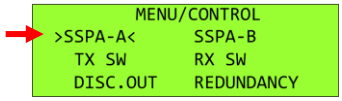
Go to Transmit Inhibit for information to add a transmit inhibit switch to the RMC.

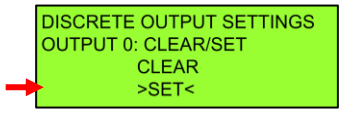
Example:

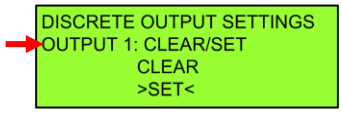
1. From the Home position select the SSPA. Press **Enter**.
2. Select **DISC.OUT** and press **Enter**.
3. Select **Clear** (0 V) or **Set** (5 V). For this example select **Set**.
4. Press the right arrow on the front of the RMC.

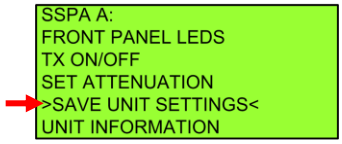


5. You should see OUTPUT 1. Select **Set**.
6. Press the **Home** button to return to the SSPA-A home menu and select **Save Unit Settings**.
7. Repeat steps 1-6 for SSPA-B, select Clear or Set as appropriate.









GUI Installation

System and Software Requirements

Connection via Ethernet only.

Controller Computer Specifications

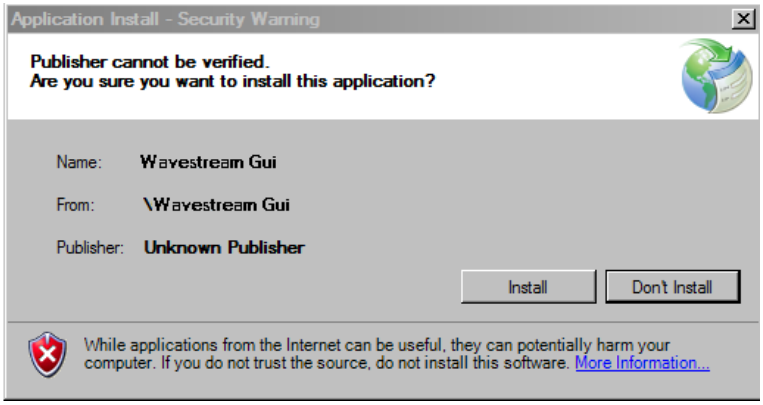
Operating system	Windows

Required Equipment / Tools

Wavestream software CD	Setup.exe wavestreamgui.exe
Lantronix	DeviceInstaller.exe (www.lantronix.com)

GUI Installation

1. Copy all of the files from the CD to a directory on the controller.
2. Double-click **Setup.exe**.

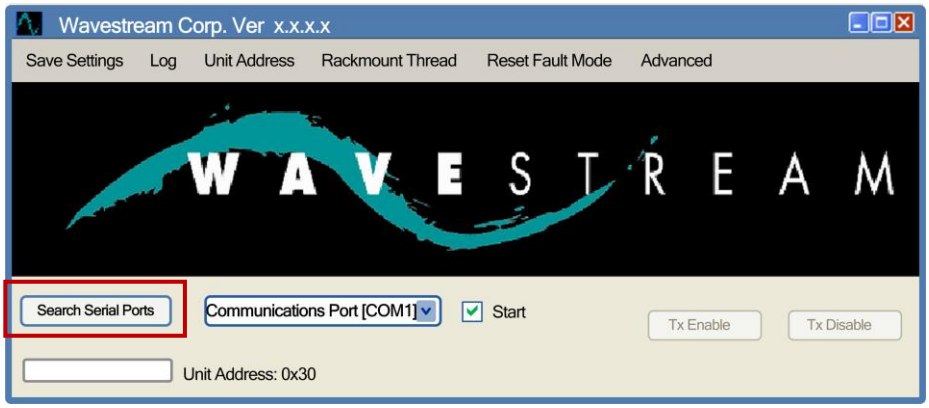


install-controller

3. Click **Install**.
   - The program uses Microsoft .net Framework. This software will automatically be installed if setup does not detect it.

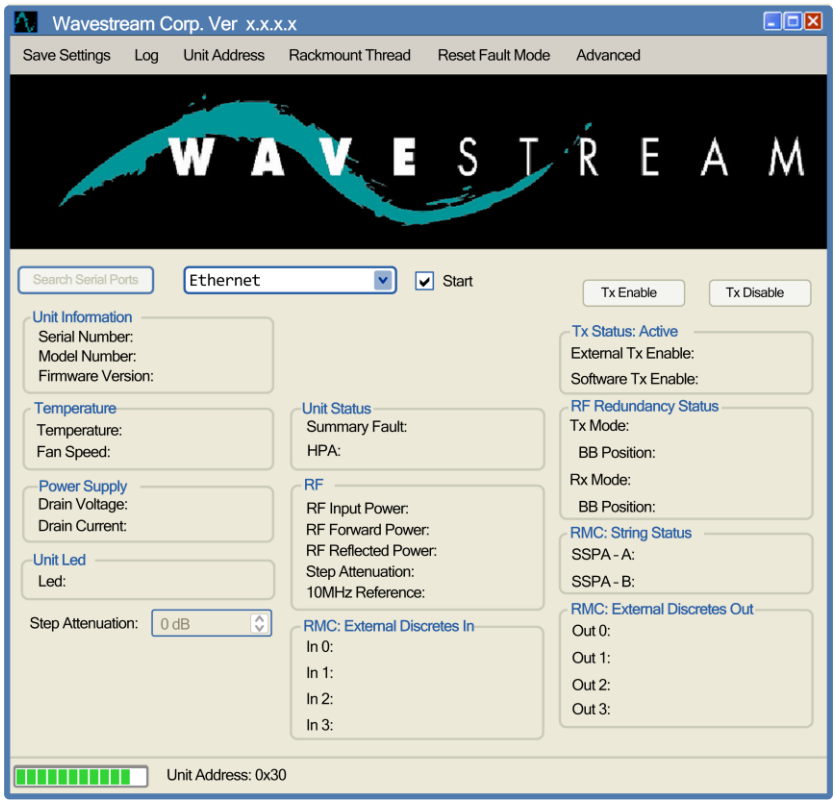
GUI Configuration

1. Double-click **WavestreamGUI.exe**.



2. Click **Search Serial Ports**. A list of available ports will be displayed in the adjacent window. Click the dropdown arrow to list all available ports.
   Select *Ethernet*.

3. Click **Start** to start communication between the unit and the PC.



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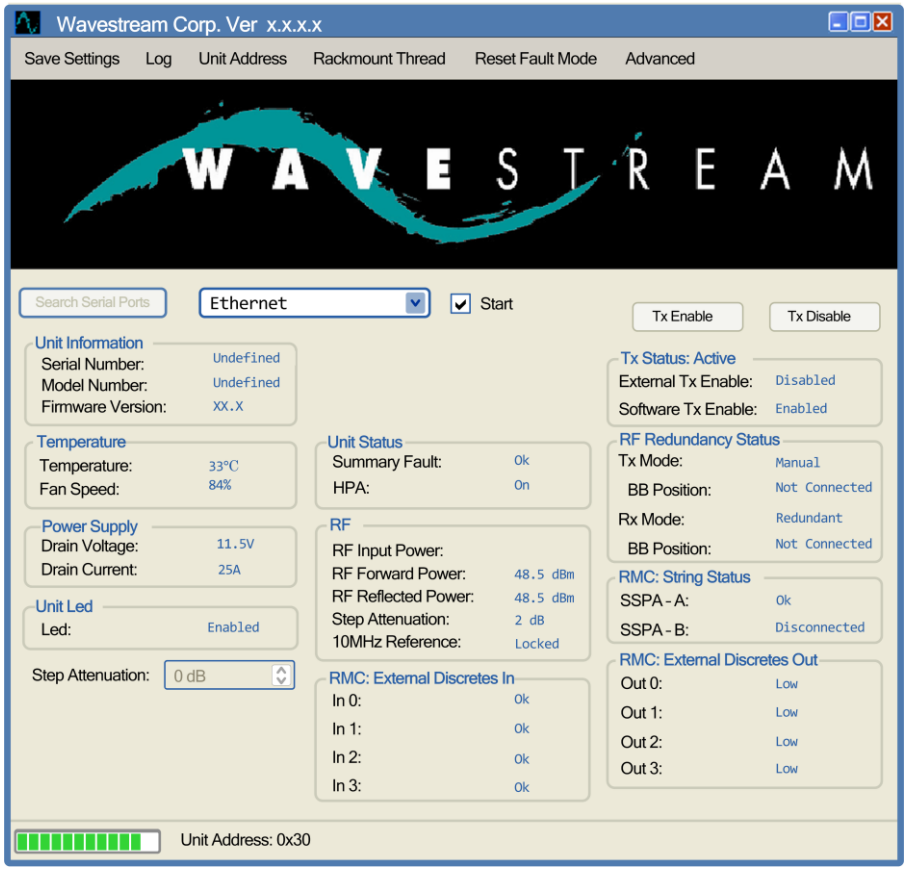
4. Confirm connectivity by movement on the progress bar [green dots in the lower left of the screen] which indicates that there is activity between the unit and GUI. After a few seconds status data will be displayed.

GUI Description



Controls

Active control functions allowed from the GUI are shown as buttons. When a button is clicked the command is sent to the unit. Dropdown menus are used to access local GUI functions.

Status

All digital monitor signal states have a description next to the name of the monitor. For example, Summary Fault will display either Ok or Fault depending on the state.

Display readings

All analog monitor signal readings are presented in the appropriate units.

Tx Enable	Press to send a transmit enable signal to the unit. Transmitting is enabled if there are no faults.
Tx Disable	Press to send a disable signal to the unit which will shut down the amplifier unless the unit has been externally enabled.
Search Serial Ports	From the dropdown box select a communications port between the unit and the controller.
Start	Select to start communications to the specified port. Once connected data will be displayed.
Step Attenuation	Set the gain attenuator to a specific value. The value will be changed immediately on the unit. The unit only holds from 0 to 20 dB of attenuation.

NOTE: Click **Save Settings** → **Save Attenuator Setting** to save the state in non-volatile memory so that the unit will power up in this state. The unit will revert to the saved value at power up.

The following SSPA status definitions are displayed on the GUI and indicate the status of the SSPAs. The following definitions can also be found in the appropriate manual associated with each power amplifier. For complete definitions, refer to the SSPA manual.

To view the redundant SSPA information, click the **Rackmount Thread** pull down menu. Select **View Thread Status, → Thread B**.

Unit Information	Information about the SSPA that the GUI is communicating with and is indicated at the left upper portion of the screen.
Serial Number	Provides the unit serial number.
Model Number	Provides the model number of the unit.
Firmware Version	Provides the version of firmware that is running on the unit.
Temperature	
Temperature	Displays the temperature of the unit in degrees C.
Fan Speed	Displays the fan speed. Fan speed depends on the system temperature and automatically increases or decreases to control the overall temperature.
Power Supply	
Drain Voltage	Displays the analog output voltage from the internal power supply.
Drain Current	Displays the analog output current from the internal power supply.
Unit Led	
LED	Indicates if the LEDs on the unit have been enabled or disabled via Save Led Settings (Save Settings → Save Led Settings).
Unit Status	
Summary Fault	• [OK/Fault]. Displays the status of the Summary Fault signal. If the signal reads Fault, one of the following has occurred: • the unit is over temperature • the unit cannot safely turn on due to bias problems
HPA	[On/Off]. Displays the status of the unit's amplifier
RF	
RF Input Power	Where applicable, displays the input power level in dBm.
RF Forward Power	Where applicable, displays the analog RF forward power level (output) in dBm. Note that for RF forward power readings below 25 dBm, the forward power may not read accurately.
RF Reflected Power	Where applicable, reads the analog RF reflected power level (reflected back into unit). The approximate output power in dBm is displayed. For RF reflected power readings below 25 dBm, the forward power may not read accurately.
Step Attenuation	Where applicable, displays the gain attenuation.
10MHz Reference	[OK/Fault]. Where applicable, displays the status of the BUC 10 MHz reference signal If the display shows Fault, the unit has lost lock on the 10 MHz reference signal.

RMC External Discretes In

In 0:	High– J2 Pin1 is high (5V). Low– J2 Pin1 is low (0V).
In 1:	High – J2 Pin 2 is high (5V). Low – J2 Pin 2 is low (0V).
In 2:	High – J2 Pin 3 is high (5V). Low – J2 Pin 3 is low (0V).
In 3:	High – J2 Pin 4 is high (5). Low – J2 Pin 4 is low (0V).

Tx Status

	[Active/Inactive]
H/W Tx Enable	[Enable/Disable] Displays the status of the external TX enable signal.
Software Tx Enable	Software Tx Enable is logically OR'd with the External Tx Enable; either one will enable the unit.

RF Redundancy Status

Tx Mode	Manual– User has defined switch position; system will not switch automatically in case of a signal chain fault. Redundant– Waveguide switching position is determined by the status of the system. The system will attempt to switch when selected SSPA has incurred a fault and if the redundant SSPA is present and clear of any faults.
BB Position	Side A– Tx waveguide baseball switch is set to side A RF pass through. Side B-Tx waveguide baseball switch is set to side B RF pass through. Not connected.
Rx Mode	Manual– User has defined switch position; system will not switch automatically in case of a signal chain fault. Redundant– Waveguide switching position is determined by the status of the system. The system will attempt to switch when selected Rx chain has incurred a fault and if the redundant Rx chain is present and clear of any faults.
BB Position:	Side A-Rx waveguide baseball switch is set to side A RF pass through. Side B-Rx waveguide baseball switch is set to side B RF pass through.

RMC: String Status

SSPA-A:	Ok– SSPA is present and clear of any system faults. Fault– SSPA is present but has incurred a system fault. Disconnected– No SSPA is connected.
SSPA-B	SSPA-B: Ok– SSPA is present and clear of any system faults. Fault– SSPA is present but has incurred a system fault. Disconnected– No SSPA is connected.

RMC External Discretes Out:

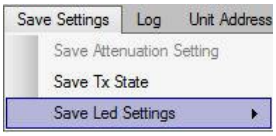
Out 0:	High– 5 volts is placed on J2 Pin 5 Low– 0 volts is placed on J2 Pin 5
Out 1:	High– 5 volts is placed on J2 Pin 6 Low– 0 volts is placed on J2 Pin 6
Out 2:	High– 5 volts is placed on J2 Pin 7 Low– 0 volts is placed on J2 Pin 7
Out 3:	High– 5 volts is placed on J2 Pin 8 Low– 0 volts is placed on J2 Pin 8

Unit Serial Connection

Green dots in lower left	Serial connection activity is indicated by a series of dots on the bottom left of the GUI screen. • If the series of dots is moving, then the GUI is connected to the unit. • If there are no dots or the dots have stopped moving, the GUI is not communicating with the unit. • The number to the right of the box indicates cumulative packets transferred.
Unit Address	Displays the unit address.

Toolbar Menus

Save Settings



Allows the user to save a setup value for the unit.

Save Attenuation Setting – saves the attenuation value. It will change immediately on the unit. The unit specification holds from 0 to 20 dB of attenuation.

Select **Save Settings → Save Attenuator Setting** to save the state in non-volatile memory so that the unit will power up in this state. The unit reverts to the saved value at power up.

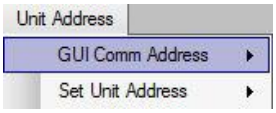
Save Tx State – saves the transmitter state.

Save Led Settings – the LEDs may be enabled or disabled via the **Save Settings** dropdown menu. Note, the LED's will turn on for a brief moment at start up even if this software LED command is used. If you do not want the LED's to turn on even during start up, then use the hardwired LED disable signal.

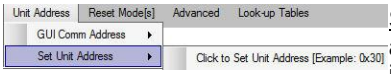
Log

Opens a scrollable log field below the main screen. Each entry is a time-stamped command or status activity including any faults that may have occurred.

Unit Address

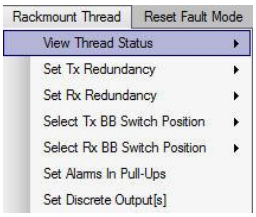


GUI Comm Address – the address that the unit is communicating with.



Set Unit Address – changes the default address (0x30) to a required address [e.g. if in a chain]. To change the unit address, first connect to the unit via the existing address.

Rackmount Thread



Selects SSPA-A or SSPA-B

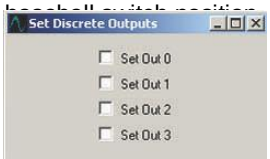
View Thread Status – [*Thread A or B*] When a rackmount controller is used with one or two units, select unit (A or B) as the unit being viewed.

Set Tx Redundancy – [*On / Off*] Enables or disables the Tx waveguide baseball switch redundancy feature. On = redundancy switchover is active, if the unit experiences an error, control automatically switches over to the other unit – if the other unit is free of faults. Off = manual selection.

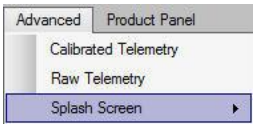
Set Rx Redundancy – [*On / Off*] Enables or disables the Rx waveguide baseball switch redundancy feature. On = controls the feed to a baseball switch. Off = manual selection.

Select Tx BB Switch Position – [*SSPA-A / SSPA-B*] Manually select the Tx waveguide baseball switch position.

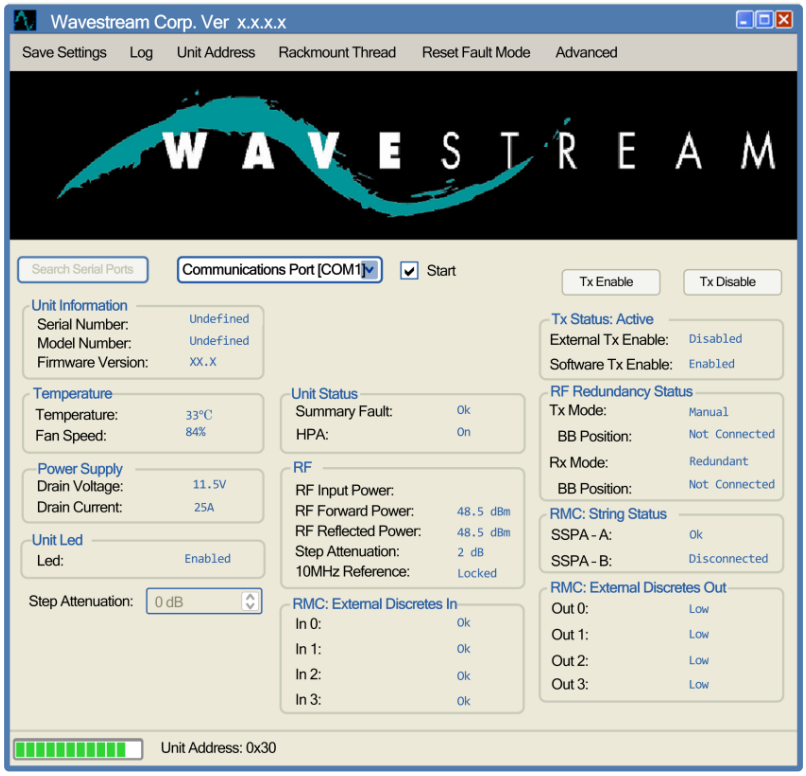
Select Rx BB Switch Position – [*LNB-A / LNB-B*] Manually selects Rx waveguide baseball switch position.



Set Discrete Output[s] – There are 4 general purpose discrete outputs 1-4. The user maps in software how they are used; 5V = set, 0 = clear. The rackmount controller reads back the state of each pin.

Reset Fault Mode	Reset a reflected power fault.
Advanced  	Calibrated Telemetry – returns calibrated telemetry values (i.e. voltages, currents, RF power). Raw Telemetry – displays raw telemetry values (internal measurement). Splash Screen – enable / disable displaying the splash screen when starting the GUI application.

Power On



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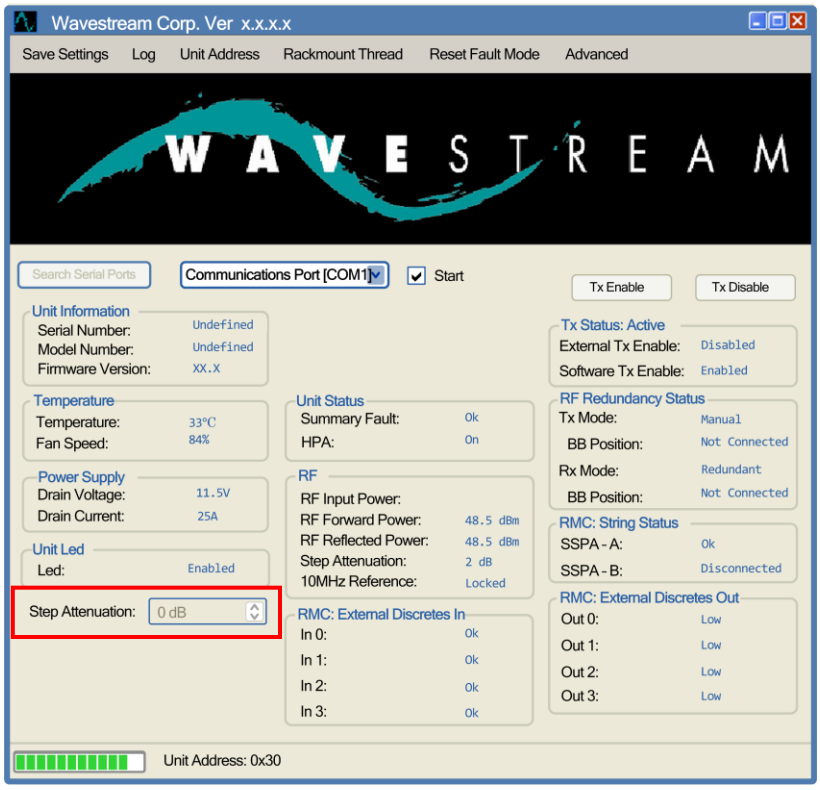
1. Verify that all cables, units, and waveguides are connected to the RMC.
1. Turn on the computer where the Wavestream GUI is loaded and open the GUI application by double-clicking the Wavestream icon. 
2. Turn on power to the RMC.
3. Apply power to the SSPAs / BUCs.
4. In the **Serial Ports** field on the GUI, select the appropriate com port; the only valid port for the RMC is Ethernet.
5. Press **Start**.
6. Communication with the unit is established.
7. The units are queried and status information is displayed for the primary unit.
8. To view status for the backup / secondary unit press **Rackmount Thread** on the GUI toolbar
9. Select **Thread A** to view SSPA-A or **Thread B** to view SSPA-B.

Select Power On Setting

To configure the power on setting:

- Apply the software TX enable; note that this is not applicable in a redundancy configuration.
- Configure the power on setting in the GUI and save the default TX setting so that it will be enabled at power up.

Set or Change the Step Attenuation



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- Press the up and down arrows in the Step Attenuation field to set the gain to a specific value.
- Click **Save Settings → Save Attenuator Setting**, to save the step attenuation setting upon boot-up.

System Faults and Activity

To view the system faults that have occurred click **Log** in the toolbar.

A scrollable field will appear below the GUI. It displays a time-stamped list of command and status activity for the unit as well as any faults that may have occurred.

View the Log

- Press **Log** in the toolbar.
- Review the faults (listed in the log).

Check System Faults

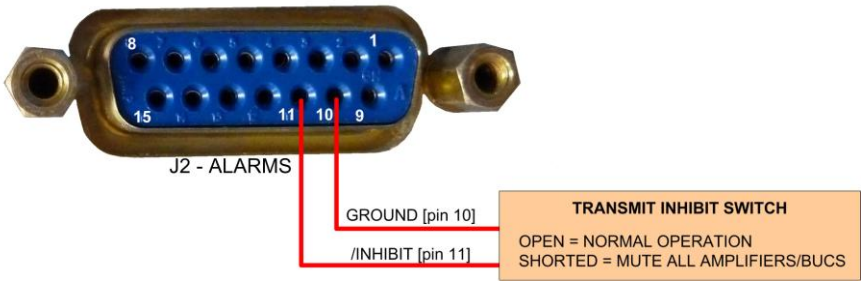
If a latching fault occurs (for example, reverse power exceeds the threshold) press **Reset Fault Mode** on the Wavestream GUI to clear the latching fault.

- From the **Home** menu, press **Log** → **Maximize**.
- Review the faults (listed in the log).

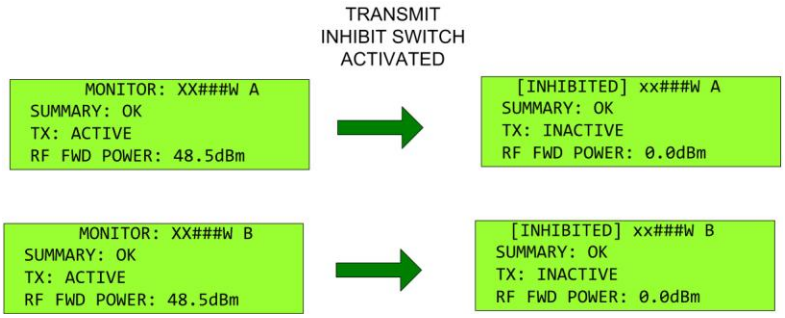
- Press **Reset Fault Mode**.
  - With this first press, if it is a latching fault (for example, reverse power exceeds the threshold) this will clear the fault.

Transmit Inhibit

Shorting /Inhibit (pin 11) to Ground (pin 10) of J2 mutes all units connected to the RMC, this configuration may be used to implement a transmit inhibit switch on the system:



When transmit inhibit is activated the display for all connected amplifiers/BUCs will instantly change showing that the connected amplifiers/BUCs have been muted.

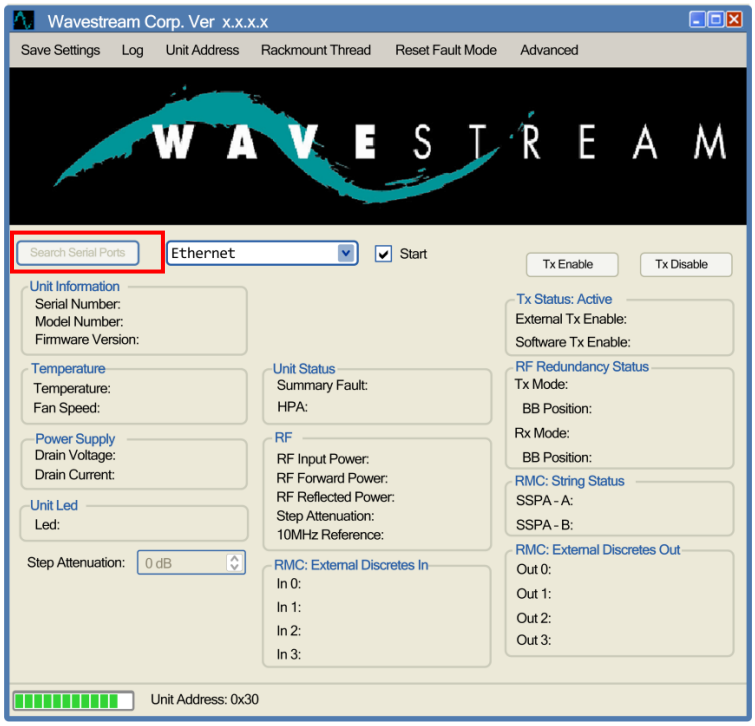


To reactivate the units, the short must be removed.

Troubleshooting

If there is no communication between the GUI and unit in serial applications check the following:

- Verify that the unit has power.
- Verify IP address is set correctly.
- Verify IP address is not being used.



Gui

Problem: No LEDs are Lit, Fan is Operating, Display is displaying information.

- Check the front panel settings for LEDs Enabled. Reset and enable LEDs for both A and B Power Amplifiers.

Problem: No LEDs are Lit, Fan is Operating, Display is not displaying information.

- Possible power supply problem. Return RMC to Wavestream.

Any problems that occur past these simple tests probably indicate internal failures and the RMC must be returned to Wavestream. See front section of this manual for returning procedures.

Maintenance / Service

Maintenance

The unit is low maintenance and service-free.

Frequency	Inspection to perform	Description
6 months	Inspect equipment and connections	Inspect equipment and connections
6 months	Connectors	Remove corrosion Verify they are securely connected

Service

Do not attempt to service this equipment, there are no internal replaceable components or assemblies. Under all circumstances contact Wavestream or your distributor for service.

D A N G E R

Hazardous Voltage.

Opening or removing the cover of the unit may expose you to dangerous voltages, high power RF energy or other hazards as well as void your warranty.

N o t e

Opening or removing any component or sealed area will immediately void the warranty.

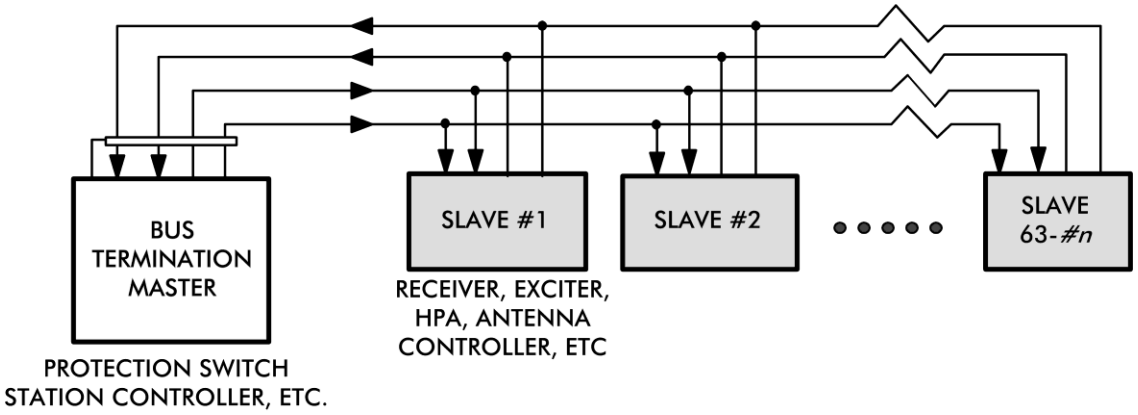
Appendix A – SAbus

This appendix describes the Serial Monitor and Control protocol for the serial remote control interface. The SAbus provides monitor and control capability and some flexibility not available in customized systems solutions.

General Protocol Description

The SAbus interface is a multi-drop, balanced line, asynchronous, full-duplex communications link that interconnects equipment for remote control and switching applications. SAbus compatible equipment can be linked together over a parallel-connected 4-wire circuit regardless of their particular function.

The SAbus subset of RS-422/485 allows up to 63 slave devices with one master to be connected in parallel with a maximum of 4000 feet between any master and group of slaves.



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Each slave device is internally configured to respond to a unique address. A master could be a protection switch, earth station controller, or any microcomputer or minicomputer that is electrically and operationally compatible with the SAbus. Since the electrical specifications are very similar to EIA standards RS-422/485 and RS-449, typically any computer that meets these standards can control remote devices over the SAbus.

RS 422/485 interfaces are unipolar, balanced, 5-volt serial interfaces that connect equipment which must exchange data over considerable distances with high-noise immunity and high speed. Standard IC drivers and receivers convert RS-422/485 signals to and from TTL logic levels.

Physical Specifications

- The SAbus interface uses four data lines, circuit common, and shield.
- No hardware handshaking is used in the SAbus protocol.
- All SAbus devices can operate in electrical parallel with a single cable connecting all devices controlled by a master.

Wavestream Modified SAbus

SAbus data format supports industry's standard asynchronous ASCII format as shown in the comparison to the Wavestream modified SAbus protocol below.

	Industry standard SAbus protocol	Wavestream SAbus Protocol
	Asynchronous ASCII	Asynchronous ASCII
Start bits	1	1
Data bits	8 (7-bit ASCII with 8th bit set to even parity)	8 (no parity bit)
Stop bits	1	1

Data Format

The ASCII control character subset 00-1F (hex) are used for address, command, and data characters.

The standard bus data rate via direct connect (up to 4000 feet) is 9600 baud; the data rate for devices connected to a master via modem is 1200 baud.

Message format and protocol over the SAbus is a derivative of IBM's binary synchronous communications protocol (BISYNC).

- The master station sends a command over the bus to all remote stations.
- The station whose address is contained in the second byte of the command message carries out the requested commands and then sends a response message containing its own address and status information relating to its present condition.
- A remote station only sends a response following a command from the master containing its unique address. This prevents bus contention caused by more than one remote device communicating over the SAbus at the same time.
- A remote device ignores all commands that contain parity or checksum errors, protocol errors, a wrong address, or message overrun errors.
- A remote device replies with a not-acknowledged (NAK) character if it receives an invalid command or data.

Message Format

Command messages begin with a start-of-text (STX) byte followed by a remote address, a command byte, and multiple data bytes. The end-of-text (ETX) byte is sent following the last data byte and the message is terminated by a checksum character.

COMMAND MESSAGE:

STX	ADDRESS	COMMAND	D1	D2	Dn	Dn+1	ETX	CHKSUM

RESPONSE MESSAGE: COMMAND ACKNOWLEDGED

ACK	ADDRESS	COMMAND	D1	D	Dn	Dn+1	ETX	CHKSUM

RESPONSE MESSAGE: COMMAND NOT ACKNOWLEDGED-UNABLE TO EXECUTE OR INCORRECT COMMAND

NAK	ADDRESS	COMMAND	ETX	CHKSUM

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Response messages are identical to command messages in format with the exception of the acknowledge (ACK) and not-acknowledged (NAK) character at the start of the message instead of STX.

A command or reply message may vary in length; it may have a maximum of 200 bytes including delimiters and checksum. Although most currently implemented SAbus devices require no (or very few) data bytes, the capability for long messages is built into the protocol so that future applications requiring the transfer of large amounts of data can be accommodated.

Message Delimiters

- A command message begins with STX (02 hex), the ASCII start-of-text character.
- A message-acknowledged reply begins with ACK (06 hex), the ASCII acknowledge control character.
- A message-not-acknowledged reply begins with NAK (15 hex), the ASCII not-acknowledged control character.
- All messages end with ETX (03 hex), the ASCII end-of-text control character, followed by the checksum byte.

Address Character

The device address must be a valid ASCII printable character between 1 and 0, or 31 through 6F (hex); providing the possibility of 63 SAbus addresses.

Command Character

The command (CMD) character immediately follows the device address and specifies one of a possible 80 different commands for a particular device. Values from 30 to 7F (hex) are allowed. Commands may be completely device dependent with the exception of command 30 (hex), which must cause a device to return its six-character device type and command 31 (hex) which is a status poll.

Command and Reply Data

A command or device reply may contain from 0 to 128 data characters and is restricted only to printable ASCII characters 20 through 7F (hex).

Check Character

The last character of any SAbus message is the check (CHK) character. This character is simply the bit-by-bit exclusive OR of all characters in the message starting with the STX character through the ETX character. This forms a longitudinal redundancy parity check over the entire message.

Message Timing

Different devices will require different times to execute commands from a Master. A receiver, for example, may be instructed to change frequency and may require up to a second for the synthesizer to lock. This should not prevent it from immediately acknowledging the command. The NAK or ACK reply does not signify that a function has actually taken place, but only that the message was received and understood. A status reply should indicate when a device is executing a time-consuming function.

A remote device must begin responding to a command within 100 milliseconds after receiving the last character of the command and no more than 10 milliseconds must pass between each character. If the remote device does not respond within this time, the master/controller should attempt to re-establish communication by re-polling this device at least once.

At least a 10-bit time delay must be inserted between command messages in order to wake up a remote device. Once the device is awakened by data on the bus, it looks for STX followed by its address. If it does not see its own address, it ignores the rest of the message by going to sleep and remains in that state until the serial data line idles for at least 10-bit times or approximately 10 milliseconds.

All SAbus compatible devices must respond to a command 0 (30 hex), with 6 data bytes of ASCII characters in the following form:

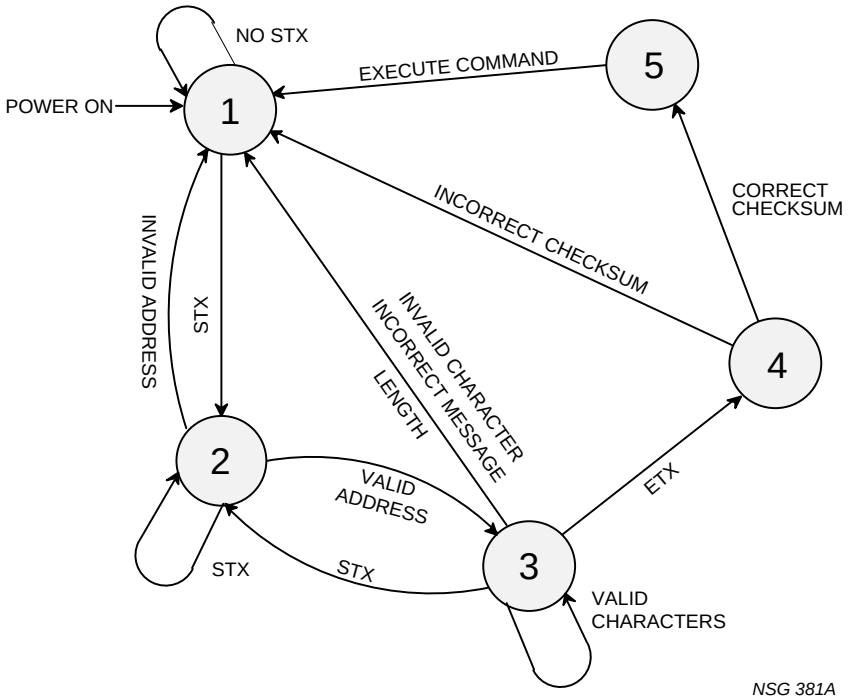
ACK	ADDR	30	D1	D2	D3	D4	D5	D6	ETX	CHSUM

where D1 through D4 are four ASCII characters representing the model number and D5 and D6 are two ASCII characters representing a software version number.

If more than one command is required to obtain status information of device's functions that can cause a change bit to be set. Then the device must implement a clear change bit command and this must be the only command which causes the change bit to clear. If several commands have to be executed in order to set all the information that can cause a change bit to be set, then multiple change bits may be used to reduce the bus traffic.

Wherever possible, SAbus numeric data should be sent encoded as ASCII data characters and only in cases where it cannot be avoided, numeric data should be sent in binary or BCD packed format. Status bits in data bytes (i.e., change bits, alarm bits, etc.) should occupy no more than four bits in the low-order nibble. The high-order nibble should be set to 03 to guarantee that the byte will contain a printable ASCII character.

The slave state diagram presents the required protocol implementation at the slave device that guarantees the proper transfer and processing of communication messages sent by a master/controller over SAbus.



State Diagram Notation

In the state diagram each state that a device can assume is represented graphically as a circle. The single-digit number in the circle identifies the state. All permissible transitions between states are represented graphically by arrows between them. Each transition is qualified by a condition that must be true in order for the transition to occur. The device will remain in its current state if the conditions which qualify transitions leading to other states are false or conditions that qualify pseudo-transitions are true. A pseudo-transition is a transition that occurs within the same state and is represented graphically by arrows leaving from and arriving at the same state.

The following mnemonics describe transitions in the state diagram.

STX	Start-of-text ASCII control character, used as a header in the SAbus command messages. It identifies the beginning of a new message.
ETX	End-of-text ASCII control character used as a termination character in SAbus messages to identify the end of data.
Checksum	The longitudinal redundancy check (LRC) byte is the last byte in the SAbus message data block. The value of the LRC byte is the exclusive OR of all message bytes including the STX and the ETX bytes and is used to detect errors during transmission of data.

The following table defines the transitions between states.

State	Name	Description
	Device Idle State	In State 1, a device is ready to receive a new message, and therefore, must complete any previous message reception. A device always powers on in State 1. A device will exit State 1 and enter State 2 (device addressed state) only if STX byte is received.
	Device Addressed state	In State 2, a device is waiting to receive the address byte, the second byte of the SAbus command message. A device will exit State 2 and enter: • State 3 (device data state) if received address byte equals a device's address. • State 1 (device idle state) if received address byte does not equal a device's address. • State 2 (remain in current state) if STX byte is received which may be the beginning of a new message data block.
	Device Data State	In State 3, a device is engaged in receiving the command and associated data bytes sent by a master/controller. A device will exit State 3 and enter: • State 4 (device data error state) if ETX byte is received signifying the end of data in the message. • State 1 (device idle state) if invalid command, or data character, or incorrect number of data bytes are received.
	Device Data Error State	In State 4, a device is waiting to receive a checksum byte which tests the transmitted message for errors. A device will exit state 4 and enter: • State 5 (command execute state) if a checksum byte is true (received LRC value of checksum byte equals LRC value computed by a device during message reception) • State 1 (device idle state) if a checksum byte is false (received LRC value of checksum byte does not equal LRC value computed by a device during message reception).
	Command Execute	In State 5, a device, having completed a reception of SAbus message, executes a device's function specified by a command byte. A device will send and appropriate

State	Name	Description
	State	response message to a master/controller within 100 milliseconds after receiving the last character of the message. A device will always exit State 5 and enter State 1 - Device Idle State.

Packet Structure

Data and information from the controller to the unit is transmitted in packets.

Response to errors:

- If the address does not match, the M&C will not respond.
- If the checksum is invalid, the M&C will not respond.

DEC	HEX	ABR	Char Name	
02	0x02	STX	Start of Text	
03	0x03	ETX	End of Text	
06	0x06	ACK	Acknowledge	
21	0x15	NAK	Negative acknowledge	
	0x30 to 0x39		address	One byte, typically in the range 0x30 to 0x39, but can be any value other than STX, ETX, ACK or NAK. Must match the value configured into the M&C unit or message is ignored.
	0x30 to 0xF0		Command	One byte, typically in the range 0x30 to 0xF0, but can be any value other than STX, ETX, ACK or NAK.
			Data Checksum	Up to 570 bytes of ASCII characters. One byte containing the XOR of all previous bytes including STX and ETX.
			Echo Address	
			Echo Command	

ASCII Encoding of Binary Data

All binary data sent and received by the M&C is encoded into ASCII characters. If a communication protocol allows unrestricted binary data, designate a unique start, stop, ACK or NAK byte. However, since the data payload of a packet can contain bytes of any value, you are never sure if a byte is a control code, or part of the payload. If a communication is corrupted and the receiver loses track of where it is in a message, then there is no reliable way to guarantee resynchronization. In the worst case scenario, depending on the data payload, the communication might never recover synchronization.

When data is encoded into ASCII format the start, stop, ACK, and NAK codes are guaranteed to never be present in the data payload.

All binary data is encoded in hex ASCII in Intel byte order. Intel byte order, also called little-endian, because the least significant byte is first in memory. For example, if a 16-bit word contains the binary value 0x12AB, it will be stored in memory as AB12, and converted to the ASCII string AB12.

Master-Slave Communication

All communication is initiated by the Master. The M&C will never initiate communication; it will only respond. Communication is via a 4-wire RS-485. The M&C receiver is always active. The transmitter is activated to send a reply, then it is deactivated. This allows multiple units to exist in parallel.

The default address 0x30 is assigned to each M & C unit. The unit will only respond to messages sent to this address.

Combined Status Message

The M & C responds with the entire status of the amplifier in a single communication.

Separate messages are not currently available to get individual pieces of information.

To get the PowerStream 757C-i status, use the command

CMD_GET_STATUS = 0x40

Status Message Definition

The most convenient way to use the data definitions is to use C or C++ programming language on an Intel architecture machine. The structures and bit-fields can be used directly. Pack the structures using byte alignment. Most compilers will default to WORD, DWORD or larger alignment. The compiler must be configured to pack these structures correctly.

Use the following directive for Microsoft Visual C++ V6.0:

#pragma pack(1)

Commands

Command	Hex	Notes
CMD_GET_MODEL_NUMBER	0x30	Returns the unit model number in ASCII Unit ID is an ASCII string. It is returned directly (not converted to hex).
CMD_GET_SERIAL_NUMBER	0x31	Returns the serial number in ASCII (not converted to hex).
CMD_GET_VERSION	0x32	Returns the firmware version in ASCII.
CMD_GET_STATUS	0x40	Returns the amplifier status in hex ASCII format.
CMD_GET_RAW_STATUS	0x41	Returns the amplifier status in hex ASCII format without calibration factors
CMD_ENABLE TRANSMITTER	0x50	Sets the Transmit Soft Enable bit. Enables the transmitter if not in fault mode. Successful response is ACK with –OK‖.
CMD_DISABLE TRANSMITTER	0x51	Clears the Transmit Soft Enable bit. Successful response is ACK with –OK‖.
CMD_SET_ATTENUATION	0x52	Sets attenuation to user specified 8 bit value. Range = 0 - 120 The step increment it relative, it changes with each unit, it depends on the unit's configuration (for example it may have 4 dB, 2 dB, ¼ dB steps, etc) Successful response is ACK with —OK‖.
CMD_SAVE_ATTENUATION	0x53	Saves the SET_ATTENUATION value to non-volatile memory
CMD_SET_LED_OFF	0x54	Follows entry of a command line, toggles the LED_OFF bit. Requires parameter of 0 or 1. 00>LED;01>LED OFF
CMD_SAVE_LED_OFF	0x55	Saves the current LED_OFF bit value to non-volatile memory.
CMD_SAVE_TRANSMITTER_ENABLED	0x56	Saves the current Transmit Soft Enable bit to non-volatile memory.
CMD_GET_RMC_STATUS	0x70	Returns the RMC status
CMD_SET_THREAD_CONTROL	0x71	Sets which SSPA to view
CMD_SET_TX_REDUNDANCY	0x72	Enable/disable Tx redundancy setting (0=disabled, 1= enabled)
CMD_SET_RX_REDUNDANCY	0x73	Enable/disable Rx redundancy setting (0=disabled, 1= enabled)
CMD_SET_TX_BBSWITCH	0x74	Sets Tx waveguide switch position (0=A, 1=B)
CMD_SET_RX_BB_SWITCH	0x75	Sets Rx waveguide switch position (0=A, 1=B)
CMD_SET_DISCRETE_OUTS	0x76	

Compatibility GET_RMC Status Data Structure

Command: 0x70

Byte	Name	Bit	Data Type	Notes
0-3	Project_Id		Unsigned Int	
4-7	DataStructureVersion		Unsigned Int	
8	In0	Bit 0	Bit	
	In1	Bit 1	Bit	
	In2	Bit 2	Bit	
	In3	Bit 3	Bit	
9	ExtDiscrete0	Bit 0	Bit	
	ExtDiscrete1	Bit 1	Bit	
	ExtDiscrete2	Bit 2	Bit	
	ExtDiscrete3	Bit 3	Bit	
10	RxRedundancyOn	Bit 0	Bit	
	RxBaseBallSwitchState	Bit 1	Bit	
	RxBaseBallSwitchState	Bit 2	Bit	
	RMCSerialLinkA	Bit 3	Bit	
11	Thread	Bit 0	Bit	
	TxRedundancyOn	Bit 1	Bit	
	TxBaseBallSwitchState	Bit 2	Bit	
	TxBaseBallSwitchState	Bit 3	Bit	
12	RedundancySetting	Bit 0	Bit	
	Inhibit	Bit 1	Bit	
	Reserved	Bit 2	Bit	
	Reserved	Bit 3	Bit	
13	RMCSerialLinkB	Bit 0	Bit	
	SSspaAOk	Bit 1	Bit	
	SspaBOk	Bit 2	Bit	
	RedundancySetting	Bit 3	Bit	
14-17	Reserved		unsigned int	

CMD_SET_DISCRETE_OUTS

	Out 0	Out 1	Out 2	Out 3
00	Clear	Clear	Clear	Clear
01	Set	Clear	Clear	Clear
02	Clear	Set	Clear	Clear
03	Set	Set	Clear	Clear
04	Clear	Clear	Set	Clear
05	Set	Clear	Set	Clear
06	Clear	Set	Set	Clear
07	Set	Set	Set	Clear
08	Clear	Clear	Clear	Set
09	Set	Clear	Clear	Set
0A	Clear	Set	Clear	Set
0B	Set	Set	Clear	Set
0C	Clear	Clear	Set	Set
0D	Set	Clear	Set	Set
0E	Clear	Set	Set	Set
0F	Set	Set	Set	Set

Appendix B - Ethernet

The Ethernet interface is an alternative to the serial interface. It provides access to the same Monitor and Control (M&C) parameters that are available via the serial M&C interface. Detailed descriptions of the fields and Wavestream Graphical User Interface (GUI) are located in other sections in this manual.

TCP-based Monitor & Control

The TCP-Based protocol is a simple encapsulation of the serial protocol into TCP packets which allows the Wavestream GUI to talk to the unit via Ethernet. Instead of using a COM port and running over a serial link, the GUI encapsulates commands into TCP packets on port 10001 and receives response TCP packets from the unit. The operation of the GUI remains the same as when used over a serial link.

Appendix C - Change the IP Address

Use this procedure to change the IP address. Contact Wavestream Technical Support at support@wavestream.com to obtain a copy or replacement copy of the software.

Equipment

Wavestream CD **(**shipped with the unit)	WavestreamGUI.exe
DeviceInstaller (free download from www.lantronix.com)	DeviceInstaller.exe

Procedure

N o t e

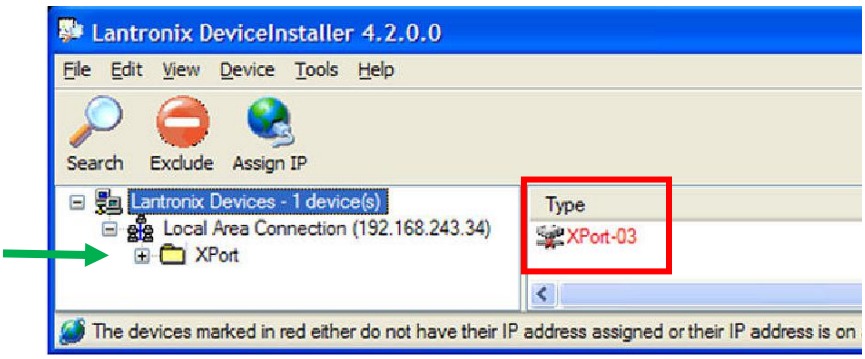
A correctly connected unit with power and Ethernet connectivity is assumed prior to changing an IP address.

Antivirus software and/or firewalls may interfere with the installation of Wavestream software.

Consult an IT specialist if needed.

Ethernet Connection

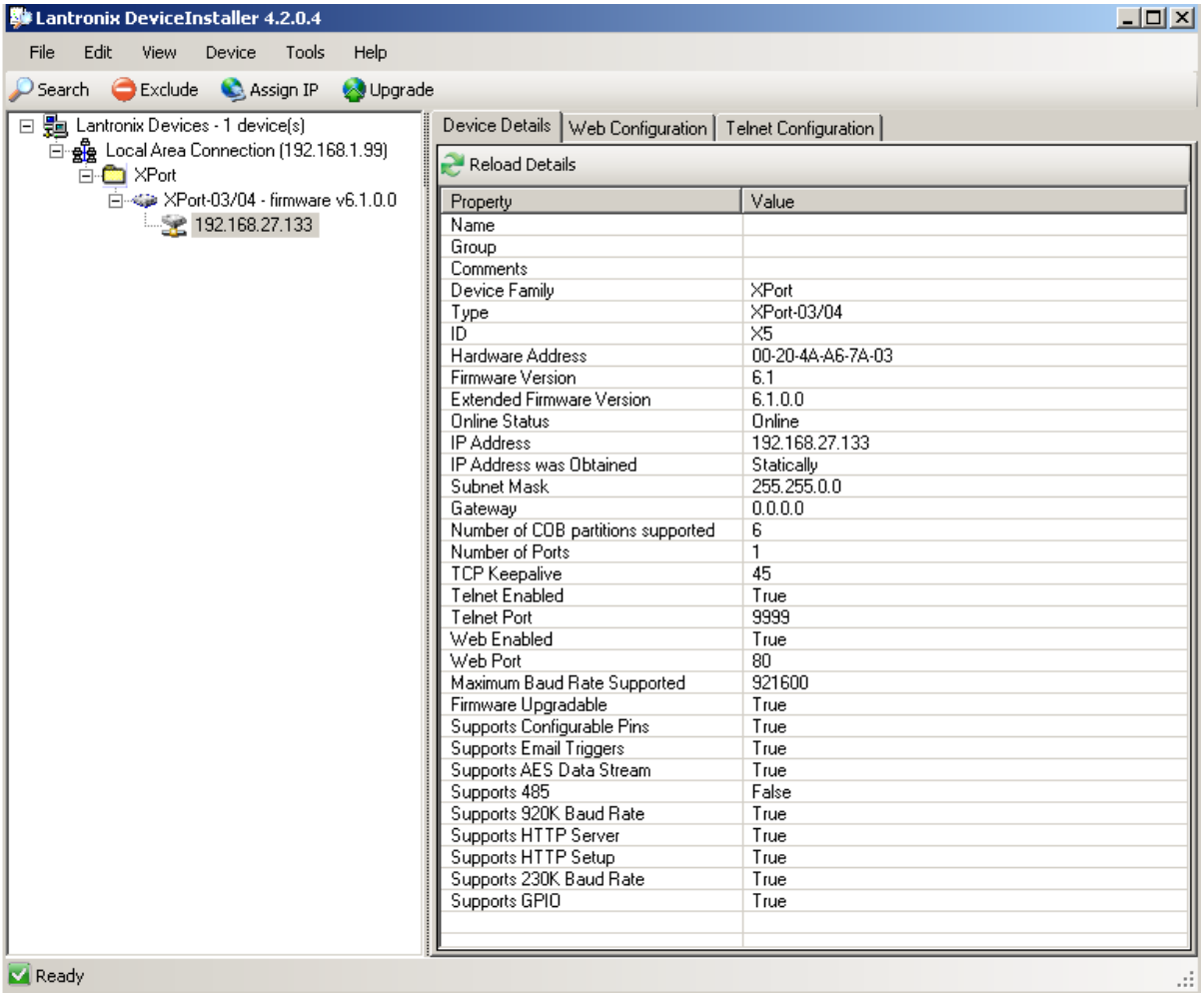
1. Insert the Wavestream CD. Open the folder containing the DeviceInstaller.exe or obtain the latest version from. www.lantronix.com/device-networking/utilities-tools/device-installer.html.
2. Run **DeviceInstaller.exe**, it will self install.
3. Click **Search** to search for the connected unit. The device installer will locate any devices on the network.
   - It may ask for the MAC address of the unit. The MAC address is located on the unit label.
   - Enter the MAC address, the unit will be located and the IP address displayed.



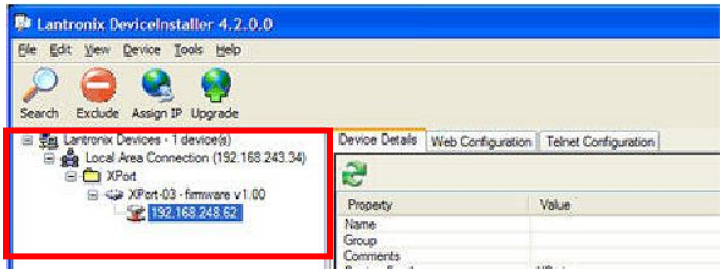
ip1a

   - If the unit is displayed in red with a status of `unreachable;` determine if the unit is set to an IP domain different from the network/PC. It may take a few minutes to display after cycling power.

4. Expand the **Xport → X Port-03 – firmware v1.00** directories.

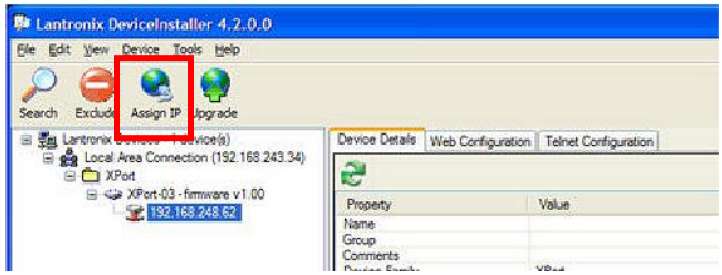


5. Select the unit IP address. Click it for details. This will display the IP address, Subnet Mask and other information for the unit.



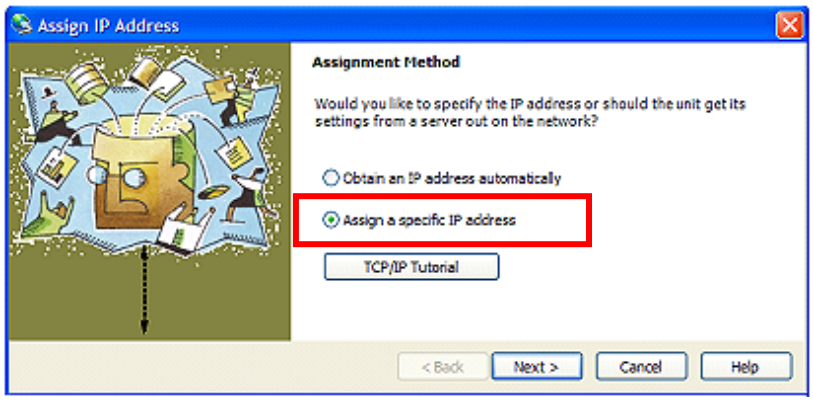
ip2a

6. Click **Assign IP** on the menu bar.



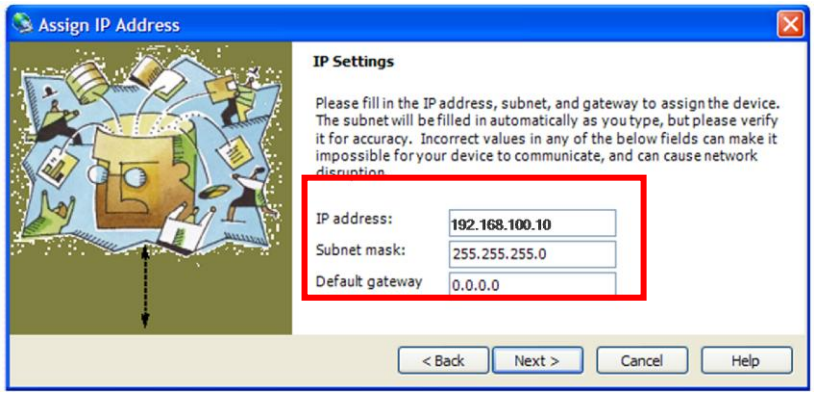
ip3a

7. Select **Assign a specific IP address**, click **Next**. By assigning a specific IP address, the address will remain fixed and will not change.



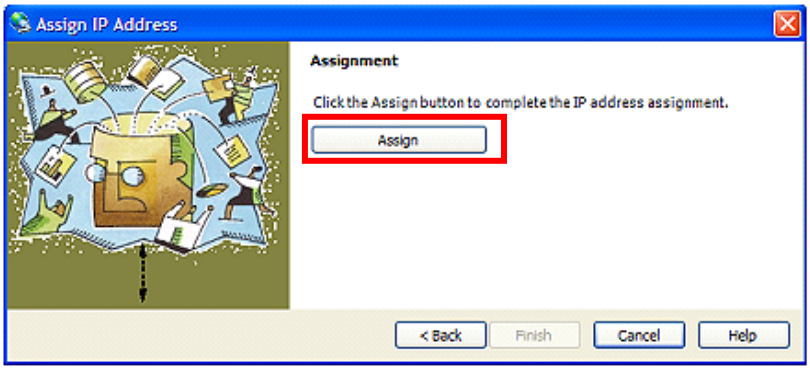
ip4a

8. Enter the appropriate IP address and subnet mask, click **Next**.



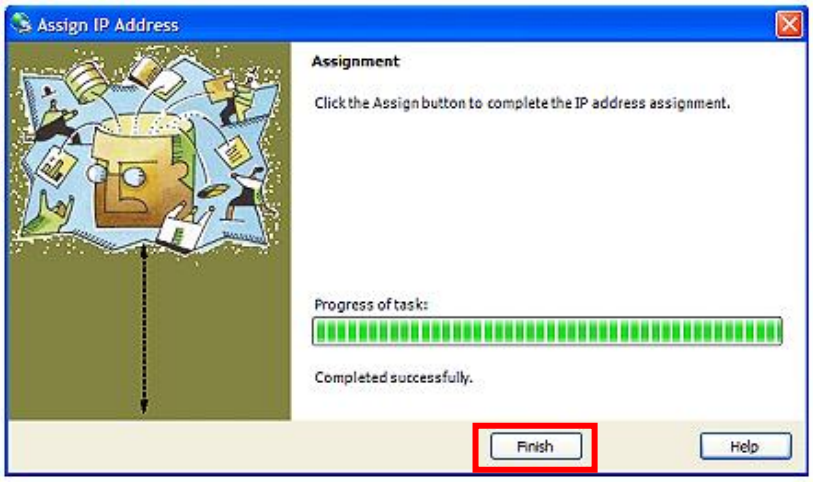
ip5a

9. Click **Assign**.



ip6a

10. Click **Finish**. Wait while the unit completes the IP address assignment.



ip7a

11. If you receive any error messages or the unit does not resume communication and or regain connectivity, contact Wavestream Technical Support at support@wavestream.com.

Appendix D - Glossary

	Description
ACK	Acknowledge
BUC	Block Up Converter. In the transmission or uplink of satellite signals, a BUC on an antenna converts a band or block of frequencies from a lower frequency to a higher frequency on a Ka, Ku, or C band satellite.
cmd	command
dBc	dBc (decibels relative to the carrier) is the power ratio of a signal to a carrier signal, expressed in decibels.
dBm	dBm (sometimes dBW) is the power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW), or 1 watt.
ESD	Electrostatic discharge
ETX	End of text
GFI	Ground fault interrupt
GUI	Graphical User Interface
HPA	High power amplifier
LRC	longitudinal redundancy check
M & C	Monitor and Control
NAK	Not acknowledged
OQPSK / QPSK	Offset quadrature phase-shift keying (OQPSK) is a variant of phase-shift keying modulation using 4 different values of the phase to transmit.
RF	Radio Frequency
RMA	Return Material Authorization
RS-422	This standard specifies voltages and impedance levels on balanced line interconnections. The data is transmitted on a twisted pair of wires (4 wires on a full duplex system).
RS-485	RS-485 defines a system for interconnecting several data terminals to a common twisted pair balanced line. The interconnection is similar to RS-422, but all of the connected devices listen with their transmitters off.
SAbus	Communications protocol connecting equipment for remote control and switching applications. SAbus compatible equipment can be linked together over a parallel connected 4-wire circuit without regard to function.
SSPA	Solid-State Power Amplifier
STX	Start-of-text
thread	e.g. rackmount thread, select A or B amplifier
TWTA	traveling wave tube amplifier
UPS	Uninterruptible Power Source
VSWR	Voltage Standing Wave Ratio. The ratio between the minimum and maximum voltage on a transmission line, cable, waveguide, or antenna system.
waveguide	A structure which guides waves, such as electromagnetic waves or sound waves.

Revision History

Rev	ECO Number	Brief Description	Requestor	Date
A	-	Initial release	David Nakhla	6/21/10
B	11-043	per ECO	Lanis Bell	1/26/11
C	11-535	per ECO	Solomon Viveros	11/17/11
D	11-565	per ECO	George Sun	12/8/11
E	12-291	per ECO	George Sun	7/18/2012