



Broadcast Devices, Inc.

Technical Reference Manual

***SWP-300- Remote Control with Instructions
For Use with the DPS-100D Power Monitor System and
IOX-24 Expander Panel***

**READ THIS MANUAL IN ITS ENTIRETY BEFORE ATTEMPTING
INSTALLATION FAILURE TO DO SO MAY RESULT IN LIMITED CUSTOMER
SUPPORT!**



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SWP-300-1/2T Firmware 3.10.3 and higher Serial # 107 and higher

SWP LAN Firmware 5.9.28 or higher

DPS-100D Firmware 1.2.002 or higher

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I. Introduction

This technical manual covers the installation and configuration of the Broadcast Devices, Inc. **SWP-300 Remote Control/Motorized Switch Controller Chassis** and its connection to the Broadcast Devices, Inc. **DPS-100D** Power Monitor System. An accompanying DPS-100D Technical Reference Manual is supplied with each system. Please refer to the DPS-100D Technical Reference Manual for operation and setup of the DPS-100D system.

The SWP-300 System family of controllers is designed to simplify the connection and operation of 4 port switches in broadcast applications and provide additional control and status inputs for general remote control functions. Like its SWP-200 series product companion the SWP-300 is designed to control and sequence switches and transmitters to provide safe and reliable control of the transmitter plant. In addition there are 8 relay outputs, 8 solid state outputs and 8 status inputs on the base chassis. More channels can be added to the system by adding the IOX-24 Expander Panel available from BDI. The IOX-24 provides an additional 24 relay outputs and status inputs. In addition it provides 8 analog inputs. In addition to providing standard remote control functions the SWP-300 is a motorized RF switch controller which automatically “steers” the interlock connections to the transmitters according to the position of the RF switches. When installed with a DPS-100D series power meter the power meter section of the system provides RMS forward and reflected power indication suitable for analog FM, digital power measurement such as needed for in band, on channel broadcasting, DAB and digital television 8 VSB/DVB modulation techniques.

The SWP-300 is an intelligent controller which may be connected to optional BDI DPS-100D RF sensors to provide additional functionality and safety. When equipped with BDI DPS-100D series RF sensors, the SWP-300 “Switch Saver” will detect and prevent an attempt to move a switch while RF is present to prevent damage to the switch and/or other equipment.

The SWP-300 provides both forward and reflected power display for a main and auxiliary sensor channel as well as reflected power protection via a proprietary “three strike”™ algorithm contained within the DPS-100D power sensor if supplied. This algorithm prevents the SWP-300 from responding to transient events such as close-by lightning strikes and avoids unnecessary off-air incidents.

In addition, the SWP-300 via the DPS-100D power sensor is capable of detecting a drop in RF power below a user configured threshold and automatically switching to backup transmitter. Dual switch versions of the SWP-300 are capable of responding to a reflected power fault by automatically moving to a backup antenna.

The SWP-300 along with the DPS-100D series power meters act as SNMP V2 agents. The SWP-300 and DPS-100D can be used with any standard MIB browser or SNMP enabled remote control for access to control and status information. The MIB files associated with these products are contained on the BDI Product Data CD supplied with each unit. The MIB files can also be downloaded from our web site support page.

Basic Description of models:

The SWP-300-1 Series controls one - two position switch assembly.

Basic single switch controller/site controller for controlling up to two transmitters connected to up to two loads, typically an antenna and dummy load. – Optional RF sensors available for “Switch Saver”™ operations, auto switching upon power loss and VSWR 3 strike protection. Provides 8 relay outs with NC/C/NO, 8 solid state outputs, and 8 status inputs. Also provides local control of TX Off/On, TX select, TX Interlock Status, and fault reset/status, Auto/Manual Command/Status and 4 analog inputs for legacy equipment.

The SWP-300-2 Series controls two – two position switch assemblies. - Optional RF sensors available for “Switch Saver”™ operations, auto switching upon power loss and VSWR 3 strike protection, VSWR detection for switch operation to a standby antenna. For two switch controllers connect SWITCH 1 rear panel connector to switch that will select transmitters and SWITCH 2 to the switch that will select antennas. Provides 8 relay outs with NC/C/NO, 8 solid state outputs, and 8 status inputs. Also provides local control of TX Off/On, TX select, TX Interlock Status, and fault reset/status, Auto/Manual Command/Status and 4 analog inputs for legacy equipment.

II. Unpacking and Inspection

Carefully inspect the unit after unpacking and make certain that no damage has occurred during shipping. If damage is noted, contact the shipper immediately and file a claim for damages. Each unit is carefully packed and carries full insurance against damage. Inspect the packing list and make sure that the contents of the package match those described on the packing list.

III. IP Configuration – Do This First!

READ THIS ENTIRELY BEFORE INSTALLING THIS EQUIPMENT!

FAILURE TO DO SO WILL RESULT IN WASTED TIME – YOURS!

We realize that this product will require at times good customer support from the factory and BDI attempts to provide a high standard of customer support. You can assist us in this endeavor by doing the following before calling for customer support:

1. Thoroughly read this manual entirely **BEFORE YOU CALL.**
2. Be present at the site where the SWP-300 unit is located. You may think this is obvious but it isn't to the numerous people we have talked to calling for customer support while driving their car down the highway. Please be courteous to us and do yourself a favor and heed this advice. The most expedient way to get you the help you need is for you to be prepared at the site.
3. Make sure you have a good telephone connection to call us. While we realize some sites have limited access to landlines and good cell service it is difficult to assist if we cannot communicate with you. Also, a corded telephone with a cord long enough to reach the front of our unit and wherever your computer is located. This reduces the amount of time you need to spend on the phone with us while we wait for you to put the phone down and go do something because the cord won't reach.
4. When calling be prepared at the site as some support questions will center around front panel configuration items or if you cannot access the unit from a location or observe conditions of externally connected equipment.
5. Have your computer ready with the app loaded on it and connected to the unit.
6. Have some test equipment available such as a DMM or VOM and ideally an oscilloscope if needed. Test clip leads also come in very handy. Paper and pencil are handy items to have also. It's a good idea to have some hand tools available such as a set of screwdrivers, cutting pliers and yes, a soldering iron. These things may not be needed but if they are and you don't have access to them when you call us delay in correcting any issues may ensue.

If all of the above sounds vaguely familiar it's because some teacher you had in elementary school admonished you and the rest of the class to be prepared when you come to class. Be on time, have a sharpened pencil and have paper available and have the assignment done from the night before – substitute read the manual in item 1 above for this one!

IP Configuration:

Prior to installation it is strongly urged that the IP configuration be performed first as it will be necessary to power cycle the unit in order for the changes to take effect. This should be done with the unit in front of you on a workbench with a Windows computer directly connected to the unit via the LAN connection.

Communications Interface Information

To configure the SWP-300 for LAN operation, connect the LAN interface a category 5 local area network cable. This is a standard cable. You do not need to use a crossover cable for this purpose. Next, open a browser window and enter the default IP address for the SWP-300. **The factory default IP address is: 192.168.1.107**



Hit the Setup button and enter the default username and password below or if this is not a first time setup enter the username and password previously set up. If you do not know the username and password it can be obtained from the SWP-300 chassis setup screen. Press the Green check mark key and use the L/R arrow keys to scroll over to the setup information shown below.



It will then scroll by all of the pertinent information about how the unit was setup.



You can only do this on site with access to the SWP-300 chassis. There is no username and password recovery routine that can be done without removing the unit from service and it really shouldn't ever be necessary.

Default Username is: **username** – lower case

Default Password is: **password** – lower case

Once the username and password have been entered the screen below should appear and then you can make the changes that you need to be compatible with your network including the name of the unit that will appear when you start the app and the username and password that you have selected.

The screenshot shows a web browser window with the address bar displaying "192.168.1.250/setup.htm". The page content includes the "bdi" logo and the website "www.broadcast-devices.com". The main heading is "SWP-300-2T Setup". Below the heading, it shows "Firmware Revision: 5.7.23, MAC: 54:10:EC:D9:C5:D8". The setup form has the following fields:

Unit Name	User Name	Password
UnitName	username	password
SNMP Read Community	SNMP Write Community	SNMP Port
public	private	161
IP Address	IP Mask	Default Gateway
192.168.1.250	255.255.255.0	192.168.1.1
DNS		
192.168.1.1		

A "Save" button is located at the bottom right of the form.

This screen allows the user to change the IP address, subnet mask and default gateway to match local LAN configuration. Contact your network administrator to

obtain the correct settings. Click the [Save] after changes are made. **In order for the changes to take effect you must power cycle the SWP-300 unit for at least 5 seconds. Failure to do this will result in the unit remaining on the default settings**

NOTE: Be sure to record the new IP address before power cycling (see below).

It is strongly recommended that you record the new IP parameters, username and password:

NEW IP ADDRESS: _____

SUBNET MASK: _____

PORT ASSIGNMENT: _____

NEW USERNAME: _____

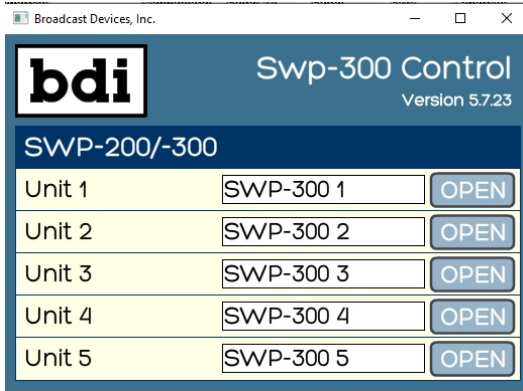
NEW PASSWORD: _____

Before moving on did you enter the information above? Please take a moment and do that right now.

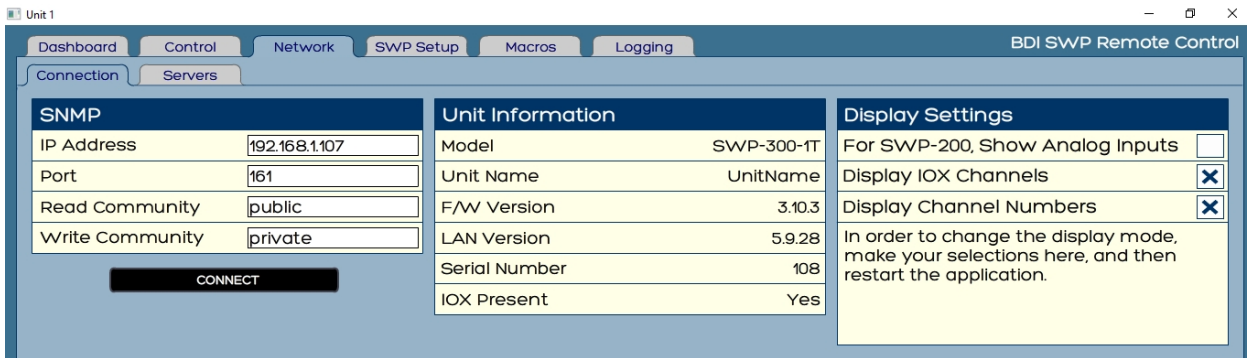
To allow remote access to the SWP-300 your router and firewall must be configured to allow requests to **PORT 161** or whatever port you decide to use to pass to the IP address configured for the SWP-300. Failure to do so will prevent access to the SWP-300 from outside the local network. Port 161 is the default port and can be changed but the new port must be forwarded as well.

Connection to the SWP-300 with the SWP-300 Application Software

Once the initial configuration has been confirmed you can now connect to the unit using the supplied BDI SWP-300 Applications software. After installing the software by copying the APP folder onto on a Windows computer start the app executable and the open screen will appear as shown:

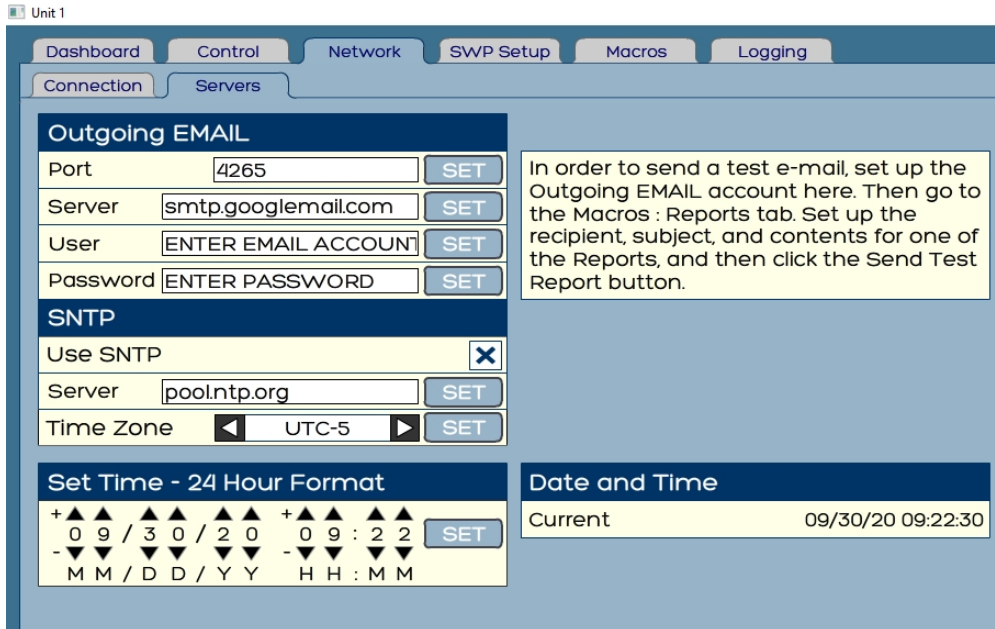


Up to 5 SWP-300 systems can be configured to run with the app. Choose the unit that is configured and select open. Once opened, the first thing to do is select the Network tab/Connection.



Enter the IP Address, Port, Read/Write community information and then click on connect. If you have successfully connected to the unit the proper Unit Information should be displayed as shown. Make the other display settings as desired.

Next, it's a good idea to select the Servers tab and adjust the NTP server information and to select the correct time zone based on UTC for your local area. This is important for proper timed events to occur at the expected time and for logging events.



If you do not have access to a network time protocol server the time/date information can be adjusted and internal battery backed up real time clock will keep time. For time critical events such as AM directional pattern changes it is strongly recommended that network time protocol synchronization be used. The internal real time clock oscillator in the unit is very accurate the best way to keep the most accurate time is through use of an NTP server.

While on this tab you can also set up your particular outgoing email server information for email logging and alarm notification. The default outgoing email server is smtp.googlemail.com and that can be used but we strongly advise that you use your own outgoing email server provider as reliability and customer support for the default email server may be limited.

Once this configuration is complete. You can move on to configuring the app for your particular operation. Again, we suggest that this be done on the bench before installation. While not all the configuration may be completed this way such as analog input configuration but it is far more convenient to configure and then test configuration with the unit on the bench in a quiet location. Doing the initial setup at a noisy transmitter site with limited cell phone coverage is not recommended particularly if you are calling for customer support.

IV. Wiring Considerations

The SWP-300 has the capability to totally automate the control of transmitters and switch operations with the touch of a button or the click of a mouse for remote operation. The units have provision to turn transmitters off/on and provide interlock closures without having to create a specific macro to do so. Selection of

which transmitter is placed on air and/or which antenna is to be selected is performed by a built in macro and the control of which is provided by a single button on the Control/RF or Dashboard tabs of the app. Some applications may require separate transmitter off and on control in addition to interlock closures managing transmitter on/off functions. Contacts are provided for both on J4 TX CTL/INTERLOCKS rear panel connector. The wiring of this connector is covered further on so keep reading you know you can do it! Some installations may call for interlock connections only to turn transmitters on and off. It is entirely up to the installer.

Rear Panel Connections

If a motorized switch is be connected start here:

Interlock inputs are provided for each position of both switches on DSUB-15 connectors marked EXTERNAL INTERLOCK 1/2 shown on page (19) to assist in wiring the interlock string for each mode. Connect any interlock switches associated with each mode in series between the pin associated with that mode and a control/status common pin. The SWP-300 automatically “steers” the interlock connections to the transmitters according to the position of the RF switches. Refer to page (26) for a diagram illustrating interlock steering.

FAILURE TO MAKE CONNECTIONS TO THE EXT. INTERLOCK 1/2 CONNECTOR(S) WILL RESULT IN NO INTERLOCK CLOSURE OPERATION OF THE TX 1 and TX 2 INTERLOCK RELAYS! If no external interlock paths exist simply place jumpers across the pins shown on page (20) – External Interlock connector for the respective switch 1 and/or 2.

A. SWP-300-1/2 Install the unit in a suitable EIA rack enclosure.

As a safety precaution, never install a switch controller to a switch system that has radio frequency energy present on it or where AC/DC control power is applied. This can be dangerous and can easily damage a switch!

1. Before applying power to the SWP-300-1/2 or to the switch assembly, connect the supplied DSUB-15 connector to the motorized switch cable or using an optional BDI switch interface cable if supplied. Refer to section IX typical Switch Connections Diagrams section for suggested wiring details for most motorized switches available. If you are attempting to interface a switch assembly not covered in this section please contact the factory for assistance with your switch assembly. The DSUB-15 connection plugs into the SWP-300 “SWITCH 1 and/or 2” connector inputs on the rear of the unit. These connections are the only control/status connections to the switches required. Control of the switches, position status and interlock control are all handled by these two DSUB-15 cables. Additional switch position and/or interlock connections may be available on the respective manufacturer’s switch connector if desired for some other use.

2. Next, apply power the SWP-300 and observe the front panel. If all connections are made properly and the switches are correctly seated in positions A (1) or B (2), the front panel display should indicate the present position of the switch assemblies. If the switch assemblies are not connected properly or are in the middle of their travel, the front panel will indicate "Check Switch 1 (2) "Both". In this case check that the switches are seated properly by applying A.C. power to the switch(es) **WITHOUT RF POWER APPLIED!** For some manufactures if a switch is in mid travel it will go to the position that the switch internal latching relay commands it to be in. Exercise extreme caution when doing this and do not have RF applied to the switch as damage may result if the interlock connections have not been made to the transmitters. Some other switch manufacturers do not use latching relays and when plugged into an AC source will remain in the last selected position. Recheck the SWP-300 display for proper position indication. If the SWP-300 still shows "Check Switch" then the most probable cause is a defective interface cable or a problem with the switch electronics.

Note for SWP-300 use without a motorized switch:

For installations where the SWP-300 will be used for power measurement only and for remote control where no motorized switch is to be connected it is necessary to place a jumper across pins 6 and 14 of the "Switch 1" connector. For SWP-300-2 models place a jumper across pins 6 and 14 of the "Switch 2" connector. Use one or both of the provided DB15 connectors for this purpose. Failure to do this will result in a "Check Switch 1 and/or 2" indication on the display. Also make the appropriate interlock connections if relevant to your installation/operation.

3. Make control out, status in, analog in, and transmitter control connections to SWP-300 rear panel remote control connector according to connector diagrams on pages 14-17. Note that the common connection for command and status is ground. The interlock connections are dry contact relays with 24 VDC 3 Ampere contact ratings which can be interfaced to an external interlock as desired.

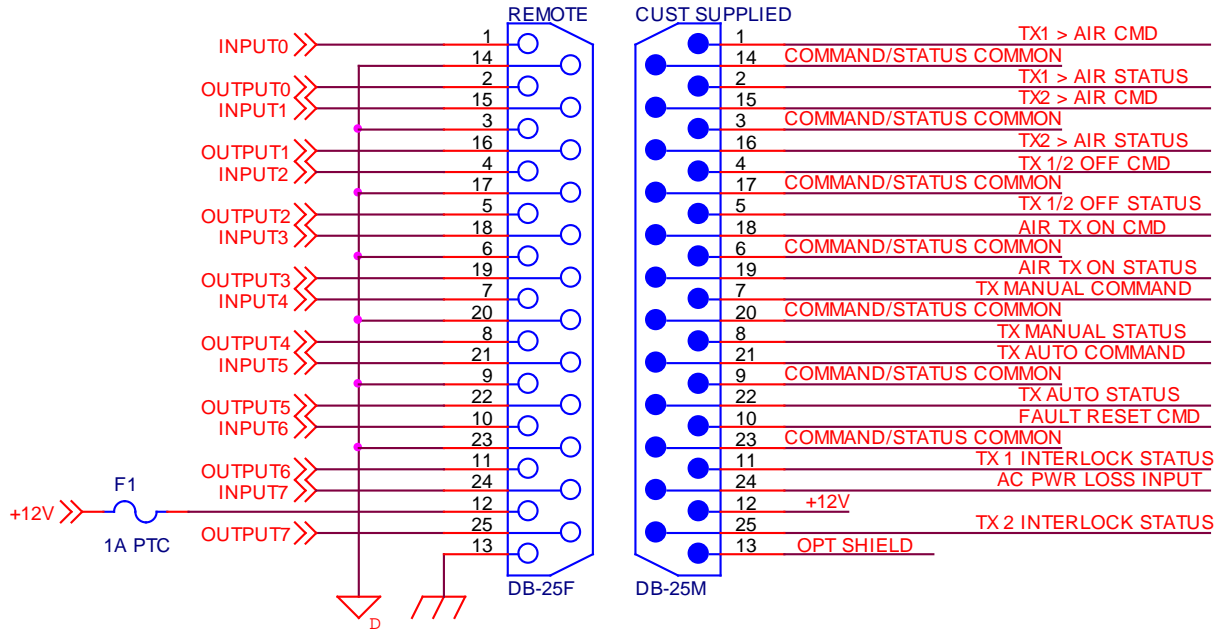
Frequently asked Questions including Interlock Relay Operation:

1. All external interlock connections are made to the SWP-300 rear panel DB 15 connector labeled EXT. INTERLOCK 1 or 1 and 2 if a two switch controller is installed. **THESE CONNECTIONS MUST BE MADE OR THE INTERLOCK RELAYS WILL NOT CLOSE. SEE PAGE 11 for CONNECTION INFORMATION. EVEN IF YOU HAVE NO EXTERNAL INTERLOCK PATHS YOU MUST PLACE JUMPERS ON THE APPROPRIATE PINS DESCRIBED ON PAGE 11.**
2. The motorized switch is properly connected to the SWITCH 1 or SWITCH 1 and 2 SWP-300 DB-15 connectors. Check for proper front panel status of each position of the switch by manually moving the switch to each position. If the switch does not provide proper status you will see a CHECK SWITCH indication on the front panel. Recheck your wiring or the

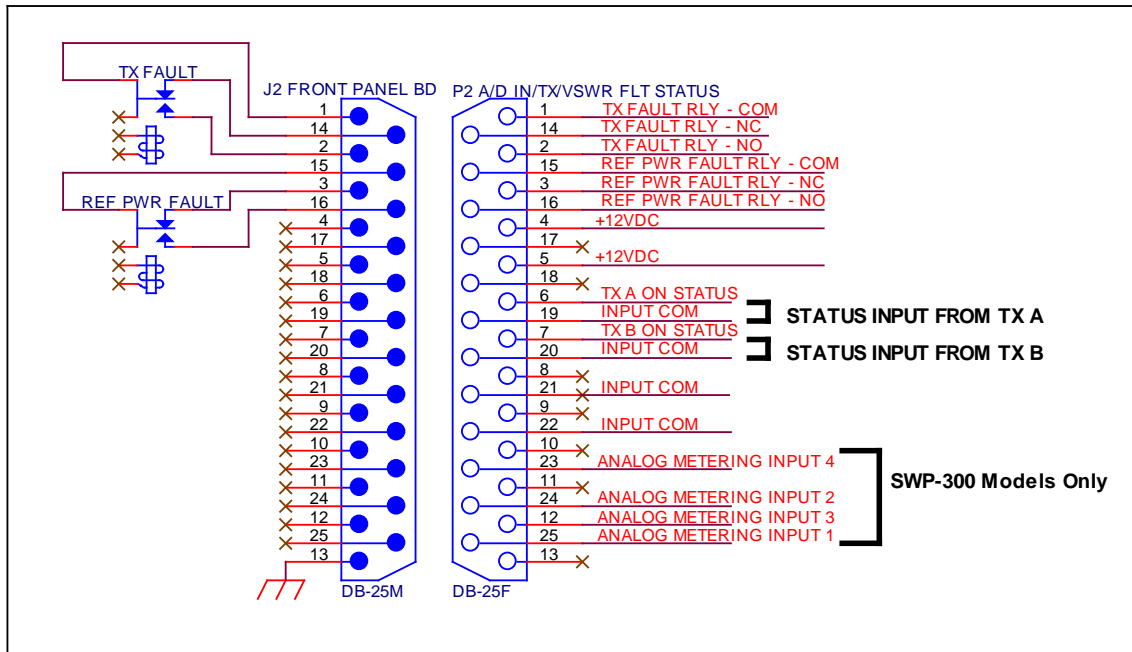
- switch itself for proper operation.
- Power is applied to the SWP-300 chassis and DPS-100D if installed.

Rear Panel Diagrams

J1 SW1 LOCAL CTL/STATUS DB-25 Pin Connection Diagram



J2 A/D IN/TX/VSWR FLT ST. Rear Panel Connector



Reflected Power Fault COM/NC/NO – This relay will close if a VSWR/reflected power fault is detected and can be used for external status. To reset the fault press the red X key on the front panel or via the APP.

TX 1(A) On Status – provides TX 1 (A) On status to the APP and via SNMP when connected to transmitter 2 (B) On tally if available from transmitter.

TX 2 (B) On Status – provides TX 2 (B) On status to the APP and via SNMP when connected to transmitter 2 (B) On tally if available from transmitter.

Analog Inputs 1-4 – for monitoring analog sample voltages from 0-5 VDC which appear as the first 4 analog inputs on the APP and via SNMP.

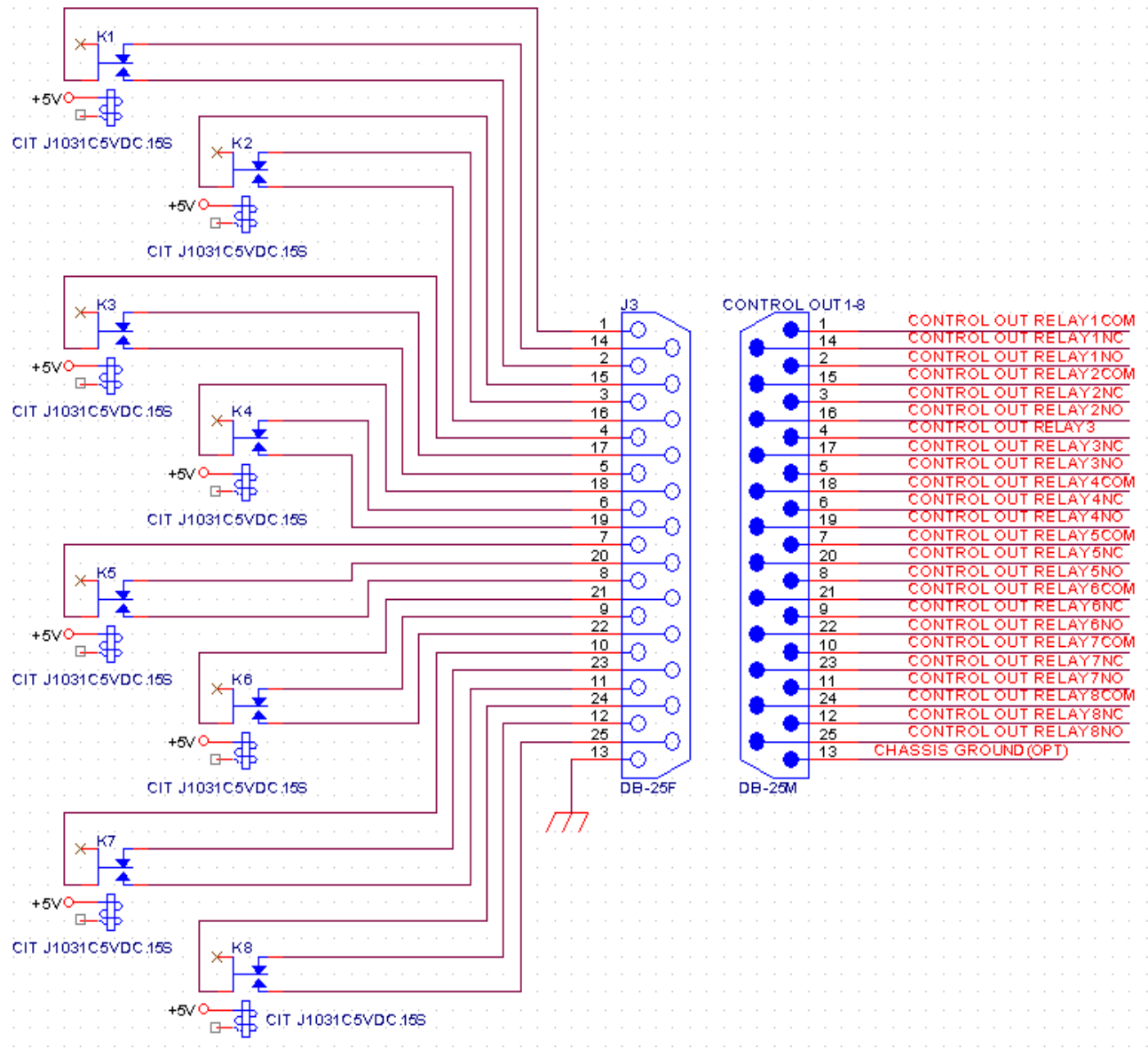
Input Common – use with status and analog inputs. May also be used as a common reference for use with the two relays described above.

12 VDC – available to be used for pullup and for reference with the two relays described above.

J3 Control 1-8 OUTPUT

Control 1-8 are dry relay outputs available on rear panel connector J3 Control 1-8 OUTPUT. NC/C/NO connections are available. See the diagram below for pin configuration information. These relays can be programmed to be momentary or latched in operation on a relay by relay basis and custom naming in the SWP

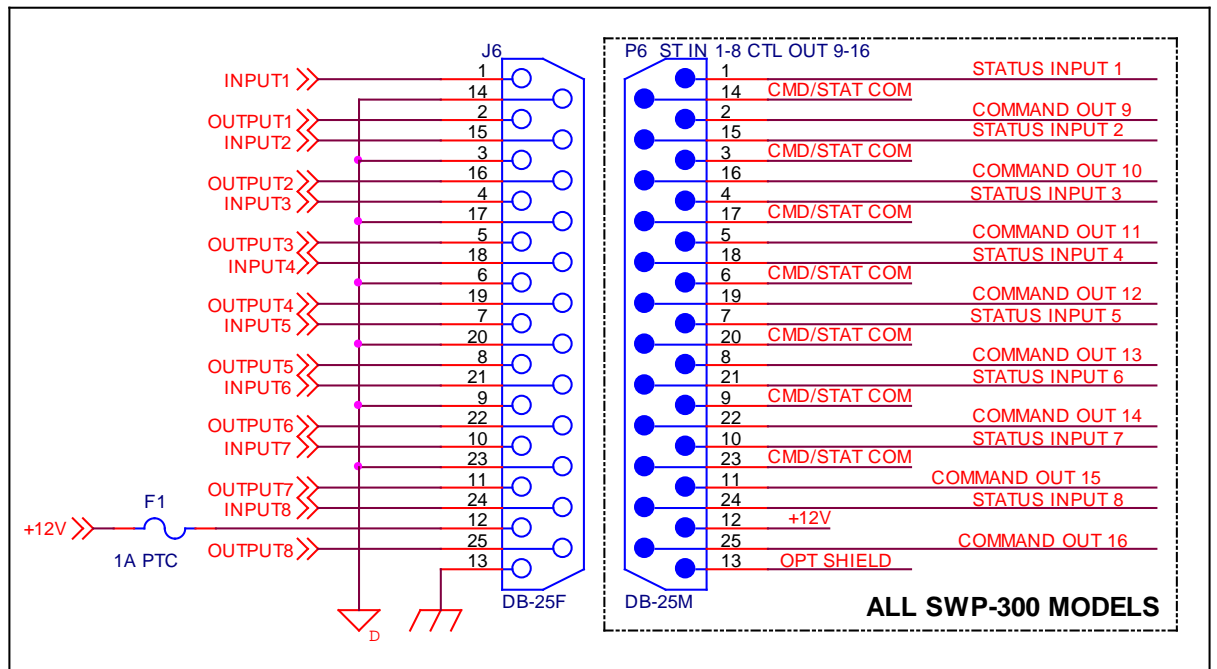
Setup/Relays tab.



J4 – IOX-24 I/O

This connector is reserved for interconnection of the BDI optional IOX-24 interface panel via a supplied interface cable. See the IOX-24 Technical Reference Manual for installation and configuration information.

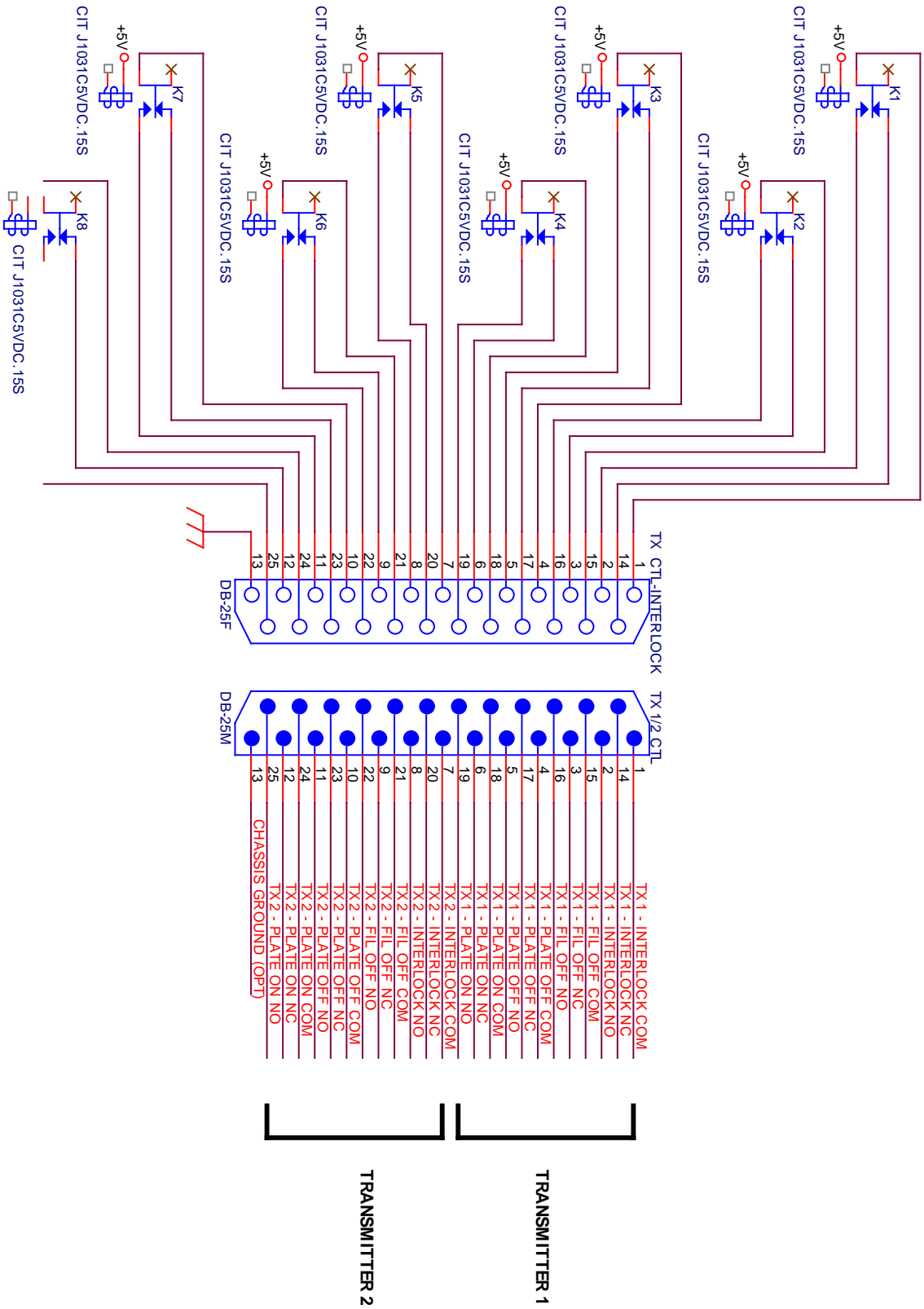
J6 STATUS IN 1-8/CONTROL OUT 9-16



Input connections are open collector and pulled up to 12 VDC. Indication polarity can be set for each status input by way of the SWP Setup/GPIO tab of the app. Default is common/ground applied to an input will cause the app indicator for that channel to illuminate. Opposite polarity can be set in the app so that when the respective status input is in the “high” pulled up state the app indicator for that channel will illuminate. This can be done on a channel by channel basis.

Command outputs are open collector. Use external open collector voltage up to 12 VDC. If a pullup voltage is required use pin 12 of J1 for pullup.

J7 – TX CTL/INTERLOCKS Connector



J7 Connection Description

J7 is provided as a convenient connection point for two transmitters for basic TX ON/OFF and External Interlock commands. For TX ON/OFF command relays including Filament ON/OFF relays momentary closure from common to normally open occurs when one of the respective commands is executed. There is a discussion below discussing TX External Interlock relay operation. Read this thoroughly so as to know how the external interlock relays behave. These relays will open any time switch movement, external interlock inputs are interrupted or the loss of communication with a DPS-100D series power meter occurs if connected to the system.

Question 1: How do the SWP-300 interlock relays function?

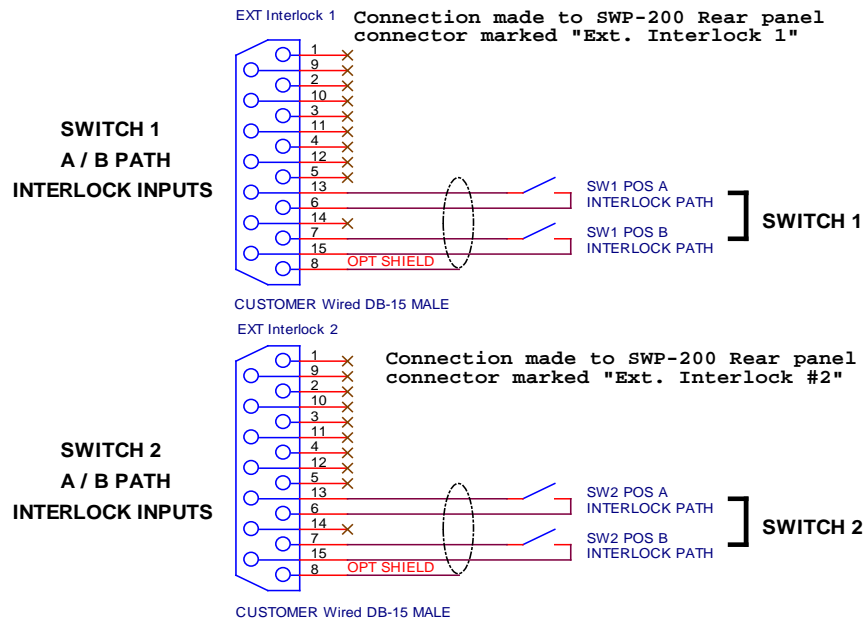
Answer 1: The SWP-300 system is designed to be a “failsafe” system. This means that the SWP-300 and/or DPS-100D power sensor provide interlock closures only when the SWP-300 has electrical power and the conditions in answer 2 are met below. This means that the SWP-300 will drop your interlocks (connection between NO and C relay contacts) if power is removed from the SWP-300 chassis or the SWP-300 fails. Failsafe by definition means that failure of the “system” designed to protect life and/or equipment must fail in a **safe** way. If the SWP-300 and/or DPS-100D power sensor fail they can no longer protect your transmission system from damage and therefore shut down your transmitter. In the unlikely event of the failure of a DPS-100D series power meter connected causes an “Interlock Open” condition it is possible to disable the DPS-100D at the chassis either on site or remotely with the app. So if a sensor were to fail you don’t have to make a trip to the site to temporarily restore interlocks. Other conditions that occur to external equipment connected to the SWP-300 or the DPS-100D series power meter would warrant inspection on site. Consider that a bit of lost air time is a small price to pay compared to a high VSWR condition causing thousands or tens of thousands of dollars’ worth of damage to your transmission line and or transmitter. In addition consider the cost of lost air time while you are waiting for a new transmission line to be installed.

Question 2: Which set of contacts should I use, normally open/common or normally closed/common?

Answer 2: It depends on your transmitter manufacturer specification. Most manufacturers require a closure between their “external interlock” connections for the transmitter to operate. If this is the case with your transmitters then you need to connect the external interlock connection of the transmitter to the **normally open** and **common** connections on SWP-300 J7 – TX. CTL/INTERLOCKS. Here is why. With all connections made to the SWP-300 the SWP-300 will provide interlock closure on the normally open/common (relays energized) connections provided that:

- 0. Any DPS-100D power meters are properly connected and communicating with the SWP-300 chassis and that the EXT interlock jumper or path is closed on the DPS-100D sensor. Or the DPS-100D is disabled from the chassis from the front panel or remotely. This connection can be found on positions 11 and 12 of the 12 position Phoenix connector on top of the DPS-100D sensor. Proper closure is indicated if when viewing the DPS-100D sensor there is no icon showing under the LOTO (Lock Out Tag Out) indication. If a padlock icon is showing on the DPS-100D display there is no interlock closure and should be investigated. If no DPS-100D meters are connected then the main/aux power sensors should be disabled from the SWP-300 front panel menu. To do this from the front panel press the green check mark key and use the left arrow to advance to the "Sensor 1 and or Sensor 2" Enable/Disable screen. Use the down arrow to disable and the up arrow to enable. From the app go to the SWP Setup/RF Meter tab and disable Meter 1 and or Meter 2. Keep in mind when disabling a meter that you will lose 3-Strike™ VSWR protection until the meter is restored to "Enable".

Interlock Path Connectors – "External Interlock" connectors 1, 2



22 AWG CABLE RECOMMENDED

NOTES:

1. TRANSMITTER INTERLOCK PATH WILL BE CLOSED WHEN CORRESPONDING SWITCH INTERLOCK INPUT PATH IS COMPLETED.
2. IF PATH IS NOT REQUIRED, JUMPER INPUT ON CONNECTOR.

For SWP-300-2T two switch models connect switch 1 connector to the switch that will select transmitters and switch 2 to switch that will select antennas.

V. DPS-100D Power Meter/Directional Coupler Installation and Interconnection with the SWP-300 chassis

1. Determine a suitable location for the supplied EIA flanged precision directional coupler. The coupler should be placed in the load path such as the antenna or in the case of a dual meter system a dummy load path. Note RF direction indication on the directional coupler and install accordingly.

The SWP-300 remote control can display data from up to 2 - DPS-100D Digital Power Sensors in a single rack unit display. The SWP-300 measures 2 - forward/reflected meter outputs simultaneously providing interlock control to safeguard against damage caused by high reflected power or dummy load presence. The SWP-300 displays the forward/reflected power, temperature and line pressure measurements from the DPS-100D on chassis screen and the app Dashboard and Control tabs. Because these indications are available on the APP so no additional analog inputs are needed for this purpose.

DPS-100D Installation Considerations

Each DPS-100D directional coupler/sensor should be placed in the desired location for measurement. There is also provision for external temperature and line pressure sensors. Each DPS-100D has an internal temperature sensor for measurement of internal electronics temperature. These indications will be available in three places: 1 – the DPS-100D on board display, 2 – the SWP-300 Site Controller LCD display and 3 - via a web server connection and the SWP-300 APP. Refer to the accompanying DPS-100D Technical Reference Manual for complete operating instructions and set up of the DPS-100D. This section of the SWP-300 manual is intended to give the installer and operator information on interconnecting the two products.

1. Install the coupler making sure that the flow of RF follows the arrow direction marked on the coupler. Failure to do this will provide erroneous power indications as they will be reversed. Also heed the calibration sticker on the directional coupler. **DO NOT ATTEMPT TO DISASSEMBLE THE INNER CONDUCTOR IN ANY WAY AS IT WILL VOID THE WARRANTY AND RUIN THE CALIBRATION OF THE METER!**

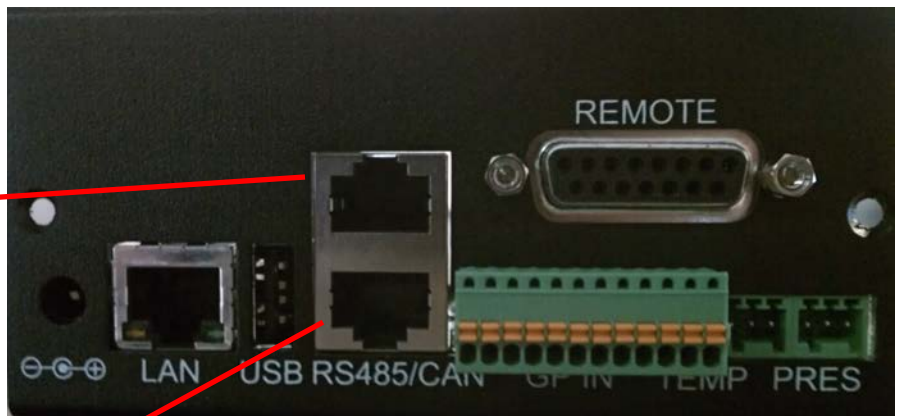
2. Using standard CAT 5 cable attach a cable from the rear panel of the SWP-300 chassis using the supplied DB9 to RJ45 adapter plugged into the RS485 DSUB-9 connector. Connect the other end of this cable to the first DPS-100D RJ45 receptacle marked RS485. Note that each DPS-100D sensor has two RJ45 receptacles marked RS485. The second connector is used to connect to the next DPS-100D sensor if desired. The DPS-100D is powered by the SWP-300 chassis through the same cable.

3. In a suitable EIA 19" rack enclosure mount the SWP-300 chassis. ***It is strongly recommended that the SWP-300 be plugged into a personal computer style UPS system if the system is to be used where interlock control of broadcast transmitters is contemplated.***

4. Attach the supplied DB9 to RJ45 adapter to the rear panel DB9 connector marked RS-485 on the SWP-300 chassis.

5. Using the supplied Ethernet cables attach one Ethernet cable to the RJ45 receptacle of the adapter installed in step 2 to the first sensor in the system. Using supplied cable daisy chain attach from the first sensor to the next if supplied. Each DPS-100D sensor has been supplied with its own RS485 address 1 or 2. The data for each sensor will appear on the respective SWP-300 channel Sensor 1 – (main) or Sensor 2 – (auxiliary). Main is RS485 address 1 and auxiliary is address 2 as set using the DPS-100D meter app. Note that when the DPS-100D sensors are used in conjunction with the SWP-300 chassis they are powered through the RS-485 connection. **Do not use the external power jack on the DPS-100D when used with the SWP-300 chassis.** Make sure all connections are complete and all DPS-100D sensors show an active display. The RS485 address of each sensor is programmed at the factory but it is possible to change this address if desired. To perform this change consult the DPS-100D Technical Reference Manual supplied with the DPS-100D sensor. NOTE: No two DPS-100D sensors can have the same RS-485 address or the system will fail to operate properly. See Fig. 1 below

Connect Provided Category 5 Cable from SWP-300 Chassis to first DPS-100D sensor



Connect Provided Category 5 Cable To second DPS-100D If supplied

Fig. 1 Shows connection from SWP-300 Chassis and to succeeding DPS-100D if supplied

Once all DPS-100D sensors have been connected their local displays should be lit and should display the normal operating screen which shows Forward/Reflected Power, Temperature, Pressure and other data. Note that when properly connected and addressed the SWP-300 channels will show power indication. For channels where no sensor is present but enabled as described on page () under section V. Programming Features the power indication will be a series of dotted lines indicating no data available. This will happen for one of two reasons. A connected sensor for that channel is not communicating with the SWP-300 chassis or it is programmed on the wrong RS-485 address. To verify and adjust the RS485 address for the DPS-100D sensor refer to the DPS-100D Technical Reference Manual for instructions. If no sensor is attached for that channel and the dotted line indication is shown for that sensor go to the setup menu as described on page 17 and select Sensor 1 or Sensor 2 and disable it. If for some reason a desired channel is not showing data when connected to a DPS-100D sensor, check the cabling to make sure it is seated properly and check the display ICON under COMMS. Review Fig.2 Also make certain that the RS485 address is set properly for all connected sensors.

Communications Icon
Indicating RS-485
Communications established with
SWP-300 Chassis

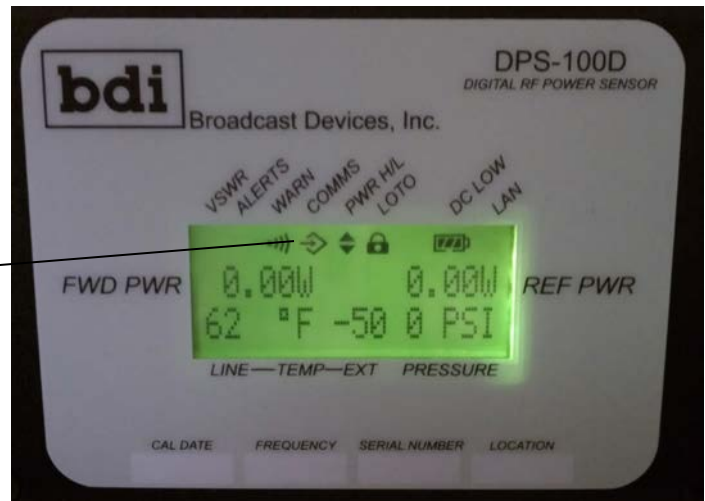


Fig. 2

Optional Connections:

When the optional BDI TMP-100 temperature and PSW-100-5 pressure sensors are attached to the DPS-100D RF sensor a complete set of data including forward/reflected power/VSWR, temperature and pressure can be displayed on the SWP-300 chassis for the respective DPS-100D channel. DPS-100D information will also be available on the APP and via SNMP connected devices. Normal operation of the SWP-300 chassis displays forward/reflected power. To

access the temperature and pressure readings use the left/right arrow keys to access the screen indicating temperature and pressure. Of course forward/reflected power, temperature and pressure indications are available through the BDI Stack GUI as well.

BDI TMP-100 can be attached to any DPS-100D. The DPS-100D provides power for the sensor. A three position plug is supplied with each TMP-100 for direct plug in to the DPS-100D sensor

BDI PSW-100-5 Pressure sensors can be connected in a similar fashion to the temperature sensor described above.

Temperature and pressure can be monitored from the front panel of the SWP-300 by advancing the left arrow key until the temperature and pressure screen appear for the respective DPS-100D connected to the system. Temperature and pressure indications are also available via the APP and via SNMP and third party software.

VI. Front Panel Programming Features and Operation of the SWP-300 Site Controller Chassis

The SWP-300-1T is preprogrammed for single switch operation and requires only minimal setup. The SWP-300-1T is factory configured to switch between 2 transmitters. The SWP-300-2T is preprogrammed to switch between 2 transmitters on SWITCH 1 and between two antennas on SWITCH 2

To enable full functionality of the enhanced features a number of parameters must be configured during the installation process. Most switch behavior programming can be accomplished from the front panel.

To enter the programming menu, press the green CHECK MARK key in the center of the keypad. Pressing the CHECK MARK key again will exit the programming mode and save all settings which were modified. Pressing the red X key will exit the programming menu and discard all changes.

Once in the programming mode pressing the LEFT or RIGHT arrows will sequence through the list of programmable parameters. Pressing the UP or DOWN arrows will sequence through the available options for the currently displayed parameter.

The following parameters are user configurable advance the left arrow key for this order of programming functions after entering the programming menu:

Local/Remote – In the remote position allows the unit to accept commands from both J1 Remote Control connector inputs and web interface remote control. In the local position the unit will respond only to front panel commands.

SNMP On/Off – Use the Up arrow to turn on SNMP control – factory default. Use the down arrow to turn SNMP control off. This is for situations where the user desires to have the SWP-300 remote controllable only through the GPIO connections provided. It prohibits SNMP remote control and status. In the off position the APP will not function. If you are planning to use the APP or other SNMP software or hardware to monitor and control the SWP series controller the SNMP mode must be turned on.

System Information – This menu item allows you to interrogate the unit to determine SWP and LAN firmware revisions, IP address, subnet mask, port, read and write community passwords and username and password for remote access. The information scrolls and is repeated until another menu item is selected or the menu unattended time out is reached whereby the display reverts back to the normal control/status screen. For security reasons this information can only be gotten from the unit on site.

TX 1 / 2 Interlock Status – This menu item will display the interlock status for both transmitter paths and can be useful in troubleshooting problems with interlock paths. Keep in mind that the interlock status of the respective transmitter deals with the position of the RF switch so that if TX 1 is selected to air the interlock path is the air path for TX1 and TX 2 interlock would follow the dummy load path for the typical Main/Standby to antenna and dummy load situation. This reverses if TX2 is selected to air. The SWP-300 steers the appropriate interlock path to the appropriate transmitter.

Sensor 1 / 2 Enable/Disable – This menu item allows the user to enable and disable the up to two DPS-100D series power meters that can be connected to the SWP series controllers. Only enable sensors if they are present in the system. If a sensor is enabled and there is no sensor connected to the system the interlock for the sensor path will remain open. This is for safety reasons because if an RF power meter is being used for RF Safety purposes, VSWR protection and/or RF switch protection the interlock opens to fail in a safe way to protect personnel and equipment in that order of priority. If a sensor fails for some reason it can be disabled from the front panel and also remotely via the APP to restore interlock function for that path. Other reasons to disable a sensor would be for routine maintenance of the RF power meter such as removal from service for inspection, repair and/or calibration.

Auto Switch Level – Configures the transmitter output power level at which the SWP-300 will automatically move to the backup transmitter. Care must be taken when setting this threshold. The threshold must be less than the normal transmitter power or the SWP-300 will not permit automatic operation.

Auto Switch Time – Sets the amount of time that the main transmitter must remain below the user configurable transmitter power level before the SWP-300

will switch to the backup transmitter.

Auto Antenna Switch Mode (Two Switch Models Only) when enabled will transfer the selected transmitter to the auxiliary antenna when a high reflected power condition above the threshold set in the DPS-100D menu. To enable this function enter programming menu and use left/right arrow keys to navigate to the selection Auto ANT SW = On/Off. To select on mode press the up key the down key to select off. This mode can only be entered if RF power is applied to the system.

Auto Return – Enable/disable automatic return to the main transmitter if the backup transmitter fails to turn on or if the backup transmitter power is less than the Auto Switch Level. If the SWP-300 executes an Auto Return, it will enter the Manual mode to prevent undesirable subsequent switching operations. If auto return is enabled, an “R” will be displayed to the right of the auto switch indicator while auto switch is enabled.

Auto Switching – Enable/disable automatic backup transmitter switching based on RF power level. If auto switching is enabled an “A” will displayed in the lower left corner of the display. If auto switching is disabled, an “M” will be displayed. Note that Auto Switching can only be enabled if the transmitter power output read by the DPS-100D power meter is present and above the auto switch threshold.

Basic Theory of Operation:

Upon front panel or remote control command the SWP-300 operation sequence is as follows:

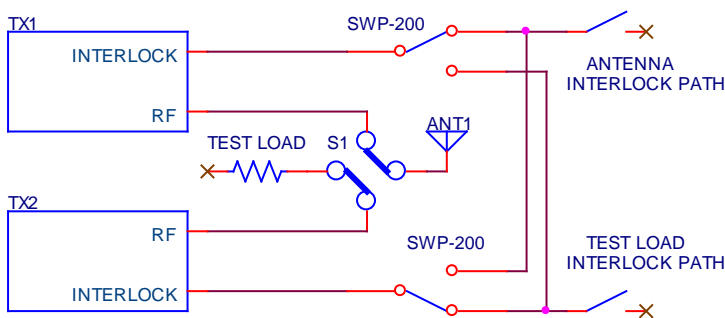
1. Command from the CPU board is issued to the transmitter control/interlock board to issue a TX OFF (PLATE OFF)/TX “OFF” commands and open the safety interlocks of both transmitters connected to the four port switch.
2. Approximately 2 seconds after these commands are issued the SWP-300 issues a switch command to the appropriate pin of the SWx I/O interface connector.
3. Once the switch reaches its commanded position the SWP-300 receives new position information from the switch via the SWx I/O interface connectors and issues an interlock closure command. Approximately 2 seconds later the chosen “Position relay” closes and then issues a TX ON (Plate On) “ON” command to the transmitter selected the on air position. The SWP-300 connects the correct A/B interlock path inputs to the transmitters for the path they are feeding. The circuit shown below is typical of what may be encountered a typical installation. If no additional interlock connections are needed simply connect the respective A/B interlock inputs to common as shown on page 12 External Interlock connections.

Note:

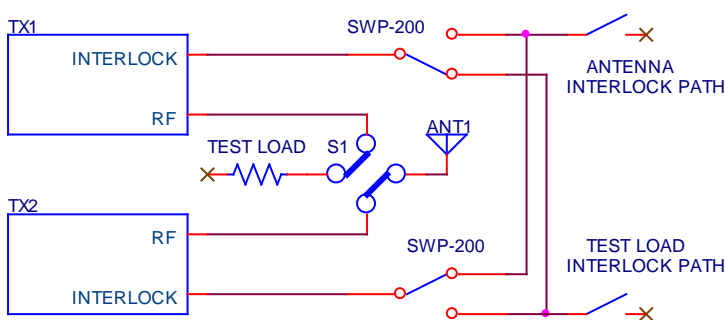
It is a convention that the SWP-300 uses the use of A and B positions and A and B transmitters is interchangeable with 1 and 2 throughout this manual and the unit status. TX 1 = TX A, TX 2 = TX B, additionally Switch POS A = SWITCH POS 1 and SWITCH POS B = SWITCH POS 2. The SWP-300 assumes switch position A or 1 to be TX 1 or A feeding the AIR path and SWITCH POS B or 2 to be TX 2 feeding the AIR path.

The accompanying diagrams show the switch position relative to the interlock steering for each position and transmitter. The only connections needed at the transmitter external interlock input are those that are connected to the J7/P7 TX CTL/INTERLOCKS connector. This allows the SWP-300 to steer the interlocks for a given path to the appropriate transmitter.

INTERLOCK STEERING - TX1 ON AIR



INTERLOCK STEERING - TX2 ON AIR



Note: If the 4 port switch fails to reach the commanded position due to mechanical or power failure, the SWP-300 will hold the interlock connections in the open position and will not issue a TX "ON" command.

The SWP-300 will reflect the actual position and status of the four port switch. If it becomes necessary to manually move the four port switch to a new position the SWP-300 will sequence the interlock and other transmitter control relays as from

a front panel or remote control command to the SWP-300.

CAUTION!

Certain motorized switch manufacturers offer switches that when manually moved with the AC power removed will revert back to the previous position when AC power is reapplied. This is NOT the SWP-300 commanding the switch. Due to the use of magnetically latching relays in some manufacturer's products they will "remember" the last position commanded and move to that position. It is not recommended to disconnect the SWITCH ½ connector(s) from the rear of the powered up SWP-300 during manual switch operation. In addition power must be applied to the SWP-300 for proper interlock action when manual switching is performed. If the SWP-300 SWITCH 1 and or 2 connectors are disconnected from the controller all transmitters should be turned off otherwise the risk of moving a switch with RF applied may occur. It is always a good idea to remove A.C. power from the RF switch during manual switching operations as the switch may move back to the previous position on its own due to its design. **IF YOU ARE NOT SURE OF WHAT WILL HAPPEN ALWAYS TURN TRANSMITTERS OFF AND DISABLE THEM WHEN IT IS DESIRED TO MOVE A SWITCH MANUALLY.**

Switch-Saver RF sensing:

This function requires an optional DPS-100D RF power sensor installed and enabled.

The SWP-300 equipped with at least one BDI DPS-100D series power meter will examine the RF level present on the switch to prevent movement of any switch when RF is present. This prevents damage to a switch or other equipment due to incorrect/damaged transmitter interlock connections or transmitter malfunction. ***The Safe Switch Level configures maximum level that may be present for the SWP-300 to allow manual or automatic movement of a switch. While this level can be changed by the user, we do not recommend increasing the level above the default 1 W level without consulting with the factory prior to such a change. At some locations where multiple carriers are present it is common to have a small amount of power mutually coupled to the antenna in question. That will be read as reflected power on the DPS-100D power meter and if it indicates a higher level than the safe switch threshold it will prevent switching. In congested RF locations it is best to monitor the antenna system reflected power without intended transmitter running to determine what that power level is and then based on that indication set the safe switch level based that level. Caution should be exercised if RF levels of this type exceed 50-100 watts it is advisable to place a suitable filter to remove that RF as moving an RF switch even with that small a level***

of RF power may over time damage the inner connections of the switch mechanism.

Automatic Transmitter Switching:

This function requires an optional DPS-100D RF power sensor installed.

The SWP-300 automatic transmitter function can (if enabled) switch a backup transmitter to the air antenna when the RF power from the currently selected air transmitter falls below the user configured TX Auto Level. The TX Auto Time parameter sets the delay during which the SWP-300 will wait for the power to return to a level above the TX Auto Level before initiating an automatic switching operation. When the RF power of the air transmitter drops below the TX Auto Level (user configured) for longer than the TX Auto Time (user configured) the SWP-300 will execute the transmitter turn off sequence, connect the other transmitter to the air antenna by moving SWITCH 1 to the alternate position and subsequently executing the air transmitter turn on sequence. If the TX Auto Return function has been enabled by the user, the SWP-300 will monitor the RF power level to determine if the “auxiliary” transmitter power is above the TX Auto Level. If the auxiliary transmitter fails to turn on or if it does not produce more power than the original (main) transmitter, the SWP-300 will return to the original transmitter. Note: The SWP-300 will only execute the TX Auto Return function ONCE. This function ensures that the station remains on-air with the highest possible power given the state of the two connected transmitters.

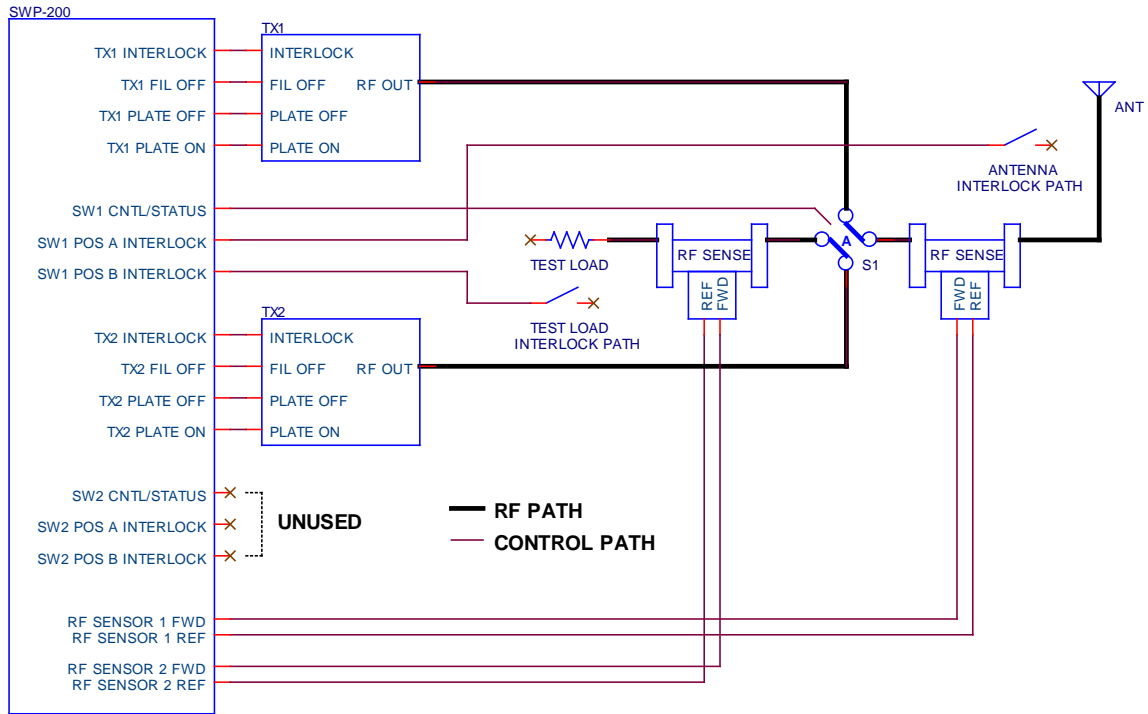
Note: The SWP-300 will NOT attempt to auto switch if the SWP-300 has opened the air transmitter interlock due reflected power in excess of the reflected power level setting.

Automatic Antenna Switching: (2 – Switch SWP-300 models only)

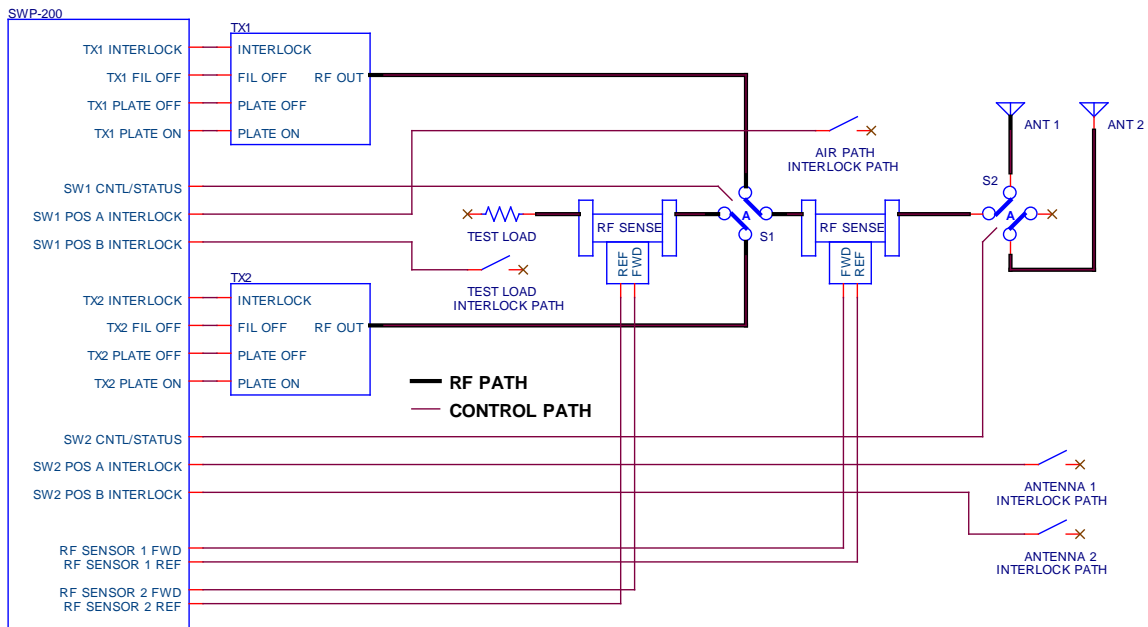
This function requires an optional DPS-100D RF power sensor for forward and reflected power.

When the SWP-300 Three-strike algorithm detects a reflected power level in excess of the user configured REF PWR LEVEL, the SWP-300 will execute the transmitter turn off sequence, and connect antenna B as the air antenna by moving SWITCH 2 to the B position. The SWP-300 will then execute the air transmitter turn on sequence.

SIMPLIFIED SYSTEM INTERCONNECTION DIAGRAM SINGLE SWITCH CONFIGURATION



SIMPLIFIED SYSTEM INTERCONNECTION DIAGRAM 2 - SWITCH CONFIGURATION



VII. Front Panel Operation:

To select a transmitter to switch press the down arrow key to show the current transmitter switch status. Press the appropriate F1 or F2 key to select the alternate transmitter. For two switch models to select an antenna press the up key to show the current status of the antenna switch and then select the antenna by pressing the appropriate F1 or F2 key. The Red F3 button is TX 1+2 (BOTH) Off and the Green F4 button is TX selected to AIR On. F3 turns both transmitters off and defeats auto switching operation. F4 will turn on the transmitter selected to the air path. **Note:! When placing the SWP-300 in Auto Switch mode the F4 button must be depressed to initiate the Auto Switch function after placing the unit in Auto Mode. – Also note that it is not possible to place the SWP-300 in Auto mode unless RF power above switch threshold is indicated in the air path.**

When depressing a switch mode all interlock relays are opened (de energized). TX OFF commands if used are issued next. Next the attached switch will move to the desired position. The interlock relays are then closed (Reenergized). Last, the TX selected to the active load such as an antenna is commanded on if this connection is made.

Remote operation of the SWP-300 series functions identically to the front panel operation discussed above. Momentary closure to common of the appropriate pin on the remote connector or BDI APP GUI command will cause the SWP-300 to operate as described above. BDI APP GUI control functions operate in identical fashion to front panel and parallel connectors J1-3 GPIO remote control.

The SWP-300 normally displays data from the main (air) RF sensor. To view the auxiliary RF Sensor information press the left arrow key. To return to the main menu press the left arrow key again. After 5 minutes the SWP-300 will automatically return to the main screen.

The lower left corner of the main screen will display “M” when auto switching is disabled and “A” when auto switching is enabled. When one or more three strike counter events have been recorded by a connected DPS-100D power meter, the lower left hand corner of the display will have 1 to 3 bell-shaped characters to indicate the number of strikes. After the 3rd strike, the air transmitter interlock will be latched in the open position until the three strike counter is reset from the front panel using the “X” key or by the remote reset input. The three strike counter can be cleared at any time by pressing the “X” key.

Conventional GPIO Remote Operation with Legacy Remote Controls: This feature allows paralleling of operations with existing legacy remote controls or local lighted pushbutton panels. Commands are issued to the SWP-300 via J1

page 13, J2 page 14 and J5 page 16 by connecting the command pin associated with that function to command common using a momentary contact. Status feedback is provided via an open collector driver which is active low (sinking) when the associated function is enabled.

This section describes each of the command and status indications for J1

TX 1(2) TO AIR - Selects the transmitter which will be connected to the SW1 Position A (1) (air) load. The associated status pin indicates which transmitter is selected to the air position.

TX 1+2 OFF – Turns OFF both transmitters by issuing TX OFF / filament OFF commands. The associated status output indicates when both transmitters have been commanded OFF. **Issuing this command will cause the SWP-300 to suspend automatic transfer if enabled.**

AIR TX ON – This command will close both interlock paths and issue a plate on command to the transmitter which is selected to the AIR position. The associated status output will be active when the air transmitter is on.

TX MANUAL – This command suspends automatic transmitter switching by the SWP-300. When the SWP-300 is in the manual mode the associated status output will be active. In this mode switch operations will only occur with front panel or remote control actuation.

TX AUTO – This command will activate the SWP-300's automatic transmitter switching function. When automatic switching is enabled the TX AUTO status pin will be active. NOTE: The SWP-300 requires the user to issue an AIR TX ON command to turn on the transmitter if it is not already on. For safety reasons it WILL NOT automatically issue TX ON when placed in TX AUTO mode for automatic restart of the transmitter after a switch operation you must press the Green F4 button after placing the unit back in auto mode or for manual switch operations.

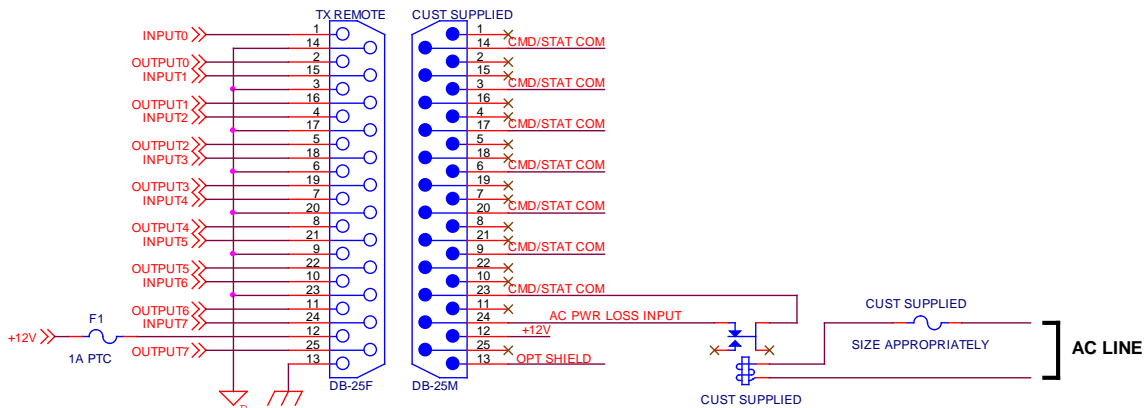
TX 1(2) INTERLOCK STATUS – These status pins will be active when the interlock path to the associated transmitter is closed. The status pin reflects the state of whichever interlock path is connected to each transmitter based on the position of the 4 port switch.

REMOTE FAULT RESET – This input resets the SWP-300 Three Strike Counter to re-enable transmitter interlocks after a reflected power fault. This input is only active after a "3rd Strike" and will not reset the three strike counter unless it has reached the 3rd strike. This allows the operator to view the 1st and 2nd strike indicators to be aware of a possible intermittent condition. The front panel fault reset is used to clear the counter prior to the 3rd strike.

AC PWR LOSS INPUT – This input may be connected through the normally closed contacts of a relay and the common contact to the SWP-300 common. The external relay should be configured such that it is energized when power is applied to the transmitter. A loss of power will close the contacts to inhibit the SWP-300 from attempting to switch transmitters before backup power stabilizes or if AC power has been lost to both transmitters. This closure must be present for the duration of the AC power loss event. **DO NOT UNDER ANY CIRCUMSTANCES MAKE CONNECTION TO 120 VAC DIRECTLY!!**

See drawing on next page which illustrates how to configure this feature.

SWP-200 AC POWER LOSS DETECTION EXAMPLE



NOTES:

1. RELAY COIL VOLTAGE MUST MATCH AC LINE VOLTAGE.
2. FUSE SHOULD BE SIZED APPROPRIATELY FOR RELAY COIL CURRENT.
3. OTHER REMOTE & STATUS CONNECTIONS HAVE BEEN OMITTED FOR CLARITY.

The above connector diagram is for illustration purposes. The actual connector that these connections are made to is rear panel J1 Remote Control.

For the purpose of connecting to a second remote control or for a local control/status panel the following remote commands and status outputs apply only to the SWP-300-2 switch model via J5 SW2 LOCAL CONTROL/STATUS:

ANT MANUAL – This command suspends the automatic antenna switching function of the SWP-300. The associated status pin will become active indicating that the SWP-300 is in MANUAL mode.

ANT AUTO – This command will activate the automatic antenna switching function of the SWP-300.

Remote Control Descriptions for J3 Remote Antenna Switch Connector

Air > Ant1 CMD – Selects Antenna 1 (Main) for transmitter selected to “Air”

Air > Ant2 CMD – Selects Antenna 2 (Aux.) for transmitter selected to “Air”

Ant Manual CMD – Places SWP-300 in manual antenna select mode. No automatic operation of antenna selection

Ant Auto CMD – Places SWP-300 in Auto select of antenna if high reflected power is detected by DPS-100D power meter

VIII. Specifications

SWP-300-1/2

Power Indication:	Watts/Kilowatts accuracy within +/- 5% of reading – With DPS-100D installed
Control Input	Momentary contact to ground
Control Output to Switch Rating 24VDC @6 A.	Dry relay form C contact closure Contact
Status Output	Open collector output – Active Low
Status Inputs	8 Open Collector
Control Outputs	8 Relay NC/C/NO, 8 Open Collector Outputs
Connector Control in/Status out	DB-25 Female
Connector Type Control to	Switch DB-15 Female
Interlock/TX Control	DB-25 Female
RS-485	For use with DPS-100D DB-9 Female
LAN connection	RJ45 TCP/IP – SNMP v2 Agent
Physical Specification	19" L X 1.75" H X 10" D – Standard EIA rack
Electrical Requirements	100-240 VAC 50-60 Hertz
Environmental	0 – 60 degrees C. non condensing atmosphere

IX. Warranty

Broadcast Devices, Inc. products manufactured for Electronics Research, Inc. are warranted against failure due to faulty materials or workmanship for a period of two years from the date of shipment to the ultimate user. The warranty covers repair or replacement of defective parts at the factory, provided the unit has been returned prepaid by the user. All shipments to the factory shall have affixed to the outside of the container an R. A. number obtained from the factory. The above warranty is void if the unit has been modified by the user outside of any recommendations from the factory or if the unit has been abused or operated outside of its electrical or environmental specifications. If customer conducted field tests suggest that the unit may be faulty, whether or not the unit is in warranty, a full report of the difficulty should be sent to Broadcast Devices, Inc. factory at Cortlandt Manor, New York. The office may suggest further tests or authorize return for factory evaluation.

Units sent to the factory should be well packed in the original packing if possible and shipped to Broadcast Devices, Inc. Please go to www.broadcast-devices.com for shipping address. Remember to affix the R.A. number to the outside of the carton. Any packages received without such R.A. number will be refused. Note: freight collect shipments will also be refused. When the unit has been received, inspected and tested, the customer will receive a report of the findings along with a quotation for recommended repairs, which are found falling outside of the standard warranty. Units returned for in-warranty repairs which are found not to be defective will be subject to an evaluation and handling charge. In-warranty units will be repaired at no charge and returned via prepaid freight.

Out-of-warranty units needing repair require a purchase order and will be invoiced for parts, labor, and shipping charges.

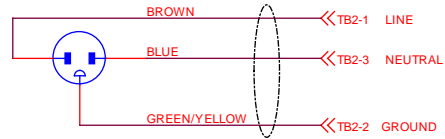
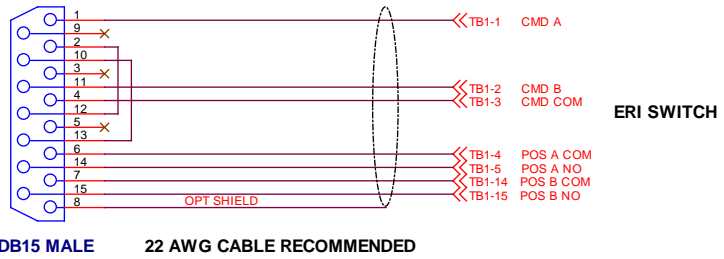
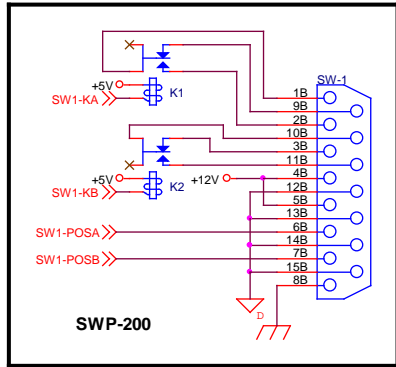
When ordering replacement part, always specify A) Part number or Description, and Quantity; B) Date of Purchase, Where Purchased; C) Any Special Shipping Instructions. Always specify a street address, as shipping companies cannot deliver to a postal box.

Broadcast Devices, Inc. is not responsible for any other manufacturer's warranty on original equipment. Nor are we responsible for any failure, damage, or loss of property that may occur due to the installation or operation of our equipment outside of recommended specifications.

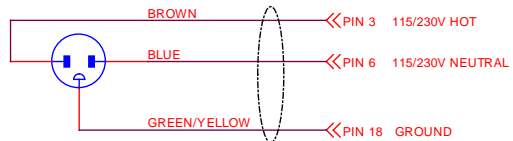
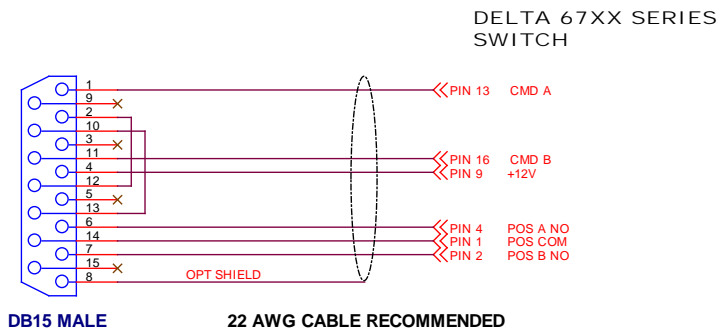
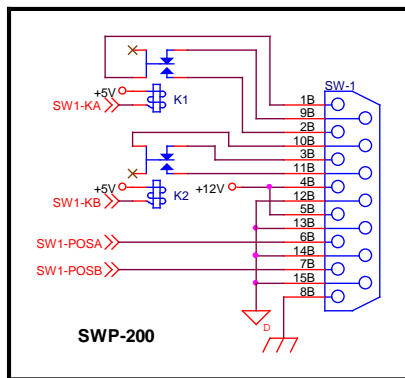
Broadcast Devices, Inc. may from time to time make changes to the materials used in the manufacture of its equipment and reserves the right to do so without further notice.

X. Typical Switch Connection Diagrams

Electronics Research, Inc. Coaxial and Waveguide Motorized Switches

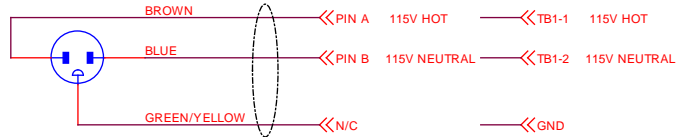
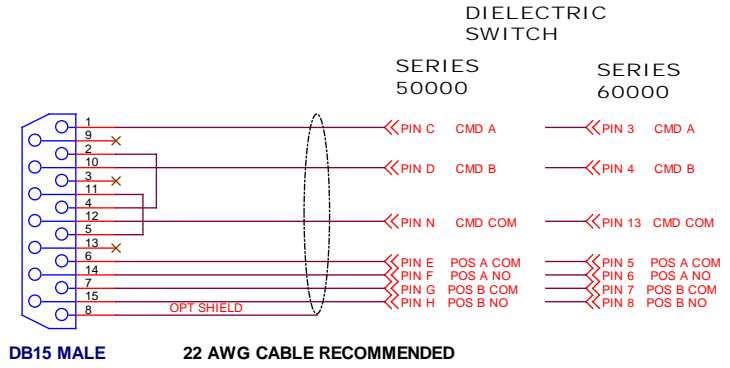
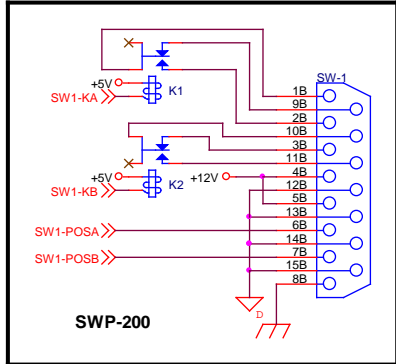


Delta Electronics. Motorized Coaxial Switches

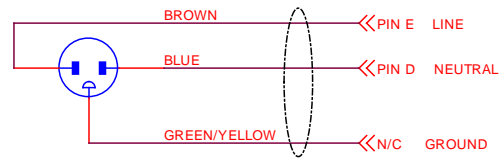
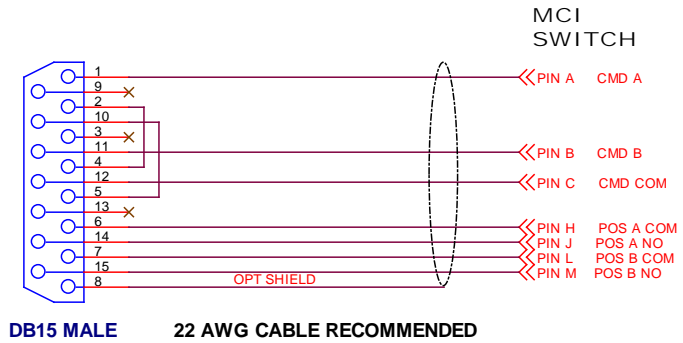
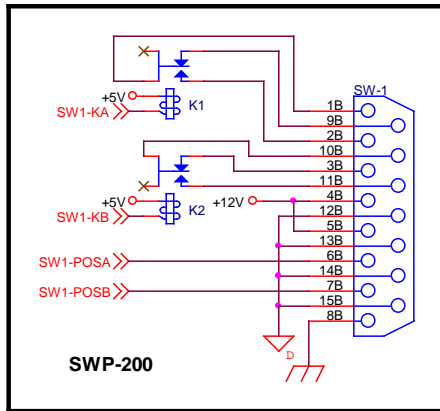


NOTE:
SWITCH MUST HAVE DELTA D42-87-1 12V RELAY
KIT INSTALLED.

Dielectric/SPX 50000/60000 Series Coaxial Switches



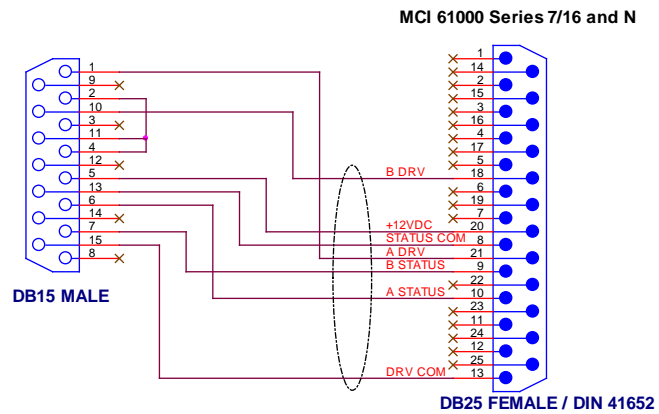
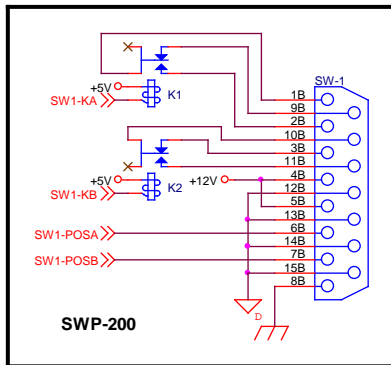
Mega/MCI and MCI/Rymrsa Coaxial Motorized Switches



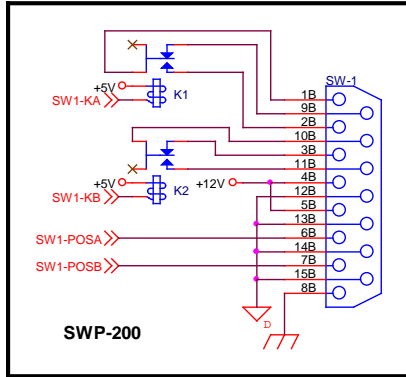
NOTES:

1. CONNECTOR: MIL TYPE MS3102A2214P
2. SWITCH MUST HAVE K1 INSTALLED FOR 12VDC OPERATION.
3. K1 P/N: 7/8" & 3 1/8" SWITCHES: DS2E-ML2-DC12V - ALLIED 788-1057
4. K1 P/N: 4 1/16" & 6 1/8" SWITCHES: KUL11D15D-12 - ALLIED 886-0129

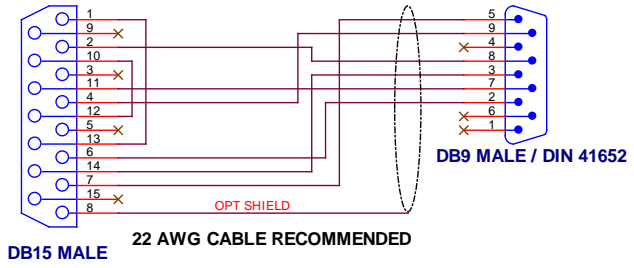
MCI 61000 7/16 DIN/N Type Switch



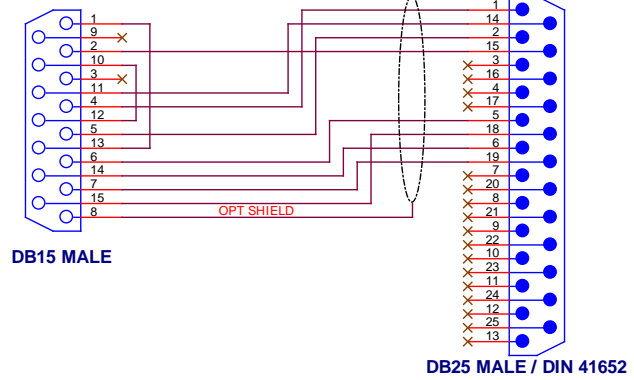
Spinner GmbH Motorized Switch Series



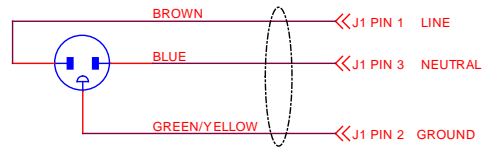
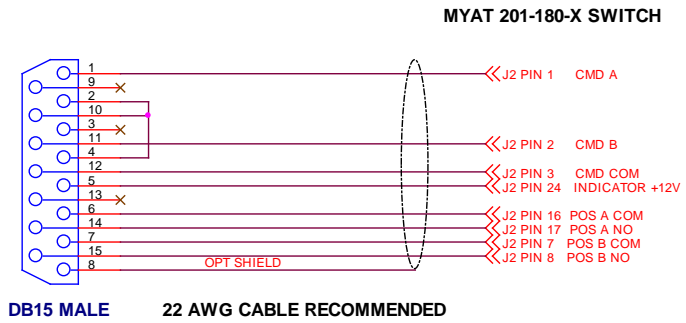
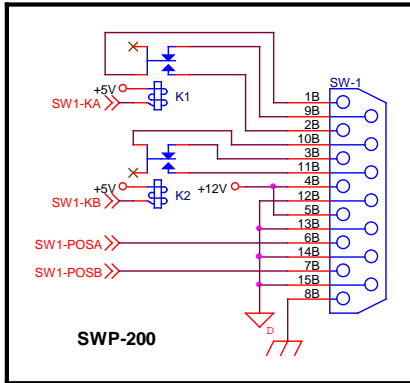
SPINNER SOLENOID DRIVE



SPINNER MOTOR DRIVE



Myat 201-180-X Motorized Switch Series



NOTES:

1. 24 PIN CONTROL CONNECTOR: MYAT P/N 180-135
2. SWITCH MUST HAVE K1 - MYAT P/N 175-40 INSTALLED FOR 12VDC OPERATION

Dow Key Solenoid Type 412-420132, 412-480132, 412-430132 Switch Series

