TSR900 Hookup
and
Diagnostics Manual

Register map
TSR900, TSR900AO
TSR900M

Table of Contents

Revision 1.0

A. Hookup

1. Check DIP switch positions. (TSR900/TSR900AO Address; TSR900Master number of remotes/display)

   Note that address DIP switches select the Modbus address of the internal I/O. This is different from the radio unit addresses. See the radio setup manual for radio parameter settings.

   Address = Sum of up switches where: ***Right to Left***: switch value= 1, 2, 4, 8, 16, 32, 64.
   (Note: #'s on switches go from Left to Right)

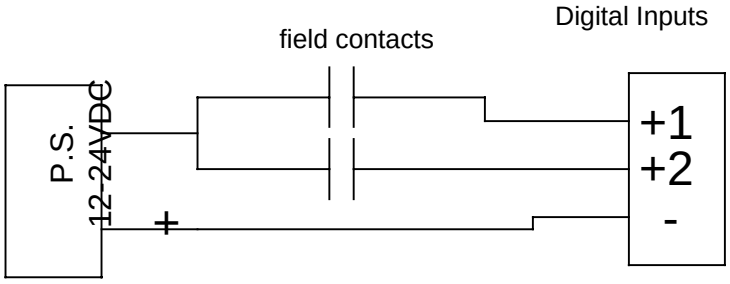
2. Connect antenna. (Connector= MCX)

3. Connect power leads to power connector. (and, for TSR900Master, analog output power).

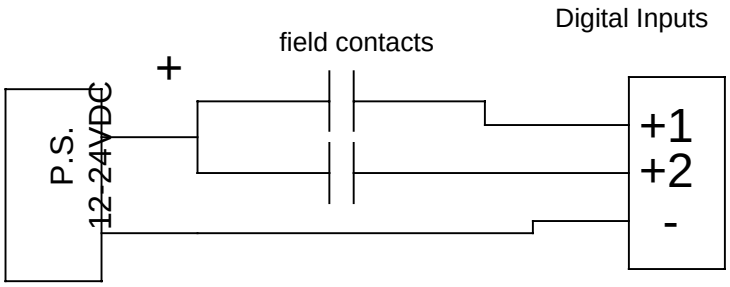
4. Connect Digital Inputs.

   Digital inputs are not polarity sensitive and can be powered by an isolated PS or the same one as powers the TSR900x unit. Recommended hookup options are:

   Preferred: (+ doesn't have to leave enclosure)

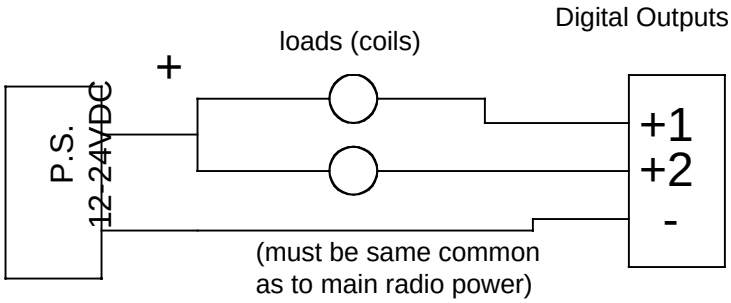


Alternate: (should fuse + to the field)



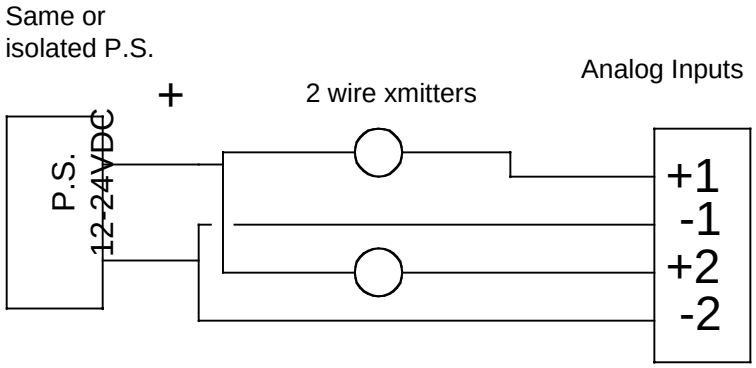
5. Connect Digital Outputs.

Digital outputs are current sinking and (active state) pulls to PS common. (this IS the PS common that powers the unit) Recommended hookup is:



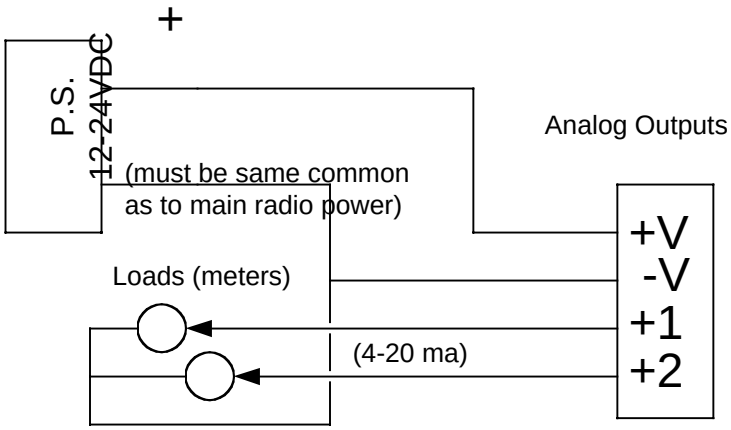
6. Connect Analog Inputs. (TSR900 RTU only)

Analog inputs are polarity sensitive 0-20 ma (0-5VDC if internal resistor is clipped). The inputs will tolerate +-200V of common mode. Recommended hookup options are:



7. Connect Analog Outputs. (TSR900Master and TSR900AO only)

Analog outputs are polarity sensitive and referenced to PS common. There are separate +V and -V (common) terminals, and the actual current sourcing output. Recommended hookup options are:



B. **LED Display Information**

1. Normal Display (lower front- left)

The normal function of I/O LEDS is to reflect the Digital Input and Digital Output states. Additionally, there is a RUN LED, which flashes at a < 1 sec cycle rate, and a TX data LED (left most on lower front), which briefly flashes when the I/O module transmits data.

(TSR900 has: TX, RUN, 5 Dig In, 2 Dig Out)
(TSR900Master and TSR900AO have: TX, RUN, 2 Dig In, 2 Dig Out)

2. Communications Display (TSRMaster)

When in the communications display mode, the LEDS are:

TX
RUN and next led= run flash (flashes <1 sec cycle)
Com Status RTU 3
Com Status RTU 2
Com Status RTU 1

(Com status ON indicates comm fail on that station)

(Note: TSR900 only- RUN LED will flash slower if comm with master is lost for more than ~5 minutes. Other action (dropping of outputs) will occur if DIP SW 1 is down)

(Note: TSR900AO only- 5th output provides comm fail output)

3. Analog Display (Calibration/Validation)

TSR900Master / TSR900AO only
(selected with DIP switch 3 or 4 - selects AI 1 or AI 2)
When the Analog display mode is selected, the run light will flash briefly prior to each of three nibbles of hex data. The 3 nibbles will show the current value of the selected analog point. Following the 3rd nibble, there will be a pause before the sequence is repeated.

Hex Nibble Display Values: (1=ON, 0=OFF)

value	hex	leds
0	0=	0000
1	1=	0001
2	2=	0010
3	3=	0011
4	4=	0100
5	5=	0101
6	6=	0110

7	7=	0111
8	8=	1000
9	9=	1001
10	A=	1010
11	B=	1011
12	C=	1100
13	D=	1101
14	E=	1110
15	F=	1111

To calculate the current analog value, sum the following:

1st nibble*256
2nd nibble *16
3rd nibble*1

This result is a fraction of full scale which is 4095.
(i.e., n/4095= percent of full scale)

C. Analog Adjustment (TSR900Master and TSR900AO)

Factory adjusted. Normally no field adjustment required.

Hook a milli-ammeter to the desired analog output pin and common.

Verify that 4-20 ma signal matches the 4-20 ma value being transmitted from the source slave unit.

Use the analog display mode described above to confirm value of slave AI value.
The displayed value should correspond to the actual values.

D. Radio LED Indicators

The radio LED indicators are located on the front, upper portion of the units.

There are 5 LEDs in a row:

left:	RX LED
	TX LED
	Signal Strength 1
	Signal Strength 2
	Signal Strength 3

The signal strength lights will flash in a rotating fashion if the radio is searching to link to other radios. They will light up steady if a signal is detected. The number of leds lit will provide an indication of how strong the signal is. At least 1 of the 3 LEDs should be on steady.

E. Radio Jumpers

(Back of TSR900Master and TSR900AO)
Normally, the communications enable jumper is installed.
If the jumper is removed it will block any transmit data being sent. At the Master, all polling is blocked if the jumper is OFF. (This is necessary when making adjustments to the Radio parameters)
At the TSR900AO, the jumper can be removed so that the unit will operate as a non-participating receiver (monitor) of the Analog and Digital outputs from the Master.

F. Installation Instructions for TSRLink (or TSR/SR radios)

1. Normally, units ordered *as a system* will come with the radios pre-configured to a single system configuration and I/O DIP switch addresses preset. (READY TO RUN) (note: changing the I/O DIP switches does NOT require reconfiguration of the radios) This means that all of the radios are set up with the same network ID, the same hop pattern, the same encryption code, etc. Also, it is normally assumed that the Master will communicate directly with each remote. If this is not the case, or if there is a need to change the hop pattern (due to interference), then go to the section on "Setup of Radio Parameters".

2. Install antennae at sites. Normally, if the master can "see" the remotes directly, it would use an omni-directional antenna and the remotes would use a Yagi antenna pointed to the Master. If the system requires that one remote act as a repeater for a second remote, then that remote will probably need an omni directional antenna and the master can be equipped with a Yagi if it is only communicating with the one repeater site. Additional repeaters may be added without affecting the TSRLink end to end operation.

3. Assuming that the radio parameters are consistent for all units, you need to verify the I/O Dip switches for correct positions.

MASTER	Number of RTUs (I/O config) +LED display mode
RTU 1	CommFail operation / Address=1
RTU 2	CommFail operation / Address=2
RTU 3	CommFail operation / Address=3

4. Mount the units. Connect power to the radios. Verify that the master radio is communicating with the remotes as indicated by the radio TX LED being dimly lit (indicating a very rapid on/off operation). The remote units will have the receive LED on and the 3 signal strength LEDs will indicate the strength of the signal from the master at least 1 LED should be on steady for good communications. The other two will either be on or flashing. (The 3 LEDs form a rudimentary bar graph)

5. On the rear side of the TSR Master, there is a jumper pin which allows the Modbus master I/O board to interrogate the I/O at the remotes. This jumper must be in place for the I/O signals to be transmitted through the system. Note that the radios will link up regardless of whether or not the I/O is enabled.
When the jumper is in place, the master will interrogate the remotes every few seconds.
The end LED on the I/O board of the master (poll TX) will flash when polling.
The end LED on the remote I/O board will flash when it responds.
(radio TX/RX LEDs will flash also when there is traffic)
6. Power down units when wiring I/O. Make I/O connections as necessary. See the TSR Master or TSR Remote connection diagram to verify terminal strip locations.

G. Configuring Radio Parameters

1. Install the TSR Configuration program on your computer (PC). After installation complete, start up program.

2. Connect the radio to a serial port (normally COM 1) on the PC with a straight through 9 pin cable. (for the TSR Master, remove the I/O polling enable jumper)
(Note that it is desirable to configure the radio master first)

3. Apply power to the radio, and immediately click "Read Radio" menu item.

4. The current parameter settings of the radio will be displayed. Modify parameters as necessary.

5. Save the file in a sub-directory named as desired for the system being configured. (generally, you should create a sub-directory for each separate radio system, and store the configuration files for each node in that system in the appropriate "system" sub-directory)

6. Click "Write to Radio" menu item.

7. For subsequent radios in the same system, without changing any of the parameters set for the first radio except unit number and click "Slave". (for repeater, see below) Do a "SaveAs" to save this configuration to a file in the same sub-directory named RTU1 or as desired.

8. Connect the radio to the PC serial port. Connect power. Click "Write to Radio" menu item.

9. Do the next radio. (same as 7 and 8)

10. Restore polling enable jumper on Master. Verify RTU DIP switches are set to addresses 1,2, or 3 etc.

11. The automatic startup in data mode is normally set, so when you power up the units the next time they should link up and go.

Repeater Setup

If the system is going to use one of the remotes as a repeater, or if an additional radio is added as a separate repeater, then there is an additional step in setting up the system.

1. Set up the master parameters as above and save the file as described. Next click on the Quick System Configurator menu item.

2. This program allows you to create files for each node in the system in a simple tree structure view. Use the previously created Master file as the base. as you add stations and repeaters, the unit address and hop patterns will be assigned as necessary. (each repeater group has its own hop pattern)

3. When all stations and repeaters have been added, save the configuration files selecting to propagate the master parameters to all other stations (along with individual addresses and hop patterns).

4. Back in the main TSR configuration program, you can now Open the appropriate configuration file and simply click the "Write to Radio" menu item, for each unit.

H. Accessing Registers -TSR900

Modbus Register Assignments:

Reg 0	40001-	Digital Inputs (bits 0-4)	
	40002-	Analog Input 0	(0-4095)
	40003-	Analog Input 1	(0-4095)
	40004-	Cycles DI0	
	40005-	Cycles DI1	
	40006-	Cycles DI2	
	40007-	Cycles DI3	
	40008-	Run Time DI0	
	40009-	Run Time DI1	
	40010-	Run Time DI2	
	40011-	Run Time DI3	
	40012-	Max Val of AI0	
	40013-	Min Val of AI0	
Reg 13	40014-	Dig Outputs	(bits 0,1)

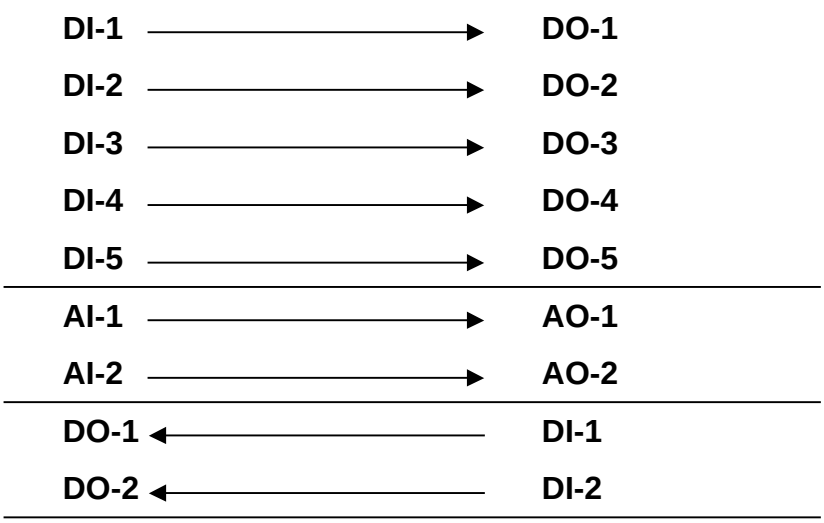
I. Accessing Registers - TSR900AO

Modbus Register Assignments:

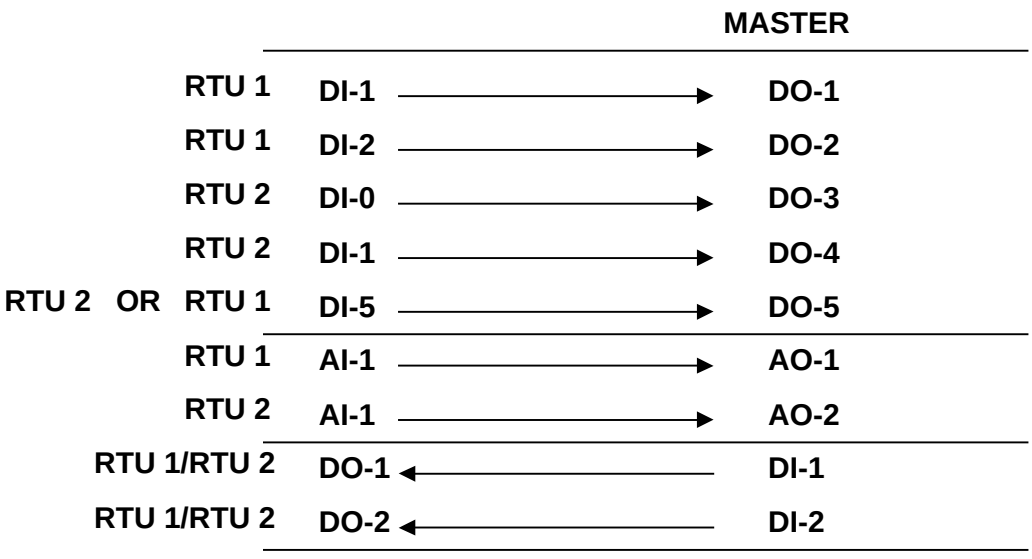
Reg 0	40001-	Digital Inputs (bits 0-1)	
	40002-		
	40003-		
	40004-	Cycles DI0	
	40005-	Cycles DI1	
	40006-		
	40007-		
	40008-	Run Time DI0	
	40009-	Run Time DI1	
	40010-		
	40011-		
	40012-		
	40013-		
Reg 13	40014-	Dig Outputs	(bits 0,4)
	40015-	Anl Output 0	
	40016-	Anl Output 1	

J. Mapping I/O with TSR900M

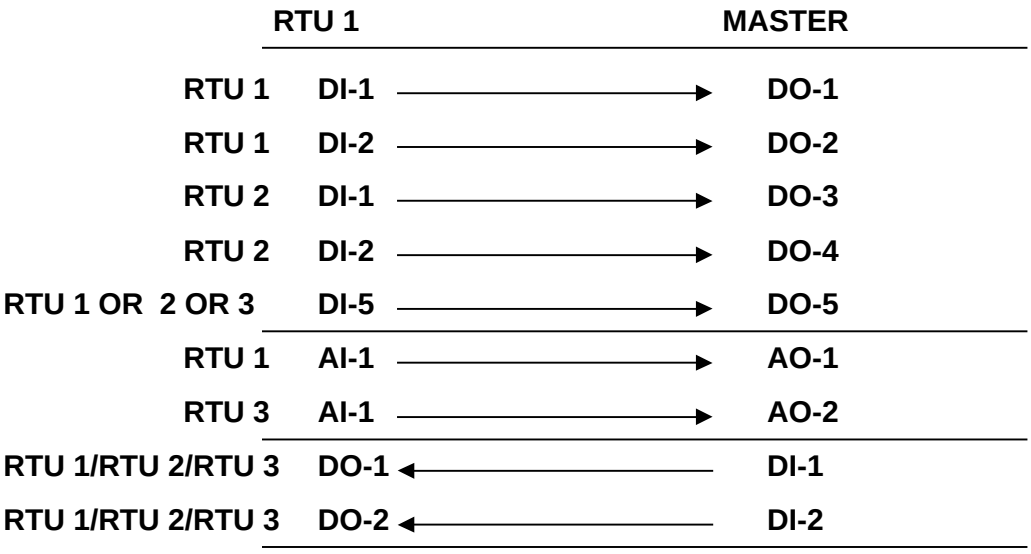
1 RTU TO/FROM MASTER



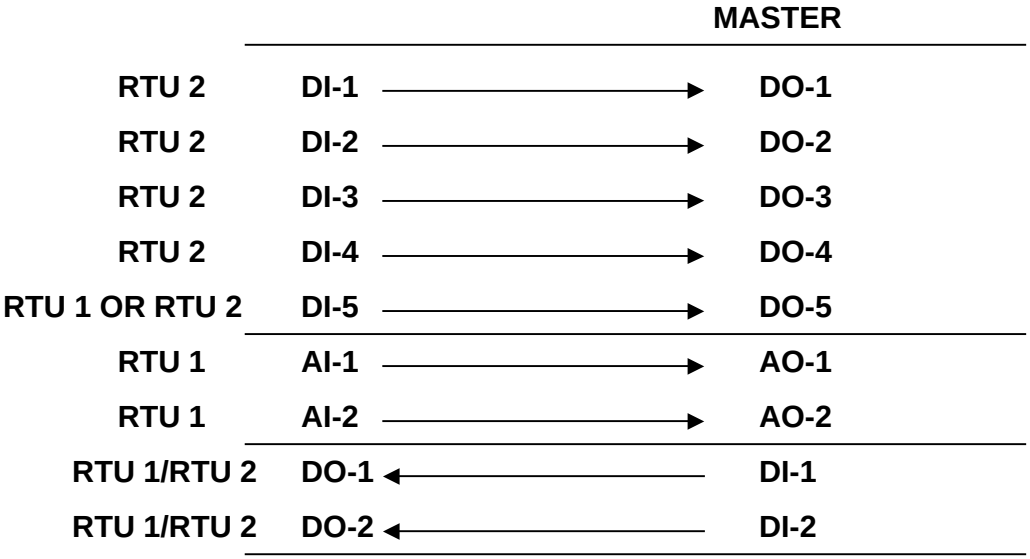
2 RTU TO/FROM MASTER



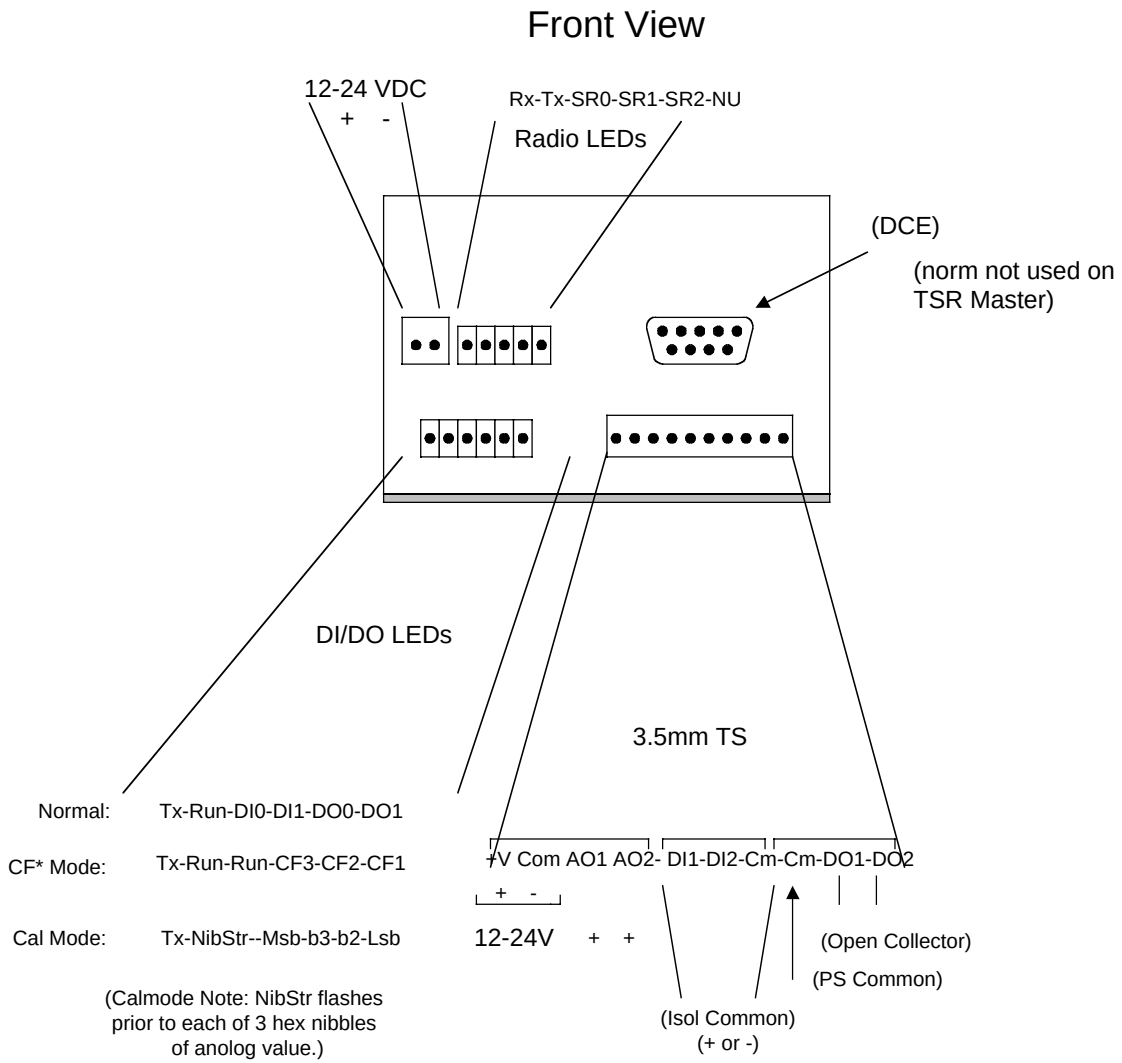
3 RTU TO/FROM MASTER



2' RTU TO/FROM MASTER (Alternate 2 RTU configuration)

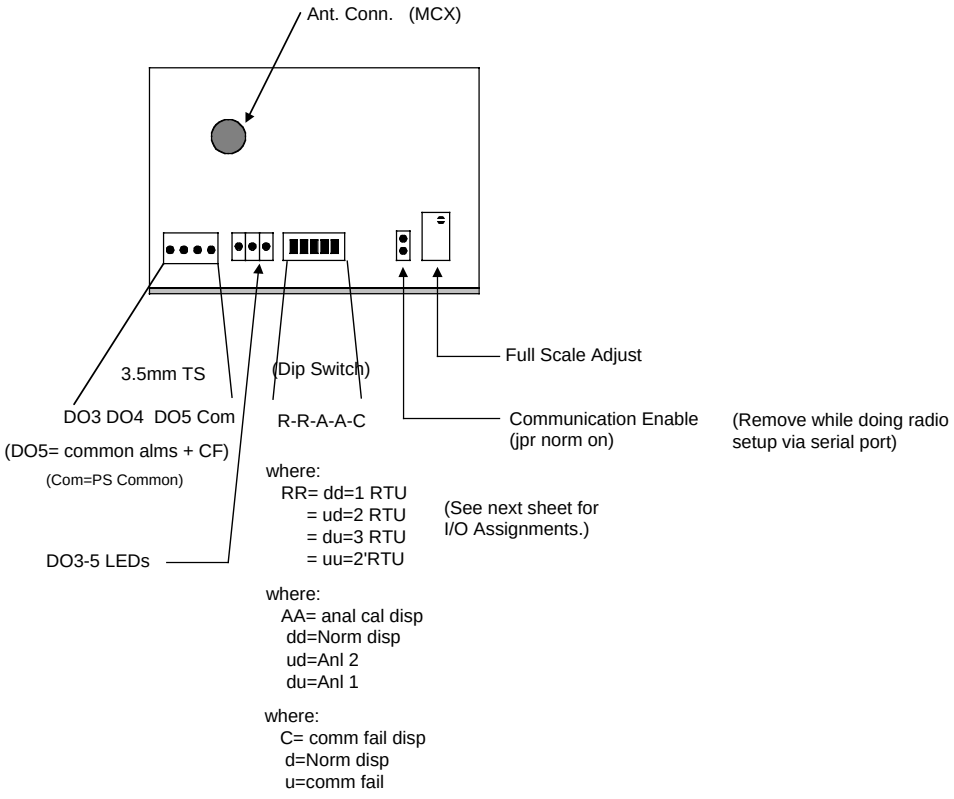


K. Physical Layout- TSR900M

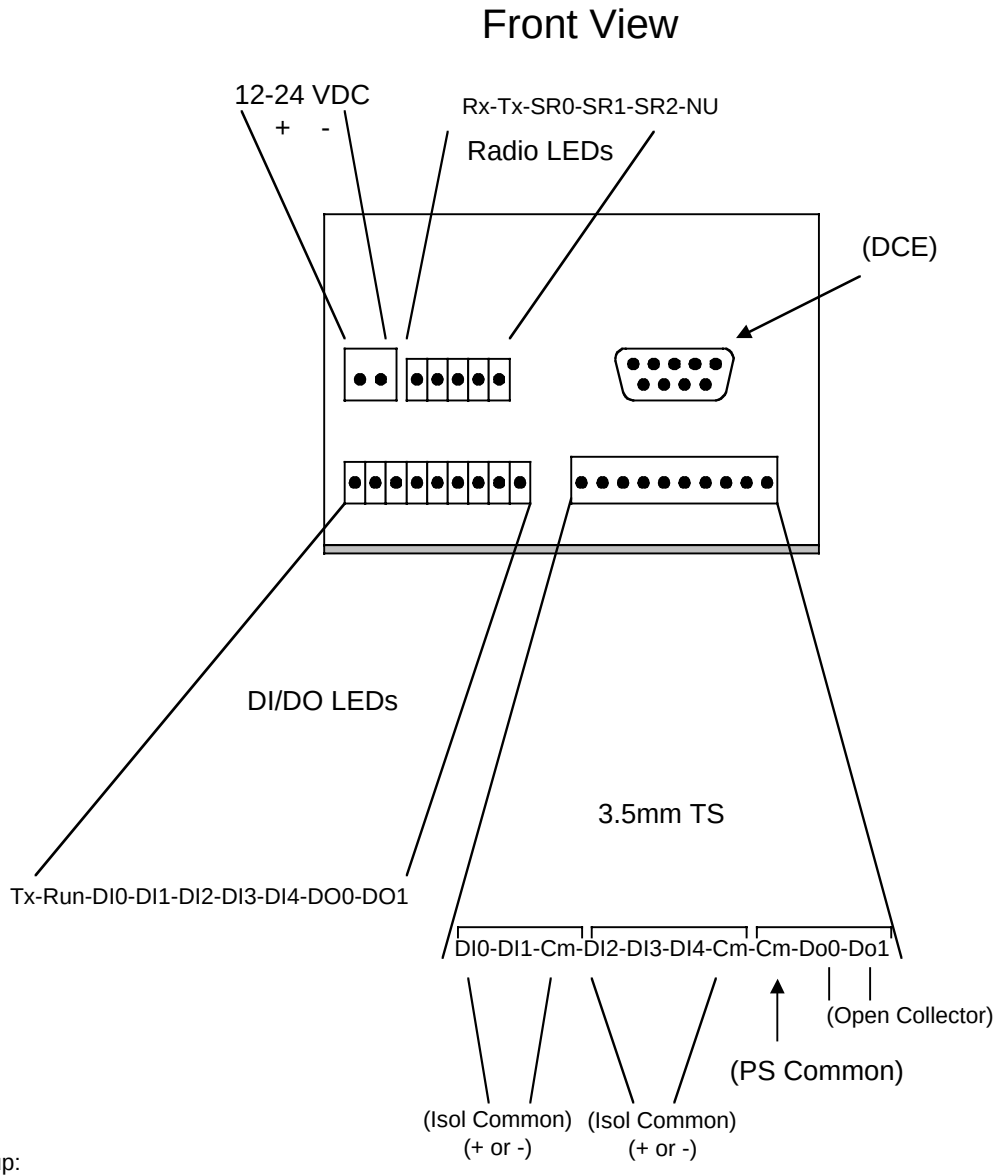


* CFn is on solid for comm fail; flashes if DI5 from that station is active.

Rear View

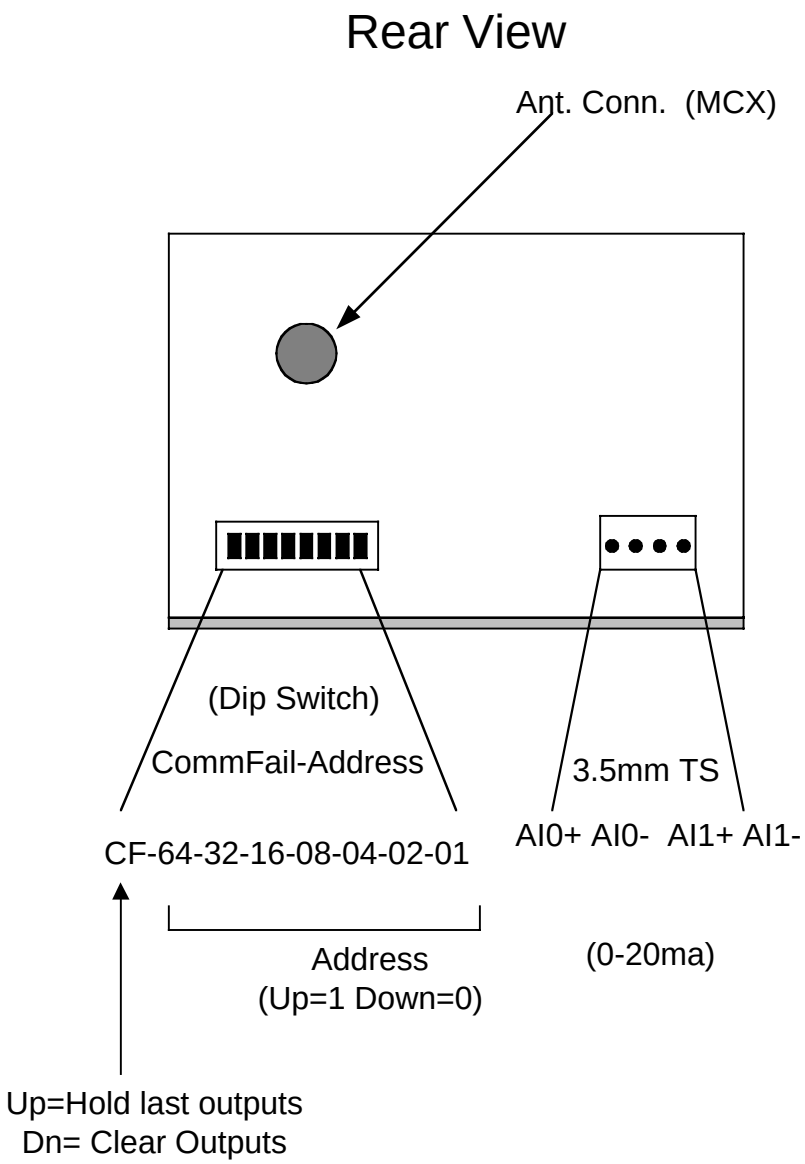

Ant. Conn. (MCX)
3.5mm TS
(Dip Switch)
Full Scale Adjust
DO3 DO4 DO5 Com
(DO5= common alms + CF)
(Com=PS Common)
R-R-A-A-C
Communication Enable
(jpr norm on)
(Remove while doing radio
setup via serial port)
where:
RR= dd=1 RTU
= ud=2 RTU
= du=3 RTU
= uu=2'RTU
(See next sheet for
I/O Assignments.)
DO3-5 LEDs
where:
AA= anal cal disp
dd=Norm disp
ud=Anl 2
du=Anl 1
where:
C= comm fail disp
d=Norm disp
u=comm fail

L. Physical Layout- TSR900

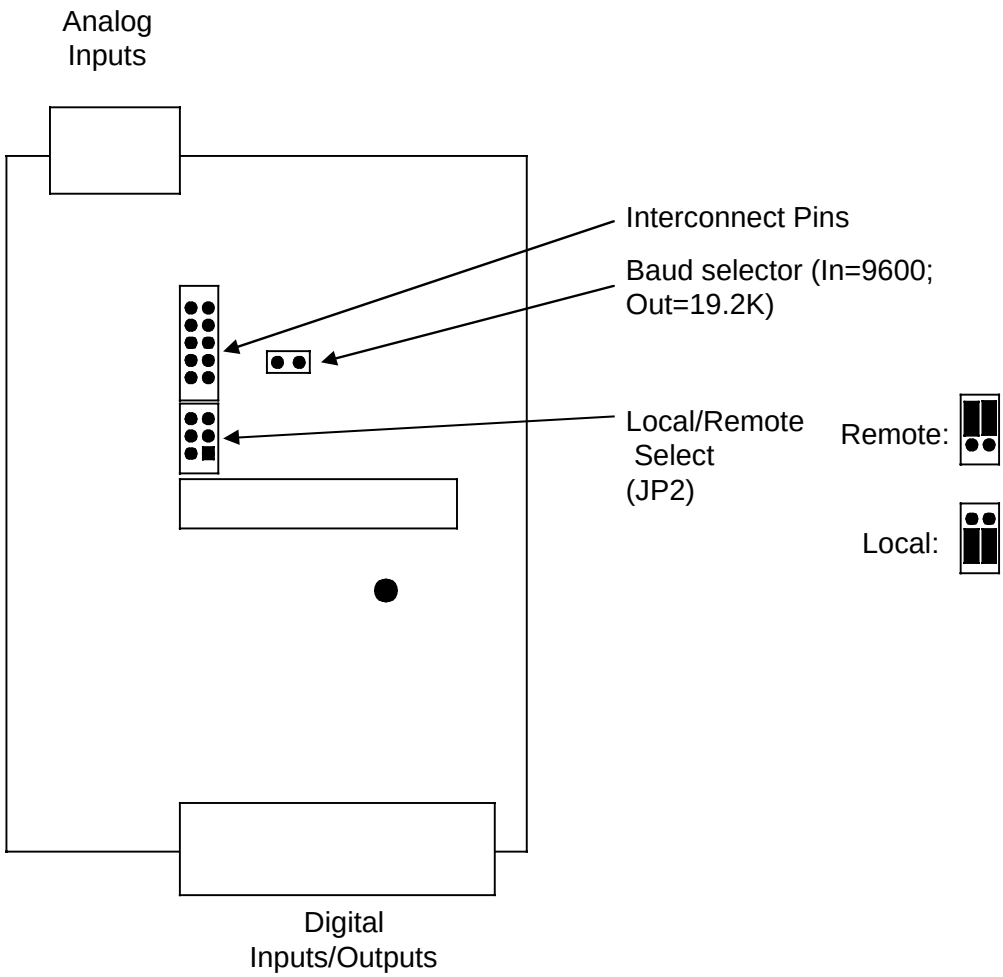


Startup:

Tx-Run-Sw4-Sw3-Sw2-Sw1-NU-NU-NU


Rear View
Ant. Conn. (MCX)
(Dip Switch)
CommFail-Address
CF-64-32-16-08-04-02-01
Address
(Up=1 Down=0)
Up=Hold last outputs
Dn= Clear Outputs
3.5mm TS
AI0+ AI0- AI1+ AI1-
(0-20ma)

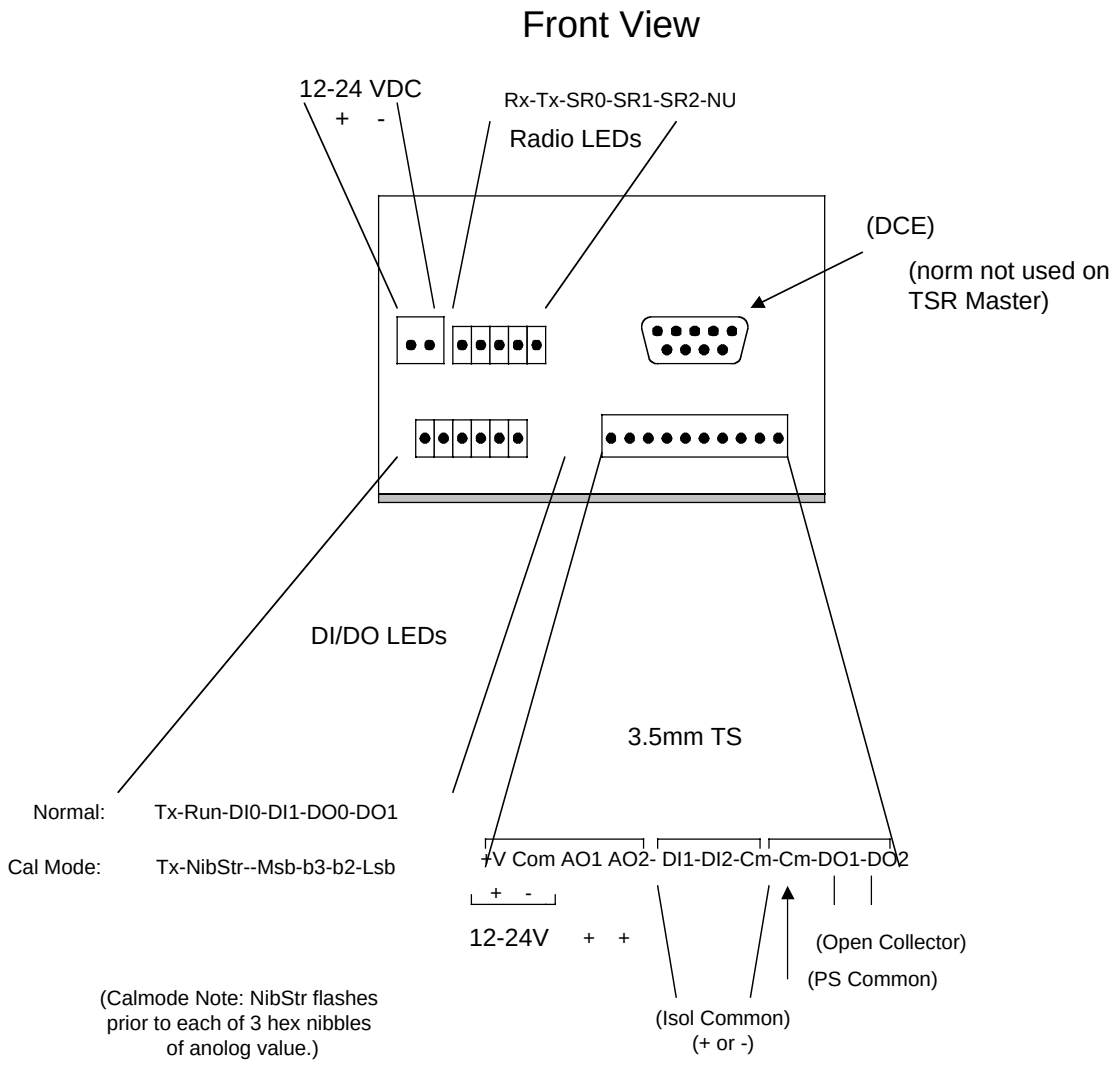
Internal Options



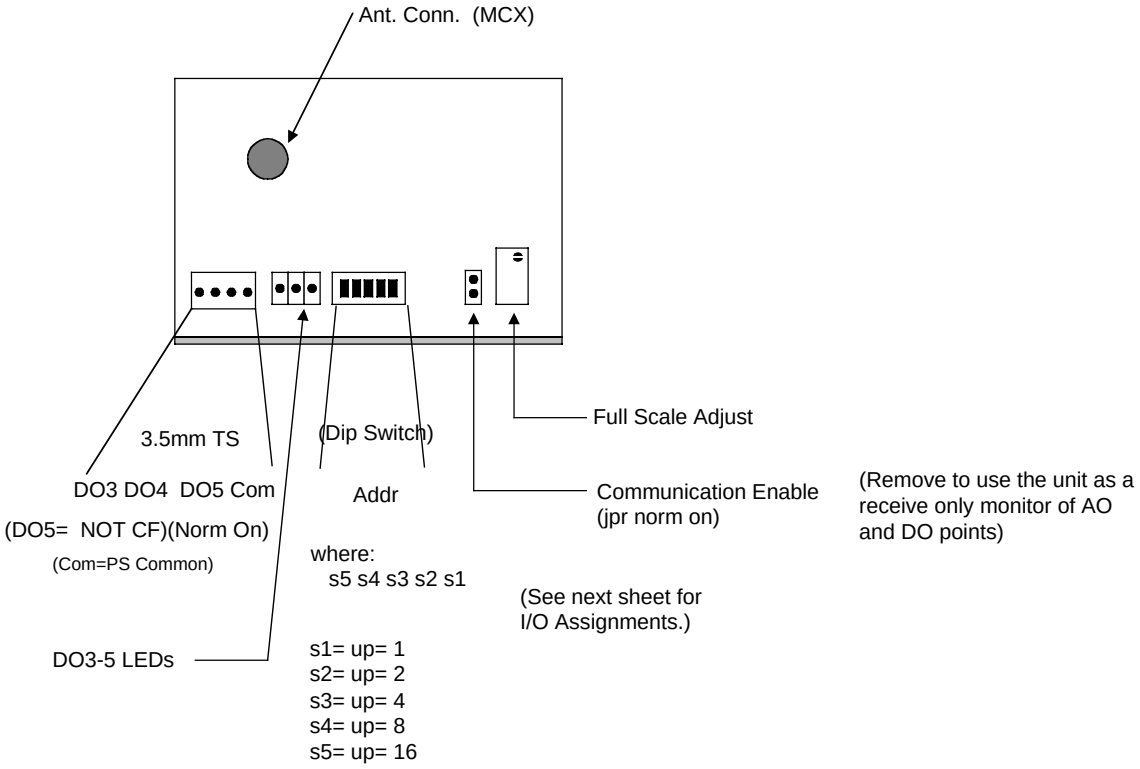
To open unit:

* Remove end plate.
* Remove phillips screw from bottom.
  (caution- nylon washer between standoff and board)

M.Physical Layout- TSR900AO



Rear View



(Remove to use the unit as a receive only monitor of AO and DO points)