FCC Compliance

Labeling Requirements CFR 47, FCC part 15, Sections 15, 19, 109.
A device shall bear the following label in a conspicuous location on the Antenna Controller.

OTi GMS	**FCC ID: JNX-OTI-GMS-V1**
Manufacturer: On Track Innovations Ltd.	
This device complies with Part 15of the FCC Rules.	
Operation is subject to the following two conditions:	
1. This device may not cause harmful interference, and	
2. this device must accept any interference received, including interference that may cause undesired operation.	

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which this receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help**

Changes or modifications in this equipment, not expressly approved by the party responsible for compliance (On Track Innovations Ltd,) could void the user's authority to operate the equipment.

1.1 Antenna Controller Interface Summary, By Reference Designation

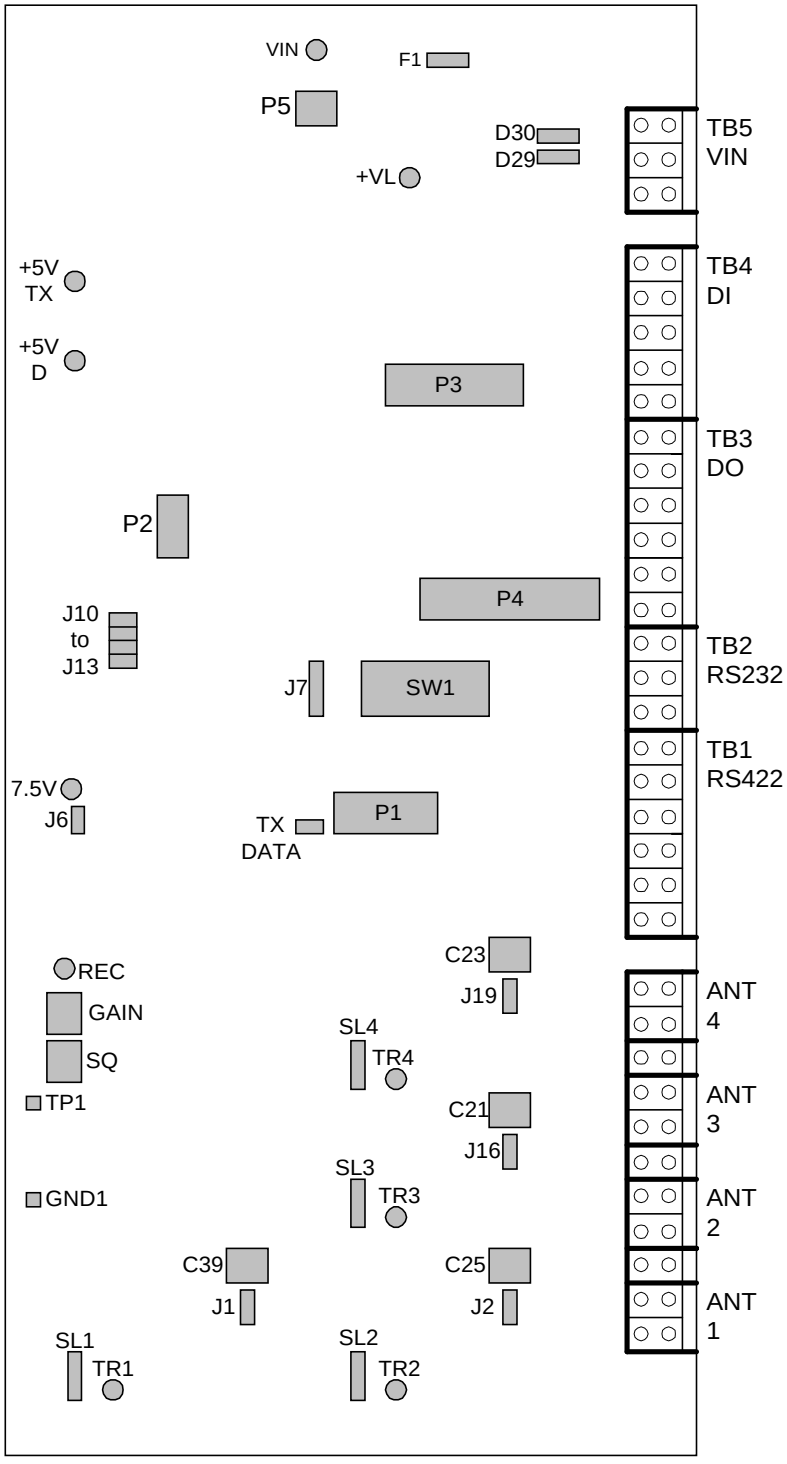


Figure 0-1: Interface Layout (4 channel)

1.1.1 Terminals

ANT-1→ANT-4 Antenna coils connection
TB1 RS422/485 serial communication connection.
TB2 RS232C serial communication connection
TB3 Open collector Digital outputs.
TB4 Digital inputs.
TB5 12Vac input power supply connection.

1.1.2 Molex Connectors

P1 Optional TTL Serial communication.
P3 8 Digital Inputs.
P4 8 Digital outputs (10 pin Molex connector).

1.1.3 Fuses

F1 MCI PCB main fuse (500mA).
F2, F3, F4 Automatic self resetting Poli-switch fuses

1.1.4 LED's

Power Supply indicators (red)
VIN 12Vdc Supply to system.
+VL 12Vdc supply to Outputs.
+5VD 5Vdc supply to digital section.
+5V TX 5Vdc supply to transmitters.
+7.5V 7.5Vdc supply to receiver.

Transmit indicators (green)
TR1 Transmitter 1
TR2 Transmitter 2
TR3 Transmitter 3
TR4 Transmitter 4

REC Receive indicator led (yellow)
L1 → L8 Eight Digital output indicator LED's (red)
IN1 → IN8 Eight Digital input indicator LED's (red)

1.1.5 Jumpers

SL1, SL2, SL3, SL4 Transmitter mode selectors
(for transmitters 1 to 4 respectively)
J1, J2, J16, J19 50Ω load connection at transmitter output
J6 Receiver Disable, by-pass
J7 RS232/RS422(485) serial communication mode selector

J10→J13 Channel enable.
TX DATA Data transmission enable.

1.1.6 Tuning Capacitors

C39 Transmitter #1
C25 Transmitter #2
C21 Transmitter #3
C23 Transmitter #4

1.1.7 Potentiometers

SQ Received data Squelch control (factory set)
GAIN Received data gain control (optional).

1.1.8 Diodes

D29 & D30 diode bridge's negative diodes, These diodes **must be removed** when using center taped transformer supply (refer to Figure 0-1)

1.1.9 DIP Switch

SW1 RS422/485 network address selection and self diagnostics (see section 4.5)

1.1.10 Test Points

TP1 & GND1 Received signal measuring points.

2. Electrical Installation

The Antenna Controller power requirements are 12Vac/dc@500mA.
This power supply, protected by a 0.5A fuse on the reader, does not include supply to external outputs.
Maximum consumption, including supply to external outputs, is 1A
Power to the Antenna Controller can be supplied in three different ways:
a) 12Vac, rectified by a diode bridge on the reader.
B) 12Vac from a transformer with two 12Vac outputs and a center point,
Important note! For this option the two negative polarity diodes of the diode bridge rectifier **D29 and D30** (see Figure 0-1) **must be removed**.
c) 12 regulated/non regulated DC voltage.

2.1 Power Connections

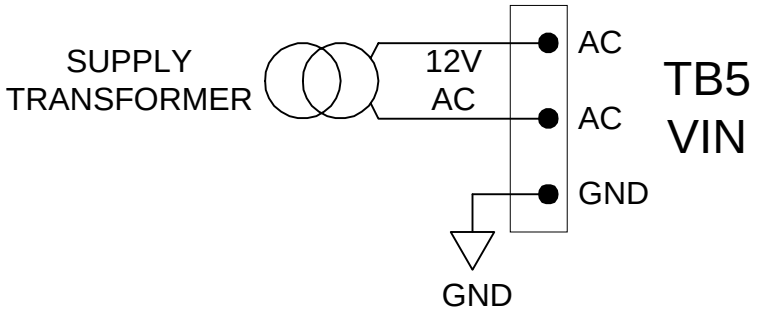


Figure 2-1: 12Vac Supply

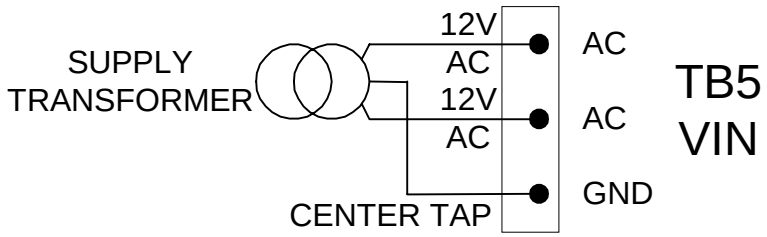


Figure 2-2: Center Tap Transformer Supply

Important note! For this option the two negative polarity diodes of the diode bridge rectifier **D29 and D30** (see Figure 0-1**) must be removed.**

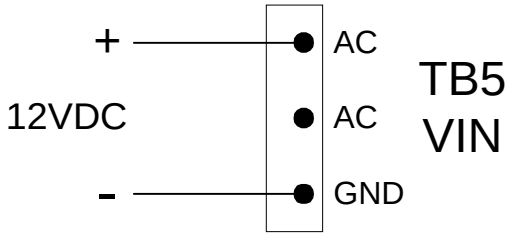


Figure 2-3: 12Vdc Supply

2.2 Serial Interface Connections

2.2.1 TTL - Optional Molex 6 pin connector

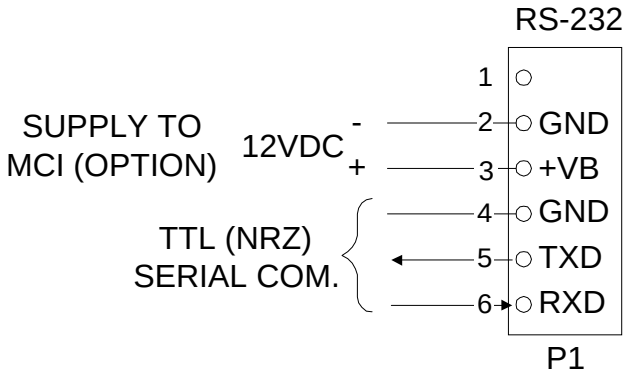


Figure 2-4: TTL

2.2.2 RS-232 (Jumper 7 must be in RS232 position)

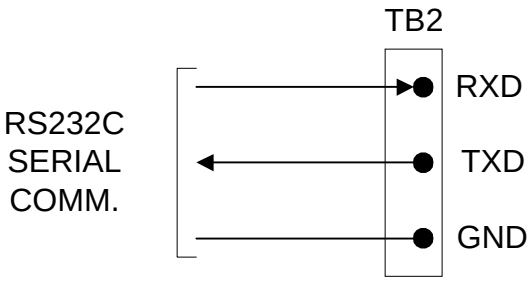


Figure 2-5: RS-232

2.2.3 RS-422 (Jumper J7 must be in RS422 position)

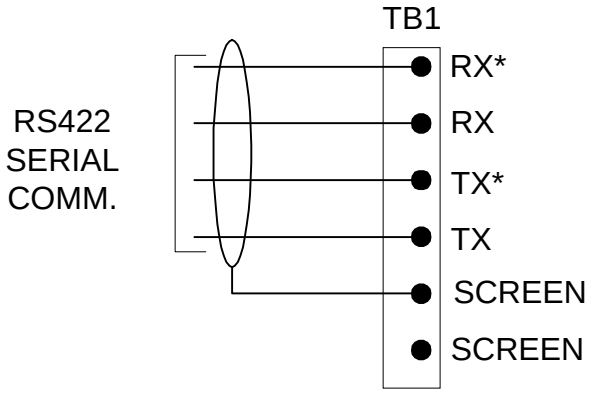


Figure 2-6: RS-422

2.2.4 RS-485

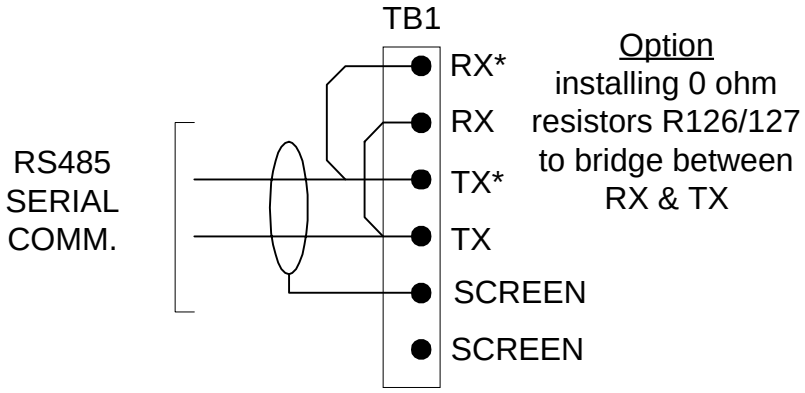


Figure 2-7: RS-485

2.3 Antenna Cable Connections

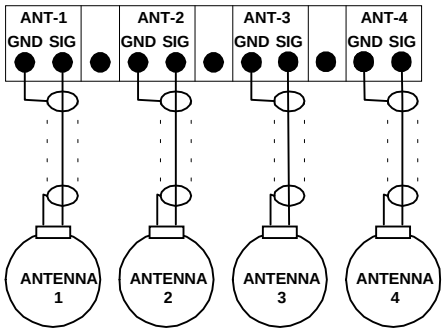


Figure 2-8: Antenna Terminal Block

Twisted pair wire can be used for distances of up to 20 centimeters.
At any distance ranging between 20 cm. and 1.2 m., coaxial cable should be used.
For distances from 1.2 m. to 33 m. coaxial cable is used, in half-length multiples of the wavelength. See table 3-1 for half- wavelength calculations.
(Cable length over 33 m. is possible but reading distance will be reduced).

Table 2-1: Half Wavelengths by Cable Type

Cable Type	**λ/2**
RG-58	7.30 m.
RG-174	7.30m.
14008	7.70m
Raychem EPD 84952Q	8.20m
Belden 89307	8.83m

When using coaxial cable, the center lead is connected to “SIG”, the shield to “GND”.

2.4 Digital Outputs

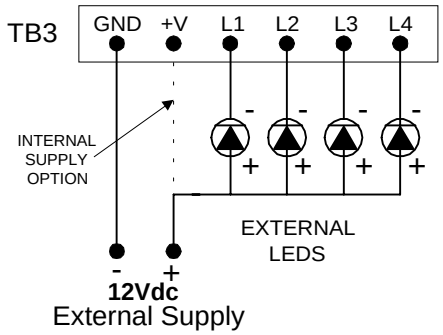


Figure 2-9: Terminal TB3

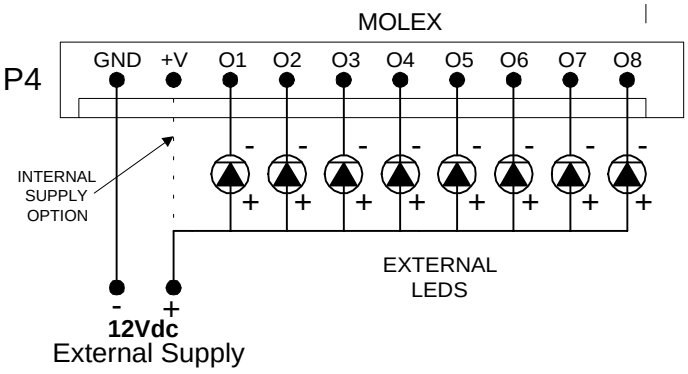


Figure 2-10: Molex connector P3

Digital outputs are open collector with a serial 750Ω resistor.
For internal 12V supply option, install jumper VL
(located between TB4 & TB 5).
Terminals L1 to L4 in TB3 and Pins O1 to O4 in connector P3
are connected in parallel.

2.5 Digital Inputs

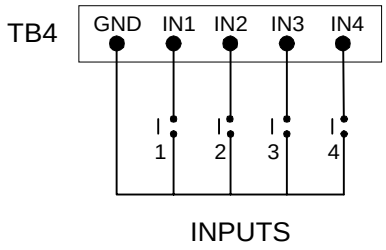


Figure 2-11: TB4

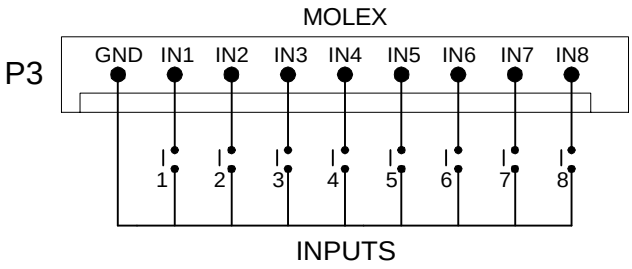


Figure 2-12: Connector P3

Inputs are Active Low.

2.6 Antenna Matching Circuits

2.6.1 Loop Antenna

Size - X × Y (mm).
Windings - Single-turn.
Wire - 24 AWG.

2.6.2 Matching Circuitry

Ls = matching coil (see Table 2-1).
Cp = matching capacitor (see Table 2-1)
note: Use high quality ceramic capacitors, preferably SMD.
Vcp = Variable capacitor - 30 pF (FCV05E30).

2.6.3 Typical Values

Table 2-1: Typical Antenna Matching Circuit Values

Antenna Dimensions, (in mm.)	Ls (μH)	Cp (pF)
50 × 80	3.3	560
60x100	3.3	470
100 ∅	3.3	180 + 180 = 360
100 × 100	3.3	180 +180 = 360
80 × 100	3.3	150 + 150 = 300
70 x 120	3.3	150 + 150 = 300
100 × 150	3.3	270

3. Antenna Tuning

3.1 Factory Tuning

The antenna is factory tuned and does not require customer adjustment. If it becomes necessary to tune the antenna, the following sections describe the process.

3.2 Antenna Tuning Equipment

- **DVM** - Digital Voltmeter (mV range).
- **DVM *adapter Cable*** (see Figure 3-1).
- Non-conductive ***ceramic screwdriver***.

Figure 3-1: DVM Adapter Cable

3.3 Tuning Procedure

Antenna tuning should be performed after the antenna has been installed in its final position. This will ensure that the tuning will compensate for the effects of nearby metallic objects.
To tune the selected antenna, follow the procedures below:

1) Choose the transmitter of antenna to be tuned by removing it's SL jumper (for constant RF transmission) and by placing all other SL jumpers in OFF position
2) Connect ***Antenna*** coax cable or twisted wires to the selected antenna terminal block on the Reader (Figure 0-1)
3) Connect the ***DVM adapter Cable*** to connector P5 (Figure 0-1).
4) Apply power to the Reader.

Note: Do not touch the *Antenna*.

4) Using the ***ceramic screwdriver***, turn the antenna matching capacitor to reach ***maximum*** capacity.

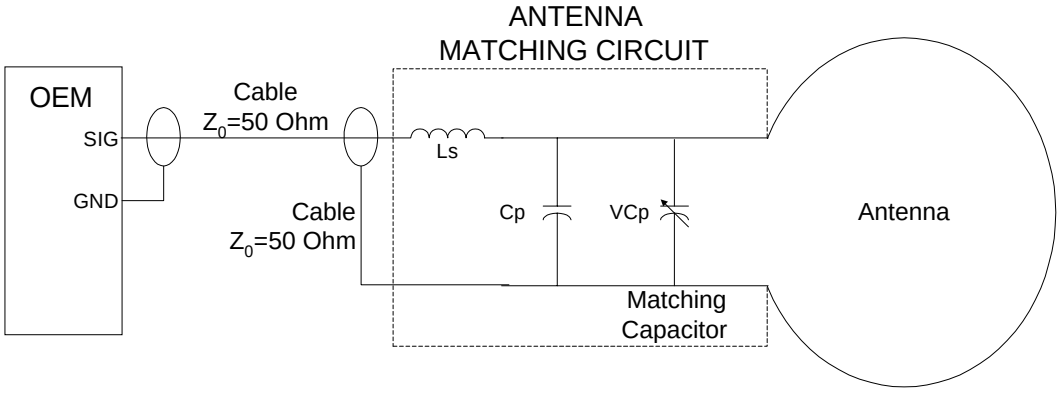


Figure 3-2: Antenna Matching Circuit

5) Turn the antenna matching capacitor slowly counter-clockwise (CCW) until the maximum DVM reading is achieved (approximately 110 - 130 mV).

Note: **If voltage is highest when the matching capacitor is at the position of its maximum capacitance, replace existing Cp capacitor with one of the next *higher* value. If voltage is highest when the matching capacitor is at the position of its minimum capacitance, replace the existing Cp capacitor with one of the next *lower* value (see Table 4.1).**
Next, repeat steps 4 & 5.

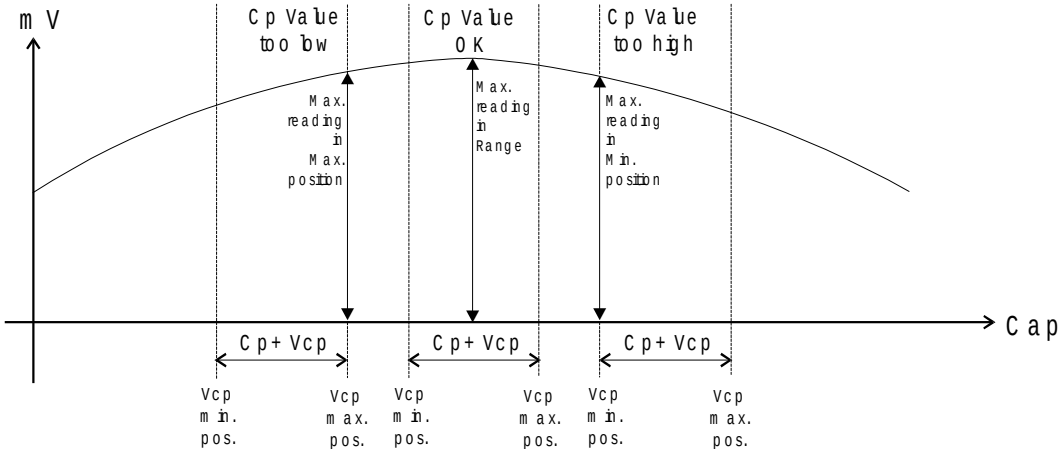


Figure 3-3: Choosing the Antenna Matching Capacitor (Cp)

6) Turn the ***Antenna matching capacitor*** clockwise (**CW**) to reduce the reading by 10mV to 15 mV (i.e. if the maximum reading was 120mV, the final reading should be 105mV to 110mV).

7) Slowly move a metallic object close to the ***Antenna*** assembly (up to 2 cm from the ***Antenna***). The reading should rise slightly towards the ***maximum*** before it drops, when the metallic object is placed very close to the ***Antenna*** assembly.

Note: If the reading does not rise, but only drops, readjust CCW to reduce reading by 10 - 15mV, then re-check with a metallic object.

3.4 Antenna Tuning Final Check and Assembly

At the completion of the procedures in Section 5-3, perform the following procedures:

1) Return all SL jumpers to MT position.
2) Check Antenna operation with a card.
3) Cover and seal ***Antenna matching capacitor*** tuning opening with special non-corrosive RTV ("Rotacil 1112", or equivalent).

3.5 Procedure for Choosing Coil - Ls

- Refer to section 1.1 for connector and jumper positions on card.

1) Connect a 50Ω resistor, to simulate antenna load, by applying a jumper to the selected transmitter.
   (**J1** - Xmtr. #1, **J2 -** Xmtr. #2, **J16 -** Xmtr. #3 or **J19 -** Xmtr. #4).
2) Remove the **SL** jumper of the selected transmitter (for constant RF transmission) and place all other **SL** jumpers in **OFF** position
3) Connect DVM to connector **P5**.
4) Apply power to card and register the DVM reading.
5) Remove 50Ω resistor jumper (see step #1) and connect the selected antenna cable to the selected antenna terminal block.
6) Perform antenna-tuning procedure. (Refer to section 1.1).
7) If DVM reading **at maximum** point is lower by more than 10 mv with antenna than with 50Ω resistor, replace **Coil Ls** with one of the next lower value .(i.e. 3.9µH → 3.3µH)
8) If DVM reading at **maximum point** is higher by more than 40 MV with antenna than with 50Ω resistor, replace **Coil Ls** with one of the next higher value. (i.e. 3.9µH →4.7µH)
9) After replacing **Coil Ls**, repeat procedure from step 6.
10) Return all **SL** jumpers to **MT** position.

4. Jumper & Dip Switch Settings

4.1 J10 - J13

Channel enable Jumpers- should be placed to enable normal microprocessor controlled operation of the desired channel.

	CH1	CH2	CH3	CH4
J10	**x**			
J11		**x**		
J12			**x**	
J13				**x**

4.2 Communication Jumper J7

Jumper J7 should be placed in RS232 position for RS232 applications or in RS422 position for RS422/RS485 applications.

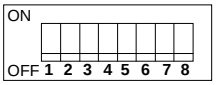
4.3 Transmission Channel Jumpers

Jumpers SL1, SL2, SL3, & SL 4 for channels 1 to 4 respectively offer the following modes:
1) MT position - normal microprocessor controlled data transmission.
2) Off position - no transmission.
3) No jumper - constant transmission.

4.4 Normal Operation Jumper Settings

1) Jumpers J10→J13 should be placed to enable operation of desired channel
2) Jumpers SL1→SL4 should be placed in MT position.
3) Jumper J7 should be placed in RS-232 or RS-422 position depending on application
4) The following jumpers should be removed for normal operation: J1, J2 J16 J19&J6.
5) The following jumpers should be installed for normal operation: TXDATA

4.5 Dip Switch SW1



SW1

Sw1 selects the address of the first channel of the MCI for RS-232/422 network operation. Addresses of channels 2, 3 and 4 follow in sequential order. The address number (0-255) is binary coded, #1 being the most significant bit and #8 being the least significant bit.
Address #0 is reserved for self-diagnostics. In this mode the channels are

scanned sequentially in repetitive cycles

FCC Compliance

Labeling Requirements CFR 47, FCC part 15, Sections 15, 19, 109.
A device shall bear the following label in a conspicuous location on the device.

OTi GMS	FCC ID: JNX-OTI-GMS-V1
Manufacturer: On Track Innovations Ltd.	
This device complies with Part 15 of the FCC Rules.	
Operation is subject to the following two conditions:	
1)	**This device may not cause harmful interference, and**
2)	**this device must accept any interference received, including interference that may cause undesired operation.**

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which this receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help**

Changes or modifications in this equipment, not expressly approved by the party responsible for compliance (On Track Innovations Ltd,) could void the user's authority to operate the equipment.

5. Product Overview

5.1 UL Version Models

Table 5-1 UL Version Site Controller models

Description	Model No.	Catalog No.
GBI 2	SC-U1-110/12-40-D9F	1001150

5.2 GBI 2.0 Site Controller Board Interface Summary, By Reference Designation

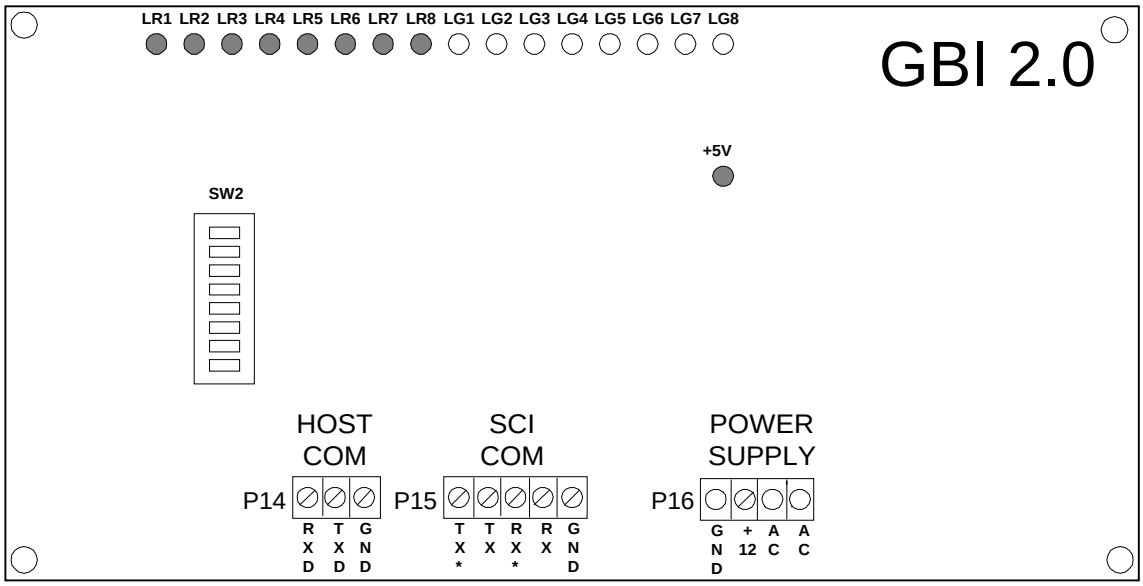


Figure 5-4: GBI 2.0 Site Controller Board Interface Layout

5.2.1 Terminals

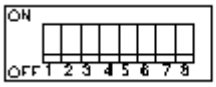
P14 RS232 Host communication
P15 RS422/485 Transceiver station communication
P16 AC/DC Power supply

5.2.2 Leds

LR1 → LR8 Channel select, 8 led binary coded indication (red)
LG1 → LG8 Successful response, 8 led binary coded indication (green)
+5V +5VDC power indicator (red)

5.2.3 Dip Switch

SW1 Mode selection Dip Switch



SW1

Address #0 (all switches in off position)
Self diagnostics mode: The channels are scanned sequentially in repetitive cycles.

Address #1 (only switch#1 is in on position)
Host mode: The channels are addressed by the Host computer.

6. Electrical Installation

6.1 Power connections

Incoming AC power is applied to terminals L, N and GND, connected to a class 2, UL certified transformer. This transformer converts the incoming voltage to 12VAC supplying power to the GBI2.0 Site Controller board and the antenna controller units in the field. Please refer to Power Supply section for transformer and fuse ratings.
The GBI 2.0 Site Controller Board can be powered either from a DC or an AC power source.

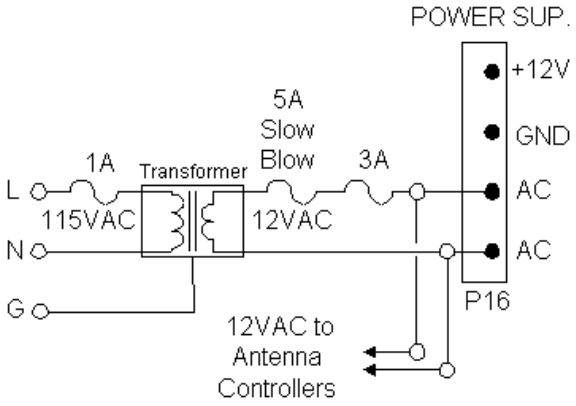


Figure 6-1:AC Supply

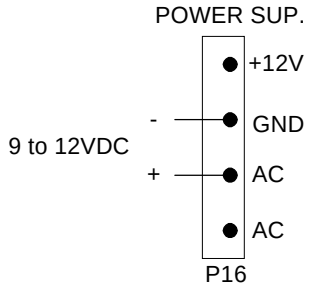


Figure 6-2:DC Supply

6.2 Network Connections

6.2.1 Host PC - RS232 Connection

Note: Use a shielded twisted pair cable.

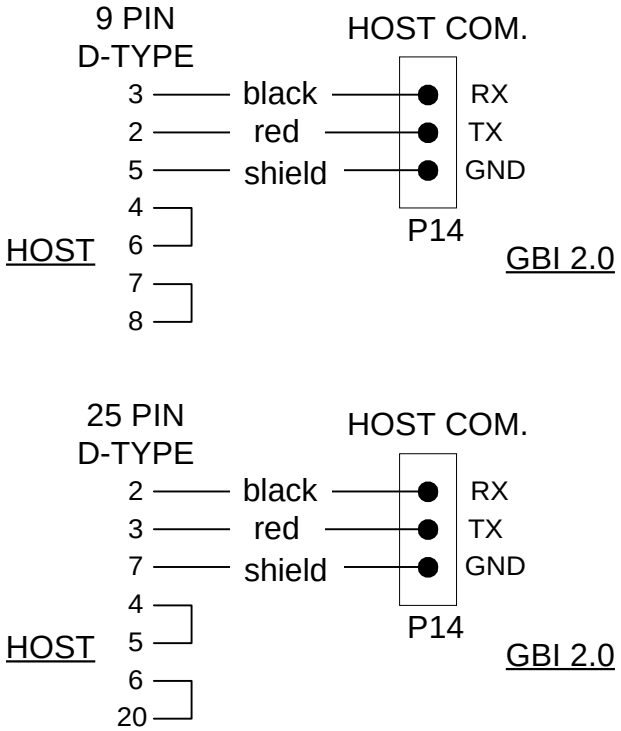


Figure 6-3:RS232 Serial connection to PC

6.2.2 RS422 Network Connection

Antenna Controller units are connected to the Site Controller network via RS422 communication cable in daisy chain fashion. All communication lines are connected in parallel (RX&RX, RX*&RX*, TX&TX, TX*&TX*).
Note: use shielded double twisted pair cable.

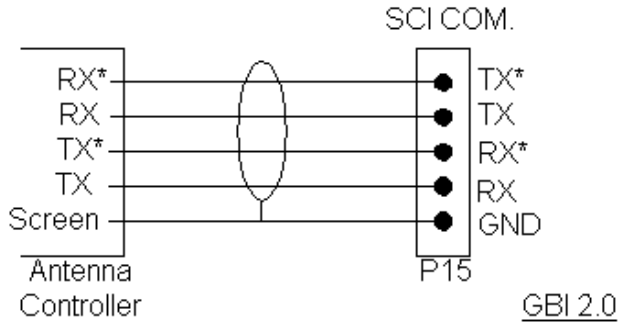


Figure 6-4:RS422 Serial connection to Antenna Controller Network

6.2.3 RS485 Network Connection

Each Antenna Controller unit is connected to the Site Controller network via RS485 communication cable in daisy chain fashion. Communication lines are connected in parallel.
Note: Use a shielded twisted pair cable.

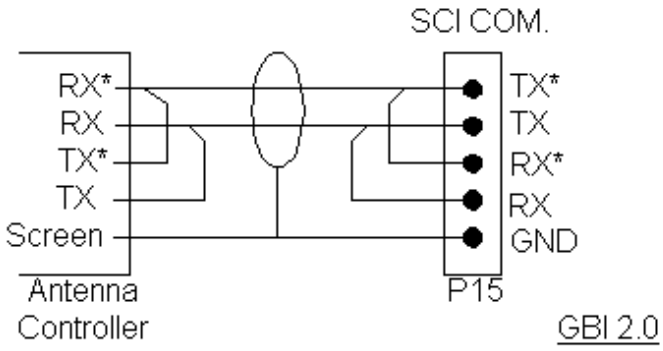


Figure 6-5:RS422 Serial connection to Antenna Controller Network

Power Supply

A single Site Controller supplies power to a limited network of Antenna Controllers. Power supply to all system elements should take into consideration the total and distributed current loads according to the routing topology of the supply lines with the associated voltage drops. Class 2 limits the maximum allowed current via field wiring to 8A. This actually means a maximum rating of about 5A for the fuse on the transformers secondary circuit.

6.3 Transformer

The Site Controllers transformer is intended to convert the incoming AC power (115/230) to 12VAC @ 3.3A used to power the Site Controller GBI 2.0 board and a limited number of Antenna Controller units.

6.4 Fuses

The Site Controller's AC supply system is protected by three fuses, one on the transformer's primary circuit and two (in series) on the transformer's secondary circuit.

To comply with class 2 requirements, the 5A slow blow fuse on the transformer's secondary circuit is non-replaceable. The 3A fuse placed in series with this 5A fuse is replaceable and is intended to blow before the 5A fuse.

Table 6-2: Glass Fuses

Description	Rating	Type	Recommended Manufacturer/Series
Transformer primary circuit Replaceable	1A	Fast acting	- ELU 179021, 1A - Little Fuse 235001
Transformer secondary circuit Replaceable	3 - 3.15A	Fast acting	- ELU 179021, 3.15A - Little Fuse 235003

Description	Rating	Type	Recommended Manufacturer/Series
Transformer secondary circuit Non-replaceable	5A	Slow blow	- ELU 189021, 5A (Wire leads)