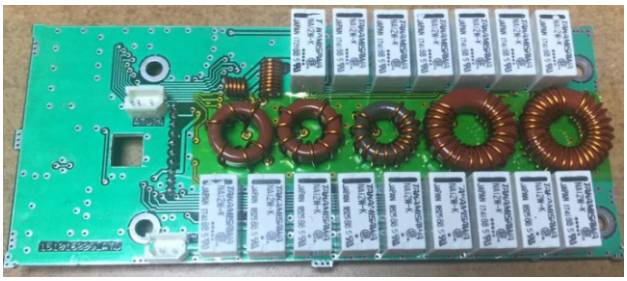
RGO ONE Automatic Antenna Tuner

Operating manual

Rev. 1.01b



Introduction

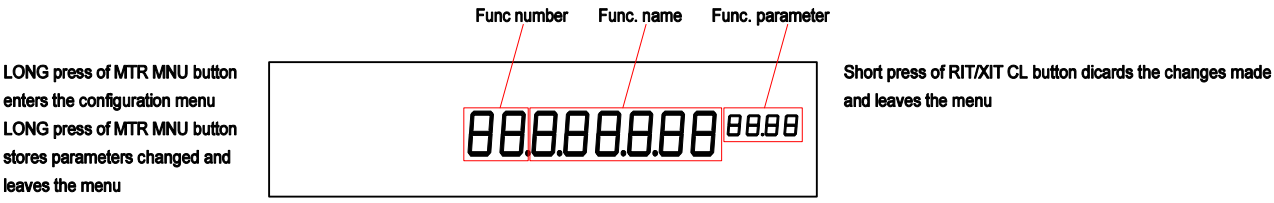
RGO ONE internal ATU option is compact plug & play module that allows non resonant (off resonant) antennas to be connected to RGO ONE output and used on most HF bands. Variety of antennas can be used: coaxial fed dipoles, verticals, yagis and loops. With proper transformer connected a balanced feedlines/antennas can be used. Circuit topology uses L-C (series L – shunt C) configuration, relay switched L bank of 7 components and C bank of 8 components giving 128x256=32768 possible combinations. Capacitor bank can be either connected as LoZ or HiZ configuration (C switched to transceiver or antenna side) which doubles possible tuning steps. RGO ONE main board microcontroller instantly monitors and tunes loads within assigned safe SWR limits. In order to protect board components, tuning of outside SWR limits is not allowed. Parameters from successful tuning are stored in dedicated memory locations where smart tuning algorithm can easily and fast acquire them when needed. Antenna tuner option when installed is right on the RX/TX path and on receive acts as additional selective filter/transformer for signals coming from the antenna.

Specifcations:

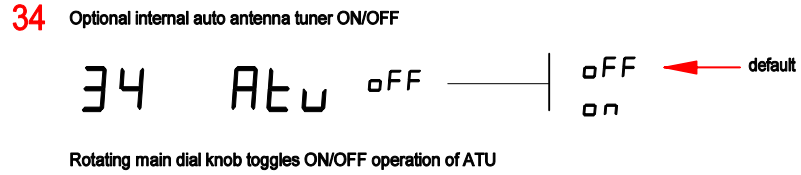
- Tuning range	Z = 8 - 300 Ω
- L-C tank circuit	Series L bank (128 values); Shunt C bank (256 values) switchable in LoZ/HiZ configuration
- L-C ranges	L~0 - 8.4µH in 128 steps; C~0 – 2500pF in 256 steps
- SWR Range	Up to 6:1 for bands 80-10m; Up to 4:1 for 160m band. (SWR protection for higher values).
- Memory locations	98 segment memories cover all HF amateur bands 1.8 – 29.7MHz
- Tuning Time	3÷9sec. typical for initial tune-up (80/160m higher); <1 second when restore from segment memory
- Current Drain	~120mA typical on transmit; ~80mA on receive
- Supply Voltages	Internally fed – 13V; 3.3V
- Size	PCB in shielded tin box L123mm x W52mm x H16mm

ATU operation

1. Activate ATU (if installed) in menu 34. Turn parameter on. When this parameter is off - ATU is in bypass mode L=0; C=0; HiZ.



FUNCTION selection is controlled by encoder 3
PARAMETER selection is controlled by encoder 4



2. When ATU is properly installed and menu 34 is on - TUN icon on LCD is permanently lit.

3. Long press of XMT TUNE button initiates tuning procedure. Steady carrier is transmitted with assigned power according to menu 1 (5 - 10W). During ATU work TUN icon on LCD blinks rapidly. If antenna SWR is higher than 6:1 (4:1 for 160m) tuning will be stopped prior tuning start.

4. Once SWR criteria (SWR<1.2) is achieved auto tuner stops transmitting, rewrites parameters into respective frequency segment memory and returns operation on receive.

5. If SWR requirement is met - tuner parameters are stored in segment memory.

6. ***Fine tune:*** If SWR criteria has not been met (SWR>1.2) a second long press of XMT TUNE button within 1.5 sec from previous tuning activates fine tune procedure. ATU will try to refine the combinations of L/C in order to obtain better SWR.

7. Tuning process can be stopped any time by pressing PTT/paddle/keyer lines or XMT TUNE button

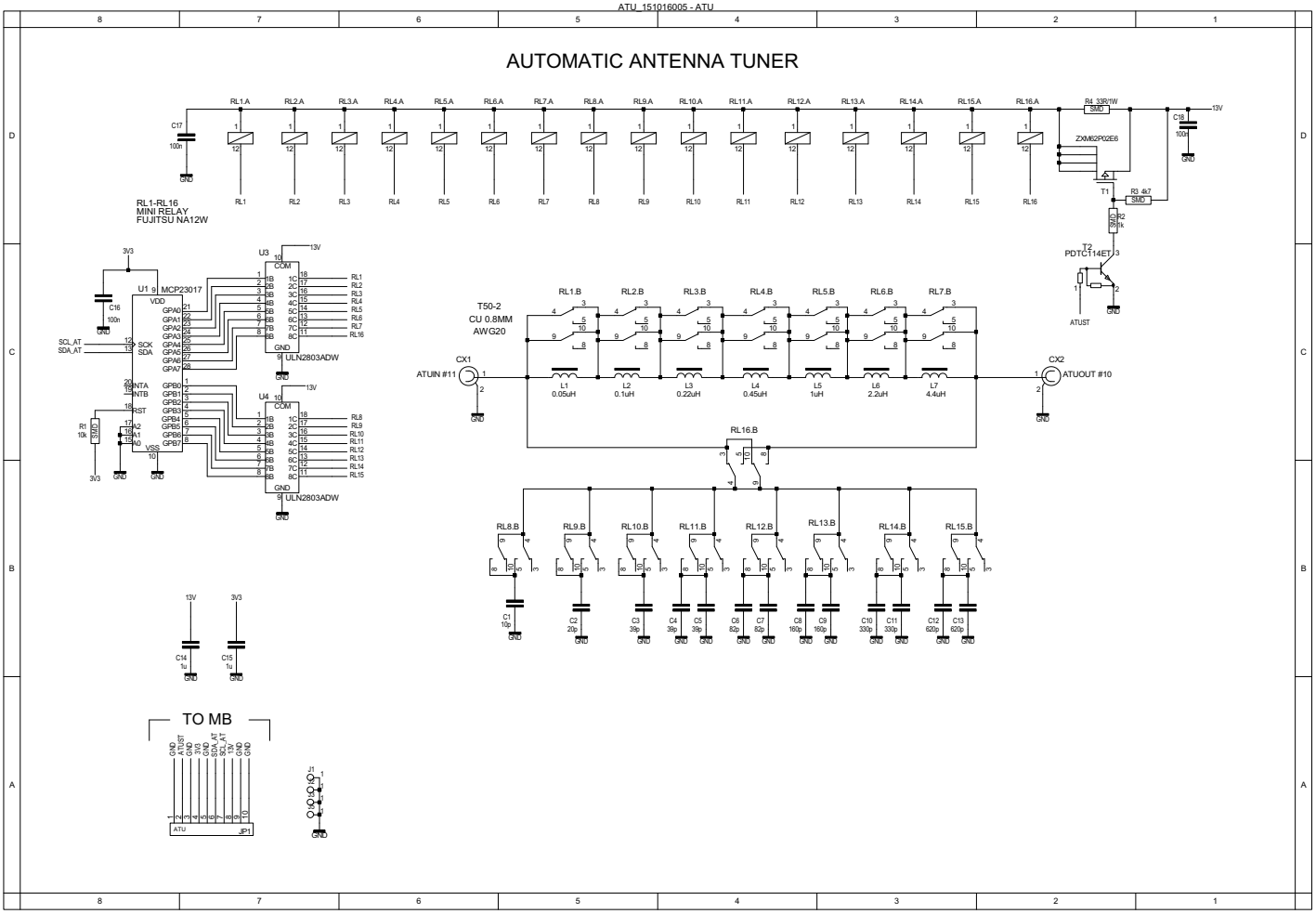
SCHEMATICS

ATU board consist of U1 - MCP23017 16bit I²C expander, U3, U4 - ULN2803 relay drivers, DPDT relays RL1 – RL16 Fujitsu NA-12W and L-C tank components L1 – L7 and C1 – C13. T1 and T2 shorten resistor R4 which increase relays current and speed to nominal value.

Relays are controlled over RGO ONE main board microcontroller which monitors SWR and frequency and take actions according to operator's request. In order to reduce current drain on receive relays are supplied via R4. On transmit R4 is shortened and all relays are supplied with nominal current.

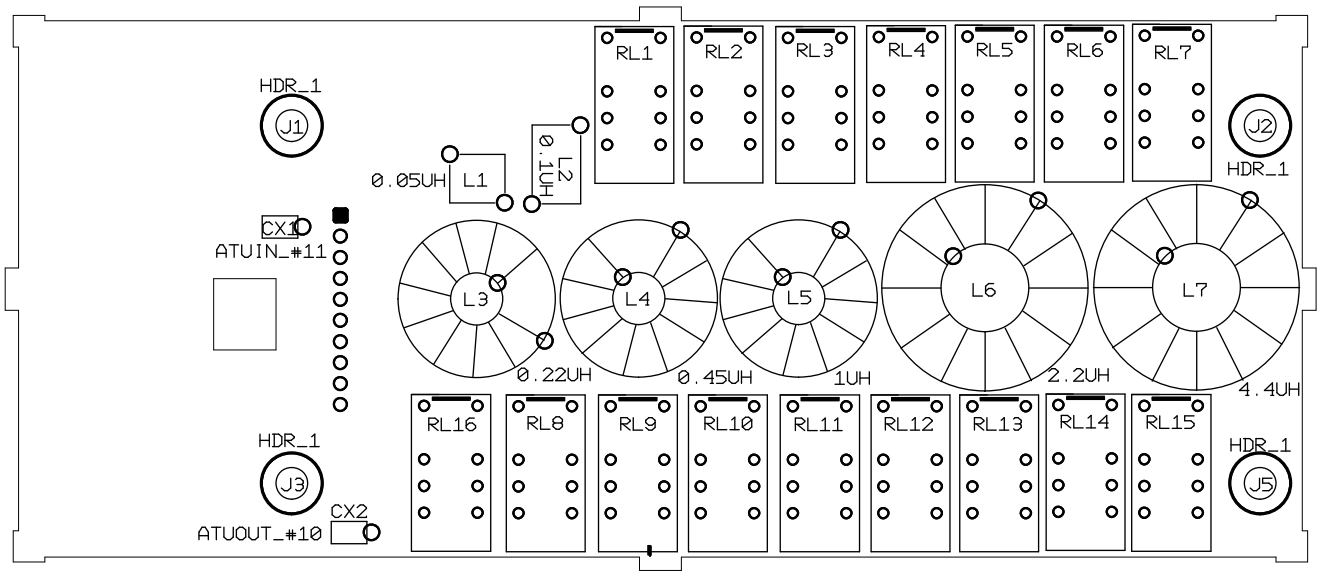
All capacitors in RF tank circuit are multilayer ceramic high voltage 1000V(2000V) C0G type. Inductors are wound over MICROMETALS ™ metal powder T68 and T50 torroids. L1 and L2 are air wound inducrtors.

To reduce RF stray and EMI inside RGO ONE chassis, ATU board is well shielded.

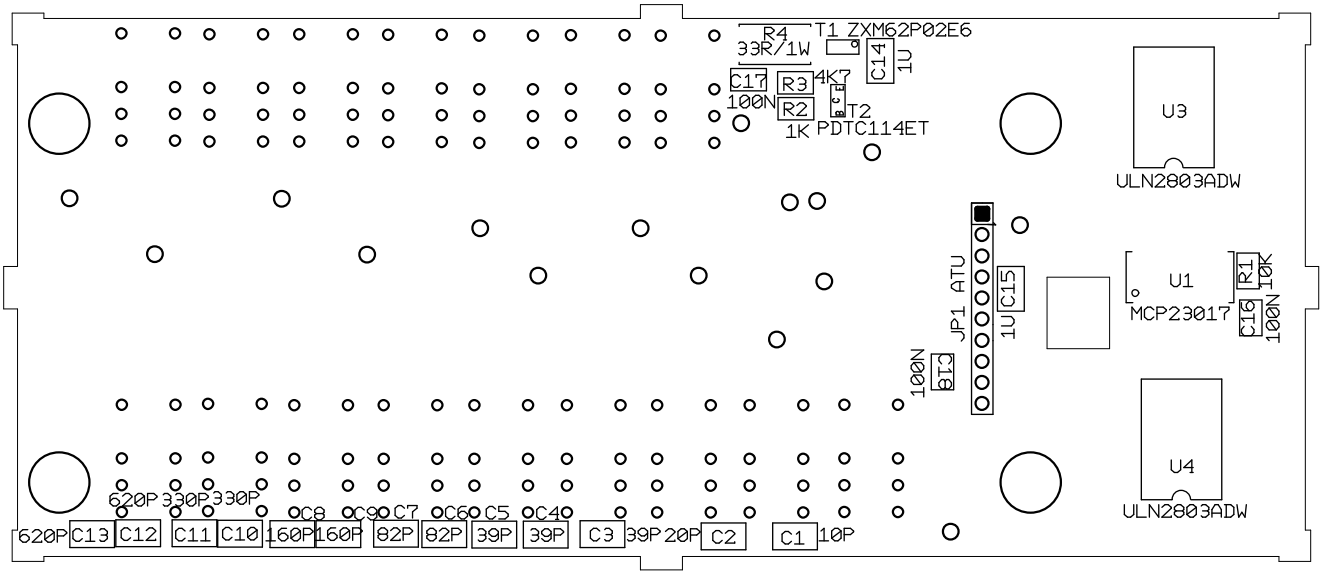


PCB layouts

Top view



Bottom view



ATU parts list

Name	Alias	Shape	Qnty	Part info
C1	10P	$R1206	1	C1206 2000V C0G
C2	20P	$R1206	1	C1206 2000V C0G
C3	39P	$R1206	1	C1206 2000V C0G
C4	39P	$R1206	1	C1206 2000V C0G
C5	39P	$R1206	1	C1206 2000V C0G
C6	82P	$R1206	1	C1206 2000V C0G
C7	82P	$R1206	1	C1206 2000V C0G
C8	160P	$R1206	1	C1206 2000V C0G
C9	160P	$R1206	1	C1206 2000V C0G
C10	330P	$R1206	1	C1206 2000V C0G
C11	330P	$R1206	1	C1206 2000V C0G
C12	620P	$R1206	1	C1206 2000V C0G
C13	620P	$R1206	1	C1206 2000V C0G
C14,C15	1U	$R0805	2	C0805 1.0uF 16V X7R SAMSUNG
C16,C17,C18	100N	$C0805	3	C0805 100nF 50V X7R SAMSUNG
CX1	ATUIN_#11	coax.pads	1	coax cable RG-404 length 8cm
CX2	ATUOUT_#10	coax.pads	1	coax cable RG-404 length 8cm
J1,J2,J3,J5	HDR_1	HOLE	4	screw M3x6 lock washer 3mm
JP1	ATU	HDR1X10_2MM	1	HARWIN - M22-2512005 1/2 cut
L1	0.05UH	COIL0.05	1	air wound inductor
L2	0.1UH	COIL0.1	1	air wound inductor
L3	0.22UH	T50-2	1	micrometals torroid core T50-2
L4	0.45UH	T50-2	1	micrometals torroid core T50-2
L5	1UH	T50-2	1	micrometals torroid core T50-2
L6	2.2UH	T68-2	1	micrometals torroid core T68-2
L7	4.4UH	T68-2	1	micrometals torroid core T68-2
R1	10K	$R0805	1	R0805 10K 1%
R2	1K	$R0805	1	R0805 1.0K 1% YAG/ASJ
R3	4K7	$R0805	1	R0805 4.7K 1% YAG/ASJ
R4	33R/1W	R2512	1	R2512 33R 1% YAG/ASJ
RL1-RL16	NA-12W-K	DPDT relay	16	NA-12W-K
T1	ZXM62P02E6	$TRA_SOT23_6	1	ZXM62P02E6
T2	PDTC114ET	DIGITRANSISTOR	1	PDTC114ET
U1	MCP23017	SSOP28	1	MCP23017-E/SS
U3,U4	ULN2803	SO18	2	ULN2803ADW SMD