4 Inch Field-Adjustable Turns Ratio Isolation Transformer (IsoT) Printable instructions for use at antenna feed. (V.2022.02.15)

This transformer is designed for tuning a 160m L/FCP using method B from "Taming the Exasperating Inverted L" on k2av.com. It also supports the 80m and 40m dual- and tri-banding of 160m L/FCP detailed on k2av.com. If you have not read the "Taming" and "Field Adjustable IsoT" articles on k2av.com, please do so. *Make sure the date above matches the date at k2av.com/FieldAdjIsoT.pdf*. If not, destroy this copy and print k2av.com/FieldAdjIsoT.pdf from the web site. The web site article and pdf is updated from installer experience. This printed text is only intended as a copy/reminder for use up a ladder at the IsoT site, not as a permanent reference document. *Highlighted* text highlights tests and branches in the procedure or points out various *issues and warnings*.

DO NOT SUBSTITUTE OTHER CORES. These pages *only apply to a T400A-2 (or Micrometals T400-2D)* #2 powdered iron core (4" diam, 1.3" thick, red on 3 surfaces and gray on one). *Do not use* T400-2 (0.625" thick), multi-core stacks, other core materials/sizes, to avoid various issues.

WHILE TESTING USE THE SPECIAL COAX JUMPER between analyzer and IsoT *with clip lead connecting the jumper shield to shack feedline coax shield*. See k2av.com/SpecialJumper for illustration and text. Using the special jumper ensures your adjustments account for the effect of the aerial's vertical wire inducing RF common mode current (CMC) on the feedline shield.

Before measurements, coax and connections all the way from transmitter to FCP/aerial wire should be final ready-to-TX-for-contests-and-DX, except for jumper to RF analyzer and the shack coax center conductor unconnected at the IsoT. Then R+jX seen by feed coax will match R+jX seen by RF analyzer. Induction effect can be seen and measured by R+jX change with clip connected and then disconnected.

Unsatisfied with amount of induction-caused change? It can cause noise on RX, RFI and hidden RF loss. Reduce induction before IsoT field adjustment. Reducing induction will change the starting R0, F0 values, likely requiring different turn and length adjustment. There is a simple fix if coax length is near or less than a physical 1/4 wave (130 feet,40m) or less from IsoT to first encountered ground (frequently a grounded dwelling entry lightning arrestor). Insert a *designed-for-160* ferrite CMC block at antenna side of grounding. Or construct one from http://k9yc.com/2018Cookbook.pdf *Only use K9YC specified materials according to his instructions.*

DO NOT USE SWR TO ADJUST WINDING TURNS RATIO - USE R and X. Use an RF analyzer showing resistance and *signed* reactance. Best to use graphic display of both R and ±X like "R,X" display on Rig Expert graphic analyzers. The "X" line crossing 0 on the graph gives a sharply defined X=0 frequency (F0) to accurately measure R0 (RF resistance at frequency where reactance is zero). F0 and R0 are required to accurately determine any antenna or turns adjustment. If you need to, borrow or purchase an appropriate instrument, or enlist an owner to assist.

MAKE MEASUREMENTS AT COAX SIDE OF IsoT AT ANTENNA FEED POINT.
Use intended final coax and wire connections shack to FCP/aerial other than special jumper at IsoT. *To measure with an RF analyzer in the shack, you will need total* coax lengths IsoT to analyzer *to be a *measured* *exact* *electrical* half-wave multiple at F0 to measure in the shack.* Otherwise R and X are transformed and unusable without advanced knowledge, procedures, equipment and software. Some analyzers come with these. Consult manufacturer's documentation on "calibration".

DON'T EVEN THINK ABOUT REMOVING MULTIPLE TURNS AT SAME TIME by extrapolating from initial R+jX readings at the IsoT coax jack. *Unwinding an IsoT turn or changing the horizontal wires's length can change F0 and R0 in a non-linear manner, defeating in-advance extrapolations. Transformers have been ruined trying to do everything at once, needing a complete rewind to repair.* Carefully follow procedure below, *one turn at a time.* Your QTH FCP/IsoT/aerial *system* is unique. Unwinding an IsoT turn may or may not change F0. Reducing horizontal wire length may or may not change wire end capacitance to surroundings, effecting R0. *WE CANNOT RELIABLY PREDICT the exact R+jX variance **YOUR** turn and horizontal wire changes will generate at **YOUR UNIQUE** QTH. Remove only one turn at a time, remeasure and recycle through the "Adjust" procedure if needed.*

23:27 Turns IsoT, ~36Ω:50Ω, Field Adjustable ~27Ω-46Ω:50Ω

Start Connect Aerial/FCP to IsoT in the manner and location you intend to keep. Connect RF analyzer graphing R,X to IsoT output using special jumper, with clip lead clamped to body of shack coax connector. *Other than special jumper at IsoT, coax shield connections all the way from transmitter to IsoT should be in the final operating configuration.* Test whether degree of R,X change is acceptable first measuring with clip-lead *on* the shack coax shield, then *off*. **If unacceptable, remedy before any adjustment of the IsoT.** See k2av.com/FieldAdjIsoT for expanded text and illustrations.

Confirm X=0 at desired center frequency (F0). If X=0 not close enough, adjust far end drooper/horizontal wire, re-graph R,X. Repeat as needed. Measure R at F0 (R0). If 49Ω ≤ R0 ≤ 51.5Ω, **you are finished. Otherwise…**

If R0 < 49Ω, record this R0 value and "1234". *You may only use turn schemes (1)(2)(3)(4) for entire procedure.* Adjust turns *only in the Aerial/FCP (A) winding*

If R0 > 51.5Ω, record this R0 value and "1567". *You may only use turn schemes (1)(5)(6)(7) for entire procedure.* Adjust turns *only in the coax feed (O) winding*.

Adjust Unwind *one* turn only. Fold, do not coil or cut excess now. Re-graph R,X. Record R0/turn scheme. **If now 49Ω ≤ R0 ≤ 51.5Ω,** go to [Clean Up X]

IF turn unwind has taken R0 too far, and/or you would rather have the prior value, unfold wire and rewind the turn, re-graph R,X to confirm prior R0. **Go to** [Clean Up X]. **Otherwise, go to** [Adjust] to remove another turn.

Clean Up X Removing folds may move X=0 point. **If still close enough to F0, you are finished. Otherwise** adjust far end drooper/horizontal wire, re-graph R,X. Repeat as needed. **If still 49Ω ≤ R0 ≤ 51.5Ω you are finished.**

23:27 Ratio IsoT Turns Scheme Diagram, Covers Range 27Ω-46Ω : 50Ω

AAAA = Aerial/FCP Winding Turns OOOOO = Coax Winding Turns

<- Aerial Wire, Coax Center Conductor Connections FCP, Coax Shield Connections ->

As Originally Wound 23:27 Ratio, Roughly 36Ω transformed up to 50Ω:

(1) Four OO turn pairs skip an A turn to create 23:27 turn winding

Remove A A A end turns only, OR O O O end turns only for more turns ratios:

(2) A This end-turn removed for 22:27 ratio, roughly 33Ω:50Ω

(3) A A These two end-turns removed for 21:27 ratio, roughly 30Ω:50Ω

(4) A A A These three-end turns removed for 20:27 ratio, roughly 27Ω:50Ω

(5) O This end-turn removed for 23:26 ratio, roughly 39Ω:50Ω

(6) O O These two end-turns removed for 23:25 ratio, roughly 42Ω:50Ω

(7) O O O These three-end turns removed for 23:24 ratio, roughly 46Ω:50Ω

"A" turns removed: 50 then 48 then 2. "O" turns removed: 1 then 3 then 49.

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22:28 Turns IsoT, ~31Ω:50Ω Field Adjustable ~23Ω-39Ω:50Ω

Start Connect Aerial/FCP to IsoT in the manner and location you intend to keep. Connect RF analyzer graphing R,X to IsoT output using special jumper, with clip lead clamped to body of shack coax connector. *Other than special jumper at IsoT, coax shield connections all the way from transmitter to IsoT should be in the final operating configuration.* Test whether degree of R,X change is acceptable first measuring with clip-lead *on* the shack coax shield, then *off*. **If unacceptable, remedy before any adjustment of the IsoT.** See k2av.com/FieldAdjIsoT for expanded text and illustrations.

Confirm X=0 frequency (F0) is at desired center frequency. If not close enough, adjust far end drooper/horizontal wire, re-graph R,X. Repeat as needed. Measure R at F0 (R0). If 49Ω ≤ R0 ≤ 51.5Ω, **you are finished. Otherwise…**

If R0 < 49Ω, record this R0 value and "1234". *You may only use turn schemes (1)(2)(3)(4) for entire procedure.* Adjust turns *only in the Aerial/FCP (A) winding*.

If R0 > 51.5Ω, record this R0 value and "1567". *You may only use turn schemes (1)(5)(6)(7) for entire procedure.* Adjust turns *only in the coax feed (O) winding*.

Adjust Unwind *one* turn only. Fold, do not coil or do not cut excess now. Re-graph R,X. Record R0/turn scheme. **If now 49Ω ≤ R0 ≤ 51.5Ω**, go to [Clean Up X]

IF turn unwind has taken R0 too far, and/or you would rather have the prior value, unfold wire and rewind the turn, re-graph R,X to confirm prior R0. **Go to** [Clean Up X]. **Otherwise, go to** [Adjust] to remove another turn.

Clean Up X Removing folds may move X=0 point. **If still close enough to F0, you are finished**. **Otherwise** adjust far end drooper/horizontal wire, re-graph R,X. Repeat as needed. **If still 49Ω ≤ R0 ≤ 51.5Ω you are finished.**

22:28 Ratio IsoT Turns Scheme Diagram, Covers Range 23Ω-39Ω : 50Ω

AAAA = Aerial/FCP Winding Turns OOOOO = Coax Winding Turns

<- Aerial Wire, Coax Center Conductor Connections FCP, Coax Shield Connections ->

As Originally Wound 22:28 Ratio, Roughly 31Ω transformed up to 50Ω:

(1) Six OO turn pairs skip an A turn to create 22:28 turn winding

Remove A A A end turns only, OR O O O end turns only for more turns ratios:

(2) A This end-turn removed for 21:28 ratio, roughly 28Ω:50Ω

(3) A A These two end-turns removed for 20:28 ratio, roughly 25Ω:50Ω

(4) A A A These three-end turns removed for 19:28 ratio, roughly 23Ω:50Ω

(5) O This end-turn removed for 22:27 ratio, roughly 33Ω:50Ω

(6) O O These two end-turns removed for 22:26 ratio, roughly 36Ω:50Ω

(7) O O O These three-end turns removed for 22:25 ratio, roughly 39Ω:50Ω

"A" turns removed: 50 then 48 then 2. "O" turns removed: 1 then 3 then 49.

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