



**RADIO ASTRONOMY CENTRE
NATIONAL CENTRE FOR RADIO ASTROPHYSICS**

INTERNAL REPORT NUMBER: NCRA-OOTY/R301

**PROCEDURE TO BE FOLLOWED AFTER DIFFERENTIAL SYNCHRO
ERROR VOLTAGE SYSTEM TRIPS THE POWER SUPPLY TO ORT**

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OBJECTIVE: To describe the set of activities to be followed with ownership details for Restoring the power supply to ORT after differential synchro error voltage system trips the power supply to ORT

APPROVAL BLOCK		
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SUMMARY

ORT (ooty Radio telescope) commissioned in the early of 1970 in 11.25 degree slope and 530 meter long. It includes total 4nos drive platforms, servo platform and 20nos non drive platform and each platform is connected with each other using 4 inch drive pipe shaft. One of the safety systems available with ORT is differential synchro error voltage system. It is designed to trip the power supply to ORT when the radial misalignment between the drive pipe shafts is equal or more than 90 degree.

Main intension of this document preparation is to describe the step by step procedure to be followed to restore the power supply to ORT after differential synchro error voltage system trips the power supply to ORT.

All activities are described with ownership details and followed by annexures and appendix.

If the Differential synchro trips the power supply to ORT, then follow this SOP.

Encoders are set to trip the power supply to ORT @ 60 degrees of the over travel of the drive shaft pipe

Differential Synchro's are set to trip the power supply to ORT @ 90 degrees of the over travel of the drive shaft pipe.

STEP	ACTIVITY DETAILS	RESPONSIBILITY
1a	Inform to Mechanical,Electrical,Electronics departments immediately after differential synchro trips the power to ORT	Observer
1 b	Inform the status of ORT rotation during which this above trip occurred (whether it is during TRACK or SLEW)	Observer
2	<u>If ORT tripped at track mode,</u> the discontinuity shall be exist between N12 and S12 anywhere (please refer appendix I)	Electronics, Electrical & Mechanical Dept & Observer
3	<u>If ORT tripped at slew mode,</u> the discontinuity shall be exist between N12 and N10 OR S10 and S12 only. (please refer appendix I)	Electronics, Electrical & Mechanical Dept & Observer
4	Reason to be identified for Encoder malfunction	Electronics, Electrical & Mechanical Dept & Observer
5	Rectification work for Encoder malfunction shall be done parallel to discontinuity identification work and detailed report shall be generated for Encoder malfunction.	Electronics
6	Discontinuity shall be identified visually from ground level at first.	Electronics, Electrical & Mechanical Dept &

	(If discontinuity identified then follow from STEP 11) (However, Check for both Differential synchro wire cables and connection to circuits & confirm all the connections are proper.)	Observer
7	If discontinuity is not identified by STEP6 , then all platforms (as mentioned in above situations) shall be thoroughly inspected by all the RAC Staff till the cut-location OR the problem is identified. (If discontinuity identified then follow from STEP 11)	Electronics, Electrical & Mechanical Dept & Observer
8	If discontinuity is not identified by STEP7 , then first and last trial can be taken after clearance from all department and followed by approval from RAC HEAD	Electronics, Electrical & Mechanical Dept & Observer
9	After approval from RAC HEAD, both encoder and differential synchro shall be reset in system and software to provide power supply to ORT.	Electronics, Electrical Dept
10	After power supplied to ORT, first and last trial can be taken in track mode, with individual person standing in each tower platform	Electronics, Electrical & Mechanical Dept & Observer
11	After discontinuity is identified, Rectification work shall be carried out through Drive pipe shaft replacement procedure to restore the ORT to its operating condition.	Electronics, Electrical & Mechanical Dept
12	After rectification work Annexure A to be signed by concern department to obtain approval to follow STEP 11 .	Electronics, Electrical & Mechanical Dept
13	A) Encoder & Differential synchro shall be reset in system and software to bring the power to ORT and Annexure B shall be filled B) Trial rotations should be taken both in Track & Slew modes in presence of All the Section Heads.	Electronics Dept Observer
14	After satisfactory trial testing, bring ORT to west limit position & measure Q- Height READING & Compare it with old recorded values. Annexure-C Shall be filled & signed by all the concerned. <u>Now onwards, these new set of Q-Height readings will now be the base readings.</u>	Observer, Mechanical, Electrical & Electronics Dept.
15	ORT will be released for Observations.	Mechanical, Electrical & Electronics Dept
16	Detailed report is to be generated by all the concerned Dept section Heads & to be kept in records.	Mechanical, Electrical & Electronics Dept

ANNEXURE - A

All Rectification works are carried out & restored the ORT to its normal operating Condition.

Now we all certify that ORT be rotated to its west limit for Q-Height measurements.

WITNESSED BY DEPARTMENT	SIGNATURE	DATE
MECHANICAL		
ELECTRICAL		
ELECTRONICS		

ANNEXURE-B

ORIGINAL , TRIPPED, RESET ENCODER
VALUES

As per the SOFTWARE	S12 ENCODER		N12 ENCODER	
Encoder ORIGINAL READINGS (as on date:- _____)	No.of Rotoation	No. of Division	No.of Rotoation	No. of Division
At the time of trip (as on date:- _____)	No.of Rotoation	No. of Division	No.of Rotoation	No. of Division
After Reset (as on date:- _____)	No.of Rotoation	No. of Division	No.of Rotoation	No. of Division
NEW REFERENCE Encoder readings (as on date:- _____)	No.of Rotoation	No. of Division	No.of Rotoation	No. of Division

(Electronics)

(Mechanical)

(Electrical)

ANNEXURE – C

TOWER NO	Q –Height READING (mm) (after rectification works) <u>Date:-</u>	Q –Height READING (mm)OLD (17-01-2019)	REMARKS
N12		5435	
N11		2170	
N10		2165	
N9		2040	
N8		1690	
N7		1895	
N6		2130	
N5		1800	
N4		1595	
N3		2180	
N2		2700	
N1		3305	
S1		3920	
S2		4450	
S3		3110	
S4		2790	
S5		2915	
S6		3242	
S7		3425	
S8		3125	
S9		2450	
S10		2035	
S11		2080	
S12		1650	

- Q – Readings are found satisfactory and ORT can be operated.
- ORT is herewith released for observations.

(Mechanical)

(Electrical)

(Electronics)

APPENDIX I

To examine the response of DIFFERENTIAL SYNCHRO ERROR VOLTAGE SYSTEM based upon the various cut locations of drive pipe shaft, trial was taken in test bench by disconnecting the respective coupling to create the drive pipe shaft cut scenario at respective location as below,

EAST to WEST rotation of ORT in SLEW MODE:

DRIVE PIPE SHAFT CUT LOCATION	MODE	RESULT
BETWEEN N4 TO S4	SLEW	NO Tripping
BETWEEN N4 TO N10	SLEW	NO Tripping
BETWEEN N10 TO N12	SLEW	Tripped
BETWEEN S4 TO S10	SLEW	NO Tripping
BETWEEN S10 TO S12	SLEW	Tripped

WEST to EAST rotation of ORT in SLEW MODE:

DRIVE PIPE SHAFT CUT LOCATION	MODE	RESULT
BETWEEN N4 TO S4	SLEW	NO Tripping
BETWEEN N4 TO N10	SLEW	NO Tripping
BETWEEN N10 TO N12	SLEW	Tripped
BETWEEN S4 TO S10	SLEW	NO Tripping
BETWEEN S10 TO S12	SLEW	Tripped

EAST to WEST rotation of ORT in TRACK MODE:

DRIVE PIPE SHAFT CUT LOCATION	MODE	RESULT
BETWEEN TRACK PLATFORM TO N4	TRACK	Tripped
BETWEEN N4 TO N10	TRACK	Tripped
BETWEEN N10 TO N12	TRACK	Tripped
BETWEEN TRACK PLATFORM TO S4	TRACK	Tripped
BETWEEN N4 TO S10	TRACK	Tripped
BETWEEN N10 TO S12	TRACK	Tripped

Above results were obtained from ORT test bench setup and it will be helpful in identifying the drive pipe shaft cut location by just knowing the direction of rotation and mode of operation of ORT.