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**TECHNICAL DETAILS**

**OF**

***SAITRONIX***

***Electro Drives pvt Ltd***

**DIGITAL NOTCH INDICATOR**

**for 25 KV AC Locomotives**

**TYPE SNI 135 EAZ (DC-DC)**

Date: 20-11-2003

Rev.0

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## **INTRODUCTION:**

Saitronix introduces Digital Notch Indicator Type SNI 135 EAZ(DC-DC) with DC-DC converter by using the State of Art Technology to provide accurate Notch position indication for 25 KV AC Electric Locomotives having N.32 Tap Changer. It is designed to withstand severe shocks and vibrations encountered in loco service and special care has been taken in design to withstand wide Voltage fluctuation ( $\pm$  22.5%) in AC and DC mains supply to avoid damage to the equipment.

The Digital Notch Indicator is designed with time proven electronic hardware and programmed with specially designed software to display correct Notch numbers. It is also capable to identify, display, and record all faulty DJ trip and half Notch events with data retrieving facility from its memory. It is in fact works like black box for tap changer and the recorded data is very useful to loco maintenance personnel to diagnose tap changer to avoid loco failures.

## **SPECIAL FEATURES:**

The DNI is having the following many user-friendly built-in special features.

- Half Notch / Notch Sticking events identification, indication, recording and data retrieving facility from memory.
- DJ trip events at all Notch positions will be indicated and recorded.
- Auto zero set facility in NR with reference to SMGR zero notch position to nullify drift in electrical zero position of transmitter while fixing it to SMGR.
- Compatible to use with either ABB or GENZ types of SMGR by simply selecting required mode on terminal block. The selected mode will be indicated on Display panel.
- Last notch will be displayed whenever DJ opens and automatically resumes normal notch indication after closing of DJ
- Totally inter changeable with existing ECIL make Notch indicators. No need for any modifications in loco cabin or in loco wiring.

## **TECHNICAL DESCRIPTION:**

The Digital Notch indicator can be functionally divided to two models.

1. Synchro Torque transmitter - 1 No.
2. Digital Notch Repeaters - 2 Nos.

The Synchro torque transmitter is a positioning device, when energized with its rated voltage – generates a set of theoretical electrical voltages corresponding to every physical position of its rotor.

The Digital Notch repeaters convert analog voltage signals from synchro transmitter into digital angles and process the data to display the notch numbers. The Digital Notch repeater is having the following four sub-modules.

- (a) Synchro to Digital conversion module.
- (b) Micro Controller module.
- (c) Display module.
- (d) Power Supply and protection module.

### **(a) Synchro to Digital Conversion Module :**

The Synchro to Digital converter requires five wire input supply i.e. R1, R2 through internal power supply (110V AC) and S1, S2, S3 Synchro voltage signals from Synchro Transmitter. These voltage signals are converted into digital form in a particular format suitable to convert the data into notch numbers.

An extensive data has been collected while performing various tests on **SMGR – Synchro – Repeaters** in finalizing components to get required resolution, accuracy with reference to the speed of Notch movements to achieve best performance.

### **(b) Micro Controller Module :**

The Digital data generated in the Synchro to digital conversion module is further processed by the micro controller into a particular format suitable for display module to display various numerical functions. Further the Controller is programmed to do the following functions.

**(i) Half Notch display and record function:**

The Controller is programmed to read and monitor the movements of SMGR through Synchro transmitter- whenever SMGR is failed to move to the specified angle at specified time the controller will identify the wrong location of G.R. contact arm and notify to the driver about half notch / notch sticking position corresponding to the present notch number with the help of up/down ( $\uparrow \downarrow$ ) arrow marks on display. It also records the event with arrow mark corresponding of that particular notch.

**(ii) Auto Zero Set Function:**

The Controller is programmed with specified angular values of both types of SMGR's. Once user selects the required SMGR Model (ABB or GANZ) and actuate the zero set switch by keeping SMGR in zero position, then the controller will consider the position of transmitter as zero. Thereafter after any increment in angle or movement will be computed corresponding to the SMGR model selected and instructs the display module to display the relevant notch numbers.

**(iii) D.J Trip Events Identification:**

The Controller is programmed to identify power off conditions at all the notch positions and instruct the display module to glow the flashing LED marked it as D.J. Trip. It also records this event and stores it in the memory.

**(iv) Retrieving data from Memory:**

The Controller is programmed to retrieve stored data in its memory with the help of memory up / memory down keys provided in keypad. The user can activate either memory up key to read the recorded data from its current Notch display to latest event or alternatively he can activate memory down key to read to events from latest to old records. The important feature of this digital notch repeater is that the user can have access to memorized data on loco by energizing Digital Notch repeater with 110V DC and or on test bench without closing DJ.

**(v) Memory Erase:**

The recorded events can be deleted from memory by activating erase switch provided in the Key pad. However to erase data certain conditions should be accomplished to avoid access to unauthorized person to perform this function. For details please refer to our instructions and maintenance manual.

**(c) Display Module:**

This module displays the Notch numbers with up / down arrows to indicate half Notch events. The Display module has a set of LEDS indicating current SMGR mode i.e ABB / Genz, D.J. trip events with the flashing LED and half notch record / not record mode with another set of LEDs etc.

Whenever traction power goes off or power is switched off Display will continue at that particular position as long as 110VDC is available in Loco.

**(d) Power Supply & Protection Module :**

The Power Supply & Protection module has been designed to meet the entire power requirements of Digital Notch Display unit with built in protection circuits. This module derives complete power requirement from the 110 VDC power from loco Battery through DC-DC converter of NR. However 110AC power is also required to R1 & R2 terminals of Synchro Transmitter to generate voltage signals to measure angular positions of SMGR. Further this module and its internal circuits are designed to withstand  $\pm 22.5\%$  AC& DC mains line fluctuations.

**SAITRONIX SYNCHRO TRANSMITTER**  
**SPECIFICATIONS/TECHNICAL DATA**

1. Type		23 TX 5b
2. Function		TX
3. Primary voltage	Volts	100/110
4. Primary/input frequency	Hz	50/60
5. Primary current (max)	milliamps	230 @no load
6. Transformation ratio		90v ±3v
7. Electrical error (max)	Minutes	16
8. Torque grad.	(g-cm/deg.min)	7.5
9. Temperature rise (max)	deg-centi.	60
10. Insulation resistance (min)	MΩ min	10 (DC 500V)
11. High potential (1 minute)	volts	1000
12. Friction torque	Gms-cm	25

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**DIGITAL NOTCH REPEATER**  
**TECHNICAL SPECIFICATION**

1. Input voltage	110 volts ac ±22.5% &110 VDC
2. Power consumption (max) at 110 VDC	< 15 milli amps
3. Sensitivity	
a. Accuracy in Synchro angle sensing	better than 0.1 degree
b. Resolution of angle sensing	better than 0.02 degree
c. Zeroing Synchro angle	at ±0.1 degree
4. Load on Synchro at 110 volts	<10 mille amps
5. Dimensions (LWXH) in mm	175 x 175 x 101 mm

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# **CONGRATULATIONS!!!**

You're our esteemed customer to use the advanced state of art digital notch indicator from Saitronix electro drives pvt Ltd. Here are few useful tips for correct installation of digital notch indicator to experience real technical advantage.

## **What to do before DNI installation**

Please route 110 volts AC input supply to notch indicator through QV60 relay spare NC interlock to cutoff power instantly whenever power trips. This is must for DNI to record precisely half notch and DJ trip events. This modification is one time effort useful for not only to digital indicator also to ECIL NR. It will help you to identify precisely at which notch number the loco was failed.

## **How to install synchro transmitter**

Now go ahead by coupling transmitters on to SMGR by keeping it in zero notch position as you do earlier. Please check for the transmitter-mounting studs are in good shape and are in equal height. Please ensure to connect synchro-connecting lever to SMGR pin at its arrow marked slot. Now do the electrical wiring as per loco wiring diagram. Please don't interchange S1 and S3 terminals at transmitter since NR's will show notch numbers in reverse direction.

## **How to install digital notch repeaters**

It's now time to install NR's in loco cabins. Please remove mounting bracket from NR. Now connect loco cables 169, 170, 171, 172 & 173 to R1, R2, S1, S2 & S3 respectively on to 5-way terminal and 110 V DC to 2-way terminal from loco battery available at the bottom of each NR and switch on loco battery. You will observe that the digital notch repeater (DNR) will indicate notch number, present SMGR make (ABB/GNZ) and record/not record mode with LEDs indication on its display panel.

## **How to select SMGR model in DNR**

By default NR work under ABB mode. If you are using GENZ make SMGR please remove cover on control terminal located at the bottom of NR and short the terminals as shown on the label to its side to get into GENZ mode.

## **How to do zero setting in DNR**

It's very simple! Close the DJ and NR may show some random notch number or may sometimes even zero. Please remove nameplate screws. At its underneath you will find keypad having four keys. Please keep SMGR/GR in zero position and press gently 'zero set' switch and hold for 15 seconds – you will get zero on display. Please remember that you should set NR

to zero position only when the DJ is in closed condition and keeping GR in zero notch position.

## **How to select half notch record or not record mode in DNR**

By default DNR will always in half notch record mode. If you want to bypass half notch record mode, please short the terminals on control TB at the bottom of DNR as shown on its label. However DJ trip events can't be bypassed.

Please remember half notch events are displayed with arrow mark LEDs which will appear only when SMGR/ GR fails to move from one notch to another within specified time and distance. The blinking LED on display has been marked as DJ trip, which will glow only when power off condition occurs other than at zero notch position.

## **How to read& erase memory in DNR**

The digital notch repeater memorizes faulty conditions in loco like half notch and DJ trip events at other than zero notch positions. If you want to go through recorded events, unscrew the name plate-underneath you will find keypad. Please energize loco and press 'memory up' or 'memory down' key to scan through recorded data. Alternatively you can take DNR to your test room and connect 110VDC to its two-way terminal to read memory.

**Do you want to erase data? Yes! It can be.**

1. On Loco: If you want to erase memory in loco- Pl. open DJ and also switch off loco battery (LT OFF). Now switch on Loco battery. Unscrew name plate on DNR and press hold 'Memory erase' & 'zero set' buttons simultaneously till you read zero and double arrows on display to erase old data in DNR.
2. In Test Room: If you want erase old data in test room – Simply connect 110VDC supply to 2 way terminal located underneath DNR and press hold 'Memory erase' & 'zero set' buttons simultaneously till you read zero and double arrows on display.

**NOTE:** Please keep it confidential and don't disclose the above info to unauthorized persons who may erase your useful data.

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**S A I T R O N I X**

**D I G I T A L   N O T C H  
I N D I C A T O R  
F O R 2 5 K V A C L O C O S**

**T Y P E : S N I 1 3 5 E A Z ( D C - D C )**



**Doc. No : DNI AC-INST-1      REV -1**

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## **DIGITAL NOTCH INDICATOR SNI135EAZ (DC-DC) TROUBLESHOOTING**

**Caution:** Trouble shooting should be done by only qualified personnel with proper care and with suitable instruments. Improper handling may result in damage to equipment and leads to electrical shock and may cause injury or loss of life!

### **1. NO DISPLAY**

#### POWER BOARD

- Check availability of 110V DC at 2 way terminal block.
- Open the Digital Notch Indicator cover and check the following things.
- Check for the continuity from 110 VDC from 2 way terminal block to pin no. 8&9 of J2 connector on the power board.
- Check for 110 VDC at pin 5 of T1 (SMPS) transformer with respect to ground.. If voltage is not coming check healthiness of TH1 and line filter LF1. If any one of these found defective change that component.
- Check the out put voltage 5.0 VDC (of DC-DC converter) at TZ1 cathode with respect to ground at TZ1 Anode. If voltage is not coming than change the power board.

#### CONTROL BOARD

- Check for the voltage 5.0 VDC at 3rd pin of J3 connector with respect of ground at 4<sup>th</sup> pin of U6 IC and if it doesn't exist then press J3 connector to its base and check the voltage again. If still problem persists than change the control board and check again.

#### DISPLAY BOARD

- Check for 5.0 VDC at 14<sup>th</sup> pin of J10 connector with respect to ground at 4<sup>th</sup> pin of U6 IC. If it did not exist than press J10 female to its base and check again. If still problem continues than change eck again.
- Still problem persists change the Display Board.

## **2. INCORRECT NOTCH NUMBERS**

Check for the proper connections at S1, S2, S3 terminals of 5way terminal at digital NR and also at transmitter.

- Check for the proper selection of Mode at ABB/ GANZ terminal.
- Check the continuity of the wiring from the S1, S2, S3 terminals to J2 connector of the Power Board.
- If the above things are O.K keep the SMGR in zero position and press and hold the Zero set switch on key pad till you get zero on display.
- Check for any loose contacts at PCB interconnecting connector between Power board and Controller Board.
- Press the IC, s into their corresponding bases on the Controller Board.
- Still the problem persist change the Controller Board.

## **3. DNI HANGED**

- Switch off 110VDC supply and turn on with 110VDC the system after the Display goes off.
- Check the R1, R2, S1, S2, S3 connections at the corresponding terminals
- Check for any loose contact at PCB interconnecting connector (J3 & J1).
- Change the Controller (U7) and check the system.
- Still the problem persists, Change the Controller Board and checks the system.

## **4. MEMORY UP/MEMORY DOWN IS NOT WORKING**

- Check the continuity from 5<sup>th</sup> pin of keypad to 4<sup>th</sup> pin of J5 connector for memory up and 4<sup>th</sup> pin of keypad to 3<sup>rd</sup> pin of J5 connector for memory down with the multimeter.
- Check Memory up/Memory down switches function by checking the continuity from 1<sup>st</sup> pin of keypad to 5<sup>th</sup> pin of keypad (for Mem-up) and 1<sup>st</sup> pin of keypad to 4<sup>th</sup> pin of keypad (for Mem-Down) by pressing the respective switch.
- Still problem exist change the keypad.
- Still problem exist change the Controller Board.

## **5. Zero set is not working.**

- Check the continuity of the Zero Set switch from the 2<sup>nd</sup> pin of keypad to 5<sup>th</sup> pin of J5 connector with the multimeter
- Check Zero Set switch function by checking the continuity from 2<sup>nd</sup> pin of keypad to 1 pin of keypad by pressing the Zero set switch (on the keypad) with the multimeter.
- Still problem exist change the keypad.
- Still problem exist change the Controller Board.

## **6. MEMORY ERASE IS NOT WORKING**

- Please note that memory erase cannot be done in loco it should be done in test room only. And also please follow the installation instructions carefully to erase data in memory. However still if you have problems with memory erase check the following.
- Bring NR to test room and first check the continuity of the Memory Erase switch from 3<sup>rd</sup> pin of keypad to 2<sup>nd</sup> pin of J5 connector with the multimeter
- Check switch function by checking the continuity from 3<sup>rd</sup> pin of keypad to 1<sup>st</sup> pin of keypad by pressing the Memory Erase switch (on the keypad) with the multimeter.
- Still problem exist change the keypad.
- Still problem exist change the Controller Board.

## **7. NOT RECORD MODE SELECTION IS NOT WORKING**

- Ensure that the shorting wires are properly connected to get into not record mode at the control terminal.
- Check the continuity from 1<sup>st</sup> pin of J5 connector to 3 way terminal not record pin.
- Check the voltage 5.2 VDC at 4<sup>th</sup> pin of U7 IC with respect to ground at 4<sup>th</sup> pin of U6 IC. still the problem exist change the Controller Board.