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लखनऊ – 226011
Government of India - Ministry of Railways
Research, Designs & Standards
Organization, LUCKNOW - 226011

No. EL/11.5.5/3 Date: 30.10.09

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SPECIAL MAITENANCE INSTRUCTION No. RDSO/2009/EL/SMI/ 0260. (Rev.'0'), Dated. 30.10.09

1.0 Objective:

Instructions for development of testing set up of signal conditioning cards (SAP) and Sensors for three phase electric locomotives.

2.0 Introduction:

There are three signal conditioning cards (SAP) available in traction converter electronics. These are UAB 630A36, UAB 630A91 and UAB 630A93. Each signal conditioning card (UAB 630) gets six analog values from the various sensors such as current, voltage, temperature and pressure. via the front connectors to traction converter control electronics. Outputs of these sensors are processed/conditioned in the signal conditioning cards (SAP) in the converter electronics. After being conditioned the analog signals are routed via rack wiring to the appropriate device for further processing. Mal-operation of either sensor or SAP card itself is seldom of permanent nature and locomotive is found normal subsequently. Sometimes it is not possible to diagnose whether the sensor is faulty or the electronic card. In order to test and identify weather the sensor is faulty/calibration not proper or the card is faulty the instructions for development of in house testing of signal conditioning cards and sensors are being prepared so that on line locomotive failures can be avoided.

Following cards and sensors can be checked with this test set up.

A) Cards

1) UAB 630 A 36 (signal conditioning card for SLG of SR)
2) UAB 630 A 91 (signal conditioning card for NSC of SR)
3) UAB 630 A 93 (signal conditioning card of SR)
4) ARB 705 B 01 (signal routing board of SLG of SR)
5) UAB 514 B 33 (Analog I/O board of SR)

B) Sensors

1) Temperature sensors for SR,TFP&TM
2) Pressure sensors of SR & TFP
3) LEM current sensors
4) Voltage sensors D.C. Link & Earth fault Relay
5) Wandler module

3.0 Testing Set up:

Proposed test set up for signal conditioning cards (SAP) comprises one spare electronic rack of traction converter and vehicle control unit (VCU) each and a docking station to monitor values as sensed by electronics. SAP inputs or sensor outputs may be generated either by actual sensor or with the help of external voltage/current source of corresponding value. Actual values as would be sensed by locomotive are monitored on docking station. Defect either in the sensor or in the card can thus be identified. The basic block diagram of SAP card testing set up is shown in fig.1 and typical picture of test set up is shown in fig.2.

Test Setup comprises of the following:

- Spare SR Electronic Rack;
- Spare CEL Rack;
- Docking station; and
- Measurement Prints.

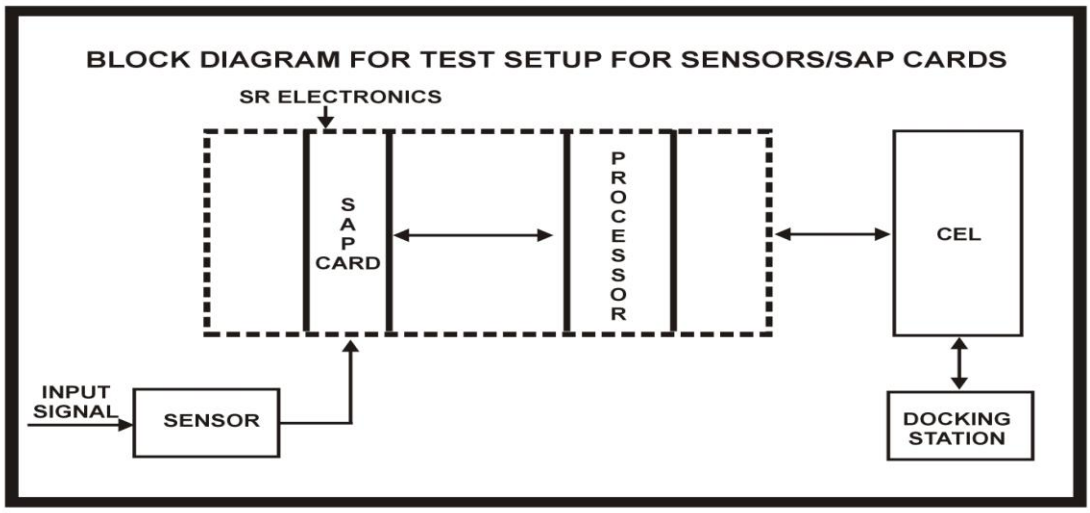


Fig.1

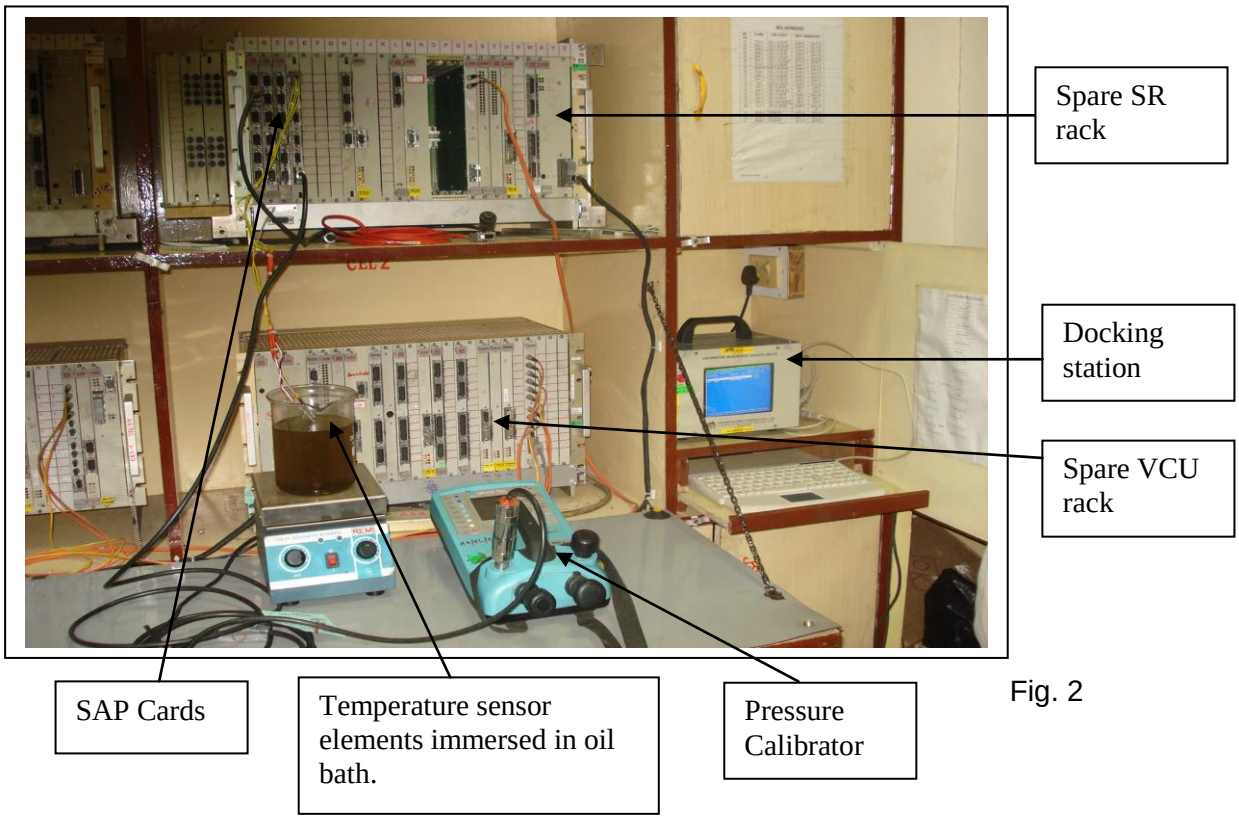


Fig. 2

4.0 Method of Testing: The inputs are generated with the help of external voltage/current source equivalent to actual input and the output is monitored on various test points on the cards with the help of various measurement print PCBs and on docking station. Signals and the cards involved for a particular sensor are identified. Related signals are selected on docking station for monitoring.

4.1 Test Set up for Temperature Sensors:

General set up for testing TM temperature sensors and associated cards is as shown in Fig. 3 below.

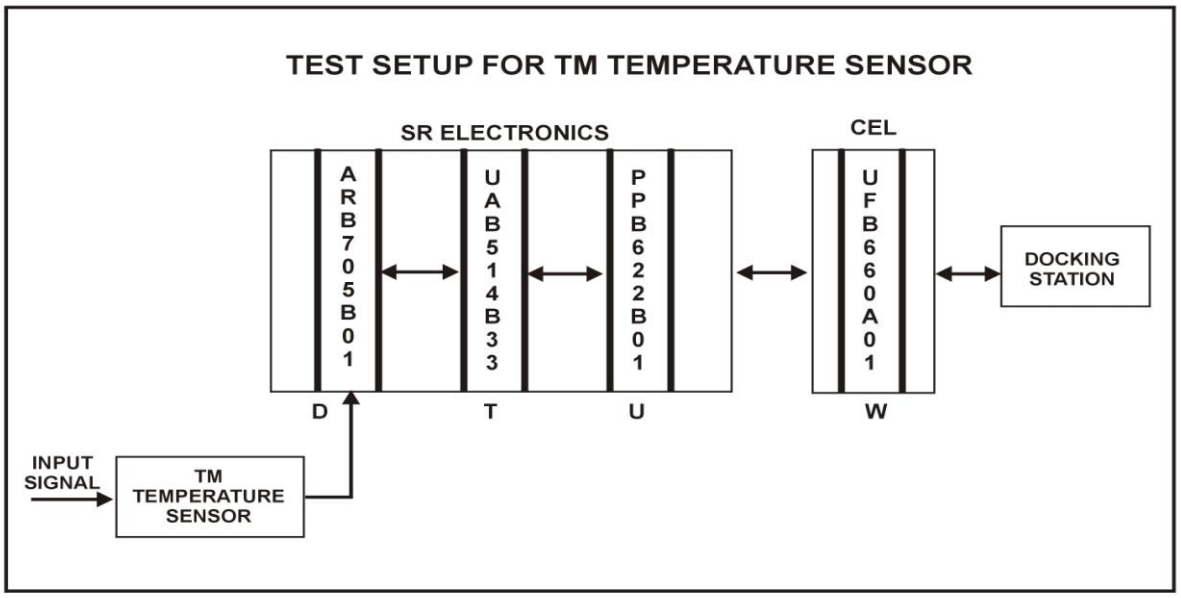
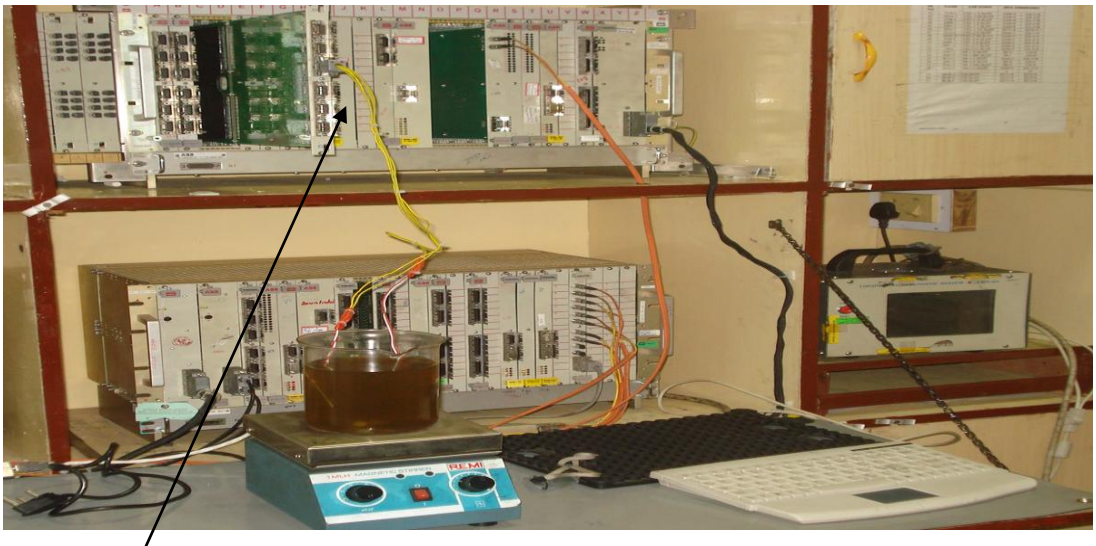


Fig.3

4.1.1 The input signal is simulated by heating the oil as in fig.4 below, by dipping temperature sensors in oil bath. The output of the temperature sensors is fed to ARB705B01 (D slot) as above. Further the data is processed through UAB514B33 & PPB622B01 in SR rack and through VCU electronics. It is further fed to docking station as shown in figure 3 & 4. Output values of the temperature sensor under test are measured and compared with standard values for healthy sensor. “Dist Temp sensor” message gets generated if the temperature difference between two elements is more than 10^0C.



ARB705B01 on extender

Fig.4

If the sensor element is PT-100, it has ohmic value of 100 Ohms at 0^0C and increases linearly with temperature. Resistance increases by 4 Ohms for temperature rise of 10^0C. Therefore, resistance value at 40^0C shall be 116 Ohms.

Values measured at different temperatures on docking station are shown in fig 5, 6, 7, 8 & 9 below:

Values recorded at docking station at 40^0C:

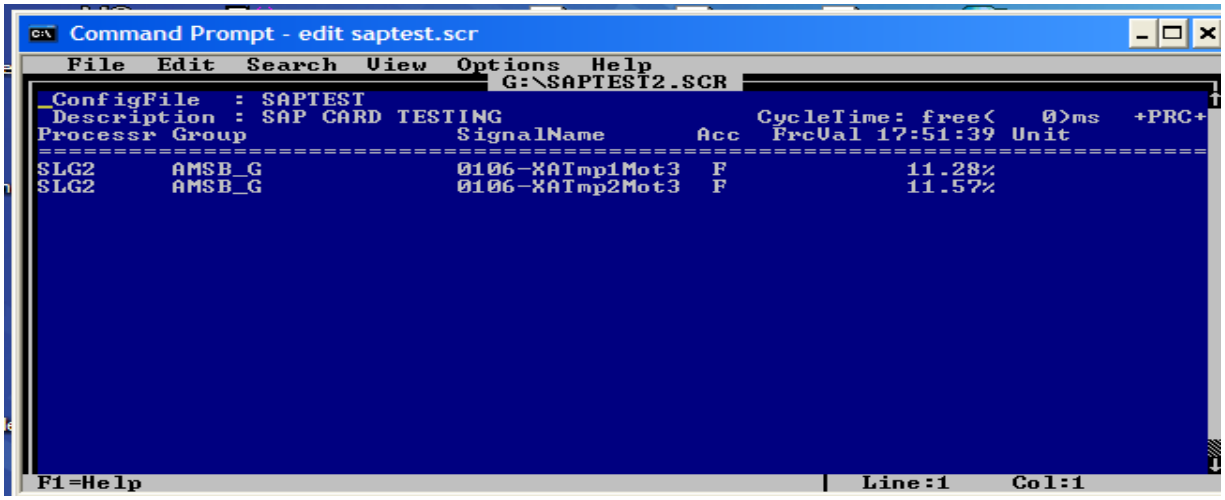


Fig 5.

Signal Value 11.28% = 112.8 Ohms

Actual Value 11.57% = 115.7 Ohms

Values recorded at docking station at 50^0C:

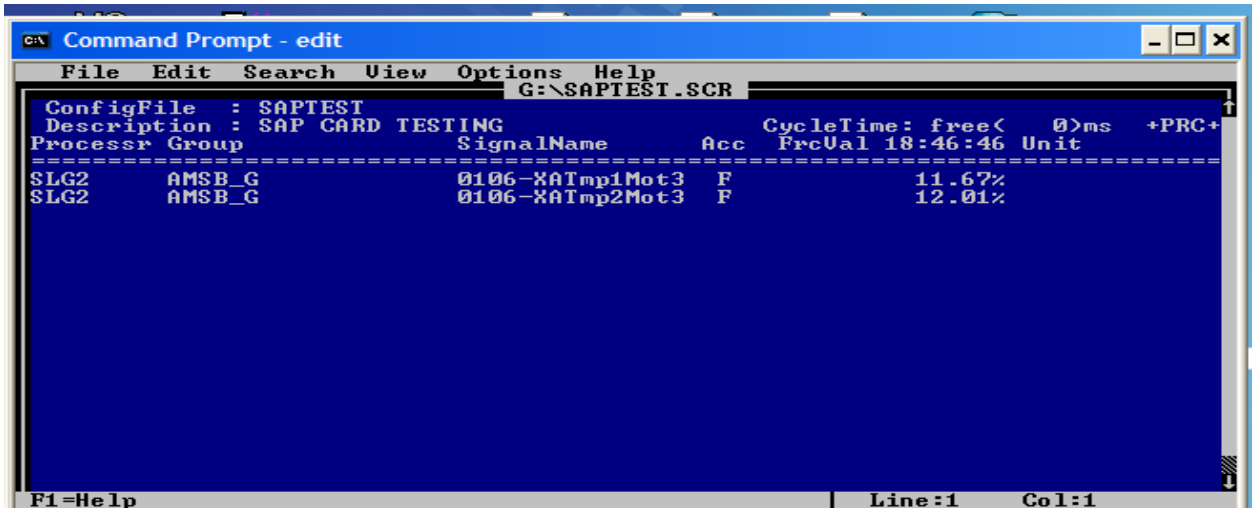
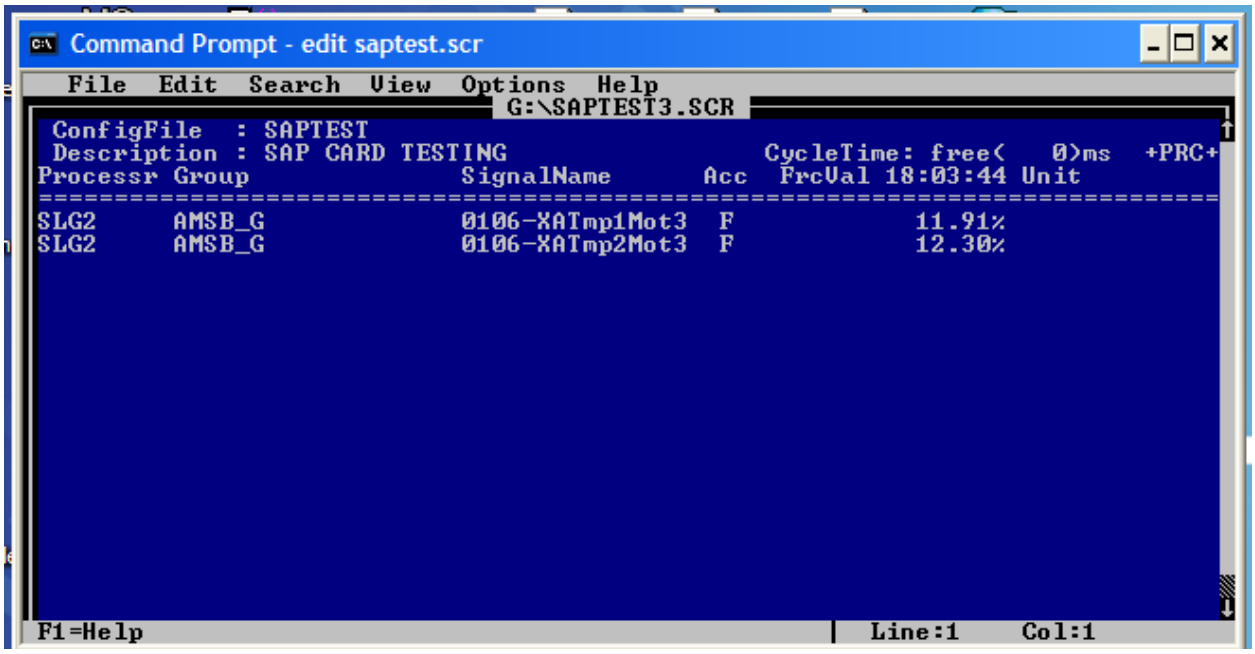


Fig.6

Signal Value 11.67% = 116.7 Ohms

Actual Value 12.01% = 120.1 Ohms

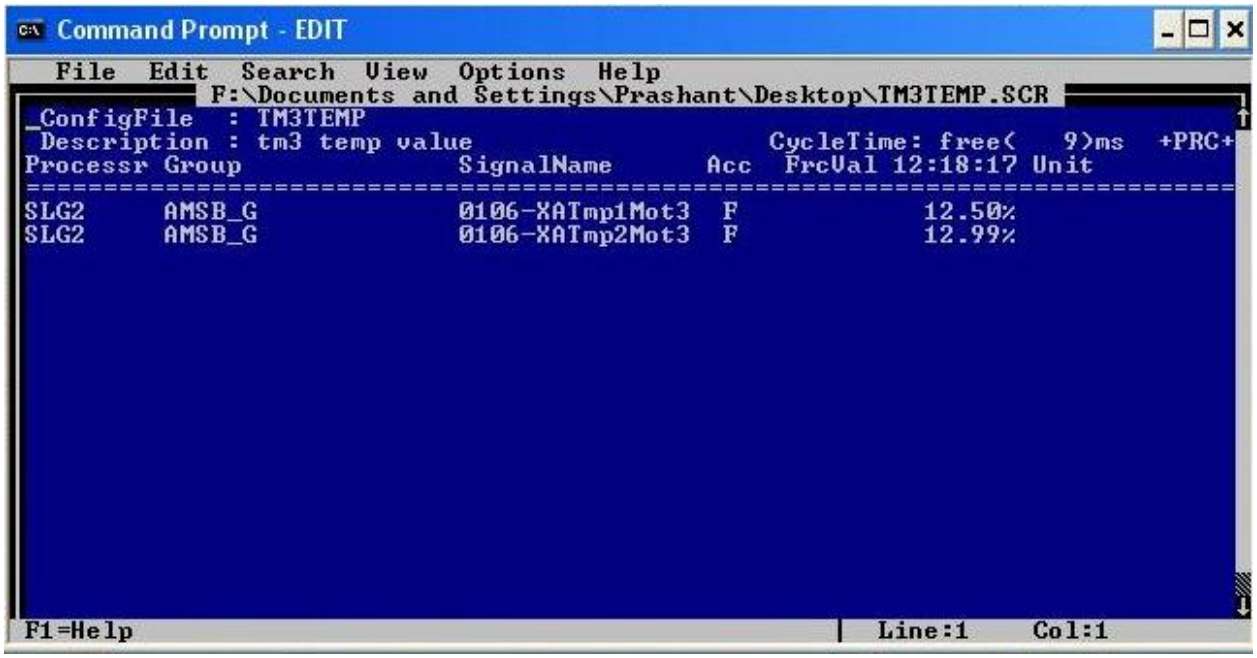
Values recorded at docking station at 60^0C:



Signal Value 11.91% = 119.1 Ohms Fig.7

Actual Value 12.30% = 123.0 Ohms

Values recorded at docking station at 70^0C:



Signal Value 12.5% = 125.0 Ohms Fig.8

Actual Value 12.99% = 129.9 Ohms

Corresponding output voltage values at card extender of card ARB705B01 are measured at following test points:

Element No.	Voltage measured between	Std Value at 40^0C
Element 1	Pin no 2a10 and 2b10	1.16 Volts
Element 2	Pin no 2a12 and 2b12.	1.16 Volts

Output on card will be dependent on the input value of the sensor. If SAP card output is found perfect, and there is no difference in values measurements, it indicates that there is no problem in SAP card. Else Particular section of SAP card is faulty and calls for further checking. SAP card output is fed to Analog I/O card (UAB 514 B33) for A/D conversion. Analog I/O (UAB 514 B33) card is then taken out on card extender to check output values on test point as shown in fig.9

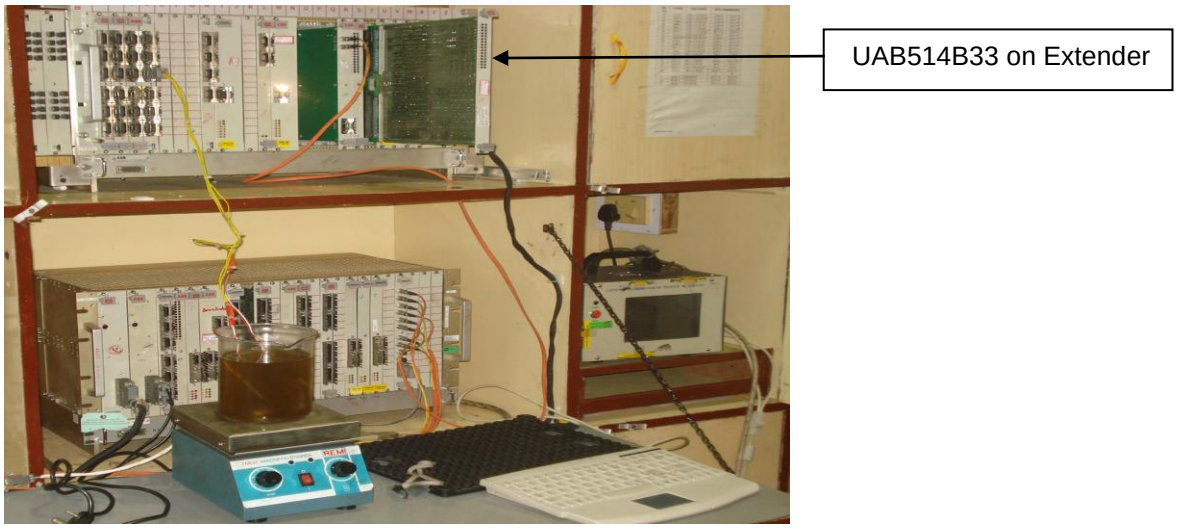


Fig.9

The values at the test points at card extender are measured in the form of voltage at following test points:

Element No.	Voltage measured between test point	Std Value at 40^0C
Element 1	403 w.r.t. ground	1.16 Volts
Element 2	304 w.r.t. ground	1.16 Volts

Values on Input test point are compared with values on output test points. If input and output are found different for a particular channel, it indicates fault on that particular channel. Card can then be taken up for further investigation and repair.

This data is then sent to SLG processor (PPB 622 B01) for further processing and communication to Multiple Bus Coupler (UFB 660 A01) in VCU.

If Output at UAB514 B33 is accurate and value is not shown on docking station, then SLG processor (PPB 622 B01) may be defective.

Similarly all three temperature sensors of traction motors and respective cards can be checked with the help of following signals.

TM-1 SLG- AMSB_0106-XATmp1Mot1

SLG- AMSB_0106-XATmp2Mot1

TM-2 SLG- AMSB_0106-XATmp1Mot2

SLG- AMSB_0106-XATmp2Mot2

TM-3 SLG- AMSB_0106-XATmp1Mot3

SLG- AMSB_0106-XATmp2Mot3

Based on above method, cards for temperature sensors for SR and TFP can also be tested.

Signals to be monitored for SR temperature sensors are as follows:

SR-1 SLG1- AMSB_0106-XATmp10elSR

SLG1- AMSB_0106-XATmp20elSR

SR-2 SLG2- AMSB_0106-XATmp10elSR

SLG2- AMSB_0106-XATmp20elSR

Signals to be monitored for transformer temperature sensors are as follows:

SLG1- AMSB_0106-XATmp10elTr

SLG1- AMSB_0106-XATmp20elTr

4.2 Test Set up for testing Pressure Sensor:

A typical example of testing pressure sensor and associated cards is as shown in following fig 10 below.

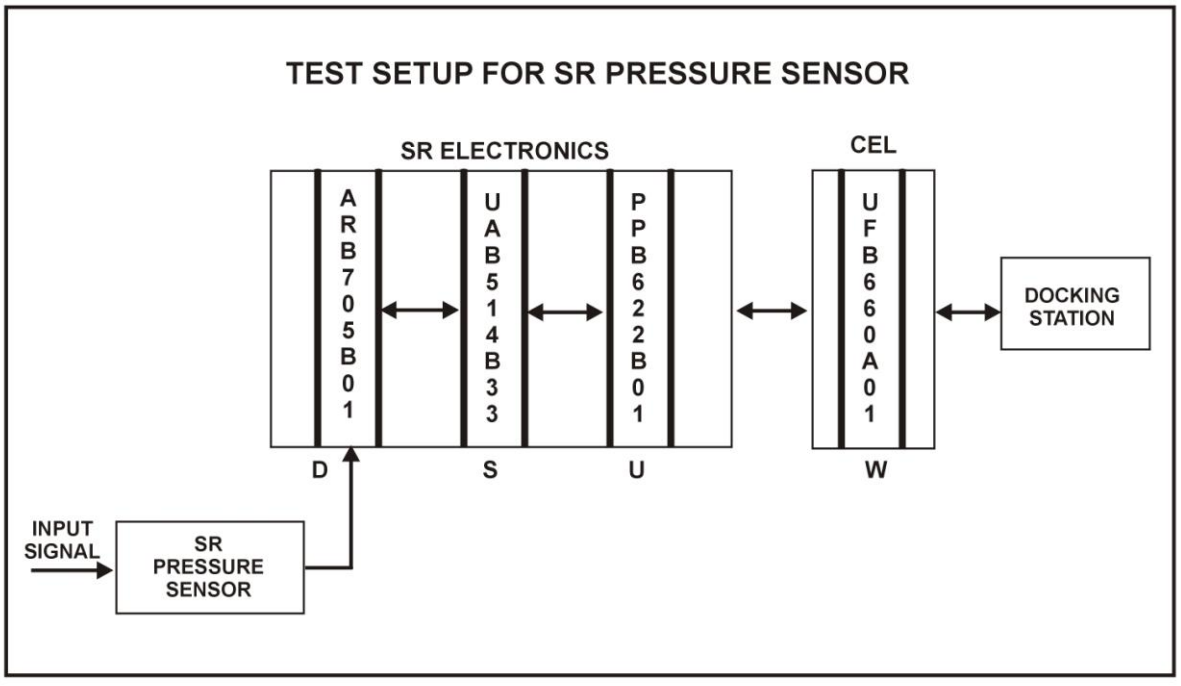


Fig. 10

Pressure sensor can be checked separately for various inputs with the help of pressure calibrator. Sensor is then provided on test setup along with pressure calibrator. Output value of card is measured at test points of ARB 705 B01 card i.e. voltage between Pin no 2c22 and ground. (Std Value at 0 bar – 2.0 Volts). Output on card will be dependent on the input value of the sensor. If found correct, the output is checked on Analog I/O card (UAB514B01) test points. Test point available on UAB514B01 card is 404 for transformer oil pressure & 406 for converter oil pressure. (Standard value 2.0 Volts w.r.t. ground for 0 bar pressure). If input

and output are found different for a particular channel, it indicates fault on that particular channel. Card can then be taken up for further investigation and repair.

Signals to be monitored for SR and transformer at docking station are:

SR-1 SLG1- AMSB_0106-XADruckSR1

SR-2 SLG2- AMSB_0106-XADruckSR2

TFP SLG1- AMSB_0106-XADruckTr

Standard Value is 20% at 0 bar and actual value is as shown in fig. 11 below.

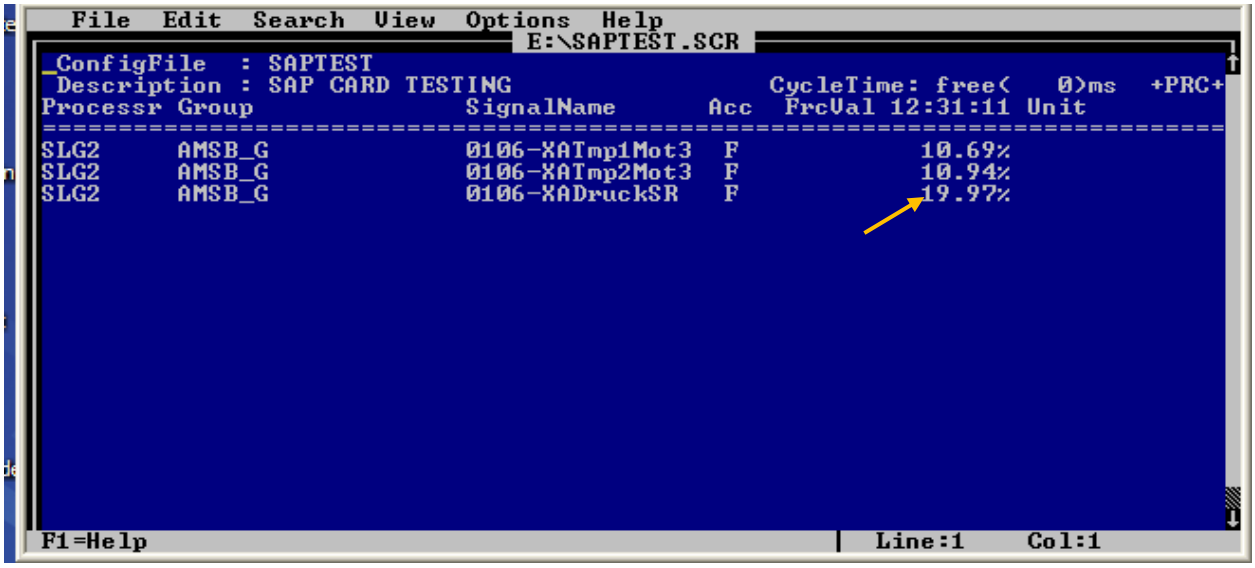


Fig. 11

Standard Value is 60% at 2 bar and actual value is as shown in fig. 12 below.

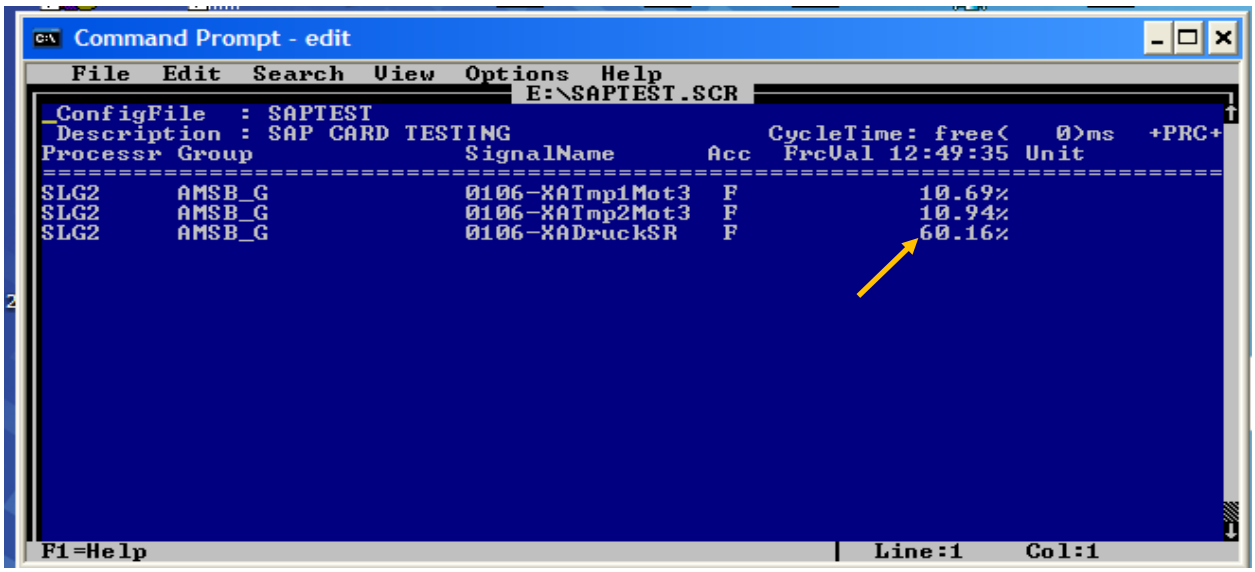


Fig. 12

4.3 Test Set up for testing current sensors:

A typical example of testing current sensor and associated cards is as shown in fig. 13 below:

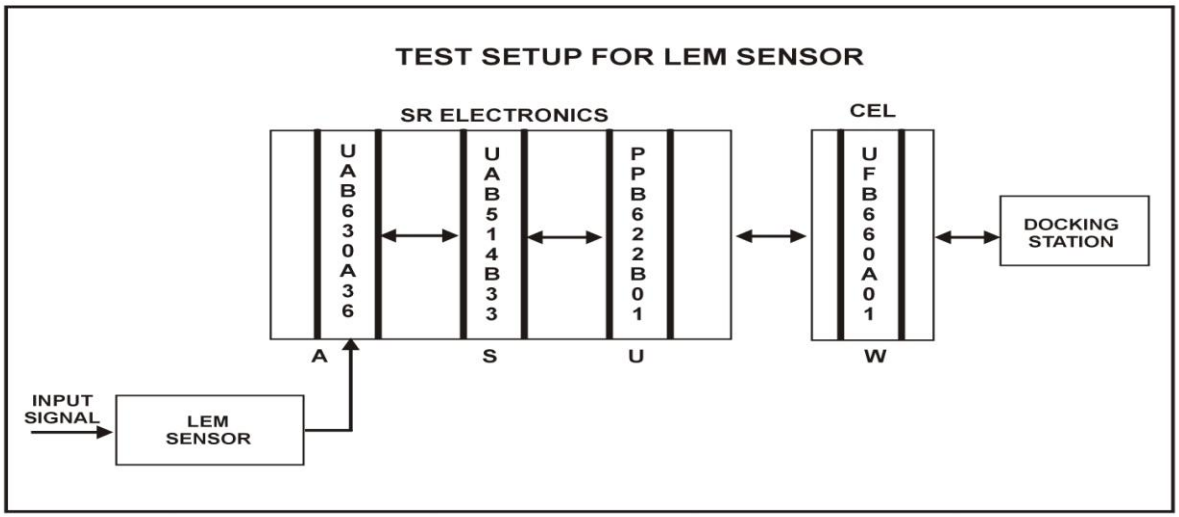


Fig. 13

Current sensor can be checked separately for various inputs with the help of current sensor test unit. Sensor is then provided on test setup along with sensor test unit. For 100 Amp primary input current, 20mA current has to be injected on SAP channel. Output value of voltage at card is measured at pin no 1c04 of SAP A (UAB 630 A36) card. Voltage between Pin no 1c04 and ground should be 0.33 volts. (Std Value at 100 Amp: 0.33 volt)

Similarly the output can also be checked on test points on Analog I/O card (UAB 514B33) at point No 307 and ground. Sensor output can also be checked at measurement print (XVA 937 A01) at test socket no 1c04. Std Value at 100 Amp: 0.33 volts.

Signals to monitor at docking station are as follows:

SR-1	SLG1- AMSB_0104-XAIpr
SR-2	SLG2- AMSB_0104-XAIpr

4.4 Test Set up for testing DC link voltage Sensors/Earth fault relay: Test set up for testing voltage sensor and SAP card is as shown in fig.14 below:

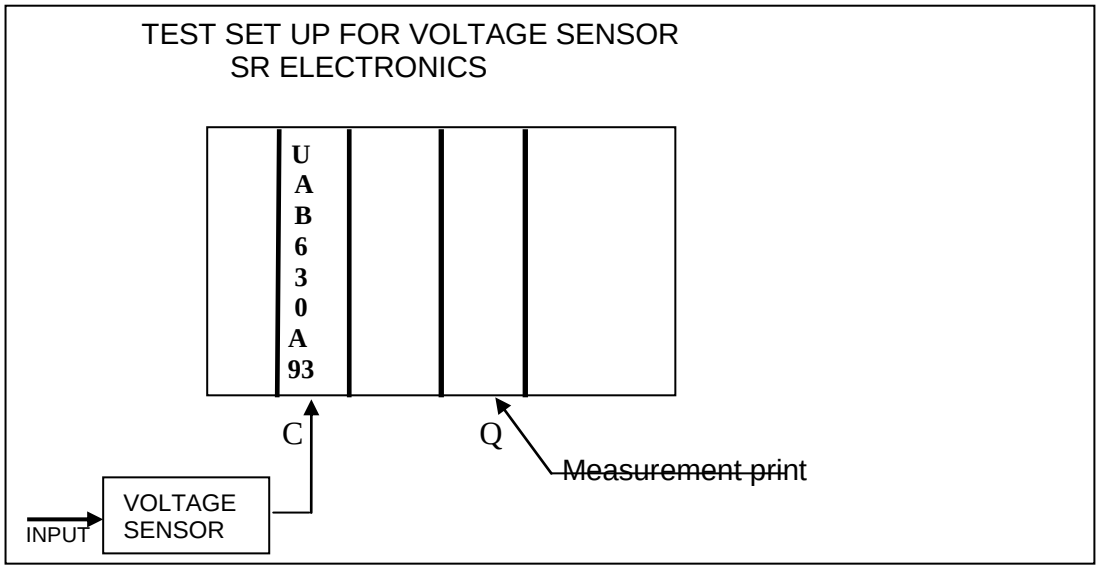


Fig.14

Voltage sensor can be checked separately for various inputs with the help of 4 kV DC Voltage source. Output of sensor is in the ratio of 400:1 i.e. the sensor output for 4kV DC input shall be 10 volt DC. Sensor is then provided on test setup along with voltage source. Variable voltage of 1 to 8 volt is injected at I or K slot of UAB 630 A 93 card. Output value of card is measured at test points of measurement print card (XVA 987) in Q slot. Same voltage as injected shall be available between pin no 1a05 & ground and 1b05 & ground shall be available for healthy card.

4.5 Test Set up for testing Wandler module:

A typical example of testing wandler module and associated cards is as shown in fig.15 below.

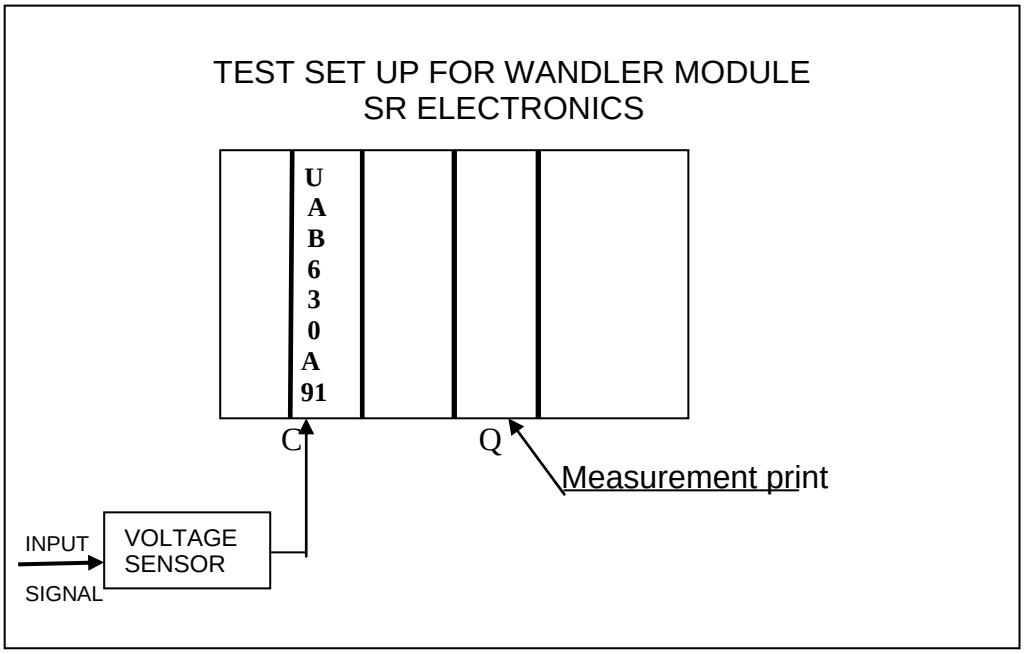


Fig. 15

Wandler module can be checked separately for various inputs with the help of voltage source. Wandler module is then provided on test setup along with variable voltage source of 200 volt AC. Voltage level of 1 to 08 volt AC is injected at A slot of UAB 630 A 91 card. Output value of card is measured at test points of measurement print card in Q slot. Voltage between pin no 1c10 & ground should be 10 volts AC corresponding to 8 volt input injected at UAB 630 A 91 for healthy card and proportionately lesser for less input voltage.

5.0 Tolerance limits:

The tolerance limits for various values given above are different for different signals. The values of tolerances are given in ABB document No. 3 EHL 421 088, available in IR, WAG 9 manuals Volume F6

6.0 Test equipments required for Testing Kit:

1. Spare SR Electronic Rack
2. Spare CEL Rack
3. Docking station
4. Measurement Print
5. Temperature Calibrator (oil bath with heater)
6. Pressure Calibrator
7. Voltage source and Current source of suitable capacity
8. Multimeter

7.0 Application to:
WAP5, WAP7, WAG9 and WAG9H locomotives.

8.0 Agency of implementation:
All sheds, workshops holding & maintaining WAP5, WAP7, WAG9 and WAG9H locomotives including CLW.

30/x/09
(Sandeep Srivastava)
for Director General (Elect)

Encl: Nil

Copy to:

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30/x/09
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for Director General (Elect)

Encl: Nil

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30/10/09