

# ***norscan***

## **1303 System Test Set Application & Operation Manual**



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# 1.0 ABBREVIATIONS

$\Omega$	Ohms
k $\Omega$	kilo Ohms
AC	Alternating Current
ACU	Alarm Circuit Unit
BCT	Branch Cable Termination
CMS	Cable Management System (4200)
CO	Central Office
DC	Direct Current
IVF	Induced Voltage Filter
LED	Light Emitting Diode
LPU	Line Protection Unit
LTU	Line Termination Unit
mA	milliamps
MDT	Moisture Detection Tape
MTM	Multi-Tone Module
SGU	Sheath Grounding Unit
SSU	Splice Sensor Unit
STS	System Test Set
STU	Sequenced Termination Unit
TSU	Termination Sensor Unit

## 2.0 SPECIFICATIONS

Power Source: 8 “D” Cells (1.5V) (Alkaline, NiMh or NiCad)

Battery Life: 20 hours (approx.)

Max. AC input rejection: 12V ACrms

Max. Input Voltage on V AC, V DC range: 350 V

Max. Input Current on 2000, 200 mA range: 2 A

Max. Input Current on 20, 2 mA range: 200 mA

Accuracy on V DC (all ranges): +/- 1%

Accuracy on A DC (all ranges): +/- 4%

Accuracy on V AC (all ranges): +/- 2%

Accuracy on A AC (all ranges): +/- 4%

Accuracy on k $\Omega$  (all ranges): +/- 1%

Accuracy on mA DC and mA AC range: +/- 2%

Operating Temperature Range: 5 to 30°C

Auto Shutdown Period: 5, 10 or 15 minutes

Fuse – F1: 200mA Buss GDA

Fuse – F2: 2A Buss GDA

Fuse – F3: 1A Buss GDA

Max. range to detect & decode SSU, STU or TSU:

30 km for 3 baud, 20 km for 10 baud and

10 km for 32 baud

## 3.0 DESCRIPTION

The 1303 System Test Set (STS) is a battery operated, field-rugged measurement system used to test cable armor, copper pairs, moisture detection tape and all Norscan sensor units. The 1303 STS is both a specialized test system for testing sensors and a noise immune, auto-ranging multimeter.

The 1303 STS is required for the installation and maintenance of all Norscan Cable Management System field components.

The 1303 STS functions are:

- AC & DC voltage and current measurements
- Resistance measurements
- Sensor testing and address decoding
- Termination Sensor Unit (TSU) remote testing

During cable installation and splicing, the 1303 STS is used to verify proper operation of the sensors, measure AC and DC voltage & current and test cable pairs and armor for faults.

The 1303 STS is housed in a field-rugged, water resistant case. The 1303 STS is supplied with one set of test leads with alligator clips which is stored in a pouch mounted to the inside cover.

# 4.0 OPERATION

This section describes the general operation of the 1303 STS.

## **WARNING!**

Potential for electrical shock exists when handling cables. Always take DC and AC measurements using a Norscan 1303 STS to determine what AC or DC voltages are present, before handling the cable. If induced AC voltage levels exceed 16 V rms, install additional induced voltage filtering products to bring levels below 16 V rms. Always keep sheath grounding products connected to the cable armor to ensure adequate protection against transient voltage activity.

## **WARNING!**

Even low-level voltages and currents can cause injury or even death from electrical shock. Do not use this or any piece of test equipment without proper training.

## 4.1 POWER ON



To turn the 1303 STS on, press the **power button**. It will beep and then start in the AUTO V DC range. The 1303 STS AUTO power-off cannot be disabled, but can be changed to 5, 10 or 15 minutes.

## 4.2 SETTINGS/CONFIG MENU



To select the settings/config menu, press the **settings menu button**.



The **scroll button** will cycle through configuration options. Press the OK button to select the setting you want to change. Using the **scroll button**, cycle through the item's possible options then hit OK again to accept. Any other button will exit you out.

Configuration options:

- **Auto-Power Off** (Choose power off after 5, 10 or 15 minutes of no activity.)
- **Backlight Auto** (Turns off the backlight after 5 minutes or off always or on always no button-press activity. This differs from auto-power off in that it's only the backlight that turns off, the unit stays on.)
- **Contrast Adjustment**
- **About Menu** (s/w version, h/w version)
- **Calibration** (Factory use only)



## 4.3 DC VOLTAGE MEASUREMENT



To select the DC voltage measurement function, press the **V DC button** once. The 1303 STS will beep and the VDC will be displayed on the screen. The 1303 STS will automatically select Auto Range.

Connect the blue lead to the circuit being measured and the white lead to common or ground. The 1303 STS will display the voltage at the blue lead with respect to the white lead in volts.



Press the **scroll button** until you reach the range you want. If the measured voltage is greater than the selected range, the display will indicate “overload.”

## 4.4 AC VOLTAGE MEASUREMENT



To select the AC voltage measurement function, press the **V AC button** once. The 1303 STS will beep and the VAC will be displayed on the screen. The 1303 STS will automatically select Auto Range.


Connect the blue lead to the circuit being measured, then connect the white lead to common or ground. The 1303 STS will display the voltage at the blue lead with respect to the white lead in volts.




Press the **scroll button** until you reach the range you want. If the measured voltage is greater than the selected range, the display will indicate “overload.”

## 4.5 DC CURRENT MEASUREMENT

**NOTE:** Extreme over-current can blow the protection fuses or damage the set. *Disconnect the test leads immediately if E1 or E2 readings appear in the display.*

 To select the DC current measurement function, press the **mA DC button** once. The 1303 STS will beep. To prevent damage from over-current, the 1303 STS does *not* Auto Range in the current mode. The highest range (2000 mA) will be selected automatically.

Connect the test leads to the conductors to be measured. The 1303 STS will display current measurement in mA.

 To read the current with the greatest resolution, select a lower range using the **scroll button** (starting at 2000) and work down in range to a reading that does not overdrive the unit. If the measured current is greater than the selected range, the display will indicate “overload.”

## 4.6 AC CURRENT MEASUREMENT

**NOTE:** Extreme over-current can blow the protection fuses or damage the set. *Disconnect the test leads immediately if E1 or E2 readings appear in the display.*



To select the AC current measurement function, press the **mA AC button** once. The 1303 STS will beep. To prevent damage from over-current, the 1303 STS does *not* Auto Range in the current mode. The highest range (2000 mA) will be selected automatically.

Connect the test leads to the conductors to be measured. The 1303 STS will Auto Range down to the lowest suitable range within the unknown resistance value and display the result in k $\Omega$ .



To read the current with the greatest resolution, select a lower range using the **scroll button** (starting at 2000) and work down in range to a reading that does not overdrive the unit. If the measured current is greater than the selected range, the display will indicate “overload.”

## 4.7 RESISTANCE MEASUREMENT

**k Ω**

To select standard resistance measurement, press the **kΩ button**. The 1303 STS will beep. The 1303 STS will start in the Auto Range mode and continuously update the display. Connect the test leads to the conductors to be measured. The 1303 STS will Auto Range down to the lowest suitable range within the unknown resistance value and display the result in kΩ.

## 4.8 ARMOUR-TO-GROUND RESISTANCE MEASUREMENT

**k Ω**

The 1303 STS performs the armor-to-ground resistance measurement automatically. To eliminate the errors caused by DC offsets or noise, the 1303 STS applies both positive and negative polarity measurement currents to the line and then calculates and displays the resulting average resistance value.

Prior to measuring the armor-to-ground resistance on a cable section, be certain the section is isolated from both the Central Office (CO) equipment and the termination units (TSU) or Branch Cable Termination (BCT). The CO equipment can be removed from the cable section by turning the Alarm Circuit Unit (ACU) and Multi-Tone Module (MTM) off.

**NOTE:** A STU, IVF, SGU, LTU or LPU at the terminatuion will not affect the resistance measurement since these units are an ‘open circuit.’ Only the TSU or BCT will affect the measurement since they have a 100 k $\Omega$  input resistance.

Connect the blue test lead to the armor and the white test lead to ground. Select the armor-to-ground resistance measurement be pressing the **k $\Omega$  button** twice within two seconds.

During the measurement, the set will beep in one-second intervals. When the measurement is complete, the result will be displayed in k $\Omega$ .

## 4.9 ARMOR-TO-GROUND RESISTANCE MEASUREMENT (ALTERNATE METHOD)

When it is not possible to isolate the termination units from the cable end, use the following alternative method:

**k  $\Omega$**  Prior to measuring the armor-to-ground resistance on the cable section, be certain that the section is isolated from the CO equipment by turning off the ACU and MTM.

When measuring armor-to-ground resistances be certain to place the blue lead to the armor and the white lead to ground. Press the **kΩ button** twice within two seconds. The 1303 STS will beep. The test set will start in the Auto Range mode and continuously update the measurement.

**NOTE:** If you turn on the armor-to-ground resistance mode by pressing the **kΩ button** once, the TSU or the Sequence Termination Unit (STU) will activate since the voltage polarity is flipped while in this mode. If a TSU or STU is connected, be sure to press the **kΩ button** twice within two seconds. The 1303 STS will display the result in kΩ.

Each TSU and BCT on the line will place a 100 kΩ resistance in parallel across the armor-to-ground. The resulting measured resistance will be a parallel combination of the termination units and the armor-to-ground resistance (Figure 1).

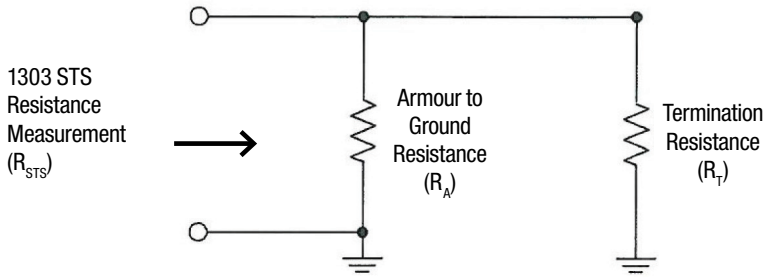


Figure 1: Armor-to-Ground Resistance Schematic

The armor-to-ground resistance can be calculated as follows:

$$R_A = (R_{STS} \times R_T) / (R_T - R_{STS})$$

Where:

$R_{STS}$  = 1303 STS armor-to-ground resistance reading

$R_T$  =  $100 \text{ k}\Omega / (\text{number of termination units})$

$R_A$  = True armor-to-ground fault resistance in  $\text{k}\Omega$  (unknown)

**Example:** A 1303 STS resistance measurement from armor-to-ground is  $37.5 \text{ k}\Omega$ . There is a TSU and a BCT so the number of termination units is two.

The true armor-to-ground resistance is:

$$\begin{aligned} R_A &= (37.5 \text{ k}\Omega \times (100 \text{ k}\Omega / 2)) / ((100 \text{ k}\Omega / 2) - 37.5 \text{ k}\Omega) \\ &= (37.5 \times 50) / (50 - 37.5) \\ &= 150 \text{ k}\Omega \end{aligned}$$



## 4.10 SSU AND STU TEST



The Sensor test function is used to check for proper operation of the Splice Sensor Unit (SSU) or the STU. This is typically done prior to closing a splice during installation or after a splice repair. Under favorable conditions, the 1303 STS will detect and decode a triggered Norscan sensor unit at distances of up to 30 km for 3 baud, 20 km for 10 baud, and 10 km for 32 baud.

An STU has the same MDT functionally as the SSU and both sensors can be tested with the Sensor test function on the 1303 STS. To fully test the STU, however, use the CMS shelf to initiate a termination test. Before proceeding, disconnect the monitoring and toning voltage by turning off the ACU and MTM, isolate the sensor from the circuit by disconnecting the lead from the cable armor. Connect the 1303 STS across the output leads of the sensor: blue-to-blue and white-to-white. Then, press the **sensors button** to select the sensor test function. During the reading the set will beep in one second intervals. The LCD will display -48v.

Trigger the sensor by momentarily shorting the MDT leads together. Depending upon STU revision number, the MDT leads could be shorted together for up to 15 seconds. A pulsing tone will be heard after several seconds and the sensor code will be displayed.

If no regular pulsing is heard then the sensor is not triggered. Make sure the blue lead is disconnected from the cable network or cable armor and the MDT leads are momentarily shorted together.

**NOTE:** *A ground fault below 5k $\Omega$  may prevent the sensor code from being displayed.*

## 4.11 TERMINATION TEST



The sensor test function is also used to check for proper operation of the TSU or STU during installation or when the CMS shelf is unavailable.

During the Termination Test, the 1303 STS applies a reverse polarity test voltage that triggers the TSU/STU and causes it to transmit its identification code. A maximum of five STUs can be activated and decoded. Under favorable conditions, the 1303 STS will detect and decode a TSU/STU at distances of up to 30 km for 3 baud, 20 km for 10 baud and 10 km for 32 baud.

Before proceeding, disconnect the CO equipment from the line by turning off the ACU and MTM.

Connect the 1303 STS across the output leads of the TSU/STU: blue-to-blue and white-to-white or blue-to-armor and white-to-ground.

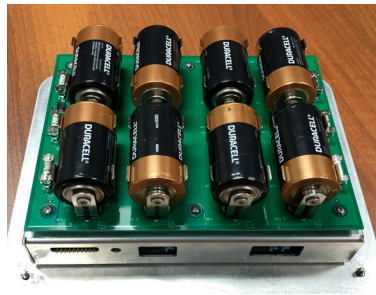
To select the TSU/STU test function, press the **sensors button** once. The set will beep once and the display will show -48v DC SSU/STU decoding. Then press the **scroll button** (up/down) to flip the polarity. The display will show SSU/STU (+48V) decoding. During reading, the set will beep in one second intervals.

A pulsing tone will be heard and the sensor identification code of the TSU/STU will appear in the display.

# 5.0 MAINTENANCE

## 5.1 BATTERY AND FUSE REPLACEMENT

The 1303 STS is powered by eight 1.5 Volt alkaline “D” cells. The batteries should be changed when the LO BATT warning appears in the display.



- 1) Remove the faceplate by unscrewing the four faceplate screws.
- 2) Lift up the faceplate, set it down next to the 1303 STS, face down.
- 3) Replace batteries and fuses as required. The fuses and spares are located on either side of the battery holder.
- 4) Place faceplate back on, screw the screws back into the faceplate.

## 5.2 CLEANING

When cleaning is required, use a mild soap solution and soft cloth. Dampen the cloth and carefully clean the front panel and case. Follow with a cloth moistened with clean water. **Do not use solvents or abrasives on the front panel.**

## 5.3. STORAGE

Remove the batteries when storing the 1303 STS for long periods of time.

# 6.0 TROUBLESHOOTING

**Symptom:** The LO BATT warning is present on the display.

**Cause:** The batteries are exhausted.

**Action:** Replace the batteries with 1.5 Volt “D” cells (Alkaline, NiMh, NiCad)

**Symptom:** The 1303 STS will not power up.

**Cause 1:** The batteries are dead.

**Action:** Replace the batteries.

**Cause 2:** Fuse F3 is blown.

**Action:** Replace fuse F3.

**Cause 3:** The 1303 STS is damaged.

**Action:** Return the 1303 STS for repair.

**Symptom:** The E1 warning is present on the display when measuring current.

**Cause 1:** The fuse F1 is blown.

**Action:** Replace fuse F1.

**Cause 2:** The input circuit is damaged.

**Action:** Return the 1303 STS for repair.

**Symptom:** The E2 warning is present on the display when measuring current.

**Cause 1:** The fuse F2 is blown.

**Action:** Replace fuse F2.

**Cause 2:** The input circuit is damaged.

**Action:** Return the 1303 STS for repair.

**Symptom:** The SSU Test does not decode the sensor (SSU or STU).

**Cause 1:** A low resistance fault ( $<5k\Omega$ ) exists on the line.

**Action:** Check the line for resistance faults.

**Cause 2:** The SSU or STU is not triggered.

**Action:** Short the MDT leads of the sensor.

**Cause 3:** The SSU or STU is too far away.

**Action:** Limits are: 30 km for 3 baud, 20 km for 10 baud and 10 km for 32 baud

**Cause 4:** The STU is not coded x99.

**Action:** Due to the sequenced action of the STU, an STU coded for x97 will only be decoded after enough time has passed for the x98 and x99 STUs to be received (3 minutes per STU).

**Cause 5:** SSU is defective.

**Action:** Replace SSU.

**Cause 6:** 1030 STS is defective.

**Action:** Check with known good SSU. If no response, return the 1303 STS for repair.

**Symptom:** The TSU/STU Test does not decode the termination sensor.

**Cause 1:** A short or low resistance fault exists on the line.

**Action:** Check the line for resistive faults.

**Cause 2:** TSU/STU is defective.

**Action:** Replace TSU/STU.

**Cause 3:** 1303 STS is defective.

**Action:** Check with known good TSU/STU.

If no response, return the 1303 STS for repair.



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