

# NTS 02-E

## USER MANUAL



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## 1. Introduction

The NTS 02-E Network Time Server provides a precision time reference for synchronizing Ethernet networks. The NTS 02-E features multiple independently-addressed Ethernet Ports each supporting the NTP protocol. Each NTS 02-E base unit has a built-in GPS-synchronized master clock which, in the default operating mode, provides the source reference time used by all of the Ethernet ports. It follows, therefore in terms of Network Time Protocol (NTP) definitions, that all NTS 02-E Ethernet Ports are Stratum 1 sources.

The NTS 02-E product is ideally suited for use in industrial environments and can provide NTP server functions to multiple independent Ethernet networks.

All NTS 02-E units feature a front panel display (See figure 1) giving visual feedback about the time data being generated on the outputs. LED indicators provide “at a glance” status information.

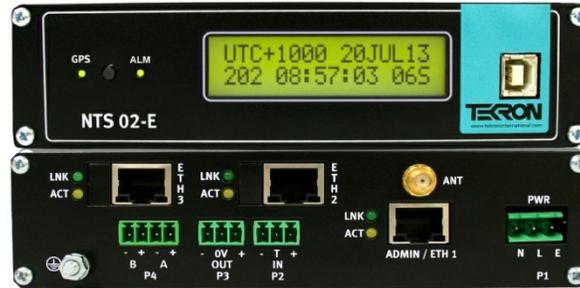


Figure 1 – NTS 02-E chassis and front and back panels

The NTS 02-E features an administrative 10/100 Mb Ethernet port through which the unit’s inputs and outputs can be configured.

It comes complete with Ethernet cables to allow for customization and easy setup from the Windows™ Configuration software which is available to download from [www.tekron.com](http://www.tekron.com). Optional accessories include antenna, low loss antenna cable, antenna pipe mounting components and lightning protection kit.

## 2. Front Panel



Figure 2 – NTS 02-E front panel

The NTS 02-E features two LED indicators on the front panel (See figure 2), together with a USB port and a 2-line by 16-character backlit LCD display.

**GPS LED:** This LED shows the status of the current sync source.

**ALM LED:** This LED shows the alarm status of the NTS 02-E.

**USB Port:** This port may be used to configure the clock using the Tekron Configuration Tool available for download on the Tekron website.



## LCD Display

On initial power-up, the LCD display shows a copyright message, along with the serial number and revision level of the unit (See figure 3a). Approximately 10 seconds after power-up, if the NTS 02E is operating in its default mode as a GPS-synchronized Grand Master Clock, then the display changes automatically to indicate that it is waiting for satellites (See figure 3b). Once one or more satellites have been discovered, it transitions to the operating default display (See figure 3c). Figures 3d and 3e show alternative time displays that the user can access by pushing the recessed button on the front panel between the LED indicators. Successive button-pushes can be used to cycle through all the display screens in turn. The screen display examples below all show the same instant in time.

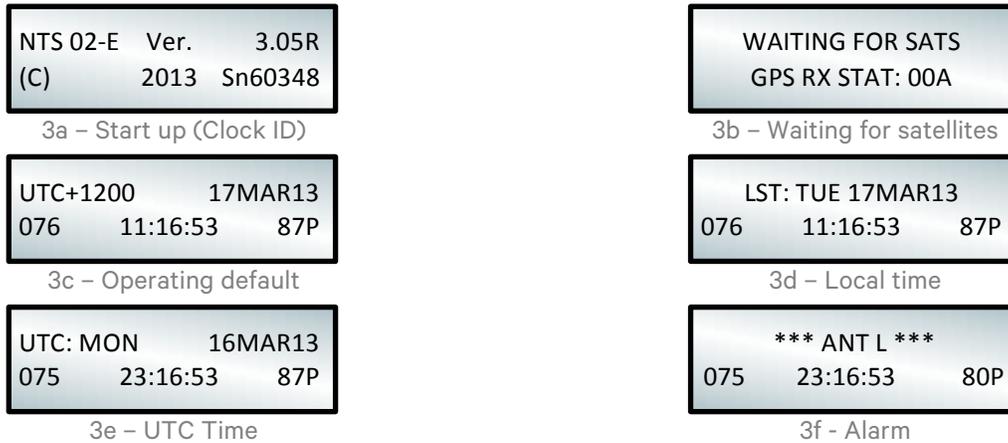


Figure 3 – LCD display screens

“UTC” denotes Universal Time Coordinated (approximately equivalent to GMT). The top line of screen 3c shows the clock’s current local time offset from UTC (hours & minutes), together with local date. The local time day-of-year and time-of-day are on the bottom line.

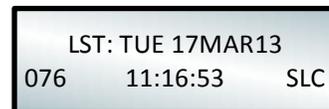
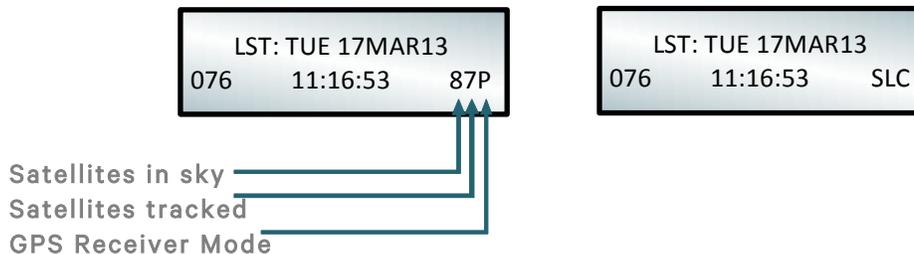
Screen 3c shows that the clock is operating with a local time offset of 12 hours ahead of UTC. The local date is 17th March 2013, and the local time is 11:16:53 in the morning.

Screen 3d shows the same time and date, but also indicates that the time displayed is Local Standard Time, and that the day is Tuesday. “LST” denotes Local Standard Time. If daylight savings time is active, the “LST” in screen 3d changes to “LDT”, denoting Local Daylight Time.

Screen 3e shows the UTC time and date which is 11:16:53 on the evening of Monday 17th March 2013.

The display screens in Figure 3b, 3c, 3d and 3e, each show a three-character status field at the bottom right-hand side of the display. When the NTS 02-E is operating in its default mode as a GPS-synchronized Grand Master, this field provides further details about the GPS function as shown in fig 4a and table 1a below.

When the NTS 02-E is sync’d from an IRIG-B source, this field directly indicates the sync source. (see example for “SLC” source in fig 4b). Table 1b shows the alternate sync sources supported by the NTS 02-E.



**LED INDICATORS Table 1a – GPS Status**

Character	Values	Description
Satellites in the sky	"O - 9": 0 - 9 "A - E": 10-14 "F": >14	Represents the total number of satellites currently present in the sky according to the GPS almanac. "O" in this position means that NTS 02-E has lost its knowledge of the GPS satellites' orbit geometries. This occurs if the unit has been in storage for an extended period, or if the GPS receiver has been reset. It may take up to two hours for the NTS 02-E to operate normally again.
Satellites tracked	"O - 9": 0 - 9 "A - E": 10 - 14 "F": >14	This digit represents the number of satellites currently being used to compute the time solution. A "0" value means that no updated time solution is available, ("out of lock" condition). If this condition persists for the "Sync Hold" time (see 3.6 below) the clock will indicate "out of sync" as described under (2.1) below.
GPS Receiver Mode	"A"	NTS 02-E in Acquisition mode - attempting to get satellite fixes.
	"G"	"Poor satellite geometry": Satellites are positioned in almost a straight line so best accuracy cannot be obtained, but the unit will still attempt to synchronize to UTC.
	"S"	Site Survey in progress. NTS 02-E is synchronized and is refining the position calculation for higher precision. Once complete the mode will change to Position hold.
	"P"	"Position hold": Position is now known precisely, and the NTS 02-E is providing its most accurate time, typically within 40 ns of UTC.

**LED INDICATORS Table 1b – Alternative Sync Source**

Character	Values	Description
Alternate Sync Source	"SLC"	Clock is synchronized to an IRIG-B source on P2 input "Slave:Cu"
	"SLF"	Clock is synchronized to an IRIG-B source on the Fiber input "Slave:Fiber"
	"TST"	Clock is operating with manually set time. Please refer to configuration tool "Set Time" function for further details



**If the clock is configured to synchronize to IRIG-B only (ignore GPS) then "SL?" will be displayed in the status field if there is no IRIG-B signal input.**

**LED Indicators**

The **GPS LED** shows the status of the sync source. The various states are shown as follows:-

**Off:** The NTS 02-E has no power.

**On:** The NTS 02-E is synchronized to the source indicated by the LCD display

**Slow Flash** (1 flash per second): The NTS 02-E is operating in the "hold-over" state (Sync Hold timer running)

**Fast Flash** (5 flashes per second): The NTS 02-E is not synchronized. "Out of Sync" condition

The **ALM LED** indicates the internal alarm status of the NTS 02-E. It has only two operating states:-

**Off:** The NTS 02-E is operating normally. i.e., there are no alarms

**Fast Flash** (5 flashes per second): Alarms are active. In this case, the actual alarm state is shown on the top line of the LCD display, replacing the normal date information (see example in fig 3f above).

## USB Port

A USB port (type B) is provided to support local configuration/administration. The NTS02-E configuration software supports both USB and Ethernet configuration.

## 3. Back Panel

Examples of the NTS 02-E back panel are shown (See figures 5 & 6). The unit appearance varies depending on the types of Ethernet modules fitted (orderable factory options).

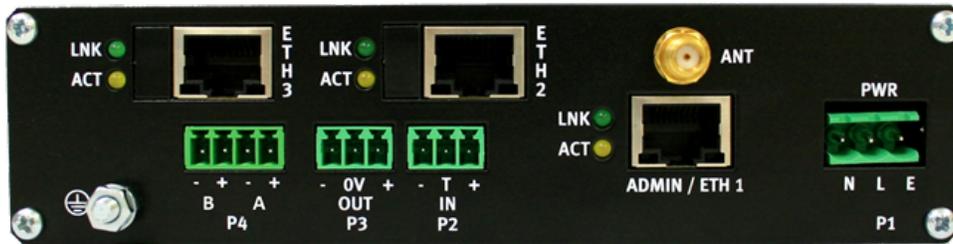


Figure 5 – Rear panel of NTS 02-E with Copper Outputs

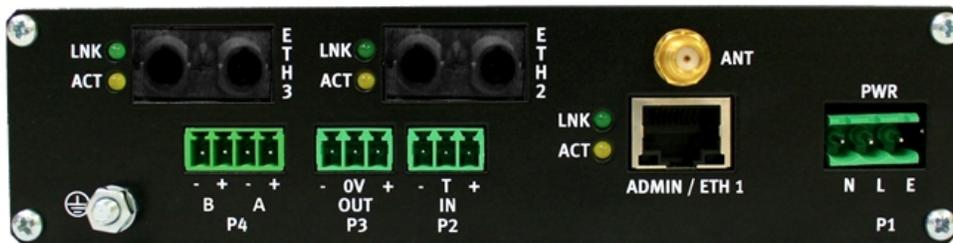


Figure 6 – Rear panel of NTS 02-E with Fiber Outputs

## P1 Power Input



Power is applied to the NTS 02-E via P1, a 5.08 mm 3-pin connector. DC power should be applied to pins L and N. Despite the L and N markings, DC polarity is not critical, but only Pin L is fused internally. Maximum steady state power consumption is 6 Watt, and surge protection is provided. Both electronics and case are isolated from the power supply inputs, enabling the use of positive earth, negative earth or fully floating supplies. The mating connector (supplied) accommodates wire sizes up to 1.5 mm<sup>2</sup>. The input voltage range is marked on the label located below the P1 connector.



Check the label on the unit base for power supply voltage ratings before applying power.

## Earth Stud (M4 Nut)



An M4 bolt (to chassis) is provided for earthing of cable shields.

## Ant: Antenna Connector (SMA Connector)



The “ant” antenna input provides an interface for an external active antenna which should be connected using a high quality low-loss 50Ω coaxial cable. 5 V DC (100 mA max) is supplied to the center conductor to power an active antenna. The GPS receiver inside the NTS 02-E is a high-sensitivity unit that supports a wide range of antenna and lead-in cable combinations. The overall gain of the installed antenna system (antenna gain less the combined losses in cable, connectors and any amplifiers/splitters/protection devices included) must fall in the range of 0dB to 40dB, with 5dB to 35dB preferred.

### Antenna and Lead-in Cable Considerations

NTS 02-E is typically ordered with a timing-optimized narrow-band antenna with nominal gain of 38dB. When coupled with a 30m lead-in cable (CNT-240) and a lightning protection device, this combination yields an overall gain of around 23dB, comfortably within the preferred range. For lead-in lengths longer than about 75m, amplification and/or larger diameter, lower loss cable should be considered and can be supplied to order.

**CNT-240** 33dB/100 m. (10dB/100ft) Plus 1 dB/connector  
Preferred Length Range: 6m to 70m (20ft - 230ft)  
Maximum Length: 100m (330ft)

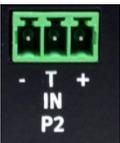
**CNT-400** 17dB/100 m. Plus 1 dB/connector  
Preferred Length Range: 12m to 138m (40ft - 450ft)  
Maximum Length Range: 4m to 190m (13ft - 625ft)

**Note:** The examples shown above are based on an average GPS signal strength of -130 dBm at sea-level and assume that the antenna is positioned with a clear view of the sky, with a lightning protection device fitted in the lead-in cable. It is highly recommended that such a device be installed. A suitable lightning protection device complete with additional cable connectors, connector crimping tool, and mounting hardware is available as an optional kit. The lightning protection device inserts a further 2.5dB of loss into the antenna system (largely due to the loss in the additional connectors). This is equivalent to 8m (25ft) of CNT-240 cable, or 4 m (13ft) of CNT-400 cable.



Care should be taken to ensure that the connector is not cross-threaded when attaching the antenna lead in cable. The connector should be tightened firmly by hand or by a SMA torque wrench only. Do not over tighten.

### P2: IRIG-B Input (3-pin 3.81 mm Connector)



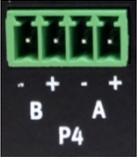
This port accepts an RS422 format un-modulated IRIG-B signal (B004 + C37.118 extensions). When configured appropriately, the NTS02-E can synchronize to this source rather than the internal GPS receiver, thus operating as a slaved device from another NTS02-E Master source. Connection of the incoming RS422 line (120 Ω twisted pair recommended) is to pins “+” and “-” of the mating connector. An RS422 termination load is provided on pin “T”, and can be activated by linking pins “T” and “-” in the mating connector.

### P3: IRIG-B Output (3-pin 3.81 mm Connector)



This port transmits an un-modulated IRIG-B signal (B004 + C37.118 extensions) in RS422 format on pins “+” and “-” of the pluggable connector. It can be used as the Master Source signal to drive the P2 inputs of one or many Slave NTS02/03-E units on the IRIG-B timing pulses (both leading and trailing edges) from this port is typically to within 100ns of UTC. A TTL-compatible output signal (single-ended, 0V referenced) can be obtained by connecting the signal cable to “+” and “0V” instead of to “+” and “-”.

## P4: Alarm Relays (4-pin 3.81 mm Connector)



The port provides two alarm output channels. The alarm outputs are type “A” (normally-open) dry contact types. Note: the “Normally-Open” descriptor refers to the de-energized state of the relay. The NTS 02-E operates with the alarm relays energized during normal operation, and de-energized in the alarm state. It follows that, in the event of all power to the clock being lost, both of the alarm relays default to the “alarm” state (open contact). The “+” and “-” symbols are included for reference purposes only, as the alarm contacts are not polarized.

**P4 A** is a GPS signal fail (antenna disconnected or antenna short (over-current)) alarm. Activation of the alarm (opening of the contact) is delayed by 10 seconds from the onset of the triggering condition.

**P4 B** is a synchronization fail alarm. This alarm is active (contact open) when the unit is initially powered on, and remains active until synchronization is achieved. The contact then closes, deactivating the alarm. If a loss of synchronization later occurs, then the NTS 02-E will operate in “Sync Hold” mode for a period defined by the “Sync Hold time”. At the expiry of the “Sync Hold time”, the alarm condition is again activated (contact open). Note that the “Sync Hold Time” is configurable up to a maximum of 2400 minutes. The default setting is 1 minute.

## ADMIN/ETH 1: Ethernet Administration Port (RJ45)



The Ethernet administration port (ETH1), features an RJ45 connector and supports 10/100 Mbps, Auto MDX & Auto Negotiate. The LEDs convey Link (LNK) and Activity (ACT) status for the port. This port is used to configure the clock via the Tekron Configuration Tool which is available for download on the NTS 02-E page on the Tekron website.

## ETH 2 & ETH3 – Ethernet Communication Ports (RJ45/ST Fiber Connector)



The second and third Ethernet communication ports (ETH2 & 3), feature RJ45 (10/100 Mbps, Auto MDX & Auto Negotiate) or ST Fiber (100 Mbps) connectors (orderable option). The LEDs convey Link (LNK) and Activity (ACT) status for the associated port.

### NOTE:

The NTS02-E features absolute security between all ports, so that no Ethernet paths exist between any of the three Ethernet ports. For this reason, the NTS02-E does *not* support hub, switch or router functions.

## 4. Software

### Configuration Tool

The NTS 02-E can be configured via USB or Ethernet. The configuration tool can be downloaded from the NTS 02-E product page on the Tekron website ([www.tekron.com/nts-02-e](http://www.tekron.com/nts-02-e)). By default the unit is shipped with DHCP enabled for automatic IP address assignment, with a fall back to link local addressing (169.254.xxx.xxx) if no DHCP server is present.

**Default Username:** admin

**Default Password:** Password

### NOTE:

The user is required to change the default password on first login.

## USB driver

The USB driver can be downloaded from the NTS 02-E product page of the Tekron website ([www.tekron.com/nts-02-e](http://www.tekron.com/nts-02-e)).

## 5. Factory Hardware Options

### Power Supply Options

This table shows the three different power supply options that can be ordered with NTS02-E.

Designator	Input Range
High Voltage (3 pin)	85 - 265 Vac / 90 – 300 Vdc
Medium Voltage (3 pin)	20– 75 Vdc
Low Voltage (3 pin)	14– 36 Vdc

### Slave Only Option (Fiber input)

The NTS 02-E can be ordered as a slave-only device in which case, the SMA Antenna Jack is removed, and an ST Fiber receiver port (multi-mode) is fitted instead. The unit will then synchronize to an incoming IRIG-B signal on either P2 (RS422 format signal required) or on the Fiber input.

## 6. Appendix

### NTS02-E Specifications

Physical Specifications			
Dimensions	Width	160 mm	
	Depth	155 mm	
	Height	40 mm	
Weight		800 g	
Operating Temperature Range		-10 ~ + 65 °C	
Storage Temperature Range		-40 ~ + 85 °C	
Operating Humidity		10 ~ 95 % non-condensing	
Electrical Specifications			
Power Supply	Low Voltage	14 ~ 36 Vdc	
	Medium Voltage	20 ~ 75 Vdc	
	High Voltage	90 ~ 300 Vdc / 85 ~ 265 Vac	
Power drain		3 W max	
Protection		Surge and Transient	
Isolation		Power In to NTS: 3.0 kV	
		NTS to Alarm outputs: 3.5 kV	
		NTS to Ethernet: 1.5 kV	
Input & Output Specifications			
Ethernet Port (Administrator)		RJ45	10/100 Mbps
		Isolation	1.5 kV
Ethernet Ports (2 & 3)		Type	RJ45
		Isolation	1.5 kV
		Type	ST Fiber
USB Port		Type B	
P2 Input		Voltage level	RS422
P3 Output		Voltage level	RS422
			Capable of driving 50 unit loads from 3.3V (1 V out @ 80 ma)
P4 Relay		Isolation	3.5 kV
		Max contact rating	300 V @ 100 mA (AC or DC)
GPS Receiver			
L1 (1575.42 MHz) Frequency, C/A Code, 14 Channel, parallel-tracking receiver			
Position Accuracy	Horizontal	<9 m (90%)	
	Altitude	<18 m (90%)	
Timing Accuracy		<15 ns to UTC	
Acquisition	Reacquisition	<2 s (90%)	
	Hot Start	<18 s (90%)	
	Cold Start	<50 s (90%)	
Sensitivity	Acquisition	-160 dBm	
	Tracking	-155 dBm	
Antenna output voltage		5 V	
Antenna output current		100 mA (Max)	



## 7. Warranty Statement

Tekron International Ltd (Tekron) warrants for a period of TEN years from the date of shipment that each Product supplied shall be free of defects in material and workmanship. During this period, if the customer experiences difficulty with a product and is unable to resolve the problem by phone with Tekron Technical Support, a Return Material Authorization (RMA) will be issued. Following receipt of an RMA number, the customer is responsible for returning the product to Tekron, freight prepaid. Tekron, upon verification of warranty will, at its option, repair or replace the product in question and return it to the customer, freight prepaid. No services are handled at the customer's site under this warranty.



Tekron shall have no obligation to make repairs, or to cause replacement required through normal wear and tear or necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the Product, or use of the Product in such a manner for which it was not designed, or by causes external to the Product, such as, but not limited to, power or failure of building services.

A product will not be warranted if it is an accessory not carrying the Tekron brand name. In this case, warranties are limited to the warranty provided by the original manufacturer of the accessory. Examples of such products and accessories are antennas, cables, etc.

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Warranty claims must be received by Tekron within the applicable warranty period. A replaced product, or part thereof, shall become the property of Tekron and shall be returned to Tekron at the Purchaser's expense.

A return material authorization number issued by Tekron must accompany all return material.

### WARNING

This product has been designed to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against such interference when operating in a commercial environment.

### Notes

The information in this manual may change without notice. The manufacturer assumes no responsibility for any errors that may appear in this manual.

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