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RTC-P3: Theory of Operation

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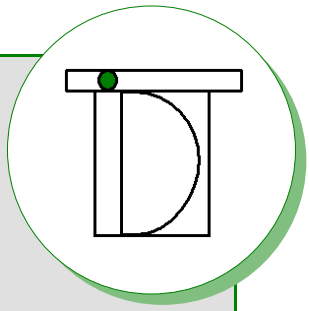

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Introduction

The purpose of this document is to provide background information about the general theory of operation of our RTC-P3 traffic counter and RTC-S2X and RTC-S2XL door sensors. This document should be used by individuals such as system integrators or IT personnel who are in the need of creating an interface from the traffic counter to an in-house database. This document reflects version 5.0 of the RTC-P3's firmware. Feel free to give us a call if you have detailed questions that are not answered in this document.

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Product Description:

The RTC-P3 is a modular unit, not an all-in-one unit. This means that the traffic counter and door sensors are housed in separate enclosures. The traffic counter can be placed anywhere; however, it is usually placed behind the sales counter or in the back office. The RTC-P3 can accept up to three door sensors, which are each connected to the RTC-P3 with a communications cable.

RTC-P3 Retail Traffic Counter

RTC-S2X Standard Door Sensor

The RTC-P3 compiles and saves traffic data from the entrances in hourly increments. It saves up to the last 250 days of traffic history. The RTC-P3 can be connected to a PC, POS or any RS-232-compatible device. The RTC-P3 transmits the traffic history in a comma-delimited format.

The standard door sensor that we use with the RTC-P3, the RTC-S2X, can sense traffic on entrances as wide as 8 feet.

More Product Description information on next page

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Product Description:

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We also offer the optional RTC-S2XL, which is a long-range sensor that can be used with the RTC-P3 for entrances wider than 8 feet. This long-range sensor is useful for wide entrances such as those found in mall environments. The RTC-P3 can accept up to three of these door sensors, in any combination.

RTC-S2XL Long-Range Door Sensor (Master & Slave)

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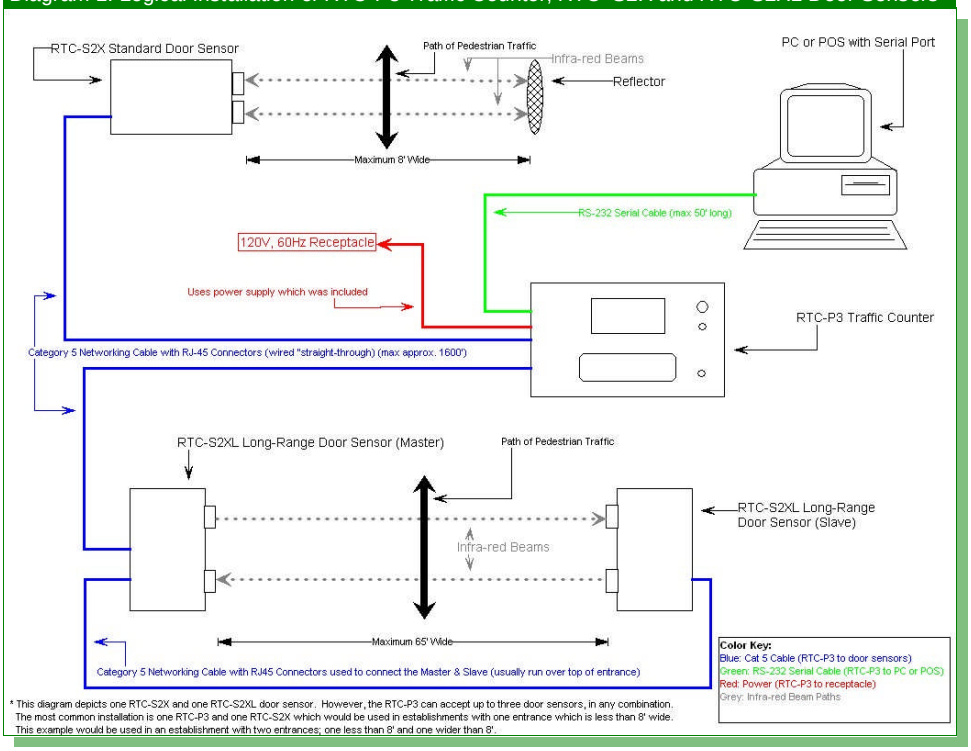
RTC-P3/Door Sensor Interface

We use standard Category 5 networking cable to interface from the RTC-P3 traffic counter to the door sensors. They are terminated with RJ45 connectors. Internally, they are wired "straight-through." For example, pin 1 on the one end connects to pin 1 on the other end. Similarly, pin 8 on the one end connects to pin 8 on the other end. See the Cable Specifications section.

Diagram 1: Logical Installation of RTC-P3 Traffic Counter, RTC-S2X and RTC-S2XL Door Sensors



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RTC-P3/Door Sensor Interface

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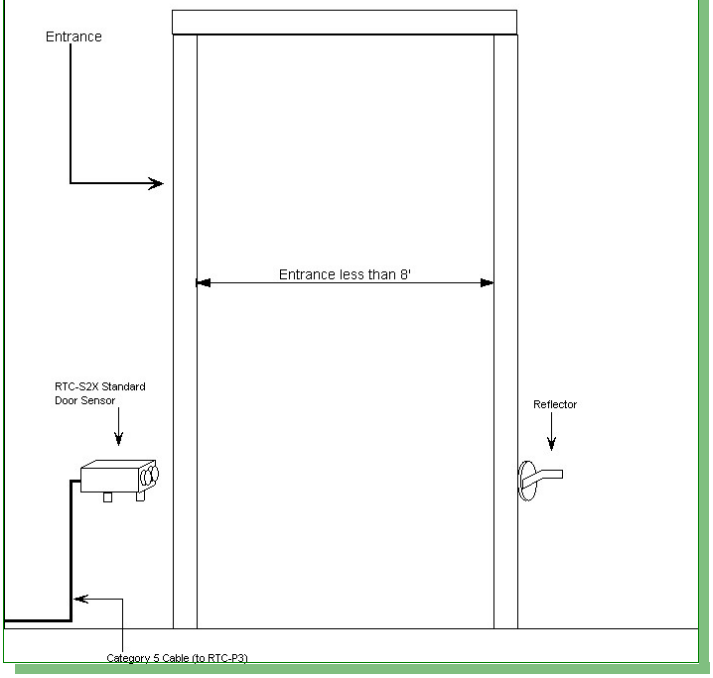
This cable is used for the following:

- Connecting the RTC-P3 to the RTC-S2X standard door sensor. **(see Diagrams 1 and 2)**

Diagram 2: Typical installation of the RTC-S2X door sensor and reflector



More RTC-P3/Door Sensor Interface information on next page

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RTC-P3/Door Sensor Interface

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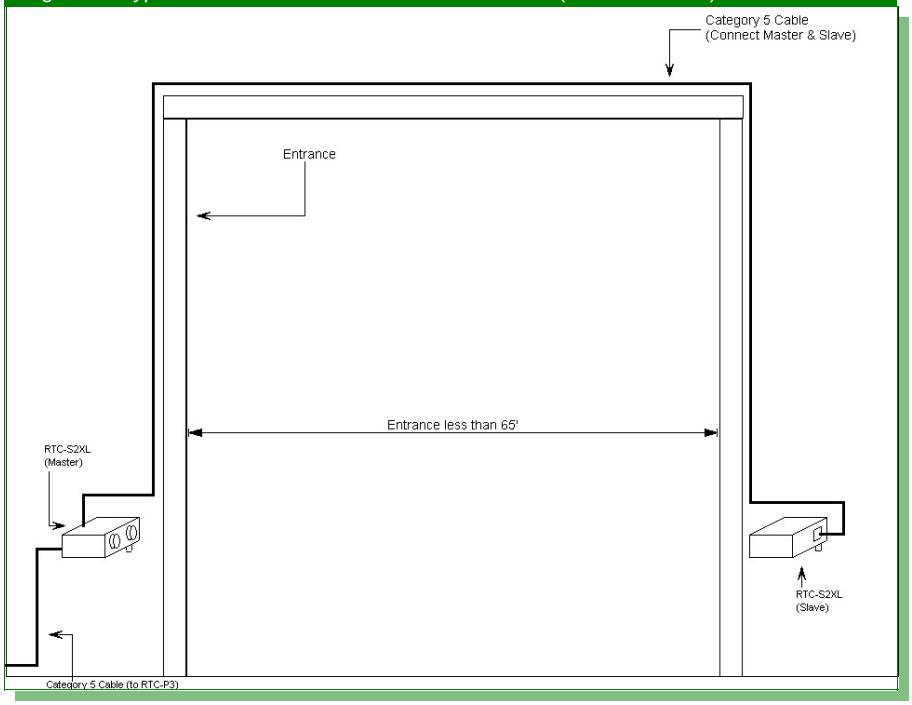
- Connecting the RTC-P3 to the master box of the RTC-S2XL long-range sensor. **(see Diagrams 1 and 3)**
- Connecting the "master" box of the RTC-S2XL long-range door sensor to its "slave" box. **(see Diagrams 1 and 3)**

Diagram 3: Typical installation of RTC-S2XL Door Sensor (Master & Slave)



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RTC-P3/PC or POS Interface

We connect the RTC-P3 to the PC or POS via a standard RS-232 serial cable with a standard 9-pin D-subminiature connector on either end. As stated in the RS-232 standard, Data Communications Equipment (DCE) should have a female connector. Therefore, the RTC-P3 has a female DB-9 connector. Only the TD, RD and ground lines are used. We do not implement hardware handshaking, and as a result do not use the additional control lines. The communications is half-duplex.

At this time, we do not offer a USB-enabled traffic counter. However, we resell a serial-to-USB converter which creates a “virtual serial port” in the Windows operating system. This virtual port allows our custom transmission/graphing software to always communicate with the RTC-P3 as though it was connected to a 9-pin RS-232 connector. **See Diagram 1.**

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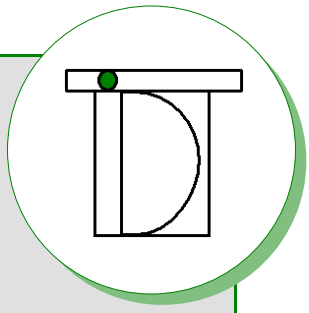
Communication Settings

The basic serial communications settings are fairly standard and are as follows:

- Baud Rate: 2400
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None



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Transmission Protocol

Before describing the Transmission Protocol, let's first give a little bit more background on the RTC-P3 traffic counter. The traffic counter holds up to the last 250 days of traffic data in hourly increments. There is a menu option on the traffic counter which allows the user to select how many of these days to transmit each time the transmit process takes place. The default from our factory is seven days; however, this value can be changed as often as desired. This means that if the traffic counter is set to transmit seven days, then the traffic counter will transmit the *last* seven days, which would include the current day.

Our protocol is a very simple one. Generally speaking, the PC software initiates the transmission and the traffic counter ends it.

The PC software initiates the transmission by sending a "T" and then an "X" over the serial port to the traffic counter.

At that point, the traffic counter will automatically start sending the traffic information over the serial port. The traffic counter ends the transmission by simply stopping the transfer of data after the appropriate number of days has been transmitted.

More Transmission Protocol information on next page

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Transmission Protocol

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There are, of course, a number of ways to execute this protocol. The following describes how our software executes this task:

1. Our PC software continually sends a “TX” over the serial port to the traffic counter until the PC software senses activity coming back across the port. We retry with the “TX” 25 times. This is done because our traffic counter polls the door sensors in a “round-robin” fashion and if a pedestrian is coming through the door at the time when we send the “TX”, the traffic counter can miss the transmission request. At some point, we may change the traffic counter’s firmware to use interrupts instead of this round-robin polling technique. This will be more efficient, and the PC software would only need to send the “TX” once. However, even if we make this change, this looping in the PC software will be a fail-safe. In our testing, 25 times seems more than enough. As a matter of fact, if no pedestrians are coming through the entrances at the time of transmission, we have found that the traffic counter will always sense the first “TX” attempt.

2. The traffic counter begins sending data across the serial port and the PC software begins to capture it.

3. Our software waits for 1.5 seconds of inactivity on the port. After that time, we close our transmission software on the PC side. The traffic counter automatically goes back to sensing pedestrian traffic. We wait 1.5 seconds because, as indicated above, the traffic counter “ends” the transmission process when it is done transmitting the correct number of days of traffic. This number of days could be from

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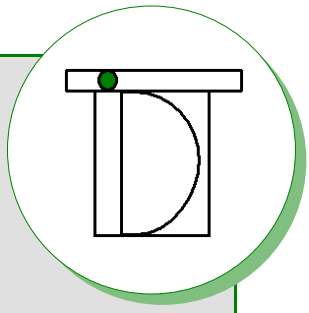

Transmission Protocol

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one to 250. So the PC software cannot anticipate or know how many days will be transmitted. (We are thinking about upgrading the protocol to do something along the lines of sending a "TX15" which would request that the traffic counter send the last 15 days of traffic. This way, the software would know how many days (records) to expect. However, this upgrade is not currently planned.

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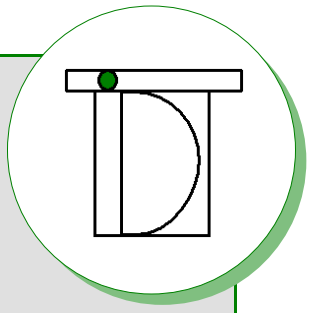


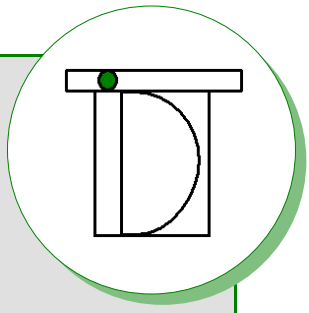
Data Format

Each day of traffic is saved in the traffic counter in 24 hourly increments. Therefore, each day should be thought of as a record. Each record will have 28 fields. The first three are the month, day and year, respectively. The next 24 fields are the hourly traffic totals starting at 12:00am-12:59am and ending at 11:00pm-11:59pm. These fields are comma-delimited. At the end of each record the traffic counter sends across a LF/CR combination which will indicate that the first field of the next day is coming next.

In other words, we save the data in a standard comma-delimited ASCII file. This file can not only be imported into our graphing software which we supply to the user, but it can be imported into Microsoft Excel, or any other application which can import comma-delimited files. Next is a short summary of these 28 fields:

Field #	Field Description	Valid Values	Field #	Field Description	Valid Values
1	Month	1..12	15	11 AM Traffic Total	0..65,535
2	Date	1..31 *	16	12 PM Traffic Total	0..65,535
3	Year	**	17	1 PM Traffic Total	0..65,535
4	12 AM Traffic Total	0..65,535	18	2 PM Traffic Total	0..65,535
5	1 AM Traffic Total	0..65,535	19	3 PM Traffic Total	0..65,535
6	2 AM Traffic Total	0..65,535	20	4 PM Traffic Total	0..65,535
7	3 AM Traffic Total	0..65,535	21	5 PM Traffic Total	0..65,535
8	4 AM Traffic Total	0..65,535	22	6 PM Traffic Total	0..65,535
9	5 AM Traffic Total	0..65,535	23	7 PM Traffic Total	0..65,535
10	6 AM Traffic Total	0..65,535	24	8 PM Traffic Total	0..65,535
11	7 AM Traffic Total	0..65,535	25	9 PM Traffic Total	0..65,535
12	8 AM Traffic Total	0..65,535	26	10 PM Traffic Total	0..65,535
13	9 AM Traffic Total	0..65,535	27	11 PM Traffic Total	0..65,535
14	10 AM Traffic Total	0..65,535	28	Door Number ***	1..3

More Data Format information on next page



Data Format

More Data Format information on previous page

As you can see, there is no field for the total traffic for the day. The PC software should loop through fields 4 through 27 and calculate this figure if needed.

Of course, the data which was imported can be saved to any subdirectory and can use any filename. (We use c:\idt\rtc-p3.dat as our default. We then append this data to a c:\idt\rtc-p3.his, which is used to analyze the traffic data graphically in our software.) Of course, you may opt to import the data directly into your application's data format instead of saving it to disk in the comma-delimited ASCII format.

Notes concerning Field Summary Chart:

*** - Date:** The valid values are 1..31. However, this is the maximum value. Obviously, the greatest value will be dependent upon field #1, Month.

**** - Year:** Currently in four-digit format. However, some earlier versions of our firmware only sent one digit. For example, 2003 came across as 3. So your software should still convert anything that is not in four-digit format, just to be safe.

***** - Door Number:** By default, the RTC-P3 sums the data for all door sensors into one set of data. However, there is a menu option on the RTC-P3 to allow for the separating of the traffic data for each door. If we transmit one day of traffic history, and the data is being summed for all door sensors, then one record will be transmitted and the last field will be "1." If we transmit one day of traffic history, and the data is being separated for each door sensor, then three records will be transmitted and the last field of each of those records will be "1," "2," and "3," respectively. Three records will be transmitted, even if there are only two door sensors being used. There will be one record with all zeros for the traffic totals.

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Product Specifications

RTC-P1 Traffic Counter

Weight:	Approx 12 oz.
Dimensions:	Approx 3 1/16" W x 5 7/8" L x 2" H
Power Consumption:	Approx 250 mA
Power Supply Required:	Input: 120 V AC, 60 Hz Output: 14 – 15 V DC, 500 mA or greater UL Listed
Sensor Range:	Entrances of 8' wide or less *

RTC-P3 Traffic Counter

Weight:	RTC-P3: Approx 1 lb 8 oz
Dimensions:	RTC-P3: Approx 5 3/8" W x 8 1/2" L x 3 1/8" H
Power Consumption:	Approx 250 mA (with three sensors connected)
Power Supply Required:	Input: 120 V AC, 60 Hz Output: 14 – 15 V DC, 800 mA or greater UL Listed
Max Distance from RTC-P3 to Entrance:	Approx 1600 ft

RTC-S2X Standard Door Sensor

Weight:	Approx 6 oz.
Dimensions:	Approx 3 1/4" W 5 3/4" L x 1 11/16" H
Power Consumption:	Included in RTC-P3 Specifications
Power Supply Required:	None required. Powered through RTC-P3
Sensor Range:	Entrances of 8' wide or less *
Max Distance from RTC-P3 to Entrance	Approx 1600 ft

RTC-S2XL Long-Range Door Sensor

Weight:	Approx 6 oz for each piece
Dimensions:	Approx 5 3/4" W x 3 1/4" L x 1 11/16" H for each piece
Power Consumption:	Included in RTC-P3 Specifications
Power Supply Required:	None required. Powered through RTC-P3
Sensor Range:	Entrances of 65' or less *
Max Distance from RTC-P3 to Entrance	Approx 1600 ft

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Cable Specifications

When installing the RTC-P3, some customers choose to have their installers run the cable in the wall, such as when the walls are still open before a store is open for business. If you need to run your own cable for this reason, or any other reason, the following are the cable specifications.

Cable Type	8-conductor, Category 5 networking cable
Connector Type	RJ45
Internal Wiring Scheme	Wired straight-through For example: pin 1 to pin 1; pin 8 to pin 8

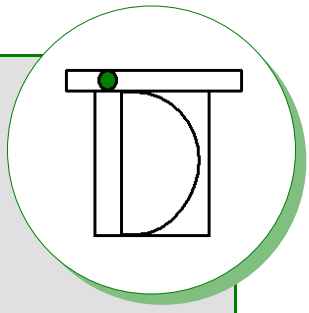
Note: If cable is to be run inside wall or ceiling, the cable should have plenum shielding to help conform to fire codes. If it is to be run outside the wall PVC shielding will be sufficient. The cable should be kept as far away from florescent lighting, relays, motors, power cables and any other devices that may radiate EMI. If the networking cable must cross a power cable, cross them at right angles. Do not run them along side each other. Please feel free to contact us with any questions that you may have.

Software File Summary

There are a number of data files that are created during the normal use of the software. Here is a summary of those:

- ***.trx:** This is the actual data that was transmitted on any given day. The format of the file is mm-dd-yy.trx, where mm is a two-digit month, dd is a two-digit day and yy is a two-digit year. If a user downloads more than once in a given day, then only the last download is saved in this file.
- **rtc-p3.dat:** This is the last data that was transmitted. It is basically a copy of the last .trx file.
- **rtc-p3-trunc.dat:** This is the same file as *rtc-p3.dat*; however, this will "truncate" any data outside of the open hours settings in the Settings section of the software. It truncates the closed hours by placing a zero in each of these closed hours. This file can be used if the user wishes to import traffic data into another application, while only using the data for the open hours of the establishment.
- **rtc-p3.his:** This is the file to which the data is appended after each transmission. *The graphing software uses this file. In other words, this is your database of traffic history.* Upon entering the main menu, the system checks to see if this file already exists. If it doesn't, the system makes a zero-byte file. If it already exists, nothing happens.
- **rtc-p3.bak:** Since the *rtc-p3.his* file is so important, this is a backup of that file. The software creates this file each time the user enters the graphing option. So if anything goes wrong while the *rtc-p3.his* file is open in the graphing section, such as the PC locking up, there is a backup made. This is useful when *rtc-p3.his* gets corrupted, such as becoming a zero-byte file. However, if *rtc-p3.his* gets deleted, and the user goes into the graphing option, *rtc-p3.bak* will get overwritten with the *rtc-p3.his* file, which was corrupted

More Software File Summary information on next page



Software File Summary

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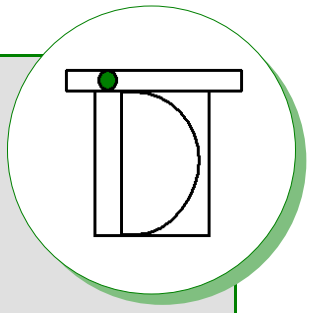
in our example. So this backup file is useful when *rtc-p3.his* gets corrupted, but will not be useful if *rtc-p3.his* is deleted. In that case, the user will have to restore from backup.

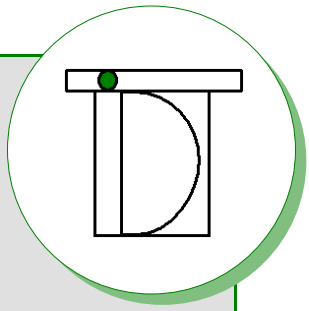
- **view-traffic.xls, view-traffic2.xls, view-traffic3.xls:** These are spreadsheet templates that can be used to view traffic in Microsoft Excel. These were originally supplied to our customers before our graphing software was available. We recommend that you use our graphing software to view and print traffic data. We include these three spreadsheet templates only in an attempt to maintain backward compatibility.



Summary

We currently have one other traffic counter model, the RTC-P1. However, this keeps only one running-total and does not transmit to the PC. We have no plans to allow this to ever transmit to the PC.

As stated in the Introduction section, this is general introduction to the theory of operation of the RTC-P3 traffic counter. If your questions are not answered in this document, please give us a call and we can discuss it with you in more detail.



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