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TecNote 1000 - The Naztec NTCIP Protocol

The StreetWise system in Cupertino, CA. was the first ATMS in the nation to fully implement NTCIP as a complete system. The City of Richardson, Texas and Ada County, Idaho are also currently upgrading their systems to NTCIP. Naztec is fully committed to NTCIP as the standard protocol for all ITS based products.

In 1996, Naztec upgraded their TS-1 controller line to TS-2 and the 16-phase / 16-overlap TxDOT specifications. During the same period, NEMA began finalizing the NTCIP protocol. NTCIP became part of the design process as Naztec moved from the TS-1 controller (16-bit 8 MHz processor, 256K memory) to the TS-2 controller (32-bit 16 MHz processor, 4 meg memory). Naztec chose to incorporate the NTCIP object definitions into the database of the new TS-2 controller rather than write controller software to translate the old TS-1 database to NTCIP. This one-to-one match between the controller database and the byte definitions of the NTCIP objects helps insure compatibility with the intent of the NEMA specifications.

Naztec's implementation of the NTCIP protocol fully supports SNMP, STMP and dynamic objects - click here to download our NTCIP Conformance Statement. In addition, the Naztec 2070 controller software supports both asynchronous communication (NTCIP 2101 - PMPP/RS232 Sub-Network Profile) and IP connectivity (NTCIP 2104 - Ethernet Sub-Network Profile).

Naztec will continue to support it's own communications protocol and has developed other protocols including AB3418 and Protocol-90. However, NTCIP has proved superior to the other protocols after Naztec developed block transfers to increase the data packet size and minimize the overhead of the protocol. Naztec controllers also support baud rates up to 56K Baud which also improve data throughput.

Block Transfers

Naztec developed a block transfer method to enhance the communication throughput of NTCIP. This enhancement maintains all NTCIP packet structures and will not interfere with other NTCIP messages broadcasted from other ITS devices that do not support block transfers. Naztec field devices can communicate with the ATMS at a much higher data rate because the block transfer method increases the data packet size when communication environment is stable. This minimizes the overhead of the header information required by NTCIP for each data packet.

An analogy between the block transfer method and the standard NTCIP packet size is the difference between carrying a load of cargo with a semi tractor-trailer and a 4-wheel drive jeep. The semi would obviously allow you to minimize the haul time for a large amount of cargo. However, if you had to carry the load to the top of a mountain, you would use the 4-wheel drive vehicle but make far more trips. In a similar way, the block transfer method increases the data packet size when the communication path is free of errors and reduces the data block back to the NTCIP packet size when the communication path is noisy and error prone. The following example illustrates the speed improvement achieved with Naztec's block transfers enhancement to the NTCIP protocol.

Example: Volume/Occupancy Report - 24 hours of data (18,432 bytes) at 9600 Baud

Protocol	Mode	Data bytes (per message)	Total Messages (Bytes)	Total Time (Minutes)
Standard NTCIP		1	18,432	61.0
Naztec TS-1 Protocol		16	1,152	3.8
Naztec NTCIP With Block Transfers	Mode 1	16	1,152	4.8
	Mode 2	32	576	2.6
	Mode 3	64	288	1.7
	Mode 4	128	144	1.2
	Mode 5	256	72	0.9
	Mode 5	512	36	0.8
	Mode 7	1024	18	0.6

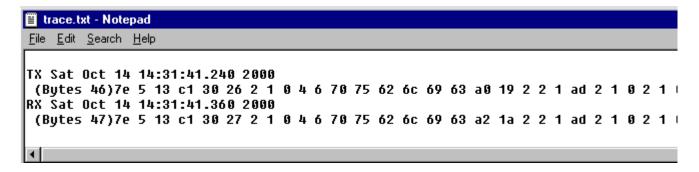## Naztec NTCIP Protocol Analyzer and Object Tester

Currently there are no standardized tests for the NTCIP objects. Even when standard tests become available, each manufacturer will need to test proprietary MIB's (Message Information Blocks) that not included in the NTCIP objects. Therefore, Naztec has developed an NTCIP Protocol Analyzer and Object Tester as part of the StreetWise ATMS software.

The Naztec Protocol Analyzer is built into the StreetWise Communications Server and is capable of intercepting all NTCIP messages transmitted over the serial ports to the ITS field devices.
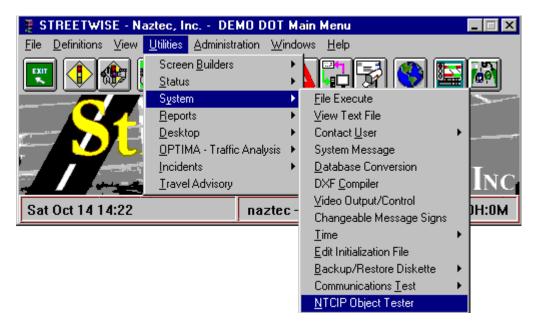
The Protocol Analyzer provides the ability to capture and trace all NTCIP data between StreetWise and the field devices. The trace capture is a byte-by-byte definition of the protocol transmitted (TX) and received (RX) from the field. These byte definitions agree with the byte definitions required by the NTCIP objects in the NEMA protocol.
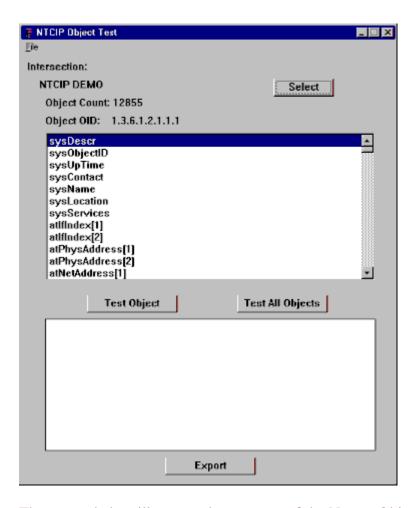

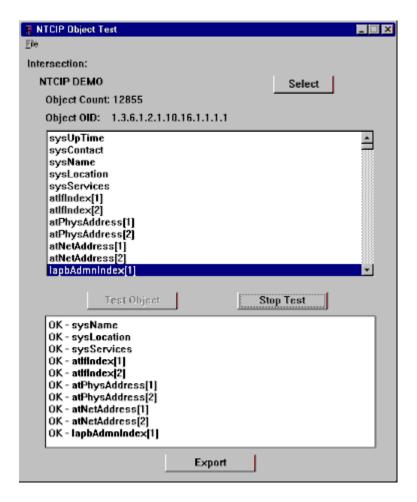The Naztec Object Tester is built into the StreetWise client as shown below:

The Naztec Object Tester exercises and tests 12,855 NTCIP objects including all Naztec proprietary MIB's defined in StreetWise the 970, 980 and 981 family of controllers as shown below. The Object Tester is also being used to develop NTCIP based software for Naztec's 2070 controller line. The Object Tester insures that all communications software developed by Naztec for NTCIP is systematically tested for compliance with the NEMA specifications.
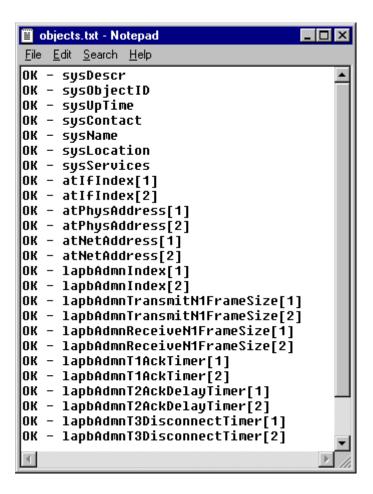
The screen below illustrates the progress of the Naztec Object Tester while testing all 12,855 objects - a process that takes over 3 hours to complete.

As each object is tested, the Object Tester indicates an OK or fail message.

```
objects.txt - Notepad
File  Edit  Search  Help
OK - sysDescr
OK - sysObjectID
OK - sysUpTime
OK - sysContact
OK - sysName
OK - sysLocation
OK - sysServices
OK - atIfIndex[1]
OK - atIfIndex[2]
OK - atPhysAddress[1]
OK - atPhysAddress[2]
OK - atNetAddress[1]
OK - atNetAddress[2]
OK - lapbAdmnIndex[1]
OK - lapbAdmnIndex[2]
OK - lapbAdmnTransmitN1FrameSize[1]
OK - lapbAdmnTransmitN1FrameSize[2]
OK - lapbAdmnReceiveN1FrameSize[1]
OK - lapbAdmnReceiveN1FrameSize[2]
OK - lapbAdmnT1AckTimer[1]
OK - lapbAdmnT1AckTimer[2]
OK - lapbAdmnT2AckDelayTimer[1]
OK - lapbAdmnT2AckDelayTimer[2]
OK - lapbAdmnT3DisconnectTimer[1]
OK - lapbAdmnT3DisconnectTimer[2]
```

Conclusions

Naztec, Inc. is fully committed to support NTCIP as the communications and database standard for all ITS field devices. Naztec has made a major investment in developing and testing NTCIP for all TS-2 products and the emerging 2070 controller line. The Protocol Analyzer and Object Tester built into the Naztec StreetWise ATMS insure compatibility with the 12,855 NTCIP objects and MIB's currently implemented in the Naztec family of ITS devices. Naztec will insure that future enhancements to the NEMA standards and it's own MIB objects are fully tested and supported.

Be sure to visit the excellent NTCIP website at http://www.ntcip.org - the NTCIP Guide is available as a free download from this site and is an excellent resource for understanding the NTCIP family of protocols.

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